Toronto and Region Conservation Authority and the City of Brampton

DOWNTOWN BRAMPTON FLOOD PROTECTION

Addendum to the Environmental Study Report

2024

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1. Introduction

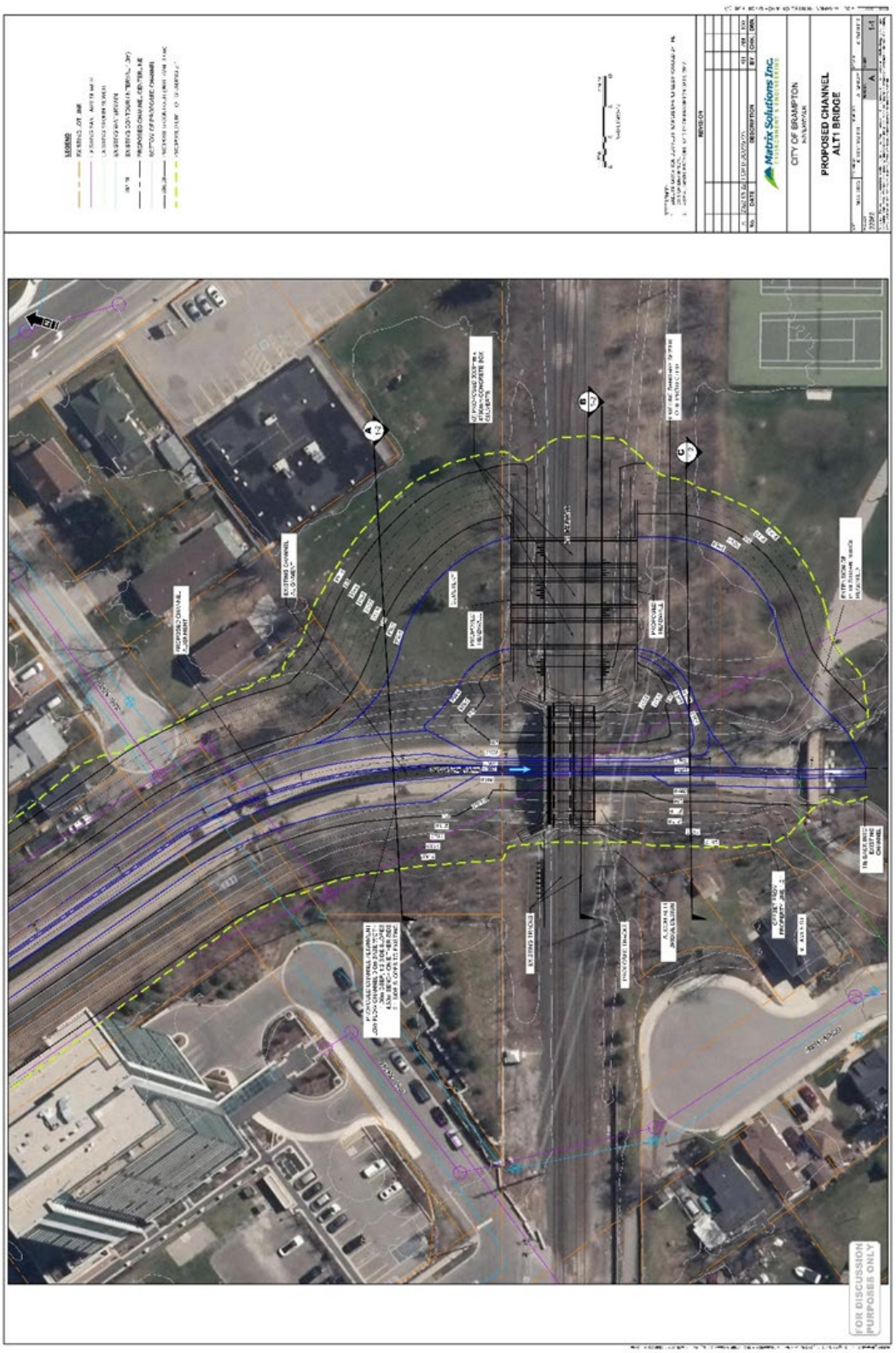
1.1. Project Background

The Downtown Brampton Flood Protection Project Schedule C Municipal Class Environmental Assessment was completed by Toronto Region Conservation Authority and the City of Brampton in late 2020. The Environmental Study Report (hereafter referred to as the EA) documented a planning and decision-making process that resulted in a preferred alternative to mitigate flooding during the Regulatory storm caused by a spill from Etobicoke Creek within downtown Brampton. The approved preferred alternative included:

- widening and deepening the existing Etobicoke Creek Bypass Channel from Church Street to the CN crossing;
- the realignment of Ken Whillans Drive and regrading of Church Street and the valley;
- bridge replacements at Church, Scott and Queen Streets;
- modifications to the CN Rail bridge; and
- relocation or replacement of the pedestrian bridge in Centennial Park.

The EA identified the CN rail crossing as a significant constraint for the project and proposed a solution for providing additional conveyance needed for passing the Regulatory storm via the installation of three culverts located to the east of the existing crossing (see Figure 1). However, this alternative resulted in significant impacts on the St Mary's Heritage Cemetery likely resulting in the relocation of graves. The question of how to provide for the flood conveyance at the CN crossing was to be further investigated during detailed design.

Figure 1 CN Crossing Alternative Approved in ESR



1.2 Municipal Class EA Addendum Process

The Municipal Class Environmental Assessment makes provision for changes to be made to a project following EA approval as follows:

> *Due to unforeseen circumstances, it may not be feasible to implement the project in the manner outlined in the Environmental Study Report. Any significant modification to the project or change in the environmental setting for the project which occurs after the filing of the Environmental Study Report shall be reviewed by the proponent and an addendum to the Environmental Study Report shall be prepared. The addendum shall describe the circumstances necessitating the change, the environmental implications of the change, and what, if anything can and will be done to mitigate any negative environmental impacts. The addendum shall be filed with the Environmental Study Report and a Notice of Addendum shall be issued immediately to all potentially affected members of the public, Indigenous Communities and review agencies, as well as those who were notified in the preparation of the original Environmental Study Report. A period of 30 calendar days following the issuance of the Notice of Addendum shall be allowed for review of the Addendum. If a change is being proposed to the project, the Notice of Addendum shall include the public's right to request a section 16 order. A proponent must wait a minimum of 30-days following the end of the comment period before proceeding with the implementation and construction of the project, subject to a section 16 order request being submitted, the minister making an order or the director issuing a Notice of Proposed Order. During the 30-day comment period and 30-day waiting period, no work shall be undertaken that would adversely affect the matter under review. Furthermore, where implementation of a project has already commenced, those portions of the project which are the subject of the addendum, or have the potential to be directly affected by the proposed change, shall be stopped and shall not restart until the end of the comment period and any statutory waiting period.*

As part of detailed design, the City of Brampton has, as described in this addendum, undertaken further investigations and consultation which has resulted in the identification of a new solution for one component of the Downtown Brampton Flood Protection project namely, the CN crossing of Etobicoke Creek.

1.3 Current Status of Project

Since approval of the EA the City of Brampton has undertaken and approved an Urban Design Master Plan for the public realm surrounding the approved flood protection works and commenced detailed design of the flood protection project in early 2023.

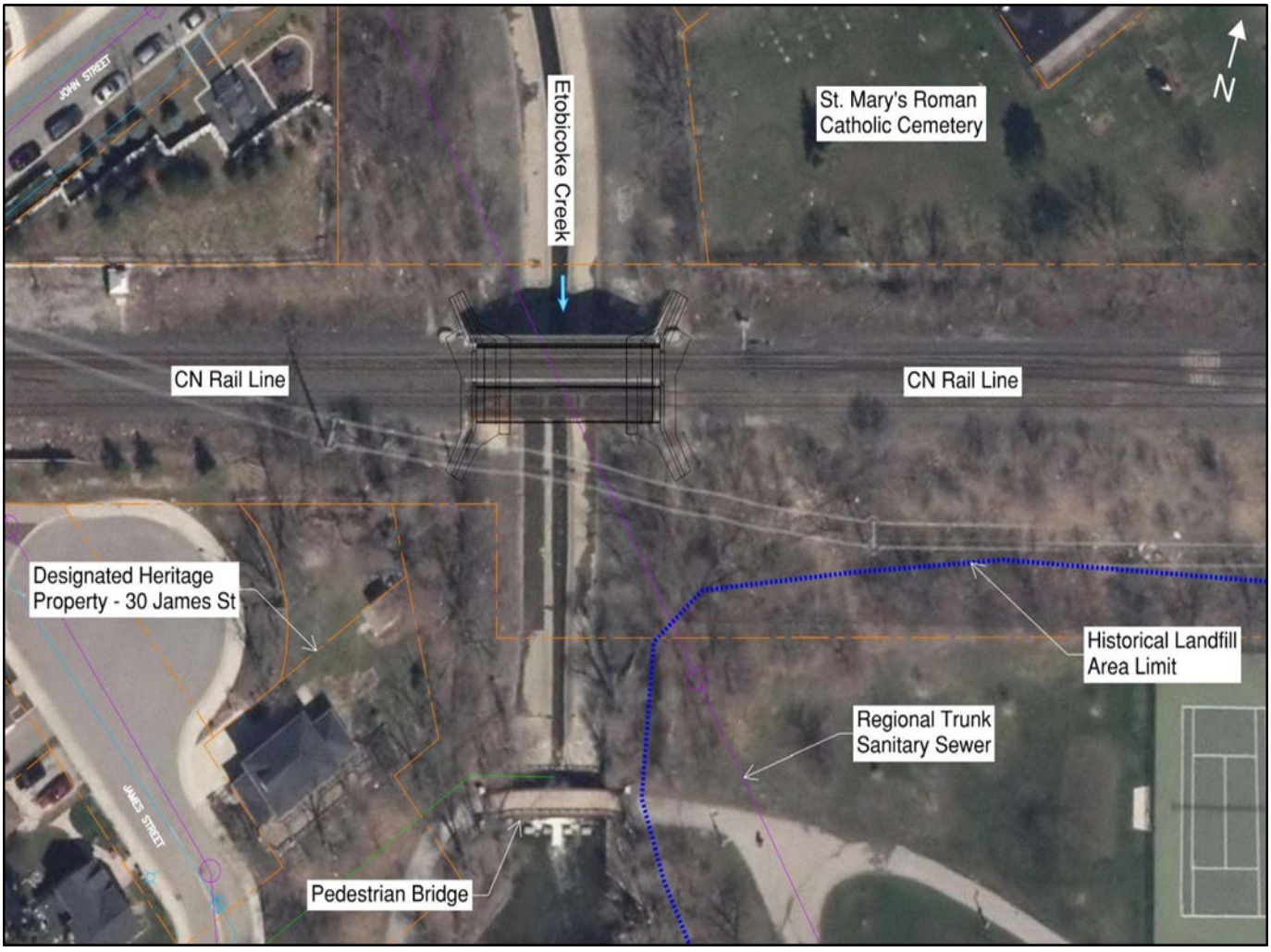
During the EA the City of Brampton worked with CN to achieve a workable solution for the CN crossing of Etobicoke Creek in the south end of the study area. Throughout project planning it was recognized that any solution must achieve the required flood protection, respect the operational needs of CN and Metrolinx who use the corridor and address or not limit the long-term plans of CN and Metrolinx for track expansion through the corridor. To this end, the EA presented a range of alternatives for the CN crossing of Etobicoke Creek and noted that during detailed design work must be done to finalize the design of the crossing (see Section 7.1.6 of the ESR). It was also noted during the EA that the preferred alternative resulted in the disturbance and removal of grave sites from St Mary's Heritage Cemetery and that detailed discussions with Roman Catholic Cemeteries and the Bereavement Association of Ontario would be required to understand these impacts and seek to minimize them.

During the detailed design phase, detailed discussions have been held with CN, Metrolinx, Roman Catholic Cemeteries, and the Bereavement Association of Ontario. As a result of these discussions, additional alternatives for the CN crossing of Etobicoke Creek were assessed. This addendum documents the choice of a new preferred alternative.

2 Update to Existing Conditions

The Etobicoke Creek crossing (see Figure 2) is on one of the busiest rail corridors in Canada. Underneath the crossing is a 1500 mm trunk sanitary sewer operated by the Region of Peel. Northeast of the site is St. Mary's Roman Catholic Heritage Cemetery. South of the crossing is a pedestrian bridge and southeast of the crossing there is a historic landfill. To the southwest of the crossing is a listed heritage property, 30 James St that currently abuts the Etobicoke Creek valley corridor. As part of developing this addendum, these existing conditions were revisited and confirmed.

Figure 2 CN Crossing of Etobicoke Creek – Existing Condition



2.1 St Marys Heritage Cemetery

St. Mary's cemetery is located northeast of the existing CN crossing of Etobicoke Creek and is a listed heritage property. During the downtown Brampton Flood Protection EA it was anticipated that St Mary's Roman Catholic Cemetery would be impacted by the construction works in the vicinity of the CN crossing. The approved ESR indicated that further research was needed to understand any impacts to the cemetery.

In order to collect more information about St Mary's cemetery, City staff met with representatives of Bereavement Authority Ontario and the Registrar of Cemeteries from the Ministry of Public and Business Service Delivery. The purpose of the meetings was to understand the processes and requirements that would need to be met for there to be encroachment into the cemetery. Key amongst these is engagement with Catholic Cemeteries. From a technical point of view, there were specific archaeological and related studies that needed to be completed in order to understand the full implications of the encroachment. Steps for the partial closure of the cemetery and relocation of burials were also discussed.

In initial discussions with Catholic Cemeteries, it was made clear that detailed cemetery records were not available because they were lost in a fire in the 19th century. The importance of this issue cannot be overstated. Essentially, to move graves, you need to know who is in them.

At the request of Catholic Cemeteries, the city hired ASI to complete a Stage 1 Archaeological Assessment for the cemetery that included a robust and thorough review of all historic records that could be identified for the cemetery. This included working with PAMA (Peel Art Gallery Museum and Archives), City staff, Catholic Cemeteries Archives, the provincial archives and TRCA. Meetings were held with ASI and Catholic Cemeteries throughout the progress of the Assessment.

The Stage 1 Archaeological Assessment of potential impacts on St. Mary's Roman Catholic Cemetery entailed consideration of the proximity of previously registered archaeological sites, the original environmental setting of the property, and its nineteenth- and twentieth century development history with particular focus on the use of the property as a cemetery beginning circa 1865.

A review of historical information and church records resulted in conflicting information with respect to the number of graves within the cemetery. This review indicated that there may be upwards of 757 burials in the cemetery including both marked and unmarked.

As part of the assessment the following information sources were reviewed or consulted:

- Land records and mapping dating as far back as 1819. This includes the land transfer records for the formal creation of the cemetery in 1863.
- St Mary's Catholic Church Parish records
- Ontario Genealogical Society records
- Catholic Cemeteries & Funeral Services - Archdiocese of Toronto
- The Archives of the Roman Catholic Archdiocese of Toronto
- Bereavement Authority of Ontario

Key findings that establish that the number of graves in the cemeteries is unknowable without complete excavation include:

1) Although records indicate that the cemetery was formally opened in 1863, it is possible that burials began in this location as early as 1850. This means an unknown number of internments may be present relating to this period.
2) All of the church records from 1863 through 1878 were lost in a fire. Any records relating to the pre-1878 period have been assembled from other, secondary sources.
3) Based on information held by Catholic Cemeteries, there have been as many as 767 burials in the cemetery. However, they only have documentation for 431. Even for the set of 431, the location information is incomplete.
4) The lack of cemetery record is further complicated by the removal of a substantial number of grave markers of the past several decades. For example, several grave markers that are visible in photos from the 1950's are no longer present today.
5) In 1939 a review of the cemetery by Perkins-Bull identified 17 burial markers for individuals for whom no current records are available.
6) The discrepancy between the number of burial markers and the number of burial records continues throughout the 20th century. For example, during the decade from 1961-1970, there are records for 147 burials but only 66 markers are known.

City staff met with ASI and Catholic Cemeteries to review the findings. At that time, Catholic Cemeteries indicated that because the cemetery records were so fragmented, there was a large part of the cemetery where it is not known how many burials were present or who was in them. Catholic Cemeteries made the point that if the City removed some of the graves in the cemetery a situation would be created where families would not know where their loved ones are buried. Regulatory approval for such an arrangement would be extremely challenging. Taken together, the data indicate that the only way to be sure that the internments within the cemetery can be attributed to the known number of burials is by keeping the cemetery intact as a single property. This led to the position of Catholic Cemeteries that "if you move one, you will need to move them all."

In addition to the matter of the remains within the cemetery the Stage 1 also established that, formerly, the cemetery boundary was further west than at present. This means that burials were almost certainly affected by the previous construction of the diversion channel. It is not known how many burials were affected and Catholic Cemeteries was clear that they could not support a similar occurrence.

Thus, the opinion of the assessment team, the City and the agencies consulted is "if you move one, you have to move them all." For this reason, any impact to the Cemetery would require the complete removal of all graves and could result in significant delays.

2.2 Ecological Conditions Around the CN Crossing of Etobicoke Creek

This is a summary of the information contained in the ESR. No new ecological field studies were undertaken.

The area in the vicinity of the CN crossing of Etobicoke Creek has been and continues to be highly impacted by human activity as has Etobicoke Creek itself. Ecological studies were undertaken during the EA (Chapter 4 of the ESR) and additional ecological studies have been undertaken in the fall of 2023. The area in the vicinity of the CN ROW was reassessed with more attention being paid to the CN ROW and the properties adjacent to it; those areas likely to be affected by any options considered for the CN crossing.

With respect to terrestrial ecology, there were no high-quality SAR habitat trees found in or surrounding the CN ROW (except for one tree on the east side of the Creek in Centennial Park). The team assessed the trees on private property from the property boundary and none were observed to be SAR or SAR habitat. Snake habitat was noted downstream of the pedestrian bridge on both the east and west banks. As noted in the ESR (Section 4.1.7), the vegetation to the northwest of the crossing is restoration mixed plantation consisting of species not of conservation concern, the vegetation to the southwest of the crossing is lowland forest with some species of urban concern and the vegetation to the southeast of the crossing is locust deciduous plantation dominated by exotic species.

With respect to aquatic ecology, the aquatic habitat is limited by the concrete by-pass channel and the drop structure immediately under the CN crossing. As noted in Section 4.1.6 of the ESR, the fish species present upstream and downstream of the drop structure are native cool water species such as Creek Chub, White Sucker and Johnny Darter. These fish are generally considered tolerant of a variety of water temperature, sediment and water quality conditions. No cold-water species, endangered species or species of concern were found throughout all the years of sampling.

2.3 Land Use and Socio-Economic Conditions

The CN crossing is located within downtown Brampton south of Queen Street. As such there is a complex array of existing land uses adjacent to the crossing. To the northeast of the CN crossing there is a small play structure and seating area associated with the Park Place condominiums. To the northwest is the St. Mary's Catholic Heritage Cemetery and some transitional residential housing along with medical offices. To the southeast and south is Centennial Park and a pedestrian bridge across Etobicoke Creek, a play structure and tennis courts. Centennial Park is, in part, an old municipal landfill site. To the southwest is a private residence, 30 James Street which is a listed heritage building and an established residential neighbourhood. The only updated existing conditions information is with respect to 30 James Street as detailed below.

A Cultural Heritage Impact Assessment Report was prepared that evaluated the Cultural Heritage Value or Interest of the property. Based on the results of the background historical research, the field review, and evaluation under O. Reg. 9/06, the Subject Property at 30 James Street was determined to possess Cultural Heritage Value or Interest (CHVI) for its design value and for it's Historical Associative Value.

The Design/Physical Value is tied to its architecture as a representative example of Edwardian Classicism that displays a high level of craftsmanship. The Historical Associative value derives from its association with the Packham and Balfour families.

The house at 30 James Street is a representative example of a two-and-a-half storey red brick veneer house with a one-storey contemporary rear wing, built in the style of Edwardian Classicism in the early 20th century, between 1905 and 1907, in the City of Brampton. The house features a hipped roof with

wide plain eaves and an original central dormer with pediment on the south (front) elevation. The house features a moulded floral motif in a wood surround above the main entrance on the south elevation. The vinyl replacement windows exhibit segmentally arched brick voussoirs with decorative pressed brick 'egg and dart' motif headers. There is also a pressed brick water table at the top of the foundation level that exhibits the same 'egg and dart' motif. There are leaded windows on the south and west elevations of the ground floor, which are associated with Edwardian Classicism. The leaded window on the south elevation retains stained glass. The placement of the windows is asymmetrical on the east and west (side) elevations.

The front verandah exhibits Classical influence with a simple frieze and architrave supported by five rounded half Doric columns. The brick verandah railing, in addition to the pressed brick headers and water table, are unique masonry elements of the house which serve as tangible evidence of its association with the Packham family of brickmakers.

In addition, the house located at 30 James Street displays a high degree of craftsmanship since it was built of brick manufactured by the Brampton Pressed Brick Company. The skill of the bricklayer is evident in the decorative pressed brick labels and unique masonry railing on the verandah.

The Subject Property has historical associative value because it is directly associated with the Packham family of brickmakers and Andrew Howden Balfour, who operated the local mill. The two-and-a-half storey brick veneer residence that remains on the property today was constructed in the architectural style of Edwardian Classicism by members of the Packham family under the ownership of Charles R.J. Packham, the son of James Packham, between 1905 and 1907. It is believed to reflect the ideas of George C. Packham, a builder and member of the Packham family. His brother, James Packham, established the Packham Pressed Brick Company (later Brampton Brick Company Ltd.) in 1871, which provided high quality red bricks used in the construction of numerous houses in Brampton and the surrounding area. Although the brickmaking business was sold outside the Packham family in 1949, it still survives today as Brampton Brick Ltd. Due to their legacy of brickmaking, the Packham family were significant to the architectural development of the City of Brampton.

In 1919, Andrew Howden Balfour purchased the residence at 30 James Street, where he lived with his family for 55 years, until 1974. Andrew H. Balfour came from a family of esteemed medical doctors from Portobello, Scotland. Unlike his grandfather and father before him, Andrew Howden Balfour was not in the medical profession, instead working as a miller and grain merchant at The Brampton Milling Company, once known as Balfour Mill. In the First World War, Andrew H. Balfour's military service took him to Iraq, India, and South Africa, where he was in charge of supplies and attained the rank of captain. In 1944, Andrew H. Balfour was elected first vice chairman of the Brampton branch of the Navy League of Canada at the annual meeting held in the Court House. As the local miller and vice-chairman of the local Navy League, he was significant to the community of Brampton.

2.4 Infrastructure

The Etobicoke Creek crossing (see **Figure 1**) is on one of the busiest rail corridors in Canada. The CN tracks carry approximately 50 passenger and freight trains per day with that number expected to increase with Metrolinx expansion plans. To this end, CN provided to the City the draft design drawings for a proposed third track south of the existing two tracks. This information was used to inform the development of alternatives for the CN crossing.

Underneath the crossing is a large (1500 mm) trunk sanitary sewer operated by the Region of Peel. Several discussions with Peel Region staff were held during the EA and it was determined that the trunk sewer must be maintained with a minimum cover depth of 1.2 m.

There have been no changes to infrastructure in the vicinity of the CN crossing since approval of the ESR.

3 Description of and Rationale for Proposed Modifications

The approved EA included a flood mitigation solution that included but was not limited to widening and deepening the existing Etobicoke Creek Bypass Channel from Church Street to the CN rail crossing. The EA identified the CN rail crossing as a significant constraint for the project. The EA proposed a solution for providing additional conveyance needed for passing the Regulatory storm via the installation of three culverts located to the east of the existing crossing. Subsequent discussions with CN and Metrolinx staff following approval of the EA revealed there may be opportunities to implement alternative crossing designs to reduce the impact on the cemetery lands northeast of the crossing where the by-pass culverts were proposed to be installed. As a result, other feasible alternatives that provide flood conveyance through the CN rail embankment while also minimizing impacts to the cemetery lands were investigated.

Four alternatives were examined to provide the required flood conveyance capacity at the CN rail crossing. The key aspects which differentiated between the alternatives were impacts to flood conveyance, the cemetery, 30 James Street and CN operations and the cost estimates. The alternatives considered were:

- Alternative 1 – Three Box Culverts to the East of the Existing Crossing; this is the solution proposed in the approved EA
- Alternative 2 – Two Box Culverts to the East and One Box Culvert to the West of Existing Crossing;
- Alternative 3 – Three Box Culverts to the West of the Existing Crossing
- Alternative 4 – Replace Existing CN Bridge with a New Longer and Wider CN Bridge

The alternatives were considered and assessed in discussion with CN and Alternative 3 was chosen as the new solution for the CN Crossing of Etobicoke Creek for the following reasons:

- Alternatives 1 and 2 affect the St. Mary's Heritage Cemetery. As noted above, due to the incomplete records for the cemetery and uncertainties around the number of graves, any impact to the cemetery will result in the relocation of the entire cemetery. The relocation of a cemetery is a long and costly process.
- Alternative 4 will result in the most impacts to CN and Metrolinx operations as a result of construction of a new bridge and the level of disruption to operations was not acceptable to CN given other viable alternatives.

Alternative 3 was chosen as the new preferred alternative to provide flood conveyance for Etobicoke Creek at the CN crossing. This alternative includes 3 box culverts on the west side of Etobicoke Creek. The proposed grading limit was kept at a 2:1 side slope but could be potentially steepened with structural engineering solutions to lessen impacts to the John Street and James Street cul-de-sacs. The slope stability assessment is being undertaken as part of detailed design. This alternative avoids impact to the cemetery however it will impact the house and property at 30 James Street and the cul-de-sacs. While both the cemetery and the house at 30 James Street have heritage value, the relocation of the cemetery has more

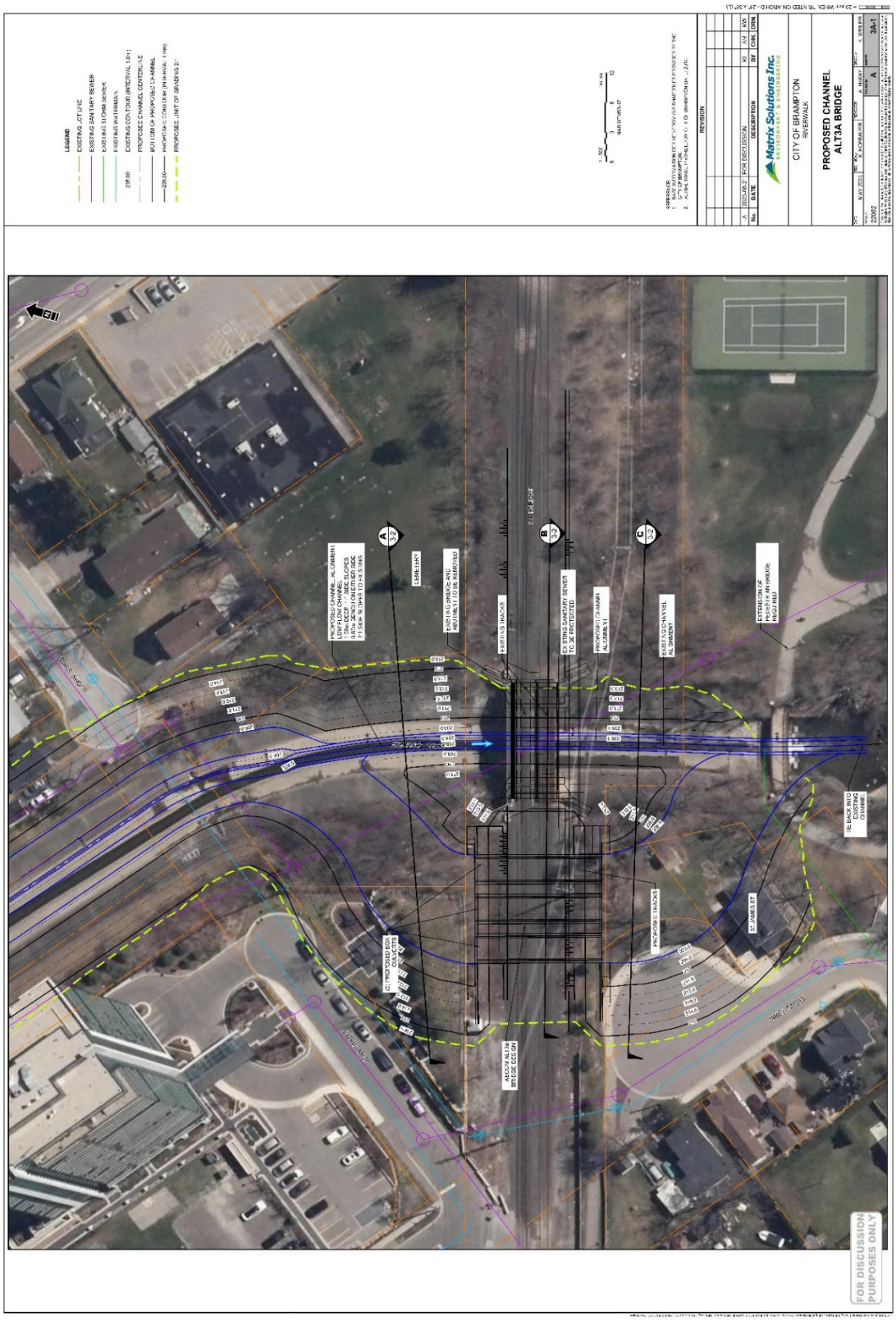
impact and significant timing implications therefore impacts to 30 James Street are preferable to impacts to the cemetery. The alternative meets or betters the flood conveyance requirements set out in the EA. A memo which details the comparison between the previously preferred and proposed new alternatives is in Appendix A. All of the proposed new alternatives have similar water profiles near the downstream end of the study area to the previously preferred alternative and Alternative 4 has lower water levels.

Box culverts rather than circular culverts were chosen as they can be 'pushed' through the embankment resulting in less disruption to CN/Metrolinx operations. With respect to construction in the vicinity of operating tracks, track monitoring will be required, the duration of workblocks and extent of night time construction will be confirmed during detailed design and will be minimized when possible. The following table sets out the construction activities and resultant track closures.

Table 3.1 Summary of Construction Activities and Track Closures

Construction Activities	Qty#	8 hrs. track closures
1. During short traffic closures for one track at a time, the first step is to install foundation piles for the temporary track support system which may consist of a pile and beam system, considering the availability of different systems in the market, some of which have been previously used in the GTA.	**12**	**3**
2. Installation of the foundation beams and the temporary track support system closing both tracks. A temporary track support system with hydraulic jacks' capabilities can be installed. This system is designed to mitigate any potential track settlement during the construction process.	**4**	**1**
3. Following the installation of the temporary track support system, the next phase involves the installation of temporary railway shoring parallel to the existing track on the south side (the box culvert push side). Simultaneously, excavation will take place in the designated area for the construction of a concrete box structure.		
4. To precast the concrete boxes at the proper level, a temporary support structure (or 2:1 slope if applicable) for the banks will be constructed around the laydown area.		
5. The construction of the concrete box structure commences, incorporating sacrificial nosing, high-performance waterproofing system, and concrete liners. Concrete thrust blocks will be constructed and jacking equipment will be installed to facilitate jacking/push tests on the concrete box.		
6. Utilizing natural rail traffic gaps and a series of short traffic closures on both tracks together, the concrete box structure will be incrementally jacked/pushed in 0.5 m increments below the temporary track support system. Simultaneously, excavation of material from inside the box structure will occur. – Advancement of all boxes at the same time will be dependent on the quantity of jacking / push equipment available. – Track closure may not be required if natural gaps are between 30 to 60 minutes.	**INTERMITTENT 30 TO 60 MINUTE CLOSURES ON BOTH TRACKS (railway "natural" traffic gaps) 50 pushes per box 25 hrs of pushing**	
7. Voids between the structure and soil will be filled with non-shrink grout to ensure stability and structural integrity.		
8. During a short traffic closure one at a time, the temporary track support system will be removed, and the construction process will continue with the installation of a ballast mat, the construction of sub-ballast, and finally, the installation of tracks.	**2**	**3**
Total of Track Closures to Complete the Installation of the Box Culverts		**7**

Figure 3 illustrates the new CN Crossing of Etobicoke Creek.



4 Effects Assessment of the Proposed Modifications

The assessment of effects in Section 8.1 of the approved ESR excluded the effects associated with construction of the proposed modifications to the CN crossing. Given the uncertainties, the potential effects of the modifications to the CN crossing were listed separately in a bulleted list. Table 4.1 below compares the effects listed in the approved ESR with the effects of the new preferred alternative.

Table 4.1 Comparison of Effects of ESR Approved Alternative and New Preferred Alternative 3A

Alternative Approved in ESR	New Preferred Alternative
Removal of ~0.2 ha of terrestrial habitat area comprised of forest/woodland and grasslands	Removal of ~0.23 ha of terrestrial habitat area comprised of forest/woodland and grasslands
Potential service disruptions to Metrolinx and/or CN rail service during construction activities	Same level of disruption as Alternative approved in ESR
Increased levels of noise and vibration during construction to be mitigated.	New alternative will result in work activities closer to existing residential uses necessitating the implementation of mitigation measures including: noise monitoring and sound control measures, and vibration and settling monitoring. With mitigation, any effects will be temporary and of short duration.
Land disturbance at St Mary's Cemetery resulting in potential relocation of graves	No direct impacts to St. Mary's Cemetery property.
No impacts to private property adjacent to crossing	Alternative requires acquisition of the property at 30 James Street and part of the property at 100 John Street (Park Place) particularly the play structure and parkette across the street from the condominium building.
Temporary closure of at grade rail crossing at John Street and James Street for the duration of construction	Temporary closure of at grade rail crossing at John Street and James Street for the duration of construction
	Cul-de-sacs on John and James Streets will be modified.
Capital costs ` approximately $13 million **	Capital costs ` approximately $13 million

** *The capital cost of the alternative approved in the ESR has been updated to be consistent with the costing for the new proposed alternatives and to reflect the box culverts and new construction method.*

Appendix A is the hydraulic modeling of the new alternative for the CN crossing and shows that the new alternative adequately conveys the regulatory flood.

The vegetation communities are similar to the east and west of the CN crossing and the alternatives result in impacts to similar areas of vegetation. No SAR species have been identified nor are any expected to be affected. The impact to aquatic habitat is unchanged for both construction and operation. The mitigation measures to minimize impacts to terrestrial habitats are detailed in the ESR.

Construction will disrupt CN/Metrolinx rail service to a similar degree for both alternatives. The proposed use of box culverts that can be 'pushed' through the embankment may lessen the degree of disruption. With respect to construction in the vicinity of operating tracks, track monitoring will be required, the duration of workblocks and extent of nighttime construction will be confirmed at the commencement of construction and will be minimized when possible. Therefore, construction will result in minor disruption to rail services to a similar degree for both alternatives.

Both alternatives will create construction effects such as noise and vibration that will be felt at residences close to construction. The New Alternative will result in work activities in closer proximity to existing residential land uses as compared to what was anticipated during the EA phase of the work, it will be necessary to implement additional mitigation measures to ensure that there are no adverse impacts. In addition, the City will notify nearby residents of construction and the complaints communication process with the City. Mitigation measures may include, but are not limited to:

- Noise monitoring and sound control measures – measures may include restrictions on the timing of certain activities (e.g., 8:00 a.m. – 5:00 p.m.), use of sound dampened equipment (e.g., pumps and generators), deployment of temporary noise attenuation barriers, etc.
- Vibration morning and settling monitoring – monitors may need to be installed at various locations throughout the corridor to ensure that work activities do not cause settlement. Pre-construction and post-construction surveys – will be required to establish benchmarks and monitoring locations for the above activity.

There is no disruption to St. Mary's Cemetery associated with the new alternative however the house and property at 30 James Street will need to be acquired. Both the cemetery and the house at 30 James are listed heritage properties however, the impacts to 30 James are less significant than complete relocation of the cemetery.

Evaluating the direct impact of the new preferred alternative on 30 James Street against the CHVI and list of heritage attributes, it is determined that implementation will have direct adverse impact on the property, especially related to the removal of the house that is in the architectural style of Edwardian Classicism. In consideration of the conservation options, it is concluded that, while retaining the heritage building in situ, is preferrable from a heritage perspective, it is understood that this option is not feasible from a design perspective. Therefore, relocation is the next preferred conservation option as it provides a more balanced approach to conserving the CHVI of the Subject Property while allowing for installation of the infrastructure. If relocation is not feasible, then the only viable option which results in the demolition of the house with commemoration and potential salvage of heritage attributes for re-use in the Project or donation.

The new preferred alternative has similar effects to the at grade rail crossing and cul-de-sacs at John and James Street and have similar capital costs.

5 Consultation

5.1 Consultation as Part of Detailed Design

The ESR indicates that the resolution of the provision of flood conveyance at the CN crossing would be the subject of additional consultation during detailed design to seek to minimize impacts to the cemetery and ensure that the preferred solution was acceptable to CN. This Addendum is a result of consultation between the City of Brampton and the following agencies and entities:

- CN Rail;
- Region of Peel;
- Catholic Cemeteries & Funeral Services - Archdiocese of Toronto; and
- Bereavement Authority of Ontario.

Early in the detailed design the City and the consultant team held a series of working group meetings with CN and the Region of Peel. The purpose of these meetings was to facilitate communication and collaboration to find a mutually agreeable solution. At these meetings issues, alternatives, construction staging and potential impacts were discussed. Four working group meetings were held and materials were made available to CN for review. At a subsequent meeting CN endorsed the choice of Alternative 3 to provide flood conveyance at the CN crossing. See Appendix B for the endorsement from CN.

Concurrently, the City undertook the detailed Stage 1 Archaeological Assessment detailed in Section 2.1 and consulting with several entities including Catholic Cemeteries & Funeral Service Archdiocese of Toronto and the Bereavement Authority of Ontario. As a result of these consultations, it was determined that any potential impact to St Mary's Heritage Cemetery would result in the relocation of the entire cemetery.

In December 2023, City staff reached out to the owners of 30 James Street with respect to acquisition and a meeting was held to provide an update with respect to the project. In January of 2024, the property owners at 100 John Street were contacted by City staff with respect to impacts to the parkette and play structure.

5.2 Consultation on the EA Addendum

Once the decision was made to change the preferred alternative for the CN crossing presented in the ESR with culverts on the east side of the creek to the new preferred alternative detailed in this addendum, the City commenced consultation with respect to this EA Addendum. Consultation efforts were focussed on those members of the public who were involved in the ESR review process, affected landowners, relevant agencies and Indigenous Communities.

5.2.1 Consultation with Interested Residents and Landowners

In March of 2024, letters were sent to affected landowners providing an update with respect to the detailed design phase of the project. Discussions with affected landowners have been on-going with respect to the mitigation and compensation of impacts.

Notification of the availability of the Draft EA Addendum for review was posted to the City website and circulated by email to the project contact list. No comments were received from interested residents.

5.2.2 Indigenous Communities

At the end of November 2023 letters were sent by email to the Indigenous communities who had been engaged as part of the development of the ESR. The letter provided an update on the project status, information with respect to the change in alternative at the CN crossing and confirmation was sought on the Indigenous community's interest in and form of continued engagement. The Indigenous communities contacted were: Mississauga's of the Credit First Nation, Six Nations of the Grand River, HDI and Huron-Wendat Nation. Tables 5.1 and 5.2 details the communication with each community who responded and any comments arising. In late 2023 the changes with respect to the CN crossing and the resultant requirement for this addendum were communicated to the Indigenous Communities.

Note that in addition to the communications described in the tables, project communication was provided to the Haudenosaunee Development Institute, Huron-Wendat Nation and Metis Nation of Ontario. To date, no response has been received from those communities.

Table 5.1 Summary of Engagement with Mississauga's of the Credit First Nation

Date	Communication	Details
December 13, 2022	Email correspondence and follow-up telephone discussion with M. LaForme, Department of Consultation and Accommodation	M. LaForme that MCFN would be interested in participating and advised that City Staff should reach out to the MCFN Special Projects Office
February 2, 2023	Initial Meeting with DOCA Special Projects Office (SPO)	Discussion regarding the consultation process and information sharing.
March 17, 2023	Email to SPO	Summary of project details
April 18, 2023	Follow-up meeting with SPO	SPO provided further details of communication process and CoB provided initial project details.
May 5, 2023	Email to MCFN SPO	Follow up email to provide additional project details and high-level discussion of project impacts.
November 27, 2023	Email to MCFN SPO	This communication advised MCFN of the change in the project impacts as a result of the effort to avoid the St Mary's Catholic Cemetery. This included details of the changes in the project design and the EA Addendum process.
May 21, 2024	Email to MCFN	Provision of Draft Addendum and request to review. The City offered tp meet to address the addendum
October 17, 2024	Email to MCFN	Email advised that the project team is planning to submit EA Amendment to MECP in November and asking that MCFN provide any comments. Advised that Detail Design will be continuing. Noted that comments on EA Amendment would be appreciated by end of October but that comments could still be received as Amendment proceeds through public review.

Table 5.1 Summary of Engagement with Six Nations of the Grand River

Date	Communication	Details
December 13, 2022	Initial email correspondence and follow-up phone call.	Advised SNGR that the project was going to commence and to seek input/consultation.
June 9, 20023	Email to SNGR Lands and Resources	Seeking the opportunity to meet and discuss City projects including DBFP.
August 18, 2023	Initial meeting with Lands and Resources staff	Primary focus was on communication structure and information sharing. Only initial details of SBFP were discussed.
August 21, 2023	Email from SNGR	Received document *Land Use Planning Together* from SNGR with request for completion and submission to their Lands and Resources office.
November 27, 2023	Email to SNGR Lands and Resources	This communication advised MCFN of the change in the project impacts as a result of the effort to avoid the St Mary's Catholic Cemetery. This included details

		of the changes in the project design and the EA Addendum process
December 4, 2023	Email from SNGR	SNGR requested a meeting regarding the DBFP and also asked for a draft copy of the EA Addendum for review before it is sent to MECP.
May 21,2024	Email to SNGR	Provision of Draft Addendum and request to review. The City offered to meet to discuss the amendment
July 2, 2024	Email from SNGR	Advised that the changes proposed in the EA Amendment are modest and stated that a meeting was not necessary. Requested further information regarding impacts to terrestrial habitat and naturalization elements as part of widening and deepening of channel.
October 17, 2024	Email to SNGR	Provided details of the approach to loss of terrestrial habitat and naturalization.

The draft EA Addendum was provided to the Indigenous communities and the following comments were received:

Indigenous Community	Comment	Response	Required Change to Addendum
SNGR	What mitigation is in place for lost terrestrial habitat? Are there naturalization elements to the widening and deepening of the channel?	While the central focus of the project is the deepening of the flood diversion channel the project includes a substantial re-naturalization component. This includes works within and adjacent to the existing channel. As noted in the Environmental Study Report, an Ecological Compensation Strategy is in development that will mitigate the loss of vegetation through on and off site compensation. In particular, during construction there will be some loss of forest/woodland within the valley. However, the project will re-establish native vegetation adjacent to the by-pass channel, which will contribute to a healthier ecosystem over the longer term. Additionally, a plan for restoration of riparian vegetation and shading of the By-pass channel is being developed as part of the Detail Design process.	No change required

5.2.3 Consultation with Relevant Agencies

The draft EA addendum was provided to CN Rail, Metrolinx, and the Region of Peel and the following comments were received:

Agency	Comment	Response	Required Change to Addendum
CN	Table 3.1 Please note that track monitoring will be required during construction	Acknowledged. The details of the monitoring will be developed during the review and approval of the push box culverts as per the design of alternative # 3.	Text has been added to paragraph above Table 3.1 to indicated that many of these issues will be
	Table 3.1 Please review requirement for 8 hour	Acknowledged. During the detailed design and development of staging plans effort to	

	workblocks. If work is completed from the field side shorter workblocks may be accommodated.	plan for the completion of the work from the field side.	addressed later in detailed design.
	Table 3.1 Does that mean there is night time construction?	There may be a need to schedule night time work if there is a net benefit to the community and the project in doing so.	
	Table 3.1 Please clarify – are tracks being removed for this work? Waterproofing and ballast mats should be completed prior to jacking?	No tracks will be removed for this work. Short duration traffic closures are needed during incremental jack / push operations which generally push the boxes forward 0.5m. The waterproofing will be placed on structure prior to jacking and a concrete slab / liner will placed over the waterproofing to protect the waterproofing during the jack / push operations. The ballast mats are completed following the installation of the boxes and during the removal of the proprietary horizontal track support system.	
	Section 4 Do we need track monitoring?	As a risk mitigation measure, track monitoring will be considered when developing the project specifications.	

Appendix A

Hydraulic Modelling of Canadian National Railway Alternatives

Version 0.1
July 12, 2023 Matrix 22062-522

Peter Midduagh, P.Eng.
AECOM CANADA LTD.
300 Water St.
Whitby, ON L1N 9J2

Subject: Hydraulic Modelling of Canadian National Railway Alternatives

Dear Peter Warburton:

1 INTRODUCTION

This letter report documents the one-dimensional (1D) MIKE HYDRO model that has been used to evaluate alternatives at the Canadian National Railway (CN) crossing and presents a comparison of water level results. A coupled 1D/two-dimensional (2D) MIKE FLOOD model, previously developed for the study area as part of the Phase 2 Feasibility Study (Matrix 2019), was used in the Downtown Brampton Flood Protection Environmental Assessment (DBFPEA; Matrix 2020) to evaluate environmental assessment (EA) alternatives. The model for the DBFPEA preferred alternative was used as baseline for this assessment. As the spill upstream of Church Street was mitigated in the EA preferred alternative (under the Regional storm), a 2D model was not required for this assessment. For more efficient model setup and run times, Matrix Solutions Inc. converted the MIKE FLOOD model to a 1D MIKE HYDRO model. The model boundary has been trimmed downstream of the CN crossing to focus on the study area.

The hydraulic suitability of four alternative designs for the CN crossing have been evaluated using the model. Brief descriptions of these alternatives follow and figures of each alternative are provided in Appendix A.

- Alternative 1 is similar to the flood conveyance solution proposed in the approved DBFPEA; however, during the evaluation process, the project team decided to change from circular culverts to box culverts due to less disruption in installation. The required grading limits to convey from the main channel through the three culverts are a similar footprint to the EA alternative.

- Alternative 2 is similar to Alternative 1, except instead of having all the culverts on the east side, two are on the east side and one is on the west side. This maintains the same additional hydraulic capacity but reduces the area of impact on the cemetery lands.

- Alternative 3 originally provided a new clear span opening that mirrors the existing CN crossing but would be located to the west of the existing crossing, thus avoiding the cemetery. Due to grading impacts to 30 James Street and extension disruption to CN operations during construction staging, this alternative was revised to include three box culverts on the west side instead.

- Alternative 4 replaces the existing CN crossing with a larger clear span based to the west to avoid the cemetery.

2 MODEL DEVELOPMENT

Prior to modelling the alternatives, a base 1D model was developed based on the DBFPEA preferred alternative model. The trimmed 1D model contains 229 cross-sections from 190 m upstream of Williams Parkway to approximately 100 m downstream of the CN crossing. The right channel bank was extended for cross-sections located upstream of Church Street through Central Public School Park to ensure the 1D model was appropriate and considered the existing conditions spill extent and the topography. Furthermore, the cross-sections from Church Street to the CN crossing were extended from 50 to 70 m to accommodate potential future channel alternatives in 1D. As per the previous modelling, a uniform Manning's *n* was applied for the concrete channel (from Church Street to the pedestrian bridge, approximately 40 m downstream of the CN crossing). For the extended cross-sections upstream of Church Street, the 1D floodplain Manning's *n* values were assigned based on a review of the coupled model's 2D Manning's *n* layer (0.05 and 0.08 for the banks). The remaining cross-sections have assigned Manning's *n* values of 0.035 for the main channel and 0.08 for the banks, consistent with the DBFPEA base model.

As per the previous model, inflow hydrographs are applied at the upstream boundary and at two lateral inflows locations at stations 3,288 m (Vodden Street) and 4,184 m (just upstream of Church Street). A new downstream boundary condition was added at station 4,818.41 m, based on the extracted Q-H relationship (discharge vs. water level) from the DBFPEA preferred alternative model (2-year through Regional plus climate change). The initial water level for all alternatives is assumed as 0.5 m.

To evaluate the CN crossing alternatives, the cross-sections from John Street to the pedestrian bridge downstream of the CN crossing are recut from the respective channel grading surface. The CN bridge and culvert configurations were modelled as the appropriate structure type (culvert or bridge) at station 4,719.73 m.

The CN alternatives were assessed for only the Regional storm at this time.

3 RESULTS

The resulting regional storm water levels of the four CN crossing alternatives are presented in Table 1 and are compared to the DBFPEA preferred alternative water levels at key locations. Alternative 4 was found to have the lowest water levels. An inventory sheet of each model scenario is provided in Appendix B.

TABLE 1 Water Level Comparison of CN Alternatives at Key locations

Bridge Location (Chainage [m])	Cross-section Location (Chainage [m])	Channel Invert (m)	Maximum Water Level at Cross-section (m)				
			DBFPEA Preferred Alternative	Alt 1	Alt 2	Alt 3	Alt 4
Church Street [4,195.78]	4,218.41	208.24	212.24	212.27	212.20	212.19	212.03
Scott Street [4,399.75]	4,388.41	207.93	212.06	212.11	212.00	211.99	211.77
Queen Street [4,553.61]	4,538.41	207.70	211.94	212.01	211.86	211.85	211.57
CN Crossing [4,719.73]	4,658.41	207.53	211.88	211.97	211.79	211.78	211.40

The water profile near the downstream end of the study area is as shown in Figure 1. Alternative 4 has the lowest water levels, whereas the other three alternatively closely match the DBFPEA preferred alternative.

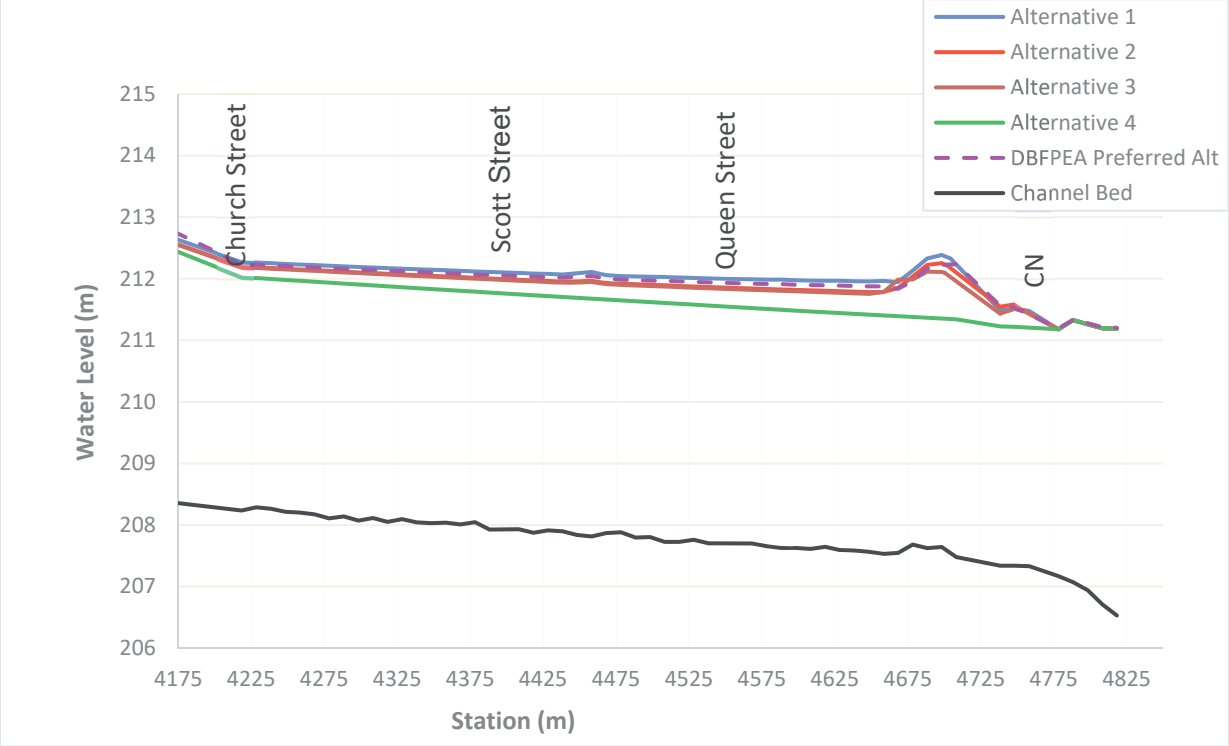


FIGURE 1 Water Level Profile Plot of CN Crossing Alternatives and DBFPEA Preferred Alternative

4 CLOSURE

We trust that this letter report suits your present requirements. If you have any questions or comments, please call either of the undersigned at 519.772.3777.

Yours truly,

MATRIX SOLUTIONS INC. **Reviewed by**

Daniel Okubay Tewolde, M.Sc., E.I.T.
Water Resources EIT

Natalie Burrows, M.A.Sc., P.Eng.
Water Resources Engineer

DOT/vc
Attachments

VERSION CONTROL

Version	Date	Issue Type	Filename	Description
0.1	12-July-2023	Draft	22062-522 Hydraulic Modeling CN Alternatives LR 2023-07-12 draft V0.1.docx	Issued to client for review

REFERENCES

Matrix Solutions Inc. (Matrix). 2020. *Downtown Brampton Flood Protection Environmental Assessment, Water Resources Engineering Technical Report*. Version 1.0. Prepared for Toronto and Region Conservation Authority. Guelph, Ontario. May 2020.

Matrix Solutions Inc. (Matrix). 2019. *Phase 2: Integrated Riverine and Urban Flood Risk Analysis*. Version 1.0. Prepared for The City Of Brampton. Guelph, Ontario. March 2019.

APPENDIX A
Drawings

DRAFT

LEGEND

- EXISTING LOT LINE
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING WATERMAIN
- 208.00 EXISTING CONTOUR (INTERVAL 1.0m)
- PROPOSED CHANNEL CENTERLINE
- BOTTOM OF PROPOSED CHANNEL
- 208.00 PROPOSED CONTOUR (INTERVAL 1.0m)
- PROPOSED LIMIT OF GRADING 2:1

1 : 300 metres
6 0 6 12
NAD UTM83-17

*Original drawing size: 36 inch by 24 inches

REFERENCE:
1. BASE INFORMATION DERIVED FROM GIS SHAPEFILES PROVIDED BY THE CITY OF BRAMPTON.
2. AERIAL IMAGE PROVIDED BY CITY OF BRAMPTON DATE: 2017.

REVISION					
A	2023-05-22	FOR DISCUSSION	KH	AM	KW
NO.	DATE	DESCRIPTION	BY	CHK.	DRN.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

CITY OF BRAMPTON
RIVERWALK

PROPOSED CHANNEL ALT1 BRIDGE

DATE	DESIGNED	PREPARED	REVIEWED
MAY 2023	K. HOFBAUER	A. McKAY	K. WELER
PROJECT	REVISION	SHEET	
220062	A	1-1	

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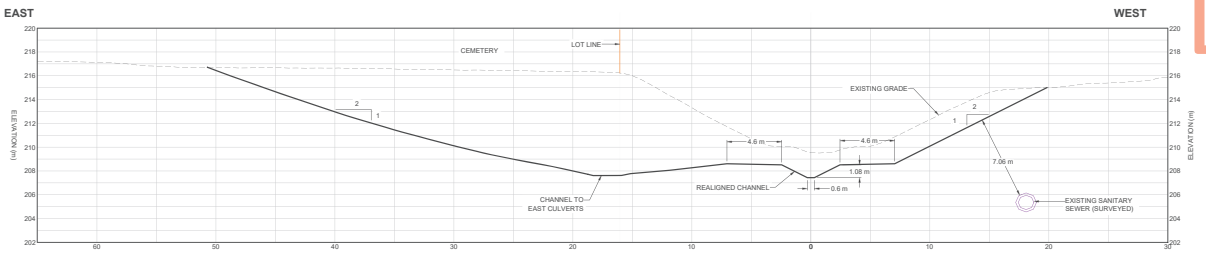
DRAFT



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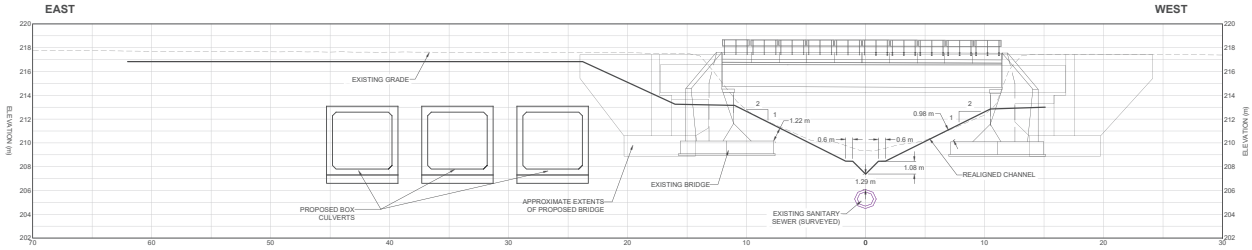

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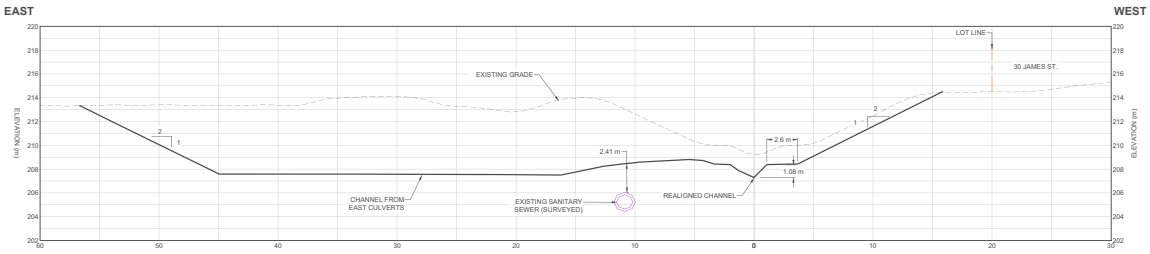

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REVISION					
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NO.	DATE	DESCRIPTION	BY	CHK	DRN

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

CITY OF BRAMPTON
RIVERWALK

PROPOSED SECTIONS
ALT1 BRIDGE

DATE	DESIGNED	PREPARED	REVIEWED
MAY 2023	K. HOFBAUER	A. McKAY	K. WELER
PROJECT	REVISION	SHEET	
220262	A	1-2	

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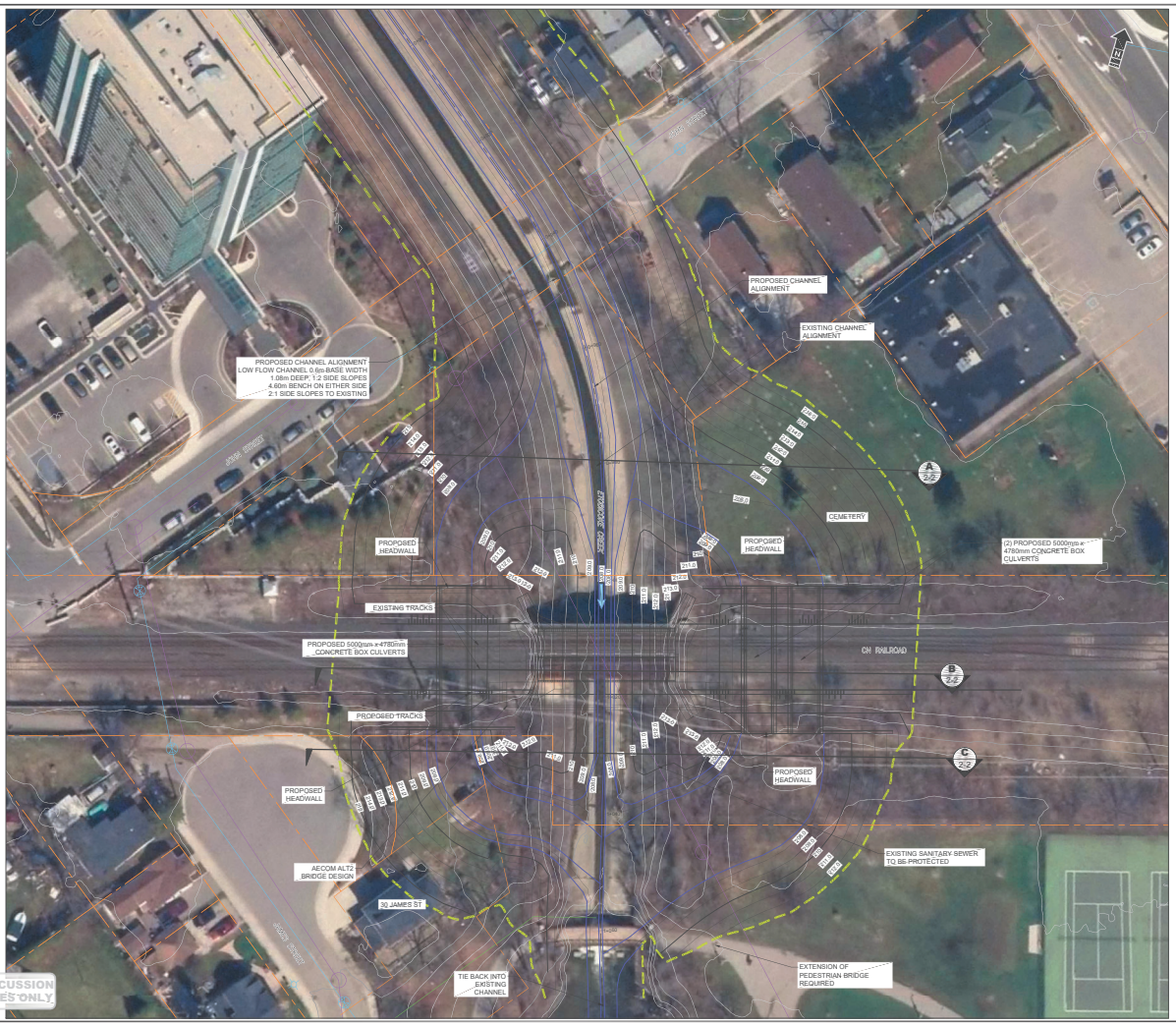

DRAFT

LEGEND

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- EXISTING STORM SEWER
- EXISTING WATERMAIN
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- BOTTOM OF PROPOSED CHANNEL
- 208.00 PROPOSED CONTOUR (INTERVAL 1.0m)
- PROPOSED LIMIT OF GRADING 2:1

1 : 300 metres
6 0 6 12
NAD UTM83-17

*Original drawing size: 36 inch by 24 inches

REFERENCE:
1. BASE INFORMATION DERIVED FROM GIS SHAPEFILES PROVIDED BY THE CITY OF BRAMPTON.
2. AERIAL IMAGE PROVIDED BY CITY OF BRAMPTON DATE: 2017.

REVISION					
NO.	DATE	DESCRIPTION	BY	CHK.	DRN.
A	2023-06-08	FOR DISCUSSION	KH	AM	KW

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

CITY OF BRAMPTON
RIVERWALK

PROPOSED CHANNEL ALT2 BRIDGE

DATE	RECHECKED	APPROVED	DESIGNED
MAY 2023	K. HOFBAUER	A. McKAY	K. WELER
PROJECT	REVISION	SHEET	
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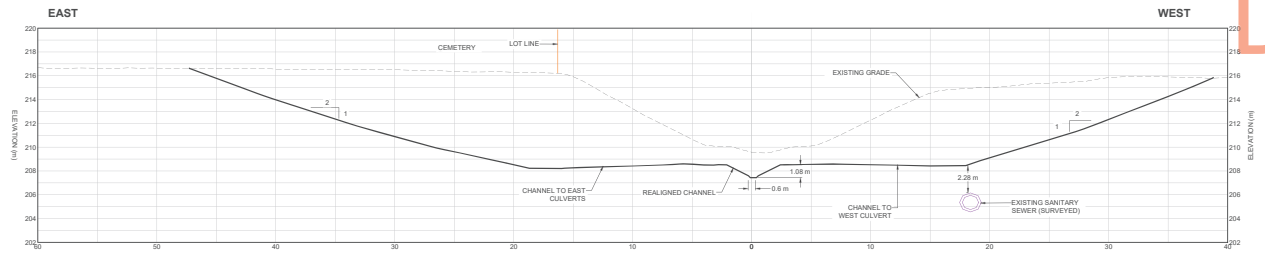
DRAFT



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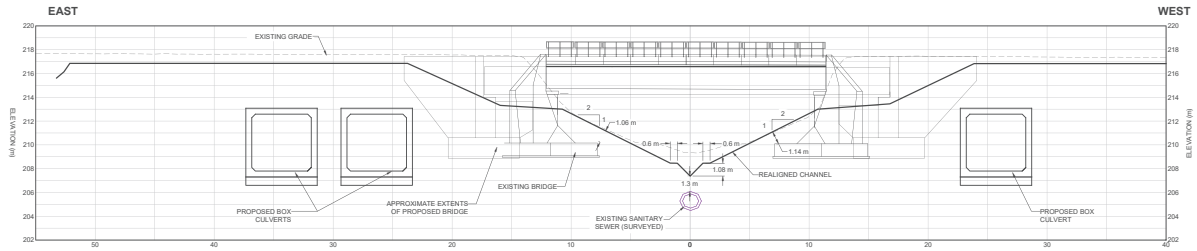

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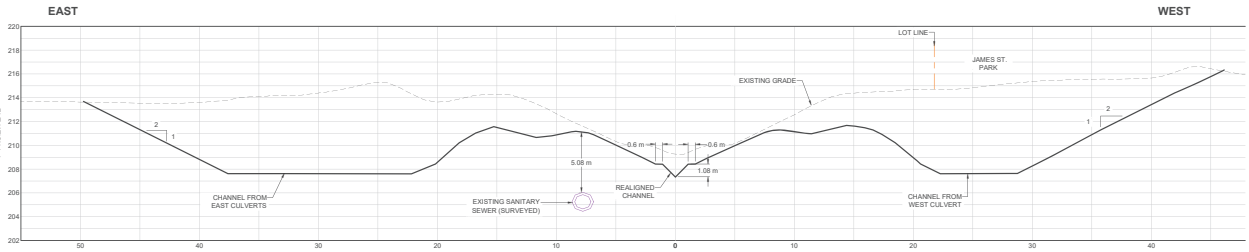

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REVISION					
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NO.	DATE	DESCRIPTION	BY	CHK	DRN

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

CITY OF BRAMPTON
RIVERWALK

PROPOSED SECTIONS
ALT2 BRIDGE

DATE	DESIGNED	DRAWN	CHECKED
MAY 2023	K. HOFBAUER	A. McKAY	K. WELER
PROJECT	REVISION	SHEET	
2/2062	A	2-2	

20 mm WHEN PRINTED ON ANSI D (24" x 36" (L)

DRAFT

FOR DISCUSSION PURPOSES ONLY

LEGEND

- EXISTING LOT LINE
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING WATERMAIN
- 208.00 EXISTING CONTOUR (INTERVAL 1.0m)
- PROPOSED CHANNEL CENTERLINE
- BOTTOM OF PROPOSED CHANNEL
- 208.00 PROPOSED CONTOUR (INTERVAL 1.0m)
- PROPOSED LIMIT OF GRADING 2:1

1 : 300 metres
6 0 6 12
NAD UTM83-17

Original drawing size: 36 inch by 24 inches

REFERENCE:
1. BASE INFORMATION DERIVED FROM GIS SHAPEFILES PROVIDED BY THE CITY OF BRAMPTON.
2. AERIAL IMAGE PROVIDED BY CITY OF BRAMPTON DATE: 2017.

REVISION					
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NO.	DATE	DESCRIPTION	BY	CHK.	DRN.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

CITY OF BRAMPTON
RIVERWALK

PROPOSED CHANNEL ALT3A BRIDGE

DATE	DESIGNED	PREPARED	REVIEWED
MAY 2023	K. HOFBAUER	A. McKAY	K. WELER
PROJECT	REVISION	SHEET	
22062	A	3A-1	

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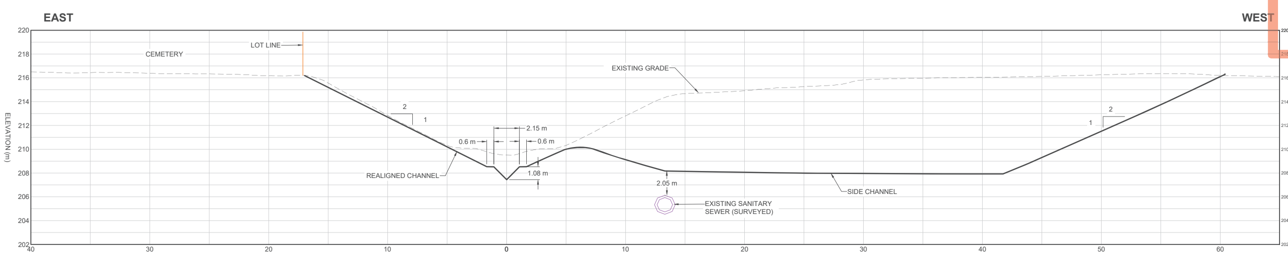

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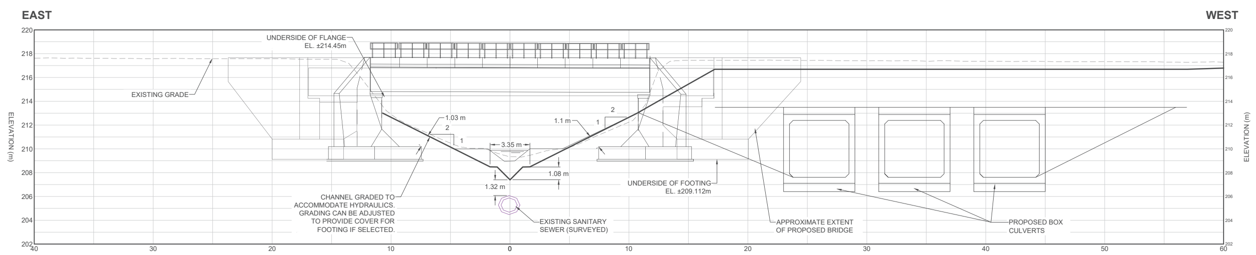

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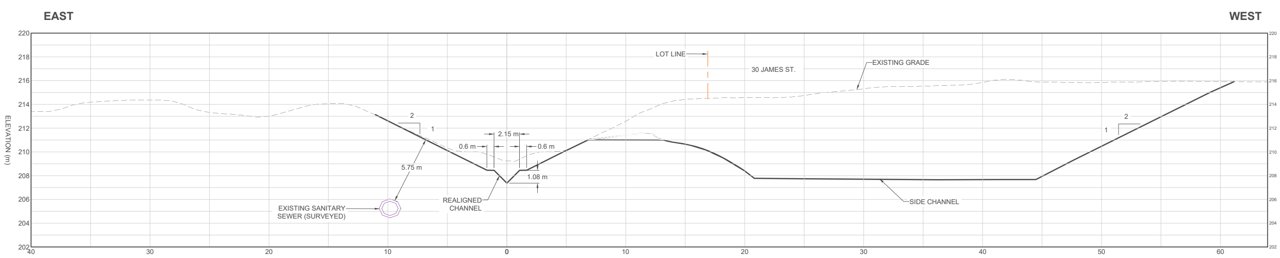

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REVISION					
A	2023-05-18	FOR DISCUSSION	KH	AM	KW
No.	DATE	DESCRIPTION	BY	CHK.	DRN.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

CITY OF BRAMPTON
RIVERWALK

PROPOSED SECTIONS
ALT3a BRIDGE

DATE: MAY 2023
TECHNICAL: K. HOFBAUER
REVIEWER: A. McKAY
DRAWN: K. WEILER
PROJECT: 22062
REVISION: A
SHEET: 3A-2

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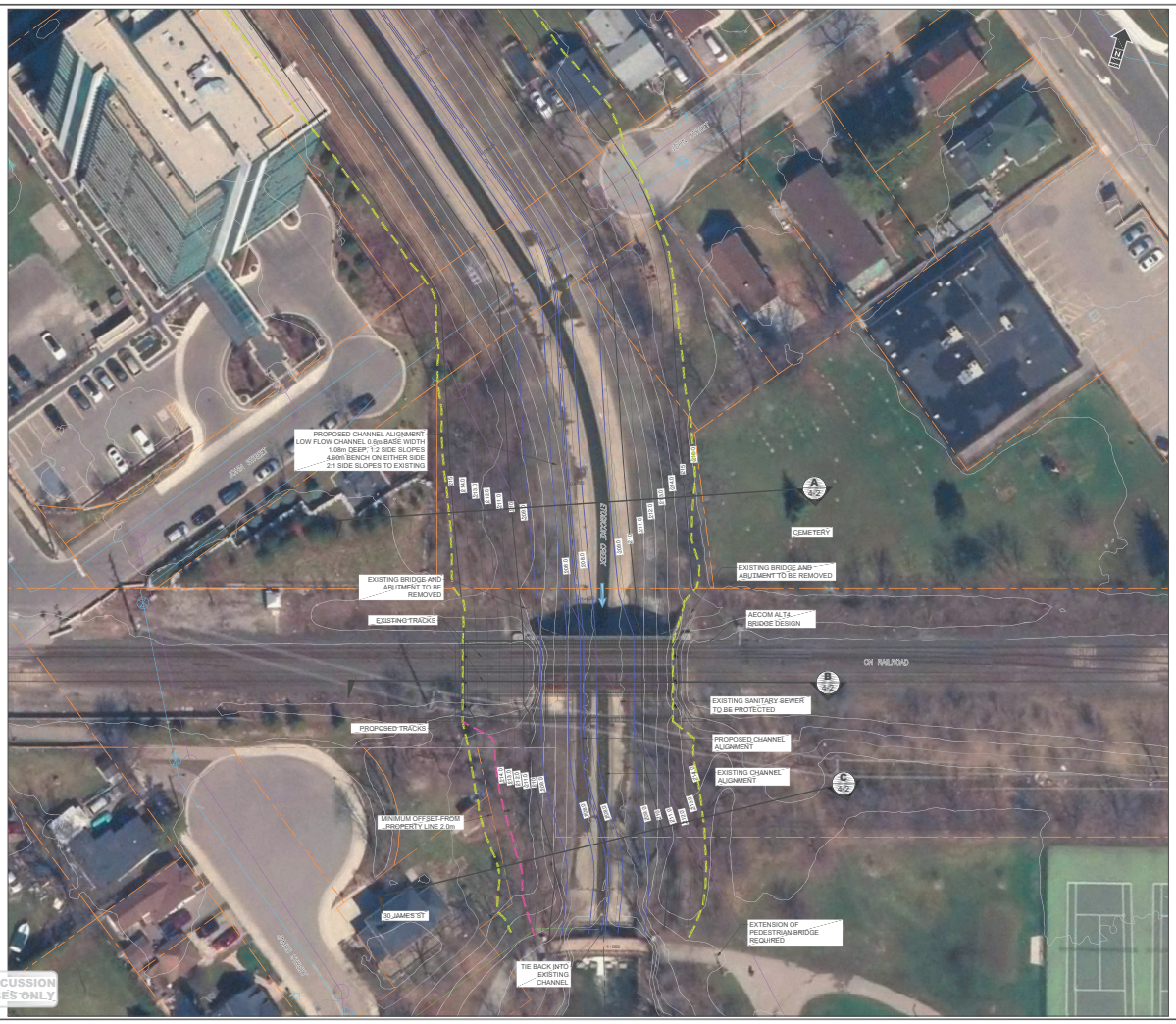

DRAFT

FOR DISCUSSION PURPOSES ONLY

LEGEND

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- EXISTING STORM SEWER
- EXISTING WATERMAIN
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- PROPOSED CHANNEL CENTERLINE
- BOTTOM OF PROPOSED CHANNEL
- 208.00 PROPOSED CONTOUR (INTERVAL 1.0m)
- PROPOSED LIMIT OF GRADING 2:1
- PROPOSED LIMIT OF GRADING 1.5:1

1 : 300 metres
6 0 6 12
NAD UTM83-17

*Original drawing size: 36 inch by 24 inches

REFERENCE:
1. BASE INFORMATION DERIVED FROM GIS SHAPEFILES PROVIDED BY THE CITY OF BRAMPTON.
2. AERIAL IMAGE PROVIDED BY CITY OF BRAMPTON DATE: 2017.

REVISION					
A	2023-05-18	FOR DISCUSSION	KH	AM	KW
NO.	DATE	DESCRIPTION	BY	CHK.	DRN.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

CITY OF BRAMPTON
RIVERWALK

PROPOSED CHANNEL ALT4 BRIDGE

DATE	DESIGNED	PREPARED	REVIEWED
MAY 2023	K. HOFBAUER	A. McKAY	K. WELER
PROJECT	REVISION	SHEET	
2/2062	A	4-1	

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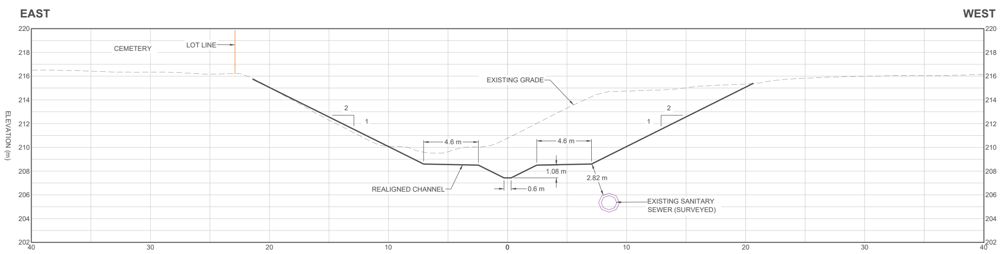
DRAFT



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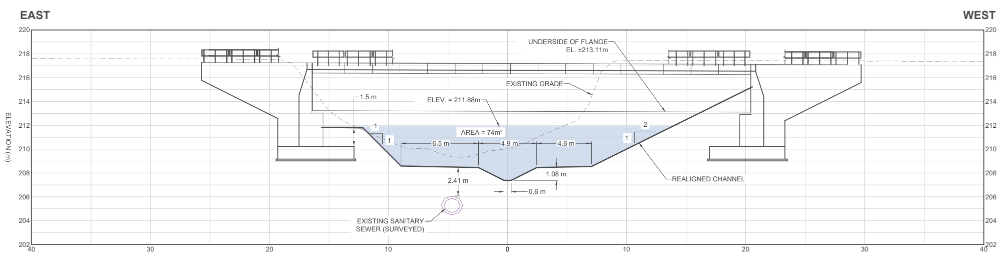

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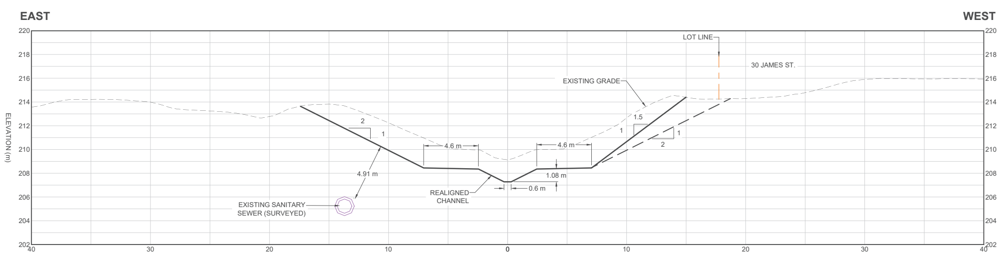

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FOR DISCUSSION PURPOSES ONLY

REVISION					
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No.	DATE	DESCRIPTION	BY	CHK.	DRN.

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

CITY OF BRAMPTON
RIVERWALK

PROPOSED SECTIONS
ALT4 BRIDGE

DATE	TECHNICAL	REVIEWER	DRAWN
MAY 2023	K. HOFBAUER	A. McKAY	K. WEILER
PROJECT 22062		REVISION A	SHEET 4-2

20 mm WHEN PRINTED ON ARCH D - 24" x 36" (L)

APPENDIX B
Model Inventory Sheets

MODEL INVENTORY SHEET

Matrix Solutions Inc.

PROJECT: 22062 RIVER WALK DETAILED DESIGN

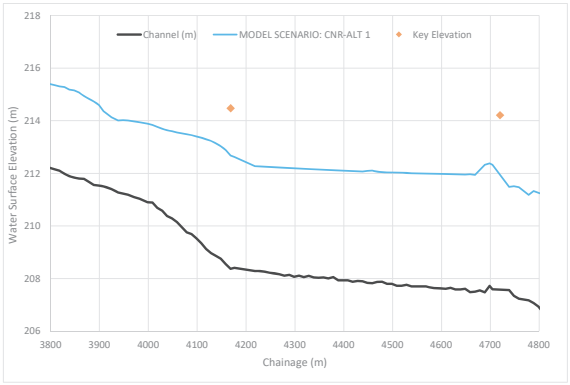
MODEL SCENARIO: CNR-ALT 1

Model Inputs

2D Files	File Name	Date
m21fm	NA	
Bathymetry	NA	
Resistance	NA	
Boundary Conditions	NA	
Output file	NA	
Other/Notes:	NA	

1D Files	File Name	Date
Hydro/River	CNR-Alt1.mhydro	2023-06-29
Cross Section File	CNR-Alt1.xns11	2023-06-29
Output file	NA_RegSS_Alt1_n013_1D.res1d	2023-06-29
Other inputs/Notes:		

Profile Plot



Scenario Notes

Modeller	Daniel Okubay Tewolde	Notes:
Run Date	2023-06-29	CNR-Alt1
Software Version	MIKE 2023	

Scenarios:

☐ 2yr ☐ 25yr ☐ 350yr

☐ 5yr ☐ 50yr ☑ Reg

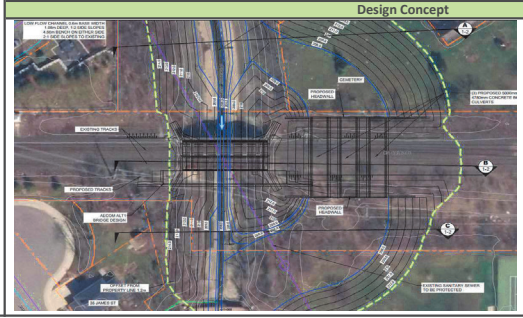
☐ 10yr ☐ 100yr ☐ Reg+CC

Structures/Key Locations

Location	Modelled	Scenario	Location	Key Elevation	Description	Upstream Cross-section	Upstream Water Level	Freeboard	Pass/ Fail
Upstream of Church			4168.41	214.47	Spill Elevation	4168.41	212.677	1.79	Pass
Church Street	☐		4195.78			4218.41	212.274		
Scott Screet	☐		4399.75			4388.41	212.110		
Queen Street	☐		4553.61			4538.41	212.006		
CN Rail	☑	Alt. 1	4719.73	214.21	Soffit	4658.41	211.965	2.25	Pass

Notes:
CN bridge and culvert based on Alternative 1 design. See attached May 2023 drawing (Revision A).
Cross-sections recut from Alternative 1 channel grading surface between John street and Pedestrian bridge downstream of CN Rail
Upstream rail cross-section stationing revised.

Design Concept



Roughness

Low Flow	0.013
Main Channel	0.013

Notes:

MODEL INVENTORY SHEET

Matrix Solutions Inc.

PROJECT: 22062 RIVER WALK DETAILED DESIGN

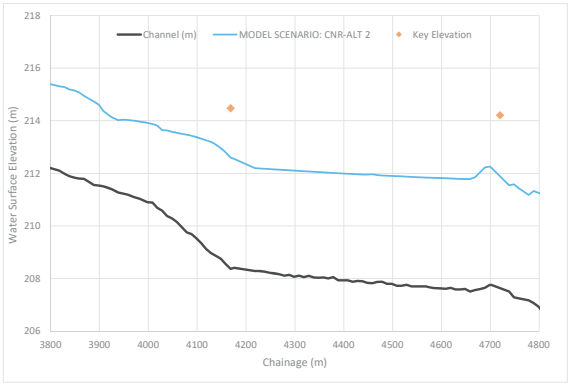
MODEL SCENARIO: CNR-ALT 2

Model Inputs

2D Files	File Name	Date
m21fm	NA	
Bathymetry	NA	
Resistance	NA	
Boundary Conditions	NA	
Output file	NA	
Other/Notes:	NA	

1D Files	File Name	Date
Hydro/River	CNR-Alt2.mhydro	2023-06-29
Cross Section File	CNR-Alt2.xns11	2023-06-29
Output file	NA_RegSS_Alt2_n013_1D.res1d	2023-06-29
Other inputs/Notes:		

Profile Plot



Scenario Notes

Modeller	Daniel Okubay Tewolde	Notes:
Run Date	2023-06-29	CNR-Alt2
Software Version	MIKE 2023	

Scenarios:

☐ 2yr ☐ 25yr ☐ 350yr

☐ 5yr ☐ 50yr ☑ Reg

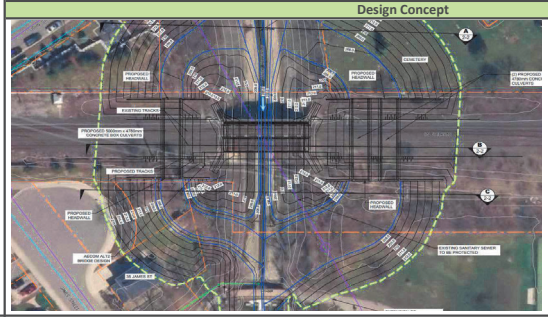
☐ 10yr ☐ 100yr ☐ Reg+CC

Structures/Key Locations

Location	Modelled	Scenario	Location	Key Elevation	Description	Upstream Cross-section	Upstream Water Level	Freeboard	Pass/ Fail
Upstream of Church			4168.41	214.47	Spill Elevation	4168.41	212.593	1.88	Pass
Church Street	☐		4195.78			4218.41	212.198		
Scott Screet	☐		4399.75			4388.41	212.004		
Queen Street	☐		4553.61			4538.41	211.864		
CN Rail	☑	Alt. 2	4719.73	214.21	Soffit	4658.41	211.785	2.43	Pass

Notes:
CN bridge and culvert based on Alternative 2 design. See attached June 2023 drawing (Revision A).
Cross-sections recut from Alternative 2 channel grading surface between John street and Pedestrian bridge downstream of CN Rail.
Upstream rail cross-section stationing revised.

Design Concept



Roughness

Low Flow	0.013
Main Channel	0.013

Notes:

MODEL INVENTORY SHEET

Matrix Solutions Inc.

PROJECT: 22062 RIVER WALK DETAILED DESIGN

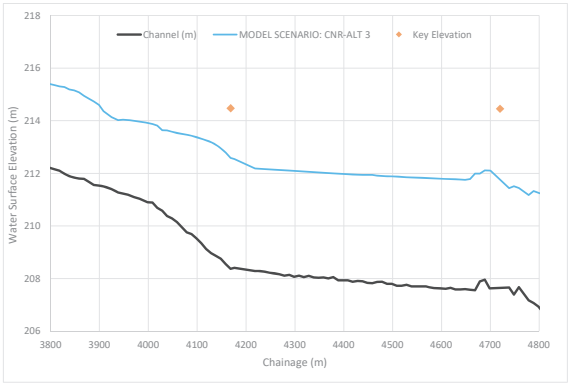
MODEL SCENARIO: CNR-ALT 3

Model Inputs

2D Files	File Name	Date
m21fm	NA	
Bathymetry	NA	
Resistance	NA	
Boundary Conditions	NA	
Output file	NA	
Other/Notes:	NA	

1D Files	File Name	Date
Hydro/River	CNR-Alt3.mhydro	2023-06-29
Cross Section File	CNR-Alt3.xns11	2023-06-29
Output file	NA_RegSS_Alt3_n013_1D.res1d	2023-06-29
Other inputs/Notes:		

Profile Plot



Scenario Notes

Modeller	Daniel Okubay Tewolde	Notes:
Run Date	2023-06-29	CNR-Alt3
Software Version	MIKE 2023	

Scenarios:

☐ 2yr ☐ 25yr ☐ 350yr

☐ 5yr ☐ 50yr ☑ Reg

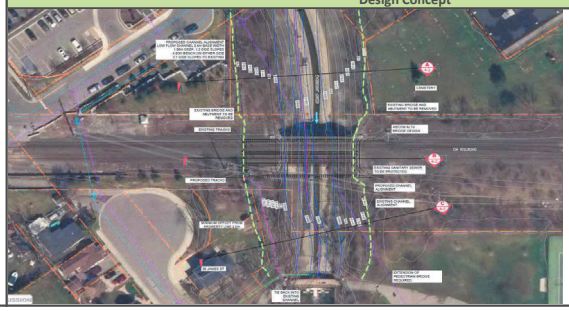
☐ 10yr ☐ 100yr ☐ Reg+CC

Structures/Key Locations

Location	Modelled	Scenario	Location	Key Elevation	Description	Upstream Cross-section	Upstream Water Level	Freeboard	Pass/ Fail
Upstream of Church			4168.41	214.47	Spill Elevation	4168.41	212.585	1.88	Pass
Church Street	☐		4195.78			4218.41	212.187		
Scott Screet	☐		4399.75			4388.41	211.989		
Queen Street	☐		4553.61			4538.41	211.845		
CN Rail	☑	Alt. 3	4719.73	214.45	Soffit	4658.41	211.783	2.67	Pass

Notes:
CN bridge and culvert based on Alternative 3 design. See attached June 2023 drawing (Revision A).
Cross-sections recut from Alternative 3 channel grading surface between John street and Pedestrian bridge downstream of CN Rail
Upstream rail cross-section stationing revised.

Design Concept



Roughness

Low Flow	0.013
Main Channel	0.013

Notes:

MODEL INVENTORY SHEET

Matrix Solutions Inc.

PROJECT: 22062 RIVER WALK DETAILED DESIGN

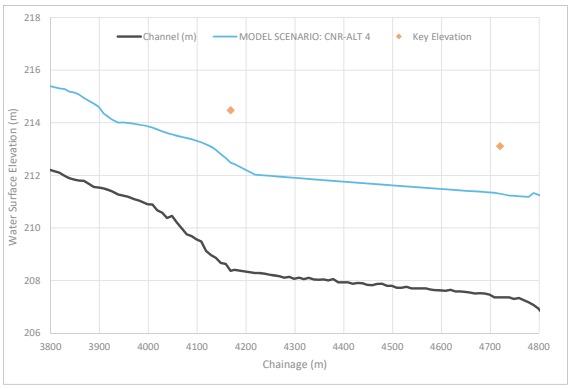
MODEL SCENARIO: CNR-ALT 4

Model Inputs

2D Files	File Name	Date
m21fm	NA	
Bathymetry	NA	
Resistance	NA	
Boundary Conditions	NA	
Output file	NA	
Other/Notes:	NA	

1D Files	File Name	Date
Hydro/River	CNR-Alt4-WideBrdg.mhydro	2023-06-29
Cross Section File	CNR-Alt4-WideBrdg.xns11	2023-06-29
Output file	NA_RegSS_CNR-Alt4-WideBrdg_n013_1D	2023-06-29
Other inputs/Notes:		

Profile Plot



Scenario Notes

Modeller	Daniel Okubay Tewolde	Notes:
Run Date	2023-06-29	CNR-Alt 4
Software Version	MIKE 2023	

Scenarios:

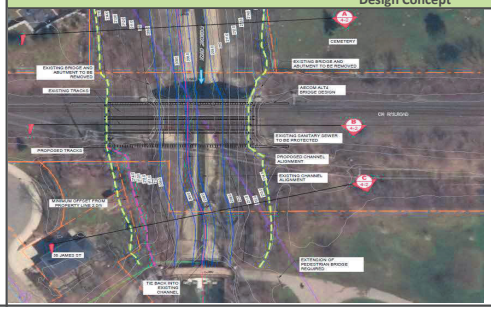
- ☐ 2yr
- ☐ 5yr
- ☐ 10yr
- ☐ 25yr
- ☐ 50yr
- ☐ 100yr
- ☐ 350yr
- ☑ Reg
- ☐ Reg+CC

Structures/Key Locations

Location	Modelled	Scenario	Location	Key Elevation	Description	Upstream Cross-section	Upstream Water Level	Freeboard	Pass/ Fail
Upstream of Church			4168.41	214.47	Spill Elevation	4168.41	212.482	1.99	Pass
Church Street	☐		4195.78			4218.41	212.026		
Scott Screet	☐		4399.75			4388.41	211.774		
Queen Street	☐		4553.61			4538.41	211.565		
CN Rail	☑	Alt. 4	4719.73	213.11	Soffit	4658.41	211.403	1.71	Pass

Notes:
CN bridge based on Alternative 4 design. See attached May 2023 drawing (Revision A).
Cross-sections recut from Alternative 4 channel grading surface between John street and Pedestrian bridge downstream of CN Rail

Design Concept



Roughness

Low Flow	0.013
Main Channel	0.013

Notes:
Notes:

P. Warburton, P.Eng.
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