Windsor Street Exchange

Functional Plan

Attachment D

Final Report

RFSQ 21-1113

CBCL HALIFAX

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May 1, 2024

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Mr. Donahoe:

RE: Windsor Street Exchange Functional Plan Report – FINAL

CBCL Limited (CBCL) is pleased to submit the Windsor Street Exchange Functional Plan Draft Report. This report summarizes the work undertaken by CBCL and HDR with HRM staff to confirm and refine the recommended reconfigurations options derived from the Value Engineering Workshop, improve confidence in the reconfiguration's ability to meet transportation objectives, and develop a workable 30% design.

Please do not hesitate to contact the undersigned if you have any questions regarding this report.

Yours very truly,

CBCL Limited

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Project No.: 231061.01

Contents

Tables

Figures

Appendices

1 Introduction

The "Windsor Street Exchange" or "WSE" area in North End Halifax functions as the fulcrum for multiple mobility systems across the Halifax region and the Beford Basin (as illustrated on Figure **1-1** and Figure **1-2**). The WSE is a node for several major transportation routes, including the MacKay Bridge, Highway 111, Highway 102/Highway 103, the Bedford Highway, and major arterial and collector roads on the Halifax Peninsula. It is home to commercial and industrial activity and serves as the primary access point to the Port of Halifax's Fairview Cove Container Terminal ("FCCT") and HRM's Mackintosh Depot.

Figure 1-1: WSE Area Context

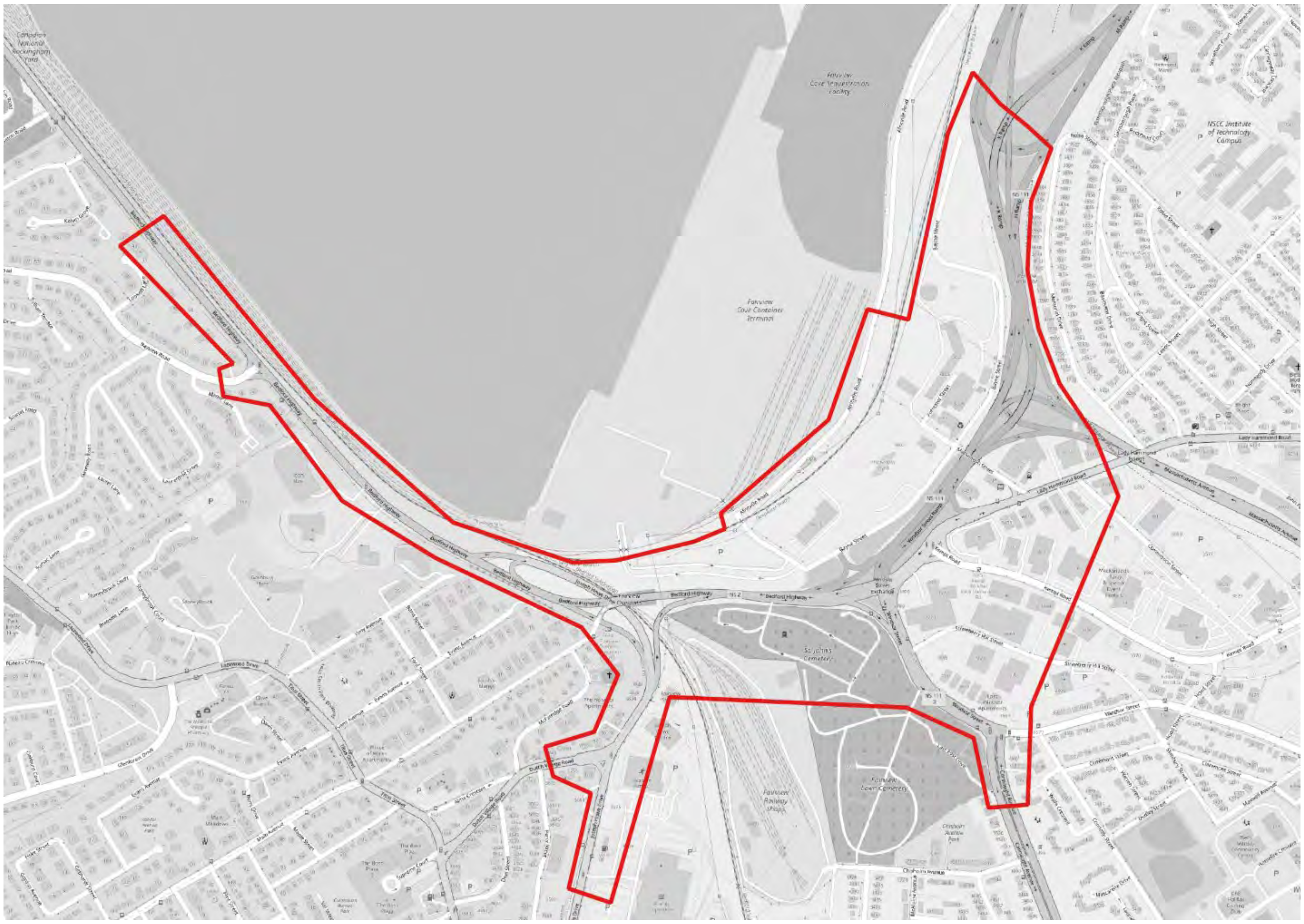


Figure 1-2: General WSE Area

To this role as a prime vehicular mover is added the need to accommodate expansion of local and rapid transit services, as well as improved Active Transportation linkages within the framework of HRM's Integrated Mobility Plan. These dynamics translate to conditions of significant friction in all directions, the formation of severe bottlenecks in peak directions, and the creation of critical conflict points between the different users of the system. The WSE accommodates 90,000-110,000 vehicles per day, with approximately 48,000 vehicles transiting the Windsor Street intersection itself. This requirement has recently been accentuated by the announcement of the Strawberry Hill Growth Node development proposal, with at least 3,500 residential units planned.

This project is led by HRM and is a joint project with the Province of Nova Scotia and the Port of Halifax, which is receiving funding from the National Trade Corridors Fund administered by Transport Canada. The scope under this funding source involves reconfiguring the WSE to improve access to FCCT and increase the capacity of a key intersection in the regional transportation network to support a complementary project submitted by the Port of Halifax. The most recent efforts towards this critical reconfiguration began in March 2023, when HRM held a Value Engineering Workshop to assess the recommended option issued from the earlier Windsor Street Exchange Functional Design Study, carried out between 2021 and 2022, and develop alternative design options towards delivering the highest value to the project. The Workshop proposed multiple alternative design options, six of which were selected by HRM for additional evaluation and refinement. The Functional Plan is a milestone in the overall project timeline, illustrated on Figure 1-3.

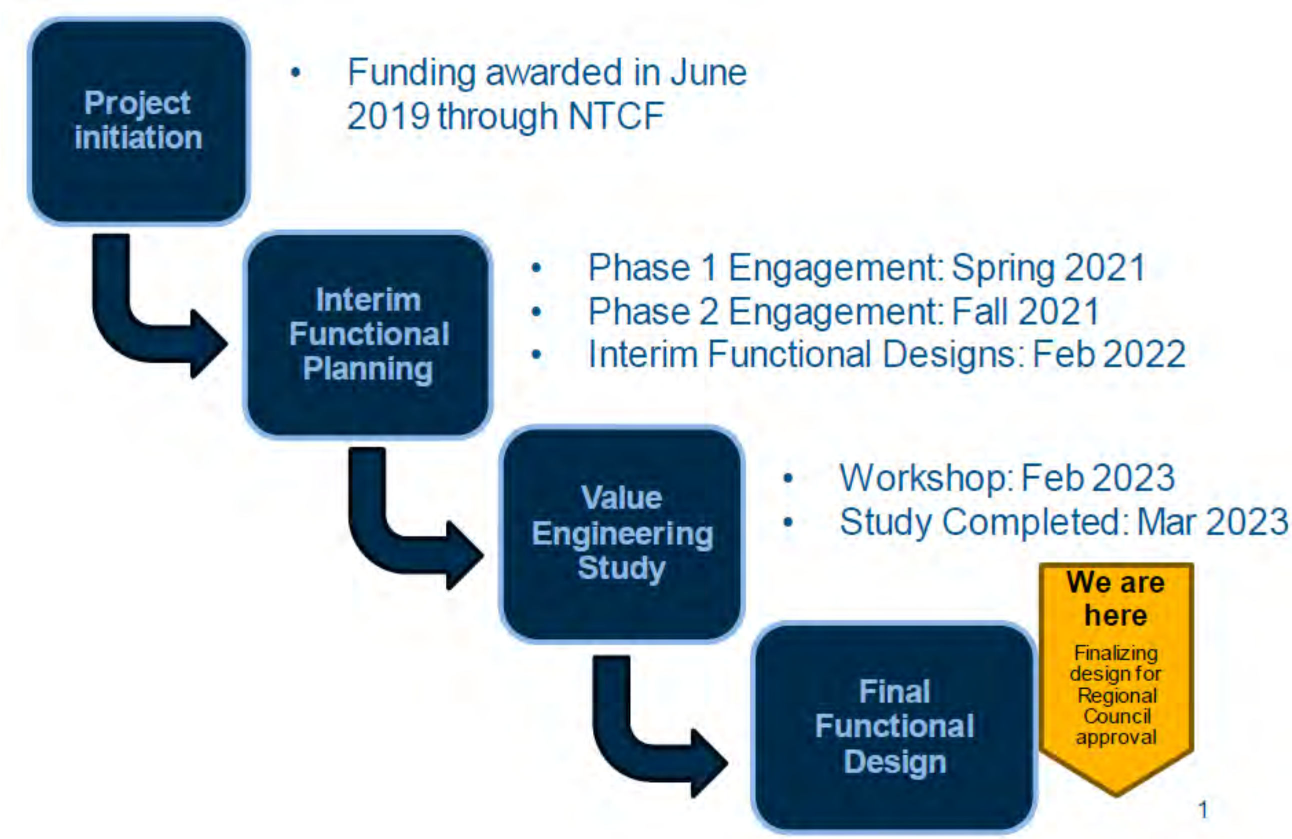


Figure 1-3: WSE Project Timeline

1.1 Study Objectives

Starting with the initiation and its funding agreement through NTCF, the project had seven key objectives, four of which are a results of the Transport Canada funding application:

1. Reduce congestion.*
2. Reduce collision frequency and severity.*
3. Reduce transit run-time variability.*
4. Reduce green house gas emissions.*
5. Improve safety for all road users.
6. Active transportation network connections.
7. Improve access to Africville museum.

Transport Canada funding requirement.

The Functional Plan addresses these objectives, and provides direct quantitative evidence derived from a comprehensive evaluation of vehicular volumes and delays. The methodology laid out below follows on the findings of the VE Workshop, and the requirements for additional traffic analysis set out at the Workshop's completion.

The six alternative design options shortlisted from the VE Workshop provide a balance in their combined ability to improve the WSE area's travel demand throughput, reduce overall multi-modal delays, reduce the number of movements contributing to vehicular collisions, improve active transportation facilities throughout the WSE area and to Africville, and generally improve transit service. Overall, these improvements lead to reduced greenhouse gas emission per capita, and incur tangible benefits.

Concurrently with this project, there are planned upgrades to Halifax Water's infrastructure, including the construction of a North End Feeder water main and a major sewer separation. These parallel projects will be incorporated into the overall WSE project but will only be briefly discussed in this Functional Plan Report.

1.2 Project Description

The intersection of Bedford Highway, Windsor Street and Lady Hammond Road is currently operating over capacity, leading to significant queuing and delays extending north on the Bedford Highway, especially during peak hours. The original project scope focused on this area; however during further assessment and traffic modeling during the development of the functional design options and the value engineering study, it was determined that travel through the WSE area was also significantly impacted by existing conditions at the Bedford Highway-Joseph Howe Interchange, and the exit from the MacKay Bridge towards Massachusetts Ave. The project scope has been expanded to include these areas as well. To this end, the 30% design is generally separated into three major intervention areas, as illustrated on Figure **1-4**. The 30% drawings are included in Appendix C.

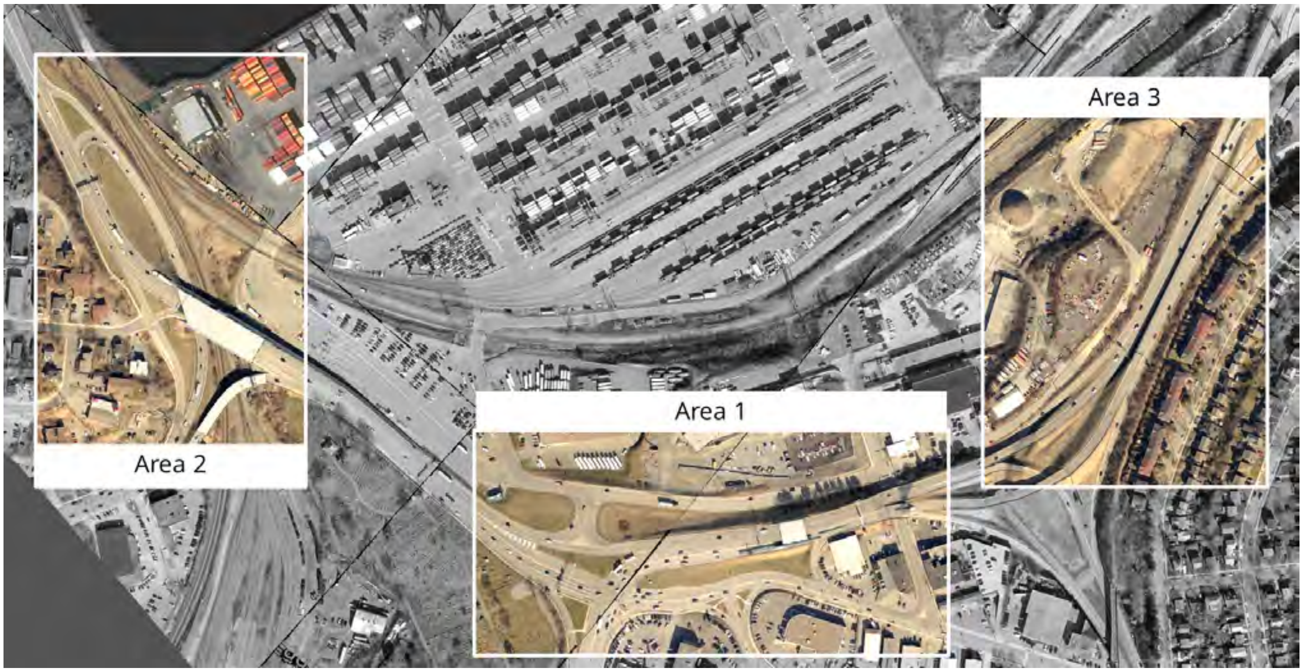


Figure 1-4:WSE Area Breakdown

1.2.1 Area 1

The core reconfiguration aspect of the WSE project involves realigning the Bedford Highway – Highway 111 eastbound (EB) lanes to match the westbound (WB) lanes in a free-flow configuration. This adjustment would eliminate the dual left turns currently required at the Windsor Street intersection. This change is illustrated on Figure 1-5.

In conjunction with improvements in Area 2 and Area 3, discussed below, an additional connection is necessary between Lady Hammond Road and Bayne Street, since the Mackintosh Street link alone does not have sufficient capacity and is constrained by existing structure. As represented in Figure **1-6**, a new underpass is therefore proposed, connecting Lady Hammond Street with Bayne Street, thus providing an additional pathway across the Bedford Highway / Highway 111 corridor. Together with Mackintosh Street, this underpass would provide a circular distributor system between Lady Hammond Road and Bayne Street to direct travelers originating in, or destined to the WSE area, towards to Bedford or MacKay Bridge gateways.

Figure 1-5: WSE Core Reconfiguration

Figure 1-6: New Connector

1.2.2 Area 2

In support of the core reconfiguration, the Project proposes to address capacity constraints on the Bedford Highway NB to Joseph Howe SB by adding a second lane to the Bedford Highway – Joseph Howe SB ramp (illustrated on Figure **1**-**7**). This expansion can be accommodated within the space under the Fairview Overpass retaining wall and pier.

South of the Fairview Overpass, the Project proposes adding an additional lane on the ramp from Main Avenue. This lane would facilitate northbound access from Joseph Howe to Bedford Highway eastbound to the west of the Fairview Overpass, via a new signalized intersection, as illustrated on Figure **1**-**8**.

To the east of the Fairview Overpass, the Project proposes introducing a signalized intersection to control access from the DVK ramp from Joseph Howe. Eastbound traffic from Bedford Highway towards the MacKay Bridge would remain free-flow through this signal. Simultaneously, the DVK ramp would be reconfigured to formalize the pavement to a single lane, and to convert the sidewalk to a 3.0m multi-use path.

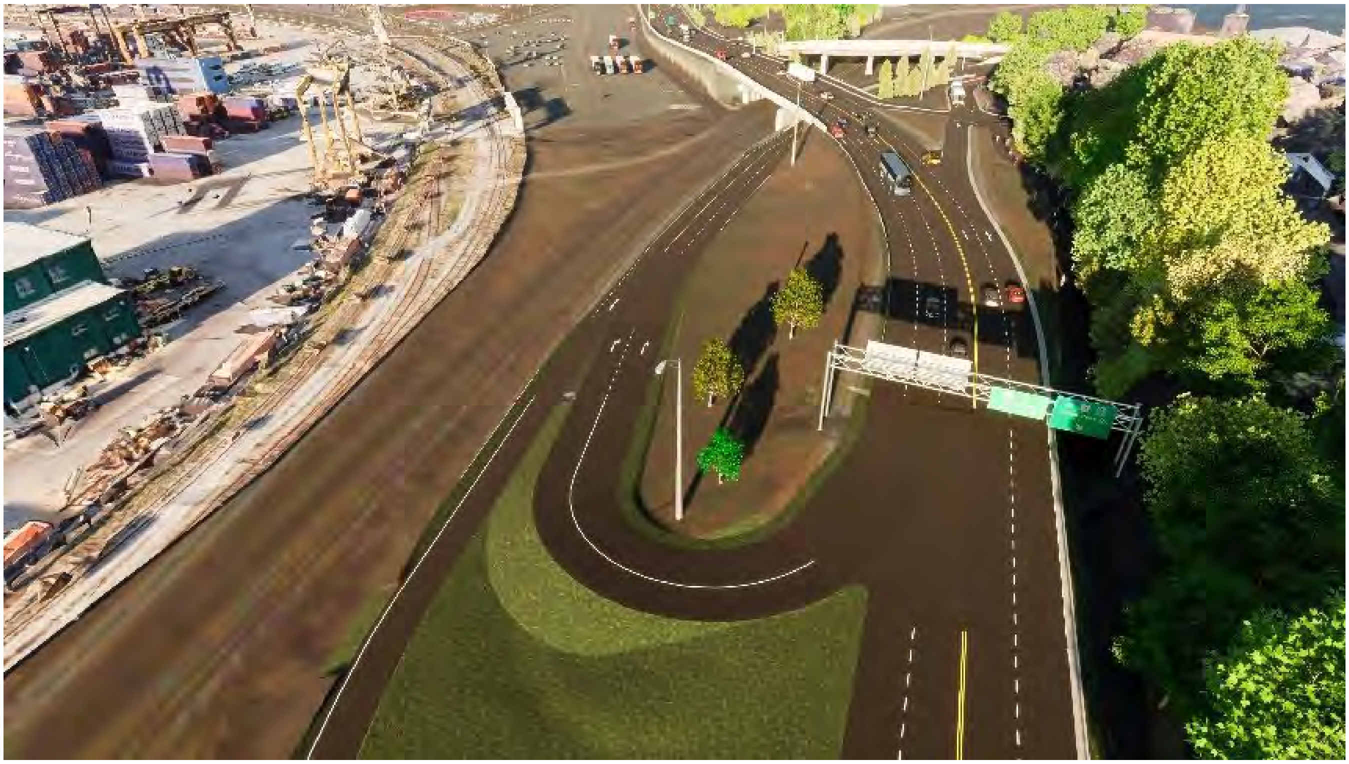


Figure 1-7: Joseph Howe Dual Ramp

Figure 1-8: Joseph Howe Displaced Left Turn and DVK Ramp Signal and Multi-Use Path

1.2.3 Area 3

To the east of the WSE area, an extension of Bayne Street would provide a direct exit from Barrington Street / MacKay Bridge to the WSE core area via a slip lane, as illustrated on Figure **1-9**. This is a modification of the option developed in the VE Workshop, in that the weaving area between Barrington Street and the MacKay Bridge ramps would be formalized to a 4-lane weaving section, with dual entry and exit lanes (see Figure **1-10**). Overall, this reconfiguration would direct travellers destined to the WSE node via Bayne Street, while keeping regional travellers destined to Joseph Howe and Bedford on the highway lanes.

Figure 1-9: Bayne Street Extension

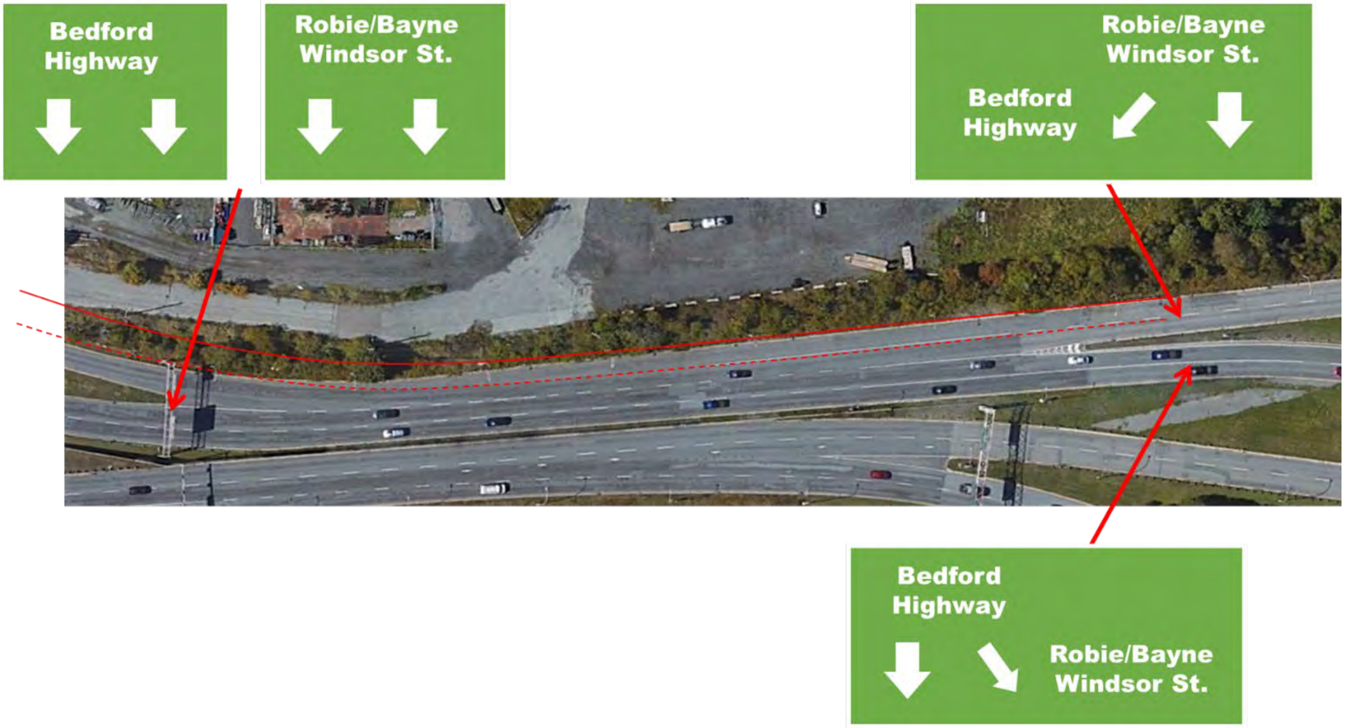


Figure 1-10: Barrington Street Weave

2 Methodology

The evaluation was conducted using a traffic modelling framework based on the PTV VISSIM microsimulation software. Traffic models are built to produce a robust analysis system that is not only capable of reproducing existing traffic patterns, but is able to reliably forecast future conditions, given changes to the transportation networks and travel demand.

Such modelling is concerned chiefly with two things: accurately estimating travel demand between two points of origin and destination, and selecting the fastest routes between these points under varying traffic conditions.

A microsimulation model breaks down all traffic generated in a Study Area into smaller, more manageable Traffic Analysis Zones (TAZ), each representing individual blocks, discrete land uses, or functional clusters such as the Port of Halifax Fairview Terminal. All traffic generated by these TAZ enters and exits a digital representation of the Study Area's road network via representative parking lots. Trips between TAZ are loaded onto the road network via Origin-Destination (O-D) matrices, that aggregate individual trips over a given analysis period. Through an iterative process, the model seeks optimal paths over the road network between each O-D pair based on initial travel times, assigns a portion of the total volume on the road network, simulates the movement of each vehicle and road user between TAZ of Origin and TAZ of Destination, and re-iterates the process with updated travel times. The process is repeated until the assignment process converges on an optimal solution. When successive iterations produce minimal change in travel times between all available paths, the network is considered to reflect Dynamic User Equilibrium, whereby road users cannot take any further action to reduce their travel time across the road network.

This methodology is outlined as follows:

- Divide the Study Area into operational TAZ.
- Build the Study Area road network in detail.
- Review seed O-D matrices extracted by HRM from the StreetLight Data analytics product;
- Review, compile and balance intersection Turning Movement Count data available for the Study Area, as illustrated on Figure 3-2, and summarized in Table 3-1.
- Factor the Street-Light Data O-D matrices to the total inbound and outbound volumes observed at the gateways to the Study Area, using a Furness doubly-constrained growth factoring method. The factoring was run for no more than 15-20 iterations, to ensure the underlying pattern of the O-D matrices was maintained, while achieving correct gateway volumes.

- Separate auto travel demand O-D matrices from commercial heavy truck demand, based on the StreetLight Data truck indices. Indices were factored to achieve correct truck volumes on the MacKay Bridge, as observed through bridge crossing data from HHB.
- Add bus transit PT routes and stops as static routes.
- Calibrate the microsimulation Dynamic Traffic Assignment procedure and road network parameters to reproduce existing traffic conditions as observed through turning movement counts (TMC) at key major intersections in the Study Area, and as seen during site visits. This entailed iteratively changing vehicle look-ahead parameters and driving behaviours to account for critical lane changes, merging and weaving actions.
- Validate the microsimulation model to travel times along the major roads, as extracted from the Google Maps API, through comparison with StreetLight Data average travel times between O-D pairs, and against direct observation.

Within this modelling framework, our overall methodology is broadly illustrated below.

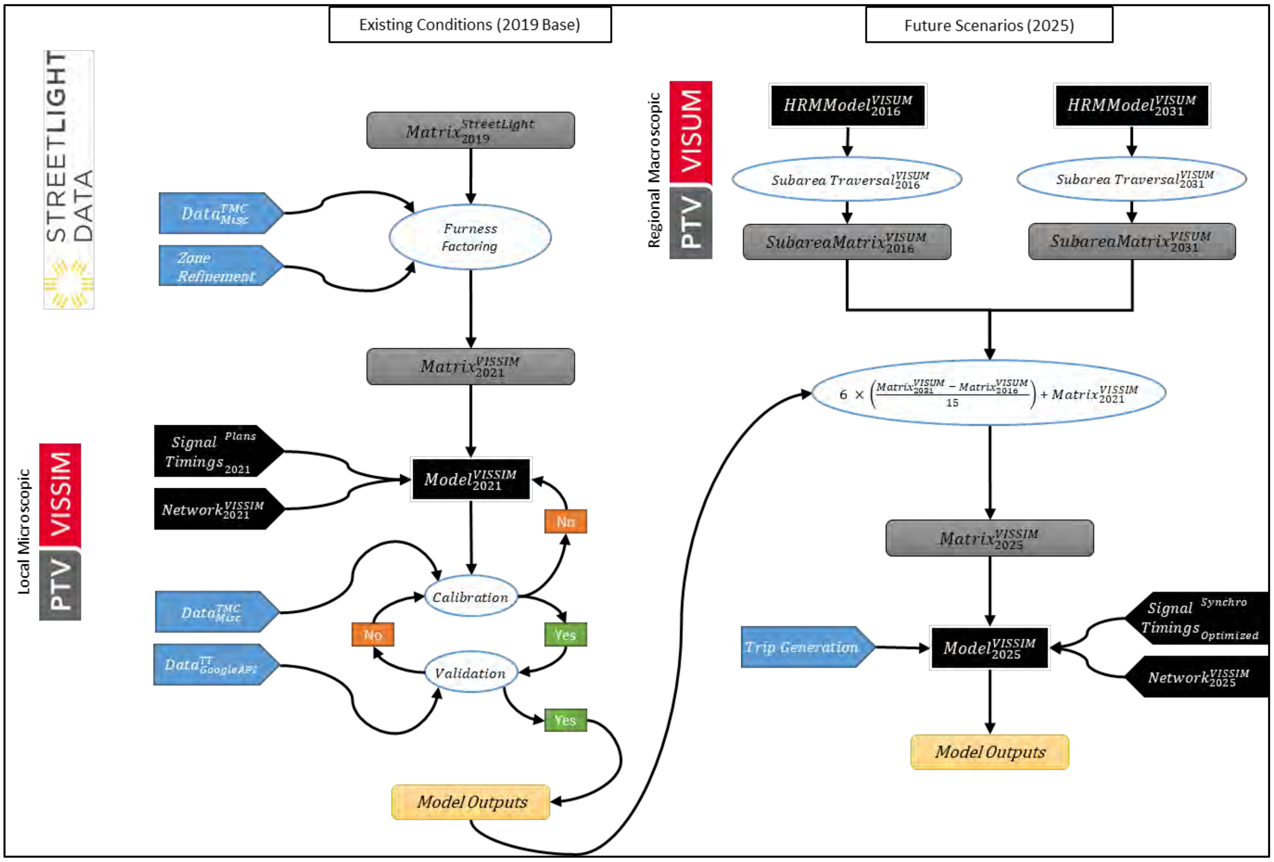


Figure 2-1: Modelling Framework Methodology

2.1 Microsimulation Model

The assessment evaluated conditions along road segments and intersections. To this end, CBCL conducted an in-depth analysis using a PTV VISSIM multi-modal traffic microsimulation model of the study area. The modelling approach simulates each individual vehicle, according to behavioural models, and intent. Vehicles (e.g., auto, trucks, bicycles, etc.) navigate the simulation environment between a point of origin and a destination point, seeking to find the shortest total travel time. In addition, Pedestrians and transit can also be effectively incorporated into the software.

The strength of this microsimulation software platform lies in its ability to accurately reproduce a road environment over a broader study area. It simulates each individual vehicle circulating on a complex surface, the movements of each vehicle at a very high-resolution, and the interaction between vehicles and pedestrians as they navigate through the study area. Potential traffic interactions in the nearby communities were incorporated to consider sensitive land uses along the road corridor (e.g., schools and places of worship).

The traffic simulation framework enabled the generation of a detailed travel demand profile for peak periods, accurately reflecting the fluctuations within both the peak hour and the adjacent shoulder periods. This approach produces a realistic loading of traffic on the road network instead of assuming a homogenous hourly demand (i.e., constant traffic demand over the peak period). The simulation provided a visual representation of complex multi-modal circulation onto an aerial map, which illustrates the dynamics of site circulation, wayfinding, conflict points, obstacles, and potential hazards.

2.2 Analysis Scenarios

The modelling exercise entailed a comparative analysis of WSE area network conditions under existing network conditions and travel demand, future no-build conditions with estimated future travel demand, and future conditions under different built scenarios, summarized in
Table **2-1**, and described in detail in Section 4.3.

Table 2-1: Analysis Scenarios

Road Network	Existing Demand	Future Demand
Existing Road Network	AM / PM peak hours	
Future No Build Road Network		AM / PM peak hours
Future Build Base Case Design with Alternative Options		AM / PM peak hours
Future Build Proposed Redesign		AM / PM peak hours

2.3 Analysis Procedure

The methodology used to conduct the traffic operational analysis is summarized as follows:

1. Divide the WSE area into Traffic Analysis Zones (TAZ) corresponding to the gateway links to/from the area.
2. Develop Origin-Demand matrices of all vehicular trips traversing the WSE area between the TAZ, for the weekday AM and PM peak hours.
3. Assess baseline Existing Conditions and identify existing capacity and operational constraints using the microsimulation model.
4. Estimate future vehicular traffic volumes based on growth derived from HRM's regional VISUM travel demand model.
5. Assess Future No-Build Conditions and identify capacity and operational constraints using the microsimulation model.
6. Modify the road network to reflect the proposed WSE reconfiguration option and evaluate Future Build Conditions using the microsimulation model and report on overall performance improvement and meeting of Project Objectives.

3 Model Preparation

3.1 Model Area

For the purposes of this study, the TAZ system consists entirely of gateway zones; the Strawberry Hill Growth Node and the Mackintosh Depot properties are also represented as gateways into the Study Area network. TAZ are numbered in sets of 100, according to cardinal directions; thus the northwestern zones are 100s, eastern zones are 200s, northern (Port) zones are 300s, and southern zones are 400s, as illustrated on Figure 3-1.

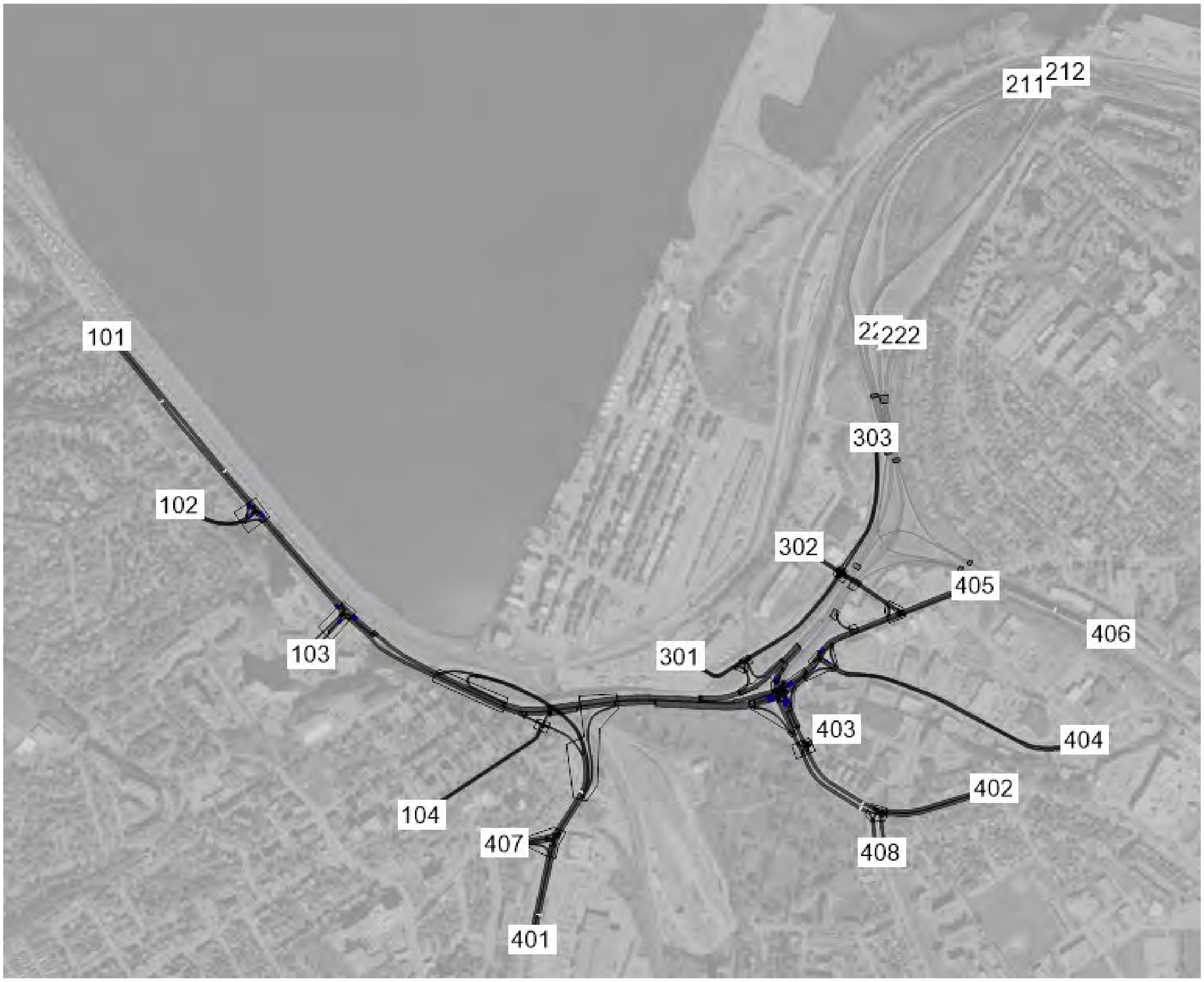


Figure 3-1: VISSIM Model TAZ System

3.2 Model Intersections

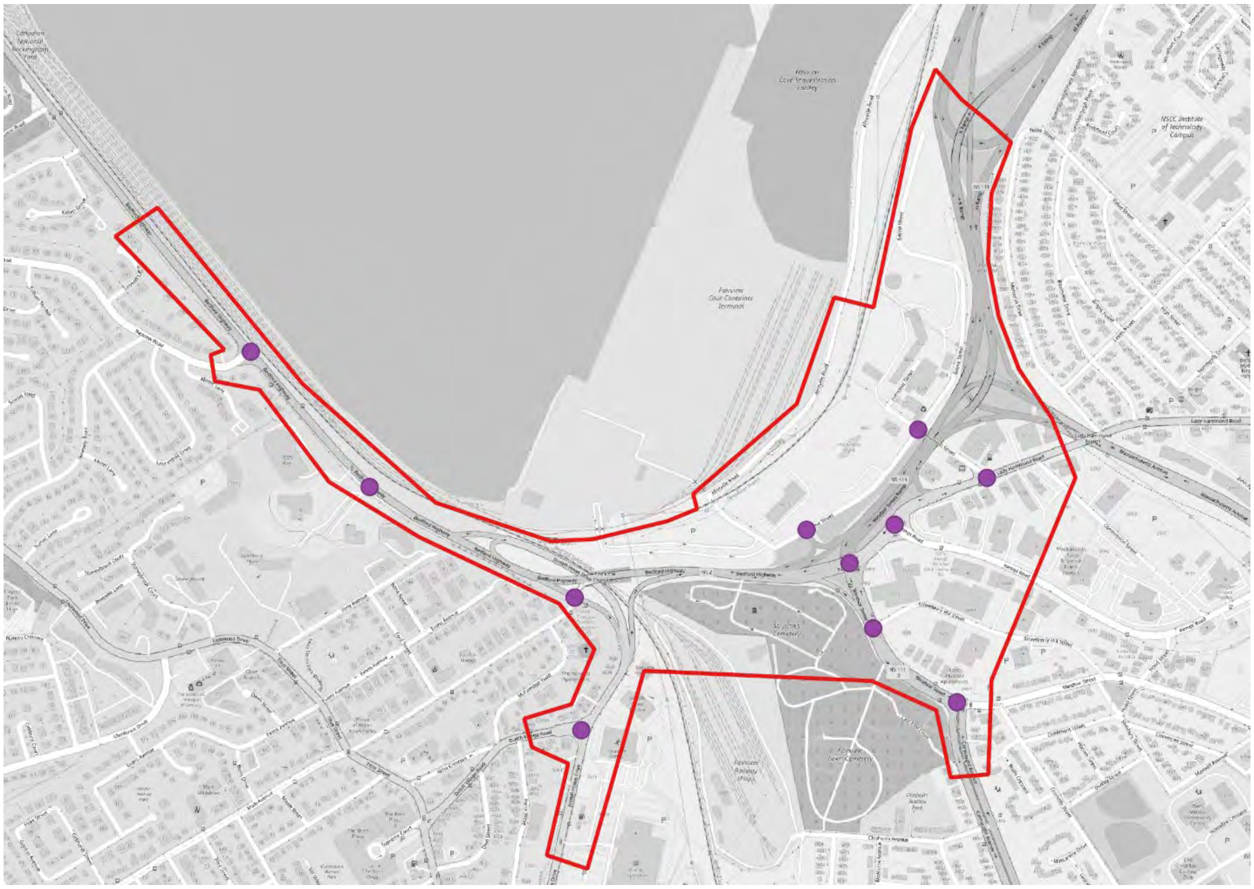


Figure 3-2: Study Area Intersections

Table 3-1: Study Area Intersections with TMC Data

Intersection ID	Intersection Name	Control Type
1	Bedford & Bayview	Signalized
2	Bedford & Dealership	Signalized
5	Bedford & Joseph Howe	Unsignalized
6	Bedford & Windsor	Signalized
8	Kempt & Lady Hammond	Signalized
9	Lady Hammond & Mackintosh	Unsignalized
12	Lady Hammond & Mackintosh	Signalized

The TMC data procured at these intersections comes from different years and seasons. They were therefore balanced to produce an approximation of a single snapshot of conditions across the Study Area. Balancing was based on the counts with the heavier volumes, and it produces conditions that may be heavier than what may now be considered as typical.

Balanced volume turn diagrams are provided in Appendix A.

3.3 Road Network Coding

The PTV VISSIM platform allows the modelling of complex transportation networks and travel patterns with very high fidelity. For the WSE Study Area, the road network was reproduced in VISSIM with all geometric and functional parameters reflecting reality. The road network includes current lane geometries, lane tapers, circulation signs, and traffic control devices. Public Transit routes were coded as routes on the network, based on Halifax Transit route maps. Speed limits were coded for each link according to speed limit signs, and the Study Area's five traffic signals were coded according to signal timing plans provided by HRM, and reviewed by CBCL.

The road network was built with behavioural controls (desired speeds, driving behaviour) consistent with the actual road classifications and posted speed limits (as summarized in Table 3-2).

Table 3-2: Summary of Study Area Highway Network

Name	Type	Posted Speed Limit (km/hr)
Bedford Highway	Arterial Road	70
Highway 111	Arterial Road	70
Barrington Street	Arterial Road	70
Windsor Street	Arterial Road	60
Joseph Howe Drive	Arterial Road	60
Lady Hammond Road	Arterial Road	60
Kempt Road	Collector Road	50
Bayne Street	Local	50
Mackintosh Street	Local	50

Public Transit services were coded into the road network with the following parameters:

- Existing Routes and schedules.
- Station dwell time 20s +/-5.
- Add BRT, assume no major changes to existing routes.
- Headways as per Rapid Transit Strategy.

3.4 Travel Demand

To develop a traffic model representative of existing vehicular volumes and travel patterns, the Project undertook a travel demand estimation exercise. The Project team considered several data sources that, in isolation, reflected different aspects of the WSE area circulation:

1. Multi-modal intersection turning movement counts at the major intersections summarized above, collected between 2017 and 2020.

2. Mobile device-based analytics from 2019 StreetLight Data Insights, providing the proportional distributions of all vehicular traffic between the WSE traffic zones, with estimates of zone-zone volumes and average travel times.
3. HRM Regional VISUM Travel Demand Model based on the future 2031 Rapid Transit Strategy.
4. Google Maps API, zone-zone typical, optimistic and pessimistic travel time estimates.

The travel demand estimation progressed as follows:

1. Compile traffic data provided by HRM, summarize for key intersections identified above and for gateway points into the model area (summarized via Turn Diagrams in Appendix A.
2. Review HRM VISUM Model subarea traversal matrices for the WSE area.
3. Review StreetLight Data insights (STL) – 2019 query yields 10,000-12,000 auto in AM/PM peak hours, double the volumes extracted from HRM VISUM model.
4. Factor STL matrices according to count data, using the Furness factor method.
5. Add Port truck traffic as separate matrices, as extracted from STL record.
6. Add bus transit PT routes and stops.

Under the baseline Existing conditions, the transportation network, as modeled, experiences a total traffic demand of over 9,350 vehicles during the weekday AM peak hour and over 11,600 vehicles during the PM peak hour, as detailed below.

3.4.1 AM Peak Hour

During the weekday AM peak hour, the Study Area is estimated to experience a volume of approximately 8,324 auto trips and approximately 600 heavy trucks, as summarized in

Table 3-3. Most of these trips occur between Bedford Highway, Massachusetts, and the MacKay Bridge.

Table 3-3: AM Peak Hour O-D Matrices

Auto AM	101	102	103	104	211	212	221	222	301	302	303	401	402	403	404	405	406	407	Total
101	0	35	11	10	0	0	368	234	12	0	0	150	213	6	105	250	119	55	1567
102	43	0	5	0	0	0	211	160	9	1	0	23	50	2	55	100	31	5	694
103	9	0	0	0	0	0	0	18	0	0	0	0	5	0	12	0	4	2	50
104	1	1	0	0	0	0	0	0	0	0	0	12	2	0	3	3	0	0	22
211	100	44	0	0	0	0	0	0	0	0	0	19	23	0	5	2	2	13	208
212	187	266	10	10	0	0	0	0	79	2	2	324	450	18	68	110	916	185	2628
221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
301	40	8	1	0	0	0	4	61	0	1	2	2	21	0	8	19	7	0	176
302	2	1	0	0	0	0	0	5	1	0	1	0	1	0	1	1	2	0	16
303	0	1	0	0	0	0	0	5	3	0	0	0	1	0	0	3	0	0	13
401	59	2	0	4	0	0	63	328	1	1	1	0	17	2	51	150	10	48	737
402	69	20	0	0	0	0	72	507	1	3	0	11	0	0	0	77	18	4	782
403	9	6	0	0	0	0	3	24	0	0	1	2	0	0	0	3	0	2	51
404	26	9	0	0	0	0	0	36	0	0	0	6	0	0	0	16	9	3	105
405	82	41	0	0	0	0	4	103	15	4	4	42	74	6	7	0	16	14	413
406	16	8	0	0	0	0	7	511	1	0	0	5	0	1	5	0	0	0	555
407	5	5	0	2	0	0	26	198	9	0	0	43	37	9	89	86	36	0	545
Total	649	447	27	27	0	0	759	2192	131	13	11	640	894	44	407	821	1170	333	8563

Truck AM	101	102	103	104	211	212	221	222	301	302	303	401	402	403	404	405	406	407	Total
101	0	1	0	1	2	0	12	9	7	0	0	2	9	1	3	4	3	1	55
102	2	0	0	0	0	0	0	7	0	0	0	0	1	0	1	2	0	0	13
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	1	4
211	6	0	0	0	0	0	1	0	2	0	0	4	1	0	0	0	1	0	15
212	14	14	0	0	0	0	0	3	12	3	1	60	32	2	5	9	71	17	243
221	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
222	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	3
301	5	0	0	1	0	1	1	13	0	0	0	7	5	1	3	7	2	3	49
302	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	3
303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401	3	0	0	0	1	1	4	37	8	1	0	0	3	0	3	4	2	1	68
402	6	0	0	1	0	0	2	22	6	0	0	1	0	1	2	5	1	2	49
403	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	3
404	1	0	0	0	0	0	0	1	1	0	0	1	2	1	0	2	1	1	11
405	3	1	0	1	0	0	1	7	9	1	0	2	8	1	2	0	1	2	39
406	6	1	0	0	0	0	0	28	1	0	0	1	1	0	1	1	0	2	42
407	1	0	0	0	0	0	1	18	1	0	0	2	4	0	4	6	1	0	38
Total	47	17	0	4	6	3	22	148	47	5	1	82	67	7	26	42	84	30	638

3.4.2 PM Peak Hour

During the weekday PM peak hour, the Study Area experiences a volume of over 9,850 auto trips and approximately 450 heavy trucks, as summarized on Table 3-4. The main contributors to trips remain the MacKay Bridge, Massachusetts, and Bedford Highway, albeit in the reverse direction from the AM peak hour.

Table 3-4: PM Peak Hour O-D Matrices

Auto PM	101	102	103	104	211	212	221	222	301	302	303	401	402	403	404	405	406	407	Total
101	0	119	26	8	0	0	163	160	6	0	1	50	84	9	51	75	12	150	912
102	51	0	4	0	0	0	74	212	5	0	0	9	15	9	36	57	4	6	483
103	30	8	0	0	0	0	8	22	0	0	0	0	0	0	0	3	0	0	70
104	2	0	0	0	0	0	0	7	0	0	0	14	0	0	1	0	0	2	26
211	389	156	3	0	0	0	0	0	10	9	4	105	58	0	13	0	31	87	867
212	259	341	8	4	0	0	0	0	10	0	4	314	425	7	25	50	450	193	2090
221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
301	139	60	0	1	0	0	10	143	0	0	7	77	26	4	0	35	1	83	586
302	4	0	0	0	0	0	0	0	3	0	0	5	2	0	0	5	0	0	18
303	4	0	0	0	0	0	0	0	0	8	0	2	0	0	0	5	0	0	20
401	135	12	1	1	0	0	46	370	21	0	1	0	22	7	40	64	8	194	925
402	198	52	6	1	0	0	49	551	13	0	2	11	0	0	0	49	3	28	962
403	12	8	0	0	0	0	2	23	1	0	0	1	0	0	0	2	0	4	52
404	87	43	0	0	0	0	4	37	0	6	0	21	0	0	0	21	7	38	265
405	258	127	8	1	0	0	12	178	103	24	9	59	94	3	14	0	4	90	984
406	169	53	2	1	0	0	31	1005	38	0	3	12	6	2	12	8	0	59	1402
407	11	5	0	1	0	0	18	139	2	0	0	58	19	6	44	44	9	0	357
Total	1748	984	58	19	0	0	416	2848	212	47	32	738	750	47	237	419	530	933	10019

Auto PM	101	102	103	104	211	212	221	222	301	302	303	401	402	403	404	405	406	407	Total
101	0	1	0	2	3	0	7	6	5	0	0	2	4	0	2	3	2	1	38
102	1	0	0	0	0	0	0	6	0	0	0	0	1	0	0	1	0	0	9
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
211	9	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	1	1	16
212	7	4	0	0	0	0	0	4	15	0	0	31	15	0	1	1	17	12	107
221	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
222	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
301	5	0	0	0	0	0	0	23	0	0	0	14	3	0	0	3	3	3	54
302	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	4
303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401	2	0	0	0	0	1	1	31	8	0	0	0	2	0	2	3	1	2	53
402	4	1	0	0	0	0	2	18	5	0	0	1	0	1	1	2	1	1	37
403	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
404	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	0	6
405	5	2	0	0	0	0	0	8	6	1	0	3	2	0	1	0	1	2	31
406	9	3	0	0	0	0	0	77	1	0	0	2	1	0	0	1	0	1	95
407	1	0	0	0	0	0	0	8	1	0	0	2	1	0	1	1	0	0	15
Total	44	11	0	2	3	1	10	184	41	1	0	62	31	1	9	18	27	23	468

3.5 Simulation Parameters

The traffic simulation exercise used VISSIM's Dynamic Traffic Assignment Module, with the following parameters:

- Load 30 minute seed and 1-hour demand matrices – Review TMC data to segment hourly volume into 15-minute slices to capture variation within the peak hour, add 15-minute tail.
- Distribute vehicle class according to TMC data (95% auto, 5% truck).

The model was run using the Dynamic User Equilibrium Traffic Assignment module (DTA). This entailed running the DTA path finding procedure, which searches for the quickest paths between each origin-destination pair. The procedure short-lists the 3 best paths, avoiding long detour options. Up to 50 iterations of the path finding procedure were run; the procedure searches for new paths each time, assigning the travel demand in small increments, repeating the process until the path finding convergences on a stable, optimal "equilibrium" solution to assign the complete travel demand.

We note that path selection parameters were constrained such that detouring paths between common nodes are excluded if they are 50% longer than the optimal path. This parameter allows for some random adjustment of paths over the peak hour, but generally keeps major flows together.

3.6 Model Calibration

Once the network was reviewed for connectivity, consistency and correct intersection and link operations, the calibration effort focused on reproducing actual travel patterns as observed through intersection Turning Movement Counts (TMC) at the intersections within the Study Area that had traffic count data.

A set of model calibration criteria were followed for this assignment, consistent with industry modelling standards. These criteria, illustrated below, follow two target sets:

- Ensuring that linear regression between observed and modelled volumes at intersections and on links is at least 90%.
- Ensuring that the relative difference between observed and modelled volumes for intersection turning movements falls within a GEH measure of 5-10 for most intersections. The GEH "Statistic" is an assessment formula named after its creator, Geoffrey E. Havers. It allows comparison of the relative differences between observed and modelled results, and is defined as:

$$GEH = \sqrt{\frac{2/M - C^2}{(M + C)}}$$

Where M is the modelled hourly volume, and C is the observed volume.

With path selection at equilibrium, 10 iterations of the model were run to extract turning movement volumes at key intersections, and travel times between gateway zones. This process entailed comparing modelled volumes to the count data; manually adjusting the matrices to produce more realistic movements at count locations, adjusting driver behaviour and road parameters, and re-running the DTA procedure until convergence was achieved. The process was repeated until the calibration criteria were met.

AM Peak Hour

Observation of link flows and individual OD paths along the model network found logical behaviour; not surprising as the Study Area road network consists of linear corridors, with no parallel paths.

The model was found to be well calibrated during the weekday AM Peak Hour. As illustrated in Figure 3-3, the model assignment produced an R2 of close to 98% for turn volumes. The model is balanced, with modelled volumes following the regression line closely on both sides with few outliers. Demands remain consistent and are not systemically over-estimated or underestimated. One outlier is observed, corresponding with the Joseph Howe Northbound DVK ramp, which fails to achieve the observed demand processing rates.

This discrepancy can be attributed to two factors. Firstly, although the ramp features a single lane, it is wide enough to function as a de facto two-lane road on the approach to Highway 111, thereby processing higher volumes than is strictly possible on a single lane. This geometry is not reproduced in the model, as the intent is to restrict such stacking in the future for safety reasons. Secondly, the ramp merging onto Highway 111 requires weaving between two heavy eastbound vehicular flows. This is often only possible through courtesy gaps and a high level of collaboration between lane-changing vehicles. This behaviour is not entirely captured by the simulator, which takes an all-or-nothing approach to movement priority.

Overall, the model accurately reproduces the observed conditions, with the most significant queues observed in the eastbound direction on Bedford Highway, and the northbound direction on Joseph Howe. Users on the road demonstrate high familiarity with the road network, with a preference for early lane changes leading to a marked lane imbalance in the utilization of road capacity.

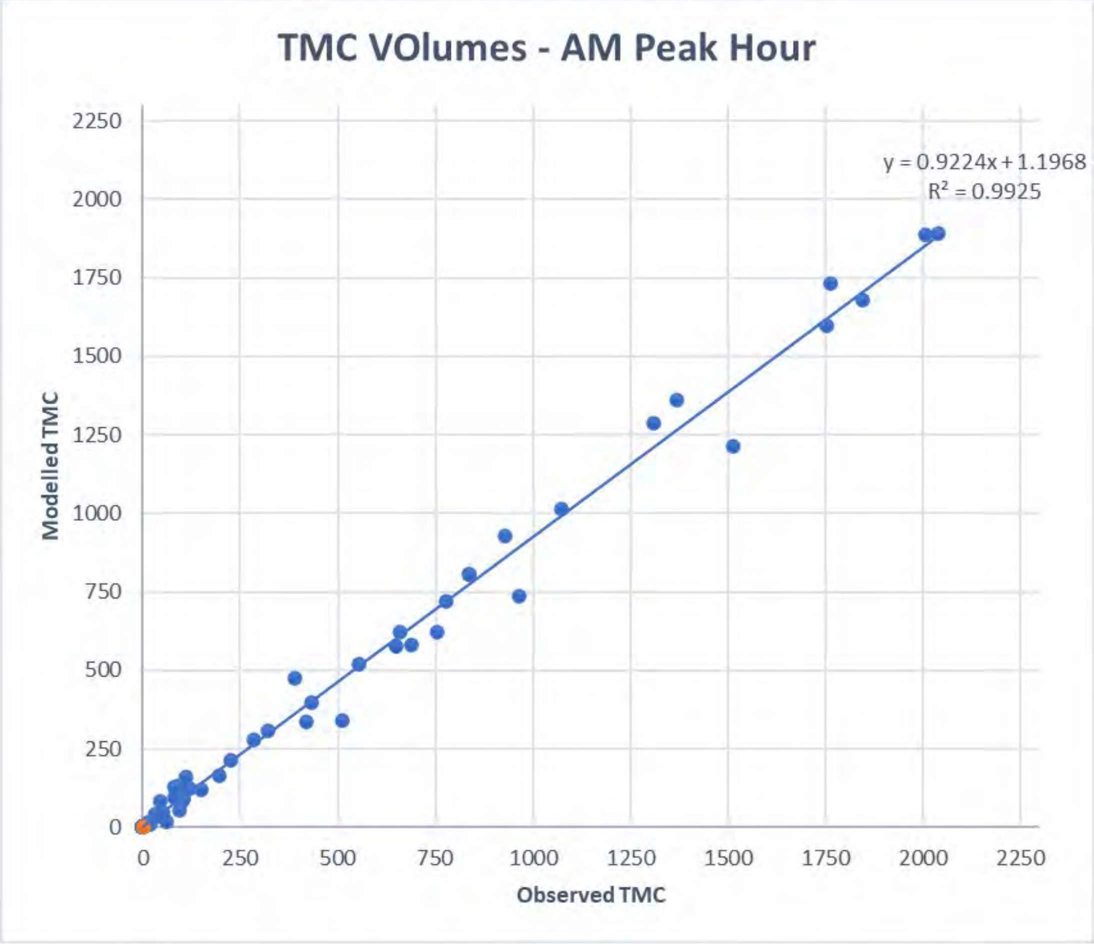


Figure 3-3: Turn Volume Calibration – AM Peak Hour

GEH analysis shows that 88% of turns have a GEH less than 5 exceeding the criteria threshold of 85%; almost all turns have a GEH less than 10, also exceeding the threshold of 95%. This was achieved equally well across the whole road network, demonstrating that the model overall produced reliable travel patterns across the entire Study Area, as summarized in Table 3-5.

AM Peak Hour	Modelled	Total	Modelled	Target	Check
Turns with GEH <=5	46	52	88%	85%	OK
Turns with GEH <=10	51	52	98%	95%	OK

Table 3-5: AM Peak Hour TMC Calibration Measures

Node	FromLink	ToLink	TurnCode	TMC AM	Modelled AM	% Diff AM	GEH AM
1	Bedford Highway SB	Basinview WB	101SBR	35	36	3%	0.2
1	Bedford Highway SB	Bedford Highway SB	101SBT	1370	1359	-1%	0.3
1	Basinview EB	Bedford Highway NB	101EBL	43	39	-9%	0.6
1	Basinview EB	Bedford Highway SB	101EBR	649	577	-11%	2.9
1	Bedford Highway NB	Basinview WB	101NBL	434	399	-8%	1.7
1	Bedford Highway NB	Bedford Highway NB	101NBT	658	620	-6%	1.5
2	Bedford Highway NB	Bedford Highway NB	102NBT	1074	1012	-6%	1.9
2	Dealership EB	Bedford Highway SB	102EBR	31	43	39%	2.0
2	Dealership EB	Bedford Highway NB	102EBL	18	8	-56%	2.8
2	Bedford Highway SB	Dealership WB	102SBR	11	15	36%	1.1
2	Bedford Highway SB	Bedford Highway SB	102SBT	2008	1887	-6%	2.7
3	Bedford Highway SB	Bedford Highway SB	103SBT	2039	1892	-7%	3.3
3	Bedford Highway NB	Bedford Highway NB	103NBT	928	926	0%	0.1
3	Bedford Highway NB	Joseph Howe Ramp EB	103NBR	837	806	-4%	1.1
3	Joseph Howe Ramp WB	Bedford Highway NB	103WBR	105	91	-13%	1.4
5	Bedford Highway EB	Bedford Highway EB	105EBT	1754	1597	-9%	3.8
5	Bedford Highway WB	Bedford Highway WB	105WBT	1765	1732	-2%	0.8
5	Bedford Highway EB	Joseph Howe SB	105EBR	285	281	-1%	0.2
5	Joseph Howe NB	Joseph Howe NB	105NBT	105	92	-12%	1.3
5	Joseph Howe NB	Bedford Highway EB	105NBR	1515	1212	-20%	8.2
5	Joseph Howe SB	Joseph Howe SB	105SBT	837	804	-4%	1.2
6	Bedford Highway EB	Windsor NB	106EBL	1845	1679	-9%	4.0
6	Bedford Highway EB	Lady Hammond EB	106EBT	965	738	-24%	7.8
6	Bedford Highway EB	Windsor SB	106EBR	510	339	-34%	8.3
6	Windsor SB	Windsor SB	106SBT	390	473	21%	4.0
6	Windsor NB	Windsor NB	106NBT	555	521	-6%	1.5
6	Windsor NB	Lady Hammond EB	106NBR	100	85	-15%	1.6
6	Windsor NB	Bedford Highway WB	106NBL	150	120	-20%	2.6
6	Lady Hammond WB	Bedford Highway WB	106WBT	195	165	-15%	2.2
6	Lady Hammond WB	Windsor SB	106WBL	80	96	20%	1.7
7	Bayne Ramp SB	Bedford Highway WB	107SBR	110	160	45%	4.3
7	Hwy 111 WB	Bayne Ramp NB	107WBR	90	132	47%	4.0
7	Hwy 111 WB	Bedford Highway WB	107WBT	1310	1288	-2%	0.6
8	Kempt NB	Lady Hammond EB	108NBR	60	18	-70%	6.7
8	Kempt NB	Lady Hammond WB	108NBL	50	48	-4%	0.3
8	Lady Hammond EB	Kempt SB	108EBR	420	335	-20%	4.4
8	Lady Hammond EB	Lady Hammond EB	108EBT	755	620	-18%	5.1
8	Lady Hammond WB	Kempt SB	108WBL	20	17	-15%	0.7
8	Lady Hammond WB	Lady Hammond WB	108WBT	225	214	-5%	0.7
9	Lady Hammond WB	MacKintosh NB	109WBR	120	123	3%	0.3
9	Lady Hammond WB	Lady Hammond WB	109WBT	320	309	-3%	0.6
9	Lady Hammond EB	MacKintosh NB	109EBL	95	55	-42%	4.6
9	Lady Hammond EB	Lady Hammond EB	109EBT	690	582	-16%	4.3
9	MacKintosh SB	Lady Hammond WB	109SBR	80	126	58%	4.5
9	MacKintosh SB	Lady Hammond EB	109SBL	45	82	82%	4.6
12	Joseph Howe SB	Joseph Howe SB	112SBT	776	720	-7%	2.0
12	Joseph Howe SB	Dutch Village Road WB	112SBR	346	370	7%	1.3
12	Joseph Howe NB	Joseph Howe NB	112NBT	920	914	-1%	0.2
12	Joseph Howe NB	Dutch Village Road WB	112NBL	48	44	-8%	0.6
12	Dutch Village Road EB	Joseph Howe SB	112EBR	43	21	-51%	3.9
12	Dutch Village Road EB	Joseph Howe NB	112EBL	700	394	-44%	13.1

PM Peak Hour

The PM peak hour model was also well calibrated, as illustrated in Figure 3-4, with Linear Regression R2 very strong, close to 100%. Queues were produced as expected, with the major flows destined to Bedford Highway north.

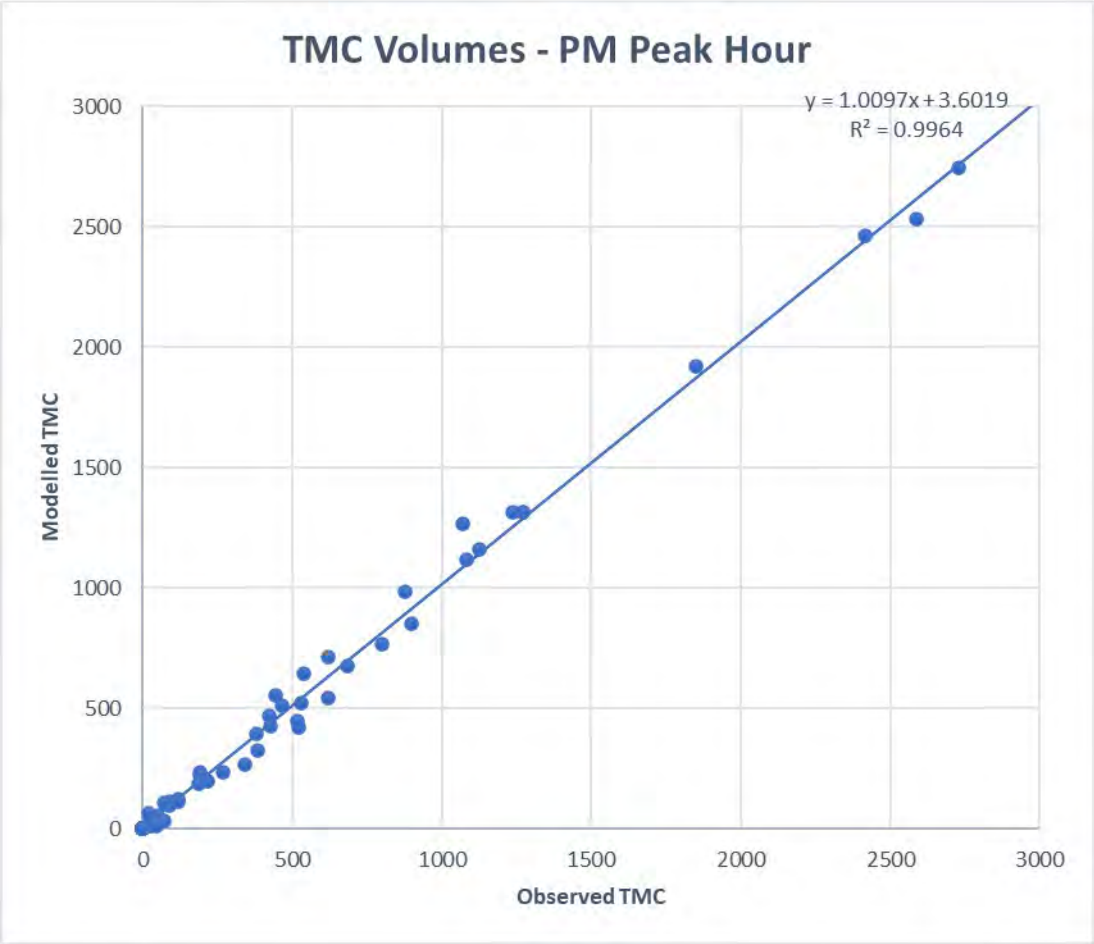


Figure 3-4: Turn Volume Calibration - PM Peak Hour

The model meets the GEH calibration criteria for most of the intersection turns.

AM Peak Hour	Modelled	Total	Modelled	Target	Check
Turns with GEH <=5	47	52	90%	85%	OK
Turns with GEH <=10	52	52	100%	95%	OK

Table 3-6: PM Peak Hour TMC Calibration Measures

Node	FromLink	ToLink	TurnCode	TMC PM	Modelled PM	% Diff PM	GEH PM
1	Bedford Highway SB	Basinview WB	101SBR	119	124	4%	0.5
1	Bedford Highway SB	Bedford Highway SB	101SBT	685	678	-1%	0.3
1	Basinview EB	Bedford Highway NB	101EBL	51	52	2%	0.1
1	Basinview EB	Bedford Highway SB	101EBR	424	469	11%	2.1
1	Bedford Highway NB	Basinview WB	101NBL	900	853	-5%	1.6
1	Bedford Highway NB	Bedford Highway NB	101NBT	1851	1922	4%	1.6
2	Bedford Highway NB	Bedford Highway NB	102NBT	2727	2749	1%	0.4
2	Dealership EB	Bedford Highway SB	102EBR	42	43	2%	0.2
2	Dealership EB	Bedford Highway NB	102EBL	24	25	4%	0.2
2	Bedford Highway SB	Dealership WB	102SBR	26	31	19%	0.9
2	Bedford Highway SB	Bedford Highway SB	102SBT	1083	1119	3%	1.1
3	Bedford Highway SB	Bedford Highway SB	103SBT	1125	1160	3%	1.0
3	Bedford Highway NB	Bedford Highway NB	103NBT	2588	2533	-2%	1.1
3	Bedford Highway NB	Joseph Howe Ramp EB	103NBR	1272	1313	3%	1.1
3	Joseph Howe Ramp WB	Bedford Highway NB	103WBR	191	234	23%	2.9
5	Bedford Highway EB	Bedford Highway EB	105EBT	875	987	13%	3.7
5	Bedford Highway WB	Bedford Highway WB	105WBT	3860	3838	-1%	0.4
5	Bedford Highway EB	Joseph Howe SB	105EBR	218	198	-9%	1.4
5	Joseph Howe NB	Joseph Howe NB	105NBT	191	223	17%	2.2
5	Joseph Howe NB	Bedford Highway EB	105NBR	1072	1266	18%	5.7
5	Joseph Howe SB	Joseph Howe SB	105SBT	1272	1316	3%	1.2
6	Bedford Highway EB	Windsor NB	106EBL	1235	1316	7%	2.3
6	Bedford Highway EB	Lady Hammond EB	106EBT	620	541	-13%	3.3
6	Bedford Highway EB	Windsor SB	106EBR	380	394	4%	0.7
6	Windsor SB	Windsor SB	106SBT	425	427	0%	0.1
6	Windsor NB	Windsor NB	106NBT	465	511	10%	2.1
6	Windsor NB	Lady Hammond EB	106NBR	90	112	24%	2.2
6	Windsor NB	Bedford Highway WB	106NBL	385	323	-16%	3.3
6	Lady Hammond WB	Bedford Highway WB	106WBT	540	646	20%	4.4
6	Lady Hammond WB	Windsor SB	106WBL	90	101	12%	1.1
7	Bayne Ramp SB	Bedford Highway WB	107SBR	520	418	-20%	4.7
7	Hwy 111 WB	Bayne Ramp NB	107WBR	20	63	215%	6.7
7	Hwy 111 WB	Bedford Highway WB	107WBT	2415	2465	2%	1.0
8	Kempt NB	Lady Hammond EB	108NBR	70	31	-56%	5.5
8	Kempt NB	Lady Hammond WB	108NBL	185	188	2%	0.2
8	Lady Hammond EB	Kempt SB	108EBR	270	235	-13%	2.2
8	Lady Hammond EB	Lady Hammond EB	108EBT	530	524	-1%	0.3
8	Lady Hammond WB	Kempt SB	108WBL	25	13	-48%	2.8
8	Lady Hammond WB	Lady Hammond WB	108WBT	445	556	25%	5.0
9	Lady Hammond WB	MacKintosh NB	109WBR	340	265	-22%	4.3
9	Lady Hammond WB	Lady Hammond WB	109WBT	620	711	15%	3.5
9	Lady Hammond EB	MacKintosh NB	109EBL	70	108	54%	4.0
9	Lady Hammond EB	Lady Hammond EB	109EBT	515	449	-13%	3.0
9	MacKintosh SB	Lady Hammond WB	109SBR	120	113	-6%	0.6
9	MacKintosh SB	Lady Hammond EB	109SBL	45	10	-78%	6.7
12	Joseph Howe SB	Joseph Howe SB	112SBT	800	767	-4%	1.2
12	Joseph Howe SB	Dutch Village Road WB	112SBR	690	750	9%	2.2
12	Joseph Howe NB	Joseph Howe NB	112NBT	895	1051	17%	5.0
12	Joseph Howe NB	Dutch Village Road WB	112NBL	194	199	3%	0.4
12	Dutch Village Road EB	Joseph Howe SB	112EBR	58	62	7%	0.5
12	Dutch Village Road EB	Joseph Howe NB	112EBL	368	436	18%	3.4

3.7 Model Validation

Once calibrated to observed traffic volumes, the model's validity was subsequently tested against travel times along the major roads in the Study Area. As summarized in Table 3-7, Study Area travel times range from 2-7 minutes during the AM peak hour, and 1-6 minutes during the PM peak hour, with the longer times corresponding to the longest traversal distance between Bedford Highway and the MacKay Bridge ramps. These travel times and average speeds are generally in line with our experiences circulating through the Study Area. We note that in some cases, the model reflects greater weaving friction, as the positive effect of courtesy gaps are not fully reproduced.

Table 3-7: Study Area Travel Times and Speeds

ID	From Link	To Link	Dst (m)	AM TT (s)	AM Spd (km/h)	PM TT (s)	PM Spd (km/h)
1	Bedford Highway SB	Joseph Howe SB	1,308	216	22	202	23
2	Bedford Highway SB	Windsor SB	1,903	368	19	254	27
3	Bedford Highway SB	Massachusetts SB	2,388	420	20	358	24
4	Bedford Highway SB	MacKay Outbound	2,495	426	21	369	24
5	Bedford Highway SB	Barrington SB	2,473	423	21	367	24
6	Joseph Howe NB	Bedford Highway NB	1,418	171	30	204	25
7	Joseph Howe NB	Windsor SB	1,153	304	14	127	33
8	Joseph Howe NB	Massachusetts SB	1,638	398	15	248	24
9	Joseph Howe NB	MacKay Outbound	1,745	395	16	250	25
10	Joseph Howe NB	Barrington SB	1,723	395	16	248	25
11	Windsor NB	Bedford Highway NB	1,725	405	15	356	17
12	Windsor NB	Joseph Howe SB	1,432	398	13	345	15
13	Windsor NB	Massachusetts SB	1,068	327	12	120	32
14	Windsor NB	MacKay Outbound	1,175	329	13	127	33
15	Windsor NB	Barrington SB	1,153	329	13	124	33
16	Massachusetts NB	Bedford Highway NB	2,312	134	62	203	41

ID	From Link	To Link	Dst (m)	AM TT (s)	AM Spd (km/h)	PM TT (s)	PM Spd (km/h)
17	Massachusetts NB	Joseph Howe SB	2,020	123	59	190	38
18	Massachusetts NB	Windsor SB	1,264	158	29	191	24
19	Massachusetts NB	MacKay Outbound	864	43	72	44	70
20	Massachusetts NB	Barrington SB	842	42	72	44	69
21	Barrington NB	Bedford Highway NB	2,941	165	64	286	37
22	Barrington NB	Joseph Howe SB	2,648	156	61	274	35
23	Barrington NB	Windsor SB	1,893	207	33	254	27
24	Barrington NB	Massachusetts SB	1,576	90	63	135	42
25	MacKay Inbound	Bedford Highway NB	2,939	165	64	274	39
26	MacKay Inbound	Joseph Howe SB	2,646	154	62	261	36
27	MacKay Inbound	Windsor SB	1,890	201	34	253	27
28	MacKay Inbound	Massachusetts SB	1,573	91	62	136	42

An initial comparison was made between modelled travel times and travel time data extracted from Google Maps, which aggregates location-based metrics from mobile devices. This was done via the Google Maps API (Application Programming Interface), which permits the submission of automated queries to the Google Maps travel time dataset, broken down by road and direction. This approach provided an estimate of typical, pessimistic, and optimistic travel times estimates based on the historical record. We note that 2021 and 2022 have had a significant impact on this record, as the lower vehicular volumes observed on the road over the two years of COVID pandemic, has significantly skewed the travel time record. It is not possible to query a given year in the Google Maps historical record; as such, the travel time estimates are smoothed out, representing a significantly more optimistic view of travel conditions. Further, we note that in the Google Maps data, there is almost no variation between the optimistic, pessimistic and typical travel time in the AM peak hour. The Google Maps query was made as an average of estimated travel times between Tuesday, Wednesday and Thursday, in September last week. The PM however, is different, showing very significant variability between the three estimates. This makes sense as afternoon patterns are generally more dispersed with more discretionary trips and staggered departure times.

For this reason, a second comparison was made to the travel times reported by the StreetLight Data analytics. By comparison to Google Maps API, the StreetLight Data shows higher times across the WSE area. While data were not available for all O-D pairs, and notwithstanding some discrepancies, generally the modelled travel demands agree with the StreetLight Data ones, and within 1-2 minutes of each other, as illustrated below on Table 3-8 and Table 3-9.

Table 3-8: AM Peak Hour Travel Times

AUTO AM Modelled		Bedford Highway	Bayview	Steele	Main	Barrington Ibd	Mackay Ibd	Barrington Obd	Mackay Obd	Port	MacKintosh	Bayne	Joseph Howe	Windsor	Strawberry Hill	Kempt	Lady Hammond	Massachusetts	Dutch Village
		101	102	103	104	211	212	221	222	301	302	303	401	402	403	404	405	406	407
Bedford Highway	101	0	50	108	209	0	0	402	404	446	0	0	238	367	366	391	409	403	231
Bayview	102	174	0	127	0	0	0	429	431	455	0	0	270	390	375	415	428	437	246
Steele	103	122	0	0	0	0	0	0	382	0	0	0	0	337	0	352	0	386	201
Main	104	0	0	0	0	0	0	0	273	0	0	0	87	0	0	233	252	0	102
Barrington Ibd	211	187	211	0	0	0	0	197	0	126	0	0	191	223	0	219	191	49	184
Mackay Ibd	212	188	212	172	0	0	0	0	226	113	152	67	192	221	212	217	200	98	183
Barrington Obd	221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mackay Obd	222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port	301	122	154	0	0	0	0	130	125	0	0	60	133	274	222	158	97	127	129
MacKintosh	302	143	0	0	0	0	0	0	95	0	0	0	0	0	0	0	65	0	0
Bayne	303	0	0	0	0	0	0	0	115	58	0	0	0	0	0	0	84	0	0
Joseph Howe	401	180	0	0	0	0	0	357	359	382	226	0	0	284	277	316	327	367	84
Windsor	402	495	530	0	0	0	0	395	402	436	380	0	515	0	154	360	372	405	492
Strawberry Hill	403	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kempt	404	324	331	0	0	0	0	0	0	75	0	0	335	268	168	0	77	0	312
Lady Hammond	405	221	244	0	0	0	0	74	77	61	33	50	226	225	199	109	0	74	212
Massachusetts	406	155	180	0	0	0	0	44	45	54	0	0	158	166	0	191	124	0	155
Dutch Village	407	225	254	0	0	0	0	413	418	407	0	0	135	345	326	368	383	417	0

AUTO AM StreetLight		Bedford Highway	Bayview	Steele	Main	Barrington Ibd	Mackay Ibd	Barrington Obd	Mackay Obd	Port	MacKintosh	Bayne	Joseph Howe	Windsor	Strawberry Hill	Kempt	Lady Hammond	Massachusetts	Dutch Village
		101	102	103	104	211	212	221	222	301	302	303	401	402	403	404	405	406	407
Bedford Highway	101	0	196	219	0	0	0	337	384	0	0	0	323	316	0	347	368	462	0
Bayview	102	180	0	0	0	0	0	278	354	0	0	0	510	357	0	429	400	355	0
Steele	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Main	104	0	0	0	0	0	0	0	0	0	0	0	117	0	0	0	0	0	0
Barrington Ibd	211	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mackay Ibd	212	298	285	0	0	0	0	0	0	125	0	0	232	154	196	186	208	80	488
Barrington Obd	221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mackay Obd	222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MacKintosh	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bayne	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Joseph Howe	401	313	0	0	0	0	0	0	263	0	0	0	0	361	0	273	330	0	133
Windsor	402	283	0	0	0	0	0	0	128	0	0	0	0	0	0	0	140	0	0
Strawberry Hill	403	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kempt	404	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lady Hammond	405	263	262	0	0	0	0	0	176	0	0	0	0	148	0	0	0	0	0
Massachusetts	406	235	0	0	0	0	0	0	62	0	0	0	0	0	0	0	0	0	0
Dutch Village	407	0	0	0	0	0	0	0	287	0	0	0	105	235	263	222	293	302	0

Table 3-9: PM Peak Hour Travel Times

AUTO PM Modelled		Bedford Highway	Bayview	Steele	Main	Barrington Ibd	Mackay Ibd	Barrington Obd	Mackay Obd	Port	MacKintosh	Bayne	Joseph Howe	Windsor	Strawberry Hill	Kempt	Lady Hammond	Massachusetts	Dutch Village
		101	102	103	104	211	212	221	222	301	302	303	401	402	403	404	405	406	407
Bedford Highway	101	0	141	179	224	0	0	383	386	463	0	0	264	289	271	330	374	382	261
Bayview	102	102	0	51	0	0	0	261	265	324	0	0	133	171	152	208	256	268	132
Steele	103	137	125	0	0	0	0	242	241	0	0	0	0	0	0	0	240	0	0
Main	104	0	0	0	0	0	0	0	224	0	0	0	96	0	0	0	0	0	94
Barrington Ibd	211	296	290	225	0	0	0	0	0	330	370	437	300	262	0	274	0	135	303
Mackay Ibd	212	288	289	232	0	0	0	0	386	321	0	306	296	266	247	291	363	130	294
Barrington Obd	221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mackay Obd	222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port	301	182	182	0	0	0	0	225	217	0	0	102	191	272	274	0	215	182	188
MacKintosh	302	216	0	0	0	0	0	0	81	71	0	0	227	0	0	128	173	0	0
Bayne	303	231	0	0	0	0	0	0	0	0	47	0	262	0	0	0	177	0	0
Joseph Howe	401	228	225	0	0	0	0	256	254	299	0	0	0	153	124	184	234	252	72
Windsor	402	410	404	324	0	0	0	162	164	245	0	0	422	0	68	101	171	165	411
Strawberry Hill	403	343	372	0	0	0	0	0	146	0	0	0	0	0	0	0	0	0	368
Kempt	404	313	313	0	0	0	0	0	0	0	155	0	329	118	0	0	128	0	324
Lady Hammond	405	250	250	199	0	0	0	72	76	77	36	53	256	148	122	90	0	75	260
Massachusetts	406	224	228	0	0	0	0	46	46	259	0	289	228	209	173	223	291	0	231
Dutch Village	407	204	207	0	0	0	0	280	276	312	0	0	44	164	174	208	253	272	0

AUTO PM StreetLight		Bedford Highway	Bayview	Steele	Main	Barrington Ibd	Mackay Ibd	Barrington Obd	Mackay Obd	Port	MacKintosh	Bayne	Joseph Howe	Windsor	Strawberry Hill	Kempt	Lady Hammond	Massachusetts	Dutch Village
		101	102	103	104	211	212	221	222	301	302	303	401	402	403	404	405	406	407
Bedford Highway	101	0	147	0	234	0	0	400	503	0	0	0	399	305	0	281	348	443	476
Bayview	102	180	0	0	0	0	0	0	497	0	0	0	0	394	0	0	400	0	0
Steele	103	99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Main	104	0	0	0	0	0	0	0	0	0	0	0	183	0	0	0	0	0	0
Barrington Ibd	211	516	507	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mackay Ibd	212	613	557	0	0	0	0	0	0	254	0	0	556	263	0	335	225	107	694
Barrington Obd	221	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mackay Obd	222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port	301	368	0	0	0	0	0	0	421	0	0	0	0	0	0	0	0	0	0
MacKintosh	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bayne	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Joseph Howe	401	307	0	0	0	0	0	0	406	0	0	0	0	355	0	400	399	0	82
Windsor	402	398	438	0	0	0	0	0	176	0	0	0	0	0	0	0	164	0	737
Strawberry Hill	403	481	407	0	0	0	0	0	248	0	0	0	0	73	0	0	0	0	0
Kempt	404	395	426	0	0	0	0	0	610	0	0	0	0	290	0	0	0	0	0
Lady Hammond	405	443	470	0	0	0	0	0	181	168	0	0	536	215	0	0	0	0	556
Massachusetts	406	427	465	0	0	0	0	0	105	0	0	0	0	0	0	0	0	0	559
Dutch Village	407	885	0	0	0	0	0	0	374	0	0	0	117	302	0	310	342	487	0

3.8 Model Limitations

The VISSIM model was based on several sources of information. The initial road network built during the Value Engineering Workshop was expanded and reconfigured to run with Dynamic Traffic Assignment, instead of static routes, and travel demand was provided through Origin-Destination matrices rather than static inputs. The travel demand was produced through a factoring of trip matrices from the 2019 StreetLight Data analytics product, to conform to intersection Turning Movement Counts complied from several studies and surveys undertaken from 2014 to 2021. Travel time was derived partly from querying the Google Maps database, which presents an optimistic view of traffic conditions, and from the more reduced StreetLight Data record. As such, discrepancies persist between the different data sources.

Furthermore, we note that the WSE area road network is metered downstream, particularly in the PM peak hour. Delays on the MacKay outbound cause a spillback into WSE, with higher delays on the EB flows. Delays on Bedford Highway north of Basinview similarly also circulation down in the WB direction. While these dynamics were reproduced to some extent in the VISSIM model road network, it was not possible to fully reflect boundary conditions.

Overall, we find that the VISSIM models generally match existing conditions well, and reproduce the phenomena observed on-site.

4 Traffic Analysis

Once calibrated and validated, the model was used to evaluate traffic conditions under the existing and 2031 scenarios for each of the weekday AM and PM peak hours. For each scenario, 10 simulation iterations were evaluated with different “seed” conditions, to account for variability and randomness in driver behaviour. Traffic conditions were collected in aggregate across the road network, at the intersection of interest, and along the WSE road corridors, with several performance indicators averaged over the 10 simulation runs.

The key performance indicators include vehicular volume, average speeds, average and maximum queues, and average vehicle delay, expressed in terms of Level of Service (LOS). LOS is the main indicator of intersection performance with respect to traffic movement and is defined by the average amount of delay experienced by motorists using each of the various intersection movements. Higher delays result in increased driver discomfort, fuel consumption, and travel time. LOS gives an indication of speed, travel time, traffic interruptions, traffic flow, comfort, and convenience, and is expressed as a scale from ‘A’ to ‘F’. LOS ‘A’ represents conditions approaching free-flow and LOS ‘F’ represents a level of delay generally unacceptable to drivers and where travel demand generally exceeds the road’s hourly capacity. LOS ‘E’ was used as the minimum acceptable level of service during peak periods for this study.

The criteria associated with each LOS are summarized in Table 4-1. As shown in the table, the delays listed for signalized intersections are higher than for the same level of service at unsignalized intersections; this is because motorists are typically more tolerant of extended delays at signalized intersections.

Table 4-1: Level of Service (LOS) Criteria for Signalized and Unsignalized Intersections

Level of Service (LOS)	Average Delay per Vehicle (sec)	
	Signalized	Insignalized
A	<10	<10
B	>10 and <20	>10 and <15
C	>20 and <35	>15 and <25
D	>35 and <55	>25 and <35
E	>55 and <80	>35 and <50
F	>80	>50

4.1 Existing Conditions

An initial evaluation was conducted of the study area road network under existing conditions.

As discussed in Section 3.4, and as summarized in Table 4-2 the study area currently experiences approximately 8,930 vehicular trips during the weekday AM peak hour, and ~10,500 trips during the weekday PM peak hour.

Table 4-2: 2021 Traffic Conditions

Time Period	Total Volume
Am Peak Hour	8,924
PM Peak Hour	10,487

4.1.1 AM Peak Hour

During the weekday AM peak hour, the study area road network experiences significant capacity constraint in the eastbound direction crossing the CN rail corridor. The dominant flow, from Bedford Highway and Joseph Howe, destined towards the MacKay Bridge, Barrington Street and Massachusetts Drive, is limited by the requirement to execute a dual-left turn at the Windsor Street intersection; relative flows are illustrated in Figure 4-1. As visualized in Figure 4-2, this causes an operational bottleneck as the demand exceeds the hourly operational capacity of the system, causing average speeds to plummet around 5-20km/h.

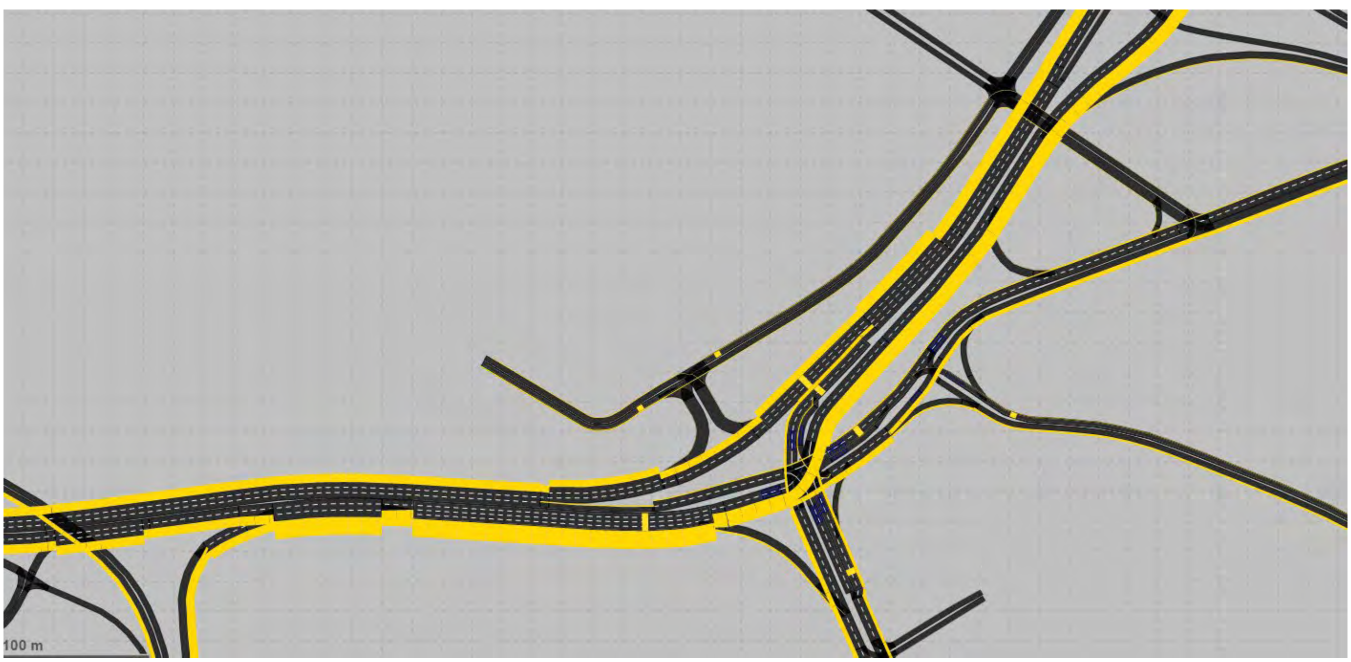


Figure 4-1: WSE Area Relative Flows – AM Peak Hour

Figure 4-2: Existing Conditions – AM Peak Hour – Speeds

This exceedance of the WSE area road network capacity translates to significant delays (Figure 4-3) and queues (see Figure 4-4) at all intersection west of Windsor Street, as well as on Joseph Howe at Dutch Village Road.

Figure 4-3: Existing Conditions – AM Peak Hour – LOS

Figure 4-4: Existing Conditions – AM Peak Hour – Average Queues

These significant queues spills back to the Fairview Overpass, with subsequent impacts on the Bedford Highway Flow, and the DVK ramp from Joseph Howe. The latter was observed to extend at least as far south as Bayer's Road (see Figure 4-5), while the latter routinely extends up Bedford Highway to at least Basinview Drive (see Figure 4-6). Similar queues form on Dutch Village Road, occasionally extending back to Titus Street and the Lacewood Drive flow.

Figure 4-5: Northbound Queue Extending to Bayer's Road

Figure 4-6: Bedford Highway Southbound Queue From Icon Bay

At a closer level, a turn visualization of the Windsor Street intersection shows in Figure 4-7, that almost all movements operate at an LOS F, with vehicles in queue waiting multiple 3-minute signal cycles to traverse the intersection. Similar levels of service are experienced on the DVK ramp (see Figure 4-8), with levels of service improving marginally to LOS E and D towards Icon Bay on Bedford Highway (see Figure 4-9).

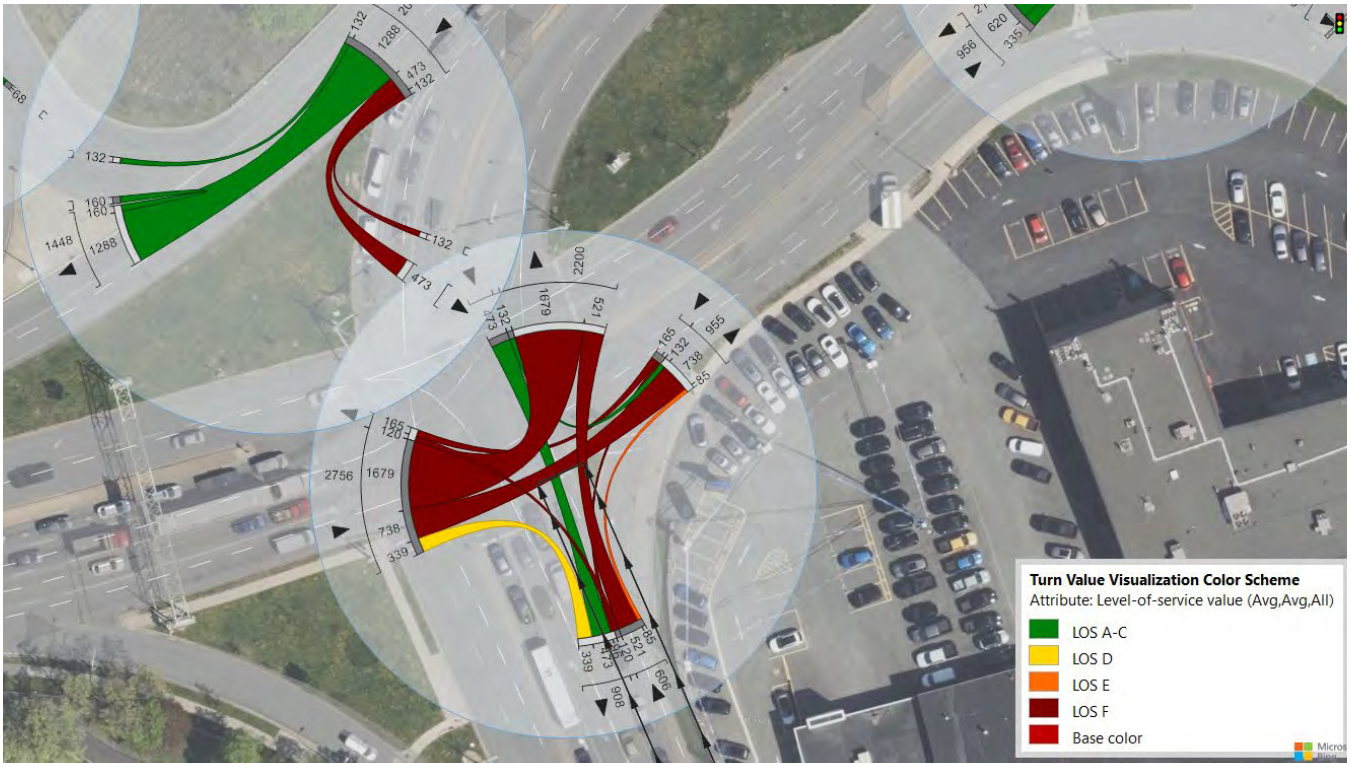


Figure 4-7: Existing Conditions - AM Peak Hour – Level of Service Windsor Street

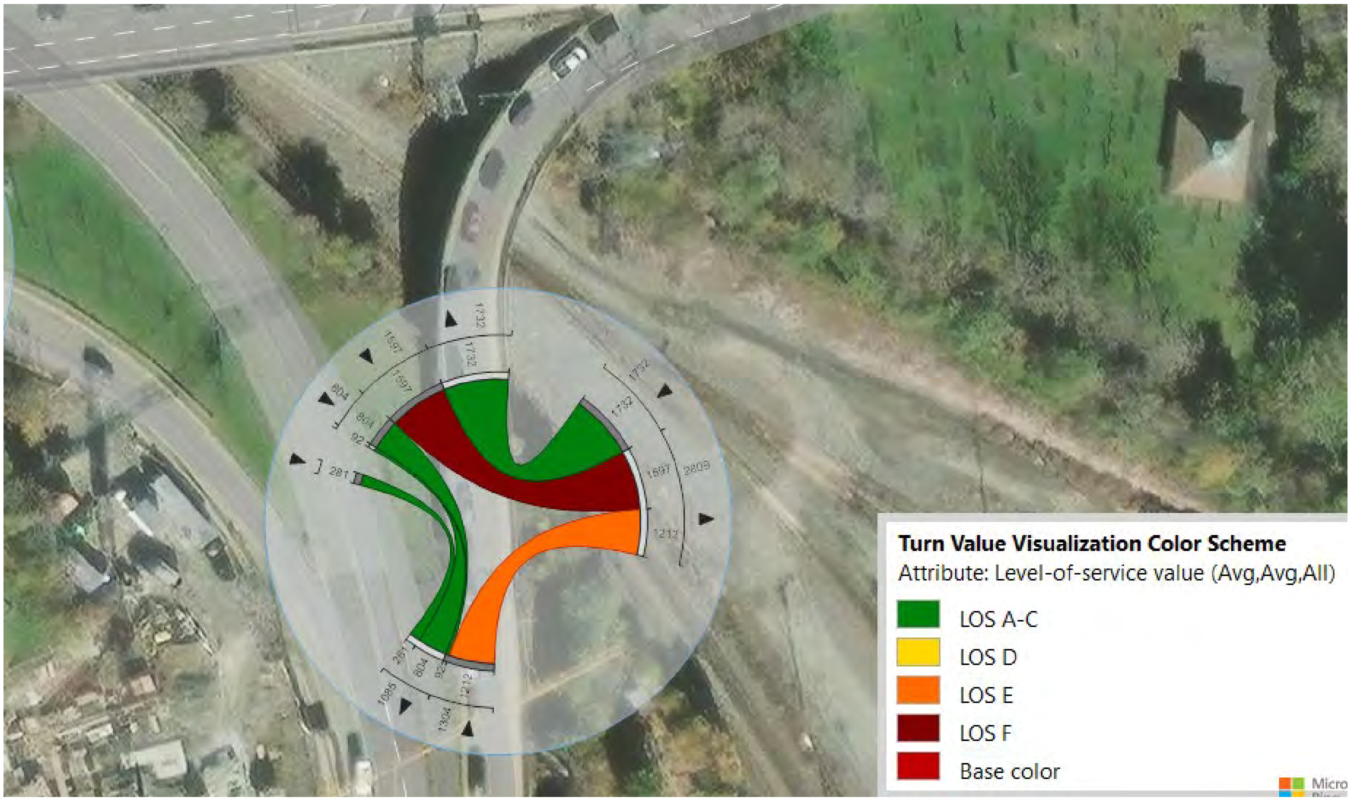


Figure 4-8: Existing Conditions – AM Peak Hour – Level of Service DVK Ramp

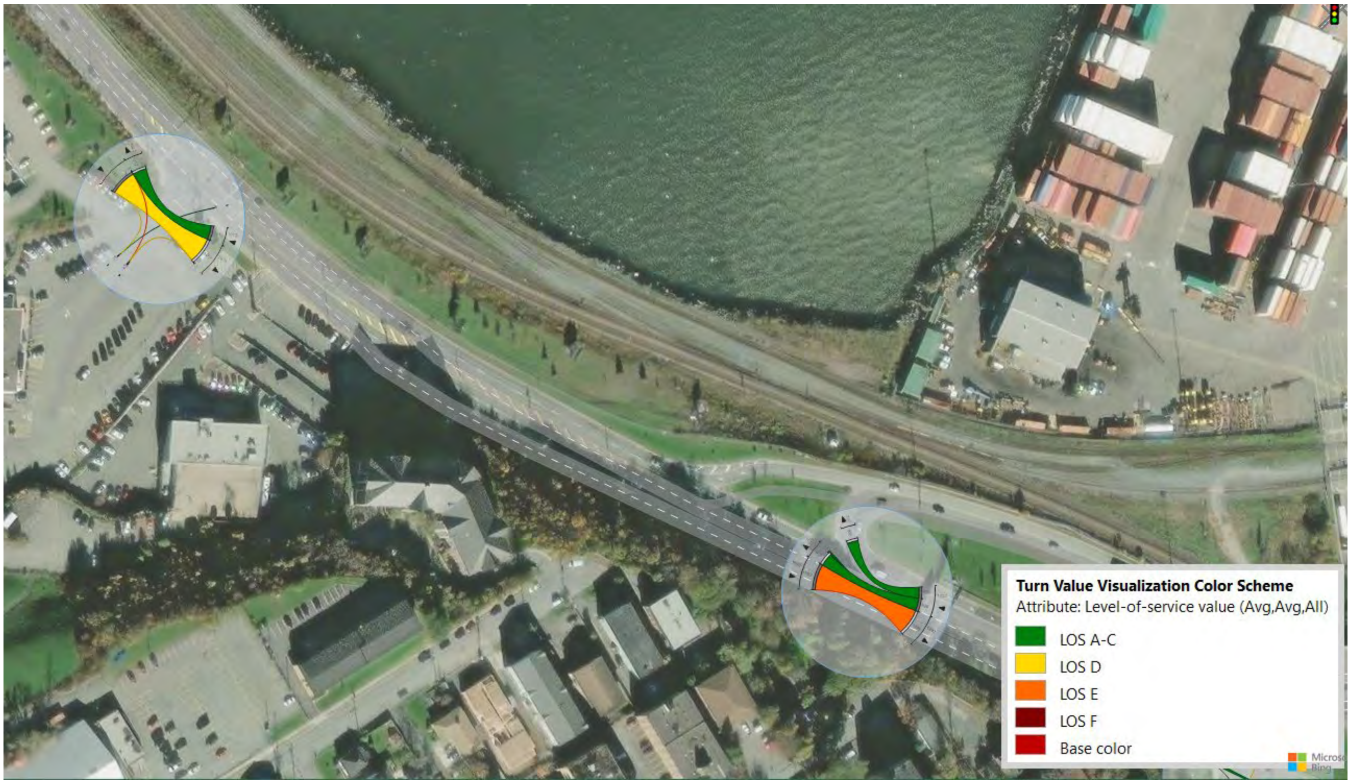


Figure 4-9: Existing Conditions – AM Peak Hour – Level of Service Bedford Highway

This standing is the most significant constraint on the WSE area's capacity during the weekday AM peak hour. As summarized on Table 4-3, on average, drivers through the area experience over two minutes of non-stopped delay, operate with an average speed of 28km/h, and experience close to 1:30 minutes of stopped delay. Under these operating conditions the WSE area can process approximately 8,400 vehicles during the AM peak hour, and statically store 600 vehicles. Close to 550 road users are in queue at the end of the AM peak hour, waiting on links at the periphery of the WSE area; these are seen on the long queues on Bedford Highway, Joseph Howe, and Dutch Village Road.

Table 4-3: Existing Conditions – General Traffic Performance Measures - AM Peak Hour

AM	Average Delay(s)	Average Stops	Average Speed	Average Stopped Delay	Vehicles Active	Vehicles Arrived	Latent Demand
Existing Conditions	130	8	28	76	599	8,397	539

Overall, the analysis finds over 113 hours of cumulative personal travel time traversing the 5 major routes during the weekday AM peak hour (as summarized in Table 4-4).

Table 4-4: Existing Conditions – Cumulative Person Travel Time – AM Peak Hour

Route	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel
RTE 1: Bedford Hwy - Mackay Bridge	376	185	226	23.59
RTE 2: Joseph Howe - MacKay Bridge	498	265	324	44.80
RTE 3: Windsor St - Bedford Hwy	250	65	79	5.52
RTE 4: MacKay Bridge - Bedford Hwy	164	192	234	10.67
RTE 5: MacKay Bridge - Windsor St	190	448	547	28.86
Cumulative Total				**113.44**

4.1.2 PM Peak Hour

Similar constrained conditions are observed during the weekday PM peak hour, when high volumes inbound from MacKay Bridge traverse the WSE area while the area itself experiences crossflows between multiple local connections.

In aggregate, as summarized on Table 4-5, the WSE area vehicles experience close to three minutes of moving delay, with average speeds of 22 km/h, and close to a minute spent in stopped delay. The area processes over 10,600 vehicles and can store close to 900. A residual demand of close to 500 vehicles is still in queue on the periphery of the WSE area at the end of the PM peak hour. During this time, significant queues propagate east along the MacKay Bridge to Dartmouth. The current toll plaza imposes a metering effect on the travel demand entering the Bridge, and thence the WSE area.

Table 4-5: Existing Conditions – General Traffic Performance Measures - PM Peak Hour

PM	Average Delay(s)	Average Stops	Average Speed	Average Stopped Delay	Vehicles Active	Vehicles Arrived	Latent Demand
Existing	171	10	22	57	886	10,618	471

A review of relative flows (Figure 4-10) demonstrates that the dominant flow is indeed the MacKay Bridge – Bedford highway axis. As illustrated on Figure 4-11, this results in significant friction at three major areas; the weaving section in the northeast between Barrington Street and the MacKay Bridge ramps, the central area around Windsor Street and Kept Road, and the westbound access to Bedford Highway and Joseph Howe.

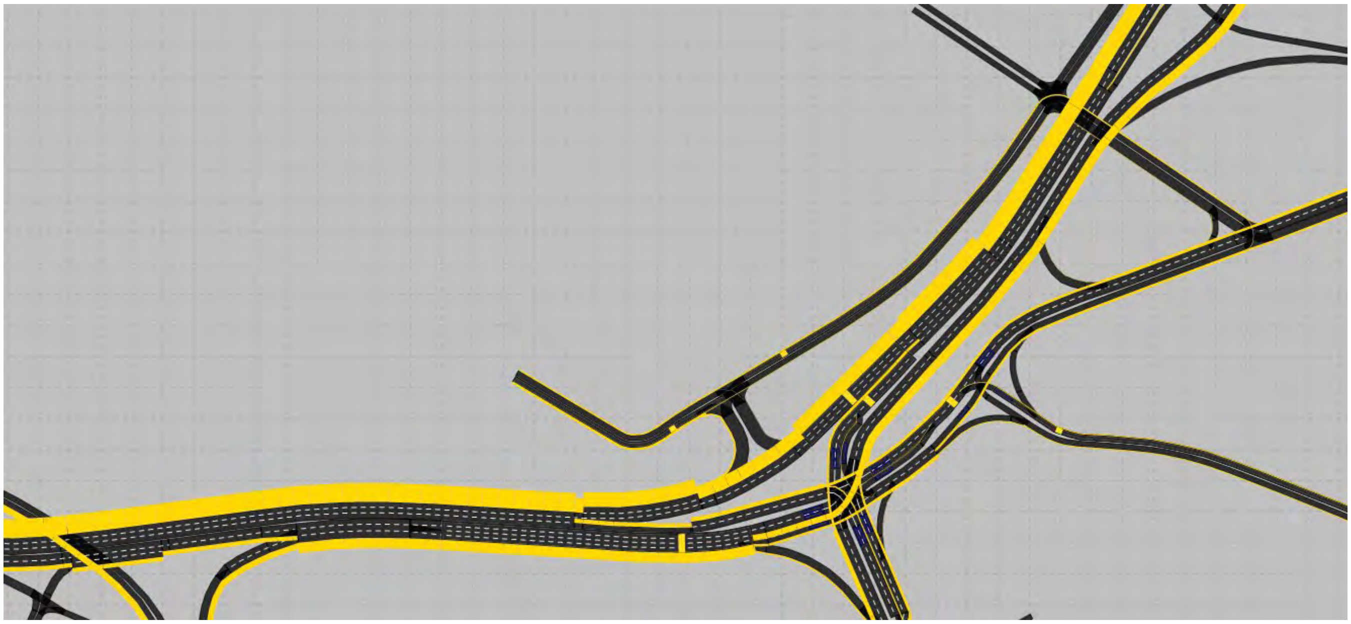


Figure 4-10: WSE Area Relative Flows – PM Peak Hour

This travel pattern translates to higher delays and queues in the westbound/southbound directions at all intersections within the study area (see Figure 4-12 and Figure 4-13).

Broadly, we observe that during the weekday PM peak hour, the westbound flows towards Bedford Highway and Joseph Howe are constrained first by the Bedford Highway to Joseph Howe southbound ramp, which is limited to a 20km/h speed due to its very tight curvature, and has low processing capacity, about 1,300 vehicles per hour (see Figure 4-14). This causes delays on a major flow that is ultimately destined towards Highway 102/103 and the South Shore. The westbound flows on the Fairview Overpass approach 3,900 vehicles during this time, as illustrated on Figure 4-15, and these flows are delayed. The delay incurred by this movement spills back into the Windsor Street intersection and the Highway 111 lanes from the MacKay Bridge. The Windsor Street intersection also experiences high conflicting vehicular demands, particularly between the eastbound and westbound flows; westbound queues on the Bedford Highway lanes spill back and impede Windsor-bound flows from exiting efficiently. Generally, this results in significant delays, even though volumes are not as high as during the weekday AM peak hour (see Figure 4-16).

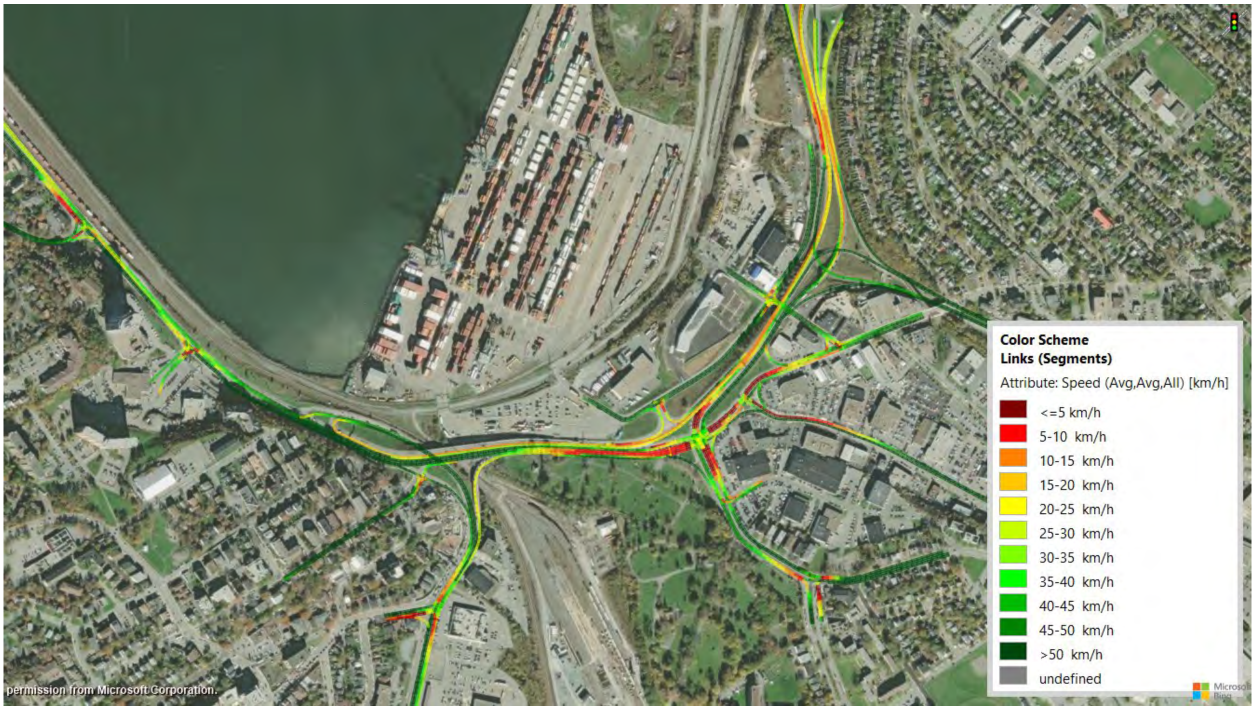


Figure 4-11: Existing Conditions – PM Peak Hour – Speeds

Figure 4-12: Existing Conditions – PM Peak Hour – Level of Service

Figure 4-13: Existing Conditions – PM Peak Hour – Average Queues

Figure 4-14: Existing Conditions – PM Peak Hour – LOS – Joseph How

Overall, these conditions suggest the need for improvements to the Bedford Highway – Joseph Howe interface, to alleviate the delays in the westbound direction. At the same time, the configuration of the Windsor Street intersection and the proximity of the Kempt Road signal introduce additional complexity that reduces the overall efficiency of the WSE area.

In terms of personal travel time, the analysis shows a cumulative of close to 250 hours of travel on the major WSE routes (see Table 4-9).

Table 4-6: Existing Conditions – Cumulative Person Travel Time - PM Peak Hour

Route	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel
RTE 1: Bedford Hwy – Mackay Bridge	513	35	43	6.09
RTE 2: Joseph Howe – MacKay Bridge	411	419	512	58.36
RTE 3: Windsor St – Bedford Hwy	323	162	198	17.77
RTE 4: MacKay Bridge – Bedford Hwy	504	682	833	116.52
RTE 5: MacKay Bridge – Windsor St	404	350	427	47.97
Cumulative Total				**247**

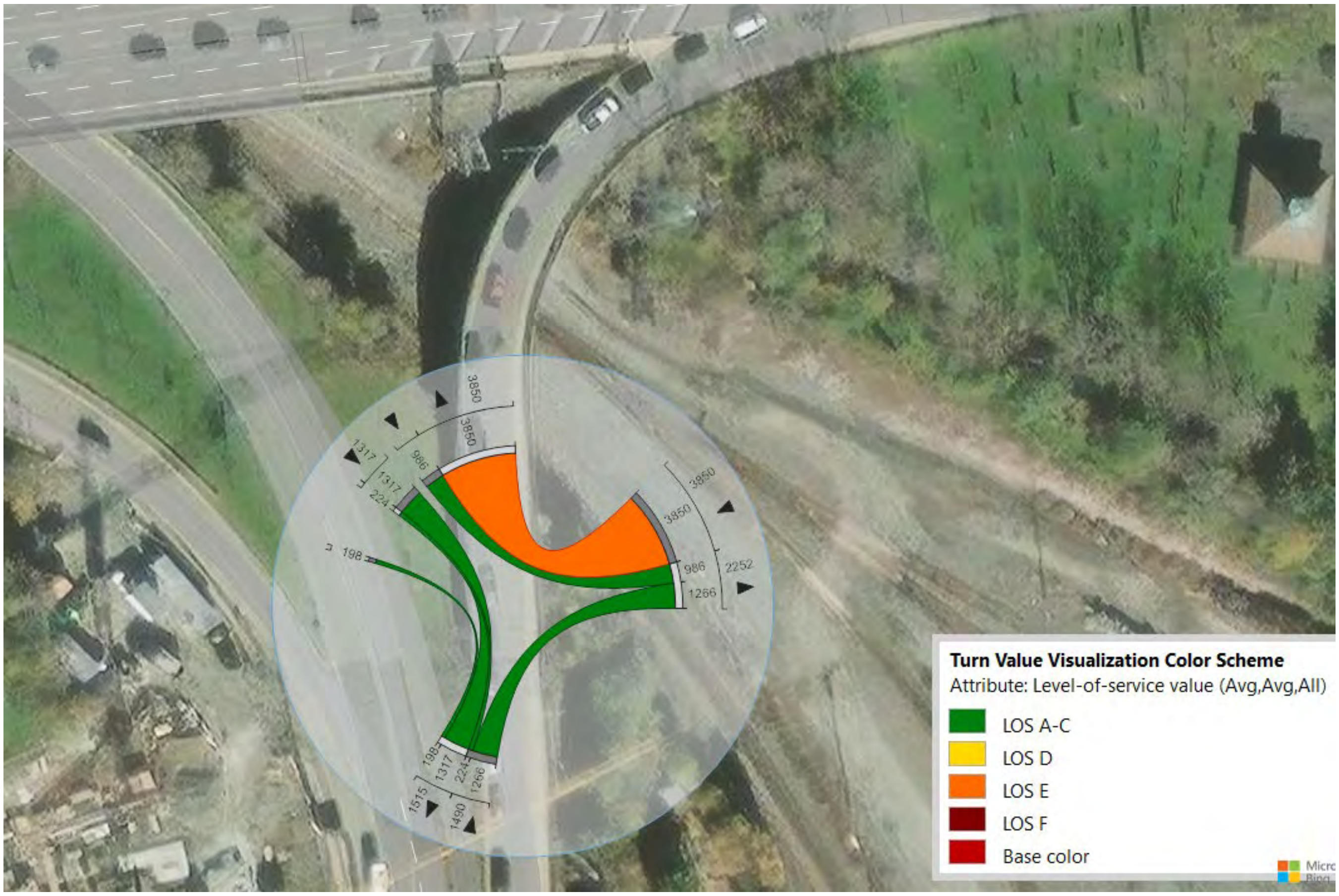


Figure 4-15: Existing Conditions – PM Peak Hour – LOS – Fairview Overpass

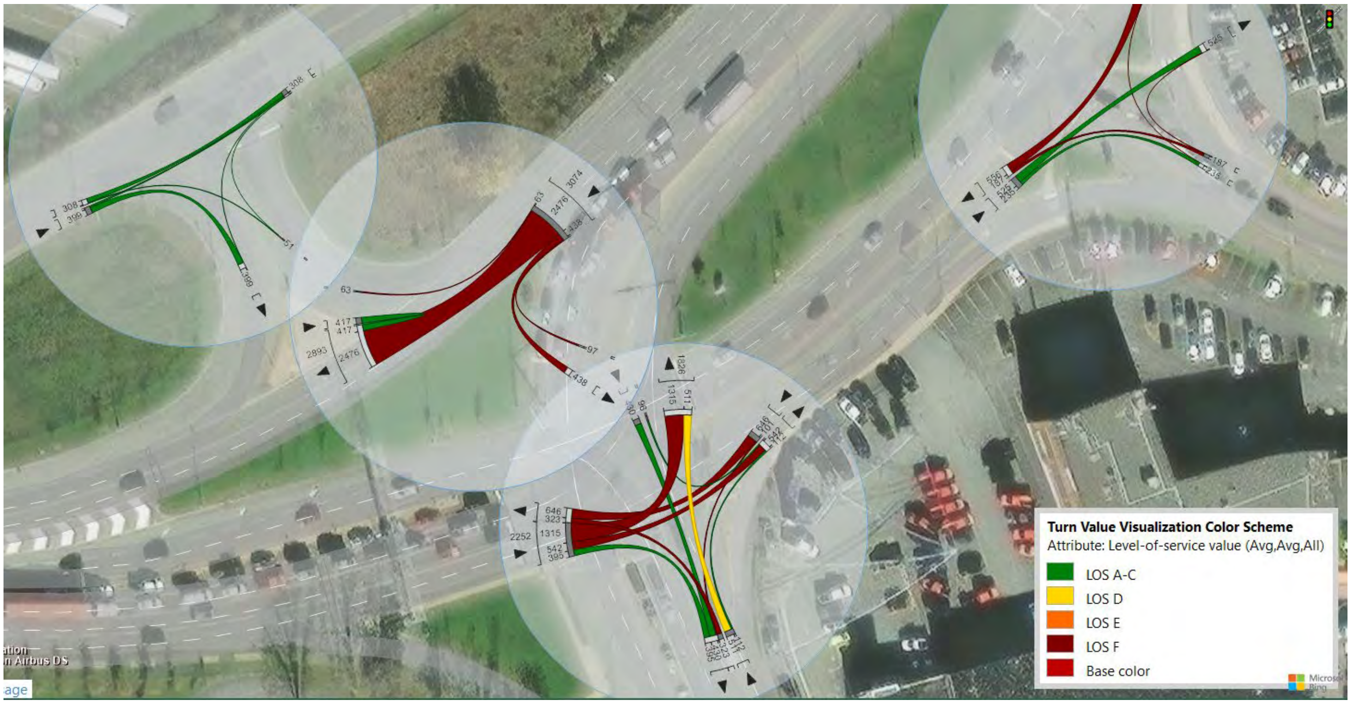


Figure 4-16: Existing Conditions – PM Peak Hour – LOS – Windsor Street

4.2 Future No-Build Conditions Analysis

4.2.1 Background Growth

The WSE project is planned to achieve substantial completion by the end of 2027. For the purposes of this Functional Plan exercise, a horizon year of 2031 was assumed, consistent with HRM travel demand planning.

Traffic growth was estimated based on HRM's regional VISUM travel demand model, which provides an estimate of vehicular travel demand across all of HRM. This model has a regional focus in that it aims to reproduce general large travel patterns across the regional high-order transportation system. It is geared to assessing impacts on the highway and arterial road network, cross-harbour circulation, and the uptake of bus transit. To estimate the vehicular flows that would be expected to cross the WSE area, the VISUM model's Rapid Transit Strategy scenario as reviewed for the years 2016 and 2031. The process generally entailed extracting a subarea of the regional model, corresponding to the WSE area, and using the vehicular volumes traversing the subarea. This is laid out as follows:

1. Reviewed 2016-2031 subarea traversal matrices from HRM VISUM model, which produced weekday PM peak hour auto volumes.
2. A subarea model extraction provided us with traversal Origin-Destination matrices of the period 2016-2031 for the weekday PM peak hour. Prorated to the 2019-2031 growth period, this resulted in ~3,200 extra personal auto vehicles on the area roads.

3. HRM’s Regional VISUM Travel Demand Model did not assess the AM period at the time of this assessment. For the weekday AM peak hour, the regional-level travel demand matrices were therefore transposed in VISUM, with the rationale that at a regional level, commuting patterns would be reversed between the AM and PM peak hours. The transposed matrices were re-assigned on the regional road network, and a subarea was again extracted. This resulted in an increase of ~3,300 personal vehicles through the WSE area. While this procedure was not calibrated or validated under existing conditions, the volumes produced on the road were reviewed and found to demonstrate a logical pattern through the WSE area.
4. The total OD matrix growth was added to existing OD matrices. Using an additive approach instead of proportional factoring achieved a more conservative and defensible estimate. Direct factoring could significantly overestimate growth on the existing demand. New total origins and destinations were used for a second round of Furness factoring to derive future OD auto matrices.
5. Future port-bound truck traffic was assumed to double within the 2031 horizon, based on information from the Port Authority.
6. We note the Strawberry Hill Growth Node, Shannon Park and Ocean Breeze will add significant growth on the road network. While these projects have just been announced and may reach some level of completion by 2031, the background growth projected through the VISUM regional model will already place maximum demand on the highway and arterial road network peak hour capacities, as well as on the MacKay Bridge. The additional travel demand associated with the growth nodes would therefore not change net conditions over the peak hour, but rather extend these conditions over a longer period.

4.2.2 AM Peak Hour

Analysis of the future No-Build scenarios suggests that, without any intervention, the constraints observed under existing conditions would be exacerbated. As illustrated on Figure 4-17, Most road segments will operate with average speeds staying within 5-10 km/h in the eastbound and northbound directions. The friction discussed under existing conditions would be accentuated, with most intersections operating at capacity (see Figure 4-18).

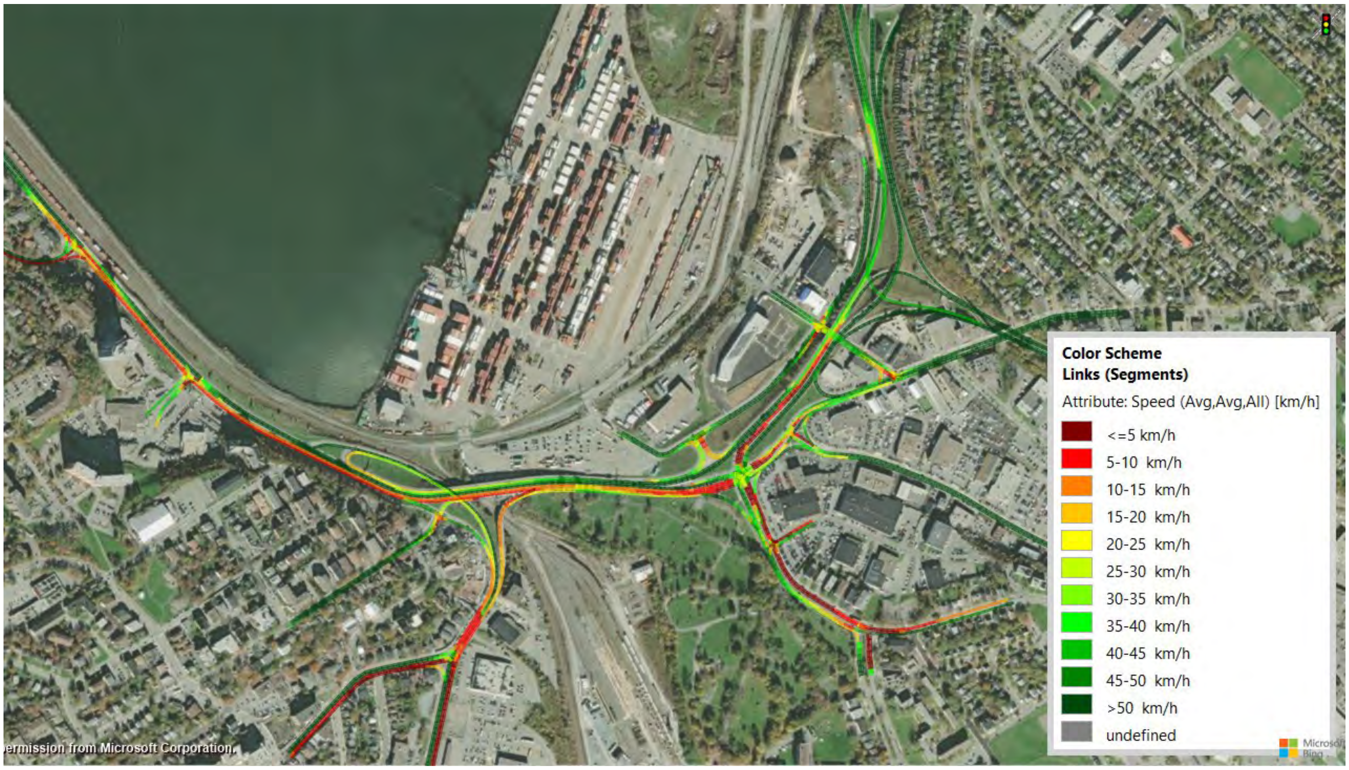


Figure 4-17: Future No-Build Conditions – AM Peak Hour – Speeds

Comparing to existing conditions, we note that the WSE area will be required to process a higher vehicle load during the AM peak hour, with worsening conditions. Table 4-7 shows that under No-Build conditions, close to 850 more vehicles would traverse the WSE area, with another 550 vehicles stored on the road. Average moving delays would increase dramatically to close to 10 minutes, with at least two minutes of stopped delay. Average speeds would have dropped by 50% to 16km/h, and a very significant portion of the travel demand growth would not enter the WSE area during the peak hour, but rather in the hour following.

Table 4-7: Future No-Build Conditions – General Traffic Performance Measures - AM Peak Hour

AM	Average Delay(s)	Average Stops	Average Speed	Average Stopped Delay	Vehicles Active	Vehicles Arrived	Latent Demand
Existing	130	8	28	76	599	8,397	539
Future No Build	295	27	16	139	1,155	9,240	2,814

Figure 4-18: Future No-Build Conditions – AM Peak Hour – LOS

Figure 4-19: Future No-Build Conditions – AM Peak Hour – Average Queues

These conditions translate to an increase of close to 70 hours of cumulative travel time, compared to existing conditions (summarized on Table 4-8).

Table 4-8: Future No-Build Conditions – Cumulative Travel Time – AM Peak Hour

	Existing Conditions				Future No-Build Conditions			
Travel Time	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel
RTE 1: Bedford Hwy – Mackay Bridge	376	185	226	23.59	508	188	230	32.39
RTE 2: Joseph Howe – MacKay Bridge	498	265	324	44.80	577	253	309	49.52
RTE 3: Windsor St – Bedford Hwy	250	65	79	5.52	438	80	98	11.88
RTE 4: MacKay Bridge – Bedford Hwy	164	192	234	10.67	247	215	263	17.98
RTE 5: MacKay Bridge – Windsor St	190	448	547	28.86	388	525	641	69.15
Cumulative Total				**113.44**				**181**

4.2.3 PM Peak Hour

During the weekday PM peak hour, the anticipated vehicular travel demand through the area will very quickly exceed the WSE area's processing capacity. As summarized in Table 4-9, the area will be able to accommodate only an additional 150 vehicles during the peak hour. Vehicles will experience in general an average moving delay of 3:40 minutes, and an additional 1:30 minutes in stopped condition. Average speeds will drop marginally to 20km/hr. As expected, and similar to the weekday AM peak hour, most of the travel demand destined for the peak hour will actually traverse during a longer peak period after the peak hour, as the peak hour has already reached saturation.

Table 4-9: Future No-Build Conditions – General Traffic Performance Measures – AM Peak Hour

PM	Average Delay(s)	Average Stops	Average Speed	Average Stopped Delay	Vehicles Active	Vehicles Arrived	Latent Demand
Existing	171	10	22	57	886	10,618	471
Future No Build	220	13	20	81	1,138	10,760	2,801

This saturation is visualized in low speeds on the MacKay Bridge approach, on Lady Hammond Road, and on Joseph Howe Drive, with general slow movement in the centre of the WSE area (Figure 4-20).

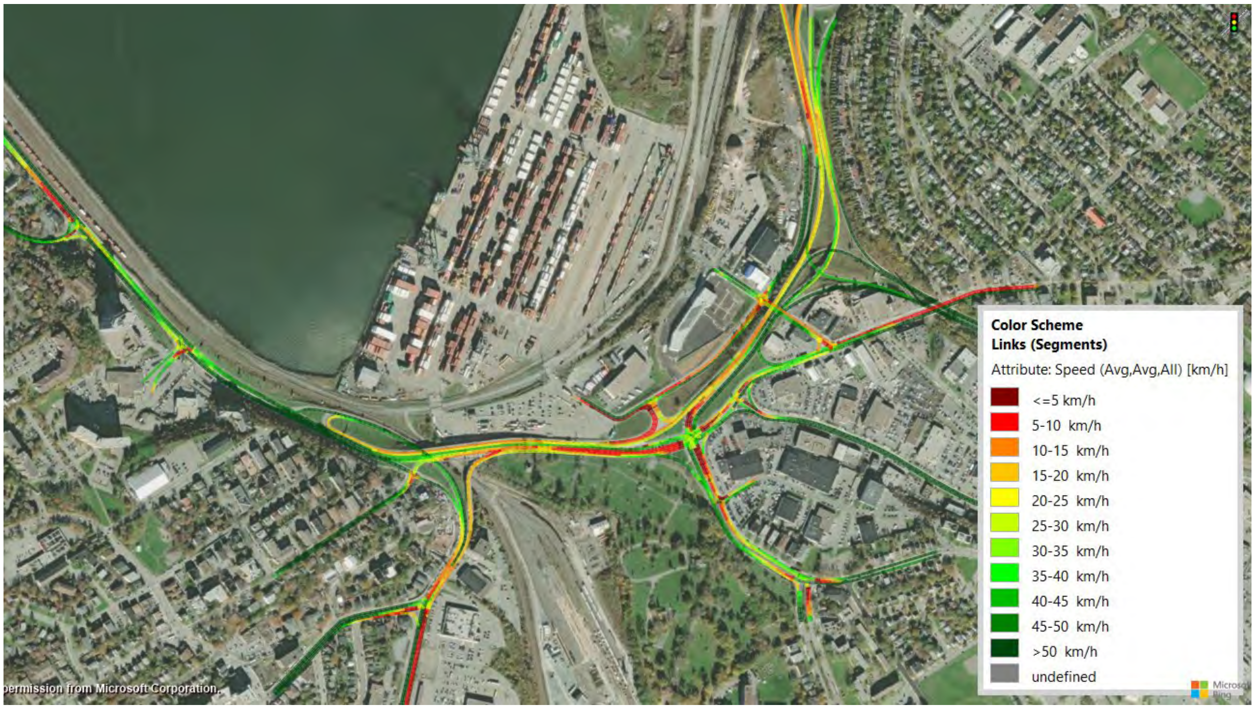


Figure 4-20: Future No-Build Conditions – PM Peak Hour – Speeds

The resulting delays are illustrated on Figure 4-21; we note significant friction on all movements between Joseph Howe and Massachusetts Drive, with the resulting queues extending to the MacKay Bridge, Lady Hammond Road, Massachusetts Drive, Joseph Howe and Dutch Village Road (see Figure 4-22).

Figure 4-21: Future No-Build Conditions – PM Peak Hour – LOS

Figure 4-22: Future No-Build Conditions – AM Peak Hour – Average Queues

Across the major routes traversing the area, we find that under the No-Build scenario, travellers would spend a cumulative 260 hours on the road during the PM peak hour (see Table 4-10).

Table 4-10: Future No-Build Conditions – Cumulative Travel Time – PM Peak Hour

Travel Time	Existing Conditions				Future No-Build Conditions			
	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel
RTE 1: Bedford Hwy – Mackay Bridge	513	35	43	6.09	502	33	40	5.62
RTE 2: Joseph Howe – MacKay Bridge	411	419	512	58.36	480	464	567	75.48
RTE 3: Windsor St – Bedford Hwy	323	162	198	17.77	334	212	259	24.04
RTE 4: MacKay Bridge – Bedford Hwy	504	682	833	116.52	467	679	829	107.46
RTE 5: MacKay Bridge – Windsor St	404	350	427	47.97	384	362	442	47.14
Cumulative Total				**247**				**260**

4.3 Reconfiguration Options

The WSE project shortlisted six alternative design options from the Value Engineering Workshop, as situated on Figure 4-23, and summarized in Table 4-11.

Figure 4-23: Reconfiguration Options

Table 4-11: Reconfiguration Options

VE Alt	Description	Alternative Challenges
BC-1	Convert the WB ramp from Bedford Highway to SB Joseph Howe Drive from a single lane ramp to a dual lane loop ramp.	The ramp is subject to significant grade changes which may impose stringent speed constraints on dual lane movement. Survey of the Fairview Overpass structures indicates that it is possible to accommodate a dual southbound lane and the northbound lane within the structure abutment and piers.
BC-2	Create a direct taper exit ramp for WB traffic coming off the MacKay Bridge and develop an either/or exit to WB Bedford Highway and Massachusetts	The existing road corridor at this location is narrow, and subject to some significant embankment widening to accommodate the platform for the layout of the direct taper and exit to Bayne Street, with appropriate lane balance.

VE Alt	Description	Alternative Challenges
	Avenue/Robie Street/Bayne Street.	
BC-3	Provide a displaced DDI for left turn onto existing ramp towards Main Avenue and install signals at ramp terminal intersection at Main Avenue. The DV-K ramp remains as a single lane ramp.	Joseph Howe Drive is the first major north-south link on the west side of the CN rail corridor. It connects the Windsor Exchange with Highway 102, and with the Armdale Roundabout, while also servicing multiple local activity generators and east-west links. It is experiencing increasing friction across its length in the form of major real-estate developments. As such, it is transitioning from a primary function as a link, to one as an activity origin and destination. The design of the new right turn lane onto EB Bedford Highway will require the development of a layout that will avoid impacting the existing bridge parapet wall at the west end of the bridge, yet still accommodate the separate transit lane. Given that skewed layout of the new signalized intersection along Joseph Howe at the ramp to/from Main Avenue, requirements for traffic signal installation will also need to be reviewed to make sure that any additional requirements for signal functionality are identified and potential impacts documented.
BC-5C	Convert Kempt Road to be right-in, right-out only. Eliminate on-ramp from Kempt Road to EB Bedford Highway and provide a new loop ramp for WB Lady Hammond onto EB Bedford Bypass.	Together with BAG-2, this design alternative simplifies the Kempt Road intersection at Lady Hammond Road, and provides the opportunity to address significant stormwater management constraints, most recently demonstrated on July 22nd 2023.
BAG-2	Re-align the Highway 111 / Bedford Highway eastbound lanes to convert the dual-left turn in the Windsor Street intersection to a through movement, equivalent to the current arrangement of the westbound direction. Introduce a grade separation to the east of Windsor Street, with a new local crossing. Includes BC-5C VE Recommendation	Combined with BC-5C, this alternative opens additional connectivity to Africville Road, and offers a loop with Bayne Street for local movement. It simplifies the Windsor Street intersection, while making the dominant Bedford Highway – MacKay Bridge axis more fluid.

VE Alt	Description	Alternative Challenges
	and revised intersection geometry for Bayne Street WB onto WB Bedford Bypass	
AT-4	Convert sidewalks into Multi Use Paths.	This design consideration allows the carrying throughout the WSE area of a 3.0m multi-use path that would connect several active transportation corridors via the WSE nexus. This intervention will improve local conditions for active road users, while also providing enhanced connectivity to Africville.

4.3.1 Reconfiguration Scenario Analysis

The initial future analysis modelling exercise evaluated the comparative advantages of different combinations of the interventions outlined in Table 4-11 and the VE Workshop Report. The intent of the exercise was to determine whether all the interventions were desirable, or whether a single reconfiguration option or a combination of them would yield the best results. The main combinations tested successfully are summarized in Table 4-12; we note that tests were also carried out with each option in isolation, with generally poor results.

Table 4-12: Reconfiguration Scenarios

	BC1	BC2 (mod*)	BC3	BAG2	BC5C	AT4
Scenario 4 – Full Buildout	x	x	X	X	x	x
Scenario 4 – Full Buildout (multiple Transit Priority Configurations configurations)	x	x	X	X	x	x
Scenario 3		x		x	x	x
Scenario 2	x	x		x	x	x
Scenario 1	x		x			

These scenarios were evaluated using the VISSIM model, to identify the optimal reconfiguration for vehicular movement. The assessment, summarized in Table 4-13 and Table 4-14, for the AM and PM peak hours, respectively, reports several key performance measures collected in aggregate over the entire WSE model area, and the total peak hours:

- Average Delay reports the delay, in seconds, experienced on average by all the vehicles that have been simulated.
- Average Stops indicates the average number of stops that a vehicle experiences through the course of traversing the model space. This includes stopping at intersections.
- Average Speed reports the average speed of all vehicles through the peak hour
- Average Stopped Delay summarizes the time spent in a stopped condition incurred by delay.
- Vehicles Active reports the number of vehicles still in the model road network at the end of the simulation period.
- Vehicles Arrived indicates the number of simulation agents (vehicles) that have completed their traversal of the model network and have reached their destination by the end of the simulation period.
- Latent Demand reports the portion of vehicular demand that has not yet entered the simulation area. This measure corresponds to the residual demand that is attempting to traverse the WSE area during the peak hour but is unable to do so. These vehicles are held back on the periphery of the WSE model are; in reality this demand spreads out of the peak hour, thereby “spreading the peak”.

Table 4-13: Future Scenario Comparison – General Traffic – AM Peak Hour

AM	Average Delay(s)	Average Stops	Average Speed	Average Stopped Delay	Vehicles Active	Vehicles Arrived	Latent Demand
Existing	130	8	28	76	599	8,397	539
Future No Build	295	27	16	139	1,155	9,240	2,814
Scenario 1	190	10	22	122	969	10,052	1,751
Scenario 2	111	3	30	64	716	10,852	1,311
Scenario 3	212	14	20	105	1,032	9,670	2,293
Scenario 4 – no Transit Priority	115	3	30	74	698	10,365	1,598
Scenario 4- TPM 1 _bus lane to DVK	119	3	29	80	685	9,947	2,080
Scenario 4 – PM 2 _transit signal at DVK _bus lane to east of Windsor	198	13	21	121	888	9,080	2,835

AM	Average Delay(s)	Average Stops	Average Speed	Average Stopped Delay	Vehicles Active	Vehicles Arrived	Latent Demand
Scenario 4- TPM 3 _transit signal at DVK _bus lane to DVK _queue jump lane at Windsor	119	3	29	81	691	9852	2166

Table 4-14: Future Scenario Comparison – General Traffic – PM Peak Hour

PM	Average Delay(s)	Average Stops	Average Speed	Average Stopped Delay	Vehicles Active	Vehicles Arrived	Latent Demand
Existing	171	10	22	57	886	10,618	471
Future No Build	220	13	20	81	1,138	10,760	2,801
Scenario 1	258	14	18	126	1,347	11,070	2,249
Scenario 2	141	11	26	50	832	11,546	2,403
Scenario 3	186	20	22	56	921	10,598	3,323
Scenario 4 - no Transit Priority	156	9	25	66	945	11,562	2,376
Scenario 4- TPM 1 _bus lane to DVK	233	24	19	108	1,188	10,593	3,154
Scenario 4- TPM 2 _transit signal at DVK _bus lane to east of Windsor	200	17	21	90	1,029	10,451	3,484
Scenario 4- TPM 3 _transit signal at DVK _bus lane to DVK _queue jump lane at Windsor	178	14	23	78	951	10675	3322

As summarized, Scenario 4, combining all of the shortlisted reconfiguration options, achieved the highest benefit in terms of reducing average and stopped delays, improving speeds, and increasing overall vehicular throughput; this confirmed the findings and recommendations of the VE Workshop.

This scenario was found to provide the best performance for vehicular travel without any dedicated Transit Priority Measures. Generally, this reconfiguration would reduce moving and stopped delays to a level below existing during the weekday AM peak hour, while increasing average speeds and increasing the vehicular throughput of the WSE area. Similar improvements would be achieved during the weekday peak hour. Considering HRM's future Bus Rapid Transit routes, however, and the objective of the study to improve transit service, several Transit Priority Measures (TPM) were explored, with marginal reductions in the overall performance of the WSE area road network. The following were selected for inclusion in the final reconfiguration scenario:

1. A transit phase at the new signal on the eastbound Fairview Overpass regulating the DVK ramp flow.
2. Dedicated bus lane from the Displaced Left Turn signal on Joseph Howe, to the top of the DVK ramp on the Fairview Overpass.
3. Queue jump lane at the Windsor Street intersection.

4.4 Future Build Conditions Analysis

Upon completion of the Reconfiguration Scenarios Analysis, Scenario 4, with Transit Priority Measures for bus routes, was found to produce the most valuable gains, and is therefore the preferred reconfiguration option from a Traffic Analysis standpoint.

4.4.1 AM Peak Hour

Comparing to the Future No-Build conditions, and to some extent the Existing conditions, we find that the proposed reconfiguration of the WSE area road network achieves significant improvements in the core, and along the Bedford Highway-MacKay Bridge axis, by virtue of eliminating the movement configuration responsible for most of the friction. As illustrated on Figure 4-24, speeds are noticeably higher along the main line, comfortably reaching averages of 50km/h or more. The segments experiencing most of the delay are on Joseph Howe Drive, Dutch Village Road, and Windsor Street, on account of the signal timings prioritizing the dominant. eastbound flows.

Figure 4-24: Future Build Conditions – AM Peak Hour – Speeds

While the current timings reflected in this analysis incur delays on these secondary collector roads (see Figure 4-25 and Figure 4-26 for summary levels of service and average queues), they produced the best overall balance in terms of delays and vehicle processing. There are opportunities to improve conditions on these roads through the implementation of different signal timings, and a balance can be struck between prioritizing the Bedford Highway-MacKay Bridge mainline, and servicing the local portion of the WSE area.

Figure 4-25: Future Build Conditions – AM Peak Hour – LOS

Figure 4-26: Future Build Conditions – AM Peak Hour – Average Queues

When compared to the No-Build conditions, the reconfiguration is found to achieve a general reduction of 46% in cumulative person travel time across the major routes traversing the WSE area, during the AM peak hour.

Table 4-15: Future Build Conditions – Cumulative Travel Time – AM Peak Hour

Travel Time	Future No-Build Conditions				Scenario 4 – TMP 3			
	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel
RTE 1: Bedford Hwy – Mackay Bridge	508	188	230	32.39	183	196	239	12.16
RTE 2: Joseph Howe – MacKay Bridge	577	253	309	49.52	952	132	161	42.64
RTE 3: Windsor St – Bedford Hwy	438	80	98	11.88	335	45	55	5.11
RTE 4: MacKay Bridge – Bedford Hwy	247	215	263	17.98	181	230	281	14.11
RTE 5: MacKay Bridge – Windsor St	388	525	641	69.15	240	295	360	24.00
Total Person-Hours				**180.91**				**98.02**
Total Person-Hour Savings								**-82.90**
Percent Savings								**-46%**

In terms of transit service, the analysis finds that the proposed reconfiguration of the WSE could achieve reductions of 7 cumulative person hours on the bus, a 36% reduction from the No-Build conditions (Table 4-16). As summarized, some routes would see very significant travel time reductions of 50% or more.

Table 4-16: Future Build Conditions – Cumulative Transit Travel Time – AM Peak Hour

Travel Time	Future No-Build Conditions				Scenario 4 – TMP 3			
	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel
RTE 1: Bedford Hwy - Mackay Bridge	510	2	60	8.50	174	2	60	2.91
RTE 2: Joseph Howe - MacKay Bridge	0	0	0	0.00	0	0	0	0.00
RTE 3: Windsor St - Bedford Hwy	424	2	60	7.07	384	2	60	6.40
RTE 4: MacKay Bridge - Bedford Hwy	246	2	60	4.10	192	2	60	3.21
RTE 5: MacKay Bridge - Windsor St	0	0	0	0.00	0	0	0	0.00
Total Person-Hours				**19.67**				**12.51**
Total Person-Hour Savings								**-7.16**
Percent Savings								**-36%**

4.4.2 PM Peak Hour

During the weekday PM peak hour, the VISSIM analysis framework demonstrates that the proposed reconfiguration with TPM achieves significant fluidity in the WSE road network. Both the eastbound and westbound flows operate with good speeds, as illustrated on Figure 4-27.

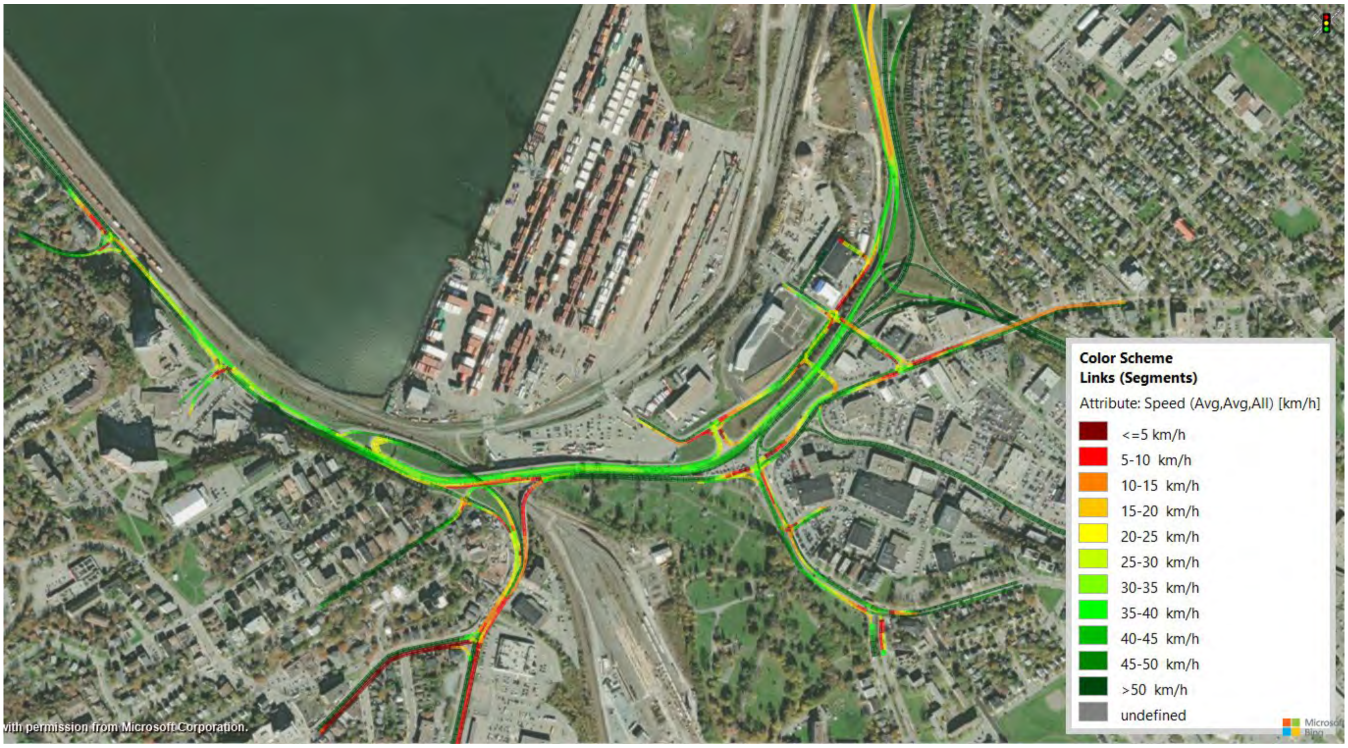


Figure 4-27: Future Build Conditions – PM Peak Hour – Speeds

The condition outlined at the Dutch Village Road and Joseph Howe intersection remains, however, while the signal timings on Bedford Highway do prioritize the mainline flows, and contribute to some queueing on the DVK ramp, they do not cause the major issue, which is rather one of competition between the two flows (see Figure 4-28 and Figure 4-29). Specifically, this intersection features an advance-left turn for the northbound Joseph Howe approach, which allows a significant demand to access Titus Street and Lacewood Drive. This flow conflicts with the one from Dutch Village Road, which is destined to the DVK ramp. We note that there is limited opportunity to improve this situation in the current configuration of this intersection specifically, and of Joseph Howe Drive in general.

The main issue on the Joseph Howe corridor is that it is itself a bottleneck leading into the WSE nexus. The reconfiguration proposed herein achieves significant improvements to the WSE nexus' capacity and throughput, but it also reaches the maximum of what is doable within the area's constraints, elaborated further in Section 5.3.

During the weekday PM peak hour, the analysis finds that the proposed reconfiguration would have a more modest impact than during the AM peak hour, on account of the WSE area road network having reached its processing capacity. As summarized in Table 4-17, drivers would observe a reduction in cumulative travel time of approximately 26 hours, equivalent to a 10% reduction against the future No-Build condition.

Table 4-17: Future Build Conditions – Cumulative Travel Time – PM Peak Hour

Travel Time	Future No-Build Conditions				Scenario 4 – TMP 3			
	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel
RTE 1: Bedford Hwy – Mackay Bridge	502	33	40	5.62	279	37	45	3.50
RTE 2: Joseph Howe – MacKay Bridge	480	464	567	75.48	374	381	465	48.34
RTE 3: Windsor St – Bedford Hwy	334	212	259	24.04	296	72	88	7.22
RTE 4: MacKay Bridge – Bedford Hwy	467	679	829	107.46	449	726	886	110.61
RTE 5: MacKay Bridge – Windsor St	384	362	442	47.14	489	386	471	63.99
Total Person-Hours				**259.74**				**233.66**
Total Person-Hour Savings								**-26.08**
Percent Savings								**-10%**

Figure 4-28: Future Build Conditions – PM Peak Hour – LOS

Figure 4-29: Future Build Conditions – PM Peak Hour – Average Queues

Similar to general traffic, transit services will also experience a reduction in travel times across the major routes. As summarized in

Table 4-18, the proposed reconfiguration of the WSE could achieve reductions of close to 4:30 hours of cumulative person hours on the bus, corresponding to a 20% reduction from the No-Build conditions. As during the AM peak hour, the routes between Bedford Highway and the MacKay Bridge, and between Windsor Street and Bedford Highway would see travel time reductions of approximately 50%.

Table 4-18: Future Build Conditions – Cumulative Transit Travel Time – PM Peak Hour

Travel Time	Future No-Build Conditions				Scenario 4 – TMP 3			
	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel	Travel Time (s)	Vehicle Trips	Person Trips	Person-Hours of Travel
RTE 1: Bedford Hwy – Mackay Bridge	523	2	60	8.71	286	2	60	4.77
RTE 2: Joseph Howe – Lady Hammond							0	0.00
RTE 3: Joseph Howe – MacKay Bridge	0	0	0	0.00	0	0	0	0.00
RTE 4: Windsor St –Bedford Hwy	350	2	60	5.83	290	2	60	4.83
RTE 5: MacKay Bridge – Bedford Hwy	472	2	60	7.86	501	2	60	8.35
RTE 6: MacKay Bridge –Windsor St	0	0	0	0.00	0	0	0	0.00
Total Person-Hours				**22.40**				**17.95**
Total Person-Hour Savings								**-4.45**
Percent Savings								**-20%**

5 Functional Plan

5.1 30% Design

The findings of the microsimulation analysis informed the refinement of a design solution incorporating all six reconfiguration interventions. The resulting 30% design is illustrated on Figure 5-1, and presented in detail in Appendix C.

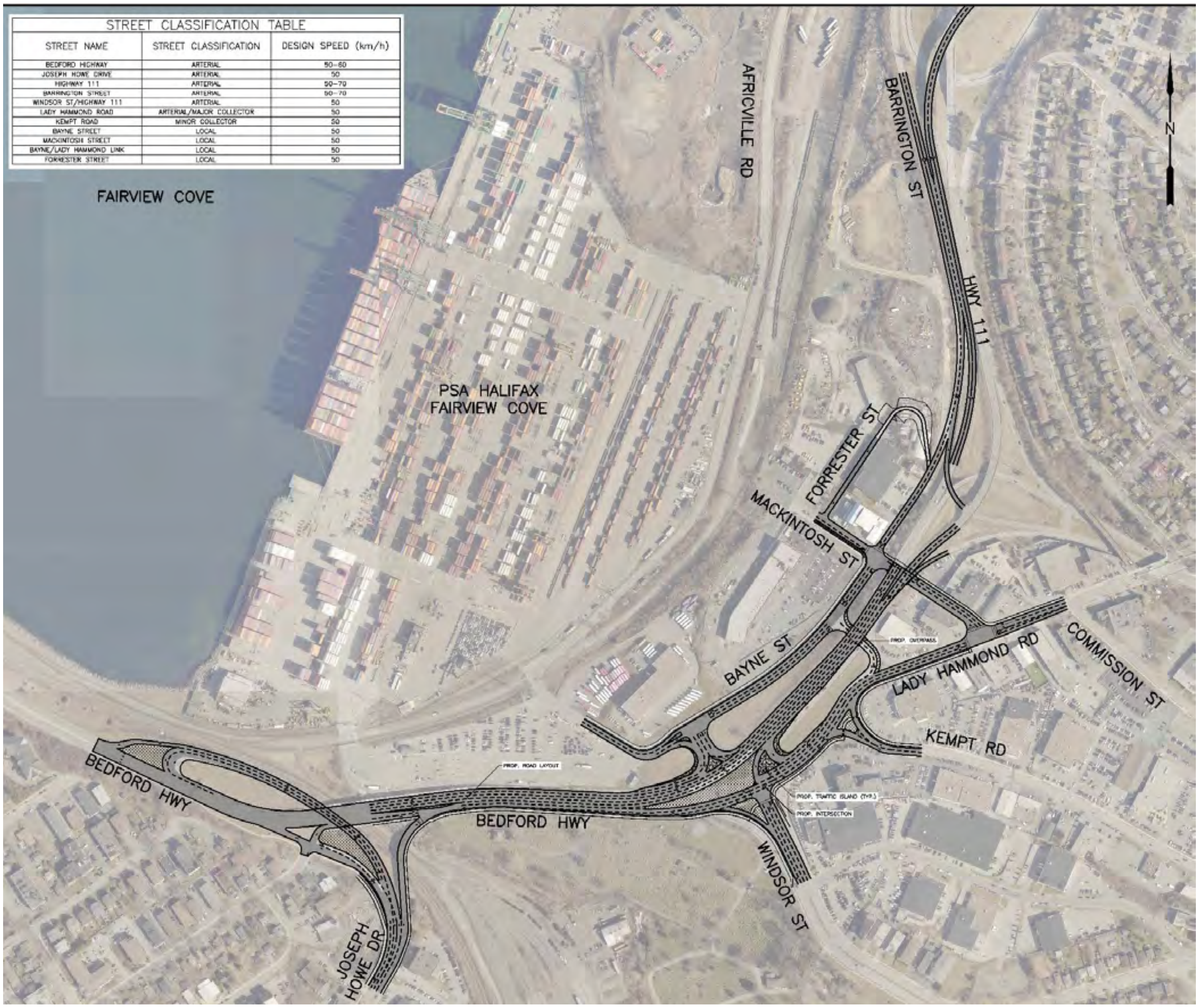


Figure 5-1: Functional Plan (30%)

5.2 New Bridge Overpass General Arrangement Drawing

The new underpass connection between Lady Hammond Road and Bayne Road is proposed to be spanned by a new 5-lane structure that will carry both the eastbound and westbound lanes of Highway 111 (see Figure 5-2 and Appendix D). The open structure will span approximately 26m, allowing for a connector road with two lanes in the southbound direction, and sufficient space for a third northbound lane, should one be considered necessary in the future (Figure 5-3).

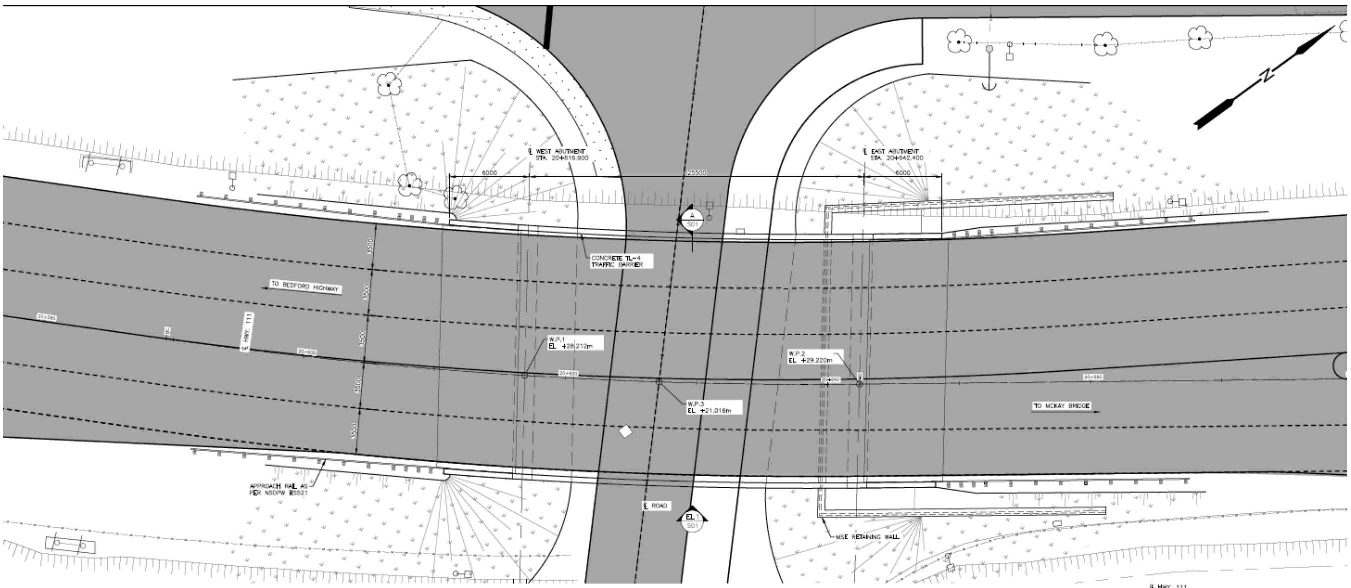


Figure 5-2: New Bridge Overpass – Plan

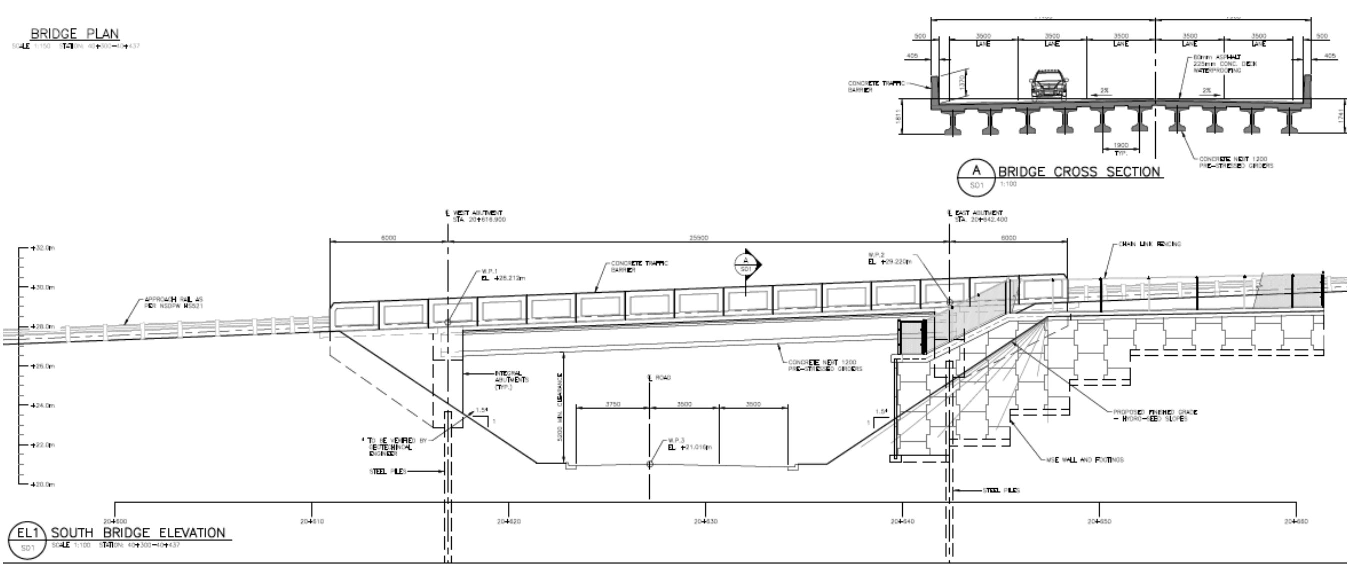


Figure 5-3: New Bridge Overpass – Sections

5.3 Study Area Constraints

The WSE project was, from its conception, required to work within certain confines dictated by existing major infrastructure and land uses, most notably the Port to the north, the Fairview Cemetery to the south, and CN rail corridor to the west. These constraints dictated to some extent the general approach to the development of a workable solution for the operational problems experienced by the WSE area.

5.3.1 Structures

Compounding the limiting land use factors of the study area, the Bedford Highway – Highway 111 corridor is marked by the presence of several major overpass structures and ramps, as illustrated on Figure 5-4.

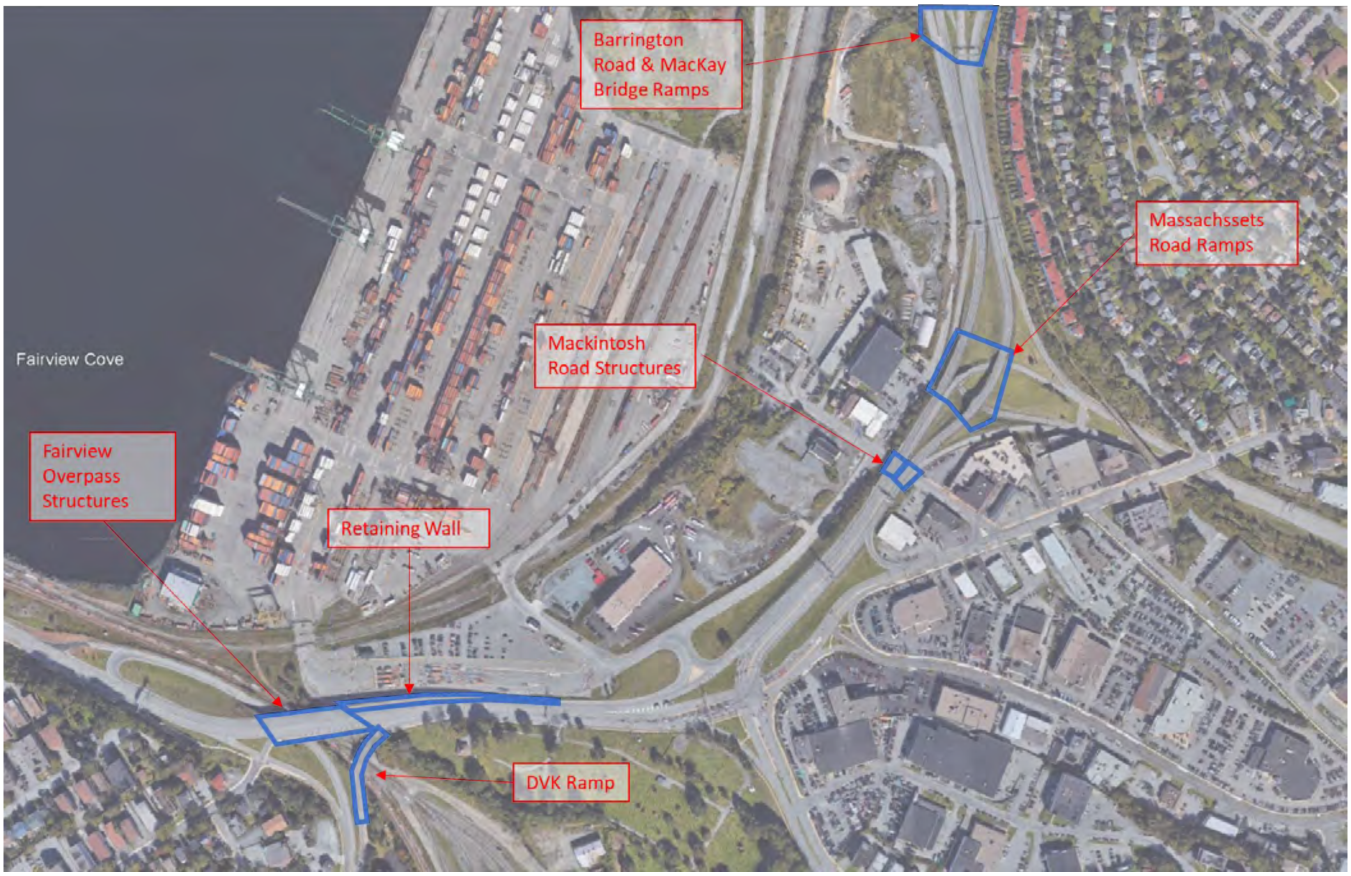


Figure 5-4: Structural Constraints

To the west, the corridor is carried over the Fairview Overpass to span the rail corridor and the terminal lanes of the Joseph Howe Drive. The eastern (WB) approach to the overpass is carried atop a significant retaining wall overlooking the FCCT marshalling yard. The EB side of the Bedford highway at this location is joined by the DVK (Dutch Village – Kempt) ramp, which funnels major flows from Armdale, Highway 102 and Highway 103 towards Dartmouth and the Circumferential Highway via the MacKay Bridge.

To the east of the WSE, Highway 111 crosses over Mackintosh Road atop two bridge structures, with ramps subsequently extending to and from Massachusetts Drive, and additional connections with Barrington Street and the MacKay Bridge.

The WSE project had to respect these structural components and work within their confines. This presented a significant limit on the engineering solutions developed through the course of the project.

5.3.2 Properties

Due to the high volume of traffic within the currently configured Windsor Street Exchange, existing properties will significantly influence design and site constraints. As summarized on Figure 5-5, and shown in detail in Appendix E - 30% Design Construction Heat Map, private properties are not significantly impacted by the current 30% design, although there is a potential for temporary construction impacts. Roads, flatworks, and the new MUP were integrated into HRM-owned land to minimize the impact on private properties.

Figure 5-5: Property Impacts

5.3.3 Utilities

The WSE area is characterized as a junction point and traversal area for multiple municipal infrastructure corridors, on account if being one of only four crossings over the rail cut. Water and wastewater, telecommunications, and gas linear plant crisscross the area, posing some complexity to the project design and future construction, as illustrated in detail in Appendix F, and discussed below.

5.3.3.1 Halifax Water

The Windsor Street Exchange project presents an opportunity to realign aging water infrastructure in Halifax. Therefore, existing site conditions will impact not only stormwater systems but also existing grades, ramps, flatworks, and will extend to deep services as well.

Halifax Water provided GIS files for the project area, which CBCL integrated with new survey data into the design. Based on externally provided information, several design constraints were identified.

Shallow stormwater systems within the WSE Study Area must be re-aligned to meet redesign constraints. In addition, current combined sewer flows and historical surcharging manhole and increasing HRM water demands has led to the identification of two major projects in coordination with Halifax Water. These projects will be considered during ongoing design and construction of the WSE interchange:

- The Fairview Cove Trunk Sewer.
- The North End Feedermain Replacement.

Existing water, sanitary, and storm systems within the Windsor Street Exchange construction zone will be removed and relocated in coordination with Halifax Water. The design and construction zone, illustrated on Figure 5-6 and Appendix F will allow for continued coordination and partnership with Halifax Water, providing an opportunity to replace many of their services while utilizing traffic control measures implemented for the Windsor Street Exchange Project.

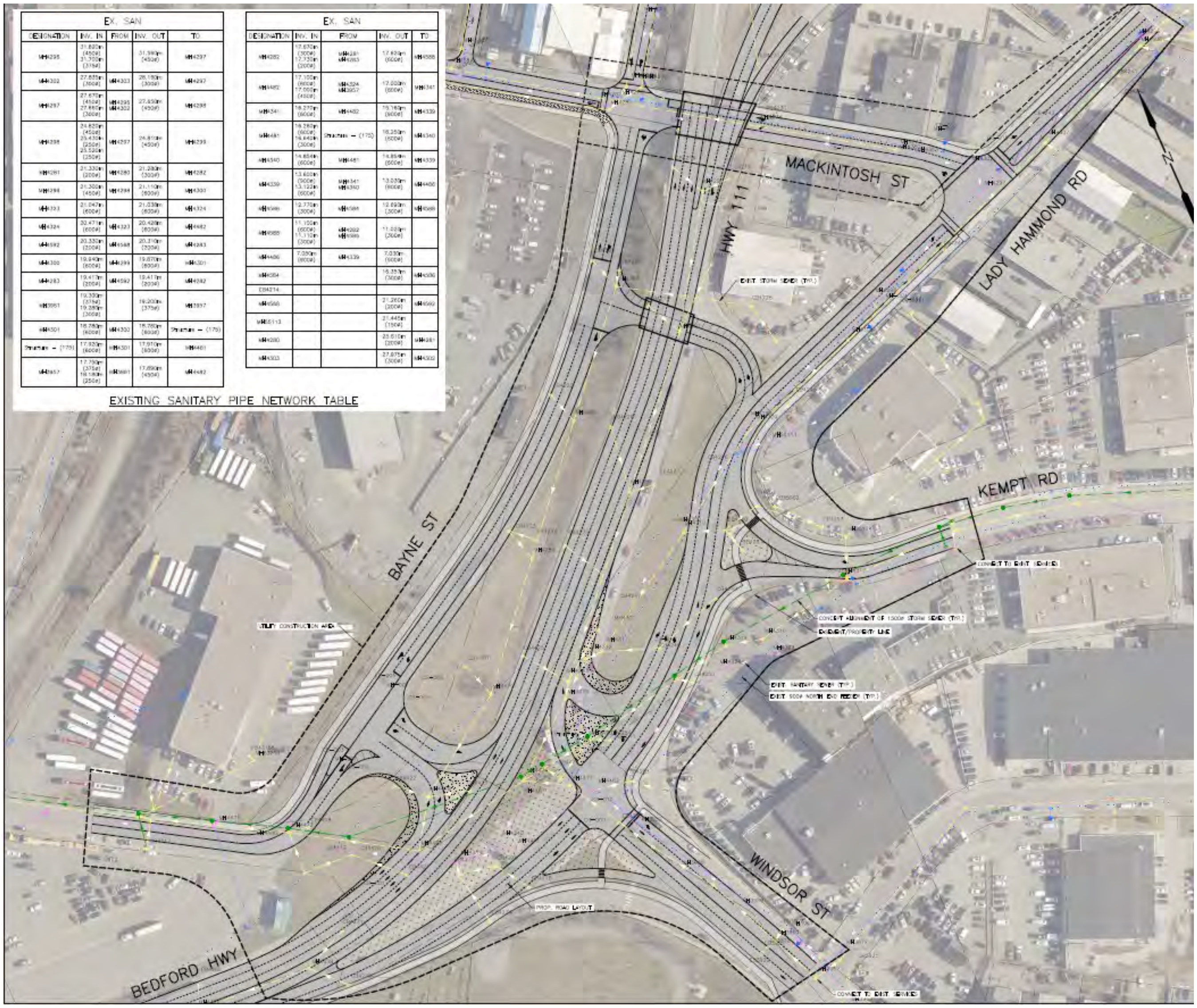


Figure 5-6: Utility Construction Zone

5.3.3.2 Eastlink and Bell Aliant

Eastlink and Bell Aliant have identified existing infrastructure locations, including ductbanks in several critical areas of the project site:

- North side of Lady Hammond Road.
- North of the Windsor Street Intersection.
- South side of Kempt Road.
- South of the Bedford Highway near the Joseph Howe Interchange.
- Along Mackintosh Street.

Based on current information and design, the project is expected to pose limited direct construction impact on existing Eastlink and Bell Aliant infrastructure.

5.3.3.3 Nova Scotia Power

Nova Scotia Power (NSPI) record information has been incorporated into the 30% Design work file to prevent future conflicts. Significant ductbanks are outlined as follows:

- Routed along the south side of the Bedford Highway and Lady Hammond Road, extending to Kempt Road.
- Routed along MacKintosh Street, between Lady Hammond Road and Forrester Street.

Additionally, NSPI maintains easements for overhead cables and towers across the western portion of the site. Overall the project is expected to incur minimal construction impacts on underground ductbanks, with limited temporary impacts on surface cables.

5.3.3.4 Heritage Gas

CBCL and HRM met with Heritage Gas to discuss their network within the vicinity of the WSE Project, encompassing both high-pressure and low-pressure lines. Information gathered during this meeting and from provided GIS data has been integrated into the 30% design, with no impacts anticipated.

5.4 Circulation Rationale

The proposed reconfiguration of the WSE area satisfies the Project Objectives by generally optimizing the dominant movements in the area. While some of the minor movements are made more circuitous, the design achieves a good overall balance, as demonstrated in the microsimulation analysis.

The overarching rationale of the design is that the major regional flows stay on the higher-order facilities (Bedford Highway, Highway 111) without any need for turning movements, while movements to and from the WSE node itself are routed via Bayne Street, Lady Hammond Street, Mackintosh Street, and a new underpass connection. These roads take on a collector/distributive role, providing access to the major ramps.

Circulation towards Bedford Highway, the Mackay Bridge and Barrington Street, and to local destination, is illustrated on Figure 5-7, Figure 5-8, and Figure 5-9, respectively.

Microscopic traffic analysis of the proposed reconfiguration demonstrated the need for signalization and changes to existing intersection controls to fluidize the conflicting flows revolving around the WSE node. The overall intersection control plan is illustrated on Figure 5-10. Signal coordination has been explored along the Lady Hammond Road and Bayne Street corridors to optimize east-west flows. Additional signal refinement will be required at later detailed design stages to balance the connecting movements.

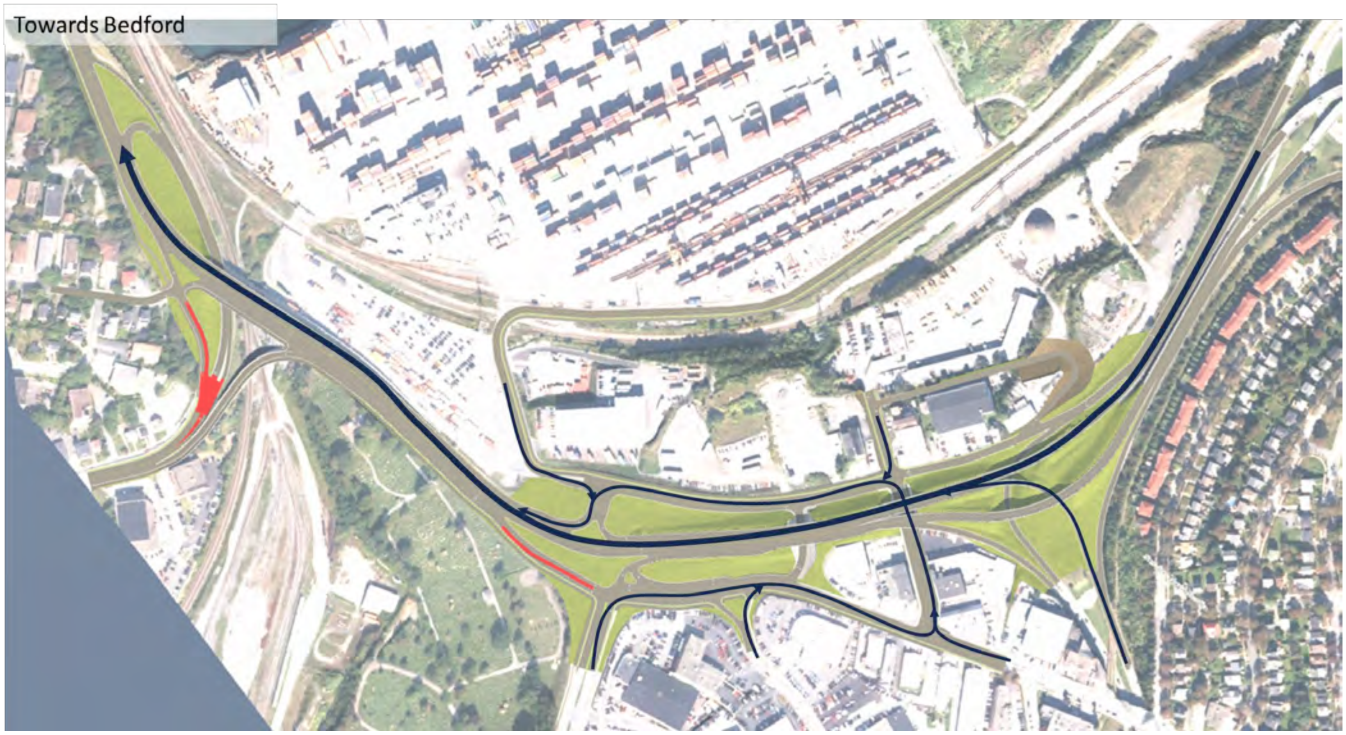


Figure 5-7: Circulation Towards Bedford

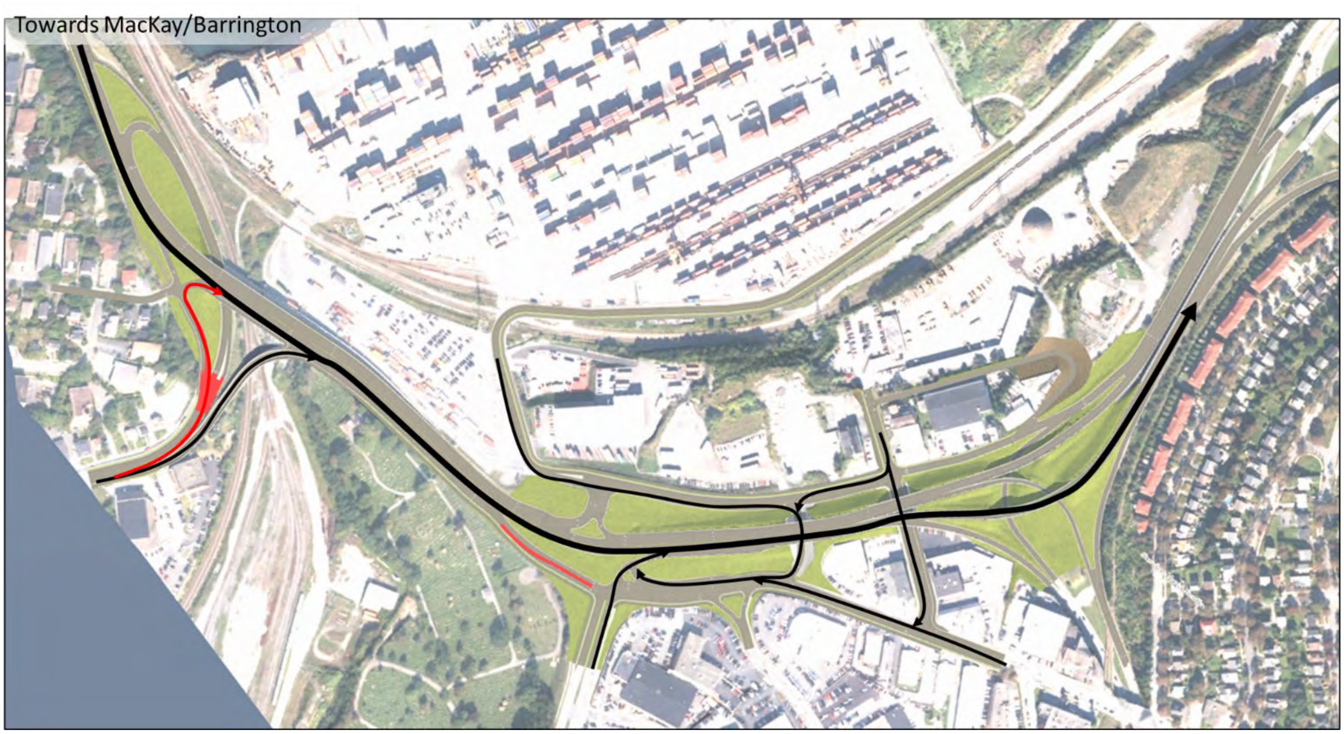


Figure 5-8: Towards MacKay Bridge / Barrington Street

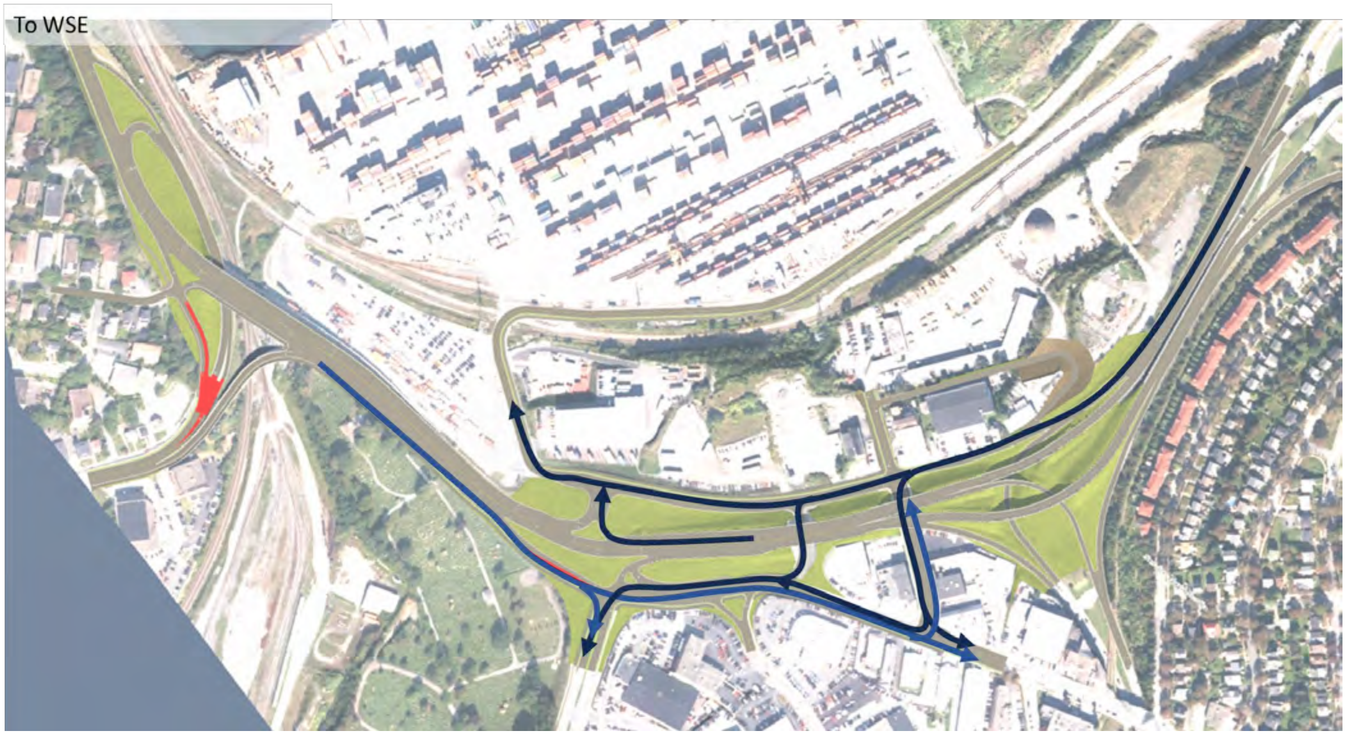


Figure 5-9: Local WSE Access

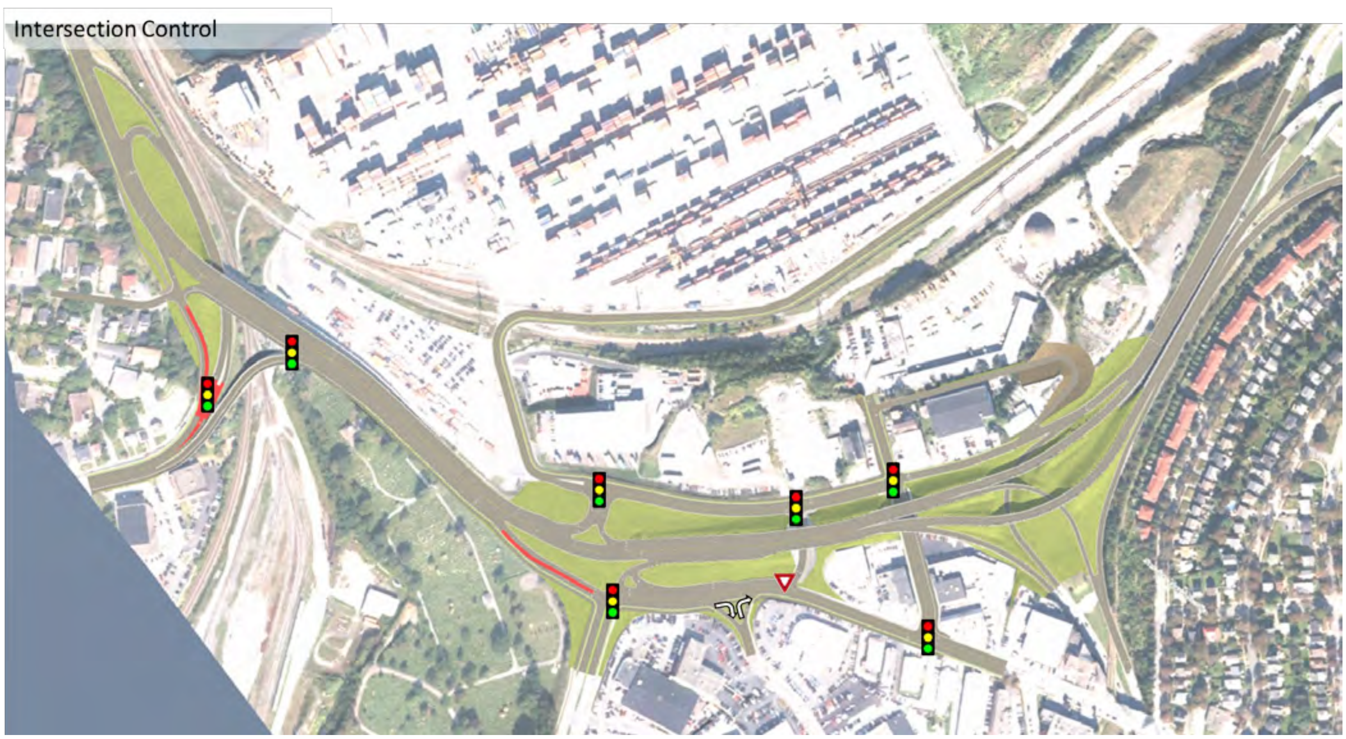


Figure 5-10: Intersection Control

5.5 Active Transportation Considerations

In addition to these road-based reconfigurations, the project proposes a minimum 3m Multi-Use Path (MUP) (illustrated conceptually on Figure 5-11). along the south/west side of Bedford Highway and Lady Hammond Road, along the side of Mackintosh Road, and along the north side of Bayne Street (as illustrated on Figure 5-12). This MUP network would provide continuous connectivity to planned facilities on Bedford Highway and Windsor Street, and allow for future connections to Africville Road, the Barrington Street Greenway, and to planned active transportation facilities on the MacKay Bridge (see Figure 5-13).

Figure 5-11: Multi-Use Path Network

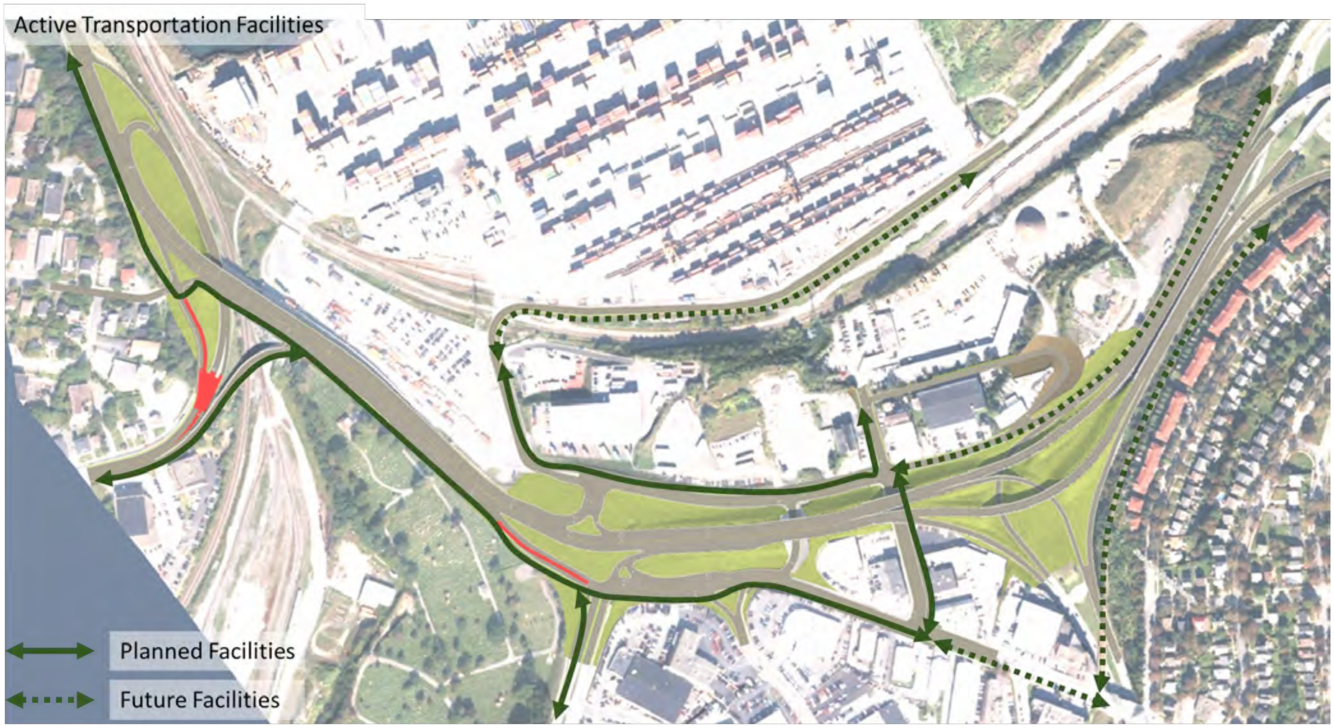


Figure 5-12: Active Transportation Facilities

To improve connectivity to Africville, the project has explored several options of extending Mackintosh Street directly to Africville Road. Given the topography of this area, a Mackintosh Street extension would have a steep grade on the order of 10%-12% to incorporate a crossing of the CN rail corridor before joining Africville Road. Such a direct connection would deviate from HRM active transportation standards, and would also be sub-optimal for trucks and auto travel. Alternatives were also explored to weave a switchback ramp down to the track level, or to span the entire corridor with an AT structure, as illustrated on Figure 5-13. None of these options, however, were found to be practical or safe; therefore, an extension of Mackintosh Road to Africville Road is not being considered.

Figure 5-13: Mackintosh Street Extension AT Facilities

6 Conclusion

The proposed reconfiguration of the WSE area detailed herein achieves the objectives laid out for the project.

In terms of vehicular traffic, the reconfiguration will make the major east-west movement more fluid and eliminate the major source of delay in the area. It would increase the WSE area's vehicular throughput by ~1,200 vehicles in the AM peak hour and ~800 in the PM peak hour, corresponding to an increase of 7-12% over the future No-Build scenario.

While accommodating a higher throughput, the reconfiguration also translates to a reduction in the average vehicular delay by 29% (PM) to 61%(AM), keeping it to ~2 minutes over the entire Study Area. Overall, it will reduce total person hours travelled by 400 hours in the AM and 133 hours in the PM peak hours, reductions of 13% to 37%.

Focusing on the FCCT operations, the reconfigurations will reduce cumulative Port travel time by 19 hours during the PM peak hour. At the same time, it will reduce access time between the Port and main peripheral destinations by 30-50% (Bedford Highway, Massachusetts, Joseph Howe, MacKay Bridge, Barrington).

In terms of non-auto travel, the proposed changes to the WSE area would achieve a 44% reduction in transit delay (from 5 minutes to just over 2:30 minutes) during the AM peak hour, and 30% (from 3:30 minutes to 2:30 minutes) during the PM peak hour. The provision of transit priority signalling at the Fairview Overpass and at Windsor Street will allow buses to bypass queues and generally achieve more higher reliability and lower service variability.

These improvements will also reduce the number of conflicting movements responsible for the most critical collision types. This is particularly evident at the Windsor Street intersection, where the majority of vehicular collisions have occurred, primarily between northbound-left and westbound-through movements towards Bedford Highway, and southbound movements.

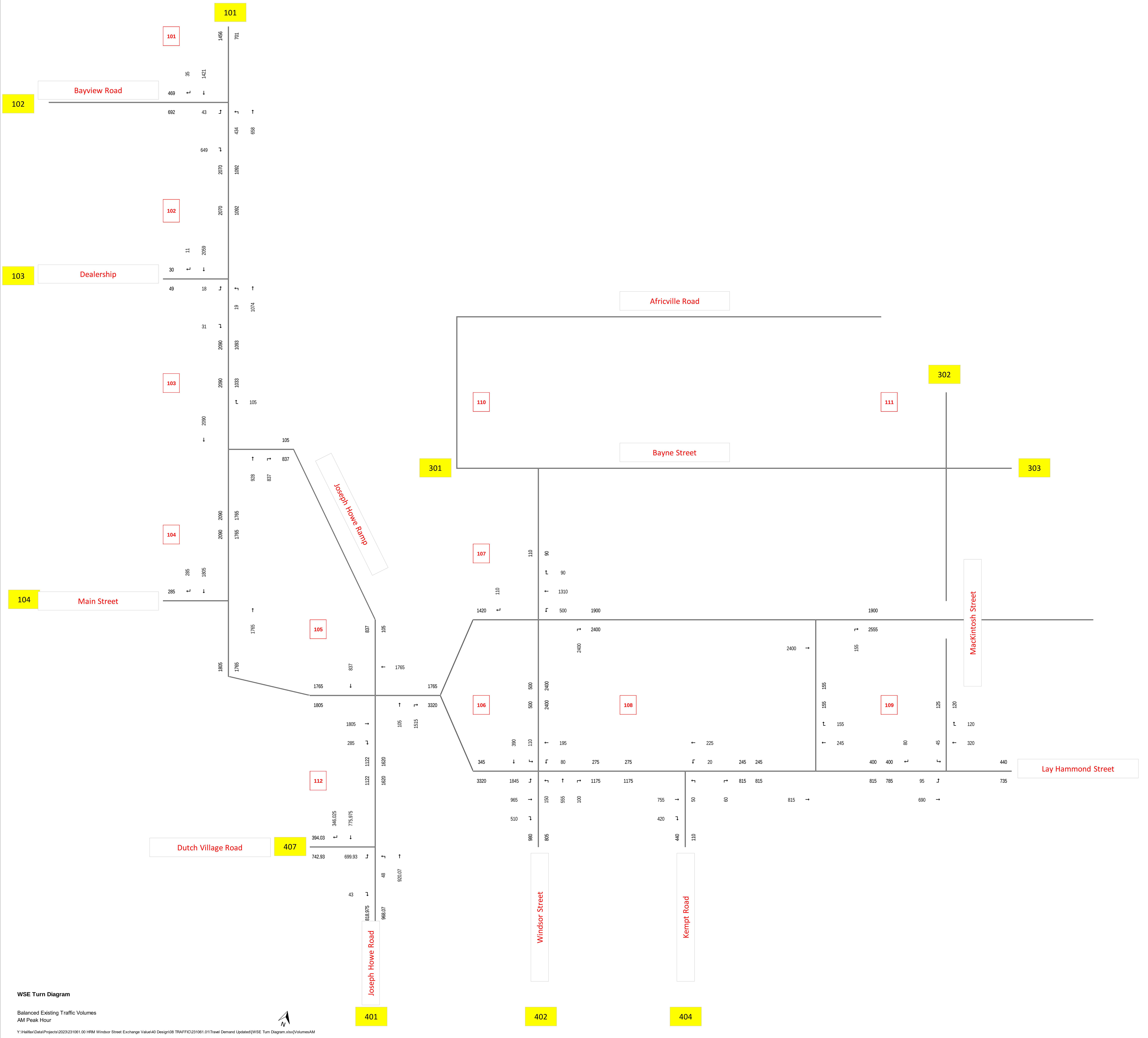
The proposed reconfiguration will also introduce a formal 3m Multi-Use Path network throughout the area, with connections to planned active transportation infrastructure on all sides of the WSE area, improved crossings across the Bedford Highway-Highway 111 corridor, and allowances for future connections to the Barrington Street Greenway and the MacKay Bridge.

Ultimately, the proposed reconfiguration of the WSE area is a significant intervention on one node of the road network that is also a nexus point on one of the five access points to the Halifax peninsula. The reconfiguration maximizes the achievable improvements within the area's constrains. In the long term, additional consideration should be given to additional crossings of the railway cut to provide networkwide improvements.

Prepared by:	Reviewed by:
Emanuel Nicolescu, MCIP, LPP	Garrett Mallery, P.Eng.
Group Lead, Transportation Planning & Engineering	Municipal Engineer

APPENDIX A

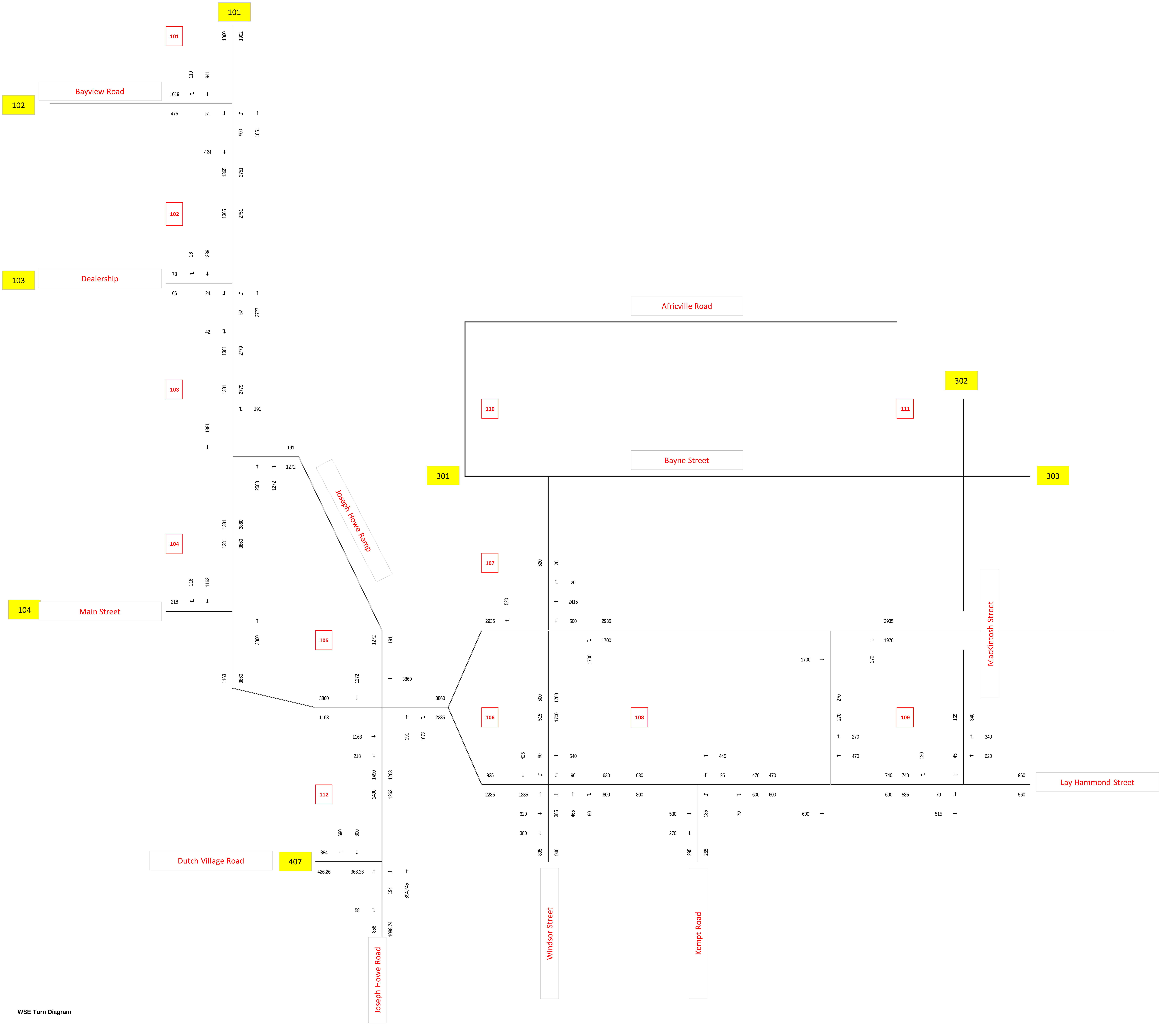
Intersection Turn Diagrams



WSE Turn Diagram

Balanced Existing Traffic Volumes
AM Peak Hour

Y:\Halifax\Data\Projects\2023\231061.00 HRM Windsor Street Exchange Value\40 Design\08 TRAFFIC\231061.01\Travel Demand Updated\[WSE Turn Diagram.xlsx]VolumesAM



WSE Turn Diagram

Balanced Existing Traffic Volumes
PM Peak Hour

Y:\Halifax\Data\Projects\2023\231061.00 HRM Windsor Street Exchange Value\40 Design\08 TRAFFIC\231061.01\Travel Demand Updated\[WSE Turn Diagram.xlsx]VolumesAM

APPENDIX B

Intersection Movement LOS Summary

AM Peak Hour LOS Summary		Existing Conditions					2031 No-Build					2031 Build (Scenario 4 - TPM3)				
Intersection	Movement	Vol	Queue Avg	Queue Max	Delay	LOS	Vol	Queue Avg	Queue Max	Delay	LOS	Vol	Queue Avg	Queue Max	Delay	LOS
1: Bedford Highway & Bayview	SBR	36	19	114	15	B	32	42	161	29	C	28	11	97	10	B
	SBT	1356	25	127	19	B	1384	50	174	35	D	1384	16	110	12	B
	EBL	40	31	129	113	F	32	52	154	181	F	56	22	144	75	E
	EBR	596	63	154	59	E	444	141	183	139	F	792	32	165	19	B
	NBL	400	25	106	33	C	428	44	159	47	D	364	24	105	33	C
	NBT	616	25	106	4	A	840	44	159	8	A	732	24	105	5	A
2: Bedford Highway & Car Dealership	EBR	44	3	18	40	D	40	2	16	62	E	44	1	11	19	B
	EBL	8	1	8	56	E	8	2	16	68	E	8	1	11	56	E
	SBR	16	78	189	39	D	12	198	311	88	F	16	3	67	3	A
	SBT	1908	75	183	33	C	1788	193	305	77	E	2156	3	62	2	A
	NBL	0	0	0	0	A	8	3	62	27	C	8	2	49	37	D
	NBT	1008	1	40	2	A	1264	3	62	2	A	1084	2	49	2	A
3: Bedford Highway & Joseph Howe	SBT	1912	80	209	66	F	1828	181	265	110	F	2196	0	14	6	A
	NBT	924	0	14	0	A	1208	85	191	3	A	1064	0	2	2	A
	NBR	804	0	14	4	A	1040	85	191	48	E	1288	0	2	2	A
	WBR	88	0	10	2	A	60	0	0	0	A	32	0	0	0	A
5: Joseph Howe & Bedford Highway	EBT	1612	178	334	47	E	1572	329	394	56	F	See intersection 4010				
	WBT	1732	0	0	0	A	2264	42	99	13	B					
	EBR	280	0	0	4	A	284	0	17	24	C	312	14	79	30	C
	NBT	88	20	116	1	A	60	76	125	22	C	32	1	14	57	E
	NBR	1204	20	116	32	D	1080	76	125	81	F	600	103	138	226	F
	SBT	804	0	5	4	A	1036	126	340	47	E	1288	32	141	28	C
6: Windsor & Lady Hammond	EBL	1684	399	586	130	F	1560	364	601	91	F					
	EBT	744	399	587	83	F	712	365	602	80	F	684	18	122	42	D
	EBR	340	175	535	35	C	384	155	542	29	C	388	6	92	6	A
	SBT	472	33	64	13	B	584	33	52	12	B					
	SBL	132	18	56	21	C	120	15	42	24	C					
	NBT	520	63	122	91	F	592	100	135	109	F	624	90	131	75	E
	NBR	84	0	5	66	E	104	1	8	76	E	184	95	139	41	D
	NBL	120	22	50	>120	F	140	30	72	>120	F					
	WBT	164	31	76	89	F	168	30	80	74	E					
	WBL	96	25	75	106	F	132	46	102	119	F	480	31	124	42	D
7: Hwy 111 & Windsor	SBR	160	0	0	0	A	264	0	3	1	A					
	SBT	472	15	124	61	F	588	506	872	>120	F					
	WBR	132	0	0	2	A	192	14	42	30	D	76	0	4	2	A
	WBT	1288	0	0	1	A	1716	14	42	41	E	1776	0	4	1	A
8: Lady Hammond & Kempt	NBR	20	0	5	7	A	32	0	9	10	A	128	0	16	3	A
	NBL	48	8	34	81	F	76	11	46	84	F					
	EBR	340	0	9	1	A	352	1	18	2	A	244	0	4	3	A
	EBT	620	7	90	6	A	584	10	93	8	A	624	0	4	1	A
	WBL	16	13	59	37	D	24	26	81	67	E					
	WBT	212	13	59	25	C	224	26	81	44	D	812	0	8	3	A
9: Lady Hammond & MacKintosh	WBR	124	0	4	1	A	212	0	0	1	A	420	17	82	16	B
	WBT	308	0	4	0	A	348	0	0	1	A	236	17	82	26	C
	EBL	56	8	128	11	B	64	11	142	13	B	244	30	125	21	C
	EBT	580	5	101	6	A	548	7	114	8	A	512	30	125	23	C
	SBR	128	1	35	4	A	160	3	48	6	A	20	31	99	53	D
	SBL	84	5	46	29	D	124	10	73	26	D	260	31	99	48	D
10: Hwy 111 & Bayne	NBL	68	2	33	9	A	92	9	62	14	B	64	4	32	26	C
	NBR	64	3	38	7	A	100	8	61	12	B	8	4	32	8	A
	EBR	68	0	0	0	A	92	0	0	1	A	84	6	63	20	B
	EBT	136	0	0	0	A	172	0	0	1	A	0	0	0	0	A
	WBL	92	0	6	1	A	176	1	23	4	A	492	10	85	13	B
	WBT	72	0	0	0	A	96	0	12	1	A	116	10	85	15	B
11: MacKintosh& Bayne	NBR	4	0	1	1	A	4	0	12	1	A	0	0	0	0	A
	NBL	164	0	11	1	A	264	0	13	1	A	656	17	79	21	C
	NBT	8	0	1	0	A	8	0	11	1	A	12	17	79	23	C
	SBL	0	0	0	0	A	0	0	0	2	A	0	0	0	0	A
	SBR	0	0	0	0	A	4	0	0	0	A	12	0	12	10	A
	SBT	12	0	0	0	A	16	0	2	1	A	4	1	14	64	E
	WBT	4	0	12	7	A	4	0	1	8	A	372	34	116	27	C
	WBR	0	0	6	0	A	0	0	1	0	A	8	34	116	14	B
	WBL	12	0	11	7	A	8	0	12	7	A	232	34	116	29	C
	EBT	4	5	46	10	B	4	7	57	14	B	0	0	0	0	A
	EBL	8	4	44	9	A	4	11	65	12	B	4	0	19	38	D
	EBR	188	2	37	8	A	264	7	57	12	B	40	0	18	6	A
12: Joseph Howe & Dutch Village	SBT	720	40	157	26	C	932	114	221	36	D	1184	44	189	16	B
	SBR	372	34	149	21	C	396	103	210	29	C	424	38	177	13	B
	NBT	840	162	210	>120	F	464	196	217	>120	F	256	200	218	>120	F
	NBL	40	162	210	82	F	20	195	215	>120	F	12	198	217	>120	F
	EBR	28	0	0	105	F	36	0	0	>120	F	20	0	4	>120	F
	EBL	456	67	83	>120	F	676	300	330	>120	F	376	319	330	>120	F
15: Bayne & Connector	WBT											608	6	85	1	A
	WBL											432	6	85	7	A
	EBT											44	3	50	17	B
	EBR											120	2	46	9	A
902: Lady Hammond & Connector	WBT											256	0	0	0	A
	SBR											552	0	23	2	A
	EBT											752	1	18	1	A
4010: Bedford Highway & DVK	EBR											864	104	314	33	C
	EBT											1056	94	314	6	A
	NBR											204	178	231	46	D
	NBT											384	178	231	46	D

PM Peak Hour LOS Summary		Existing Conditions					2031 No-Build					2031 Build (Scenario 4 - TPM3)				
Intersection	Movement	Vol	Queue Avg	Queue Max	Delay	LOS	Vol	Queue Avg	Queue Max	Delay	LOS	Vol	Queue Avg	Queue Max	Delay	LOS
1: Bedford Highway & Bayview	SBR	124	52	152	59	E	104	92	225	104	F	100	25	106	35	D
	SBT	676	62	165	67	E	688	103	238	114	F	692	35	119	42	D
	EBL	52	8	78	62	E	64	13	104	64	E	64	14	96	67	E
	EBR	468	2	46	5	A	556	5	81	8	A	556	3	62	8	A
	NBL	836	76	300	26	C	632	57	290	22	C	704	103	286	31	C
	NBT	1860	76	300	13	B	1964	57	290	11	B	2008	103	286	17	B
2: Bedford Highway & Car Dealership	EBR	44	1	16	8	A	36	3	16	10	A	36	3	16	11	B
	EBL	24	3	16	61	E	24	3	16	61	E	24	3	16	61	E
	SBR	32	8	100	8	A	28	6	96	7	A	24	13	104	10	A
	SBT	1116	7	94	7	A	1212	5	91	6	A	1220	12	98	10	A
	NBL	28	34	233	15	B	20	28	246	15	B	20	121	336	23	C
	NBT	2664	34	233	8	A	2572	28	246	6	A	2676	121	336	14	B
3: Bedford Highway & Joseph Howe	SBT	1156	0	0	2	A	1252	0	2	4	A	1232	20	44	35	D
	NBT	2476	110	256	7	A	2400	107	254	11	B	2476	164	456	35	D
	NBR	1276	110	256	38	E	1264	107	254	51	F	1412	164	456	22	C
	WBR	208	3	31	11	B	200	0	1	1	A	224	0	13	4	A
5: Joseph Howe & Bedford Highway	EBT	988	1	22	4	A	1048	45	183	31	D	See intersection 4010				
	WBT	3744	224	399	35	D	3664	166	381	33	D					
	EBR	196	0	0	12	B	204	0	3	16	C	192	14	73	48	D
	NBT	204	48	128	3	A	196	40	120	4	A	1084	77	136	83	F
	NBR	1144	48	128	50	F	1164	40	120	55	F	4	1	13	47	D
	SBT	1280	13	143	14	B	1268	37	265	19	C	1416	30	146	28	C
6: Windsor & Lady Hammond	EBL	1220	396	600	>120	F	1236	368	601	>120	F					
	EBT	516	396	601	89	F	516	359	602	74	E	452	11	74	40	D
	EBR	388	345	549	35	C	424	155	542	32	C	392	4	72	7	A
	SBT	412	29	61	16	B	444	27	51	14	B					
	SBL	92	16	51	29	C	56	12	38	46	D					
	NBT	512	26	110	38	D	660	50	131	44	D	672	47	114	33	C
	NBR	112	0	15	20	C	140	1	19	28	C	344	50	120	6	A
	NBL	320	43	107	108	F	392	77	125	>120	F					
	WBT	640	55	94	78	E	268	53	95	92	F					
	WBL	100	17	73	82	F	76	12	63	65	E	580	44	135	47	D
7: Hwy 111 & Windsor	SBR	416	7	39	10	B	536	46	79	37	E					
	SBT	508	2807	3051	>120	F	452	1419	1530	109	F					
	WBR	64	1420	1526	62	F	76	1420	1530	50	E	88	646	952	32	D
	WBT	2380	1420	1526	>120	F	2480	1420	1530	110	F	2588	646	952	62	F
8: Lady Hammond & Kempt	NBR	28	0	4	>120	F	0	0	0	0	A	152	0	14	2	A
	NBL	180	177	300	>120	F	180	23	84	67	E					
	EBR	228	0	0	0	A	208	0	0	0	A	132	0	3	1	A
	EBT	504	16	97	16	B	508	3	44	4	A	664	0	3	0	A
	WBL	12	85	181	111	F	8	54	95	222	F					
	WBT	556	85	181	109	F	160	54	95	119	F	904	1	26	6	A
9: Lady Hammond & MacKintosh	WBR	264	8	72	9	A	368	326	394	>120	F	708	308	394	105	F
	WBT	712	8	72	8	A	252	326	394	>120	F	248	308	394	94	F
	EBL	104	41	170	40	E	92	7	89	28	D	404	28	116	23	C
	EBT	428	28	143	28	D	456	7	89	9	A	416	28	116	22	C
	SBR	120	5	43	15	B	108	2	14	9	A	16	13	64	31	C
	SBL	12	1	21	27	D	28	4	34	29	D	124	11	59	38	D
10: Hwy 111 & Bayne	NBL	52	2	30	17	C	56	2	37	8	A	52	6	39	42	D
	NBR	16	3	34	13	B	20	1	32	6	A	40	6	39	11	B
	EBR	400	3	31	6	A	292	104	142	>120	F	436	46	149	35	D
	EBT	124	3	31	3	A	108	104	142	>120	F	164	41	147	38	D
	WBL	16	3	20	24	C	244	208	262	>120	F	840	28	134	21	C
	WBT	304	2	18	4	A	196	201	253	>120	F	232	28	134	22	C
11: MacKintosh& Bayne	NBR	12	0	2	1	A	8	95	162	51	F	0	0	0	0	A
	NBL	304	0	12	1	A	424	94	158	66	F	1068	18	97	14	B
	NBT	52	0	3	1	A	28	93	158	62	F	44	18	97	14	B
	SBL	0	0	0	0	A	0	0	1	0	A	0	0	0	0	A
	SBR	8	0	0	0	A	8	0	2	7	A	8	1	18	12	B
	SBT	8	0	1	1	A	8	0	2	4	A	8	2	19	63	E
	WBT	8	0	13	8	A	4	0	3	15	B	464	77	119	77	E
	WBR	4	0	7	5	A	4	0	3	6	A	12	77	119	51	D
	WBL	4	0	12	6	A	4	0	13	7	A	100	77	119	97	F
	EBT	12	3	40	9	A	8	3	47	12	B	0	0	0	0	A
	EBL	4	3	38	7	A	0	5	56	12	B	8	1	21	51	D
	EBR	120	1	31	7	A	120	3	47	12	B	32	1	20	9	A
12: Joseph Howe & Dutch Village	SBT	748	76	213	30	C	752	84	216	31	C	828	72	192	21	C
	SBR	732	70	205	22	C	724	75	204	22	C	788	63	181	18	B
	NBT	928	172	212	114	F	860	180	217	>120	F	760	187	217	>120	F
	NBL	172	172	212	104	F	160	179	216	111	F	120	186	216	>120	F
	EBR	60	0	0	82	F	72	0	3	48	D	44	0	1	>120	F
	EBL	424	61	83	105	F	504	62	151	64	E	332	301	323	>120	F
15: Bayne & Connector	WBT											1072	11	98	1	A
	WBL											472	11	98	10	A
	EBT											36	5	61	24	C
	EBR											164	4	59	10	B
902: Lady Hammond & Connector	WBT											264	0	2	1	A
	SBR											640	1	34	3	A
	EBT											816	0	6	0	A
4010: Bedford Highway & DVK	EBR											588	193	322	85	F
	EBT											460	182	322	28	C
	NBR											256	148	232	25	C
	NBT											604	148	232	25	C

APPENDIX C

30% Design Drawings

HALIFAX

WINDSOR STREET EXCHANGE VALUE

ISSUED FOR 30% DESIGN
MAY 10/2024

WINDSOR STREET EXCHANGE VALUE DRAWING LIST	
Sheet Number	Sheet Title
COVER SHEET	
00	COVER SHEET
CIVIL	
C01	OVERALL EXISTING SITE PLAN
C02	EXISTING CONDITIONS AND REMOVAL PLAN - JOSEPH HOWE DR SHEET 1 OF 2
C03	EXISTING CONDITIONS AND REMOVAL PLAN - JOSEPH HOWE DR SHEET 2 OF 2
C04	EXISTING CONDITIONS AND REMOVAL PLAN - WINDSOR ST INTERSECTION
C05	EXISTING CONDITIONS AND REMOVAL PLAN - MACKINTOSH & LADY HAMMOND
C06	EXISTING CONDITIONS AND REMOVAL PLAN - BARRINGTON ST & HWY 111
C10	OVERALL SITE PLAN - PROPOSED WORK
C11	PROPOSED PLAN AND PROFILE - JOSEPH HOWE DR SHEET 1 OF 2
C12	PROPOSED PLAN AND PROFILE - JOSEPH HOWE DR SHEET 2 OF 2
C13	PROPOSED PLAN AND PROFILE - BEDFORD HIGHWAY SHEET 1 OF 2
C14	PROPOSED PLAN AND PROFILE - BEDFORD HIGHWAY SHEET 2 OF 2
C15	PROPOSED PLAN AND PROFILE - LADY HAMMOND ROAD SHEET 1 OF 2
C16	PROPOSED PLAN AND PROFILE - LADY HAMMOND ROAD SHEET 2 OF 2
C17	PROPOSED PLAN AND PROFILE - BAYNE ST SHEET 1 OF 2
C18	PROPOSED PLAN AND PROFILE - BAYNE ST SHEET 2 OF 2
C19	PROPOSED PLAN AND PROFILE - MACKINTOSH ST
C20	PROPOSED SITE PLAN AND PROFILE - LADY HAMMOND RD & BAYNE ST LINK
C21	PROPOSED PLAN AND PROFILE - BAYNE ST & BARRINGTON ST HWY 111 S-W SHEET 1 OF 2
C22	PROPOSED PLAN AND PROFILE - BAYNE ST & BARRINGTON ST HWY 111 S-W SHEET 2 OF 2
C23	PROPOSED PLAN AND PROFILE - HWY 111 S-W SHEET 1 OF 3
C24	PROPOSED PLAN AND PROFILE - HWY 111 S-W SHEET 2 OF 3
C25	PROPOSED PLAN AND PROFILE - HWY 111 S-W SHEET 3 OF 3
STRUCTURAL	
S01	GENERAL ARRANGEMENT

CBCL

KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING | REMOVAL

- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- STORM HEADWALL
- STORM SEWER
- SANITARY SEWER
- COMBINED SEWER
- WATER MAIN
- GAS MAIN
- O/H UTILITY
- U/G UTILITY
- LINE MARKING
- SIDEWALK
- TREE
- HEDGE
- TOP OF SLOPE
- BOTTOM OF SLOPE

NOTES

1. PLAN VALUES ARE BASED ON THE NOVA SCOTIA COORDINATE REFERENCING SYSTEM.
1. FOR GENERAL NOTES, SEE DWG C01.
2. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
3. ALL WORK IS TO BE DONE IN ACCORDANCE WITH HRM CONTRACT DOCUMENTS.
4. GRADES SHOWN ARE APPROXIMATE. FINISHED GRADES ARE TO BE APPROVED IN THE FIELD BY THE ENGINEER.
5. UTILITY INFORMATION IS APPROXIMATE ONLY. CONTRACTOR IS RESPONSIBLE TO ARRANGE FOR ON SITE LOCATES WITH ALL UTILITIES PRIOR TO START OF WORK. CONTACT www.info-ex.com AND OTHERS AS REQUIRED.
6. CONTRACTOR TO OBTAIN ALL NECESSARY PERMITS REQUIRED TO PERFORM WORK AND TO COMPLY WITH ALL APPLICABLE ENVIRONMENTAL REGULATIONS.
7. WHERE EXISTING CONDITIONS ARE SHOWN THEY ARE NOT NECESSARILY ACCURATE OR COMPLETE. THE CONTRACTOR SHALL CONFIRM ALL EXISTING DIMENSIONS AND LOCATIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER.
8. THE CONTRACTOR SHALL CHECK AND VERIFY ALL PROPOSED DIMENSIONS BEFORE PROCEEDING WITH CONSTRUCTION. ANY ADJUSTMENTS WILL BE MADE BY THE ENGINEER AS NECESSARY.
9. CONTRACTOR IS RESPONSIBLE FOR SETTING GRADES AND LAYOUT CONTROL.
10. TRAFFIC SIGNS ARE NOT TO BE REMOVED OR REPLACED WITHOUT AUTHORIZATION FROM THE TRAFFIC AUTHORITY AND THE ENGINEER.
11. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTION OF TREES. UNLESS OTHERWISE NOTED, TREES ARE NOT TO BE REMOVED WITHOUT PERMISSION FROM THE ENGINEER.
12. WORK IN THE IMMEDIATE AREA OF A NOVA SCOTIA COORDINATE MONUMENT MUST BE CARRIED OUT BY HAND. THE CONTRACTOR IS RESPONSIBLE FOR ANY REINSTATEMENT COSTS IF MONUMENTS ARE DISTURBED.
13. AT COMPLETION OF WORK REINSTATE ALL DISTURBED SURFACES TO THE SATISFACTION OF THE ENGINEER.
14. WATER VALVE BOX EXTENSIONS – THE MINIMUM INSIDE DIAMETER OF A VALVE BOX EXTENSION SHALL BE 125 mm AND THE MINIMUM LENGTH OF A VALVE BOX EXTENSION SHALL BE 300 mm. CONTRACTOR TO CONFIRM APPROPRIATE PRODUCT TO BE USED WITH HALIFAX WATER OPERATIONS DEPARTMENT STAFF.
15. ALL NEW PEDESTRIAN RAMPS SHALL INCLUDE TACTILE WALKING SURFACE INDICATOR PLATES AS PER HRM DETAIL 131 UNLESS OTHERWISE NOTED.
16. LANE WIDTH DIMENSIONS ON PLAN ARE TO EDGE OF PAVEMENT UNLESS OTHERWISE NOTED.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

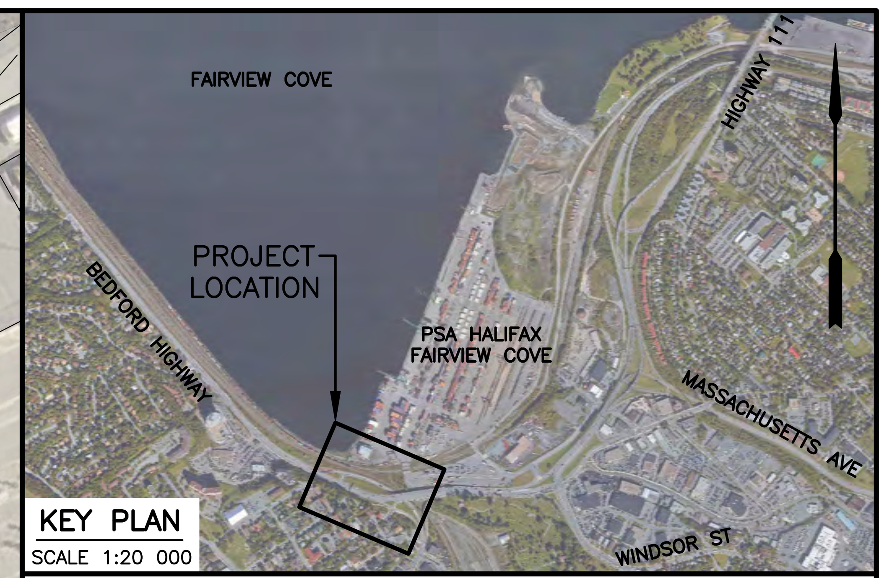
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111
BEDFORD

OVERALL EXISTING SITE PLAN

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:2000 Vert.	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 1 OF 23
Checked R. GIFFIN		Drawing No. C01

EXISTING CONDITIONS AND REMOVAL PLAN – JOSEPH HOWE DR SHEET 1



KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING | REMOVAL

- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- STORM HEADWALL
- STORM SEWER
- SANITARY SEWER
- COMBINED SEWER
- WATER MAIN
- GAS MAIN
- O/H UTILITY
- U/G UTILITY
- LINE MARKING
- SIDEWALK
- TREE
- HEDGE
- TOP OF SLOPE
- BOTTOM OF SLOPE

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

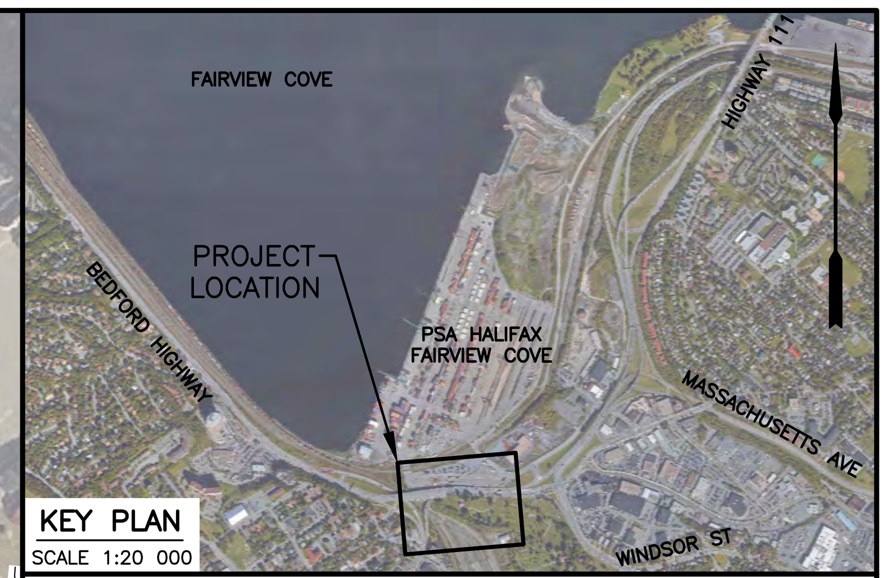
HALIFAX

WINDSOR STREET EXCHANGE VALUE
BEDFORD HWY TO HWY 111
BEDFORD

EXISTING CONDITIONS AND REMOVAL PLAN – JOSEPH HOWE DR SHEET 1 OF 2

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 2 OF 23
Checked R. GIFFIN		Drawing No. C02

EXISTING CONDITIONS AND REMOVAL PLAN – JOSEPH HOWE DR SHEET 2



KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING | REMOVAL

- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- STORM HEADWALL
- STORM SEWER
- SANITARY SEWER
- COMBINED SEWER
- WATER MAIN
- GAS MAIN
- O/H UTILITY
- U/G UTILITY
- LINE MARKING
- SIDEWALK
- TREE
- HEDGE
- TOP OF SLOPE
- BOTTOM OF SLOPE

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111
BEDFORD

EXISTING CONDITIONS AND REMOVAL PLAN – JOSEPH HOWE DR SHEET 2 OF 2

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	Sheet 3 OF 23
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. C03
Checked R. GIFFIN		

EXISTING CONDITIONS AND REMOVAL PLAN – WINDSOR ST INTERSECTION

KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		REMOVAL
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X	FENCE	X
GR	GUIDERAIL	GR
RW	RETAINING WALL	RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
	STORM HEADWALL	
	STORM SEWER	
	SANITARY SEWER	
	COMBINED SEWER	
	WATER MAIN	
G	GAS MAIN	G
OH	O/H UTILITY	
	U/G UTILITY	
	LINE MARKING	
	SIDEWALK	
	TREE	
H	HEDGE	H
	TOP OF SLOPE	
	BOTTOM OF SLOPE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

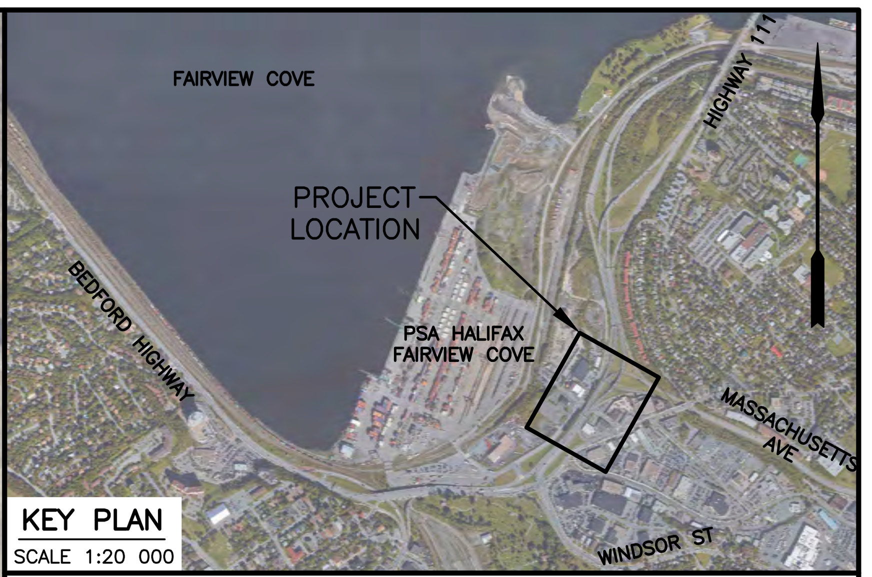
HALIFAX

WINDSOR STREET EXCHANGE VALUE
BEDFORD HWY TO HWY 111
BEDFORD

EXISTING CONDITIONS AND REMOVAL PLAN – WINDSOR ST INTERSECTION

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	Sheet 4 OF 23
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. C04
Checked R. GIFFIN		

EXISTING CONDITIONS AND REMOVAL PLAN
– MACKINTOSH ST & LADY HAMMOND DR



KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		REMOVAL
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
— X — X —	FENCE	— X — X —
— GR — GR —	GUIDERAIL	— GR — GR —
— RW — RW —	RETAINING WALL	— RW — RW —
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
	STORM HEADWALL	
	STORM SEWER	
	SANITARY SEWER	
	COMBINED SEWER	
	WATER MAIN	
— G — G —	GAS MAIN	— G — G —
— OH — OH —	O/H UTILITY	
	U/G UTILITY	
	LINE MARKING	
	SIDEWALK	
	TREE	
— H — H —	HEDGE	— H — H —
	TOP OF SLOPE	
	BOTTOM OF SLOPE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
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1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

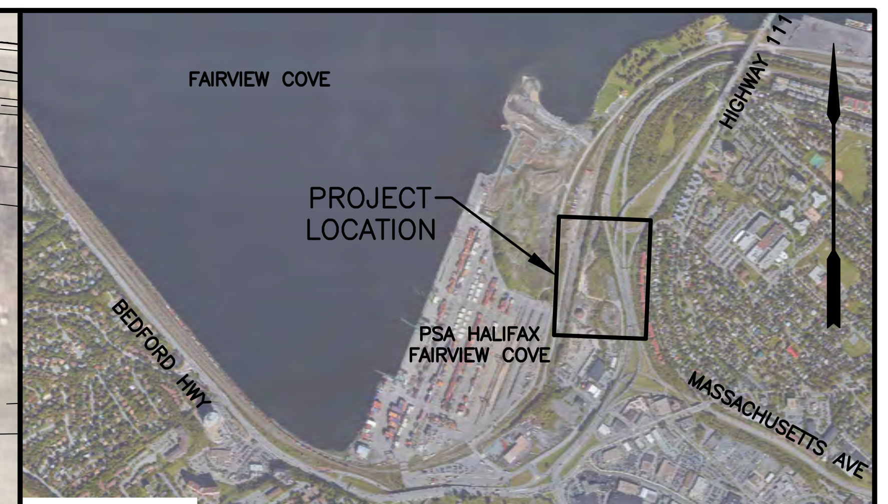
PRELIMINARY

HALIFAX

WINDSOR STREET EXCHANGE VALUE
BEDFORD HWY TO HWY 111
BEDFORD

EXISTING CONDITIONS AND REMOVAL PLAN
– MACKINTOSH ST & LADY HAMMOND DR

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 5 OF 23
Checked R. GIFFIN		Drawing No. C05



KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING | REMOVAL

- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- STORM HEADWALL
- STORM SEWER
- SANITARY SEWER
- COMBINED SEWER
- WATER MAIN
- GAS MAIN
- O/H UTILITY
- U/G UTILITY
- LINE MARKING
- SIDEWALK
- TREE
- HEDGE
- TOP OF SLOPE
- BOTTOM OF SLOPE

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

WINDSOR STREET EXCHANGE VALUE

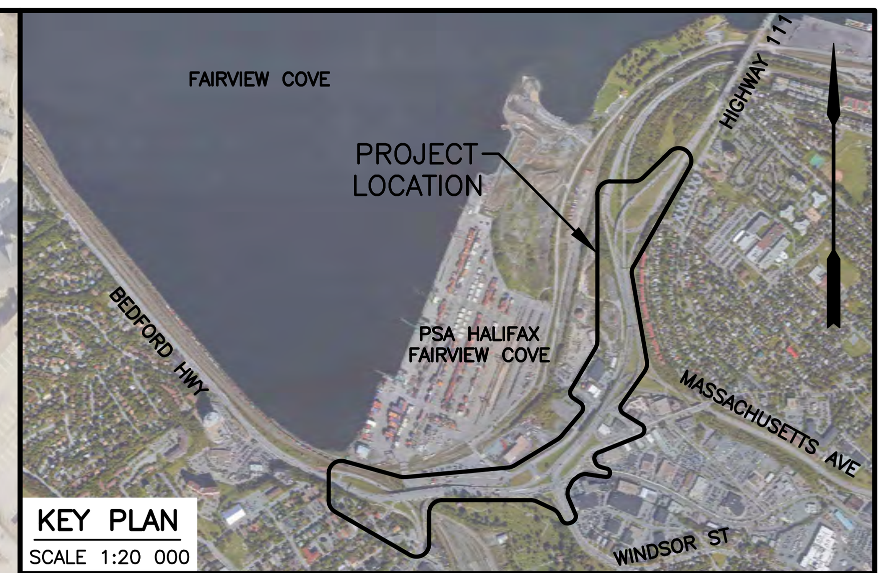
BEDFORD HWY TO HWY 111
BEDFORD

EXISTING CONDITIONS AND REMOVAL PLAN – BARRINGTON ST & HWY 111

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 6 OF 23
Checked R. GIFFIN		Drawing No. C06

STREET CLASSIFICATION TABLE

STREET NAME	STREET CLASSIFICATION	DESIGN SPEED (km/h)
BEDFORD HIGHWAY	ARTERIAL	50–60
JOSEPH HOWE DRIVE	ARTERIAL	50
HIGHWAY 111	ARTERIAL	50–70
BARRINGTON STREET	ARTERIAL	50–70
WINDSOR ST/HIGHWAY 111	ARTERIAL	50
LADY HAMMOND ROAD	ARTERIAL/MAJOR COLLECTOR	50
KEMPT ROAD	MINOR COLLECTOR	50
BAYNE STREET	LOCAL	50
MACKINTOSH STREET	LOCAL	50
BAYNE/LADY HAMMOND LINK	LOCAL	50
FORRESTER STREET	LOCAL	50



KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
PT NO	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X X	FENCE	X X
GR GR	GUIDERAIL	GR GR
RW RW	RETAINING WALL	RW RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G G	GAS MAIN	G G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI–USE PATH	
	ASPHALT REINSTATEMENT	
	NEW ROAD CONSTRUCTION	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H H	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	FEB 23/24	ISSUED FOR DESIGN REVIEW	EN

PRELIMINARY

HALIFAX

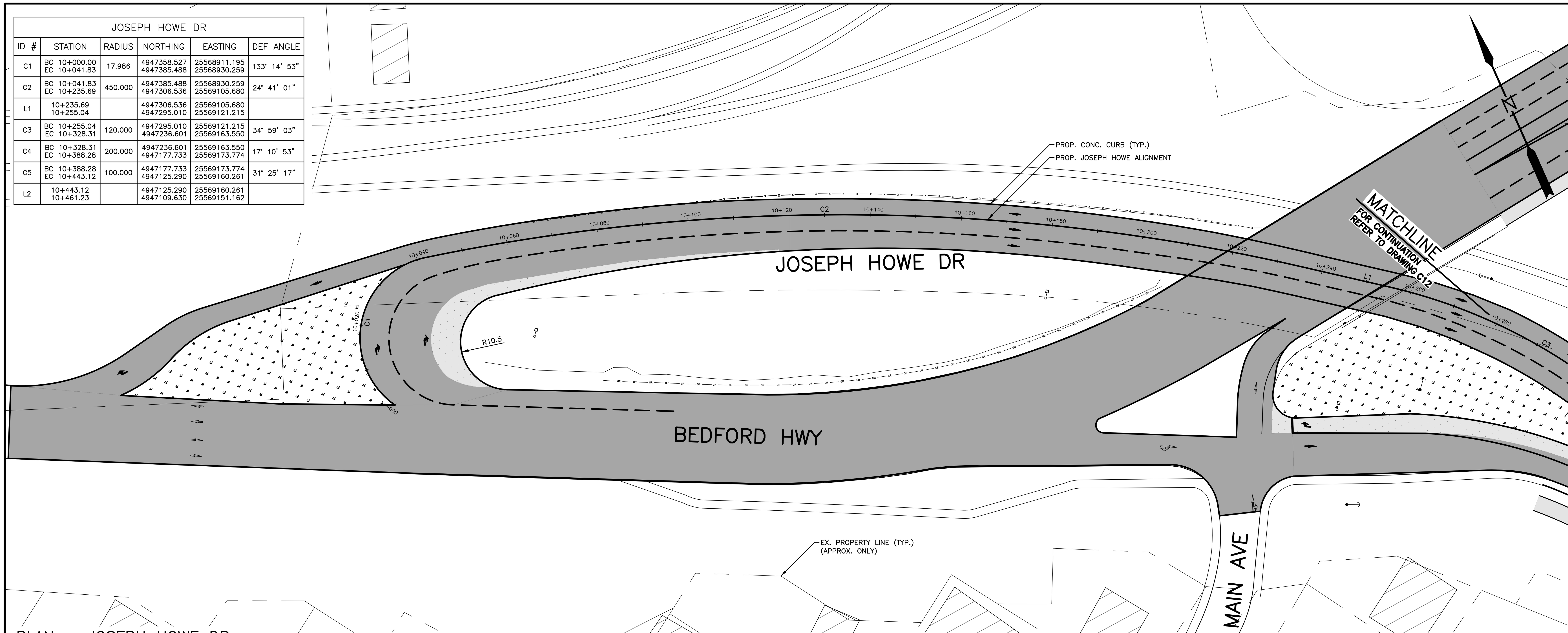
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111
BEDFORD

OVERALL SITE PLAN – PROPOSED WORK

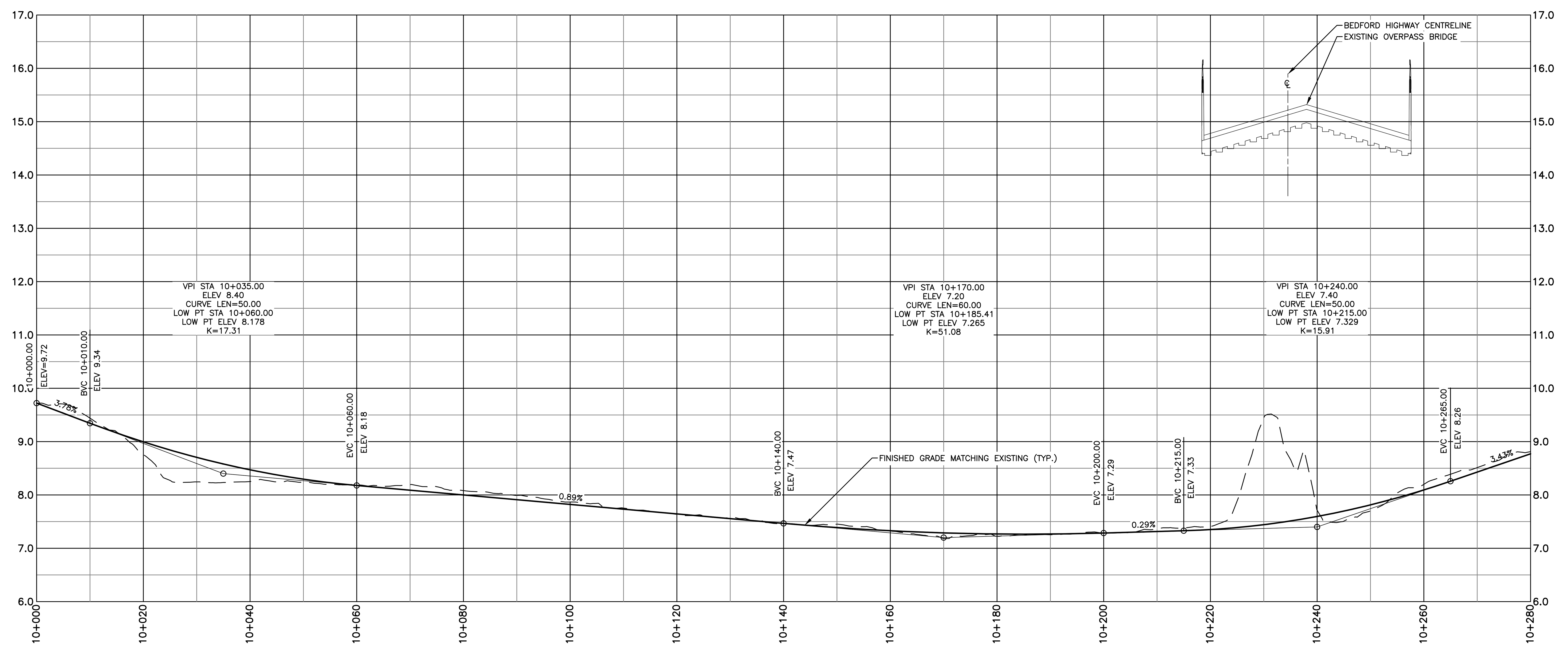
Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:2000 Vert.	Survey No. SU21xxxx	Sheet 7 OF 23
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. C10
Checked R. GIFFIN		

JOSEPH HOWE DR					
ID #	STATION	RADIUS	NORTHING	EASTING	DEF ANGLE
C1	BC 10+000.00 EC 10+041.83	17.986	4947358.527 4947385.488	25568911.195 25568930.259	133° 14' 53"
C2	BC 10+041.83 EC 10+235.69	450.000	4947385.488 4947306.536	25568930.259 25569105.680	24° 41' 01"
L1	10+235.69 10+255.04		4947306.536 4947295.010	25569105.680 25569121.215	
C3	BC 10+255.04 EC 10+328.31	120.000	4947295.010 4947236.601	25569121.215 25569163.550	34° 59' 03"
C4	BC 10+328.31 EC 10+388.28	200.000	4947236.601 4947177.733	25569163.550 25569173.774	17° 10' 53"
C5	BC 10+388.28 EC 10+443.12	100.000	4947177.733 4947125.290	25569173.774 25569160.261	31° 25' 17"
L2	10+443.12 10+461.23		4947125.290 4947109.630	25569160.261 25569151.162	



PLAN – JOSEPH HOWE DR

STATION: 10+000–10+280



PROFILE – JOSEPH HOWE DR

STATION: 10+000–10+280

KEY PLAN

SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X	FENCE	X
GR	GUIDERAIL	GR
RW	RETAINING WALL	RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G	GAS MAIN	G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT REINSTATEMENT	
	NEW ROAD CONSTRUCTION	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H	HEDGE	H

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
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1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

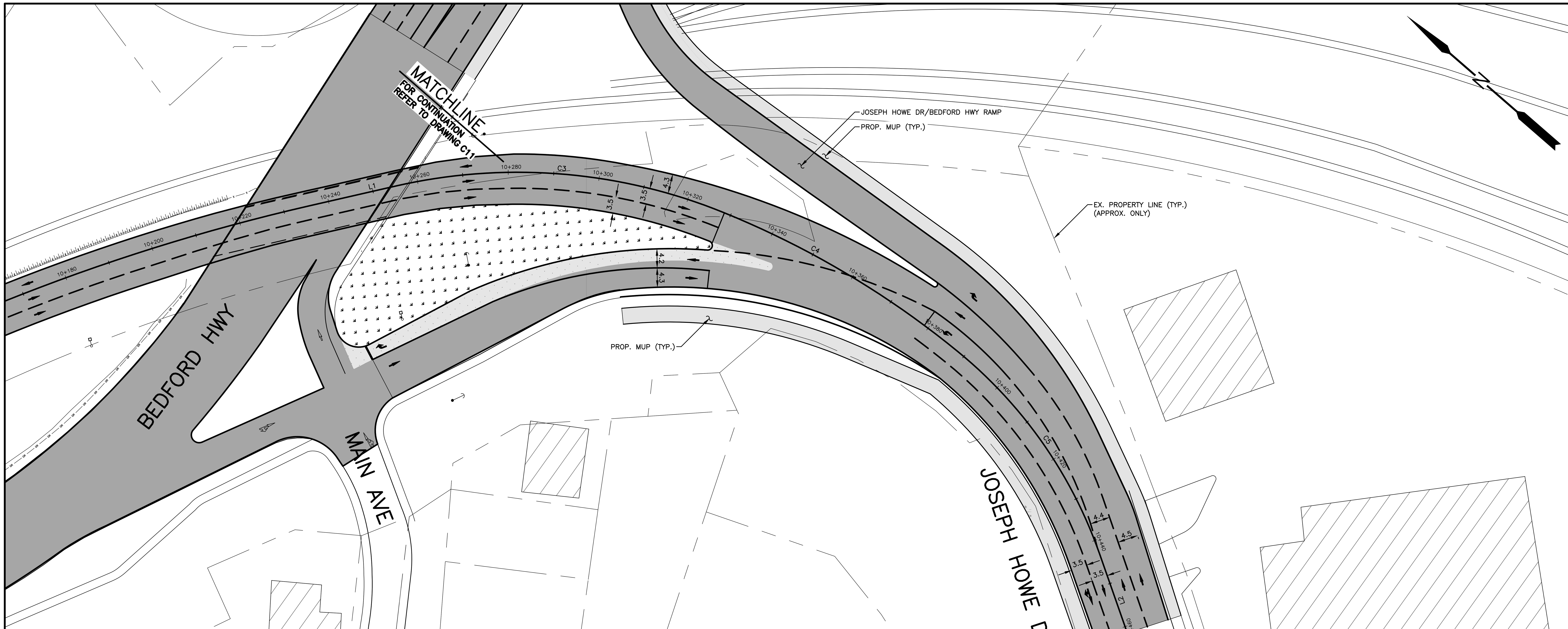
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111

BEDFORD

PROPOSED PLAN AND PROFILE – JOSEPH HOWE DR SHEET 1 OF 2

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 8 OF 23
Checked R. GIFFIN		Drawing No. C11



PLAN – JOSEPH HOWE DR
STATION: 10+280–10+460

KEY PLAN
SCALE 1:20 000

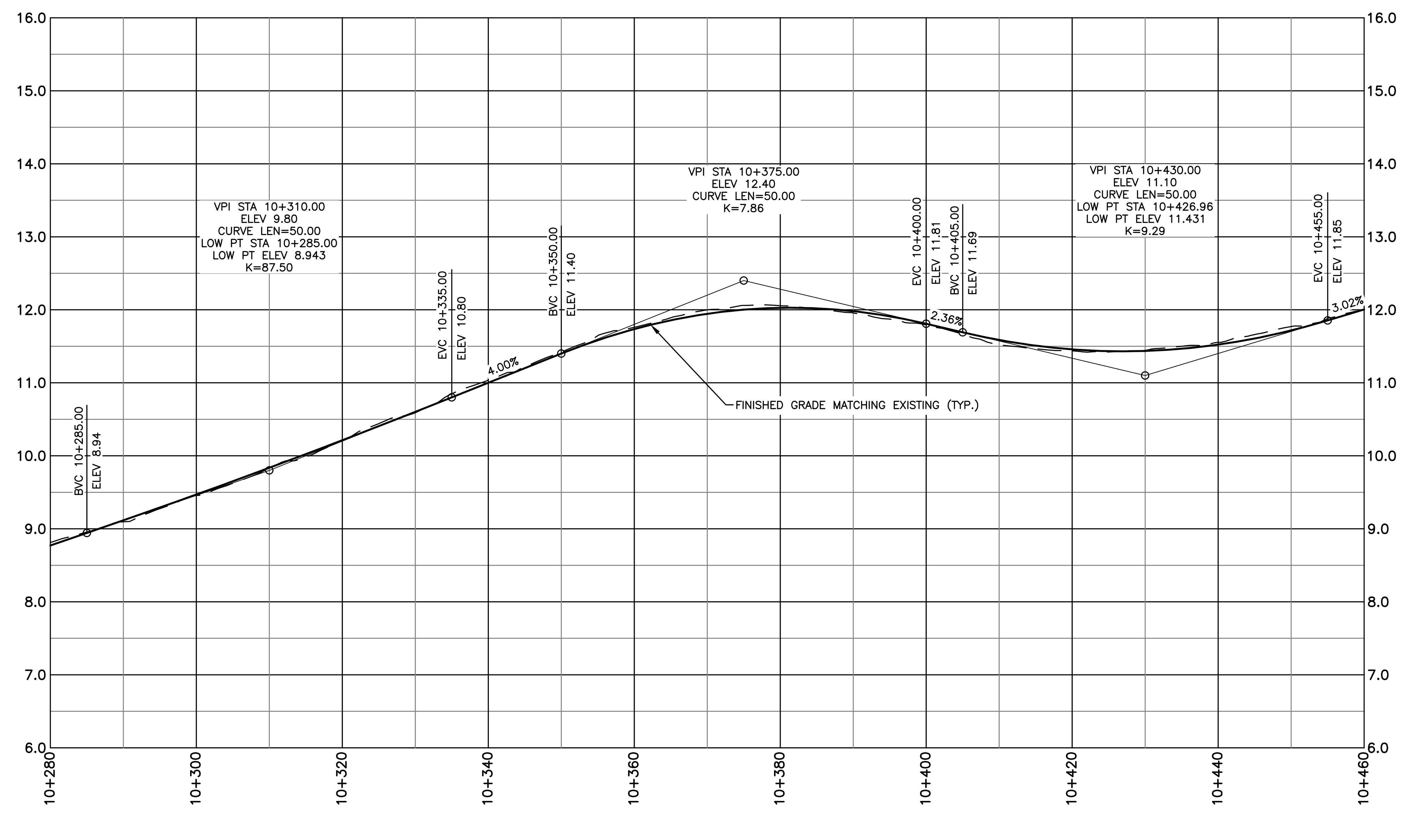
PLAN LEGEND

EXISTING / PROPOSED

- SURVEY CONTROL POINT
- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- GAS MAIN
- LINE MARKING
- BOTTOM OF SLOPE
- SIDEWALK
- MULTI-USE PATH
- ASPHALT REINSTATEMENT
- NEW ROAD CONSTRUCTION
- LANDSCAPE SURFACE
- PAVEMENT MARKING
- TREE
- HEDGE

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.



PROFILE – JOSEPH HOWE DR
STATION: 10+280–10+460

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

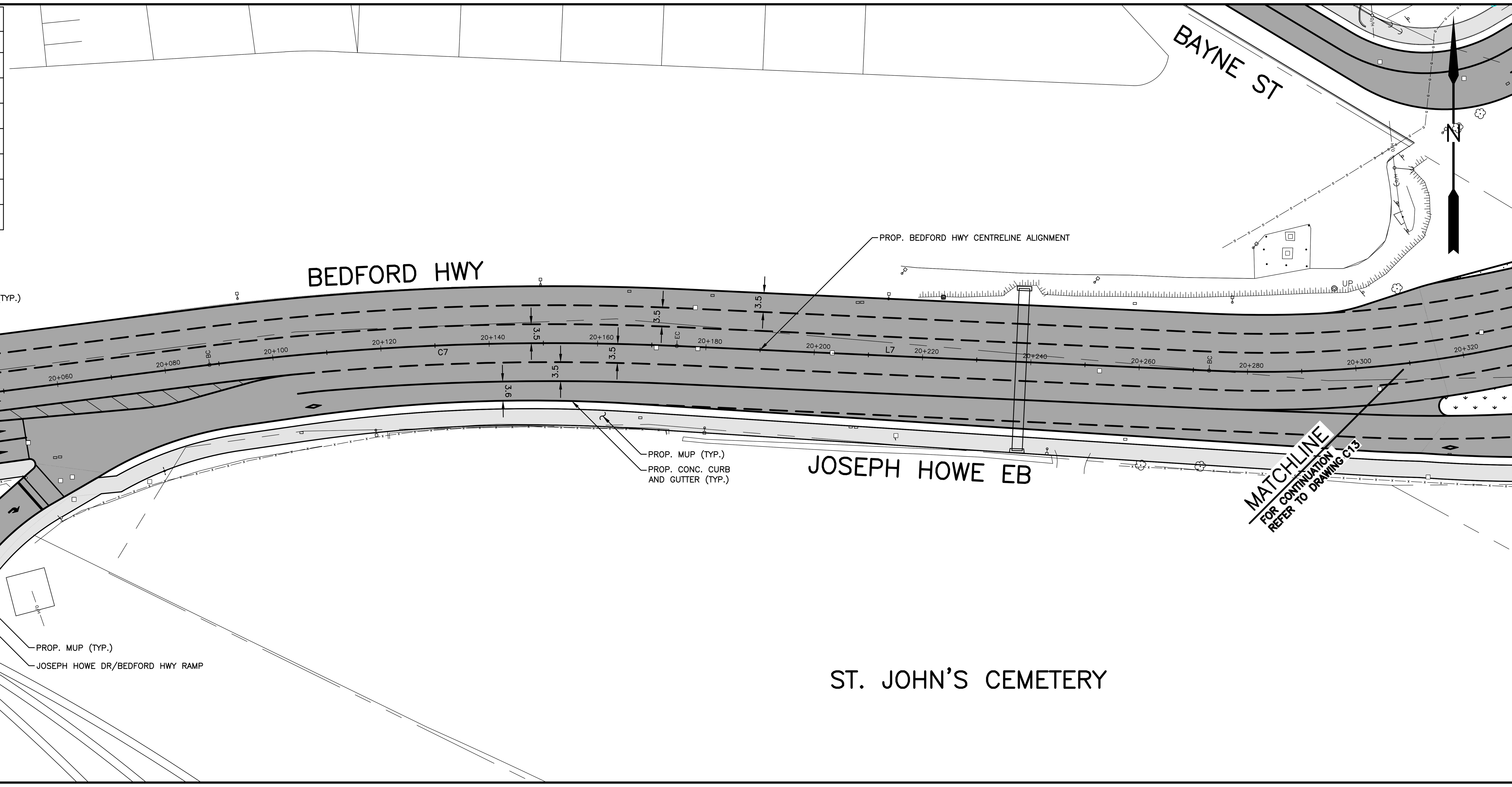
HALIFAX

WINDSOR STREET EXCHANGE VALUE
BEDFORD HWY TO HWY 111
BEDFORD

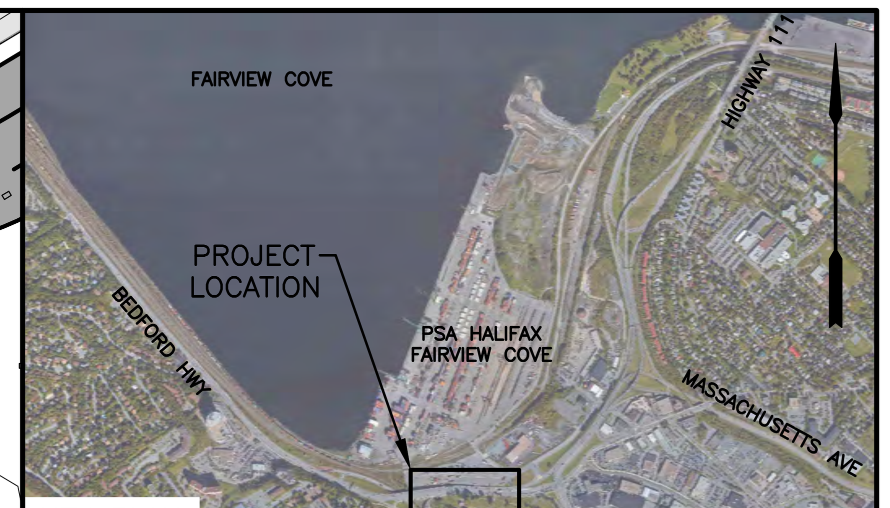
PROPOSED PLAN AND PROFILE – JOSEPH HOWE DR SHEET 2 OF 2

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	Sheet 9 OF 23
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. C12
Checked R. GIFFIN		

BEDFORD HWY					
ID #	STATION	RADIUS	NORTHING	EASTING	DEF ANGLE
L6	20+000.00 20+088.25		4947313.450 4947324.595	25569147.877 25569235.415	
C7	BC 20+088.25 EC 20+174.62	500.000	4947324.595 4947328.066	25569235.415 25569321.613	9° 53' 52"
L7	20+174.62 20+272.92		4947328.066 4947323.534	25569321.613 25569419.805	
C8	BC 20+272.92 EC 20+458.56	220.000	4947323.534 4947389.665	25569419.805 25569587.417	48° 20' 55"
L8	20+458.56 20+589.45		4947389.665 4947483.348	25569587.417 25569678.820	
C9	BC 20+589.45 EC 20+642.44	350.000	4947483.348 4947523.927	25569678.820 25569712.817	8° 40' 28"
L9	20+642.44 20+713.56		4947523.927 4947581.740	25569712.817 25569754.237	



PLAN – BEDFORD HIGHWAY
STATION: 20+000–20+320



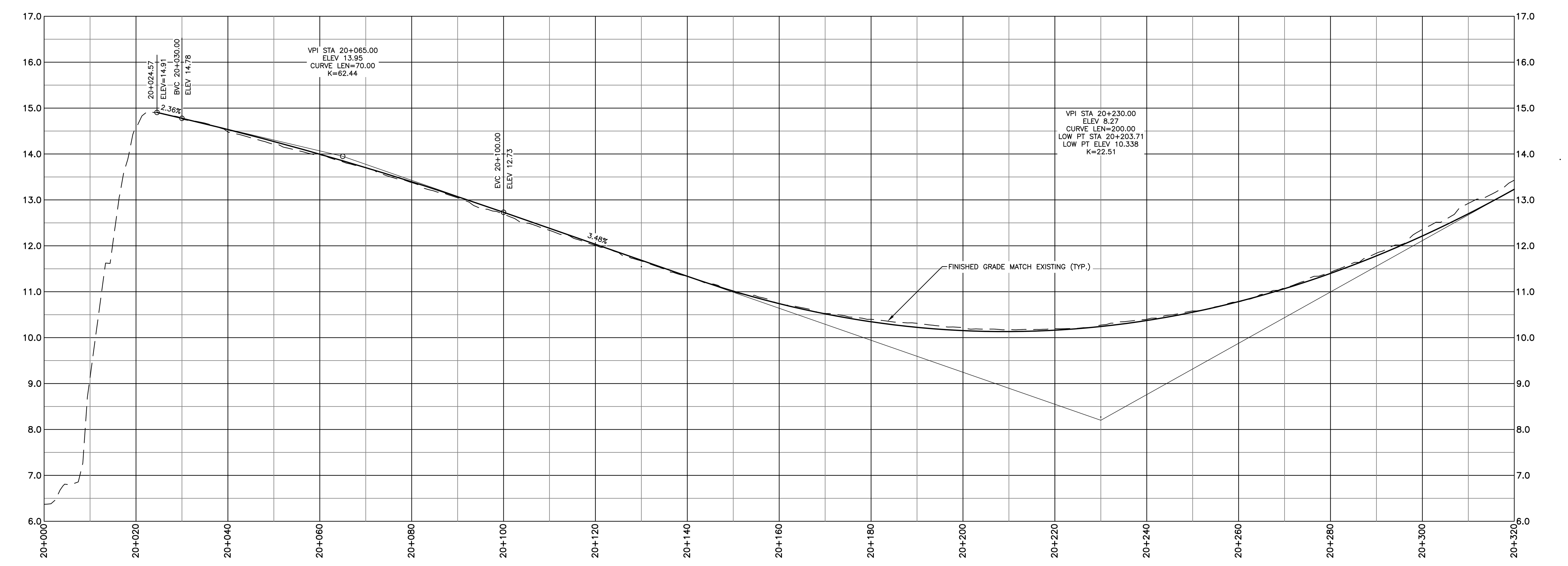
KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
PT NO	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X X	FENCE	X X
GR GR	GUIDERAIL	GR GR
RW RW	RETAINING WALL	RW RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G G	GAS MAIN	G G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI–USE PATH	
	ASPHALT REINSTATEMENT	
	NEW ROAD CONSTRUCTION	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H H	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.



PROFILE – BEDFORD HIGHWAY
STATION: 20+000–20+320

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

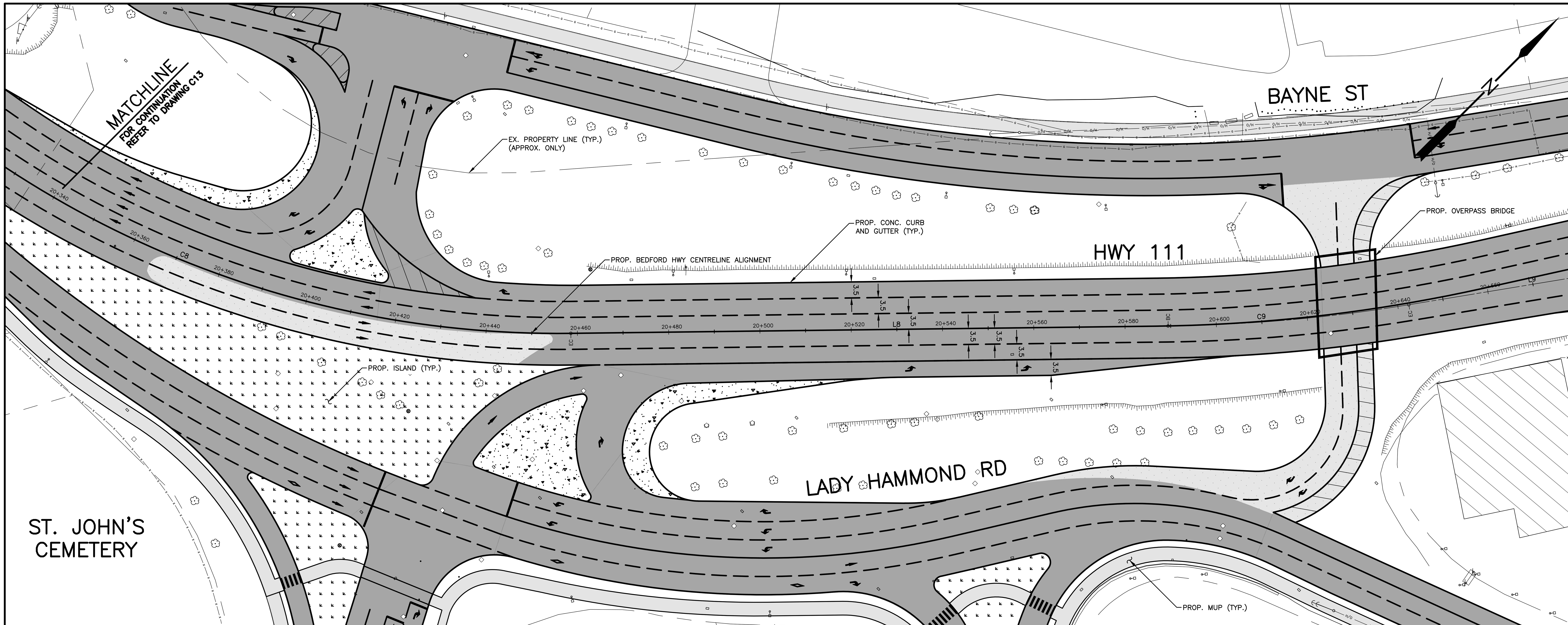
PRELIMINARY

HALIFAX

WINDSOR STREET EXCHANGE VALUE
BEDFORD HWY TO HWY 111
BEDFORD

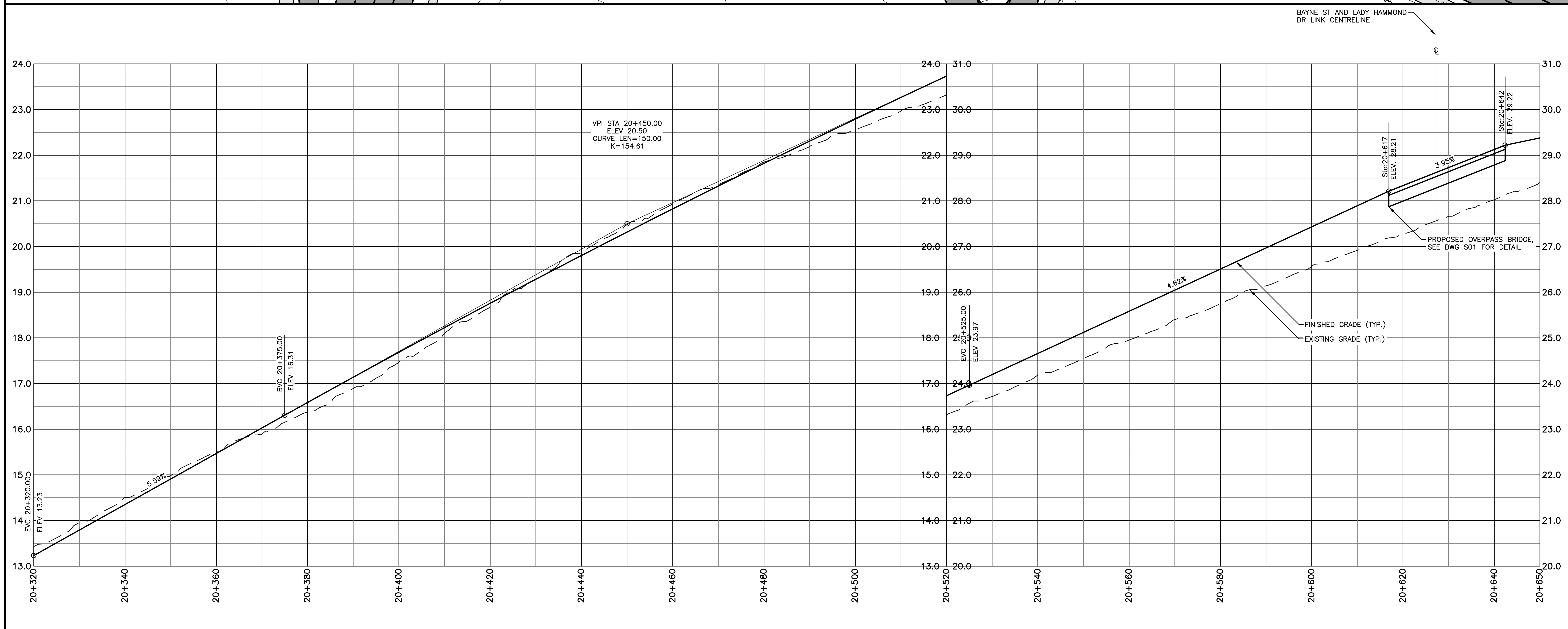
PROPOSED PLAN AND PROFILE – BEDFORD HIGHWAY SHEET 1 OF 2

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	Sheet 10 OF 23
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. C13
Checked R. GIFFIN		



PLAN – BEDFORD HIGHWAY

STATION: 20+320–20+660



PROFILE – BEDFORD HIGHWAY

STATION: 20+320–20+660

KEY PLAN

SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X	FENCE	X
GR	GUIDERAIL	GR
RW	RETAINING WALL	RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G	GAS MAIN	G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT REINSTATEMENT	
	NEW ROAD CONSTRUCTION	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

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PRELIMINARY

HALIFAX

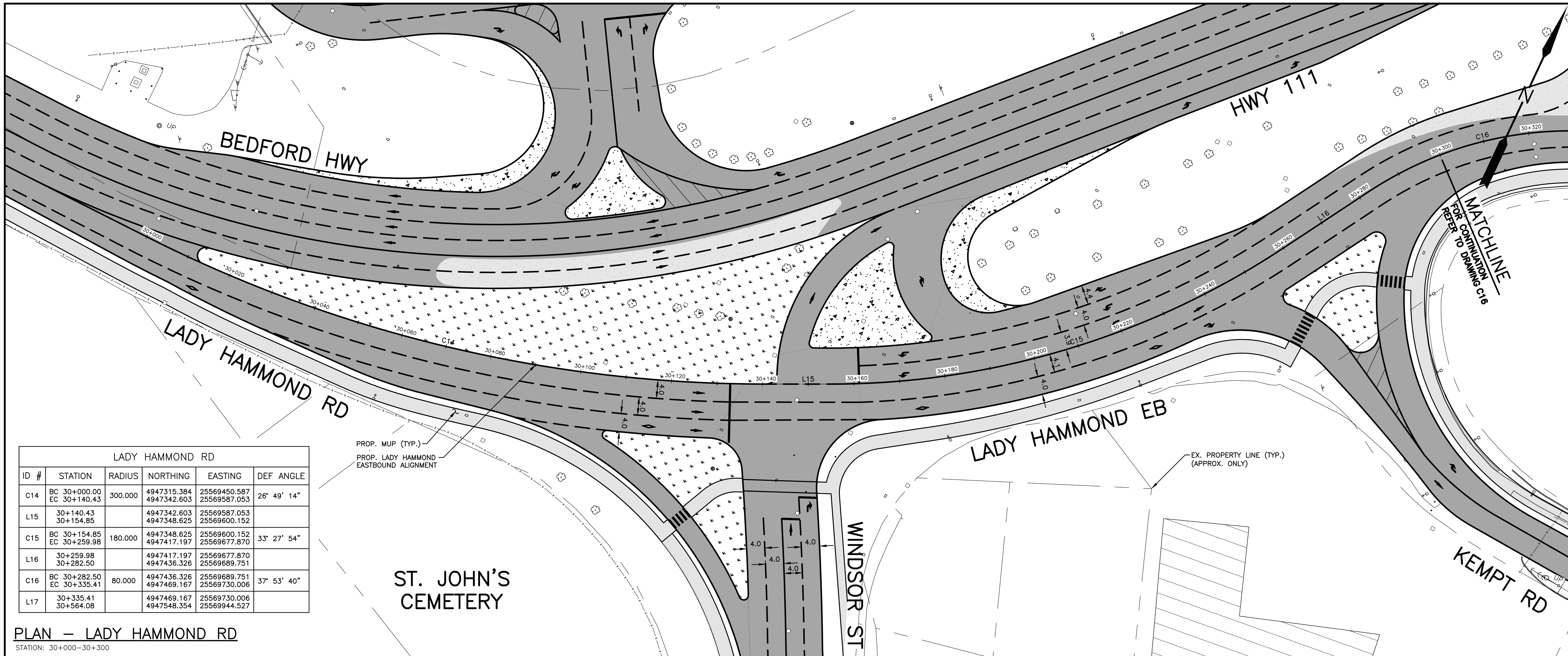
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111

BEDFORD

PROPOSED PLAN AND PROFILE – BEDFORD HIGHWAY SHEET 2 OF 2

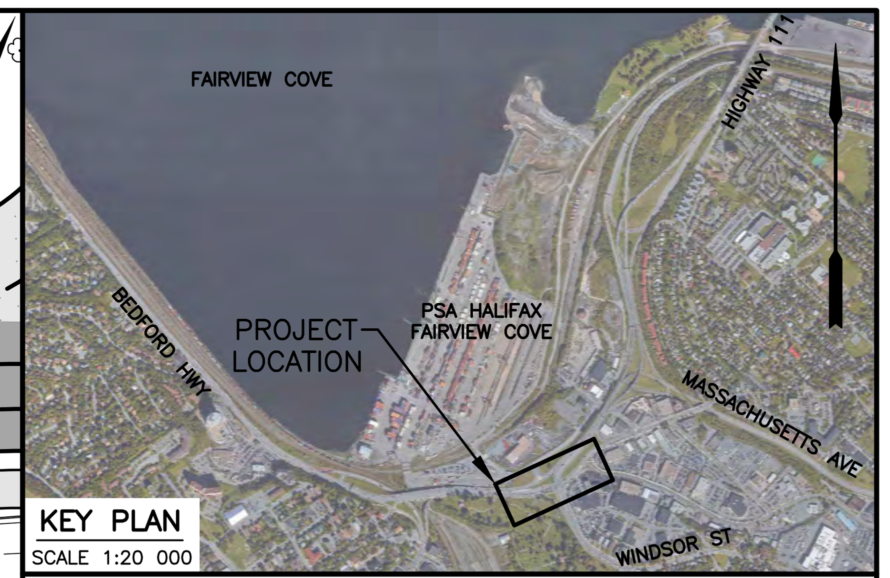
Date FEB 2024	Drawn M. ZHOU	Tender No.	
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx		
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 11 OF 23	
Checked R. GIFFIN		Drawing No. C14	



LADY HAMMOND RD					
ID #	STATION	RADIUS	NORTHING	EASTING	DEF ANGLE
C14	BC 30+000.00 EC 30+140.43	300.000	4947315.384 4947342.603	25569450.587 25569587.053	26° 49' 14"
L15	30+140.43 30+154.85		4947342.603 4947348.625	25569587.053 25569600.152	
C15	BC 30+154.85 EC 30+259.98	180.000	4947348.625 4947417.197	25569600.152 25569677.870	33° 27' 54"
L16	30+259.98 30+282.50		4947417.197 4947436.326	25569677.870 25569689.751	
C16	BC 30+282.50 EC 30+335.41	80.000	4947436.326 4947469.167	25569689.751 25569730.006	37° 53' 40"
L17	30+335.41 30+564.08		4947469.167 4947548.354	25569730.006 25569944.527	

PLAN – LADY HAMMOND RD

STATION: 30+000–30+300



KEY PLAN
SCALE 1:20 000

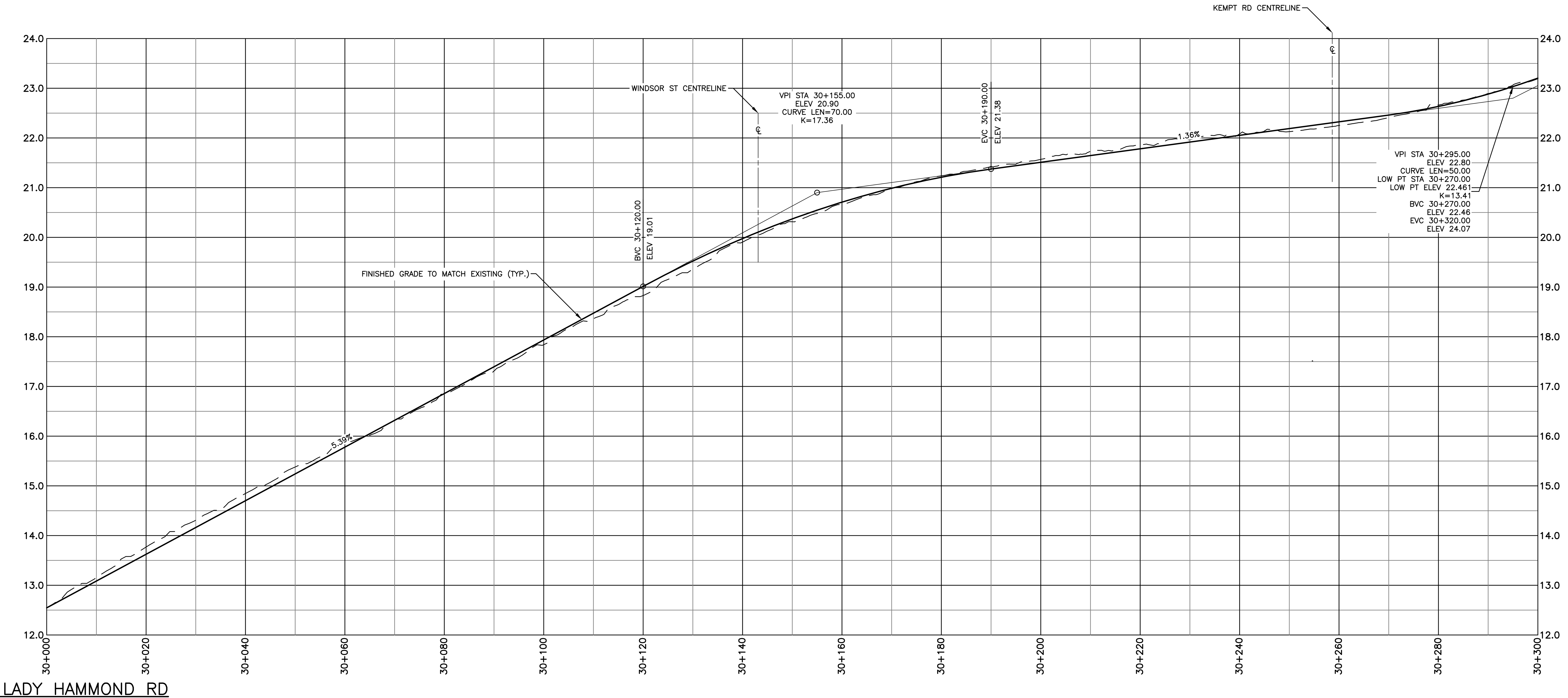
PLAN LEGEND

EXISTING / PROPOSED

- SURVEY CONTROL POINT
- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- GAS MAIN
- LINE MARKING
- BOTTOM OF SLOPE
- SIDEWALK
- MULTI–USE PATH
- ASPHALT REINSTATEMENT
- NEW ROAD CONSTRUCTION
- LANDSCAPE SURFACE
- PAVEMENT MARKING
- TREE
- HEDGE

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.



PROFILE – LADY HAMMOND RD

STATION: 30+000–30+300

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

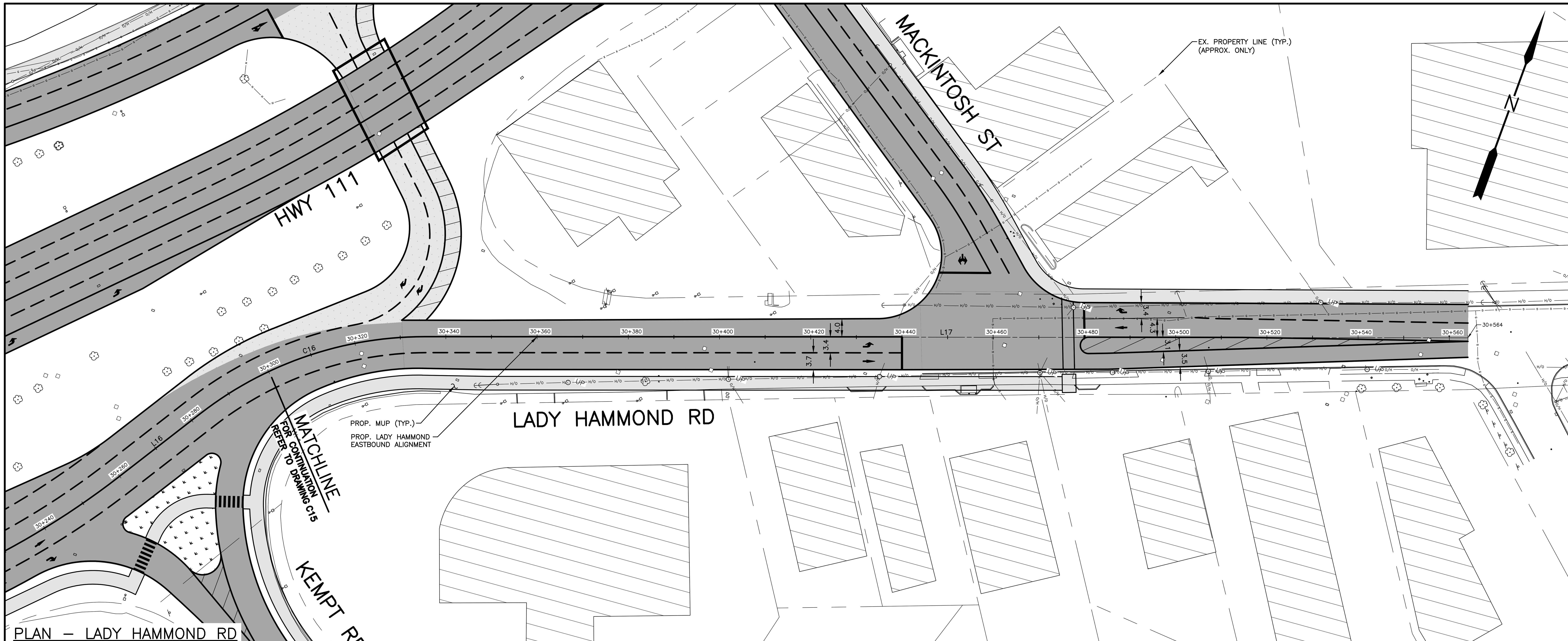
PRELIMINARY

HALIFAX

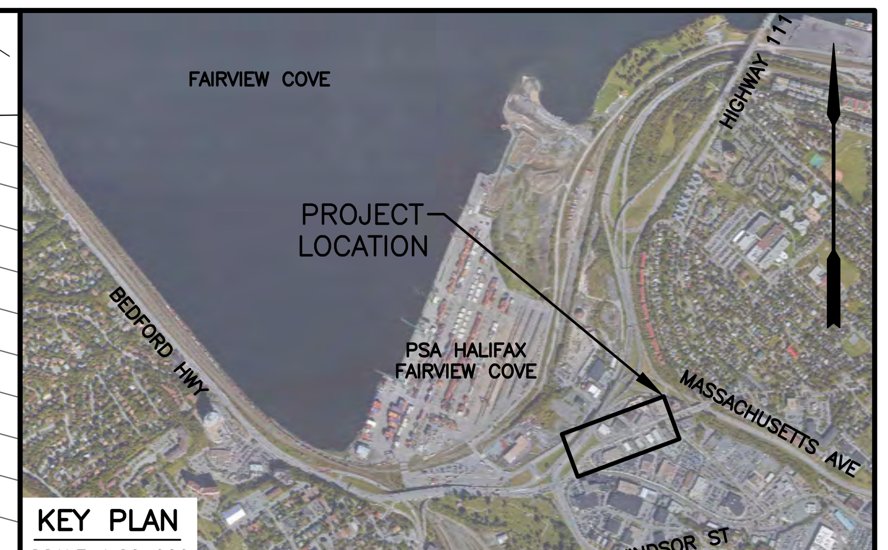
WINDSOR STREET EXCHANGE VALUE
BEDFORD HWY TO HWY 111
BEDFORD

PROPOSED PLAN AND PROFILE – LADY HAMMOND ROAD SHEET 1 OF 2

Date: FEB 2024	Drawn: M. ZHOU	Tender No.	
Scale: Horz.1:500, Vert. 1:50	Survey No. SU21xxxx		
Reference	DATUM: HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 12 OF 23	
Checked: R. GIFFIN		Drawing No. C15	



PLAN – LADY HAMMOND RD
STATION: 30+300–30+564



KEY PLAN
SCALE 1:20 000

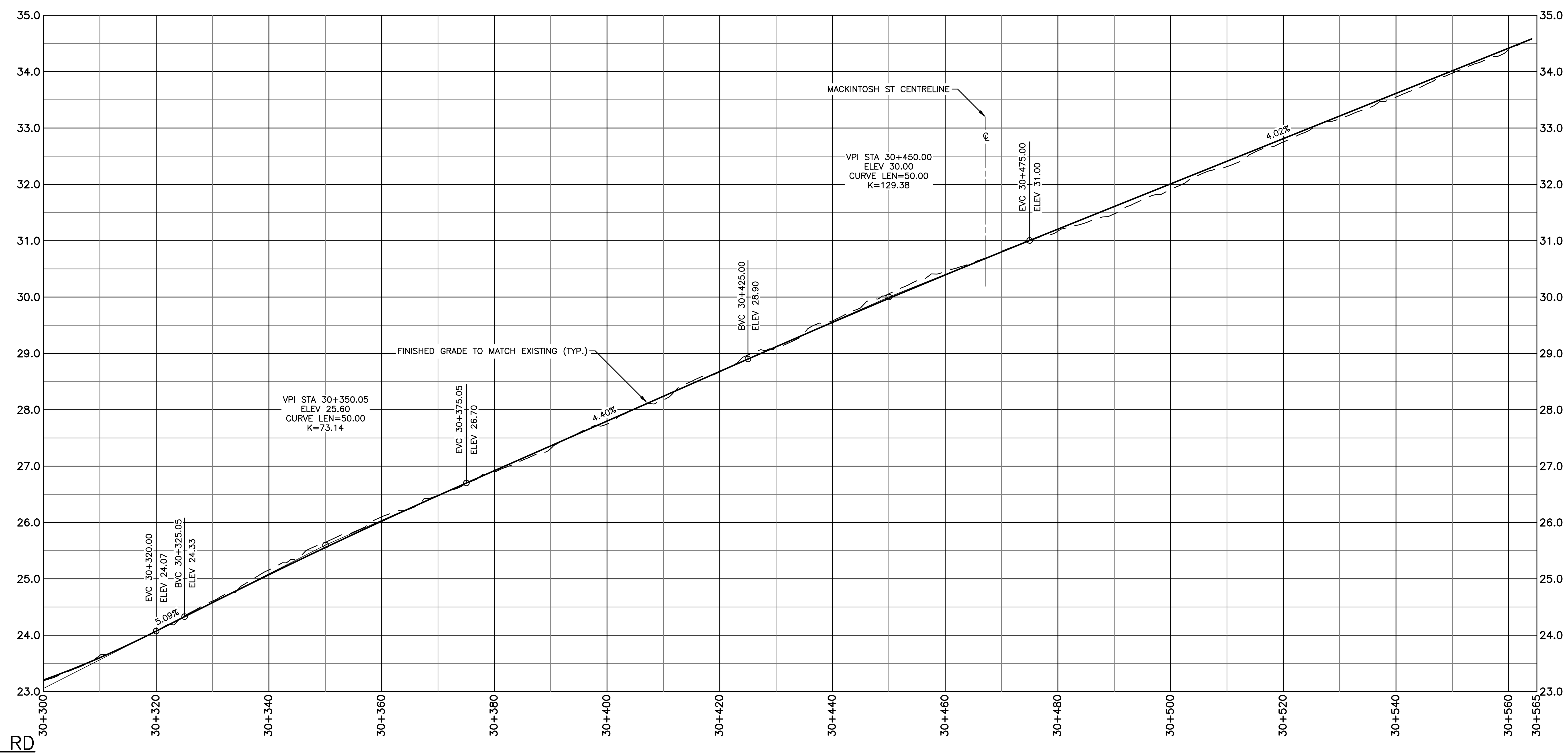
PLAN LEGEND

EXISTING | PROPOSED

- SURVEY CONTROL POINT
- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- GAS MAIN
- LINE MARKING
- BOTTOM OF SLOPE
- SIDEWALK
- MULTI-USE PATH
- ASPHALT REINSTATEMENT
- NEW ROAD CONSTRUCTION
- LANDSCAPE SURFACE
- PAVEMENT MARKING
- TREE
- HEDGE

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.



PROFILE – LADY HAMMOND RD
STATION: 30+300–30+564

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

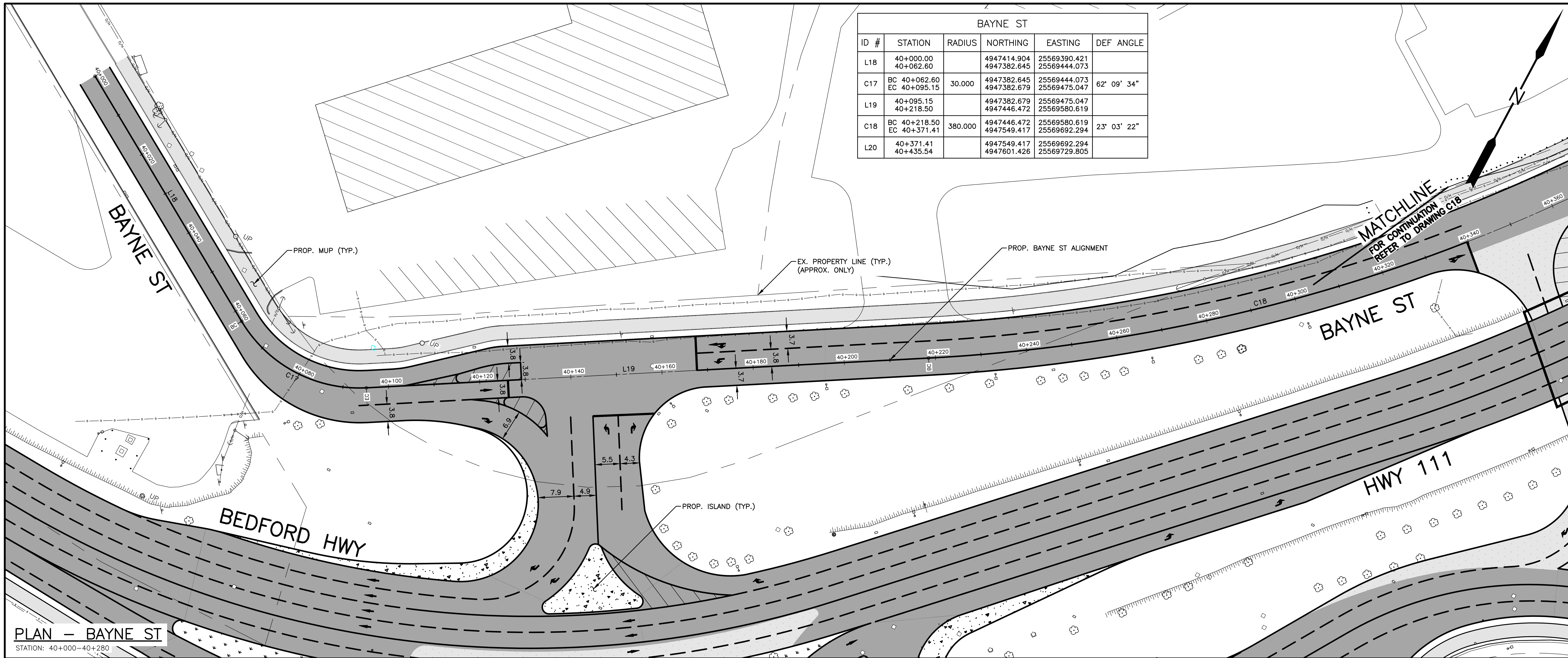
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111
BEDFORD

PROPOSED PLAN AND PROFILE – LADY HAMMOND ROAD SHEET 2 OF 2

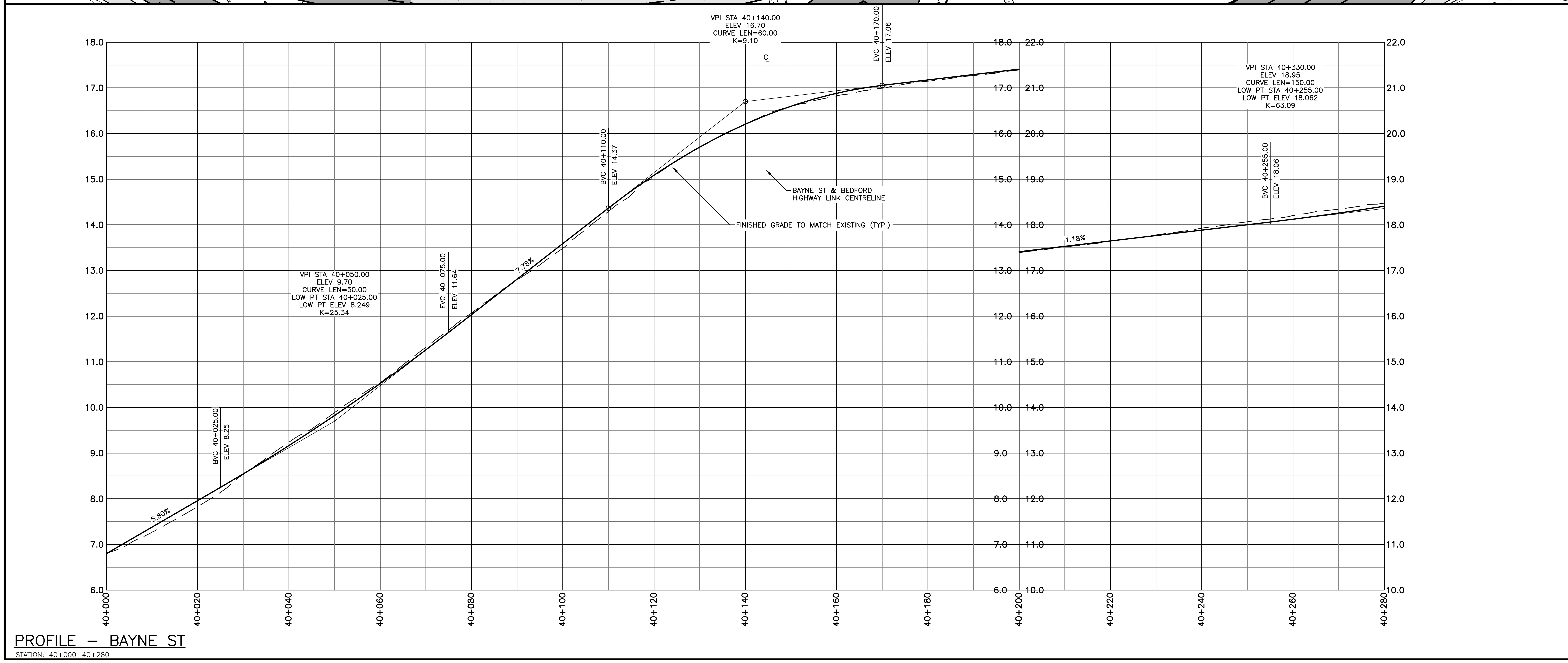
Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 13 OF 23
Checked R. GIFFIN		Drawing No. C16

BAYNE ST					
ID #	STATION	RADIUS	NORTHING	EASTING	DEF ANGLE
L18	40+000.00 40+062.60		4947414.904 4947382.645	25569390.421 25569444.073	
C17	BC 40+062.60 EC 40+095.15	30.000	4947382.645 4947382.679	25569444.073 25569475.047	62° 09' 34"
L19	40+095.15 40+218.50		4947382.679 4947446.472	25569475.047 25569580.619	
C18	BC 40+218.50 EC 40+371.41	380.000	4947446.472 4947549.417	25569580.619 25569692.294	23° 03' 22"
L20	40+371.41 40+435.54		4947549.417 4947601.426	25569692.294 25569729.805	



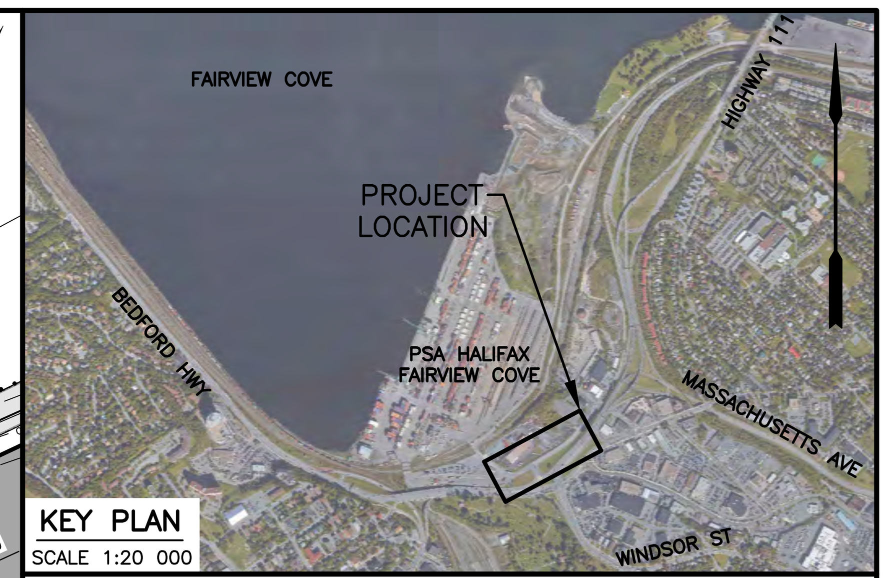
PLAN – BAYNE ST

STATION: 40+000–40+280



PROFILE – BAYNE ST

STATION: 40+000–40+280



KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING / PROPOSED

- SURVEY CONTROL POINT
- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- GAS MAIN
- LINE MARKING
- BOTTOM OF SLOPE
- SIDEWALK
- MULTI-USE PATH
- ASPHALT REINSTATEMENT
- NEW ROAD CONSTRUCTION
- LANDSCAPE SURFACE
- PAVEMENT MARKING
- TREE
- HEDGE

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

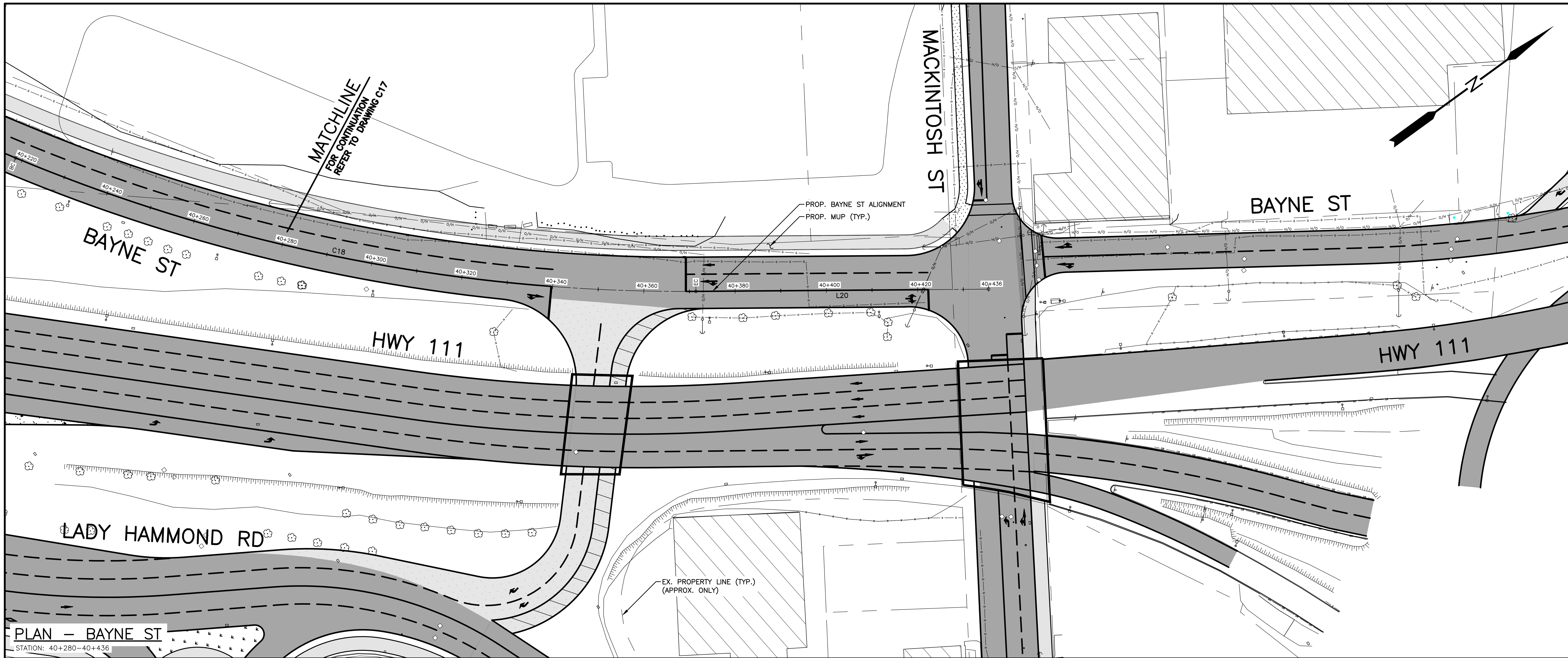
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111

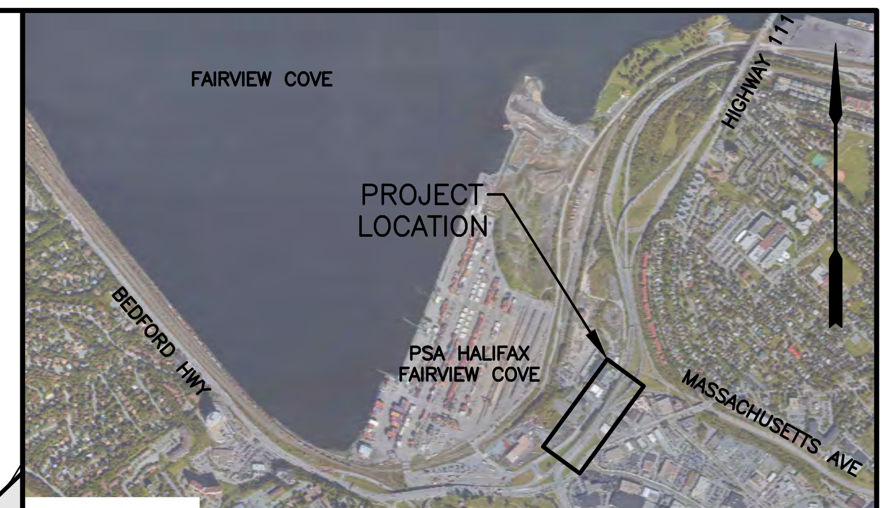
BEDFORD

PROPOSED PLAN AND PROFILE – BAYNE ST SHEET 1 OF 2

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 14 OF 23
Checked R. GIFFIN		Drawing No. C17



PLAN – BAYNE ST
STATION: 40+280–40+436



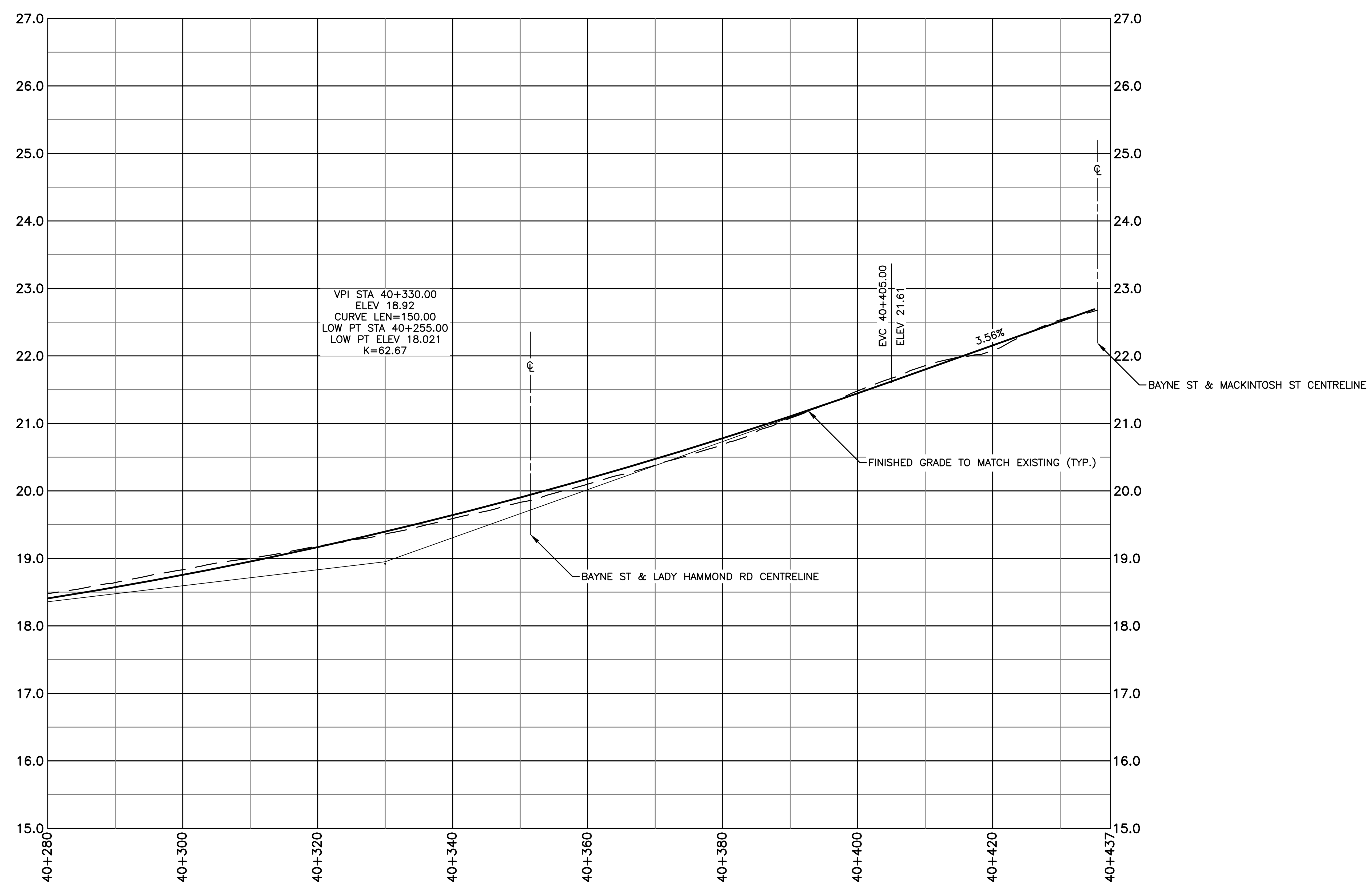
KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X	FENCE	X
GR	GUIDERAIL	GR
RW	RETAINING WALL	RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G	GAS MAIN	G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT REINSTATEMENT	
	NEW ROAD CONSTRUCTION	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.



PROFILE – BAYNE ST
STATION: 40+280–40+436

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

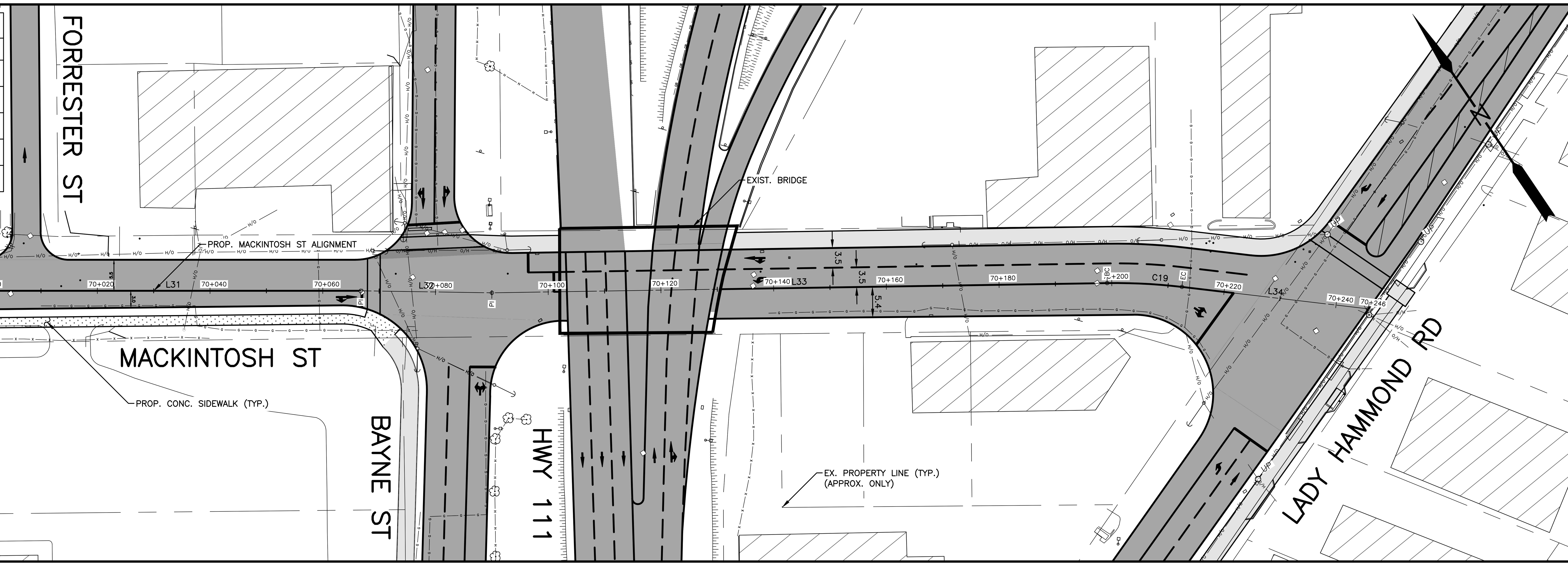
HALIFAX

WINDSOR STREET EXCHANGE VALUE
BEDFORD HWY TO HWY 111
BEDFORD

PROPOSED PLAN AND PROFILE – BAYNE ST SHEET 2 OF 2

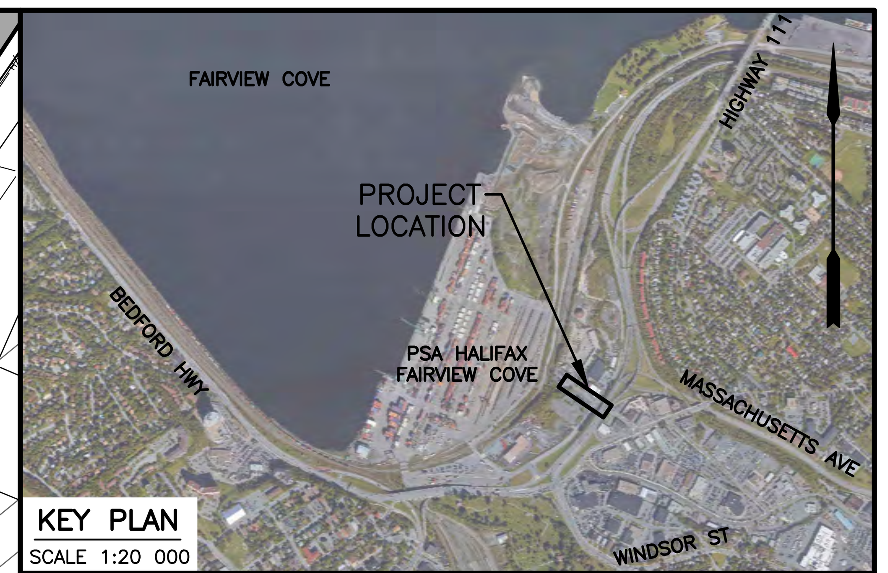
Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 15 OF 23
Checked R. GIFFIN		Drawing No. C18

MACKINTOSH ST					
ID #	STATION	RADIUS	NORTHING	EASTING	DEF ANGLE
L31	70+000.00 70+066.75		4947650.310 4947612.761	25569658.490 25569713.680	
L32	70+066.75 70+090.01		4947612.761 4947599.387	25569713.680 25569732.707	
L33	70+090.01 70+199.18		4947599.387 4947539.406	25569732.707 25569823.921	
C19	BC 70+199.18 EC 70+212.47	100.000	4947539.406 4947531.386	25569823.921 25569834.512	7° 37' 03"
L34	70+212.47 70+245.80		4947531.386 4947509.547	25569834.512 25569859.683	



PLAN – MACKINTOSH ST

STATION: 70+000–70+246



KEY PLAN

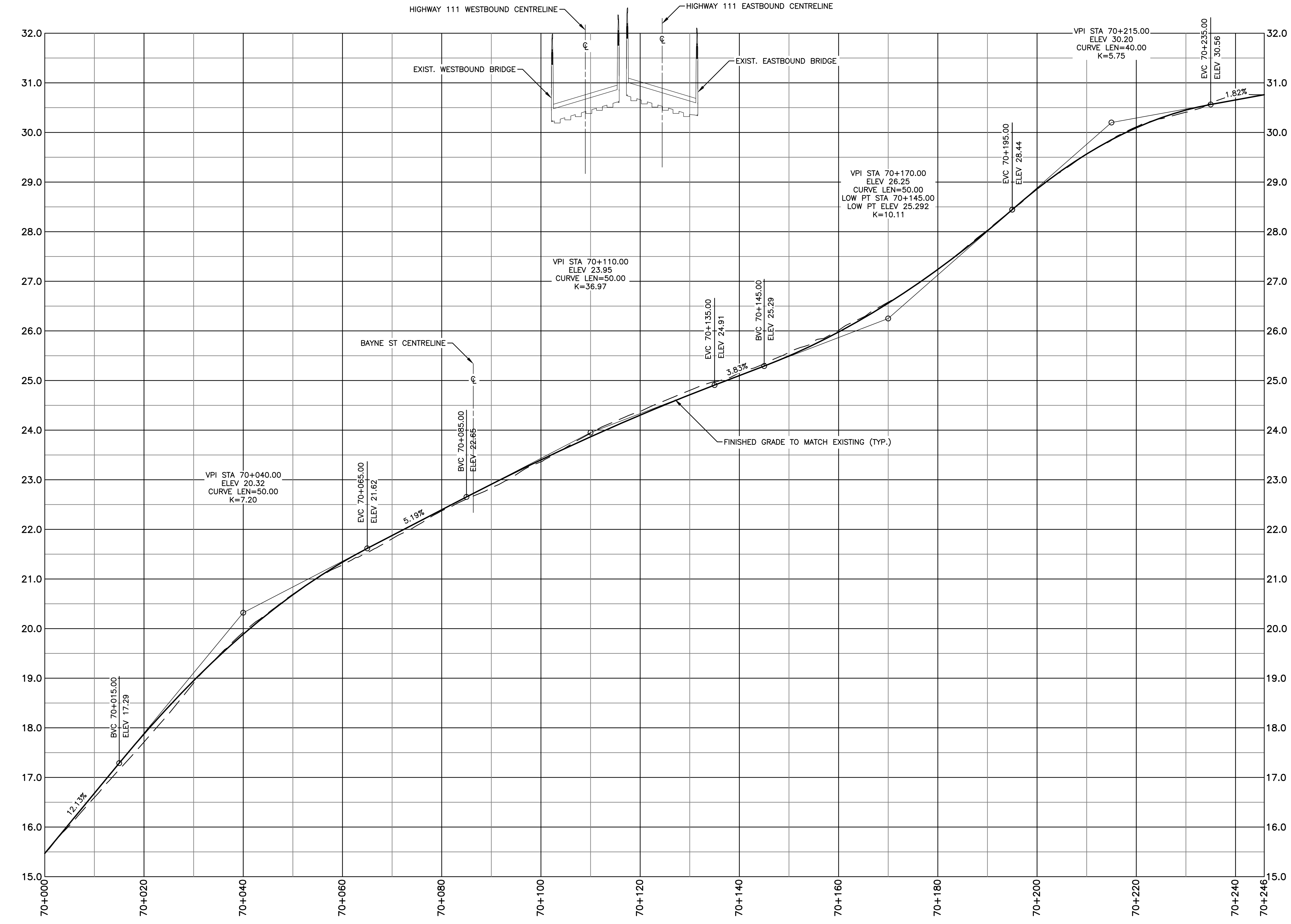
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
PT NO	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X	FENCE	X
GR	GUIDERAIL	GR
RW	RETAINING WALL	RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G	GAS MAIN	G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT REINSTATEMENT	
	NEW ROAD CONSTRUCTION	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.



PROFILE – MACKINTOSH ST

STATION: 70+000–70+246

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

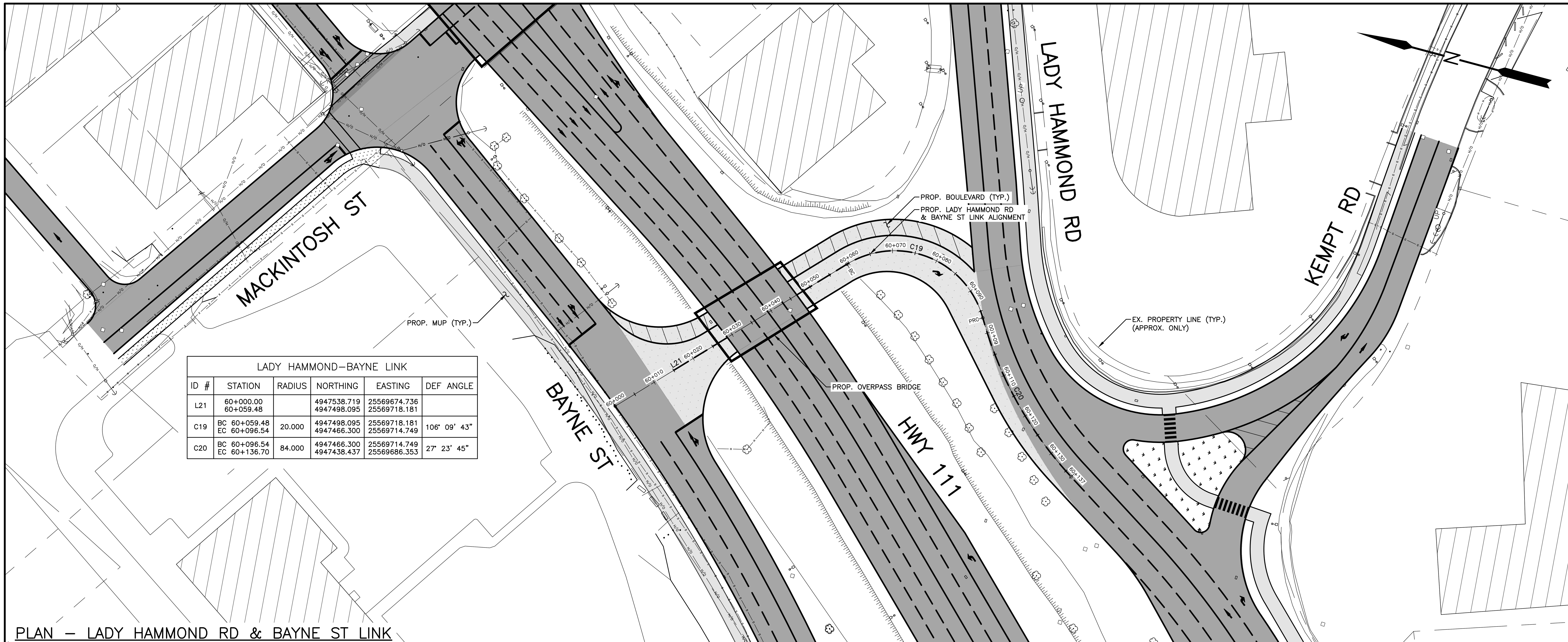
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111

BEDFORD

PROPOSED PLAN AND PROFILE – MACKINTOSH ST

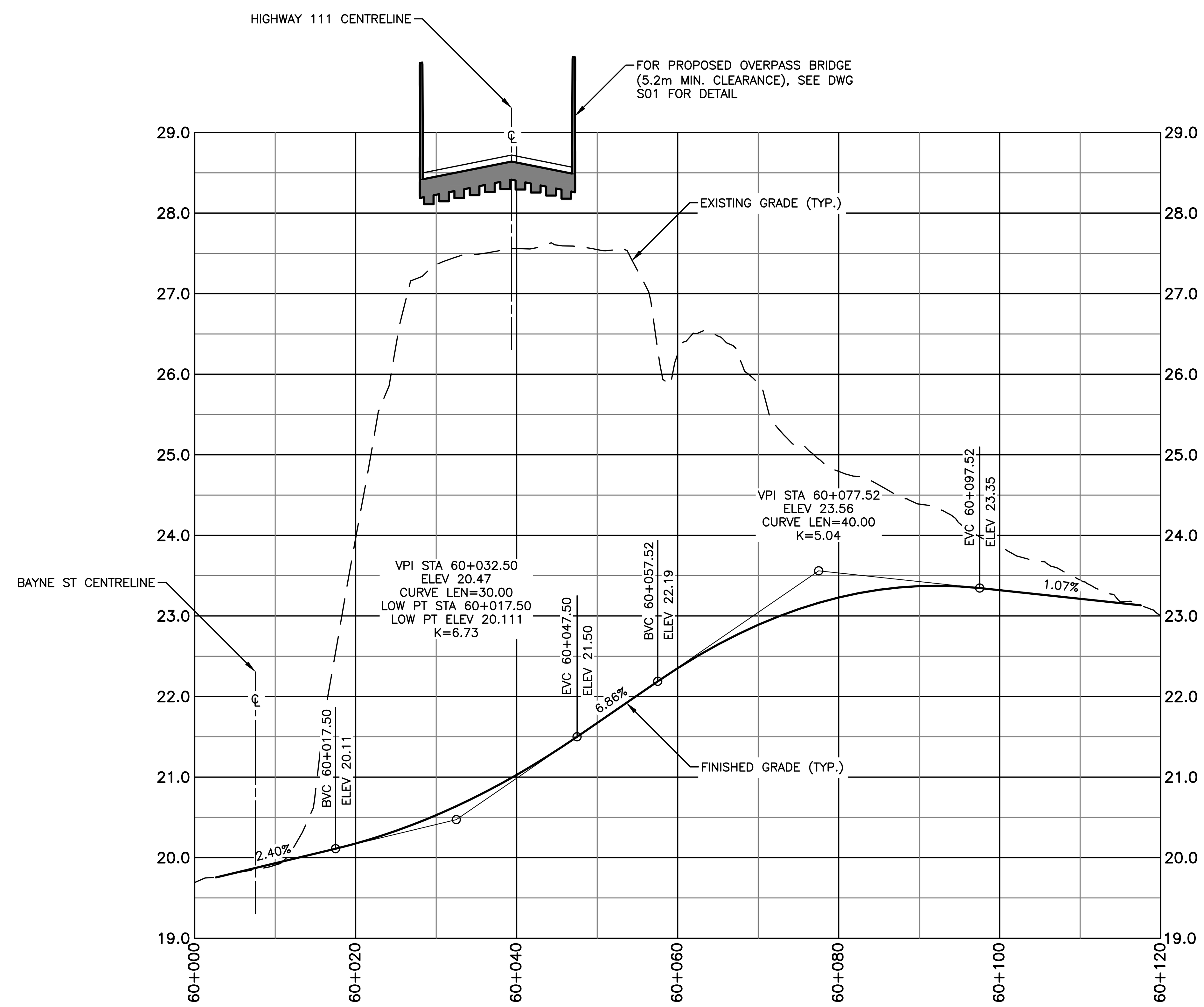
Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 16 OF 23
Checked R. GIFFIN		Drawing No. C19



LADY HAMMOND–BAYNE LINK					
ID #	STATION	RADIUS	NORTHING	EASTING	DEF ANGLE
L21	60+000.00 60+059.48		4947538.719 4947498.095	25569674.736 25569718.181	
C19	BC 60+059.48 EC 60+096.54	20.000	4947498.095 4947466.300	25569718.181 25569714.749	106° 09' 43"
C20	BC 60+096.54 EC 60+136.70	84.000	4947466.300 4947438.437	25569714.749 25569686.353	27° 23' 45"

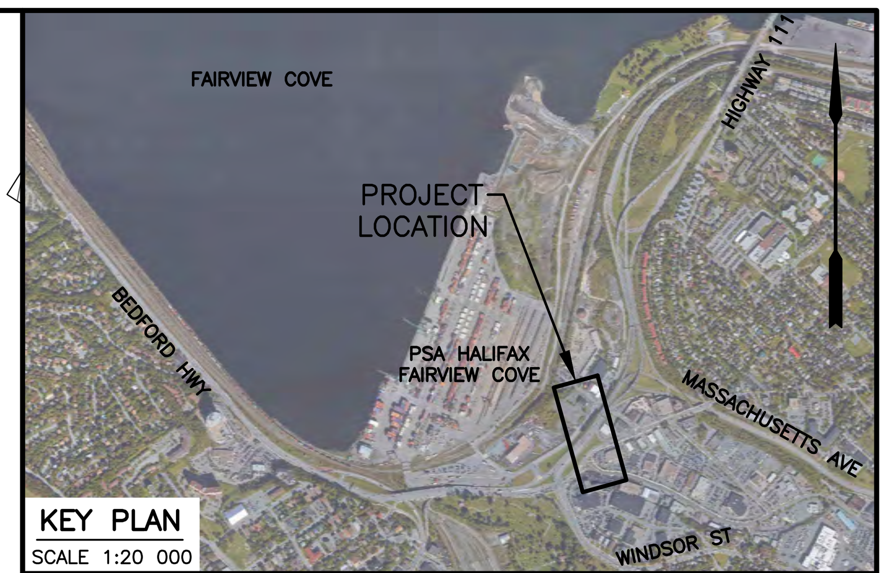
PLAN – LADY HAMMOND RD & BAYNE ST LINK

STATION: 60+000–60+137



PROFILE – LADY HAMMOND RD & BAYNE ST LINK

STATION: 60+000–60+137



KEY PLAN

SCALE 1:20 000

PLAN LEGEND

EXISTING / PROPOSED

- SURVEY CONTROL POINT (PT NO)
- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- GAS MAIN
- LINE MARKING
- BOTTOM OF SLOPE
- SIDEWALK
- MULTI-USE PATH
- ASPHALT REINSTATEMENT
- NEW ROAD CONSTRUCTION
- LANDSCAPE SURFACE
- PAVEMENT MARKING
- TREE
- HEDGE

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

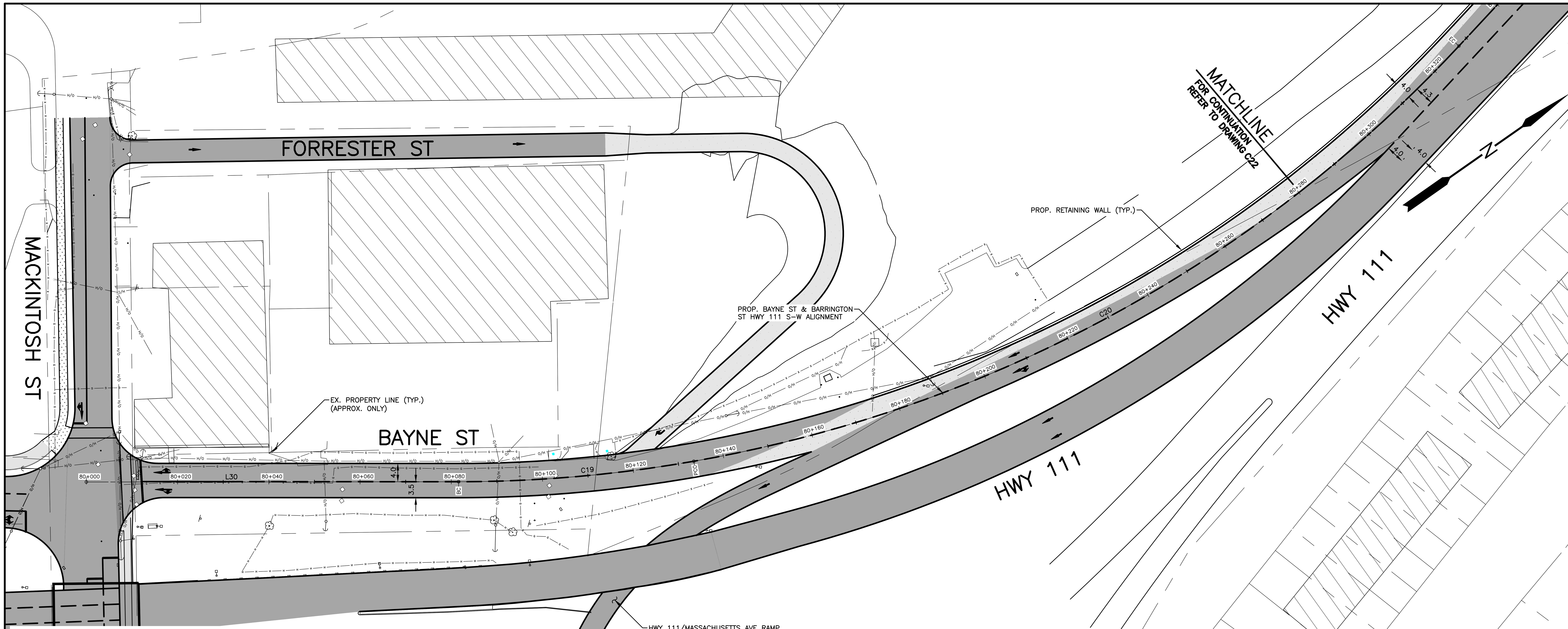
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111

BEDFORD

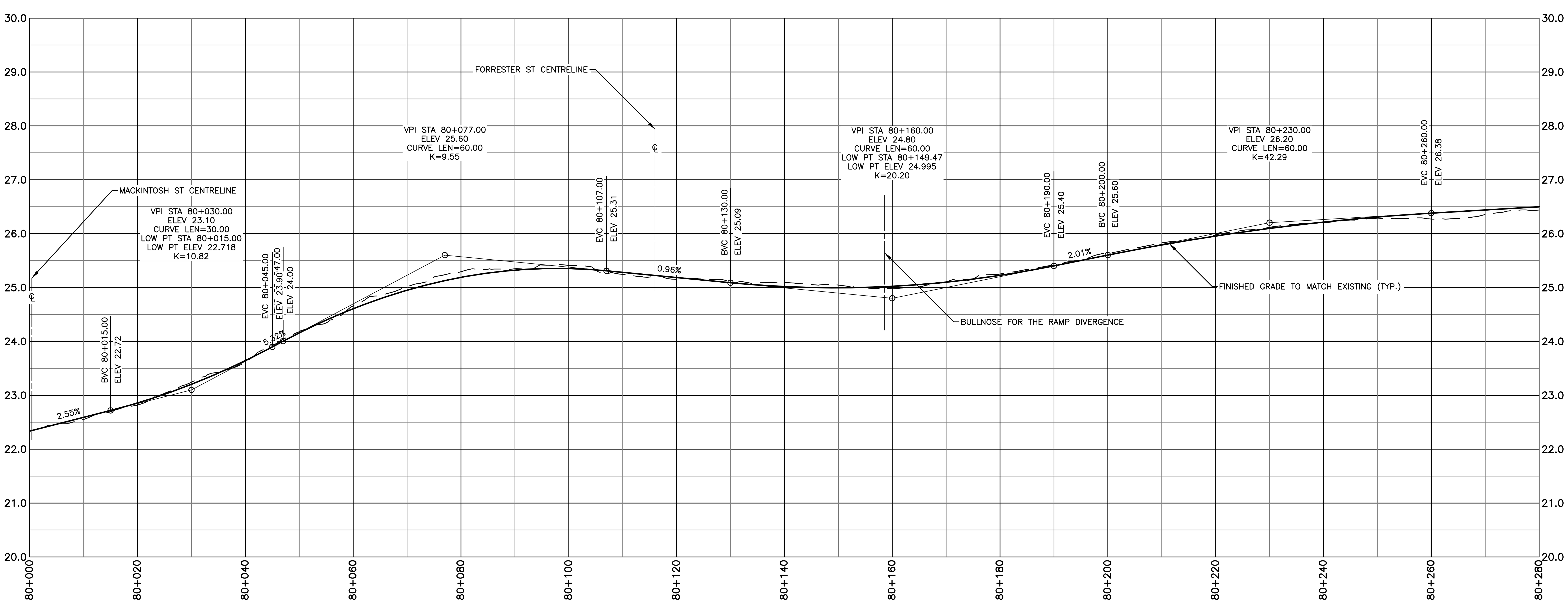
PROPOSED SITE PLAN AND PROFILE – LADY HAMMOND RD & BAYNE ST LINK

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 17 OF 23
Checked R. GIFFIN		Drawing No. C20



PLAN – BAYNE ST & BARRINGTON ST HWY 111 S-W

STATION: 80+000–80+280



PROFILE – BAYNE ST & BARRINGTON ST HWY 111 S-W

STATION: 80+000–80+280

KEY PLAN

SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X	FENCE	X
GR	GUIDERAIL	GR
RW	RETAINING WALL	RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G	GAS MAIN	G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT REINSTATEMENT	
	NEW ROAD CONSTRUCTION	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

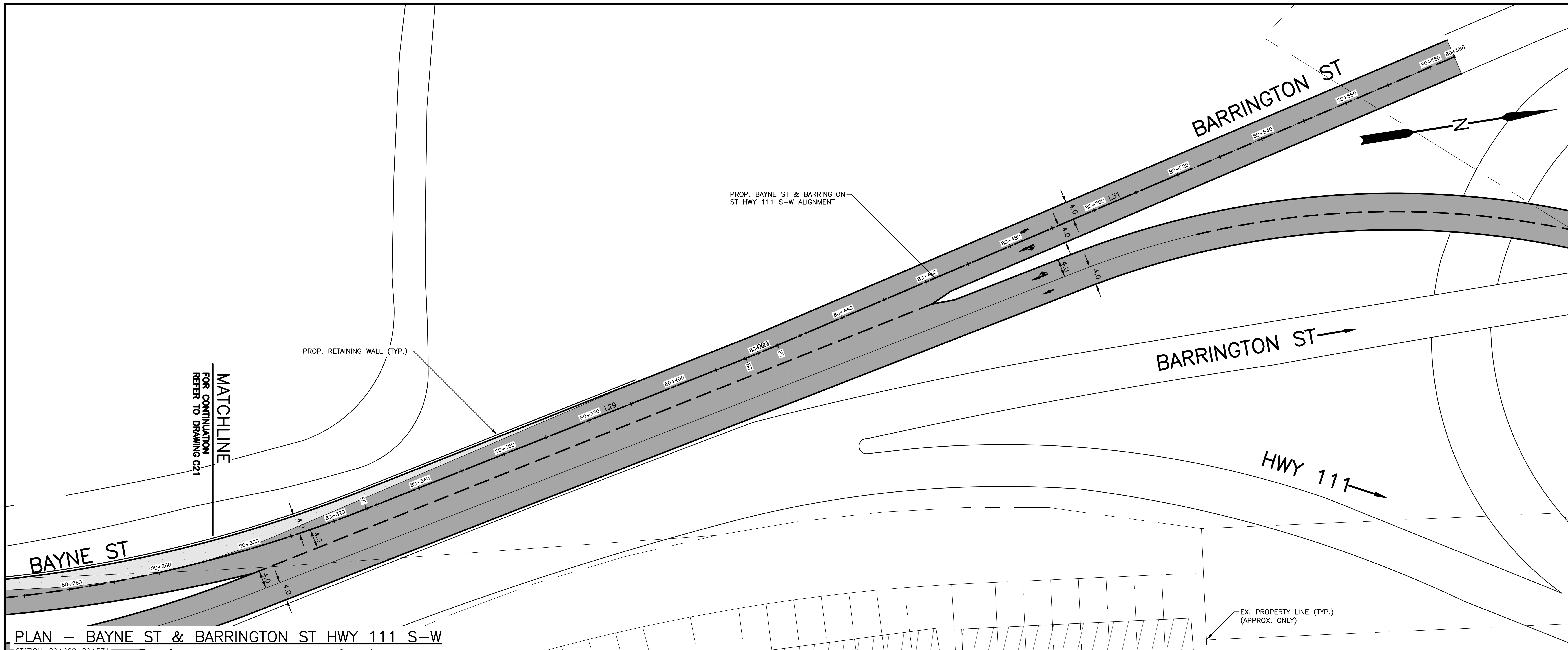
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111

BEDFORD

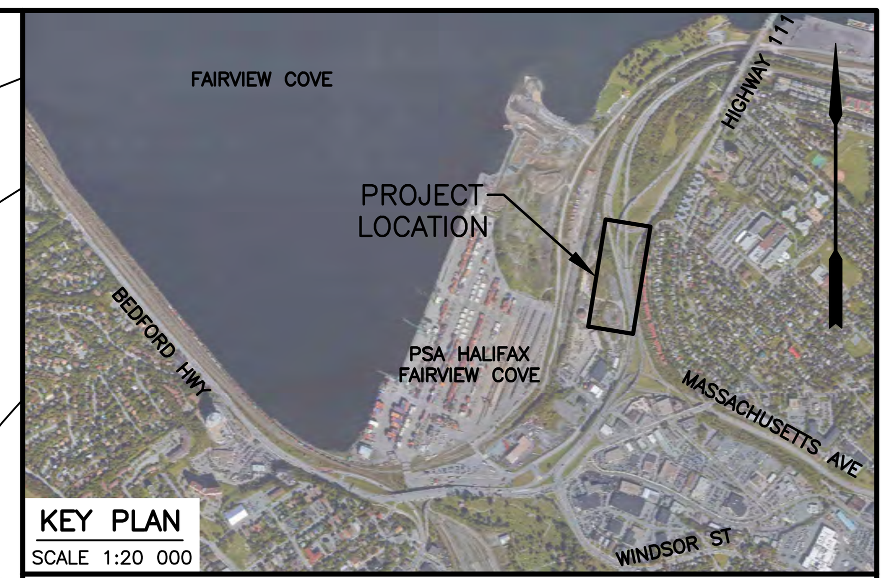
PROPOSED PLAN AND PROFILE – BAYNE ST & BARRINGTON ST HWY 111 S-W SHEET 1 OF 2

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 18 OF 23
Checked R. GIFFIN		Drawing No. C21



PLAN – BAYNE ST & BARRINGTON ST HWY 111 S–W

STATION: 80+280–80+574



KEY PLAN

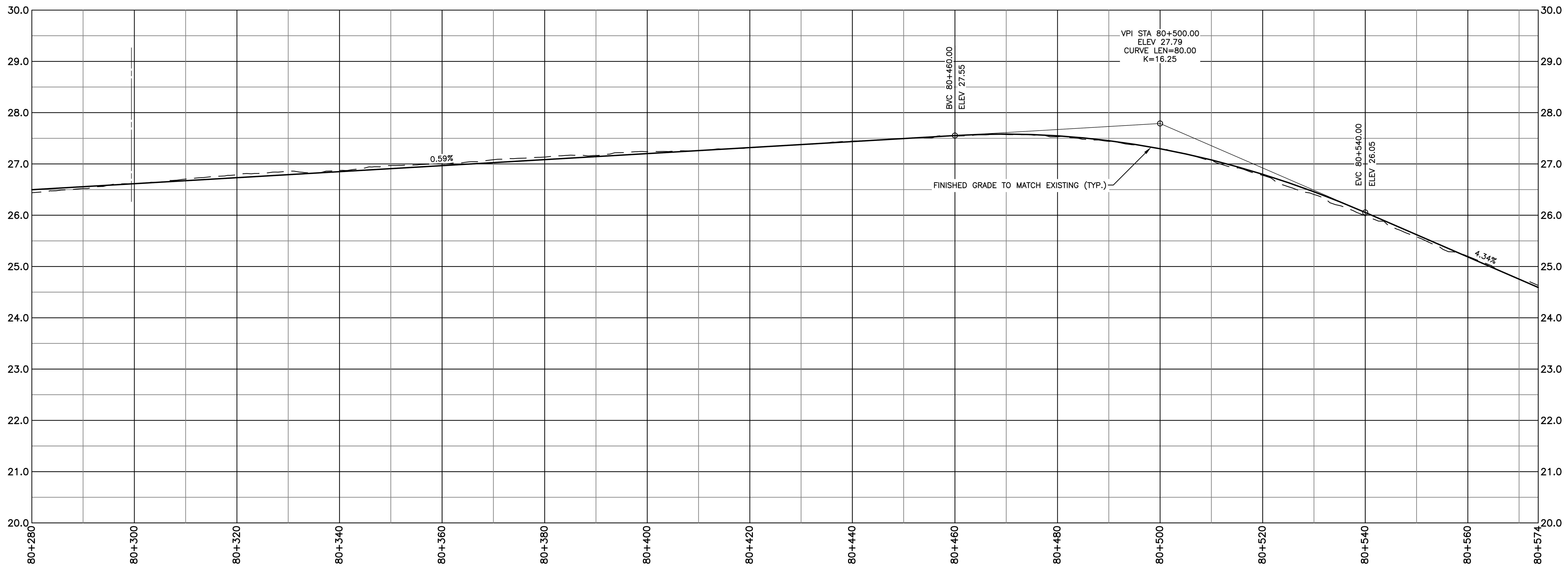
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X	FENCE	X
GR	GUIDERAIL	GR
RW	RETAINING WALL	RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G	GAS MAIN	G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT REINSTATEMENT	
	NEW ROAD CONSTRUCTION	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.



PROFILE – BAYNE ST & BARRINGTON ST HWY 111 S–W

STATION: 80+280–80+574

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

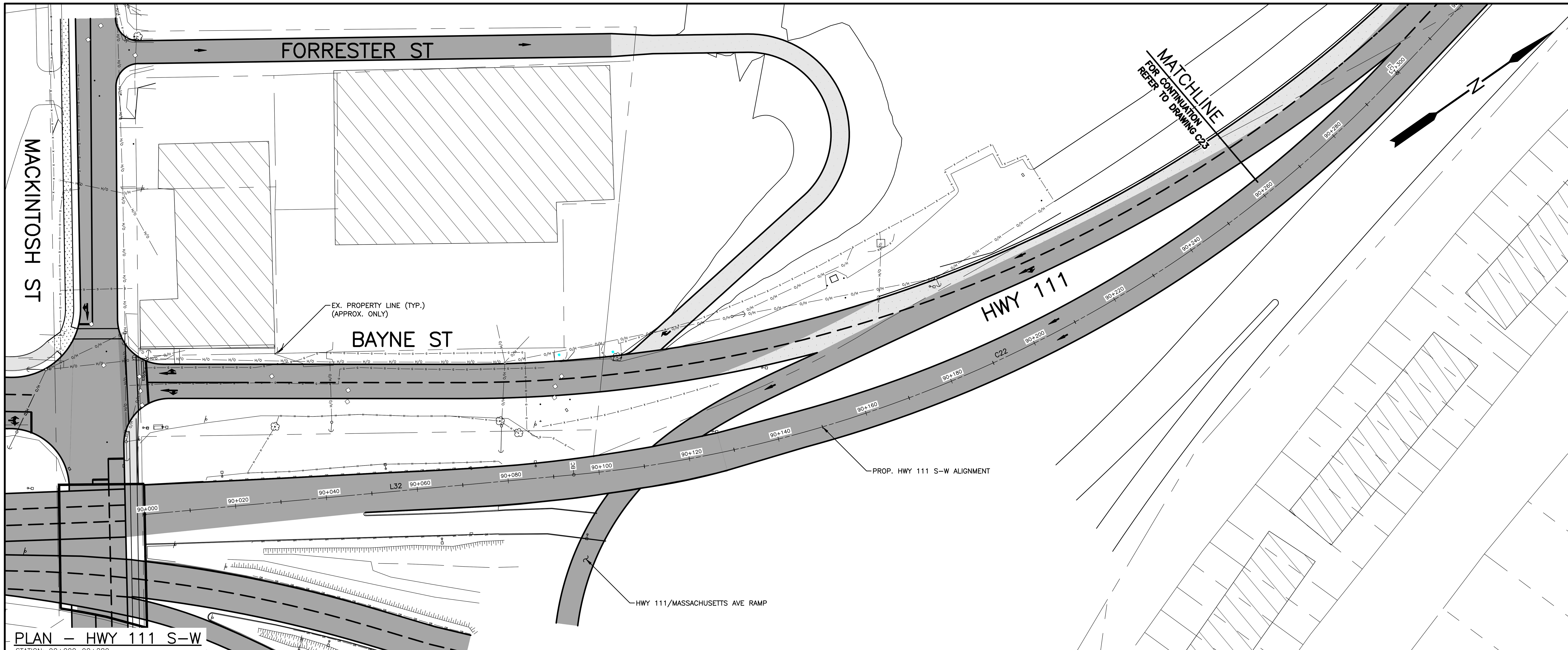
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111

BEDFORD

PROPOSED PLAN AND PROFILE – BAYNE ST & BARRINGTON ST HWY 111 S–W SHEET 2 OF 2

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 19 OF 23
Checked R. GIFFIN		Drawing No. C22



PLAN – HWY 111 S-W
STATION: 90+000–90+280

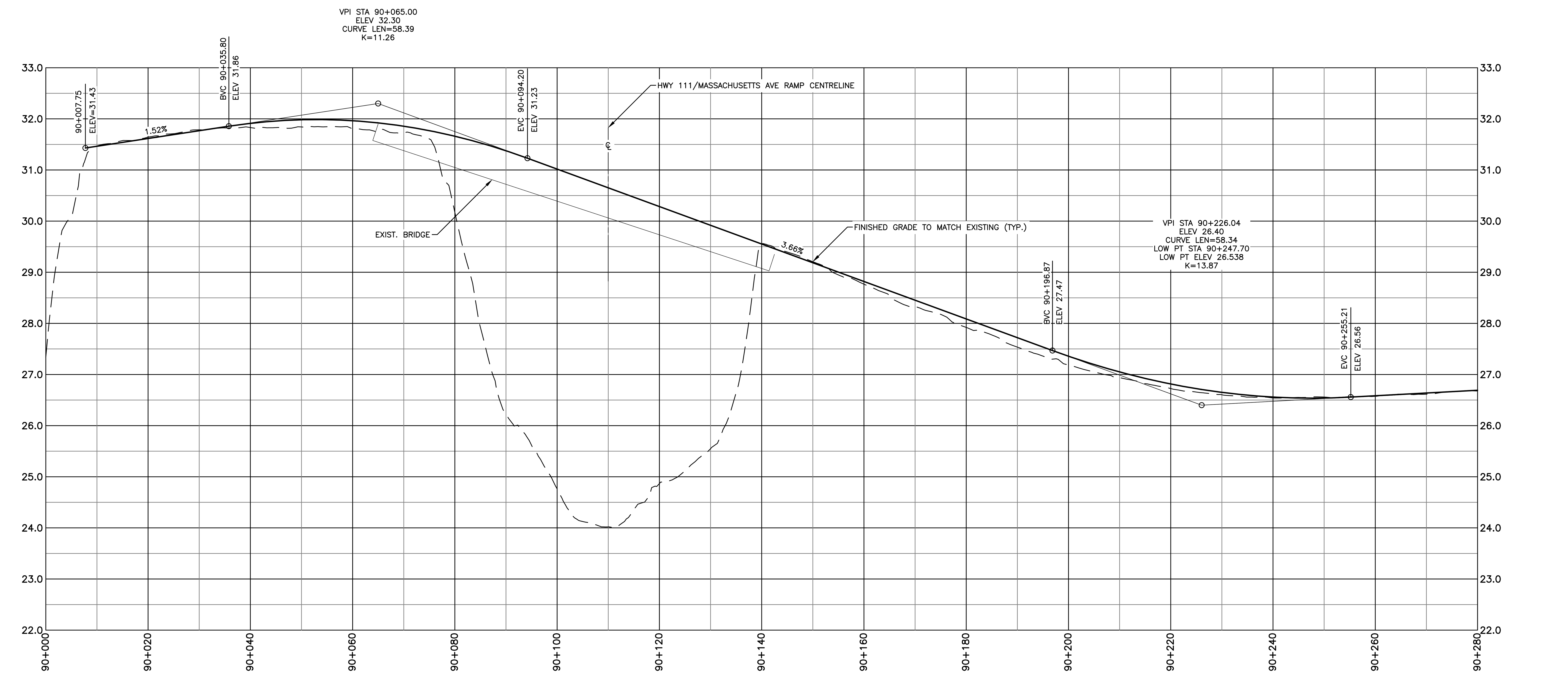
KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
PT NO	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X X	FENCE	X X
GR GR	GUIDERAIL	GR GR
RW RW	RETAINING WALL	RW RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G G	GAS MAIN	G G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT REINSTATEMENT	
	NEW ROAD CONSTRUCTION	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H H	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.



PROFILE – HWY 111 S-W
STATION: 90+000–90+280

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

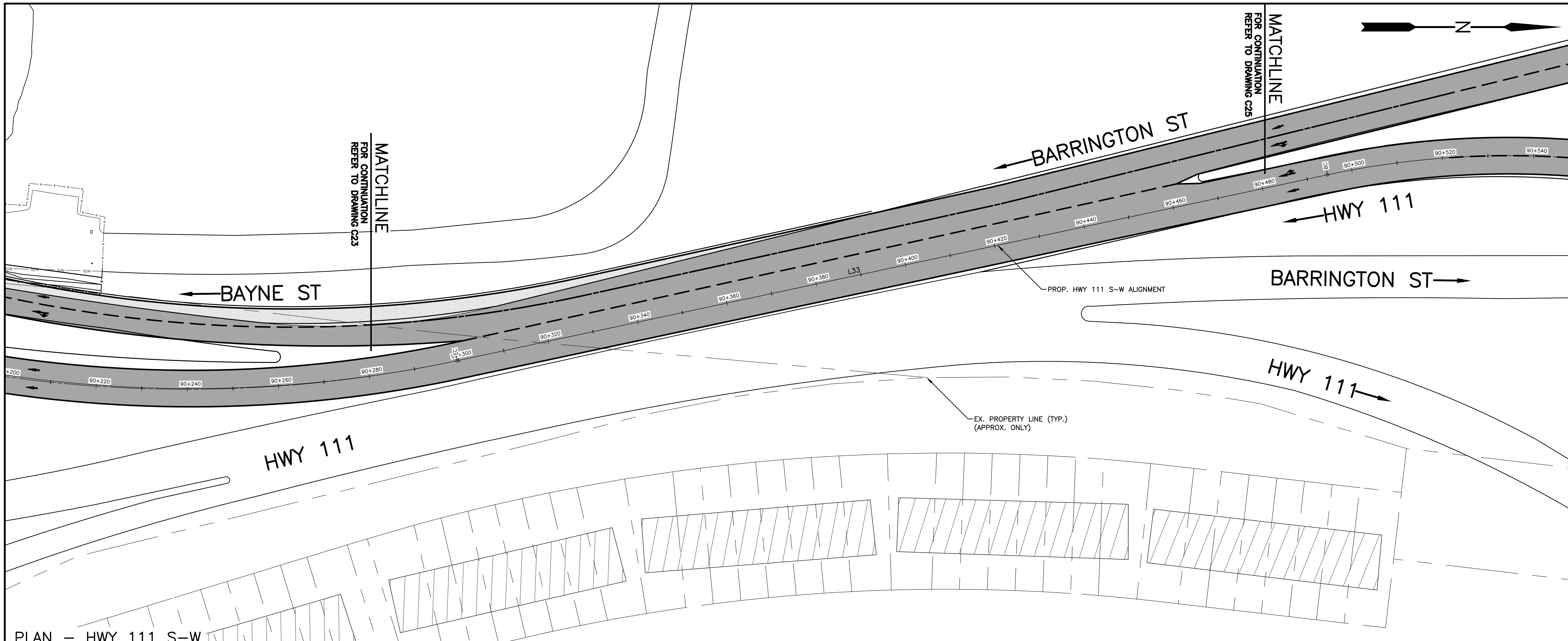
PRELIMINARY

HALIFAX

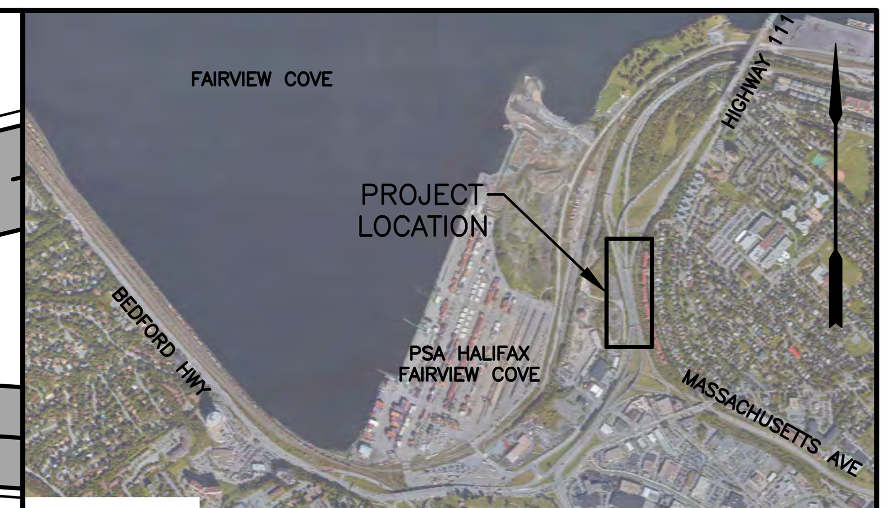
WINDSOR STREET EXCHANGE VALUE
BEDFORD HWY TO HWY 111
BEDFORD

PROPOSED PLAN AND PROFILE –
HWY 111 S-W SHEET 1 OF 3

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 20 OF 23
Checked R. GIFFIN		Drawing No. C23



PLAN – HWY 111 S–W
STATION: 90+280–90+480



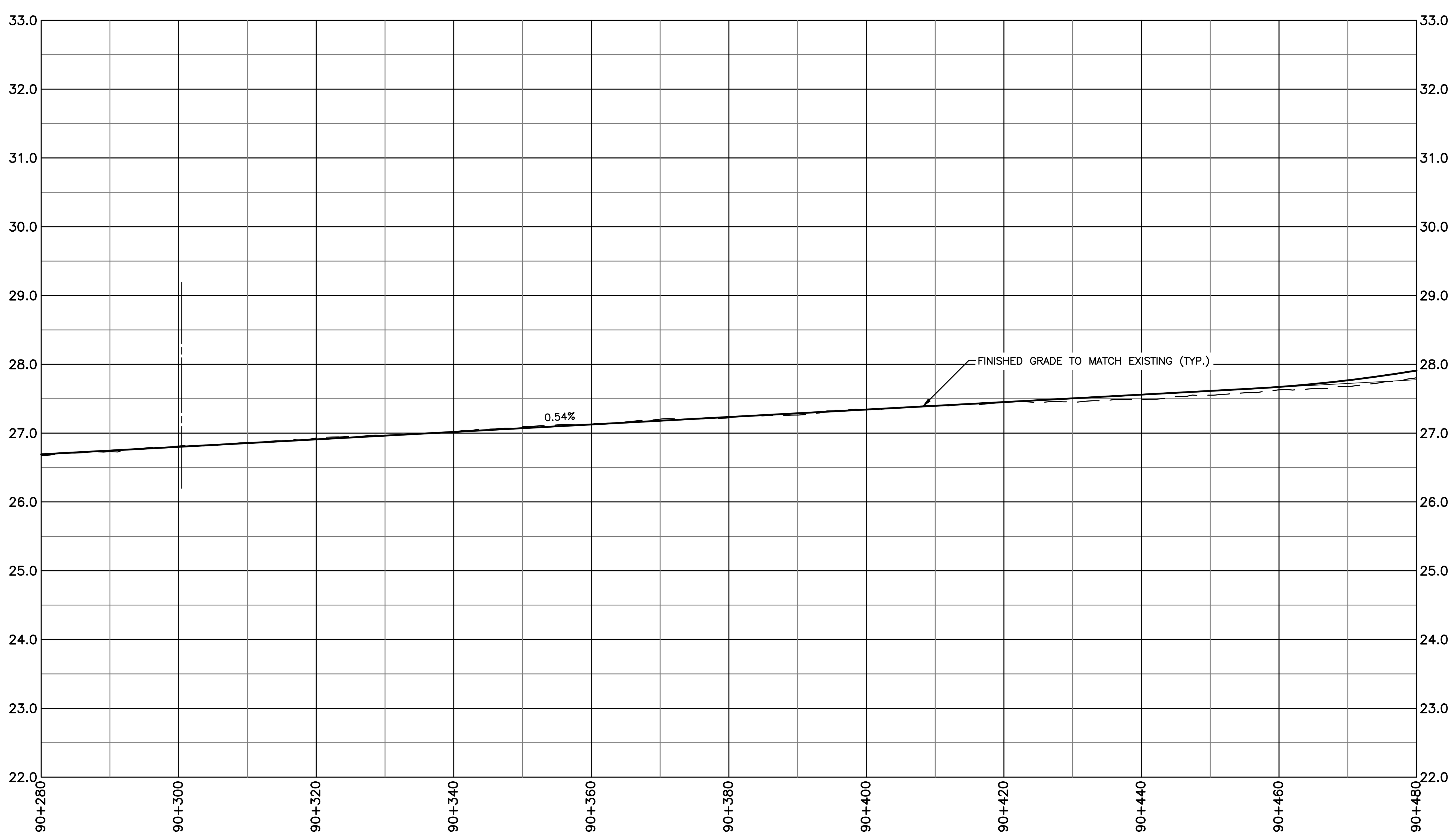
KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
PT NO	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X X	FENCE	X X
GR GR	GUIDERAIL	GR GR
RW RW	RETAINING WALL	RW RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G G	GAS MAIN	G G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT REINSTATEMENT	
	NEW ROAD CONSTRUCTION	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H H	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.



PROFILE – HWY 111 S–W
STATION: 90+280–90+480

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

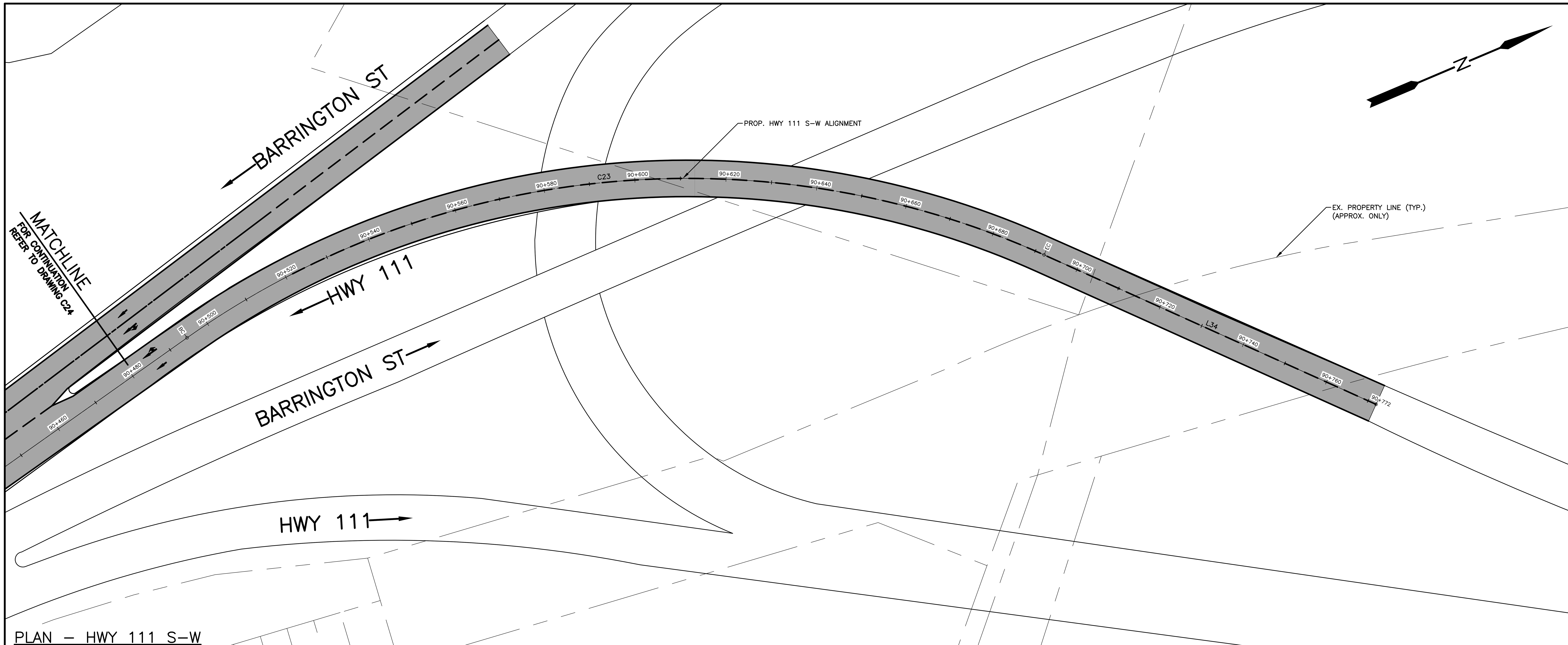
PRELIMINARY

HALIFAX

WINDSOR STREET EXCHANGE VALUE
BEDFORD HWY TO HWY 111
BEDFORD

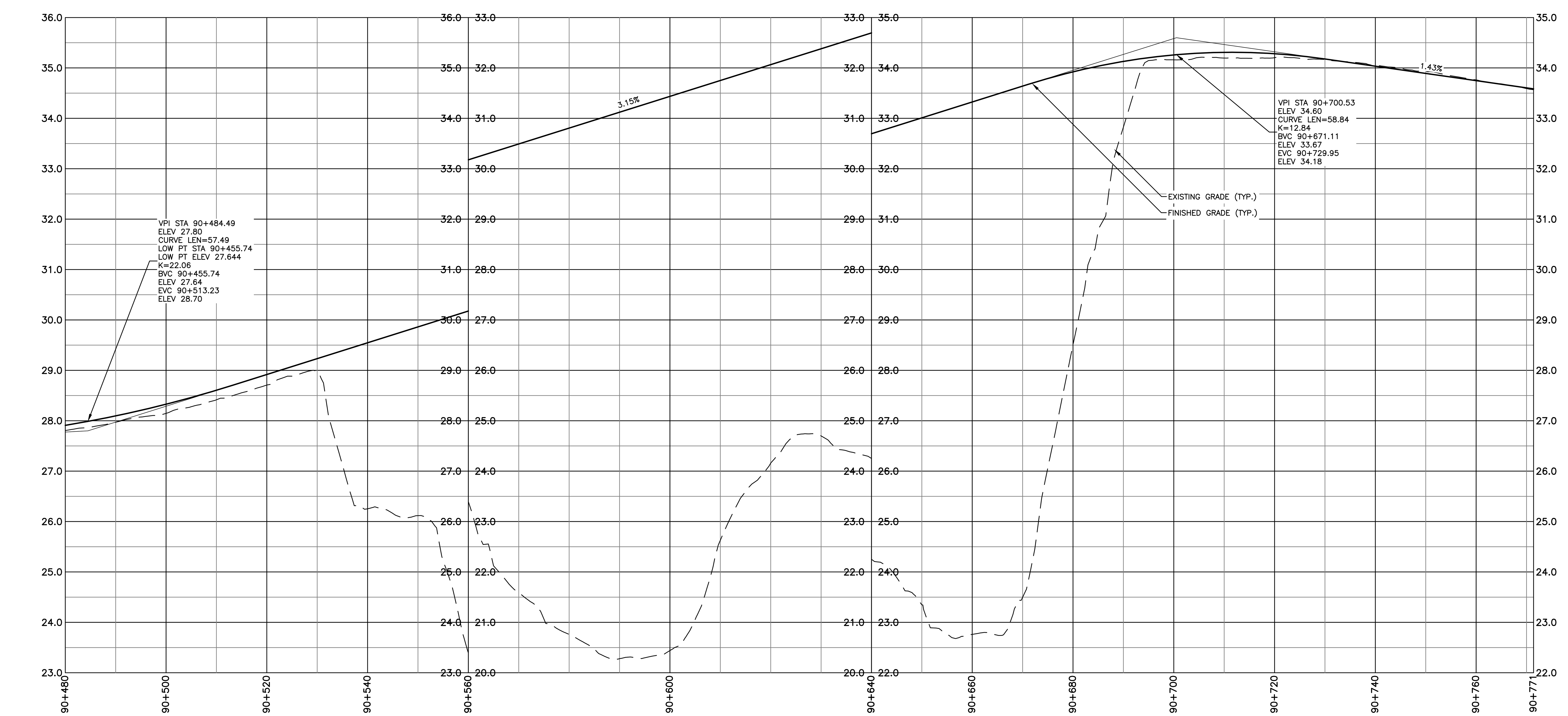
PROPOSED PLAN AND PROFILE –
HWY 111 S–W SHEET 2 OF 3

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 21 OF 23
Checked R. GIFFIN		Drawing No. C24



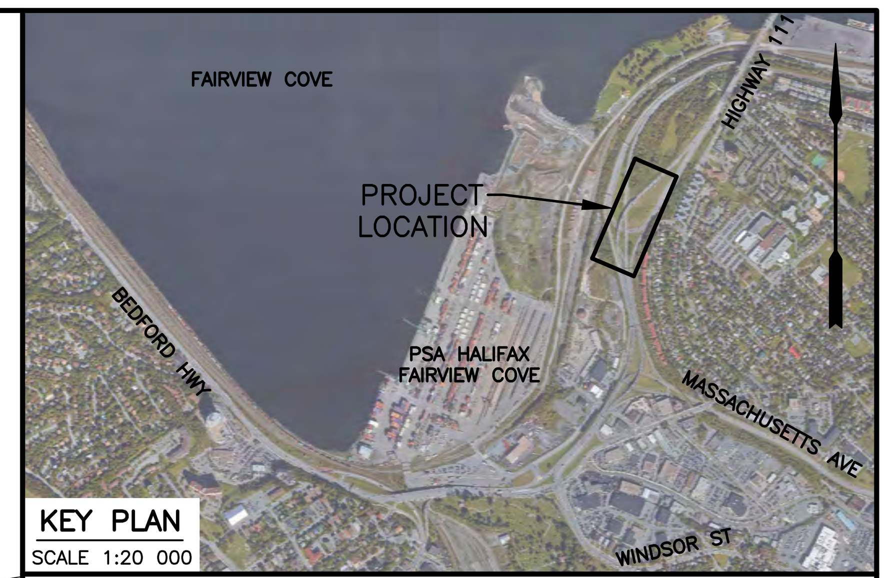
PLAN – HWY 111 S-W

STATION: 90+480–90+771



PROFILE – HWY 111 S-W

STATION: 90+480–90+771



KEY PLAN

SCALE 1:20 000

PLAN LEGEND

EXISTING / PROPOSED

- SURVEY CONTROL POINT
- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- GAS MAIN
- LINE MARKING
- BOTTOM OF SLOPE
- SIDEWALK
- MULTI-USE PATH
- ASPHALT REINSTATEMENT
- NEW ROAD CONSTRUCTION
- LANDSCAPE SURFACE
- PAVEMENT MARKING
- TREE
- HEDGE

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 08/24	ISSUED FOR DESIGN REVIEW	RG

PRELIMINARY

HALIFAX

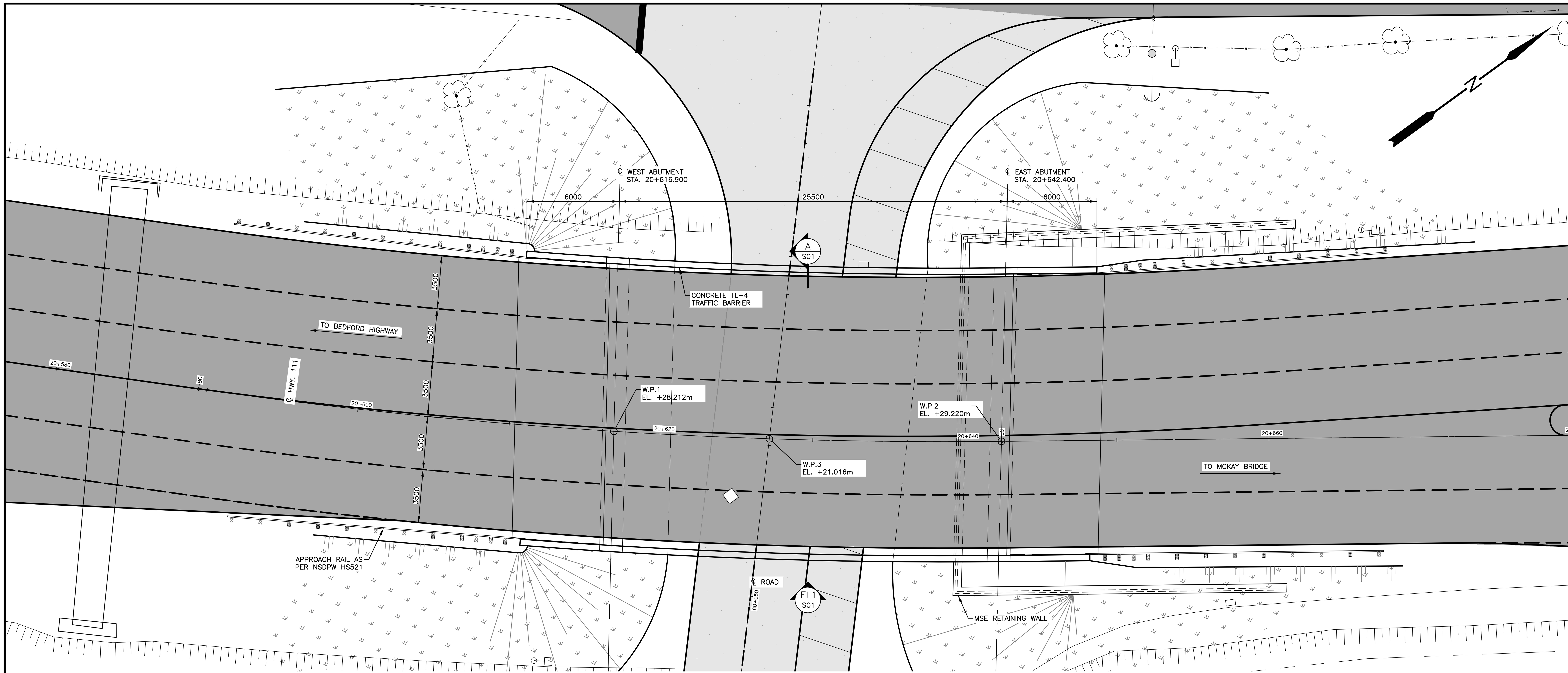
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111

BEDFORD

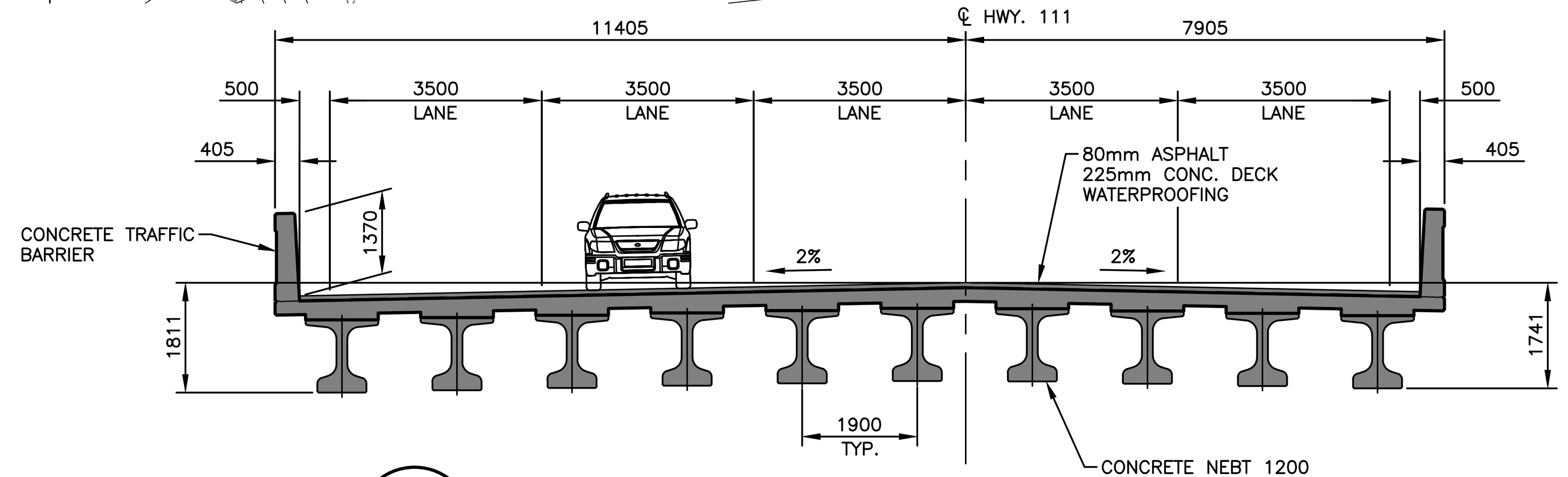
PROPOSED PLAN AND PROFILE – HWY 111 S-W SHEET 3 OF 3

Date FEB 2024	Drawn M. ZHOU	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 22 OF 23
Checked R. GIFFIN		Drawing No. C25



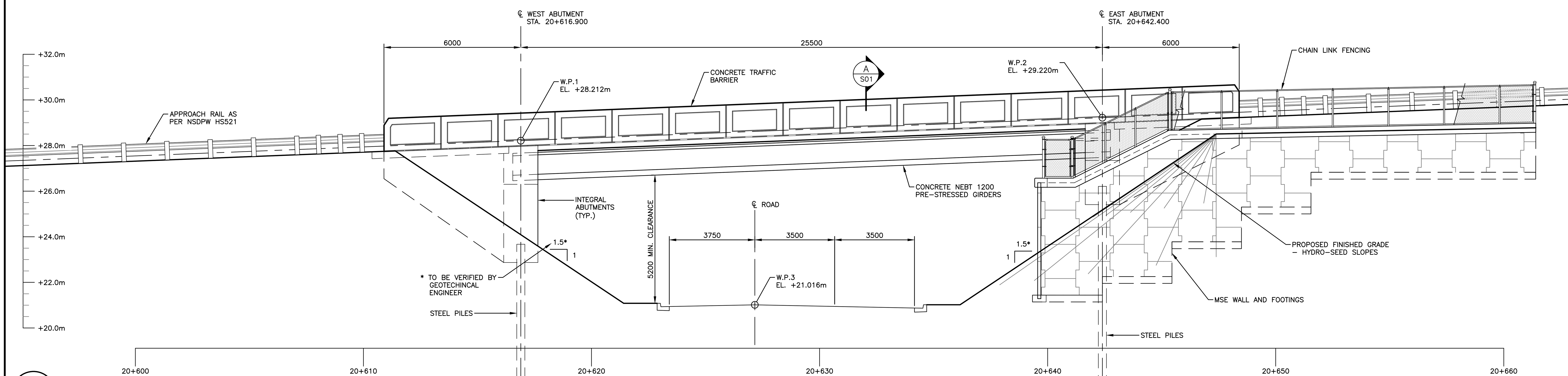
BRIDGE PLAN

SCALE 1:150 STATION: 40+300–40+437



A
S01
BRIDGE CROSS SECTION

1:100



EL1
S01
SOUTH BRIDGE ELEVATION

SCALE 1:100 STATION: 40+300–40+437

PLAN LEGEND

EXISTING		PROPOSED
△ PT NO	SURVEY CONTROL POINT	
⊗ ●	WATERVALVE	⊗ ●
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
— X — X —	FENCE	— X — X —
— GR — GR —	GUIDERAIL	— GR — GR —
— RW — RW —	RETAINING WALL	— RW — RW —
	CONCRETE CURB	
	PROPERTY LINE	
□ ○ ◫	SEWER MANHOLES	□ ○ ◫
□	CATCHBASIN	□
— G — G —	GAS MAIN	— G — G —
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI–USE PATH	
	ASPHALT SURFACE	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
— H — H —	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
2	MAY 03/24	ISSUED FOR 30% DESIGN	RG
1	MAR 15/24	ISSUED FOR DESIGN REVIEW	EN

PRELIMINARY

HALIFAX

WINDSOR STREET EXCHANGE VALUE

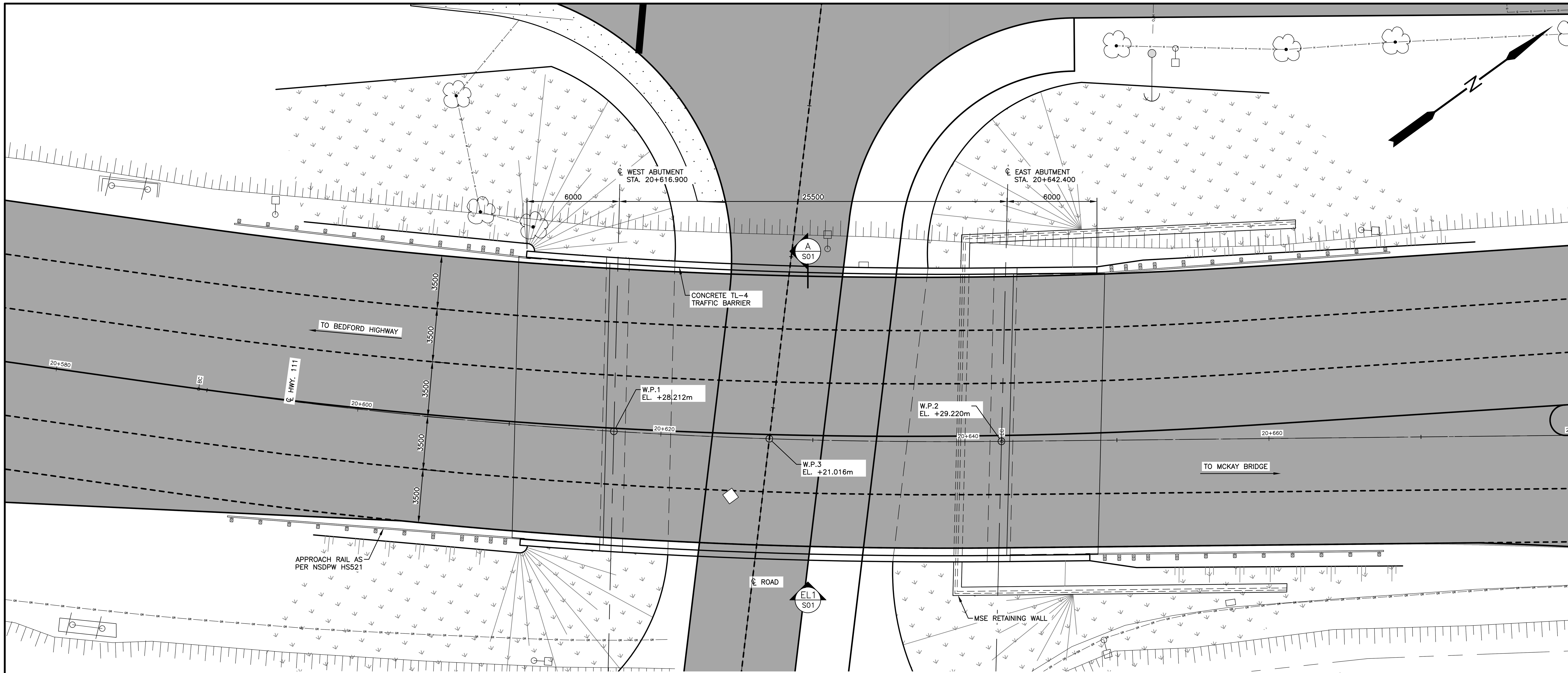
BEDFORD HWY TO HWY 111
BEDFORD

GENERAL ARRANGEMENT

Date FEB 2024	Drawn JD	Tender No.
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 23 OF 23
Checked EN/TB		Drawing No. S01

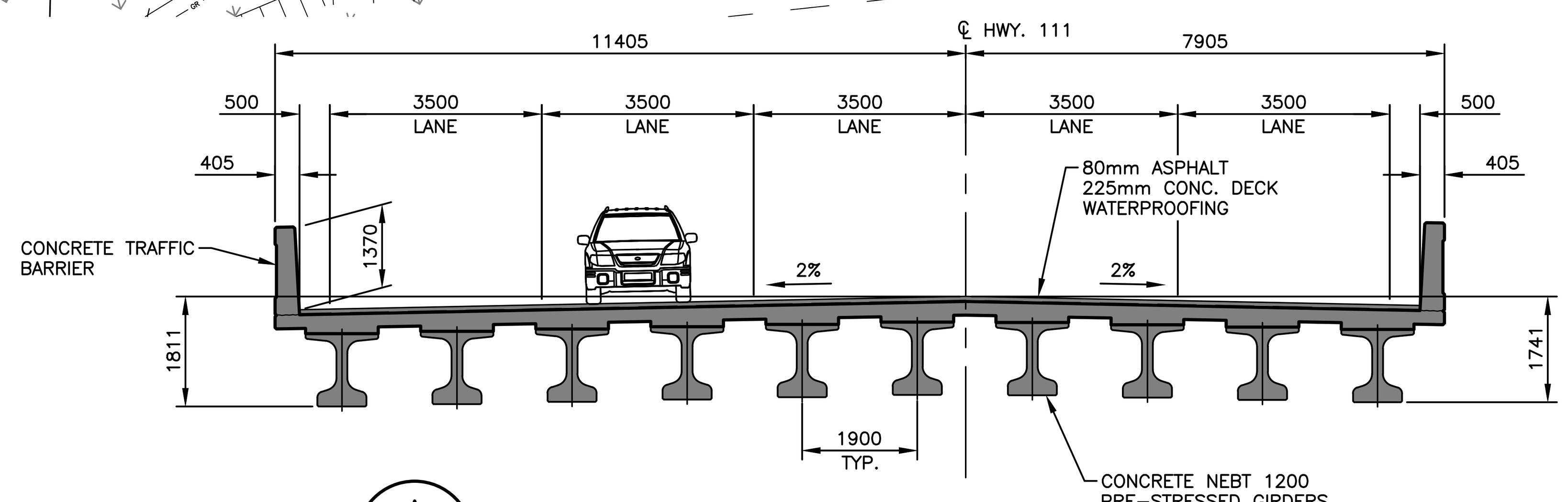
APPENDIX D

Bridge Overpass General Arrangement Drawing



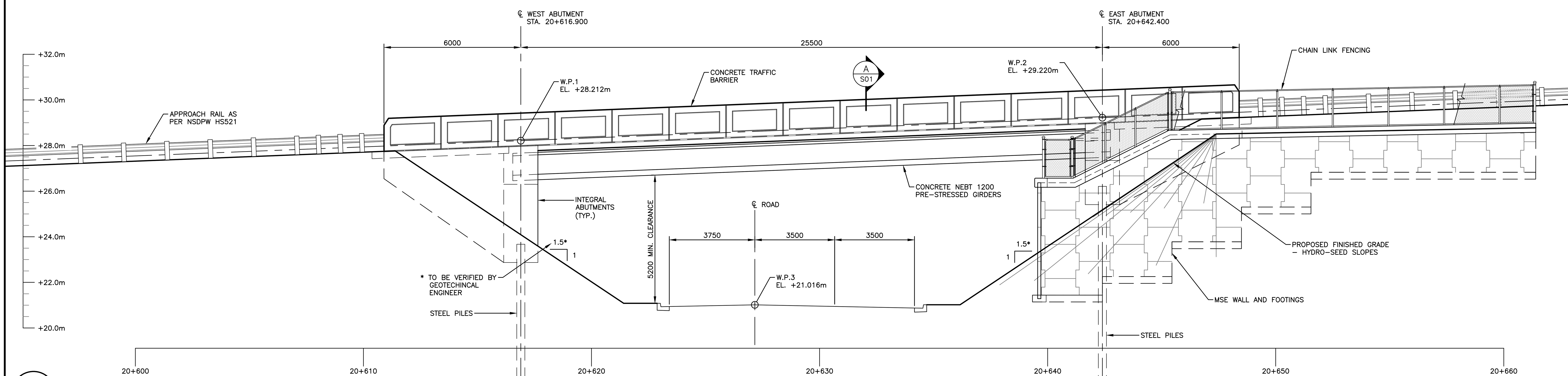
BRIDGE PLAN

SCALE 1:150 STATION: 40+300–40+437



A / S01 BRIDGE CROSS SECTION

1:100



EL1 / S01 SOUTH BRIDGE ELEVATION

SCALE 1:100 STATION: 40+300–40+437

PLAN LEGEND

EXISTING		PROPOSED
	SURVEY CONTROL POINT	
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
X	FENCE	X
GR	GUIDERAIL	GR
RW	RETAINING WALL	RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
G	GAS MAIN	G
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT SURFACE	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	TREE	
H	HEDGE	

NOTES

1. FOR GENERAL NOTES, SEE DWG C01.

No.	Date	Revision Description	Appr'd
A	MAR 15/24	ISSUED FOR DESIGN REVIEW	EN

PRELIMINARY

HALIFAX

WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111

BEDFORD

GENERAL ARRANGEMENT

Date FEB 2024	Drawn JD	Tender No. 22–000
Scale Horz.1:500 Vert. 1:50	Survey No. SU21xxxx	
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3' MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 1 OF X
Checked EN/TB		Drawing No. S01

APPENDIX E

30% Design Construction Heat Map

KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
	PROPERTY LINE	
	MULTI-USE PATH	
	ASPHALT SURFACE	

- 30% DESIGN WILL IMPACT PID **AFTER** CONSTRUCTION
- 30% DESIGN WILL IMPACT DURING CONSTRUCTION
- 30% DESIGN IMPACT PROBABLE DURING CONSTRUCTION
- 30% DESIGN IMPACT UNLIKELY DURING CONSTRUCTION
- PID CLEAR PER 30% DESIGN DURING CONSTRUCTION

No.	Date	Revision Description	Appr'd

PRELIMINARY

HALIFAX

WINDSOR STREET EXCHANGE VALUE

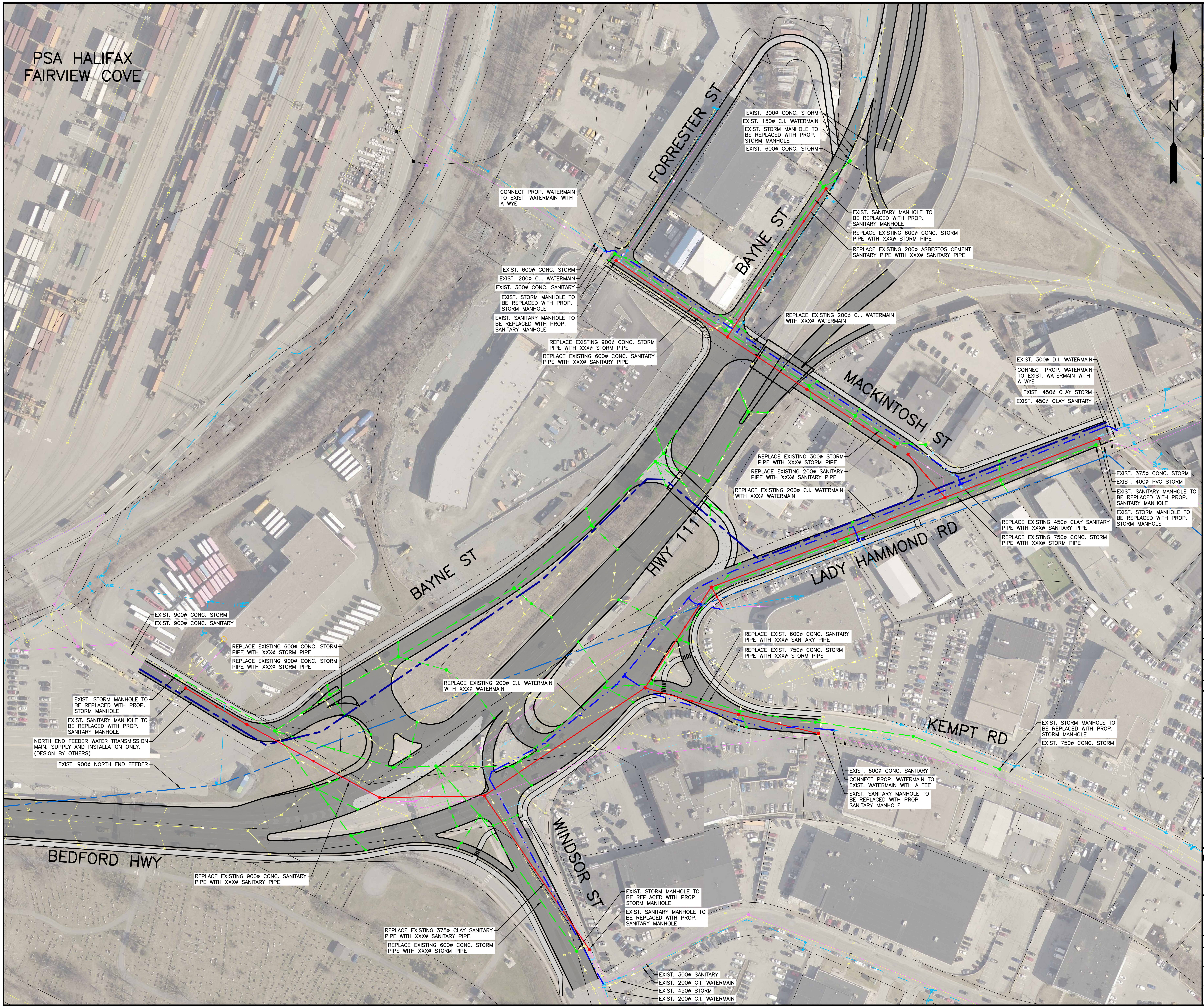
BEDFORD HWY TO HWY 111
BEDFORD

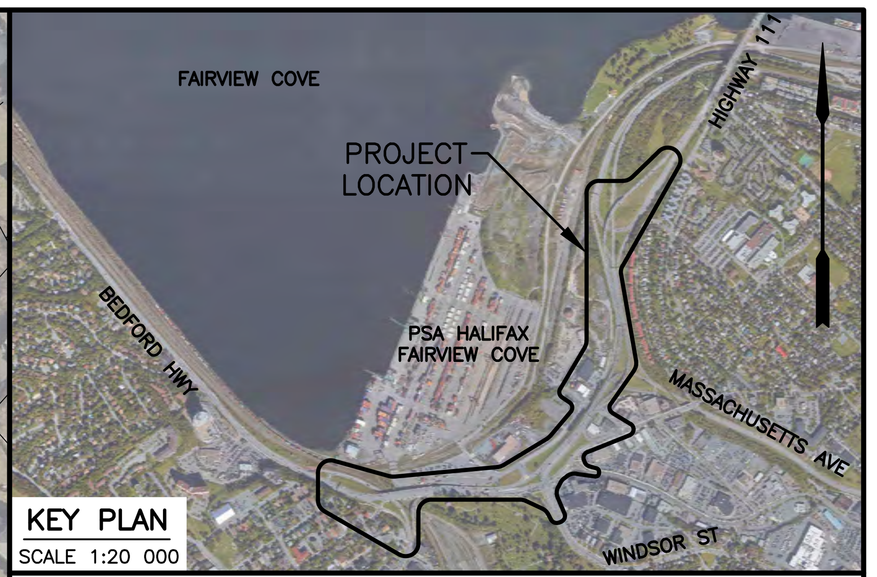
PROPERTY IMPACTS SITE PLAN

Date FEB 2024	Drawn M. ZHOU	Tender No. 22–000	
Scale Horz.1:2000 Vert.	Survey No. SU21xxxx		
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Sheet 1 OF X	
Checked R. GIFFIN		Drawing No. CSK03	

APPENDIX F

Utility Review





KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
	FENCE	
	GUIDERAIL	
	RETAINING WALL	
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
	STORM HEADWALL	
	STORM SEWER	
	SANITARY SEWER	
	COMBINED SEWER	
	WATER MAIN	
	TRANSMISSION MAIN	
	GAS MAIN	
	O/H UTILITY	
	U/G UTILITY	
	LINE MARKING	
	SIDEWALK	
	TREE	
	HEDGE	
	TOP OF SLOPE	
	BOTTOM OF SLOPE	
	GAS MAIN	
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT SURFACE	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	HEDGE	

NOTES

1. THIS DRAWING DEPICTS THE PROPOSED PIPE LAYOUT OVERLAID ON THE EXISTING PIPE NETWORK. THIS IS A CONCEPT LAYOUT AND SUBJECT TO CHANGE.
2. PROPOSED PIPE SIZES ARE APPROXIMATE AND WILL NEED TO BE CONFIRMED BY THE PBD TEAM WITH HALIFAX WATER.

No.	Date	Revision Description	Appr'd
2	APR 23/24	ISSUED FOR REVIEW	AB
1	APR 19/24	ISSUED FOR REVIEW	AB

PRELIMINARY

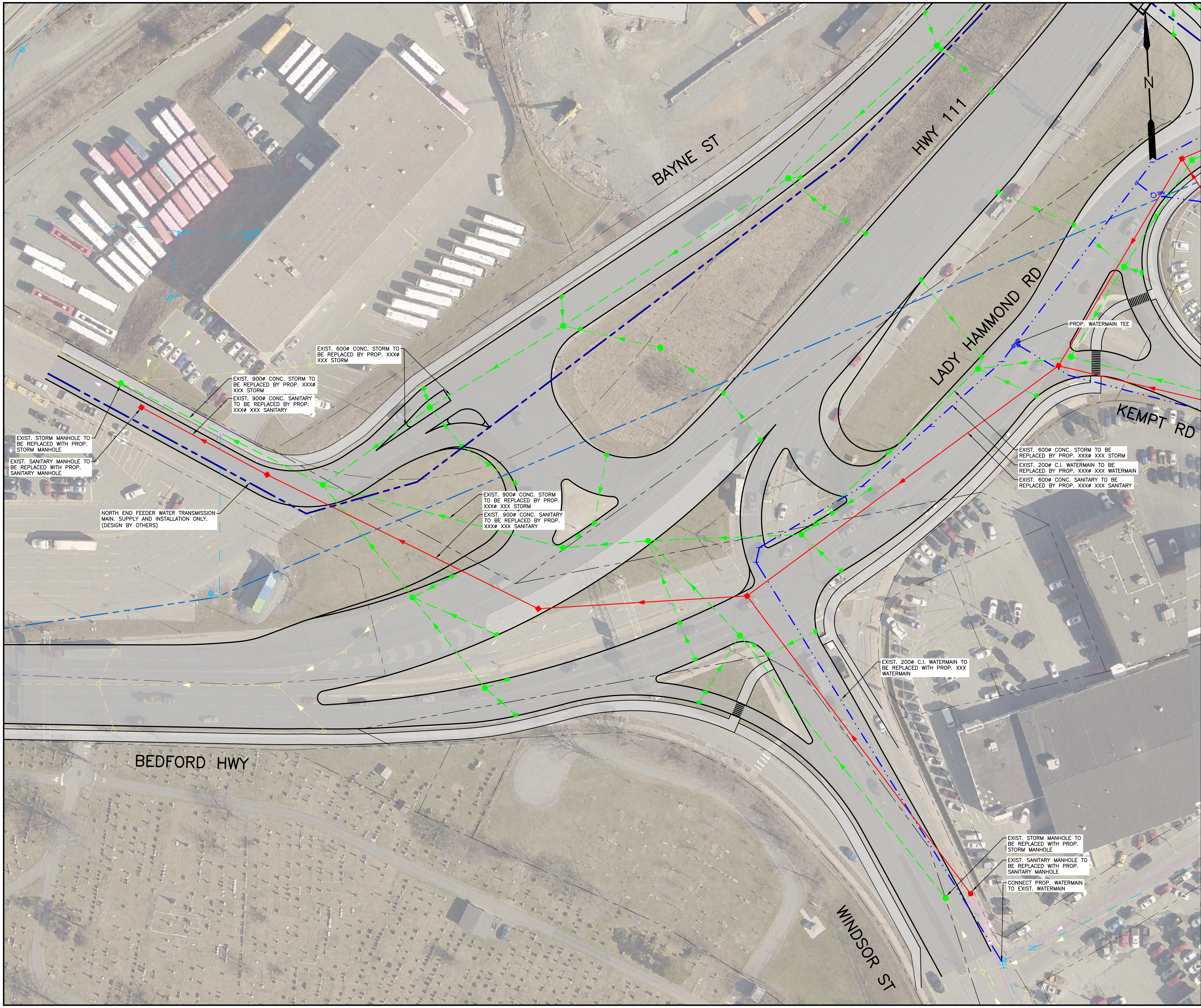
HALIFAX

WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111
BEDFORD

OVERALL SITE SERVICING PLAN

Date: FEB 2024	Drawn: M. ZHOU		Tender No. 22-000
Scale: Horz.1:1000 Vert.	Survey No. SU21xxxx		Sheet 1 OF 7
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013		Drawing No. CSK05
Checked: A. BAILLIE			



KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING | PROPOSED

WATERVALVE
UTILITY POLE AND GUY WIRE
SIGN POST/BASE
LIGHT STANDARD
FENCE
GUIDERAIL
RETAINING WALL
CONCRETE CURB
PROPERTY LINE
SEWER MANHOLES
CATCHBASIN
STORM HEADWALL
STORM SEWER
SANITARY SEWER
COMBINED SEWER
WATER MAIN
TRANSMISSION MAIN
GAS MAIN
O/H UTILITY
U/G UTILITY
LINE MARKING
SIDEWALK
TREE
HEDGE
TOP OF SLOPE
BOTTOM OF SLOPE
GAS MAIN
LINE MARKING
BOTTOM OF SLOPE
SIDEWALK
MULTI–USE PATH
ASPHALT SURFACE
LANDSCAPE SURFACE
PAVEMENT MARKING
HEDGE

NOTES

1. THIS DRAWING SHOWS THE PROPOSED FINAL STATE WITH EXISTING PIPES REMOVED AND NEW PIPES INSTALLED. THIS IS A CONCEPT LAYOUT AND SUBJECT TO CHANGE.
2. PROPOSED PIPE SIZES ARE APPROXIMATE AND WILL NEED TO BE CONFIRMED BY THE PBD TEAM WITH HALIFAX WATER.

No.	Date	Revision Description	Appr'd
2	APR 23/24	ISSUED FOR REVIEW	AB
1	APR 19/24	ISSUED FOR REVIEW	AB

PRELIMINARY

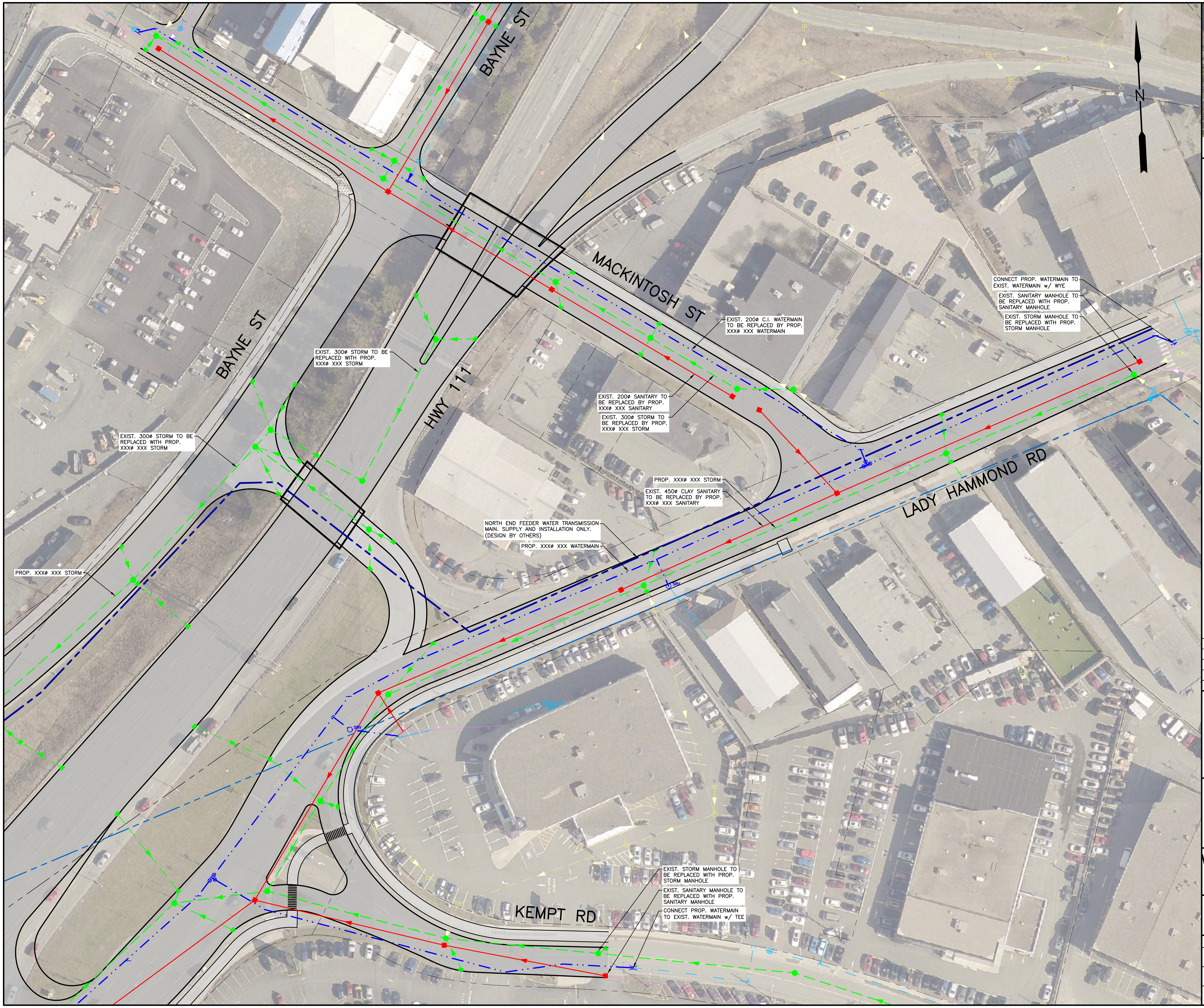
HALIFAX

WINDSOR STREET EXCHANGE VALUE
BEDFORD HWY TO HWY 111
BEDFORD

PROPOSED SITE SERVICING PLAN – SHEET 2 OF 7

Date APR 2024	Drawn M. ZHOU	Tender No. 22–000
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	Sheet 2 OF 7
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. CSK05A
Checked A. BAILLIE		

NOTES
1. SEE CSK02 FOR EXISTING STORM PIPE NETWORK TABLE.



KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING | PROPOSED

- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- STORM HEADWALL
- STORM SEWER
- SANITARY SEWER
- COMBINED SEWER
- WATER MAIN
- TRANSMISSION MAIN
- GAS MAIN
- O/H UTILITY
- U/G UTILITY
- LINE MARKING
- SIDEWALK
- TREE
- HEDGE
- TOP OF SLOPE
- BOTTOM OF SLOPE
- GAS MAIN
- LINE MARKING
- BOTTOM OF SLOPE
- SIDEWALK
- MULTI-USE PATH
- ASPHALT SURFACE
- LANDSCAPE SURFACE
- PAVEMENT MARKING
- HEDGE

NOTES

1. THIS DRAWING SHOWS THE PROPOSED FINAL STATE WITH EXISTING PIPES REMOVED AND NEW PIPES INSTALLED. THIS IS A CONCEPT LAYOUT AND SUBJECT TO CHANGE.
2. PROPOSED PIPE SIZES ARE APPROXIMATE AND WILL NEED TO BE CONFIRMED BY THE PBD TEAM WITH HALIFAX WATER.

No.	Date	Revision Description	Appr'd
2	APR 23/24	ISSUED FOR REVIEW	AB
1	APR 19/24	ISSUED FOR REVIEW	AB

PRELIMINARY

HALIFAX

WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111
BEDFORD

PROPOSED SITE SERVICING PLAN – SHEET 3 OF 7

Date APR 2024	Drawn M. ZHOU	Tender No. 22–000
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	Sheet 3 OF 7
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. CSK05B
Checked A. BAILLIE		

KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING | PROPOSED

- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- STORM HEADWALL
- STORM SEWER
- SANITARY SEWER
- COMBINED SEWER
- WATER MAIN
- TRANSMISSION MAIN
- GAS MAIN
- O/H UTILITY
- U/G UTILITY
- LINE MARKING
- SIDEWALK
- TREE
- HEDGE
- TOP OF SLOPE
- BOTTOM OF SLOPE
- GAS MAIN
- LINE MARKING
- BOTTOM OF SLOPE
- SIDEWALK
- MULTI–USE PATH
- ASPHALT SURFACE
- LANDSCAPE SURFACE
- PAVEMENT MARKING
- HEDGE

NOTES

1. THIS DRAWING SHOWS THE PROPOSED FINAL STATE WITH EXISTING PIPES REMOVED AND NEW PIPES INSTALLED. THIS IS A CONCEPT LAYOUT AND SUBJECT TO CHANGE.
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No.	Date	Revision Description	Appr'd
2	APR 23/24	ISSUED FOR REVIEW	AB
1	APR 19/24	ISSUED FOR REVIEW	AB

PRELIMINARY

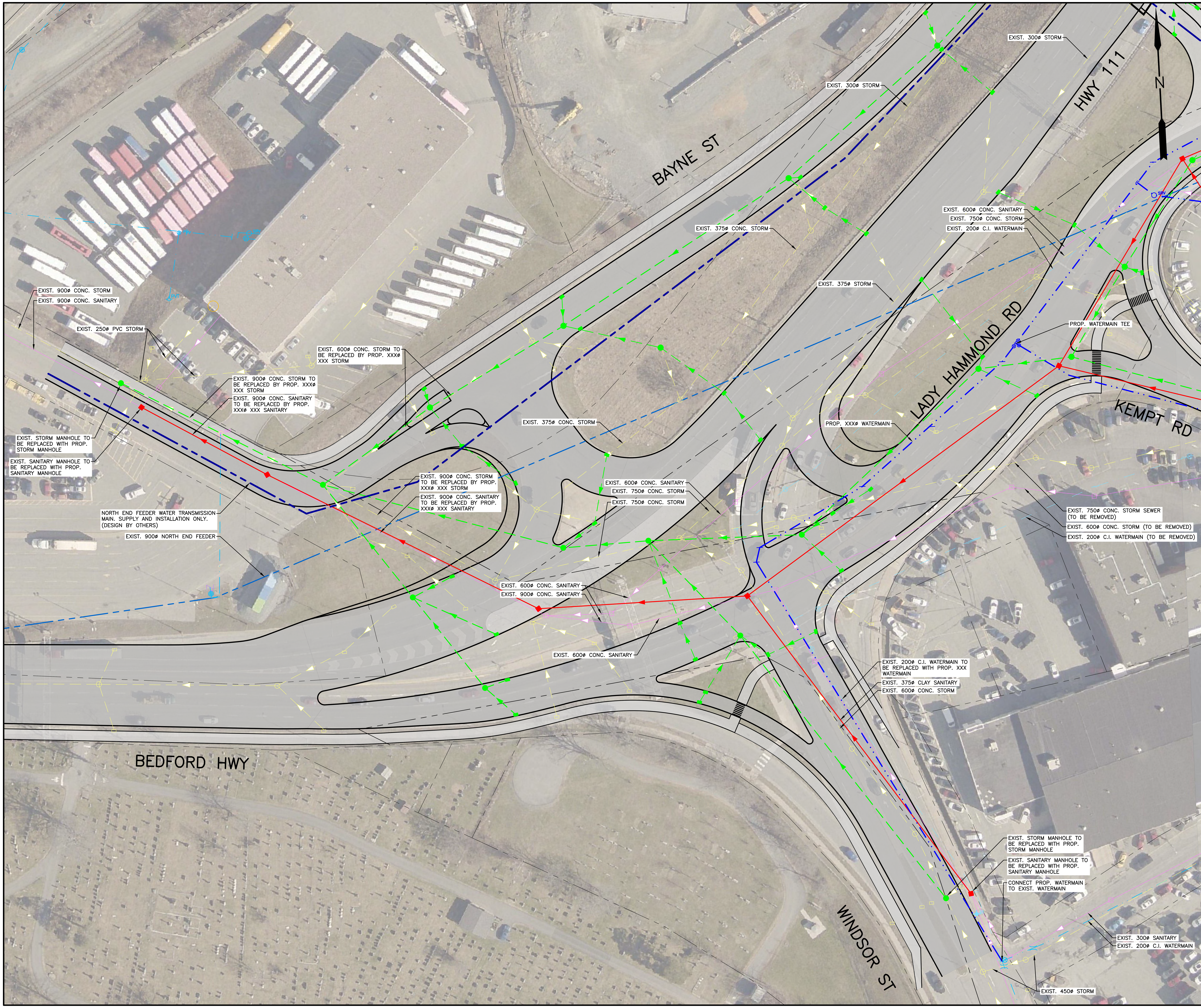
HALIFAX

WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111
BEDFORD

PROPOSED SITE SERVICING PLAN – SHEET 4 OF 7

Date APR 2024	Drawn M. ZHOU	Tender No. 22–000
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	Sheet 4 OF 7
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. CSK05C
Checked A. BAILLIE		



KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
	FENCE	
	GUIDERAIL	
	RETAINING WALL	
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
	STORM HEADWALL	
	STORM SEWER	
	SANITARY SEWER	
	COMBINED SEWER	
	WATER MAIN	
	TRANSMISSION MAIN	
	GAS MAIN	
	O/H UTILITY	
	U/G UTILITY	
	LINE MARKING	
	SIDEWALK	
	TREE	
	HEDGE	
	TOP OF SLOPE	
	BOTTOM OF SLOPE	
	GAS MAIN	
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT SURFACE	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	HEDGE	

NOTES

1. THIS DRAWING DEPICTS THE PROPOSED PIPE LAYOUT OVERLAID ON THE EXISTING PIPE NETWORK. THIS IS A CONCEPT LAYOUT AND SUBJECT TO CHANGE.
2. PROPOSED PIPE SIZES ARE APPROXIMATE AND WILL NEED TO BE CONFIRMED BY THE PBD TEAM WITH HALIFAX WATER.

No.	Date	Revision Description	Appr'd
2	APR 23/24	ISSUED FOR REVIEW	AB
1	APR 19/24	ISSUED FOR REVIEW	AB

PRELIMINARY

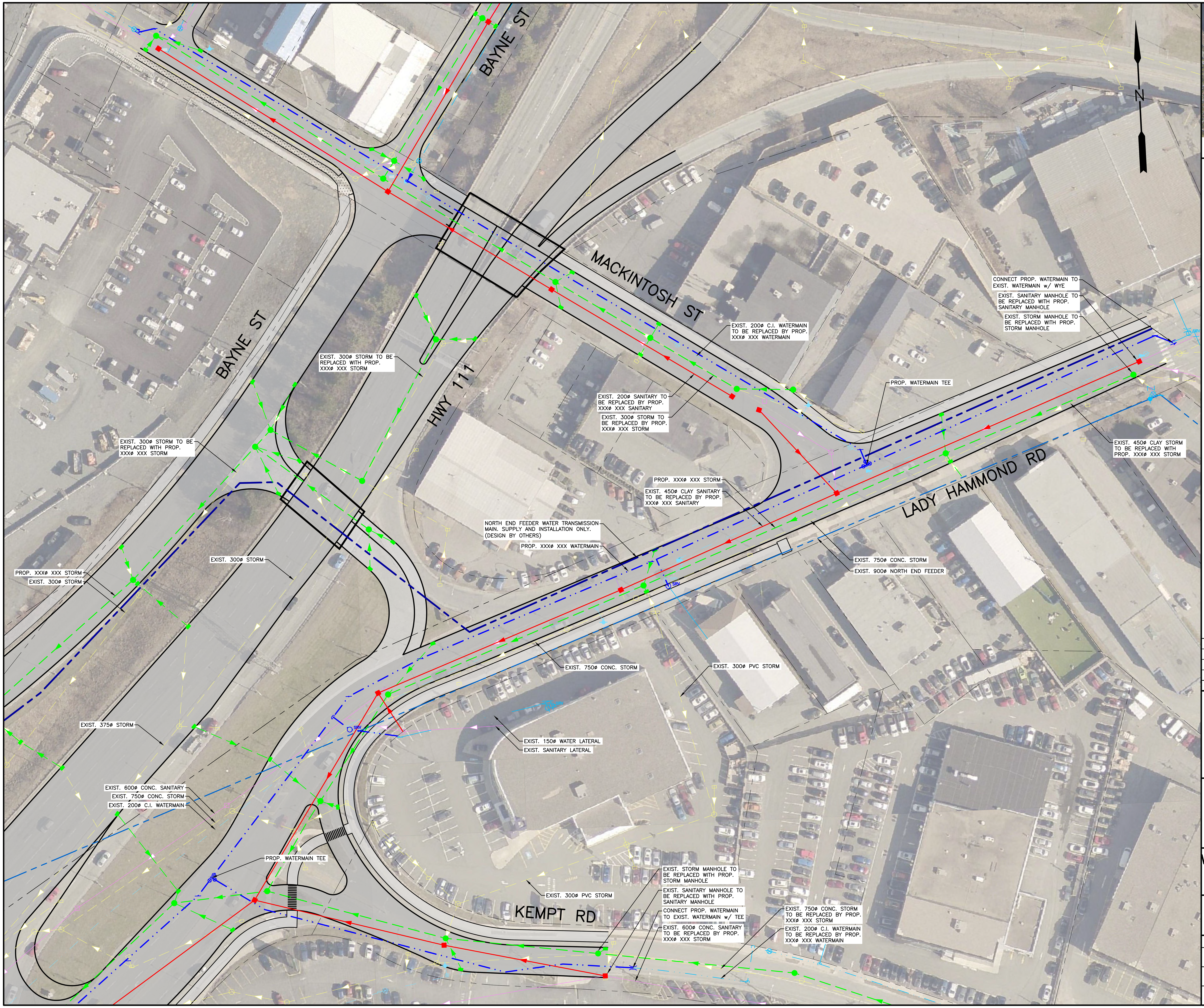
HALIFAX

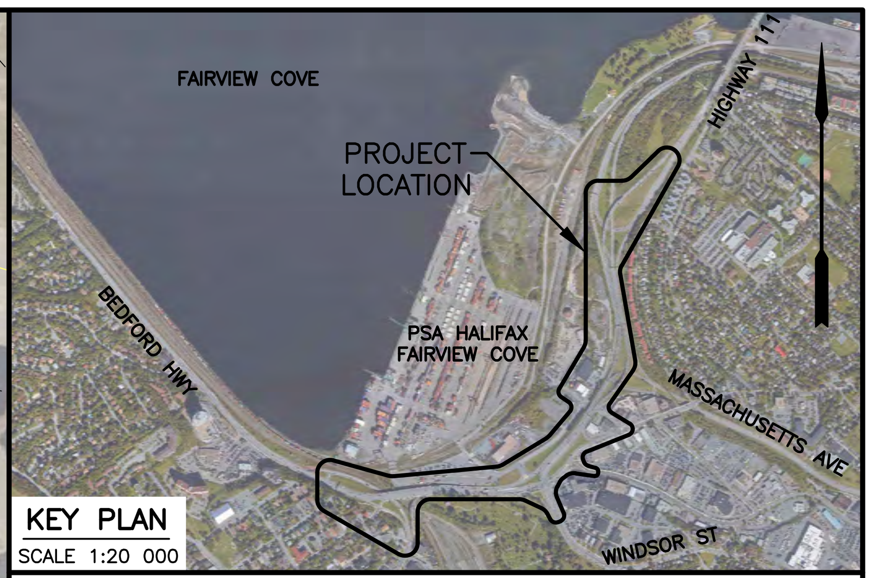
WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111
BEDFORD

PROPOSED SITE SERVICING PLAN
– SHEET 5 OF 7

Date APR 2024	Drawn M. ZHOU	Tender No. 22–000
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	Sheet 5 OF 7
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. CSK05D
Checked A. BAILLIE		





KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING		PROPOSED
	WATERVALVE	
	UTILITY POLE AND GUY WIRE	
	SIGN POST/BASE	
	LIGHT STANDARD	
x x x x	FENCE	x x x x
GR GR GR GR	GUIDERAIL	GR GR GR GR
RW RW RW RW	RETAINING WALL	RW RW RW RW
	CONCRETE CURB	
	PROPERTY LINE	
	SEWER MANHOLES	
	CATCHBASIN	
	STORM HEADWALL	
	STORM SEWER	
	SANITARY SEWER	
	COMBINED SEWER	
	WATER MAIN	
	TRANSMISSION MAIN	
G G G G	GAS MAIN	
OH OH OH OH	O/H UTILITY	
	U/G UTILITY	
	LINE MARKING	
	SIDEWALK	
	TREE	
H H H H	HEDGE	
	TOP OF SLOPE	
	BOTTOM OF SLOPE	
	GAS MAIN	
	LINE MARKING	
	BOTTOM OF SLOPE	
	SIDEWALK	
	MULTI-USE PATH	
	ASPHALT SURFACE	
	LANDSCAPE SURFACE	
	PAVEMENT MARKING	
	HEDGE	

NOTES

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No.	Date	Revision Description	Appr'd
2	APR 23/24	ISSUED FOR REVIEW	AB
1	APR 19/24	ISSUED FOR REVIEW	AB

PRELIMINARY

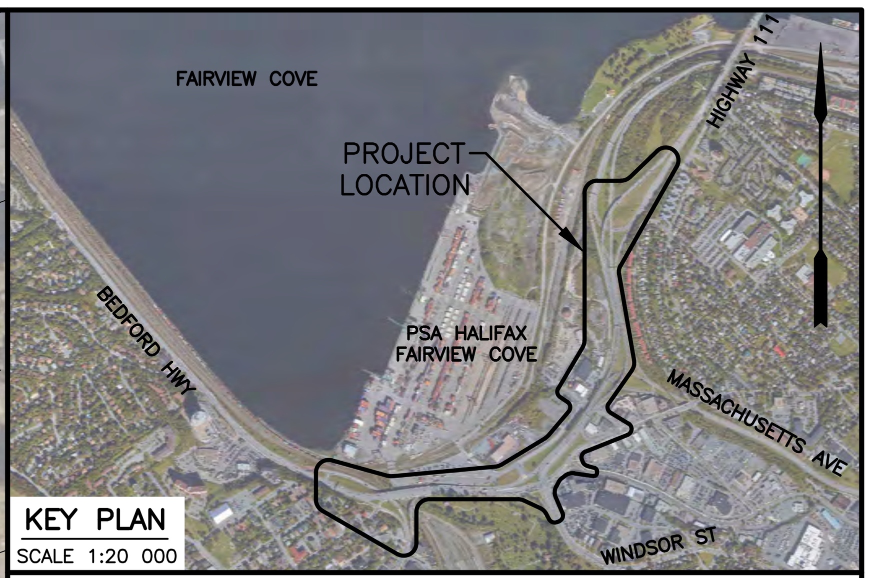
HALIFAX

WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111
BEDFORD

PROPOSED SITE SERVICING PLAN
– SHEET 6 OF 7

Date APR 2024	Drawn M. ZHOU	Tender No. 22–000
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	Sheet 6 OF 7
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. CSK05E
Checked A. BAILLIE		



KEY PLAN
SCALE 1:20 000

PLAN LEGEND

EXISTING | PROPOSED

- WATERVALVE
- UTILITY POLE AND GUY WIRE
- SIGN POST/BASE
- LIGHT STANDARD
- FENCE
- GUIDERAIL
- RETAINING WALL
- CONCRETE CURB
- PROPERTY LINE
- SEWER MANHOLES
- CATCHBASIN
- STORM HEADWALL
- STORM SEWER
- SANITARY SEWER
- COMBINED SEWER
- WATER MAIN
- TRANSMISSION MAIN
- GAS MAIN
- O/H UTILITY
- U/G UTILITY
- LINE MARKING
- SIDEWALK
- TREE
- HEDGE
- TOP OF SLOPE
- BOTTOM OF SLOPE
- GAS MAIN
- LINE MARKING
- BOTTOM OF SLOPE
- SIDEWALK
- MULTI-USE PATH
- ASPHALT SURFACE
- LANDSCAPE SURFACE
- PAVEMENT MARKING
- HEDGE

NOTES

1. THIS DRAWING DEPICTS THE PROPOSED PIPE LAYOUT OVERLAID ON THE EXISTING PIPE NETWORK. THIS IS A CONCEPT LAYOUT AND SUBJECT TO CHANGE.
2. PROPOSED PIPE SIZES ARE APPROXIMATE AND WILL NEED TO BE CONFIRMED BY THE PBD TEAM WITH HALIFAX WATER.

No.	Date	Revision Description	Appr'd
2	APR 23/24	ISSUED FOR REVIEW	AB
1	APR 19/24	ISSUED FOR REVIEW	AB

PRELIMINARY

HALIFAX

WINDSOR STREET EXCHANGE VALUE

BEDFORD HWY TO HWY 111
BEDFORD

PROPOSED SITE SERVICING PLAN – SHEET 7 OF 7

Date APR 2024	Drawn M. ZHOU	Tender No. 22–000
Scale Horz.1:500 Vert.	Survey No. SU21xxxx	Sheet 7 OF 7
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No. CSK05F
Checked A. BAILLIE		

Solutions today | Tomorrow IN mind

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