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mississauga@jewelleng.ca

www.jewelleng.ca

April 7, 2024

Attention: Trevor Day

RE: 85 Fire Route 19, Havelock ON
Control of Flooding Letter + Cut-Fill Calculations & Drawing
Jewell File No. 230-5387

Mr. Day,

We have prepared this letter to summarize our calculations and recommendations to ensure the control of flooding is not affected by the proposed driveway at 85 Fire Route 19 located near the perimeter of Belmont Lake (see figure below). As part of this assessment, we completed the following:

- A review of the Site Plan by Trevor Day & Associates dated August 30, 2023. We completed supplemental topographic survey using high precision GPS equipment in the vicinity of the proposed compensatory cut volume.

- Cut/fill balance calculations and drawing to accommodate the proposed driveway.

- An assessment of the proposed driveway elevations with equalization culvert to ensure safe access to the property is provided.

- A site visit on August 3, 2023 to observe individual characteristics of the subject property as it relates to floodplain.

The Owner is proposing to build a single-family dwelling on the subject property shown in the site plan by Trevor Day & Associates in Appendix A of this letter. As part of this application, the Owner is seeking to include a proposed driveway with equalization culvert that will require 64 m^3 of fill to achieve safe access.

The site plan shows a final floor elevation (FFE) of the dwelling of 190.7m. This FFE is greater than 0.3m above the regulatory flood elevation as recommended in *Appendix C* of the CVC's *Floodproofing Guidelines.*

Site Location – 85 Fire Route 19C, Havelock

The applicable section from the CVC Policy Manual relating to the fill for the proposed driveway is Section 5.3.13.3. An excerpt of this section is provided below.

"Notwithstanding Policy 5.3.13.1 development associated with the construction of a driveway or access way through the Regulatory floodplain in order to provide access to lands outside of the Regulatory floodplain may be permitted subject to the provision of safe access as identified in Section 3.3 and if it has been demonstrated to the satisfaction of CVCA that there is no viable alternative outside of the regulated area and that the control of flooding, erosion, pollution, or the conservation of land will not be affected;"

This section of the Policy Manual is useful as it provides direction on the path forward for the subject property; the driveway is permissible so long as CVCA is satisfied the following three (3) conditions are met:

1. Safe access is provided per Section 3.3 of the Policy Manual,
2. There is no viable alternative, and

3. The control of flooding, erosion, pollution, or the conservation of land will not be affected.

Condition 1: Safe Access

Section 3.3 of the CVC Policy Manual indicates safe access is achieved if the following criteria are met in the regulatory storm event:

A. Depth of vehicle access may not exceed 0.3m.
B. Depth for pedestrian access may not exceed 0.8m.
C. Velocities may not exceed 1.7m/s.

The subject property is adjacent to Belmont Lake. *Table 2* of the CVC Policy Manual identifies the 1:100 Elevation for Belmont Lake. *Page 48* of the *CVC Policy Manual* identifies the 1:100-yr storm as its regulatory event.

The regulatory (1:100-yr) water level for Belmont Lake is 188.8m.

Along the alignment of the proposed driveway location, the existing grade drops below the regulatory water level of 188.8m, and also below the minimum elevation of 188.5m required for safe access. Therefore, fill would be needed to ensure safe access is available to the residence as part of Condition 1.

The intent of the 0.3m depth limitation is to ensure safe access for motor vehicles. Based on this guidance, the minimum proposed driveway elevation is 188.5m (188.8m – 0.3m = 188.5m). Therefore, Condition 1A is met.

The driveway is limited to a maximum of 0.3m flood depth in the regulatory event. This is less than the maximum allowable depth of 0.8m for pedestrian access. Therefore, Condition 1B is met.

For the velocity constraint, we reviewed the location of the subject property relative to the flood waters. The regulatory water level is imposed by the Belmont Dam on the opposite (downstream) side of the lake. The backwater imposed by the dam would cause the water level to increase to 188.8m in the regulatory flood event. This means that the driveway would be subject to flood depths over the driveway with near-zero velocities, and certainly below 1.7m/s. Therefore, Condition 1C is met.

Based on the above, **Condition 1 for Safe Access is satisfied.**

Condition 2: No Viable Driveway Alternative

Based on the Site Plan from Trevor Day & Associates and a review of topographic survey with supplemental terrain data downloaded from the province, there is no viable alternative outside of the regulated area since the high ground at the center of the property is entirely surrounded by the regulatory flood limit and/or wetlands. The proposed driveway location is placed between (but outside of) the two individual wetlands.

With no viable driveway alternative based on the surrounding wetlands and the regulated flood limit as shown in the Site Plan, **Condition #2 is satisfied.**

<u>Condition 3: No Negative Impacts to Control of Flooding</u>

The last part of Section 5.3.13.3 requires that the control of flooding, erosion, pollution, or the conservation of land not be negatively affected. We do not suspect CVCA would be concerned with the proposed driveway as it relates to erosion, pollution, or the conservation of land as we do not believe the proposed driveway is applicable to these categories (although we leave that to CVCA's discretion). Therefore, to address Condition 3, we put our focus to the potential impact to the control of flooding.

When completing an assessment to determine whether fill will negatively impact the control of flooding, two parameters need to be investigated.

1) Conveyance
2) Storage

<u>Conveyance:</u>

River and drainage systems rely on effective flow areas to convey runoff from upstream to downstream. The *effective flow areas* are defined as areas that contribute to the river's ability to move the water in its desired flow path. *Ineffective flow areas* on other hand, represent areas that are within the floodplain, but do not contribute to the conveyance of flows. Examples of *ineffective flow areas* would be runoff that is blocked by a bridge approach, or an infill development where there are existing structures on either side of the proposed development location. An ineffective flow area can be similar to a blocked obstruction along a cross sections of the river, depending on the individual site.

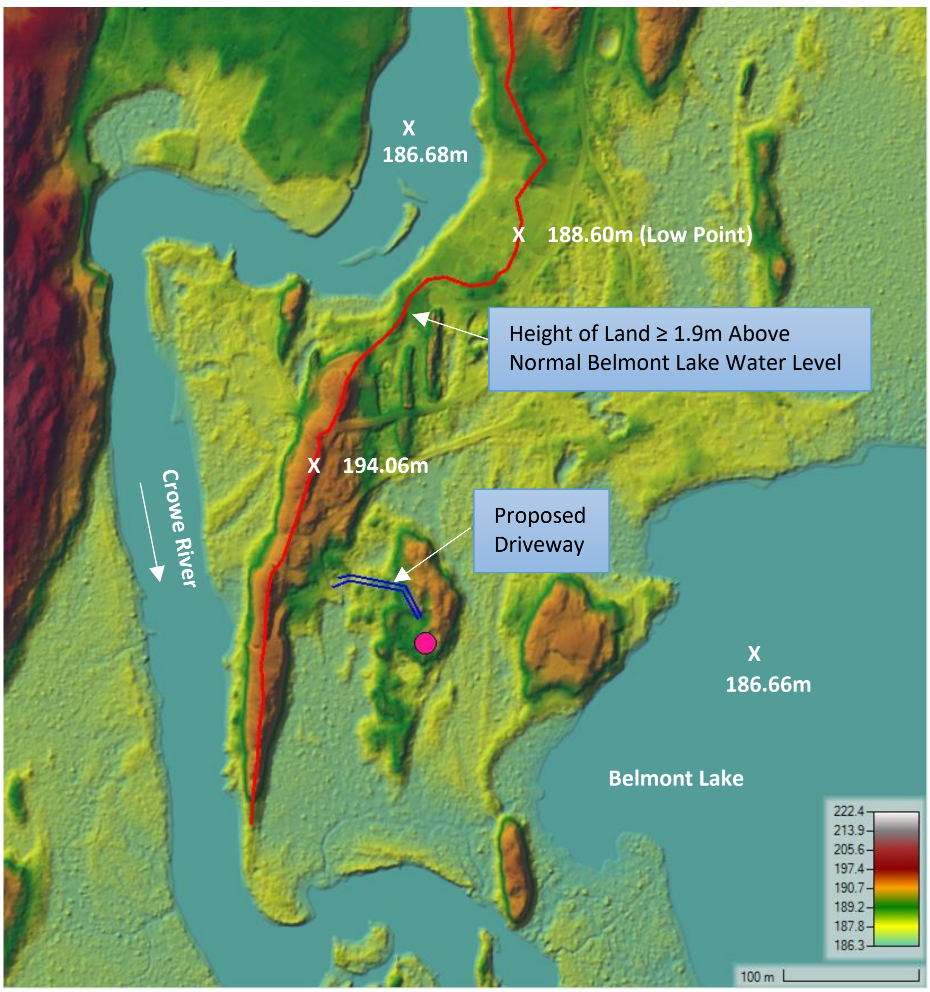
It is obvious the proposed driveway is within an ineffective flow area since there is a minimum 1.9m height of land that separates the downstream branch of the Crowe River that inlets to Belmont Lake from the subject lot (see figure below). The subject lot is also located at the outside perimeter of the reservoir. As noted in the *<u>Condition 1: Safe Access</u>* discussion, the floodplain at the subject site is the result of the backwater imposed by the Belmont Dam, and velocities at the driveway in the regulatory event would be negligible (i.e. rounded to 0m/s).

In drainage systems, lakes function as a reservoir, and are not relied upon for conveyance in the same manner as a river. The proposed driveway is within an ineffective flow area of both Crowe

River and Belmont Lake; therefore, the proposed fill to provide safe access to the lot will not affect the drainage system's ability to convey runoff from upstream to downstream.

Note: Even if the proposed addition *was* within an effective flow are (which it is not), the cross-sectional area of Crowe River and/or Belmont Lake perpendicular to the direction of flow is exceptionally larger than the cross-sectional area associated with the fill proposed for the driveway. Cross-sectional area is the driving factor in calculating the conveyance and subsequent water level in a drainage system (more so for rivers since lakes have little conveyance and are primarily dead storage).

Based on the above discussion, **we acknowledge the proposed driveway would not impede flood flows** and would subsequently not negatively impact the hydraulic and/or fluvial functions of Crowe River and Belmont Lake.



Schematic of Height of Land Separating Proposed Driveway from Crowe River Flow Path (Terrain Background)

Storage:

The volume of fill required for the proposed driveway is 64 m^3. **The applicant has included an equal volume of compensatory cut at < 0.3m intervals to achieve a cut/fill balance;** the discussion below is to demonstrate the minimal risk associated with this permit application as it relates to the control of flooding. The objective is to provide CVCA comfort that the proposed compensatory cut to offset the fill will ensure the control of flooding is not affected within their watershed.

The general concern for instances of fill within the floodplain is that the loss of flood storage may affect the routing of the drainage system and subsequently increase water levels.

For the subject application, the 64 m^3 of fill would have no negative impacts to the control of flooding since its impact is immeasurable due to the massive volume of active storage within Belmont Lake (20,151,000 m^3). The fill is also offset by the compensatory cut, leaving no loss of flood storage in Belmont Lake.

The table below summarizes the active storage of Belmont Lake, measured using GIS applications from the normal operating level (186.66m) to the regulatory water level (188.8m). The normal operating level for winter was selected for the table below since a review of the Water Survey of Canada flow gauge data shortly downstream of the nearby Marmora Dam indicates that >90% of annual instantaneous peak flows occur during a spring melt condition.

Table 1: Belmont Lake Active Storage (Cumulative)

Elevation	Storage
m	1000 m3
186.66	0
186.86	1,616
187.06	3,231
187.26	4,847
187.46	6,568
187.66	8,324
187.86	10,216
188.06	12,069
188.26	14,254
188.46	16,336
188.66	18,580
188.8	20,151

We offer the following to quantify the negligible amount of fill volume relative to the remainder of the reservoir:

- The fill volume represents 3 parts per million (ppm) relative to the Belmont Lake active storage volume. It is atypical to quantify storage volumes in hydrologic calculations as ppm, however it is the unit of measurement required given the minimal relative amount of proposed fill volume.

- As a depth, the maximum amount the proposed fill could *theoretically* raise water levels in Belmont Lake if no compensatory cut was provided is 0.009mm. This theoretical volume increase is measured by dividing the proposed fill by the surface area of Belmont Lake, yielding a depth of 0.000009m = 0.009mm = 9 micrometers.
    - Again, it is unusual to quantify storage volumes in micrometers, but it is the unit if measurement required. For context, any widths less than 20 micrometers (0.02mm) are not visible to the human eye.

- The Belmont Lake regulatory water level is 188.8m; it is rounded to the nearest 10cm. Hydrology model results used in practice are at best published to the nearest 1cm. Therefore, a hydrologic model of the subject drainage system for the purpose of assessing the impacts of the proposed fill (with or without compensatory cut) would show zero impact as our modeling tools are simply not designed to focus efforts on this negligible of an impact.

- Although the law (O. Reg. 159/06) suggests the Authority is to review potential impacts based on “the Development” (i.e. singular), we anticipate CVCA may review the application with regard to cumulative impacts.
    - If no compensatory cut was provided, then at 9 micrometers of depth increase, the CVCA would need to provide a permit for >1,000 applications to achieve a measurable (i.e. 1cm) increase in water level. This conservatively assumes all homes are built on the perimeter of Belmont Lake – the impact would be less if distributed throughout the watershed. Since fill without compensatory cut would need to go to the CVCA board, then it would take >1,000 board hearing applications brought to the board (and approved) before a measurable impact is achieved.
    - **Given the compensatory cut volume that accompanies this permit application, the cumulative impacts are zero.**

Given the above quantification of the fill relative to Belmont Lake, it is impossible for the subject application to increase water levels in Belmont Lake to any measurable effect, with or without compensatory cut. However, to alleviate potential CVCA concerns regarding cumulative impacts, an equal amount of cut to offset the fill is proposed as described below.

The stage-storage and storage-discharge relationship that dictates the water levels and floodplain extents can be maintained by an incrementally balanced cut and fill operation to ensure no negative impacts to the control of flooding. Section 5.3.13 of the CVC Policy Manual recommends this cut and fill operation be quantified in 0.3m vertical increments.

Appendix B shows the elevations and corresponding cut/fill volumes for the incrementally balanced cut fill. Appendix B provides the calculations used to produce the values in this cut/fill balance. The increments are less than 0.3m, meaning they are simply more detailed than the guidance in the CVC Policy Manual. The calculations in Appendix B are based on the site-specific topographic survey prepared by Jewell survey crew using GPS and a total station in datum CGVD 28.

With no increase in volume at each increment and no effect on the Belmont Lake water levels, there would be no negative impacts to the control of flooding.

Therefore, **Condition 3 is satisfied.**

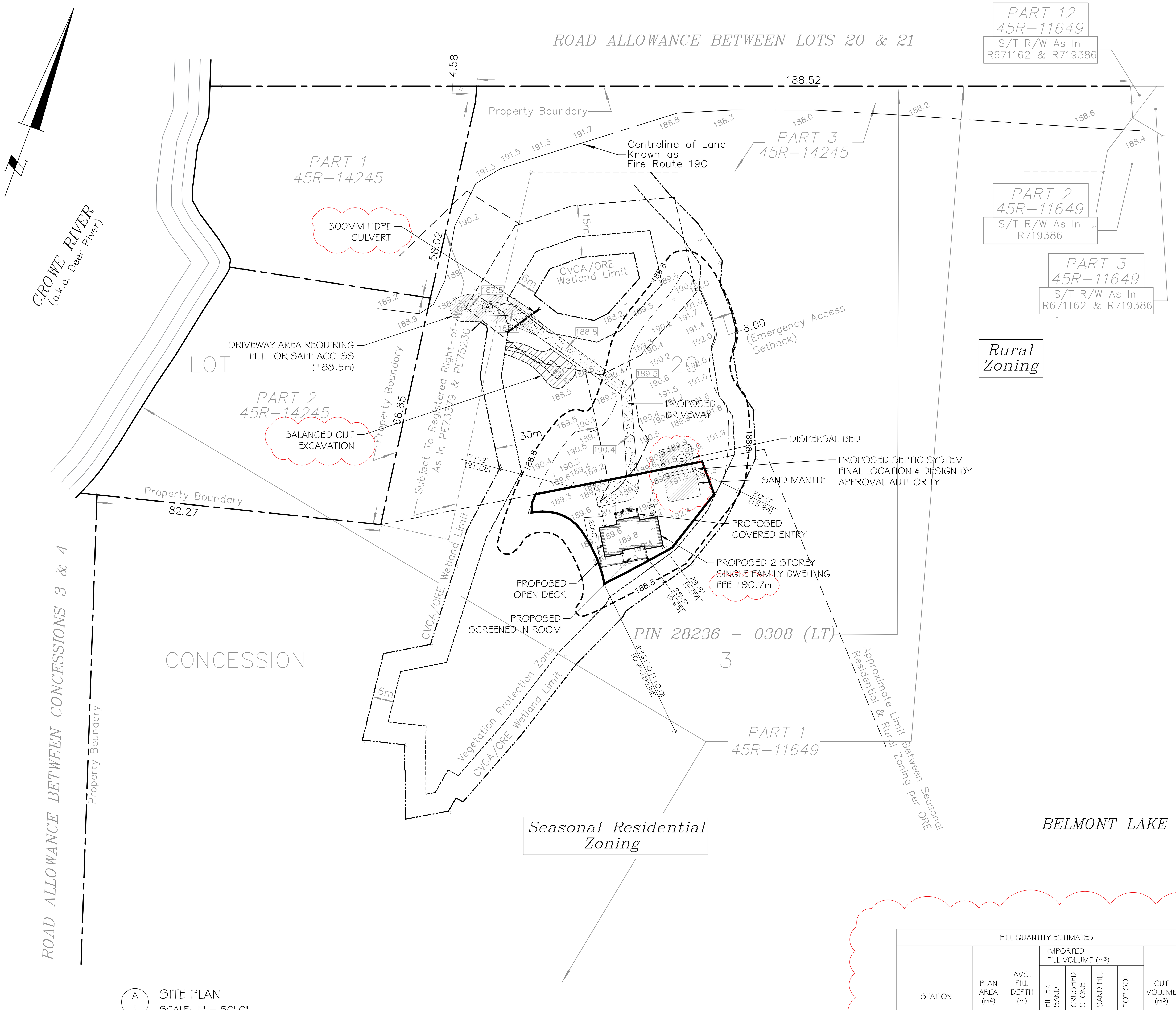
With Conditions 1-3 satisfied, the subject application is permissible at the discretion of CVCA staff per Section 5.3.13.2 of their Policy Manual. Should the subject application go before the CVC board, then subject application is permissible at the discretion of CVCA board members per O. Reg. 159/06.

If you have any questions or concerns, please feel free to contact the undersigned.

Sincerely,

Elliott Fledderus, P. Eng.
Jewell Engineering Inc.

APPENDIX A –Site Plan



SITE PLAN (A/1)
SCALE: 1" = 50'-0"

INFORMATION OBTAINED FROM:
SKETCH TO ILLUSTRATE ZONING AND BUILDING ENVELOPE AT
85 FIRE ROUTE 19
GEOGRAPHIC TOWNSHIP OF BELMONT
TOWNSHIP OF HAVELOCK-BELMONT-METHUEN
COUNTY OF PETERBOROUGH

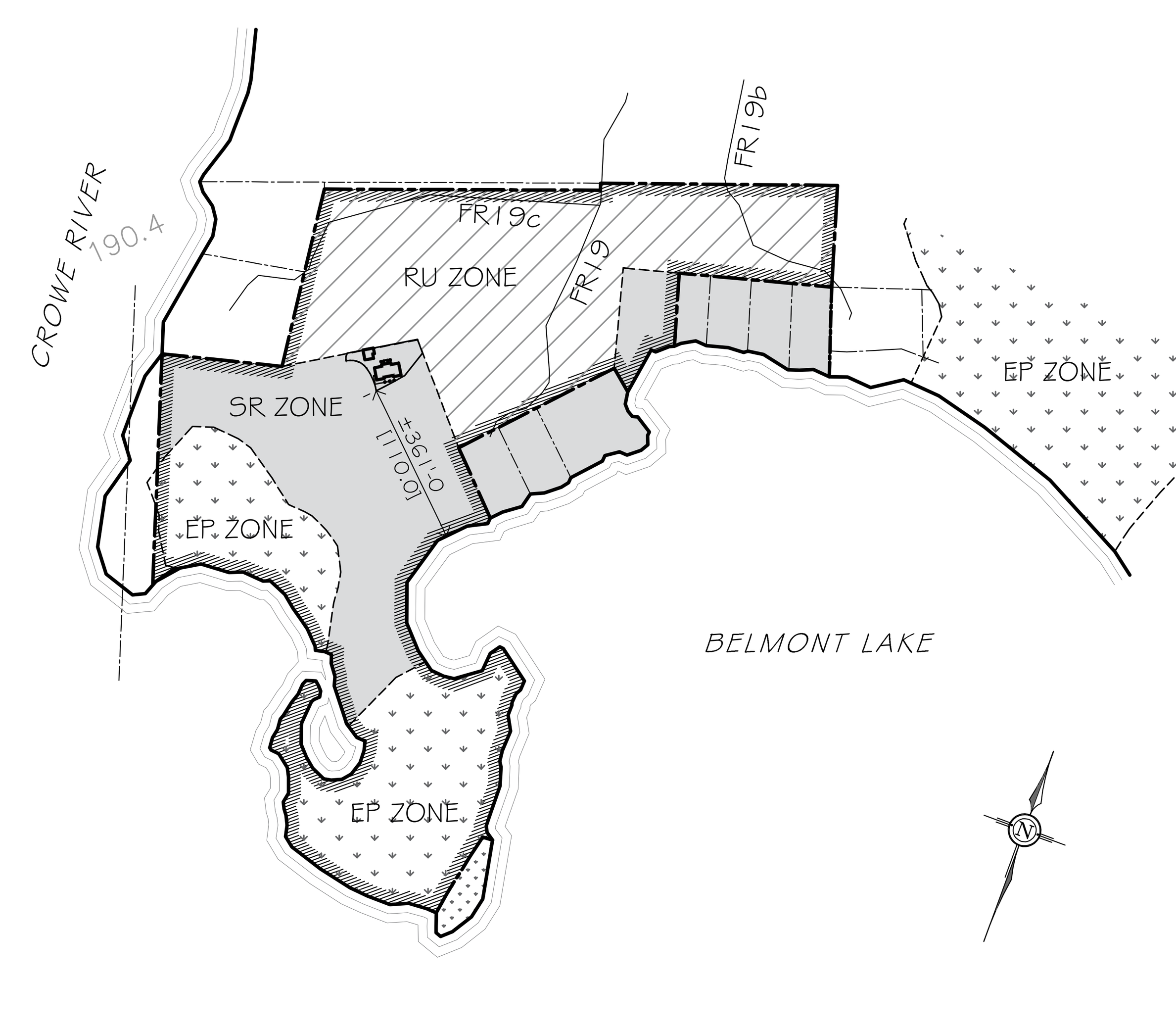
P.A. MILLER SURVEYING LTD.
ONTARIO LAND SURVEYOR

SITE STATISTICS

ZONE:
SEASONAL RESIDENTIAL (SR)
RURAL (RU)
ENVIROMENTAL PROTECTION (EP)

AREAS:	SF	SM	
LOT AREA:	995 020.0	92 440.4	
EXISTING BUILDINGS	0.0	0.0	TOTAL
PROPOSED BUILDING			
SINGLE FAMILY DWELLING	1 593.0	148.0	
OPEN DECK	258.0	24.0	
SCREENED ROOM	270.0	25.1	
COVERED ENTRY	168.0	15.6	
	2 289.0	212.7	TOTAL
PROPOSED TOTAL BUILDING AREA			
	2 289.0	212.7	TOTAL

EX. BLDG. COVERAGE: 0.0%
PROPOSED BLDG. COVERAGE: 0.23%



KEY PLAN (B/1)
SCALE: N.T.S.

FILL QUANTITY ESTIMATES

	STATION	PLAN AREA (m²)	AVG. FILL DEPTH (m)	IMPORTED FILL VOLUME (m³): FILTER SAND	CRUSHED STONE	SAND FILL	TOP SOIL	CUT VOLUME (m³)	NET FILL VOLUME (m³)
A	DRIVEWAY	183.5	0.43		78.7			Ø	78.7
B	SEPTIC FIELD	143.5	0.64	27.6	13.8	69.2	16.7	35.9	91.4
								NET SITE FILL VOLUME	170.1 m³

LEGEND

—·—·—	PROPERTY LINE
■	SURVEY MONUMENT
▨	EXISTING BUILDING
▨	PROPOSED BUILDING
HP●	EXISTING HYDRO POLE
— OH —	EXISTING OVERHEAD HYDRO
———	ORE DEFINED BUILDING ZONE
– – –	1:100 FLOODLINE 188.8
— — —	6.0M EMERGENCY ACCESS SETBACK FROM 1:100 FLOODLINE
—··—··—	WETLAND LIMIT (CVCA / ORE)
- - - - -	6.0M SETBACK FROM WETLAND LIMIT (VEGETATION PROTECTION ZONE)
– – – –	15.0M SETBACK FROM WETLAND LIMIT
— — — —	30.0M SETBACK FROM WETLAND LIMIT
185.5	EXISTING ELEVATION- METRIC

TREVOR DAY
& ASSOCIATES
DESIGN - PLAN - BUILD

BCIN 101814
6464 HIGHWAY 7 EAST
HAVELOCK, ONTARIO,
CANADA, K0L 1Z0
705-778-3291

PROJECT # 1470
ISSUED 02 AUG '23
REVISED 01-APR-24
FILE NAME
Deshane.dwg

DRAWN BY: MV
CHECKED BY: TREVOR DAY
BCIN 32144
I HAVE REVIEWED & TAKE RESPONSIBILITY FOR THIS DESIGN

CLIENT
ANTHONY QUINN

NO.	REVISION	DATE	BY

LICENSED PROFESSIONAL ENGINEER
T. C. DAY
90291071
1-Apr-24
PROVINCE OF ONTARIO

DRAWING NOTES:
.1 CONTRACTOR TO VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION AND NOTIFY DESIGNER OF ANY DISCREPANCIES.
.2 DEVIATION FROM THESE PLANS IS THE RESPONSIBLITY OF THE OWNER AND/ OR CONTRACTOR; THE DESIGNER IS NOT LIABLE FOR CONSTRUCTION NOT CONFORMING TO THESE PLANS.
.3 MATERIAL AND ASSEMBLY SUBSTITUTIONS ARE THE RESPONSIBILTY OF THE OWNER AND/OR CONTRACTOR. ANY REQUIRED WORK OF THE DESIGNER DUE TO SUBSTITUTIONS IS SUBJECT TO ADDITIONAL DESIGN FEES.

PROJECT
ZONING AMENDMENT
#85 FIRE ROUTE 19, HAVELOCK

SHEET CONTENTS
SITE PLAN

SCALE
AS NOTED

SHEET NO.
1 OF 1

APPENDIX B – Cut-Fill Calculations & Drawing

Driveway Fill

Station, m	Existing Elev, m	Proposed Driveway, m	Top Width, m	Base Width, m	Cross Section, m^2	Fill Required, m^3/m
0	188.80	188.80	5	5.00	0.00	0.00
1	188.71	188.76	5	5.21	0.26	0.26
2	188.62	188.72	5	5.41	0.54	0.54
3	188.53	188.68	5	5.62	0.82	0.82
4	188.43	188.64	5	5.83	1.12	1.12
5	188.34	188.60	5	6.03	1.43	1.43
6	188.25	188.56	5	6.24	1.74	1.74
7	188.16	188.55	5	6.57	2.27	2.27
8	188.07	188.55	5	6.93	2.88	2.88
9	187.98	188.55	5	7.30	3.54	3.54
10	187.88	188.55	5	7.67	4.22	4.22
11	187.79	188.55	5	8.03	4.94	4.94
12	187.70	188.55	5	8.40	5.70	5.70
13	187.93	188.55	5	7.47	3.84	3.84
14	188.17	188.55	5	6.53	2.21	2.21
15	188.40	188.55	5	5.60	0.80	0.80
16	188.38	188.55	5	5.68	0.91	0.91
17	188.36	188.55	5	5.76	1.02	1.02
18	188.34	188.55	5	5.84	1.14	1.14
19	188.32	188.55	5	5.92	1.26	1.26
20	188.30	188.55	5	6.00	1.38	1.38
21	188.26	188.55	5	6.16	1.62	1.62
22	188.22	188.55	5	6.32	1.87	1.87
23	188.18	188.55	5	6.48	2.12	2.12
24	188.14	188.55	5	6.64	2.39	2.39
25	188.17	188.55	5	6.52	2.19	2.19
26	188.20	188.55	5	6.40	2.00	2.00
27	188.23	188.55	5	6.28	1.80	1.80
28	188.26	188.55	5	6.14	1.59	1.59
29	188.30	188.55	5	6.01	1.39	1.39
30	188.33	188.55	5	5.87	1.19	1.19
31	188.37	188.55	5	5.74	0.99	0.99
32	188.40	188.55	5	5.60	0.80	0.80
33	188.44	188.55	5	5.42	0.55	0.55
34	188.49	188.55	5	5.24	0.31	0.31
35	188.53	188.56	5	5.11	0.13	0.13
36	188.58	188.60	5	5.09	0.11	0.11
37	188.62	188.64	5	5.07	0.09	0.09
38	188.67	188.68	5	5.05	0.07	0.07
39	188.71	188.72	5	5.04	0.04	0.04
40	188.76	188.76	5	5.02	0.02	0.02
41	188.80	188.80	5	5.00	0.00	0.00

Ditch Storage

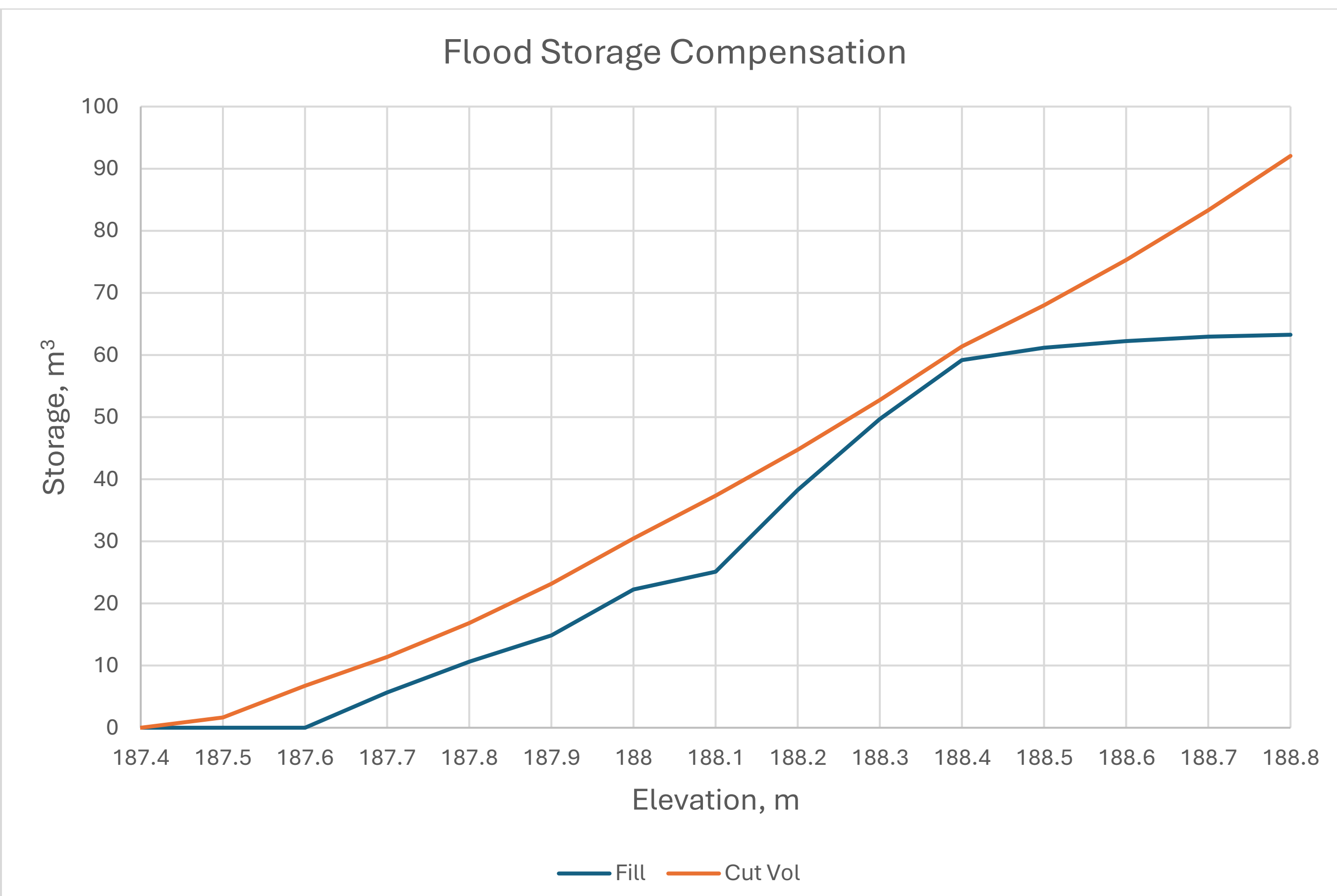
Station, m	Ditch Invert, m	Existing Ground, m	Base Width, m	Top Width, m	Cross Section, m^2	Cut Volume, m^3
0	187.40	188.00	1	3.40	1.32	-
1	187.40	188.07	1	3.68	1.57	1.44
2	187.40	188.14	1	3.96	1.84	1.70
3	187.40	188.21	1	4.24	2.12	1.98
4	187.40	188.23	1	4.32	2.21	2.17
5	187.40	188.25	1	4.40	2.30	2.25
6	187.40	188.27	1	4.48	2.38	2.34
7	187.40	188.29	1	4.56	2.47	2.43
8	187.40	188.31	1	4.64	2.57	2.52
9	187.40	188.33	1	4.72	2.66	2.61
10	187.40	188.35	1	4.80	2.76	2.71
11	187.40	188.40	1	5.00	3.00	2.88

Basin Storage

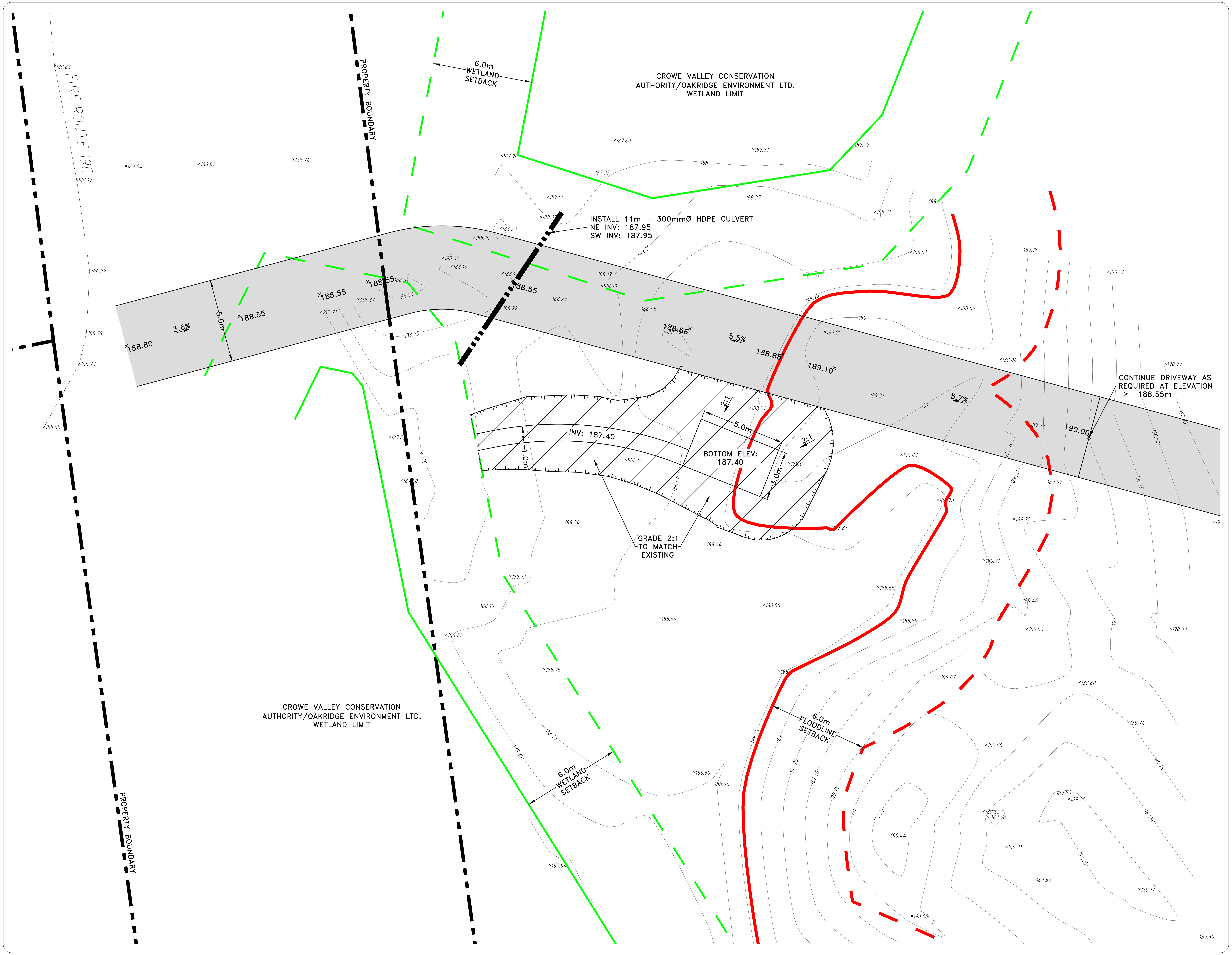
Elevation, m	Area	Average Area	Incr. Storage	Cum. Storage
187.4	15.00	-	-	0
187.5	18.36	16.68	1.67	1.67
187.6	22.04	20.20	2.02	3.69
187.7	26.04	24.04	2.40	6.09
187.8	30.36	28.20	2.82	8.91
187.9	35.00	32.68	3.27	12.18
188	39.96	37.48	3.75	15.93
188.1	45.24	42.60	4.26	20.19
188.2	50.84	48.04	4.80	24.99
188.3	56.76	53.80	5.38	30.37
188.4	63.00	59.88	5.99	36.36
188.5	69.56	66.28	6.63	42.99

Total Storage

Elevation, m	Fill, m^3	Cut, m^3	Δ Flood Storage, m^3
187.4	0	0.0	0.0
187.5	0	1.7	1.7
187.6	0.0	6.8	6.8
187.7	5.7	11.4	5.7
187.8	10.6	16.8	6.2
187.9	14.9	23.2	8.3
188	22.2	30.4	8.2
188.1	25.1	37.3	12.2
188.2	38.3	44.8	6.5
188.3	49.7	52.8	3.1
188.4	59.2	61.4	2.2
188.5	61.2	68.0	6.8
188.6	62.2	75.3	13.1
188.7	62.9	83.3	20.4
188.8	63.3	92.1	28.8



03/28/2024



GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES.
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

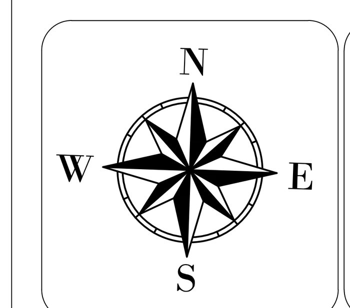
* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY

LEGEND

- REGULATORY FLOOD LIMIT - 188.8m
- REGULATORY FLOOD LIMIT SETBACK
- WETLAND
- WETLAND SETBACK
- PROPOSED COMPENSATORY CUT AREA



JEWELL ENGINEERING

TREVOR DAY & ASSOCIATES
85 FIRE ROUTE 19

TOWNSHIP OF HAVELOCK-BELMONT-METHUEN

DRIVEWAY CUT/FILL PLAN

DRAWN BY: MB	PROJECT NO: 230-5498
DESIGNED BY: AJR	DATE: March 2024
CHECKED BY: EF	SCALE: HORIZONTAL - 1:100 VERTICAL - N/A
APPROVED BY:	CONTRACT NO:
	DRAWING NO: 1

F:\FTP\PROJECT FILES\1 CIVIL 3D PROJECT FILES\2305498 - DAY, TREVOR - BELMONT LAKE DESHANE PROPERTY\2 - MODELS\2305498 - BASE MODEL