TECHNICAL MEMORANDUM

DATE August 12, 2025 **Project No.** 1791470A

TO David Hanratty
CBM Aggregates, a division of St. Mary's Cement Inc. (Canada)

CC George Schneider

FROM Mohsin Siddique; Craig DeVito **EMAIL craig.devito@wsp.com**

FLOOD MAPPING – PROPOSED ABERFOYLE SOUTH LAKE PIT

1.0 INTRODUCTION

In November 2023, CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada), submitted a Class A Pit Below Water licence application under the *Aggregate Resources Act (ARA)* at the proposed Aberfoyle South Lake Pit located at 6947 Concession Road 2, in the Township of Puslinch, County of Wellington, Ontario (referred herein as Property). WSP Canada Inc. (WSP), has been retained by CBM to complete an assessment of various return period event flood elevations from Mill Creek on the Property, as requested from the Grand River Conservation Authority (GRCA) during their review of the Terms of Reference for the ARA licence application.

The Property is approximately 85 hectares (ha) in size and is located at 6947 Concession Road 2, in the Township of Puslinch, County of Wellington, Ontario. Of this Property, approximately 44 ha are proposed for licensing under ARA (referred herein as Site) and the extraction area within the Site is approximately 27 ha in size (Figure 1.1). The Property is comprised of approximately 50% agricultural fields which are flanked by three wooded areas in the northwest, north-central and southeast portions of the Property and an unoccupied residence in the western portion of the Property (Figure 1.1).

The predominant surface water features in the vicinity of the Site include Mill Creek and its tributaries. Mill Creek flows from north to south along the eastern and southeastern portion of the property (Figure 1.1), exits the Property along the southern boundary, and then flows westward approximately 150 m to the south of the Property boundary. There are five small tributaries to Mill Creek proximal to the Property (Figure 1.1), referred to as Tributary 1, 2, 3, 4 and 5. Tributaries 1, 3 and 5 originate off-Property but then flow onto the Property and join Mill Creek, while Tributaries 2 and 4 are located entirely off-Property.

2.0 OBJECTIVE

The primary objective of this technical memorandum is to assess floodplains of Mill Creek and Tributary 3 and provide the results in terms of storm flood elevations and floodplain maps for 5-year, 10-year, 25-year, 50-year and 100-year storm floods, noting that considering the layout of Site and extraction area, and the overall drainage pattern, floodplains of Tributaries 1, and 5 were not assessed. Flood elevation data was not provided for a 2-year

storm flood, however typically a 2-year flood will be contained within the creek channel and will not overtop the top of channel and therefore not enter the site.

3.0 METHODOLOGY

To assess the floodplain of the study area, hydraulic modeling was conducted using HEC-RAS software (version 6.3.1). Two (2) one-dimensional steady flow HEC-RAS models: (1) Mill Creek and (2) Tributary 3, were used. The models of Mill Creek and Tributary 3 are based on GRCA's HEC-RAS models for the regional flood (provided by GRCA) and uses Canadian Geodetic Vertical Datum of 1928 (CGVD28) / North American Datum (NAD) of 1983 of the Canadian Spatial Reference System (NAD83(CSRS)). Note that for floodplain mapping, flood elevations were converted to CGVD2013 / NAD1983 using GPS.H tool (Government of Canada, 2024).

The calibration parameters and associated values in both models were assumed unchanged from their respective regional flood models. Upstream and downstream boundary conditions in the models included storm inflows (for 100-year, 50-year, 25-year, 10-year and 5-year storm floods), extracted from GRCA's respective HEC-2 models, along the reaches and downstream channel bed slopes. Note that the 2-year storm flow data were not provided by GRCA and hence these were not included in the assessment. Tables 1 and 2 provide input boundary conditions (storm inflows for 5-year to 100-year storm floods) for HEC-RAS models along the reaches of Mill Creek and Tributary 3, respectively.

4.0 RESULTS

The results of the HEC-RAS modeling based on CGVD2013 / NAD1983 are presented as storm flood elevations (Tables 3 and 4) and the floodplain maps (Figures 1.2 through 1.6) along the reaches of Mill Creek and Tributary 3. The summary of results is as follows:

- **Mill Creek:**
  - Floodplain boundaries of 100-year and 50-year storm floods, were found to overlap the Site boundary at the northeastern corner of the Property, however, floods were not found to extend beyond the extraction area limit. No flooding was observed in the other parts of the Site due to Mill Creek. Flood due to 2-year storm (being relatively lower than 5-year storm) is expected to be contained within the creek channel and not enter the Site boundary.
  - Storm flood elevations at the northeast corner of the Property, where the Mill Creek flood water is found to enter the Property (Section 14551), ranged from 303.61 metres above sea level (masl) for 100-year storm flood to 303.17 masl for 5-year storm flood.
- **Tributary 3:**
  - Floodplain boundaries of all storm floods were found to overlap the Site boundary, however, only the 100-year and 50-year storm floods were found to extended beyond the extraction area limit. Note that the extraction area is located on the southern side of the Tributary 3. Flood levels due to 2-year storm (being relatively lower than 5-year storm) is expected to be contained within the tributary channel and not extend beyond the banks.

- Storm flood elevations at the northern corner of the Property, where the Tributary 3 flood water is found to enter the Property (Section 1600.1), ranged from 302.8 masl for 100-year storm flood to 302.61 masl for 5-year storm flood.

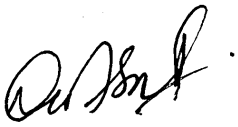
5.0 POTENTIAL IMPACTS TO SURFACE WATER

- Due to the overlapping of floodplain and the extraction area, flood water is expected to enter the Site and extraction area, however, in general, the flooding due to 2-year storm event is expected to be contained within the creek channel. It is expected that the pits in the extraction area would act as storage area and provide additional temporary storage capacity for the flood water in comparison to the current conditions, which would help reduce the effects of flooding downstream from the Site. By extension, the retention of runoff and reduction to peak flows would lead to the potential for lower rates of sediment erosion / transport.
- It is expected that the large flood events would result in a temporary stoppage in operations, depending on the elevation of the flood waters. If pit access or the safe operation of equipment is at risk, operations will be stopped. This stoppage is expected to be short-lived, as flood waters are expected to recede in a matter of days and the potential for significant damage to the site infrastructure would be minimal.
- Pit operations will be planned to limit the risks of flood water being conveyed through the pit pond(s) and short circuiting of the creek channel. This will be achieved through perimeter grading up to an elevation of 304.6m to control flood water bypassing the channel and extraction planning. Figure 1.7 shows the location of proposed perimeter grading. Note that even with the additions of perimeter grading that increases ground elevations in some areas, the pit extraction will still have an overall benefit to flood volumes in the area as the pit would provide additional storage for water if the flood reached the extraction limit at the northeast corner of the property. The site plans have been updated to address flood risk potential and the comments received so the pit pond can provide flood storage without short circuiting. Updated site plans are provided in the attachments.

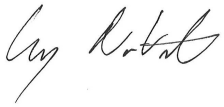
6.0 CLOSURE

We trust that this technical memorandum meets your current needs. If you have any questions or require clarification, please contact the undersigned at your earliest convenience.

WSP Canada Inc.



Mohsin Siddique, PhD, PEng
Water Resources Engineer



Craig DeVito, PEng
Water Resources Engineer

MS/CDV/ld

Attachments: **Tables:**

Table 1: Storm Inflows along Mill Creek
Table 2: Storm Inflows along Tributary 3
Table 3: Water Surface Elevations of Storm Floods along Mill Creek
Table 4: Water Surface Elevations of Storm Floods along Tributary 3

Figures:

Figure 1.1: Site Location and Cross Sections
Figure 1.2: Storm Flood Elevation Map for 100-year Storm Flood
Figure 1.3: Storm Flood Elevation Map for 50-year Storm Flood
Figure 1.4: Storm Flood Elevation Map for 25-year Storm Flood
Figure 1.5: Storm Flood Elevation Map for 10-year Storm Flood
Figure 1.6: Storm Flood Elevation Map for 5-year Storm Flood
Figure 1.7: Perimeter Grading Location Map

https://wsponline.sharepoint.com/sites/gld-21291g/deliverables/4000 5000 hydrogeology level 1 and 2/10 floodplain assessment/1791470a-tm-revx-cbm lake flood assessment-23june2025.docx

REFERENCES

Government of Canada (2024). GPS.H tool. Available at: https://webapp.csrs-scrs.nrcan-rncan.gc.ca/geod/tools-outils/gpsh.php

TABLES

Table 1: Storm Inflows along Mill Creek

Cross-section ID	Storm Inflow (m^3/s)					
	Regional Flood (1982)	100-year	50-year	25-year	10-year	5-year
19380	127	15	12.5	9.8	6.2	4.1
16101	165	18.4	16	13.3	9.2	6.2
12200	165	16	14.2	12.5	9.2	6.4
8901.4	165	14.6	13.3	11.5	8.5	6
8886.3	153	n/a	n/a	n/a	n/a	n/a
4560	141	13.2	12	10.5	7.8	5.6

n/a: not applicable

Table 2: Storm Inflows along Tributary 3

Cross-section ID	Storm Inflow (m^3/s)					
	Regional Flood (1982)	100-year	50-year	25-year	10-year	5-year
1600.4	15.3	2.4	1.9	1.4	0.8	0.5

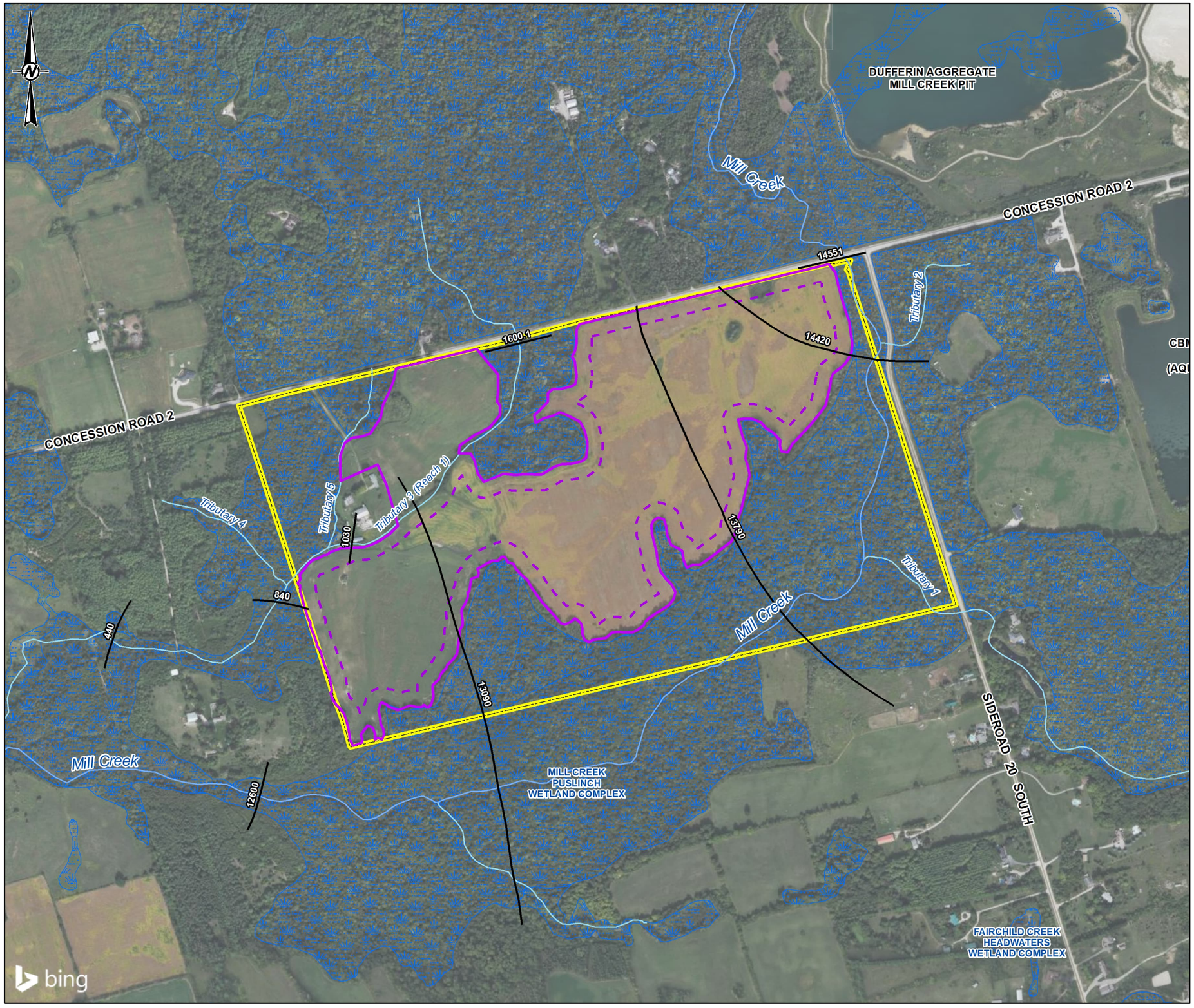
Table 3: Water Surface Elevations of Storm Floods along Mill Creek

Cross Section ID	Storm Flood Elevations (masl)					
	Regional Flood (1982)	100-year	50-year	25-year	10-year	5-year
14551	304.55	303.61	303.55	303.48	303.33	303.17
14420	304.48	303.51	303.45	303.37	303.19	303.01
13790	303.75	302.50	302.43	302.34	302.18	302.03
13090	303.27	301.24	301.17	301.08	300.91	300.76
12600	302.80	300.94	300.86	300.77	300.59	300.41

Table 4: Water Surface Elevations of Storm Floods along Tributary 3

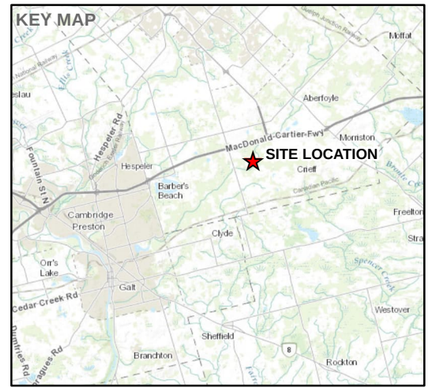
Cross Section ID	Storm Flood Elevations (masl)					
	Regional Flood (1982)	100-year	50-year	25-year	10-year	5-year
1600.1	303.19	302.80	302.78	302.74	302.65	302.61
1030	302.55	301.96	301.90	301.84	301.86	301.79
840	302.03	301.59	301.55	301.50	301.21	301.14
440	301.66	300.78	300.74	300.71	300.65	300.61

FIGURES



LEGEND

- CROSS-SECTION
- WATERCOURSE
- ROAD
- PROVINCIALLY SIGNIFICANT WETLAND (EVALUATED)
- PROPERTY BOUNDARY
- LICENCE BOUNDARY / SITE BOUNDARY
- PROPOSED EXTRACTION AREA



0 100 200 300 400

1:7,500 METRES

REFERENCE(S)

1. BASEDATA: MNRF LIO, OBTAINED 2019
2. IMAGERY SOURCE: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
© 2025 MICROSOFT CORPORATION © 2025 MAXAR ©CNES (2025) DISTRIBUTION AIRBUS DS IMAGE SEPTEMBER 2016
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
ABERFOYLE SOUTH LAKE PIT

TITLE
SITE LOCATION AND CROSS-SECTIONS

CONSULTANT

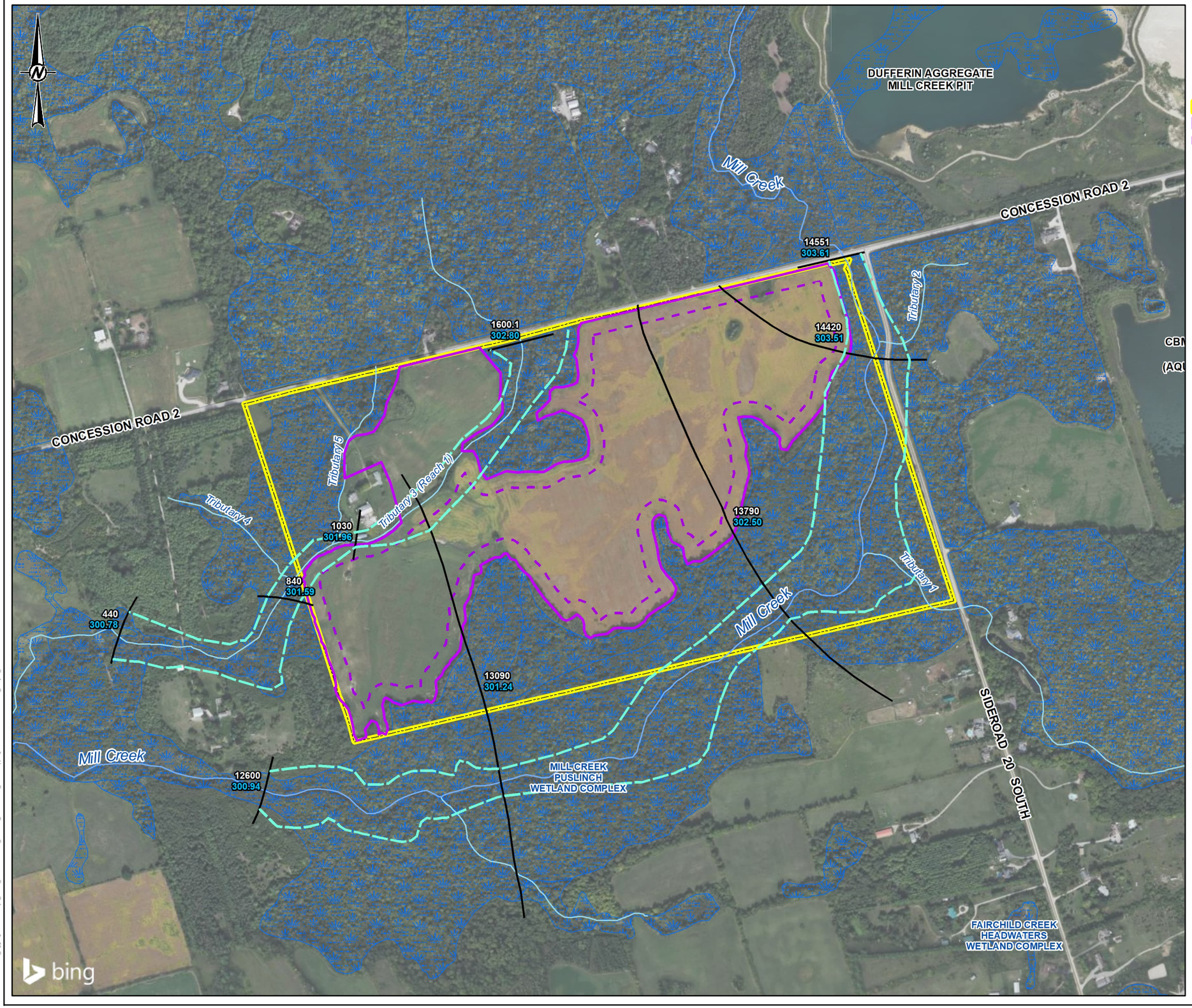
wsp

YYYY-MM-DD	2025-01-23
DESIGNED	ST
PREPARED	CGE/SO
REVIEWED	AS
APPROVED	HM

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0017	0	**1.1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm
0

Path: S:\Clients\CBM_Aggregates\Aberfoye_P499_PRO\1791470_CBM40_PROD\0017_FloodMapping\1791470-0017-CS-0001.mxd



LEGEND

- CROSS-SECTION
- FLOODPLAIN EXTENT
- WATERCOURSE
- ROAD
- PROVINCIALLY SIGNIFICANT WETLAND (EVALUATED)
- PROPERTY BOUNDARY
- LICENCE BOUNDARY / SITE BOUNDARY
- PROPOSED EXTRACTION AREA

0 100 200 300 400

1:7,500 METRES

REFERENCE(S)

1. BASEDATA: MNRF LIO, OBTAINED 2024
2. IMAGERY SOURCE: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
© 2025 MICROSOFT CORPORATION © 2025 MAXAR ©CNES (2025) DISTRIBUTION AIRBUS DS IMAGE SEPTEMBER 2016
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
ABERFOYLE SOUTH LAKE PIT

TITLE
STORM FLOOD ELEVATION MAP - 100 - YEARS FLOOD LEVELS (CGVD2013)

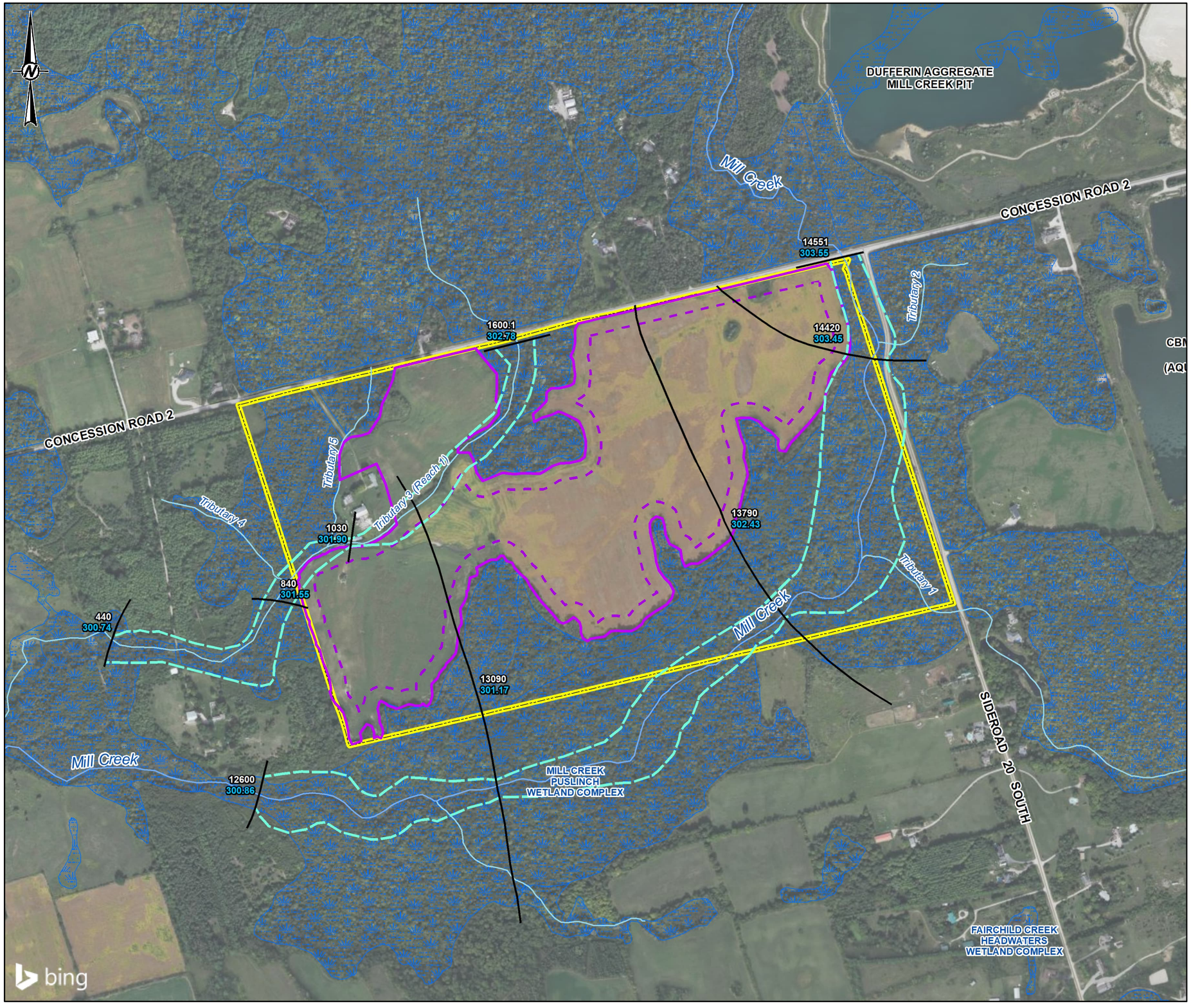
CONSULTANT

YYYY-MM-DD	2025-01-23
DESIGNED	ST
PREPARED	KP
REVIEWED	AS
APPROVED	HM

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0017	0	**1.2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

Path: S:\Clients\CBM_Aggregates\Aberfoyle_Pit99_PRO\1791470_CBM40_PROD\0017_FloodMapping\1791470-0017-CS-0002_100yrs_2013.mxd



LEGEND

- CROSS-SECTION
- FLOODPLAIN EXTENT
- WATERCOURSE
- ROAD
- PROVINCIALLY SIGNIFICANT WETLAND (EVALUATED)
- PROPERTY BOUNDARY
- LICENCE BOUNDARY / SITE BOUNDARY
- PROPOSED EXTRACTION AREA

0 100 200 300 400

1:7,500 METRES

REFERENCE(S)

1. BASEDATA: MNRF LIO, OBTAINED 2024
2. IMAGERY SOURCE: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
© 2025 MICROSOFT CORPORATION © 2025 MAXAR ©CNES (2025) DISTRIBUTION AIRBUS DS IMAGE SEPTEMBER 2016
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
ABERFOYLE SOUTH LAKE PIT

TITLE
STORM FLOOD ELEVATION MAP - 50 - YEARS FLOOD LEVELS (CGVD2013)

CONSULTANT

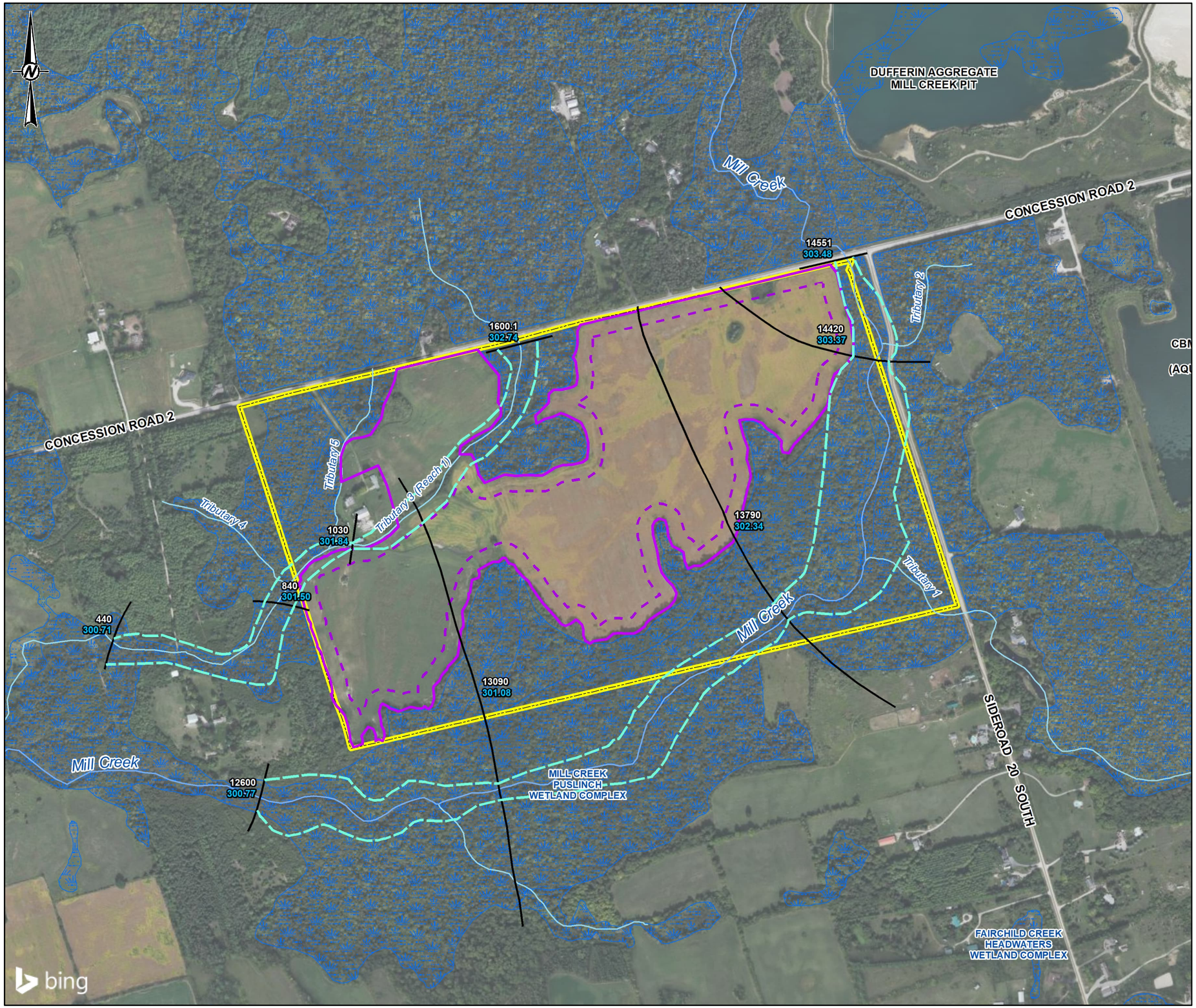
wsp

YYYY-MM-DD	2025-01-23
DESIGNED	ST
PREPARED	KP
REVIEWED	AS
APPROVED	HM

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0017	0	**1.3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

Path: S:\Clients\CBM_Aggregates\Aberfoyle_Pit(9b)_PRO\1791470_CBM40_PRO0\0017_FloodMapping\1791470-0017-CS-0002_50yrs_2013.mxd



LEGEND

- CROSS-SECTION
- FLOODPLAIN EXTENT
- WATERCOURSE
- ROAD
- PROVINCIALLY SIGNIFICANT WETLAND (EVALUATED)
- PROPERTY BOUNDARY
- LICENCE BOUNDARY / SITE BOUNDARY
- PROPOSED EXTRACTION AREA

0 100 200 300 400

1:7,500 METRES

REFERENCE(S)

1. BASEDATA: MNRF LIO, OBTAINED 2024
2. IMAGERY SOURCE: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
© 2025 MICROSOFT CORPORATION © 2025 MAXAR ©CNES (2025) DISTRIBUTION AIRBUS DS IMAGE SEPTEMBER 2016
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
ABERFOYLE SOUTH LAKE PIT

TITLE
STORM FLOOD ELEVATION MAP - 25 -YEARS FLOOD LEVELS (CGVD2013)

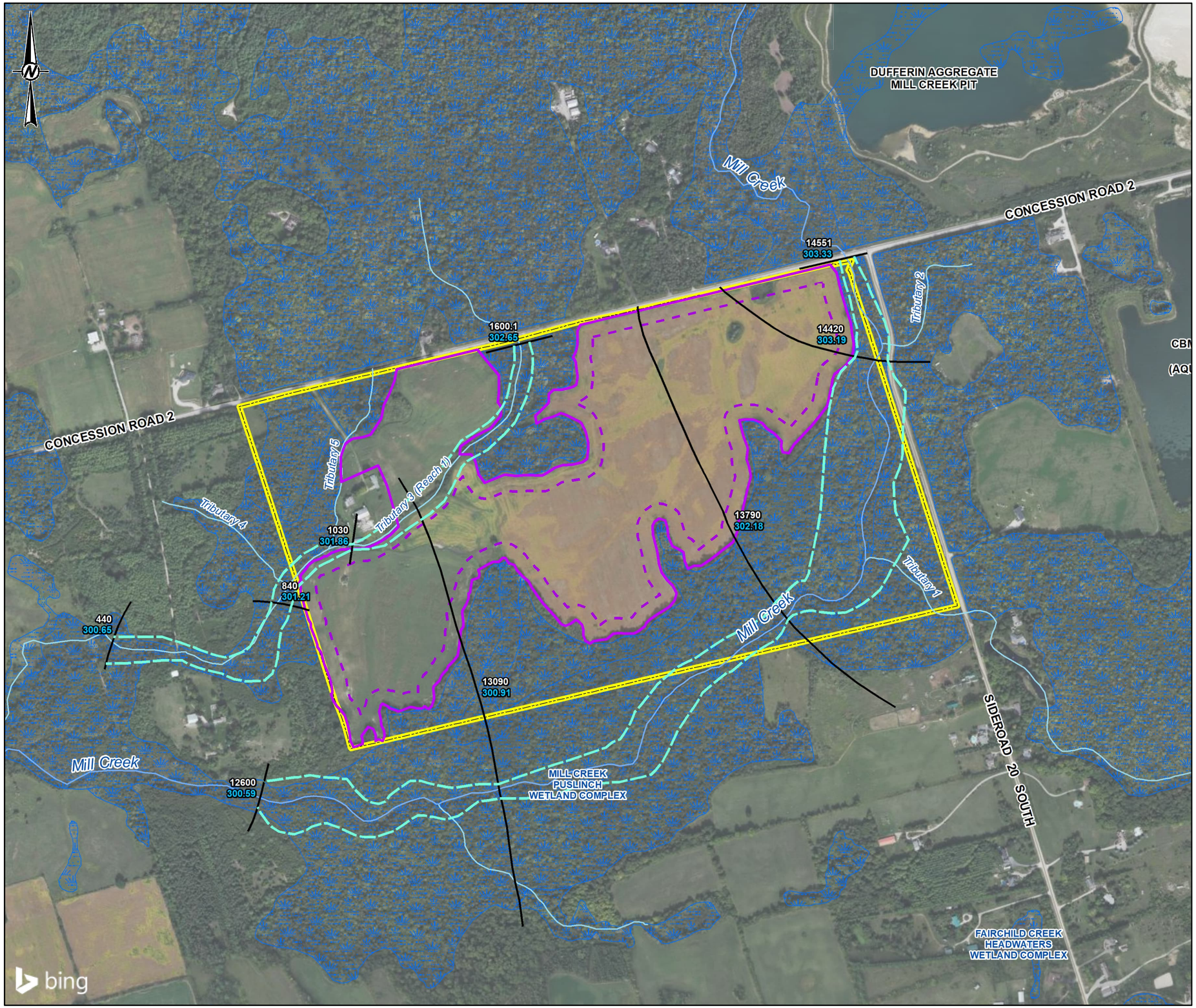
CONSULTANT

YYYY-MM-DD	2025-01-23
DESIGNED	ST
PREPARED	KP
REVIEWED	AS
APPROVED	HM

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0017	0	**1.4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

Path: S:\Olen\s\CBM_Aggregates\Aberfoyle_Pit\99_PROJ\1791470_CBM\40_PROD\0017_FloodMapping\1791470-0017-CS-0002_25yrs_2013.mxd



LEGEND

- CROSS-SECTION
- FLOODPLAIN EXTENT
- WATERCOURSE
- ROAD
- PROVINCIALLY SIGNIFICANT WETLAND (EVALUATED)
- PROPERTY BOUNDARY
- LICENCE BOUNDARY / SITE BOUNDARY
- PROPOSED EXTRACTION AREA

0 100 200 300 400

1:7,500 METRES

REFERENCE(S)

1. BASEDATA: MNRF LIO, OBTAINED 2024
2. IMAGERY SOURCE: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

IMAGE SEPTEMBER 2016
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
ABERFOYLE SOUTH LAKE PIT

TITLE
STORM FLOOD ELEVATION MAP - 10 - YEARS FLOOD LEVELS (CGVD2013)

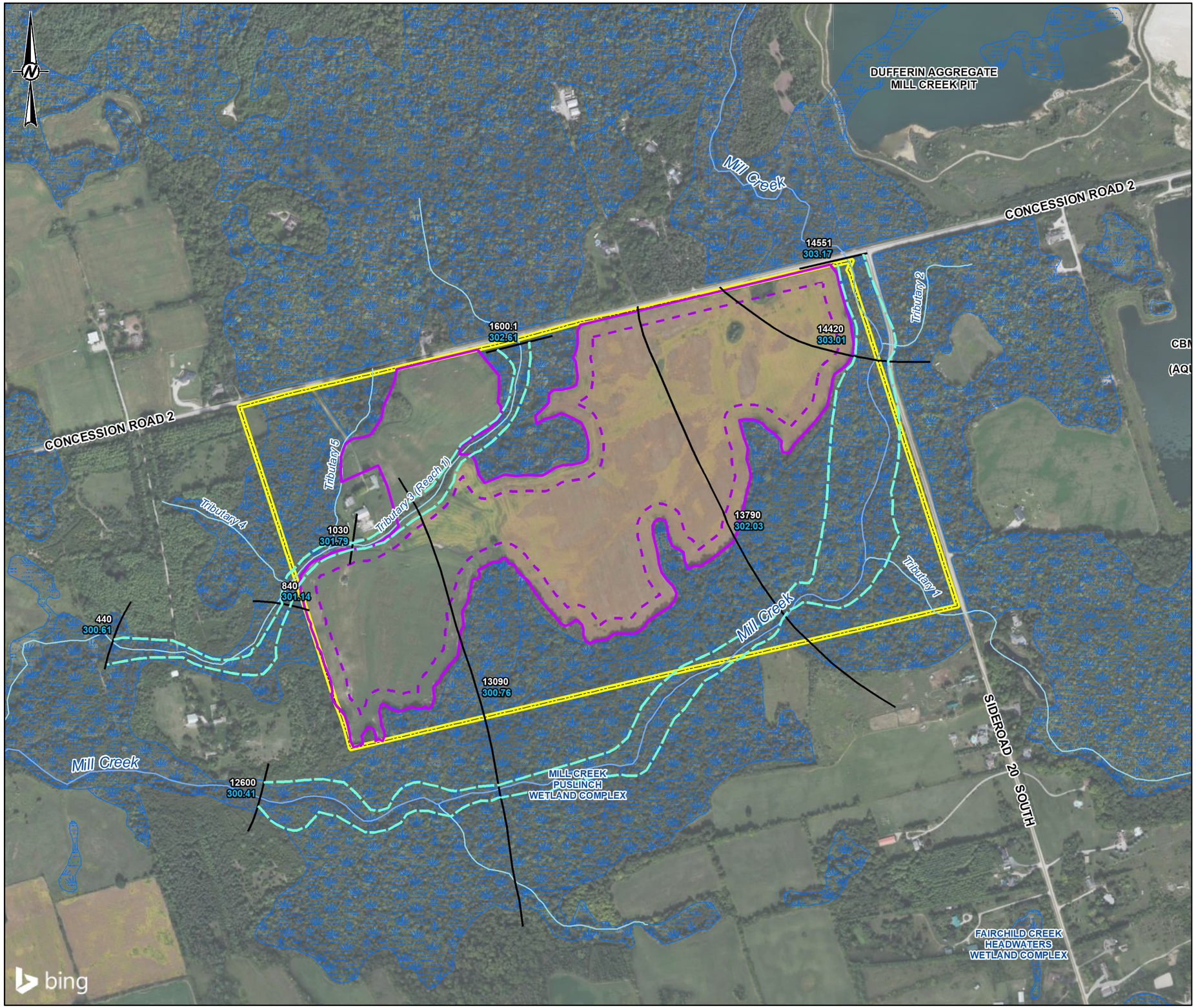
CONSULTANT

YYYY-MM-DD	2025-01-23
DESIGNED	ST
PREPARED	KP
REVIEWED	AS
APPROVED	HM

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0017	0	**1.5**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm
0

Path: S:\Olen\s\CBM_Aggregates\Aberfoyle_Pit\99_PROJ\1791470_CBM\40_PROD\0017_FloodMapping\1791470-0017-CS-0002_10yrs_2013.mxd



LEGEND

- CROSS-SECTION
- FLOODPLAIN EXTENT
- WATERCOURSE
- ROAD
- PROVINCIALLY SIGNIFICANT WETLAND (EVALUATED)
- PROPERTY BOUNDARY
- LICENCE BOUNDARY / SITE BOUNDARY
- PROPOSED EXTRACTION AREA

0 100 200 300 400

1:7,500 METRES

REFERENCE(S)

1. BASEDATA: MNRF LIO, OBTAINED 2024
2. IMAGERY SOURCE: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
© 2025 MICROSOFT CORPORATION © 2025 MAXAR ©CNES (2025) DISTRIBUTION AIRBUS DS IMAGE SEPTEMBER 2016
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
ABERFOYLE SOUTH LAKE PIT

TITLE
STORM FLOOD ELEVATION MAP - 5 - YEARS FLOOD LEVELS (CGVD2013)

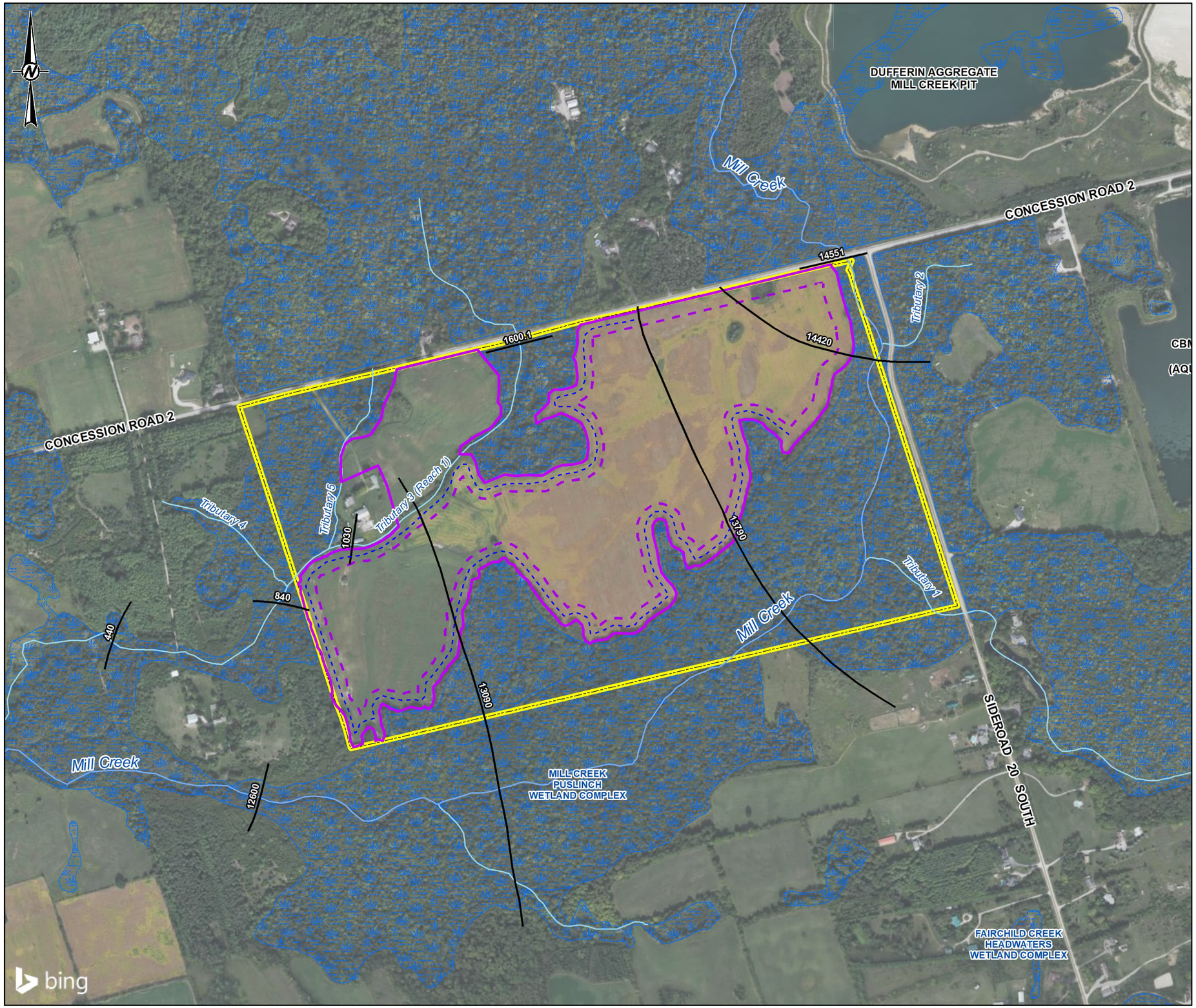
CONSULTANT

YYYY-MM-DD	2025-01-23
DESIGNED	ST
PREPARED	KP
REVIEWED	AS
APPROVED	HM

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0017	0	**1.6**

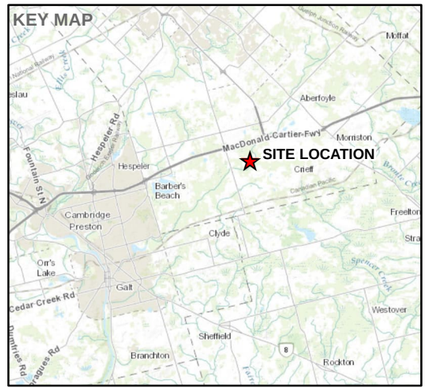
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

Path: S:\Clients\CBM_Aggregates\Aberfoyle_P499_PROJ\1791470_CBM\40_PROD\0017_FloodMapping\1791470-0017-GIS-0002_5yrs_2013.mxd



LEGEND

- CROSS-SECTION
- WATERCOURSE
- ROAD
- PROVINCIALLY SIGNIFICANT WETLAND (EVALUATED)
- PROPERTY BOUNDARY
- LICENCE BOUNDARY / SITE BOUNDARY
- PROPOSED EXTRACTION AREA
- PERIMETER GRADING LOCATION



0 100 200 300 400

1:7,500 METRES

REFERENCE(S)

1. BASEDATA: MNRF LIO, OBTAINED 2019
2. IMAGERY SOURCE: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
   © 2025 MICROSOFT CORPORATION © 2025 MAXAR ©CNES (2025) DISTRIBUTION AIRBUS DS IMAGE SEPTEMBER 2016
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

PROJECT
ABERFOYLE SOUTH LAKE PIT

TITLE
Perimeter Grading Location

CONSULTANT
wsp

YYYY-MM-DD	2025-07-02
DESIGNED	
PREPARED	MS
REVIEWED	CDV
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
1791470	0017	0	**1.7**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0 25mm