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Burns Maendel Consulting Engineers Ltd.

Crystal Springs Colony - New Colony Development 200-Year Flood Level Assessment

Prepared for:

Ashley Haigh, P.Eng.
Burns Maendel Consulting Engineers Ltd.
Civil Engineer
903 Rosser Avenue
Brandon, MB
R7A 0L3

Project Number:

0105 068 00

Date:

July 26, 2024



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Our File No. 0105 068 00

Ashley Haigh, P.Eng.
Burns Maendel Consulting Engineers Ltd.
Civil Engineer
903 Rosser Avenue
Brandon, MB
R7A 0L3

**RE: Crystal Springs Colony - New Colony Development
200-year Flood Level Assessment**

TREK Geotechnical Inc. is pleased to submit our report to support the previously submitted Hydrologic and Hydraulic Assessment. This report provides additional information regarding the 200-year Flood Level for the Proposed Lagoon site as part of the Crystal Springs Colony New Colony Development. This additional information is provided to comply with Provincial Standards.

Please contact the undersigned if you have any questions. Thank you for the opportunity to serve you on this assignment.

Sincerely,

TREK Geotechnical Inc.
Per:

A handwritten signature in blue ink, appearing to read "Natasha Woelcke".

Natasha Woelcke, P. Eng.
Water Resources Engineer
Tel: 204.792.2913

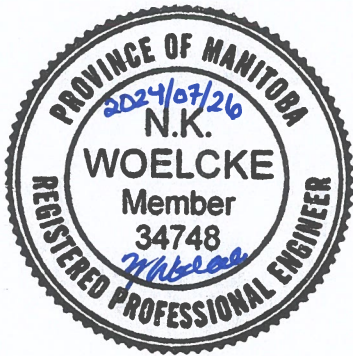
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Revision History

Revision No.	Author	Issue Date	Description
0	NW	July 26, 2024	Report

Authorization Signatures

Prepared By:




Natasha Woelcke, P.Eng.
Water Resources Engineer

Reviewed By:





John Doering, Ph.D., P.Eng., FCSCE, FEC, FCAE, FCSSE
Senior Water Resources Engineer



Table of Contents

Letter of Transmittal

Revision History and Authorization Signatures

1.0	Introduction	1
2.0	Updated Hydrology	1
3.0	Hydraulic Assessment	2
	3.1 Flood Protection Level Recommendation	2
4.0	Closure.....	4

List of Appendices

Figures

1.0 Introduction

TREK Geotechnical Inc. (TREK) completed a Hydrologic and Hydraulic Assessment of the Crystal Springs Colony new colony development site in 2022 for Burns Maendel Consulting Engineers (BMCE) to provide a drainage assessment of a portion of Willow Creek, South Malonton Drain, and an unnamed drain to support the new proposed development.

During the regulatory authorization phase for the wastewater treatment lagoon, BMCE received comments from the Province of Manitoba requiring an assessment of the 200-year flood level at the site. BMCE requested that TREK undertake the required analysis and reporting to provide the 200-year flood level.

All engineering analysis undertaken in preparation of this report follows the methodology provided in the report titled “Crystal Springs Colony – New Colony Development Hydrologic and Hydraulic Assessment” by TREK dated November 21, 2022. The contents of this report should be reviewed and considered in conjunction with the aforementioned report.

2.0 Updated Hydrology

The hydrology was derived using methodology as presented in the 2022 Hydrologic and Hydraulic Assessment. As recommended by the Province of Manitoba, instantaneous peak flows are used in the assessment of flood protection levels. Instantaneous peak regional discharge coefficients were provided to TREK by Manitoba Transportation and Infrastructure - Hydrologic Forecasting and Water Management in July 2024. The following tables provide updated hydrologic estimates for Willow Creek, South Malonton Drain and Unnamed Drain for a 200-year return period.

Table 1: Willow Creek - Flood Hydrology

Discharge Event	Regional Discharge Coefficient*	Instantaneous Peak Discharge Willow Creek at Rd 107N Drainage Area = 131.3 km ² (m ³ /s)	Instantaneous Peak Discharge Willow Creek at Rd 15E Drainage Area = 175.3 km ² (m ³ /s)
200-year (0.5%)	0.822	34.3	42.8

* Updated discharge coefficients for WSC Gauge 05SB002 provided by MTI on July 4, 2024 (regional exponent n = 0.765).

Table 2: South Malonton Drain at the Confluence with Willow Creek - Flood Hydrology

Discharge Event	Regional Discharge Coefficient* Willow Creek near Gimli Gauge 05SB002 Drainage Area = 236 km ²	Instantaneous Peak Discharge South Malonton Drain at the Confluence with Willow Creek (Rd 15E) Drainage Area = 41.8 km ² (m ³ /s)
200-year (0.5%)	0.822	14.3

* Updated discharge coefficients for WSC Gauge 05SB002 provided by MTI on July 4, 2024 (regional exponent n = 0.765).

Table 3: South Malonton Drain Just Downstream of Sta 22+10 - Flood Hydrology

Discharge Event	Regional Discharge Coefficient* Willow Creek near Gimli Gauge 05SB002 Drainage Area = 236 km ²	Rational Discharge Coefficient** Rational Method*** Drainage Area = 13 km ²	Mean Daily Discharge Estimate for South Malonton Drain at Sta 22+10 Drainage Area = 24.5 km ² Transitional Method (m ³ /s)
200-year (0.5%)	0.822	0.53	9.9

* Updated discharge coefficients for WSC Gauge 05SB002 provided by MTI on July 4, 2024 (regional exponent n = 0.765).

** Flat, silty soil and a combination of woodland, pasture, and crop.

*** Source – Province of Manitoba Department of Natural Resources Water Resource Branch “Runoff from Small Watersheds.

Table 4: Unnamed Drain at the Confluence with South Malonton Drain - Flood Hydrology

Discharge Event	Rational Discharge Coefficient*	Mean Daily Discharge Estimate for Unnamed Drain at the Confluence with South Malonton Drain Drainage Area = 1.7 km ² Rational Method (m ³ /s)
200-year (0.5%)	0.50	0.83

* Flat, silty soil and a combination of mostly woodland and pasture.

3.0 Hydraulic Assessment

Steady-state hydraulic backwater models of the Willow Creek study reach, South Malonton Drain and Unnamed Drain were developed to assess the hydraulic conditions of the creek, drains and culvert crossings. The models were updated to run the 200-year flows and estimate the corresponding water levels.

3.1 Flood Protection Level Recommendation

Upon review of the Crystal Springs Colony Wastewater Treatment Lagoon, the Province of Manitoba provided the following feedback with respect to TREK’s 2022 Hydrologic and Hydraulic Report:

*The information in the report quotes the 100-year flood protection level, however, the province has been using the 200-year flood protection level as the standard since 2013. We would recommend that this be increased to a **200-year level** to comply with provincial standards.*

The hydraulic HEC RAS model that was developed by TREK in 2022 of the study area was updated to assess the 200-year levels at the proposed lagoon site. Steady state analysis was undertaken with updated 200-year flows for Willow Creek, South Malonton Drain and Unnamed Drain.

Steady state simulations do not account for storage in the system and assume an infinite volume of water. The model simulations showed that the South Malonton Drain has the potential to overflow the north bank of the drain on Road 106 N and west bank of the drain on Road 15 E in the vicinity of the proposed development during events greater than the 50-year event and as a result inundate these adjacent areas. The drain capacity is restricted by the undersized culvert crossings on Rd 106 N and Rd

15 E. Upgrading of the culvert structures would help to locally lower the flood levels within the study reach, however, the lower bank sections near the Unnamed Drain and southeast corner of property would still flood during larger flood events due to low prairie elevations.

In the determination of the 200-year flood levels, TREK assumed that the drainage upgrades as described in Section 3.3 of their 2022 Hydrologic and Hydraulic Report are implemented. A summary of the proposed drainage improvements include:

- New 2 x 1.8m diameter CSP access crossing from Rd 106N at STA 23+79
- Removal of the existing undersized access crossing at STA 22+10
- Replacement of the access crossing along Rd 15E at STA 6+86 with 2 x 2.0m diameter CSP

The RM of Gimli Zoning By-Law 11-0013 states that no permanent building shall be constructed or placed in the vicinity of a lake, river, watercourse or body of water on land that has been identified by the province as a flood hazard or would be inundated by the hundred year flood or by a recorded flood exceeding the hundred year flood.

The results of the 200-year hydraulic analysis yield a 200-year water level at the proposed lagoon site of **248.06 m**. The proposed lagoon berms designed by others are set at an elevation of 248.5 m which is higher than the 200-year flood level as stipulated by the Province of Manitoba. It is typically prudent to provide 2 feet (0.61 m) of freeboard above the estimated flood level. The designed top of berm provides 0.7 m of freeboard above the 100-year flood level specified in the Gimli Zoning By-Law and 0.44 m of freeboard above the 200-year level.

Figure 1 shows the Project Area and Figure 2 shows updated Water Surface Profiles including the 200-year flood level at the proposed lagoon site.

4.0 Closure

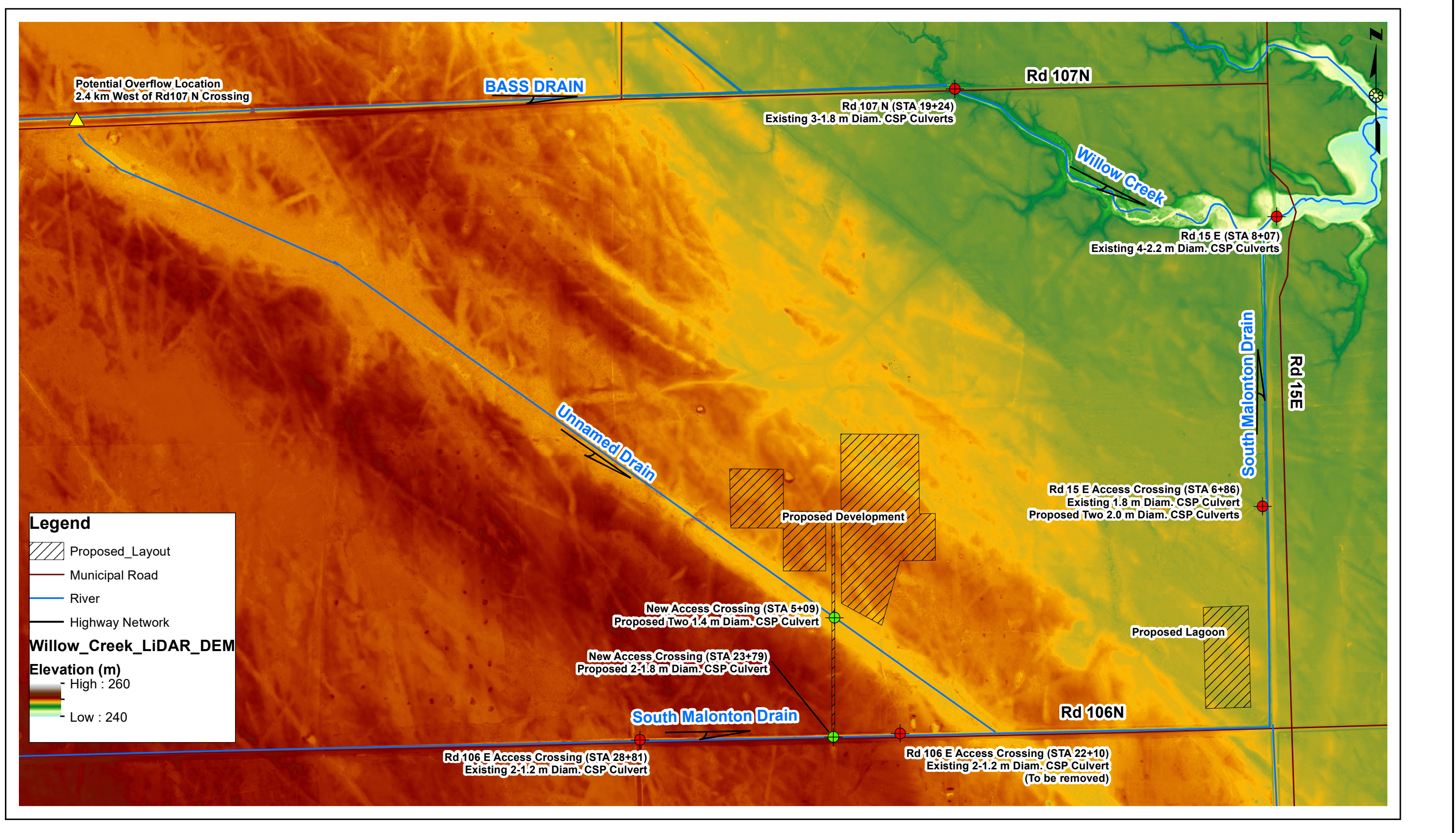
The technical information provided in this report is in accordance with current engineering principles and practices (Standard of Practice). The findings of this report were based on information (field investigation & survey) provided by BMCL. Hydrotechnical analysis is based on environmental characteristics assumed to extend uniformly throughout the contributing area and watershed-scale, temporally-discrete hydrologic events.

All information provided in this report is subject to our standard terms and conditions for engineering services, a copy of which is provided to each of our clients with the original scope of work, or a mutually executed standard engineering services agreement. If these conditions are not attached, and you are not already in possession of such terms and conditions, contact our office and you will be promptly provided with a copy.

This report has been prepared by TREK Geotechnical Inc. (the Consultant) for the exclusive use of the BMCL (the Client) and their agents for the work product presented in the report. Any findings or recommendations provided in this report are not to be relied upon by any third parties, except as agreed to in writing by the Client and Consultant prior to use.

Figures

Document Path: Z:\Projects\0105 Burns Maendel Consulting Ltd\0105 068 00 Crystal Springs Drainage\3 Survey and Dwg\3.3 GIS\Proposed_Development_TEMPLATE_Template_Figure 2.mxd



NOTES:

1. REFERENCE: CANVEC © NATURAL RESOURCES CANADA, 2012
2. REFERENCE: LIDAR PROVIDED BY MTI FOR THE RM OF BROKENHEAD

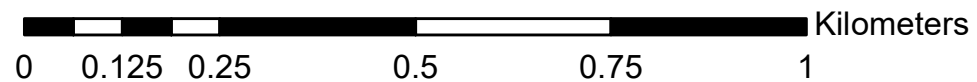
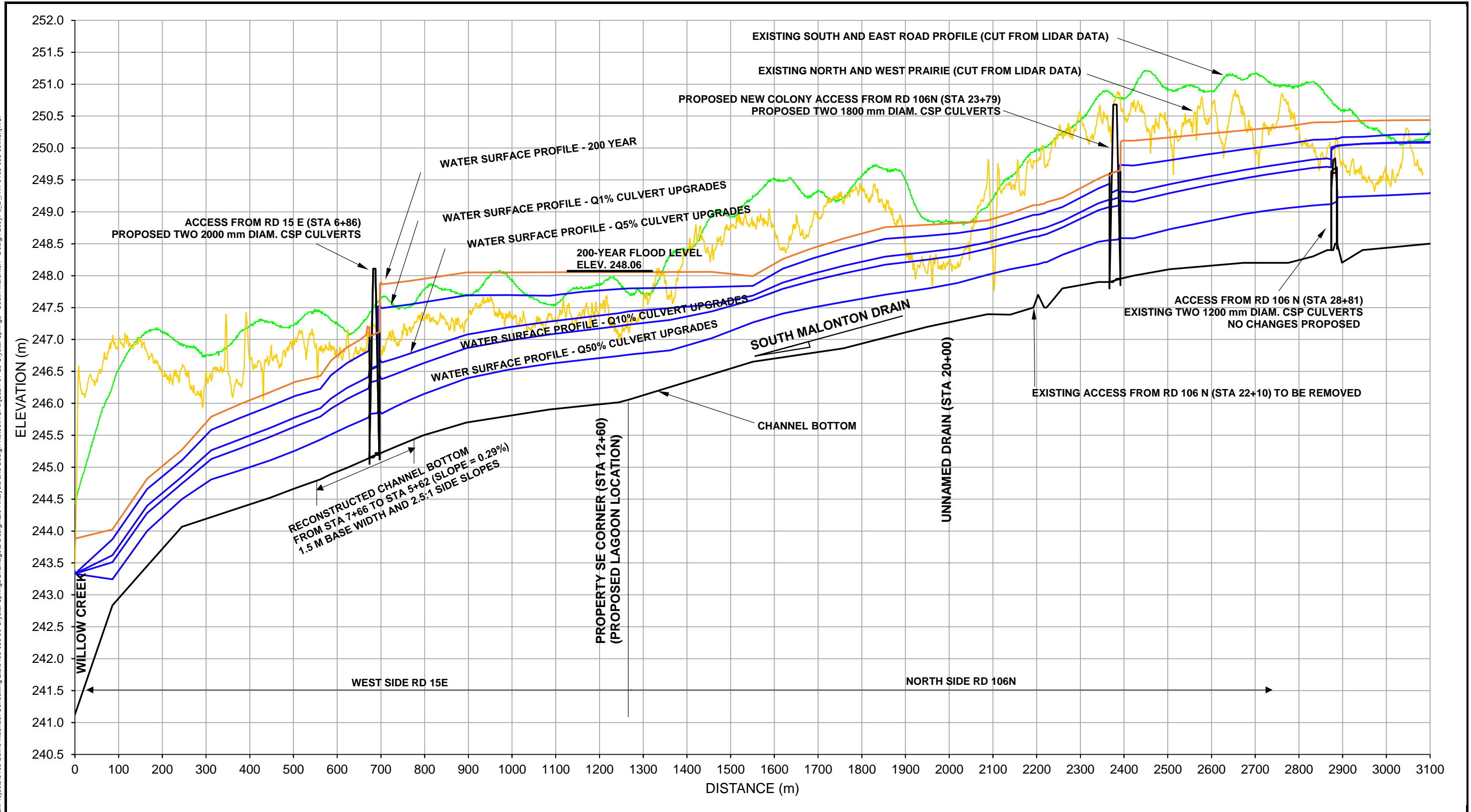


Figure 01
STUDY AREA
LAYOUT PLAN



NOTES:

1. HEC-RAS MODEL DEVELOPED FROM 2022 SURVEY DATA PROVIDED BY BURNS MAENDEL CONSULTING LTD.
2. WATER SURFACE PROFILES REFLECT HYDRAULIC CONDITIONS WITH 1% TAILWATER LEVEL ON WILLOW CREEK - EL. 243.88.
WATER SURFACE PROFILES REFLECT HYDRAULIC CONDITIONS WITH THE PROPOSED DOUBLE 1800 mm DIAM. CSP CULVERTS AT THE PROPOSED ACCESS ROAD FROM RD 106 N AND DOUBLE 2000 mm DIAM. CSP CULVERTS AT THE EXISTING FARMYARD CROSSING AT RD 15 E, WITH THE EXISTING FIELD CROSSING AT STA 22+10 REMOVED, AND WITH PROPOSED REGRADED CHANNEL FROM STA 7+97 TO STA 5+62.

Figure 02

SOUTH MALONTON DRAIN ALONG RD 106 N AND RD 15E
CULVERT UPGRADES - WATER SURFACE PROFILES