

01 September 2026

Proposed Residential Development

Southern Links 1

GEOTECHNICAL EFFECTS MANAGEMENT PLAN

Colliers Project Leaders

Job No. HAM2025-0056AO | Version 2



Hamilton
Level 1 | Block C
401 Grey Street
Hamilton 3216
New Zealand
Ph: +64 7 2820 039
www.cmwgeosciences.com

Version Control

Document version information	
Job number	HAM2025-0056AO
Prepared by	Mark McVinnie, Project Engineering Geologist 
Reviewed by	David MacPherson, Associate Geotechnical Engineer CMEngNZ, CPEng 
Authorised by	David Sullivan, Principal Engineering Geologist CMEngNZ, CPEng 

Review and Update History

Version	Date	Comments
A	04 August 2026	Initial draft for internal review
0	06 August 2026	Final draft for client review
1	28 August 2026	Final Issue
2	01 September 2026	Final Issue



CONTENTS

1.0 INTRODUCTION 1

2.0 REPORT PURPOSE 1

3.0 SITE DESCRIPTION AND LANDFORM 1

4.0 PROPOSED DEVELOPMENT 1

5.0 POTENTIAL GEOTECHNICAL EFFECTS..... 2

5.1 Drawdown and Drawdown Induced Ground Settlements 2

5.1.1 Wastewater Pump Stations..... 2

5.1.2 Wastewater Pipelines and other Trenches 2

5.1.3 Discharge and Surface-Water Continuity..... 2

5.1.4 Summary 2

5.2 Static and Seismic Slope Stability 2

5.2.1 Wetland uplift and stability..... 2

6.0 MONITORING AND REPORTING REQUIREMENTS 3

6.1 Instrumentation..... 3

6.2 Pre-Condition and Post-Condition Surveys 3

6.3 Groundwater Level Monitoring..... 3

6.4 Ground Settlement Monitoring..... 4

6.5 Groundwater Flows and Volume..... 4

6.6 Data Processing and Reporting..... 4

7.0 TRIGGER ACTION RESPONSE PLAN (TARP) 5

7.1 Groundwater Monitoring Triggers 5

7.2 Settlement Monitoring Triggers 5

7.3 Contingency Measures 5

7.3.1 Response Procedure 5

7.3.2 Amber Level Responses 5

7.3.3 Red Level Responses 6

7.4 Mitigation Measures..... 6

8.0 ROLES AND RESPONSIBILITIES 6

9.0 GEMP AND TARP REVIEW 7

10.0 FUTURE RESIDENTIAL DEVELOPMENT 7

Appendices

- APPENDIX A WGA Drawdown Calculations and Contour Plans
- APPENDIX B Drawings
- APPENDIX C Geotechnical Investigation Report

1.0 INTRODUCTION

CMW Geosciences (CMW) was engaged to carry out geotechnical investigations and a geohazards assessment and to prepare a geotechnical effects management plan (“GEMP”) to support the substantive application for the Southern Links 1 project (“SL1” or the “Project”) under the Fast-track Approvals At 2024 (“FTAA”) in Hamilton. This GEMP relates to the residential portion of SL1, referred to as the “Residential Area” and the “Residential Development”.

CMW has also prepared a Geotechnical Investigation Report to accompany the application, which is attached as **Appendix C**.

The SL1 Project is a combined 106ha development, including residential and industrial activities. The Residential Area comprises approximately 46Ha of pastoral land located on the southern boundary of the current Hamilton City limits, within the Waipa District. The Residential Development proposes to establish 938 residential lots, neighbourhood commercial node, open spaces, waterbodies, roading and wetlands.

This GEMP outlines the potential risks, mitigation and contingency measures relating to groundwater drawdown and the potential for induced ground settlement. This GEMP is based on the information provided in the documents outlined in Table 2.1 below and should be read in conjunction with the Geotechnical Investigation Report.

The GEMP is considered a live document, and relies on the design and assessment information available at the date of preparation. Accordingly, this GEMP must be reviewed and updated as appropriate.

Where this GEMP differs from a subsequently issued consent condition or certified technical design, the more stringent requirement applies until the discrepancy has been resolved and the GEMP formally updated.

2.0 REPORT PURPOSE

The key purpose of this GEMP is to set out methods to manage the geotechnical effects associated with the Residential Development, including effects relating to ground settlement and increase in seismic hazard from the formation of the artificial wetlands within the Residential Area.

This GEMP outlines the potential risks, mitigation and contingency measures relating to groundwater drawdown and the potential for induced ground settlement.

The geotechnical aims of the GEMP are to:

- Minimise effects on nearby infrastructure and occupied buildings;
- Implement of a Trigger Action Response Plan (TARP) to monitor ground settlement in the vicinity of the wetlands; and
- Identify actions and mitigation measures to rectify any minor or more than minor effects created by ground settlement in the vicinity of the artificial wetlands.

This GEMP is based on the information provided in the documents outlined in **Table 2.1**.

Table 2.1: Project Documentation

Report Type	Reference and/or Comments	Author
Geotechnical Investigation Report – Residential Area (GIR)	HAM2025-0056AD Rev 4	CMW, August 2026
Wetland A Design Review	HAM2025-0056AK Rev 4	CMW, August 2026
Hydrogeological Effects Assessment (HEA)	WGA242463-RP-HG-0003_B	WGA, May 2026
Technical Memo – Groundwater modelling	WGA242463-MM-HG-0013_A	WGA, March 2026
Current civil and earthworks drawings	298001-R1	Maven, June 2026

3.0 SITE DESCRIPTION AND LANDFORM

The Residential Area is located within the Waipa District, south of Saxbys Road on the southern margin of Hamilton. It is generally flat and low lying, with existing levels typically between approximately RL38m and RL43m. The Mangakōtukutuku Stream and open farm drains intersect the site. The Stream flows in a general south to north direction with drains connecting to the stream flowing in a west to east direction. Existing residential development lies to the north and east, with rural land to the west and south. Key surrounding infrastructure is described in more detail within the GIR.

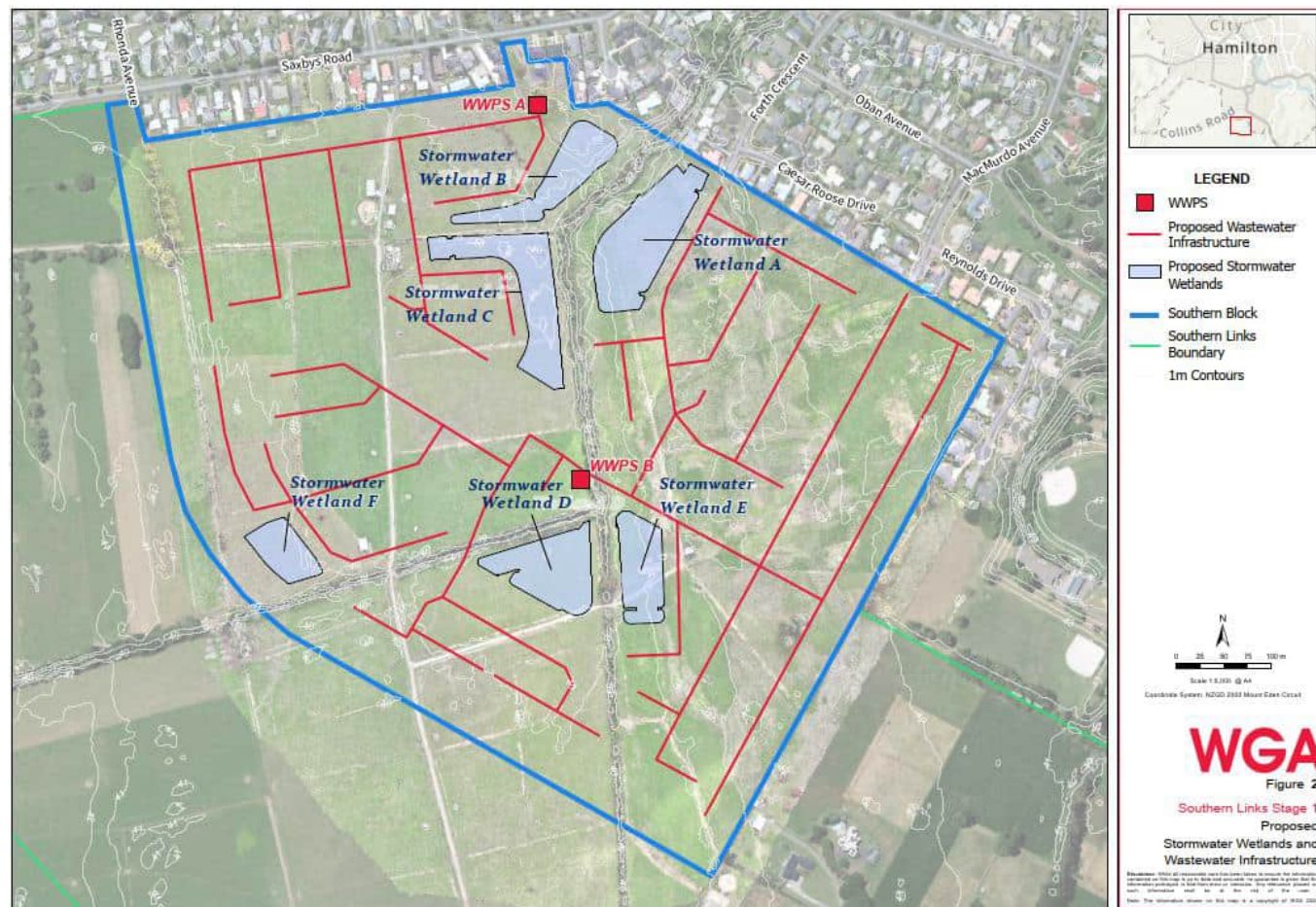
4.0 PROPOSED DEVELOPMENT

Enabling works are required to establish developable land, including bulk earthworks across the Residential Area. The details for the Residential Development are as follows:

- Establishment of 938 residential lots for predominantly one and two storey dwellings;
- Bulk earthworks with cuts of up to approximately 5m and fills of up to approximately 2m;
- The formation of six artificial stormwater wetlands (A to F), with depths of up to approximately 4.8m, with wetland batter slopes up to 1V:3H. Perimeter sheet piles are proposed around the artificial wetlands to mitigate against the risk of hydrostatic uplift from the underlying artesian aquifer;
- Local, collector and arterial roads with connecting pedestrian pathways;
- A series of retaining walls, with a maximum retained height of 2.3m;
- Culverts, swales and stormwater structures; and
- Riparian and ecological works associated with the Mangakōtukutuku Stream corridor.

Calculation of the drawdown effects has been provided by WGA to inform the preparation of this GEMP. The basin specific drawdown analyses have been provided in **Appendix A**.

Figure 4.1: Site Location Plan Depicting Proposed Wetlands (Ref. WGA Southern Links 1 Hydrology Assessment of Effects Report (ref. WGA242463-RP-HG_0003_A, dated March 2026)



5.0 POTENTIAL GEOTECHNICAL EFFECTS

5.1 Drawdown and Drawdown Induced Ground Settlements

The groundwater modelling carried out as part of the WGA HEA¹ provides details of potential environmental effects during and following drawdown as part of the formation of the wetlands as well as the construction of the wastewater pump stations (WWPS) and wastewater pipelines required to service the proposed Residential Development.

WGA open-pit modelling predicts winter construction inflows ranging from approximately 1,702 m³/day at Wetland F to 5,361 m³/day at Wetland A before allowance for the selected sheet-pile cut-off. The modelled 0.25m drawdown radius ranges from about 25m to 90m. Summer dry-pit drawdown at the nearest buildings is approximately 0.45m for Wetland A and 0.31m for Wetland B. The final cut-off design is expected to materially reduce these inflows and must be incorporated into updated predictions and trigger levels.

5.1.1 Wastewater Pump Stations

The hydrogeological assessment completed by WGA assumes 5.3m deep wet wells supported by a shield-pile wall, with a dewatering bore outside the wall and local shallow pumping as required. WWPS A requires an indicative

confined-aquifer pumping rate of 6.5 L/s (562m³/day) for up to 15 days, with an assessed 0.25m drawdown radius of approximately 295m in the confined aquifer. WWPS B requires an indicative 36 L/s (3,110m³/day), with an assessed confined-aquifer radius of approximately 780m and shallow-aquifer radius of approximately 80m.

The GIR² estimates worst-case groundwater-drawdown settlement beneath neighbouring properties north of WWPS A to be less than 5mm. Targeted groundwater and settlement monitoring comprised outlined in Section 6, is nevertheless required at WWPS A to validate the assumptions of the models.

5.1.2 Wastewater Pipelines and other Trenches

Wastewater pipelines are expected to be installed progressively in short trench sections. WGA indicates that overlapping operations may create cumulative dewatering rates of approximately 1,500 m³/day to 2,000 m³/day. During construction we recommend that the contractor minimise open length and duration, use trench support, maintain stable drawdown, and backfill promptly with compacted material meeting the approved specification. Dewatering arrangements must not create uncontrolled loss of fines, boiling, base heave or off-site settlement.

5.1.3 Discharge and Surface-Water Continuity

Where dewatering intercepts groundwater that would otherwise support drains or the Mangakōtukutuku Stream, water is to be treated as necessary and returned upstream of the works where practicable and environmentally acceptable. Discharges must comply with the erosion and sediment control framework, consent conditions and water-quality requirements. Flow, erosion, iron staining, turbidity and scour at discharge points must be inspected during pumping.

5.1.4 Summary

The analyses completed in the GIR indicates negligible groundwater drawdown induced settlements are anticipated for the existing neighbouring residential dwellings following the formation of the artificial wetlands, and construction of the wastewater pump stations and pipelines. The maximum dewatering depth should be in accordance with the WGA HEA¹. If, for any reason, an increase is required in the dewatering depth, all settlement calculations should be revised and this GEMP updated to reflect these changes.

5.2 Static and Seismic Slope Stability

Static and seismic analyses are detailed in the GIR. Results indicate that the proposed artificial wetlands do not meet the requisite factor of safety under seismic conditions, with foundations required to be designed to accommodate the predicted lateral stretch. The WGA Hydrogeological Effects Assessment¹ identified a low-permeability aquitard which has a confining effect on the underlying deep aquifer, putting it under some degree of pressure. During the excavation of the proposed wetlands the reduced overburden pressure over the confined aquifer may cause the aquitard layer to rupture and destabilise the ponds under static slope stability conditions.

5.2.1 Wetland uplift and stability

The Wetland A Design Review³ identifies an uplift pressure of approximately 13.9kPa and, for a factor of safety of 1.2, a required overburden pressure of 16.7kPa. Retaining sufficient natural cover would require about 1.05 m of overburden above the aquitard and would raise the Wetland A base by approximately 1.31 m, which conflicts with the stormwater design.

The preferred mitigation option to address uplift within the proposed wetlands is a permanent sheet-pile groundwater cut-off around each wetland.

¹ WGA, (May 2026) Hydrogeological Effects Assessment (HEA), Ref: WGA242463-RP-HG-0003_B

² CMW (August 2026) Geotechnical Investigation Report – Residential Area (GIR) Ref: HAM2025-0056AD Rev 4

³ CMW (August 2026) Wetland A Design Review, Ref: HAM2025-0056AK Rev 4

Alternative mitigation options include the installation of pressure relief valves through the aquitard or a basal drainage system beneath the wetland. These are discussed in detail within the Wetland Design Memo⁴.

It is noted that no excavation through or within the design protection depth of the aquitard may start until the sheet-pile cut-off and associated monitoring system have been installed, tested and accepted in writing by the Project Geotechnical Engineer and Hydrogeologist.

6.0 MONITORING AND REPORTING REQUIREMENTS

6.1 Instrumentation

Instruments required to be installed and monitored for the proposed Residential Development are listed in **Table 6.1** below and depicted on **Drawing 05**.

Table 6.1: Required Monitoring Instrumentation

Type	Monitoring ID
Groundwater Monitoring Piezometers with standpipes with downhole datalogger (divers) (Wetlands)	Proposed MP04 to MP07
(WWPS and Service Trenches)	Proposed MP01 to MP04 and MP07 to MP10
Ground Settlement Markers	Proposed SM01 to SM10

Piezometers for geotechnical monitoring purposes are required to all be constructed as double standpipes (nested). Each nested piezometer will monitor a shallow groundwater level (anticipated between RL36.9m and RL38.7m) and groundwater below the aquitard layer (anticipated between RL36.2m and RL38m). These depths are indicative and will be confirmed on site during borehole drilling with screen depths installed to match site conditions encountered. A single barologger should be installed at the site office to compensate all level loggers installed across the project (30km radius).

Monitoring results shall be submitted to Colliers and Geotechnical Engineer in electronic format (excel spreadsheet or similar) within 24 hours of the monitoring being undertaken, at the intervals set out herein to confirm compliance with the Resource Consent conditions.

Should any of the monitoring instruments be damaged and become inoperable, the Geotechnical Engineer, Colliers and HCC is to be informed, and a new monitoring instrument may be required to be installed at a nearby location as agreed in consultation with the Geotechnical Engineer and Asset owner.

6.2 Pre-Condition and Post-Condition Surveys

Due to the anticipated negligible groundwater drawdown induced settlements for the existing residential dwellings following the proposed excavations it is determined that conditional surveys for the adjacent properties is not required. However, areas of the project that have fill adjacent to improved properties (northern side of Stage 2 and eastern corner of Stage 1) may benefit from a pre-condition survey and is considered optional.

6.3 Groundwater Level Monitoring

To supplement the existing piezometers, a series of additional boreholes with standpipe piezometers are to be installed around the perimeter of the site adjacent to existing residential dwellings, with groundwater levels to be monitored during the works. Locations of proposed monitoring sites are presented on **Drawing 05**.

As the proposed development involves the artificial stormwater wetlands to be constructed consecutively over multiple years, the associated groundwater drawdown effects will be cumulative. Hence a phased approach to the monitoring is proposed, with the maximum geotechnical effect considered the 1m drawdown contour which is shown on the WGA Drawdown Contour Drawings provided in **Appendix A**.

Construction of the artificial wetlands will involve installing the perimeter sheet piles, then cutting into the existing soil profile, thereby reducing the overburden pressure on the silt aquitard layer which could cause it to breach. As the aquifer extent is limited by the sheet piles, effects will be limited to the wetland construction area. However, to validate this we recommend groundwater monitoring is undertaken at an increased frequency during initial construction and then relaxed following observation of the stabilisation of groundwater levels.

Groundwater levels from piezometers with dataloggers will be collected at 15-minute automated intervals. Data will be downloaded and the remaining piezometers manually measured at the monitoring frequency presented in **Table 6.2** and **6.3** below.

Table 6.2: Groundwater Monitoring Frequency – Wetland Monitoring Points

Timeframe	Duration	Frequency
Pre-construction	At least 6 months prior to construction to obtain baseline seasonal fluctuations	Every 4 to 6 weeks
During construction	For the full duration of construction of respective basin	Once a week
Post-construction	For 2 years following construction	Every 4 weeks for 6 months and then 6 monthly
Note: The monitoring frequency may be amended should anomalous or concerning data be recorded.		

Table 6.3: Groundwater Monitoring Frequency – WWPS and Service Trench Monitoring Points

Timeframe	Duration	Frequency
Pre-construction	At least 6 months prior to construction to obtain baseline seasonal fluctuations	Every 4 to 6 weeks
During construction	For the full duration of construction of respective basin	Once a week
Note: The monitoring frequency may be amended should anomalous or concerning data be recorded.		

Required piezometers for groundwater monitoring are outlined for each respective excavations (construction phase) within **Table 6.4** below.

Table 6.4: Required Groundwater Monitoring for Respective Excavations

Construction Phase	Potentially Affected Structures	Proposed Piezometer for Geotechnical Assessment of Potential Effects
Wetland A	Residential dwellings adjacent to the subdivision boundary between Mangakōtūkutuku Stream and 6 Caesar Roose Drive	MP06 and MP07
Wetland B	Saxbury Road residential dwellings between 37 and 41B Saxbys Road and Southbrook Close properties	MP04 and MP05
Wastewater Pipe and WWSP Installation (Stage 2A and 2B)	Residential dwellings along Saxbys Road adjacent to site boundary	MP01 to MP03

⁴ CMW (August 2026) Wetland A Design Review, Ref: HAM2025-0056AK Rev 4

Construction Phase	Potentially Affected Structures	Proposed Piezometer for Geotechnical Assessment of Potential Effects
Wastewater Pipe Installation (Stage 1A, 1B and 1E)	Residential dwellings adjacent to subdivision boundary between Mangakōtutuku Stream and 24 Reynolds Drive	MP07 to MP10

6.4 Ground Settlement Monitoring

Settlement monitoring of neighbouring critical infrastructure will be required where any buildings, utilities or assets are present to measure any drawdown induced settlement. A suitably qualified and certified surveyor will be responsible for installing settlement monitoring points and providing survey results at the locations indicated on the plans presented in **Appendix B**.

The proposed monitoring frequency for settlement is presented in **Table 6.5**.

Table 6.5: Settlement Monitoring Frequency (1)

Timeframe	Duration	Frequency
Pre-construction	Minimum of 3 readings for each point to be taken over a 3-week period prior to dewatering	3 readings to obtain baseline
During construction	For the full duration of construction of respective basin	Once a week for first 4 weeks, reducing to once every 4 weeks during construction of respective basin
Post-construction	For 2 years following construction	Every 4 weeks for 6 months and then only when drawdown amber or red triggers are exceeded ⁽²⁾
Notes: ⁽¹⁾ The frequencies above may be decreased or increased by the Geotechnical Engineer depending on the results of the monitoring. ⁽²⁾ Six Monthly groundwater monitoring will be undertaken for 5 years post construction, settlement is linked directly to the drawdown, therefore monitoring is only required when drawdowns exceed what is anticipated.		

Required settlement monitoring points are outlined for each respective excavation (construction phase) in Table 7 below and presented on **Drawings 05**.

Table 6.6: Required Settlement Monitoring Points for Each Respective Excavation

Construction Phase	Potentially Affected Structures	Monitoring Points
Wetland A	Residential dwellings adjacent to the subdivision boundary between Mangakōtutuku Stream and 6 Caesar Roose Drive	SM06 and SM07
Wetland B	Saxbury Road residential dwellings between 37 and 41B Saxbys Road and Southbrook Close properties	SM04 and SM05
Wastewater Pipe and WWSP Installation (Stage 2A and 2B)	Residential dwellings along Saxbys Road adjacent to site boundary	SM01 to SM03
Wastewater Pipe Installation (Stage 1A, 1B and 1E)	Residential dwellings adjacent to subdivision boundary between Mangakōtutuku Stream and 24 Reynolds Drive	SM07 to SM10

Settlement markers shall be levelled by precise survey to an accuracy of $\pm 2\text{mm}$ at the frequencies outlined above. All survey data must be provided to the Geotechnical Engineer as soon as possible following completion.

These levels may be amended subject to approval by the relevant party (Colliers, HCC, and Waikato Regional Council) as part of the GEMP approval process, and, after the receipt of pre-dewatering monitoring data, building condition surveys and recommendations from a Suitably Qualified Engineering Professional (SQEP), but only to the extent that avoidance of damage to building, structures and services can still be achieved.

6.5 Post-Construction Monitoring

Following construction monitoring of respective wetland structures will shift into monitoring frequencies outlined in **Table 6.2 and 6.5**. **Table 6.5** outlines the structures that will require monitoring post construction (this table assumes basins will be constructed in order from A to F).

Table 6.7: Post-construction Monitoring Trigger

Construction Phase	Structures
Wetland A	Residential dwellings adjacent to the subdivision boundary between Mangakōtutuku Stream and 6 Caesar Roose Drive
Wetland B	Residential dwellings adjacent to the subdivision boundary between Mangakōtutuku Stream and 6 Caesar Roose Drive.
Wetland C to F	None.
Note: The above outlined timeframes are based on construction sequencing of the Basins from a to f in order. If any changes are made where basins will be constructed out of order this table should be reconsidered.	

6.6 Groundwater Flows and Volume

To verify that soil permeabilities, inflow rates and volumes can be compared with the estimates outlined within the WGA HEA, pump capacities are to be recorded, and daily pumping records kept by the contractor. These records are to be provided to CMW on a monthly basis for review.

Daily rainfall records are also to be maintained by the contractor and presented with the monthly pumping records.

6.7 Data Processing and Reporting

Groundwater and survey monitoring data will be entered into a database, typically within 24 hours of being provided. The data will be compared to anticipated effects and levels. Any trends will be noted and implications considered with respect to future and current activities and effects.

During construction groundwater monitoring and settlement monitoring, data should be provided to Waikato Regional Council on a fortnightly basis. These results should be presented in a format which shows the monitoring results compared against trigger levels, along with a summary analysis of any data trends and forecasts.

In the event of an alarm level being triggered, the Consent Holder shall notify Waikato Regional Council in writing within 48 hours of the event.

An annual groundwater monitoring report should be prepared by the Consent Holder within one calendar month following completion of construction of each basin for a period of 2 years and provided to Waikato Regional Council and HCC.

7.0 TRIGGER ACTION RESPONSE PLAN (TARP)

7.1 Groundwater Monitoring Triggers

The groundwater triggers have been set as:

- Green – drawdown (below baseline) is within predicted range (<80% of predicted)
- Amber – drawdown is at the upper end of the predicted range (within 80% - 100% of predicted)
- Red – drawdown exceeding the predicted range (exceeded 100% of predicted)

Specific trigger levels are to be determined at the detailed design phase.

To better understand the groundwater regime and potential drawdown effects associated with the construction of the wetlands, both shallow and deep piezometers are proposed across the Residential Area. The deeper aquifer, being semi-confined, is not expected to experience a reduction in hydraulic head, only a change in pore pressure. As such, it is unlikely to contribute to geotechnical impacts such as settlement. Therefore, trigger levels have been established solely for the shallow piezometers. The installation of deep piezometers is intended to monitor pressure responses within the semi-confined aquifer and assess their potential influence on the overlying unconfined aquifer.

7.2 Settlement Monitoring Triggers

The ground settlement triggers have been set as:

- Green – settlement that is within predicted range and is below the threshold for expected damage or loss of service
- Amber – settlement at the upper end of the predicted range
- Red – drawdown exceeding the predicted range, and/or reaching potentially damaging magnitudes

Specific trigger levels are to be determined at the detailed design phase.

Differential settlements across structures should be back calculated where amber trigger level are exceeded. Red level trigger actions should be followed where any back calculated differential settlement across a platform exceeds 1:300, with structural condition surveys undertaken within 48 hours of exceedance of this differential settlement tolerance.

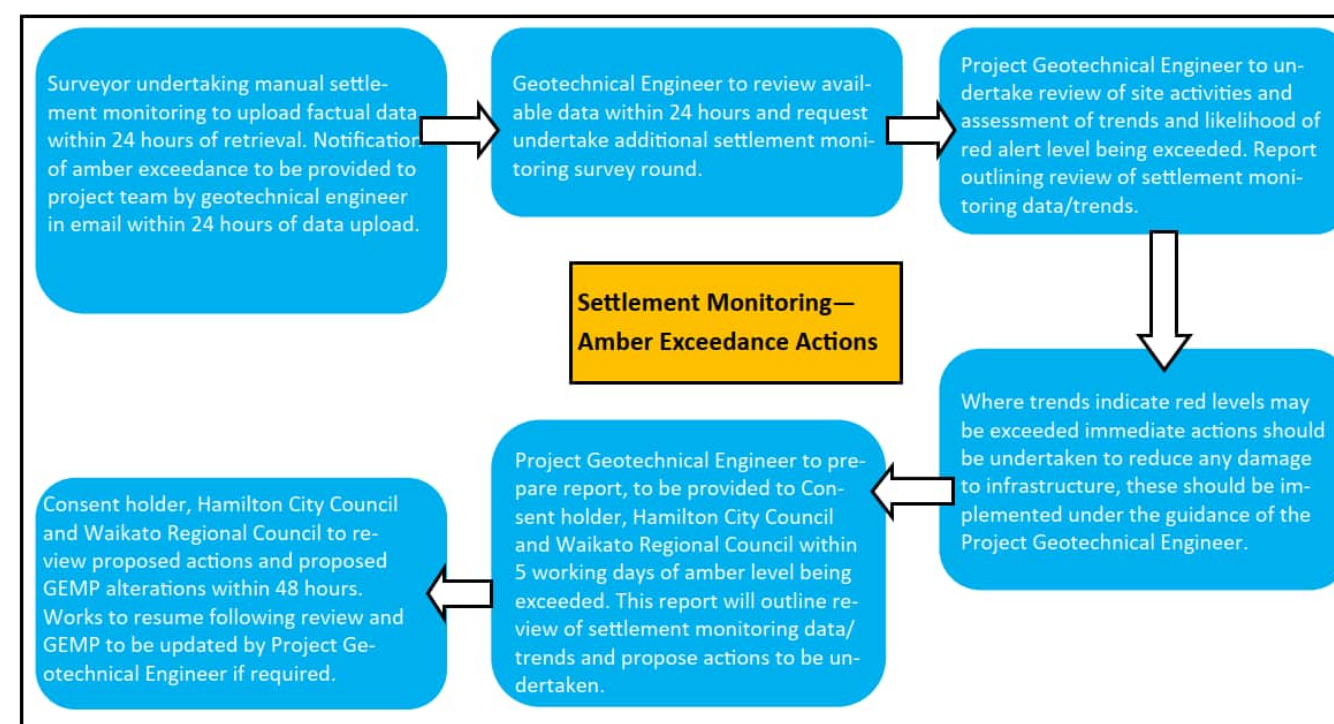
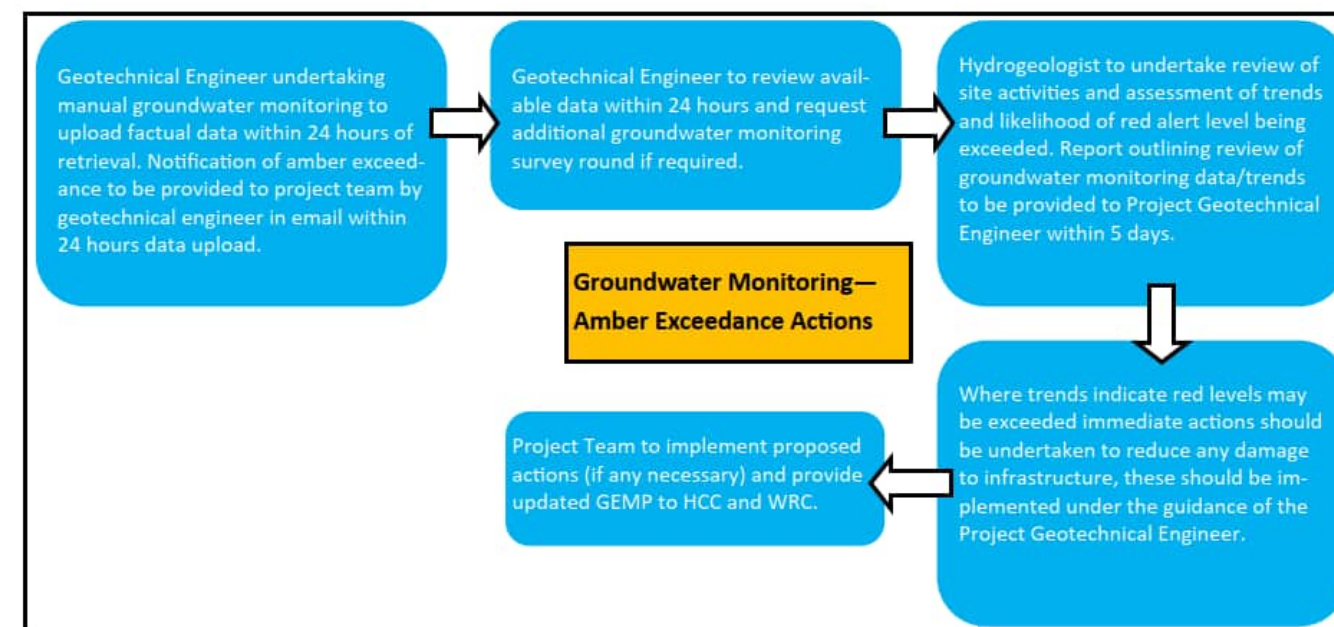
7.3 Contingency Measures

7.3.1 Response Procedure

Any trigger exceedances for Amber and Red Levels, with recommended actions, will be communicated immediately to the project team by either the contractor or the project geotechnical engineer.

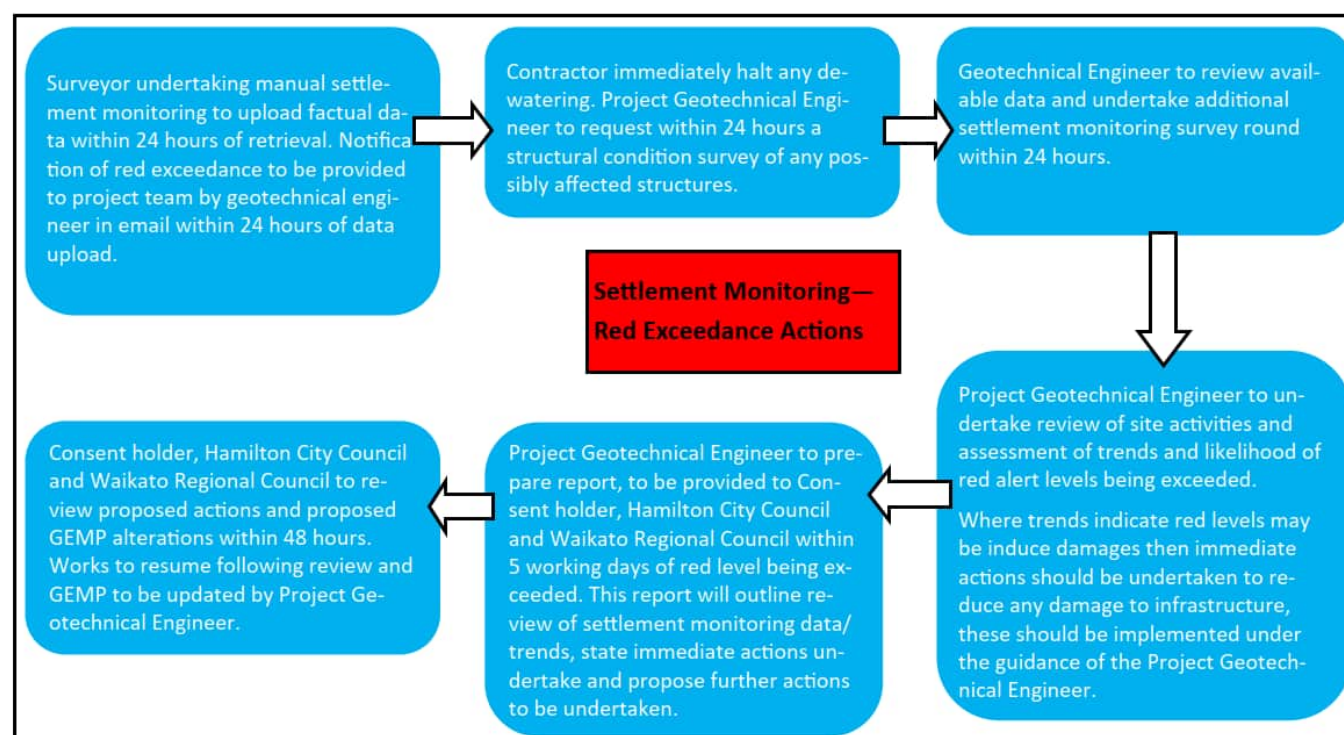
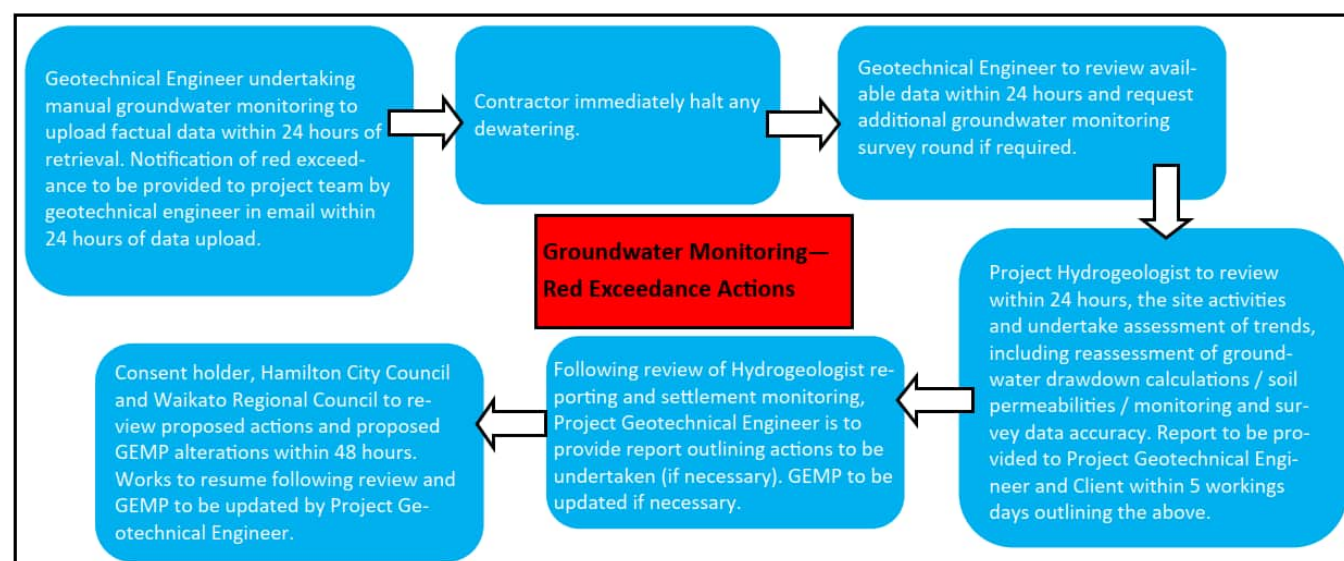
7.3.2 Amber Level Responses

Following exceedance of any Amber Level the actions are to be undertaken in steps are outlined in the flowcharts below.



7.3.3 Red Level Responses

Following exceedance of any Red Level the actions to be undertaken in steps are outlined in the flowcharts below.



Red level example actions following review by Project Geotechnical Engineer may involve the following steps:

- Alert to contractors to cease or reduce dewatering and/or construction works;
- Further review of construction methodology including reducing areas of excavation / dewatering, potential for groundwater recharge options;
- Possible further geotechnical investigation to confirm ground conditions;
- Revise construction methodology based on appropriate review of data.

7.4 Mitigation Measures

Although not anticipated, if any damage to buildings, road or infrastructure is observed or reported we propose the following:

- A register of notifications/contacts and complaints to be maintained by Colliers (or delegated body) with details of all correspondence regarding issues raised;
- Notification of issues to stakeholders / asset owners as appropriate;
- Appropriate team member to liaise with asset owner, inspect asset and report on findings to Colliers;
- If any issues raised are found to be related to settlement induced damage, then remedial actions to be agreed, final decision to be made by Colliers, and implemented; and
- Following construction of each basin the results from groundwater and settlement monitoring will be reviewed and the risk to third party assets should be re-assessed.

8.0 ROLES AND RESPONSIBILITIES

A list of key stakeholders, roles and responsibilities in obtaining data, processing the data and alerting the design team and relevant stakeholder to exceedances and trends of concern, instructing and carrying out actions is provided in the below tables.

Table 8.1: Roles and Responsibilities

Stakeholder	Role	Personnel	Responsibility
Colliers Project Leaders	Client / developer	Dillon Kellier Dillon.Kelliher@colliers.com 022 033 7705	Site ownership, approval for additional works if required.
CMW Geosciences	Geotechnical engineer	Mark McVinnie markmcv@cmwgeo.com 027 166 1865	Data review, alert/action notifications, proposed additional works as required
Wallbridge Gilbert Aztec (WGA)	Hydrogeologist	Catherine Howell chowell@wgan.co.nz	Data review, review of groundwater drawdown trends following alerts
TBD	Contractor in control of site	Contractor representative	Data review, alert/action notifications, daily pump records, daily rainfall records, proposed additional works as required
TBD	Site surveyor	Surveyor Representative	Settlement monitoring survey
Maven	Civil engineer	Min Shon mins@maven.co.nz 022 198 6876	Earthworks and civil design inputs if any additional works are required
Hamilton City Council	Governing agency	Project Sponsor or delegate	Approving of monitoring plan, and any modifications if necessary
Waikato Regional Council	Governing agency	Fiona Forrest Fiona.Forrest@waikatoregion.govt.nz 021 483 005 After Hours – 0800 800 401	Approving of monitoring plan, and any modifications if necessary

Table 8.2: Responsibilities

Stakeholder	Responsibility
Colliers Project Leaders	Site ownership and liaison with Council (HCC & WRC) approval for additional works if required. Instruction to contractor for additional works if required.
CMW Geosciences (CMW)	Data review of groundwater monitoring and settlement monitoring, alert / actions notifications to Colliers, proposed additional works if required following alert / action notifications, review and modifications to GEMP as required.
Wallbridge Gilbert Aztec (WGA)	Data review of groundwater monitoring, re-assessment of groundwater monitoring trends following alert / action notifications.
Contractor	Review of data (groundwater drawdown pumping), daily rainfall monitoring, undertake proposed additional works as required as instructed by Colliers.
Surveyor	Settlement monitoring survey, review of monitoring data, alert / action notifications to CMW and Colliers within 24 hours of taking reading. Set up of groundwater / settlement monitoring systems.
Maven	Earthworks and civil design inputs if any additional works are required.
Hamilton City Council (HCC)	Approval of management plans, approval of any updates to management plans following monitoring, and any modifications if necessary.
Waikato Regional Council (WRC)	Approval of management plans, approval of any updates to management plans following monitoring, and any modifications if necessary.

9.0 GEMP AND TARP REVIEW

Upon completion of detailed design, the GEMP should be revised to reflect the geotechnical effects and proposed construction methodology.

Following construction of each respective basin, the GEMP will be reviewed and updated prior to construction of the following basin and following analyses of data obtained during the completed phase of works. At that time, the Project Geotechnical Engineer must assess and report predicted groundwater drawdown, predicted ground settlements, and predicted differential settlement gradients. The review of the monitoring results and plan must outline whether the shift from construction monitoring to post-construction monitoring frequencies for each piezometer and settlement marker is appropriate at that time.

If any key design elements change then the GEMP will require review and updating to ensure it adequately manages the risk to environment, existing buildings and existing infrastructure.

Following pre-construction monitoring and at least 20 working days prior to the commencement of any construction works in relation to the project site, this GEMP and the TARP must be updated with baseline monitoring levels and provided to Waikato Regional Council.

10.0 FUTURE RESIDENTIAL DEVELOPMENT

We recognise that residential development may occur concurrently with, or prior to, the construction of the artificial wetlands. It is important to note that these structures may be impacted by settlement caused by groundwater drawdown. Any future geotechnical assessments for any development within the drawdown effected area must consider cumulative settlements, both drawdown-induced and static settlements, to ensure compliance with NZS 3604 requirements for residential dwellings.

APPENDIX A

WGA Drawdown Calculations and
Contour Plans



SL1 Consortium Group

Southern Links 1 Residential Stage 1 Southern Block Hydrogeological Effects Assessment

ASSESSMENT OF EFFECTS

WGA242463

WGA242463-RP-HG-0003_B

May 2026



Revision History

REV	DATE	ISSUE	ORIGINATOR	CHECKER	APPROVER
A	27/03/2026	Draft to Client	TDB, JFM & JF	BS	CHO
B	29/05/2026	Final	JF	CHO	CHO

Authors

AUTHOR	QUALIFICATIONS	EXPERIENCE
Clare Houlbrooke	B Sc Earth Sciences, MSc (Hons, Tech) Earth Sciences	Hydrogeologist with over 25 years of experience. Clare focuses on sustainable management of groundwater resources and connected surface water systems. She gained broad experience in multiple hydrogeological disciplines during her 9-year stint as a Groundwater Scientist in two Regional Councils before becoming a consultant in 2011.
Brett Sinclair	BSc. Geology, MSc (Hons) Geology, Postgraduate Certificate in Hydrogeology and Engineering Geology of Tropical and Subtropical Regions,	Brett is a Senior Principal Hydrogeologist with more than 30 years' experience in hydrogeology, geology, water management, water quality assessment and environmental effects mitigation.
Toby Beisly	BSc (Tech), Environmental Sciences and Geology, MSc (Research), Environmental Sciences	Toby is a Graduate Hydrogeologist with a passion about the natural environment and the informed management of natural resources.
Joanne Ferry	BSc. Geology and Biology, endorsed in Environmental Science. MSc. (Hons) Engineering Geology.	Hydrogeologist with over 12 years of experience in hydrogeological drilling, conceptualisations and managing large scale groundwater projects in industry and local government.
James Manning	BSc. Environmental Science and Geography. MWaterRM (Research), Master of Water Resource Management.	James is a hydrogeologist with over 3 years of experience. James has been involved in a wide range of projects around Australia and New Zealand ranging from stopbank seepage modelling to water bore drilling in remote communities.

CONTENTS

1	INTRODUCTION	1
1.1	Background	1
1.2	Site Description	1
1.3	Proposed Activity	1
2	EXISTING ENVIRONMENT	4
2.1	Rainfall	4
2.2	Surface Water Bodies and Catchment Boundary	4
2.3	Geology and Hydrogeology	6
2.3.1	Regional Geology and Hydrogeology	6
2.3.2	Local Shallow Lithology	8
2.3.3	Local Hydrogeology	8
2.4	Hydrogeological Parameters	11
2.5	Catchment Water Balance	12
2.5.1	Recharge	12
2.5.2	Groundwater and Surface Water Flow Paths	13
2.5.3	Groundwater Levels	13
2.6	Surrounding Groundwater Users	15
3	DRAWDOWN EFFECTS OF STORMWATER WETLANDS	17
3.1	Introduction	17
3.2	Analytical Pit Modelling Methodology for Stormwater Wetlands	17
3.3	Results	18
3.3.1	Drawdown Effects of Stormwater Wetlands on Groundwater	18
3.3.2	Drawdown Effects of Stormwater Wetlands on Surface Water	18
4	DRAWDOWN EFFECTS OF WASTEWATER INFRASTRUCTURE	21
4.1	Introduction	21
4.2	Drawdown Effects of Wastewater Pump Station Installation	21
4.2.1	Construction	21
4.2.2	Dewatering for Wet Well Installation	22
4.2.3	Shallow Aquifer Dewatering During Wet Well Excavation	24
4.3	Drawdown Effects of Wastewater Pipeline Trenching	26
4.3.1	Wastewater Pipeline Modelling Methodology	26
4.3.2	Wastewater Pipeline Analytical Modelling Results	27
5	GROUNDWATER EFFECTS ASSESSMENT	31
5.1	Effects Overview on Catchment Water Balance	31
5.2	Dewatering Effects Assessment	32
5.2.1	Effects on Nearby Bores	33
5.2.2	Effects on Nearby Surface Water Features	33
5.2.3	Effects on Natural Wetlands	33
5.2.4	Effects on Ground Subsidence	33
5.3	Anticipated Implications for Water Quality	34

6	MONITORING AND MITIGATION.....	35
6.1	Groundwater Monitoring	35
6.2	Surface Water Monitoring	35
7	CONCLUSIONS	36
8	REFERENCES	37
9	LIMITATIONS	38

Figures

Figure 1: Southern Block Residential Master Plan.....	2
Figure 2: Proposed Stormwater Wetlands and Wastewater Infrastructure	3
Figure 3: Rainfall Record at Ruakura (6.2 km northeast).....	4
Figure 4: Catchment Map of the Mangakōtukutuku Stream	5
Figure 5: Geological Setting of the Hamilton Basin (Lowe, 2021)	6
Figure 6: Underlying Geological Units	7
Figure 7: Investigation Locations and Piezometric Surface	9
Figure 8: Twin Bore Headworks for P2S (Shallow) and P2D (Deep), Screened Above and Below the Low Permeability Aquitard Layer.....	10
Figure 9: Field Identification of Lithological Units Present at Bore P3	11
Figure 10: Southern Block Piezometer Groundwater Level Responses to Rainfall	14
Figure 11: Discolouration in Drain Due to Iron Oxidation from Groundwater Discharge.....	14
Figure 12: 1 km Site Buffer and Surrounding Groundwater Bores and Consents	16
Figure 13: Projected Drawdown in confined and unconfined Aquifers Following Dewatering of Wet Well Excavation WWPS A	23
Figure 14: Projected Drawdown in confined and unconfined Aquifers Following Dewatering of Wet Well Excavation WWPS B	24
Figure 15: Inputs for Pit Model Assessing Potential Dewatering of Unconfined Aquifer of Planned WWPS A Installation.....	25
Figure 16: Inputs for Pit Model Assessing Potential Dewatering of Unconfined Aquifer of Planned WWPS B Installation.....	25
Figure 17: Summer Drawdown Contours for Wastewater Pipeline 20m Trenches.....	28
Figure 18: Projected Drawdown from Wastewater Pipelines at the Centre of the Site During Summer	29
Figure 19: Projected Drawdown from Wastewater Pipelines at the Edges of the Site During Summer	29
Figure 20: Projected Groundwater Inflows Over Time into a 20 m Trench at the Centre of the Site During Summer.....	30
Figure 21: Projected Groundwater Inflows over Time into a 20 m Trench at the Edges of the Site During Summer.....	30
Figure 22: Conceptual Schematic of Water Flow Required and Induced by the Proposed Activity	31

Tables

Table 1: Stratigraphic Units of the Southern Block (CMW, 2025).....	8
Table 2: Piezometer Construction Details	8
Table 3: Hydraulic Conductivities of the Southern Block Area.....	12
Table 4: Manual Static Water Level Measurements in Each Piezometer (18 July 2025)	13
Table 5: Nearby Groundwater Takes	15
Table 6: Inputs for Pit Models Representing Each of the Stormwater Wetlands.....	17
Table 7: Projected Effects of Proposed Stormwater Wetlands	19
Table 8: Existing and Design Elevations of Stormwater Wetlands Compared to Neighbouring Stream/Drain Heights.....	20
Table 9: Input Parameters for Hunt and Scott Assessment of Dewatering WWPS A and WWPS B	22
Table 10: Projected Effects of Wet Well Excavation Through Upper Aquifer Only	26
Table 11: Input Parameters for Wastewater Pipeline Analytical Modelling	27
Table 12: Projected Distance of Influence.....	27
Table 13: Summary of Construction Dewatering Flow Rates and Operational Cumulative Groundwater Diversions.....	32

Appendices

APPENDIX A LITHOLOGICAL INVESTIGATIONS AND GROUNDWATER LEVELS

APPENDIX B HYDRAULIC TESTING

APPENDIX C WGA MARKUP ON MAVEN DESIGN DRAWING NO. R1-C440 REV C

APPENDIX D STORMWATER WETLAND DRAWDOWN PIT MODELLING

APPENDIX E STORMWATER WETLAND DRAWDOWN CONTOURS

APPENDIX F WASTEWATER INFRASTRUCTURE DRAWDOWN MODELLING

1 INTRODUCTION

1.1 Background

Saxby Rd JV Limited has contracted Wallbridge Gilbert Aztec (WGA NZ Pty Ltd; WGA) for technical services to support the construction of the Southern Links 1 (SL1) Residential Stage 1 Southern Block (Southern Block; 'the Site'). The SL1 Listed project is to provide a range of housing typologies and land tenure opportunities to provide affordable housing and to boost the industrial capability of the region (Figure 1). This assessment of effects focuses only on the Southern Block, which is for residential housing.

1.2 Site Description

The entire SL1 area is approximately 440 ha in size and is situated between the established Hamilton suburbs of Dinsdale, Frankton, Deanwell and Glenview to the northeast, and rural land within Waipa to the southwest. The SL1 area is currently zoned rural under the Waipa District Plan and consists of lots in pasture, rural lifestyle, equine industry and peri-industrial use.

The SL1 development will consist of both residential and industrial areas with green spaces scattered throughout the development. Stormwater across the SL1 area will be managed by naturalised streams, rain gardens and constructed wetlands. The SL1 site has been divided into two blocks, known as the 'Northern Block' and the 'Southern Block'. This assessment of effects focuses only on the Southern Block (Figure 1).

The Southern Block is a 46 ha block of rural dairy farmland to the south of Saxbys Road. The proposed development is for subdivision for residential development. This includes 900 to 1,000 residential units in a range of typologies, as well as the establishment of associated works, roads and infrastructure.

1.3 Proposed Activity

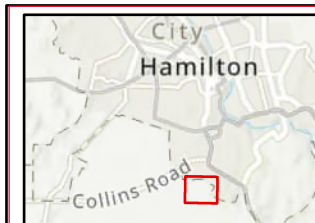
For the Southern Block, six wetlands are proposed to be constructed to manage stormwater in the development. Additionally, two wastewater pump stations (WWPS) and site-wide wastewater pipeline infrastructure need to be constructed to support the development Figure 2.

The proposed activity has two main groundwater-related components that have the potential to influence catchment water balances:

1. **Short-term temporary dewatering during construction earthworks**, for proposed Stormwater Wetlands and wastewater infrastructure (site-wide pipeline and two wastewater pumping stations). Dewatering is anticipated to be localised and temporary, with groundwater managed and discharged in accordance with the site erosion and sediment control framework and any relevant consent requirements.
2. **Long-term groundwater interception and diversion to the proposed Stormwater Wetlands**, which will act as persistent hydraulic features within the developed catchment.

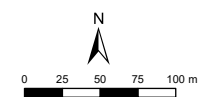


Figure 1: Southern Block Residential Master Plan



LEGEND

- WWPS
- Proposed Wastewater Infrastructure
- Proposed Stormwater Wetlands
- Southern Block
- Southern Links Boundary
- 1m Contours



Scale 1:5,000 @ A4

Coordinate System: NZGD 2000 Mount Eden Circuit

WGA

Figure 2

Southern Links Stage 1

Proposed

Stormwater Wetlands and
Wastewater Infrastructure

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2 EXISTING ENVIRONMENT

2.1 Rainfall

Rainfall data are recorded at the Ruakura Weather Station, which is located approximately 6.2 km northeast of the proposed development. The available record spans from November 2005 to the present, with a peak daily rainfall of 87.8 mm recorded during this period (Figure 3). The long-term mean annual rainfall at the station is approximately 1,018 mm.

During the period of groundwater level monitoring undertaken at the Southern Block for this assessment (July 2025 to January 2026; see Section 2.5.3), the peak daily rainfall recorded at Ruakura was 42.4 mm. Total rainfall over this monitoring period was approximately 620 mm. When annualised, this equates to an annual rainfall of approximately 1,048 mm/year, which is slightly above the long-term mean annual rainfall. Overall, rainfall conditions during the monitoring period are considered to be broadly representative of average long-term conditions.

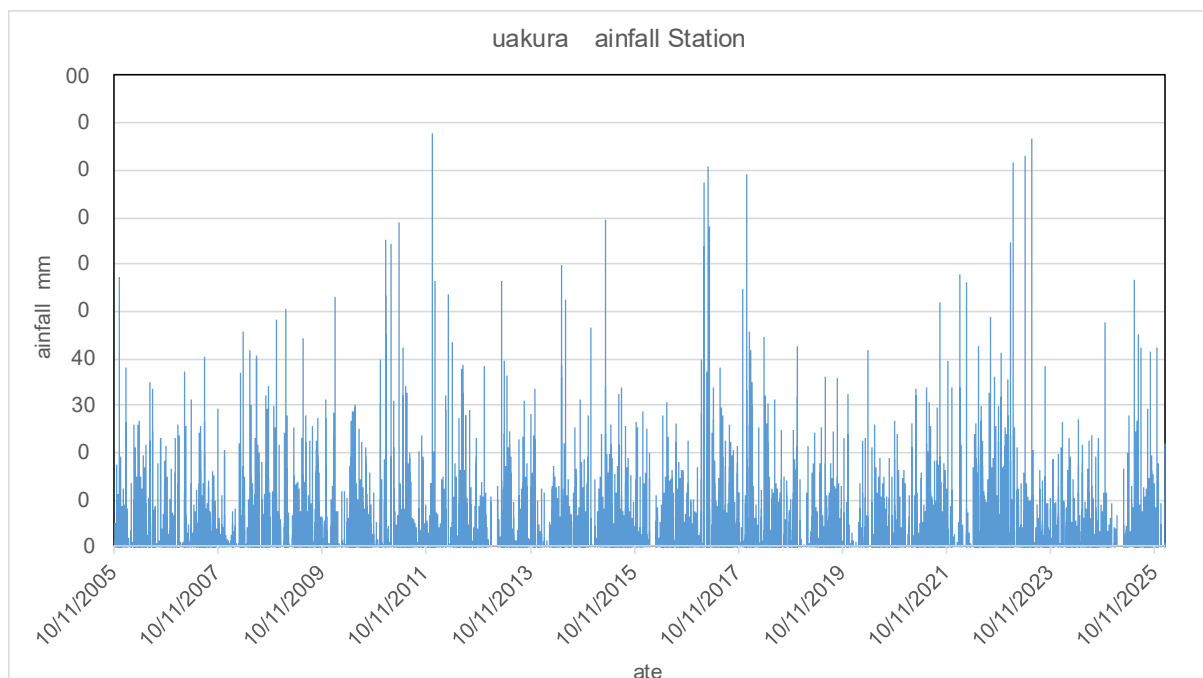
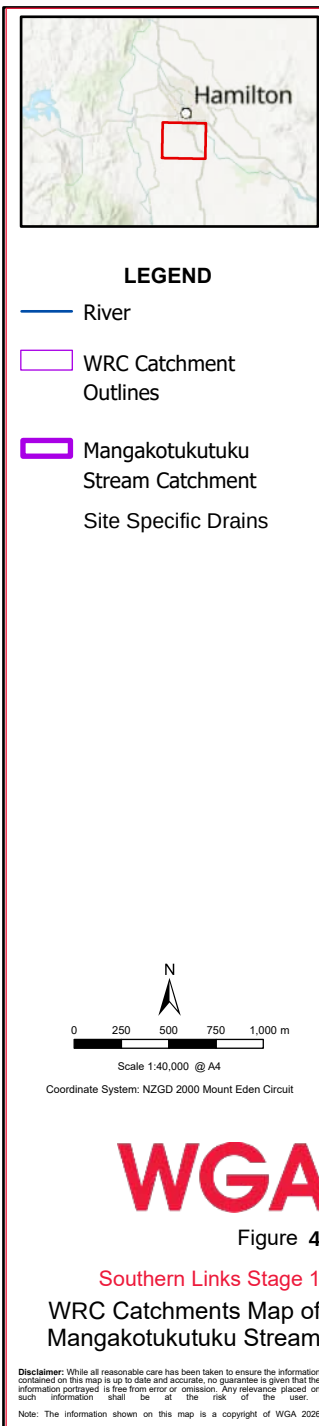
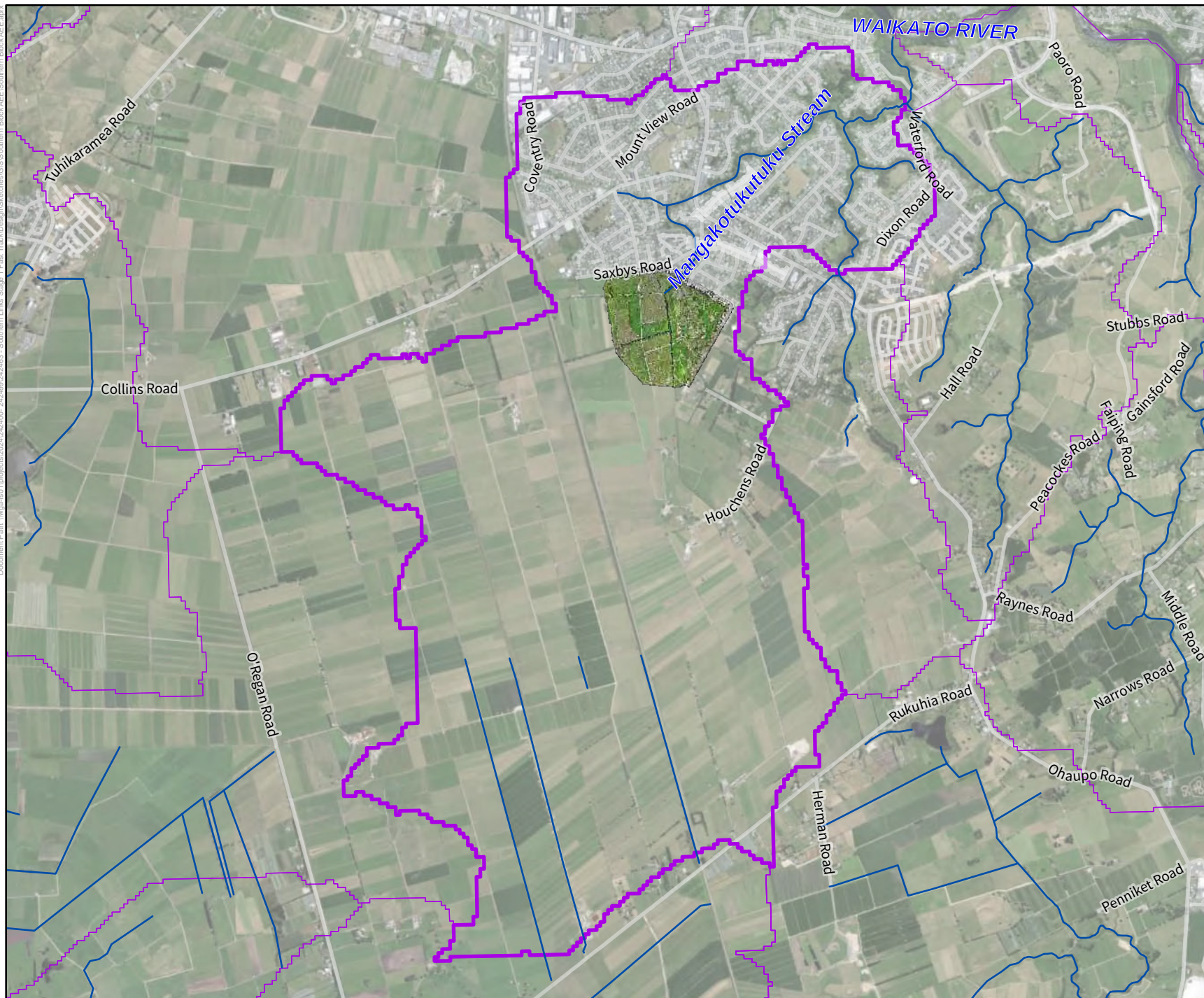


Figure 3: Rainfall Record at Ruakura (6.2 km northeast)

2.2 Surface Water Bodies and Catchment Boundary

The Site is characterised by two converging drains (receiving water from a network of surrounding farmland drains). These two drains are approximately 1 to 2 m deep and have “moderate” ecological habitat (EcoLogical Solutions, 2025). The drains are flanked by riparian plantings, which are to be maintained during the construction period and as part of the proposed development. The drains flow into the headwaters of the Mangakōtukutuku Stream, which extends 150 m into the north-eastern end of the Site (Figure 4). During project-specific field investigations, EcoLogical Solutions (2025) surveyed stream widths of between 2.6 to 4.2 m, with water depths ranging from 0.45 to 0.87 m and velocities of 0.1 to 0.9 m/s.



The Site exists within the Mangakōtukutuku catchment, which is approximately , hectares in area (AECOM, 2020). The catchment is bound to the north and east by the Peacocke Riverside catchment and to the west by the Waitawhiriwhiri catchment (AECOM, 2020). The Mangakōtukutuku stream discharges into the Waikato River approximately 2.5 km to the northeast of the site (Figure 4). WGA has been advised that stormwater from the Site will be discharged into planned stormwater wetlands that will connect to the existing drains and the Mangakōtukutuku Stream.

Two natural wetlands were also identified within the Site by EcoLogical Solutions Ltd (2025). One of these wetlands is located on the northeastern boundary of the Site (approximately 285 m² in area) and in the upper reaches of the Mangakōtukutuku Stream approximately 0 m²).

2.3 Geology and Hydrogeology

2.3.1 Regional Geology and Hydrogeology

The Hamilton Basin, in which the proposed SL1 Stage 1 Residential Development is located, is a large tectonic basin centred on Hamilton City with an area of approximately 2,000 km² and traversed by the Waikato River. The basin is surrounded by ranges of Mesozoic (Manaia Hill Group) and Tertiary age rocks (Te Kuiti and Waitemata Groups). At depth, basement greywacke underlies the sedimentary deposits that infill the basin (GNS, 2005).

The basin is infilled with Tauranga Group alluvial sediments, dating from the Pliocene to the middle Holocene. The Tauranga Group sediments are up to 300 m thick and include gravels, sands, silt, muds and peats of fluvial, lacustrine and distal ignimbric origin. Underlying the low hills within the basin are older ignimbrites, tephra fall deposits and alluvium of the Walton Subgroup (Lowe 2021; Figure 5).

The younger Hinuera Formation of the Tauranga Group underlies much of the Hamilton basin (Figure 6). This formation was deposited by braided river systems of the Waikato River, initiated by the supply of large volumes of sediment from volcanism in the Taupo Volcanic Zone (Petch, 1987). Within this formation, the most productive aquifers consist of well-sorted coarse sands and gravels. Discontinuous sequences of rhyolitic and pumiceous gravelly sands and gravels are interspersed with pumiceous silt, clay and peat layers. Lithological variability generally results in zones of higher permeability within the formation rather than a single, continuous aquifer (Scholfield, 1972). Low-lying areas comprise younger Holocene Swamp Deposits of the Tauranga Group, such as the Piako Subgroup, locally consisting of peat.

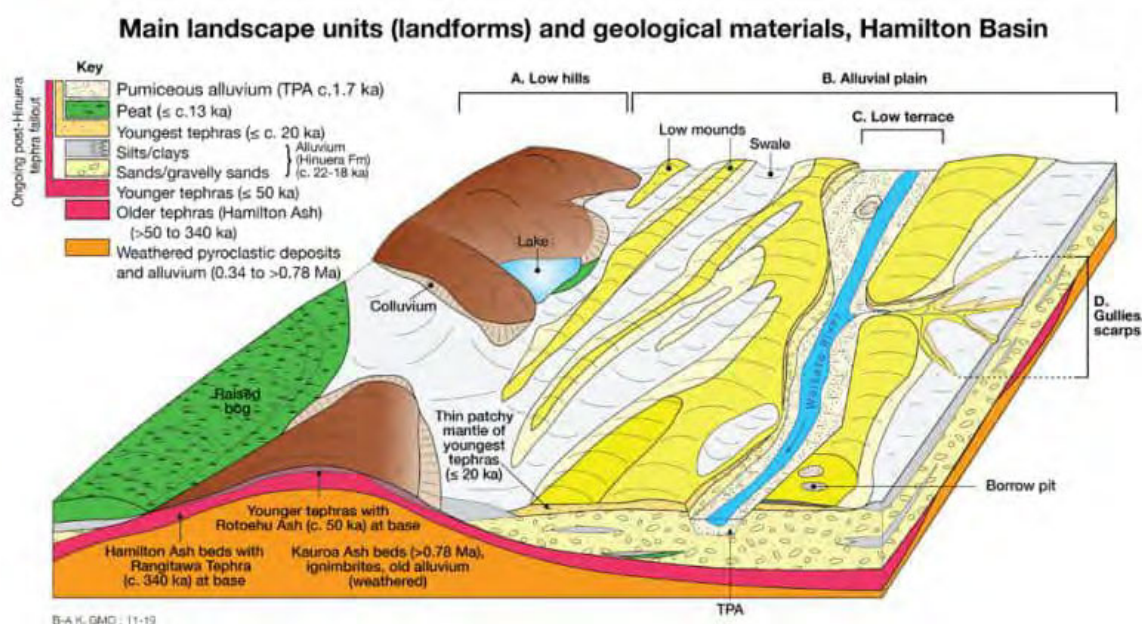
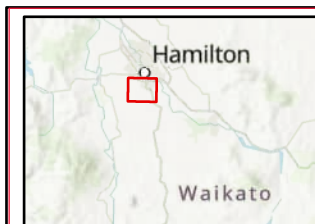
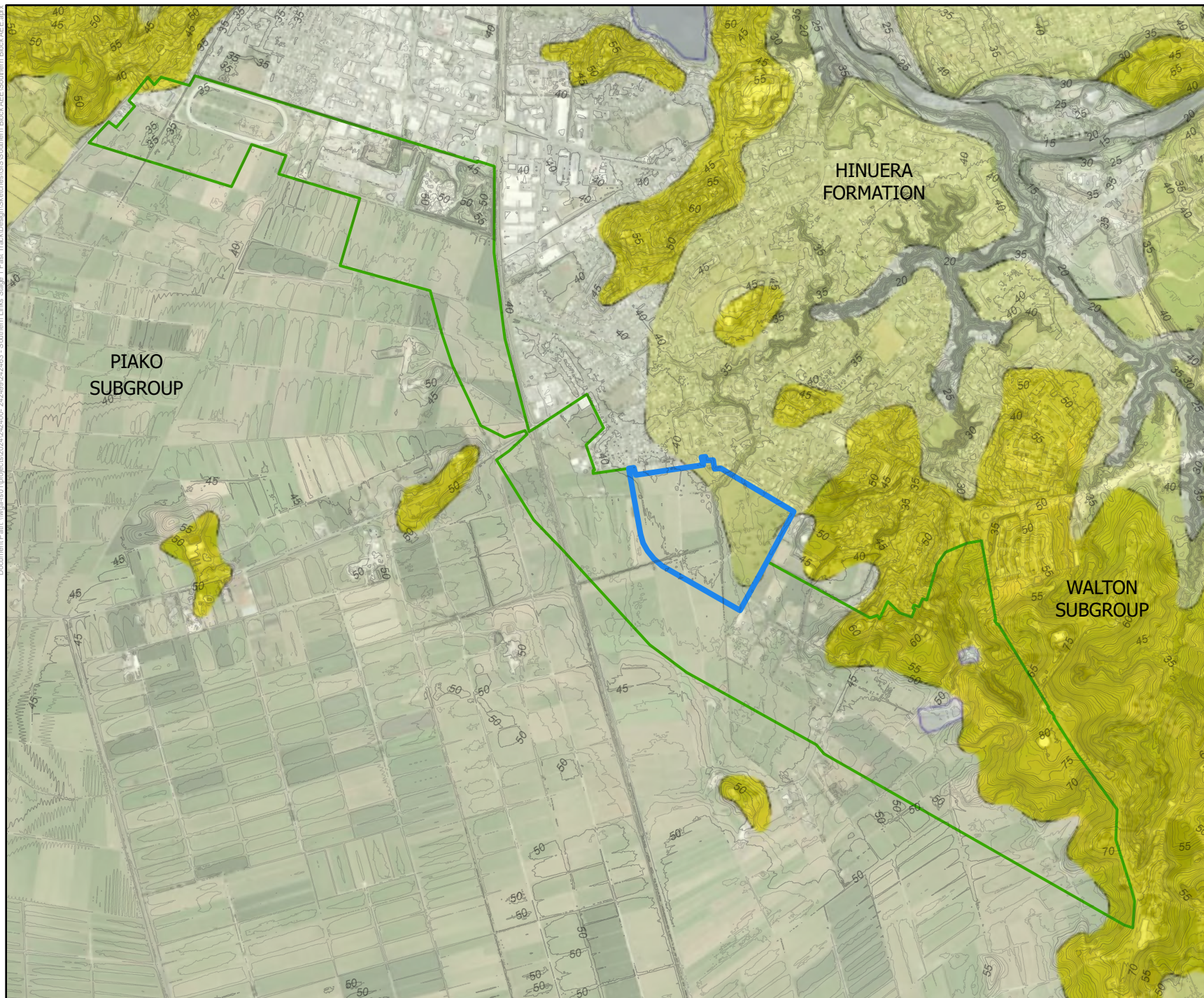


Figure 5: Geological Setting of the Hamilton Basin (Lowe, 2021)



LEGEND

- Southern Block
- Southern Links Growth Cell
- 1m Contours



Scale 1:30,000 @ A4

Coordinate System: NZGD 2000 Mount Eden Circuit

WGA

Figure 6

Southern Links Stage 1
Underlying Geological Units

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2.3.2 Local Shallow Lithology

The Site is predominantly underlain by sediments of the Hinuera Formation. The Hinuera Formation consists of Late Pleistocene river deposits, including cross-bedded pumice sand, silt and gravel with interbedded peat. GNS Science Web Geology mapping (Figure 6) shows Piako Subgroup Holocene sediments are overlying the Hinuera Formation sediments at the Site. However, based on the onsite observations of CMW (2025), the site is completely underlain by Hinuera Formation soils and the Piako Subgroup Holocene sediments (peat swamp deposits) are located further to the south-west, outside the Southern Block area (CMW, 2025). A summary of the underlying geology encountered from the investigation is presented in Table 1.

Table 1: Stratigraphic Units of the Southern Block (CMW, 2025)

UNIT	DEPTH TO TOP OF SOIL UNIT (m)		THICKNESS (m)	
	Min	Max	Min	Max
Topsoil	0		0.1	0.5
Interbedded loose to dense Sands and firm to very stiff Silts (Hinuera Formation)	0.1	0.5	1.9	18.0
Stiff to very stiff Clayey Silt (Hamilton Ash/Walton Subgroup) ⁽¹⁾	1.9	18.0	5.0 to 10.0 +	

- **Note:** (1) Base of unit not encountered

2.3.3 Local Hydrogeology

In July 2025, WGA oversaw the installation of five piezometers at four locations at the Site (Figure 7). An overview of piezometer as-built layouts is provided in Table 2. Piezometers P1, P3 and P4 were installed at a target depth of 6 m. Two piezometers were installed at the P2 location (Figure 8), the deeper one screened from 8.5 to 10 m below ground level (bgl; P2D) and the shallow piezometer was screened from 3.5 to 5 m bgl (P2S, Figure 7).

Drilling provided sediment core samples for each drilling location. Samples were logged on-site by CMW in order to have consistent results with other geological tests undertaken at the site. Comprehensive drill logs and core photos are provided in Appendix A.

Table 2: Piezometer Construction Details

PIEZOMETER	DEPTH (m bgl)	CASING DIAMETER (mm)	SCREEN LENGTH (m)	EASTING (NZTM)	NORTHING (NZTM)
P1	6.14	40	1.5	1800593	5811145
P2S	5.14	40	1.5	1800673	5811072
P2D	10.06	40	1.5	1800670	5811073
P3	6.02	40	1.5	1800589	5811047
P4	5.92	40	1.5	1800595	5810750

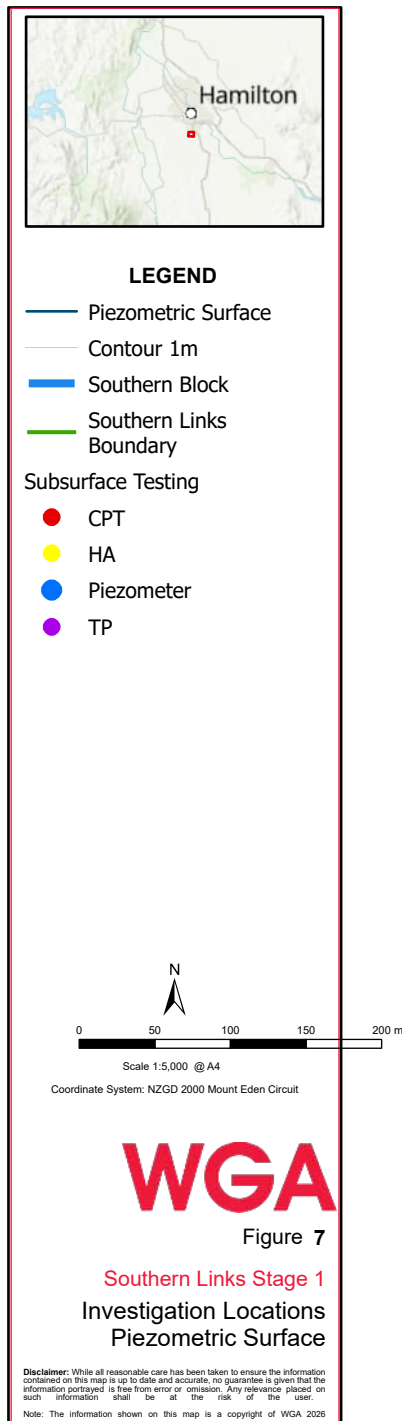




Figure 8: Twin Bore Headworks for P2S (Shallow) and P2D (Deep), Screened Above and Below the Low Permeability Aquitard Layer

Sites P1, P2 and P3 were all characterized by coarse sand, typical of the Hinuera Formation, with a thin clayey silt layer (referred to as a low permeability aquitard layer) appearing between 36 and 36.5 m RL.

Piezometer P4 was characterized by approximately 1 m of silt toward the top of the bore in addition to the low permeability aquitard layer at 37.4 m RL (metres Relative Level, or metres above mean sea level).

Across the four sites, the low permeability aquitard layer varied in thickness from 0.13 m to 0.45 m but appeared to be relatively persistent and to have an effect on the groundwater characteristics of the site. During drilling, after penetrating the low permeability aquitard layer, sand tended to rapidly flow into the borehole from below (called flowing sands by the drillers). This is evidence that the low permeability aquitard layer has a confining effect on the underlying deep aquifer, which is under some degree of pressure. The layer appears to be continuous across the site, appearing clearly in the majority of the geotechnical investigation sites. CMW have prepared a summary map illustrating this and presented in Appendix A.

WGA observed that sand layers above the aquitard had an orange-brown coloration while below the layer they tended to be entirely grey (Figure 9). This indicates that water levels above the low permeability aquitard layer fluctuate seasonally, while sediment below the low permeability aquitard layer is saturated year-round, providing further evidence to the confining effect of the aquitard.

Groundwater across the site is also likely strongly influenced by the two major drains (tributaries of Mangakōtukutuku Stream) running through the farm. From the limited observations taken during site visits these drains appear to have significant flow for the catchment size, indicating that they are at least partially groundwater fed. This is also supported by the brown discolouration of the drain, known locally to be caused by groundwater discharge and iron oxidation. In general, groundwater levels are likely drawn down to the water level in the incised drains.



Figure 9: Field Identification of Lithological Units Present at Bore P3

2.4 Hydrogeological Parameters

The hydraulic conductivity of the geological layers found at the site has been determined by WGA. Hydraulic conductivities were determined by the analysis of hydraulic slug tests performed on-site. These analysis results were compared to the results from soakage testing undertaken by CMW, and decisions were made on appropriate hydraulic conductivity values for each of the sedimentary units listed in Table 3. For lithological units with no data available for hydraulic test analysis, appropriate literature values have been applied.

The hydraulic conductivity for the Hinuera Formation sediments found at the site has been determined by hydraulic slug tests performed in each of the five piezometers. Both falling head and rising head slug tests were analysed where data was available. Methods and results of each test are presented in Appendix B. The groundwater at each site reacted very rapidly, typically recovering within a few seconds of each test. For the Hinuera Formation screened beneath the low permeability aquitard layer, resulting hydraulic conductivities were on average 4×10^{-4} m/sec, which is considered a representative value for the Site. This value is consistent with the hydraulic conductivity determined from pumping tests in the same aquifer, completed as part of hydrogeological investigations at a site 800 m north-west at Collins Road (Earthtech, 2025).

Only one of the five piezometers tested by WGA was screened above the low permeability aquitard layer. To consider the hydraulic conductivity of the Hinuera Formation above the low permeability aquitard layer, the hydraulic slug test analysis results were compared to the results from soakage tests undertaken by CMW. A decision was then made on an appropriate hydraulic conductivity value for above the low permeability aquitard layer of 2.5×10^{-5} .

WGA notes that due to the rapid recovery of the slug tests, resulting hydraulic conductivities should be treated as minimum values as they may represent the screen and filter pack characteristics rather than those of the target aquifer. Similarly, CMW notes that during soakage testing, water emptied from four soakage test locations faster than they could be filled, indicating the resulting permeabilities may be higher than recorded values (CMW, 2026). However, the consistency of the results with recent hydrogeological studies conducted by Earthtech (2025) offers confidence in the validity of the findings.

A hydraulic conductivity range of $7.5 \times 10^{-6} \text{ m/s}$ to $2 \times 10^{-8} \text{ m/s}$ was determined for the low permeability aquitard layer characterised as organic silt with low plasticity. This range was produced from calibrated hydrogeological modelling at the nearby Collins Road investigation (Earthtech, 2025) and testing completed by WGA at the nearby Rotokauri Project (Table 3; WGA 2023). An assumed vertical hydraulic conductivity $4 \times 10^{-9} \text{ m/s}$ was adopted for modelling purposes.

2.5 Catchment Water Balance

2.5.1 Recharge

The shallow groundwater and surface water bodies of the catchment are predominantly recharged directly by local rainfall. Differences in the observed responses between the shallow and deep groundwater levels indicate that the deep aquifer has a direct connection with the rainfall influenced fluctuations in the nearby drain

A lysimeter has been installed and monitored at Ruakura, approximately 6.2 km northeast of the proposed development. Annual recharge (soil drainage) derived from the lysimeter dataset is generally in the range of 235 mm to 428 mm (A. Judge, AgResearch pers. comm. 3 February 2021). Given the proximity and similarity in climatic conditions, WGA considers groundwater recharge at the proposed site to be comparable to the Ruakura lysimeter. A recharge value at the lower end of the estimated range (250) was adopted for groundwater modelling purposes, to provide a conservative assessment of potential groundwater drawdown and associated dewatering effects.

Table 3: Hydraulic Conductivities of the Southern Block Area

MATERIAL NAME	HYDRAULIC CONDUCTIVITY RANGE (m/s)	HYDRAULIC CONDUCTIVITY ADOPTED FOR MODELLING (m/s)
Unsaturated zone Hinuera Formation ⁽¹⁾	$1.27 \times 10^{-06} - 1.43 \times 10^{-04}$	2.5×10^{-05}
Upper Interbedded loose to dense sands and firm to very stiff silts Hinuera Formation ⁽²⁾	$1.25 \times 10^{-04} - 1.83 \times 10^{-04}$	
Low permeability aquitard layer. Organic silt with low plasticity. Hinuera Formation ^(3,4,5)	$7.5 \times 10^{-06} \text{ (4)} - 2 \times 10^{-08} \text{ (3)}$	$K_h = 2 \times 10^{-08}$ $K_v = 4 \times 10^{-09} \text{ (5)}$
Lower Interbedded loose to dense sands and firm to very stiff silts Hinuera Formation ⁽²⁾	$8.75 \times 10^{-05} - 1.03 \times 10^{-03}$	4×10^{-04}

Notes: (1) Range derived from CMW soakage tests (1 - 1.7m deep) considered to underestimate the hydraulic conductivity of the unit (CMW, 2026).

(2) Average derived from WGA aquifer hydraulic slug testing is considered to underestimate the hydraulic conductivity of the unit (Appendix B)

(3) Derived through separate investigations by WGA (2023). Assessed from the testing of unit 2b Hinuera Formation: Soft to firm SILT, some organics, low plasticity

(4) Earthtech (2025) value used for hydrogeological modelling of the local confining unit.

(5) K_v (vertical hydraulic conductivity) = K_h (horizontal hydraulic conductivity)/5 = $2 \times 10^{-08}/5$

2.5.2 Groundwater and Surface Water Flow Paths

Groundwater within the Mangakōtukutuku catchment is closely connected to surface water bodies, providing sustained flow to nearby drains, wetlands, and streams. In the upper catchment, which is characterised by rural land use and peat-rich soils, infiltrating rainfall that then flows to drains provides baseflows to surface water features. This groundwater–surface water interaction controls local groundwater flow paths and underpins the maintenance of baseflows through the catchment, ultimately contributing to flows in the Waikato River.

Groundwater levels have been measured and monitored by WGA and CMW at the Site. Site observations and an array of geotechnical investigations undertaken in the area between 2011 and 2025 were used to estimate a preliminary winter piezometric surface (Figure 7). WGA notes that much of the geotechnical groundwater data used to produce the piezometric surface does not align temporally. Consequently, the surface created is based on our interpretation of the data and general understanding of the site's hydrogeological setting. Interpreted groundwater flow directions discharges to local drains and the headwaters of the Mangakōtukutuku Stream.

2.5.3 Groundwater Levels

Groundwater levels were recorded by WGA manually from the installed piezometers on 18 July 2025 (Table 4). Measurements from the deeper piezometers indicate the aquifer underlying the thin organic silt layer is confined, with recorded groundwater levels being above the low permeability aquitard described in Section 2.3.3. Water level measurements were made by CMW at numerous investigation sites in April 2025. Recorded groundwater level measurements ranged from 1.7 to 5.5 m bgl (refer to Table A1 in Appendix A).

Table 4: Manual Static Water Level Measurements in Each Piezometer (18 July 2025)

PIEZOMETER	STATIC WATER LEVEL (m bgl)	STATIC WATER LEVEL (m RL)	TOP OF AQUITARD LAYER (m RL)
P1	2.38	37.80	36.39
P2S	3.43	38.10	36.56
P2D	3.88	37.70	36.56
P3	2.07	37.90	36.32
P4	1.42	38.40	37.53

Downhole continuous groundwater level monitoring was installed in all five piezometers to record fluctuations between dry and wet periods from July 2025 to January 2026. The continuous monitoring also confirmed the confined nature of the aquifer beneath the low permeability aquitard layer (Figure 10; P1, P2D, P3 and P4), compared to the aquifer responses observed in the shallower P2S.

The shallower P2S aquifer shows only small water table fluctuations in response to rainfall. The strong groundwater level fluctuations exhibited in the deeper bores (Figure 10; P1, P2D, P3 and P4) indicate the confined aquifer is directly connected to the nearby drains. Water level responses in these drains to storm events cause similar responses in the confined aquifer, as recorded in the deep piezometers. This interpretation aligns with the observation that the drain is groundwater fed. Figure 11 shows the discolouration of the drain water due to oxidation of dissolved iron carried in groundwater discharges.

The maximum groundwater level height experienced during monitoring at Southern Block was 38.73 mRL in the southernmost piezometer, P4. During the summertime, levels dropped as low as 36.96 mRL in the northernmost piezometer, P1.

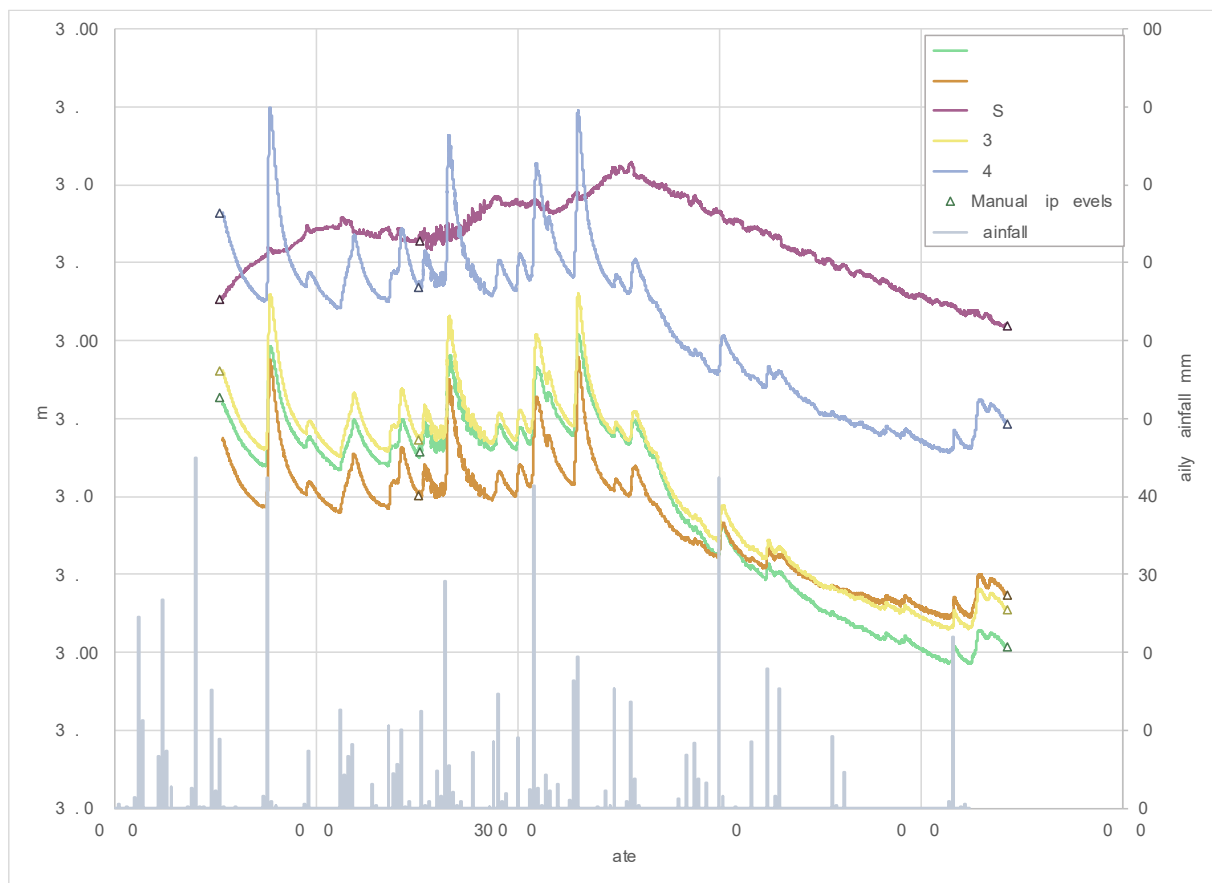


Figure 10: Southern Block Piezometer Groundwater Level Responses to Rainfall



Figure 11: Discolouration in Drain Due to Iron Oxidation from Groundwater Discharge

2.6 Surrounding Groundwater Users

Water supply bores (as listed in Appendix A) and groundwater abstraction consents within one kilometre of the Site are shown in Figure 12, with the consents summarised in Table 5. At the time of writing, according to the WRC consents database, there are five groundwater abstraction consents within one kilometre of the Site. Of these, two are related to agricultural supplies. The remaining three are related to dewatering activities that are considered to be 'zero' net takes. The two consents related to agriculture are upgradient of the proposed Site activities (south of the Site).

Table 5: Nearby Groundwater Takes

CONSENT NUMBER	USER	PERMITTED VOLUME (m ³ /day)	PURPOSE
AUTH125828.01.01	Golden Valley Farm Limited	28	Agricultural farming - dairy
AUTH140970.01.01	The land Tahi Farm Group Limited AgVice Limited (Holders' Representative)	66	Agricultural farming - dairy
AUTH145510.01.01 and AUTH145510.02.01	Hamilton City Council AECOM New Zealand Limited (Auckland) (Holders' Representative)	0 (Zero net take)	Land development (Dewatering)
AUTH147036.01.01	Hamilton City Council Potentialis Limited (Holders' Representative)	0 (Zero net take)	Waste treatment/disposal (Dewatering)

3 DRAWDOWN EFFECTS OF STORMWATER WETLANDS

3.1 Introduction

The proposed Stormwater Wetlands are designed to intersect the existing groundwater levels. WGA has modelled the drawdown effects of the proposed Stormwater Wetlands using analytical methods, drawing on parameters from on-site testing (Section 2.4) and the Southern Block design provided by Maven (Drawing no. R1-C440 Rev C). The analytical pit modelling was used to identify drawdown impacts of the Stormwater Wetlands extending to neighbouring properties and the drains of the Mangakōtukutuku stream headwaters, which could potentially be affected.

WGA has depicted monitored high and low groundwater levels on Maven Drawing no. R1-C440 Rev C, included in Appendix C. Maven has verified that stormwater soakage is not required as a component of the wetland function. Furthermore, the operational “permanent” water levels in the wetlands are below the existing surrounding groundwater levels. Therefore, groundwater mounding is not expected to occur as a result of the Stormwater Wetland operations.

3.2 Analytical Pit Modelling Methodology for Stormwater Wetlands

An assessment of potential groundwater inflows to each of the planned Stormwater Wetlands within Southern Block has been undertaken using a published method of estimating groundwater inflows to open-cut pits (Marinelli & Niccoli 2000). This methodology uses analogue equations to approximate horizontal groundwater inflows through the sides of the pit and vertical groundwater inflows through the floor of the pit (Appendix D).

The equations used by this methodology assume laterally radial groundwater flows toward a circular pit. In applying this methodology to the proposed Stormwater Wetlands, their layouts needed to be simplified by converting them to equivalent circular ponds. This has been done by taking the full footprint area of each wetland, including forebays and rain gardens, assuming the area is circular and calculating the radius of the “equivalent” area. The effective radii for the wetlands derived using this “equivalent” calculation are presented in Table 6.

Table 6: Inputs for Pit Models Representing Each of the Stormwater Wetlands

STORMWATER WETLAND NUMBER	EXISTING GROUND ELEVATION (mRL) ⁽¹⁾	EXISTING WINTER GROUNDWATER LEVEL (mRL) ⁽²⁾	DESIGN PERMANENT WATER ELEVATION (mRL) ⁽³⁾	DESIGN INVERT ELEVATION (mRL) ⁽¹⁾	DESIGN EXCAVATION DEPTH (m)	DESIGN AREA AT RIM FLOW ELEVATION (m ²) ⁽¹⁾	EFFECTIVE RADIUS AT OVERFLOW ELEVATION (m) ⁽⁴⁾
A	41.74	38.57	37.50	37.00	4.74	8,700	53
B	39.95	38.57	37.40	36.90	2.69	4,200	37
C	39.74	38.57	37.40	37.35	2.39	6,700	46
D	39.74	38.75	37.95	37.48	2.26	5,000	40
E	41.02	38.75	37.90	37.46	3.56	4,350	37
F	40.24	39.20	38.80	38.40	1.84	3,400	33

Notes: (1) Existing and deepest design levels provided by Maven Ltd (Appendix C)
(2) 38.57 mRL (P2S, 28/10/2025). 38.75 mRL (P4, 30/07/2025). 39.20 mRL (Level recorded in CMW CPT)
(3) As provided by Maven Ltd (M. Shon, pers. comm., 6 March 2026)
(4) Assuming ponded area is treated as a circle

For long-term scenarios, the Stormwater Wetlands have been modelled with an operational 'pit lake' representing the permanent water level. To assess inflows during the construction phase, the base of the Stormwater Wetland has been modelled as dry. Both models used surrounding winter groundwater levels as the starting conditions to identify peak inflow rates. For those wetlands near existing housing or buried infrastructure, an additional scenario has been run using summer groundwater levels as the starting conditions. The drawdowns derived from this summer drawdown assessment are intended to inform ground settlement calculations.

3.3 Results

3.3.1 Drawdown Effects of Stormwater Wetlands on Groundwater

The projected drawdown effects have been modelled for each of the Stormwater Wetlands, (as detailed in Appendix D) and the results summarised in Table 7. The groundwater inflows (groundwater abstraction during construction) at each of the Stormwater Wetlands have been calculated assuming the drawdowns generated by each of the wetlands do not intersect during individual construction. The radius of groundwater drawdown influence and the groundwater inflows are presented separately for construction (dry pit) and for long-term (operational permanent water level) effects in Table 7.

Maps identifying long-term (operational Stormwater Wetland permanent water level) effects on groundwater drawdown contours are provided in Appendix E, with the 'de-minimis' contour being defined as 0.25 m drawdown. Drawdown below that magnitude is considered to be effectively indistinguishable from natural fluctuations. Drawdown assessments were conducted using winter groundwater levels to provide a conservative estimate of inflows. Drawdown contours do not intersect hydraulic boundaries such as the farm drains and streams, with the exception of the drain currently between Stormwater Wetland B and C, which WGA understands from Maven will be removed. This drain will be filled with soil and existing flows will be diverted via 825 mm pipe (M. Shon, pers. comm., 17 March 2026).

In addition, summer groundwater level scenarios were simulated for Stormwater Wetlands A and B to demonstrate how seasonality affects drawdown results. These Stormwater Wetlands were chosen for the summer scenarios because they are located close to existing residences. For Stormwater Wetland A, drawdown impacts at the nearest building reduce from 1.06 m in winter to 0.45 m in summer. Wetland B shows a similar pattern, with drawdown impacts at the nearest building reducing from 0.91 m in winter to 0.31 m in summer. The accompanying drawdown contour figures (Appendix E) illustrating this difference. The larger drawdown beneath housing in winter includes approximately 0.6 m attributed to the existing seasonal variance in natural groundwater levels. If required, ground settlement assessments should be undertaken based on the summer drawdown scenarios.

3.3.2 Drawdown Effects of Stormwater Wetlands on Surface Water

Stormwater Wetlands D and E are expected to temporarily cause stream depletion effects during construction due to their design base levels being lower than the surveyed bed level of the adjacent farm drain (Table 8). Groundwater that would otherwise discharge to the drain is captured by construction dewatering. To manage this effect, it is anticipated and recommended that groundwater inflows intercepted during construction be discharged back to the receiving drain upstream of the planned works. This approach maintains surface water flows and mitigates depletion effects during the construction period.

Interception of shallow groundwater contributions to the neighbouring drains/stream baseflow is also anticipated during construction of the remaining Stormwater Wetlands. However, to a lesser extent, because the remaining Stormwater Wetlands do not extend deeper than the drains/stream (Table 8). Any intercepted groundwater from these works can likewise be temporarily diverted back to the local drainage network or stream.

Table 7: Projected Effects of Proposed Stormwater Wetlands

STORMWATER WETLAND	SCENARIO	INITIAL SATURATED THICKNESS ABOVE BASIN BASE (m)	RADIUS OF DRAWDOWN INFLUENCE (m) ^(1,2)	CALCULATED GROUNDWATER INFLOW (m ³ /day) ⁽²⁾	DRAWDOWN AT NEAREST BUILDING (m)	DISTANCE TO NEAREST BUILDING (m)
Wetland A	Winter Construction Dry	1.57	90	5,361	1.06	8
	Summer Construction Dry	1.04	15	3,434	0.45	
	Winter Permanent Level	1.57	80	3,703	0.87	
	Summer Permanent Level	1.04	10	1,789	0.30	
Wetland B	Winter Construction Dry	1.67	89	4,000	0.91	15
	Summer Construction Dry	1.14	17	2,617	0.31	
	Winter Permanent Level	1.67	80	2,876	0.78	
	Summer Permanent Level	1.14	12	1,474	0.22	
Wetland C	Winter Construction Dry	1.22	60	3,648	0.05	133
	Winter Permanent Level		59	3,504	0.05	
Wetland D	Winter Construction Dry	1.27	60	3,284	0.00	200
	Winter Permanent Level		49	2,100	0.00	
Wetland E	Winter Construction Dry	1.25	57	3,018	0.00	250
	Winter Permanent Level		49	2,080	0.00	
Wetland F	Winter Construction Dry	0.80	25	1,702	0.00	420
	Winter Permanent Level		12	869	0.00	

Notes: (1) Radius of influence considered to be 0.25 m drawdown

(2) Drawdown extents and inflows do not take account of changes in permeability such as Walton Subgroup sediments underlying the Hinuera Formation

Table 8: Existing and Design Elevations of Stormwater Wetlands Compared to Neighbouring Stream/Drain Heights

STORMWATER WETLAND	EXISTING GROUND ELEVATION (mRL) ⁽¹⁾	DESIGN INVERT ELEVATION (m RL) ⁽¹⁾	DESIGN EXCAVATION DEPTH (m)	DESIGN PERMANENT WATER ELEVATION (mRL) ⁽²⁾	STREAM/DRAIN INVERT (mRL)	DEPTH FROM DESIGN INVERT TO STREAM/DRAIN INVERT (m)
A	41.74	37.00	4.74	37.50	36.67	0.33
B	39.95	36.90	2.69	37.40	35.85	1.05
C	39.74	37.35	2.39	37.40	36.67	0.68
D	39.74	37.48	2.26	37.95	37.70	-0.22
E	41.02	37.46	3.56	37.90	37.70	-0.20
F	40.24	38.40	1.84	38.80	37.83	0.57

4 DRAWDOWN EFFECTS OF WASTEWATER INFRASTRUCTURE

4.1 Introduction

WGA has modelled the drawdown effect of the dewatering required for the construction of two proposed wastewater pump stations and the associated wastewater pipeline network. The modelling used hydrogeological parameters from on-site testing (Section 2.4) and the updated design provided by Maven (Drawing no. R1-C440 Rev C).

Dewatering is not required in association with the installation of the proposed water supply pipeline. Design information provided by Maven (pers. comm. 27 May 2026) advises that the pipeline will be above the groundwater level.

4.2 Drawdown Effects of Wastewater Pump Station Installation

4.2.1 Construction

Two wastewater pumping stations (WWPS) are planned for construction: “S A” located on the northern boundary and “S B” centrally positioned within the development (Figure 2). The engineering design team has provided an outline of the proposed WWPS designs (Appendix F).

Earthworks associated with the wastewater pumping stations involve excavations below the groundwater table and beneath the confining aquifer's low permeability aquitard layer. The wet wells' depth necessitates specialised construction techniques to minimize excavation size and the groundwater dewatering required. In accordance with environmental regulations and guidelines, the contractor is required to implement erosion and sediment control measures as stipulated by the Waikato Region Standard TR2009/02.

The schedule for the construction of these pumping stations remains undetermined at this stage. For the purposes of this assessment, it is assumed that installation of the wet well and related infrastructure will require 10 days. Therefore, dewatering has been modelled to be achieved within 15 days.

Due to the position of the low permeability aquitard layer within the wet well excavation, this determines that the disconnected shallow aquifer and deep aquifer are both required to be dewatered. To achieve this, a combination of top-down and bottom-up dewatering methods is anticipated. Assessments assume the use of a sheet pile wall to support each excavation. A dewatering bore situated outside the sheet pile wall is to be employed to facilitate dewatering beneath the low permeability aquitard layer. Additionally, a surface water pump may be utilized during earthworks to temporarily lower shallow groundwater levels, where necessary, ensuring safe and efficient excavation above the low permeability aquitard layer. The sheet pile wall is expected to reduce horizontal groundwater inflows from the shallower aquifer.

Groundwater dewatering is not required for earthworks associated with the pump station pipework, as these excavations are above the groundwater table.

4.2.2 Dewatering for Wet Well Installation

As described above, excavation for the installation of each wet well is expected with the following dimensions:

- **WWPS A** will require a 2.5 m width and 6.6 m depth for wet well installation beneath the aquitard.
- **WWPS B** will require a 2.5 m width and 6.2 m depth for wet well installation beneath the aquitard.
- Any further excavations required for WWPS infrastructure do not appear to extend beneath the aquitard with the design information provided (Appendix F). Excavations for WWPS infrastructure can be dewatered with similar volumes as the trenching dewatering excavations described in Section 4.3.

It is assumed that the excavation will be completed and the walls of the wet well sealed within a maximum of 10 days. The wet well excavation will intersect the confined aquifer. An assessment applying the Hunt and Scott (2007) solution for pumped drawdown in a two-aquifer system has been used to assess the drawdown effects of the excavation.

Due to the limited area of the excavation, it is expected that one bore is sufficient to achieve the required dewatering for wet well construction. Multiple bores may be used for dewatering, but for modelling purposes, using one bore is a reasonable assumption. A number of hydraulic tests and drillhole logs are available in the area, and aquifer transmissivities have been derived from hydraulic conductivity values from on-site testing (Section 2.4). Table 9 presents the hydraulic parameters applied to each drawdown assessment. A period of 15 days of dewatering was modelled to allow for delays over the planned duration of the works.

Table 9: Input Parameters for Hunt and Scott Assessment of Dewatering WWPS A and WWPS B

INPUT PARAMETER	WWPS A	WWPS B
Transmissivity in pumped confined aquifer	192 m ² /day Based on an aquifer thickness of 5.55 m at WWPS A and K value of 34.56 m/day (Table 3)	501 m ² /day Based on an aquifer thickness of 14.49 m at WWPS B and K value of 34.56 m/day (Table 3)
Storativity of pumped aquifer	0.001 Typical of a semi-confined aquifer in the Hinuera Formation	
Transmissivity in overlying aquifer	4.71 m ² /day Based on an aquifer thickness of 2.18 m and a K value of 2.16 m/day (Table 3)	1.0152 m ² /day Based on an aquifer thickness of 0.47 m and a K value of 2.16 m/day (Table 3)
Specific yield in overlying aquifer	0.2 Value for sandy material as described in the Castlegrace Farms bore log (Heath, 1983).	
Aquitard thickness	0.2 m (thickness of layer in piezometer P1, Appendix A).	0.2 m (thickness of layer in piezometer P4, Appendix A).
Vertical hydraulic conductivity for the aquitard	3.46 x 10 ⁻⁴ m/day (Table 3)	
Starting groundwater level	3.82 m bgl (38.02 mRL from P1)	1.05 m bgl (38.74 mRL from P4)
Target drawdown required to dewater 0.5 m below excavation	3.28 m	5.65 m

4.2.2.1 Deep Dewatering Results

Results of the Hunt and Scott analysis are shown in Figure 13 and Figure 14.

The WWPS A analysis indicates that pumping from a bore at a rate of 10.5 L/s (907 m³/day) will achieve a drawdown in the confined aquifer of 3.28 m at a distance of 5 m from the pumped bore. Provided the bore was positioned alongside the wet well, this drawdown would enable the excavation to be undertaken while maintaining a dry floor (Table 9). After 15 days pumping at this rate the area of influence (drawdown of 0.25 m) extends 412 m from the pumping bore within the confined aquifer. Drawdown in the overlying unconfined aquifer reaches 0.25 m at 19 m from the pumped bore.

The WWPS B analysis indicates that pumping from a bore at a rate of 42.4 L/s (3,661 m³/day) will achieve a drawdown in the confined aquifer of 5.65 m at a distance of 5 m from the pumped bore. Provided the bore was positioned alongside the wet well, this drawdown would enable the excavation to be undertaken while maintaining a dry floor (Table 9). After 15 days pumping at this rate the area of influence (drawdown of 0.25 m) extends 854 m from the pumping bore in the confined aquifer and 107 m in the overlying unconfined aquifer.

A notes that the aquifer described as 'confined' is technically 'semi-confined' due to the confining layer being leaky. However, for simplicity, the lower aquifer is described in this report as confined.

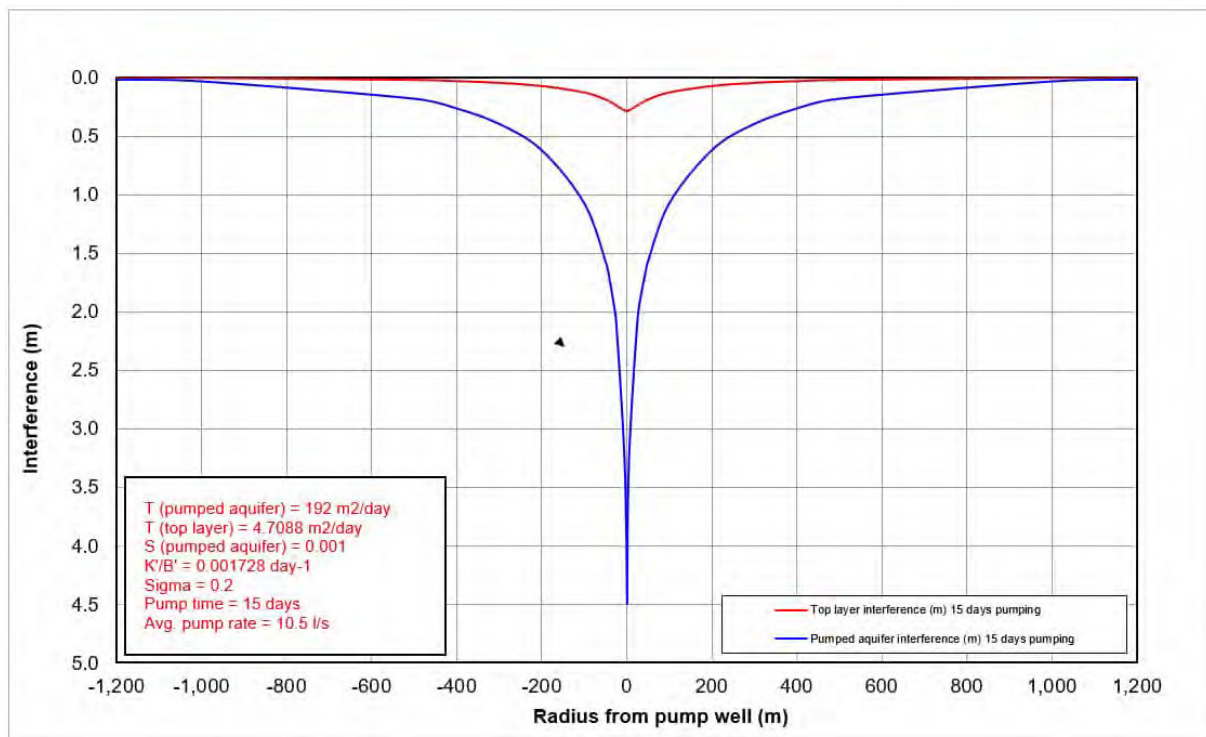


Figure 13: Projected Drawdown in confined and unconfined Aquifers Following Dewatering of Wet Well Excavation WWPS A

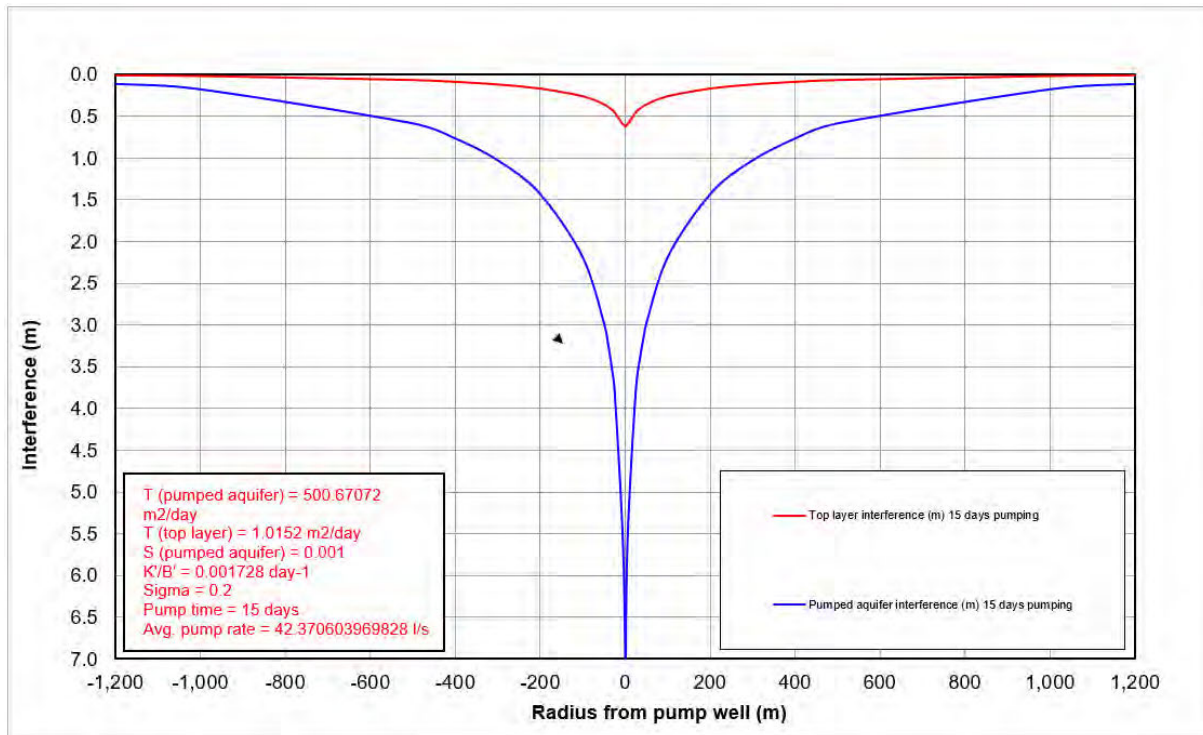


Figure 14: Projected Drawdown in confined and unconfined Aquifers Following Dewatering of Wet Well Excavation WWPS B

4.2.3 Shallow Aquifer Dewatering During Wet Well Excavation

If construction of the wet well is undertaken using a technique that requires dewatering of the unconfined aquifer until the excavation reaches the confining layer, temporary dewatering of the aquifer may be required to support the excavation process. This dewatering would result in a direct drawdown of the groundwater table. For completeness, an assessment has been undertaken to estimate how much water would flow into this excavation and therefore, require pumping. The extent of the consequent drawdown in the unconfined aquifer has been estimated from these assessments. The modelling has a conservative assumption that the dewatering method leads to floor heave within the excavation and consequent unhindered flows upward from the underlying confined aquifer.

The shallower excavation dewatering has been assessed using the published method of estimating groundwater inflows to open-cut pits (Marinelli & Niccoli 2000), as was applied to the assessment of the Stormwater Wetland dewatering in Section 3. The pit model accounts for two zones of inflow, the upper zone being Zone 1 and the lower being Zone 2, with a no flow boundary between them at a level equivalent to the position of the confining layer. The hydraulic conductivity for the Upper Hinuera Formation has been applied to Zone 1 and Lower Hinuera Formation to Zone 2 (as described with modelling parameters in Table 3). The input parameters for the pit models are shown in Figure 15 and Figure 16. The highest recorded localised groundwater level was used for the assessment.

The pit dewatering model applied in this assessment functions on a steady-state basis, which means the equations used apply for permanent dewatering. As the wet well construction process is expected to require only a few days, the extent of the zone of influence calculated using this methodology is conservatively large.

The pit model assumes Zone 2 is infinite in depth. However, according to lithological logs from local bores, this aquifer is between 5.5 m and 14.5 m thick (for WWPS A and WWPS B, respectively). Therefore, inflows from Zone 2 may be overestimated in the modelling.

The results of the pit dewatering modelling are summarised in Table 10.

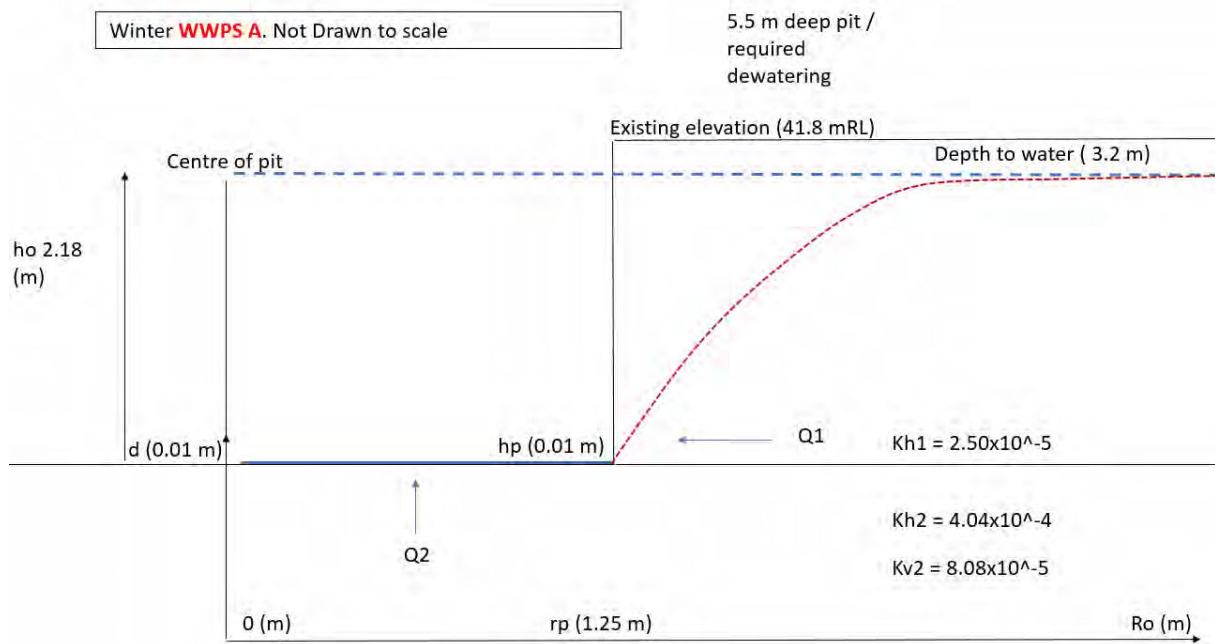


Figure 15: Inputs for Pit Model Assessing Potential Dewatering of Unconfined Aquifer of Planned WWPS A Installation

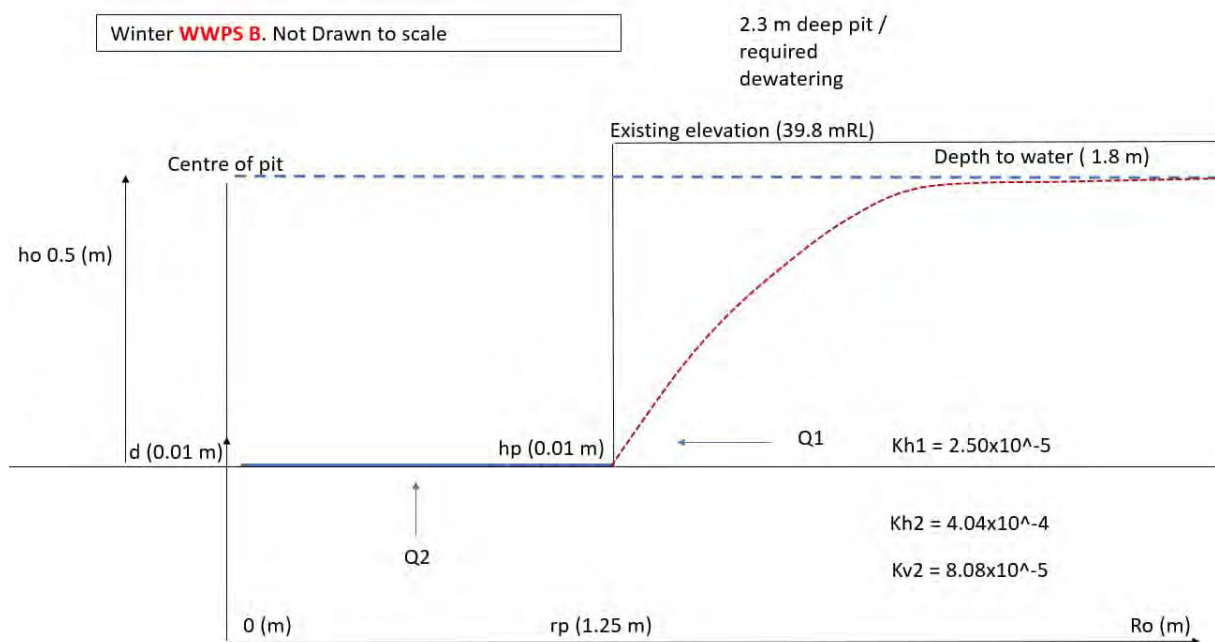


Figure 16: Inputs for Pit Model Assessing Potential Dewatering of Unconfined Aquifer of Planned WWPS B Installation

Table 10: Projected Effects of Wet Well Excavation Through Upper Aquifer Only

SITE	DEPTH TO GROUNDWATER (m)	INITIAL SATURATED THICKNESS ABOVE BASIN BASE (m)	RADIUS OF INFLUENCE (m) ⁽¹⁾	CALCULATED GROUNDWATER INFLOW (m ³ /day)	DISTANCE TO NEAREST BUILDING (m)	DRAWDOWN AT NEAREST BUILDING (m)
WWPS A	3.2	2.18	20	179	8	0.59
WWPS B	1.8	0.51	2.2	40	15	0

Notes: 1) Radius of influence is considered to be defined by 0.25 m drawdown

4.3 Drawdown Effects of Wastewater Pipeline Trenching

4.3.1 Wastewater Pipeline Modelling Methodology

The construction of the planned wastewater pipeline network requires the excavation of trenches below the water table, with the requirement that these trenches are maintained in a dry state until backfilling starts. WGA understands that the wastewater pipeline is likely to be constructed in 20 m sections, and that each section will be completed within a period of 10 days (M. Shon pers. comm., 24 March 2026). This has been used as the basis of the groundwater drawdown and inflow modelling. The trench excavation depths have been provided by Maven to WGA (version 16 March 2026).

An analytical modelling approach for the wastewater pipeline was used to calculate temporary groundwater drawdown curves and expected inflows to the trenches. The analytical model used equations from McWhorter and Sunada (1977), which estimate transient drawdown and groundwater inflows into trenches.

WGA understands that the wastewater pipelines will be constructed at varying depths throughout the Site. As hydraulic conductivity varies with depth at the Site, WGA has completed two worst case scenarios for consideration of drawdown effects:

1. A section of 20 m pipeline trench on the northern residential boundary of the site, requiring temporary dewatering in the upper Hinuera formation, above the low permeability aquitard layer.
2. A section of 20 m pipeline in one of the deepest pipeline trenches located centrally in the Site, requiring temporary dewatering in the lower Hinuera formation, below the low permeability aquitard layer.

The differing hydraulic conductivities for the upper and lower Hinuera Formations (Section 2.4) are applied to reflect the different dewatering aquifer depths of the wastewater pipeline trench (Table 11).

For these models, WGA has assumed that the trenching for the wastewater pipeline will occur during the summer. Tabulated drawdown scenarios and dewatering rates for winter have been provided for comparison.

Table 11: Input Parameters for Wastewater Pipeline Analytical Modelling

WASTEWATER PIPELINE	HYDRAULIC CONDUCTIVITY (m/s)	AQUIFER SPECIFIC YIELD	NUMBER OF DAYS TRENCH OPEN	RECHARGE (mm/year)	TRENCH DRAWDOWN REQUIRED (m)
Wastewater Pipelines on the Edges of the Site Summer	2.5×10^{-5}	0.25	10	250	1.44
Wastewater Pipelines at the Centre of the Site Summer	4.04×10^{-4}	0.25	10	250	1.27
Wastewater Pipelines on the Edges of the Site Winter	2.5×10^{-5}	0.25	10	250	1.97
Wastewater Pipelines at the Centre of the Site Winter	4.04×10^{-4}	0.25	10	250	2.38

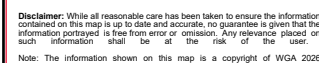
4.3.2 Wastewater Pipeline Analytical Modelling Results

Projected drawdown from the wastewater pipeline trenches is summarised in Table 12, Figure 18 and Figure 19. Projected groundwater inflows are shown in Figure 20 and Figure 21.

Table 12: Projected Distance of Influence

WASTEWATER PIPELINE	DISTANCE OF INFLUENCE (m)
Wastewater Pipelines on the Edges of the Site Summer	73
Wastewater Pipelines at the Centre of the Site Summer	250
Wastewater Pipelines on the Edges of the Site Winter	83
Wastewater Pipelines at the Centre of the Site Winter	330

Note: Distance of influence considered to be defined at 0.25 m drawdown.



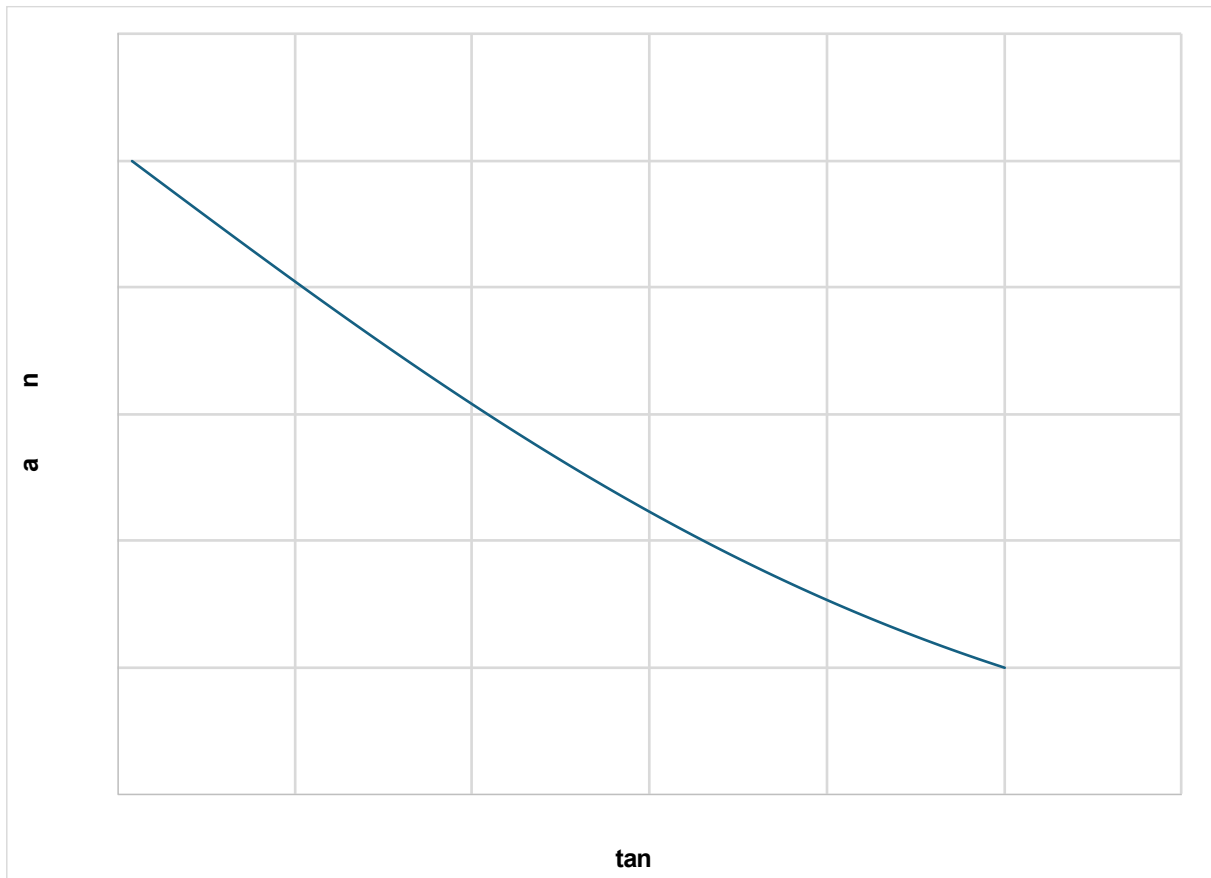


Figure 18: Projected Drawdown from Wastewater Pipelines at the Centre of the Site During Summer

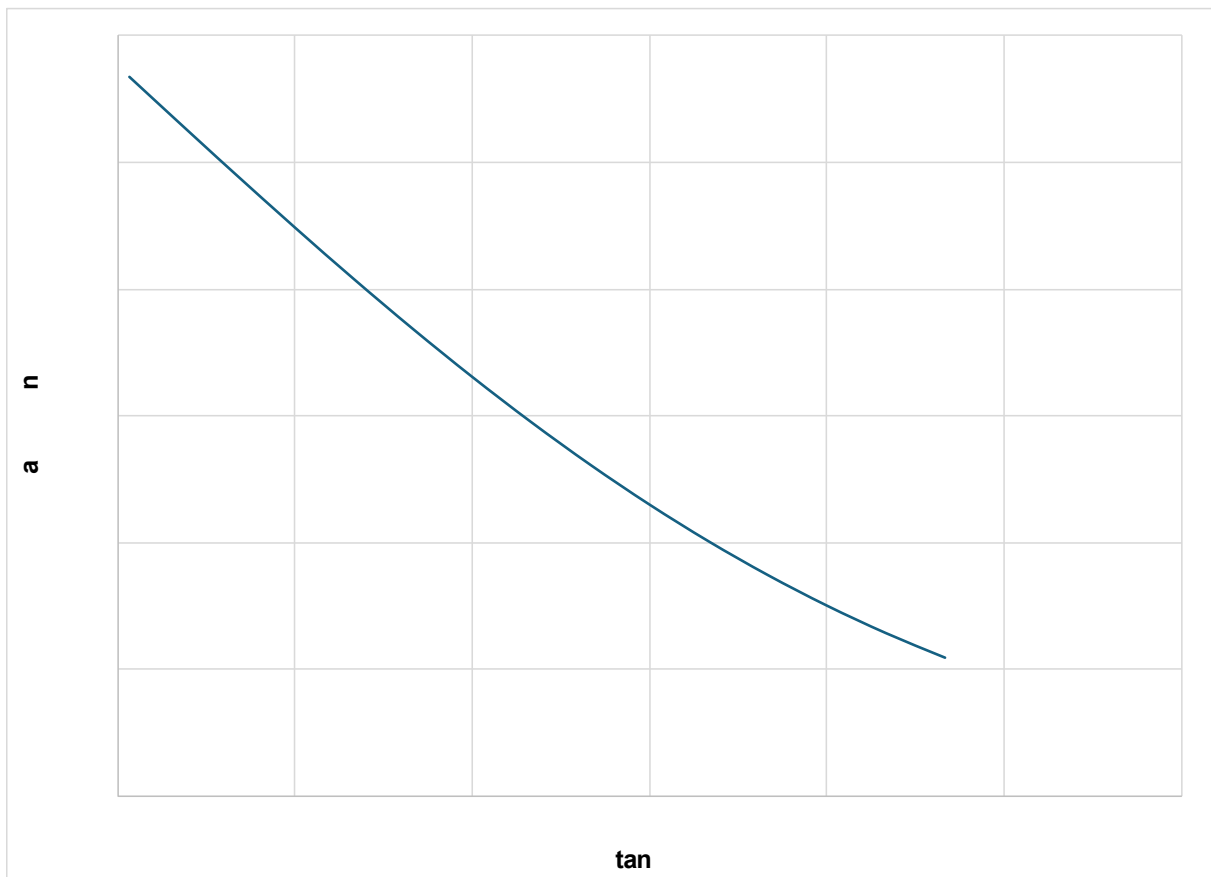


Figure 19: Projected Drawdown from Wastewater Pipelines at the Edges of the Site During Summer

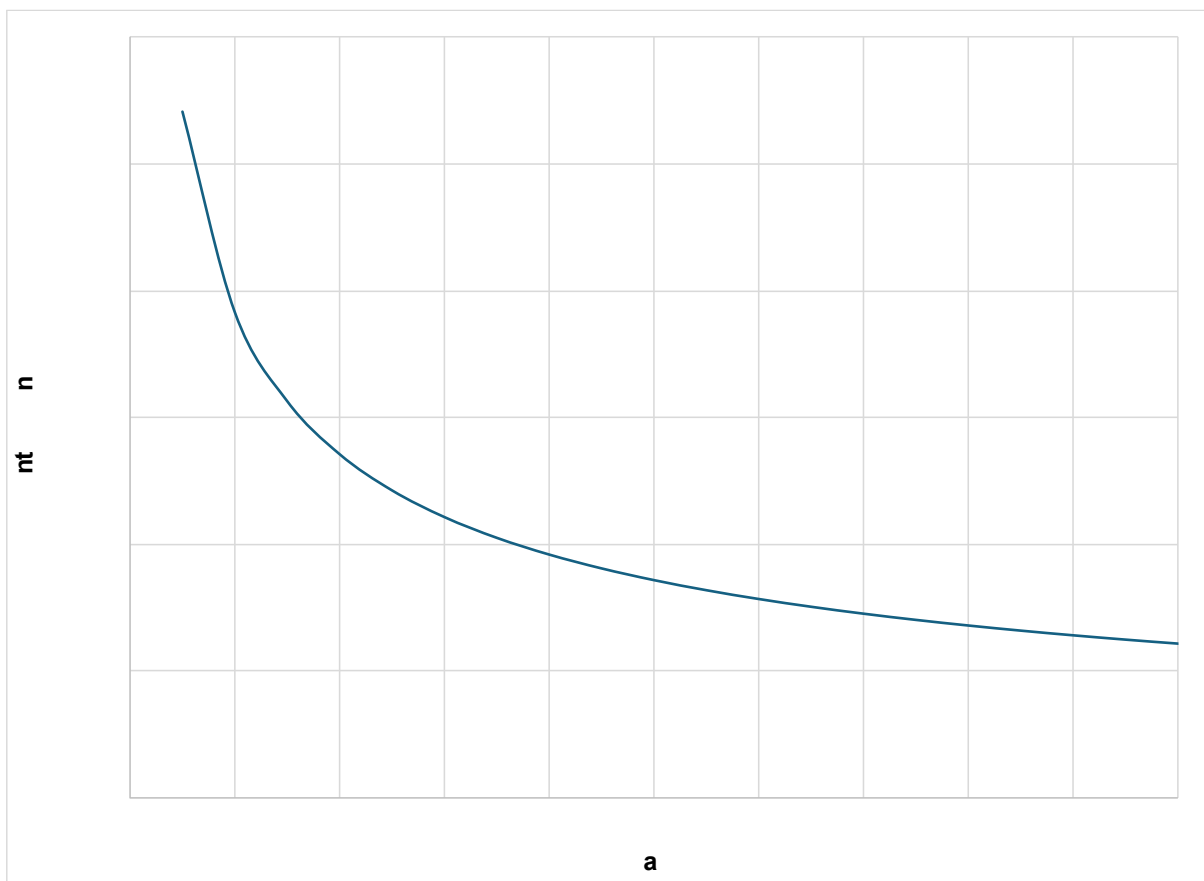


Figure 20: Projected Groundwater Inflows Over Time into a 20 m Trench at the Centre of the Site During Summer

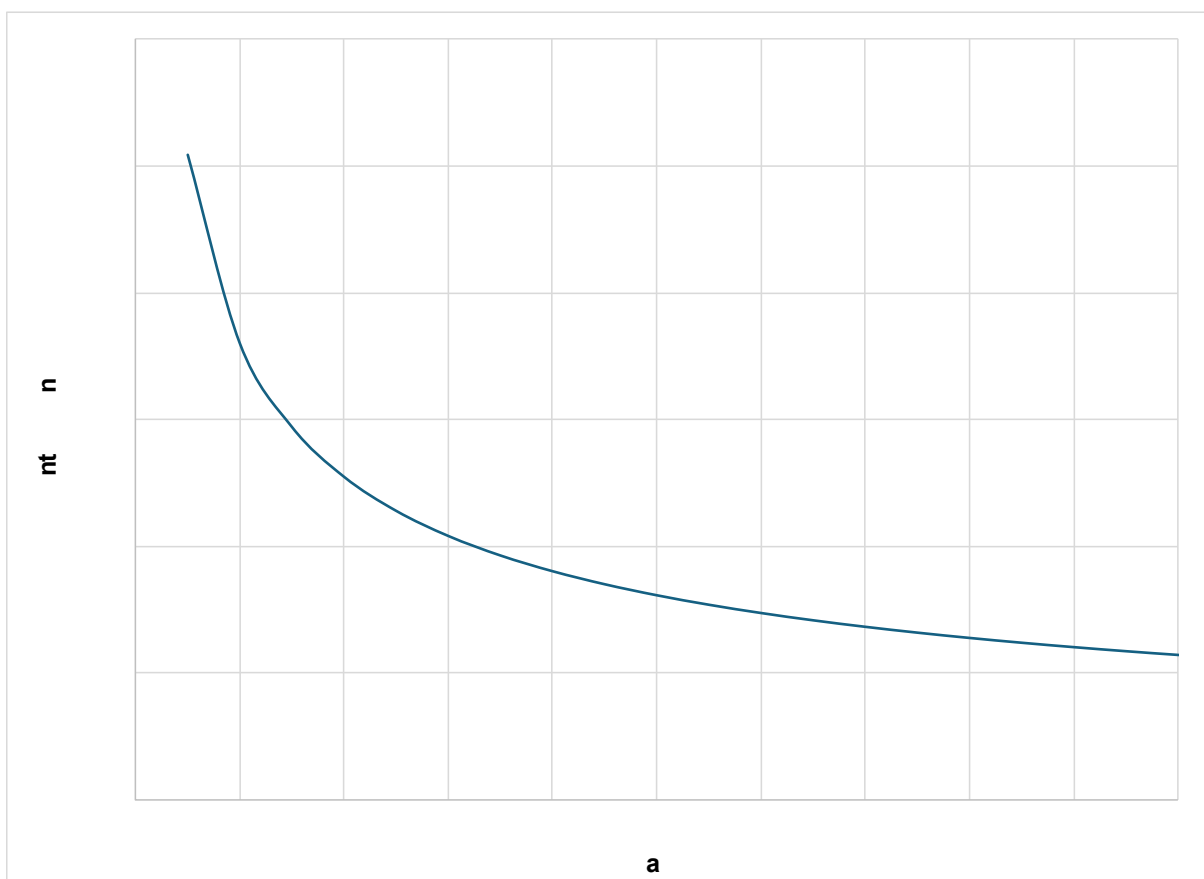


Figure 21: Projected Groundwater Inflows over Time into a 20 m Trench at the Edges of the Site During Summer

5 GROUNDWATER EFFECTS ASSESSMENT

5.1 Effects Overview on Catchment Water Balance

The proposed development is located within the upper Mangakōtukutuku catchment, where the catchment's hydrology is characterised by strong interaction between groundwater and surface water features. The groundwater contributes flows to drains; natural wetlands, and headwater stream reaches (as described in Section 2.5). This connectivity influences local groundwater flow paths and supports the persistence of flow through the catchment.

The proposed activity has two main groundwater-related components that have the potential to influence the catchment water balance (Figure 22):

1. Short-term temporary dewatering during construction of the Stormwater Wetlands and wastewater infrastructure.
2. Long-term groundwater interception and diversion to the proposed Stormwater Wetlands, which will act as persistent hydraulic features within the developed catchment.

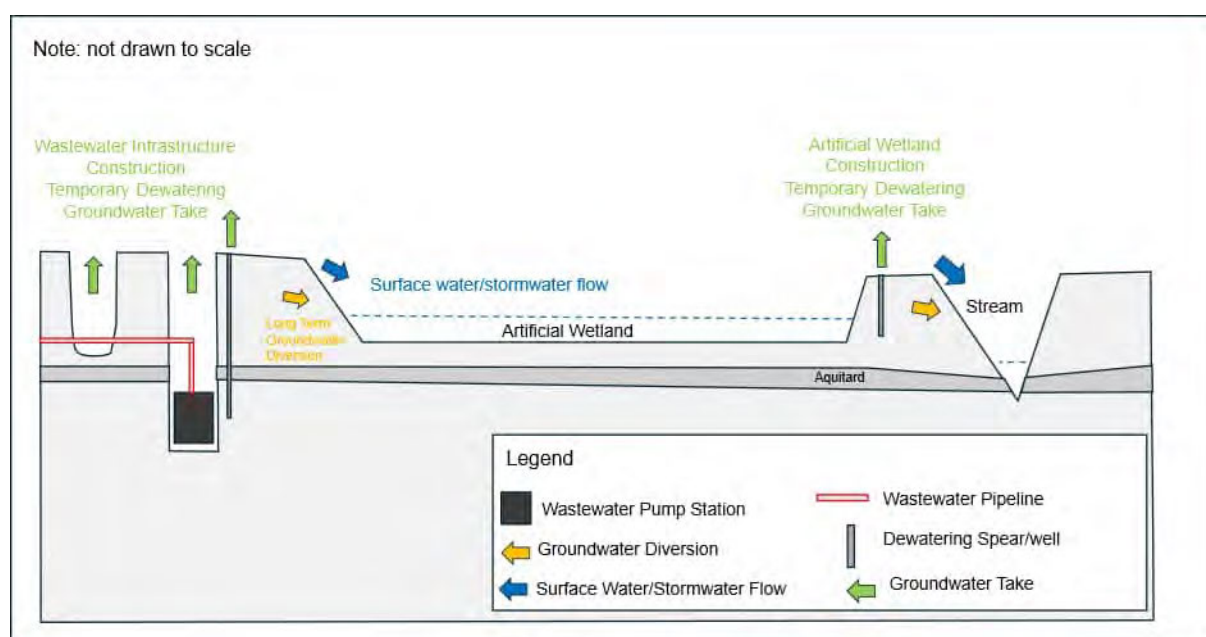


Figure 22: Conceptual Schematic of Water Flow Required and Induced by the Proposed Activity

The development represents a land use change from existing dairy farmland to residential. This land use change is expected to alter the way rainfall is divided between infiltration (recharge), evapotranspiration, and runoff. A typical residential development ratio for impervious/pervious land is approximately 70 % impervious and 30 % pervious. A similar ratio is anticipated across the Southern Block developed area (M. Shon pers. comm., 16 March 2026). Rainfall recharge is expected to reduce beneath impervious surfaces relative to the existing rural state, with a corresponding increase in runoff captured by the proposed stormwater management system (Figure 22).

In the long term, the Site water balance is expected to shift from predominantly distributed recharge and surface runoff toward a more managed regime, where a larger proportion of the rainfall is routed to engineered Stormwater Wetlands, stored within, and subsequently discharged to existing drains and the Mangakōtukutuku Stream. Because the catchment currently exhibits close groundwater–surface water connectivity, maintaining hydraulic continuity to headwater drains and wetlands is an important consideration in the design and staging of temporary dewatering activities.

5.2 Dewatering Effects Assessment

Stormwater Wetland construction is planned to be staged. The combined rate of groundwater abstraction during the construction phase is expected to vary as each wetland is excavated and brought online (Table 13). Based on current design and staging, the largest construction groundwater abstraction is expected to occur for Wetland A (**5,361 m³/day** during construction). Pumped groundwater (where required during construction) and diverted inflows will be managed under a water management plan and an erosion and sediment control plan for the project.

Table 13: Summary of Construction Dewatering Flow Rates and Operational Cumulative Groundwater Diversions

EXCAVATION TYPE	TOTAL INFLOW (WINTER) CONSTRUCTION (m³/day)	TOTAL INFLOW (WINTER) OPERATIONAL GROUNDWATER DIVERSION (m³/day)	CUMULATIVE OPERATIONAL GROUNDWATER DIVERSION (m³/day)
See Section 3			
Stormwater Wetland A	5,361	3,703	15,132
Stormwater Wetland B	4,000	2,876	
Stormwater Wetland C	3,648	3,504	
Stormwater Wetland D	3,284	2,100	
Stormwater Wetland E	3,018	2,080	
Stormwater Wetland F	1,702	869	
See Section 4.2			
WWPS A	907 (Deep Aquifer) + 179 (Shallow Aquifer)	N/A	
WWPS B	3,661 (Deep Aquifer) + 40 (Shallow Aquifer)		
See Section 4.3			
Shallow 20 m Trench for Wastewater Pipeline	< 153	N/A	
Deep 20 m Trench for Wastewater Pipeline	< 690		

Notes: Table 11 combines results from different groundwater assessment methods, including steady state and transient dewatering analyses. These values are not directly comparable and should be interpreted with reference to the relevant methodology in Sections 3 and 4. Those listed with "<" are the starting rates for dewatering analyses.

Wastewater infrastructure is planned to be constructed progressively, based on the installation of consecutive 20 m lengths of pipeline in similar dewatered trench sections. The WWPSs will be constructed separately, with construction schedules that will probably overlap the construction schedule for the pipelines. Based on the current design, the largest individual groundwater abstraction to enable for wastewater infrastructure construction is expected to occur for WWPS B (**3,661 m³/day**). Similarly, the largest abstraction for pipeline summer installation is expected to occur for the deepest section of pipe, at **690 m³/day**. Other sites with sandy aquifers have reported combined and overlapping trench dewatering rates of up to **1,500 m³/day** (Beca 2022), this upper range should be adopted as a conservative limit.

5.2.1 Effects on Nearby Bores

Of the surrounding groundwater users, there are only two current groundwater take consents within one kilometre of the Site (Table 5, Figure 12). The furthest radial extent of dewatering impacts from proposed Site activities assessed in this report is the 854 m extent of drawdown from WWPS B in Winter conditions. Neither of the two groundwater takes exists within this radius from WWPS B.

Of the existing groundwater bores within one kilometre of the Site, one bore may be impacted by drawdown during construction of WWPS B, during winter conditions of high groundwater levels (Section 0). Bore 70_501 is located 770 m from WWPS B. At this distance, it may experience up to 0.30 m of drawdown after 15 days of dewatering. As this drawdown effect would only apply during otherwise high groundwater conditions, the impact on water availability at Bore 70_501 is expected to be less than minor and within the range of annual groundwater level fluctuations.

There are no other drawdown effects, assessed in this report, that extend to nearby bores.

5.2.2 Effects on Nearby Surface Water Features

Where construction activities temporarily intercept groundwater that would otherwise discharge to local drains or the Mangakōtukutuku Stream, it is recommended that the intercepted groundwater be discharged back to the receiving drainage network upstream of the works. This measure maintains continuity of surface water flows and mitigates short-term stream depletion effects during construction. With these measures in place, no sustained reduction in surface water flows or substantial changes to downstream hydrology are expected. Overall effects on stream flows are assessed to be minor and temporary.

5.2.3 Effects on Natural Wetlands

Two natural inland wetlands have been identified within the site (EcoLogical Solutions Ltd, 2025). These include a small pasture wetland and a floodplain wetland associated with the Mangakōtukutuku Stream. The pasture wetland will be unavoidably removed as part of the proposed development. As a result, any effects of groundwater drawdown on this feature are not relevant to the construction or operational assessment.

The floodplain wetland is hydraulically connected to the Mangakōtukutuku Stream and is primarily supported by surface water runoff rather than local groundwater discharges. During construction at the Site, stream flows will be maintained. No sustained reduction in stream stage is anticipated as a result of groundwater drawdown. Water pumped during dewatering operations to support some components of Site construction can be discharged to this floodplain wetland to support the wetland water balance. If necessary, sediment removal systems can be implemented under an erosion and sediment control plan to manage the quality of the water discharged to the wetland.

Groundwater drawdown arising from construction operations is therefore not expected to alter the hydrological regime, extent, or ecological function of the floodplain wetland. Overall effects on natural wetlands are assessed to be minor and temporary.

5.2.4 Effects on Ground Subsidence

The effect of the “worst-case” drawdown associated with construction dewatering has the potential to induce ground subsidence, particularly where drawdown occurs within compressible near surface soils or where seasonal groundwater levels are temporarily lowered beyond naturally experienced fluctuations. The projected groundwater drawdown during construction of WWPS A may extend beneath nearby housing.

While this assessment has quantified the extent and magnitude of groundwater drawdown, it does not evaluate the resulting subsidence response of underlying soils or foundations. It is therefore recommended that the predicted drawdown contours and timeframes presented in this report are reviewed by suitably qualified geotechnical specialists to assess potential subsidence risk and to determine whether any mitigation or monitoring measures are required during construction consistent with RITS requirements. A detailed monitoring network could be proposed with automatic monitoring and reporting to allow adaptation to any unforeseen effect (i.e. reduced pumping during construction if needed).

5.3 Anticipated Implications for Water Quality

The land use change from dairy farming to residential land use, together with the introduction of Stormwater Wetlands, is expected to result in reduced nutrient inputs to shallow groundwater and the Mangakōtukutuku Stream over time (relative to the existing rural baseline). While construction activities can temporarily elevate sediment related risks, this risk is to be addressed through the development and implementation of an erosion and sediment control plan.

As presented in Section 2.5.3 there is existing discolouration of drain water due to oxidation of dissolved iron carried in groundwater discharges. This discolouration is expected to continue in the existing streams during low flow conditions.

6 MONITORING AND MITIGATION

6.1 Groundwater Monitoring

Groundwater levels across the Southern Block have been characterised using a network of five piezometers installed and monitored between July 2025 and January 2026. This monitoring period captured both winter and summer groundwater conditions and confirmed the presence of a shallow aquifer overlying a confined deeper aquifer, separated by a thin, laterally persistent, low-permeability aquitard. The monitoring data were sufficient to define seasonal groundwater level variability, hydraulic connectivity with local drains, and baseline groundwater conditions for the purposes of the effects assessment.

The predicted groundwater drawdown effects associated with construction dewatering and long-term operation of the proposed stormwater wetlands are localised, temporary (during construction), and have been conservatively assessed using site-specific hydraulic parameters. Groundwater drawdown effects do not impact the availability of water at nearby groundwater abstraction bores. The long-term groundwater diversion to the stormwater wetlands represents a redistribution of groundwater discharge within the Site catchment rather than a net loss.

No additional permanent groundwater monitoring sites are considered necessary to manage or verify effects from the proposed development.

Targeted short-term groundwater level monitoring may be required to support the identification and mitigation of potential ground settlement effects during construction of WWPS A to confirm groundwater behaviour remains consistent with predictions. In addition, should subsidence risks be assessed by a suitably qualified geotechnical specialist from the groundwater drawdown predicted in this report, a detailed monitoring network may be proposed with automatic monitoring and reporting to allow adaptation to any unforeseen effect.

Should the existing site piezometers be destroyed during construction, replacement piezometers may be required for the above reasons.

6.2 Surface Water Monitoring

Surface water features within and downstream of the Southern Block comprise farm drains and the headwaters of the Mangakōtūkutuku Stream. At least some of these features are hydraulically connected to the confined groundwater system identified within Southern Block. Potential effects on surface waters are limited to localised interception of groundwater contributions during construction dewatering for stormwater wetlands and wastewater infrastructure. These effects have been assessed as temporary and manageable through construction methodology and the appropriate placement of temporary water discharge points rather than ongoing operational controls.

Given the short duration of dewatering activities, the absence of predicted long-term surface water effects, and the implementation of erosion and sediment control measures under the project's construction management framework, additional surface water flow or level monitoring is not considered necessary for the operational phase of the development. Visual inspections of drains and stream reaches during construction, undertaken as part of standard environmental compliance checks, are considered sufficient to confirm expected performance.

7 CONCLUSIONS

This Hydrogeological Effects Assessment has evaluated the potential groundwater effects associated with the Southern Links 1 Residential Stage 1 Southern Block development. The assessment has focused on temporary stormwater and wastewater infrastructure construction dewatering for and longer-term groundwater diversion associated with the proposed Stormwater Wetlands.

Site specific investigations and groundwater monitoring have confirmed the presence of a shallow unconfined aquifer overlying a deeper confined aquifer, separated by a thin, laterally persistent low permeability aquitard. Confined groundwater levels exhibit seasonal variability and indicate the deeper aquifer is hydraulically connected to local drains and the headwaters of the Mangakōtukutuku Stream, which act as key discharge features within the catchment.

Analytical modelling indicates that groundwater drawdown effects associated with the construction of stormwater wetlands and wastewater infrastructure will be localised and temporary. Conservative assumptions have been adopted throughout the assessment, including the appropriate use of seasonal groundwater levels to support the effects assessment and worst-case construction scenarios. It is recommended that the calculated drawdown impacts are assessed by Geotechnical specialists for potential of settlement beneath existing residences, to determine whether any mitigation or monitoring measures are required during construction, consistent with RITS requirements.

Where dewatering temporarily intercepts groundwater that would otherwise contribute to local drains or stream baseflow, effects can be effectively managed through controlled abstraction and return of flows upstream of works, maintaining surface water continuity during construction.

In the operational phase, the proposed stormwater wetlands will function as permanent hydraulic features that intercept and redistribute groundwater discharge within the catchment. This represents a modification of groundwater flow paths rather than a net loss of groundwater from the system. Long-term effects on groundwater levels, nearby bores, natural wetlands, and connected surface water bodies are assessed as less than minor.

Based on the investigations undertaken, modelling completed, and mitigation measures proposed, WGA considers that the groundwater effects associated with the construction and operation of the Southern Block development can be appropriately managed. No additional permanent groundwater or surface water monitoring is currently considered necessary, with standard construction-phase environmental controls providing sufficient verification of predicted effects.

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9 LIMITATIONS

This report has been based on data provided to WGANZ by others. WGANZ has not attempted to resolve data quality issues except where clearly stated. The data has been analysed on an “as provided” basis. No liability is accepted for incorrect or misleading analysis results arising from data provided to WGANZ.

While this assessment has quantified the extent and magnitude of groundwater drawdown, it does not evaluate the resulting subsidence response of underlying soils or foundations. It is therefore recommended that the predicted drawdown contours and timeframes presented in this report are reviewed by suitably qualified geotechnical specialists to assess potential subsidence risk and to determine whether any mitigation or monitoring measures are required during construction, consistent with RITS requirements

Dewatering is not required in association with the installation of the proposed water supply pipeline. Design information provided by Maven (pers. comm. 27 May 2026.) advises the pipeline will be above the groundwater level.

APPENDIX A LITHOLOGICAL INVESTIGATIONS AND GROUNDWATER LEVELS



BOREHOLE LOG - BH25-P1

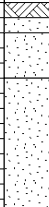
Client: Colliers Project Leaders Ltd
 Project: Southern Links Stage 1 Residential Area
 Site Location: Deanwell, Hamilton
 Project No.: HAM2025-0056
 Date: 09/07/2025



Borehole Location: Refer to Site Plan Logged by: DB Checked by: WD Scale: 1:50 Sheet 1 of 1

Position: 445348.9mE; 694955.0mN Projection: Mt Eden 2000
 Datum: NZVD 2016

Survey Source: Handheld GPS

Well	Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)			Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results									5	10	15	
					1		OL: Organic SILT: dark brown. Low plasticity. (Topsoil) SP: Fine SAND: with some silt. Light brown. Poorly graded. (Hinuera Formation) SW: Fine to coarse SAND: with trace silt. Light brown. Well graded. (Hinuera Formation) SW: Fine to coarse SAND: with trace fine gravel. Grey. Well graded. Gravel; subrounded, pumiceous. (Hinuera Formation)	M		77					
					2				TP	75					
					3		... from 2.90m to 3.36m, sand becoming coarse with some fine gravel. ... from 3.36m to 3.70m, becoming light orange brown.				DPP				
					4		OL: Organic SILT: black. Low plasticity. (Hinuera Formation) ML: SILT: with some fine sand. Grey. Low plasticity. (Hinuera Formation) SW: Fine to coarse SAND: with trace fine gravel. Grey. Well graded. Gravel; subrounded, pumiceous. (Hinuera Formation)	S	F	97					
					5				TP	100					
					6		Borehole terminated at 6.0 m								
					7										
					8										
					9										
					10										

Termination Reason: Target Depth Reached.

Shear Vane No: DCP No:

Remarks: Groundwater encountered at 2.42m. Piezometer screened from 4.5 to 6.0m.

BOREHOLE LOG - BH25-P2

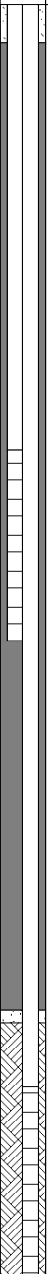
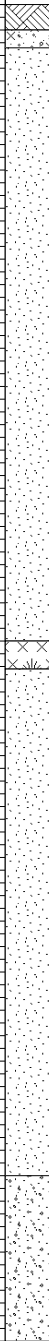
Client: Colliers Project Leaders Ltd
Project: Southern Links Stage 1 Residential Area
Site Location: Deanwell, Hamilton
Project No.: HAM2025-0056
Date: 08/07/2025



Borehole Location: Refer to Site Plan Logged by: DB Checked by: WD Scale: 1:60 Sheet 1 of 1

Position: 445423.8mE; 694892.5mN Projection: Mt Eden 2000
Datum: NZVD 2016

Survey Source: Handheld GPS

Well	Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Weathering					Recovery	RQD	Estimated Strength					Defect Spacing (mm)	Drilling Method/ Support	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks	
		Depth	Type & Results							RS	CW	HW	MW	SW			UW	EW	VW	W	MS				S
							OL: Organic SILT: dark brown. Low plasticity. (Topsoil) GW: Silty Sandy fine GRAVEL: dark orange. Well graded. Gravel; angular. Iron pan. (Hinuera Formation) SW: Fine to coarse SAND: with trace silt. Light brown. Well graded. (Hinuera Formation) ... at 0.54m, silt becoming absent. ... at 1.12m, becoming grey. ... at 2.00m, containing trace fine pumiceous gravel. ... at 2.50m, becoming slightly iron stained.	M	TP								75								
					1																				
					2																				
					3																				
					4																				
					5			OL: Organic SILT: black. Low plasticity. (Hinuera Formation) SW: Fine to coarse SAND: with trace fine gravel. Well graded. Gravel; subrounded. (Hinuera Formation) ... from 6.00m to 6.70m, sand becoming medium to coarse.	M	F to St															
					6																				
					7																				
					8			... from 8.00m to 8.70m, sand becoming fine to medium.	S	TP															
					9																				
					10			SW: Fine Gravelly fine to coarse SAND: grey. Well graded. Gravel; subrounded, some pumiceous gravel. (Hinuera Formation)																	
					11			Borehole terminated at 10.50 m																	
					12																				

Termination Reason: Target Depth Reached.

Shear Vane No: DCP No:
Remarks: Groundwater measured at 3.7m. Deep piezometer screened from 8.5 to 10m, shallow piezometer screened from 3.5 to 5.0m.

BOREHOLE LOG - BH25-P3

Client: Colliers Project Leaders Ltd
 Project: Southern Links Stage 1 Residential Area
 Site Location: Deanwell, Hamilton
 Project No.: HAM2025-0056
 Date: 08/07/2025



Borehole Location: Refer to Site Plan Logged by: DB Checked by: WD Scale: 1:50 Sheet 1 of 1

Position: 445342.6mE; 694873.7mN Projection: Mt Eden 2000
 Datum: NZVD 2016

Survey Source: Handheld GPS

Well	Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Recovery	Drilling Method/Support	Dynamic Cone Penetrometer (Blows/100mm)			Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results									5	10	15	
	Groundwater				1		OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M		80					
							SW: Fine to coarse SAND: with trace silt. Brown. Well graded. (Hinuera Formation)								
							... at 0.65m, becoming light grey, containing trace fine gravel.								
					2			TP		79					
					3		... at 3.00m, becoming grey.	S		DPP					
							ML: SILT: with some clay. Dark grey. Low plasticity. (Hinuera Formation)								
							... from 3.65m to 3.75m, lens of organic silt, black, low plasticity.								
					4		SW: Fine to coarse SAND: with trace fine gravel. Grey. Well graded. Pumiceous. (Hinuera Formation)	TP		100					
							... from 4.96m to 5.15m, lens of fine pumiceous gravel.								
					5		SW: Gravelly fine to coarse SAND: grey. Well graded. Gravel; fine to medium, subrounded. (Hinuera Formation)			100					
					6		Borehole terminated at 6.0 m								
					7										
					8										
					9										
					10										

Termination Reason: Target Depth Reached.

Shear Vane No: DCP No:

Remarks: Groundwater encountered at 2.12m. Piezometer screened from 4.5 to 6.0m.

BOREHOLE LOG - BH25-P4

Client: Colliers Project Leaders Ltd
Project: Southern Links Stage 1 Residential Area
Site Location: Deanwell, Hamilton
Project No.: HAM2025-0056
Date: 08/07/2025



Borehole Location: Refer to Site Plan

Logged by: DB

Checked by: WD

Scale: 1:50

Sheet 1 of 1

Position: 445349.9mE; 694563.3mN

Projection: Mt Eden 2000

Datum: NZVD 2016

Survey Source: Handheld GPS

Well	Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Recovery	Drilling Method/ Support	Dynamic Cone Penetrometer (Blows/100mm)			Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
		Depth	Type & Results									5	10	15	
08-07-2025					1		OL: Organic SILT: dark brown. Low plasticity. (Topsoil) ML: Fine Sandy SILT: grey streaked orange brown. Low plasticity. (Hinuera Formation)	M	F to St	47					
					2		SP: Silty Fine SAND: grey streaked orange brown. Poorly graded. (Hinuera Formation) ... at 1.77m, containing lens of clayey silt. SW: Gravelly fine to coarse SAND: grey. Well graded. Gravel; fine, subrounded, pumiceous. (Hinuera Formation) SP: Fine SAND: with some silt. Grey. Poorly graded. (Hinuera Formation) ML: SILT: with some clay. Grey. Low plasticity. (Hinuera Formation) OL: Organic SILT: black. Low plasticity. (Hinuera Formation) ML: Clayey SILT: grey. Low plasticity. (Hinuera Formation) SW: Fine to coarse SAND: with trace silt. Grey. Well graded. (Hinuera Formation)	S	TP	83					
					3						DPP				
					4					97					
					5		... at 4.60m, containing minor fine gravel, pumiceous.		TP						
					6		Borehole terminated at 6.0 m								
					7										
					8										
					9										
					10										

Termination Reason: Target Depth Reached.

Shear Vane No: DCP No:

Remarks: Groundwater encountered at 1.57m. Piezometer screened from 4.5 to 6.0m.

PHOTOGRAPH SHEET - BH25-P1

Client: Colliers Project Leaders Ltd
Project: Southern Links Stage 1 Residential Area
Location: Deanwell, Hamilton
Project ID: HAM2025-0056
Date: 9/07/2025



This borehole report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination.

PHOTOGRAPH SHEET - BH25-P2

Client: Colliers Project Leaders Ltd
Project: Southern Links Stage 1 Residential Area
Location: Deanwell, Hamilton
Project ID: HAM2025-0056
Date: 8/07/2025



This borehole report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination.

PHOTOGRAPH SHEET - BH25-P3

Client: Colliers Project Leaders Ltd
Project: Southern Links Stage 1 Residential Area
Location: Deanwell, Hamilton
Project ID: HAM2025-0056
Date: 8/07/2025



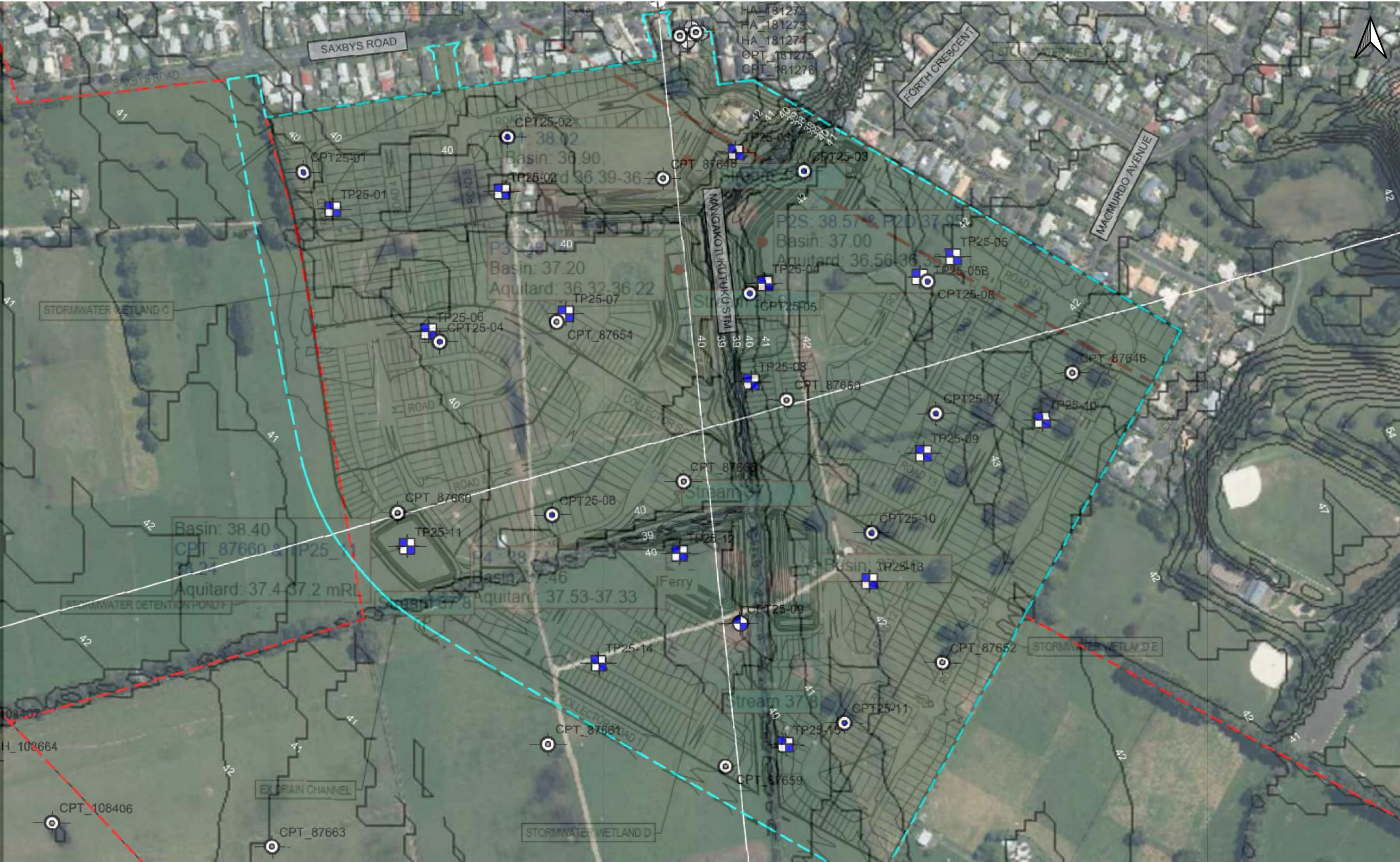
This borehole report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination.

PHOTOGRAPH SHEET - BH25-P4

Client: Colliers Project Leaders Ltd
Project: Southern Links Stage 1 Residential Area
Location: Deanwell, Hamilton
Project ID: HAM2025-0056
Date: 8/07/2025



This borehole report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination.



LEGEND:

Site Investigation Plan_modified

- Band 1 (Red)
- Band 2 (Green)
- Band 3 (Blue)

WGA Markup - Aquitard_modified

- Band 1 (Red)
- Band 2 (Green)
- Band 3 (Blue)
- Wetland A

OpenStreetMap

NOTES:

70 0 70 140



CLIENT:	COLLIERS PROJECT LEADERS		DRAWN:	MM	PROJECT:	HAM2025-0056
PROJECT:	SOUTHERN LINKS STAGE 1 RESIDENTIAL		CHECKED:		DRAWING:	XX
TITLE:			REVISION:	XX	SCALE:	1:3,500
			DATE:	01/01/2025	SHEET:	A3L

Table A1: Groundwater Levels Recorded in April 2025 by CMW

SITE NUMBER	GROUNDWATER LEVEL (m bgl)	GROUNDWATER LEVEL (m RL)
TP25-01	3.5	36.5
TP25-02	2.8	37.8
TP25-03	2.8	36.8
TP25-04	5	36.6
TP25-05	5.5	36.5
TP25-05 B	2.8	38.8
TP25-06	2.5	37.5
TP25-07	1.7	38.3
TP25-08	3.9	36.8
TP25-09	4.5	38
TP25-10	3.1	39.2
TP25-10	2	38.5
TP25-10	3.2	36.8
TP25-10	3.7	38.8
TP25-10	2	38.4
TP25-10	3.5	37.2
CPT25-01	3.5	36.5
CPT25-02	2.8	37.2
CPT25-03	2.8	39
CPT25-04	2.5	37.5
CPT25-05	5	35.9
CPT25-06	2.8	39.2
CPT25-07	4.5	37.8
CPT25-08	2	38
CPT25-09	3.2	36.8
CPT25-10	3.7	38.8
CPT25-11	3.5	39

Note: Source CMW (2025)

Table A2: Nearby Bores within 1km of Proposed Site Activities from the WRC Database (March 2026)

BORE ID	TYPE	STATUS	EASTING	NORTHING	EXTERNAL CASING DIAMETER (mm)	DRILLED DEPTH (m)
69_1208	Well/Bore	Existing	1800661	5811970	100	10.3
70_388	Well/Bore	Existing	1799262	5811368	100	26.8
70_363	Well/Bore	Existing	1801264	5810271	100	8.2
70_512	Well/Bore	Existing	1801664	5810371	100	34
70_501	Well/Bore	Existing	1799862	5810869	100	24
70_506	Well/Bore	Existing	1799262	5811268	100	28
70_476	Well/Bore	Existing	1801364	5809871	75	9.09
72_192	Well/Bore	Existing	1801664	5810371	200	76.7
72_1264	Well/Bore	Existing	1799363	5810768		61.5
72_1628	Well/Bore	Existing	1799962	5811269	100	23
72_3943	Well/Bore	Existing	1799461	5810252	104	42
72_3754	Well/Bore	Existing	1801210	5811472	75	2.5
72_3755	Well/Bore	Existing	1801204	5811459	50	2.5
72_3756	Well/Bore	Existing	1801213	5811454	50	2.5
72_3757	Well/Bore	Existing	1801222	5811452	50	2.5
72_3219	Well/Bore	Existing	1801266	5811455	100	3.5
72_3220	Well/Bore	Existing	1801252	5811439	100	2.9
72_3221	Well/Bore	Existing	1801235	5811452	100	2.7
72_3222	Well/Bore	Existing	1801231	5811460	100	2.7
72_3223	Well/Bore	Existing	1801257	5811469	100	4.2
72_3765	Well/Bore	Existing	1801230	5811445	50	2.5
72_3766	Well/Bore	Existing	1801271	5811507	50	5
72_3767	Well/Bore	Existing	1801251	5811473	50	2.2
72_3768	Well/Bore	Existing	1801250	5811481	50	2.1
72_3769	Well/Bore	Existing	1801243	5811477	50	2.15
72_3218	Well/Bore	Existing	1801262	5811440	100	3.5
72_3715	Well/Bore	Existing	1801255	5811489	50	4
72_3469	Well/Bore	Existing	1801219	5811483	50	2.5
72_3716	Well/Bore	Existing	1801272	5811475	50	5
72_3717	Well/Bore	Existing	1801268	5811463	50	4
72_4049	Well/Bore	Existing	1800564	5809970	100	40
70_348	Well/Bore	Existing	1801863	5810572	150	83.82
70_1042	Well/Bore	Existing	1799162	5811268		
72_5293	Well/Bore	Existing	1801014	5809500		6
72_11515	Well/Bore	Existing	1801585	5810417	100	54.7
72_11662	Piezometer	Existing	1800153	5811891	50	15
72_11665	Well/Bore	Existing	1800145	5811864	50	13.95

BORE ID	TYPE	STATUS	EASTING	NORTHING	EXTERNAL CASING DIAMETER (mm)	DRILLED DEPTH (m)
72_11989	Well/Bore	Existing	1800171	5811880		16
72_11990	Piezometer	Existing	1800155	5811876	50	4
72_11992	Piezometer	Existing	1799950	5811960	50	4
72_11661	Piezometer	Existing	1800223	5811911		10.95
72_11663	Well/Bore	Decommissioned	1799658	5812063	32	3.8
72_11664	Well/Bore	Decommissioned	1799950	5811960	32	3.9
72_11666	Well/Bore	Existing	1800155	5811876	32	4
72_11667	Well/Bore	Existing	1800128	5811858		2.7
72_11668	Well/Bore	Decommissioned	1800155	5811876	32	4
72_11669	Well/Bore		1799659	5812056		
72_11670	Well/Bore		1799949	5811951		
72_12408	Well/Bore	Existing	1800157	5811887	101	15.9
72_12409	Well/Bore	Existing	1800130	5811869	101	15.9
72_12410	Well/Bore	Existing	1800120	5811884	200	19
72_12411	Well/Bore	Existing	1800123	5811905	200	20
72_12412	Well/Bore	Existing	1800146	5811903		20.7
72_12413	Well/Bore	Existing	1800146	5811858		18.5
72_12414	Well/Bore	Existing	1800167	5811875		20.1
72_12527	Well/Bore	Existing	1800153	5811891		4
72_12835	Well/Bore	Existing	1800172	5811878	200	18
72_12836	Well/Bore	Existing	1800168	5811886		18
72_12837	Well/Bore	Existing	1800114	5811922	150	18
72_12838	Well/Bore	Existing	1800133	5811916	150	17
72_12839	Well/Bore	Existing	1800152	5811913		18
72_12840	Well/Bore	Existing	1800167	5811904		18
72_12841	Well/Bore	Existing	1800182	5811902	150	18
72_12842	Well/Bore	Existing	1800136	5811864		16
72_12843	Well/Bore	Existing	1800136	5811906		16
72_12844	Well/Bore	Existing	1800162	5811877		16
72_12845	Well/Bore	Existing	1800165	5811859	32	14.5
72_12846	Well/Bore	Existing	1800168	5811901	32	15
72_12847	Well/Bore	Existing	1800101	5811877	32	15
72_12848	Well/Bore	Existing	1800130	5811915	32	15
72_12977	Piezometer	Existing	1800593	5811145		6
72_12978	Piezometer	Existing	1800673	5811072		10.5
72_12979	Piezometer	Existing	1800670	5811073		10.5
72_12980	Piezometer	Existing	1800589	5811047		6
72_12981	Piezometer	Existing	1800595	5810750		6
72_13299	Well/Bore	Proposed				

BORE ID	TYPE	STATUS	EASTING	NORTHING	EXTERNAL CASING DIAMETER (mm)	DRILLED DEPTH (m)
72_13300	Well/Bore	Proposed				
72_13301	Well/Bore	Proposed				
72_13302	Well/Bore	Proposed				
72_13303	Well/Bore	Proposed				
72_13320	Well/Bore	Proposed				
72_13321	Well/Bore	Proposed				
72_13322	Well/Bore	Proposed				
72_13327	Well/Bore	Proposed				
72_13328	Well/Bore	Proposed				

APPENDIX B

HYDRAULIC TESTING



Introduction

The hydraulic conductivity of the geological layers found at the Stage 1 Residential Southern Block site has been determined by WGA. Hydraulic conductivities were determined by the use of slug tests; the results of each test are presented in this Appendix.

Slug Testing

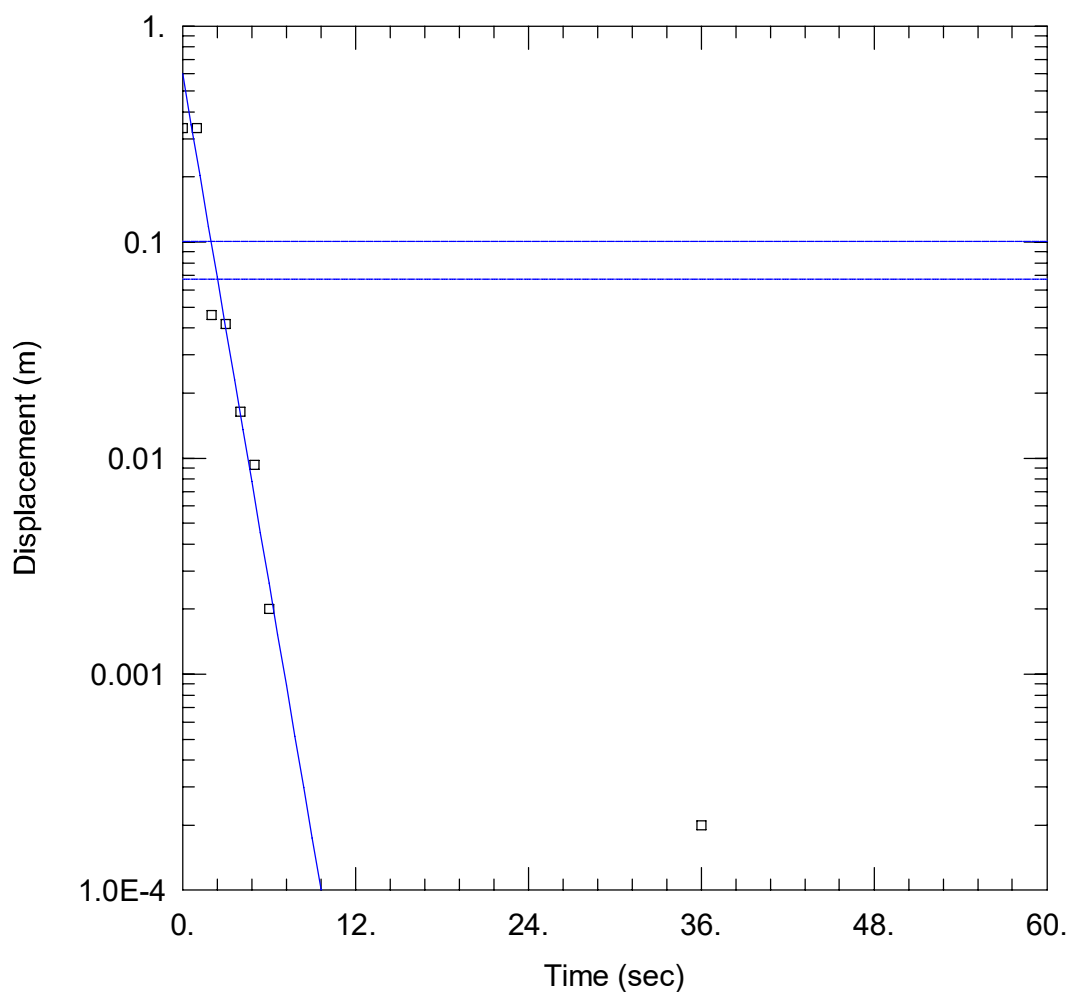
WGA conducted slug testing on the five piezometers within the site area, targeting the sands of the Hinuera Formation. Slug test results were analysed using the Bouwer and Rice (1974). Both falling head and rising head tests were analysed where data was available. AQTESOLV Pro v4.5 software package from HydroSolve Inc was used to analyse the datasets.

Slug tests across the site reacted very rapidly, typically recovering within the first two seconds of each test. Resulting hydraulic conductivities were on average **4E-04 m/sec**, which is considered a representative value for the site.

WGA notes that due to the rapid recovery of the slug tests, resulting hydraulic conductivities should be treated as minimum values as they may be representing the screen and filter pack rather than the target aquifer.

Table B1: Results of Slug Testing

BORE	TEST TYPE	HYDRAULIC CONDUCTIVITY (m/sec)
BH25-P1	RHT 1	1.23E-04
	FHT 3	3.35E-04
	RHT 3	8.75E-05
BH25-P2D	FHT 1	1.03E-03
	FHT 2	3.50E-04
BH25-P2S	RHT 1	1.25E-04
	FHT 2	1.83E-04
BH25-P3	RHT 2	5.53E-04
	RHT 4	4.34E-04
BH25-P4	RHT 2	4.72E-04
	RHT 3	7.51E-04



WELL TEST ANALYSIS

Data Set: V:\...\P1 - Test 3 - Falling Head.aqt

Date: 03/03/26

Time: 08:28:33

PROJECT INFORMATION

Company: WGA

Client: SL - Southern Block

Project: 242463

Location: Hamilton

Test Well: P1

Test Date: 18/07/2025

AQUIFER DATA

Saturated Thickness: 8.104 m

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P1)

Initial Displacement: 0.3361 m

Total Well Penetration Depth: 3.77 m

Casing Radius: 0.02 m

Static Water Column Height: 3.77 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

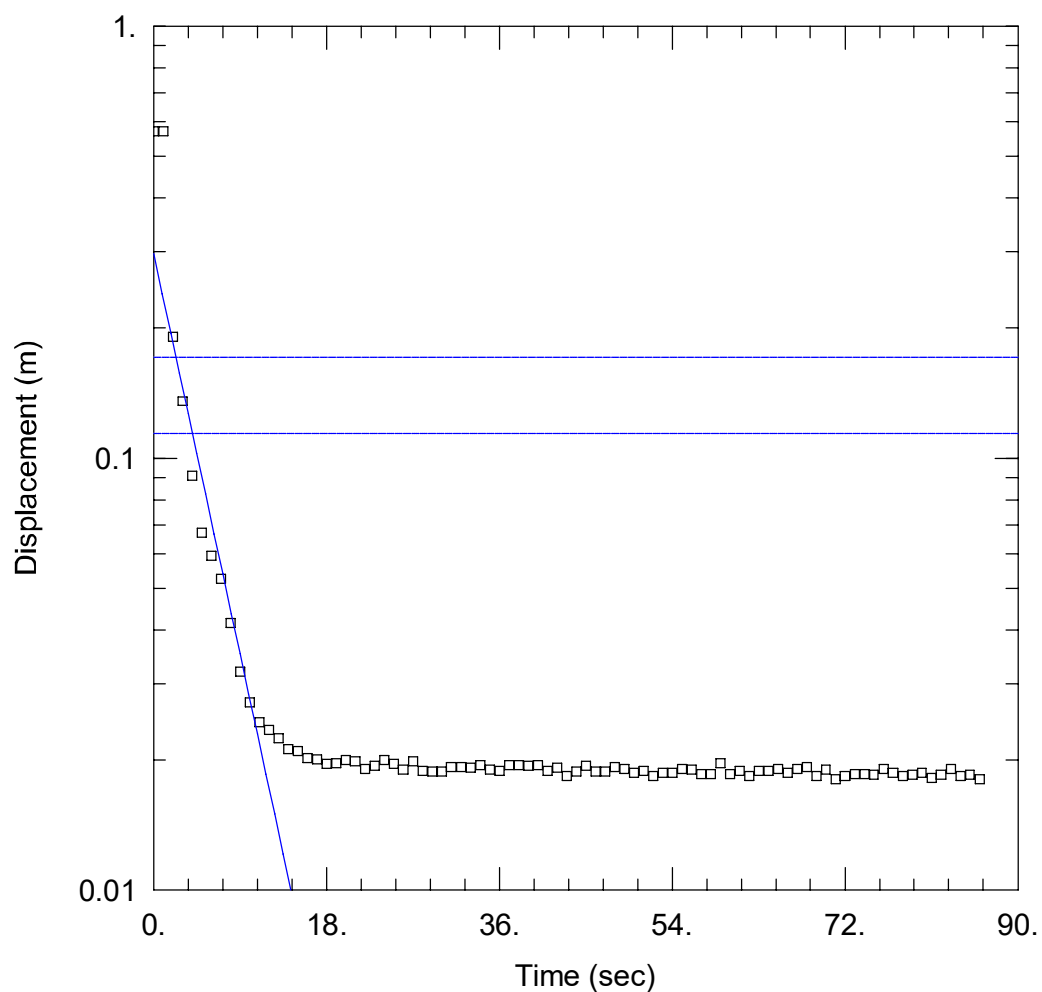
SOLUTION

Aquifer Model: Unconfined

K = 28.91 m/day

Solution Method: Bouwer-Rice

y0 = 0.6019 m



WELL TEST ANALYSIS

Data Set: V:\...\P1 - Test 3 - Rising Head.aqt

Date: 03/03/26

Time: 08:31:56

PROJECT INFORMATION

Company: WGA

Client: SL - Southern Block

Project: 242463

Location: Hamilton

Test Well: P1

Test Date: 18/07/2025

AQUIFER DATA

Saturated Thickness: 8.104 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P1)

Initial Displacement: 0.5698 m

Total Well Penetration Depth: 3.77 m

Casing Radius: 0.02 m

Static Water Column Height: 3.77 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

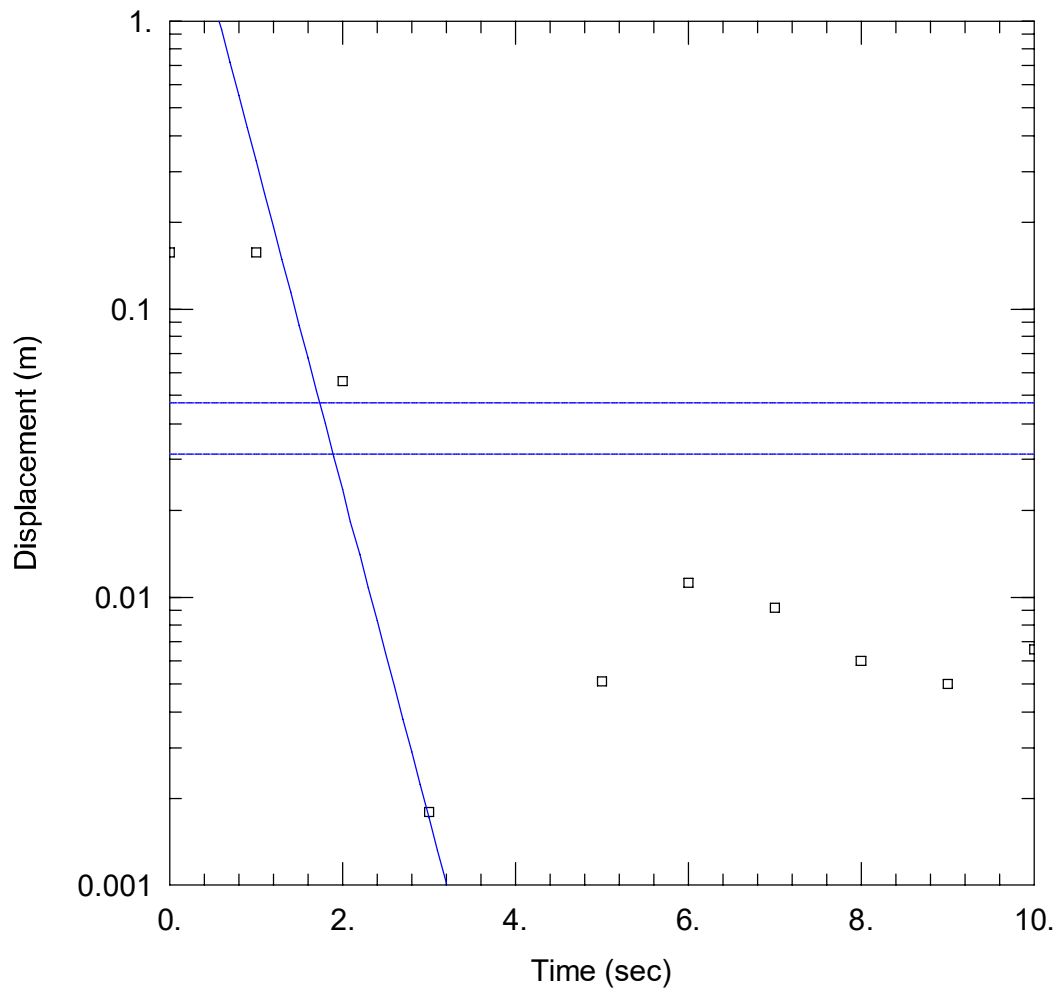
SOLUTION

Aquifer Model: Unconfined

$K = 7.562$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.297$ m



WELL TEST ANALYSIS

Data Set: V:\...\P2D - Test 1 - Falling Head.aqt

Date: 03/03/26

Time: 08:34:11

PROJECT INFORMATION

Company: WGA

Client: SL - Southern Block

Project: 242463

Location: Hamilton

Test Well: P1

Test Date: 18/07/2025

AQUIFER DATA

Saturated Thickness: 10.71 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P2D)

Initial Displacement: 0.1572 m

Static Water Column Height: 6.18 m

Total Well Penetration Depth: 6.18 m

Screen Length: 1.5 m

Casing Radius: 0.02 m

Well Radius: 0.0375 m

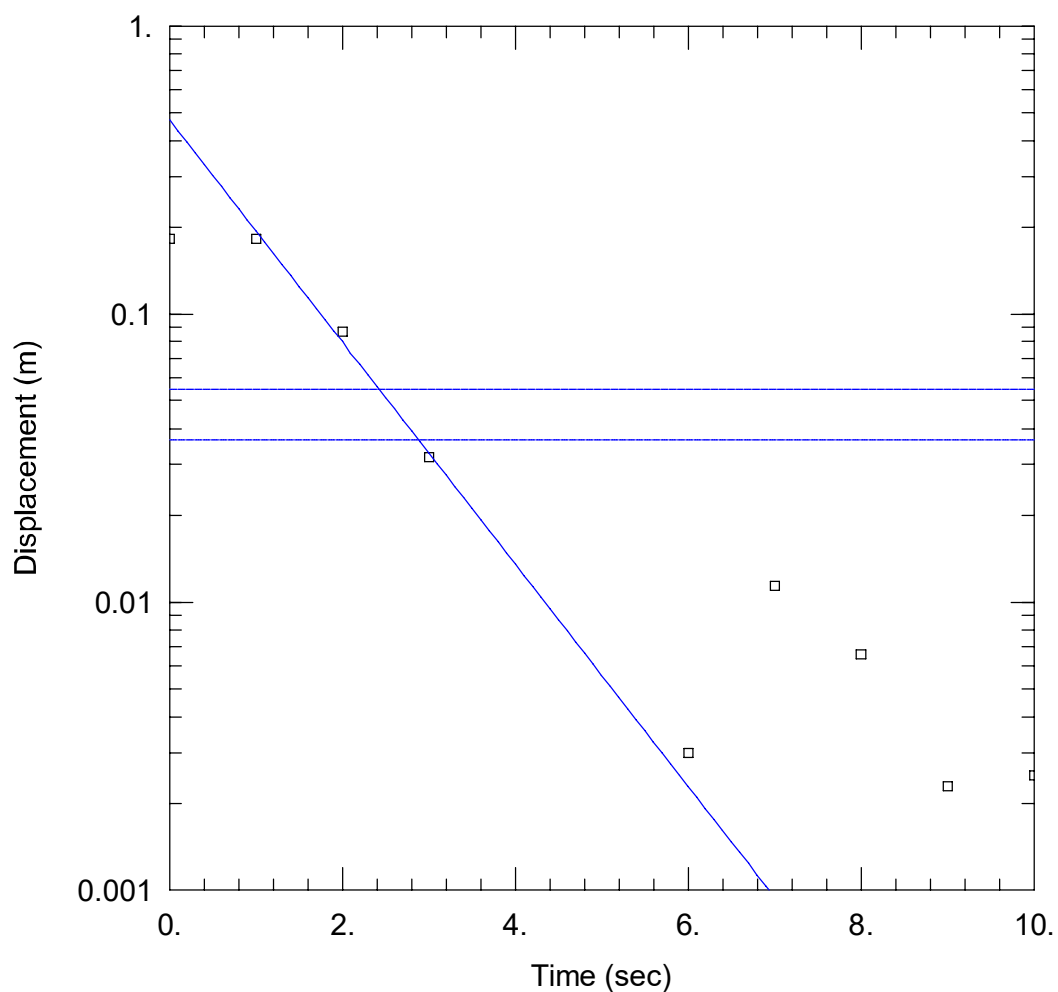
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 89.4 m/day

y_0 = 4.507 m



WELL TEST ANALYSIS

Data Set: V:\...\P2D - Test 2 - Falling Head.aqt

Date: 03/03/26

Time: 08:34:58

PROJECT INFORMATION

Company: WGA

Client: SL - Southern Block

Project: 242463

Location: Hamilton

Test Well: P1

Test Date: 18/07/2025

AQUIFER DATA

Saturated Thickness: 10.71 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P2D)

Initial Displacement: 0.1826 m

Total Well Penetration Depth: 6.18 m

Casing Radius: 0.02 m

Static Water Column Height: 6.18 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

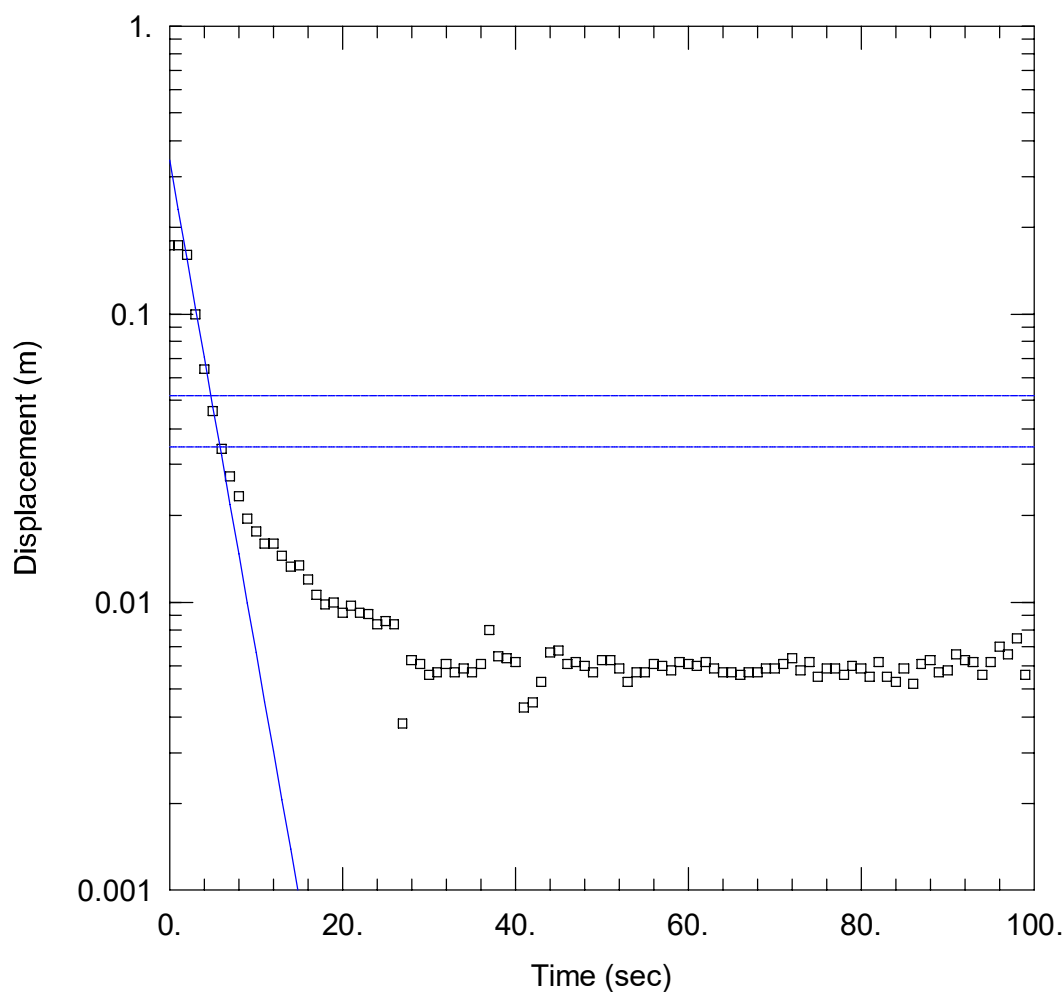
SOLUTION

Aquifer Model: Unconfined

$K = 30.23$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.4716$ m



WELL TEST ANALYSIS

Data Set: V:\...\P2S - Test 1 - Rising Head.aqt

Date: 03/03/26

Time: 08:36:40

PROJECT INFORMATION

Company: WGA

Client: SL - Southern Block

Project: 242463

Location: Hamilton

Test Well: P1

Test Date: 18/07/2025

AQUIFER DATA

Saturated Thickness: 11.16 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P2S)

Initial Displacement: 0.1733 m

Total Well Penetration Depth: 1.71 m

Casing Radius: 0.02 m

Static Water Column Height: 1.71 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

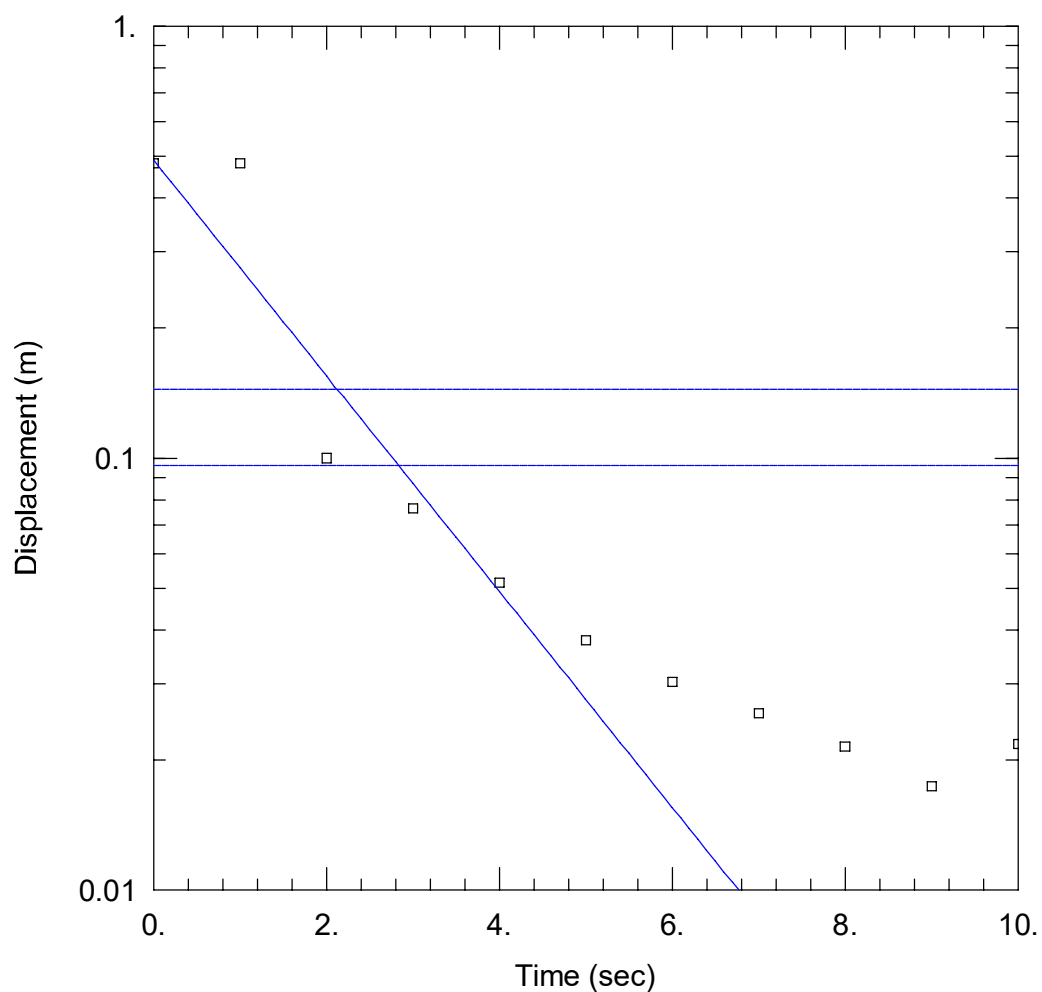
SOLUTION

Aquifer Model: Unconfined

$K = 10.82$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.3418$ m



WELL TEST ANALYSIS

Data Set: V:\...\P2S - Test 2 - Falling Head.aqt

Date: 03/03/26

Time: 08:37:13

PROJECT INFORMATION

Company: WGA

Client: SL - Southern Block

Project: 242463

Location: Hamilton

Test Well: P1

Test Date: 18/07/2025

AQUIFER DATA

Saturated Thickness: 11.16 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P2S)

Initial Displacement: 0.4804 m

Total Well Penetration Depth: 1.71 m

Casing Radius: 0.02 m

Static Water Column Height: 1.71 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

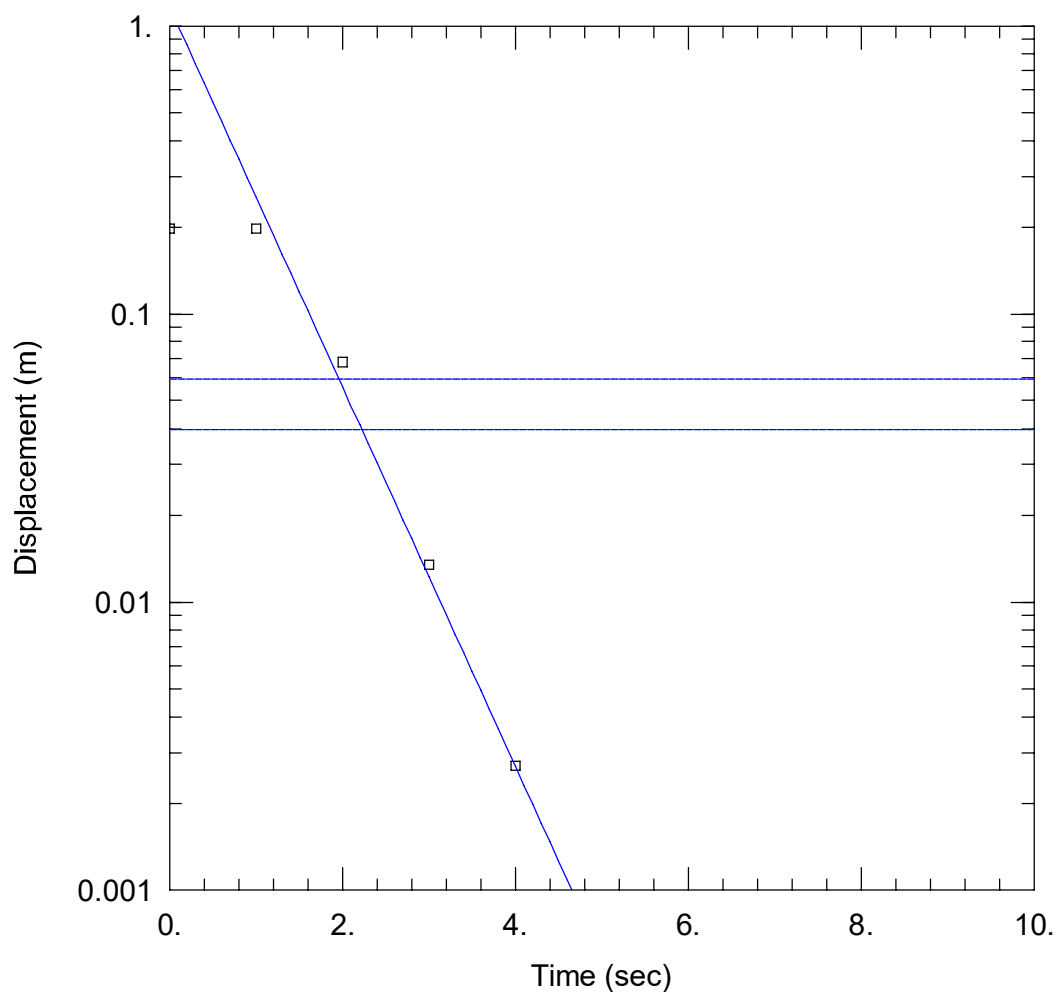
SOLUTION

Aquifer Model: Unconfined

$K = 15.8$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.4896$ m



WELL TEST ANALYSIS

Data Set: V:\...\P3 - Test 2 - Rising Head.aqt

Date: 03/03/26

Time: 08:35:46

PROJECT INFORMATION

Company: WGA

Client: SL - Southern Block

Project: 242463

Location: Hamilton

Test Well: P1

Test Date: 18/07/2025

AQUIFER DATA

Saturated Thickness: 12.61 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P3)

Initial Displacement: 0.198 m

Total Well Penetration Depth: 3.955 m

Casing Radius: 0.02 m

Static Water Column Height: 3.955 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

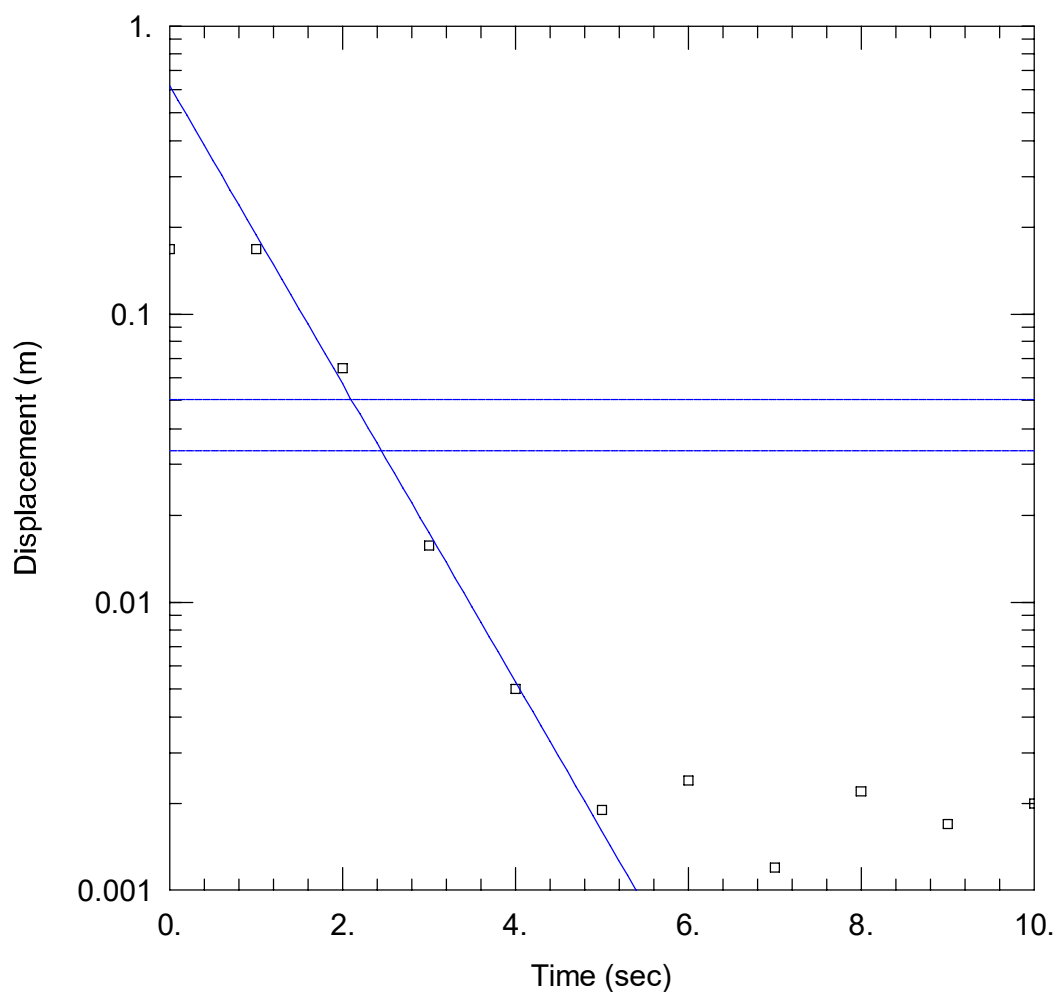
SOLUTION

Aquifer Model: Unconfined

$K = 47.75$ m/day

Solution Method: Bouwer-Rice

$y_0 = 1.162$ m



WELL TEST ANALYSIS

Data Set: V:\...\P3 - Test 4 - Rising Head.aqt

Date: 03/03/26

Time: 08:37:54

PROJECT INFORMATION

Company: WGA

Client: SL - Southern Block

Project: 242463

Location: Hamilton

Test Well: P1

Test Date: 18/07/2025

AQUIFER DATA

Saturated Thickness: 12.61 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P3)

Initial Displacement: 0.1681 m

Total Well Penetration Depth: 3.955 m

Casing Radius: 0.02 m

Static Water Column Height: 3.955 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

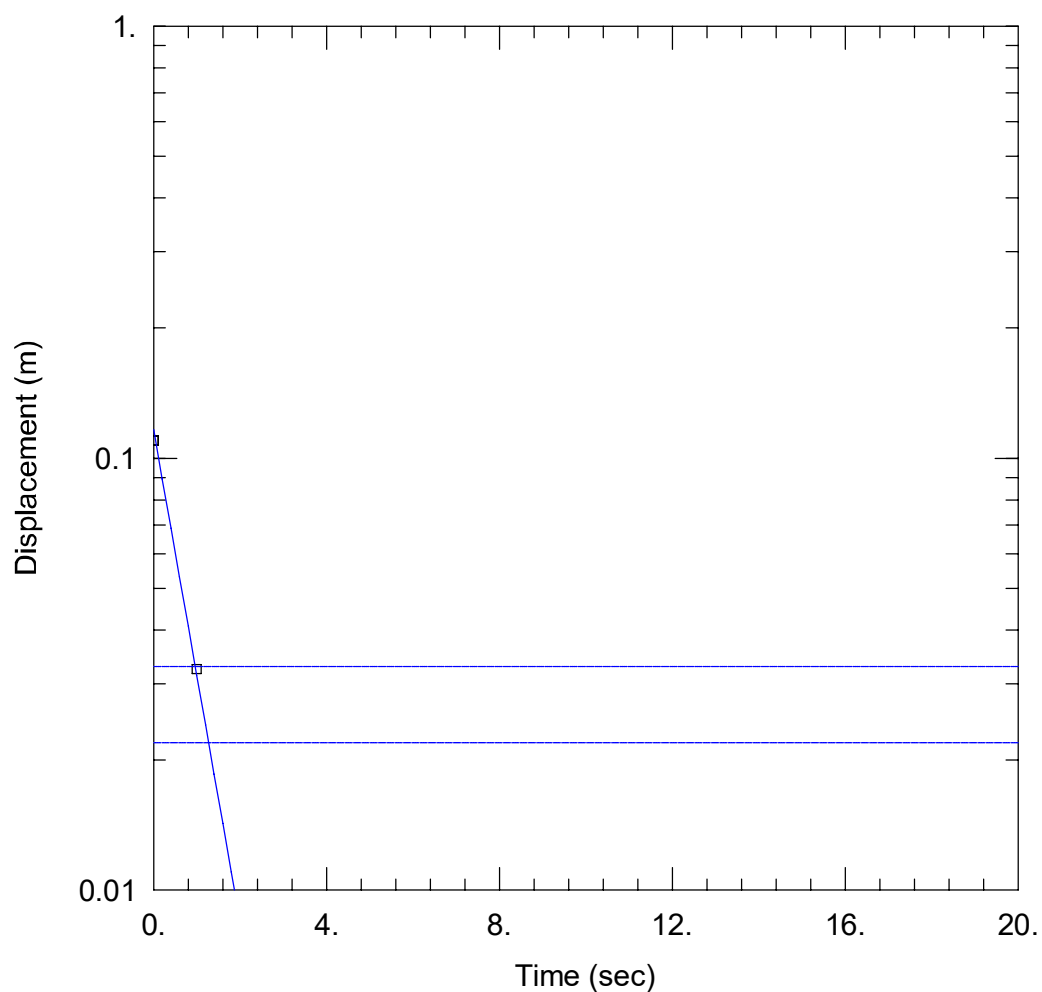
SOLUTION

Aquifer Model: Unconfined

$K = 37.47$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.6202$ m



WELL TEST ANALYSIS

Data Set: V:\...\P4 - Test 2 - Rising Head.aqt

Date: 03/03/26

Time: 08:41:03

PROJECT INFORMATION

Company: WGA

Client: SL - Southern Block

Project: 242463

Location: Hamilton

Test Well: P1

Test Date: 18/07/2025

AQUIFER DATA

Saturated Thickness: 10.68 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P4)

Initial Displacement: 0.1097 m

Total Well Penetration Depth: 4.5 m

Casing Radius: 0.02 m

Static Water Column Height: 4.5 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

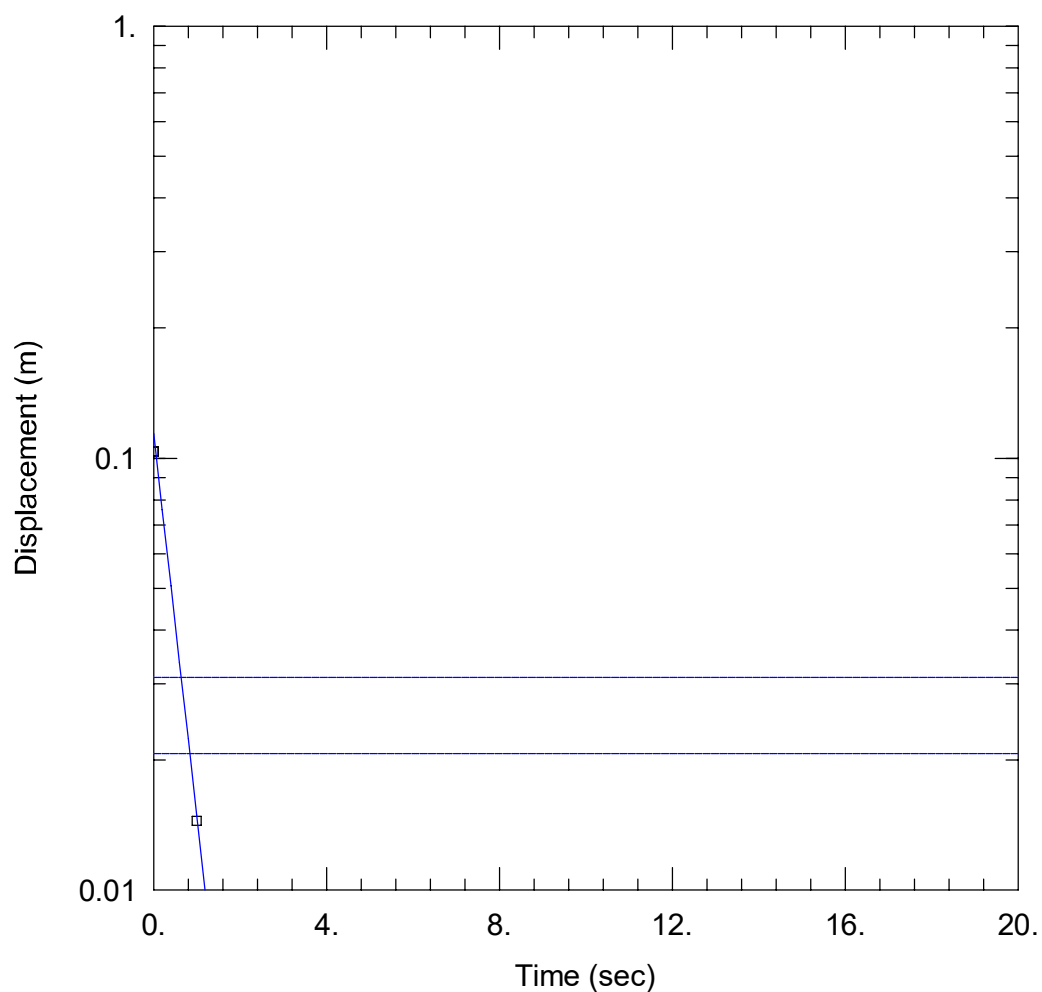
SOLUTION

Aquifer Model: Unconfined

$K = 42.41$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1164$ m



WELL TEST ANALYSIS

Data Set: V:\...\P4 - Test 3 - Rising Head.aqt

Date: 03/03/26

Time: 08:41:41

PROJECT INFORMATION

Company: WGA

Client: SL - Southern Block

Project: 242463

Location: Hamilton

Test Well: P1

Test Date: 18/07/2025

AQUIFER DATA

Saturated Thickness: 10.68 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (P4)

Initial Displacement: 0.1035 m

Total Well Penetration Depth: 4.5 m

Casing Radius: 0.02 m

Static Water Column Height: 4.5 m

Screen Length: 1.5 m

Well Radius: 0.0375 m

SOLUTION

Aquifer Model: Unconfined

$K = 65.88$ m/day

Solution Method: Bouwer-Rice

$y_0 = 0.1142$ m

APPENDIX C
WGA MARKUP ON MAVEN DESIGN
DRAWING NO. R1-C440 REV C





DRAFT FOR REVIEW

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
 2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING 777m.
 3. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY HIS OPERATIONS.
 4. ALL CONCRETE SW PIPE TO BE INSTALLED IN ACCORDANCE WITH AS/NZS 3725:2007 FOR BURIED CONCRETE PIPES AND AS/NZ 4058:2007 FOR PRECAST CONCRETE PIPES (PRESSURE AND NON-PRESSURE) AS STIPULATED IN THE RITS 2018.
 5. APPROVED HARDFILL IS TO BE USED IN BACKFILLING OF ALL STORMWATER LINES WITHIN THE ROAD RESERVE.
 6. HEAVY DUTY MANHOLE LIDS AND FRAMES TO BE USED IN TRAFFICKED AREAS.
 7. ALL CESSPIT LEADS SHALL HAVE MIN COVER 0.9m.
 8. ALL LINES ARE TO BE CLASS4 RCRRJ UNLESS SHOWN OTHERWISE.
 9. ALL LINES TO BE ABANDONED SHALL BE SEALED AT EACH END. TIMING OF ALL SEALING TO BE COORDINATED WITH COUNCIL STAFF.

LEGEND

--- EX BOUNDARY

— PROP BOUNDARY

C	DRAFT	MJRA	02/2026
B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MJRA		11/2025
Checked	DJM		11/2025



Project

SOUTHERN LINKS 1

RESIDENTIAL STAGE 1

HAMILTON, WAIKATO

FOR

SL1 CONSORTIUM GROUP

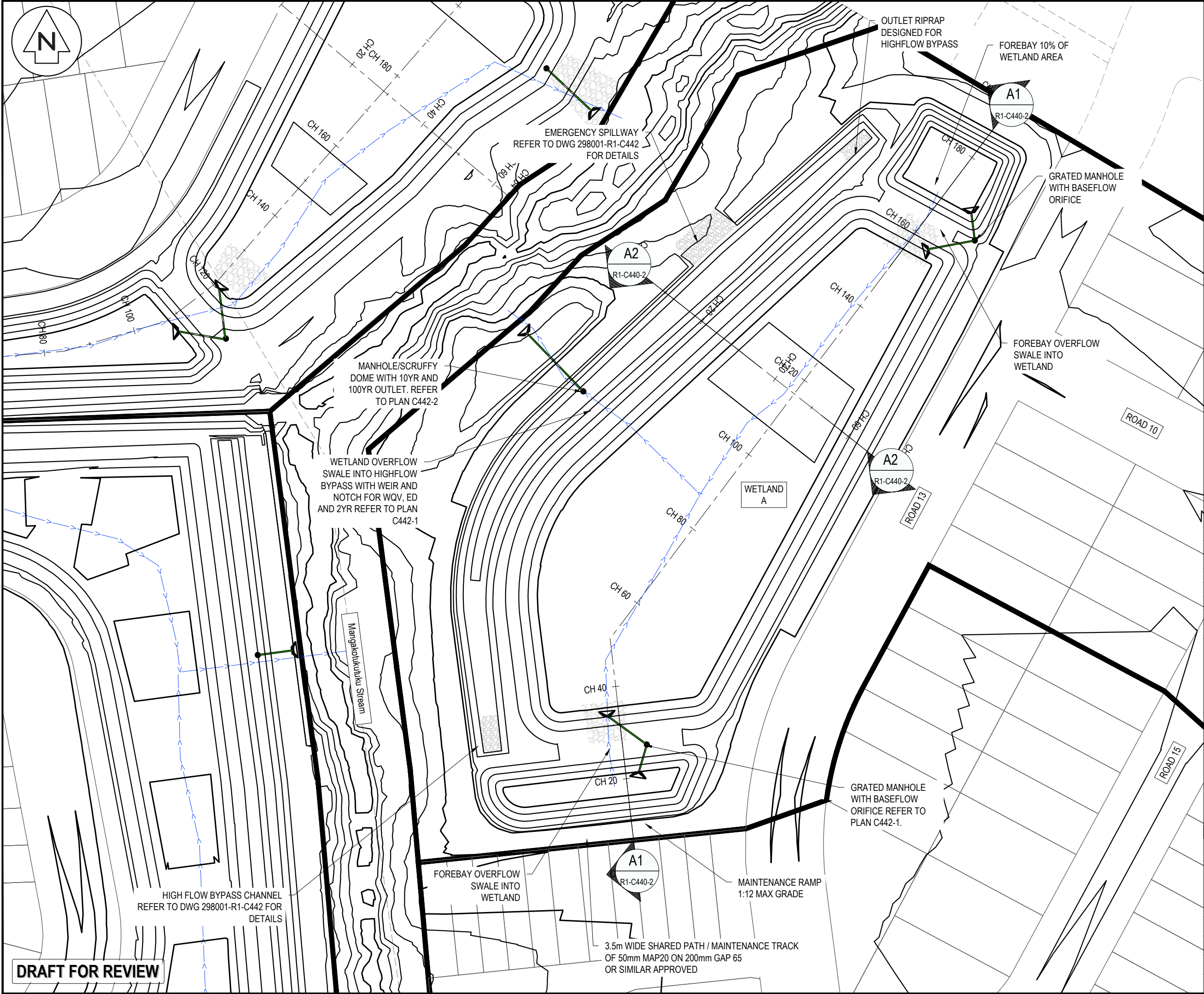
Title

PROPOSED STORMWATER

WETLAND + DETENTION

POND - OVERVIEW PLAN

Project no.	298001-R1 SL1		
Scale	1:4000 @ A3		
Cad file	298001-R1-C440 SW WETLAND.DWG		
Drawing no.	R1-C440	Rev	C



NOTES

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LEGEND

--- EX BOUNDARY

--- PROP BOUNDARY

C	DRAFT	MJRA	02/2026
B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MJRA		11/2025
Checked	DJM		11/2025



Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project

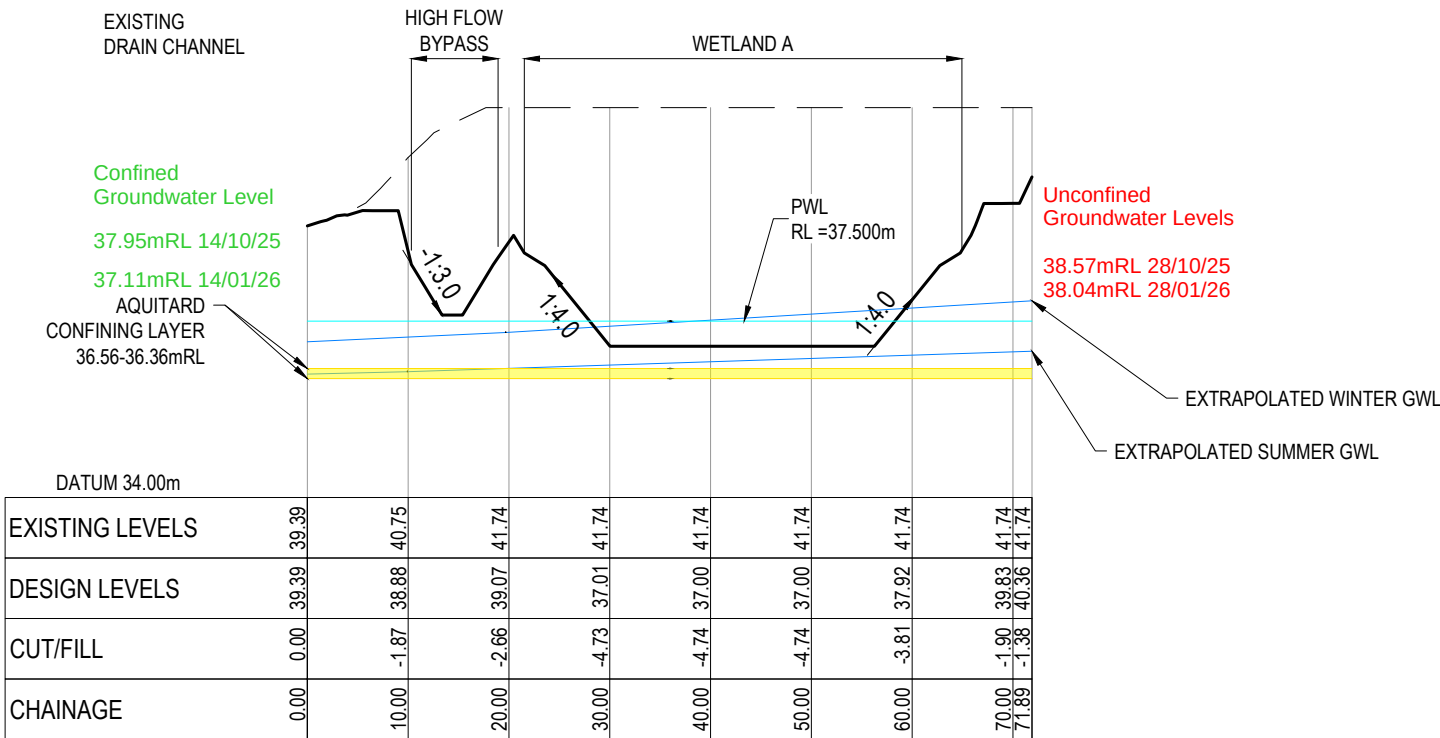
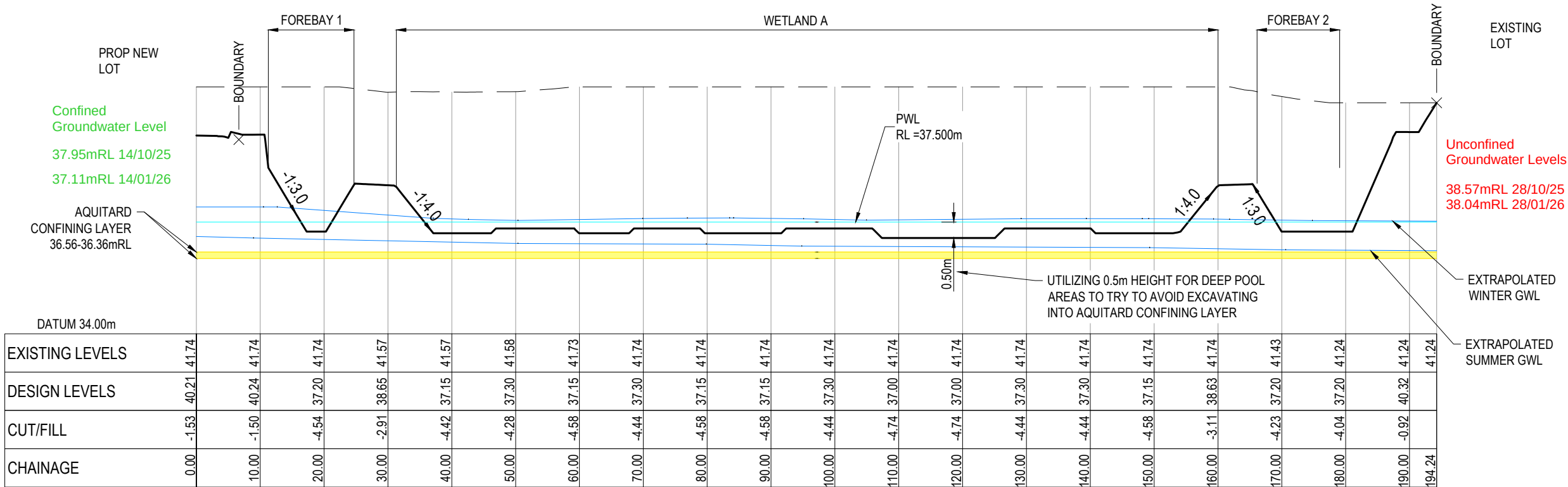
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SL1 CONSORTIUM GROUP**

Title

**PROPOSED STORMWATER
WETLAND A
PLAN**

Project no.	298001-R1 SL1		
Scale	1:750 @ A3		
Cad file	298001-R1-C440 SW WETLAND.DWG		
Drawing no.	R1-C440-1	Rev	C

DATE: 22/08 FILE PATH: \\MAVEN\MAVEN\CONSULTING\CO NZ\SHARE\CURRENT\MAVEN - HAMILTON - PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C440 SW WETLAND.DWG



- NOTES
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Legend

—	EX GROUND LEVEL
—	PROP GROUND LEVEL
—	100YR - 10 YR LEVEL
—	GROUNDWATER LEVEL

C	DRAFT	MJRA	02/2026
B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
	Survey	MAVEN	06/2025
	Design	MKS	07/2025
	Drawn	MJRA	11/2025
	Checked	DJM	11/2025



Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SL1 CONSORTIUM GROUP**

Title
**PROPOSED STORMWATER
WETLAND A
SECTIONS**

Project no.	298001-R1 SL1
Scale	AS SHOWN
Cad file	298001-R1-C440 SW WETLAND.DWG
Drawing no.	R1-C440-2
Rev	C

DRAFT FOR REVIEW



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LEGEND

EX BOUNDARY

PROP BOUNDARY

C	DRAFT	MJRA	02/2026
B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MJRA		11/2025
Checked	DJM		11/2025

M Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SL1 CONSORTIUM GROUP**

Title

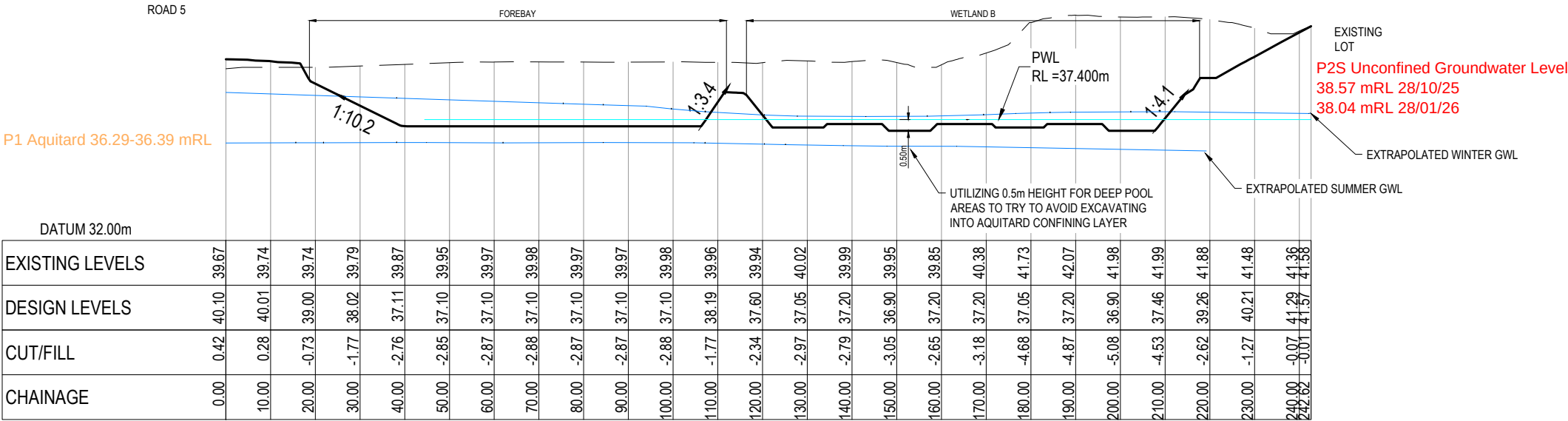
**PROPOSED STORMWATER
WETLAND B
PLAN**

Project no.	298001-R1 SL1
Scale	1:750 @ A3
Cad file	298001-R1-C440 SW WETLAND.DWG
Drawing no.	R1-C440-3
Rev	C

DATE: 22/08 FILE PATH: \\MAVEN\MAVENCONSULTING\CO_NZ\SHARE\CURRENT\MAVEN_HAMILTON\PROJECTS\298001 - SOUTHERN LINKS 1\STG 1\DWG\298001-R1-C440 SW WETLAND.DWG

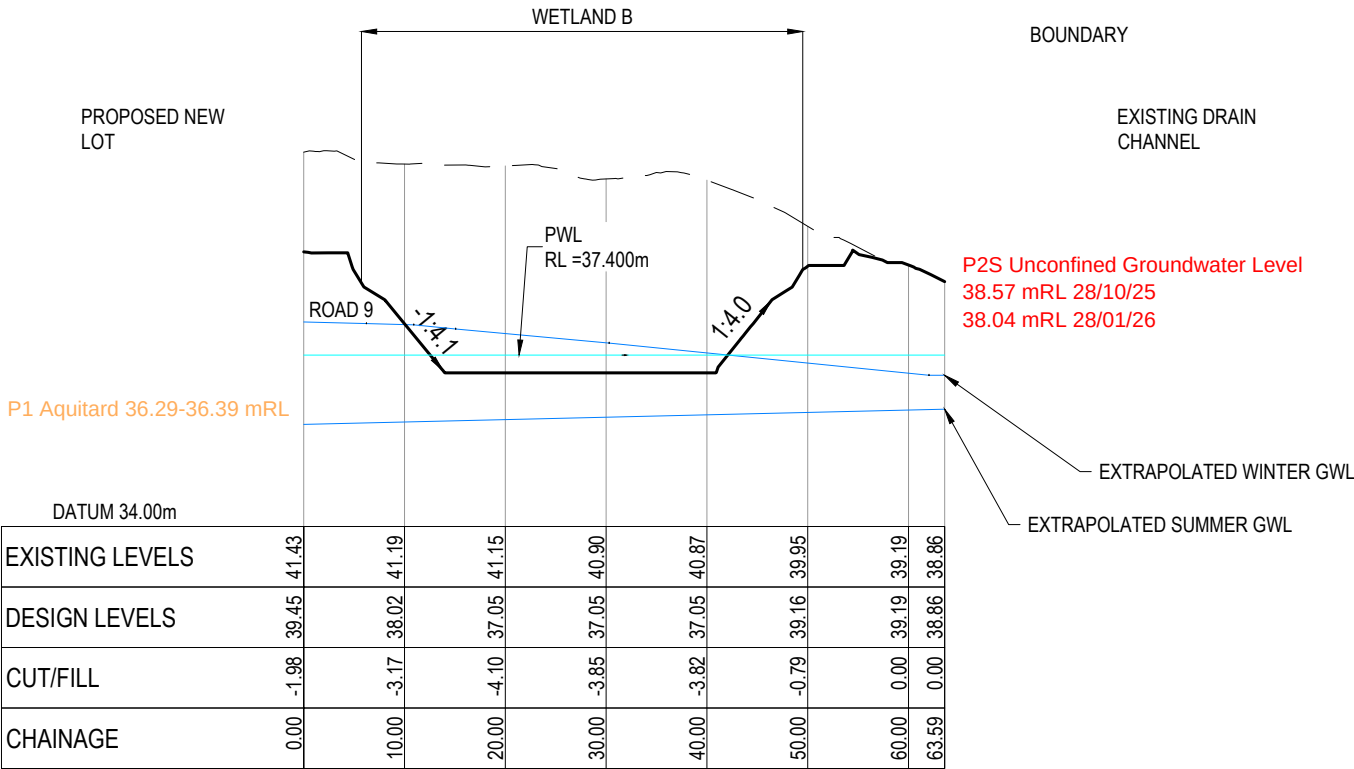
DRAFT FOR REVIEW

DATE: 22/08 FILE PATH: \\MAVEN\MAVEN\CONSULTING\CO NZ\SHARE\CURRENT\MAVEN - HAMILTON\ PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C440 SW WETLAND.DWG



PROPOSED - Section - B1 CH 0+00.00 TO CH 2+42.62
SCALE: 1:750 H / 1:150 V

SCALE: 1:1250 H / 1:250 V (pers. comm. M.Shon 25/02/26)



PROPOSED - Section - B2 CH 0+00.00 TO CH 0+63.59
SCALE: 1:750 H / 1:150 V

DRAFT FOR REVIEW

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
 2. CO-ORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016. CONVERSION TO MOTURIKI 1953 CAN BE ACHIEVED BY ADDING ???m.
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 7. ALL CESSPIT LEADS SHALL HAVE MIN COVER 0.9m.
 8. ALL LINES ARE TO BE CLASS4 RCRRJ UNLESS SHOWN OTHERWISE.
 9. ALL LINES TO BE ABANDONED SHALL BE SEALED AT EACH END. TIMING OF ALL SEALING TO BE COORDINATED WITH COUNCIL STAFF.

LEGEND

EX BDY

PROP BDY

C	DRAFT	MJRA	02/2026
B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
	Survey	MAVEN	06/2025
	Design	MKS	07/2025
	Drawn	MJRA	11/2025
	Checked	DJM	11/2025



Project

SOUTHERN LINKS 1

RESIDENTIAL STAGE 1

HAMILTON, WAIKATO

FOR

SL1 CONSORTIUM GROUP

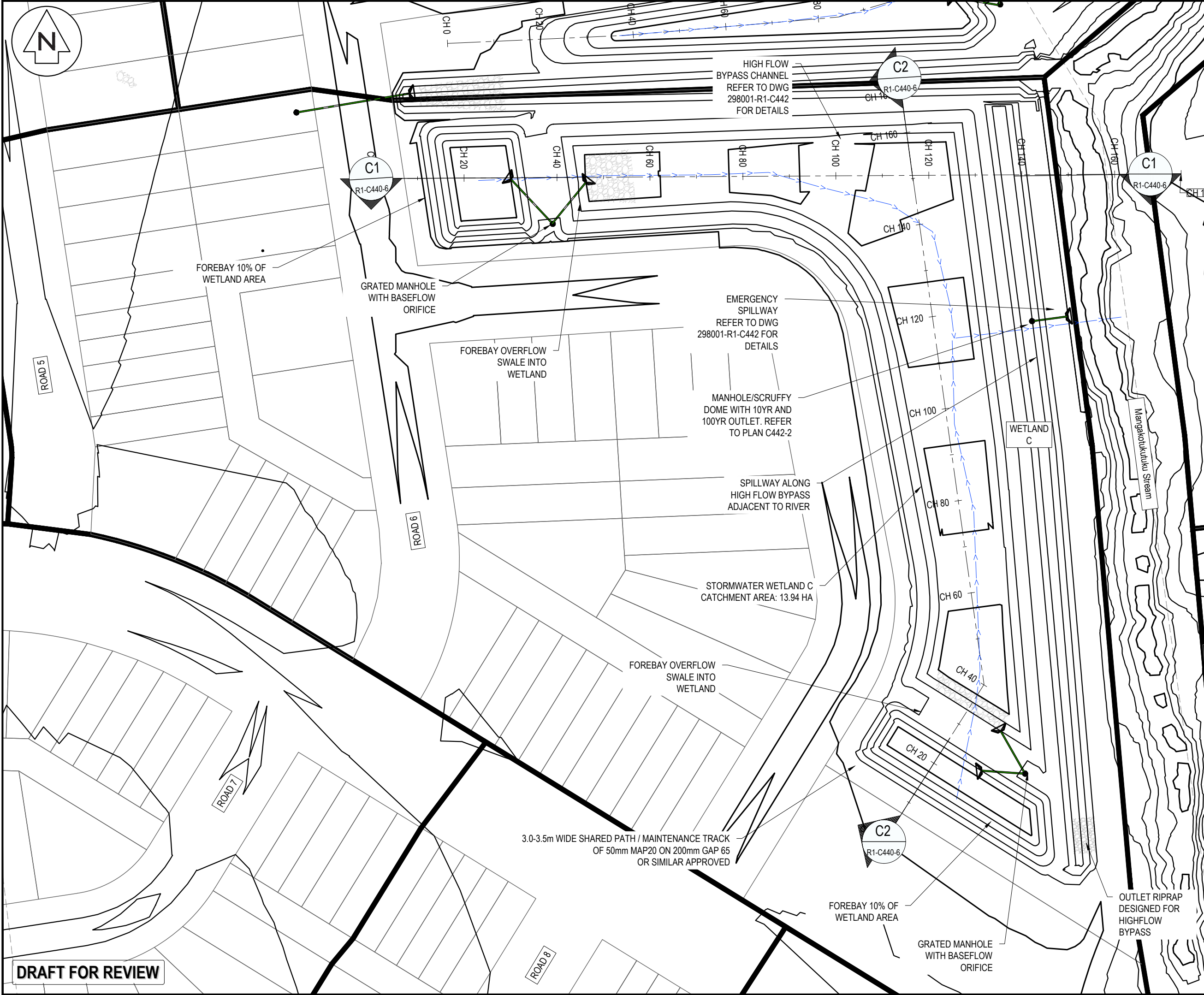
Title

PROPOSED STORMWATER

WETLAND B

SECTIONS

Project no.	298001-R1 SL1		
Scale	AS SHOWN		
Cad file	298001-R1-C440 SW WETLAND.DWG		
Drawing no.	R1-C440-4	Rev	C



NOTES

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LEGEND

--- EX BOUNDARY

--- PROP BOUNDARY

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B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
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Design	MKS		07/2025
Drawn	MJRA		11/2025
Checked	DJM		11/2025

Maven Waikato
07 242 0601
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Level 1 286 Victoria Street, Hamilton
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Project

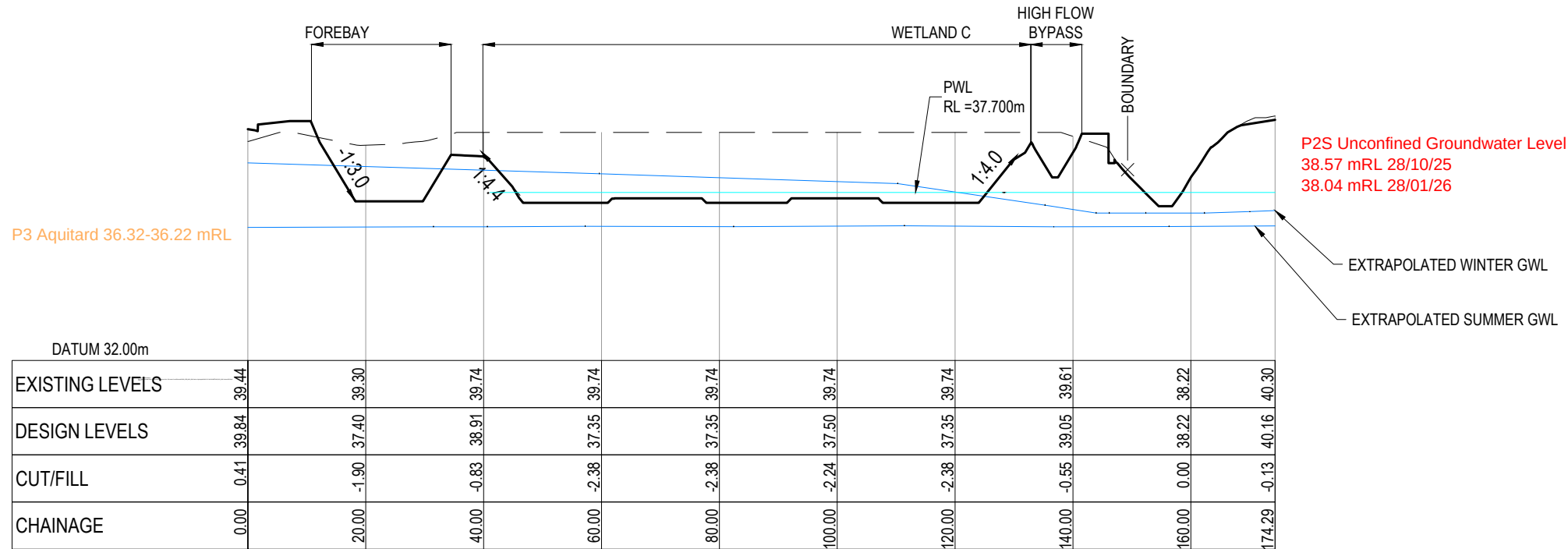
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SL1 CONSORTIUM GROUP**

Title

**PROPOSED STORMWATER
WETLAND C
PLAN**

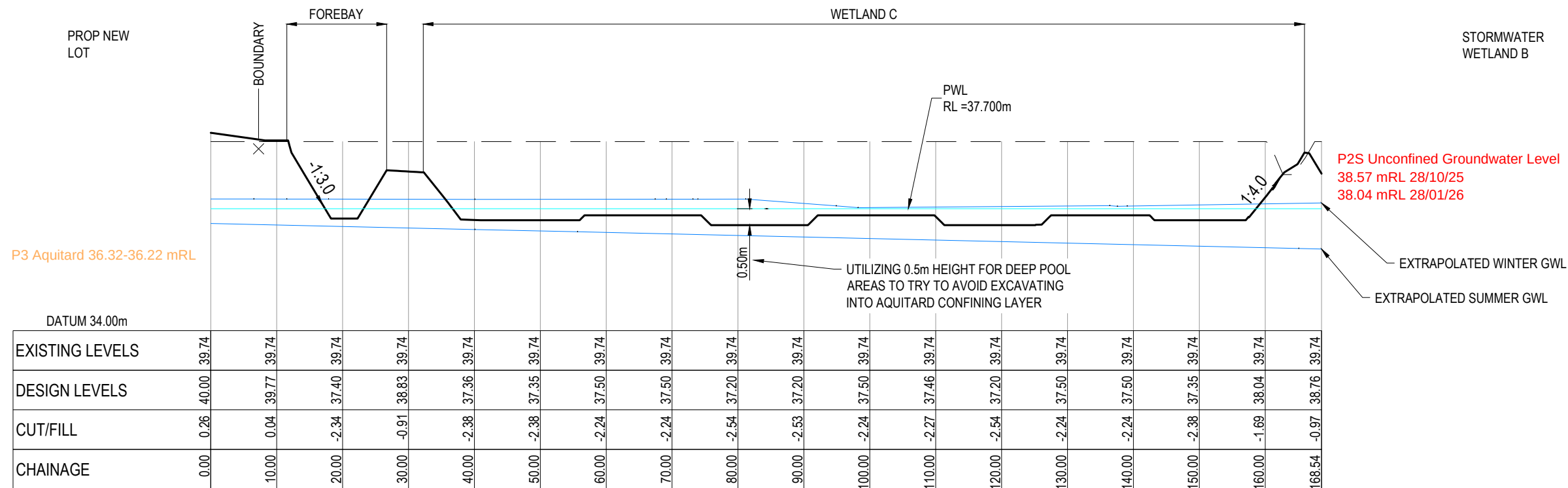
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Scale	1:750 @ A3
Cad file	298001-R1-C440 SW WETLAND.DWG
Drawing no.	R1-C440-5
Rev	C

DATE: 22/08 FILE PATH: \\MAVEN\MAVEN\CONSULTING\CO NZ\SHARE\CURRENT\HAMILTON\ PROJECT\298001-R1-C440 SW WETLAND.DWG



PV - Section - C1
SCALE: HORI 1:750 VERT 1:150

SCALE: HORI 1:1000 VERT 1:200 (pers. comm. M.Shon 25/02/26)



PROPOSED - Section - C2 CH 0+00.00 TO CH 1+68.54
SCALE: 1:750 H / 1:150 V

DRAFT FOR REVIEW

- NOTES
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LEGEND

EX BDY

PROP BDY

C	DRAFT	MJRA	02/2026
B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
	Survey	MAVEN	06/2025
	Design	MKS	07/2025
	Drawn	MJRA	11/2025
	Checked	DJM	11/2025



Project

SOUTHERN LINKS 1

RESIDENTIAL STAGE 1

HAMILTON, WAIKATO

FOR

SL1 CONSORTIUM GROUP

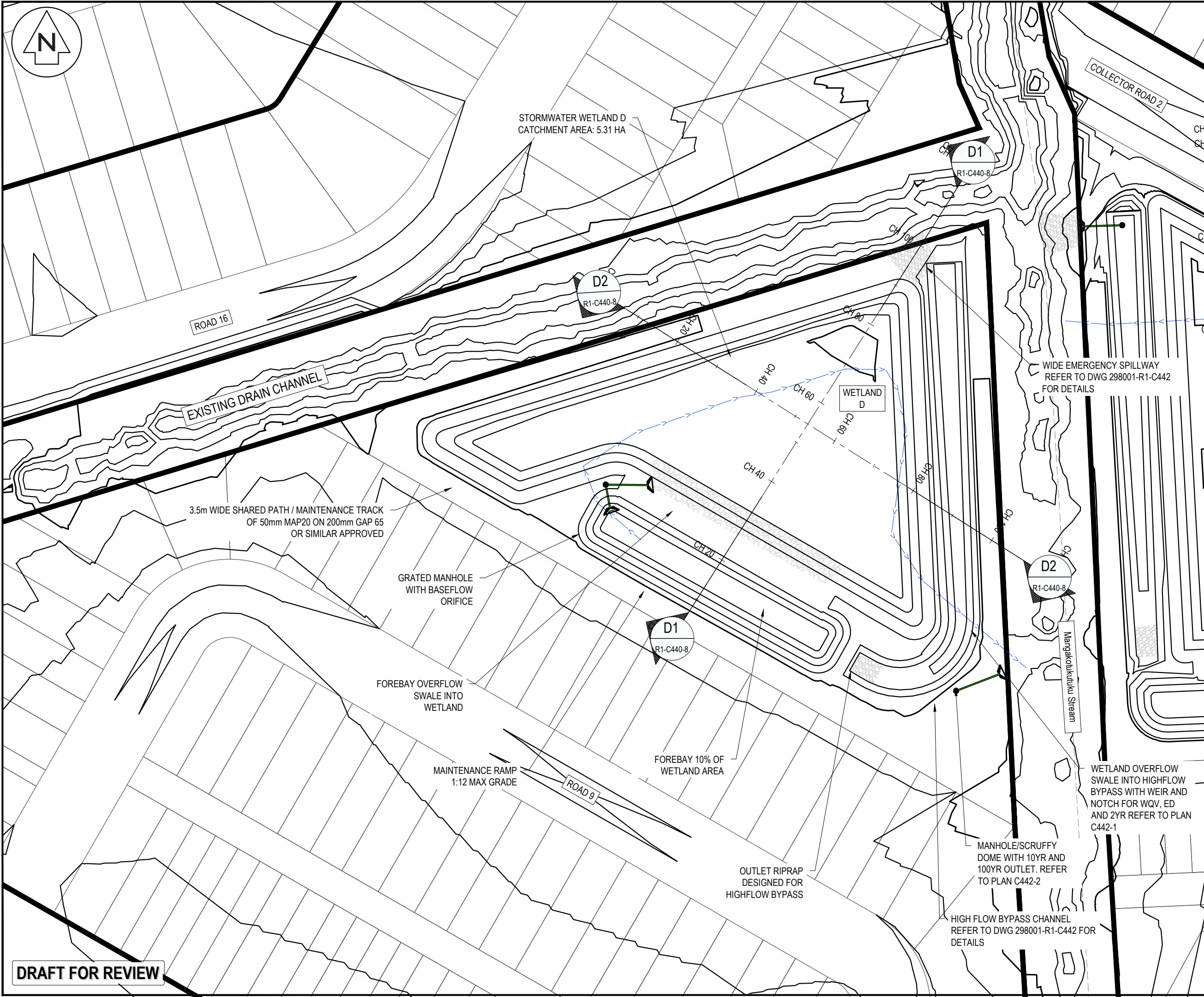
Title

PROPOSED STORMWATER

WETLAND C

SECTIONS

Project no.	298001-R1 SL1
Scale	AS SHOWN
Cad file	298001-R1-C440 SW WETLAND.DWG
Drawing no.	R1-C440-6
Rev	C



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
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LEGEND

--- EX BOUNDARY

--- PROP BOUNDARY

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Rev	Description	By	Date
Survey	MAVEN	06/2025	
Design	MKS	07/2025	
Drawn	MJRA	11/2025	
Checked	DJM	11/2025	

M Maven Waikato
07 242 0601
info@maven.co.nz
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Level 1 286 Victoria Street, Hamilton
New Zealand

Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SL1 CONSORTIUM GROUP**

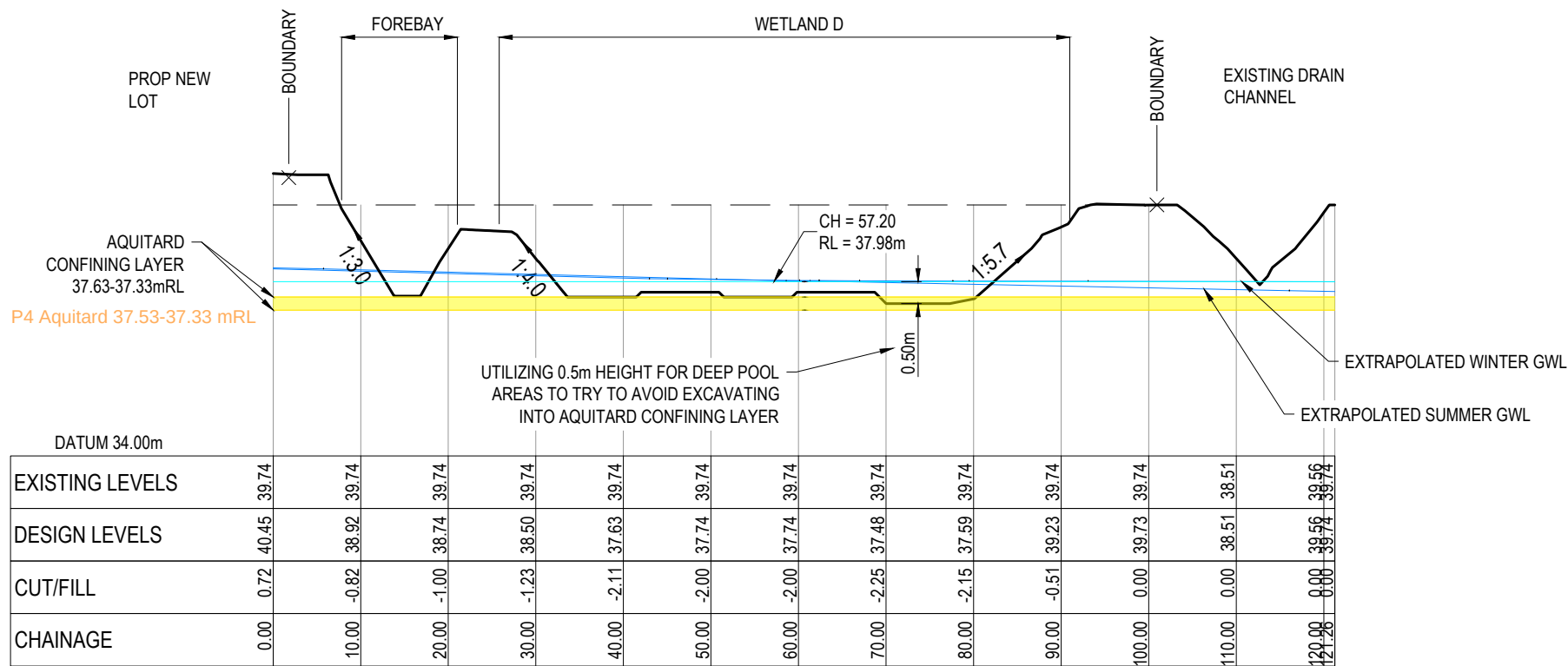
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**PROPOSED STORMWATER
WETLAND D
PLAN**

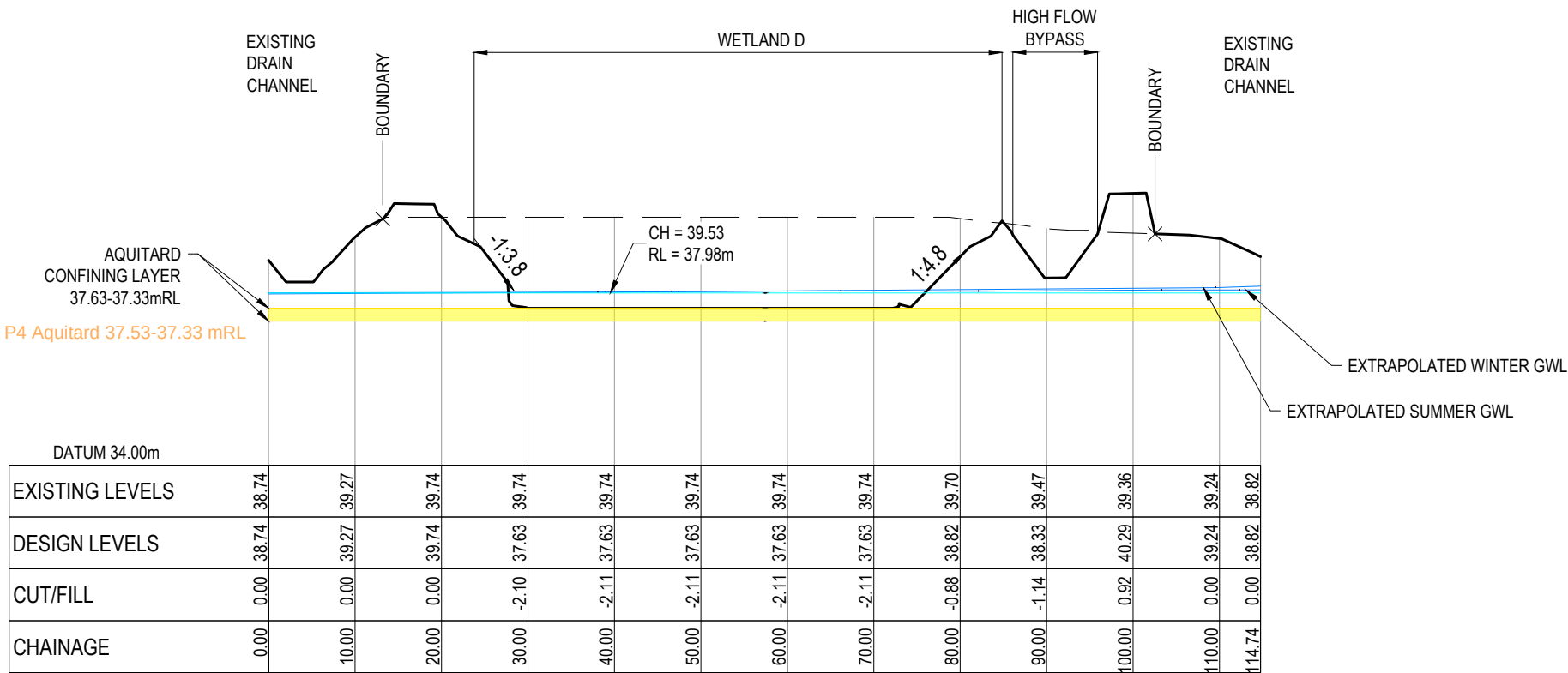
Project no.	298001-R1 SL1
Scale	1:750 @ A3
Cad file	298001-R1-C440 SW WETLAND.DWG
Drawing no.	R1-C440-7
Rev	C

DATE: 22/08 FILE PATH: \\MAVEN\MAVENCONSULTING\CO NZ\SHARE\CURRENT\HAMILTON - PROJECT\298001 - SOUTHERN LINKS 1\STG 02\298001-R1-C440 SW WETLAND.DWG

DATE: 22/08 FILE PATH: \\MAVEN\MAVENCONSULTING\CO NZ\SHARE\CURRENT\MAVEN - HAMILTON - PROJECTS\298001 - SOUTHERN LINKS R1\298001-R1-C440 SW WETLAND.DWG



PROPOSED - Section - D1 CH 0+00.00 TO CH 1+21.26
SCALE: 1:750 H / 1:150 V



PROPOSED - Section - D2 CH 0+00.00 TO CH 1+14.74
SCALE: 1:750 H / 1:150 V

DRAFT FOR REVIEW

- NOTES
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LEGEND

EX BDY
PROP BDY

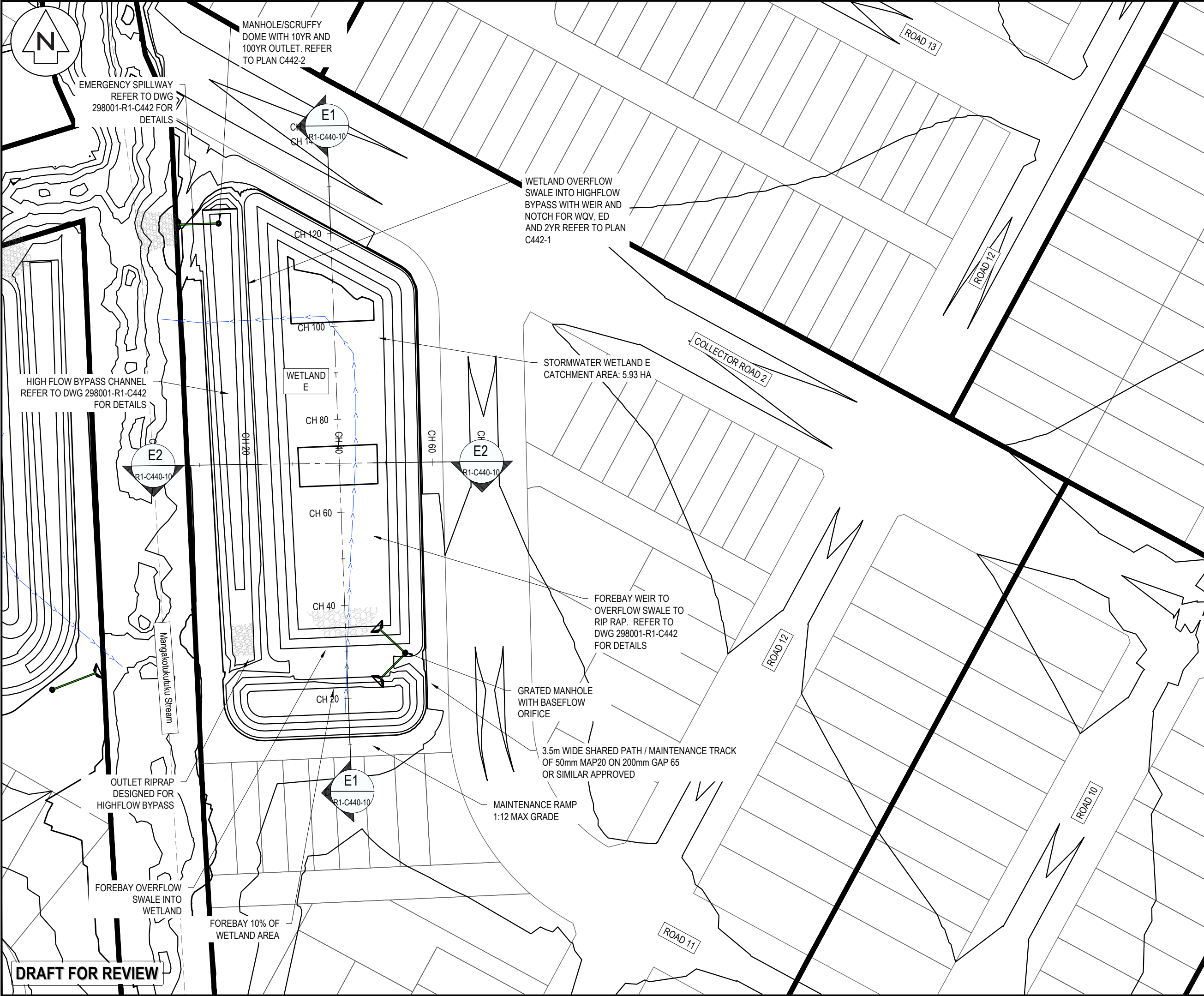
C	DRAFT	MJRA	02/2026
B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
	By	Date	
Survey	MAVEN	06/2025	
Design	MKS	07/2025	
Drawn	MJRA	11/2025	
Checked	DJM	11/2025	



Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SL1 CONSORTIUM GROUP**

Title
**PROPOSED STORMWATER
WETLAND D
SECTIONS**

Project no.	298001-R1 SL1
Scale	AS SHOWN
Cad file	298001-R1-C440 SW WETLAND.DWG
Drawing no.	R1-C440-8
Rev	C



NOTES

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LEGEND

----- EX BOUNDARY

----- PROP BOUNDARY

C	DRAFT	MJRA	02/2026
B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MJRA		11/2025
Checked	DJM		11/2025



Maven Waikato
07 242 0601
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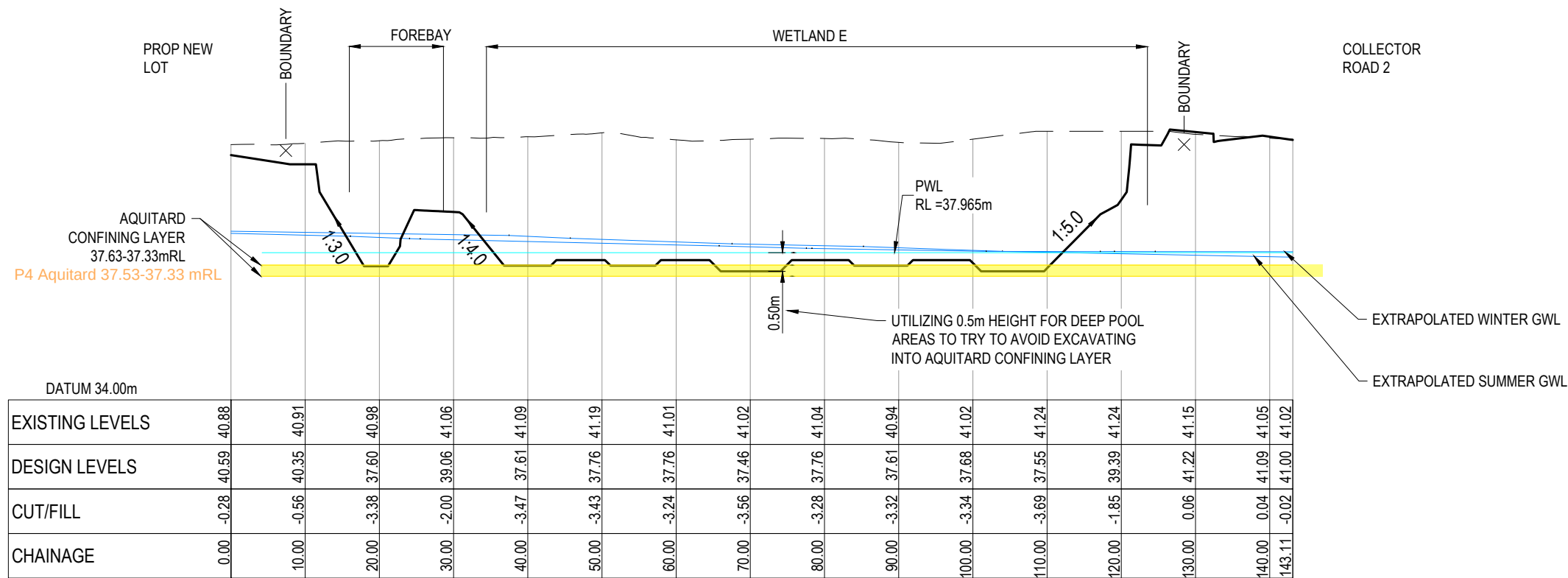
Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SL1 CONSORTIUM GROUP**

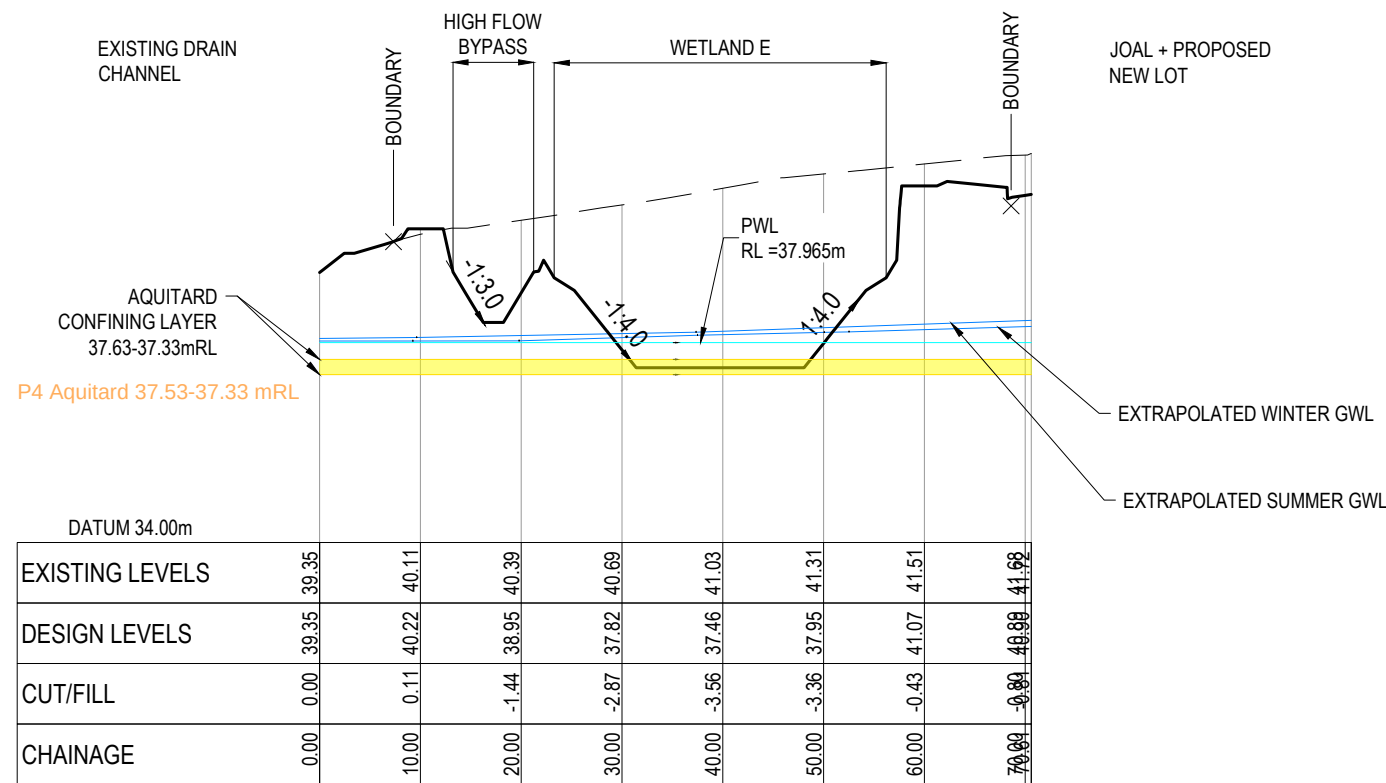
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**PROPOSED STORMWATER
WETLAND E
PLAN**

Project no.	298001-R1 SL1		
Scale	1:750 @ A3		
Cad file	298001-R1-C440 SW WETLAND.DWG		
Drawing no.	R1-C440-9	Rev	C



PROPOSED - Section - E1 CH 0+00.00 TO CH 1+43.11
SCALE: 1:750 H / 1:150 V



PROPOSED - Section - E2 CH 0+00.00 TO CH 0+70.61
SCALE: 1:750 H / 1:150 V

- NOTES
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LEGEND

EX BDY
PROP BDY

C	DRAFT	MJRA	02/2026
B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
	By	Date	
Survey	MAVEN	06/2025	
Design	MKS	07/2025	
Drawn	MJRA	11/2025	
Checked	DJM	11/2025	



Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SL1 CONSORTIUM GROUP**

Title
**PROPOSED STORMWATER
WETLAND E
SECTIONS**

Project no.	298001-R1 SL1
Scale	AS SHOWN
Cad file	298001-R1-C440 SW WETLAND.DWG
Drawing no.	R1-C440-10
Rev	C

DRAFT FOR REVIEW



STORMWATER DETENTION D
CATCHMENT AREA: 4.20 HA

DETENTION
POND F

F1

R1-C440-12

F2

R1-C440-12

F2

R1-C440-12

F1

R1-C440-12

Mangakotukutuku Stream

ROAD 8

ROAD 16

ROAD 9

WIDE EMERGENCY SPILLWAY
REFER TO DWG 298001-R1-C442
FOR DETAILS

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
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LEGEND

----- EX BOUNDARY

----- PROP BOUNDARY

C	DRAFT	MJRA	02/2026
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Rev	Description	By	Date
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Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SL1 CONSORTIUM GROUP**

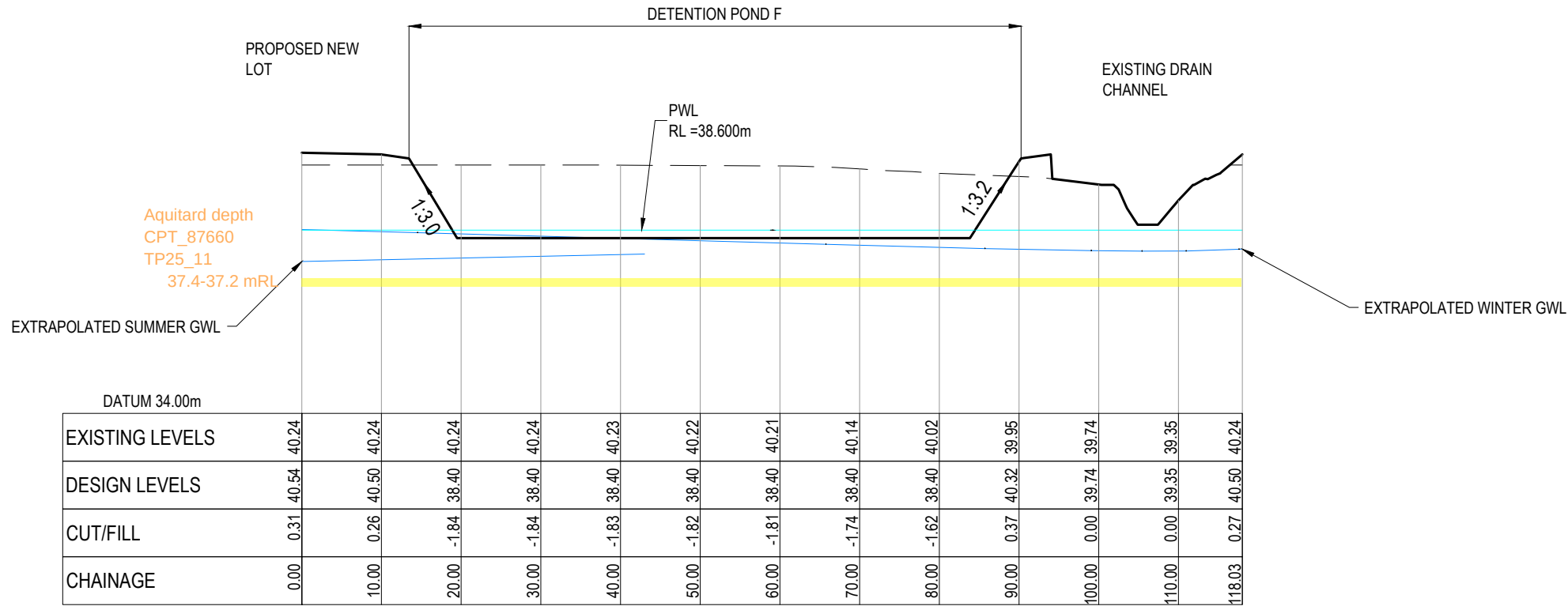
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**PROPOSED STORMWATER
DETENTION POND F
PLAN**

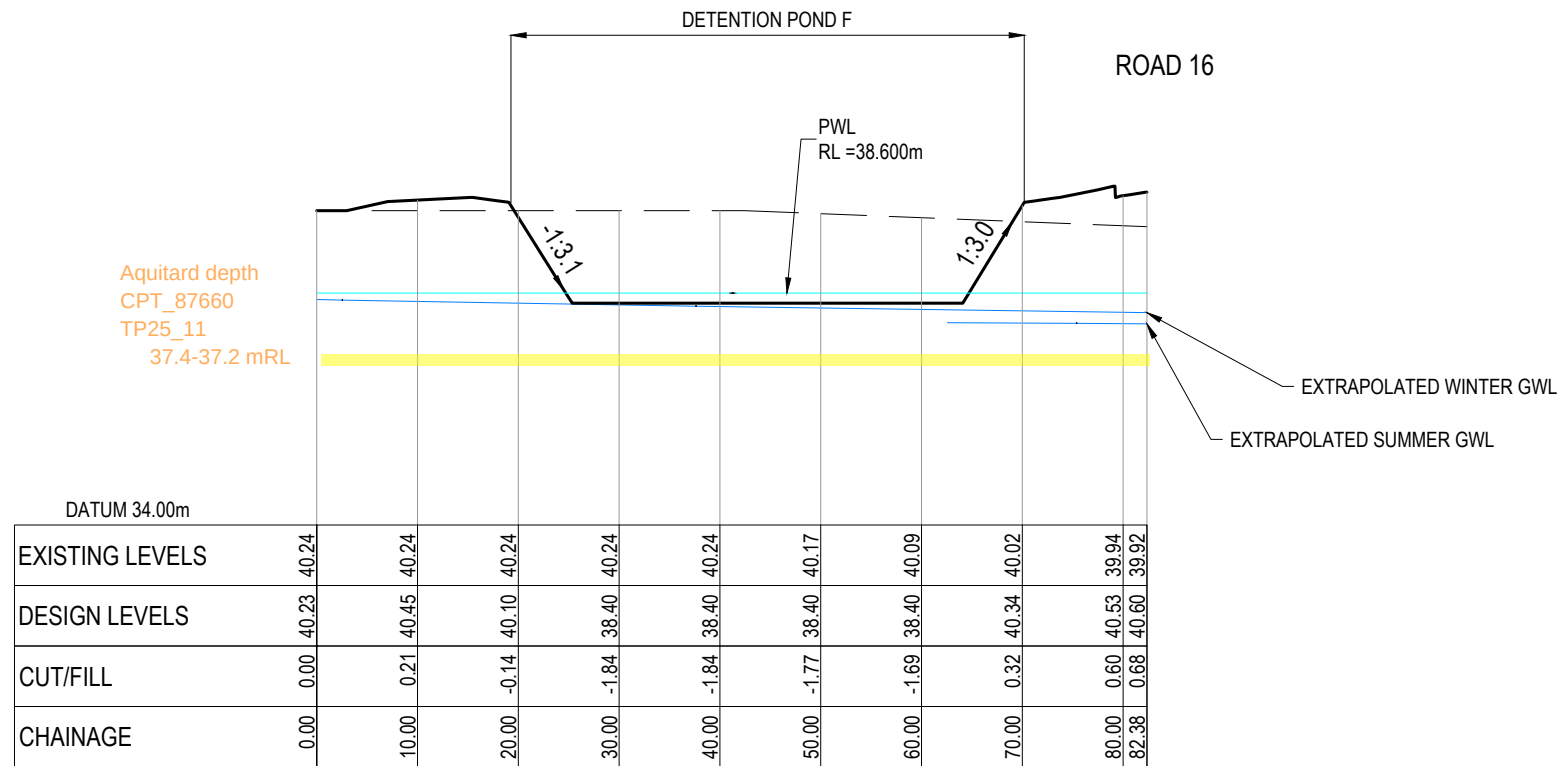
Project no.	298001-R1 SL1		
Scale	1:750 @ A3		
Cad file	298001-R1-C440 SW WETLAND.DWG		
Drawing no.	R1-C440-11	Rev	C

DRAFT FOR REVIEW

DATE: 22/03 FILE PATH: \\MAVEN\MAVEN\CONSULTING\CO NZ\SHARE\CURRENT\MAVEN - HAMILTON - PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C440 SW WETLAND.DWG



PROPOSED - Section - F1 CH 0+00.00 TO CH 1+18.03
SCALE: 1:750 H / 1:150 V



PROPOSED - Section - F2 CH 0+00.00 TO CH 0+82.38
SCALE: 1:750 H / 1:150 V

DRAFT FOR REVIEW

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LEGEND

EX BDY

PROP BDY

C	DRAFT	MJRA	02/2026
B	DRAFT	MJRA	02/2026
A	DRAFT	MJRA	11/2025
Rev	Description	By	Date
	Survey	MAVEN	06/2025
	Design	MKS	07/2025
	Drawn	MJRA	11/2025
	Checked	DJM	11/2025



Project

SOUTHERN LINKS 1

RESIDENTIAL STAGE 1

HAMILTON, WAIKATO

FOR

SL1 CONSORTIUM GROUP

Title

PROPOSED STORMWATER

DETENTION POND F

SECTIONS

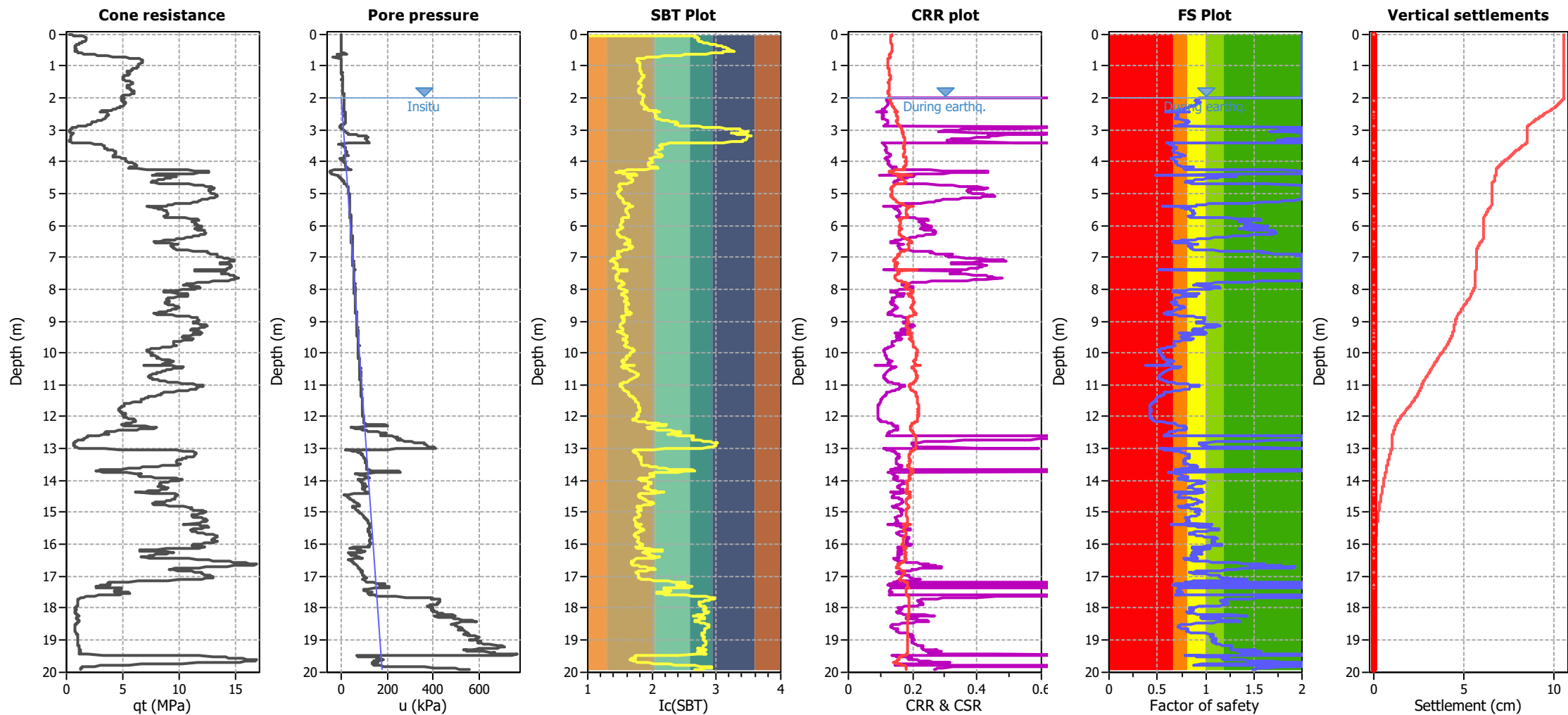
Project no.	298001-R1 SL1		
Scale	AS SHOWN		
Cad file	298001-R1-C440 SW WETLAND.DWG		
Drawing no.	R1-C440-12	Rev	C

Project:

Location:

CPT: CPT_87660

Total depth: 19.93 m



Analysis method: B&I (2014)
Fines correction method: B&I (2014)
Points to test: Based on I_c value
Earthquake magnitude M_w : 5.90
Peak ground acceleration: 0.25

G.W.T. (in-situ): 2.00 m
G.W.T. (earthq.): 2.00 m
Average results interval: 3
 I_c cut-off value: 2.60
Unit weight calculation: Based on SBT

Use fill: No
Fill height: N/A
Fill weight: N/A
Trans. detect. applied: No
 K_o applied: Yes

Clay like behavior applied: .
Limit depth applied: No
Limit depth: N/A
MSF method: Method based

Client: Colliers Project Leaders Ltd
Project: Southern Links Stage 1 Residential Area
Site Location: Deanwell, Hamilton
Project No.: HAM2024-0017
Date: 23/04/2025



Position: 445066.9mE; 694588.0mN	Projection: Mt Eden 2000	Pit Dimensions: 4.0m by 1.0m
Elevation: 40.50m	Datum: NZVD 2016	Survey Source: Hand-held GPS

[illegible]

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

PHOTOGRAPH SHEET - TP25-11

Client:
Project: Southern Links
Location: Hamilton
Project ID: HAM2024-0017
Date: 23/04/2025



TP25-11:



TP25-11:

This borehole report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination.

APPENDIX D

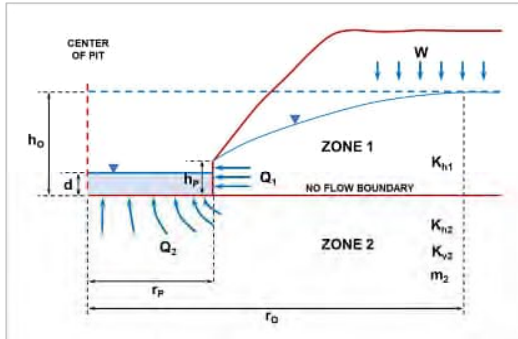
STORMWATER WETLAND DRAWDOWN PIT MODELLING



INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Wetland A - Winter Dry Pit
 Date: Friday, 13 March 2026
 Document #: WGA242463-RP-HG-0003_A



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.57	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	52.6241	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 312 m

Known h_o 1.57 m

h_o calculated using Equation A 1.57 m

Q₁ 2.4E-03 m³/s
2.0E+02 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 6.0E-02 m³/s
5.2E+03 m³/day

Total Pit Inflow

Q_{TOT} 6.2E-02 m³/s
5361.39 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

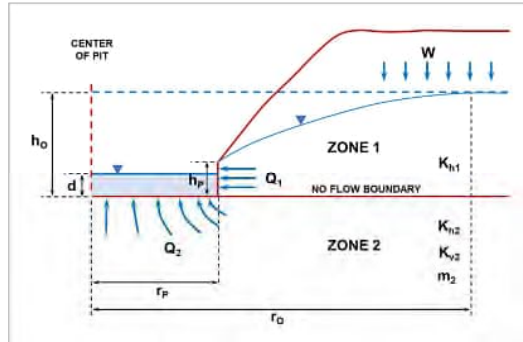
Analysed by: Toby _____ Beisly _____
 Checked by: _____

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Wetland A - Winter Dry Pit
 Date: Friday, 13 March 2026
 Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone1} = h_o - \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

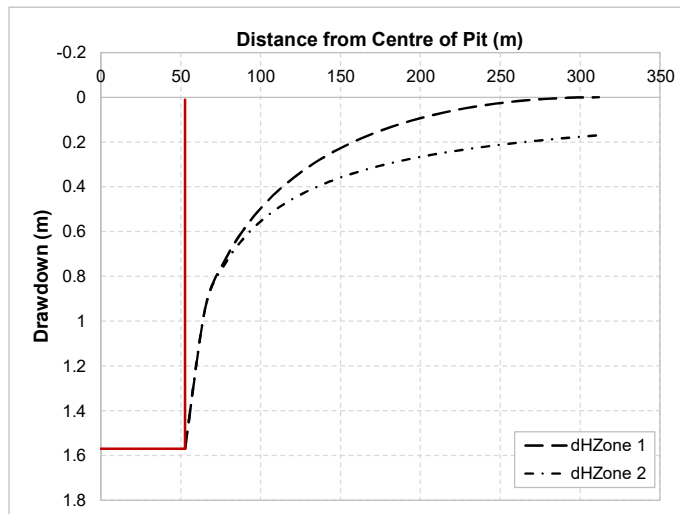
$$dH_{Zone2} = \frac{2(h_o - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.57	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	52.6241	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_o calculated by iterating equation A in analysis sheet 1 312 m



Drawdown curves

r	dH _{Zone 1}	dH _{Zone 2}
52.6241	1.57	1.6
65.6	0.9	0.9
78.5	0.7	0.7
91.5	0.6	0.6
104.4	0.5	0.5
117.4	0.4	0.5
130.3	0.3	0.4
143.3	0.3	0.4
156.3	0.2	0.3
169.2	0.2	0.3
182.2	0.1	0.3
195.1	0.1	0.3
208.1	0.1	0.3
221.0	0.06	0.2
234.0	0.04	0.2
246.9	0.03	0.2
259.9	0.02	0.2
272.8	0.01	0.2
285.8	0.00	0.2
298.7	0.00	0.2
311.7	0.00	0.2

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

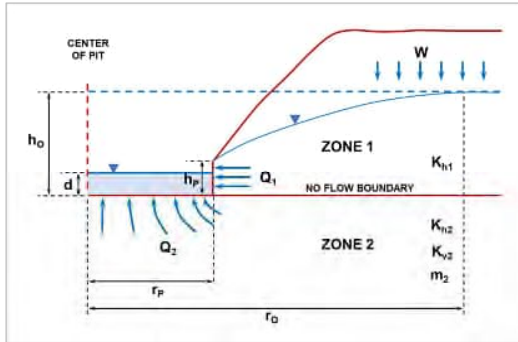
Analysed by: Toby Beisly
Checked by:

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland B Winter Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.67	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	36.56366	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 298 m

Known h_o 1.67 m
 h_o calculated using Equation A 1.67 m

Q₁ 2.2E-03 m³/s
1.9E+02 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 4.4E-02 m³/s
3.8E+03 m³/day

Total Pit Inflow

Q_{TOT} 4.6E-02 m³/s
4000.06 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

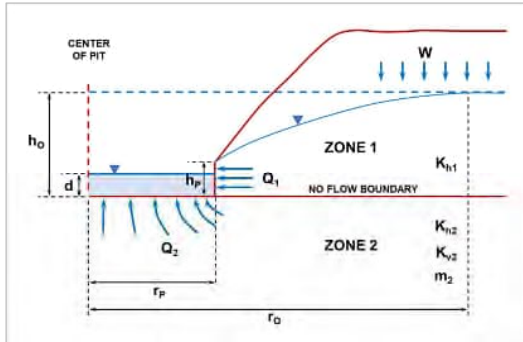
Analysed by: Toby Beisly
Checked by:

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Wetland B Winter Dry Pit
 Date: Friday, 13 March 2026
 Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

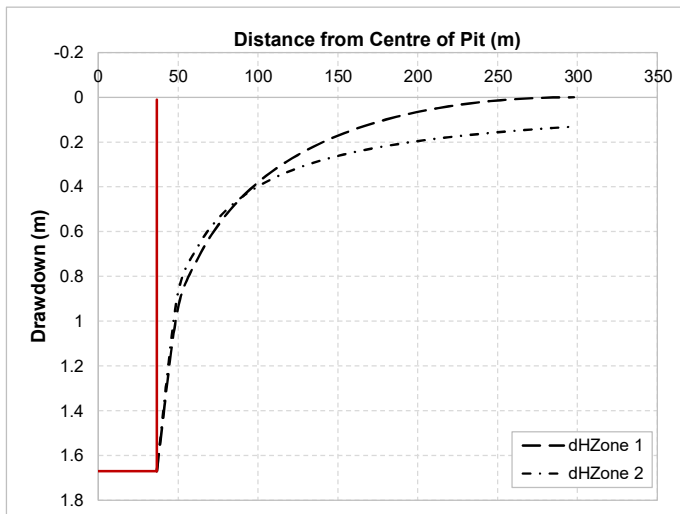
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
Kh1	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
Kh2	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
Kv2	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h0	1.67	m	initial saturated thickness above the base of Zone 1
hp	0	m	saturated thickness at the pit wall
rp	36.56366	m	effective pit radius
d	0	m	depth of the pit lake

r_0 is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_0 calculated by iterating equation A in analysis sheet 1

298 m



Drawdown curves		
r	dHZone1	dHZone2
36.56366	1.67	1.7
49.6	0.9	0.9
62.7	0.7	0.7
75.7	0.6	0.5
88.8	0.5	0.5
101.8	0.4	0.4
114.9	0.3	0.3
127.9	0.2	0.3
141.0	0.2	0.3
154.1	0.2	0.3
167.1	0.1	0.2
180.2	0.1	0.2
193.2	0.1	0.2
206.3	0.06	0.2
219.3	0.04	0.2
232.4	0.03	0.2
245.4	0.02	0.2
258.5	0.01	0.2
271.5	0.00	0.1
284.6	0.00	0.1
297.6	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

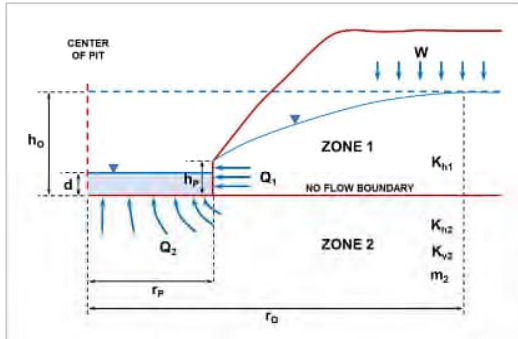
Analysed by: Toby
 Checked by: Beisly

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland C Winter Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$\begin{aligned}
 \text{A } h_o &= \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}, \\
 \text{B } Q_1 &= W \pi (r_o^2 - r_p^2), \\
 \text{C } Q_2 &= 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d), \\
 \text{D } m_2 &= \sqrt{\frac{K_{h2}}{K_{v2}}}
 \end{aligned}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.22	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	46.18091	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 251 m

Known h_o 1.22 m
 h_o calculated using Equation A 1.22 m

Q₁ 1.5E-03 m³/s
1.3E+02 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 4.1E-02 m³/s
3.5E+03 m³/day

Total Pit Inflow

Q_{TOT} 4.2E-02 m³/s
3648.07 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

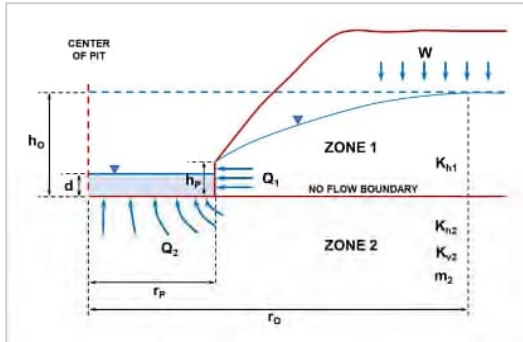
Analysed by: Toby _____ Beisly _____
Checked by: _____

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Wetland C Winter Dry Pit
 Date: Friday, 13 March 2026
 Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone\ 1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone\ 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

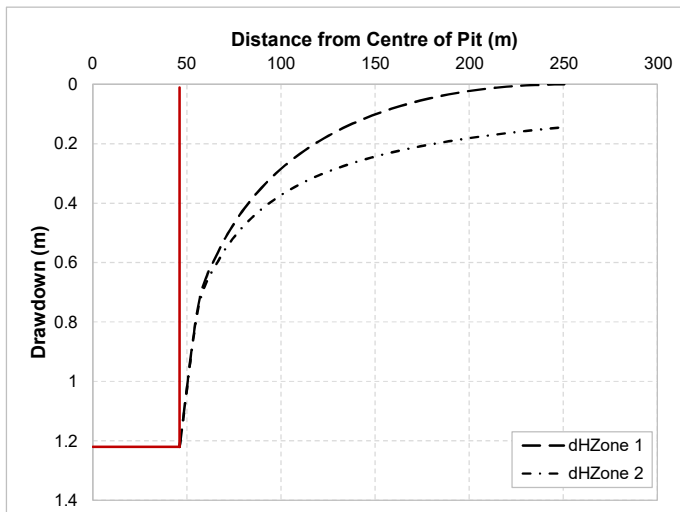
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h ₀	1.22	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	46.18091	m	effective pit radius
d	0	m	depth of the pit lake

r₀ is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r₀ calculated by iterating equation A in analysis sheet 1

251 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
46.18091	1.22	1.2
56.4	0.7	0.7
66.6	0.6	0.6
76.8	0.5	0.5
87.1	0.4	0.4
97.3	0.3	0.4
107.5	0.2	0.3
117.7	0.2	0.3
127.9	0.2	0.3
138.2	0.1	0.3
148.4	0.1	0.2
158.6	0.1	0.2
168.8	0.1	0.2
179.0	0.05	0.2
189.2	0.03	0.2
199.5	0.02	0.2
209.7	0.01	0.2
219.9	0.01	0.2
230.1	0.00	0.2
240.3	0.00	0.2
250.6	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

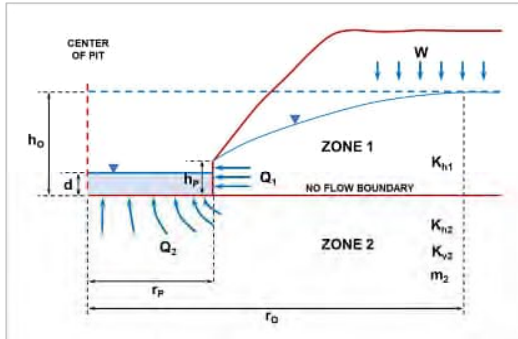
Analysed by: Toby Beisly
 Checked by: _____

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland D Winter Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.266998	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	39.89423	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 248 m

Known h_o 1.27 m

h_o calculated using Equation A 1.27 m

Q₁ 1.5E-03 m³/s
1.3E+02 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 3.7E-02 m³/s
3.2E+03 m³/day

Total Pit Inflow

Q_{TOT} 3.8E-02 m³/s
3284.48 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

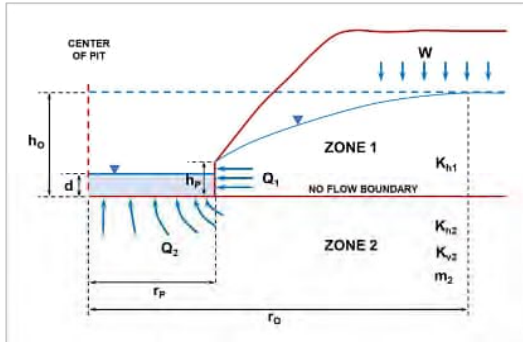
Analysed by: Toby _____ Beisly _____
Checked by: _____

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland D Winter Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone\ 1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone\ 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

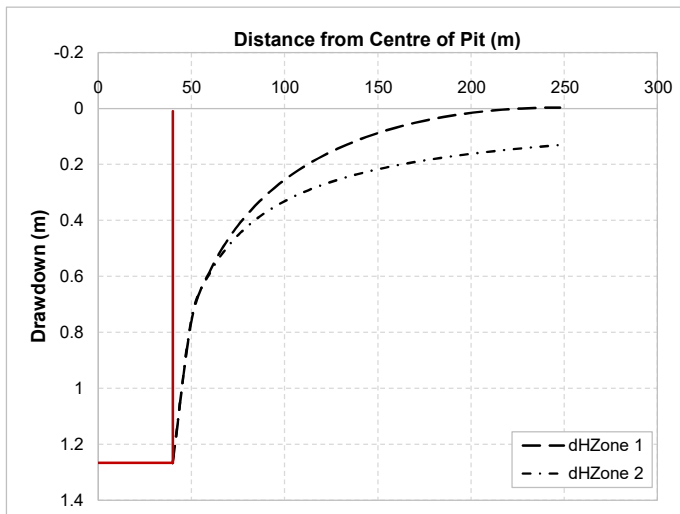
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h₀	1.266998	m	initial saturated thickness above the base of Zone 1
h_p	0	m	saturated thickness at the pit wall
r_p	39.89423	m	effective pit radius
d	0	m	depth of the pit lake

r_0 is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_0 calculated by iterating equation A in analysis sheet 1

248 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
39.89423	1.266998	1.3
50.3	0.7	0.7
60.7	0.6	0.6
71.1	0.5	0.5
81.5	0.4	0.4
91.9	0.3	0.4
102.3	0.2	0.3
112.7	0.2	0.3
123.1	0.2	0.3
133.4	0.1	0.2
143.8	0.1	0.2
154.2	0.1	0.2
164.6	0.1	0.2
175.0	0.04	0.2
185.4	0.03	0.2
195.8	0.02	0.2
206.2	0.01	0.2
216.6	0.00	0.1
227.0	0.00	0.1
237.4	0.00	0.1
247.8	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

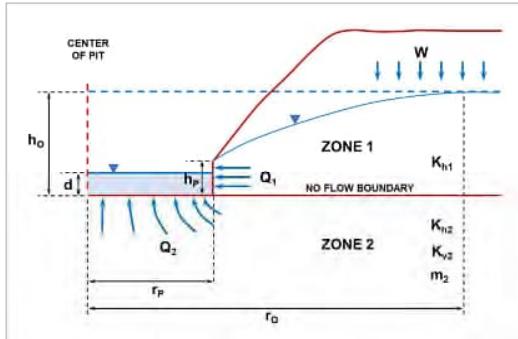
Analysed by: Toby
Checked by:

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland E Winter Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.246998	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	37.21086	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 240 m

Known h_o 1.25 m

h_o calculated using Equation A 1.25 m

Q₁ 1.4E-03 m³/s
1.2E+02 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 3.4E-02 m³/s
2.9E+03 m³/day

Total Pit Inflow

Q_{TOT} 3.5E-02 m³/s
3018.46 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

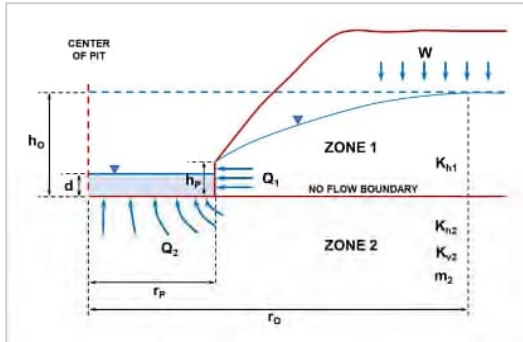
Analysed by: Toby _____ Beisly _____
Checked by: _____

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland E Winter Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone\ 1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

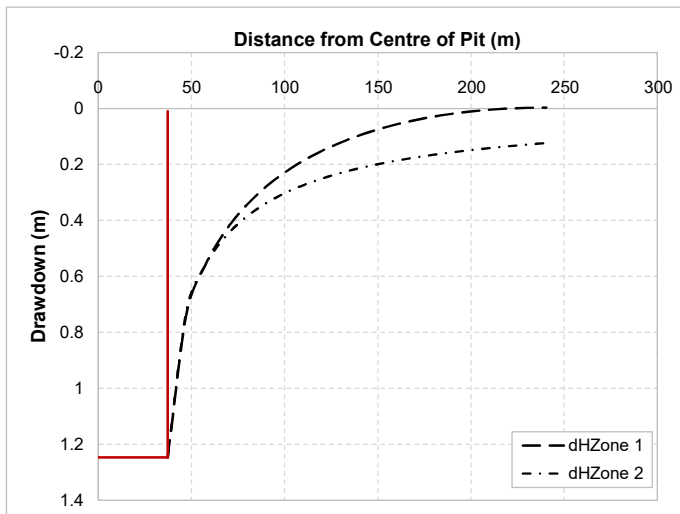
$$dH_{Zone\ 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h₀	1.246998	m	initial saturated thickness above the base of Zone 1
h_p	0	m	saturated thickness at the pit wall
r_p	37.21086	m	effective pit radius
d	0	m	depth of the pit lake

r_0 is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_0 calculated by iterating equation A in analysis sheet 1 240 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
37.21086	1.246998	1.2
47.4	0.7	0.7
57.5	0.6	0.6
67.7	0.4	0.5
77.9	0.4	0.4
88.0	0.3	0.3
98.2	0.2	0.3
108.3	0.2	0.3
118.5	0.2	0.3
128.7	0.1	0.2
138.8	0.1	0.2
149.0	0.1	0.2
159.1	0.1	0.2
169.3	0.04	0.2
179.5	0.03	0.2
189.6	0.02	0.2
199.8	0.01	0.1
209.9	0.00	0.1
220.1	0.00	0.1
230.3	0.00	0.1
240.4	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

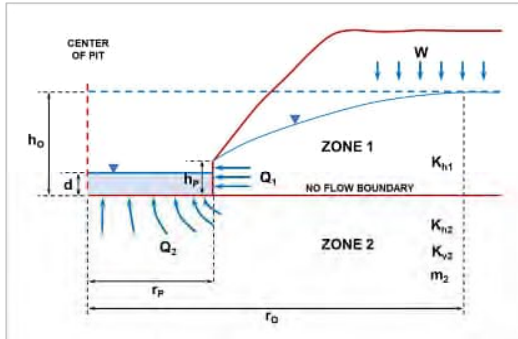
Analysed by: Toby Beisly
Checked by:

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland F Winter Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$\begin{aligned}
 \text{A } h_o &= \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}, \\
 \text{B } Q_1 &= W \pi (r_o^2 - r_p^2), \\
 \text{C } Q_2 &= 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d), \\
 \text{D } m_2 &= \sqrt{\frac{K_{h2}}{K_{v2}}}
 \end{aligned}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	0.8	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	32.89762	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A

168 m

Known h_o

0.80 m

h_o calculated using Equation A

0.80 m

Q₁ 6.8E-04 m³/s
 5.9E+01 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D

2.236068

Q₂ 1.9E-02 m³/s
 1.6E+03 m³/day

Total Pit Inflow

Q_{TOT} 2.0E-02 m³/s
 1701.87 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

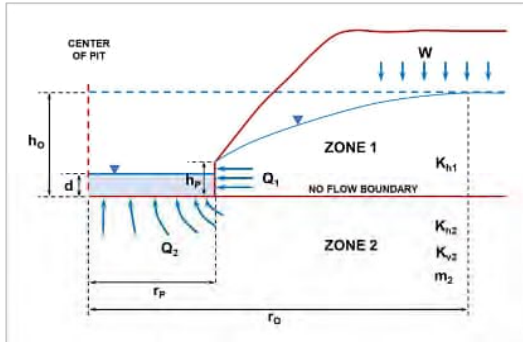
Analysed by: Toby Beisly
Checked by:

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland F Winter Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone\ 1} = h_0 - \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

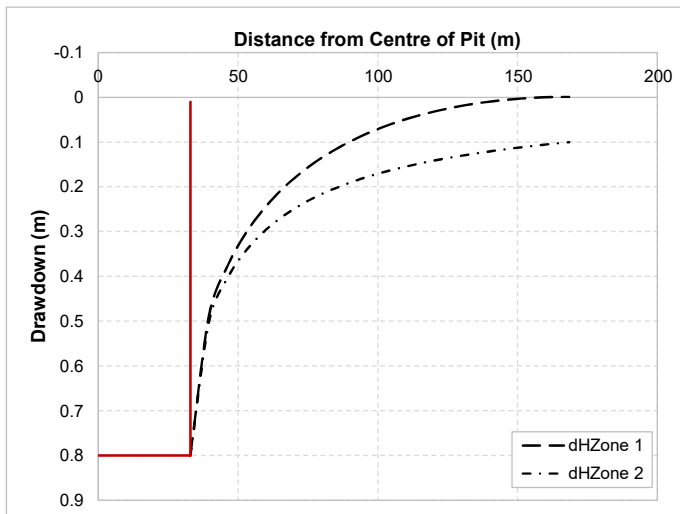
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h₀	0.8	m	initial saturated thickness above the base of Zone 1
h_p	0	m	saturated thickness at the pit wall
r_p	32.89762	m	effective pit radius
d	0	m	depth of the pit lake

r_0 is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_0 calculated by iterating equation A in analysis sheet 1

168 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
32.89762	0.8	0.8
39.7	0.5	0.5
46.5	0.4	0.4
53.2	0.3	0.3
60.0	0.2	0.3
66.8	0.2	0.3
73.6	0.2	0.2
80.3	0.1	0.2
87.1	0.1	0.2
93.9	0.1	0.2
100.7	0.1	0.2
107.4	0.1	0.2
114.2	0.0	0.1
121.0	0.03	0.1
127.8	0.02	0.1
134.6	0.01	0.1
141.3	0.01	0.1
148.1	0.00	0.1
154.9	0.00	0.1
161.7	0.00	0.1
168.4	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

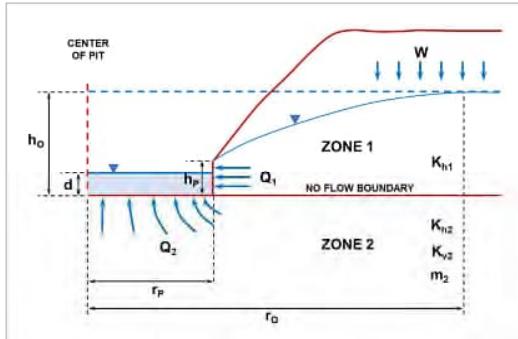
Analysed by: Toby _____
Checked by: _____

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland A Winter PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$\begin{aligned}
 \text{A } h_o &= \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}, \\
 \text{B } Q_1 &= W \pi (r_o^2 - r_p^2), \\
 \text{C } Q_2 &= 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d), \\
 \text{D } m_2 &= \sqrt{\frac{K_{h2}}{K_{v2}}}
 \end{aligned}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h_o	1.57	m	initial saturated thickness above the base of Zone 1
h_p	0.5	m	saturated thickness at the pit wall
r_p	52.62	m	effective pit radius
d	0.5	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 300 m

Known h_o 1.57 m
 h_o calculated using Equation A 1.57 m

Q_1 2.2E-03 m³/s
1.9E+02 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q_2 4.1E-02 m³/s
3.5E+03 m³/day

Total Pit Inflow

Q_{TOT} 4.3E-02 m³/s
3703.05 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

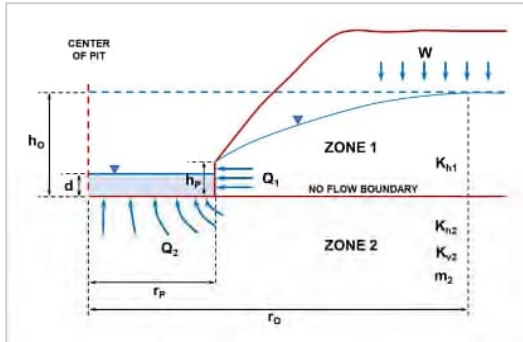
Analysed by: Toby _____ Beisly _____
Checked by: _____

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Wetland A Winter PWL
 Date: Friday, 13 March 2026
 Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone\ 1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone\ 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

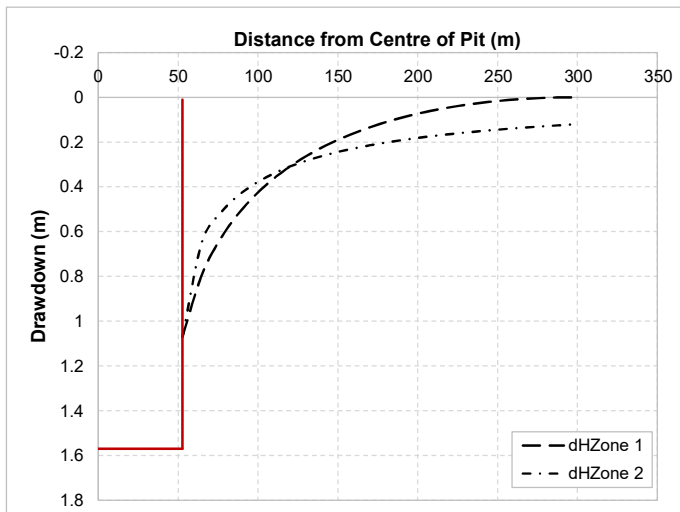
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.57	m	initial saturated thickness above the base of Zone 1
h _p	0.5	m	saturated thickness at the pit wall
r _p	52.6241	m	effective pit radius
d	0.5	m	depth of the pit lake

r₀ is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r₀ calculated by iterating equation A in analysis sheet 1

300 m



Drawdown curves

r	dH _{Zone 1}	dH _{Zone 2}
52.6241	1.07	1.1
65.0	0.8	0.6
77.3	0.6	0.5
89.7	0.5	0.4
102.1	0.4	0.4
114.4	0.3	0.3
126.8	0.3	0.3
139.2	0.2	0.3
151.5	0.2	0.2
163.9	0.1	0.2
176.2	0.1	0.2
188.6	0.1	0.2
201.0	0.1	0.2
213.3	0.05	0.2
225.7	0.04	0.2
238.1	0.03	0.2
250.4	0.02	0.1
262.8	0.01	0.1
275.1	0.00	0.1
287.5	0.00	0.1
299.9	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

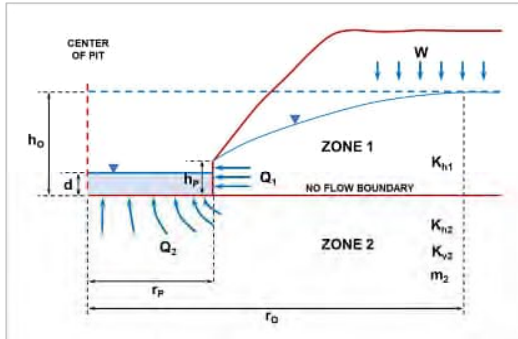
Analysed by: Toby Beisly
 Checked by: _____

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland B Winter PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.67	m	initial saturated thickness above the base of Zone 1
h _p	0.5	m	saturated thickness at the pit wall
r _p	36.56366	m	effective pit radius
d	0.5	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 287 m

Known h_o 1.67 m
 h_o calculated using Equation A 1.67 m

Q₁ 2.0E-03 m³/s
1.7E+02 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 3.1E-02 m³/s
2.7E+03 m³/day

Total Pit Inflow

Q_{TOT} 3.3E-02 m³/s
2845.51 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

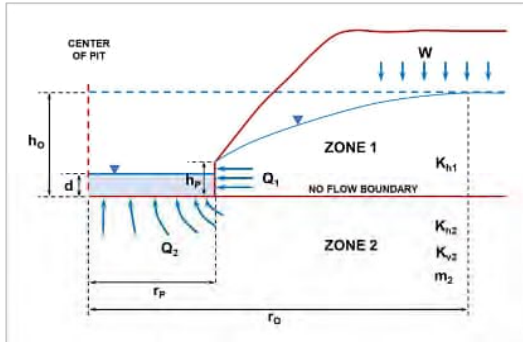
Analysed by: Toby Beisly
Checked by:

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland B Winter PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone 1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

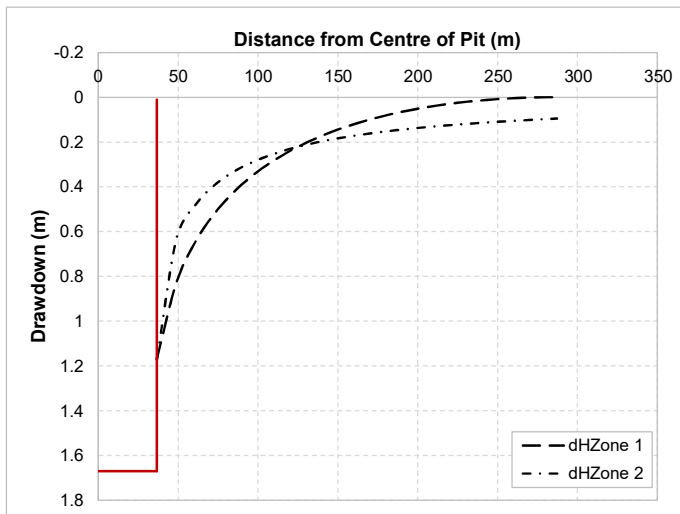
$$dH_{Zone 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h₀	1.67	m	initial saturated thickness above the base of Zone 1
h_p	0.5	m	saturated thickness at the pit wall
r_p	36.56366	m	effective pit radius
d	0.5	m	depth of the pit lake

r_0 is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_0 calculated by iterating equation A in analysis sheet 1 287 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
36.56366	1.17	1.2
49.1	0.8	0.6
61.6	0.6	0.5
74.2	0.5	0.4
86.7	0.4	0.3
99.2	0.3	0.3
111.8	0.3	0.2
124.3	0.2	0.2
136.8	0.2	0.2
149.4	0.1	0.2
161.9	0.1	0.2
174.4	0.1	0.2
186.9	0.1	0.1
199.5	0.05	0.1
212.0	0.04	0.1
224.5	0.02	0.1
237.1	0.02	0.1
249.6	0.01	0.1
262.1	0.00	0.1
274.7	0.00	0.1
287.2	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

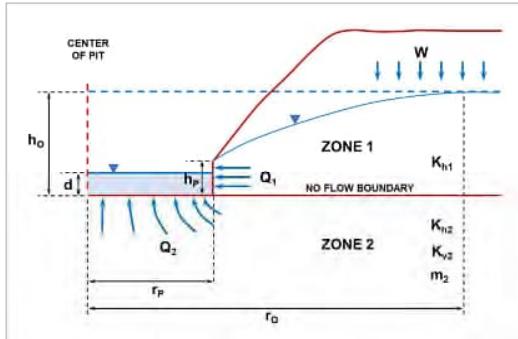
Analysed by: Toby Beisly
Checked by:

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland C Winter PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.22	m	initial saturated thickness above the base of Zone 1
h _p	0.05	m	saturated thickness at the pit wall
r _p	46.18091	m	effective pit radius
d	0.05	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 250 m

Known h_o 1.22 m

h_o calculated using Equation A 1.22 m

Q₁ 1.5E-03 m³/s
1.3E+02 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 3.9E-02 m³/s
3.4E+03 m³/day

Total Pit Inflow

Q_{TOT} 4.1E-02 m³/s
3503.75 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

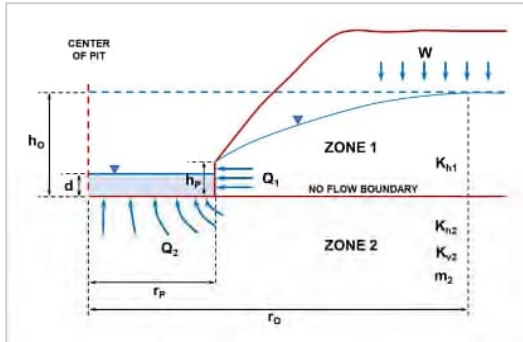
Analysed by: Toby Beisly
Checked by:

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Wetland C Winter PWL
 Date: Friday, 13 March 2026
 Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone 1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln \left(\frac{r}{r_p} \right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1} \left(\frac{r_p}{r} \right)$$

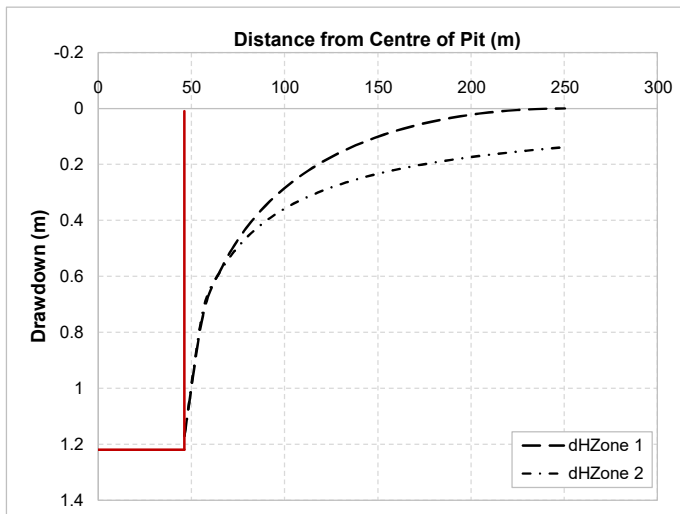
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h ₀	1.22	m	initial saturated thickness above the base of Zone 1
h _p	0.05	m	saturated thickness at the pit wall
r _p	46.18091	m	effective pit radius
d	0.05	m	depth of the pit lake

r₀ is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r₀ calculated by iterating equation A in analysis sheet 1

250 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
46.18091	1.17	1.2
56.4	0.7	0.7
66.6	0.6	0.6
76.8	0.5	0.5
87.0	0.4	0.4
97.2	0.3	0.4
107.4	0.2	0.3
117.7	0.2	0.3
127.9	0.2	0.3
138.1	0.1	0.3
148.3	0.1	0.2
158.5	0.1	0.2
168.7	0.1	0.2
178.9	0.05	0.2
189.1	0.03	0.2
199.4	0.02	0.2
209.6	0.01	0.2
219.8	0.01	0.2
230.0	0.00	0.2
240.2	0.00	0.1
250.4	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

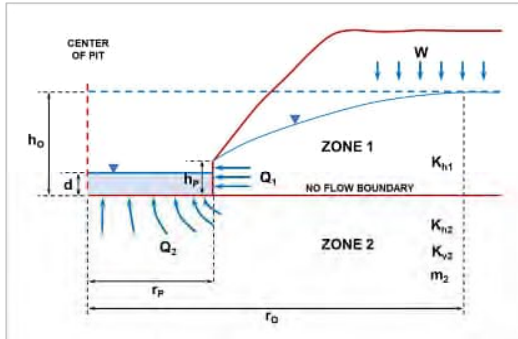
Analysed by: Toby Beisly
 Checked by: _____

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland D Winter PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.266998	m	initial saturated thickness above the base of Zone 1
h _p	0.47	m	saturated thickness at the pit wall
r _p	39.89423	m	effective pit radius
d	0.47	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 235 m

Known h_o 1.27 m
 h_o calculated using Equation A 1.27 m

Q₁ 1.3E-03 m³/s
1.2E+02 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 2.3E-02 m³/s
2.0E+03 m³/day

Total Pit Inflow

Q_{TOT} 2.4E-02 m³/s
2100.34 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

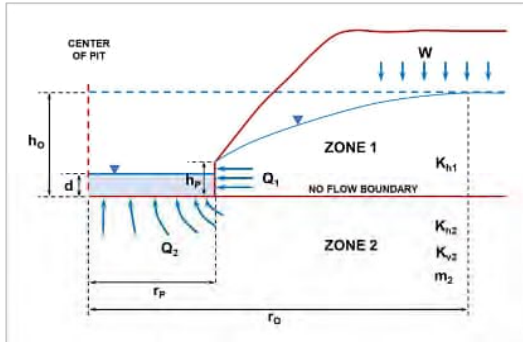
Analysed by: Toby Beisly
Checked by:

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Wetland D Winter PWL
 Date: Friday, 13 March 2026
 Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone 1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln \left(\frac{r}{r_p} \right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1} \left(\frac{r_p}{r} \right)$$

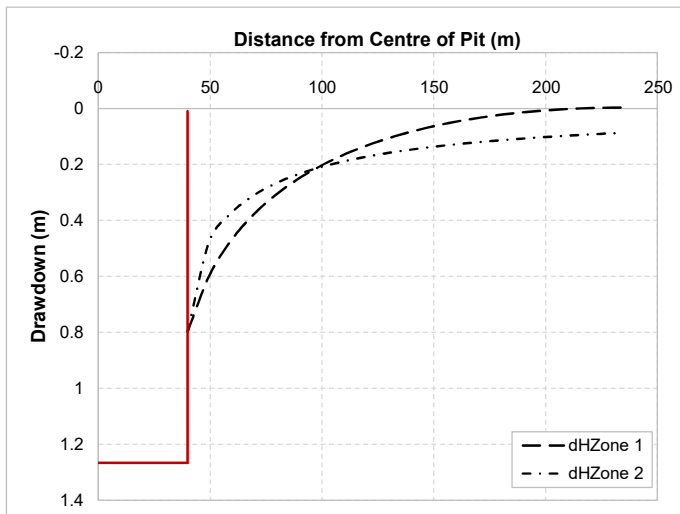
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h ₀	1.266998	m	initial saturated thickness above the base of Zone 1
h _p	0.47	m	saturated thickness at the pit wall
r _p	39.89423	m	effective pit radius
d	0.47	m	depth of the pit lake

r₀ is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r₀ calculated by iterating equation A in analysis sheet 1

235 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
39.89423	0.796998	0.8
49.6	0.6	0.5
59.4	0.5	0.4
69.1	0.4	0.3
78.9	0.3	0.3
88.6	0.3	0.2
98.4	0.2	0.2
108.1	0.2	0.2
117.9	0.1	0.2
127.6	0.1	0.2
137.3	0.1	0.1
147.1	0.1	0.1
156.8	0.1	0.1
166.6	0.04	0.1
176.3	0.03	0.1
186.1	0.02	0.1
195.8	0.01	0.1
205.6	0.00	0.1
215.3	0.00	0.1
225.1	0.00	0.1
234.8	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

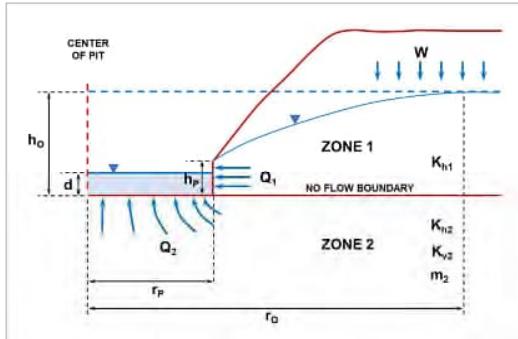
Analysed by: Toby Beisly
Checked by:

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland E Winter PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.246998	m	initial saturated thickness above the base of Zone 1
h _p	0.4	m	saturated thickness at the pit wall
r _p	37.21086	m	effective pit radius
d	0.4	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 231 m

Known h_o 1.25 m

h_o calculated using Equation A 1.25 m

Q₁ 1.3E-03 m³/s
1.1E+02 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 2.3E-02 m³/s
2.0E+03 m³/day

Total Pit Inflow

Q_{TOT} 2.4E-02 m³/s
2079.67 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

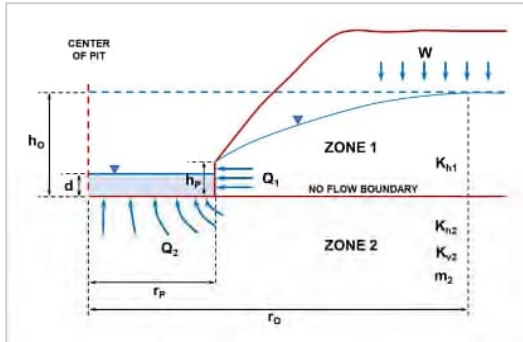
Analysed by: Toby Beisly
Checked by:

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland E Winter PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone\ 1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln \left(\frac{r}{r_p} \right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone\ 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1} \left(\frac{r_p}{r} \right)$$

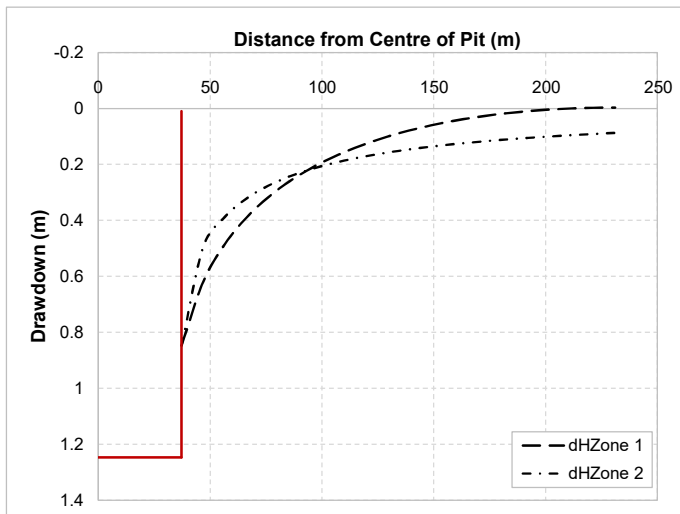
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h₀	1.246998	m	initial saturated thickness above the base of Zone 1
h_p	0.4	m	saturated thickness at the pit wall
r_p	37.21086	m	effective pit radius
d	0.4	m	depth of the pit lake

r_0 is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_0 calculated by iterating equation A in analysis sheet 1

231 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
37.21086	0.846998	0.8
46.9	0.6	0.5
56.6	0.5	0.4
66.3	0.4	0.3
76.0	0.3	0.3
85.7	0.3	0.2
95.4	0.2	0.2
105.1	0.2	0.2
114.8	0.1	0.2
124.4	0.1	0.2
134.1	0.1	0.2
143.8	0.1	0.1
153.5	0.1	0.1
163.2	0.04	0.1
172.9	0.03	0.1
182.6	0.02	0.1
192.3	0.01	0.1
202.0	0.00	0.1
211.7	0.00	0.1
221.4	0.00	0.1
231.1	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

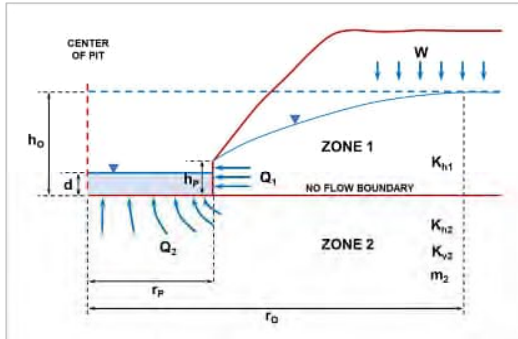
Analysed by: Toby _____
Checked by: _____

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland F Winter PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$\begin{aligned}
 \text{A } h_o &= \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}, \\
 \text{B } Q_1 &= W \pi (r_o^2 - r_p^2), \\
 \text{C } Q_2 &= 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d), \\
 \text{D } m_2 &= \sqrt{\frac{K_{h2}}{K_{v2}}}
 \end{aligned}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	0.8	m	initial saturated thickness above the base of Zone 1
h _p	0.4	m	saturated thickness at the pit wall
r _p	32.89762	m	effective pit radius
d	0.4	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 152 m

Known h_o 0.80 m
 h_o calculated using Equation A 0.80 m

Q₁ 5.5E-04 m³/s
4.8E+01 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 9.5E-03 m³/s
8.2E+02 m³/day

Total Pit Inflow

Q_{TOT} 1.0E-02 m³/s
869.11 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

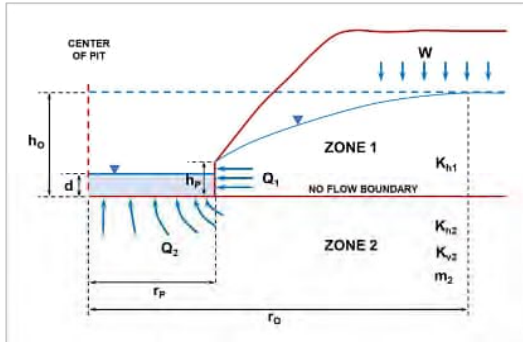
Analysed by: Toby _____ Beisly _____
Checked by: _____

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland F Winter PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone\ 1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

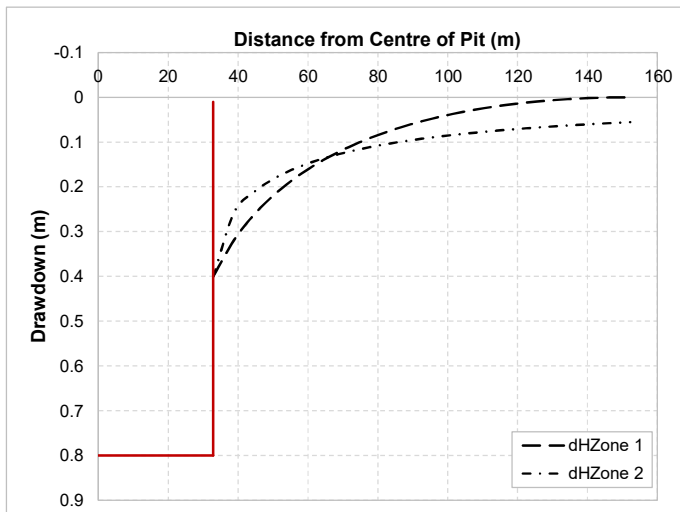
$$dH_{Zone\ 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	0.000404	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h₀	0.8	m	initial saturated thickness above the base of Zone 1
h_p	0.4	m	saturated thickness at the pit wall
r_p	32.89762	m	effective pit radius
d	0.4	m	depth of the pit lake

r_0 is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_0 calculated by iterating equation A in analysis sheet 1 152 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
32.89762	0.4	0.4
38.9	0.3	0.3
44.8	0.3	0.2
50.8	0.2	0.2
56.8	0.2	0.2
62.7	0.1	0.1
68.7	0.1	0.1
74.7	0.1	0.1
80.6	0.1	0.1
86.6	0.1	0.1
92.6	0.1	0.1
98.5	0.0	0.1
104.5	0.0	0.1
110.5	0.02	0.1
116.4	0.02	0.1
122.4	0.01	0.1
128.4	0.01	0.1
134.3	0.00	0.1
140.3	0.00	0.1
146.3	0.00	0.1
152.2	0.00	0.1

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

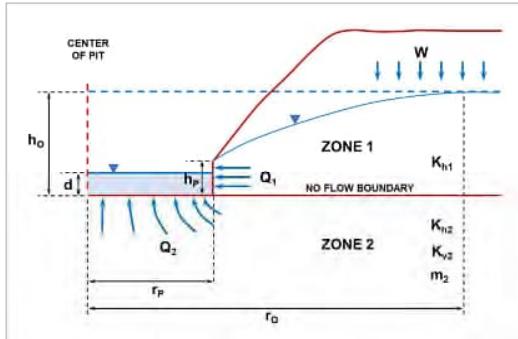
Analysed by: Toby Beisly
Checked by:

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland A - Summer Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$\begin{aligned}
 \text{A } h_o &= \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}, \\
 \text{B } Q_1 &= W \pi (r_o^2 - r_p^2), \\
 \text{C } Q_2 &= 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d), \\
 \text{D } m_2 &= \sqrt{\frac{K_{h2}}{K_{v2}}}
 \end{aligned}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	2.50E-05	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.04	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	52.62	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 105 m

Known h_o 1.04 m
 h_o calculated using Equation A 1.04 m

Q₁ 2.0E-04 m³/s
1.8E+01 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 4.0E-02 m³/s
3.4E+03 m³/day

Total Pit Inflow

Q_{TOT} 4.0E-02 m³/s
3434.50 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

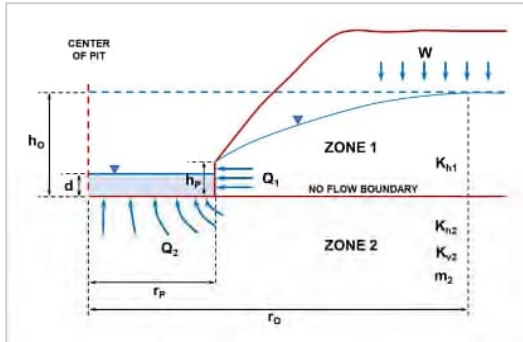
Analysed by: Toby Beisly
Checked by:

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: Wetland A - Summer Dry Pit
 Date: Friday, 13 March 2026
 Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone2} = \frac{2(h_0 - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

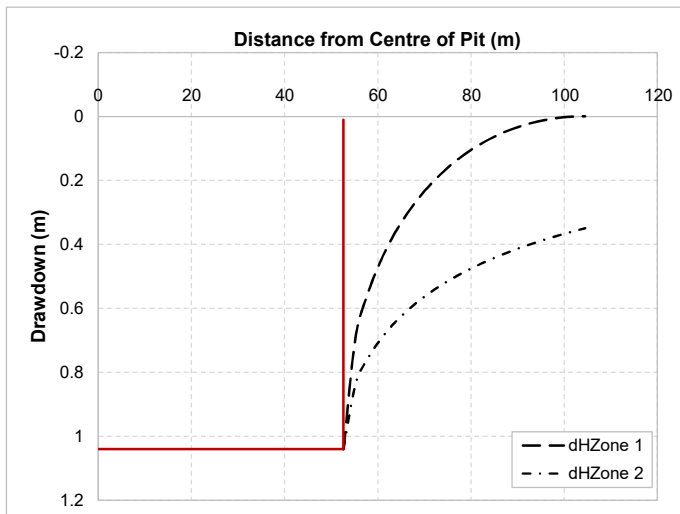
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
Kh1	0.000025	m/s	horizontal hydraulic conductivity in Zone 1
Kh2	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
Kv2	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h0	1.04	m	initial saturated thickness above the base of Zone 1
hp	0	m	saturated thickness at the pit wall
rp	52.6241	m	effective pit radius
d	0	m	depth of the pit lake

r_0 is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_0 calculated by iterating equation A in analysis sheet 1

105 m



Drawdown curves		
r	dHZone1	dHZone2
52.6241	1.04	1.0
55.2	0.7	0.8
57.8	0.6	0.8
60.4	0.5	0.7
63.0	0.4	0.7
65.6	0.3	0.6
68.2	0.3	0.6
70.8	0.2	0.6
73.4	0.2	0.5
76.0	0.1	0.5
78.6	0.1	0.5
81.2	0.1	0.5
83.8	0.1	0.5
86.3	0.05	0.4
88.9	0.04	0.4
91.5	0.03	0.4
94.1	0.02	0.4
96.7	0.01	0.4
99.3	0.00	0.4
101.9	0.00	0.4
104.5	0.00	0.3

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

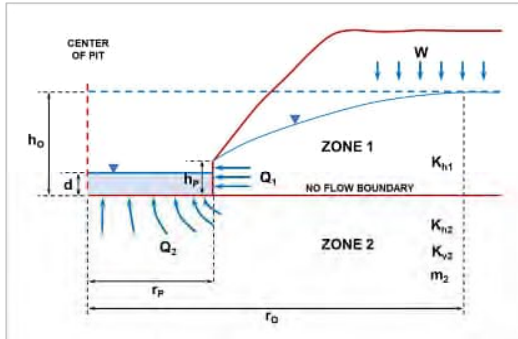
Analysed by: Toby Beisly
 Checked by: _____

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland B - Summer Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	2.50E-05	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.14	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	36.56366	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 91 m

Known h_o 1.14 m
 h_o calculated using Equation A 1.14 m

Q₁ 1.7E-04 m³/s
1.5E+01 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 3.0E-02 m³/s
2.6E+03 m³/day

Total Pit Inflow

Q_{TOT} 3.0E-02 m³/s
2617.41 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

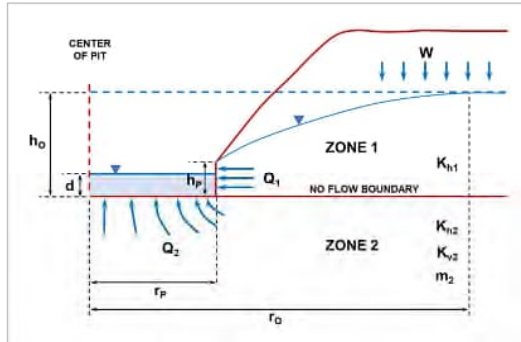
Analysed by: Toby Beisly
Checked by:

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland B - Summer Dry Pit
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone1} = h_o - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_o^2 \ln \left(\frac{r}{r_p} \right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone2} = \frac{2(h_o - d)}{\pi} \sin^{-1} \left(\frac{r_p}{r} \right)$$

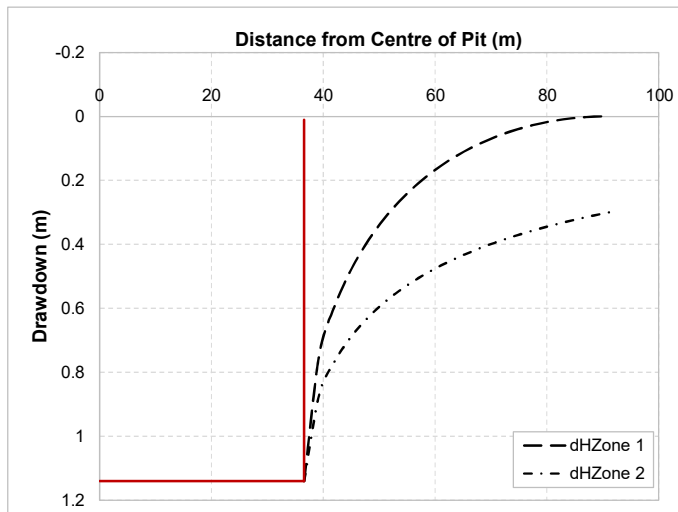
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	0.000025	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.14	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	36.56366	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_o calculated by iterating equation A in analysis sheet 1

91 m



Drawdown curves

r	dH _{Zone 1}	dH _{Zone 2}
36.56366	1.14	1.1
39.3	0.7	0.9
42.0	0.6	0.8
44.8	0.5	0.7
47.5	0.4	0.6
50.2	0.3	0.6
52.9	0.3	0.6
55.7	0.2	0.5
58.4	0.2	0.5
61.1	0.2	0.5
63.9	0.1	0.4
66.6	0.1	0.4
69.3	0.1	0.4
72.0	0.06	0.4
74.8	0.04	0.4
77.5	0.03	0.4
80.2	0.02	0.3
83.0	0.01	0.3
85.7	0.00	0.3
88.4	0.00	0.3
91.1	0.00	0.3

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

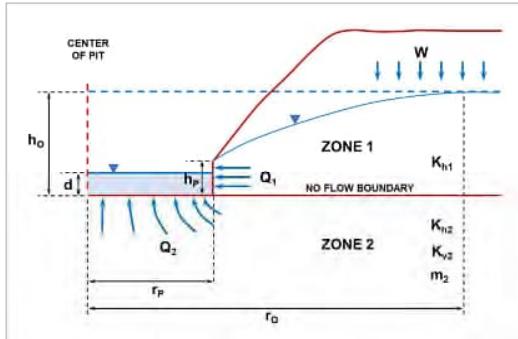
Analysed by: Toby _____ Beisly _____
Checked by: _____

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The dH_{Zone2} line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland A Summer PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$\begin{aligned}
 \text{A } h_o &= \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}, \\
 \text{B } Q_1 &= W \pi (r_o^2 - r_p^2), \\
 \text{C } Q_2 &= 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d), \\
 \text{D } m_2 &= \sqrt{\frac{K_{h2}}{K_{v2}}}
 \end{aligned}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	2.50E-05	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.04	m	initial saturated thickness above the base of Zone 1
h _p	0.5	m	saturated thickness at the pit wall
r _p	52.62	m	effective pit radius
d	0.5	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 99 m

Known h_o 1.04 m
 h_o calculated using Equation A 1.04 m

Q₁ 1.7E-04 m³/s
1.5E+01 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 2.1E-02 m³/s
1.8E+03 m³/day

Total Pit Inflow

Q_{TOT} 2.1E-02 m³/s
1789.13 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

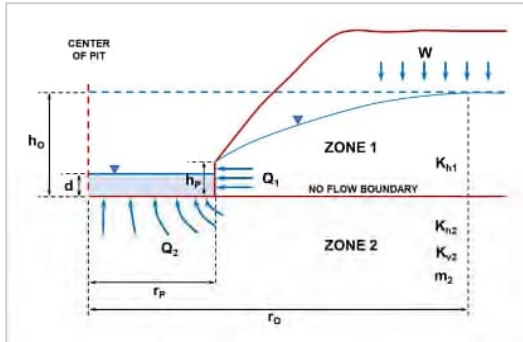
Analysed by: Toby Beisly
Checked by:

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland A Summer PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone 1} = h_0 - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_0^2 \ln \left(\frac{r}{r_p} \right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1} \left(\frac{r_p}{r} \right)$$

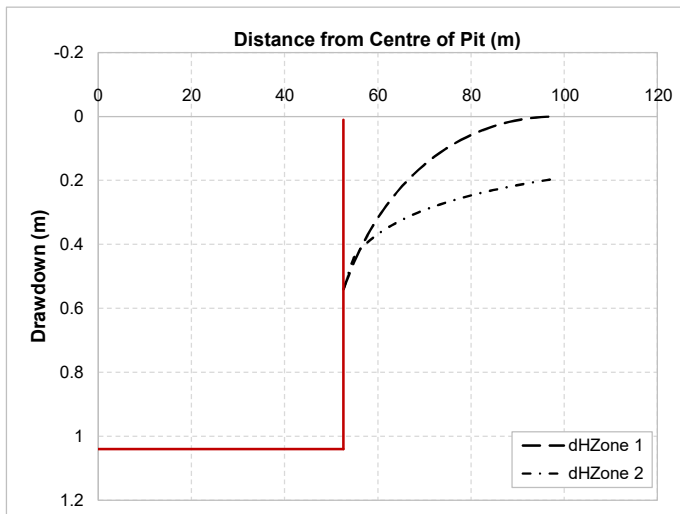
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	0.000025	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h₀	1.04	m	initial saturated thickness above the base of Zone 1
h_p	0.5	m	saturated thickness at the pit wall
r_p	52.6241	m	effective pit radius
d	0.5	m	depth of the pit lake

r_0 is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_0 calculated by iterating equation A in analysis sheet 1

99 m



Drawdown curves

r	dH _{Zone 1}	dH _{Zone 2}
52.6241	0.54	0.5
54.9	0.5	0.4
57.2	0.4	0.4
59.5	0.3	0.4
61.8	0.3	0.4
64.1	0.2	0.3
66.4	0.2	0.3
68.7	0.2	0.3
71.0	0.1	0.3
73.3	0.1	0.3
75.6	0.1	0.3
77.9	0.1	0.3
80.2	0.1	0.2
82.5	0.04	0.2
84.8	0.03	0.2
87.1	0.02	0.2
89.4	0.01	0.2
91.7	0.01	0.2
94.0	0.00	0.2
96.3	0.00	0.2
98.6	0.00	0.2

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

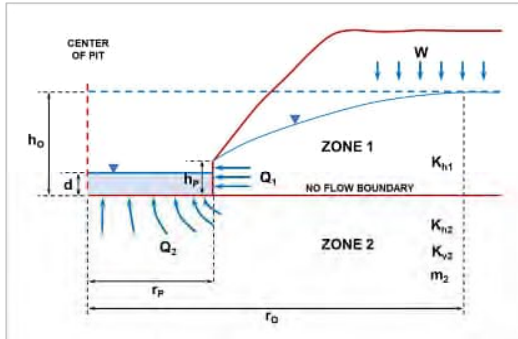
Analysed by: Toby
Checked by:

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The $dH_{Zone 2}$ line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland B Summer PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$A \quad h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}$$

$$B \quad Q_1 = W \pi (r_o^2 - r_p^2)$$

$$C \quad Q_2 = 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d)$$

$$D \quad m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	2.50E-05	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	1.14	m	initial saturated thickness above the base of Zone 1
h _p	0.5	m	saturated thickness at the pit wall
r _p	36.56366	m	effective pit radius
d	0.5	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 86 m

Known h_o 1.14 m
 h_o calculated using Equation A 1.14 m

Q₁ 1.5E-04 m³/s
1.3E+01 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 1.7E-02 m³/s
1.5E+03 m³/day

Total Pit Inflow

Q_{TOT} 1.7E-02 m³/s
1474.08 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

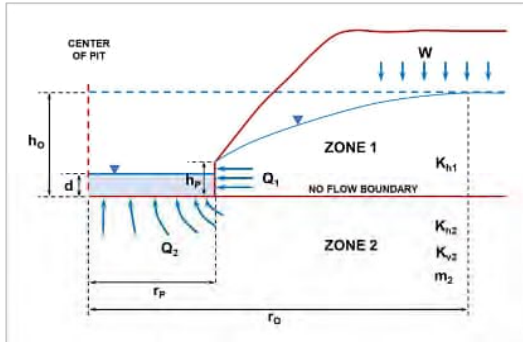
Analysed by: Toby Beisly
Checked by:

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: Wetland B Summer PWL
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone\ 1} = h_o - \sqrt{h_p^2 + \frac{W}{k_{h1}} \left[r_o^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone\ 2} = \frac{2(h_o - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

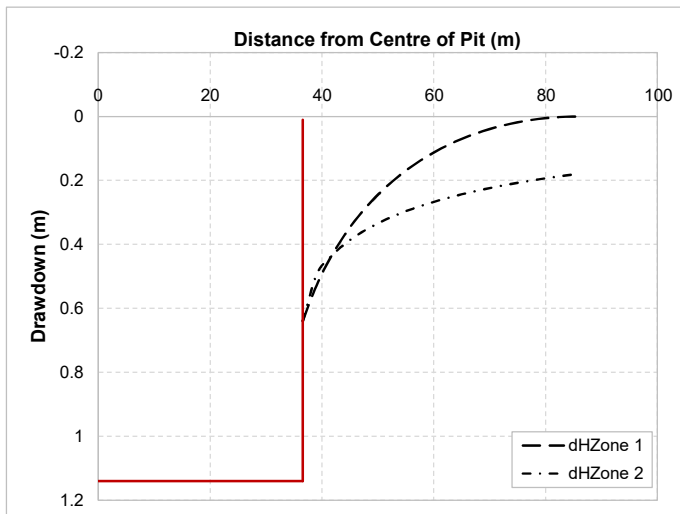
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	0.000025	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h_o	1.14	m	initial saturated thickness above the base of Zone 1
h_p	0.5	m	saturated thickness at the pit wall
r_p	36.56366	m	effective pit radius
d	0.5	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_o calculated by iterating equation A in analysis sheet 1

86 m



Drawdown curves		
r	dH _{Zone 1}	dH _{Zone 2}
36.56366	0.64	0.6
39.0	0.5	0.5
41.5	0.4	0.4
44.0	0.4	0.4
46.5	0.3	0.4
48.9	0.3	0.3
51.4	0.2	0.3
53.9	0.2	0.3
56.4	0.2	0.3
58.9	0.1	0.3
61.3	0.1	0.3
63.8	0.1	0.2
66.3	0.1	0.2
68.8	0.05	0.2
71.2	0.03	0.2
73.7	0.02	0.2
76.2	0.01	0.2
78.7	0.01	0.2
81.1	0.00	0.2
83.6	0.00	0.2
86.1	0.00	0.2

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

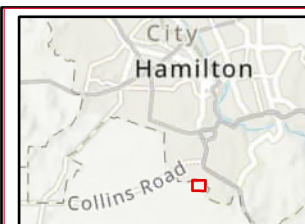
Analysed by: Toby
Checked by:

Notes: The drawdown curves apply along the no-flow boundary line at an elevation equivalent to the base of the pit.
 The $dH_{Zone\ 2}$ line does not take into account recharge from above.
 Drawdown projections are initial approximations only.

APPENDIX E

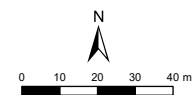
STORMWATER WETLAND DRAWDOWN CONTOURS





LEGEND

- Drawdown Contours
- Stormwater Wetland A



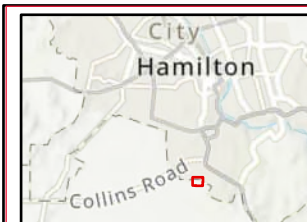
Coordinate System: NZGD 2000 Mount Eden Circuit

WGA

Figure E1
Southern Links Stage 1
Drawdown Contours For
Stormwater Wetland A

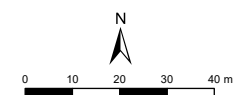
Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any reliance placed on such information shall be at the risk of the user.

Note: The information shown on this map is a copyright of WGA 2026



LEGEND

- Drawdown Contours
- Stormwater Wetland B



Scale 1:1,600 @ A4

Coordinate System: NZGD 2000 Mount Eden Circuit

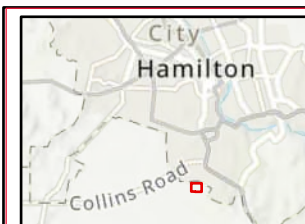
WGA

Figure E2

Southern Links Stage 1
Drawdown Contours For
Stormwater Wetland B

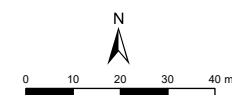
Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any reliance placed on such information shall be at the risk of the user.

Note: The information shown on this map is a copyright of WGA 2026



LEGEND

- Drawdown Contours
- Stormwater Wetland C



Scale 1:1,600 @ A4

Coordinate System: NZGD 2000 Mount Eden Circuit

WGA

Figure E3

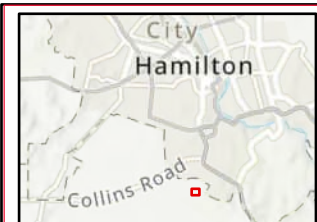
Southern Links Stage 1

Drawdown Contours for

Stormwater Wetland C

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any reliance placed on such information shall be at the risk of the user.

Note: The information shown on this map is a copyright of WGA 2026



LEGEND

- Drawdown Contours
- Stormwater Wetland D



Scale 1:1,200 @ A4

Coordinate System: NZGD 2000 Mount Eden Circuit

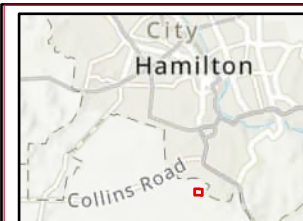
WGA

Figure E4

Southern Links Stage 1
Drawdown Contours for
Stormwater Wetland D

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any reliance placed on such information shall be at the risk of the user.

Note: The information shown on this map is a copyright of WGA 2026



LEGEND

- Drawdown Contours
- Stormwater Wetland E



Scale 1:1,200 @ A4

Coordinate System: NZGD 2000 Mount Eden Circuit

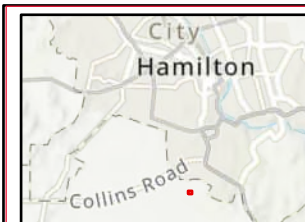
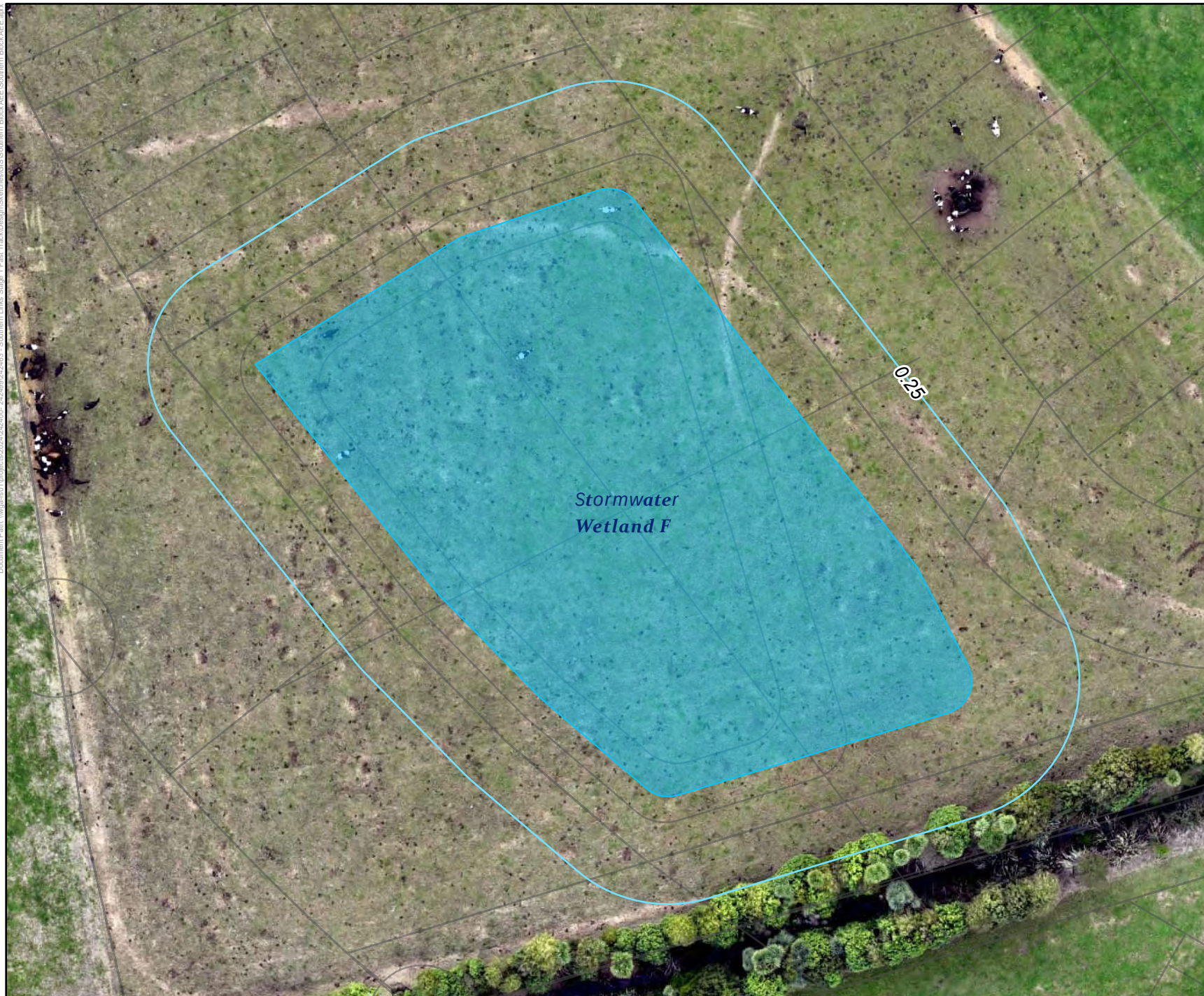
WGA

Figure E5

Southern Links Stage 1
Drawdown Contours
for Wetland E

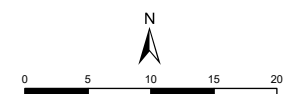
Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any reliance placed on such information shall be at the risk of the user.

Note: The information shown on this map is a copyright of WGA 2026



LEGEND

- Drawdown Contours
- Stormwater Wetland F



Scale 1:600 @ A4

Coordinate System: NZGD 2000 Mount Eden Circuit

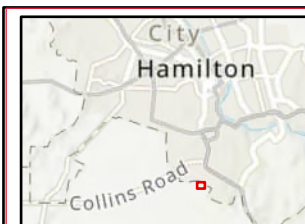
WGA

Figure E6

Southern Links Stage 1
Drawdown Contours for
Stormwater Wetland F

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any reliance placed on such information shall be at the risk of the user.

Note: The information shown on this map is a copyright of WGA 2026



LEGEND

- Summer Drawdown Contours
- Stormwater Wetland A



Scale 1:1,200 @ A4

Coordinate System: NZGD 2000 Mount Eden Circuit

WGA

Figure E7

Southern Links Stage1

Summer Drawdown Contours

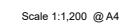
Stormwater Wetland A

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any reliance placed on such information shall be at the risk of the user.

Note: The information shown on this map is a copyright of WGA 2026



 Stormwater Wetland B



Coordinate System: NZGD 2000 Mount Eden Circuit

WGA

Figure E8

Southern Links Stage1

Summer Drawdown

Stormwater Wetland B

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Any relevance placed on such information shall be at the risk of the user.

Note: The information shown on this map is a copyright of WGA 2026

APPENDIX F

WASTEWATER INFRASTRUCTURE DRAWDOWN MODELLING



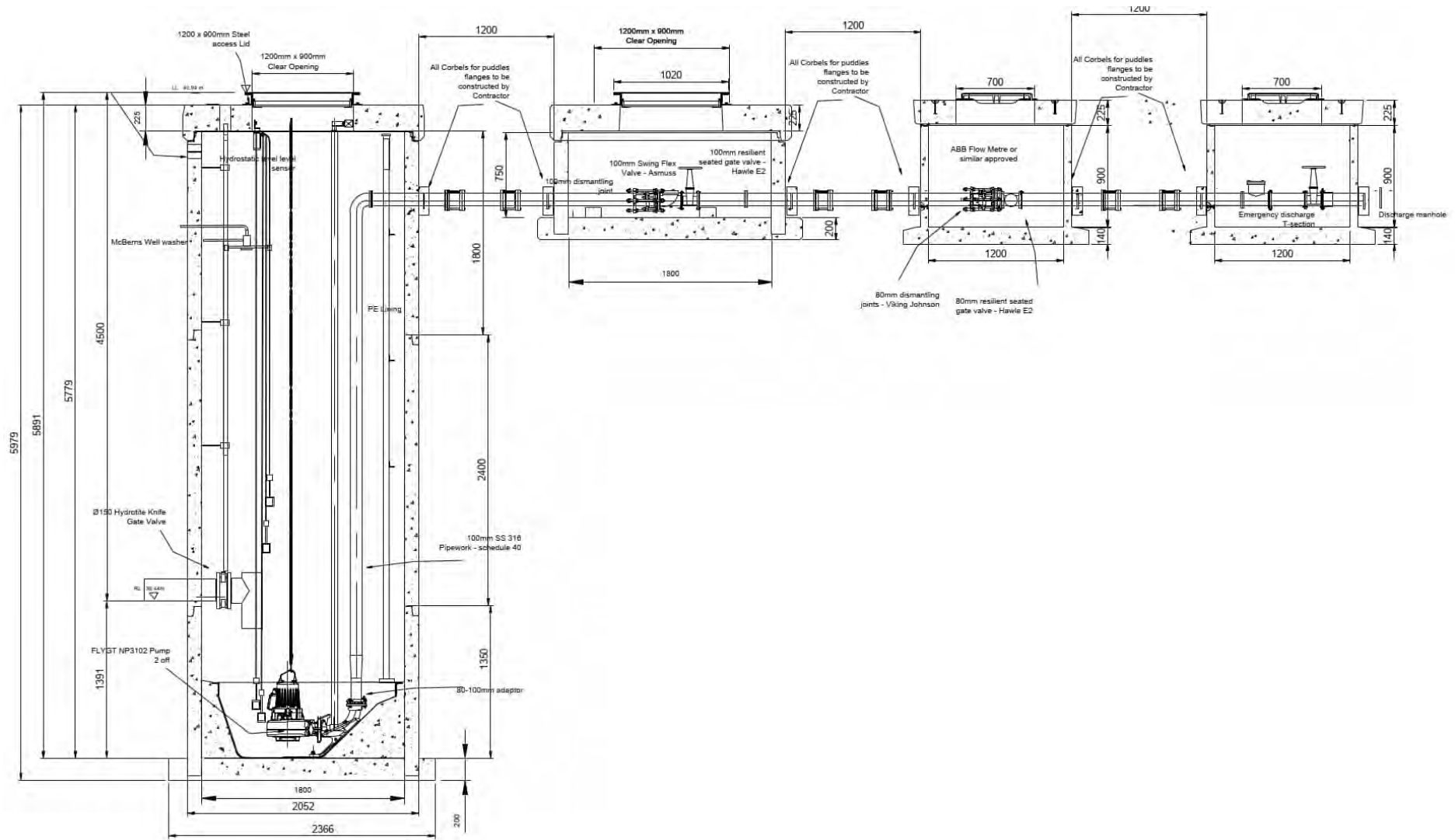
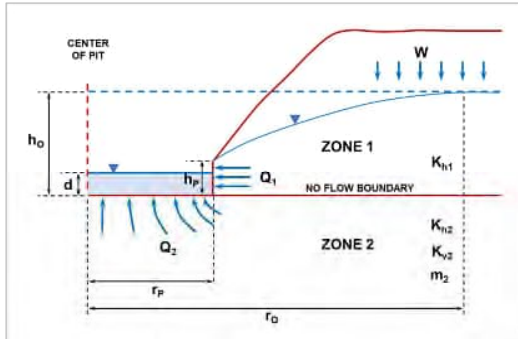


Figure F2: Proposed Wastewater Pump Station B Design, Provided by Maven

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: WWPS A
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$\begin{aligned}
 \text{A } h_o &= \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}, \\
 \text{B } Q_1 &= W \pi (r_o^2 - r_p^2), \\
 \text{C } Q_2 &= 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d), \\
 \text{D } m_2 &= \sqrt{\frac{K_{h2}}{K_{v2}}}
 \end{aligned}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	2.50E-05	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	2.18	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	1.25	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A 66 m

Known h_o 2.18 m
 h_o calculated using Equation A 2.18 m

Q₁ 1.1E-04 m³/s
9.3E+00 m³/day

Inflow from Zone 2

Anisotropy parameter calculated using equation D 2.236068

Q₂ 2.0E-03 m³/s
1.7E+02 m³/day

Total Pit Inflow

Q_{TOT} 2.1E-03 m³/s
179.44 m³/day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow
 to a mine pit. Ground Water 38, no. 2: 311-314.

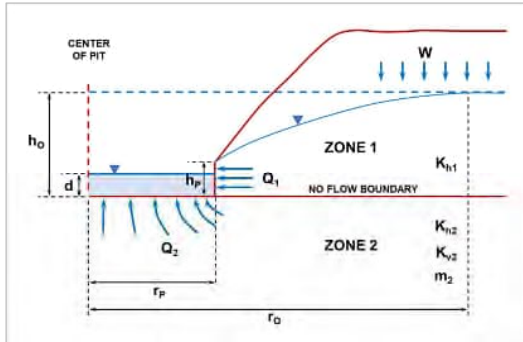
Analysed by: T Beisly 19/03/2026
Checked by: B Sinclair 19/03/2026

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.
 Inflows from Zone 2 do not apply. This analysis is specific to Zone 1 only.
 Also note that if a sheet pile wall is used to support the excavation, the likely inflows through the pile wall will be much smaller than those calculated in this sheet.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: WWPS A
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone 1} = h_0 - \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r}{r_p} \right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone 2} = \frac{2(h_0 - d)}{\pi} \sin^{-1} \left(\frac{r_p}{r} \right)$$

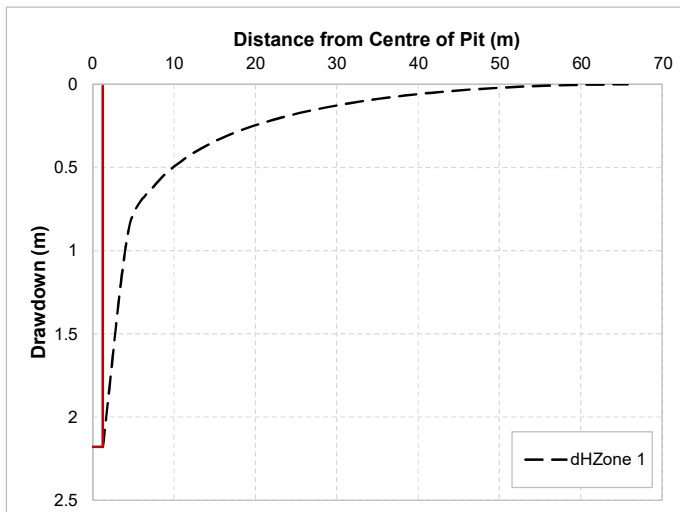
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	0.000025	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h_o	2.18	m	initial saturated thickness above the base of Zone 1
h_p	0	m	saturated thickness at the pit wall
r_p	1.25	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_o calculated by iterating equation A in analysis sheet 1

66 m



Drawdown curves

r	dH _{Zone 1}	dH _{Zone 2}
1.25	2.18	2.2
4.5	0.9	0.4
7.7	0.6	0.2
10.9	0.5	0.2
14.2	0.4	0.1
17.4	0.3	0.1
20.6	0.2	0.1
23.8	0.2	0.1
27.1	0.2	0.1
30.3	0.1	0.1
33.5	0.1	0.1
36.7	0.1	0.0
40.0	0.1	0.0
43.2	0.04	0.0
46.4	0.03	0.0
49.6	0.02	0.0
52.9	0.01	0.0
56.1	0.01	0.0
59.3	0.00	0.0
62.5	0.00	0.0
65.8	0.00	0.0

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water inflow to a mine pit. Ground Water 38, no. 2: 311-314.

Analysed by: T Beisly 19/03/2026
Checked by: B Sinclair 19/03/2026

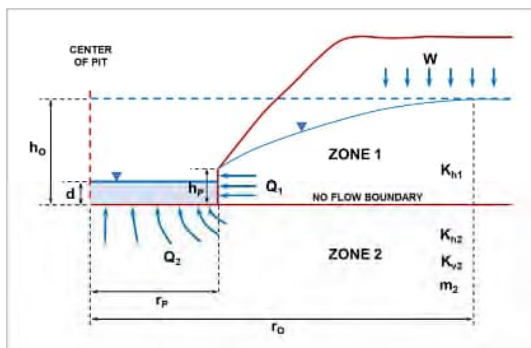
Notes: Drawdown projections are initial approximations only.

If a sheet pile wall is used to support the excavation, the likely inflows through the pile wall and consequent drawdown will be much smaller than that calculated in this sheet.

INFLOW TO OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
PROJECT: Southern Links - Southern Block
Project #: WGA242463
Location: WWPS B
Date: Friday, 13 March 2026
Document #: WGA242463-RP-HG-0003_A



$$\begin{aligned}
 \text{A } h_o &= \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln \left(\frac{r_o}{r_p} \right) - \frac{(r_o^2 - r_p^2)}{2} \right]}, \\
 \text{B } Q_1 &= W \pi (r_o^2 - r_p^2) \\
 \text{C } Q_2 &= 4 r_p \left(\frac{K_{h2}}{m_2} \right) (h_o - d), \\
 \text{D } m_2 &= \sqrt{\frac{K_{h2}}{K_{v2}}}
 \end{aligned}$$

W	7.93E-09	m/s	recharge flux
K_{h1}	2.50E-05	m/s	horizontal hydraulic conductivity in Zone 1
K_{h2}	4.04E-04	m/s	horizontal hydraulic conductivity in Zone 2
K_{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h_o	0.507	m	initial saturated thickness above the base of Zone 1
h_p	0	m	saturated thickness at the pit wall
r_p	1.25	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Inflow from Zone 1

Radius of influence r_o calculated by iterating equation A	19	m
Known h_o	0.51	m
h_o calculated using Equation A	0.51	m
Q₁	9.1E-06	m ³ /s
	7.9E-01	m ³ /day

Inflow from Zone 2

Anisotropy parameter calculated using equation D	2.236068	
Q₂	4.6E-04	m ³ /s
	4.0E+01	m ³ /day

Total Pit Inflow

Q_{TOT}	4.7E-04	m ³ /s
	40.36	m ³ /day

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water
 inflow to a mine pit. Ground Water 38, no. 2: 311-314.

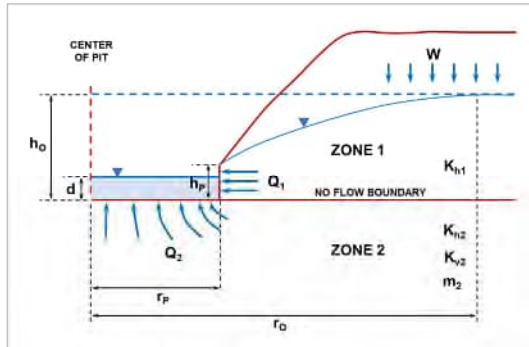
Analysed by: T Beisly 19/03/2026
Checked by: B Sinclair 19/03/2026

Notes: The hydraulic conductivity of 4.04E-04 used in this assessment is a minimum estimate.
 Inflows from Zone 2 do not apply. This analysis is specific to Zone 1 only.
 If a sheet pile wall is used to support the excavation, the likely inflows through the pile wall will be much smaller than those calculated in this sheet.

GROUNDWATER DRAWDOWN AROUND OPEN PIT - APPROXIMATION

WGA

CLIENT: Barker & Associates
 PROJECT: Southern Links - Southern Block
 Project #: WGA242463
 Location: WWPS B
 Date: Friday, 13 March 2026
 Document #: WGA242463-RP-HG-0003_A



$$dH_{Zone 1} = h_o - \sqrt{h_p^2 + \frac{W}{K_{h1}} \left[r_o^2 \ln\left(\frac{r}{r_p}\right) - \frac{(r^2 - r_p^2)}{2} \right]}$$

$$dH_{Zone 2} = \frac{2(h_o - d)}{\pi} \sin^{-1}\left(\frac{r_p}{r}\right)$$

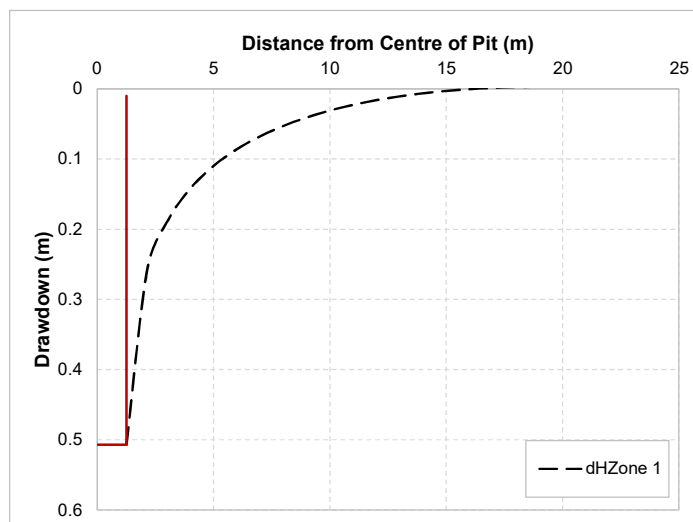
$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

W	7.93E-09	m/s	recharge flux
K _{h1}	0.000025	m/s	horizontal hydraulic conductivity in Zone 1
K _{h2}	0.000404	m/s	horizontal hydraulic conductivity in Zone 2
K _{v2}	8.08E-05	m/s	vertical hydraulic conductivity in Zone 2
h _o	0.507	m	initial saturated thickness above the base of Zone 1
h _p	0	m	saturated thickness at the pit wall
r _p	1.25	m	effective pit radius
d	0	m	depth of the pit lake

r_o is the radius of influence measured from the center of the pit beyond which groundwater drawdown is nil.

Radius of influence r_o calculated by iterating equation A in analysis sheet 1

19 m



Drawdown curves

r	dH _{Zone 1}	dH _{Zone 2}
1.25	0.507	0.5
2.1	0.3	0.2
3.0	0.2	0.1
3.9	0.1	0.1
4.8	0.1	0.1
5.7	0.1	0.1
6.6	0.1	0.1
7.5	0.1	0.1
8.4	0.0	0.0
9.3	0.0	0.0
10.2	0.0	0.0
11.1	0.0	0.0
12.0	0.0	0.0
12.9	0.01	0.0
13.8	0.01	0.0
14.7	0.00	0.0
15.6	0.00	0.0
16.5	0.00	0.0
17.4	0.00	0.0
18.3	0.00	0.0
19.2	0.00	0.0

Reference: Marinelli, F. & Niccoli W. L. 2000.
 Simple analytical equations for estimating ground water
 inflow to a mine pit. Ground Water 38, no. 2: 311-314.

Analysed by: T Beisly 19/03/2026
 Checked by: B Sinclair 19/03/2026

Notes: Drawdown projections are initial approximations only.

If a sheet pile wall is used to support the excavation, the likely inflows through the pile wall and consequent drawdown will be much smaller than that calculated in this sheet.



FOR FURTHER INFORMATION CONTACT:

Joanne Ferry
Senior Hydrogeologist

T [REDACTED]
M [REDACTED]
E [REDACTED]

WGA.COM.AU
WGANZ.CO.NZ



APPENDIX B

Drawings



LEGEND:

- Site Boundary
- Proposed Stormwater Wetland
- Proposed Wastewater Pump Station

NOTES:

- Proposed Wastewater Pipeline
- PIEZOMETER
- SETTLEMENT MARKER



CLIENT:	COLLIERS PROJECT LEADERS		DRAWN:	RT	PROJECT:	HAM2025-0056
PROJECT:	SOUTHERN LINKS STAGE 1 RESIDENTIAL		CHECKED:	DM	DRAWING:	05
TITLE:			REVISION:	0	SCALE:	1:3,500
	PROPOSED MONITORING PLAN		DATE:	04/08/2026	SHEET:	A3L

APPENDIX C

Geotechnical Investigation Report

1 September 2026

**SOUTHERN LINKS 1 – RESIDENTIAL DEVELOPMENT
HAMILTON**

GEOTECHNICAL INVESTIGATION REPORT

Colliers Project Leaders

HAM2025-0056AD Rev 5



EXECUTIVE SUMMARY

This report presents the results of geotechnical investigations and a geohazards assessment to support the substantive application for the Southern Links 1 project (“SL1” or the “Project”) under the Fast-track Approvals Act 2024 (“FTAA”). This report relates to the residential portion of the SL1 Project, referred to as the “Residential Area”, “Residential Development” in this report.

The 46Ha Residential Area site, as shown in **Figure 1**, is located on the southern boundary of the current Hamilton City limits in Hamilton, New Zealand. The Residential Development proposal is for a range of residential and associated development, as conceptually summarised in **Figure 2**.

The existing topography of the Residential Area site is generally level between RL38m and RL43m. The regional groundwater table is generally within 3 metres of the surface. The geology typically consists of interbedded sands and silts of the Hinuera Formation.

The assessment of natural hazard risk for the site is assessed as low to medium for all hazards considered. We consider that the Residential Area is suitable for the proposed Residential Development from a geotechnical/geohazards perspective, subject to the adoption of the geohazard and geotechnical recommendations summarised below, which we understand have been incorporated into the project design and resource consent conditions as appropriate. In other words, we consider: the construction of the Residential Development is feasible from a geotechnical perspective; there are satisfactory techniques available to address the geotechnical constraints identified within the Residential Area; and that any potential geotechnical/geohazard effects/risks can be appropriately managed.

Key recommendations from our geotechnical investigations and geohazards assessment include:

(1) Slope Stability:

- Proposed artificial wetland batter slopes of 1V:3H were assessed for stability. Results indicated proposed batters are generally stable;
- During liquefaction, lateral stretch of less than 50mm across foundations is recommended to be accounted for during detailed foundation design.
- Mangakotukutuku stream bank is marginally stable and future buildings should remain outside the 20m wide stream corridor.

(2) Earthworks and Filling

- The site is to be filled with either site won silts or sands to form level building sites with maximum proposed Scut levels of 5m and proposed fill levels of up to 2m.
- Fill-induced ground settlements are predicted to be generally <25mm, with the exception of a few isolated areas with up to 40mm predicted settlement. Settlement is anticipated to be elastic and built out rapidly during construction.

(3) Road Subgrades

- Where pavements are constructed over granular engineered fill, a design subgrade CBR of 10% is considered appropriate. Where over natural sands/silts, a subgrade CBR of 2% to 3% are predicted. Conventional earthworks quality control, together with excavation observations, will be required during construction.

(4) Shallow Foundations

- The potential ULS liquefaction risk is moderate for the Hinuera Formation soils. These effects can be reduced to acceptable levels by utilising TC2 raft foundations.

- Following the preliminary assessment that has been undertaken, it is considered that most of the site is suitable for TC2 raft foundations, with localised areas of higher predicted settlements that will require TC2/TC3 hybrid foundations. This is to be further refined during future investigations and detailed earthworks design. Alternative foundation solutions, such as geogrid-reinforced gravel rafts or piled foundations, may also be suitable.
- A preliminary geotechnical ultimate bearing pressure of 300kPa should be available in the static case for shallow strip and pad foundations constructed within both the natural cut ground and engineered fill areas.

(5) Artificial Wetlands

- The WGA Hydrogeological Effects Assessment¹ identified a low permeability aquitard layer running beneath the site which has a confining effect on the underlying deep aquifer, putting it under some degree of pressure. Excavating the proposed stormwater ponds will remove the existing soil overburden pressure and the uplift pressure from the confined aquifer could rupture the aquitard layer and destabilise the ponds.
- A separate design memorandum has been prepared by CMW in collaboration with WGA and Maven Associates, to address this specific issue, and provide options for mitigation, and presented in **Appendix I**.



Figure 1: SL1 Residential Development Masterplan prepared by Barkers & Associates (Ref: 25546 & 26111, dated February 2026)

¹ Southern Links 1 Residential Stage 1 Southern Block Hydrogeological Effects Assessment, prepared by WGA, Ref: WGA242463-RP-HG-0003_B, dated May 2026

STATEMENT OF QUALIFICATIONS AND EXPERIENCE

Mark McVinnie

I am an Engineering Geologist at CMW Geotechnical NZ Limited, trading as CMW Geosciences. CMW Geosciences is a specialist geotechnical engineering and geological services consultancy with offices in New Zealand and Australia. I have been employed at CMW Geosciences since March 2022.

I hold the qualifications of BSc(Tech) in Earth Sciences from the University of Waikato, which I completed in 2016.

I have 8 years of professional experience in geotechnical engineering in the Waikato and Auckland regions. My experience has been primarily in land development, infrastructure, and landslide mitigation, and for the last several years, I have been focused on projects in the Waikato.

David MacPherson

I am an Associate Geotechnical Engineer at CMW Geotechnical NZ Limited, trading as CMW Geosciences. I have been employed at CMW Geosciences since August 2017.

I hold the qualifications of MEngSc from the University of New South Wales, which I completed in 2022, as well as an MSc from the University of Waikato, which I completed in 2016. I am a Chartered Professional Engineer and a Chartered Member of Engineering New Zealand.

I have over 8 years of experience as a geotechnical engineer, including in project management, design solutions, and team leadership. My background includes extensive work in infrastructure projects. My experience includes managing and participating in site investigations, instrumentation and monitoring, slopes and geotechnical hazard assessments, and slope stability design for major infrastructure projects such as the Peacockes Bridge in Hamilton.

Dave Sullivan

I am a Principal Engineering Geologist at CMW Geotechnical NZ Limited, trading as CMW Geosciences. I have been employed at CMW Geosciences since May 2025.

I hold the qualifications of a BSc in Geological Engineering from Mackay School of Mines at the University of Nevada, which I completed in 1997, and a Master of Business Administration from the University of Phoenix, which I completed in 2023. I am a Chartered Professional Engineer and a Chartered Member of Engineering New Zealand, as well as a Category 1 Geoprofessional (TCC), and a Licensed Civil Engineer in California and Nevada, USA.

I have over 30 years of professional experience in engineering geology and geotechnical engineering. My experience has been primarily in land and building development, disaster relief, and linear infrastructure. The years in New Zealand have been focused on the Christchurch rebuild, the Waikato Expressway, and land development in the Waikato and Bay of Plenty.

HAM2025-0056AD

Date	Revision	Comments
27 May 2025	A	Internal Review
6 June 2025	0	Report Issue
24 April 2026	1	Revised report Issue
11 June 2026	2	Revised report Issue
17 July 2026	3	Revised report Issue
28 August 2026	4	Revised report Issue
1 September 2026	5	Revised report Issue

	Name	Signature	Position
Prepared by	Mark McVinnie		Project Engineering Geologist
Reviewed by	David MacPherson		Associate Geotechnical Engineer CMEngNZ, CPEng
Authorised by	David Sullivan		Principal Geotechnical Engineer CMEngNZ, CPEng



Table of Contents

Executive summary.....	2
Statement of Qualifications and Experience	3
Mark McVinnie	3
David MacPherson.....	3
Dave Sullivan.....	3
1 INTRODUCTION	2
1.1 Project Description	2
2 SITE DETAILS	2
2.1 Site Description.....	2
2.2 Landform.....	2
2.3 Site History.....	3
3 PROPOSED DEVELOPMENT.....	3
4 INVESTIGATION SCOPE.....	3

5 GEOLOGY	3
6 GEOTECHNICAL MODEL	3
6.1 Stratigraphic Units	3
6.2 Groundwater	4
6.3 Geotechnical Design Parameters	5
7 GEOHAZARDS ASSESSMENT	6
7.1 Geohazard Risk Register	6
7.2 Seismicity	9
7.3 Fault Rupture	9
7.4 Liquefaction.....	9
7.5 Lateral Spread	10
7.6 Slope Stability.....	10
7.7 Load Induced Settlement.....	11
7.8 Cross Boundary Effects	12
8 RECOMMENDATIONS	13
8.1 Slope Stability.....	13
8.2 Earthworks and Filling.....	13
8.3 Road Subgrades.....	13
8.4 Trench and Open Drain Backfilling.....	13
8.5 Culverts	13
8.6 Shallow Foundations.....	14
9 SUITABILITY STATEMENT	14
10 CLOSURE	14
11 Context	5
12 Basis of Assessment	5
12.1 Risk Classification	5
12.2 Likelihood	6
12.3 Consequence.....	6
12.4 Proportionate Management of Natural Hazard Risk	7

Appendices

Appendix A: Drawings

Appendix B: Development Plans

Appendix C: Investigation Logs

Appendix D: Geotechnical Hazards Register Methods

Appendix E: Swale Slope Stability

Appendix F: Liquefaction Analysis Results Summary

Appendix G: Lateral Stretch Summary

Appendix H: Static Settlement Summary

Appendix I: Wetland Design Memorandum

1 INTRODUCTION

CMW Geosciences (CMW) was engaged Colliers Project Leaders to carry out a geotechnical investigation of a site located at Hamilton, which is being considered for the construction of a 938 Lot residential subdivision (the Residential Development). This site is denoted as the Residential Area as part of the wider Southern Links 1 (SL1) Development situated along the south-western boundary of Hamilton City (the “Project”). CMW have previously undertaken a desktop study of the wider southern links development.²

This report has been prepared to assess the suitability of the Residential Area land for the Residential Development, to support a substantive application for the Project under the FTAA. It incorporates relevant information from the previous desktop study and from subsequent site investigations.

1.1 Project Description

The SL1 Residential South development forms part of the residential component of Southern Links 1, a listed project under FTAA 2024. The Southern Links 1 project is a combined 106ha development, including residential and industrial activities. The residential component comprises circa 46ha and is in single ownership and is currently used for rural farming activities. The landholding includes five land parcels legally described as Lot 2 DP 589463 (22.21 ha); Part Lot 2 DP 25668 and Part Lot 1 DP 25668 (33.64 ha); Lot 3 DP 394366 and Lot 1 DP South Auckland 51518 (7.58 ha); Lot 1 DPSA 69842, Lot 2 DPSA 11357, Lot 1 DPSA 75305 and Section 1 SO 60814 (26.13 ha); and Part Lot 1 DP 25668 (26.50 ha). This site is part of the wider Southern Links Growth Cell, a circa 440ha contiguous land area that stretches the south-western edge of Hamilton that includes the Hamilton Southern Links (RoNS) designation.

The proposal seeks approval for a Substantive Application under the Fast-Track Approvals Act 2024 for a comprehensively master planned and staged residential development. This includes all necessary resource consents under the Resource Management Act 1991, including regional, district approvals where required.

The residential component provides for the establishment of circa 938 residential units, together with a neighbourhood commercial node, open spaces, waterbodies, and infrastructure devices including wetlands and roading.

The proposal includes substantial enabling works to establish developable land, including bulk earthworks across the site. An integrated stormwater management system including wetlands, detention/attenuation devices and treatment ponds supports the development. Ecological restoration is integrated via riparian and corridor planting with appropriate design measures being adopted to enhance and protect key features including the upper tributaries of the Mangakōtukutuku Stream and associated drains.

Access and integration with the surrounding Hamilton area is provided through connected transport framework, including the establishment of intersections, roading, and walking and cycle networks, along with upgrades to existing transport infrastructure. The residential development is proposed to be serviced via a coordinated strategy, including the extension of public networks, upgrades, and installation of appropriate infrastructure.

2 SITE DETAILS

2.1 Site Description

The Residential Area site comprises an area of approximately 44.5ha and is located on Saxby Road, as shown within **Figure 2**. Details of the site are as follows:



Figure 2: Proposed Staging Plan prepared by Maven (Ref: 298001-R1 SL1, Drawing No: R1-C130 Rev A, dated June 2026)

The site is accessed by Saxby Road in the north and is bound by high-density residential houses to the north and east, and pastoral land and rural properties to the west and south. At the time of our 2025 investigation, a residential dwelling and sheds were present in the northern corner of the site. Current land use is primarily grazing pasture.

2.2 Landform

The Residential Area site is situated on flat, low-lying land with open drains between Relative Levels 38 and 43m (ASL). The drains were noted as being up to approximately 2m in depth and were observed running from the west to east, draining into the Mangakotukutuku Stream, which runs from south to north through the centre of the site.

² Ref. HAM2024-0017AB, dated 15 March 2024

2.3 Site History

Based on our review of aerial images available on Retrolens³ and Google Earth, the Residential Area site appears to have been used primarily for pasture and farmland since the early 1940's (earliest available aerial photograph). The large open drains that discharge to the Mangakotukutuku Stream must have been formed prior to 1943. Subsoil drains were installed in 2024.

3 PROPOSED DEVELOPMENT

The proposed Residential Development extent is shown within **Figure 1** and **Figure 2**. Development drawings are presented in **Appendix B**.

Details for the Residential Development are as follows:

- The Residential Area comprises 941 residential lots of varying size with an associated access road extending from Saxbys Road and Croft Lane with an additional five roads to provide access to the proposed lots.
- Residential buildings are proposed to comprise stand-alone and terraced one to two storey buildings.
- The existing landform will need to be modified by raising the ground level with up to 2m fill; and cuts up to 5m will also be required.
- Minor slopes are proposed across the site in the form of swale drains. Preliminary plans indicate these drains will be to a maximum depth of 5m, with slope gradients of approximately 1V:3H.
- Minor fill batters requiring retaining walls up to 2.27m are also proposed.

4 INVESTIGATION SCOPE

Following a dial before you dig search, and onsite service location, the site investigation was carried out on 22 April 2025 during mid-autumn conditions. The scope of fieldwork completed is summarised in **Table 1** below:

Table 1: Investigation Summary		
Test ID	Test Type	Depth (m)
TP25-01 to TP25-15	Test Pits (TP)	3.4m (hole collapsing) to 6.3m
CPT25-01 to CPT25-11	Cone Penetrometer Tests (CPT)	20m
Notes: Refer to Section 6.1 for details		

These tests were supplemented by existing publicly available (New Zealand Geotechnical Database) data, which included ten CPTs and four shallow hand augers within the Residential Area.

The approximate locations of the respective investigation sites referred to above are shown on the Geotechnical Investigation Plan as **Drawing 1** attached in **Appendix A**.

5 GEOLOGY

The local published geological map⁴ details the Residential Area site to be partially underlain by Holocene Swamp deposits and partially by Hinuera Formation interbedded silt and sand soils. Walton Subgroup forms

the base of the hills to the east and is expected to underlie the Hinuera Formation at depth as shown in **Figure 3** below.

However, based on our onsite observations and 3D Leapfrog modelling of subsurface soil conditions, the site is completely underlain by Hinuera Formation soils and the Peat (swamp deposits) soils are located further to the south-west, outside the Residential Area. The modelled geology is presented on **Drawing 2, Appendix A**.

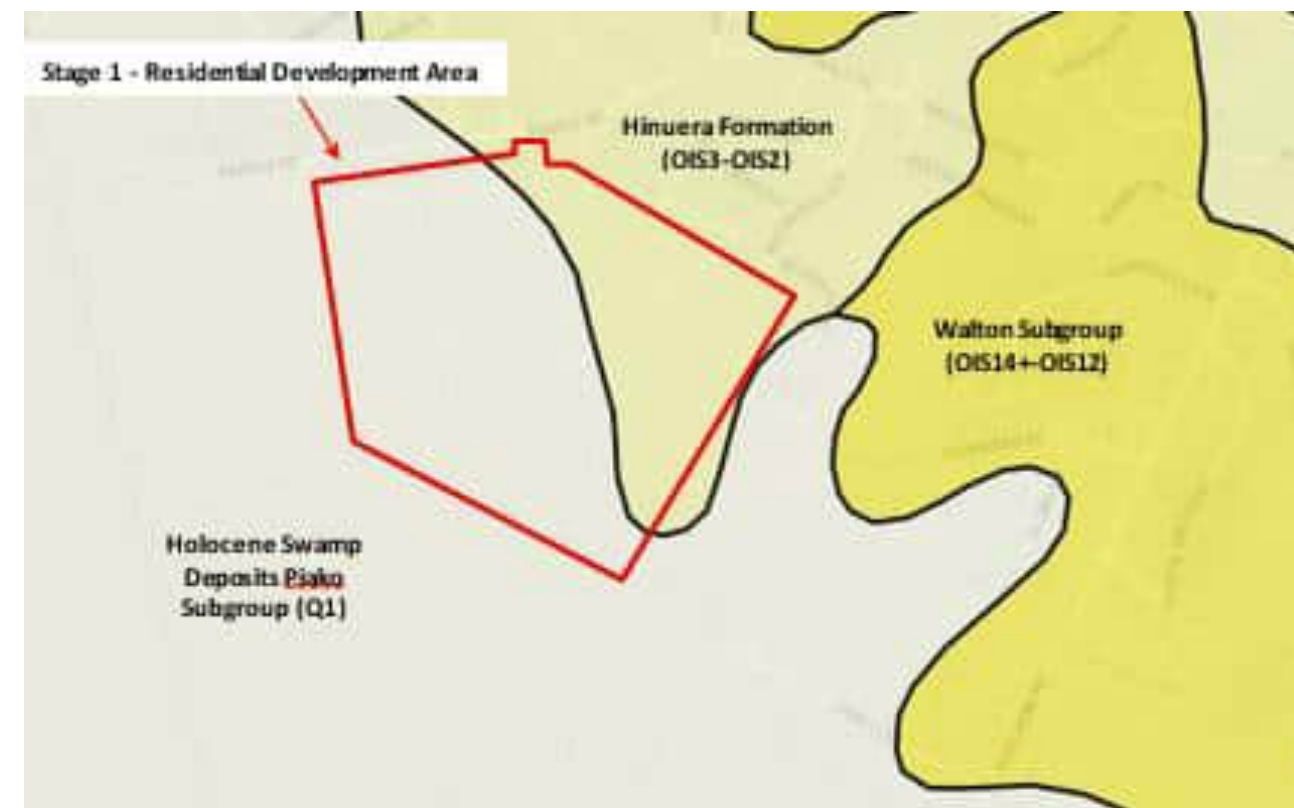


Figure 3: Regional Geology (GNS Science Web Geology Map)

6 GEOTECHNICAL MODEL

6.1 Stratigraphic Units

The distribution of the stratigraphic layers at our specific investigation locations are presented in Table 2 below. Variations can be anticipated between these locations. Our findings are illustrated on the appended Geological Sections (**Drawings 3 and 4**) presented in **Appendix A**.

Table 2: Ground Model			
Geological Unit	Depth to top of soil unit (m)		Thickness (m)
	Min	Max	
Topsoil	0		0.1 to 0.5
Interbedded loose to dense Sands and firm to very stiff Silts (Hinuera Formation)	0.1	0.5	1.9 to 18.0
Stiff to very stiff Clayey Silt (Hamilton Ash/Walton Subgroup)	1.9	18.0	*
*NOTE: base of unit not encountered			

³ <https://retrolens.co.nz/Map/>

⁴ Edbrooke, S.W. (compiler) 2005: Geology of the Waikato area. Institute of Geological & Nuclear Sciences 1:250000 geological map 4.

A description of the soils encountered is given below:

- **Topsoil:** Encountered from ground level to between 0.1m and 0.5m below ground level in all test pits.
- **Interbedded loose to dense Sands and firm to very stiff Silts:**
Between 1.9m and 18.0m of interbedded silts and sands underlie the topsoil. The Sands were generally loose to dense with dynamic cone penetrometer (DCP) blow counts of between 3 and 20 blows per 100mm with an average of 4 blows per 100mm. The Silts generally exhibited peak vane shear strengths (VSS) of between 41 and >140kPa with an average of 60kPa. Residual VSS range from 21 to 37kPa, indicating the Silts are moderately sensitive to sensitive.

Some isolated firm to very stiff Organic Silt layers were present within this unit, ranging from 0.1 to 0.5m thick, at depths between 0.5 and 3.5m below the existing ground level.

CPT cone resistance (qc) values were generally medium dense, between 5 to 10 MPa, and up to 15 MPa within this unit.
- **Stiff to very stiff Clayey Silt:** This is the lower-most soil unit which extends below the 20m deep CPT tests. This soil unit is exposed across low rolling hills to the east and dips below Hinuera and was encountered at the surface in Test Pit TP25-10 with peak shear strengths between 83 and 127kPa.

CPT qc readings in this layer were generally stiff to very stiff between 50 and 150kPa. Thick medium dense to dense sand beds are present within this layer, with CPT qc readings typically around 10 to 15 MPa.
- **Uncontrolled fill:** Variable strength Silt, Sand and Topsoil was encountered in TP25-02, 03, 05B, 07. It is thought this material was leftover from subsoil drains installed in 2024.

Soft to firm peat was not encountered in the investigations for the Residential Area, but nearby historic testing indicates this unit as soft to firm and up to 8m thick.

6.2 Groundwater

During the investigation, groundwater was encountered at depths ranging from 1.7 to 5.5m below existing ground levels. Groundwater observations from the CPTs and test pits are listed in Table 3 below.

Table 3: Groundwater Depths		
	Depth to groundwater (m)	Groundwater Relative Level RL(m)
TP25-01	3.5	36.5
TP25-02	2.8	37.8
TP25-03	2.8	36.8
TP25-04	5	36.6
TP25-05	5.5	36.5
TP25-05 B	2.8	38.8
TP25-06	2.5	37.5
TP25-07	1.7	38.3
TP25-08	3.9	36.8
TP25-09	4.5	38
TP25-10	3.1	39.2
TP25-11	2	38.5

⁵ Southern Links 1 Residential Stage 1 Southern Block Hydrogeological Effects Assessment, prepared by WGA, Ref: WGA242463-RP-HG-0003_B, dated May 2026

TP25-12	3.2	36.8
TP25-13	3.7	38.8
TP25-14	2	38.4
TP25-15	3.5	37.2
CPT25-01	3.5	36.5
CPT25-02	2.8	37.2
CPT25-03	2.8	39
CPT25-04	2.5	37.5
CPT25-05	5	35.9
CPT25-06	2.8	39.2
CPT25-07	4.5	37.8
CPT25-08	2	38
CPT25-09	3.2	36.8
CPT25-10	3.7	38.8
CPT25-11	3.5	39
Average depth	3.3	37.7
Minimum depth	1.7	39.2
Maximum depth	5.5	35.9

The historic New Zealand Geotechnical Database (NZGD) test logs indicated water levels between 1 and 4.6m below existing ground level, however those tests were undertaken before the 2024 drainage upgrades to the site so those measurements have been disregarded.

Additionally, groundwater monitoring has been carried out by WGA from mid 2025 (winter conditions) to early 2026 (summer conditions), with findings presented findings in the WGA hydrogeological report⁵. The maximum groundwater level height experienced during monitoring was 38.73 mRL. During the summertime, levels dropped as low as 36.96 mRL.

Additionally, WGA noted a thin organic silt band, 0.1-0.4m thick at approximately 36.36-36.56mRL (typically 5-6m below existing ground level) was acting as a low permeability aquitard that separated the soil profile into an upper unconfined aquifer and a lower confined aquifer. Slug testing and site observations indicated that the lower confined aquifer is under some pressure.

Pressure in the confined aquifer is discussed in Section 7.6.2, and a separate design memorandum⁶ has been prepared by CMW in collaboration with WGA and Maven Associates and is attached in **Appendix I** to address this specific issue and provide options for mitigation.

⁶ Wetland Design Memorandum Ref:HAM2025-0056AK Rev 4, dated August, 2026

6.3 Geotechnical Design Parameters

The various geological strata encountered across the site have been rationalised based on geotechnical engineering properties and grouped into broad units to define a geotechnical model used in subsequent assessments and analyses. The Hinuera formation is split into granular and cohesive units in Table 4 below to account for differing soil behaviours.

Parameters are based on the results of the investigations, known correlations from literature, and our experience with similar soils in the Hamilton area.

The geotechnical design parameters adopted are presented below:

Table 4: Geotechnical Parameters					
Soil Unit	ϕ' (deg)	c' (kPa)	C_u (kPa)	E_v' (MPa)	γ kN/m ³
Stiff to Very Stiff Clayey Silt (Hinuera Formation)	28	2	80	25	17
Generally Medium Dense Sand (Hinuera Formation)	35	0	NA	40	18
Stiff to very stiff Clayey Silt (Hamilton Ash/Walton Subgroup)	30	5	140	40	17
Where: ϕ' = angle of internal friction, c' = drained cohesion, C_u = Undrained Shear Strength, E_v' = drained elastic modulus (vertical), γ = bulk unit weight					

7 GEOHAZARDS ASSESSMENT

7.1 Geohazard Risk Register

Section 106 of the Resource Management Act 1991 (RMA) requires an assessment of the risk from natural hazards to be carried out when considering the granting of a subdivision consent. S106 of the RMA specifically states that the assessment must consider the combined effect of the natural hazard likelihood and relevant material damage to land or structures (consequence).

Table 5 below is a summary of the assessment of the potential geohazards for this site based on information available to date. This risk register of the geohazards at this site is a live document that will be updated as the Project progresses. A summary of the natural hazard risk classification is provided within Appendix D.

Item	Geotechnical Hazard	Description	Area Affected	Assessment Outcome	Existing Risk of Damage to Land / Structures			Mitigation Measure	Residual Risk of Damage to Land / Structures		
					Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
1	Earthquake	Seismicity	Whole Site	Site subsoil class = Class D ULS PGA = 0.25g Importance Level 2 or 3	1	5	5	Not applicable	1	5	5
		Fault Rupture	Whole site	Nearest active fault approximately 3km east of the site (Te Tatua o Wairere Fault). Recurrence interval 100,000 years	1	5	5	Mitigation not required	1	5	5
		Liquefaction Damage	Whole site	Refer to Section 7.4	3	4	12	Liquefaction-induced settlement should be accounted for within the foundation designs. These will be lot-specific and need to be carried out prior to building consent and reviewed by a suitably qualified geotechnical engineer.	2	4	8
		Lateral Spread Damage	Area in vicinity of Artificial Wetlands and Mangakotukutuku Stream	Refer to Section 7.6	3	3	9	Lateral spreading risk is assessed to be minor, and sufficient setbacks are currently in place to mitigate potential risk to structures; the lateral spreading risk should be reviewed during detailed design.	2	3	6
		Cyclic Softening	Entire Site	Not anticipated.	1	4	4	Mitigation not required.	1	4	4
2	Slope Instability / Landslide	Global Instability	Whole Site	Refer to Section 7.3. Due to the general near-level landforms, slope instability is not anticipated across the wider site; it is a risk for the swale drain and fill batters with proposed retaining walls. It is noted that the swale drain and fill batters with proposed retaining walls met the required Factor of Safety requirements.	2	4	8	Slope stability should be reviewed during detailed design within areas adjacent to retaining walls, Artificial Wetlands and the Mangakotukutuku Stream.	2	4	8
3	Problematic Soils	Expansive Soils	Entire Site	Experience in similar soils indicates that the soils on the site are non-expansive.	1	3	3	Mitigation not required.	1	3	3

Table 5: Geohazard Assessment Summary

Item	Geotechnical Hazard	Description	Area Affected	Assessment Outcome	Existing Risk of Damage to Land / Structures			Mitigation Measure	Residual Risk of Damage to Land / Structures		
					Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
		Uncontrolled Fill	Entire Site	Thin isolated pockets of uncontrolled fill were encountered in the northern corner of the site during our site investigation and may be encountered during earthworks elsewhere on the site. It is noted that this also includes the geotechnical exploratory testpit backfill material.	2	3	6	Undercut and replace materials.	1	3	3
5		Debris and Existing Improvements	Entire Site	Existing foundation elements, burn piles, offal pits, abandoned underground utilities, soak holes and septic systems may be encountered during earthworks.	2	3	6	Undercut and replace materials if encountered.	1	3	3
6	Settlement	Compressible Soils	Entire Site	Compressible soils are present across the site.	2	3	6	Construction monitoring by geotechnical engineer to ensure top-up fill is placed where necessary.	1	3	3
		Bearing Capacity Failure	Building Platforms	Loose or unsuitable material may be encountered beneath the building platforms.	2	3	6	Densify or undercut and replace low strength materials beneath building platforms, use appropriate foundation design.	1	3	3
7	Erosion	Soil Erosion	Swale Drains	Some minor erosion is possible to the banks of pond and swale drains during construction	2	3	6	Construction monitoring by geotechnical engineer to ensure good earthworks practices are in place to prevent erosion	1	3	3
8	Groundwater	Groundwater Impacts	Stormwater Controls	Groundwater was encountered at shallow depths below the site. Therefore, any formation of stormwater ponds, swales etc. will require stability analyses.	2	4	8	Stability analysis required at design stage and mitigation measures implemented as required.	2	4	8
9	Geothermal activity	Site not within geothermal area.									
10	Construction Risks	Excavatability	Building Platforms	Given the site is being built up with engineered fill, excavation is expected to be readily achieved with normal earthworks plant.	3	3	9	Construction monitoring by geotechnical engineer to ensure good earthworks practices.	1	3	3
		Sediment Retention Ponds	Building Platforms	Depending on their size sediment retention ponds may require geotechnical input at design stage to ensure batter stability is achievable.	2	3	6	Consideration given to batter stability of proposed ponds at design and construction phase.	1	3	3
		Subgrade Preparation	Building Platforms and Road Alignment	Topsoil and existing vegetation within the building footprints and road alignments will be cleared as part of the proposed development earthworks. In particular buried rootballs from felled trees and	5	2	10	Undercut to remove topsoil and roots and other materials. For saturated subgrade, allow to dry or undercut and replace.	1	2	2

Table 5: Geohazard Assessment Summary

Item	Geotechnical Hazard	Description	Area Affected	Assessment Outcome	Existing Risk of Damage to Land / Structures			Mitigation Measure	Residual Risk of Damage to Land / Structures		
					Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
				hedgerows in the eastern half of the site. Saturated, over optimum moisture condition causing pumping and yielding of the subgrade.							
		Service Trenches (trench collapse / long term settlement)	Building Platforms and Road Alignment	Trench collapse may occur in surficial soils / if proposed service trenches extend below GW level.	3	3	9	Mitigation should be considered in the form of: -trench support -temporary dewatering, in the form of regular spaced pumps	1	3	3
		Short term erosion of swale drains	Swale drains	Erosion of swale drains may occur, due to the battered slope gradient on unvegetated slopes	2	3	6	Mitigation may comprise rapid revegetation, erosion control matting. This is to be confirmed in the design phase.	1	3	3
		Low road/pavement subgrade strengths	Roads and Paths	Low subgrade strengths and/or saturation of pavement subgrade	3	4	12	Further site investigations and specific pavement design is required.	1	4	4

Appendix D contains references for the assessment methods used.

7.2 Seismicity

The seismic subsoil class has been assessed as Class D, deep soil, in accordance with NZS1170.5 Section 3.1.1.⁷

The Peak Ground Acceleration (PGA) for this development was calculated based on a 50-year design life in accordance with the New Zealand Building Code⁸ and importance level (IL) 2 and IL (3) structures. The seismic design and analysis for this site should consider two earthquake events in accordance with NZ1170, which are the serviceability limit state (SLS) and ultimate limit state (ULS) earthquakes. The calculated PGAs for these events are summarised in Table 6 below.

Table 6: Peak Ground Acceleration (PGA) for Two Limit States				
Limit State	AEP	PGA(g) IL2	PGA(g) IL3	Magnitude _{eff}
SLS	1/25	0.06	0.06	5.9
ULS	1/500	0.25	0.32	5.9

Note: SLS = serviceability limit state; ULS = ultimate limit state; AEP = annual exceedance probability

7.3 Fault Rupture

As indicated on the GNS Community Fault Model the nearest known active fault to site is the Te Tatua o Wairere Fault, located approximately 3km to the east. Kututaruhe Fault is also noted to the west approximately 4.6km from the site. We consider the site to be at 'very low' risk with respect to fault rupture. The low return period of the Te Tatua o Wairere Fault has been considered within our analysis.

7.4 Liquefaction

7.4.1 Methodology

In accordance with MBIE/NZGS guidance, the liquefaction susceptibility of the soils at this site was assessed with respect to geological age and compositional (soil fabric and density) criteria, based on the following assumptions:

- Only saturated soils below an assessed seasonal average groundwater level were modelled as being susceptible to liquefaction. A perched water table was considered, due to the bands of stiff silt encountered at a depth of approximately 4m within CPT01, CPT02, and CPT05.
- In accordance with MBIE/NZGS guidance⁴ and in the absence of site-specific shear wave velocity measurements, no aging / strength gain factor has been applied to the Pleistocene aged soils.
- Soils are also classified with respect to their grain size and plasticity to assess liquefaction susceptibility. For this Project, a cut-off threshold soil behaviour type index value (I_c) of 2.6 was used to distinguish between liquefiable (I_c<2.6) and non-liquefiable (I_c>2.6) soils.
- Specific liquefaction analyses were undertaken for IL2 structures, using the software package CLiq and the Boulanger and Idriss (2014) method. The cyclic stress ratio (CSR), being a function of the PGA corrected for the relevant magnitude for the design return period event, was compared to the cyclic resistance ratio (CRR), being a function of the CPT data.
- Free-field liquefaction induced settlements were determined in accordance with Zhang et al. (2002). With respect to liquefaction response, consideration was given to a 10m cut-off depth to estimate index settlements as per MBIE⁹ guidance (foundation technical categories). These were compared to

liquefaction settlement estimates over the full depth range of the CPT's with a depth weighting factor (e_v) applied ranging from 1 at the ground surface to 0 at 20m depth.

7.4.2 Results

Results are presented in **Appendix F** and are summarised in Table 7 below.

Table 7: Liquefaction Analyses Results						
CPT No.	SLS Settlement (mm)	Total ULS Settlement IL2 (mm)	Liquefaction Severity Number (LSN) IL2	Index ULS Settlement	Total ULS Settlement IL3 (mm)	Depth to Liquefied Layer (m)
CPT25-01	<10	65	6	25	80	8
CPT25-02	<10	75	11	60	95	3.1
CPT25-03	<10	110	20	80	120	2.8
CPT25-04	<10	65	7	30	85	6.2
CPT25-05	<10	45	5	25	65	7.8
CPT25-06	<10	85	14	65	110	3
CPT25-07	<10	45	6	35	60	4.5
CPT25-08	<10	110	17	75	135	2.2
CPT25-09	<10	75	8	35	95	6.2
CPT25-10	<10	115	17	80	130	3.7
CPT25-11	<10	100	12	55	120	3.3
CPT_181275	<10	55	11	50	80	2.8
CPT_181276	<10	55	10	40	75	2.8
CPT_87648	<10	95	14	65	115	3
CPT_87654	<10	90	18	80	125	2
CPT_87660	<10	105	20	70	125	2.2
CPT_87655	<10	70	7	35	85	4.6
CPT_87650	<10	80	10	45	105	4
CPT_87646	<10	40	8	35	50	3.2
CPT_87661	<10	130	20	80	150	2.4
CPT_87659	<10	80	10	45	95	3.5
CPT_87652	<10	70	10	40	95	3.7

Note: All settlements and depths based on existing ground profile.

Index settlements are calculated based on the upper 10m of the soil profile using no depth weighting factor.

Total ULS settlements are based on the full depth of the CPT trace with a depth weighting factor applied.

Index settlements are for assessment of the site against the MBIE site Technical Category guidelines and are not comparable to the total ULS settlements.

⁷ NZS 1170.5: 2004 Structural Design Actions Part 5 Earthquake Actions – New Zealand

⁸ Earthquake Geotechnical Engineering Practice, Module 3: Identification, assessment and mitigation of liquefaction hazards", (November 2021)

⁹ Repairing and Rebuilding House affected by the Canterbury Earthquakes", (December 2012)

The calculations indicate that liquefaction may occur in some soil layers during a ULS earthquake event. Affected layers are shown within the liquefaction report attached within **Appendix F**.

Results indicate liquefaction is triggered at a seismic load of PGA 0.14, which is slightly above the 100-year return period PGA of 0.12 for the Hamilton area as per MBIE guidance.

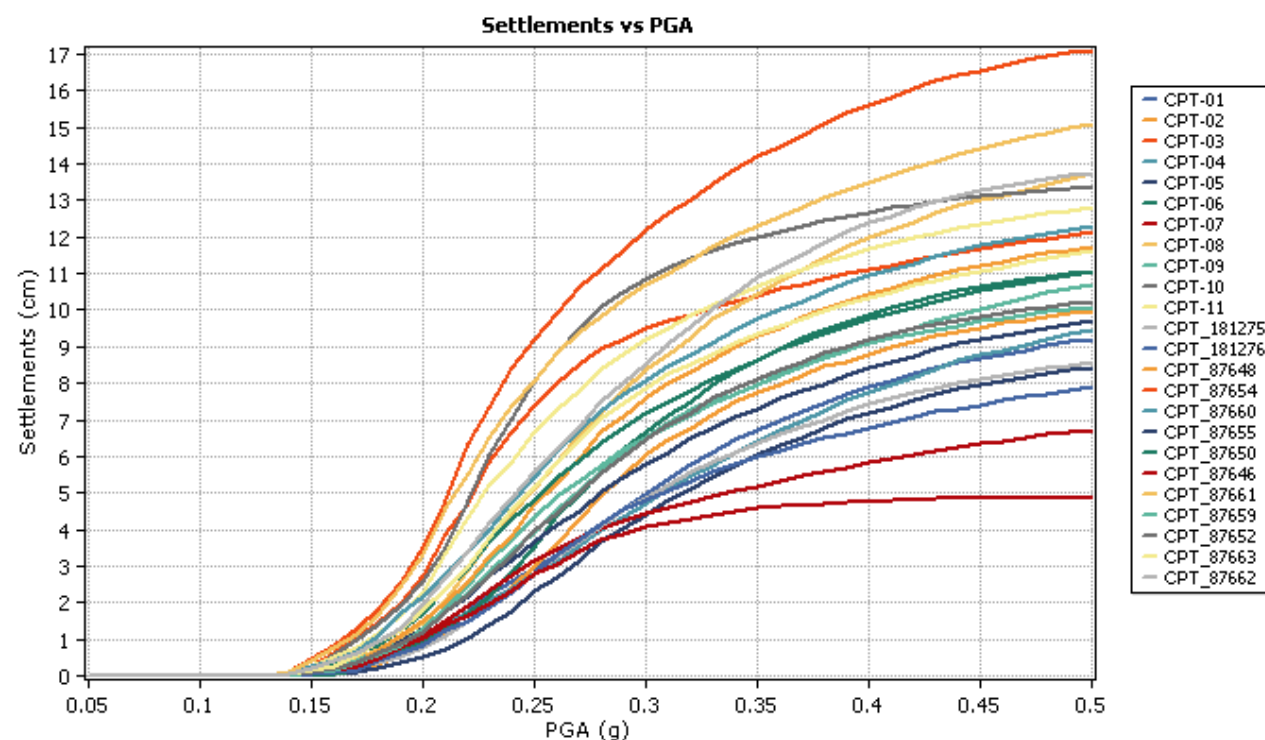


Figure 4: Parametric Summary of predicted vertical settlements from soil liquefaction following a ULS seismic event (IL3: PGA 0.32g)

In the ULS case liquefaction analyses results using the full depth of the CPT testing indicate a moderate to high risk of liquefaction occurring at the site. Recommendations follow in Section 8.6.

7.5 Lateral Spread

Following the onset of liquefaction, the liquefied soils behave as a very weak undrained material, which can give rise to lateral spreading where a free face is present within the vicinity of the site or where proposed cut and fill batters are proposed over or within liquefied soils.

However, preliminary results of the liquefied slope stability analyses estimate 13-35mm lateral spread displacement during the ULS event (within 30m of the top of slope). The estimated lateral spread is within the 50mm limit for TC2 Foundation Technical Category outlined within Table 3.1 of the MBIE Canterbury rebuild guidelines Part A. A summary of this is attached within **Appendix G**.

Although not anticipated to be excessive, the potential lateral spread risk should be reviewed during detailed design.

7.6 Slope Stability

7.6.1 Overview

Minor slopes are proposed across the site in the form of stormwater ponds, with maximum slope gradients of 1V:3H, and may be prone to small scale instability and erosion.

Additionally, Maven have indicated that there will be some minor slope batters requiring retaining up to 2.5m high (refer to Maven preliminary drawings presented in **Appendix B**).

To assess this hazard further, a preliminary slope stability assessment was undertaken.

7.6.2 Design Criteria

The stability of the swale drains under a range of design conditions is expressed in terms of a factor of safety, which is defined as ratio of the resisting forces to destabilising forces acting on a slope. Table 8 below presents the recommended performance standards¹⁰ for slope stability assessment:

Table 8: Slope Stability Factor of Safety Criteria	
Condition	Required Factor of Safety
Static long-term conditions (drained soil conditions, normal groundwater)	1.5
Transient short-term conditions (elevated groundwater and pore water pressures)	1.3
Seismic (ULS) case*	1.0
Note: *Factor of safety < 1.0 acceptable where displacement-based approach is adopted.	

7.6.3 Slope Stability Analysis

Slope stability analyses were undertaken using the Morgenstern-Price method of slices under both circular and translational failure mechanisms using the proprietary software Slide2. Analyses were completed for the various conditions stated in *Error! Reference source not found.* based on the following:

- Static long-term conditions were analysed for the prevailing case with the groundwater table based on the modelled groundwater table.
- When analysing transient conditions, an elevated groundwater table using measured winter flood levels along with an excess pore water pressure of $r_u = 0.3$ above the water table.
- Seismic displacements were estimated based on a Newmark Sliding Block approach using 50th percentile correlations published in Ambraseys & Srbulov (1995)¹¹ and Jibson (2007)¹² for thin, translational rigid sliding block cases, and Bray & Travarasrou (2007)¹³ and Bray and Macedo (2019)¹⁴ for flexible sliding mass cases.
- A 10 kPa dead load was used to model typical residential dwelling loads.

The following slopes have been assessed:

- Section A: 4.8m deep stormwater pond (Wetland A – Section A2 on Maven Associates drawings) embankment with a maximum cut slope of 1V:3H. Note, there are several proposed ponds; however, Wetland A is representative of all of them, as the maximum slope angle in all ponds is 1V:3H, and the geologic profile is laterally consistent between ponds.
- Section B: 3.5m deep Mangakotukutuku stream gully with an existing maximum slope of 1V:1.6H.

¹⁰ CoLab, (October 2025). Regional Infrastructure Technical Specification (RITS) V2, Table 16: Proposed factors for safety for different slope stability scenarios

¹¹ Ambraseys, N. and Srbulov, M. (1995) Earthquake induced displacement of slopes, Journal of Soil Dynamics and Earthquake Engineering, Vol 14

¹² Jibson, R.W., (2007) Regression models for estimating coseismic landslide displacement, Journal of Engineering Geology, Vol 91

¹³ Bray, J. D., & Travarasrou, T. (2007). Simplified procedure for estimating earthquake-induced deviatoric slope displacements. *Journal of geotechnical and geoenvironmental engineering*, 133(4), 381-392.

¹⁴ Bray, J.D., and Macedo, J. (2019) "Procedure for Estimating Shear-Induced Seismic Slope Displacement for Shallow Crustal Earthquakes," J. of Geotechnical and Geoenvironmental Engineering, ASCE, V. 145(12), doi: 10.1061/(ASCE)GT.1943-5606.0002143.

- Preliminary Retaining Wall Section: 2.27m high fill embankment supported by a timber retaining wall. This wall is the largest (and worst-case) of the proposed retaining walls.

7.6.4 Results

Selected stability printouts are attached in **Appendix E** with the factor of safety for each scenario outlined in **Table 9**.

Table 9: Slope Stability Analyses Results					
Location	Slope Stability Factor of Safety				Lateral Stretch (mm) within 30m of Top of Slope
	Prevailing	Transient	Seismic (ULS)	Yield Acceleration	
Wetland A Section A	1.64	1.3	<1	0.07 - 0.09	15-35
Mangakotukutuku Stream Section B	1.26	0.84	<1	0.15	<15
Retaining Wall	2.65	1.68	1.8	-	NA

The results show that the Section B transient case as well as the seismic and yield acceleration cases do not meet the requisite factor of safety. Recommendations are discussed in Section 8.1.

Mavens' preliminary retaining wall plans achieve the required factor of safety and are provisionally suitable, subject to detailed design.

7.6.5 Potential Pond Uplift

The WGA Hydrogeological Effects Assessment¹⁵ identified a low permeability aquitard layer running beneath the site which has a confining effect on the underlying deep aquifer, putting it under some degree of pressure. Excavating the proposed stormwater ponds will remove the existing soil overburden pressure and the uplift pressure from the confined aquifer could rupture the aquitard layer and destabilise the ponds.

A separate design memorandum has been prepared by CMW in collaboration with WGA and Maven Associates, to address this specific issue, and provide options for mitigation, and presented in **Appendix I**.

7.6.6 Mangakotukutuku Stream

The Mangakotukutuku Stream and gully system extends through the site and beyond the northern boundary. Beyond the northern boundary, the stream and gully are within the 'Waikato Riverbank and Gully Hazard Area' outlined in the Hamilton City Council Operative District Plan. Stability of the stream and gully needs to be considered, such that the proposed development does not exacerbate the Gully Hazard Area.

The development has no proposed works within the 20m wide stream corridor (or within 8-10m of the stream), therefore, there should be no additional stability risk to the stream and gully system from the proposed development.

7.7 Load Induced Settlement

Proposed fill and future building loads will induce settlements within the underlying subsoils. CPT data was used to assess the soil modulus parameters for preliminary load induced settlement analyses.

Load induced elastic settlements for the proposed fill and anticipated building loads were estimated using the software CPeT-IT and CPT data with the following correlation:

$$S_{CPT} = \sum \frac{\Delta\sigma_v}{M_{CPT}} \Delta z$$

Where S_{CPT} = Primary settlement,

$\Delta\sigma_v$ = Change in vertical stress or load applied,

M_{CPT} = Constrained modulus calculated from CPT trace, and

Δz = Change in depth.

Where $M_{CPT} = a_m \times (q_t - s_{vo})$ where a_m is dependent on the I_c .

Secondary creep settlements were calculated using the simplified approach by Mesri (1994) where:

$$S = C_a \times \Delta z \times \log(t)$$

Where $C_a = 0.04 \times \left(\frac{C_c}{1+e_0}\right) \approx 0.1 \times \frac{\sigma'_v}{M_{CPT}}$

t = time

Results are attached within **Appendix H** and summarised in Tables 10 and 11. Two cases have been considered: 10kPa load (lightweight 1-2 storey residential dwellings with widespread loads) with a 50 year design life, and no load with a 100 year design life (roads and council buried infrastructure).

Calculation elements presented in the summary tables are outlined below;

- Proposed Cut/Fill depths were adapted from Maven Plans presented in **Appendix B**.
- Fill Load. A unit weight of 19kN/m³ was assumed for the fill, rounded up to the nearest metre.
- Building Loads. A 10kPa building load has been applied (Table 10 only), suitable for lightweight one to two storey residential buildings with widespread loads.
- Applied working pressure is combined fill load plus the building load (or just the fill load in Table 11).
- Settlement was only calculated where the induced stress increase from the load was more than 20% of the existing overburden stress.
- Calculations account for total fill including minor top up fill required post consolidation.

Table 10: Preliminary Settlement Analyses Results for Building Loads - 50 year design life						
CPT No.	Proposed Cut or Fill Depth (m) (Cut is negative)	Fill Load (kPa)	Building Load(kPa)	Applied Working Pressure (kPa)	Primary Earthworks Settlement (Total) mm	Secondary Post Construction Settlement (Total) mm
CPT25-01	0.5	19	10	29	<5	<5
CPT25-02	1	19	10	29	<5	<5
CPT25-03	-0.3	0	10	10	<5	<5
CPT25-04	1	19	10	29	10	5
CPT25-05	1.1	19	10	29	5	5

¹⁵ Southern Links 1 Residential Stage 1 Southern Block Hydrogeological Effects Assessment, prepared by WGA, Ref: WGA242463-RP-HG-0003_B, dated May 2026

Table 10: Preliminary Settlement Analyses Results for Building Loads - 50 year design life

CPT No.	Proposed Cut or Fill Depth (m) (Cut is negative)	Fill Load (kPa)	Building Load(kPa)	Applied Working Pressure (kPa)	Primary Earthworks Settlement (Total) mm	Secondary Post Construction Settlement (Total) mm
CPT25-06	0	0	10	10	<5	<5
CPT25-07	0.7	19	10	29	5	5
CPT25-08	1.5	38	10	48	40	20
CPT25-09	2	38	10	48	55	35
CPT25-10	0	0	10	10	<5	<5
CPT25-11	-1.2	0	10	10	<5	<5
CPT_87646	1	19	10	29	55	30
CPT_87648	-0.3	0	10	10	<5	<5
CPT_87650	0.9	19	10	29	20	5
CPT_87652	-0.5	0	10	10	<5	<5
CPT_87654	0.5	19	10	29	10	5
CPT_87655	2	38	10	48	60	30
CPT_87659	0.5	19	10	29	50	25
CPT_87660	1	19	10	29	15	5
CPT_87661	1.5	38	10	48	70	15
CPT_181275	0	0	10	10	<5	<5
CPT_181276	-0.4	0	10	10	<5	<5

Table 11: Preliminary Settlement Analyses Results for Infrastructure – 100 year design life

CPT No.	Proposed Cut or Fill Depth (m) (Cut is negative)	Pavement Load (kPa)	Fill Load = Applied Working Pressure (kPa)	Primary Earthworks Settlement (Total) mm	Secondary Post Construction Settlement (Total) mm
CPT25-01	0.5	5	24	25	10
CPT25-02	1	5	24	15	10
CPT25-03	-0.3	5	5	<5	<5
CPT25-04	1	5	24	15	<5
CPT25-05	1.1	5	24	10	<5
CPT25-06	0	5	5	<5	<5
CPT25-07	0.7	5	24	10	<5

Table 11: Preliminary Settlement Analyses Results for Infrastructure – 100 year design life

CPT No.	Proposed Cut or Fill Depth (m) (Cut is negative)	Pavement Load (kPa)	Fill Load = Applied Working Pressure (kPa)	Primary Earthworks Settlement (Total) mm	Secondary Post Construction Settlement (Total) mm
CPT25-08	1.5	5	43	45	25
CPT25-09	2	5	43	65	40
CPT25-10	0	5	5	<5	<5
CPT25-11	-1.2	5	5	<5	<5
CPT_87646	1	5	24	75	40
CPT_87648	-0.3	5	5	<5	<5
CPT_87650	0.9	5	24	30	<5
CPT_87652	-0.5	5	5	<5	<5
CPT_87654	0.5	5	24	15	<5
CPT_87655	2	5	43	65	35
CPT_87659	0.5	5	24	65	30
CPT_87660	1	5	24	20	10
CPT_87661	1.5	5	43	75	20
CPT_181275	0	5	5	15	<5
CPT_181276	-0.4	5	5	10	<5

Results indicate that the majority of the settlement is primary and, due to the granular nature of the Hinuera Formation silts and sands, will be elastic and built out during construction. The balance of the settlement is estimated to be less than 25mm across 6m and within the Building Code limit across most of the site, with the exception of a few CPTs. In these areas, much of the settlement is predicted to occur within the Hinuera Formation silts, which are sensitive and therefore prone to being disturbed during CPT testing, resulting in inflated settlement predictions.

In our experience, the CPeT-iT over estimates settlement within these soils. Therefore, in these areas, settlement monitoring is recommended during construction to confirm that differential settlement across future building platforms is within building code limits (for residential dwellings) or is within serviceability limits for infrastructure.

Further assessment of settlement is required at the detailed design phase once design loads are known.

7.8 Cross Boundary Effects

7.8.1 Proposed Earthworks

Settlements caused by proposed earthworks along the site boundaries are predicted to be minor. As per Section 2 of the RITS Guidance¹⁶ an impact assessment will be carried out during the detailed design stage to

¹⁶ CoLab (October 2025) Regional Infrastructure Technical Specification (RITS)

confirm the acceptability of impacts on the nearby structures, once fill heights and building loads are confirmed.

Retaining walls are needed where cuts/fill exceed 1m along the boundary, such as the 2.3m high fill in the northwestern corner of the site. These areas will require retaining walls, as depicted on Maven's Proposed Retaining Wall plans presented in **Appendix B**.

7.8.2 Groundwater Drawdown

The WGA Hydrogeological Effects Assessment¹⁷ highlights that the potential worst-case drawdown during construction of WWPS A may induce ground subsidence beneath neighbouring properties to the north of WWPS A, but that drawdown below that magnitude is considered to be effectively indistinguishable from natural fluctuations.

Additionally, an assessment has been made of the potential groundwater drawdown induced settlement due to the change in effective stress below these neighbouring properties. We have estimated the change in stress based on the groundwater drawdown modelling presented in the WGA report. Based on this change in stress, the settlement was estimated using the following equation:

$$s = \frac{\sigma'_v \cdot H}{E'}$$

Where s is settlement, $\Delta\sigma'_v$ is change in effective stress, H is the thickness of the layer, and E' is the elastic modulus of the soil.

Furthermore, the groundwater table will have been subject to seasonal fluctuations in the past, therefore at least some of the stresses felt by the soil due to this drawdown will have been experienced previously.

Based on this, we have estimated settlement beneath the neighbouring properties to be less than 5mm. This is considered negligible.

8 RECOMMENDATIONS

8.1 Slope Stability

Results of the slope stability analyses in Section 7.6.4 demonstrate that the design gradients for the proposed wetlands meet the requisite slope stability factors of safety.

Foundation designs will need to account for <50mm of predicted lateral stretch.

The existing Mangakotukutuku stream bank is marginally stable in its existing state and we expect some minor translational failures during future storm events. These are not anticipated to affect adjacent structures as the proposed buildings are to be constructed outside the 20m wide stream corridor. However, if in future buildings are built in the vicinity of the stream they should either be setback at least 3m from the top of slope, or where they are within 3m they will require specific foundation design.

8.2 Earthworks and Filling

Fill-induced ground settlements are predicted to be generally <25mm, with the exception of a few isolated areas with up to 40mm predicted settlement. Settlement is anticipated to be elastic and built out rapidly during construction.

Cross-boundary effects of fill will need to be assessed during detailed design.

All earthwork activities must be carried out in general accordance with the requirements of NZS 4431:2022¹⁸ and the requirements of the Waikato District Council, Waikato R.I.T.S. and under the guidance of a Chartered Geo-professional.

The subgrade of the site will predominantly comprise engineered fill from site won material (Hinuera Formation sands and Silts). Alternatively, imported granular fill such as pit sand or rockfill would be suitable, with appropriate compaction specifications, including geotechnical testing and certification to be confirmed during detailed earthworks design.

The natural subgrade soils can be sensitive to remoulding and moisture ingress. Care will be required to avoid over working and trafficking of these materials, and to protect them from moisture ingress. Pumping and yielding conditions may be encountered near the groundwater level or during particularly rainy periods.

Other areas of unsuitable materials such as variable strength uncontrolled fill present within road or building areas should be undercut and may be used as landscape fill in reserve areas or be removed from site. This may include the geotechnical test pit excavation locations.

8.3 Road Subgrades

Based on the site investigation results, low strength near-surface silts and loose sands with typical Dynamic Cone Penetrometer values of 1 to 2 blows per 100mm penetration are present to a depth of up to approximately 1.0m over the majority of the site. These equate to an estimated CBR of 2% to 3%.

For road subgrades, after topsoil stripping and cutting to design subgrade levels the following should be undertaken:

- Proof rolling should be carried out prior to placement of any filling/hardfill to check for any areas of excessive deflection. Where clean sandy soils are exposed, moisture conditioning may be required to achieve optimum water contents and enable subgrade compaction.
- Where low strength uncontrolled fill or natural soils are exposed at subgrade levels, an allowance for undercut and replacement with clean compacted sand should be allowed for.

It is recommended that a programme of penetration resistance testing is carried out at routine intervals along road alignments as part of the road pavement design prior to road construction to confirm actual CBR values.

8.4 Trench and Open Drain Backfilling

All services trenches and open drains beneath road carriageways and within a 45 degree zone of influence of any building foundation should be backfilled with compacted trench spoil or imported pit-sand to meet engineered fill standards.

8.5 Culverts

Culverts/Arch Culverts will be required where roads cross swales and existing streams. Constructing these is feasible from a geotechnical perspective but will require careful geotechnical assessment and construction staging. Concept design philosophy is outlined below:

- Slope batter stability to be accounted for in geotechnical design. Geogrids and/or a rock buttress could be required depending on final batter configuration.
- Culverts may need to be constructed on top of a geogrid reinforced gravel raft to mitigate against seismic bearing capacity risks.

¹⁷ Southern Links 1 Residential Stage 1 Southern Block Hydrogeological Effects Assessment, prepared by WGA, Ref: WGA242463-RP-HG-0003_B, dated May 2026

¹⁸ Standards New Zealand (2022) Engineered fill construction for lightweight structures, NZS 4431:2022

- Fill embankment loads will need to be assessed by the geotechnical engineer. If settlements are greater than those allowed in the NZTA Bridge Manual, surcharging or ground improvement may be required.
- If culvert loads exceed the shallow bearing capacity of the soil, loads may need to be transferred to the underlying denser strata via piles or ground improvement elements. This will be subject to seismic design, including liquefaction induced down-drag, kinematic loads, loss of shaft friction, and lateral loads.

Culverts are subject to detailed design.

8.6 Shallow Foundations

The Residential Development proposes one and two-story buildings.

As discussed in Section 7.4.2, there is potential for liquefaction induced ground deformation to occur at the site and differential settlement is likely to occur in the subgrade soils following a ULS earthquake.

However, the actual potential for liquefaction hazard will be somewhat reduced due to the 1m to 2m layer of engineered fill which will provide a non-liquefiable crust reducing surface manifestation of liquefaction and differential settlement.

A preliminary geotechnical ultimate bearing pressure of 300kPa should be available in the static case for shallow strip and pad foundations constructed within both the natural cut ground and engineered fill areas.

Specific site investigation and foundation suitability assessments including bearing capacity and static settlement should be carried out prior to Building Consent application for any buildings larger than single-family residential structures.

Following the preliminary assessment it is considered that most of the site is suitable for TC2 raft foundations, with localised areas of higher predicted settlements that will require TC2/TC3 hybrid foundations, in the vicinity of CPT25-09, CPT_87646 and CPT_87655 where there is >25mm predicted secondary settlement. This is to be further assessed during future investigations and detailed earthworks design.

9 SUITABILITY STATEMENT AND CONCLUSIONS

The site investigation carried out is considered suitable for this assessment of geotechnical constraints and associated requirements in support of the substantive application for the Residential Development under the FTAA.

The assessment of natural hazard risk for the site is assessed as low to medium for all hazards considered.

It is our opinion that the Residential Area is geotechnically suitable for the proposed development as depicted on the Maven Scheme Plans (**Appendix B**) and subject to the recommendations contained herein.

10 CLOSURE

Additional important information regarding the use of this CMW report is provided in the '*Using your CMW Report*' document attached to this report.

This report has been prepared for use by the client Colliers Project Leaders in relation to the substantive application for the Project under the FTAA in accordance with the scope, proposed uses and limitations described in the report.

Appendix A: Drawings

Title	Reference No.	Date	Revision
Site Investigation Plan	01	09/06/2026	1
Geology Plan	02	04/06/2025	0
Geological Cross Section A-A	03	04/06/2025	0
Geological Cross Section B-B	04	04/06/2025	0



LEGEND:

- CPT25-01** CONE PENETROMETER TEST (CPT) LOCATION (2025 CMW INVESTIGATION)
- TP25-01** TEST PIT (TP) LOCATION (2025 CMW INVESTIGATION)
- BH01** DEEP MACHINE BOREHOLE (BH) LOCATION (HISTORIC TESTING - NZGD)
- CPT_01** CONE PENETROMETER TEST (CPT) LOCATION (HISTORIC TESTING - NZGD)
- CROSS SECTIONS**
- STAGE 1 RESIDENTIAL AREA EXTENT**
- SITE BOUNDARIES WITHIN WIDER SOUTHERN LINKS DEVELOPMENT**

NOTES:

- BASE CONTOUR PLAN IS ADAPTED FROM MAVEN DRONE IMAGE.
- GEOLOGY ADAPTED FROM GNS 1:250,000 QMAPS DATABASE.
- HISTORIC TEST LOCATIONS SOURCED FROM NZGD DATABASE AND ARE INDICATIVE ONLY.

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CLIENT:	SAXBYS ROAD JV LIMITED	DRAWN:	MM	PROJECT:	HAM2025-0056
PROJECT:	SOUTHERN LINKS DEVELOPMENT STAGE 1 - RESIDENTIAL AREA	CHECKED:	DS	DRAWING:	01
TITLE:	SITE INVESTIGATION PLAN	REVISION:	1	SCALE:	1:5000
		DATE:	09/06/2026	SHEET:	A3 L



LEGEND:

CPT25-01

TP25-01

BH01

CPT_01

CROSS SECTIONS

STAGE 1 RESIDENTIAL AREA EXTENT

SITE BOUNDARIES WITHIN WIDER SOUTHERN LINKS DEVELOPMENT

SOFT TO FIRM PEAT (HOLOCENE SWAMP DEPOSITS)

INTERBEDDED LOOSE TO DENSE SAND AND FIRM TO VERY STIFF SILT (HINUERA FORMATION)

STIFF TO VERY STIFF CLAYEY SILT (HAMILTON ASH / WALTON SUBGROUP)

NOTES:

1. BASE CONTOUR PLAN IS ADAPTED FROM LINZ DATA SERVICE DIGITAL ELEVATION MODEL.

2. CONTOURS AT 1m INTERVALS..

3. GEOLOGY ADAPTED FROM GNS 1:250,000 QMAPS DATABASE.

4. HISTORIC TEST LOCATIONS SOURCED FROM NZGD DATABASE AND ARE INDICATIVE ONLY.

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PROJECT: **SOUTHERN LINKS DEVELOPMENT STAGE 1 - RESIDENTIAL AREA**

TITLE: **GEOLOGY PLAN**

DRAWN: MM

CHECKED: DS

REVISION: 0

DATE: 04/06/2025

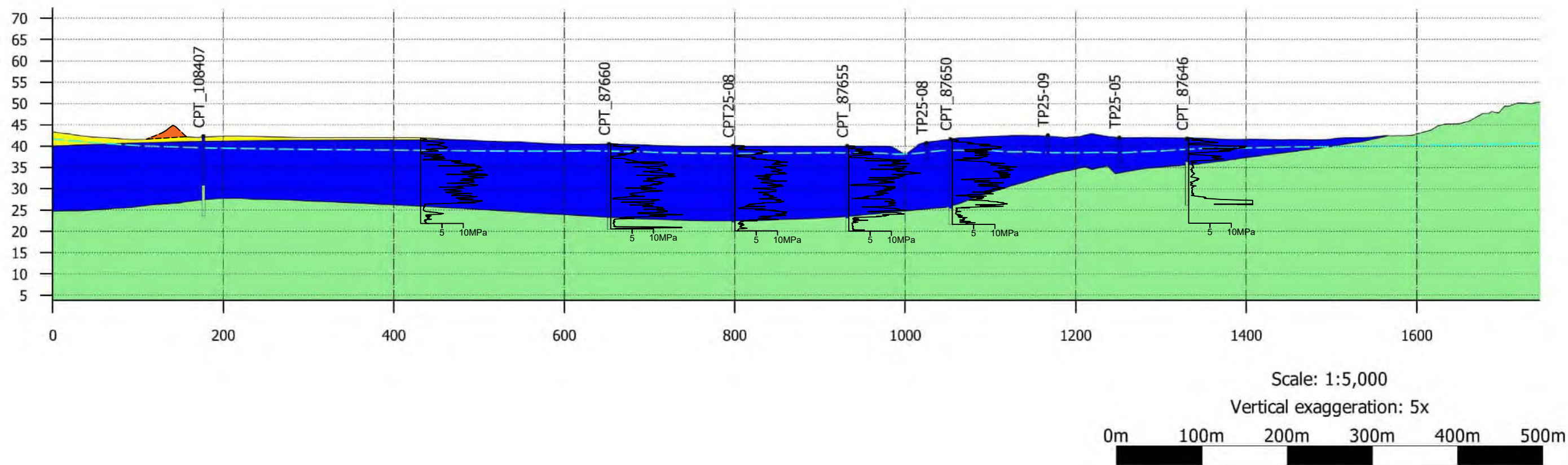
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DRAWING: 02

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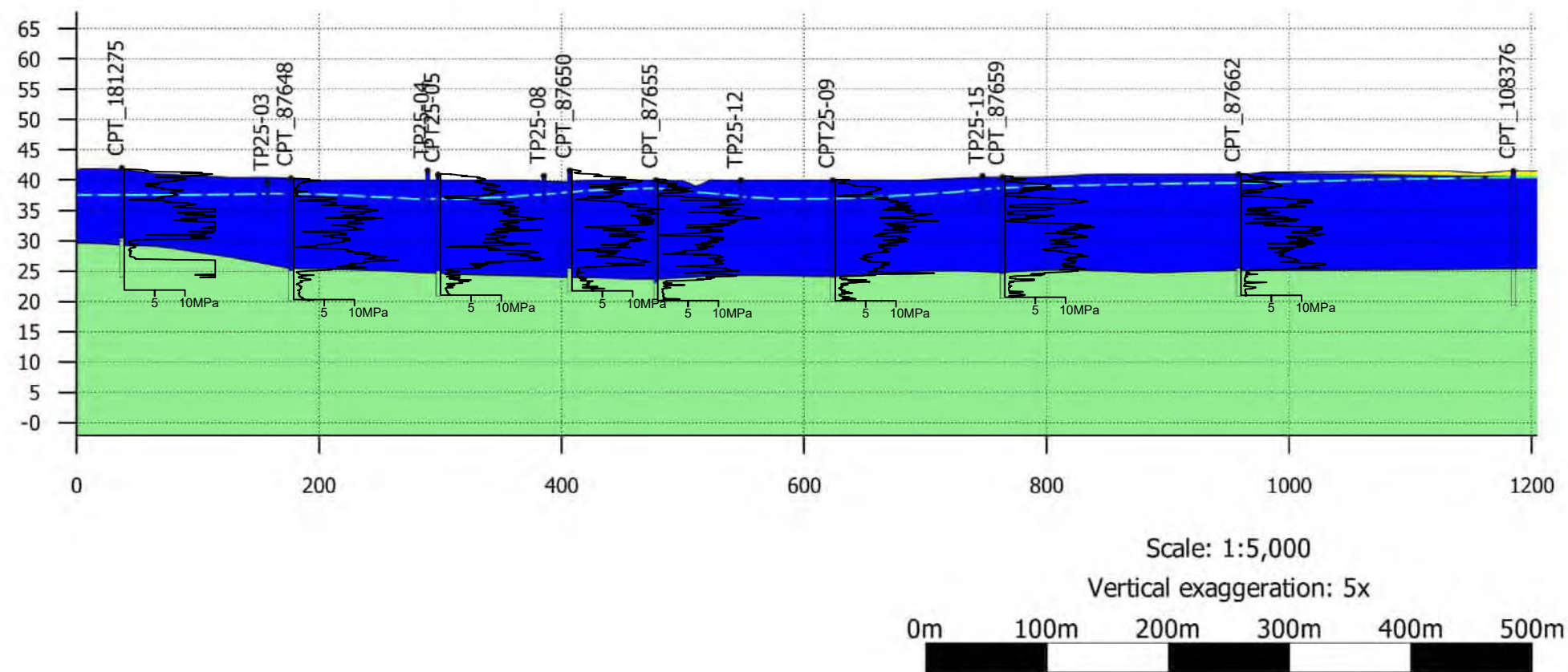
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	INTERBEDDED LOOSE TO DENSE SAND AND FIRM TO VERY STIFF SILT (HINUERA FORMATION)
	STIFF TO VERY STIFF CLAYEY SILT (HAMILTON ASH / WALTON SUBGROUP)
	GRAVEL FILL (RAILWAY BALLAST)
	GROUNDWATER

- NOTES:
- CROSS SECTION DERIVED FROM LEAPFROG 3D MODELLING SOFTWARE UTILISING EXISTING NZGD DATA. THE GEOLOGIC SURFACES ARE INDICATIVE ONLY.
 - ALL TESTS WITHIN 100M OF THE CROSS SECTION HAVE BEEN PRESENTED. AS SUCH, DISCREPANCIES BETWEEN TEST GEOLOGY AND MODEL SURFACES ARE DUE TO SETBACK.
 - GROUND SURFACE DERIVED FROM DRONE SURVEY DATA COURTESY OF MAVEN CONSULTANTS.
 - VERTICAL DATUM NZVD2016.

CMW Geosciences	CLIENT:	SAXBYS ROAD JV LIMITED		DRAWN:	MM	PROJECT:	HAM2025-0056
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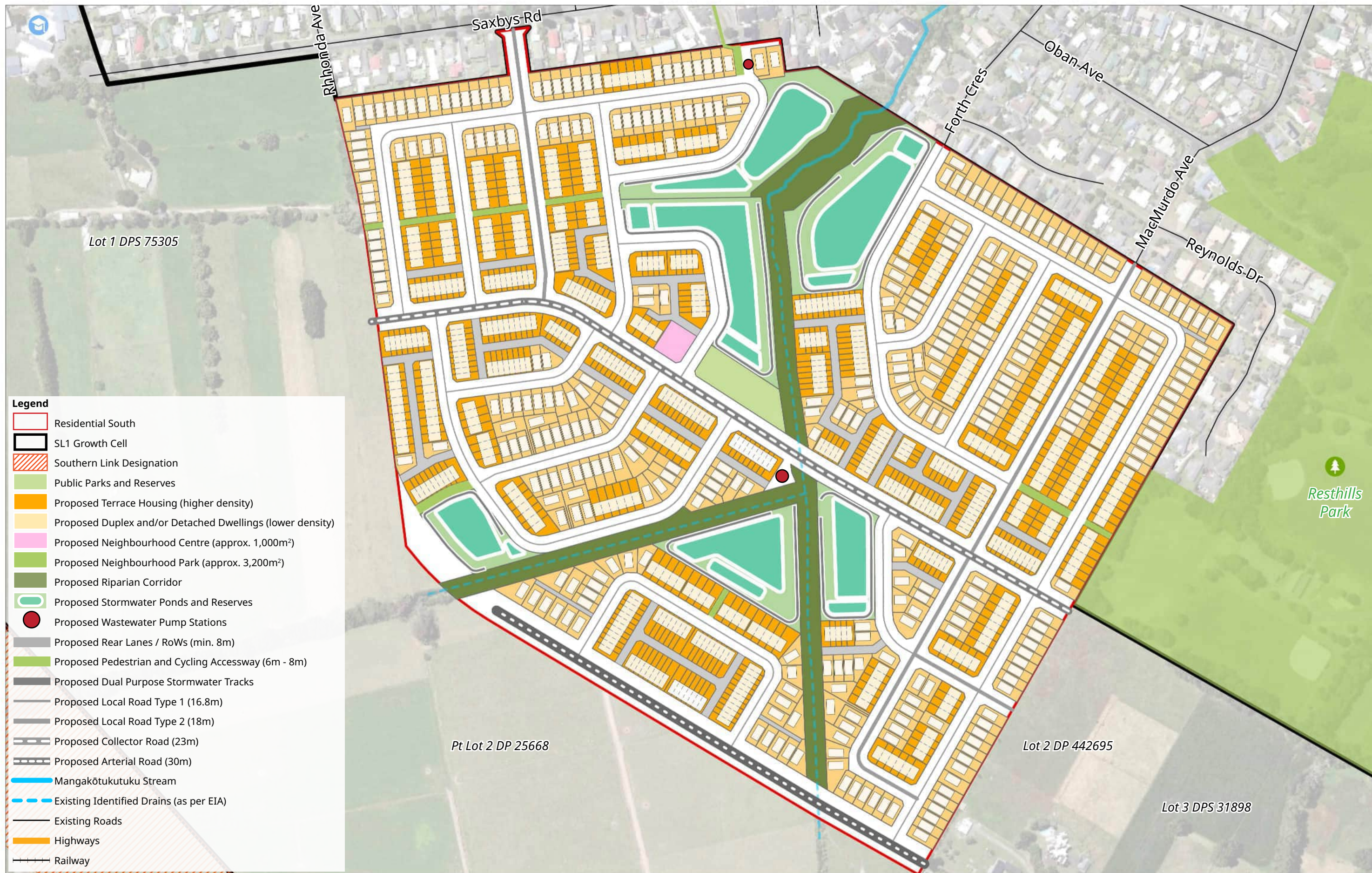
- SOFT TO FIRM PEAT (HOLOCENE SWAMP DEPOSITS)
- INTERBEDDED LOOSE TO DENSE SAND AND FIRM TO VERY STIFF SILT (HINUERA FORMATION)
- STIFF TO VERY STIFF CLAYEY SILT (HAMILTON ASH / WALTON SUBGROUP)
- GROUNDWATER

NOTES:

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	CLIENT:	SAXBYS ROAD JV LIMITED		DRAWN:	MM	PROJECT:	HAM2025-0056
	PROJECT:	SOUTHERN LINKS DEVELOPMENT STAGE 1 RESIDENTIAL AREA		CHECKED:	DS	DRAWING:	03
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Appendix B: Development Plans



Client: Saxby Rd JV Ltd, Industrie Property Tahī
& South Park Agri Development Ltd
Job Number: 25546 & 26111

Drawing: Residential South Proposed Masterplan
Version: Draft
Date: 13/07/2026

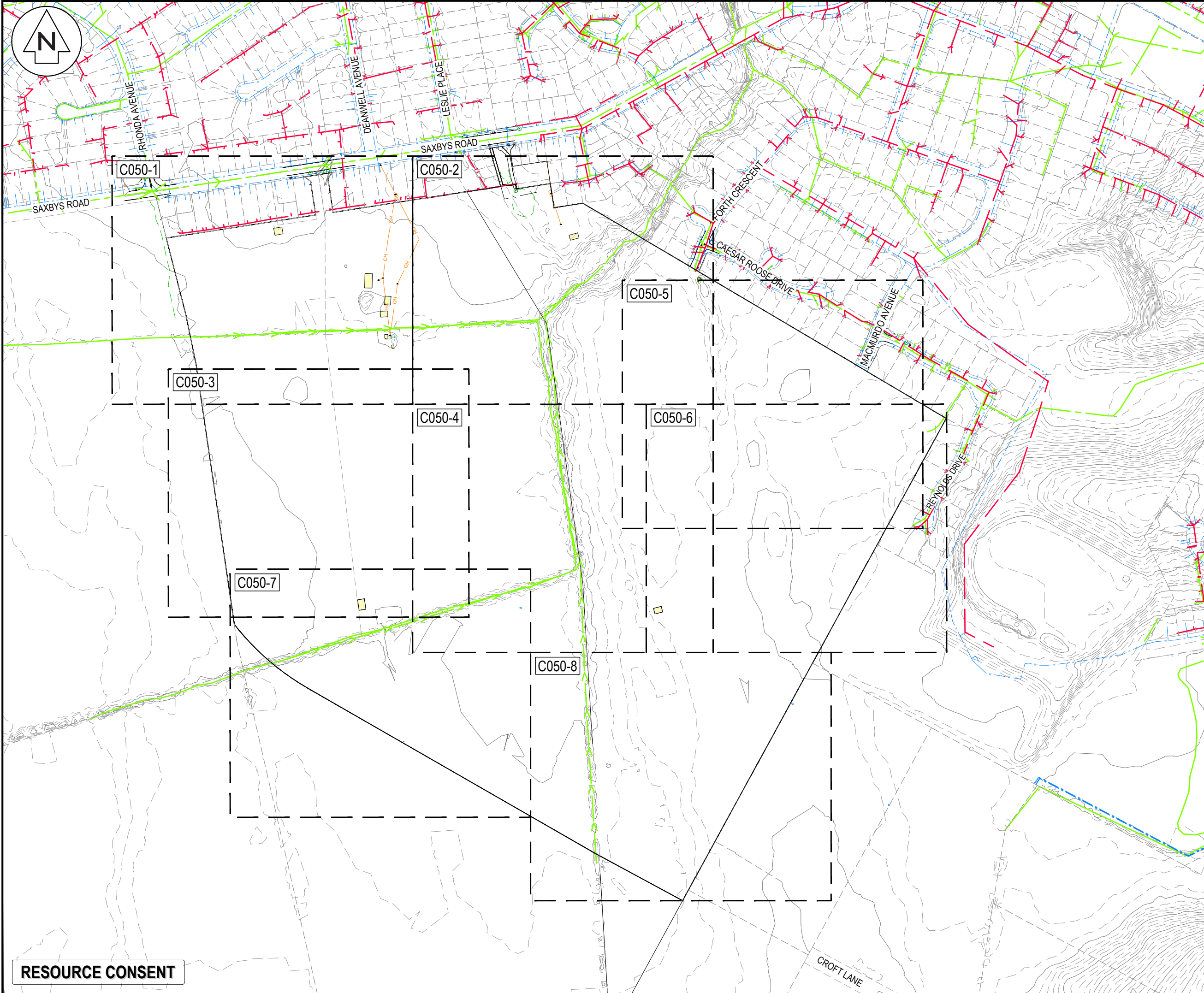
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Sheet: 1 of 1



SL1 Residential South & Industrial North Substantive Application

49A and 49B Saxbys Road, Saxbys Road, 18, 20 & 24 Wickham Street, 160 & 162 Higgins Road, Waikato

B&A
Urban & Environmental



NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
2. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000.
3. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016.
4. ORIGIN OF LEVELS = PIN 1 SO 537357 PUBLISHED RL=39.788, SOURCED FROM THE LINZ DIGITAL GEODETIC DATABASE.
5. BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
6. GROUND CONTOURS WERE CAPTURED USING A LIDAR SURVEY UNDERTAKEN IN MAY 2021.

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---	EX FENCE
---	EX BUILDING
FH	EX FIRE HYDRANT
WM	EX WATER METER
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---	EX SW / WW MANHOLE
---	EX CESSPIT
---	EX TELECOM PLINTH
---	EX TELECOM PILLAR BOX
---	EX POWER TRANSFORMER
---	EX POWER POLE
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---	EX STREET LIGHT
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A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025

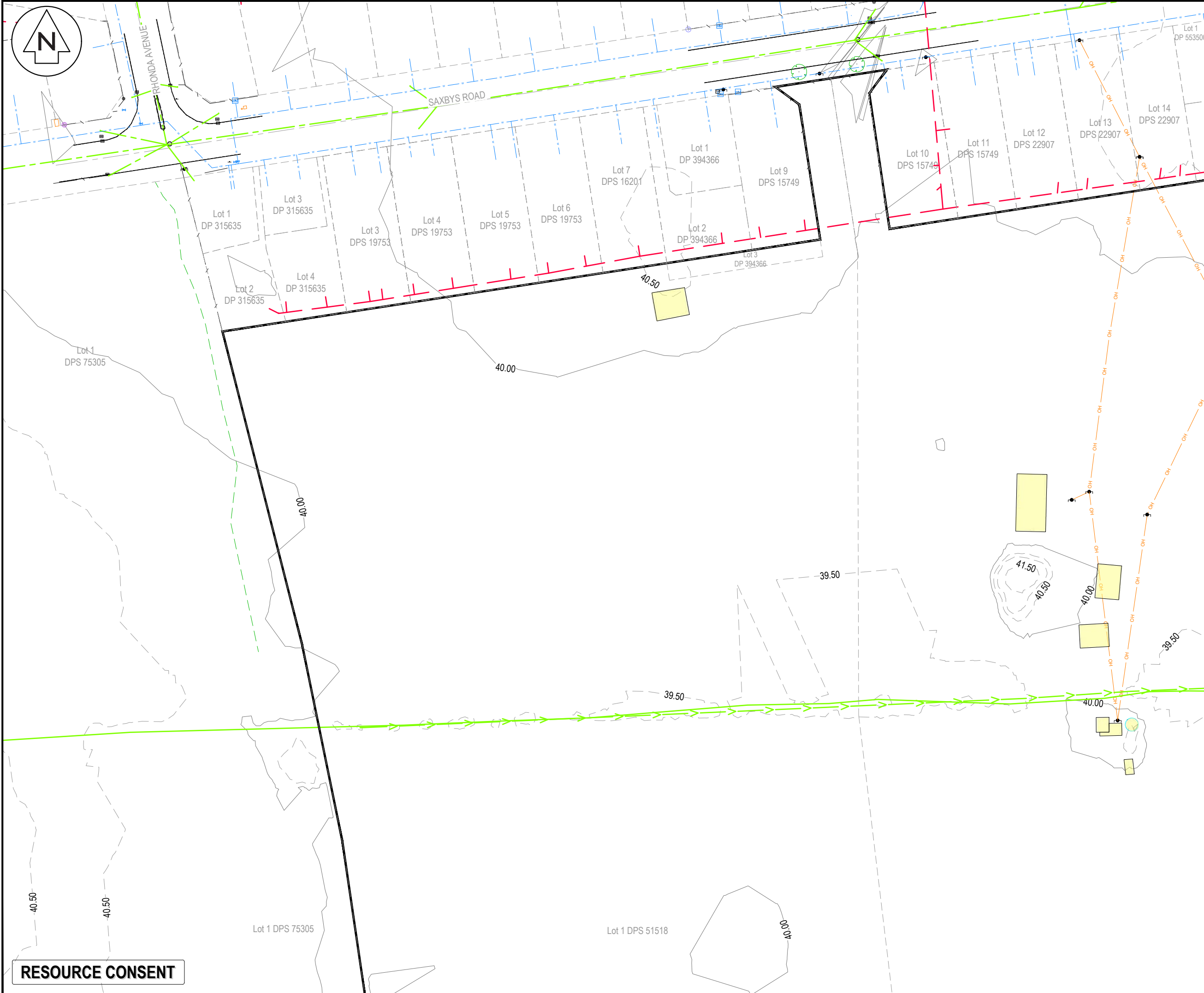
M Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
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TOPOGRAPHICAL
OVERVIEW PLAN**

Project no.	298001-R1 SL1		
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Cad file	298001-R1-C050 TOPO.DWG		
Drawing no.	R1- C050	Rev	A

RESOURCE CONSENT



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A	FAST TRACK APP	MKS	06/2026
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MAVEN

Maven Waikato

07 242 0601

info@maven.co.nz

www.maven.co.nz

Level 1 286 Victoria Street, Hamilton

New Zealand

Project

SOUTHERN LINKS 1

RESIDENTIAL STAGE 1

HAMILTON, WAIKATO

FOR

SAXBY RD JV LIMITED

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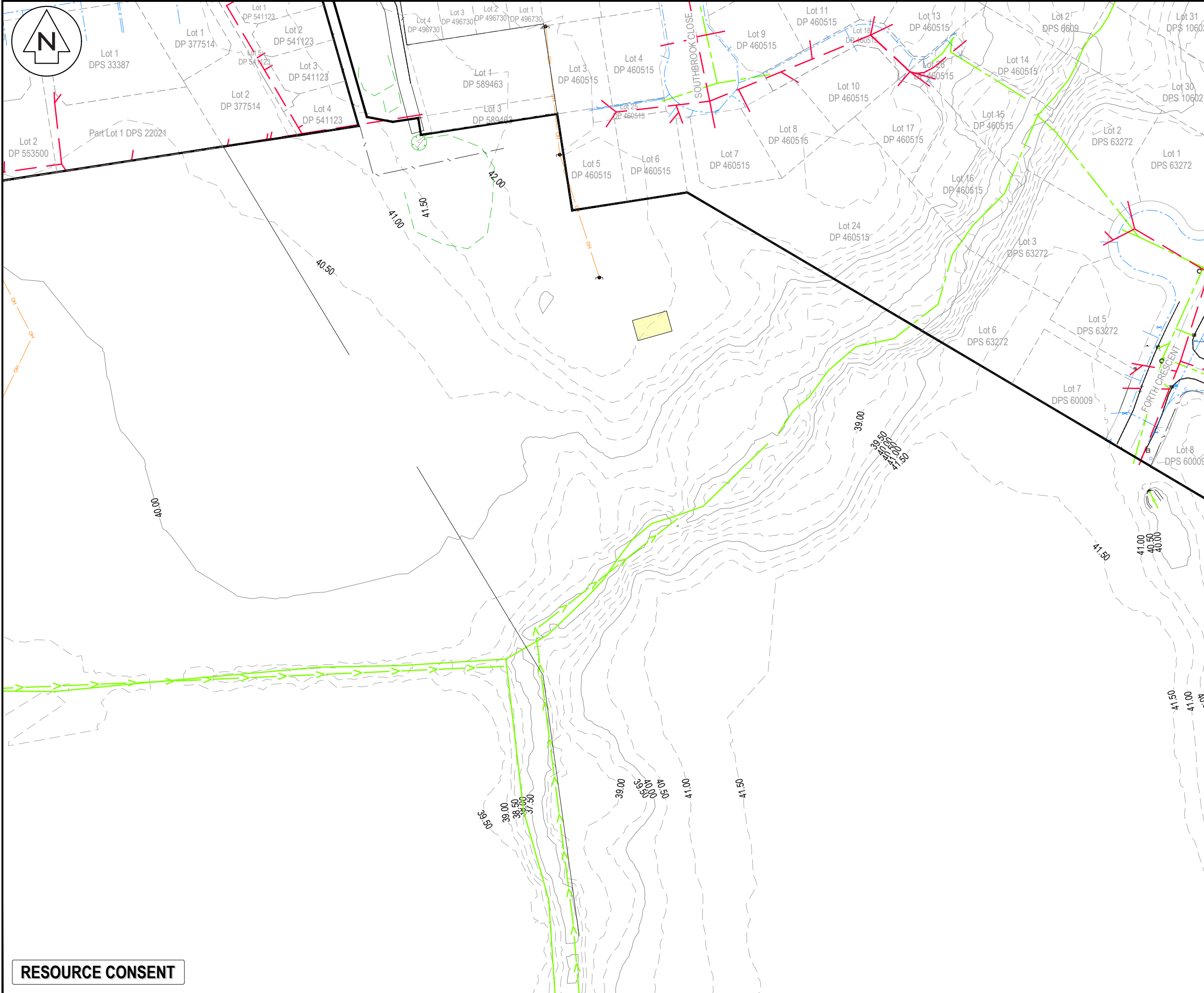
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Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
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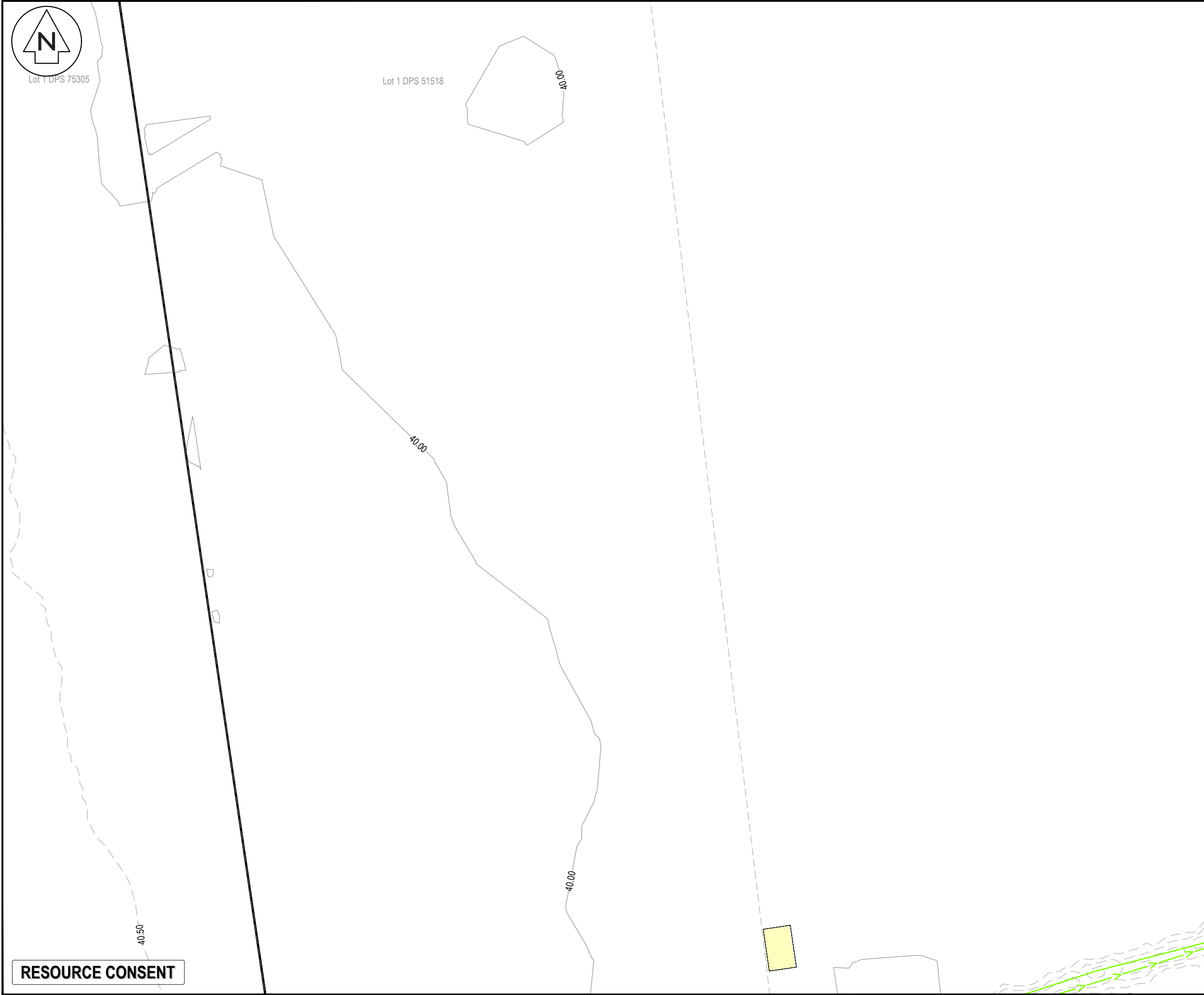
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RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

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RESOURCE CONSENT



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Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
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FOR
SAXBY RD JV LIMITED**

Title

**EXISTING
TOPO
PLAN**

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Drawing no.	R1- C050-3	Rev	A



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
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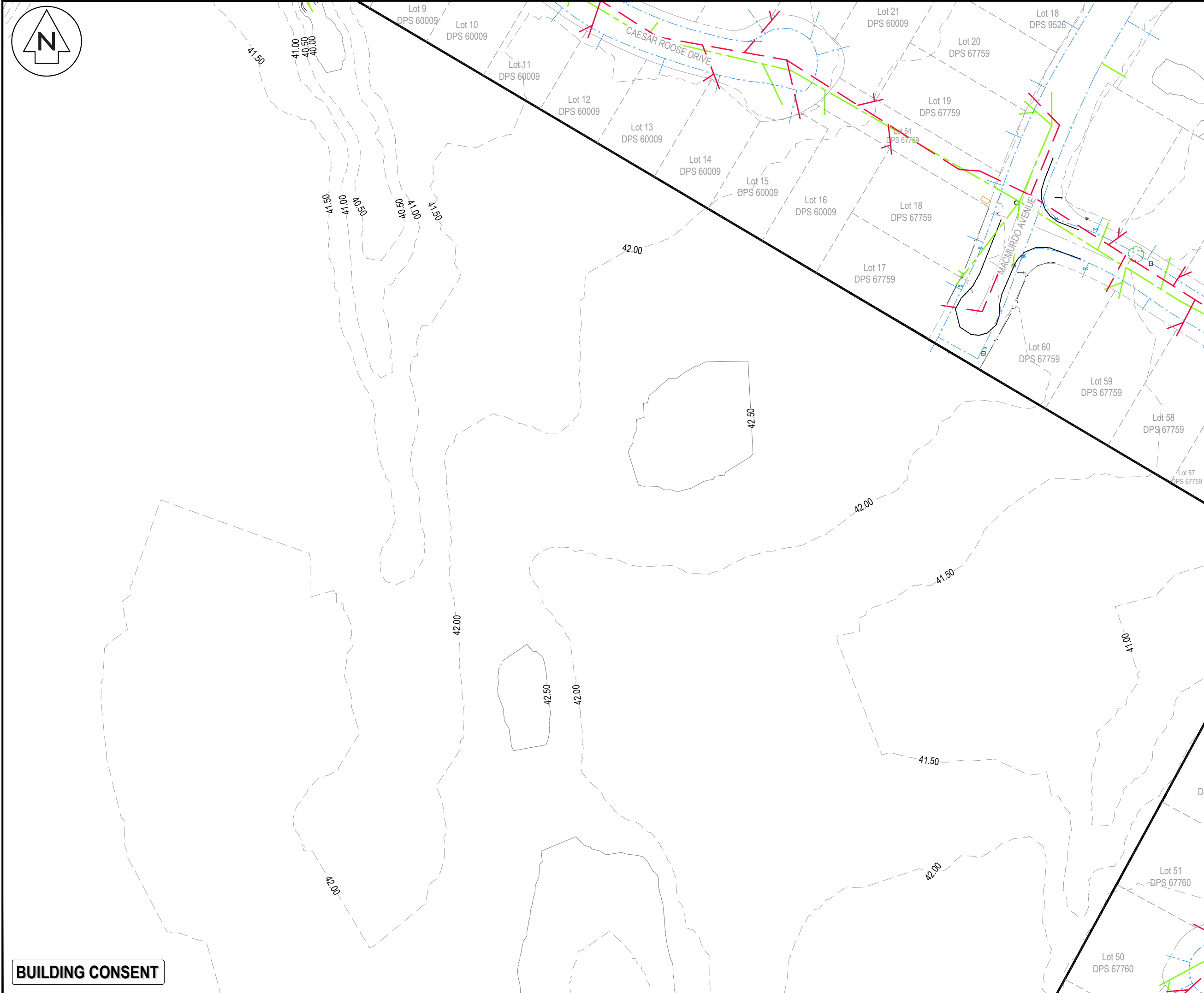
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**EXISTING
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PLAN**

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Drawing no.	R1- C050-4	Rev	A

RESOURCE CONSENT



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 4. ORIGIN OF LEVELS = PIN 1 SO 537357 PUBLISHED RL=39.788, SOURCED FROM THE LINZ DIGITAL GEODETIC DATABASE.
 5. BOUNDARIES ARE SUBJECT TO FINAL SURVEY.
 6. GROUND CONTOURS WERE CAPTURED USING A LIDAR SURVEY UNDERTAKEN IN MAY 2021.

LEGEND	
	EX BDY
	EX EASEMENT
	EX TITLE BDY
	EX MAJOR CONTOUR
	EX MINOR CONTOUR
	EX WASTEWATER
	EX STORMWATER
	EX WATER MAIN
	EX OVERHEAD POWER
	EX ROAD KERB TOP
	EX TOP OF BANK
	EX FENCE
	EX BUILDING
	EX FIRE HYDRANT
	EX WATER METER
	EX VALVE
	EX SW / WW MANHOLE
	EX CESSPIT
	EX TELECOM PLINTH
	EX TELECOM PILLAR BOX
	EX POWER TRANSFORMER
	EX POWER POLE
	EX POWER PILLAR BOX
	EX STREET LIGHT
	EX STREET SIGN
	EX TREE
	EX SLUICE VALVE

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025



Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project			
SOUTHERN LINKS 1 RESIDENTIAL STAGE 1 HAMILTON, WAIKATO FOR SAXBY RD JV LIMITED			
Title			
EXISTING TOPO PLAN			
Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C050 TOPO.DWG		
Drawing no.	R1- C050-5	Rev	A

BUILDING CONSENT



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
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LEGEND	
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	EX TITLE BDY
	EX MAJOR CONTOUR
	EX MINOR CONTOUR
	EX WASTEWATER
	EX STORMWATER
	EX WATER MAIN
	EX OVERHEAD POWER
	EX ROAD KERB TOP
	EX TOP OF BANK
	EX FENCE
	EX BUILDING
	EX FIRE HYDRANT
	EX WATER METER
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	EX SW / WW MANHOLE
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	EX TELECOM PLINTH
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	EX POWER TRANSFORMER
	EX POWER POLE
	EX POWER PILLAR BOX
	EX STREET LIGHT
	EX STREET SIGN
	EX TREE
	EX SLUICE VALVE

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025



Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project

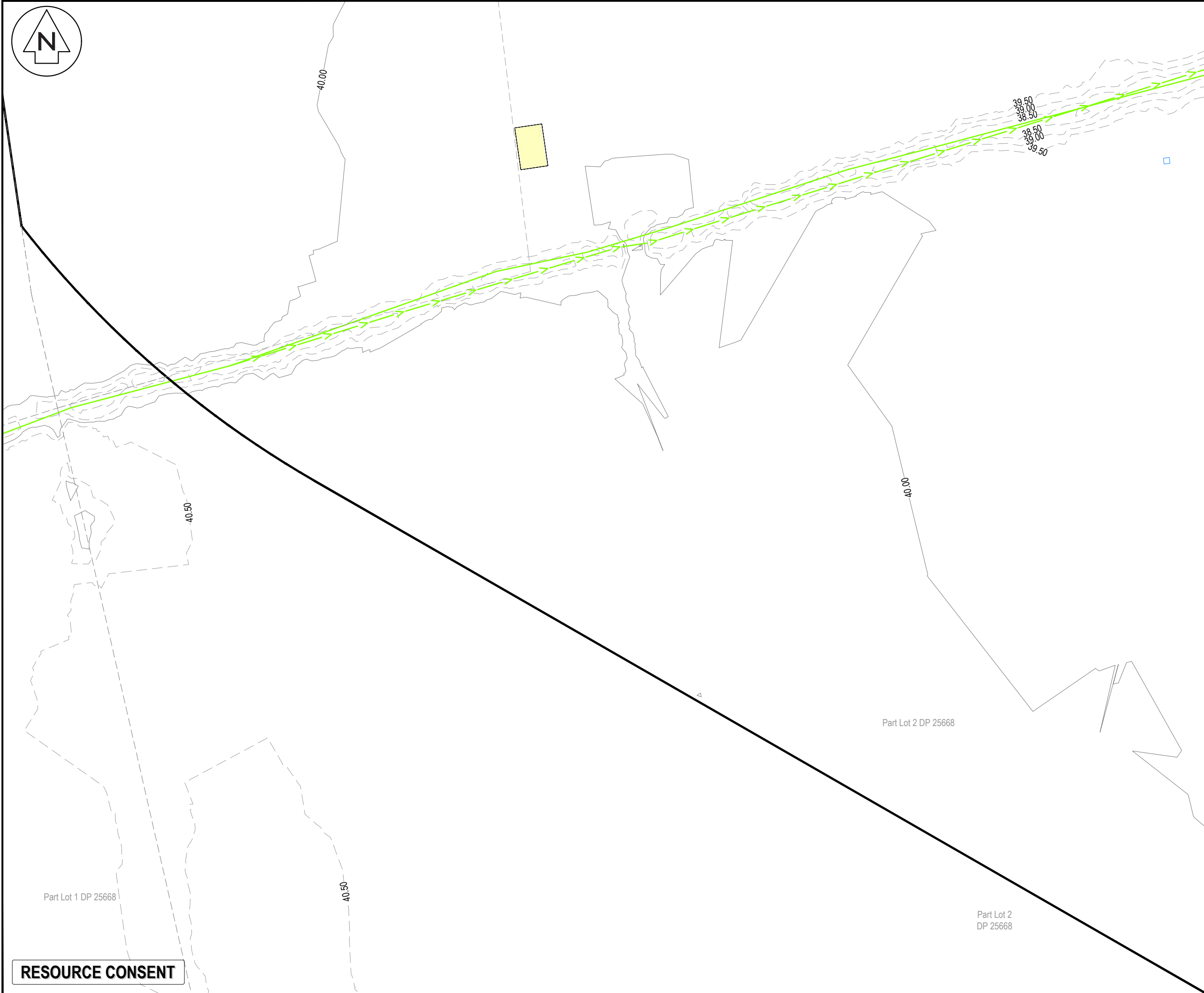
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**EXISTING
TOPO
PLAN**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C050 TOPO.DWG		
Drawing no.	R1- C050-6	Rev	A

RESOURCE CONSENT



NOTES

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LEGEND

EX BDY

EX EASEMENT

EX TITLE BDY

EX MAJOR CONTOUR

EX MINOR CONTOUR

EX WASTEWATER

EX STORMWATER

EX WATER MAIN

EX OVERHEAD POWER

EX ROAD KERB TOP

EX TOP OF BANK

EX FENCE

EX BUILDING

EX FIRE HYDRANT

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EX TELECOM PILLAR BOX

EX POWER TRANSFORMER

EX POWER POLE

EX POWER PILLAR BOX

EX STREET LIGHT

EX STREET SIGN

EX TREE

EX SLUICE VALVE

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
	By	Date	
Survey	MAVEN	06/2025	
Design	MKS	07/2025	
Drawn	MKS	07/2025	
Checked	DJM	07/2025	

M

MAVEN

Maven Waikato

07 242 0601

info@maven.co.nz

www.maven.co.nz

Level 1 286 Victoria Street, Hamilton

New Zealand

Project

SOUTHERN LINKS 1

RESIDENTIAL STAGE 1

HAMILTON, WAIKATO

FOR

SAXBY RD JV LIMITED

Title

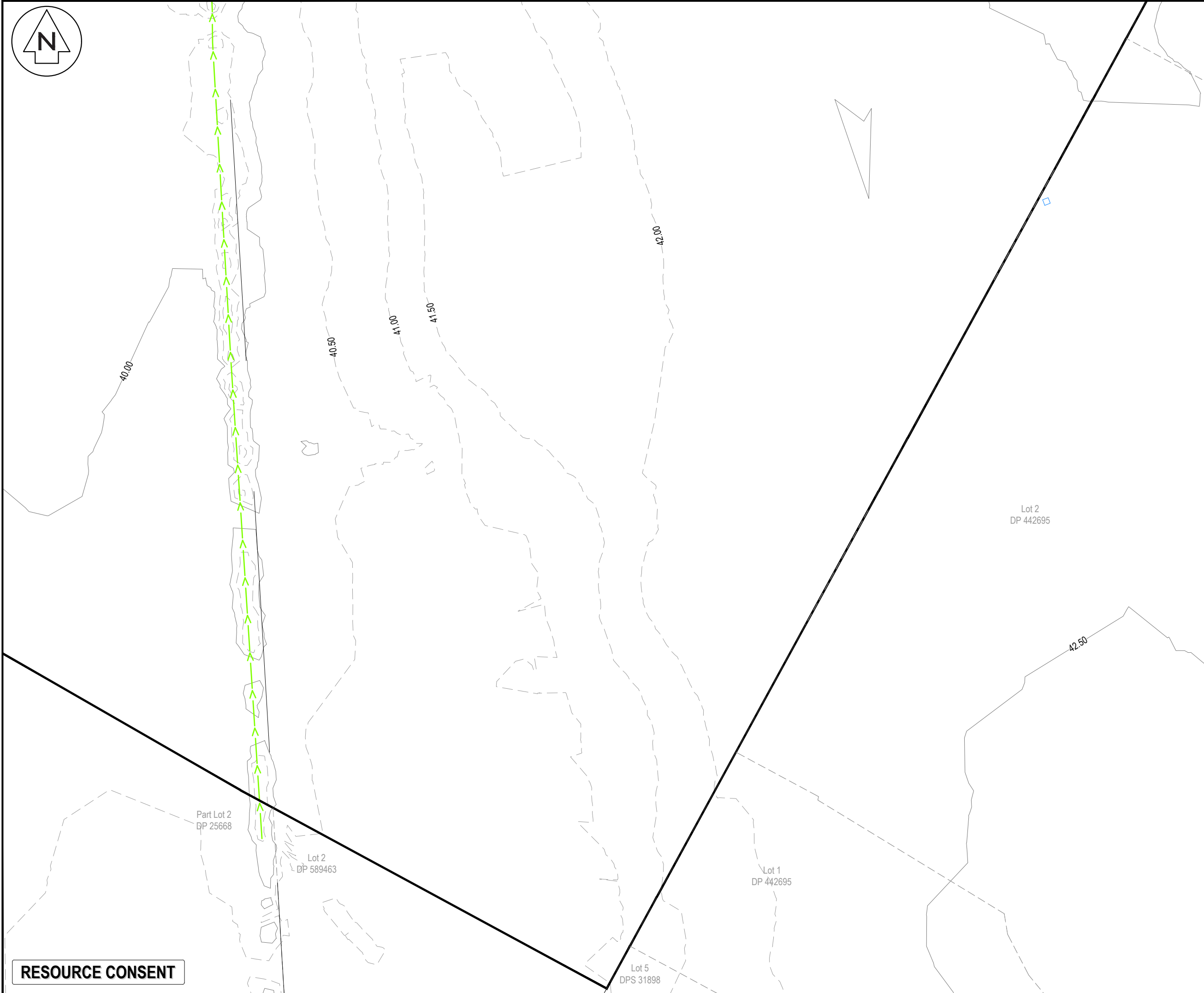
EXISTING

TOPO

PLAN

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C050 TOPO.DWG		
Drawing no.	R1- C050-7	Rev	A

DATE: 6/2/25 FILEPATH: F:\MVEN\HAMILTON6 PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C050 TOPO.DWG



NOTES

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LEGEND

EX BDY

EX EASEMENT

EX TITLE BDY

EX MAJOR CONTOUR

EX MINOR CONTOUR

EX WASTEWATER

EX STORMWATER

EX WATER MAIN

EX OVERHEAD POWER

EX ROAD KERB TOP

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EX FIRE HYDRANT

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EX VALVE

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EX TELECOM PLINTH

EX TELECOM PILLAR BOX

EX POWER TRANSFORMER

EX POWER POLE

EX POWER PILLAR BOX

EX STREET LIGHT

EX STREET SIGN

EX TREE

EX SLUICE VALVE

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025

M

MAVEN

Maven Waikato

07 242 0601

info@maven.co.nz

www.maven.co.nz

Level 1 286 Victoria Street, Hamilton

New Zealand

Project

SOUTHERN LINKS 1

RESIDENTIAL STAGE 1

HAMILTON, WAIKATO

FOR

SAXBY RD JV LIMITED

Title

EXISTING

TOPO

PLAN

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C050 TOPO.DWG		
Drawing no.	R1- C050-8	Rev	A

DATE: 6/9/25 FILEPATH: F:\MVEN\HAMILTON6 PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C050 TOPO.DWG



RHONDA AVENUE

DEANWELL AVENUE

LESLIE PLACE

SAXBYS ROAD

FORTH CRESCENT

CAESAR ROOSE DRIVE

MACMURDO AVENUE

REYNOLDS DRIVE

CROFT LANE

C130-1

C130-2

C130-5

C130-3

C130-4

C130-6

C130-7

C130-8

STAGE 2B

STAGE 2A

STAGE 1A

STAGE 2D

STAGE 2C

STAGE 1C

STAGE 3A

STAGE 3B

STAGE 1B

STAGE 3C

STAGE 1D

STAGE 1E

STAGE 4A

STAGE 5A

STAGE 5B

- NOTES
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LEGEND

EX BDY
PR BDY
STAGE BDY

- STAGE 1A
STAGE 1B
STAGE 1C
STAGE 1D
STAGE 1E
STAGE 2A
STAGE 2B
STAGE 2C
STAGE 2D
STAGE 3A
STAGE 3B
STAGE 3C
STAGE 4A
STAGE 5A
STAGE 5B

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025

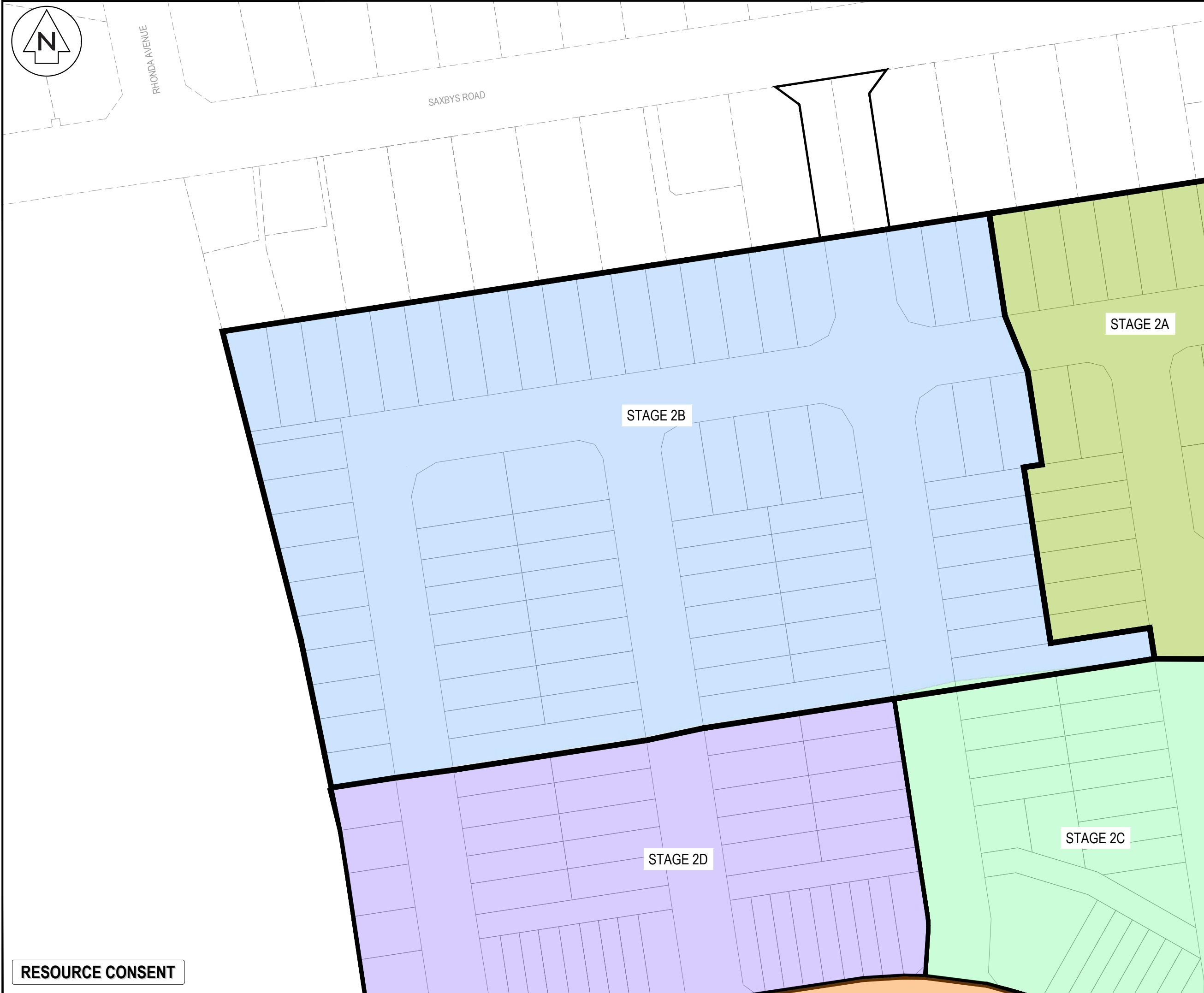
M Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
STAGING PLAN
OVERVIEW PLAN**

Project no.	298001-R1 SL1		
Scale	1:4000 @ A3		
Cad file	298001-R1-C130 STAGING PLAN.DWG		
Drawing no.	R1- C130	Rev	A

RESOURCE CONSENT



NOTES

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LEGEND

EX BDY

PR BDY

STAGE BDY

STAGE 1A

STAGE 1B

STAGE 1C

STAGE 1D

STAGE 1E

STAGE 2A

STAGE 2B

STAGE 2C

STAGE 2D

STAGE 3A

STAGE 3B

STAGE 3C

STAGE 4A

STAGE 5A

STAGE 5B

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
	By	Date	
Survey	MAVEN	06/2025	
Design	MKS	07/2025	
Drawn	MKS	07/2025	
Checked	DJM	07/2025	

M

MAVEN

Maven Waikato

07 242 0601

info@maven.co.nz

www.maven.co.nz

Level 1 286 Victoria Street, Hamilton

New Zealand

Project

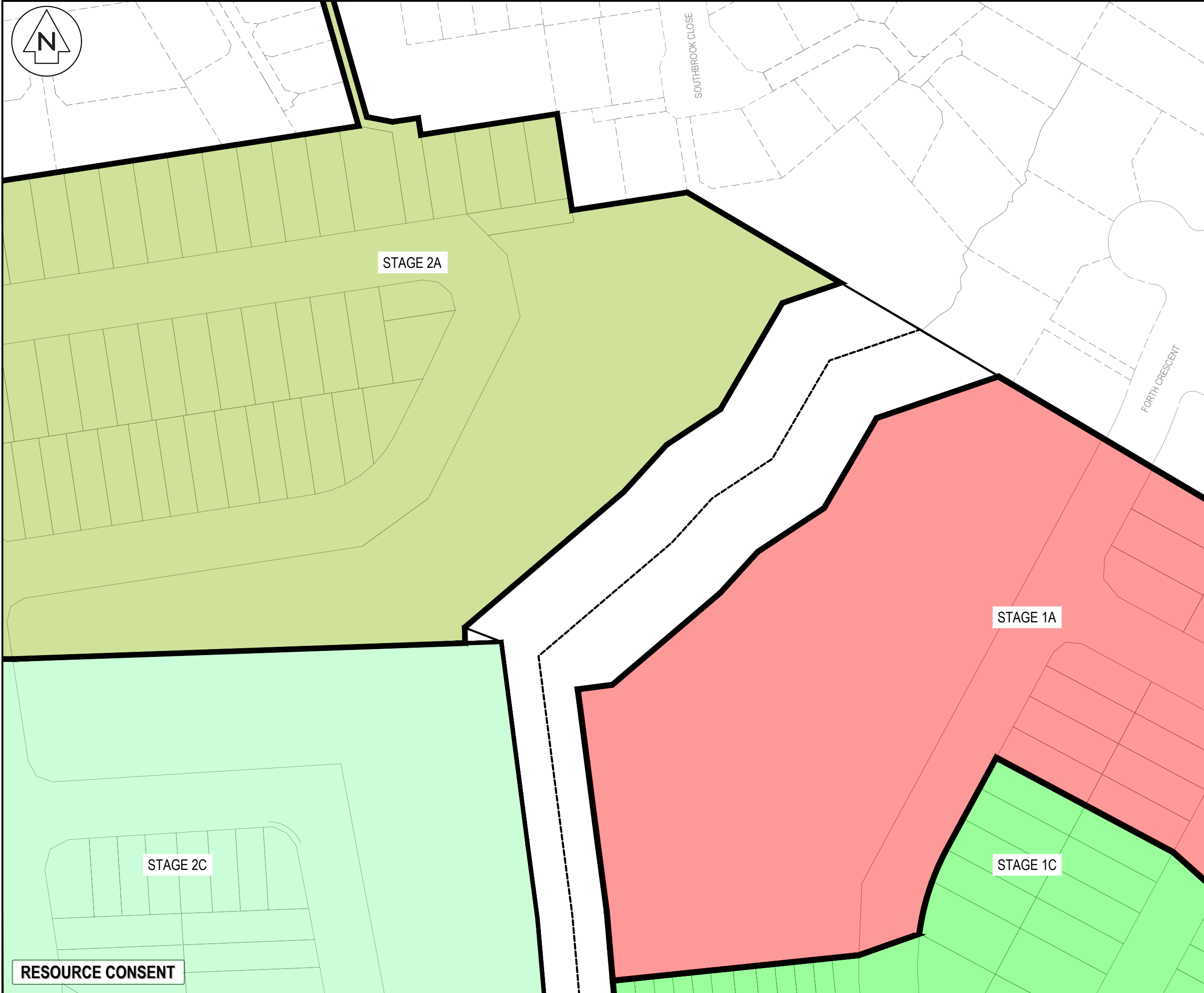
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**PROPOSED
STAGING PLAN
PLAN**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C130 STAGING PLAN.DWG		
Drawing no.	R1- C130-1	Rev	A

RESOURCE CONSENT



NOTES

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LEGEND

EX BDY

PR BDY

STAGE BDY

STAGE 1A

STAGE 1B

STAGE 1C

STAGE 1D

STAGE 1E

STAGE 2A

STAGE 2B

STAGE 2C

STAGE 2D

STAGE 3A

STAGE 3B

STAGE 3C

STAGE 4A

STAGE 5A

STAGE 5B

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025

M

MAVEN

Maven Waikato

07 242 0601

info@maven.co.nz

www.maven.co.nz

Level 1 286 Victoria Street, Hamilton

New Zealand

Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**PROPOSED
STAGING PLAN
PLAN**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C130 STAGING PLAN.DWG		
Drawing no.	R1- C130-2	Rev	A



STAGE 2D

STAGE 2C

STAGE 3A

STAGE 3B

STAGE 3C

- NOTES
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LEGEND

EX BDY
PR BDY
STAGE BDY

- STAGE 1A
STAGE 1B
STAGE 1C
STAGE 1D
STAGE 1E
STAGE 2A
STAGE 2B
STAGE 2C
STAGE 2D
STAGE 3A
STAGE 3B
STAGE 3C
STAGE 4A
STAGE 5A
STAGE 5B

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025

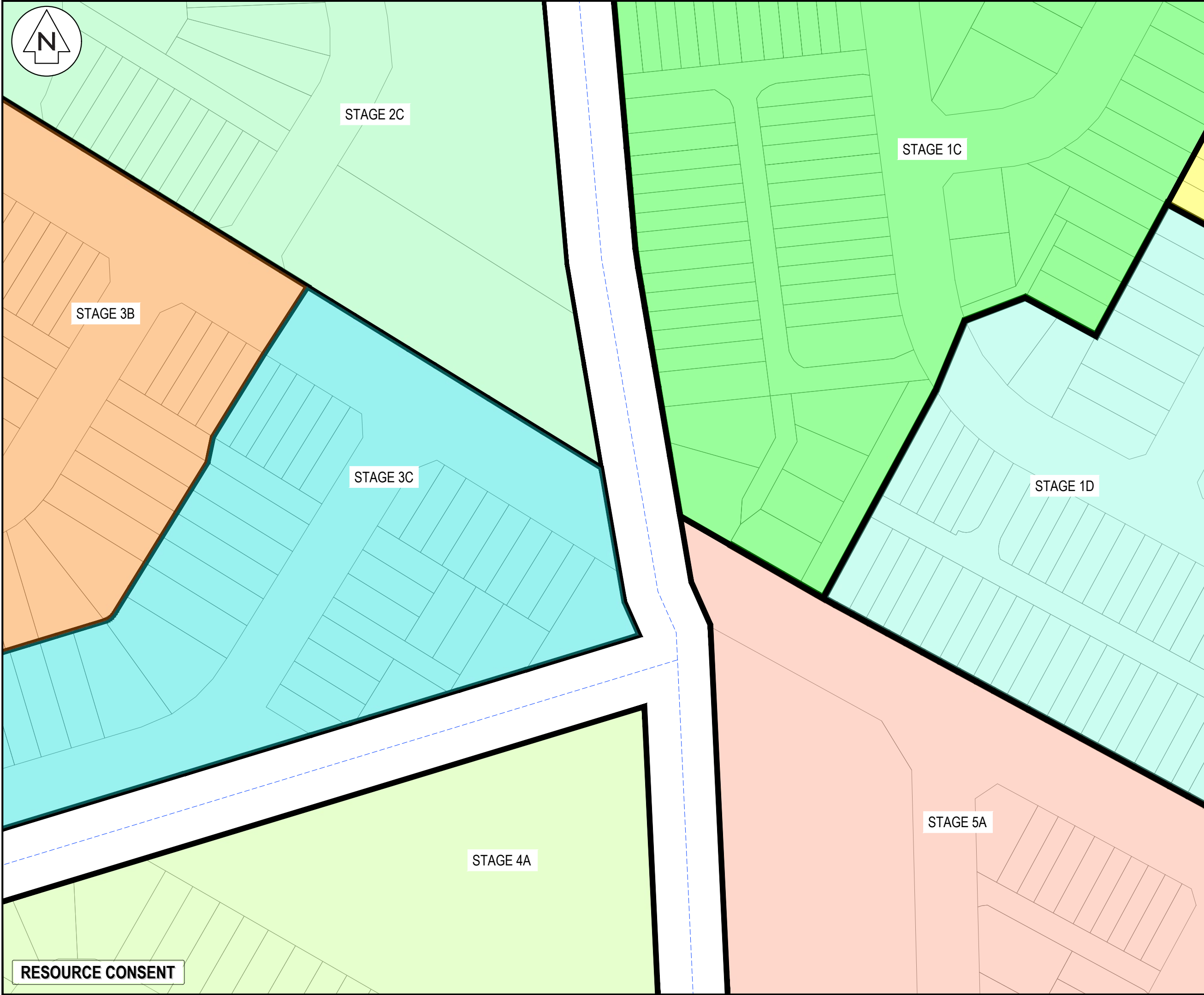
M
M A V E N
Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
STAGING PLAN
PLAN**

Project no.	298001-R1 SL1
Scale	1:1000 @ A3
Cad file	298001-R1-C130 STAGING PLAN.DWG
Drawing no.	R1- C130-3
Rev	A

RESOURCE CONSENT



NOTES

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LEGEND

EX BDY

PR BDY

STAGE BDY

STAGE 1A

STAGE 1B

STAGE 1C

STAGE 1D

STAGE 1E

STAGE 2A

STAGE 2B

STAGE 2C

STAGE 2D

STAGE 3A

STAGE 3B

STAGE 3C

STAGE 4A

STAGE 5A

STAGE 5B

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MAVEN

Maven Waikato

07 242 0601

info@maven.co.nz

www.maven.co.nz

Level 1 286 Victoria Street, Hamilton

New Zealand

Project

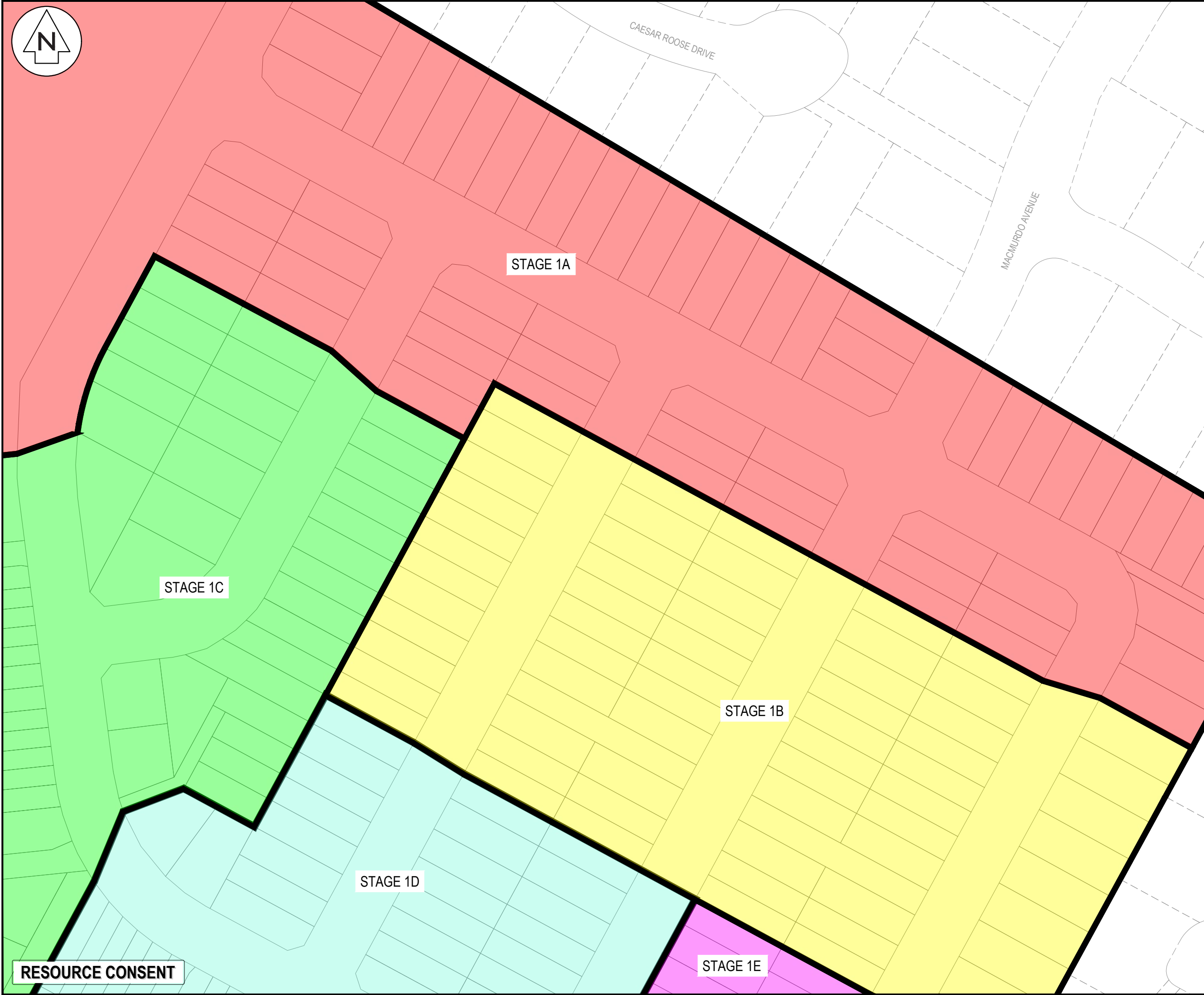
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**PROPOSED
STAGING PLAN
PLAN**

DATE: 6/9/25 FILEPATH: F:\MAVEN\HAMILTON6 PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C130 STAGING PLAN.DWG

RESOURCE CONSENT



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LEGEND

	EX BDY
	PR BDY
	STAGE BDY

	STAGE 1A
	STAGE 1B
	STAGE 1C
	STAGE 1D
	STAGE 1E
	STAGE 2A
	STAGE 2B
	STAGE 2C
	STAGE 2D
	STAGE 3A
	STAGE 3B
	STAGE 3C
	STAGE 4A
	STAGE 5A
	STAGE 5B

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
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Drawn	MKS		07/2025
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Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

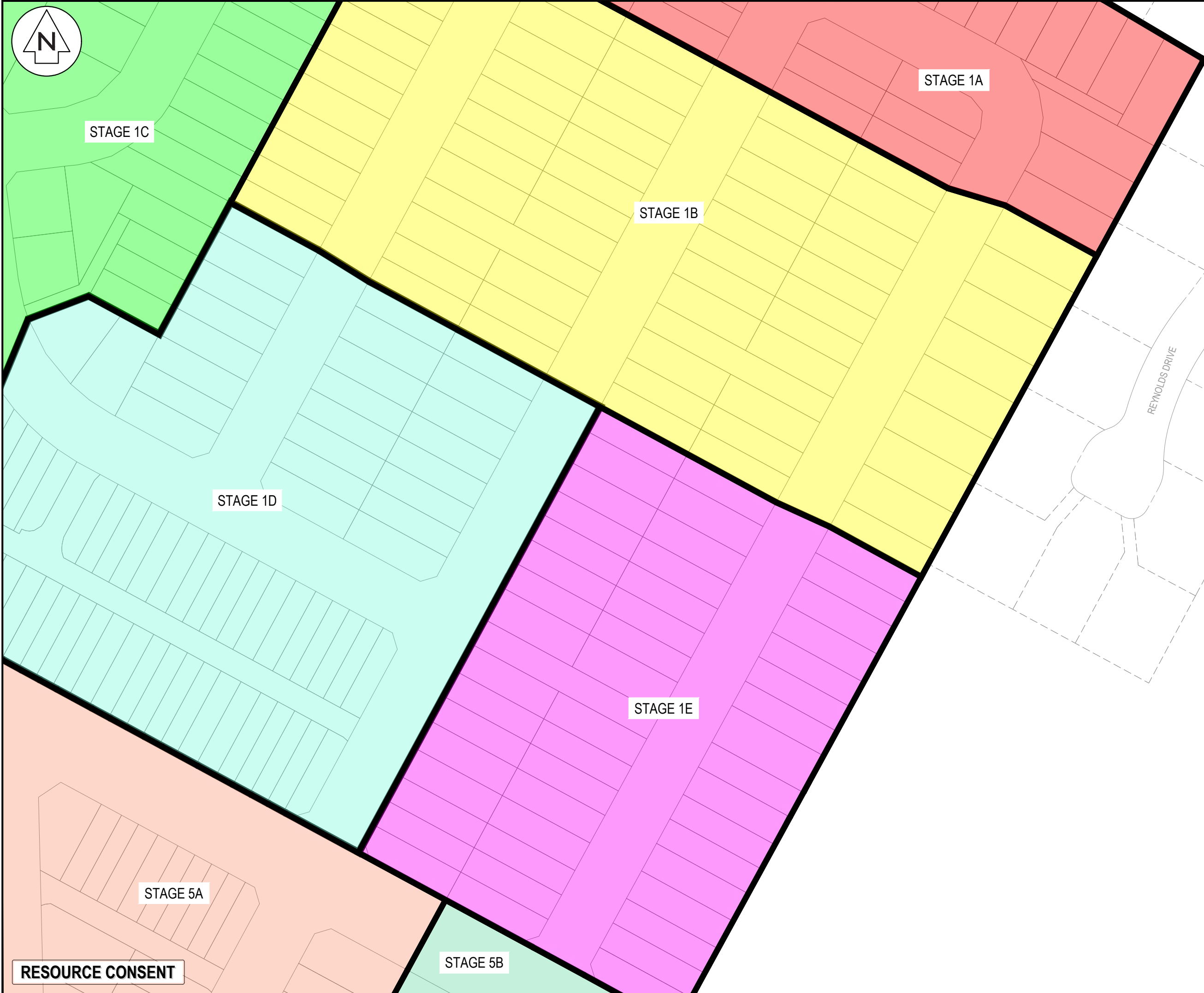
Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**PROPOSED
STAGING PLAN
PLAN**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C130 STAGING PLAN.DWG		
Drawing no.	R1- C130-5	Rev	A



NOTES

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LEGEND

	EX BDY
	PR BDY
	STAGE BDY

	STAGE 1A
	STAGE 1B
	STAGE 1C
	STAGE 1D
	STAGE 1E
	STAGE 2A
	STAGE 2B
	STAGE 2C
	STAGE 2D
	STAGE 3A
	STAGE 3B
	STAGE 3C
	STAGE 4A
	STAGE 5A
	STAGE 5B

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
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Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
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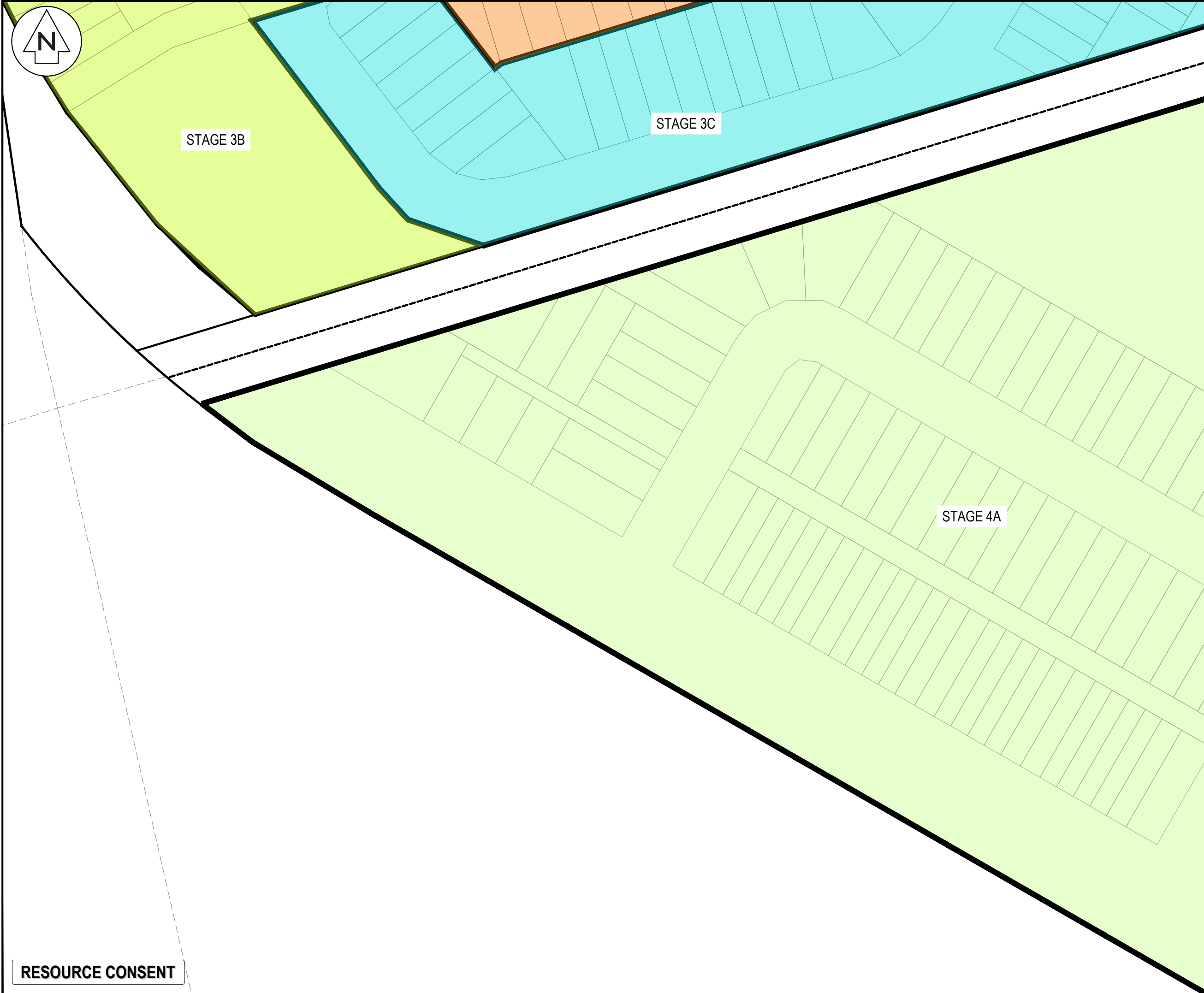
Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**PROPOSED
STAGING PLAN
PLAN**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C130 STAGING PLAN.DWG		
Drawing no.	R1- C130-6	Rev	A



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LEGEND	
	EX BDY
	PR BDY
	STAGE BDY
	STAGE 1A
	STAGE 1B
	STAGE 1C
	STAGE 1D
	STAGE 1E
	STAGE 2A
	STAGE 2B
	STAGE 2C
	STAGE 2D
	STAGE 3A
	STAGE 3B
	STAGE 3C
	STAGE 4A
	STAGE 5A
	STAGE 5B

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
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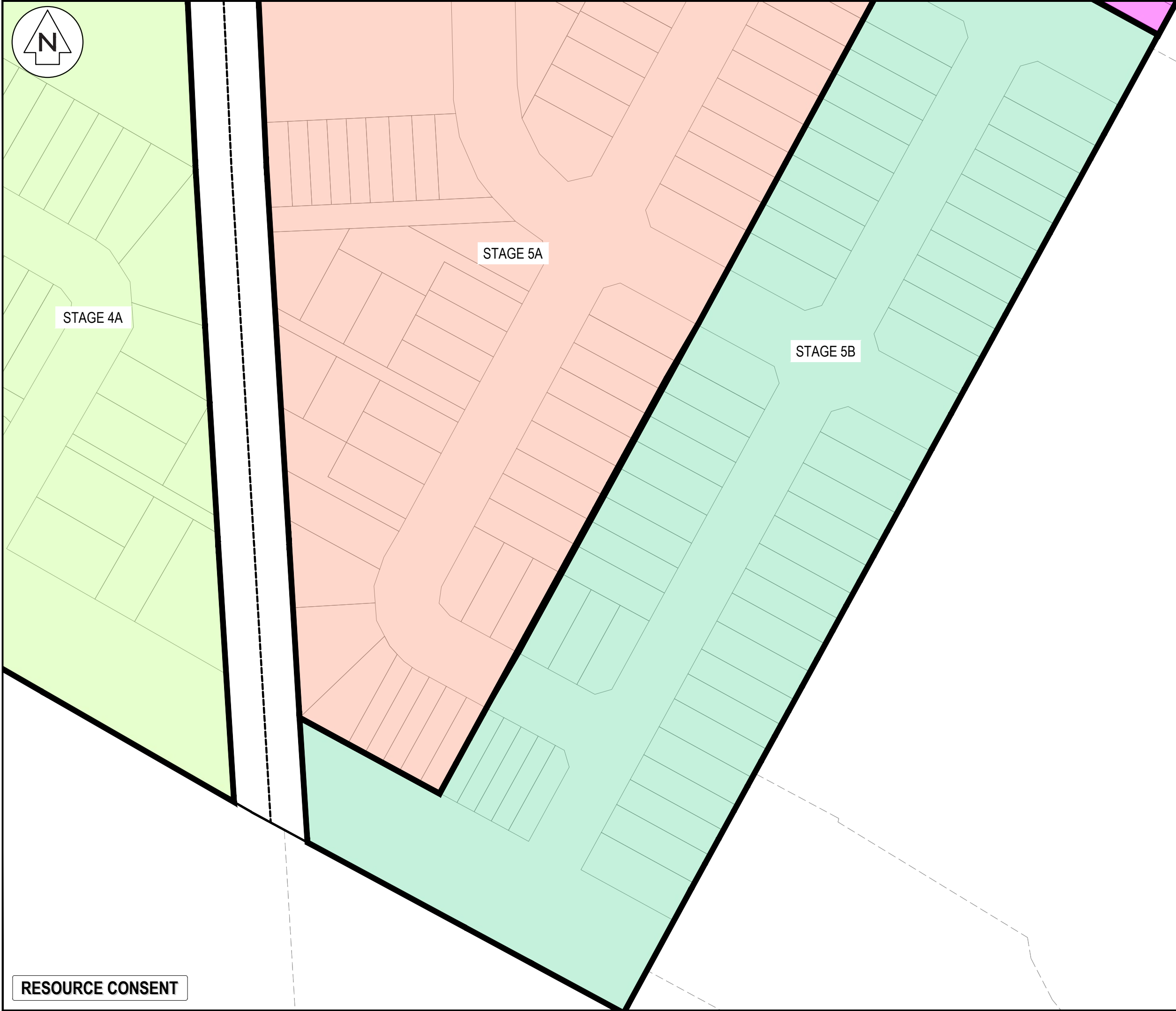
Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**PROPOSED
STAGING PLAN
PLAN**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C130 STAGING PLAN.DWG		
Drawing no.	R1- C130-7	Rev	A



- NOTES
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LEGEND

	EX BDY
	PR BDY
	STAGE BDY

	STAGE 1A
	STAGE 1B
	STAGE 1C
	STAGE 1D
	STAGE 1E
	STAGE 2A
	STAGE 2B
	STAGE 2C
	STAGE 2D
	STAGE 3A
	STAGE 3B
	STAGE 3C
	STAGE 4A
	STAGE 5A
	STAGE 5B

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
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New Zealand

Project

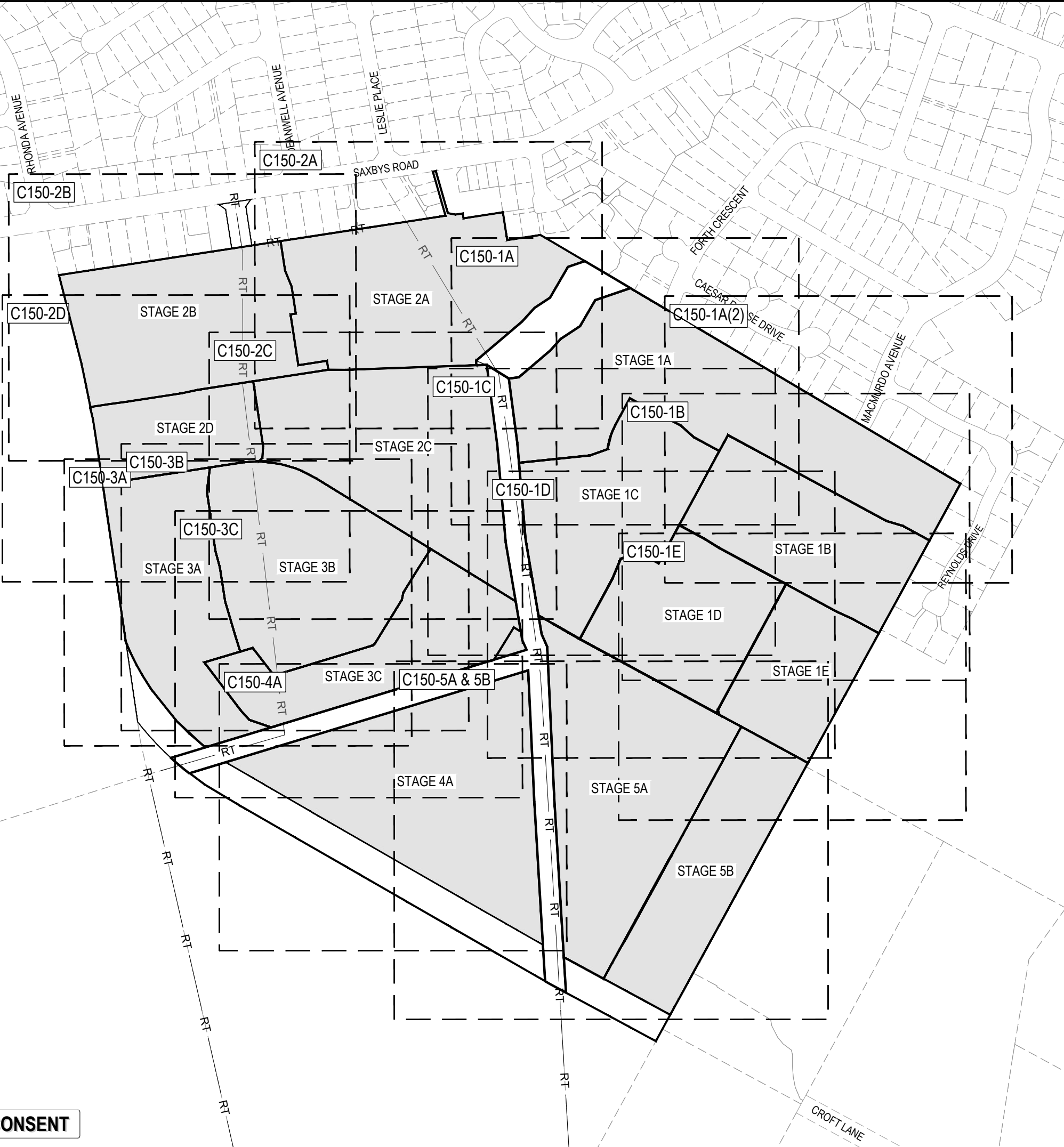
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**PROPOSED
STAGING PLAN
PLAN**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C130 STAGING PLAN.DWG		
Drawing no.	R1- C130-8	Rev	A

RESOURCE CONSENT



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
 2. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000.
 3. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016.
 4. ORIGIN OF LEVELS = PIN 1 SO 537357 PUBLISHED RL=39.788, SOURCED FROM THE LINZ DIGITAL GEODETIC DATABASE.
 5. BOUNDARIES ARE SUBJECT TO FINAL SURVEY.

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025



Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
SCHEME
OVERVIEW PLAN**

Project no.	298001-R1 SL1		
Scale	1:4000 @ A3		
Cad file	298001-R1-C150 SCHEME.DWG		
Drawing no.	R1- C150	Rev	A

RESOURCE CONSENT



- LEGEND
- EX BDY
- ==== PR BDY
- ==== SITE BDY

M M
M A E N

Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Title

**PROPOSED
SCHEME PLAN
STAGE 1A**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C150 SCHEME.DWG		
Drawing no.	R1- C150-1A-1	Rev	A



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
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 5. BOUNDARIES ARE SUBJECT TO FINAL SURVEY.

LEGEND

	EX BDY
	PR BDY
	SITE BDY

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025



Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**PROPOSED
SCHEME PLAN
STAGE 1A(2)**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C150 SCHEME.DWG		
Drawing no.	R1- C150-1A-2	Rev	A



- LEGEND
- EX BDY
- ==== PR BDY
- ==== SITE BDY

M
M A E N

Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Title

**PROPOSED
SCHEME PLAN
STAGE 1B**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C150 SCHEME.DWG		
Drawing no.	R1- C150-1B	Rev	A



STAGE 1A

STAGE 2C

STAGE 1C

STAGE 1B

STAGE 3C

STAGE 1D

STAGE 5A

RESOURCE CONSENT

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
 2. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000.
 3. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016.
 4. ORIGIN OF LEVELS = PIN 1 SO 537357 PUBLISHED RL=39.788, SOURCED FROM THE LINZ DIGITAL GEODETIC DATABASE.
 5. BOUNDARIES ARE SUBJECT TO FINAL SURVEY.

LEGEND

--- EX BDY
--- PR BDY
--- SITE BDY

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025

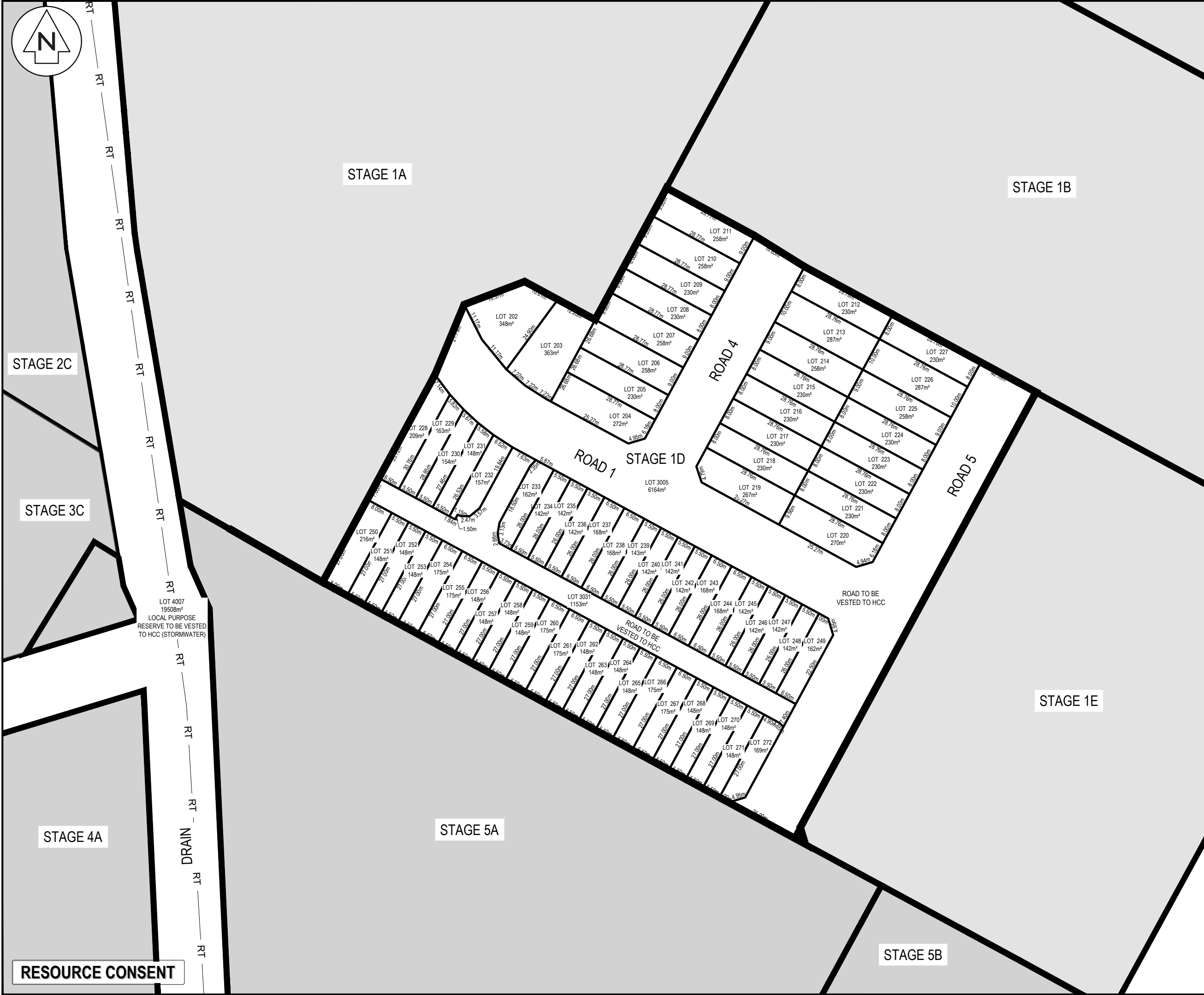
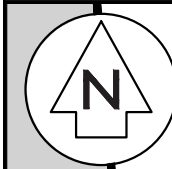


Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
SCHEME PLAN
STAGE 1C**

Project no.	298001-R1 SL1
Scale	1:1000 @ A3
Cad file	298001-R1-C150 SCHEME.DWG
Drawing no.	R1- C150-1C
Rev	A

DATE: 6/9/25 FILEPATH: F:\MVEN\HAMILTON6 PROJECTS\298001 - SOUTHERN LINKS 1\STG1\RD1\02\298001-R1-C150 SCHEME.DWG



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
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 5. BOUNDARIES ARE SUBJECT TO FINAL SURVEY.

LEGEND

---	EX BDY
---	PR BDY
---	SITE BDY

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025



Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
SCHEME PLAN
STAGE 1D**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C150 SCHEME.DWG		
Drawing no.	R1- C150-1D	Rev	A



STAGE 1D

STAGE 1B

STAGE 5A

STAGE 5B

RESOURCE CONSENT

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
 2. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000.
 3. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016.
 4. ORIGIN OF LEVELS = PIN 1 SO 537357 PUBLISHED RL=39.788, SOURCED FROM THE LINZ DIGITAL GEODETIC DATABASE.
 5. BOUNDARIES ARE SUBJECT TO FINAL SURVEY.

LEGEND

--- EX BDY
--- PR BDY
--- SITE BDY

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025



Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
SCHEME PLAN
STAGE 1E**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C150 SCHEME.DWG		
Drawing no.	R1- C150-1E	Rev	A

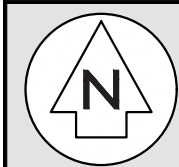
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- LEGEND
- — — — — EX BDY
- PR BDY
- SITE BDY

Maven
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C150 SCHEME.DWG		
Drawing no.	R1- C150-2A	Rev	A



STAGE 2B

STAGE 2A

STAGE 2C

STAGE 1A

STAGE 2D

ROAD 6

ROAD 9

ROAD 10

DRAIN

STAGE 3

RESOURCE CONSENT

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
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LEGEND

--- EX BDY
--- PR BDY
--- SITE BDY

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025



Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
SCHEME PLAN
STAGE 2C**

Project no.	298001-R1 SL1
Scale	1:1000 @ A3
Cad file	298001-R1-C150 SCHEME.DWG
Drawing no.	R1- C150-2C
Rev	A



RESOURCE CONSENT

Lot 1
DPS 75305

STAGE 2B

STAGE 2A

STAGE 2C

STAGE 2D

STAGE 3

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
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LEGEND

--- EX BDY
--- PR BDY
--- SITE BDY

A	FAST TRACK APP	MKS	06/2026
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		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025



Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
SCHEME PLAN
STAGE 2D**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C150 SCHEME.DWG		
Drawing no.	R1- C150-2D	Rev	A



STAGE 2D

ROAD 11

ROAD 12

STAGE 3A

STAGE 3B

STAGE 2C

STAGE 3C

STAGE 4

RESOURCE CONSENT

- NOTES
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 2. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000.
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 5. BOUNDARIES ARE SUBJECT TO FINAL SURVEY.

LEGEND

--- EX BDY
--- PR BDY
--- SITE BDY

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
	By	Date	
Survey	MAVEN	06/2025	
Design	MKS	07/2025	
Drawn	MKS	07/2025	
Checked	DJM	07/2025	

M Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
SCHEME PLAN
STAGE 3A**

Project no.	298001-R1 SL1
Scale	1:1000 @ A3
Cad file	298001-R1-C150 SCHEME.DWG
Drawing no.	R1- C150-3A
Rev	A



STAGE 2D

STAGE 2C

STAGE 3B

STAGE 3A

STAGE 3C

STAGE 4

RESOURCE CONSENT

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
 2. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000.
 3. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016.
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LEGEND

--- EX BDY
--- PR BDY
--- SITE BDY

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025



Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
SCHEME PLAN
STAGE 3B**

Project no.	298001-R1 SL1
Scale	1:1000 @ A3
Cad file	298001-R1-C150 SCHEME.DWG
Drawing no.	R1- C150-3B
Rev	A

DATE: 6/2/25 FILEPATH: F:\MVEN\HAMILTON\6. PROJECTS\298001 - SOUTHERN LINKS 1\STG1\RD\298001-R1-C150 SCHEME.DWG



FUTURE
ARTERIAL ROAD

STAGE 4

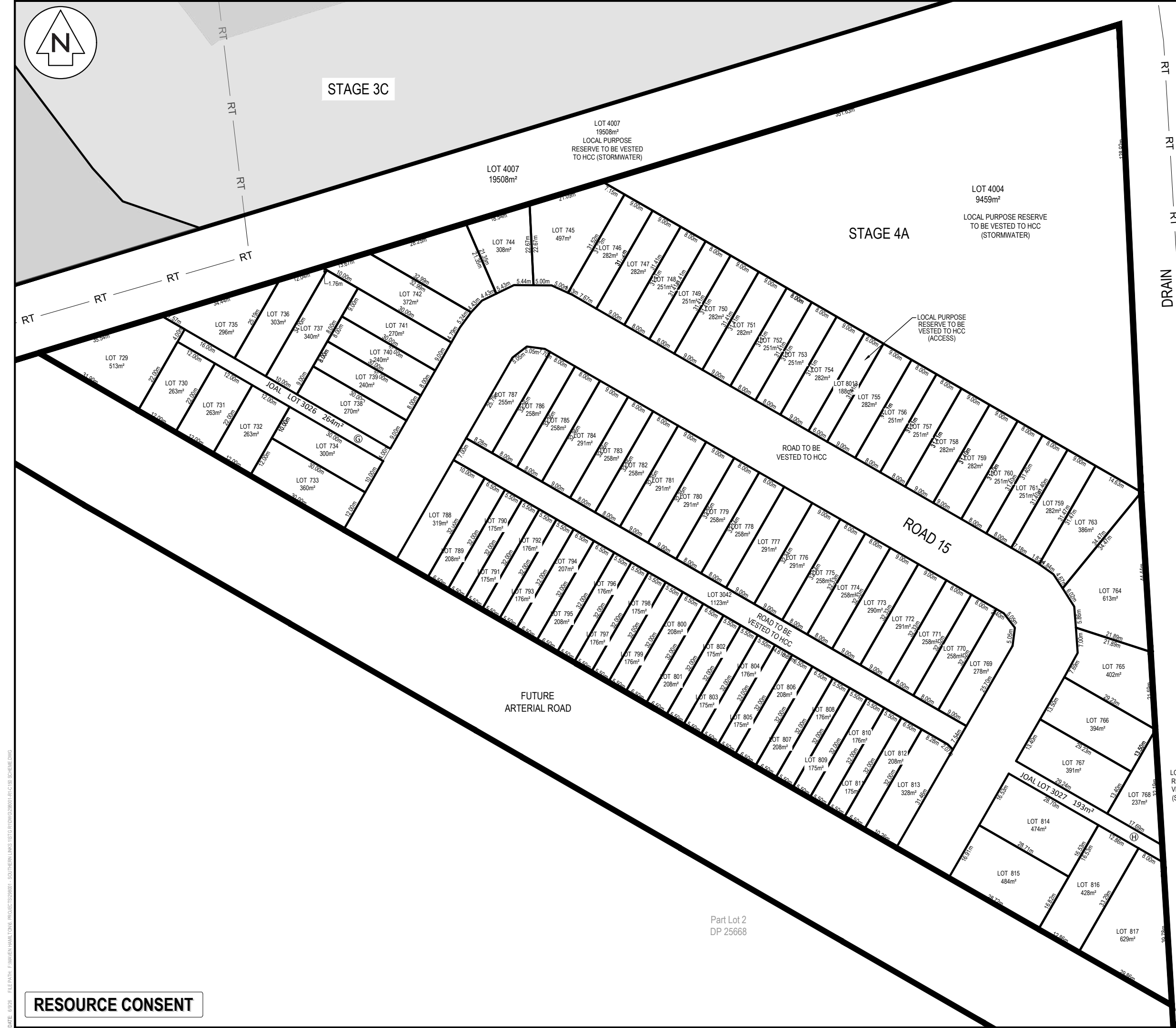
LEGEND

— — — — — EX BDY
————— PR BDY
————— SITE BDY

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M A N

Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C150 SCHEME.DWG		
Drawing no.	R1- C150-3C	Rev	A



STAGE 4A

LOT 4007
19508m²
LOCAL PURPOSE
RESERVE TO BE VESTED
TO HCC (STORMWATER)

LOT 4004
9459m²
LOCAL PURPOSE RESERVE
TO BE VESTED TO HCC
(STORMWATER)

LOCAL PURPOSE
RESERVE TO BE
VESTED TO HCC
(ACCESS)

ROAD TO BE
VESTED TO HC

ROAD 15

FUTURE
ARTERIAL ROAD

Part Lot 2
DP 25668

RESOURCE CONSENT

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
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LEGEND

EX BDY

PR BDY

SITE BDY

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
	By	Date	
Survey	MAVEN	06/2025	
Design	MKS	07/2025	
Drawn	MKS	07/2025	
Checked	DJM	07/2025	



Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
SCHEME PLAN
STAGE 4A**

Project no.	298001-R1 SL1		
Scale	1:1000 @ A3		
Cad file	298001-R1-C150 SCHEME.DWG		
Drawing no.	R1- C150-4A	Rev	A

LOT 4007
19508m²
LOCAL PURPOSE
RESERVE TO BE
VESTED TO HCC
(STORMWATER)



DRAIN

STAGE 4

FUTURE
ARTERIAL ROAD

RESOURCE CONSENT



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH HAMILTON CITY COUNCIL STANDARDS.
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 3. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016.
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 5. BOUNDARIES ARE SUBJECT TO FINAL SURVEY.

LEGEND

--- EX BDY
--- PR BDY
--- SITE BDY

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		07/2025
Drawn	MKS		07/2025
Checked	DJM		07/2025



Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
SCHEME PLAN
STAGE 5A & 5B**

Project no.	298001-R1 SL1
Scale	1:1250 @ A3
Cad file	298001-R1-C150 SCHEME.DWG
Drawing no.	R1- C150-5A&5B
Rev	A



SAXBYS ROAD

RHONDA AVENUE

DEANWELL AVENUE

LESLIE PLACE

SAXBYS ROAD

FORTH CRESCENT

CAESAR ROOSE DRIVE

MACMURDO AVENUE

REYNOLDS DRIVE

CROFT LANE

LOT 1 DPS 75305

LOT 2 DPS 9219

LOT 2 DP 442695

LOT 1 DP 442695

LOT 5 DPS 31996

PART LOT 2 DP 25668

LOT 2 DP 589463

RT

RT

RT

RT

RT

RT

RT

RT

RT

RT

RT

RT

RT

RT

DRAFT FOR REVIEW

NOTES

1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
2. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000
3. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016.
4. ORIGIN OF LEVELS = SM XXXX SO XXXX(XXXX) PUBLISHED RL=XX.XX, SOURCED FROM THE LINZ DIGITAL GEODETIC DATABASE.
5. IT IS THE CONTRACTORS RESPONSIBILITY TO LOCATE ALL SERVICES THAT MAY BE AFFECTED BY THEIR OPERATIONS.
6. THE CONTRACTOR SHALL COMPLY WITH ALL RELEVANT HEALTH AND SAFETY REQUIREMENTS.
7. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY APPROVAL FROM UTILITY OPERATORS BEFORE COMMENCING WORK UNDER OR NEAR THEIR SERVICES.
8. CONTRACTOR SHALL PROVIDE AS-BUILT OF WORKING SEDIMENT CONTROL DEVICES AND CONFIRMATION OF POND/DECENT VOLUMES TO ENGINEER.

LEGEND

- EX BDY
- PROP BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- PR MAJOR CONTOUR
- PR MINOR CONTOUR
- PROP EXTENT WORK
- PROP CLEANWATER
- PROP DIRTYWATER
- PROP SILT FENCE
- PROP STOCKPILE
- PROP DECANT
- PROP DECANT BAR

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
Survey	MAVEN		06/2025
Design	RJM		11/2025
Drawn	RJM		11/2025
Checked	DJM		11/2025



Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
CONTOUR
OVERVIEW PLAN**

Project no.	298001-R1 SL1		
Scale	1:4000 @ A3		
Cad file	298001-R1-C200 EARTHWORKS.DWG		
Drawing no.	R1-C200	Rev	A

DATE: 6/2025 FILEPATH: F:\MAVEN\HAMILTON6 PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C200 EARTHWORKS.DWG



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
 2. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000
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 7. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY APPROVAL FROM UTILITY OPERATORS BEFORE COMMENCING WORK UNDER OR NEAR THEIR SERVICES.
 8. CONTRACTOR SHALL PROVIDE AS-BUILT OF WORKING SEDIMENT CONTROL DEVICES AND CONFIRMATION OF POND/DECENT VOLUMES TO ENGINEER.

LEGEND	
	EX BDY
	PROP BDY
	EX MAJOR CONTOUR
	EX MINOR CONTOUR
	PR MAJOR CONTOUR
	PR MINOR CONTOUR
	PROP EXTENT WORK
	PROP CLEANWATER
	PROP DIRTYWATER
	PROP SILT FENCE
	PROP STOCKPILE
	PROP DECANT
	PROP DECANT BAR

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	RJM		11/2025
Drawn	RJM		11/2025
Checked	DJM		11/2025



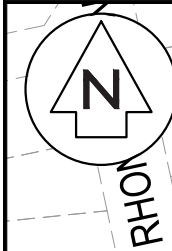
Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
STAGE 1
CONTOUR PLAN**

Project no.	298001-R1 SL1		
Scale	1:4000 @ A3		
Cad file	298001-R1-C200 EARTHWORKS.DWG		
Drawing no.	R1-C200-1	Rev	A

DRAFT FOR REVIEW



RHON

DEANWEL

LESLI

SAXBYS ROAD



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
 2. COORDINATES IN TERMS OF NZ GEODETIC DATUM MT EDEN 2000
 3. LEVELS IN TERMS OF THE NEW ZEALAND VERTICAL DATUM 2016.
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LEGEND

—	EX BDY
—	PROP BDY
—	EX MAJOR CONTOUR
—	EX MINOR CONTOUR
—	PR MAJOR CONTOUR
—	PR MINOR CONTOUR
---	PROP EXTENT WORK
—	PROP CLEANWATER
—	PROP DIRTYWATER
—	PROP SILT FENCE
—	PROP STOCKPILE
—	PROP DECANT
—	PROP DECANT BAR

A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
Survey	MAVEN		06/2025
Design	RJM		11/2025
Drawn	RJM		11/2025
Checked	DJM		11/2025

M Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
STAGE 1
CONTOUR PLAN**

Project no.	298001-R1 SL1
Scale	1:4000 @ A3
Cad file	298001-R1-C200 EARTHWORKS.DWG
Drawing no.	R1-C200-2
Rev	A

DRAFT FOR REVIEW



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
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- LEGEND
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 - PROP BDY
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 - EX MINOR CONTOUR
 - PR MAJOR CONTOUR
 - PR MINOR CONTOUR
 - PROP EXTENT WORK
 - PROP CLEANWATER
 - PROP DIRTYWATER
 - PROP SILT FENCE
 - PROP STOCKPILE
 - PROP DECANT
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A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
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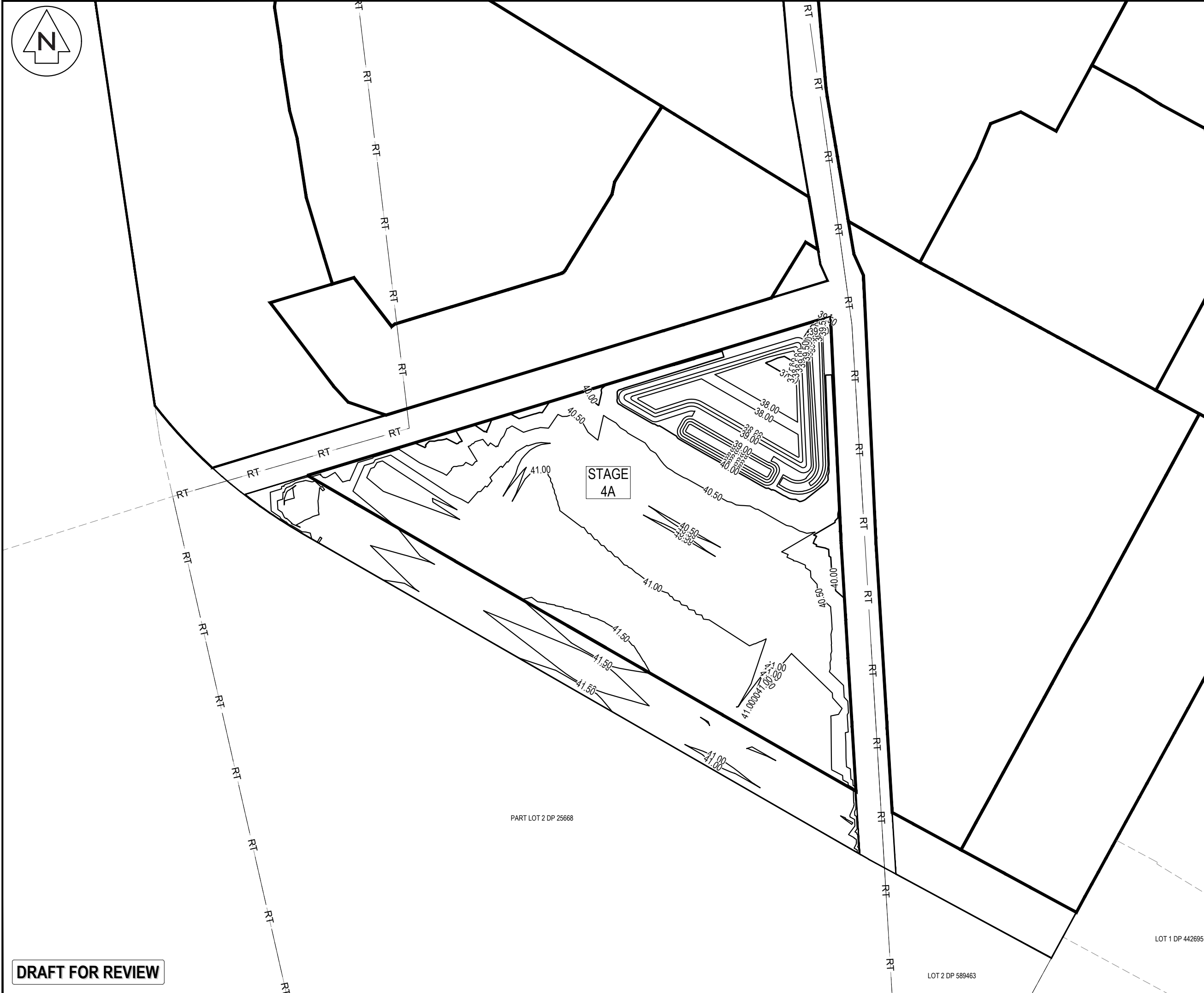
M Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
STAGE 1
CONTOUR PLAN**

Project no.	298001-R1 SL1
Scale	1:4000 @ A3
Cad file	298001-R1-C200 EARTHWORKS.DWG
Drawing no.	R1-C200-3
Rev	A

DRAFT FOR REVIEW



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
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	PROP BDY
	EX MAJOR CONTOUR
	EX MINOR CONTOUR
	PR MAJOR CONTOUR
	PR MINOR CONTOUR
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A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
Survey	MAVEN		06/2025
Design	RJM		11/2025
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Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
STAGE 1
CONTOUR PLAN**

Project no.	298001-R1 SL1		
Scale	1:4000 @ A3		
Cad file	298001-R1-C200 EARTHWORKS.DWG		
Drawing no.	R1-C200-4	Rev	A

DRAFT FOR REVIEW



- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
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		By	Date
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Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title

**PROPOSED
STAGE 1
CONTOUR PLAN**

Project no.	298001-R1 SL1		
Scale	1:4000 @ A3		
Cad file	298001-R1-C200 EARTHWORKS.DWG		
Drawing no.	R1-C200-5	Rev	A

DATE: 6/2025 FILEPATH: F:\MAVEN\HAMILTON6 PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C200 EARTHWORKS.DWG

DRAFT FOR REVIEW



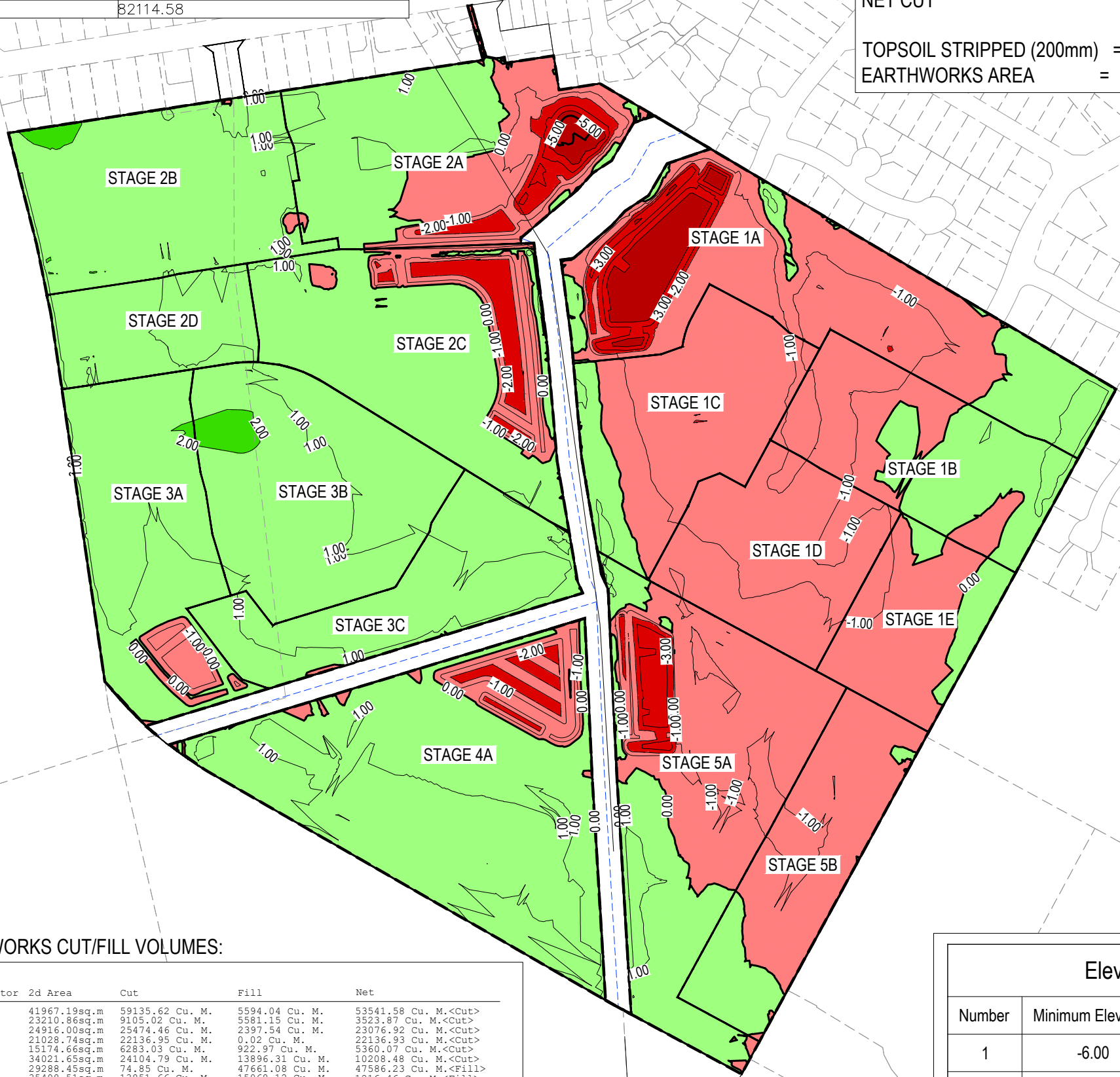
Extrapolated/Estimated Spoils Excavated (cu.m.)	
SW Pipe Embedment Spoils	6110.71
SW Manhole Spoils	260.25
WW Pipe Embedment Spoils	1449.78
WW Manhole Spoils	426.02
WS Pipe Spoils	301.88
Road Paving Excavated	47103.37
Footpath Paving Excavated	10585.03
JOAL Paving Excavated	15877.54
Total	82114.58

WHOLE SITE EARTH WORKS (SURFACE PSGL COMPARISON WITH SURFACE ESGL)

CUT VOLUME	207,910 m ³
CUT VOLUME (FROM SPOILS)	82,100 m ³
FILL VOLUME	272,850 m ³
NET CUT	17,160 m ³

TOPSOIL STRIPPED (200mm)	= 86,690 m ³
EARTHWORKS AREA	= 433,460 m ² / 43.34 Ha

- NOTES
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WHOLE SITE STAGING BULK EARTHWORKS CUT/FILL VOLUMES:

Cut/Fill Summary						
Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
PSGL vs ESGL - STAGE 1A	1.000	1.200	41967.19sq.m	59135.62 Cu. M.	5594.04 Cu. M.	53541.58 Cu. M.<Cut>
PSGL vs ESGL - STAGE 1B	1.000	1.200	23210.86sq.m	9105.02 Cu. M.	5581.15 Cu. M.	3523.87 Cu. M.<Cut>
PSGL vs ESGL - STAGE 1C	1.000	1.200	24916.00sq.m	25474.46 Cu. M.	2397.54 Cu. M.	23076.92 Cu. M.<Cut>
PSGL vs ESGL - STAGE 1D	1.000	1.200	21028.74sq.m	22136.95 Cu. M.	0.02 Cu. M.	22136.93 Cu. M.<Cut>
PSGL vs ESGL - STAGE 1E	1.000	1.200	15174.66sq.m	6283.03 Cu. M.	922.97 Cu. M.	5360.07 Cu. M.<Cut>
PSGL vs ESGL - STAGE 2A	1.000	1.200	34021.65sq.m	24104.79 Cu. M.	13896.31 Cu. M.	10208.48 Cu. M.<Cut>
PSGL vs ESGL - STAGE 2B	1.000	1.200	29288.45sq.m	74.85 Cu. M.	47661.08 Cu. M.	47586.23 Cu. M.<Fill>
PSGL vs ESGL - STAGE 2C	1.000	1.200	35498.51sq.m	13851.66 Cu. M.	15068.12 Cu. M.	1216.46 Cu. M.<Fill>
PSGL vs ESGL - STAGE 2D	1.000	1.200	12606.45sq.m	0.00 Cu. M.	16847.56 Cu. M.	16847.56 Cu. M.<Fill>
PSGL vs ESGL - STAGE 3A	1.000	1.200	27326.55sq.m	2719.46 Cu. M.	32129.16 Cu. M.	29409.70 Cu. M.<Fill>
PSGL vs ESGL - STAGE 3B	1.000	1.200	31286.41sq.m	0.00 Cu. M.	46036.93 Cu. M.	46036.93 Cu. M.<Fill>
PSGL vs ESGL - STAGE 3C	1.000	1.200	21113.31sq.m	7.92 Cu. M.	25662.40 Cu. M.	25654.48 Cu. M.<Fill>
PSGL vs ESGL - STAGE 4A	1.000	1.200	53087.67sq.m	8623.46 Cu. M.	49833.35 Cu. M.	41209.90 Cu. M.<Fill>
PSGL vs ESGL - STAGE 5A	1.000	1.200	41521.63sq.m	27600.06 Cu. M.	9305.01 Cu. M.	18295.05 Cu. M.<Cut>
PSGL vs ESGL - STAGE 5B	1.000	1.200	21410.89sq.m	8792.78 Cu. M.	1913.89 Cu. M.	6878.90 Cu. M.<Cut>
Totals			433458.96sq.m	207910.08 Cu. M.	272849.54 Cu. M.	64939.46 Cu. M.<Fill>

RESOURCE CONSENT

Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	-6.00	-4.00	Red
2	-4.00	-2.00	Red
3	-2.00	0.00	Light Red
4	0.00	2.00	Light Green
5	2.00	4.00	Green

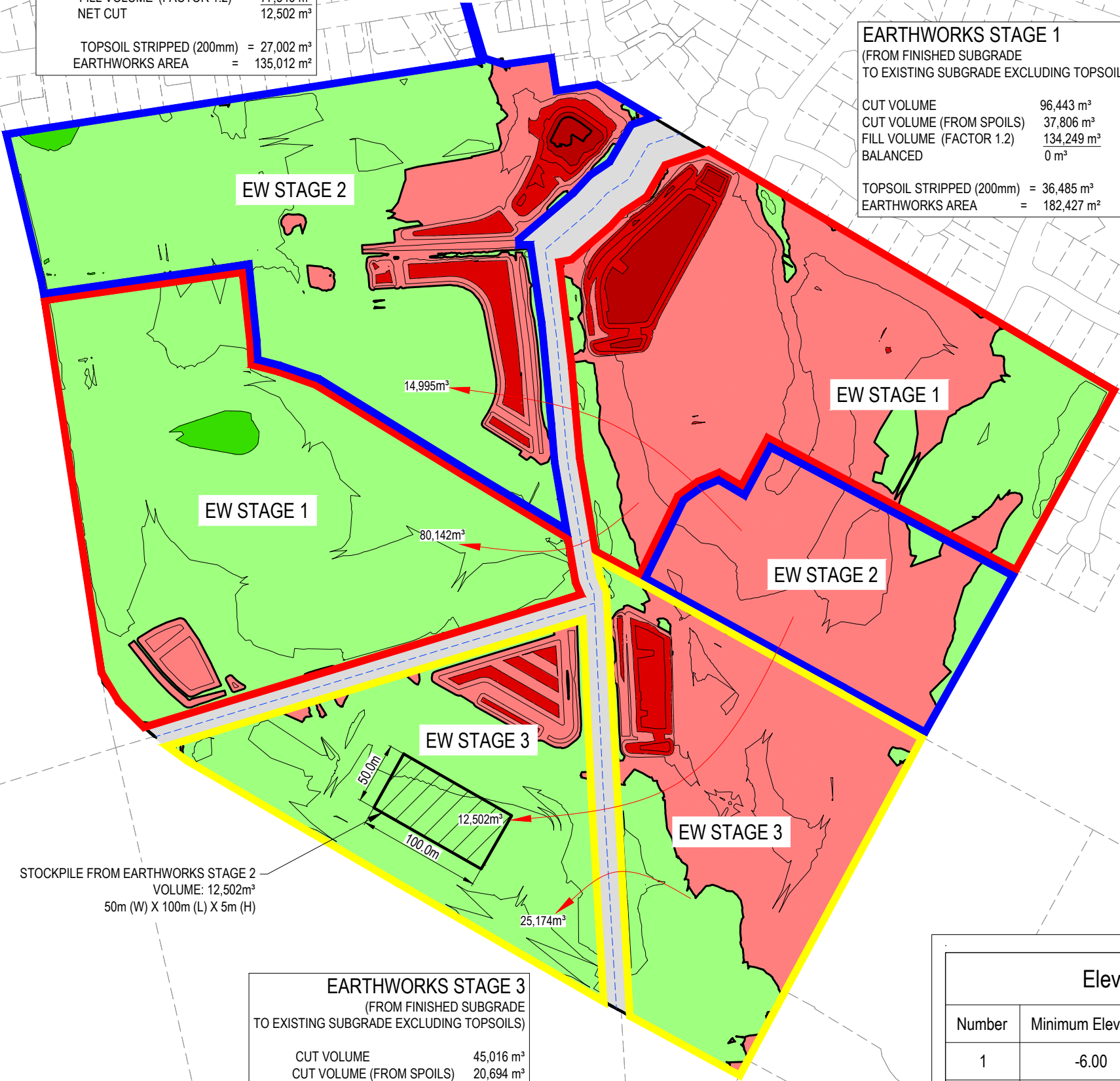
Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title PROPOSED CUT/FILL OVERVIEW PLAN	
Project no.	298001-R1 SL1
Scale	1:4000 @ A3
Cad file	298001-R1-C220 EW CUT&FILL.DWG
Drawing no.	R1-C220
Rev	A



EARTHWORKS STAGE 2	
(FROM FINISHED SUBGRADE TO EXISTING SUBGRADE EXCLUDING TOPSOILS)	
CUT VOLUME	66,451 m³
CUT VOLUME (FROM SPOILS)	23,600 m³
FILL VOLUME (FACTOR 1.2)	77,549 m³
NET CUT	12,502 m³
TOPSOIL STRIPPED (200mm) = 27,002 m³	
EARTHWORKS AREA = 135,012 m²	

EARTHWORKS STAGE 1	
(FROM FINISHED SUBGRADE TO EXISTING SUBGRADE EXCLUDING TOPSOILS)	
CUT VOLUME	96,443 m³
CUT VOLUME (FROM SPOILS)	37,806 m³
FILL VOLUME (FACTOR 1.2)	134,249 m³
BALANCED	0 m³
TOPSOIL STRIPPED (200mm) = 36,485 m³	
EARTHWORKS AREA = 182,427 m²	



STOCKPILE FROM EARTHWORKS STAGE 2
VOLUME: 12,502m³
50m (W) X 100m (L) X 5m (H)

EARTHWORKS STAGE 3	
(FROM FINISHED SUBGRADE TO EXISTING SUBGRADE EXCLUDING TOPSOILS)	
CUT VOLUME	45,016 m³
CUT VOLUME (FROM SPOILS)	20,694 m³
FILL VOLUME (FACTOR 1.2)	61,052 m³
NET CUT	4,658 m³
TOPSOIL STRIPPED (200mm) = 23,204 m³	
EARTHWORKS AREA = 116,020 m²	

Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	-6.00	-4.00	Dark Red
2	-4.00	-2.00	Red
3	-2.00	0.00	Light Red
4	0.00	2.00	Light Green
5	2.00	4.00	Green

- NOTES
1. ALL WORKS TO BE IN ACCORDANCE WITH WAIKATO REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL: GUIDELINES FOR SOIL DISTURBING ACTIVITIES TR 2009/02.
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A	FAST TRACK APP	MKS	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MKS		11/2025
Drawn	MKS		11/2025
Checked	DJM		11/2025



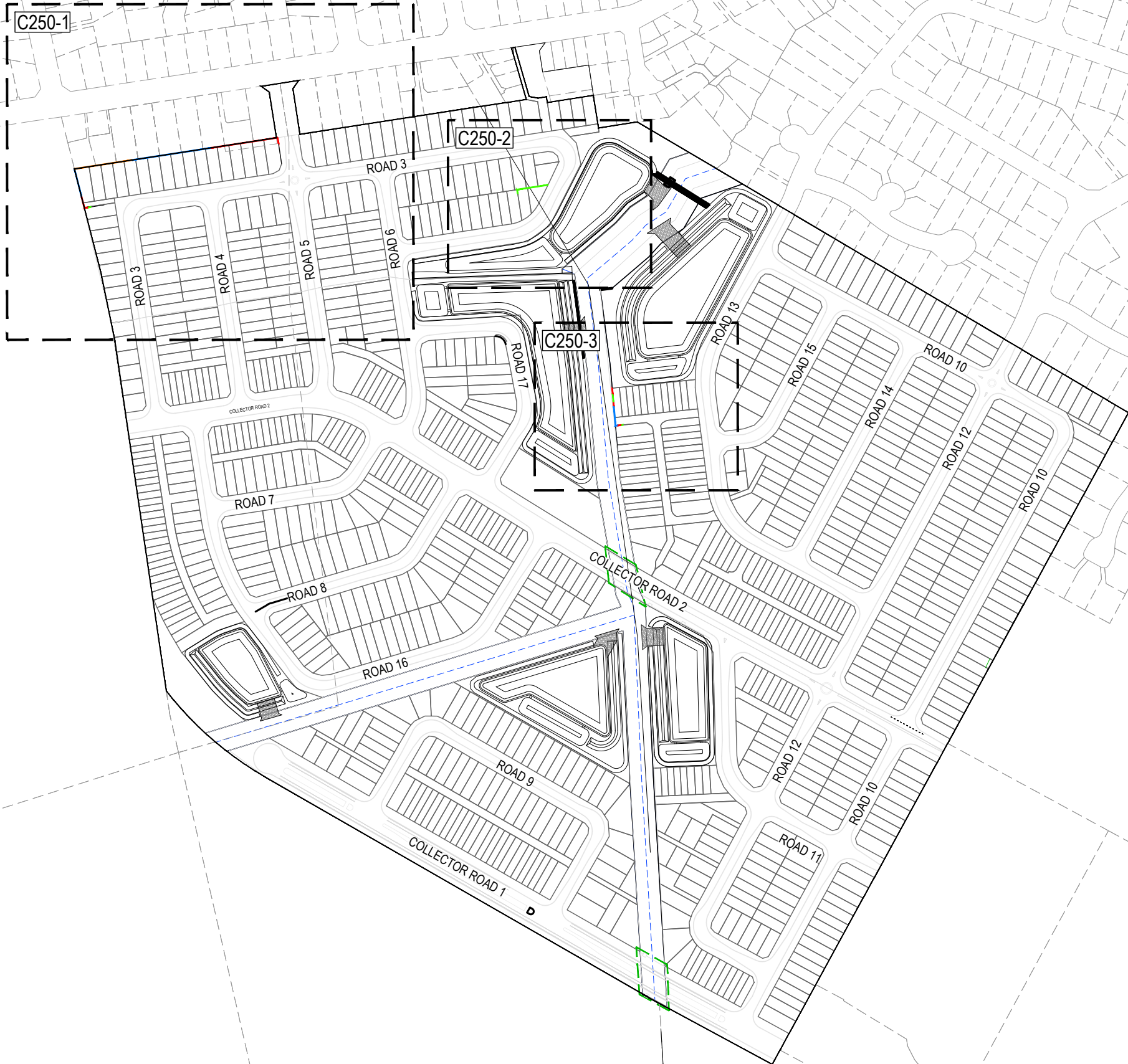
Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
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Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SL1 CONSORTIUM GROUP**

Title
**PROPOSED
CUT/FILL
STAGING PLAN**

Project no.	298001-R1 SL1		
Scale	1:4000 @ A3		
Cad file	298001-R1-C220-1 EW CUT&FILL.DWG		
Drawing no.	C220-1	Rev	A

RESOURCE CONSENT



- The maximum retained height shall be as specified on the drawing and shall not be exceeded unless approved by Maven in writing.
- The concrete encasement shall be adequately vibrated with a pencil vibrator to avoid "honey combing".
- Excavations for foundations shall be taken out by augering to the dimensions detailed with all surplus soil being disposed of away from the site.
- Allowance shall be made in positioning augered holes for the slope of the wall and for concrete surround to poles.
- Driving of poles is not acceptable as an alternative to auguring.
- The Contractor shall verify the position of all underground services and confirm that there are no clashes prior to construction.
- The Contractor shall refer to Maven as soon as possible for further instruction should any unforeseen circumstance or abnormal site condition be encountered during construction.
- Inspections are required by Geotechnical Engineer during construction to confirm assumed ground conditions.
- Maven shall inspect and approve the founding depth and condition of all pile holes prior to installation of the poles and pouring of concrete.
- Any groundwater and associated sediment/sludge within the pile holes shall be removed prior to installing the timber poles and the pouring of concrete.
- If there is potential for hole collapse e.g. due to weak ground condition or groundwater ingress, it is recommended that alternate holes be drilled initially and backfilled with concrete prior to the drilling of the remaining holes.
- Concrete encasement to extend to toe of permanent retaining wall i.e. post future backfilling in front of wall.
- Building Consent to be done by others.

Notes

- All works to be in accordance with Matamata-Piako District Council standards.
- All existing and proposed services shall be marked and protected during construction works.
- The extent of excavation required shall be marked out on the ground having regard to the positions of poles, working space for construction, backfill and drainage provisions.
- The retaining wall should be backfilled to its full height with 'no fines' concrete, fully wrapped by a separation geotextile Bidim A14 or approved similar.
- Timber pole wall
 - All timber poles shall be H5 treated radiata pine in accordance with NZS 3603 unless otherwise specified.
 - All timber poles shall have concrete encasement below the ground level with a minimum of 75mm side cover. The characteristic compressive strength of the concrete encasement shall be $f_c = 20$ MPa unless otherwise noted.
 - Poles are expressed as a minimum small end diameter $\emptyset$ (SED) and shall be installed small end upwards. Cut ends shall not be put into the ground.
 - The timber railing shall be H4 treated Radiata Pine and shall be fixed to the rear of the poles with CCA resistant coated screws or nails. Rails shall have minimum 10mm gap between them.
 - Cutting of timbers shall be avoided wherever possible. If cutting is necessary, the exposed surfaces shall be flooded with a copper naphthenate type wood preservative.

Legend

- EX BDY
- PROP BDY
- RETAINING WALL 0.0-1.0m
- RETAINING WALL 1.0-1.5m
- RETAINING WALL 1.5-2.0m
- RETAINING WALL 2.0-2.5m

A	FAST TRACK APP	MJRA	06/2026
Rev	Description	By	Date
Survey	MAVEN		06/2025
Design	MJRA		04/2026
Drawn	MJRA		04/2026
Checked	MKJ/DJM		04/2026



Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
RETAINING WALL
OVERVIEW PLAN**

Project no.	298001-R1 SL1
Scale	1:4000 @ A3
Cad file	298001-R1-C250 RETAINING WALL.DWG
Drawing no.	R1-C250
Rev	A

RESOURCE CONSENT



Notes
1. See plan C250 for all notes.

Legend	
	EX BDY
	PROP BDY
	RETAINING WALL 0.0-1.0m
	RETAINING WALL 1.0-1.5m
	RETAINING WALL 1.5-2.0m
	RETAINING WALL 2.0-2.5m

A	FAST TRACK APP	MJRA	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MJRA		04/2026
Drawn	MJRA		04/2026
Checked	MKJ/DJM		04/2026



Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

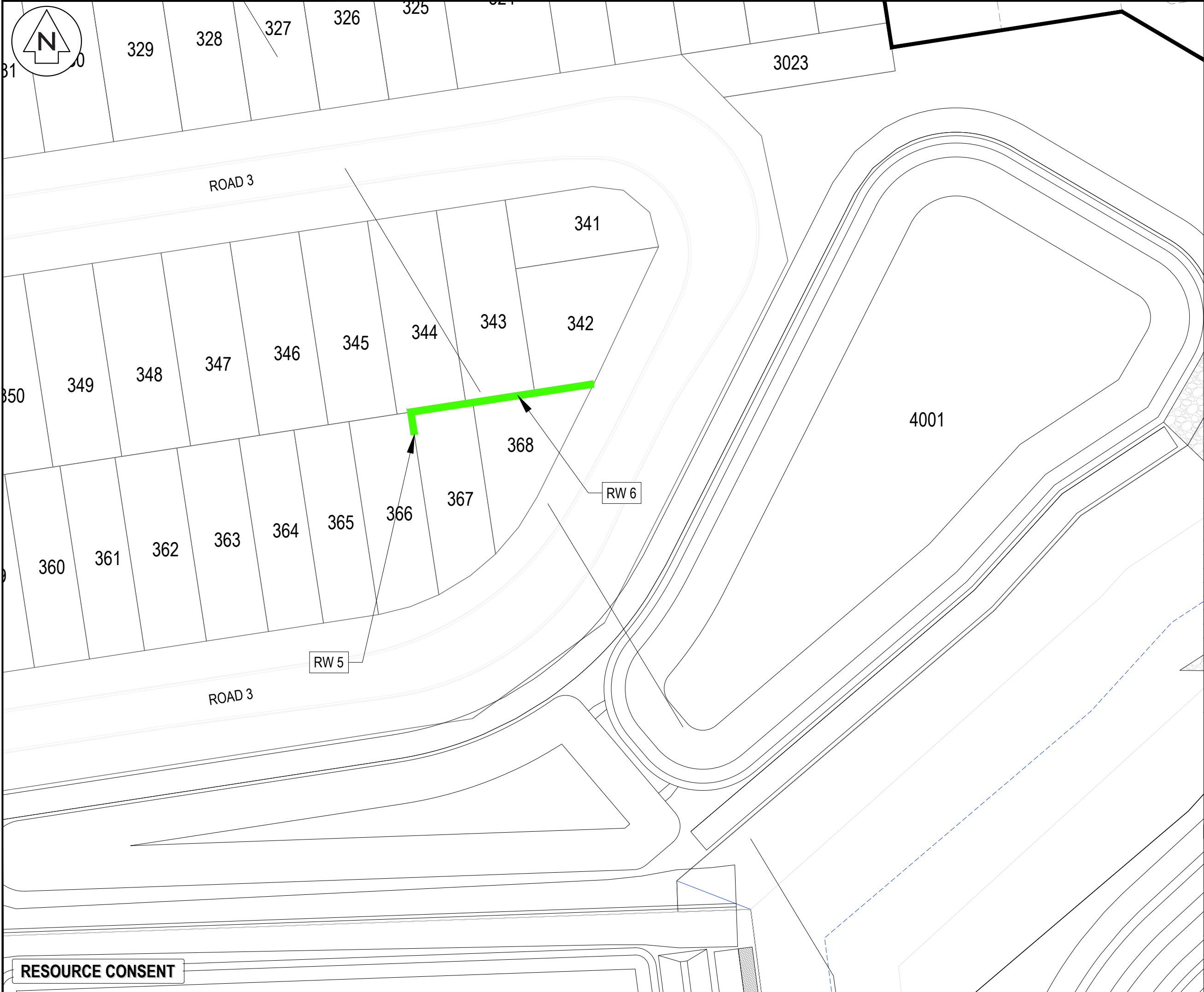
Title
**PROPOSED
RETAINING WALL
PLAN**

Project no.	298001-R1 SL1
Scale	1:1000 @ A3
Cad file	298001-R1-C250 RETAINING WALL.DWG
Drawing no.	R1-C250-1
Rev	A

RW 1
NOTE: BUILD BACK OF
RETAINING WALL ON THE
EDGE OF JOAL & LOT
BOUNDARY. NO NEED TO
APPLY THE 0.5m SETBACK
SPECIFIED ON THE RETAINING
WALL TYPICAL SECTION

RESOURCE CONSENT

DATE: 6/9/25 FILEPATH: F:\MVEN\HAMILTON\6. PROJECTS\298001 - SOUTHERN LINKS 1\STG1\DWG\298001-R1-C250 RETAINING WALL.DWG



Notes
1. See plan C250 for all notes.

Legend

EX BDY

PROP BDY

RETAINING WALL 0.0-1.0m

RETAINING WALL 1.0-1.5m

RETAINING WALL 1.5-2.0m

RETAINING WALL 2.0-2.5m

A	FAST TRACK APP	MJRA	06/2026
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M

MAVEN

Maven Waikato

07 242 0601

info@maven.co.nz

www.maven.co.nz

Level 1 286 Victoria Street, Hamilton

New Zealand

Project

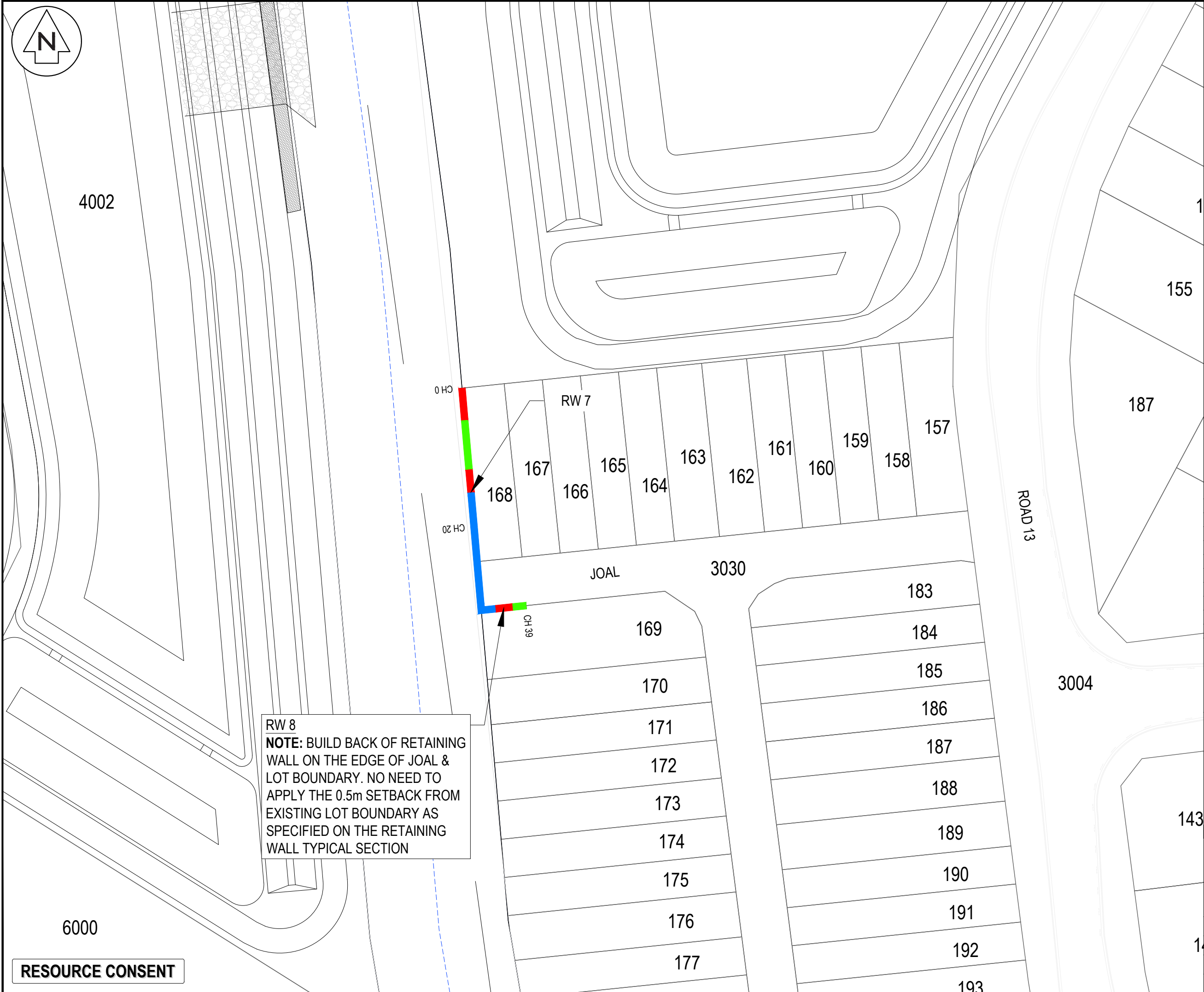
SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED

Title

PROPOSED
RETAINING WALL
PLAN

Project no.	298001-R1 SL1		
Scale	1:500 @ A3		
Cad file	298001-R1-C250 RETAINING WALL.DWG		
Drawing no.	R1-C250-2	Rev	A

DATE: 6/9/25 FILEPATH: F:\MVEN\HAMILTON6 - PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C250 RETAINING WALL.DWG



Notes

1. See plan C250 for all notes.

Legend

- EX BDY
- PROP BDY
- RETAINING WALL 0.0-1.0m
- RETAINING WALL 1.0-1.5m
- RETAINING WALL 1.5-2.0m
- RETAINING WALL 2.0-2.5m

A	FAST TRACK APP	MJRA	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MJRA		04/2026
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Maven Waikato
07 242 0601
info@maven.co.nz
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Project

**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

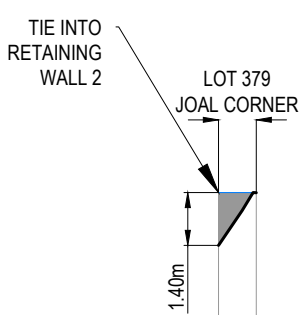
Title

**PROPOSED
RETAINING WALL
PLAN**

Project no.	298001-R1 SL1		
Scale	1:500 @ A3		
Cad file	298001-R1-C250 RETAINING WALL.DWG		
Drawing no.	R1-C250-3	Rev	A

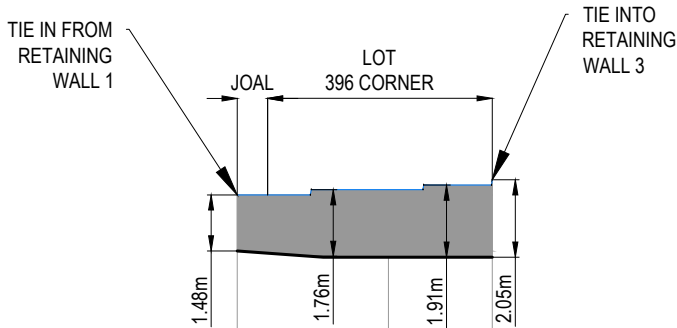
RW 8
NOTE: BUILD BACK OF RETAINING WALL ON THE EDGE OF JOAL & LOT BOUNDARY. NO NEED TO APPLY THE 0.5m SETBACK FROM EXISTING LOT BOUNDARY AS SPECIFIED ON THE RETAINING WALL TYPICAL SECTION

RESOURCE CONSENT



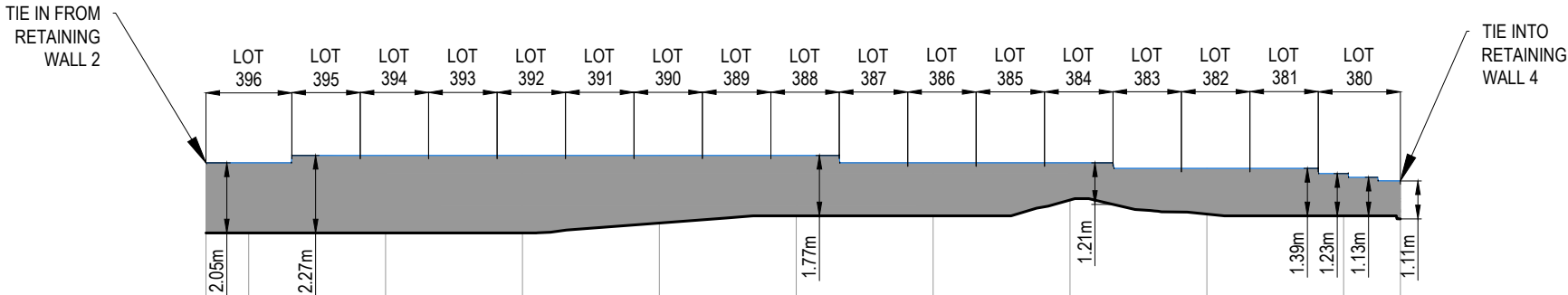
DATUM 36.00m	
TOP OF WALL	41.45
TOE OF WALL	40.05 41.44
WALL HEIGHT	1.40
CHAINAGE	0.00 5.00

Retaining Wall 1
SCALE: HORI 1:1000 VERT 1:200



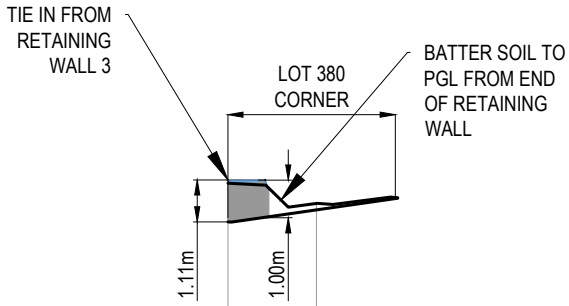
DATUM 36.00m	
TOP OF WALL	41.38 41.52 41.78
TOE OF WALL	39.90 39.74 39.74
WALL HEIGHT	1.48 1.78 2.05
CHAINAGE	0.00 20.00 33.74

Retaining Wall 2
SCALE: HORI 1:1000 VERT 1:200



DATUM 36.00m	
TOP OF WALL	41.78 41.78 42.00 42.00 42.00 42.00 42.00 42.00 41.78 41.78 41.62 41.47 41.25
TOE OF WALL	39.74 39.74 39.74 39.74 40.02 40.24 40.24 40.24 40.69 40.29 40.24 40.14 40.14
WALL HEIGHT	2.05 2.05 2.27 2.27 1.98 1.77 1.55 1.09 1.33 1.23 1.11 1.11 1.11
CHAINAGE	33.74 40.00 60.00 80.00 100.00 120.00 140.00 160.00 180.00 200.00 208.29 237.97

Retaining Wall 3
SCALE: HORI 1:1000 VERT 1:200



DATUM 36.00m	
TOP OF WALL	41.25 40.46 41.25
TOE OF WALL	40.14 40.46 40.46
WALL HEIGHT	1.11 1.11 1.11
CHAINAGE	208.29 220.00 237.97

Retaining Wall 4
SCALE: HORI 1:1000 VERT 1:200

RESOURCE CONSENT

Notes
1. See plan C250 for all notes.

A	FAST TRACK APP	MJRA	06/2026
Rev	Description	By	Date
		By	Date
Survey	MAVEN		06/2025
Design	MJRA		04/2026
Drawn	MJRA		04/2026
Checked	MKJ/DJM		04/2026

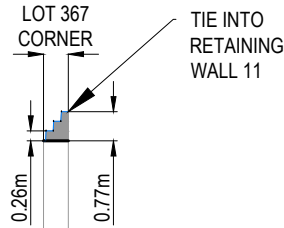


Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
RETAINING WALL
LONGSECTION**

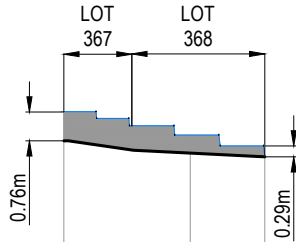
Project no.	298001-R1 SL1
Scale	AS SHOWN
Cad file	298001-R1-C250 RETAINING WALL.DWG
Drawing no.	R1-C250-4
Rev	A

DATE: 6/9/25 FILEPATH: F:\MAVEN\HAMILTON6 - PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C250 RETAINING WALL.DWG



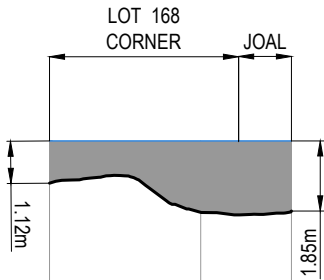
DATUM 36.00m	
TOP OF WALL	39.80 40.57
TOE OF WALL	39.80 39.80
WALL HEIGHT	0.00 0.77
CHAINAGE	0.00 3.29

Retaining Wall 5
SCALE: HORI 1:1000 VERT 1:200



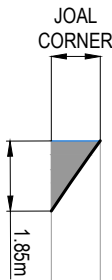
DATUM 36.00m	
TOP OF WALL	40.57 39.95 39.38
TOE OF WALL	39.80 39.47 39.37
WALL HEIGHT	0.77 0.47 0.01
CHAINAGE	3.29 20.00 29.86

Retaining Wall 6
SCALE: HORI 1:1000 VERT 1:200



DATUM 36.00m	
TOP OF WALL	40.91 40.91 40.91
TOE OF WALL	39.76 39.02 39.06
WALL HEIGHT	1.12 1.89 1.85
CHAINAGE	0.00 20.00 32.02

Retaining Wall 7
SCALE: HORI 1:1000 VERT 1:200



DATUM 36.00m	
TOP OF WALL	40.91 40.91
TOE OF WALL	39.06 40.91
WALL HEIGHT	1.85 0.00
CHAINAGE	32.02 38.51

Retaining Wall 8
SCALE: HORI 1:1000 VERT 1:200

RESOURCE CONSENT

Notes
1. See plan C250 for all notes.

A	FAST TRACK APP	MJRA	06/2026
Rev	Description	By	Date
	By	Date	
Survey	MAVEN	06/2025	
Design	MJRA	04/2026	
Drawn	MJRA	04/2026	
Checked	MKJ/DJM	04/2026	

M

MAVEN

Maven Waikato

07 242 0601

info@maven.co.nz

www.maven.co.nz

Level 1 286 Victoria Street, Hamilton

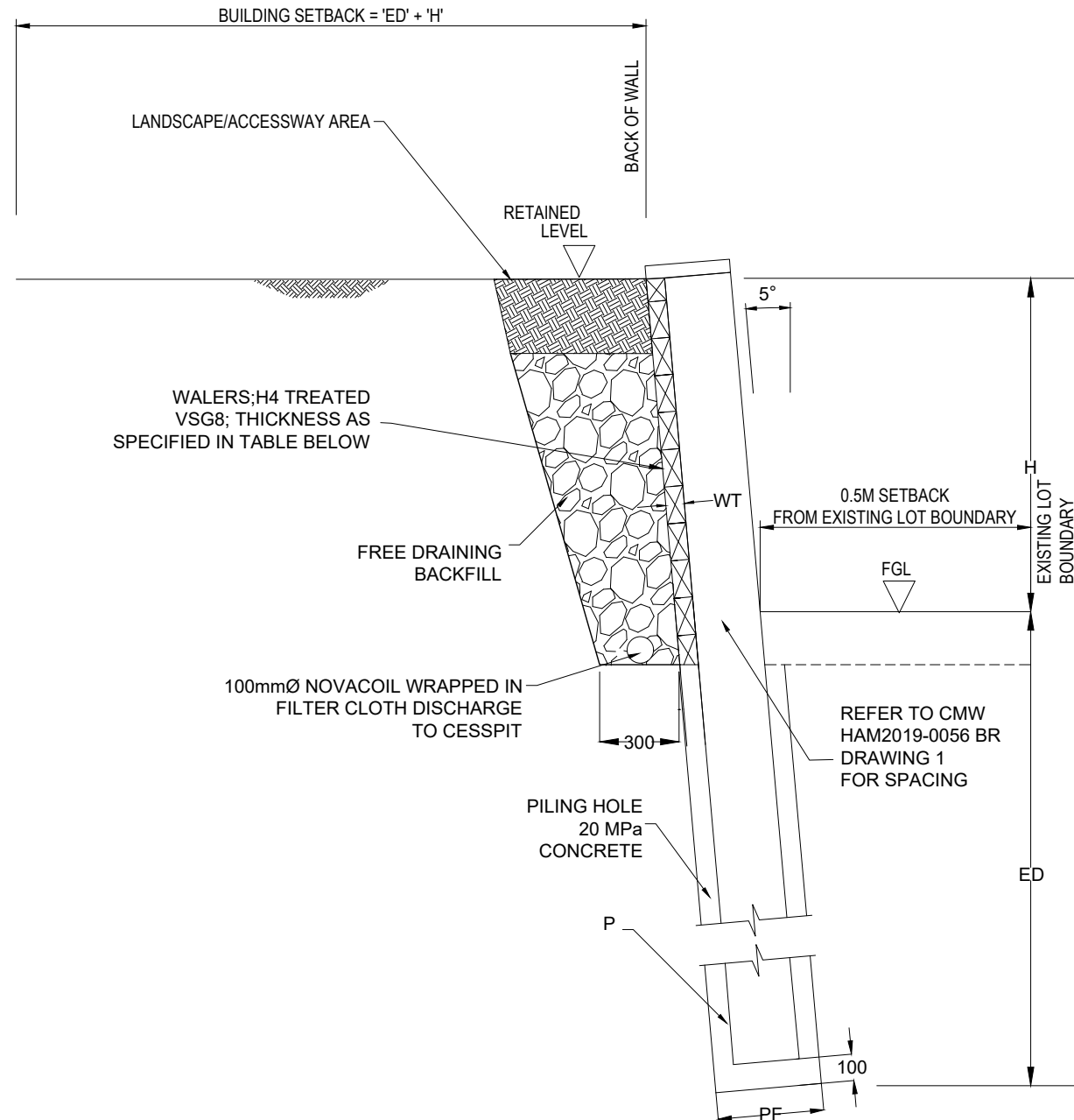
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title
**PROPOSED
RETAINING WALL
LONGSECTION**

Project no.	298001-R1 SL1		
Scale	AS SHOWN		
Cad file	298001-R1-C250 RETAINING WALL.DWG		
Drawing no.	R1-C250-5	Rev	A

DATE: 6/9/26 FILEPATH: F:\MAVEN\HAMILTON\6. PROJECTS\298001 - SOUTHERN LINKS 1\STG R1\DWG\298001-R1-C250 RETAINING WALL.DWG



RETAINING HEIGHT 'H' 'm' MAX.	MINIMUM SMALL END DIA (H5 TREATED) IN 'mm'	PILE FOOTING Ø 'PF' IN 'mm'	MIN. EMBEDMENT DEPTH 'ED' IN 'm'	SPACING 'm'	WALER THICKNESS WT 'mm'
1.00	200	350	1.6	1.0	(<1.5m) 45
1.50	275	425	2.1	1.0	(<1.5m) 45
2.00	325	475	2.7	1.0	(>1.5m) 90
2.30	350	500	3.0	1.0	(>1.5m) 90

NOTES:

- 1) RETAINING WALL DESIGNED FOR BACK SLOPE = 0° MAX; SURCHARGE = 12 kPa
- 2) DESIGN PARAMETERS FROM CMW GEOTECHNICAL INVESTIGATION REPORT. SOIL DENSITY = 17.0 kN/m³, ANGLE OF SOIL FRICTION = 28°, Su = 60 kPa.
- 3) WALER SHALL BE CONTINUOUS OVER MINIMUM 2 SPANS.

RESOURCE CONSENT

6. The maximum retained height shall be as specified on the drawing and shall not be exceeded unless approved by Maven in writing.
7. The concrete encasement shall be adequately vibrated with a pencil vibrator to avoid "honey combing".
8. Excavations for foundations shall be taken out by augering to the dimensions detailed with all surplus soil being disposed of away from the site.
9. Allowance shall be made in positioning augered holes for the slope of the wall and for concrete surround to poles.
10. Driving of poles is not acceptable as an alternative to auguring.
11. The Contractor shall verify the position of all underground services and confirm that there are no clashes prior to construction.
12. The Contractor shall refer to Maven as soon as possible for further instruction should any unforeseen circumstance or abnormal site condition be encountered during construction.
13. Inspections are required by Geotechnical Engineer during construction to confirm assumed ground conditions.
14. Maven shall inspect and approve the founding depth and condition of all pile holes prior to installation of the poles and pouring of concrete.
15. Any groundwater and associated sediment/sludge within the pile holes shall be removed prior to installing the timber poles and the pouring of concrete.
16. If there is potential for hole collapse e.g. due to weak ground condition or groundwater ingress, it is recommended that alternate holes be drilled initially and backfilled with concrete prior to the drilling of the remaining holes.
17. Concrete encasement to extend to toe of permanent retaining wall i.e. post future backfilling in front of wall.
18. Building Consent to be done by others.

Notes

1. All works to be in accordance with Matamata-Piako District Council standards.
2. All existing and proposed services shall be marked and protected during construction works.
3. The extent of excavation required shall be marked out on the ground having regard to the positions of poles, working space for construction, backfill and drainage provisions.
4. The retaining wall should be backfilled to its full height with 'no fines' concrete, fully wrapped by a separation geotextile Bidim A14 or approved similar.
5. Timber pole wall
 - 5.1. All timber poles shall be H5 treated radiata pine in accordance with NZS 3603 unless otherwise specified.
 - 5.1. All timber poles shall have concrete encasement below the ground level with a minimum of 75mm side cover. The characteristic compressive strength of the concrete encasement shall be f_c = 20 MPa unless otherwise noted.
 - 5.2. Poles are expressed as a minimum small end diameter Ø (SED) and shall be installed small end upwards. Cut ends shall not be put into the ground.
 - 5.3. The timber railing shall be H4 treated Radiata Pine and shall be fixed to the rear of the poles with CCA resistant coated screws or nails. Rails shall have minimum 10mm gap between them.
 - 5.4. Cutting of timbers shall be avoided wherever possible. If cutting is necessary, the exposed surfaces shall be flooded with a copper naphthenate type wood preservative.

A	FAST TRACK APP	MJRA	06/2026
Rev	Description	By	Date
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Survey	MAVEN		06/2025
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Checked	MKJ/DJM		04/2026



Maven Waikato
07 242 0601
info@maven.co.nz
www.maven.co.nz
Level 1 286 Victoria Street, Hamilton
New Zealand

Project
**SOUTHERN LINKS 1
RESIDENTIAL STAGE 1
HAMILTON, WAIKATO
FOR
SAXBY RD JV LIMITED**

Title PROPOSED RETAINING WALL TYPICAL SECTION			
Project no.	298001-R1 SL1		
Scale	1:25 @ A3		
Cad file	298001-R1-C250 RETAINING WALL.DWG		
Drawing no.	R1-C250-6	Rev	A