28 September 2023
E22851.G12_Rev1

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# Groundwater Take Assessment
# Proposed Residential Development
# 149-163 Milton Street, Ashbury

## 1. INTRODUCTION

### 1.1. BACKGROUND

At the request of MN Builders (the Client), EI Australia (EI) has prepared this Groundwater Take Assessment for 149-163 Milton Street, Ashbury (the site).

The following documents were used to assist in the preparation of this analysis:

- Architectural drawings prepared by SJB Architects, Job No. 6119, Drawing No. DA-0101, Revision 16, dated 275 October 2021;
- Structural drawings prepared by EI Consulting – Job No. E22851, Drawing Nos., S02-02 to S02-8 rev B, dated 14 July 2020.
- Detailed Site Investigation Report prepared by EI, Referenced E22851 AA Rev0, dated 25 February 2016;
- Geotechnical Investigation prepared by EI, Referenced E22851 GA Rev2 dated, 4 September 2020;
- Dewatering Management Plan prepared by EI , Referenced E22851.E16_Rev0, dated 23 August 2021;
- Groundwater Take Assessment prepared by EI, Referenced E22851.G12 dated, 23 August 2021;
- Groundwater Monitoring prepared by EI for 165 Milton Street, Ashbury, Referenced E24185.G11.01, dated 28 October 2022. This report is attached to the end of this report.

Based on the provided documents, EI understands that the proposed development involves the demolition of the existing site structures and the construction of a low rise residential development overlying a stepped one-level basement. The Finished Floor Level (FFL) of the basements proposed to be RL 31.35 towards the western side of the site and RL 35.90m towards the eastern side of the site, with the majority of the basement FFL at RL 31.71m. The Bulk Excavation Level (BEL) is assumed to range between 31.0m to 35.60m to allow for the construction of the basement slab. To achieve the BEL, an estimated of excavation depth of between 2.3m to 4.8m Below Existing Ground Level (BEGL) is expected. Locally deeper excavations may be required for footings, service trenches, crane pads, and lift overrun pits.

### 1.2. ASSESSMENT OBJECTIVES

The objective of this GTA is to provide an estimation of the groundwater take volumes that require pumping out during the construction and operational stage of the development, estimation of the groundwater drawdown as a result of the dewatering, and its associated ground settlements (if any).

# 2. SITE MODEL

## 2.1. SUBSURFACE CONDITIONS PERMEABILITY

For the purpose of the groundwater take assessment, subsurface conditions encountered in BH1M and BH3M outlined our geotechnical investigation report (E22851 GA Rev2, dated 4 September 2020) have been adopted because of the variation in the subsurface conditions and surface levels across the site from east to west. A summary of the permeability values which were adopted for the assessment of groundwater take volumes are presented in **Table 1** below.

**Table 1 Summary of Adopted Design Subsurface Conditions and Parameters (BH1M and BH3M)**

| Material [1] | Approximate Depth to Top of Unit (m BEGL) [2] | Approximate RL of Top of Unit (m AHD) [2] | | Adopted Permeability (m/s) |
|---|---|---|---|---|
| | | West | East | |
| **Topsoil/Fill** [3] | Surface | 33.7 | 40.5 | $1.0 \times 10^{-5}$ |
| **Residual Soil** [3] | 1.2 to 1.8 | 32.5 | 38.7 | $1.0 \times 10^{-8}$ |
| **Class V Shale Bedrock** [4] | 2.5 to 3.2 | 31.2 | 37.3 | $8.0 \times 10^{-9}$ |
| **Class III Shale Bedrock** [4] | 8.5 to 9.5 | 25.2 | 31.0 | $1.0 \times 10^{-7}$ |
| **Class II Shale Bedrock** [4] | 9.9 | -[5] | 30.6 [5] | $5.0 \times 10^{-8}$ |

***Notes:***

1 For more detailed descriptions of subsurface conditions reference should be made to the Geotechnical Investigation Report.
2 Depths and levels presented in **Table 1** above are generalised using the most conservative levels from the Geotechnical Investigation across the excavation area for the purpose of groundwater seepage modelling.
3 Permeability values have been correlated for material encountered during the GTA using Look (2014).
4 Permeability values have been correlated for material encountered during the GTA using Pells (2019).
5 Class II Shale Bedrock only encountered in BH3M and BH6.

## 2.2. GROUNDWATER OBSERVATIONS AND PUMP OUT TESTS

Groundwater observations were made within the monitoring wells (BH3M, BH4M and BH8M) on 22 August 2023. The details of Groundwater measurements are presented in **Table 2** below.

**Table 2 Summary of Groundwater Levels**

| Monitoring Well / Test ID | Date of Observation | Approx. Depth to Groundwater (m BEGL) | Approx. RL of Groundwater (m AHD) |
|---|---|---|---|
| BH3M | 22 August 2023 | 5.67 | 34.83 |
| BH4M | 22 August 2023 | 8.11 | 28.51 |
| BH7M | 22 August 2023 | 7.47 | 29.78 |
| BH8M | 22 August 2023 | 2.22 | 38.18 |

***Notes:***

1 Bulk excavation levels based on the supplied architectural drawings and our geotechnical investigation.

EI have also completed long-term groundwater monitoring on the site immediately to the south (165 Milton Street) for a period of at least three months between 13 July 2022 and 26 October 2022. BH201M and BH202M measured water levels varying from RL 35.11m to 35.50m and 35.70m to 35.90m, respectively. Hence, groundwater levels only varied by a maximum of 0.4m over the monitoring period.

A design groundwater level of RL 29.51m (towards western end, based on highest measured water well in BH4M) to RL 39.18m (towards eastern end, based on highest measured water well in BH8M) has been adopted for assessment of groundwater seepage inflow rates and groundwater take volumes within the excavation. An additional 1.0m has been added to the groundwater level recorded to allow for seasonal variation, which is higher than the variations observed in the long-term monitoring of 165 Milton Street. We also note the groundwater level is likely to be lower towards the western end given the presence of W.H. Wagner Oval which is at a lower elevation than the site, but the groundwater level in BH4M was used for conservatism.

## 2.3. SHORING SYSTEM

Based on the Structural Drawings, the shoring system will comprise of a combination of contiguous piles along the southern boundary, soldier piles on the north eastern corner of the basement and temporary batters. We understand

from the drawings and reports that the basement has been designed to be a drained basement and the walls have been modelled to be freely draining.

# 3. GROUNDWATER TAKE ASSESSMENT

## 3.1. GROUNDWATER SEEPAGE VOLUMES DURING CONSTRUCTION PHASE

Groundwater seepage analysis for flow through and beneath the shoring wall during construction has been undertaken using SEEP/W, a finite element groundwater seepage analysis software. SEEP/W estimates the seepage rate of water entering the excavation from beneath the shoring wall. This model estimates the volume of water which will be required to be dewatered during the construction of the basement and until the dewatering is turned off.

For the purpose of this modelling, it has been assumed that:

- The subsurface conditions were horizontal beyond the site. The permeability values presented in **Table 1** above were adopted for each unit.
- The shoring wall systems and temporary batters are assumed to be permeable and free to drain.
- For the simplicity of this model, temporary dewatering will be undertaken within the basement retaining wall perimeter to BEL, about RL 31.0m AHD.
- An external design groundwater level of RL 29.51m (towards western end) to RL 39.18m (towards eastern end) was assumed to be constant at 50m away from the excavation extent.
- The shoring wall surrounding the basement excavation has an average width of approximately 101m in the north-south direction and approximately 134m in the east-west direction.
    - The model section (A-A) was taken in an east-west direction through the excavation as shown with Section A-A on the attached **Figure 1**.
    - Seepage flows in to the excavation from the north and south directions were conservatively estimated using the in-flows measured from the western and eastern soldier pile wall/temporary batter from Section A-A for the entire length (134m).
- The basement is assumed to be constructed in 180 days.

The SEEP/W model is presented in **Appendix A. Table 3** below provides the estimated groundwater inflow rate into the basement.

**Table 3 Summary of Analysis Results**

| Direction | Inflow per m length of perimeter wall ($m^3$/sec) | Inflow per m length of perimeter wall ($m^3$/day) | Inflow into excavation ($m^3$/day) | Total Inflow during construction (ML/180 days) |
|---|---|---|---|---|
| EW | $1.01 \times 10^{-7}$ | 0.008 | 0.88 | 0.160 |
| NS | $3.47 \times 10^{-8}$ | 0.003 | 0.40 | 0.072 |

## 3.2. ASSESSMENT OF GROUNDWATER TAKE DURING OPERATIONAL PHASE

A drained basement using sub-soil drainage and a sump-and-pump system was assumed. Based on the SEEP/W results, the estimated volume of groundwater removed beneath the basement during the operational phase of the development is expected to be approximately 0.47ML per year.

# 4. CONCLUSIONS AND COMMENTS

Based on the findings of this report and within the limitations of available data, EI concludes that:

- Construction and operational phase groundwater take will be approximately:
  - 0.24ML / 180 days during construction
  - 0.47ML / year during operation
- The above estimate is based on the following assumptions:
  - The shoring wall systems are fully drained retention system;
  - Continuous dewatering in order to maintain the groundwater at a depth of BEL during construction, and construction of the basement will take 180 days;
  - The basement walls and slab will be designed as drained for the developments lifetime.
  - This assessment does not take into consideration any excavation that may be required for footings, service trenches, lift pits, or crane pads. This additional excavation, if required, is not expected to affect the retention or the dewatering system.
- The expected drawdown would be in the order of from 7.33m behind the shoring wall will be within the hard clay and bedrock profile and hence settlement due to drawdown is expected to be minimal and is unlikely to affect neighbouring properties.
- Based on our assessment, the groundwater volumes expected per year appear to be manageable using a drained basement system for its lifetime. Hence in our opinion “tanking” of the basement is not warranted and a drained basement is possible for the development.

Should any design or construction conditions differ from that adopted in this report; this GTA should be reviewed and updated as required.

# 5. LIMITATIONS

This report has been prepared for the exclusive use of MN Builders who is the only intended beneficiary of EI’s work. The scope of the inspections carried out for the purpose of this report is limited to those agreed with MN Builders.

No other party should rely on the document without the prior written consent of EI, and EI undertakes no duty, or accepts any responsibility or liability, to any third party who purports to rely upon this document without EI's approval.

EI has used a degree of care and skill ordinarily exercised in similar tasks by reputable members of the geotechnical industry in Australia as at the date of this document. No other warranty, expressed or implied, is made or intended. Each section of this report must be read in conjunction with the whole of this report, including its appendices and attachments.

The conclusions presented in this report are based on a limited assessment of conditions, with specific locations chosen to be as representative as possible under the given circumstances.

EI's professional opinions are reasonable and based on its professional judgment, experience, training and results from analytical data. EI may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified by EI.

EI's professional opinions contained in this document are subject to modification if additional information is obtained through further investigation, observations, or validation testing and analysis during remedial activities. In some cases, further testing and analysis may be required, which may result in a further report with different conclusions.

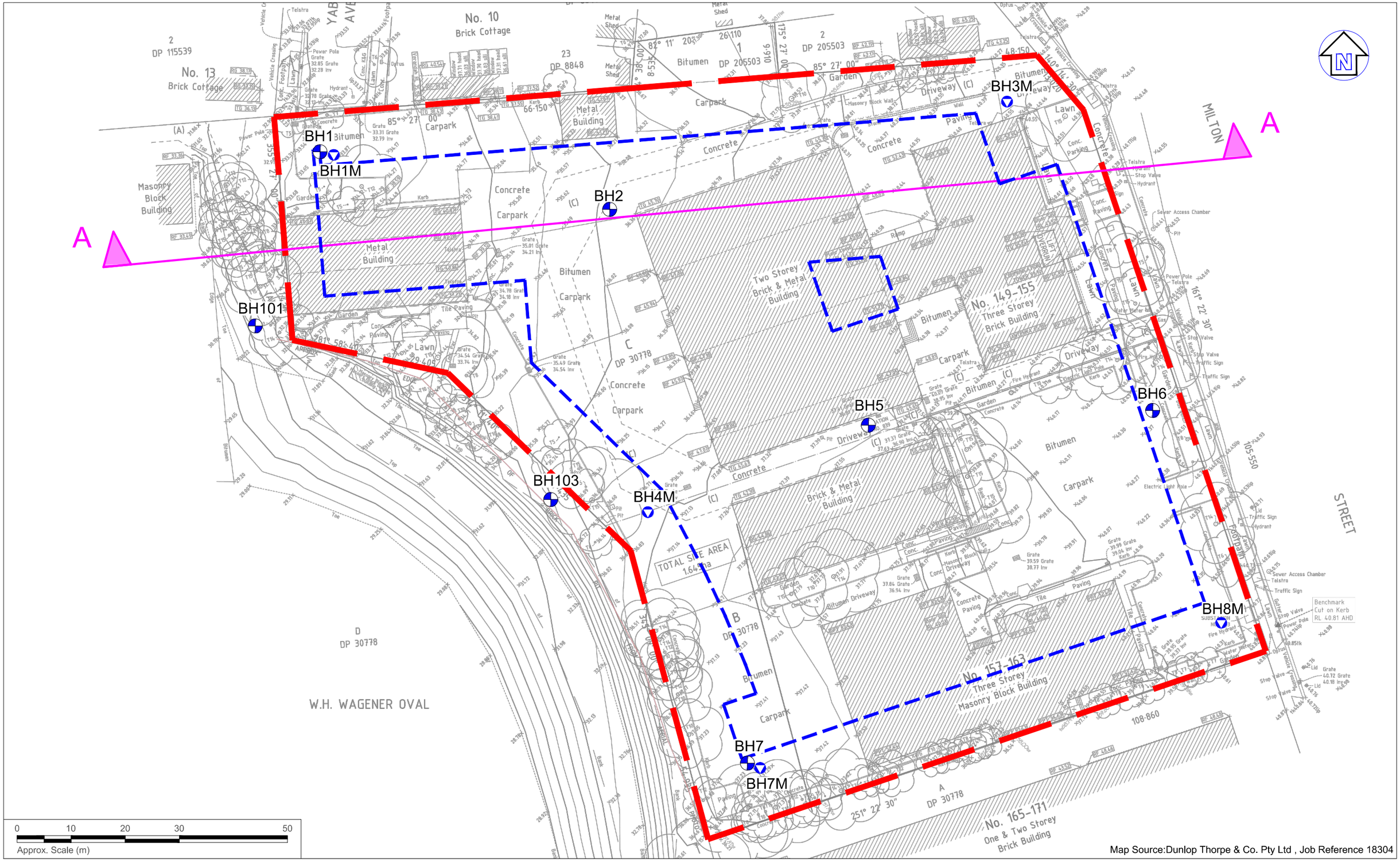
# 6. CLOSURE

Please do not hesitate to contact the undersigned should you have any questions.

For and on behalf of
EI Australia

| Author | Technical Reviewer |
| --- | --- |
|  |  |
| Gokul Pothineni<br>Geotechnical Engineer | Stephen Kim<br>Senior Geotechnical Engineer |

Attachments: Figure 1 – Section A-A
Appendix A – SEEP/W Model and Results
E24185.G11.01 – Groundwater Monitoring Report No. 1 for 165 Milton Street, Ashbury.
Important Information




Map Source:Dunlop Thorpe & Co. Pty Ltd , Job Reference 18304

**LEGEND** (all measurements are approximate)

- Site boundary
- Proposed basement boundary
- Borehole location
- Monitoring well location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| | |
|---|---|
| Drawn: | L.C. |
| Approved: | L.X. |
| Date: | 06-10-23 |

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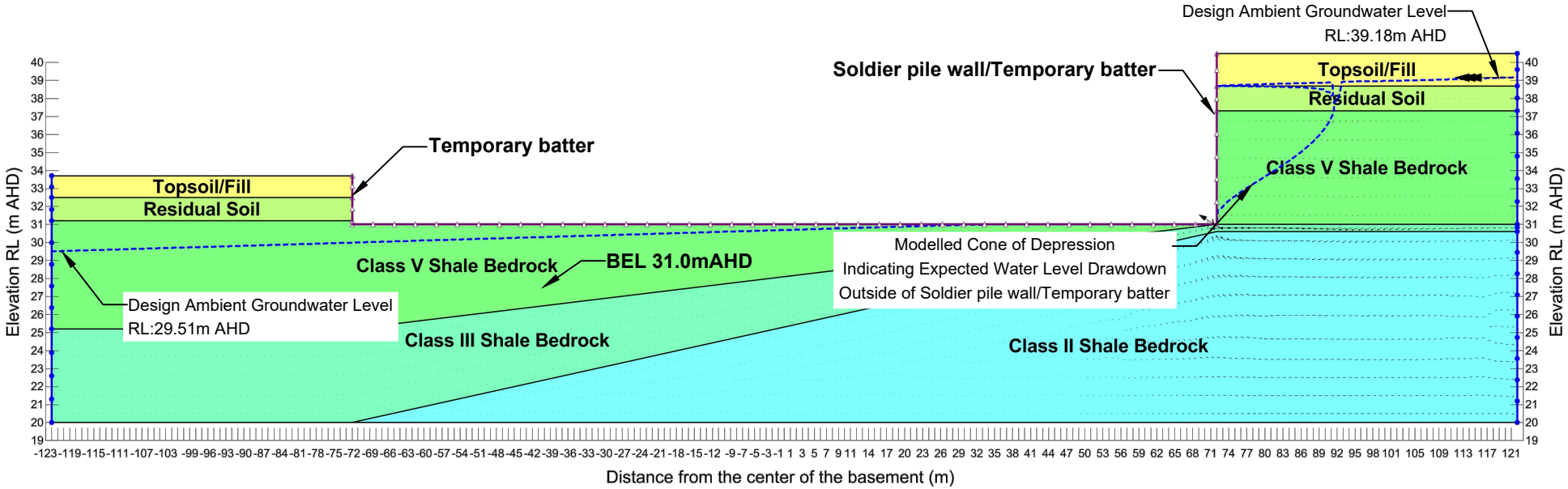
Groundwater Take Assessment
149 - 163 Milton Street, Ashbury, NSW NSW

Sampling Location Plan

Figure: 2

Project: E22851.G12

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| Approx Scale: | As Shown |

**MN Builders Pty Ltd**
Groundwater Take Assessment
149-163 Milton Street, Ashbury, NSW
SEEP/W Model and Results

Appendix:
A

Project: E22851.G12

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28 October 2022
E24185.G11.01

Mr Chris Gorton
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# Groundwater Monitoring Report No. 1
# 165 Milton Street, Ashbury, NSW

EI Australia (EI) has been engaged to prepare this factual letter report to provide continual groundwater levels at the above site for minimum 3 months period prior to dewatering. The monitoring period is from Wednesday 13 July 2022 to Wednesday 26 October 2022.

Groundwater levels were collected during the monitoring period using data loggers installed on 13 July 2022 within monitoring wells BH201M and BH202M, which were installed by EI on 14 June 2022.

The data logger / monitoring well details and the groundwater levels observed during the monitoring period are summarised in Table 1 & 2 below.

**Table 1 Summary of Data Logger & Well Installation Details**

| Monitoring Well ID | Top of Well RL (mAHD) | Existing Ground RL (mAHD) | Well Stickup (m) | Well Depth Below Ground (m) [1] | Sensor RL (mAHD) |
|---|---|---|---|---|---|
| BH201M | 37.42 | 36.50 | 0.92 | 5.11 | 31.83 |
| BH202M | 37.59 | 37.00 | 0.59 | 6.31 | 30.90 |

*Note 1: The level of the bottom of the well is based on manual measurements after the well installation. The measurement accounts for any variation of the well depth caused by factors such as infilling of material.*

**Table 2 Summary of Groundwater Levels**

| Monitoring Well ID | Baseline RL (mAHD) [1] | Highest Groundwater RL (mAHD) | Lowest Groundwater RL (mAHD) | Predicted Drawdown RL (mAHD) | Within Predicted Limits? |
|---|---|---|---|---|---|
| BH201M | 35.30 | 35.50 | 35.11 | N/A | N/A |
| BH202M | 35.90 | 36.17 | 35.70 | N/A | N/A |

*Note 1: The baseline level is calculated as an average of all groundwater levels recorded in the monitoring wells.*

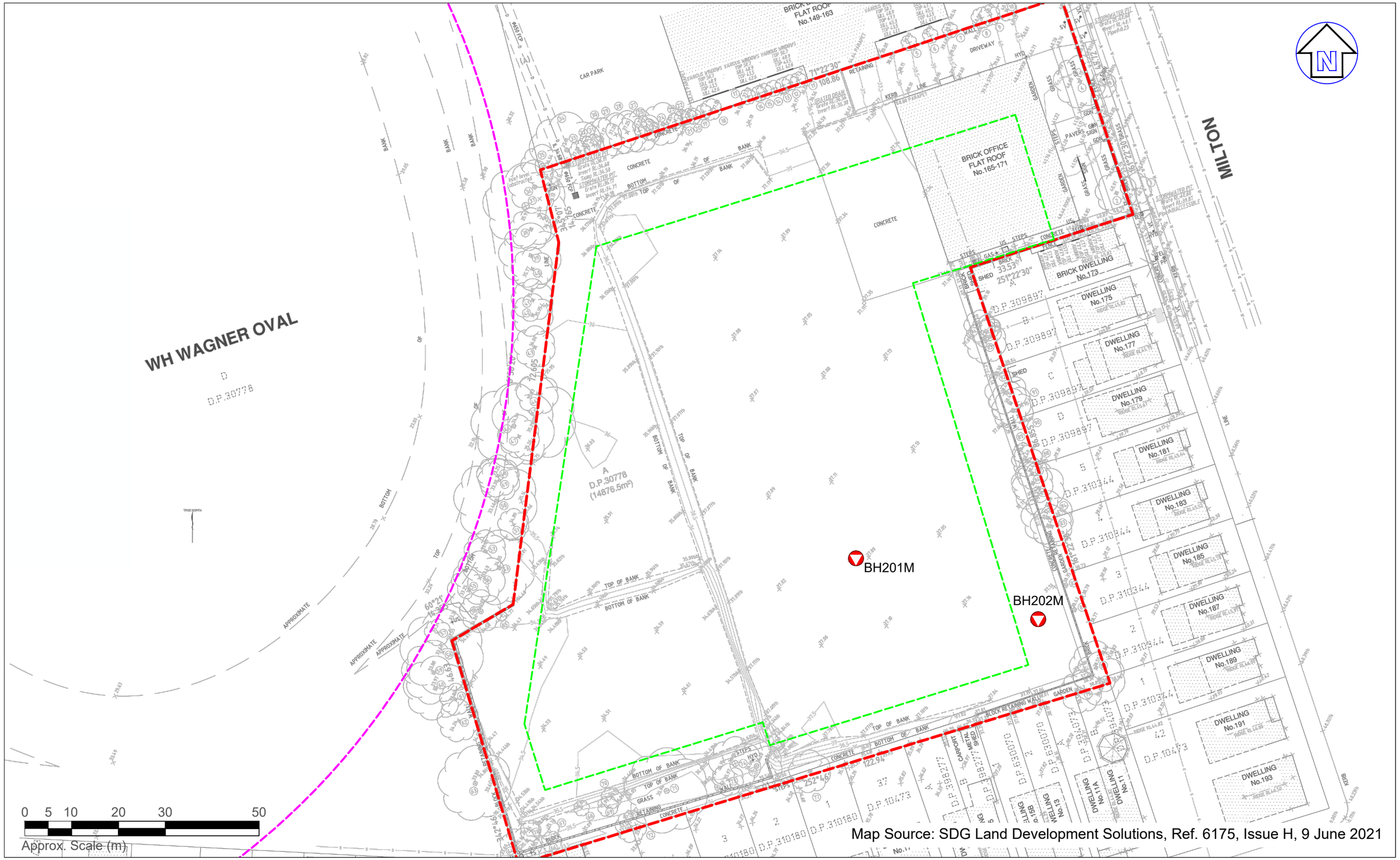
Please do not hesitate to contact the undersigned should you have any questions.

For and on behalf of:
**EI AUSTRALIA**

| Author | Reviewer |
| --- | --- |
| **Masar Jabbar** | **David Saw** |
| Geotechnical Engineer | Geotechnical Engineer |

Attachments:

| | |
| --- | --- |
| Figure 1: | Data Logger Location Plan |
| Figure 2-3: | Groundwater Level, Daily Rainfall vs. Time From Wednesday 13 July 2022 to Wednesday 26 October 2022. |
| Important Information | |




## LEGEND

- Location of Data Logger, Groundwater Monitoring Well/Borehole Location (EI Australia, 14 June 2022)
- Approximate Site Boundary
- Proposed Basement Outline
- Approximate Quarry Extent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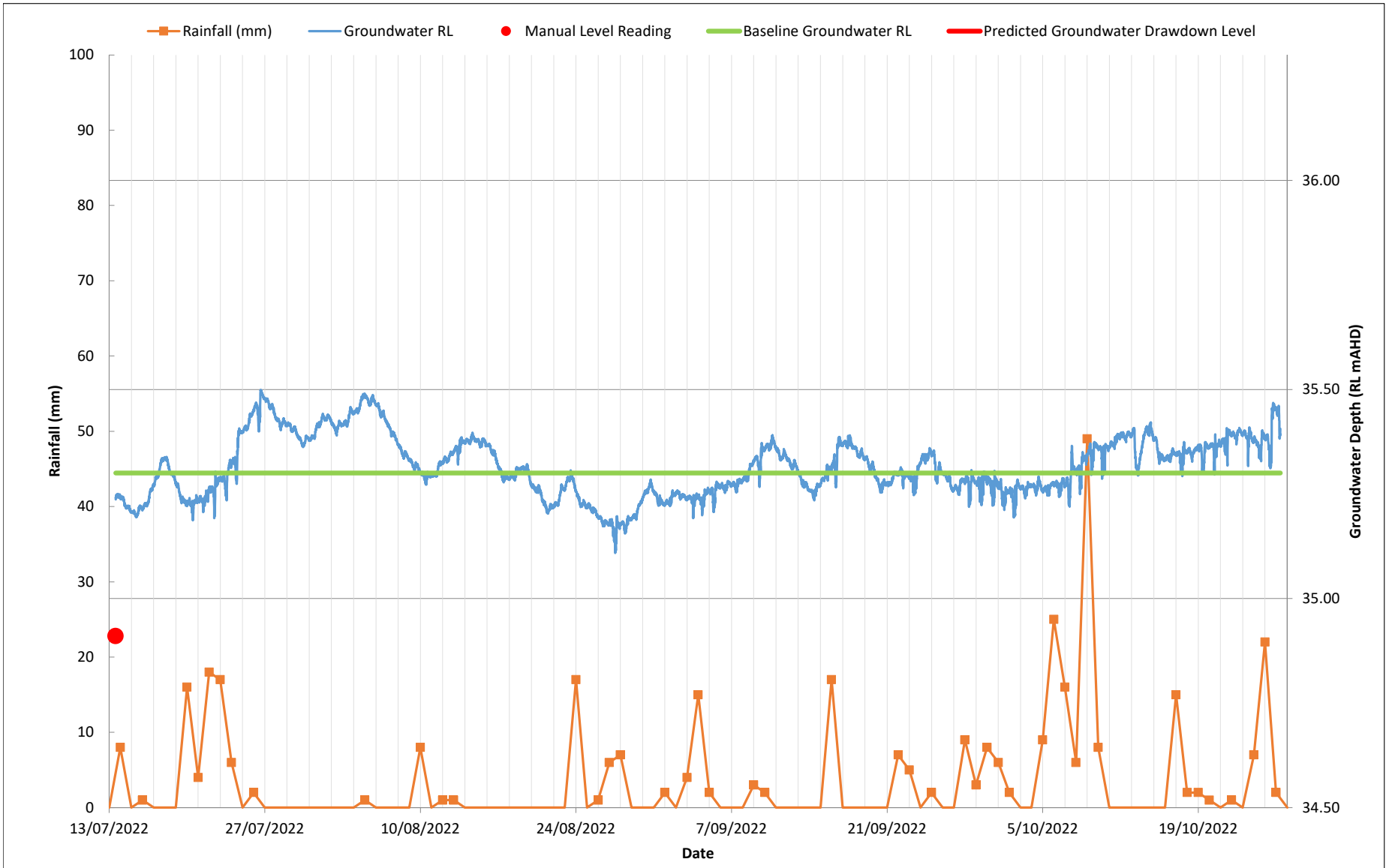
| | |

**Coronation Property Pty Ltd**
Groundwater Monitoring
165 Milton Street, Ashbury NSW
Data Logger Location Plan

Figure: 1

Project: E24185.G11

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**Coronation Property Co. Pty Ltd**

Groundwater Monitoring

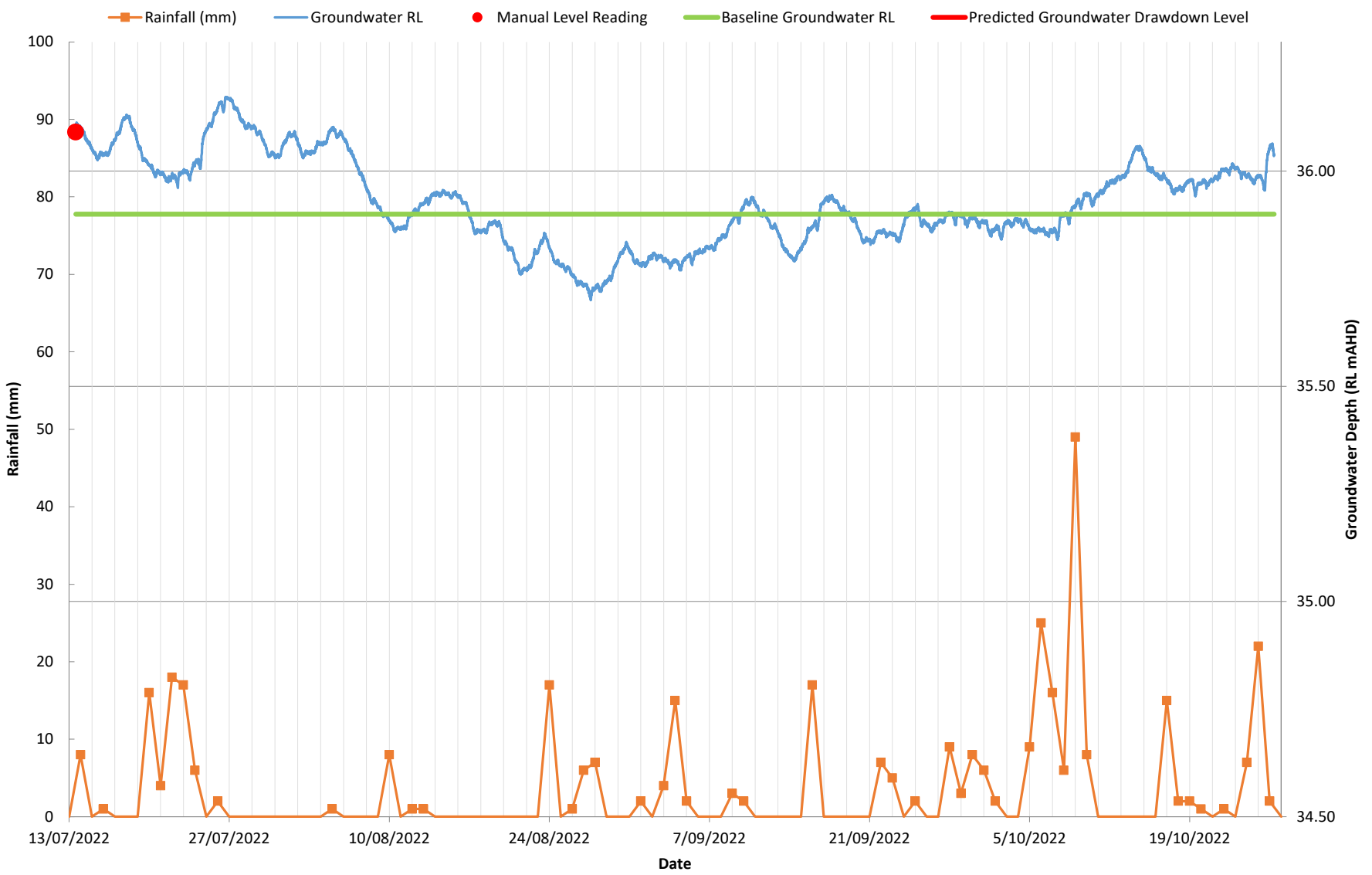
165 Milton Street, Ashbury, NSW

BH201M

Figure:

**2**

Project: E24185.G11.01

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**Coronation Property Co. Pty Ltd**

Groundwater Monitoring

165 Milton Street, Ashbury, NSW

BH202M

Figure:

**3**

Project: E24185.G11.01

# Important Information

## SCOPE OF SERVICES

The geotechnical report ("the report") has been prepared in accordance with the scope of services as set out in the contract, or as otherwise agreed, between the Client And EI Australia ("EI"). The scope of work may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

## RELIANCE ON DATA

EI has relied on data provided by the Client and other individuals and organizations, to prepare the report. Such data may include surveys, analyses, designs, maps and plans. EI has not verified the accuracy or completeness of the data except as stated in the report. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations ("conclusions") are based in whole or part on the data, EI will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to EI.

## GEOTECHNICAL ENGINEERING

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared for a specific client, for a specific project and to meet specific needs, and may not be adequate for other clients or other purposes (e.g. a report prepared for a consulting civil engineer may not be adequate for a construction contractor). The report should not be used for other than its intended purpose without seeking additional geotechnical advice. Also, unless further geotechnical advice is obtained, the report cannot be used where the nature and/or details of the proposed development are changed.

## LIMITATIONS OF SITE INVESTIGATION

The investigation programme undertaken is a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions. The data derived from the site investigation programme and subsequent laboratory testing are extrapolated across the site to form an inferred geological model, and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation, the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. The engineering logs are the subjective interpretation of subsurface conditions at a particular location and time, made by trained personnel. The actual interface between materials may be more gradual or abrupt than a report indicates.

## SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions can be modified by changing natural forces or man-made influences. The report is based on conditions that existed at the time of subsurface exploration. Construction operations adjacent to the site, and natural events such as floods, or ground water fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. EI should be kept appraised of any such events, and should be consulted to determine if any additional tests are necessary.

## VERIFICATION OF SITE CONDITIONS

Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that EI be notified of any variations and be provided with an opportunity to review the recommendations of this report. Recognition of change of soil and rock conditions requires experience and it is recommended that a suitably experienced geotechnical engineer be engaged to visit the site with sufficient frequency to detect if conditions have changed significantly.

## REPRODUCTION OF REPORTS

 Where information from the accompanying report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimize the likelihood of misinterpretation from logs.

## REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the Client and no other party. EI assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of EI or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

## OTHER LIMITATIONS

EI will not be liable to update or revise the report to take into account any events or emergent circumstances or fact occurring or becoming apparent after the date of the report.