FORTIFY
GEOTECH

Proposed Development – 2 to 6 Conway Avenue, 15 & 15A Fernleigh Avenue, & 38 to 40 Carlisle Street, Rose Bay

Preliminary Assessment of Potential Geotechnical Impacts on Neighbouring Properties

CLIENT

Fernleigh Ave, Chamberlain St, & Conway Ave Residents

ADDRESS

2 to 6 Conway Avenue, Rose Bay

DATE

February 2026

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25 February 2026
Our ref: JM/C17267_Rev1

Fernleigh Ave, Chamberlain St, & Conway Ave Residents

Via email: Sonja.reja@gmail.com

Attention: Sonja Reja

Proposed Development – 2 to 6 Conway Avenue, 15 & 15A Fernleigh Avenue, and 38 to 40 Carlisle Street, Rose Bay

Preliminary Assessment of Potential Geotechnical Impacts on Neighbouring Properties

We are pleased to present our geotechnical desk-top study as part of a proposed development at 2 to 6 Conway Avenue, 15 & 15A Fernleigh Avenue, and 38 to 40 Carlisle Street , in Rose Bay, NSW.

Given the scale of the proposed development and the history in the area of detrimental impacts to neighbouring properties due to similar construction, the aim of the assessment is to provide details on potential geotechnical impacts on neighbouring properties should the proposed development proceed.

Should you require any further information regarding this report, please do not hesitate to contact our office.

Yours faithfully
Fortify Geotech

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About us

We work with our clients to provide practical advice and solutions tailored to each project. Our professional services are reliable, responsive and efficient.

Our highly capable Geotechnical Engineers and Geologists have a comprehensive understanding of the industry. We provide the best engineering solution for complicated geotechnical engineering issues. This has earned us a solid reputation with our Construction Industry, Municipal and Government clients.

INDUSTRIES WE WORK IN

- Residential
- Commercial
- Transport Infrastructure
- Industrial Developments of all sizes.

SERVICES

- Geotechnical Site Investigations and Reporting;
- Engineering Geology;
- Mining/Rock Geotechnics;
- Foundation Engineering;
- Dam Engineering; Embankment Design and Specification;
- Geotechnical Design Recommendations;
- Pavement Engineering and Design;
- Pavement Condition Surveys;
- Slope Stability and Risk Assessments;
- Geotechnical and Hydrological Instrumentation and Monitoring;
- Footing and Excavation Supervision and Certifications;
- Excavated soil/rock assessments and VENM assessments;
- Supervision and Certification of Earthworks and Controlled Fill, including Level 1 supervision;
- Geotechnical Construction Specifications;
- Deep Excavation Support; and
- Slope/Retaining Structure Analysis and Design

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Geotechnical Assessment

Proposed Development – 2 to 6 Conway Avenue, 15 & 15A Fernleigh Avenue, and 38 to 40 Carlisle Street, Rose Bay – Preliminary Assessment of Potential Geotechnical Impacts on Neighbouring Properties

QUALITY INFORMATION

Revision history

Reference/ Revision	Description	Date	Author	Reviewer
JM/C17267 Rev1	For comment – Geotechnical Assessment	25/02/2026	JM	MD

Fernleigh Ave, Chamberlain St, & Conway Ave Residents

Proposed Development – 2 to 6 Conway Avenue, 15 & 15A Fernleigh Avenue, and 38 to 40 Carlisle Street, Rose Bay

Preliminary Assessment of Potential Geotechnical Impacts on Neighbouring Properties

1 INTRODUCTION

1.1 PROPOSED DEVELOPMENT

We are pleased to present our geotechnical desk-top study as part of a proposed development at 2 to 6 Conway Avenue, 15 & 15A Fernleigh Avenue, and 38 to 40 Carlisle Street, in Rose Bay, NSW. It is understood that the proposed development comprises an eight-storey residential building with a three-level basement extending to a maximum ~11m depth (~RL33.7). A design groundwater level has not been provided within the provided geotechnical investigation report (groundwater monitoring has not been conducted, but the geotechnical report notes that it should be carried out). However, groundwater was encountered at ~7m depth (~RL39), so the development could potentially require dewatering to temporarily lower the groundwater table by ~5m. Despite the proposed development appearing to intersect the groundwater table, no groundwater monitoring or numerical modelling of the impact of groundwater drawdown from dewatering has been carried out.

Given the scale of the proposed development and the history in the area of detrimental impacts to neighbouring properties due to similar construction, the aim of the assessment is to provide details on potential geotechnical impacts on neighbouring properties should the proposed development proceed. Potential geotechnical impacts could include:

- Settlement arising from dewatering or groundwater drawdown within the shallow aquifer,
- Cumulative impacts where multiple basements are constructed in close proximity – in this case, the development comprises multiple amalgamated sites sitting side by side,
- Foundation interaction and load transfer where new foundations are located close to (and within the zone of influence) existing load-bearing footings
- Changes in groundwater flow and drainage patterns, such as damming and shadowing, with redirected groundwater leading to seepage, damp issues, or flooding in adjoining properties.
- Vibrations from piling, compaction, excavation, and demolition could cause settlement in neighbouring loose granular soils if vibration induces densification, and
- Ground movement from excavation works, where deep or poorly supported excavations can cause lateral ground movement, footing distress, and disruption to infrastructure (roads and in-ground services).

Of particular concern is that the local planning controls appear to be inadequate in mitigating such damage and off-site effects could extend far beyond the subject properties. To date, the Councils planning controls fail to adequately require monitoring of dewatering activities on specific projects and cumulatively to ensure the 'safe' level of dewatering threshold is not breached. However, we believe that once numerical modelling of the groundwater drawdown is carried out, it will prove that the proposed development will exceed the threshold groundwater drawdown on adjacent properties.

Woollahra Municipal Council engaged GHD to assess hydrogeological and geotechnical conditions in the area to understand the impacts associated with deep excavations and dewatering (Report 12588469 of 31 July 2024 – Reference document #7 in Section 1.3). The aim of this document was to provide guidance to Woollahra Municipal Council when approving developments with deep excavations and dewatering. This Council commissioned document made the following observations, which were then incorporated into the Woollahra DCP 2015 via Amendments 18 and 30:

- Construction dewatering will extend far beyond the footprint of developments (up to 45m away).
- The lowering of groundwater levels through construction dewatering has a high risk of causing settlements to the groundsurface around the development, with consequential damage to properties.
- Developments must not cause “unacceptable lowering of groundwater levels” and cause “no adverse settlement or movement of surrounding land or structures”.
- To minimise the potential for damage to neighbouring properties, the recommendation was to **limit drawdown of groundwater levels to a maximum of 0.3m** outside of the site boundaries.

To minimise the impact of large-scale excavation from new developments, Woollahra Municipal Council has controls that limit excavation to 1,000m^3 per 1,000m^2 of property area. This development proposes to excavate ~15,000m^3 of soil for the property area of ~3,000m^2, which is about **five times the recommendation**.

1.2 EXECUTIVE SUMMARY

The proposed development will comprise the excavation of a ~11m maximum depth basement, which will require construction dewatering to drawdown groundwater levels on site by up to 5m depth. Based on modelling on similar nearby developments (the proponent has not provided any site and project-specific dewatering modelling), this construction dewatering is expected to lower the groundwater table on adjacent land, extending up to 45m from the development property boundaries. This is expected to drawdown groundwater levels by between 0.3m and 2m depth at a distance of 10m from the property (therefore, potentially impacting between 20 and 25 adjacent properties). It should be noted that this analysis is based on the estimated hydraulic conductivity of the weathered Hawkesbury sandstone bedrock, and the excavation footprint, shoring cut-off depth/leakiness, and dewatering layout/pumping rate. This modelling and analysis must be provided by the proponent for detailed analysis to be carried out.

The GHD report commissioned by Woollahra Municipal Council states that such drawdown can cause settlement and damage to properties, and therefore recommended that a limit of 0.3m of groundwater drawdown outside the development boundary be permissible. Given that our preliminary analysis shows that groundwater drawdown could be greater than this affecting between 20 and 25 neighbouring properties, it can be shown that the proposed development would not comply with Council controls which are designed to protect surrounding residences.

There are numerous examples of construction dewatering causing damage to neighbouring properties in the Rose Bay and Double Bay areas (see Section 5.2). There is also the well-known case of the Mascot Towers, where construction

dewatering on a neighbouring site caused extensive structural damage to the Mascot Towers apartment building. These examples highlight the risk and danger of excavating deep basements and dewatering next to existing structures.

In addition, the amount of proposed excavation (~15,000m^3 of soil for the property area of ~3,000m^2, or ~5,000m^3 per 1,000m^2) vastly exceeds the Council's recommended limits.

1.3 BACKGROUND INFORMATION

To enable the assessment, the following documents (among others) were used to establish the project details, subsurface conditions, and potential adverse impacts:

1) MHNDUNION (2025-2) Architectural Drawings, Ref. 25-135, Dwgs. 2100 to 2111, 2200 to 2211, 3000 to 3002, 3004 & 4000 to 4002, Rev. A, 17/12/2025

2) EI Australia – "Preliminary Geotechnical Investigation: Dian Rose Bay – 2 to 6 Conway Avenue, 38 to 40 Carlisle Street, and 15 & 15A Fernleigh Avenue, Rose Bay, NSW", Document No. E26891.G03_Rev1

3) EI Australia – "Geotechnical Opinion – Letter No. 1, Groundwater Considerations: Dian Rose Bay – 2 to 6 Conway Avenue, 38 to 40 Carlisle Street, and 15 & 15A Fernleigh Avenue, Rose Bay, NSW", Document No. E26891.G20.01_Rev1

4) Ideal Geotech – "Report on Geotechnical Assessment – Wilberforce Avenue and Ian Street Carparks, Rose Bay", Job No. 23921

5) Douglas Partners, "Report on Desktop Geotechnical and Hydrogeological Assessment - 488-492 Old South Head Rd & 30 Albermarle Ave, Rose Bay", Project No. 229319.00

6) Geo-Environmental Engineering, "Geotechnical & Hydrogeological Investigation Report – 66 to 68 Wilberforce Avenue, Rose Bay", Report ID G19075RB-R01F

7) GHD, "Rose Bay - Hydrogeological and Geotechnical Impacts – Groundwater and Geotechnical Assessment Report", for Woollahra Municipal Council, Report 12588469.

8) NSW Department of Planning, Housing and Infrastructure, "The Sydney Plan".

1.4 SCOPE OF WORKS

The aim of the report would be to summarise potential geotechnical risks and adverse impacts on neighbouring properties, and provide advice on how the Assessment Authority can implement Conditions to mitigate these risks. The preliminary geotechnical assessment report includes:

- A review of the documents provided as part of the Development Approval application, including any potential shortcomings.
- Settlement arising from dewatering or groundwater drawdown within the shallow aquifer,
- whether development of this scale can be safely accommodated within such a groundwater system

- Provide examples of damage to properties in the area attributable to dewatering and excavation activities on other developments
- Provide recommendations for measures that must be implemented to reduce the risk of damage to neighboring properties, including mandatory requirements for monitoring dewatering activities, vibrations, and potential settlements.

2 SITE LOCATION & GEOLOGY

The site is located at 2 to 6 Conway Avenue, 15 & 15A Fernleigh Avenue, and 38 to 40 Carlisle Street, in Rose Bay, in the eastern suburbs of Sydney. Plate 2-1 shows a recent aerial photo of the site, showing it to be currently occupied by five detached residential dwellings and a small townhouse development.

The MinView Seamless Geology Map documents the area to be underlain by Triassic age Hawkesbury Sandstone bedrock, comprising medium- to coarse-grained quartz sandstone displaying small- to large-scale, high-angle cross-bedding; minor shale and laminite lenses.

Topographically, the lower-lying areas of Rose Bay, such as around this site, are covered by Holocene age coastal deposits (dune facies) and estuarine interbarrier creek deposits. The coastal deposit soils comprise marine-deposited and aeolian-reworked fine- to coarse-grained quartz-lithic sand with abundant carbonate, sporadic humic debris in stabilised dunes, and marine-deposited and aeolian-reworked coastal sand dunes, while the estuarine deposit soils comprise fine- to medium-grained lithic-carbonate-quartz sand (marine-deposited), silt, clay, organic mud, peat, gravel, shell material.

There are also large areas of the Double Bay ward that are covered by Quaternary age anthropogenic deposits (man-made fill), comprising anthropocene deposits varying from large man-made clasts (concrete blocks to building demolition rubble) to quarried natural boulders, with interstitial sand-sized to clay matrix. Plate 2-2 shows the geological map of the area.

Plate 2-1: Site Location Showing the Proposed Development

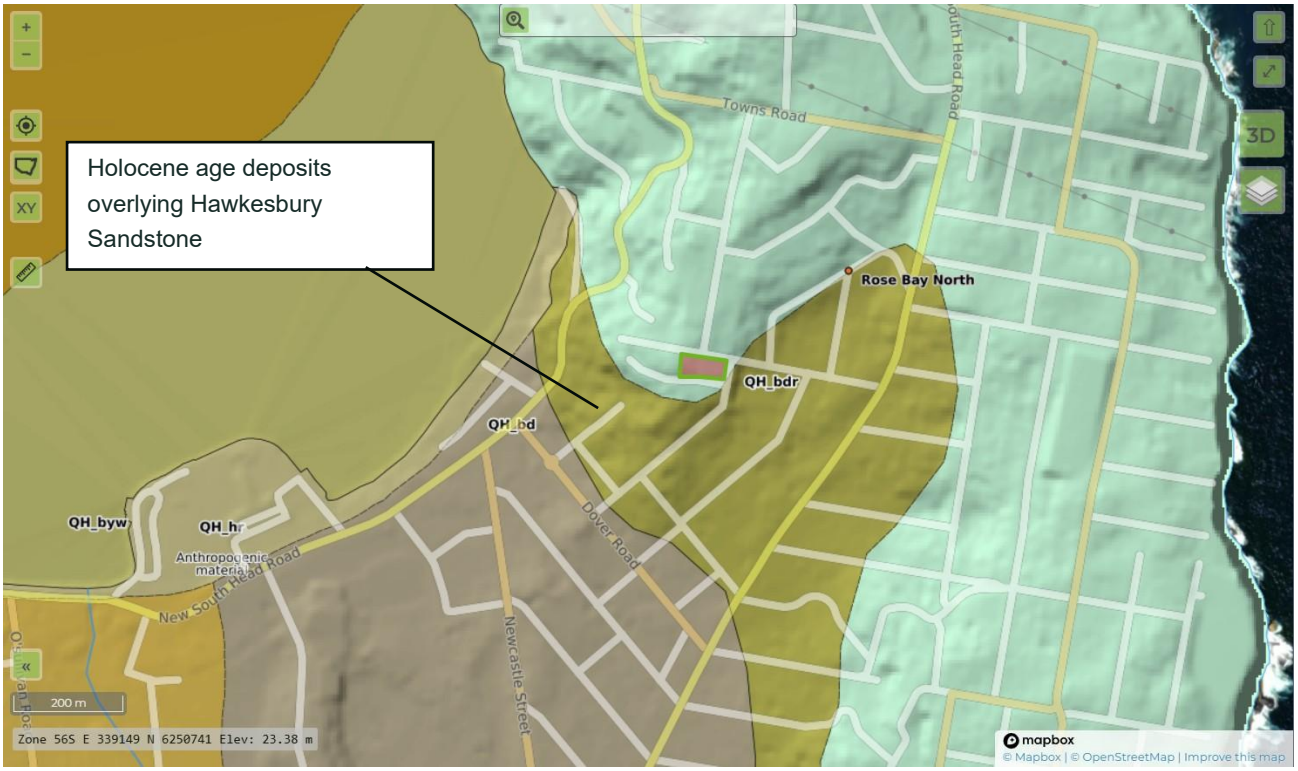

Plate 2-2: Extract of the Minview Seamless Geology Map Showing the vicinity of the site to be covered by Holocene age Coastal & Estuarine Deposits

3 ASSESSMENT METHODS

This report summarises expected geotechnical, groundwater, and geological conditions at the site based on research of available geological and topographical maps, past and recent aerial photographs, and available geotechnical and hydrogeological investigations conducted at the site and in the area (see Section 1.3).

4 ASSESSMENT RESULTS

4.1 SUBSURFACE CONDITIONS

Based on available previous geotechnical investigations, as well as reference to topographical maps and local soil and geology maps, Table 4-1 summarises the expected the subsurface profile expected at the site, primarily based on the boreholes drilled on the site by EI Australia, but is consistent with our experience on nearby projects.

Table 4-1: Expected Subsurface Profile Summary

Geological Profile	Unit	Description
TOPSOIL/FILL	Unit 1: Silty & Gravelly SAND	**Silty SAND & Sandy GRAVEL**, loose, fine grained, fine to coarse sized gravel, with some organic material. Unit 1 is inferred to be uncontrolled and poorly compacted.
AEOLIAN SAND	Unit 2: SAND	**SAND**, medium to coarse grained, loose.
RESIDUAL SOIL	Unit 3: CLAY	**Silty CLAY;** medium plasticity, very stiff to hard.
WEATHERED BEDROCK	Unit 4: SANDSTONE	**SANDSTONE**. Highly to moderately weathered (HW/MW) and very low to medium strength rock to 3.8m/>6.2m depth, over moderately to slightly weathered (MW/SW) and medium to high strength rock.

The proposed development will have a three-level basement extending to a maximum of ~11m depth (~RL33.7) which is expected to be through fill, aeolian sand, residual clay, and into weathered sandstone bedrock. The expected depth intervals of fill, aeolian sand deposits, residual clays, and sandstone bedrock are shown in Table 4-2.

Table 4-2: Typical Depth Interval of Each Soil/Rock Unit

Unit	Unit Description	Typical Depth Interval of Each Soil/Rock Layer
Unit 1	Topsoil/Fill	0m – 0.6m
Unit 2	Aeolian Sand Deposits	0m/0.6m – 0.6m/1.2m
Unit 3	Residual Clay	0.6m/1.2m – 1.2m/1.4m
Unit 4	Sandstone Bedrock	Below 1.2m/1.4m

4.2 GROUNDWATER

A design groundwater level has not been provided within the provided geotechnical investigation report (groundwater monitoring has not been conducted, but the geotechnical report notes that it should be carried out). However, groundwater was encountered at ~7m depth (~RL39), so the development could potentially require dewatering to temporarily lower the groundwater table by ~5m. EI Australia provided a Geotechnical Opinion of Groundwater Conditions, which stated that:

EI recommends that further groundwater investigations are carried out at the Site in line with DPIE's Minimum Requirements for Building Site Groundwater Investigations and Reporting 2022, including but not limited to installation of additional groundwater wells, long term groundwater level monitoring (3 months minimum), groundwater seepage analyses and preparation of a dewatering management plan. Monitoring and reporting for the works mentioned are expected to take at a total of 4-5 months.

This statement confirms that the proponent hasn't provided complying documentation to assess the groundwater conditions and impact of dewatering. **Therefore, a more detailed hydrogeological assessment, including continuous monitoring from data loggers to accurately determine the normal groundwater level and fluctuations, must be provided by the proponent.**

Given that the proposed basement excavation will extend to RL 33.7 mAHD (and possibly deeper for localised excavations such as footings, lift pits, crane pads, etc.), it is expected that the basement excavation will intersect the groundwater table and extend up to 5m (based on the current information provided on groundwater levels) below the groundwater table. Therefore, dewatering will be required for the proposed development, which will temporarily lower the groundwater table. **The proposed lowering of the groundwater table is expected to be greater than that recommended by the GHD report (expected to be >2m at the boundary based on our experience). This lowering of the groundwater table could be up to seven times greater than allowed under the DCP controls designed to safeguard neighbouring properties.**

No in-situ permeability tests were conducted, however, it is estimated that the weathered Hawksbury sandstone bedrock would have a coefficient of permeability of between 1×10^{-5} and 6×10^{-6} m/s, which is a **moderate inflow rate**. **Due to the physical constraints of this site there are limited methods of mitigating the groundwater drawdown impacts on neighbouring properties.**

4.3 PROPOSED DEWATERING METHODOLOGY

A dewatering management plan for the development has not been provided by the proponent. **A detailed dewatering management plan, including dewatering methodology, modelling and analysis of groundwater drawdown, and impact of groundwater drawdown must be provided by the proponent. Based on the data provided by the proponent, it does not appear to be feasible for this development to comply with the 0.3m groundwater drawdown limit at the site boundary.**

The EI Australia report does provide some guidance and recommendations for dewatering, which recommends the following dewatering procedure (Section 5.4):

Groundwater was observed within Unit 4 (Class III Sandstone) in BH01M at approximately 7 mBEGL [RL 39.0 mAHD], which is expected to be near the expected BEL for the Site. It is inferred that water level measured within the sandstone rock mass is perched groundwater. Hence, we expect some minor seepage inflow along any defects (i.e. bedding partings and inclined joints) and along the soil/rock interface, particularly following a period of heavy rainfall.

However based on EI experience with similar projects, seepage into basement excavations at sites with similar sandstone stratigraphy may be controllable by conventional sump pumping methods for discharge into the storm water network. On this basis the use of a drained basement at this site may be feasible, however it would have to be assessed in detail with additional groundwater investigation, long term monitoring, and inflow seepage analysis carried out with reference to the Department of Planning and Environment (DPIE) guidelines "Minimum requirements for building site groundwater investigation and reporting", dated October 2022, followed then by application to Council and the relevant state authorities for approval to use a drained basement.

For a drained excavation structure, permanent floor and basement wall drainage will need to be maintained throughout the life of the structure. It is expected that such a drainage system would include both retaining wall drains and a sub-floor drainage blanket with slotted drainage pipes connected to a sump-and-pump system, discharging to the storm water system. The assessment for a permanent groundwater control system should also take into account groundwater quality/chemistry which may dictate whether or not groundwater can be pumped into the storm water system. On-going long term maintenance of the drainage and pump systems with the ability to effectively back flush the system will also be required. In the experience of EI, this process is standard practice for basement design and construction.

A Dewatering Management Plan has not been provided, nor any results of numerical modelling to determine groundwater inflow rates , groundwater drawdown, and settlement due to groundwater drawdown, due to temporary dewatering on this project. Therefore, **it is our assessment that a detailed dewatering management plan, including dewatering methodology (and the effectiveness of any proposed method), modelling and analysis of groundwater drawdown, and impact of groundwater drawdown must be provided by the proponent prior to granting any approvals.** However, based on past experience with similar nearby projects, are comments our below:

- Based on an estimated hydraulic conductivity of between 1 x 10^{-5} and 6 x 10^{-6} m/s, the basement excavation extending 5m below the groundwater level, and a four-month dewatering period, we estimate a Short Term Flows for Temporary Dewatering During Construction of well above the WaterNSW threshold of 3ML/year for an exemption from the requirement of a Water Access Licence. Therefore, a Water Access Licence is expected to be required for the development.

- The dewatering for the proposed development will also have to comply with Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023 (WSP 2023) that applies across Sydney's metropolitan groundwater sources (including the coastal sands in the Rose Bay / eastern-Sydney zone). Therefore, any significant groundwater take (e.g. dewatering) will be subject to the rules of the plan: licence requirements, metering, compliance with extraction limits. The plan's objectives reinforce the need to protect aquifer integrity, avoid excessive drawdown, prevent interference with neighbouring works, and protect ecosystems (including those near coastal sands). Large commercial/industrial/major dewatering/groundwater take must demonstrate compliance with the plan's limits (LTAAELs) and supply-works conditions.

- Based on our own assessment of potential groundwater drawdown (no numerical modelling has been provided by the proponent), it is estimated that drawdown of the groundwater table will not just be limited to the site, but exceeds 0.3m of drawdown extending between 15m and 35m away from the excavation boundaries (and therefore exceeding the GHD and Council DCP Amendment 30 recommended value of 0.3m of drawdown up to ~35m away from the site boundaries). Therefore, the area impacted by groundwater drawdown exceeding the GHD recommendation is shown in the aerial photo in Plate 4-1 below, and impacts between 20 and 25 properties.

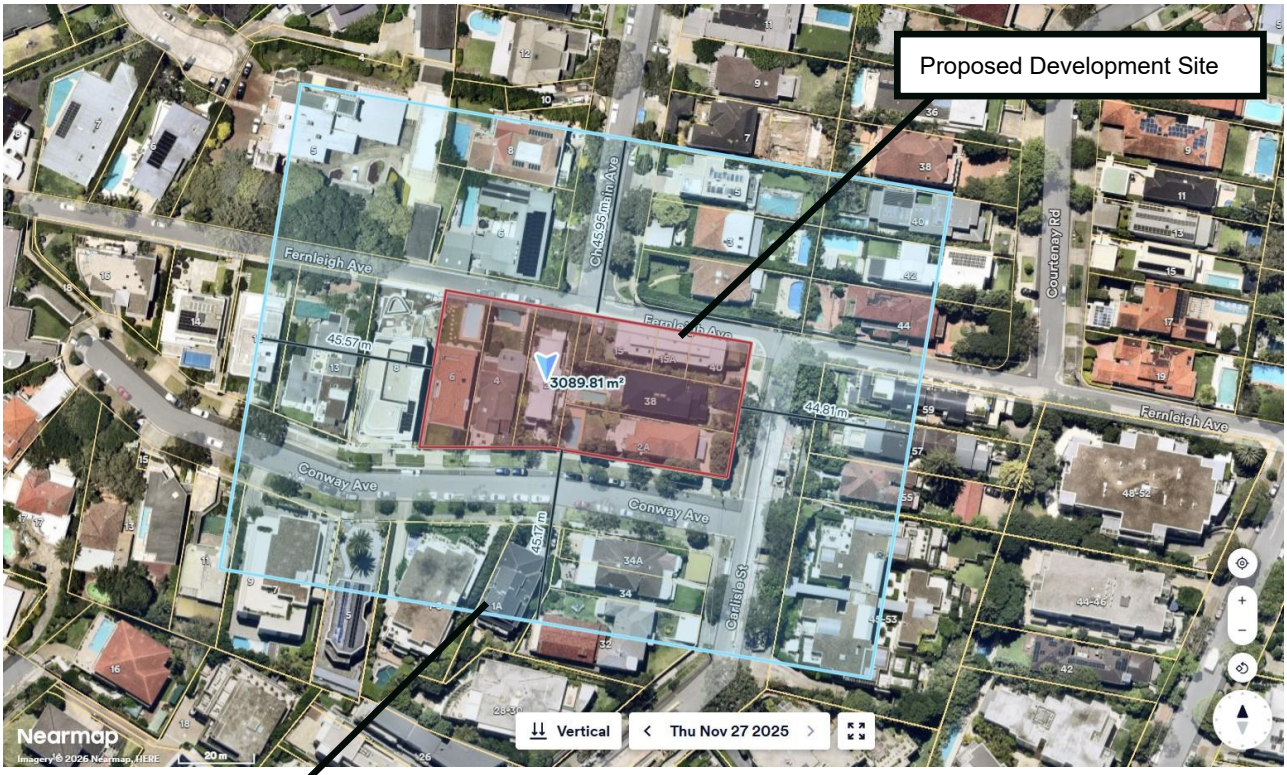

Plate 4-1: Aerial Photo Showing the Approximate Area That will be Impacted by Groundwater Drawdown During Dewatering

- There are existing structures within 5m to 10m of the proposed excavation, and our estimate is that drawdown of the water table could be greater than 2m depth at this set back distance. The GHD report commissioned by Woollahra Municipal Council states that such drawdown can cause settlement and damage to properties, and therefore recommended that **a limit of 0.3m of groundwater drawdown outside the development boundary** be permissible. Given that we estimate that groundwater drawdown will be greater than this affecting between 20 and 25 neighbouring properties, it is assessed that the proposed development would not comply with Council advice under these conditions.

- Plate 4-2 below is a graph prepared by us based on our own assessment showing the potential groundwater drawdown at set-back distances behind the excavation shoring wall. It should be noted that this is our preliminary estimate, as no numerical modelling has been provided by the proponent.

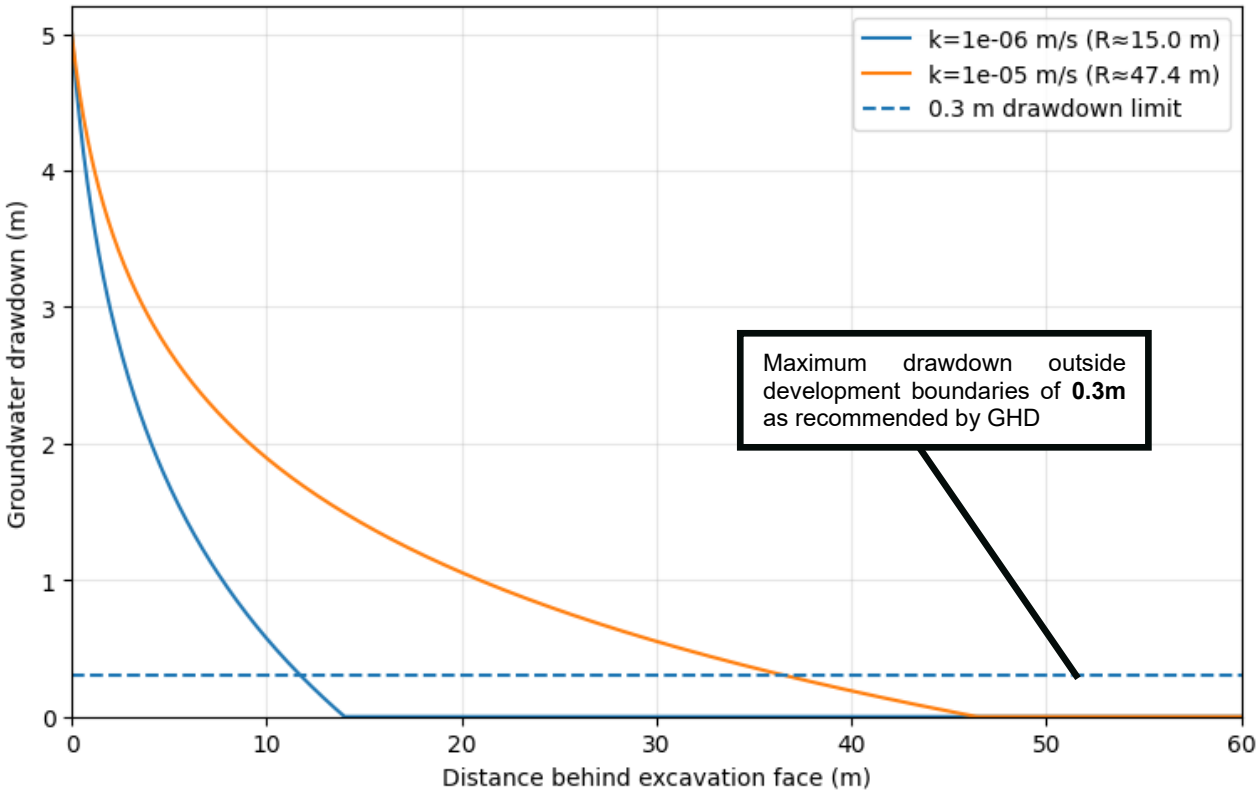

Plate 4-2: Graphical Representation of the Depth of Expected Groundwater Drawdown at Distances Extending From the Excavation Boundary (not based on numerical modelling, as this has not been provided by the proponent)

5 DISCUSSION & RECOMMENDATIONS

5.1 POTENTIAL GEOTECHNICAL IMPACTS OF THE PROPOSED DEVELOPMENT

The site is covered by Holocene age coastal deposits (dune facies) and estuarine interbarrier creek deposits, underlain by residual clays and weathered sandstone bedrock. The basement excavation for this development will extend to a maximum of ~11m depth and will be through topsoil/fill, loose sand deposits, residual clays, and into low to high strength sandstone bedrock.

A design groundwater level has not been provided within the provided geotechnical investigation report (groundwater monitoring has not been conducted, but the geotechnical report notes that it should be carried out). However, groundwater was encountered at ~7m depth (~RL39), so the development could potentially require dewatering to temporarily lower the groundwater table by ~5m. The proponent has not provided any site/project-specific numerical modelling for the proposed dewatering operations, however, based on modelling at nearby similar developments, it is estimated that the dewatering will also temporarily lower the groundwater table between 15m and 45m away from the site, which will impact many neighbouring properties. Groundwater inflow rates are expected to be moderate. **The proposed groundwater drawdown outside the property boundaries materially is expected to exceed the 0.3m threshold recommended by the GHD report**.

EI Australia confirmed that the proponent hasn't provided complying documentation to assess the groundwater conditions and impact of dewatering. **Therefore, a more detailed hydrogeological assessment, including continuous monitoring from data loggers to accurately determine the normal groundwater level and fluctuations, must be provided by the proponent.**

Given the above geotechnical, groundwater, and geological conditions, the adverse impacts due to the proposed development (which will require a deep basement excavation and temporary dewatering) are listed below:

- Excavations adjacent to existing structures have the potential to undermine and destabilise existing structures, causing settlement/subsidence of adjacent ground and damage to existing structures. There are several structures within 10m of the proposed basement excavation, and between 20 and 25 properties that are expected to have groundwater table drawdown under their properties, and would most likely be founded on shallow footings.

- The overburden sands are non-cohesive, with high permeability and little natural strength, meaning unsupported excavations could cause slippage or settlement.

- Excavations adjacent to existing infrastructure (particularly road and sewer network) have the potential to undermine and destabilise existing infrastructure, causing settlement/subsidence of adjacent ground and damage to existing road and sewer network.

- Construction activities that cause ground vibrations (such as large excavation equipment, vibratory rollers, sheet piling installation equipment) can result in settlement/subsidence of adjacent ground and damage to existing structures, road and sewer network. The excavation of high strength sandstone bedrock **is expected to cause significant vibrations** which will have a detrimental effect on surface subsidence and structural damage to adjacent properties. Expected structural damage to neighbouring properties includes internal cracking of plaster, external cracking of masonry, cracking of floor slabs and tiles, cracking of pools, etc.

- Given the expected moderate groundwater inflow rates, when dewatering is being carried out, pump-out rates are also moderate. This can sometimes exceed the capacity of the stormwater network resulting in local flooding, with subsequent settlement/subsidence of adjacent ground and damage to existing structures, road and sewer network. This is not necessarily due to a single development but from the cumulative impact of multiple developments, which is also made worse by the higher frequency of rainfall and flooding events. Some of these impact are irreversible.

- The “The Sydney Plan” produced by the NSW Department of Planning, Housing and Infrastructure states that a Disaster Adaptation Plan (DAP) is being developed to address flood risk for communities, and that the DAP will need to be taken into account in the assessment of development proposals. Appendix I of this document contains flood planning principles that should be applied to strategic planning and development decisions in parts of the Sydney region not covered by a DAP or until a DAP is released. Therefore, these potential flood risks should be considered and assessed in this Development Approval application.

- The proposed development will comprise the excavation of a maximum of ~11m deep basement, which will require construction dewatering to drawdown groundwater levels on site by up to 5m depth. It is estimated that this construction dewatering will lower the groundwater table on adjacent land, extending between 15m and 45m from the development property boundaries. This will drawdown groundwater levels by between 0.3m and 2m depth on between 20 and 25 adjacent properties. Whilst the actual development site may be underlain by sandstone bedrock, the neighbouring properties within this 45m radius may well be underlain by deep Holocene deposits (particularly to the south and east, as indicated on the geology map extract).

- The GHD report commissioned by Woollahra Municipal Council states that such drawdown can cause settlement and damage to properties, and therefore recommended that a limit of 0.3m of groundwater drawdown outside the development boundary be permissible. It is estimated that groundwater drawdown could be greater than this affecting between 20 and 25 neighbouring properties, so it is assessed that the proposed development may not comply with Council advice or local development planning controls.

- There are existing structures within 5m to 10m of the proposed excavation, and it is estimated that drawdown of the water table could be up to 2m depth at this set back distance. This could potentially result in ground settlement/subsidence up to 5mm/10mm (or more if the shoring deflects excessively), and expected damage to neighbouring properties includes internal cracking of plaster, external structural cracking of masonry, cracking of floor slabs and tiles, cracking of pools, etc.. We recommend that the development is redesigned so that groundwater drawdown on adjacent properties do not exceeds the 0.3m threshold recommended by the GHD report.

- There are numerous examples of construction dewatering causing damage to neighbouring properties in the Rose Bay and Double Bay areas (see Section 5.2). There is also the well-known case of the Mascot Towers, where construction dewatering on a neighbouring site caused extensive structural damage to the Mascot Towers apartment building. These examples highlight the risk and danger of excavating deep basements and dewatering next to existing structures.

- Construction dewatering will interrupt natural groundwater flow paths and gradients, as well changing water chemistry and salinity. By installing a sheet pile cut-off wall, groundwater flows can be held up or dammed. This can result in creating an upstream mound, reduce downstream recharge, change hydraulic gradients, and force groundwater to other aquifer zones. Consequences of this includes increasing pore pressures in the area of mounding, risk of hydraulic uplift, settlement of ground levels, and changing natural groundwater regimes.

- The amount of proposed excavation (~15,000m^3 of soil for the property area of ~3,000m^2, or ~5,000m^3 per 1,000m^2) vastly exceeds the Council's recommended limits.

- We estimate that over a four-month dewatering period that a large volume of groundwater will be extracted. This volume is expected to be well above the WaterNSW threshold of 3ML/year for an exemption from the requirement of a Water Access Licence. Therefore, a Water Access Licence is expected to be required for the development.

- The dewatering for the proposed development will also have to comply with Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023 (WSP 2023) that applies across Sydney's metropolitan groundwater sources (including the coastal sands in the Rose Bay / eastern-Sydney zone). Therefore, any significant groundwater take (e.g., dewatering) will be subject to the rules of the plan: licence requirements, metering, compliance with extraction limits. The plan's objectives reinforce the need to protect aquifer integrity, avoid excessive drawdown, prevent interference with neighbouring works, and protect ecosystems (including those near coastal sands). Large commercial/industrial/major dewatering/groundwater take must demonstrate compliance with the plan's limits (LTAAELs) and supply-works conditions.

- Acid sulphate soils (ASS) could be present within the soils in these area. If sulphide-bearing or pyritic soils are disturbed by excavation, thereby allowing ready access of the sulphides to oxygen in the air, a spontaneous or irreversible natural oxidation reaction takes place. This results in the generation of sulphuric acid or acid sulfates. Pyritic soils, which have begun to generate acid, are referred to as Actual Acid Sulfate Soils (AASS). The acid is transported by water, and if allowed to build up in sufficient concentration, poses a direct environmental threat to organisms that come in contact with such waters. While these issues can be managed to some extent, the risk posed by acid sulphate soils, particularly from flooding events, should be considered.

5.2 RECENT EXAMPLES OF ADVERSE IMPACTS

The adverse impacts for deep excavations for developments in these areas that are listed in Section 5.1 are not just hypothetical, and recent examples of adverse impacts are provided below:

- Numerous instances in Double Bay and Rose Bay of structural cracking and damage to existing houses and apartments which are located near or adjacent to building sites were deep excavations with dewatering are being undertaken. Specific instances where structural damage to neighbouring properties that have been attributed to shoring installation (both from vibrations due to installation of sheet piling and over-flighting for bored piles), excavation and dewatering works in Rose Bay are shown in Plate 5-1 and include:

    - Norwich Lane – back wall came away from the neighbouring house

    - Richmond Avenue – structural cracks appeared in block of neighbouring units (stop work issued).

    - Wilberforce Avenue – neighbouring house collapsed. The house was deemed unsafe for occupancy and it was subsequently sold and demolished.

    - Wilberforce Avenue – the same above development caused flooding into the basement of a neighbouring house.

    - O'Sullivan Road – sink holes appeared in the road

- 4 to 8 Patterson Street (Double Bay) - as many as 25 homes up to 200 metres away from the development showed signs of plumbing de-lodgement, subsidence and walls needing extensive repairs due to aggressive dewatering to facilitate the double basement level. Woollahra Council have advised the State Government that at least 25 homes were structurally damaged as a result of the dewatering required for this development's basement.

- 19 Bay Street (Double Bay) – structural cracks up to 100mm wide appeared in building next door, requiring the building to be evacuated. The building is currently being braced but it has been indicated that the extent of damage will require demolition.

- Forest Road (Double Bay) – a room of the neighbouring house was structurally damaged and had to be re-built. Another property on this street suffered where plumbing sank 1.4m, detaching itself from the house.

- Glendon Road (Double Bay) – 4 houses severely damaged. Family displaced for 18 months while the house was re-built

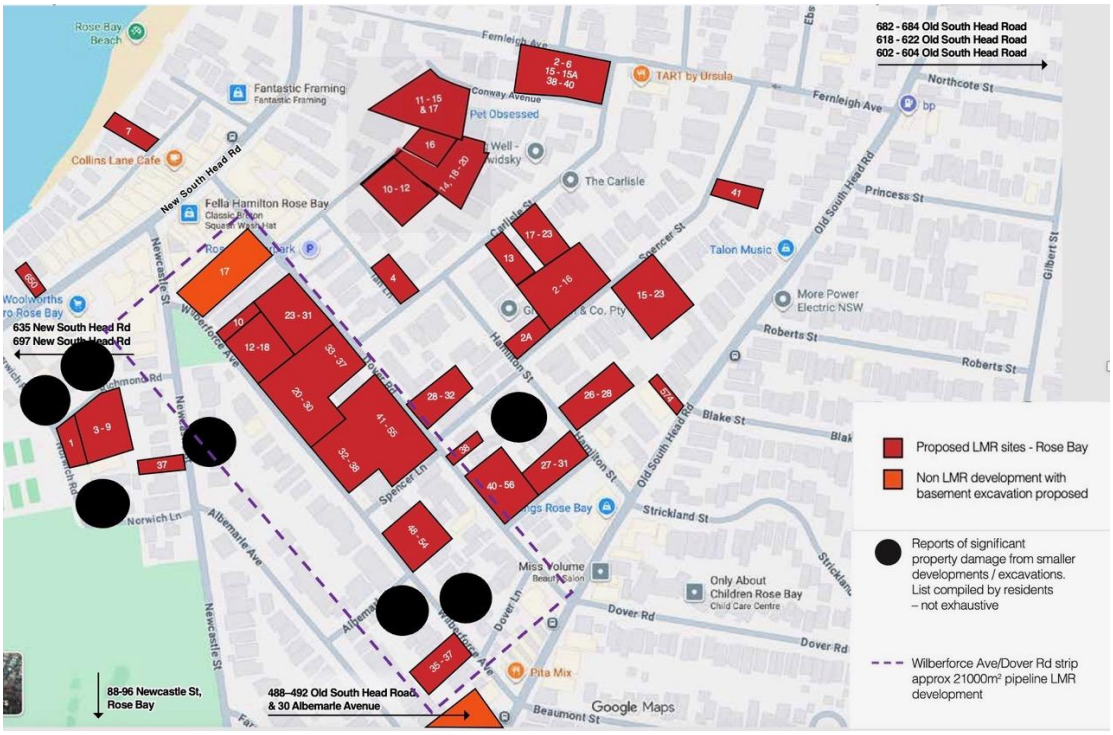

Plate 5-1 – Indicative markup provided by the client showing the development site (yellow), proposed LMR development sites (red), and known properties that have experience structural damage due to adjacent developments.

- The primary suspected cause of the major structural issues at Mascot Towers was due to dewatering activities on the site next door. Although not in the Rose Bay area, the geotechnical conditions are similar (deep aeolian sands and shallow groundwater).

  Many studies have been conducted which prove that lowering the groundwater table (dewatering) will result in groundsurface settlement. When the water table is lowered, the effective load on the subsoil is increased by an

amount equal to the difference between the drained and submerged weights of the entire soil mass between the original and lowered water. This increased overburden pressure causes additional compression and produces a settlement of the groundsurface. Generally, settlement occurs at a faster rate in sandy soils. Such settlements can cause structural damage to surrounding structures.

- We have conducted a general calculation based on typical soil and groundwater conditions using Geo 5 software, which has calculated a typical groundsurface settlement of about 5mm/10mm on properties adjacent to excavations that are being dewatered. This is based on a groundwater table drawdown of 3m, and the subsurface profile described in Section 4.1. If a settlement of 5mm/10mm were to occur under the foundation of most typical masonry houses/units, then structural damage to these structures would be expected. The likely structural damage to such structures includes cracks in walls, ceilings, and floors, walls leaning or bulging, distortion of window and door openings, and service pipes disrupted. Cracking and leaking of sewer pipes. Stormwater pipes, swimming pools, etc. is also expected.

- Recent flooding has been reported in many areas of Rose Bay and Double Bay, apparently associated with the over-loaded stormwater network. This has occurred along Bay Street (which has occurred about 4 or 5 times in less than a year), including large volumes of flood water and formation of sink holes and subsidence.

5.3 RECOMMENDED MITIGATION MEASURES

To reduce the risk of future adverse impacts, it is recommended that the following mitigation measures be implemented as conditions on new developments.

- Not allowing excavations to extend below the groundwater table.

- Not allowing dewatering that draws down the groundwater table.

- Not allowing deep excavations that undermine neighbouring structures without having adequate structural shoring support. This should consider the use of secant piles rather than sheet piles for basement shoring.

- Limiting construction activities that cause ground vibrations (such as large excavation equipment, vibratory rollers, sheet piling installation equipment), particularly the vibrations from sheet piling.

- Limit excavation volumes of soils in high risk acid sulphate soils areas.

5.4 GEOTECHNICAL INSPECTION & MONITORING

It is strongly recommended that the development be redesigned, as the development in its current does not appear to be able to comply with the requirement of groundwater drawdown of 0.3m occurring outside the development boundaries. To monitor this (and all impacts) and to help prevent damage to existing neighbouring structures due to deep excavations, dewatering, and construction vibrations, it is recommended that geotechnical inspection and monitoring be carried out. It is imperative that these records be policed by Council (or an independently appointed geotechnical engineer or hydrogeologist) to ensure compliance.

5.4.1 Groundwater Monitoring

We are of the opinion that the groundwater drawdown of the proposed development will exceed the Council DCP threshold of 0.3m drawdown on adjacent properties. We also do not believe that there are any practical methodologies or mitigation measures that will help achieve that threshold. However, if any development proceeds that will potential intersect the groundwater table, a program of groundwater monitoring would be a mandatory requirement.

- **Required Monitoring**
- **Install Perimeter Piezometers**
    - Minimum: **3–6 piezometers** located between excavation and neighbouring buildings
    - Screened at matching depths to excavation and foundation zones
    - Set to automatically log groundwater level at **hourly intervals**
- **Trigger Levels**
    - **Alert:** drawdown exceeds **0.3m** at the property boundary
    - **Action:** drawdown exceeds **0.3m** (or site-specific trigger per modelling)
    - **Stop Work:** rapid drawdown > **0.3 m/day**, or any excursion beyond model predictions
- **Dewatering Flow Monitoring**
    - Install **flow meters** on dewatering discharge lines
    - Log inflow volume → compare with modelled inflow
    - Unexpected increases indicate:
        - wall leakage
        - sand piping
        - formation instability
- **Water Quality Monitoring**

Important for detecting soil movement into pumps:

- Turbidity / suspended solids
- Presence of fines indicates internal erosion (“piping”) behind shoring.

5.4.2 Excavation Support Monitoring (Shoring / Retention Walls)

The geotechnical report requires *engineered retention* (soldier piles + anchors / sheet piles).

To protect nearby structures (45m away):

- **Inclinometers Installed Behind Shoring**
    - At least **two inclinometers per long wall**, spaced at ~20–25 m
    - Measurement frequency:
        - Daily during first 2–3 m of excavation
        - Twice weekly afterwards
    - Purpose: detect **lateral movement of shoring**
    - Acceptable movement guideline:
        - **< 10mm** for sensitive neighbouring structures
        - **< 0.2% of excavation height** (general practice)
- **Anchor Load Monitoring**

  For ground anchors:
    - Proof load testing
    - Lock-off loads recorded and verified
    - Periodic re-checking during excavation stages
    - Automatic load cells for heavily loaded anchors
- **Shotcrete & Pile Wall Inspections**
    - Daily inspections during excavation
    - Ensure no voiding, no sand boils, no groundwater ingress pockets
    - Verify pile interlocks if secant wall used
- **Toe Stability Inspection**

Loose sands overlying sandstone require:

- Confirmation that piles or sheet piles are **embedded into Unit 4 sandstone**
- Verification via drilling logs and geotechnical sign-off

5.4.3 Surface Settlement Monitoring

Settlement monitoring protects buildings from long-term drawdown and excavation movement.

- **Settlement Markers / Survey Targets**
  - Install on ground surface and on neighbouring buildings
  - Recommended spacing:
    - Every **5–10 m** along boundary
  - Frequency:
    - Weekly before excavation
    - Daily during major excavation
    - Twice weekly during dewatering
  - Accuracy:
    - **≤ ±2 mm vertical**

- **Building Condition Surveys**

Before any site work:

- **Dilapidation survey** of all neighbouring buildings within 45m
- High-resolution photo and video record
- Structural condition documented (cracks, doors/windows distortion, foundations) After significant events (anchor stressing, major dewatering changes):
- Follow-up survey

5.4.4 Vibration Monitoring

The geotechnical report recommends to Limit vibration to 5 mm/s PPV for residential structures.

- **Vibration Monitors**
- Install one monitor along each boundary
    - And additional monitors near most sensitive buildings
- **Monitoring Requirements**
    - Real-time monitoring
    - Audible + visual alarms when approaching **3 mm/s**
    - Mandatory stop-work at **5 mm/s** exceedance
    - Trial excavation and trial pile installation required before full-scale works
- **Activities That Require Vibration Monitoring**
    - Sheet pile driving
    - Rock hammering in sandstone
    - Vibratory compaction
    - Excavator operations near boundary

5.4.5 Excavation Inspections During Construction

- **Geotechnical Engineer to Attend at Key Stages**
    - Excavation to each 1 m depth increment
    - Installation of each anchor level
    - Pile toe exposure
    - Dewatering commencement
    - Any unexpected conditions (boils, sloughing, voids)

- **Daily Contractor + Superintendent Inspections**

Checking for:

- Sand running / ravelling
- Groundwater inflow
- Excessive shoring movement
- Cracks or uplift in ground behind wall
- Pump performance and sump integrity

5.4.6 Documentation and Reporting

- **Daily Logs**
  - Groundwater levels
  - Settlement data
  - Vibration readings
  - Shoring inspection notes
- **Weekly Engineering Review**
  - Compare readings to predicted movement and drawdown curves
  - Issue directions if any movement exceeds 50% of trigger levels

5.4.7 Emergency / Response Actions

If limits exceeded:

- Stop excavation/dewatering
- Reduce pumping rate
- Re-pressurise groundwater by reinjection if required

- Install additional anchors or struts
- Backfill section temporarily
- Notify structural engineer and geotechnical engineer

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