



30 September 2020

Allan Coker
Director - Planning and Development
Woollahra Municipal Council
536 New South Head Road
Double Bay NSW 2028

Our ref: 24DJSZNHUEPC-
1850682920-7
Your ref:

Dear Allan,

Double Bay - Hydrogeological Geotechnical Impacts RE: Proposed Modifications to LEP, DCP and DA Guidelines

1 Introduction

As commissioned by Woollahra Municipal Council (Council), GHD Pty Ltd (GHD) has previously carried out the Geotechnical and Hydrogeological Study in relation to the potential impacts of groundwater alteration as a result of future developments to the existing properties in Double Bay. This study was conducted in 3 stages comprising the identification of study area, desktop review and the impact assessment ("Stage 3 assessment"). The outcomes of these studies are presented in our Groundwater and Geotechnical Assessment Report/GAR (ref. 12512436-6968-21 dated June 2020). Upon the completion of this study, GHD was requested to proceed with the subsequent Stage 4 work which involved the following:

- Review of Council's planning framework and guidelines to determine whether or not the controls and guidelines, which are currently in place to mitigate the potential impacts of the lowering of groundwater table on the existing structures, are adequate. The reviewed documents consisted of:
 - Local Environmental Plan (LEP) 2014
 - Development Control Plan (DCP) 2015
 - Council's Development Application (DA) Guide/DA guideline
- Recommend any changes and their precise nature, where required.

This letter report presents the description and rationale for the proposed modifications. The draft changes proposed on the abovementioned documents are presented as the attachments of this cover letter for Council's review and consideration.

2 Proposed Modifications on Planning Framework and Guidelines

2.1 Overview

Based on our review and initial consultation with Council, we consider that a number of modifications are warranted on the abovementioned planning documents administered by Council. The proposed draft changes on the LEP 2014, DCP 2015 and DA Guideline are specifically denoted in Appendices A, B and

C, respectively, in the attachments. GHD proposed these changes on the basis of outcomes of our Stage 3 assessment. In proposing the modifications, GHD has considered the following functionality of these documents based on information given in Council's website including the hierarchy of development rules (Figure 1 below):

- LEP 2014 is Council's main legal instrument for controlling development and guiding planning decisions made by Council to ensure that growth and development occurs in a planned and coordinated manner consistent with Council and community expectations and needs. It is understood that the LEP is the legally binding document which is available exclusively to the Council. Other legally-binding documents (e.g. State Environmental Planning Policies/SEPPs and Regional Environmental Plans/REPs) are not specific to the Council due to their wider jurisdictional coverage.
- DCP 2015 is the document used by Council in the assessment and determination of Development Applications. A DCP operates with the Council's LEP and contains detailed planning provisions.
- DA Guideline provides guidelines for the preparation of DA submission.

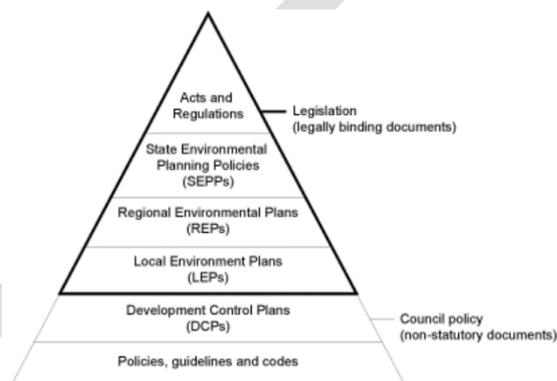


Figure 1 Hierarchy of Development Rules (source: Woollahra Municipal Council website)

Consequently, GHD has adopted the following review process and subsequent assessment:

- We have reviewed the documents in accordance with the hierarchy starting from LEP, followed by DCP and ending with DA Guidelines.
- In proposing the applicable controls, these controls should only be provided in the DCP. They should not be repeated elsewhere to prevent potential discrepancy if any of the 3 documents is to be modified.
- The outcome of previous assessments (including Stage 3 assessment) has been incorporated in our review and assessment.
- GHD has considered comments given by Council's engineers and provided during our presentation to the Council on 26 August 2020.
- Our review has not been carried out from a legal perspective. However, GHD will be able to assist Council in the finalisation of the documents by providing input from the engineering perspective.

The description of the proposed modifications along with the rationales are given in the following sections based on the order shown in the hierarchy of development rules.

2.2 Proposed Changes to Local Environmental Plan (LEP)

The impact of construction (including excavation) to the existing properties and utilities in the vicinity of the construction site could typically be due to several causes including ground movement as a direct result of excavation (loss of support), settlement as a result of groundwater drawdown induced by dewatering as well as the ground-borne vibration. As the current aims of LEP (Section 1.2 of LEP 2014) have not included any direct reference to the impact of groundwater drawdown during the construction on surrounding properties, it is important that these aims are revised to provide a clear reference. We propose to modify Item (m) of Section 1.2 (2). The proposed new sentence is shown below where the additional wording is shown using a red italics style.

- (m) *to minimise excavation and manage impacts, including the potential impact of the change in the groundwater regime induced by the development.*

Subsequent to above, the following changes to Points (1), (2) and (3) of Section 6.2 (Earthworks) are proposed in order to put emphasis on the consideration of groundwater dewatering as part of the development approval process by the consent authority.

6.2 Earthworks

- (1) *The objective of this clause is to ensure that earthworks and associated groundwater dewatering for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.*
- (2) *Development consent is required for earthworks and associated groundwater dewatering unless —*
 - (a) *the earthworks and associated groundwater dewatering are exempt development under this Plan or another applicable environmental planning instrument, or*
 - (b) *the earthworks and associated groundwater dewatering are ancillary to development that is permitted without consent under this Plan or to development for which development consent has been given*
- (3) *In deciding whether to grant development consent for earthworks and associated groundwater dewatering (or for development involving ancillary earthworks), the consent authority must consider the following matters—*
 - (a) *the likely disruption of, or any detrimental effect on, drainage patterns and soil stability in the locality of the development,*
 - (b) *the effect of the development on the likely future use or redevelopment of the land,*
 - (c) *the quality of the fill or the soil to be excavated, or both,*
 - (d) *the effect of the development on the existing and likely amenity of adjoining surrounding properties,*
 - (e) *the source of any fill material and the destination of any excavated material,*

- (f) the likelihood of disturbing relics,*
- (g) the proximity to, and potential for adverse impacts on, any waterway, drinking water catchment or environmentally sensitive area,*
- (h) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.*

GHD assumes that the above modifications in LEP will provide an overarching statement on the requirement of assessing and limiting the adverse impact of groundwater drawdown. The detailed provisions including controls are to be provided in the DCP.

2.3 Proposed Changes on Development Control Plan (DCP)

The proposed modifications in the DCP consist of new controls or the revisions of existing content which are relevant to the impact of groundwater drawdown within the Double Bay precinct. These are detailed in Table 1 below. The rationale for each proposed modification is also given. The party preparing and submitting the Development Application is denoted as “the Applicant”.

We note that the proposed controls are applicable for the “below ground structures”. The definition of “below ground structures” as proposed in the DCP is any excavation which is deeper than 1 m deep and assumed to have a potential to intersect the groundwater, unless proven otherwise by using site specific information.

Table 1 Details of Proposed Modifications in DCP and Rationales

Item No.	Section in DCP	Description of Proposed Modifications (proposed changes in <i>italics</i>) in the order of appearance in DCP	Rationale for Changes
1	General	<p>Change the wording “<i>adjacent properties</i>” or “<i>adjoining properties</i>” to one of the followings:</p> <ul style="list-style-type: none"> • <i>Surrounding properties</i>; • <i>Properties in Double Bay precinct</i>; or • <i>Properties in the vicinity of the development</i>. <p>Note: Council should assess the above wording by considering the description given in the right column</p>	<p>Our Stage 3 assessment indicated that the groundwater drawdown as a result of the future development with dewatering could extend up to a considerable distance away from the development site. This observation was consistent with the recent measurement of groundwater levels made by Jeffery and Katauskas (JK) on the property located at 14 Forest Road which occurred concurrently with the excavation work at 4 – 8 Patterson Road. The two sites are at least 100 m apart.</p> <p>Consequently, the extent of impact of groundwater drawdown considered in the assessment of Development Application (DA) should not be confined to the <i>adjoining</i> properties.</p>
2	Paragraph 3 of the general overview of Section D5.6.7	<p>Delete the following sentence:</p> <p><i>The groundwater level in the valley area is generally high and varies between RL 1.0 and RL 2.5.</i></p> <p>Replace with following sentence:</p> <p><i>The groundwater level generally varies throughout the Double Bay area and fluctuates with seasons.</i></p>	<p>The range of groundwater fluctuations analysed in our Stage 3 assessment was wider than the range given in the DCP 2015. It is understood that this range was likely introduced as part of the earlier DCP (DCP 2002), which was based on the earlier sets of groundwater monitoring data. Usually, this range could vary with time or as a result of man-made activities (i.e. developments).</p> <p>GHD considers that it would be reasonable to request the Applicant to undertake the groundwater monitoring prior to the DA submission and during the construction. It could be beneficial if Council can maintain some operational groundwater wells/standpipes and conduct periodic monitoring to obtain information on the range of groundwater levels. This information would be useful for the internal record, assessing the DA and checking the compliance of any ongoing construction dewatering.</p>
3	New Control C1 in Section D5.6.7	<p>Add new sentence for Control C1:</p> <p><i>All development must satisfy the above design objectives</i></p>	<p>This control is introduced to impose the overarching design objectives to the Applicant.</p>

Item No.	Section in DCP	Description of Proposed Modifications (proposed changes in <i>italics</i>) in the order of appearance in DCP	Rationale for Changes
4	New Control C2 in Section D5.6.7	Add new sentence for Control C2: <i>Development Applications must include a design statement and supporting drawings (if necessary) that show the design measures proposed to minimise risk to ensure that no adverse impacts will occur.</i>	As part of the DA submission, the design reports and drawings should be submitted by the Applicant. It is important that approach and assumptions are clearly stated. Drawings should be included to show clearly the adopted design measures, where applicable, for examples: recharge/reinjection well configurations, cut-off wall, locations of monitoring wells/standpipes, etc.
5	New Control C3 in Section D5.6.7	Add new sentence for Control C3: <i>Geotechnical and Hydrogeological reports with supporting design statements must be submitted with all development applications which include below ground structures.</i>	As per above (Item 4). The Geotechnical and Hydrogeological reports should form part of the design reports attached in DA submission.
6	New Control C4 in Section D5.6.7	Add new sentence for Control C4: <i>A qualified and experienced geotechnical and/or hydrogeological engineer must prepare the reports.</i> <i>The reports must include a site specific risk assessment matrix with appropriate definitions for qualitative measures of likelihood and consequences for assessing the risk of damage to existing developments by the new development.</i>	The preparation of Geotechnical and Hydrogeological reports is expected to involve not only technical works but also the identification and assessment of all risks as well as the proposal of appropriate measures to control/ mitigate these risks. Hence, it is imperative that the reports are prepared by qualified and experienced engineers who have relevant competency in undertaking such assessments, i.e. qualified geotechnical engineer.
7	New Control C5 in Section D5.6.7	Add new sentence for Control C5: <i>Where groundwater is present and dewatering is likely to occur on the site the following measures must be implemented:</i> <ul style="list-style-type: none"> <i>A minimum of two piezometers must be located within the site or in close proximity to it</i> 	Standpipe piezometers (or groundwater monitoring wells) should be used to monitor the groundwater levels at various locations at any given time. These measurements are conducted for following purposes: <ul style="list-style-type: none"> Monitor the pre-construction groundwater levels prior to the DA submission. Monitor the groundwater levels during the construction when the dewatering takes place. Monitor the groundwater levels after the dewatering system is turned off.

Item No.	Section in DCP	Description of Proposed Modifications (proposed changes in <i>italics</i>) in the order of appearance in DCP	Rationale for Changes
		<ul style="list-style-type: none"> • <i>Where piezometers are established in the footpath area a permanent installation with a cast iron cover and concrete surround must be provided</i> • <i>Existing piezometers must be used where they are available</i> • <i>The groundwater level monitoring must be undertaken using either electronic data loggers, or manual monitoring on regular time intervals commensurate with the expected groundwater level fluctuations. If manual monitoring is employed, daily reading will usually be required. This will allow fluctuations in the site groundwater level to be calibrated against natural fluctuations in the groundwater level.</i> 	<p>We consider that it is reasonably practical to request the Applicant to install at least 2 standpipes within the site or in close proximity to it where full access is available to the Applicant or its representative. These standpipes should be positioned behind the excavation line or shoring wall to avoid damaging them during the excavation. As per Item 4 above, the locations of these standpipes and their configurations (screen depths, lengths, etc) should be shown in the relevant reports and drawings relative to the excavation footprint, dewatering spear points and other important features (e.g. reinjection wells, etc), as applicable.</p> <p>It is prudent that groundwater levels at locations away from the site are monitored during construction to assess the extent of the dewatering impact. There could be possible limitation on available space outside the development site where the Applicant is able to (or allowed to) install and monitor the standpipes. There are some options that Council could consider:</p> <ul style="list-style-type: none"> • Council imposes a requirement where the Applicant will need to install new standpipe piezometers on “case by case” basis. • Council maintains a number of operational monitoring wells/standpipes within Double Bay precinct which can be used for the purpose of groundwater monitoring. Council can carry out the monitoring independently or may decide to allow the Applicant to access those standpipes for data collection prior to or during construction. <p>The above option should be determined by Council. If Council opts to maintain a number of operational standpipes, it is advisable that a qualified engineer is consulted in relation to the monitoring method and regime to suit Council’s program.</p> <p>It is usually convenient that a data logger is installed in each standpipe to allow for the regular monitoring (e.g. every 6 hours, daily, weekly or other intervals over a specific duration depending on the logger capacity). The readings collected in the data logger can be downloaded manually or transmitted remotely via data telemetry.</p>

Item No.	Section in DCP	Description of Proposed Modifications (proposed changes in <i>italics</i>) in the order of appearance in DCP	Rationale for Changes
8	New Control C6 in Section D5.6.7	<p>Add new sentence for Control C6:</p> <p><i>Temporary changes to the groundwater level, due to construction, will not exceed 0.2 m from the average monitored pre-construction groundwater level unless calculations using the results of specific field testing, support a greater change and demonstrate that the change will not induce settlements greater than the characteristic surface movement of a Class S site as defined in Table 2.3 of Australian Standard AS2870-2011.</i></p>	<p><i>Limit of Temporary Groundwater Changes due to Dewatering</i></p> <p>Based on our Stage 3 assessment, a drawdown of about 200 mm could induce a settlement of 15 mm in some locations within the Double Bay precinct. The allowable settlement of 15 mm was recommended in our Stage 3 report on the basis of the equivalence of Class S site as defined in AS2870-2011. This allowable settlement was proposed to limit the risk of any damage relating to no worse than a typical “aesthetic” damage. Because the groundwater drawdown caused by dewatering at a given site could extend over a long distance, the minimum drawdown of 200 mm has been recommended for the entire Double Bay precinct.</p> <p>Prior to DA submission, the Applicant should be requested to undertake pre-construction groundwater monitoring to obtain the range of groundwater levels over a period. This monitoring should not be undertaken in concurrence with any ongoing event of dewatering. Then, the average of the monitored range of groundwater levels should be taken as a baseline level. Although a minimum period of pre-construction monitoring is advisable to be at least 6 months, some developers may not have adequate time or resources to undertake this monitoring. Typically, a longer monitoring duration will benefit both the Applicant and the Council as more data and wider range of levels will be available for the assessment.</p> <p>The following points should be highlighted in relation to Control C6:</p> <ul style="list-style-type: none"> • The proposed 200 mm groundwater drawdown limit has taken into consideration the critical scenario when the baseline level obtained from pre-construction monitoring coincides with the historic low groundwater level, whereby the additional lowering of 200 mm brings the groundwater to below the lowest level which has occurred in the past. • To limit the settlement of any recently constructed buildings (or old buildings with newly rendered walls) to less than 15 mm, the proposed drawdown limit is considered to be suitably applied even when the current water level is within the historical range of groundwater fluctuation.

Item No.	Section in DCP	Description of Proposed Modifications (proposed changes in <i>italics</i>) in the order of appearance in DCP	Rationale for Changes
			<ul style="list-style-type: none"> Owing to the sandy ground conditions within the Double Bay area, the lowering of groundwater caused by dewatering at a given construction site is likely to extend over a long distance away of the dewatering source. Therefore, it is prudent to adopt a blanket 200 mm drawdown limit across the Double Bay area in order to limit the influences on housings within the settlement susceptible areas such as to the south of Kiaora Lane where the compressible peat layers was observed to be extensive. <p>As presented in our GAR, it is highlighted that a number of design measures may be available to limit the groundwater drawdown whilst allowing for the dewatering. These measures include the provision of groundwater recharge/reinjection wells, fully sealed excavation, etc. These design measures, if introduced, should be assessed and presented in the reports lodged as part of the DA submission.</p> <p><i>Comparison between the newly proposed groundwater drawdown limit and the existing limits stated in the current DA guidelines</i></p> <p>There are four drawdown limits given in the current DA guidelines that are associated with the different conditions. They are:</p> <ol style="list-style-type: none"> temporary change to the groundwater level during construction will not exceed 300 mm. within a shadow zone of an earlier construction, temporary changes in the level of the water table during construction will not exceed 150 mm. permanent change in the water table due to the carrying out of the development will not exceed 200 mm. within a shadow zone of an earlier construction, the permanent change in the water table due to the carrying out of the development will not exceed 100 mm. <p>We propose to replace the above four limits by a single drawdown limit of 200 mm on the basis of the following:</p>

Item No.	Section in DCP	Description of Proposed Modifications (proposed changes in <i>italics</i>) in the order of appearance in DCP	Rationale for Changes
			<ul style="list-style-type: none"> The proposed new limit is slightly more stringent than the current temporary drawdown limit of 300 mm for condition (a). For condition (b) where an earlier construction dewatering has already caused a temporary groundwater drawdown of 300 mm, any further developments within the area can still exercise a groundwater drawdown of up to 150 mm. The newly proposed drawdown limit of 200 mm is however a non-negotiable total limit. Where a new development with dewatering is to occur while another construction dewatering is ongoing, the new development will not be able to dewater any further if a total drawdown limit of 200 mm has been reached by the ongoing construction. The drawdown limits for conditions (c) and (d) for the permanent ground water changes are no longer considered to be relevant to the DCP. Based on our Stage 3 assessment presented in the GAR, the cumulative impact of the basements (providing partial depth cut-off or full depth cut-off) in long term within the residential and commercial area was not expected to induce drawdown of more than 200 mm except for a localised area to the north of Double Bay Centre, but the induced settlement for this area is less than 15 mm because of the absence of compressible peat layer in this localised area. <p><i>Analysis/Calculations using Site Specific Data</i></p> <p>As outlined above, the ground conditions could have a significant influence on the groundwater drawdown and induced settlement. The limiting drawdown of 200 mm was recommended on the basis of areas which were assessed to have more sensitivity of settlement response to the groundwater drawdown. In the GAR, it was noted that ground conditions vary across the Double Bay precinct.</p> <p>To give a degree of flexibility, the Applicant can be allowed to cause more drawdown if it can be demonstrated (<i>by means of an engineering analysis</i>) that additional drawdown will not result in settlement greater than the characteristic surface movement related to Class S site (AS2870-</p>

Item No.	Section in DCP	Description of Proposed Modifications (proposed changes in <i>italics</i>) in the order of appearance in DCP	Rationale for Changes
			<p>2011). This analysis should only be conducted by using the results of specific field testing comprising adequate geotechnical/hydrogeological investigation and laboratory testing.</p> <p>It is advisable that Council seeks an advice from qualified personnel to assist in assessing the analysis submitted by the Applicant.</p>
9	New Control C7 in Section D5.6.7	<p>Add new sentence for Control C7:</p> <p><i>As required by Council's Guidelines, geotechnical and hydrogeological reports must contain an Implementation Plan, including a Monitoring Program, Contingency Plan and Construction Methodology..</i></p>	<p>To ensure that the design objectives are satisfied and all controls implemented, it should be made compulsory that an Implementation Plan is developed and submitted along with or within the Geotechnical and Hydrogeological Report. This plan should present the summary of construction methodology and monitoring program. A contingency plan should also be included to outline the steps which need to be conducted to respond to any unforeseen adverse situation (e.g. situation involving potential structure damage due to excessive drawdown).</p>

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2.4 Proposed Changes on DA Guidelines

In the DA guidelines, the modifications are generally proposed to maintain consistency with the proposed changes in DCP, for example: the replacement of terminology “adjoining properties” by “surrounding properties”. In the sub-section “Investigation”, a change is proposed on the third point of “the required level of investigation” which results in 2 options of method for obtaining continuous strength log of the subsurface soils for the development with below ground structures:

- Option 1 employs Cone Penetration Test (CPT) with or without pore pressure measurement to allow for the assessment of thicker soil profile (>3 m) or soil profile with compressible layers (e.g. soft to firm peat, soft to firm clay).
- Option 2 employs Dynamic Cone Penetration (DCP) test with can be typically undertaken by using portable equipment. This test can be employed for soil profile comprising soil with a total thickness of no more than 3 m and without compressible soil layers.

To obtain the information regarding the soil type, it is recommended that the borehole investigation is completed prior to the undertaking of CPT or DCP.

In the sub-section “Hydrogeology”, the majority of existing content is proposed to be removed as they have been proposed for insertion in the DCP and should not be repeated in the DA guidelines.

3 Other Matters

It is our understanding that the matter relating to the approval for the undertaking of dewatering may potentially involve WaterNSW. Based on our experience, WaterNSW is currently responsible for reviewing and approving/rejecting the application for the temporary dewatering licence for the developments. It is understood that this is associated with “Water Supply Works” approval administered in accordance with Water Management Act 2000. GHD appreciates that Council may not be able to influence the internal procedure within WaterNSW. However we understand that Council will be able to determine the outcome of Development Application. Based on information supplied by Council, we understand that a similar clause to the one proposed for LEP (refer Section 2.2 above) has been incorporated in some form in the LEP documents for Hunter’s Hill council and Northern Beaches council (including Manly). Therefore, we consider that the proposed modifications to the LEP, DCP and DA guidelines above can be implemented within the Council’s process of approving the DA.

GHD understands that Council is currently in the process of consulting legal counsel pertinent to the proposed modification of LEP. It is also understood that Council is reviewing the proposed modifications in the DCP and DA guidelines. GHD can work with Council in finalising the proposed modifications.

Sincerely
GHD

Bosco Poon

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Appendix A – Proposed Modification to Local Environmental Plan (LEP)

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Woollahra Local Environmental Plan 2014



Part 1 Preliminary

1.1 Name of Plan

This Plan is *Woollahra Local Environmental Plan 2014*.

1.1 AA Commencement

This Plan commences 4 months after it is published on the NSW legislation website.

1.2 Aims of Plan

- (1) This Plan aims to make local environmental planning provisions for land in Woollahra in accordance with the relevant standard environmental planning instrument under section 3.20 of the Act.
- (2) The particular aims of this Plan are as follows—
 - (a) to ensure that growth occurs in a planned and co-ordinated way,
 - (b) to promote the management, development, conservation and economic use of property,
 - (c) to provide for an appropriate balance and distribution of land for commercial, retail, residential and tourist development and for recreation, open space, entertainment and community facilities,
 - (d) to provide greater population densities in and around centres that are well serviced by public transport,
 - (e) to facilitate opportunities, in suitable locations, for diversity in dwelling density and type,
 - (f) to conserve built and natural environmental heritage,
 - (g) to protect amenity and the natural environment,
 - (h) to minimise and manage stormwater and flooding impacts,
 - (i) to protect and promote public access to and along the foreshores,
 - (j) to promote a high standard of design in the private and public domain,
 - (k) to minimise and manage traffic and parking impacts,
 - (l) to ensure development achieves the desired future character of the area,

- (m) to minimise excavation and manage impacts, including the potential impact of the change in the groundwater regime induced by the development.

1.3 Land to which Plan applies

This Plan applies to the land identified on the [Land Application Map](#).

1.4 Definitions

The Dictionary at the end of this Plan defines words and expressions for the purposes of this Plan.

1.5 Notes

Notes in this Plan are provided for guidance and do not form part of this Plan.

1.6 Consent authority

The consent authority for the purposes of this Plan is (subject to the Act) the Council.

1.7 Maps

- (1) A reference in this Plan to a named map adopted by this Plan is a reference to a map by that name—
- (a) approved by the local plan-making authority when the map is adopted, and
 - (b) as amended or replaced from time to time by maps declared by environmental planning instruments to amend or replace that map, and approved by the local plan-making authority when the instruments are made.
- (1AA) (Repealed)
- (2) Any 2 or more named maps may be combined into a single map. In that case, a reference in this Plan to any such named map is a reference to the relevant part or aspect of the single map.
- (3) Any such maps are to be kept and made available for public access in accordance with arrangements approved by the Minister.
- (4) For the purposes of this Plan, a map may be in, and may be kept and made available in, electronic or paper form, or both.

Note. The maps adopted by this Plan are to be made available on the official NSW legislation website in connection with this Plan. Requirements relating to the maps are set out in the documents entitled *Standard technical requirements for LEP maps* and *Standard requirements for LEP GIS data* which are available on the website of the Department of Planning and Environment.

1.8 Repeal of planning instruments applying to land

- (1) All local environmental plans and deemed environmental planning instruments applying only to the land to which this Plan applies are repealed.

Note. The following local environmental plans are repealed under this provision—

[Woollahra Local Environmental Plan 1995](#)

- (2) All local environmental plans and deemed environmental planning instruments applying to the land to which this Plan applies and to other land cease to apply to the land to which this Plan

the works, and

- (b) the preliminary assessment has been provided to the consent authority and the consent authority has confirmed the assessment by notice in writing to the person proposing to carry out the works.
- (5) Despite subclause (2), development consent is not required under this clause for the carrying out of any of the following works by a public authority (including ancillary work such as excavation, construction of access ways or the supply of power)—
 - (a) emergency work, being the repair or replacement of the works of the public authority, required to be carried out urgently because the works have been damaged, have ceased to function or pose a risk to the environment or to public health and safety,
 - (b) routine maintenance work, being the periodic inspection, cleaning, repair or replacement of the works of the public authority (other than work that involves the disturbance of more than 1 tonne of soil),
 - (c) minor work, being work that costs less than \$20,000 (other than drainage work).
- (6) Despite subclause (2), development consent is not required under this clause to carry out any works if—
 - (a) the works involve the disturbance of less than 1 tonne of soil, and
 - (b) the works are not likely to lower the watertable.

6.2 Earthworks

- (1) The objective of this clause is to ensure that earthworks **and associated groundwater dewatering** for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.
- (2) Development consent is required for earthworks **and associated groundwater dewatering** unless—
 - (a) the earthworks **and associated groundwater dewatering** are exempt development under this Plan or another applicable environmental planning instrument, or
 - (b) the earthworks **and associated groundwater dewatering** are ancillary to development that is permitted without consent under this Plan or to development for which development consent has been given.
- (3) In deciding whether to grant development consent for earthworks **and associated groundwater dewatering** (or for development involving ancillary earthworks), the consent authority must consider the following matters—
 - (a) the likely disruption of, or any detrimental effect on, drainage patterns and soil stability in the locality of the development,
 - (b) the effect of the development on the likely future use or redevelopment of the land,
 - (c) the quality of the fill or the soil to be excavated, or both,
 - (d) the effect of the development on the existing and likely amenity of **adjoining surrounding** properties,

- (e) the source of any fill material and the destination of any excavated material,
- (f) the likelihood of disturbing relics,
- (g) the proximity to, and potential for adverse impacts on, any waterway, drinking water catchment or environmentally sensitive area,
- (h) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

Note. The *National Parks and Wildlife Act 1974*, particularly section 86, deals with harming Aboriginal objects.

6.3 Flood planning

- (1) The objectives of this clause are as follows—
 - (a) to minimise the flood risk to life and property associated with the use of land,
 - (b) to allow development on land that is compatible with the land’s flood hazard, taking into account projected changes as a result of climate change,
 - (c) to avoid significant adverse impacts on flood behaviour and the environment.
- (2) This clause applies to—
 - (a) land identified as “Flood planning area” on the [Flood Planning Map](#), and
 - (b) other land at or below the flood planning level.
- (3) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development—
 - (a) is compatible with the flood hazard of the land, and
 - (b) will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and
 - (c) incorporates appropriate measures to manage risk to life from flood, and
 - (d) will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and
 - (e) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.
- (4) A word or expression used in this clause has the same meaning as it has in the *Floodplain Development Manual* (ISBN 0 7347 5476 0) published by the NSW Government in April 2005, unless it is otherwise defined in this clause.
- (5) In this clause—

flood planning level means the level of a 1:100 ARI (average recurrent interval) flood event, plus 0.5 metre freeboard.

Appendix B – Proposed Modification to Development Control Plan (DCP)

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D5.6.7 Geotechnology and hydrogeology

Council will normally require geotechnical and hydrogeological reports for development applications which include below ground structures.

This is because the subsurface conditions within the Double Bay Commercial Centre generally comprise water charged alluvial sediments to great depth. The alluvium is predominantly sand which is typically loose near the surface but may at some locations be interlayered with soft compressible clay or peat bands at depth.

~~The groundwater level in the valley area is generally high and varies between RL 1.0 and RL 2.5.~~
The groundwater level generally varies throughout the Double Bay area and fluctuates with the seasons.

Any proposed development with below ground structures must consider the sub-surface conditions and the effects of construction on adjacent surrounding properties. In addition, those which are likely to extend below the level of seasonal fluctuations in the groundwater table, must also consider the effect of any changes induced in the sub-surface water levels and the groundwater flow patterns on adjacent surrounding properties. Unless site specific information exists to the contrary, excavations deeper than 1m must be assumed to have this potential to intersect the groundwater level and shall be considered as below ground structures.

Council's principal objective is to ensure there are no adverse geotechnical and hydrogeological impacts on any surrounding properties and infrastructure as a result of development, during and after construction. Typically, adverse geotechnical impacts may include vibration induced settlements from construction methods and equipment and inadequate support of adjacent land during and after construction. Typically adverse hydrogeological impacts may include settlement induced by changes in the groundwater level and seepage problems.

Objectives

Buildings must be designed and constructed with appropriate support and retention systems to ensure that:

- 01 There will be no ground settlement or movement, during and after construction, sufficient to cause an adverse impact on adjoining surrounding properties and infrastructure.
- 02 There will be no change to the ground water level, during and after construction, sufficient to cause an adverse impact on surrounding properties and infrastructure.
- 03 Vibration during construction is minimised or eliminated to ensure no adverse impact on surrounding properties and infrastructure.
- 04 The risk of damage to adjacent existing property and infrastructure by the new development will be reduced to a level no greater than that from an event with an "unlikely" likelihood of occurrence and "minor" consequence.

Note: "adverse impact" means any damage caused to the improvements on properties by the demolition, excavation or construction on the development site.

Controls

- C1 All development must satisfy the above design objectives.
- C2 Development applications must include a design statement and supporting drawings that show the design measures proposed to minimise risks and to ensure that no adverse impacts will occur.
- C3 ~~Excavation below 1m is accompanied by a geotechnical report and a structural report to demonstrate that the works will not have any adverse effect on the neighbouring structures.~~ Geotechnical and hydrogeological reports with supporting design statements must be submitted with all development applications which include below ground structures.

Note: Council may identify other circumstances where these reports are required. All reports must be prepared in accordance with Council's guidelines. Council may also require the preparation and submission of a pre-commencement dilapidation report for properties neighbouring the development.

~~Development applications include a design statement and supporting drawings (if necessary) that show the proposed design measures minimise risk and ensure that no adverse impacts will occur.~~

- C4 A qualified and experienced geotechnical and/or hydrogeological engineer must prepare the reports. The reports must include a site specific risk assessment matrix with appropriate definitions for qualitative measures of likelihood and consequences for assessing the risk of damage to existing developments by the new development.
- C5 Where groundwater is present and dewatering is likely to occur on the site the following measures must be implemented:
- A minimum of two piezometers must be located within the site or in close proximity to it
 - Where piezometers are established in the footpath area a permanent installation with a cast iron cover and concrete surround must be provided
 - Existing piezometers must be used where they are available
 - The groundwater level monitoring must be undertaken using either electronic data loggers, or manual monitoring on regular time intervals commensurate with the expected groundwater level fluctuations. This will allow fluctuations in the site groundwater level to be calibrated against natural fluctuations in the groundwater level.
- C6 *Temporary* changes to the groundwater level, due to construction, must not exceed 0.2 m from the average monitored *pre-construction groundwater level* unless calculations using the results of specific field testing, support a greater change and demonstrate that the change will not induce settlement greater than the characteristic surface movement of a Class S site as defined in Table 2.3 of Australian Standard AS2870-2011.

-
- C7 As required by Council's Guidelines, geotechnical and hydrogeological reports must contain an Implementation Plan, including a Monitoring Program, Contingency Plan and Construction Methodology.

The applicant is advised to have an appropriate current insurance policy to cover the reinstatement/repair of damages to surrounding properties as a result of new development. In addition, statements for the design and construction of the below ground structures must be supplied from a suitably qualified and experienced geotechnical or hydrogeological engineer. The design statement must confirm that the design of the below ground structures has been undertaken in accordance with approved standards (such as Australian or British Standards, etc.) where applicable. The engineer must also provide a certificate to confirm that the completed structure conforms to the design.

Appendix C – Proposed Modification to the Development
Application (DA) Guidelines for Geotechnical and
Hydrogeological Reports

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Attachment 6
Geotechnical and Hydrogeological Reports

Guidelines for geotechnical and hydrogeological reports

Introduction

Guidelines have been prepared to assist applicants, architects and engineers to understand our requirements for the preparation of geotechnical and hydrogeological reports.

If your development proposal is on land to which Chapter D5 Double Bay Centre and Chapter C1 Paddington Heritage Conservation Area of the Woollahra Development Control Plan 2015 applies and includes below ground structures, you must submit geotechnical and hydrogeological reports which contain the information set out in these guidelines. For the purpose of these guidelines, below ground structures means excavation to a depth greater than 300mm below the existing groundwater level, for excavations within 900mm of the boundary, or otherwise greater than 1.0m in depth.

A geotechnical and hydrogeological report may also be required in the areas of high water table such as Rushcutters Bay, Rose Bay, Watsons Bay as well as other sites requiring excavation

Applicants are advised to discuss these requirements with our Technical Services Division prior to the submission of a development application.

Objective

To ensure there are no adverse geotechnical or hydrogeological impacts on any surrounding property and infrastructure as a consequence of the carrying out of development.

Design Principles

Buildings must be designed and constructed with appropriate support and retention systems to ensure that:

- ▶ there will be no ground settlement or movement, during and after construction, sufficient to cause an adverse impact on adjoining surrounding properties and infrastructure.
- ▶ there will be no change to the ground water level, during and after construction, sufficient to cause an adverse impact on surrounding properties and infrastructure.
- ▶ vibration during construction is minimised or eliminated to ensure no adverse impact on surrounding properties and infrastructure
- ▶ the risk of damage to adjacent existing property and infrastructure by the new development will be reduced to a level no greater than that from an event with an 'unlikely' likelihood of occurrence and 'minor' consequence.
- ▶ all below ground structures are fully sealed to prevent the entry of all ground water such that they are fully tanked and no on-going dewatering of the site is required.

Adverse Impact Definition

Generally, an adverse impact can be assumed to be any damage caused to the improvements on adjoining surrounding properties by the demolition, excavation or construction on the development site.

Development Application - Report Requirements

Geotechnical and Hydrogeological reports must be submitted with all development applications and address the following items. The extent to which each of the items is addressed must be determined having regard to the nature of the development, site investigations and sensitivity of the surrounding properties and infrastructure. The author of the report must be satisfied as to the information provided and must be satisfied that, as a consequence of the carrying out of the development, the objectives and design principles of these guidelines will be satisfied.

General

Reports must be site specific and relate directly to the proposed development. Previous reports and data may be utilised or provided as supplementary information where certified by the author of the report as suitable for the new development.

A qualified and experienced geotechnical and/or hydrogeological engineer must prepare the reports

Should the architectural drawings be changed from a previous application or during the DA process then Council may require a revised geotechnical and hydrogeological report to be submitted

The reports must include a site specific risk assessment matrix with appropriate definitions for qualitative measures of likelihood and consequences for assessing the risk of damage to existing developments by the new development

Visual inspection and use of geological mapping alone will not be satisfactory for geotechnical and/or hydrogeological reports.

Investigations

Reports must demonstrate:

- ▶ investigation of geotechnical conditions below the proposed depth of excavation and/or founding depth for the development. Generally, the depth to bedrock should be established. As a minimum the following level of investigation is required:
 - a minimum of 2 boreholes extended to at least the likely depth of influence of construction for any site
 - Standard Penetration testing within the boreholes. The tests must be carried out at regular depth intervals not exceeding 1.5m in the upper 10m and 3m below 10m depth
 - If below ground structure is proposed, the investigation should also target at least one continuous strength log of the subsurface soils by Cone Penetrometer Testing (CPT) to supplement the information from the boreholes. As a guide, the following tests can be considered for the continuous strength log:
 - Cone Penetration Test (CPT) where the soil strata as proven during the borehole investigation shows the presence of compressible soil (soft to firm clay/clayey soil; soft to firm peat/peaty soil) or where the soil strata has a total thickness of greater than 3 m.
 - Dynamic Cone Penetration (DCP) where the soil strata as proven during the borehole investigation comprises soil with a total thickness of no more than 3 m and without

compressible soil layers.

- ▶ that the presence of groundwater has been investigated. Where present, the **pre-construction** groundwater level must be measured and monitored. (A longer historical record of natural groundwater fluctuations will be valuable as part of the implementation program. A minimum monitoring period of six months is recommended).

- ▶ that where groundwater is present and dewatering is likely to occur on the site, the piezometric monitoring of the groundwater will be required as per the requirements given in Clause D5.6.7 of the Development Control Plan.

~~— a minimum of two piezometers will be located within the site or in close proximity to it.~~

~~— a minimum of 2 piezometers will be located off site, as close to the site as possible, but outside the zone of influence of groundwater level disturbance by the new development.~~

~~— where established in the footpath area a permanent installation with a cast iron cover and concrete surround is required.~~

~~The groundwater level monitoring must be undertaken using either electronic data loggers, or manual monitoring on regular time intervals commensurate with the expected groundwater level fluctuations. This will allow fluctuations in the site groundwater level to be calibrated against natural fluctuations in the groundwater level.~~

- ▶ that investigations have been carried out to determine the design parameters appropriate to the development and site. This could include:
 - foundations
 - permanent and temporary supports
 - settlements
 - retaining walls
 - groundwater levels
 - batter slopes
 - vibration
 - dewatering including seepage and off site disposal rates.

Support and Retention

Reports must:

- ▶ include recommendations as to appropriate temporary and permanent site support and retention measures.
- ▶ predict ground settlements in areas adjacent to the development site resulting from temporary and permanent site support and retention measures and demonstrate that settlement will have no adverse impact on the surrounding properties and infrastructure.
- ▶ demonstrate that permanent earth or rock anchors will not be required on or below any road reserve or other Council property. Council may accept the use of temporary anchors if the applicant can adequately demonstrate that the use of temporary anchors would sufficiently improve the safety of the retention of excavations that may be proposed. The installation of such temporary anchors must comply with the Council's Rock Anchor Policy. (Use of permanent and/or temporary anchors on private property is not allowed without written confirmation by the property owners).
- ▶ show that permanent support and retention measures will be set back a minimum of 900mm (or minimum as advised in the relevant Development Control Plan) from the adjacent property boundaries. This is aimed at minimising the localised damage created by the installation of retention systems and to provide a corridor for perimeter drainage.

- ▶ It may be possible for a new development to be built up to the boundary on a merit-based assessment of the development. This assessment will require the geotechnical/hydrogeological report to confirm the structural adequacy of any adjacent structure including any necessary additional support for the structure ~~as well as suitable groundwater drainage systems as outlined in Hydrogeology.~~

Hydrogeology

Reports must demonstrate:

- ▶ the method and rate of dewatering, including the location and disposal of site dewaterings. This includes seepage and stormwater trapped in excavations.
- ▶ that there will be no adverse impact on surrounding property and infrastructure as a result of changes in local hydrogeology (behaviour of groundwater) created by the method of construction. This includes the short-term effects resulting from construction practices, including the method and rate of dewatering and the long-term effects resulting from the **impediment of the critical groundwater flow path due to** support and retention of property and infrastructure after construction has been completed.
- ▶ that *temporary* changes to the groundwater level, during construction, will be kept within the **limits as specified in Clause D5.6.7 of the Development Control Plan**. ~~historical range of natural groundwater fluctuations. Where data is limited or unavailable, reports must demonstrate that changes in the level of the natural water table, due to construction, will not exceed 0.3m unless calculations using the results of the site specific field testing, supporting a greater change can be provided and can demonstrate no adverse impact to surrounding properties and infrastructure.~~
- ~~▶ that in areas where the construction affects existing development within a shadow zone of an earlier construction, *temporary* changes in the level of the water table during construction will not exceed 0.15m, unless calculations using the results of the site specific field testing, supporting a greater change are provided and demonstrate no adverse impact to surrounding properties and infrastructure. The temporary shadow zone during dewatering should be taken as an area within 20m of the earlier construction, unless site specific calculations can demonstrate that a different lateral extent should be adopted.~~
- ~~▶ that where data is limited or unavailable, the *permanent* change in the level of the natural water table due to the carrying out of the development will not exceed 0.2m unless calculations using the results of the site specific field testing, supporting a greater change can be provided and can demonstrate no adverse impact to surrounding property and infrastructure.~~
- ~~▶ that in areas where the construction affects existing development within a shadow zone of an earlier construction, the *permanent* change in the water table due to the carrying out of the development will not exceed 0.1m. The permanent shadow zone of an earlier construction with full penetrating cut-off walls but without appropriate subsurface drainage should be taken as a distance equal to one building width along the groundwater flow path both in front and behind the earlier construction, unless site specific calculations can demonstrate that a different lateral extent should be adopted.~~
- ~~▶ that groundwater drainage systems have been designed to transfer groundwater through or under the proposed development without a change in the range of the natural groundwater level fluctuations.~~

- ▶ that all below ground structures are fully sealed to prevent the entry of all ground water such that they are fully tanked and no on-going dewatering of the site is required.

For short term dewatering during construction a separate approval is required from Council under S138 of the *Roads Act 1993* where the water is to be discharged to the public road.

Where an impediment to the **critical** natural **groundwater** flow path is created as a result of the nature of the construction methods utilised and/or the bulk of the below ground structure, artificial drains such as perimeter drains and through drainage may be utilised. These systems may only be utilised where **it** can be demonstrated that the natural ground**water** flow regime is re-established both upstream and downstream of the site without any adverse effects on surrounding property or infrastructure.

- ~~▶ that groundwater drainage systems are designed for a design life of 100 years.~~
- ~~▶ that the groundwater drainage system is designed to be easily maintained. Council will require a positive covenant to ensure the continued functioning and maintenance of the approved groundwater system. Laboratory tests to approved standards should be carried out to determine the clogging potential of any proposed filters used in the design of the drainage system for the new development.~~
- ~~▶ that where there is the potential for a damming effect created by several consecutive below ground structures, this potential impact has been the subject of hydrogeological modelling to demonstrate no adverse impact on the surrounding property or infrastructure. The extent of modelling must consider the potential for future development to extend the damming effect and must, as a minimum, extend between street blocks.~~
- ~~▶ that where below ground structures are in close proximity to each other (typically less than 3m) no allowance for natural groundwater flow through these narrow corridors has been included in the design of perimeter or through drainage.~~

Vibration

Reports must:

- ▶ demonstrate that there will be no adverse impact on the surrounding properties and infrastructure as a result of vibration created by the method of construction used for the development. As a minimum, reports must demonstrate compliance with the requirements of AS2187.2 Appendix J.
- ▶ recommend appropriate plant, equipment and construction methods.

Implementation Plan

The Implementation Plan will normally be part of the Conditions of Consent for the development and generally are not required to be submitted in association with the DA.

The implementation plan will comprise of the *monitoring program, contingency plan* and *construction methodology*.

Monitoring Program

The geotechnical and hydrogeological monitoring program for the development should include pre-set acceptable limits for the variation of:

- ▶ settlements associated with temporary and permanent structures;
- ▶ deflection or movement of retaining mechanisms (shoring, braces, etc.)
- ▶ vibration in accordance with AS 2187.2 Appendix J, including acceptable velocity of vibration;
- ▶ groundwater changes calibrated against natural groundwater fluctuations.

It should also:

- ▶ include the location and type of monitoring systems to be utilised;
- ▶ include recommended hold points to allow for the inspection and certification of geotechnical and hydrogeological measures by a geotechnical engineer.
- ▶ relate back to the contingency plan should the present acceptable limits for variation be exceeded.

Contingency Plan

A *Contingency Plan* must be prepared for situations where the monitoring shows the pre-set acceptable limits for the geological and hydrogeological parameters are exceeded. This could include details of measures to be adopted for restoring groundwater, additional support or bracing, remedial works and alternative procedures. Where possible, the contingency measures should be linked back to the monitoring program to enable early warning and time for preventative measures to be implemented

Construction Methodology

The construction methodology must address all aspects of the construction process as it relates to the geotechnical and hydrogeological requirements. Generally, this will include the method and staging the excavation, installing monitoring devices, support and retention measures, groundwater control, retention of groundwater flow paths and reinstatement. It may also include appropriate plant and equipment to minimise vibration, localised damage from installation of supports and noise.

Further Investigations

Reports may include recommendations for further investigations to be carried out prior to construction. Each case will be considered on their merits and whether or not further investigations are required prior to the granting of development consent or whether the additional information can be provided after the granting of consent but before the issue of a construction certificate.

Construction Certificate Application - Report Requirements

The following additional information may, as a condition of consent, be required before issue of the Construction Certificate:

- ▶ dilapidation reports
- ▶ details of dewatering method with licences as appropriate
- ▶ finalised Implementation Plan incorporating finalised Geotechnical and Hydrogeological Monitoring Program, Contingency Plan and Construction Methodology.
- ▶ further geotechnical and hydrogeological investigations as may be required by special consent conditions or as recommended in the geotechnical and/or hydrogeological report submitted with the Development Application
- ▶ design certificate from suitably qualified and experienced geotechnical and/or geotechnical engineer confirming that the design of the new below ground structure has been undertaken in accordance with approved standards (such as Australian or British Standards, etc) where applicable.

Construction Phase

The works on the site must be inspected and monitored in accordance with the Implementation Plan, Geotechnical and Hydrogeological Monitoring Program and any other recommendations made in the geotechnical and/or hydrogeological engineer must conduct monitoring and inspection. Copies of inspections and monitoring reports must be supplied to the Principal Certifying Authority.

Occupation Certificate - Report Requirements

A record of inspections and monitoring as required by the Implementation Plan and Geotechnical and Hydrogeological Monitoring Program must be submitted in report form to the Principal Certifying Authority for approval prior to release of the Occupation Certificate. A geotechnical/hydrogeological engineer must certify that all work, including groundwater drainage systems has been carried out in accordance with the applicable development consent conditions and the recommendations of the geotechnical and hydrogeological reports.

Further Information

A checklist of the above-mentioned geotechnical and hydrogeological requirements is attached. If you need further information about our requirements for geotechnical and hydrogeological reports please telephone our Development Engineer on 9391 7000.

Definitions

Geotechnical Engineer means NPER registered with a minimum of 10 years practice in the geotechnical field in the last 15 years

Geotechnical and Hydrogeological Requirement Check List

Development Application

Geotechnical and/or hydrogeological reports to include:

- Site specific risk assessment matrix
- Results of geotechnical investigation including boreholes, CPT and groundwater level piezometers.
- Recommended pertinent geotechnical design parameters.
- Recommendations on appropriate temporary and permanent site support and retention measures.
- Method and rate of dewatering where required.
- Proposed groundwater drainage systems and laboratory tests to determine filter clogging potential.
- Recommended appropriate plant, equipment and construction methods to limit vibration.

Implementation Plan comprising the following:

- Monitoring program including various preset acceptable limits, location and type of monitoring systems and recommended hold points.
- Contingency Plan including details of measures to be adopted to restore groundwater level or to provide any necessary additional support.
- Construction Methodology to address all aspects of the construction process relating to the geotechnical and hydrogeological requirements.

Recommendations for further investigations to be carried out prior to construction.

Development Consent

The approval of the Development Application by the Council may contain the following conditions:

- DA Standard Conditions of Consent - Geology and Hydrogeology
- Special Conditions of Consent

Construction Certificate Application

Depending upon the conditions of consent, the following information may be required:

- Dilapidation reports
- Details of dewatering
- Finalised implementation plan
- Further geotechnical and hydrogeological investigation report when required
- Design Certificate from a suitably qualified and experienced geotechnical and/or hydrogeological engineer

Construction Phase

A suitably qualified and experienced geotechnical and/or hydrogeological engineer must supply the following reports:

- Construction inspection reports
- Geotechnical and hydrogeological monitoring reports
- Occupation Certificate

Prior to the release of the Occupation Certificate, the following information must be supplied:

- Final construction inspection report
- Final geotechnical and hydrogeological monitoring report
- Certificate from a geotechnical and/or hydrogeological engineer to confirm that the completed structure conforms to the design