Geotechnical Review
Geotechnical Planning Controls
Northern Beaches

northern beaches council

1. Introduction

This report presents the results of a review undertaken by Douglas Partners Pty Ltd (DP) on the geotechnical planning controls for the Northern Beaches Local Government Area. The review was undertaken at the request of Northern Beaches Council and was aimed at providing recommendations for a revised unified system of geotechnical planning controls to replace the existing planning controls and to inform the planning framework for the three former council areas of Pittwater, Manly and Warringah which have been amalgamated to form the Northern Beaches Local Government Area.

The scope of work for the review comprised the following:

- Analysis of the existing planning controls from the three former councils;
- Review of the known geotechnical constraints in the Northern Beaches area;
- Consideration of the potential impacts of climate change; and
- Development of recommendations for revised planning controls and assessment processes.

2. Analysis of Existing Controls

The system for controlling planning and development in NSW comprises the following:

- The Environmental Planning and Assessment Act 1979 (EPA Act) prepared by the State Government;
- State Environmental Planning Policies (SEPP) - prepared by the State Government;
- Local Environmental Plans (LEPs) prepared by local Councils; and
- Development Control Plans (DCPs) prepared by local Councils.

The LEPs and DCPs are used by Councils to regulate development and land use. The LEPs are legally binding documents published as part of the NSW legislation, while the DCPs are documents prepared and controlled by Council to give guidance on achieving the aims and objectives of the whole planning system. The DCPs may be modified relatively easily by Council while the LEPs are laws which are more difficult to change.

For each of the three former council areas of Pittwater, Manly and Warringah, the main clauses in the LEPs and DCPs relating to geotechnical planning are listed in Table 1.

Table 1: Summary of Existing Geotechnical Related Planning Clauses

Pittwater	**Manly**	**Warringah #**
LEP 2014	LEP 2013	LEP 2011
7.1 Acid sulfate soils	6.1 Acid sulfate soils	6.1 Acid sulfate soils
7.2 Earthworks	6.2 Earthworks	6.2 Earthworks
7.5 Coastal risk planning		6.5 Coastal hazards
7.7 Geotechnical hazards	6.8 Landslide Risk	6.4 Development on sloping land
Maps – Geotechnical Hazard maps *(showing H1 and H2 areas)* Separate ASS maps Coastline Hazard maps *(showing wave inundation, coastal erosion and bluff/cliff instability areas)*	Maps – Combined ASS and Landslide Risk maps	Maps – Landslide Risk maps *(showing Areas A to E)* Separate ASS maps Coastline Hazard map *(showing reduced foundation capacity and wave impact areas)*
21 DCP	DCP 2013	DCP 2011
B3.1 Landslip Hazard	4.1.8 Sloping Sites	E10 Landslip Risk
B3.4 Coastline (Bluff) Hazard		E9 Coastline Hazard
B3.12 Climate Change		
B8.1 Construction and Demolition – Excavation and Landfill	4.4.5 Earthworks	C7 Excavation and Landfill
Appendix 5 Geotechnical Risk Management Policy	Schedule 1 Map C Potential Landslip *Hazards (showing Areas G1 to G4)*	
Appendix 6 Coastal Risk Management Policy	Schedule 11 Checklist for Preliminary Assessment of Site Conditions	

Note: # Warringah LEP 2000 applies to areas shown on the 2011 Land Application Maps as 'Deferred Matter', reference Clause 57 Development on Sloping Land and Hazard Map 2 – Land Slip

One key feature of all the existing systems is that the maps used to identify areas of geotechnical hazards, acid sulfate soils (ASS) and coastline hazard areas have been included within the LEP documents, which means that it is not easy to modify the maps if any errors are identified or changes

are required. DP proposes that, under the revised unified system, the geotechnical planning maps would be included within the DCP documents to allow changes to be made more readily if any additional information (such as from detailed geotechnical investigations) becomes available, whilst maintaining the objectives of the clauses in the LEP.

DP recognises that the DCP will also incorporate controls for sloping sites with respect to urban design outcomes, visual impact and view sharing etc. however, these matters are being addressed by a separate Urban Design Study and Council staff and are outside the scope of this report.

A detailed comparison of the words in each of the LEP and DCP clauses from the former councils is provided in the tables in Appendices A and B, together with suggested revised wording of new clauses.

The detailed comparison is summarised in Table 2.

Table 2: Summary of Comparison of Existing Geotechnical Related Planning Clauses

Clauses	Comments	Suggested Changes
LEPs		
Acid Sulfate Soils	All existing clauses are identical. All refer to ASS maps contained within the LEPs. The Manly maps combined ASS with landslide risk. The other two councils had separate ASS maps	No changes to words proposed. The ASS maps to remain in the LEP.
Earthworks	All the existing clauses are similar. The Manly clause includes groundwater dewatering associated with the earthworks. The objectives of both Manly and Warringah include allowing earthworks of a minor nature without requiring a separate development consent. Pittwater does not include this clause. Pittwater does not require the applicant to consider potential adverse impacts on watercourses or environmentally sensitive areas, whereas the other two do. All three refer to the "quality" of the fill or soil to be excavated. The term "quality" is undefined and open to multiple interpretations. The aim of this clause is unclear.	Revised composite clause which: Includes reference to groundwater dewatering. Aims to allow earthworks of a minor nature without requiring a separate development consent. Removes separate reference to disturbing relics as this is included under considering adverse impacts on any heritage item or archaeological site. Includes reference to potential for adverse impacts on watercourses or environmentally sensitive areas. Rewords the clause on "quality" of fill to refer to potential for contamination.
Coastal Hazards	Manly does not have a separate LEP clause on coastal hazards or coastal risk planning. The Pittwater and Warringah clauses have quite different wording and different emphases.	New clause to be drafted by Council's coastal management team, with reference to the geotechnical clauses applicable to Coastal Cliff Zones.

Clauses	Comments	Suggested Changes
Geotechnical Hazards	The Pittwater and Manly clauses are very similar except that Manly refers to "landslide" while Pittwater refers more generally to "geotechnical hazards". The Warringah clause concentrates specifically on developments on sloping land and the objectives and conditions are more specific, including avoiding adverse impacts on properties near the development due to slope instability caused by landslides or changes in stormwater runoff or subsurface (groundwater) flows which adversely affect the stability of the ground. All three clauses refer to the associated Landslide Risk or Geotechnical Hazard Maps	Change title of clause to Geotechnical Planning. Revised wording based on the more general wording used in the Pittwater and Manly clauses, but including a specific reference to the impact of changes to the subsurface flows. Remove reference to maps and change wording to state that the clause applies to "all land in the LGA".
Geotechnical Maps	The Pittwater maps show Hazard H1 and H2 Zones which are not defined on the plans. The Manly maps are combined ASS and Landslide Risk maps with only one zone indicating Landslide Risk and the zone boundaries running along lot boundaries rather than geotechnical features. The Warringah Maps show Landslide Risk Areas A to E, based on slopes with some special areas around Collaroy Plateau.	Prepare new combined maps for whole Northern Beaches LGA but include in the DCP rather than in the LEP so that changes can be made, if required, as more information becomes available from future geotechnical investigations.
Geotechnical Classes or Zones	Pittwater has two zones H1 and H2 which are not defined in either the LEP or the DCP. H1 appears to cover the steeper areas and H2 appears to be related to road cuts and fills. Manly has only one zone shown on the LEP maps showing lots which are affected by landslip, but in the DCP there is a more detailed map which includes four zones (G1 to G4) based mainly on topography. Warringah has five zones (A to E) based on topography, with special zones around the Collaroy Plateau area.	Divide whole area into seven zones based on a combination of topography and the underlying geology.
DCPs		
Slope Stability	Pittwater has minimal information contained within the DCP clause – all specific details, relating mainly to slope instability, are included in Appendix 5. which is very extensive. Appendix includes Forms 1 to 4 which are to be completed and submitted at different stages of development.	Base new clause on Pittwater general DCP clause Change reference to which land it applies to "All land" Revise Appendix to refer to new Geotechnical Planning Classes.

Clauses	Comments	Suggested Changes
	Manly refers to both landslip and subsidence and contains specific considerations for each of zones G1 to G4. Also includes some opinions on what stabilisation may be required. Specific requirements relate to the visual impact of the development and avoiding the loss of views. Schedule 11 provides a checklist for preliminary assessment and a flow chart which is based on the Warringah flowchart. Warringah objectives include geotechnical stability, minimising impact from stormwater discharge and on existing subsurface flows. Provides requirements for geotechnical and hydrological assessments in Areas A to E. Checklist for Council's assessment of site conditions includes flowchart.	Add reference to other geotechnical hazards relevant to the whole LGA to incorporate requirements relating to stormwater, groundwater and settlement. Include clear matrix in Appendix to determine when geotechnical or hydrogeological assessments or reports are required.
Earthworks	Pittwater clause is aimed solely at avoiding adverse stability impacts due to excavation and filling. Specifies extent of cut or fill for which Geotechnical Report is required at CC stage. Refers to Appendix 5. Manly clause has an emphasis on retaining the landscape character and limiting the change to topography and vegetation. Includes requirements on controlling sediment going into water courses and avoiding changes to natural groundwater and surface water flows. Excavation and filling limited to <1m and retaining walls within 1m of the front boundary must not exceed 1m. Warringah also has an emphasis on visual impact and requires that works do not generate airborne pollution or siltation of watercourses, that all filling is clean and revegetation of filling is undertaken.	Base clause on Pittwater clause General clauses added on: • any landfill must not be contaminated • avoiding air pollution, siltation or pollution of waterways • siltation and stormwater control devices must be in place during construction

The process for determining whether a preliminary geotechnical assessment, detailed geotechnical report or hydrogeological report is required for a development varies significantly between former council areas. A comparison of the different specific requirements is given in Table 3.

In all cases there are difficulties in defining minor works which do not require geotechnical assessments.

The Pittwater recommendations included in Appendix 5 are very comprehensive and based primarily on risk assessment of slope instability, but they are very wordy and more difficult to comprehend than the simpler Manly and Warringah documents. Only the Warringah clauses refer to the possible requirement for hydrological and hydrogeological reports to assess impacts on stormwater and groundwater.

Table 3: Comparison of Existing Requirements for Geotechnical Reports

Requirements for Geotechnical Reports	Preliminary Geotechnical Assessment Required	Detailed Geotechnical Report Required	Hydrological or Hydrogeological Report Required
Pittwater			
Required at DA stage for any land identified on maps as H1 or H2 or Coastal bluff areas		Yes	
Required at CC stage - for any development on any site that includes: • Any excavation >1m which is closer to the site boundary than the depth of excavation • Any excavation >1.5m below existing surface level • Any excavation that has potential to destabilise a tree • Any fill >1m • Any works that may affect or be affected by geotechnical processes (including low bearing capacity soils).		Yes	
If only "Minor development, minor alterations and/or development separate from geotechnical hazards" – Geotechnical engineer may assess that geotechnical report is not required	Yes	Possibly	
For "structures separated from the primary development, eg swimming pools, retaining walls" – Geotechnical engineer to determine level of investigation required.	Yes	Probably	
Warringah			
Not required if development does not include "any site, building or structural works".			
Class A – Plateau areas, footslopes and alluvial flats Not normally required. Council may require preliminary assessment	Not usually		
Class B – Flanking slopes Preliminary assessment required to see if geotechnical and hydrological report is required – Flowchart provided for assessment	Yes	Possibly	Possibly
Class C – Steeper slopes Geotechnical Report and Hydrological Assessment of stormwater discharge and subsurface flows required, unless preliminary geotechnical assessment indicates either is not required	Yes	Probably	Probably
Class D – Flanking slopes Collaroy Plateau	Yes	Possibly	Possibly

Requirements for Geotechnical Reports	Preliminary Geotechnical Assessment Required	Detailed Geotechnical Report Required	Hydrological or Hydrogeological Report Required
Preliminary assessment required to see if geotechnical and hydrological report is required – Flowchart provided for assessment			
Class E – Steeper slopes Collaroy plateau Geotechnical Report and Hydrological Assessment of stormwater discharge and subsurface flows required, unless preliminary geotechnical assessment indicates either is not required	Yes	Probably	Probably
Flowchart for Areas in Classes B and D - Geotechnical Report is required if: Site or adjacent sites have history of instability Proposed cuts or fills >2m depth On existing developed sites - Fill >1m or Cuts >2m On undeveloped sites - Slopes steeper than 1V:4H Natural cliffs higher than 3m		Yes	
Manly			
Required for any property identified on maps as being in a Landslip area		Yes	
Required for any excavation greater than 1m below natural ground level for a basement or basement car parking area		Yes	
Area G1 – Steeper slopes For load bearing building works – geotechnical report required (except for “minor works”)		Yes	
Areas G2, G3 and G4 – all other areas For load bearing building works – preliminary assessment required to determine whether geotechnical report is required using Schedule 11 checklist & flowchart	Yes	Possibly	
Schedule 11 – Includes checklist & flowchart (from Warringah DCP) Site or adjacent sites have history of instability Proposed cuts or fills >2m depth On existing developed sites - Fill >1m or Cuts >2m On undeveloped sites - Slopes steeper than 1V:4H Natural cliffs higher than 3m		Yes	

3. Review of Known Geotechnical Constraints

The historical differences in geotechnical planning for the Northern Beaches area have been based on the slightly differing geotechnical issues in each of the former council areas.

As indicated on Figure 1, while the bulk of the southern and western part of the Northern Beaches LGA is underlain by Hawkesbury Sandstone (light green), the northern peninsula and Collaroy plateau area are underlain by rocks of the Narrabeen Group (mid green), with numerous areas of typically low lying alluvial, estuarine or aeolian soils (light yellow).

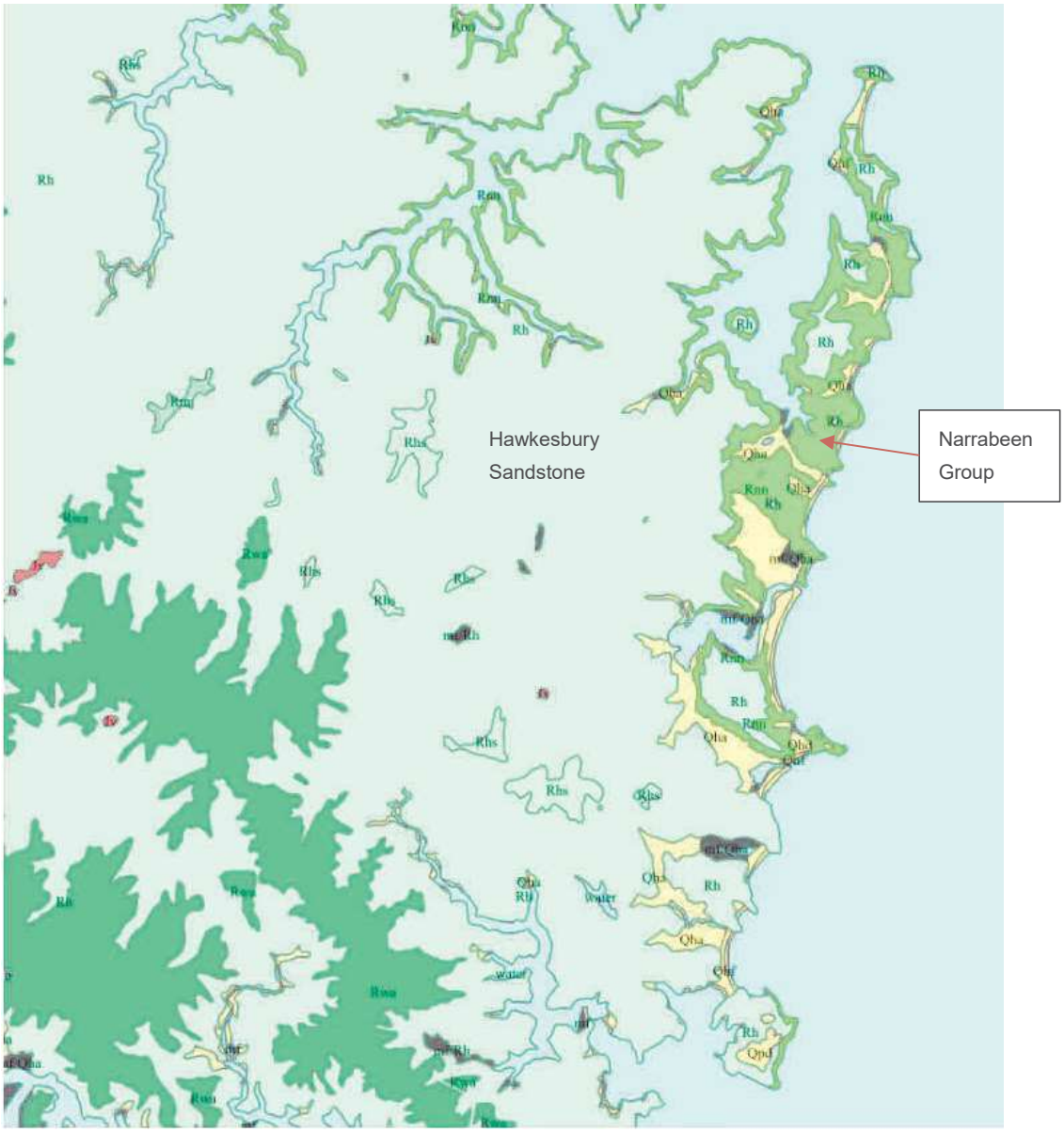

Figure 1: Regional Geology

Hawkesbury Sandstone is typically a series of thick horizontal beds of medium to coarse grained quartz sandstone. The soils forming on these rocks tend to be relatively shallow sandy soils and the landforms on areas of Hawkesbury Sandstone are usually relatively flat ridge crests or plateaus and slopes formed by a series of steps or cliffs, with or without large, potentially unstable joint blocks or boulders. Slopes developed on Hawkesbury Sandstone are usually relatively stable, the key hazards are the potential for collapse of cliff lines, boulders falling from cliffs caused by weathering of softer layers, root jacking by trees, water pressure along open joints or undermining of large boulders.

In contrast the rocks of the Narrabeen Group are known to be less stable. The rocks comprise a series of interbedded siltstones, claystones and fine grained lithic sandstones. These rocks weather more rapidly than the Hawkesbury Sandstone. Many of the slopes in the peninsula area and those around the Collaroy plateau area are underlain by thick colluvial deposits of soil and boulders which are derived from weathering of these rocks and have moved downslope under the forces of gravity, water and ancient landslides. Landslides are relatively common on slopes underlain by the Narrabeen Group rocks, particularly in areas where there have been excavations into the natural slopes or concentrations of stormwater.

The low lying areas underlain by alluvial, estuarine or aeolian soils are not usually affected by slope instability but may be affected by issues associated with low bearing capacity for foundations, settlement of soft soils, high groundwater tables, acid sulfate soils and coastal erosion or flooding.

The coastline of the Northern Beaches area is typified by a series of beaches and headland areas. The headlands are mostly near vertical cliff faces (coastal bluffs) formed within rocks of the Narrabeen Group. Studies have indicated that the overall erosion of the cliff faces is relatively slow (in human terms rather than geological time) but there is the potential at any stage for large sections of the cliff faces to collapse due to erosion and undercutting.

4. Consideration of Potential Impacts of Climate Change

Predicted effects of climate change over the next 50 years in the Sydney area include:

- possible sea level rises by about 0.4 m,
- the maximum summer temperatures may increase by 2-2.5 degrees;
- the average rainfall in the summer and autumn may increase by 10-20%; and
- there may be more extreme East Coast Low storms in the warmer months.

The predicted sea level rises will primarily increase the potential for flooding of low lying and coastal areas as well as coastal erosion, but will also increase the groundwater levels in low lying areas close to the coast. This could increase the risk of flooding of basement structures in these areas.

The predicted increase in maximum summer temperatures is not likely to have a direct impact on geotechnical hazards but could cause more cracking of exposed clay soil surfaces which could enable water to more readily penetrate into the clays.

The key impact of climate change on geotechnical hazards is likely to be the increased potential for periods of concentrated heavy rainfall which may overwhelm the existing stormwater systems and result in saturation of soils. This is one of the key triggers for many landslides.

5. Recommendations for Planning Controls and Assessment relating to Geotechnical Hazards

DP has reviewed the existing planning controls and has provided suggestions for proposed new clauses and controls that seek to combine the content of the previous planning controls and develop one standard system that can be applied to all areas of the Northern Beaches LGA.

The maps for the LGA have been revised to develop seven new geotechnical planning classes which cover all of the LGA based on underlying geology, existing slopes and proximity to the coastal cliff line. It is proposed that these maps be included within the new DCP rather than the LEP, to allow for changes and modifications to be made if more information becomes available from detailed site investigations. The system used for the suggested new Classes is given in Appendix C, together with a matrix indicating the proposed requirements for geotechnical reports at development application stage.

The proposed Classes 1 to 6 are based simply on combinations of the underlying geology and the ground slopes. Class 7 (Coastal Cliff Zone) has been developed by identifying all slopes along the coastline between Barrenjoey Head and the Spit Bridge which are steeper than 45 degrees, and then plotting an area which starts 20 m upslope of the crest of the slope (refer Figure 2). While the zone shown on the maps is a uniform width of 40 m for plotting purposes only, in all cases the Coastal Cliff Zone extends to water level in the downslope direction.

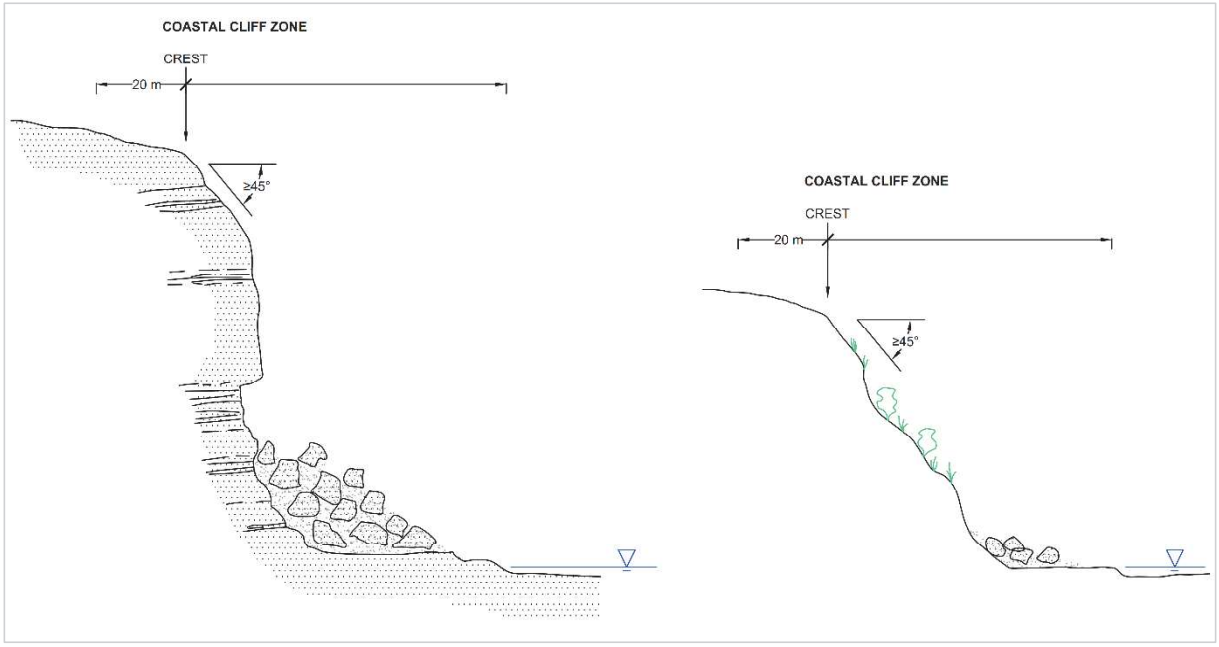

Figure 2: Definition of Coastal Cliff Zone used on maps

The new LEP and DCP clauses are based primarily on the existing Pittwater clauses but modifications have been suggested to incorporate some of the measures previously included in the Warringah and Manly clauses relating to other geotechnical issues. The majority of the geotechnical requirements are contained within an Appendix to the DCP (similar to the previous Pittwater Appendix 5) but the appendix has been revised to incorporate geotechnical hazards other than slope instability and to simplify the requirements.

The revised new appendix includes revised Forms 1 to 4, which contain references to a range of geotechnical issues (see Appendix C). DP suggests that the current Pittwater references to coastal engineers be removed from the geotechnical planning controls for coastal cliff areas as coastal engineers are usually experienced in erosion of sediments and flooding of low areas, rather than stability of rock faces. DP suggests that the coastal engineers' input will be included within revised clauses on coastal hazards, rather than with the geotechnical controls, and that the revised coastal hazard clauses will reference the geotechnical clauses for issues relating to stability of coastal cliff areas.

6. Limitations

Douglas Partners (DP) has prepared this report for Northern Beaches Council. This report is provided for the exclusive use of Northern Beaches Council for the purposes as described in the report. It should not be used by or be relied upon for other projects or purposes. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client.

DP has prepared maps of the area based upon published mapping of geology and slopes within the Northern Beaches Local Government area. The accuracy of the mapping has not been verified by DP and the advice provided by DP in this report may be affected by variations in ground conditions across the area.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully
Douglas Partners Pty Ltd

Reviewed by

Fiona MacGregor
Principal

John Braybrooke
Principal

Appendices A: Comparison of detailed LEP Clauses
- Table A1 LEP Acid Sulfate Soil Clauses
- Table A2 LEP Earthworks Clauses
- Table A3 LEP Coastal Hazard Clauses
- Table A4 LEP Geotechnical Hazard Clauses
- Table A5 Comparison of Landslide Risk Classes used on Existing Maps

B: Comparison of detailed DCP Clauses
- Table B1 DCP Landslide Clauses
- Table B2 DCP Earthworks Clauses

C: Suggested New Planning Controls
- Table C1 Suggested New Geotechnical Planning Classes
- Table C2 Suggested Requirements for Geotechnical Reports
- C3: Proposed New Appendix to DCP Geotechnical Planning Clause

Appendix A

Comparison of Detailed LEP Clauses

Table A1 - Existing LEP Acid Sulfate Soil Clauses

<table>
<tr><th>Pittwater Local Environmental Plan 2014</th><th>Manly Local Environmental Plan 2013</th><th>Warringah Local Environmental Plan 2011</th><th>Suggested New Clause</th></tr>
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7.1 Acid sulfate soils

1) The objective of this clause is to ensure that development does not disturb, expose or drain acid sulfate soils and cause environmental damage.

2) Development consent is required for the carrying out of works described in the table to this subclause on land shown on the Acid Sulfate Soils Map as being of the class specified for those works.

<table>
<tr><th>Class of Land</th><th>Works</th></tr>
<tr><td>1</td><td>Any works</td></tr>
<tr><td>2</td><td>Works below the natural ground surface.
Works by which the watertable is likely to be lowered</td></tr>
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Works by which the watertable is likely to be lowered more than 1 metre below the natural ground surface.</td></tr>
<tr><td>4</td><td>Works more than 2 metres below the natural ground surface.
Works by which the watertable is likely to be lowered more than 2 metres below the natural ground surface.</td></tr>
<tr><td>5</td><td>Works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the water table is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land.</td></tr>
</table>

3) Development consent must not be granted under this clause for the carrying out of works unless an acid sulfate soils management plan has been prepared for the proposed works in accordance with the Acid Sulfate Soils Manual and has been provided to the consent authority.

4) Despite subclause (2), development consent is not required under this clause for the carrying out of works if –

a) a preliminary assessment of the proposed works prepared in accordance with the Acid Sulfate Soils Manual indicates that an acid sulfate soils management plan is not required for 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

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3) Development consent must not be granted under this clause for the carrying out of works unless an acid sulfate soils management plan has been prepared for the proposed works in accordance with the *Acid Sulfate Soils Manual* and has been provided to the consent authority.

4) Despite subclause (2), development consent is not required under this clause for the carrying out of works if –

a) a preliminary assessment of the proposed works prepared in accordance with the *Acid Sulfate Soils Manual* indicates that an acid sulfate soils management plan is not required for 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

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Existing clauses are all the same – and all refer to Acid Sulfate Soils Maps within LEP

Recommend retain existing clause and ASS maps within LEP

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of access ways or the supply of power) – a) emergency works, 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 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.	of access ways or the supply of power) – a) emergency works, 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 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.	of access ways or the supply of power) – a) emergency works, 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 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.	
Separate ASS and Geotechnical Hazard Plans	Combined ASS and Landslide Risk Plans	Separate ASS and Geotechnical Hazard Plans	ASS Plans to be included with LEP

Table A2 - Existing LEP Earthworks Clauses

Pittwater Local Environmental Plan 2014	Manly Local Environmental Plan 2013	Warringah Local Environmental Plan 2011	Suggested New Clause
7.2 Earthworks 1) The objective of this clause is to ensure that earthworks 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.	**6.2 Earthworks** 1) The objectives of this clause are as follows – a) 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, b) to allow earthworks of a minor nature without requiring a separate development consent.	**6.2 Earthworks** 1) The objectives of this clause are as follows – a) to ensure that earthworks 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, b) to allow earthworks of a minor nature without requiring a separate development consent.	**Earthworks** 1) The objectives of this clause are as follows – a) 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, b) to allow earthworks of a minor nature without requiring a separate development consent.
2) Development consent is required for earthworks unless – a) the earthworks are exempt development under this Plan or another applicable environmental planning instrument, or b) the earthworks are ancillary to development that is permitted without consent under this Plan or to development for which development consent has been given.	2) Development consent is required for earthworks unless – a) the earthworks are exempt development under this Plan or another applicable environmental planning instrument, or b) the earthworks are ancillary to development that is permitted without consent under this Plan or to development for which development consent has been given.	2) Development consent is required for earthworks unless – a) the work is exempt development under this Plan or another applicable environmental planning instrument, or b) the work is ancillary to other development for which development consent has been given.	2) Development consent is required for earthworks unless – a) the earthworks are exempt development under this Plan or another applicable environmental planning instrument, or b) the earthworks 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 (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 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 heritage item, archaeological site or heritage conservation area. 4) In this clause – ***environmentally sensitive area*** has the same meaning as environmentally sensitive area for exempt or complying development in clause 3.3	3) Before granting development consent for earthworks (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 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, minimize or mitigate the impacts of the development	3) Before granting development consent for earthworks, the consent authority must consider the following matters – a) the likely disruption of, or any detrimental effect on, existing drainage patterns and soil stability in the locality, b) the effect of the proposed 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 proposed development on the existing and likely amenity of adjoining 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 watercourse, drinking water catchment or environmentally sensitive area,	3) In deciding whether to grant development consent for earthworks (or for development involving ancillary earthworks), the consent authority must consider the following matters – a) the likely disruption of, or any detrimental effect on, existing drainage patterns and soil stability in the locality of the development, b) the effect of the proposed development on the likely future use or redevelopment of the land, c) the possibility that the fill or the soils to be excavated are contaminated, d) the effect of the proposed development on the existing and likely amenity of adjoining properties, e) the source of any fill material and the destination of any excavated material, f) the proximity to and potential for adverse impacts on any heritage item, archaeological site or heritage conservation area, g) the proximity to and potential for adverse impacts on any watercourse, drinking water catchment or environmentally sensitive area.

Table A3 - Existing LEP Coastal Hazard Clauses

Pittwater Local Environmental Plan 2014	Manly Local Environmental Plan 2013	Warringah Local Environmental Plan 2011	Suggested New Clause
7.5 Coastal risk planning 1) The objectives of this clause are as follows – a) to avoid significant adverse impacts from coastal hazards, b) to ensure uses of land identified as coastal risk are compatible with the risks presented by coastal hazards, c) to enable the evacuation of land identified as coastal risk in an emergency, d) to avoid development that increases the severity of coastal hazards. 2) This clause applies to land identified on the Coastal Risk Planning Map as - a) Wave Inundation, or b) Coastal Erosion/Wave Inundation, or c) Bluff/Cliff Instability. 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 not likely to cause detrimental increases in coastal risks to other development or properties, and b) is not likely to alter coastal processes and the impacts of coastal hazards to the detriment of the environment, and c) incorporates appropriate measures to manage risk to life from coastal risks, and d) is likely to avoid or minimise adverse effects from the impact of coastal processes and the exposure to coastal hazards, particularly if the development is located seaward of the immediate hazard line, and e) provides for the relocation, modification or removal of the development to adapt to the impact of coastal processes and coastal hazards, and f) has regard to the impacts of sea level rise, and will have an acceptable level of risk to both property and life, in relation to all identifiable coastline hazards. 4) A word or expression used in this clause has the same meaning as it has in the *NSW Coastal Planning Guideline: Adapting to Sea Level Rise* (ISBN 978-1-74263-035-9) published by the NSW Government in August 2010, unless it is otherwise defined in this clause. 5) In this clause – ***coastal hazard*** has the same meaning as in the Coastal Management Act 2016.	*No specific clauses on coastal risk - maps show most coastal areas are included as landslip risk.*	**6.5 Coastal hazards** 1) The objectives of this clause are as follows – a) to avoid significant adverse impacts from coastal hazards, b) to enable evacuation of coastal risk areas in an emergency, c) to ensure uses are compatible with coastal risks, d) to preserve and protect Collaroy Beach, Narrabeen Beach and Fishermans Beach as national assets for public recreation and amenity. 2) This clause applies to the land identified on the Coastal Hazard Map as - a) Area of Wave Impact and Slope Adjustment, and b) Area of Reduced Foundation Capacity. 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) will not significantly adversely affect coastal hazards, and b) will not result in significant detrimental increases in coastal risks to other development or properties, and c) will not significantly alter coastal hazards to the detriment of the environment, and d) incorporates appropriate measures to manage risk to life from coastal risks, and e) avoids or minimises exposure to coastal hazards, and f) makes provision for the relocation, modification or removal of the development to adapt to coastal hazards and NSW sea level rise planning benchmarks. 4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the foundations of the development have been designed to be constructed having regard to coastal risk. 5) A word or expression used in this clause has the same meaning as it has in the *NSW Coastal Planning Guideline: Adapting to Sea Level Rise* (ISBN 978-1-74263-035-9) published by the NSW Government in August 2010, unless it is otherwise defined in this Plan.	New clause to be drafted by Council's coastal management team, with reference to the geotechnical planning clauses applicable to Coastal Cliff Zones

Table A4 - Existing LEP Geotechnical Clauses

Pittwater Local Environmental Plan 2014	Manly Local Environmental Plan 2013	Warringah Local Environmental Plan 2011	Suggested New Clause
7.7 Geotechnical hazards 1) The objectives of this clause are to ensure that development on land susceptible to geotechnical hazards - a) matches the underlying geotechnical conditions of the land, and b) is restricted on unsuitable land, and c) does not endanger life or property.	**6.8 Landslide Risk** 1) The objectives of this clause are to ensure that development on land susceptible to landslide - a) matches the underlying geotechnical conditions of the land, and b) is restricted on unsuitable land, and c) does not endanger life or property.	**6.4 Development on sloping land** 1) The objectives of this clause are as follows – a) to avoid significant adverse impacts on development and on properties in the vicinity of development sites resulting from landslides originating either on or near sloping land, b) to ensure the impacts of storm water runoff from development on or near sloping land are minimised so as to not adversely affect the stability of the subject and surrounding land, c) to ensure subsurface flows are not adversely affected by development so as to not impact on the stability of existing or adjoining land.	**Geotechnical Planning** 1) The objectives of this clause are to ensure that development on land susceptible to geotechnical hazards - a) matches the underlying geotechnical conditions of the land, and b) is restricted on unsuitable land, and c) does not endanger life or property.
2) This clause applies to land identified as "Geotechnical Hazard H1" and "Geotechnical Hazard H2" on the Geotechnical Hazard Map.	2) This clause applies to land identified as "Landslide risk" on the Landslide Risk Map.	2) This clause applies to land shown as Area A, Area B, Area C, Area D and Area E on the Landslip Risk Map.	2) This clause applies to all land in the LGA.
3) Before determining a development application for development on land to which this clause applies, the consent authority must consider the following matters to decide whether or not the development takes into account all geotechnical risks - a) site layout, including access, b) the development's design and construction methods, c) the amount of cut and fill that will be required for the development, d) waste water management, stormwater and drainage across the land, e) the geotechnical constraints of the site, f) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development	3) Before determining a development application for development on land to which this clause applies, the consent authority must consider the following matters to decide whether or not the development takes into account the risk of landslide - a) site layout, including access, b) the development's design and construction methods, c) the amount of cut and fill that will be required for the development, d) waste water management, stormwater and drainage across the land, e) the geotechnical constraints of the site, f) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development	3) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that - a) the application for development has been assessed for the risk associated with landslides in relation to both property and life, and b) the development will not cause significant detrimental impacts because of stormwater discharge from the development site, and c) the development will not impact on or affect the existing subsurface flow conditions. d) waste water management, stormwater and drainage across the land, e) the geotechnical constraints of the site, f) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development	3) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that – a) the development will appropriately manage waste water, stormwater and drainage across the land so as not to adversely affect the rate, volume and quality of water leaving the land, or adversely impact the stability of the land or adjoining land, b) the development is designed to ensure that any changes to existing subsurface flow conditions do not adversely impact on the land or adjoining land, and c) the development is designed, sited and will be managed to avoid any geotechnical risk or significant adverse impact on the development and the land surrounding the development. If that risk or impact cannot be reasonably avoided – the development is designed, sited and will be managed to minimise that risk or impact.
4) Development consent must not be granted to development on land to which this clause applies unless – a) the consent authority is satisfied that the development will appropriately manage waste water, stormwater and drainage across the land so as not to affect the rate, volume and quality of water leaving the land, and b) the consent authority is satisfied that – i) the development is designed, sited and will be managed to avoid any geotechnical risk or significant adverse impact on the development and the land surrounding the development, or ii) if that risk or impact cannot be reasonably avoided – the development is designed, sited and will be managed to minimise that risk or impact, or iii) if that risk or impact cannot be minimised – the development will	4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that the development will appropriately manage waste water, stormwater and drainage across the land so as not to affect the rate, volume and quality of water leaving the land, and that – a) the development is designed, sited and will be managed to avoid any landslide risk or significant adverse impact on the development and the land surrounding the development, or b) if that risk or impact cannot be reasonably avoided – the development is designed, sited and will be managed to minimise that risk or impact, or c) if that risk or impact cannot be minimised – the development will be managed to mitigate that risk or impact.		

be managed to mitigate that risk or impact.			
		Warringah LEP 2000 – Deferred Land	
		57 Development on sloping land On sloping land, the height and bulk of development, particularly on the downhill side, is to be minimised and the need for cut and fill reduced by designs which minimise the building footprint and allow the building mass to step down the slope. In particular – • the amount of fill is not to exceed more than 1 metre in depth, and • fill is not to spread beyond the footprint of the building, and • excavation of the landform is to be minimised. The geotechnical stability of sloping land to support development is to be demonstrated. Consent must not be granted for development involving the erection of a structure, including additions to an existing structure, on land identified as being potentially subject to landslip on the Landslip Hazard Map unless the consent authority has considered a report from a suitably qualified engineer as to the geotechnical stability of the land to support such a development and an assessment of stormwater prepared by a suitably qualified hydraulic engineer.	

Table A5 – Comparison of Landslide Risk Classes used on Existing Maps

Pittwater Landslide Risk Classes

Class	Description		Council Require
H1	Coloured red with "W"	Class not defined in LEP or DCP	Geotechnical Report
H2	Coloured orange with "AE"	Class not defined in LEP or DCP	Geotechnical Report
	Any Excavation and Landfill activities which include:	Excavation >1m close to boundary or structure	Geotechnical Report required for any excavation or landfill activities as outlined.
		Any excavation > 1.5m	
		Excavation with potential to destabilise trees	
		Fill >1.0m	
		Any works which may be affected by geotechnical processes, for example sites with low bearing capacity soils	

Manly Landslide Risk Classes

Class	Description	Slope Angle (degrees)	Geology	Council Require
G1	Steeper slopes, generally near coastal or harbourside areas	>25	Not specified	Geotechnical assessment is required.
G2	Flanking slopes	15 to 25	Not specified	Geotechnical assessment may be required.
G3	Beach foredune and alluvial flats	<5	Not specified	Should follow good engineering practice
G4	Ridge crests, major spur slopes and dissected plateau areas	<15	Not specified	Geotechnical assessment may be required.

Notes:

- These zones are not shown on maps included in LEP – shown on a map included in DCP as Schedule 1.
- Boundaries approximate only
- Ref: Coffey Report S20199/1-AM November 1999.
- More details on Sheets 1 to 5 held at Manly Council's Customer Service Centre.

Warringah Landslide Risk Classes

Class	Topographic Position	Slope Angle (degrees)	Geology	From Checklist
A	Plateau areas, ridge crests, major spur slopes, footslope areas: and beach foredune and alluvial flats	<5	At higher elevations, generally shallow residual soils developed on Hawkesbury Sandstone. Hawkesbury Sandstone exposed in occasional outcrops and in near vertical road cuts. Some areas of fill. At lower elevations, unconsolidated marine and alluvial sands often overlying deep marine sediments.	Geotechnical report not normally required.
B	Flanking slopes	5 to 25	Colluvial and residual soils, possibly deeper than in Class A, developed on Hawkesbury Sandstone. Minor detached sandstone blocks, occasional exposures of sandstone in cliffs and road cuts. Occasional fill areas associated with playing fields, roads and some developments.	Preliminary assessment of site conditions required to determine whether a geotechnical report is required.
C	Steeper slopes, generally near coastal areas adjacent to creeks and major gullies	>25	Colluvial soils and bouldery talus, with detached blocks of sandstone on steep escarpment areas, developed on Hawkesbury Sandstone. Near vertical cliffs to approximately 50m high at Dee Why Head.	Geotechnical report required.
D	Flanking slopes (Collaroy Plateau area)	5 to 15	Colluvial and residual soils (possibly deeper than in Class A) developed on Narrabeen Group or Hawkesbury Sandstone. Minor detached sandstone blocks, occasional exposures of sandstone in cliffs and road cuts. Occasional fill areas associated with playing fields, roads and some developments.	Preliminary assessment of site conditions required to determine whether a geotechnical report is required.
E	Steeper slopes (Collaroy Plateau area)	>15	Colluvial & residual soils & bouldery talus, with detached blocks of sandstone on steeper escarpment areas, developed on Narrabeen Group or Hawkesbury Sandstone. Near vertical cliffs up to about 20m high.	Geotechnical report required.

Appendix B

Comparison of Detailed DCP Clauses

Table B1 - Existing DCP Landslide Clauses

Pittwater 21 Development Control Plan	Manly Development Control Plan 2013	Warringah Development Control Plan 2011	Suggested New Clause
Section B General Controls **B3 Hazard Controls** **B3.1 Landslip Hazard** **Land to which this control applies** Land identified on the Pittwater Local Environmental Plan 2014 Geotechnical Hazard Map **Uses to which this control applies** *See extensive list* **Outcomes** Protection of people. (S) Protection of the natural environment. (En) Protection of private and public infrastructure and assets (S) **Controls** All development on land to which this control applies must comply with the requirements of the Geotechnical Risk Management Policy for Pittwater (see Appendix 5). Development must be designed and constructed to ensure that every reasonable and practical means available is used to remove risk to an acceptable level as defined by the Geotechnical Risk Management Policy for Pittwater (see Appendix 5) for the life of the development. The development must not adversely affect or be adversely affected by geotechnical processes nor must it increase the level of risk for any people, assets and infrastructure in the vicinity due to geotechnical hazards. **Variations** Nil	**Part 4 Development Controls** **4.1.8 Development on Sloping Sites** Relevant DCP objectives to be met in relation to these paragraphs include: **Objective 1)** To ensure that Council and the community are aware of, and appropriately respond to all identified potential landslip & subsidence hazards. **Objective 2)** To provide a framework and procedure for identification, analysis, assessment, treatment and monitoring of landslip and subsidence risk and ensure that there is sufficient information to consider and determine DAs on land which may be subject to slope instability. **Objective 3)** To encourage development and construction this is compatible with the landslip hazard and to reduce the risk and costs of landslip and subsidence to existing areas. See also paragraph 4.4.5 Earthworks (Excavation and Filling) of this plan, Clause 6.2 of the Manly LEP 2013, paragraph 4.1.2 Height of Buildings in respect of sloping sites and paragraph 3.1.1.1.b Setback Principles in Low Density Areas **Note:** Development on sloping sites often require geological survey to consider the stability of the slope and the suitability of the proposed design for that slope. **Requirements** a) The design of development must respond to the slope of the site, to minimise loss of views and amenity from public and private spaces. b) Developments on sloping sites must be designed to: i. generally step with the topography of the site; and ii. avoid large undercroft spaces and minimise supporting undercroft structures by integrating the building into the slope whether to the foreshore or a street. <u>Driveways on sloping sites</u> c) On steep sites, driveways must be designed so they do not dominate the street frontage, by: i. limiting their height above existing ground level to avoid the need for elevated ramps and similar structures to access car parking areas, especially those which may encroach on public land; ii. limiting their width; iii. using materials that do not visually detract from the natural surroundings; and iv. retaining significant trees. **When is a Site Stability (Geotechnical Survey) Report required?** a) A Site Stability Report is required with a DA when the proposed development involves: i. any land identified on the LEP Landslide Risk Map. DAs for development on land identified on the LEP Landslide Risk Map must consider certain matters under LEP clause 6.8; ii. any excavation greater than 1m below natural ground level for a basement or basement car parking area;	**E10 Landslip Risk** **Applies to Land** This control applies to land identified on the Warringah Local Environmental Plan 2011 – Landslip Risk Map as Area A, Area B, Area C, Area D or Area E. **Objectives** • To ensure development is geotechnical stable. • To ensure good engineering practice. • To ensure there is no adverse impact on existing subsurface flow conditions. • To ensure there is no adverse impact resulting from stormwater discharge. **Requirements** 1. The applicant must demonstrate that: i) The proposed development is justified in terms of geotechnical stability; and ii) The proposed development will be carried out in accordance with good engineering practice. 2. Development must not cause detrimental impacts because of stormwater discharge from the land. 3. Development must not cause detrimental impact on the existing subsurface flow conditions including those of other properties. 4. To address Requirements 1 to 3: i) For land identified as being in Area A: Council may decide that a preliminary assessment of site conditions is required. If Council so decides, a preliminary assessment of site conditions must be prepared, in accordance with the Checklist for Council's assessment of site conditions (see Notes) by a suitably qualified geotechnical engineer/engineering geologist. The preliminary assessment must be submitted to Council before the granting of any development consent. If the preliminary assessment determines that a geotechnical report is required, the same provisions apply in Area A as those that apply in Area B and Area D. ii) For land identified as being in Area B or D: A preliminary assessment of site conditions (see Notes) must be carried out for development. The preliminary assessment must be prepared by a suitably qualified geotechnical engineer/engineering geologist and must be submitted with the development application. If the preliminary assessment determines that a geotechnical report is required a report must be prepared by a suitably qualified geotechnical engineer / engineering geologist and	**Geotechnical Planning** **Land to which this control applies** All land to which Northern Beaches Local Environmental Plan 20xx applies. **Objectives** O1. To ensure development is geotechnical stable. O2. To ensure good engineering practice. O3. To ensure there is no adverse impact on existing subsurface flow conditions. O4. To ensure there is no adverse impact resulting from stormwater discharge. **Requirements** All development must comply with the requirements of the Geotechnical Planning Policy for Northern Beaches LGA (*naming of policy TBC*). Development must be designed and constructed to ensure that every reasonable and practical means available is used to remove geotechnical risk to an acceptable level as defined by the Geotechnical Planning Policy (*naming of policy TBC*) for the life of the development. The development must not adversely affect or be adversely affected by geotechnical processes, nor must it increase the level of risk for any people, assets and infrastructure in the vicinity due to geotechnical hazards.

	iii. building works (load bearing) on land contained in geotechnical area 'G1' in the Potential Geotechnical Landslip Hazard Map at Schedule 1 to this plan; or iv. building works (load bearing) on other land not contained in geotechnical area 'G1'. i.e. areas 'G2', 'G3' and 'G4' where a Preliminary Assessment of Site Conditions (Landslip) determines the need for a Site Stability Report, or where otherwise required by Council. **Note:** Applicants must consider which geotechnical area their property falls under in accordance with the Map of Geotechnical Areas at Schedule 1 to this DCP. Considerations for each geotechnical area include geotechnical implications on development; potential geotechnical hazards and typical consequences of failure. **Considerations required in Geotechnical area 'G1'** a) Site Stability Report required in geotechnical Area 'G1' DAs for load bearing building works to be carried out on land or in the vicinity of land in geotechnical area 'G1' on the Potential Geotechnical Landslip Hazard Map (see Schedule 1 to this plan) must be accompanied by a Site Stability Report. b) Detailed Requirements: When considering a Construction Certificate application, the Certifying Authority must be satisfied that any construction intended in the area includes appropriate precautions to prevent instability developing. Construction Certificate drawings should be viewed by the geotechnical engineer to confirm that the intent of the geotechnical recommendations has been correctly implemented. Site visits by geotechnical engineer may be appropriate during construction. Notwithstanding the above, Site Stability Report may not be required for minor works proposed in area G1 at the discretion of Council. c) Potential Geotechnical Hazards & Typical Consequences of Failure: i) Rock falls and rock toppling from natural cliffs, together with slumping of soil and fill materials from unsupported cuts onto public and private roadways and pathways are potential hazards in area G1. ii) Down slope creep of deeper talus materials may occur on steeper soil covered slopes as well as possible down slope movement of detached blocks of sandstone, soil slumps and flows. Typical consequences of failure include moderate damage to some of structure, ranging to possible extensive damage to most of structure, or extending beyond site boundaries. Significant part of site may require large stabilisation works if landslide occurs, or to prevent landslide occurring. **Considerations required in Other Geotechnical Areas (Areas G2, G3 and G4)** a) Site Stability Report may be required in Geotechnical Areas G2, G3 and G4 i) The applicant should complete Council's Checklist for Preliminary Assessment of Site Conditions (Landslip) at Schedule 11 of this plan to determine whether a Site	must be submitted with the development application. Also if the preliminary assessment determines that a geotechnical report is required a hydrological assessment of stormwater discharge and subsurface flow conditions, prepared by a suitably qualified geotechnical/hydrological engineer, must be submitted with the development application. iii) For land identified a being in Area C or Area E. A geotechnical report, prepared by a suitably qualified geotechnical engineer / engineering geologist, must be submitted with the development application. Also a hydrological assessment of stormwater discharge and subsurface flow conditions, prepared by a suitably qualified geotechnical/hydrological engineer, must be submitted with the development application. iv) When a geotechnical report is required to be submitted, (determined in accordance with i) to iii) above), the report must include a risk assessment of landslip in relation to both property and life. The risk assessment must have regard to any guidelines published by the Australian Geomechanics Society. **Exceptions** 1. No preliminary assessment of site conditions will be required in Areas B and D and no geotechnical and hydrological reports will be required in Areas C and E if the proposed development does not involve any site, building or structural works. 2. Council may determine that no geotechnical report is required for development situated in Areas C or E whether this can be demonstrated by a preliminary assessment of site conditions, prepared by a suitably qualified geotechnical engineer / engineering geologist, in accordance with the Checklist for Council's Assessment of site conditions (see Notes). 3. Council may determine that no hydrological assessment is required for development situated in Areas C or E where it can be demonstrated by a preliminary assessment of site conditions, prepared by a suitably qualified geotechnical / engineering geologist, in accordance with the Checklist for Council's Assessment of site conditions (see Notes). **Note** Landslip Risk Classes A to E, described in the following table, correlate to Areas A to E of the Warringah LEP 2011 – Landslip Risk Map	

	Stability Report is required. All development involving load bearing building works must complete the checklist for Preliminary Assessment of Site Conditions (Landslip) to ensure developments follows good engineering practice. b) Area G2 – Potential Hazards i) Potential Geotechnical hazards in this area include: • Rock falls and slumping of soil and fill materials from unsupported cuts and natural cliffs onto public and private pathways and roadways. • Possible creep of talus materials on steeper soil covered slopes. • Possible movement of detached blocks of sandstone. Limited to moderate damage of some or part of structures (for example dwelling or roadway), with part of site requiring some stabilisation works. Large scale stabilisation works unlikely to be required. c) Area G3 – Potential Hazards i) Potential for Geotechnical Hazards includes settlement of foundations due to failure of unsupported excavations, dewatering & vibrations and other construction activity. Possibility of earthquake induced settlement of foundation also exists in this area. Typical consequences of failure comprise little to moderate damage of some or part of structures, including neighbouring land including dwellings or roadway and typically requiring some stabilisation works over part of the site. The need for large scale stabilisation works is unlikely in Area G3. d) Area G4 – Potential Hazards and Requirements i) Geotechnical assessment may be required depending on location and nature of development and man-made cut and fill. ii) Residential footings are to be in accordance with AS2870. iii) Potential hazards for this land include rock falls & minor slumping of soil and fill materials from top of unsupported cuts onto public and private pathways, roadways and building platforms. there is little to moderate typical consequences of failure involving damage of some or part of structures (for example, to a dwelling or roadway), with part of site requiring some stabilisation works. Large scale stabilisation works are unlikely to be required in Area G4.		
Appendix 5 - Geotechnical Risk Management Policy for Pittwater	Schedule 1 – Maps accompanying the DCP Map C Potential Geotechnical Landslip Hazard Areas	Definitions of Landslip Risk Classes A to E	Geotechnical Planning Policy for Northern Beaches (*naming of policy TBC)*
	Schedule 11 Checklist for Preliminary Assessment of Site Conditions	Suggested Checklist for Council's Assessment of Site Conditions	

Table B2 - Existing DCP Earthworks Clauses:

Pittwater 21 Development Control Plan	Manly Development Control Plan 2013	Warringah Development Control Plan 2011	Suggested New DCP Clause
Section B General Controls **B8 Site Works Management** **B8.1 Construction and Demolition – Excavation and Landfill** **Land to which this control applies** All Land **Uses to which this control applies** *See extensive list* **Outcomes** Site disturbance is minimised. (En) Excavation, landfill and construction not to have an adverse impact. (En) Excavation and landfill operations not to cause damage on the development or adjoining property. (S) **Controls** Excavation and landfill on any site that includes the following: • Excavation greater than 1 metre deep, the edge of which is closer to a site boundary or structure to be retained on the site, than the overall depth of the excavation; • Any excavation greater than 1.5 metres deep below the existing surface; • Any excavation that has the potential to destabilize a tree capable of collapsing in a way that any part of the tree could fall onto adjoining structures (proposed or existing) or adjoining property; • Any landfill greater than 1.0 metres in height; and/or • Any works that may be affected by geotechnical processes or which may impact on geotechnical processes including but not limited to constructions on sites with low bearing capacity soils, must comply with the requirements of the Geotechnical Risk Management Policy for Pittwater (see Appendix 5) as adopted by Council and details submitted and certified by a Geotechnical Engineer and/or Structural Engineer with the detail design for the Construction Certificate. **Variations** Nil	**Part 4 Development Controls** **4.4.5 Earthworks (Excavation and Filling)** **Note:** Before granting development consent for earthworks, consideration must be given to the matters listed in LEP clause 6.2(3)(a)-(h). Relevant DCP objectives in this plan in relation to these paragraphs include: **Objective 1)** To retain the existing landscape character and limit change to the topography and vegetation of the Manly Local Government Area by: • Limiting excavation, "cut and fill" and other earthworks; • Discouraging the alteration of the natural flow of ground and surface water; • Ensuring that development not cause sedimentation to enter drainage lines (natural or otherwise) and waterways; and • Limiting the height of retaining walls and encouraging the planting of native plant species to soften their impact. See also paragraph 4.1.8 *Development on Sloping Sites (Planning Principles)* See also paragraph 3.3.2 *Preservation of Trees and Bushland V.* **4.4.5.1 General** a) Earthworks must be limited to that part of the site required to accommodate the building and its immediate surrounds to protect significant natural features of the site including vegetation and prominent rock outcrops. b) Natural and undisturbed ground level must be maintained within 0.9m of side and rear boundaries. c) On steeply sloping sites, pier and suspended slab or an equivalent non-invasive form of construction technique must be used to minimise earthworks and vegetation loss and retain natural features. d) Excavation under the canopy of any tree (including those on neighbouring properties) will only be permitted providing its long-term survival and stability is not jeopardised. Such excavation must be supported by an Arborist report. e) Approved sediment, siltation and stormwater control devices must be in place (and maintained) prior to and during the carrying out of any earthworks and other works on the site. **4.4.5.2 Excavation** a) Excavation is generally limited to 1m below natural ground level with the exception of basement parking areas (which will be contained within the footprint of the building) and swimming pools: b) A dilapidation survey report and geotechnical assessment may be required for excavation works exceeding 1m. Dilapidation survey reports are to include photographic	**Part C Siting Factors** **C7 Excavation and Landfill** **Applies to Land** This control applies to land to which Warringah Local Environmental Plan 2011 applies. **Objectives** • To ensure any land excavation or fill work will not have an adverse effect upon the visual and natural environment or adjoining and adjacent properties. • To require that excavation and landfill does not create airborne pollution. • To preserve the integrity of the physical environment. • To maintain and enhance visual and scenic quality. **Requirements** 1. All landfill must be clean and not contain any materials that are contaminated and must comply with the relevant legislation. 2. Excavation and landfill works must not result in any adverse impact on adjoining land. 3. Excavated and landfill areas shall be constructed to ensure the geological stability of the work. 4. Excavation and landfill shall not create siltation or pollution of waterways and drainage lines, or degrade or destroy the natural environment. 5. Rehabilitation and revegetation techniques shall be applied to the fill. 6. Where landfill is necessary, it is to be minimal and shall have no adverse effect on the visual and natural environment or adjoining and surrounding properties.	**Excavation and Landfill** **Land to which this control applies** All land to which Northern Beaches Local Environmental Plan 20xx applies. **Objectives** O1. To ensure that excavation, landfill and construction will not have an adverse impact on the environment. O2. To ensure that excavation and landfill operations will not cause damage on the development site or adjacent properties. **Requirements** Excavation and landfill on any site that includes the following: • Excavation greater than 1 metre deep, the edge of which is closer to a site boundary or structure to be retained on the site, than the overall depth of the excavation; • Any excavation greater than 1.5 metres deep below the existing surface; • Any excavation that has the potential to destabilise a tree or other structures capable of collapsing in a way that any part could fall onto adjoining structures (proposed or existing) or adjoining property and cause significant damage; • Any landfill greater than 1.0 metres in height; • Basement excavation which extends to within 1 m of the groundwater table or lower, and/or • Any works that may be affected by geotechnical processes or which may affect geotechnical processes including but not limited to construction on sites with low bearing capacity soils, must comply with the requirements of the Geotechnical Planning Policy for Northern Beaches LGA (*naming of policy TBC*) as adopted by Council and details submitted and certified by a Geotechnical Engineer and/or Structural Engineer with the detailed design for the Construction Certificate. **General** Any excavation and landfill must comply with the following: • All landfill must be clean and not contain any materials that are contaminated and must comply with the relevant legislation. • Excavation and landfill shall not create air pollution, siltation or pollution of waterways and drainage lines, or degrade or destroy the natural environment.

	survey of the physical condition of adjoining properties, both internally and externally, including walls, ceilings, rook, structural members and other such items. Such records are to provide proper record in relation to the proposed development to particularly assist in any dispute over damage to adjoining proposed arising from the works. It is in the interests of applicants and adjoining landowners for it to be as full and as detailed as necessary commensurate with the nature of the proposed development. **4.4.5.3 Filling** a) Filling must not exceed 1m above natural ground level. b) Only natural rock, gravels or sand material (not builder's waste or demolition materials), obtained from approved sources, must be used as filling. **4.4.5.4 Retaining walls** a) Retaining walls within 1m of the front boundary must not exceed 1m above natural ground level. *Sketch included*		• Approved sediment, siltation and stormwater control devices must be in place prior to carrying out of the earthworks and other works on site and maintained for the duration of the construction of the development.

Appendix C

Suggested New Planning Controls

Table C1 - New Geotechnical Planning Classes

Planning Class	Geology	Topographic Position	Slope Angle (degrees)	Description	Potential Geotechnical Issues			Typical requirements
					Slope Instability	Groundwater	Settlement due to poor soils	
C1	Hawkesbury Sandstone or Narrabeen Group	Plateau areas, ridge crests, and major spur slopes	<5	Generally shallow residual soils developed on bedrock. Some areas of fill.				Geotechnical report only required for excavations >1.5m or fills >1m
C2	Hawkesbury Sandstone	Flanking slopes	5 to 25	Colluvial and residual soils developed on Hawkesbury Sandstone. Minor detached sandstone blocks, occasional exposures of sandstone in cliffs and road cuts. Occasional fill areas associated with playing fields, roads and some developments.	X			Preliminary geotechnical assessment of site conditions required to determine whether a detailed geotechnical report is required.
C3	Hawkesbury Sandstone	Steeper slopes, generally near coastal areas or along the harbour foreshore, or adjacent to creeks and major gullies	>25	Colluvial soils and bouldery talus, with detached blocks of sandstone on steep escarpment areas, developed on Hawkesbury Sandstone.	X			Detailed geotechnical report required.
C4	Narrabeen Group	Flanking slopes	5 to 15	Colluvial and residual soils developed on Narrabeen Group. Minor detached sandstone blocks, occasional exposures of sandstone in cliffs and road cuts. Occasional fill areas associated with playing fields, roads and some developments.	X			Preliminary geotechnical assessment of site conditions required to determine whether a detailed geotechnical report is required.
C5	Narrabeen Group	Steeper slopes	>15	Colluvial & residual soils & bouldery talus, with detached blocks of sandstone on steeper escarpment areas, developed on Narrabeen Group.	X			Detailed geotechnical report required.
C6	Alluvial deposits and other soils	Alluvial flats and beach foredune areas		Unconsolidated marine and alluvial sands, often overlying deep marine sediments, with shallow groundwater tables.		X	X	Preliminary geotechnical assessment of site conditions and proposed development required to determine whether a detailed geotechnical or hydrogeological report is required.
C7	Hawkesbury Sandstone or Narrabeen Group	Coastal Cliff Zone – from within 20 m of the crest of a steep slope or cliff along the coast line between the Spit Bridge and Barrenjoey Head, extending down to water level		For areas along the coast line which have slopes greater than 45 degrees, a Coastal Cliff Zone has been designated which extends 20 m inland from the crest of the steep slope or cliff, and downslope to the mean water level.	X			Detailed geotechnical report required.

Note – If the subject site is mapped as being affected by more than one Planning Class, then a Preliminary Geotechnical Assessment shall be undertaken to determine which Planning Class is most appropriate for the site and whether additional geotechnical investigations and reports are required.

Table C2 – Requirements for Geotechnical Reports to support Development Applications

Development Type	Geotechnical Planning Classes						
	C1	C2	C3	C4	C5	C6	C7
	Hawkesbury & Narrabeen Slopes <5 degrees	Hawkesbury Slopes 5 to 25 degrees	Hawkesbury Slopes > 25 degrees	Narrabeen Slopes 5 to 15 degrees	Narrabeen Slopes > 15 degrees	Alluvial and Soil Deposits	Coastal Cliff Zone
Minor Development / Alterations [1]	No Geotechnical Assessment required	No Geotechnical Assessment required	No Geotechnical Assessment required	No Geotechnical Assessment required	Preliminary Geotechnical Assessment required	No Geotechnical Assessment required	Preliminary Geotechnical Assessment required
Standard development up to two storeys – all excavation <1.5 m and landfill <1 m	No Geotechnical Assessment required	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required
Development with more than two storeys [2]	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Detailed Geotechnical Report required	Detailed Geotechnical Report required	Detailed Geotechnical Report required	Detailed Geotechnical Report required
Any excavation >1 m within 1 m of site boundaries or structures	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required
Any excavation >1.5 m	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required
Any excavation with potential to destabilise trees or other structures such that they could fall onto adjoining structures or properties and cause significant damage	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required
Landfill >1 m	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required
Basement excavation to extend to within 1 m of groundwater level or lower	Preliminary Geotechnical Assessment required	Preliminary Geotechnical Assessment required	Detailed Geotechnical Report required	Detailed Geotechnical Report required	Detailed Geotechnical Report required	Detailed Geotechnical and Hydrogeological Report required [3]	Preliminary Geotechnical Assessment required

Notes:

1 Minor Alterations and Additions to existing developments that do not affect the geotechnical conditions on or around the site.

2 Storey means a space within a building which is situated between one floor level and the floor level next above, or if there is no floor above, the ceiling or roof above, but not a mezzanine.

3 Hydrogeological reports must comply with the requirements of the NSW Water Management Act and the guidelines for hydrogeological investigations published by Water NSW and the NSW Department of Planning and Environment - Water

C3: Proposed New Appendix to DCP Geotechnical Planning Clause

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Draft Geotechnical Planning Policy
Northern Beaches Council - 2021

1. Introduction

The Geotechnical Planning Policy (the Policy) establishes the approach for assessing the geotechnical planning requirements for all properties within the Northern Beaches Local Government Area (LGA).

2. Policy Statement

The primary method of geotechnical risk management in the Northern Beaches LGA is through the application of geotechnical conditions as set out in a Geotechnical Report supporting a Development Application and through the review generated by the issue of Building Certificates.

Once geotechnical risk management measures have been identified for a site, it is the owners' responsibility to ensure their site is maintained in accordance with the recommendations of the geotechnical report for the site and on the basis that every reasonable and practical step that is available should be used to remove risk.

Development must be undertaken in accordance with the "Acceptable Risk Management" criteria defined in this document for Loss of Property and Loss of Human Life for a design project life, taken to be 100 years, unless otherwise justified by the applicant and accepted by Council. These criteria are based on the guidelines established initially in AGS 2000 and as further developed in AGS 2007.

3. Objectives

The objectives of this Policy are to ensure that:

a) geotechnical and related structural matters are adequately investigated and documented by applicants prior to the lodgement of any development application to carry out any development subject to this Policy, or wherever an application is lodged for a Building Certificate,

b) the proposed development is appropriate for the site and any relevant conditions are identified in the geotechnical report,

c) in the event that a proposed development is only appropriate if carried out subject to geotechnical and related structural engineering conditions, those geotechnical conditions are identified by applicants prior to lodgement of the development application and are able to be met, including all appropriate constraints and remedial maintenance actions required prior to, during and after the carrying out of the development,

d) effective geotechnical conditions are specified in the Geotechnical Reports and are incorporated into the architectural and structural engineering design plans at the Construction Certificate stage,

e) the preparation of geotechnical and related structural engineering information and certificates required to be lodged by this Policy are carried out by suitably qualified professionals with appropriate expertise in the applicable areas of engineering,

f) developments are only carried out if geotechnical and related structural engineering risks are identified and can be effectively addressed and managed for the life of the development.

g) the development is constructed in accordance with the recommendations of the Geotechnical Engineer or Engineering Geologist and checked by the Geotechnical Engineer or Engineering Geologist.

h) ongoing requirements to maintain the integrity of the geotechnical solution as contained in consent are effectively carried out to the specified requirements for the life of the development.

4. Application

This Policy is to be applied as follows:

a) to address both structural and geotechnical requirements relating to geotechnical issues only. Separate structural requirements will also apply for the erection of any structure in accordance with the *Building Code of Australia* (BCA), engineering standards and best engineering practice.

b) to any works within the LGA that may be affected by geotechnical processes or which may affect geotechnical processes.

5. Geotechnical Zoning

All of the land in the LGA has been mapped using seven geotechnical planning classes, which are based on the underlying geology, existing slopes and proximity to the coastal cliff line.

The planning classes are listed in Table 1 and the mapping for the LGA is shown on the Northern Beaches Geotechnical Planning Maps which are available on the Council website.

The requirements for geotechnical reports to support Development Applications or applications for Building Certificates for any site in the LGA are outlined in Table 2. The requirements are based on the Planning Class for the site as identified on the Geotechnical Planning Maps, the type of development and the extent of excavation and landfilling proposed for the development.

If the subject site is mapped as being affected by more than one Planning Class, then a Preliminary Geotechnical Assessment shall be undertaken to determine which Planning Class is most appropriate for the site and whether additional geotechnical investigations and reports are required, unless Table 2 indicates that no geotechnical assessment is required for any of the combinations of Planning Classes and development types affecting the site.

Table 1 - Geotechnical Planning Classes

Planning Class	Geology	Topographic Position	Slope Angle (degrees)	Description	Typical requirements
C1	Hawkesbury Sandstone or Narrabeen Group	Plateau areas, ridge crests, and major spur slopes	<5	Generally shallow residual soils developed on bedrock. Some areas of fill.	Geotechnical report typically only required for excavations >1.5m or fills >1m
C2	Hawkesbury Sandstone	Flanking slopes	5 to 25	Colluvial and residual soils developed on Hawkesbury Sandstone. Minor detached sandstone blocks, occasional exposures of sandstone in cliffs and road cuts.	Preliminary Geotechnical Assessment of site conditions required to determine whether a Detailed Geotechnical Report is required.
C3	Hawkesbury Sandstone	Steeper slopes, generally near coastal areas or along the harbour foreshore, or adjacent to creeks and major gullies	>25	Colluvial soils and bouldery talus, with detached blocks of sandstone on steep escarpment areas, developed on Hawkesbury Sandstone.	Detailed Geotechnical Report required.
C4	Narrabeen Group	Flanking slopes	5 to 15	Colluvial and residual soils developed on Narrabeen Group. Minor detached sandstone blocks, occasional exposures of sandstone in cliffs and road cuts.	Preliminary Geotechnical Assessment of site conditions required to determine whether a Detailed Geotechnical Report is required.
C5	Narrabeen Group	Steeper slopes	>15	Colluvial & residual soils & bouldery talus, with detached blocks of sandstone on steeper escarpment areas, developed on Narrabeen Group.	Detailed Geotechnical Report required.
C6	Alluvial deposits and other soils	Alluvial flats and beach foredune areas		Unconsolidated marine and alluvial sands, often overlying deep marine sediments, with shallow groundwater tables.	Preliminary Geotechnical Assessment of site conditions and proposed development required to determine whether a Detailed Geotechnical or Hydrogeological Report is required.
C7	Hawkesbury Sandstone or Narrabeen Group	Coastal Cliff Zone – from within 20 m of the crest of a steep slope or cliff along the coastline between the Spit Bridge and Barrenjoey Head, extending down to water level		For areas along the coastline which have slopes greater than 45 degrees, a Coastal Cliff Zone has been designated which extends 20 m inland from the crest of the steep slope or cliff and downslope to the mean water level.	Detailed Geotechnical Report required.

Note – If the subject site is mapped as being affected by more than one Planning Class, then a Preliminary Geotechnical Assessment shall be undertaken to determine which Planning Class is most appropriate for the site and whether additional geotechnical investigations and reports are required.

Table 2 – Requirements for Geotechnical Reports to support Development Applications

Development Type	Geotechnical Planning Classes						
	C1	C2	C3	C4	C5	C6	C7
	Hawkesbury & Narrabeen Slopes <5 degrees	Hawkesbury Slopes 5 to 25 degrees	Hawkesbury Slopes > 25 degrees	Narrabeen Slopes 5 to 15 degrees	Narrabeen Slopes > 15 degrees	Alluvial and Soil Deposits	Coastal Cliff Zone
Minor Development / Alterations [1]	None [4]	None	None	None	Prelim	None	Prelim
Standard development up to two storeys – all excavation <1.5 m and landfill <1 m	None	Prelim	Prelim	Prelim	Detailed	Prelim	Detailed
Development with more than two storeys [2]	Prelim [5]	Prelim	Detailed [6]	Detailed	Detailed	Detailed	Detailed
Any excavation >1 m within 1 m of site boundaries or structures	Prelim	Prelim	Detailed	Prelim	Detailed	Prelim	Prelim
Any excavation >1.5 m	Prelim	Prelim	Detailed	Prelim	Detailed	Prelim	Prelim
Any excavation with potential to destabilise trees or other structures such that they could fall onto adjoining structures or properties and cause significant damage	Prelim	Prelim	Detailed	Prelim	Detailed	Prelim	Prelim
Landfill >1 m	Prelim	Prelim	Detailed	Prelim	Detailed	Prelim	Prelim
Basement excavation to extend to within 1 m of groundwater level or lower	Prelim	Prelim	Detailed	Detailed	Detailed	Detailed Geotechnical and Hydrogeological Report required [3]	Prelim

Notes:
1. Minor Alterations and Additions to existing developments that do not affect the geotechnical conditions on or around the site
2. Storey means a space within a building which is situated between one floor level and the floor level next above, or if there is no floor above, the ceiling or roof above, but not a mezzanine.
3. Hydrogeological reports must comply with the requirements of the NSW Water Management Act and the guidelines for hydrogeological investigations published by Water NSW and the NSW Department of Planning and Environment - Water
4. None = No Geotechnical Assessment required
5. Prelim = Preliminary Geotechnical Assessment required
6. Detailed = Detailed Geotechnical Report required

Classes 1 to 6 are based on simply on combinations of the underlying geology and the ground slopes.

Class 7 (Coastal Cliff Zone) has been developed by identifying all slopes along the coastline between Barrenjoey Head and the Spit Bridge which are steeper than 45 degrees, and then plotting an area which starts 20 m upslope of the crest of the slope (refer Figure 1). While the zone shown on the maps is a uniform width of 40 m for plotting purposes only, in all cases the Coastal Cliff Zone extends to water level in the downslope direction.

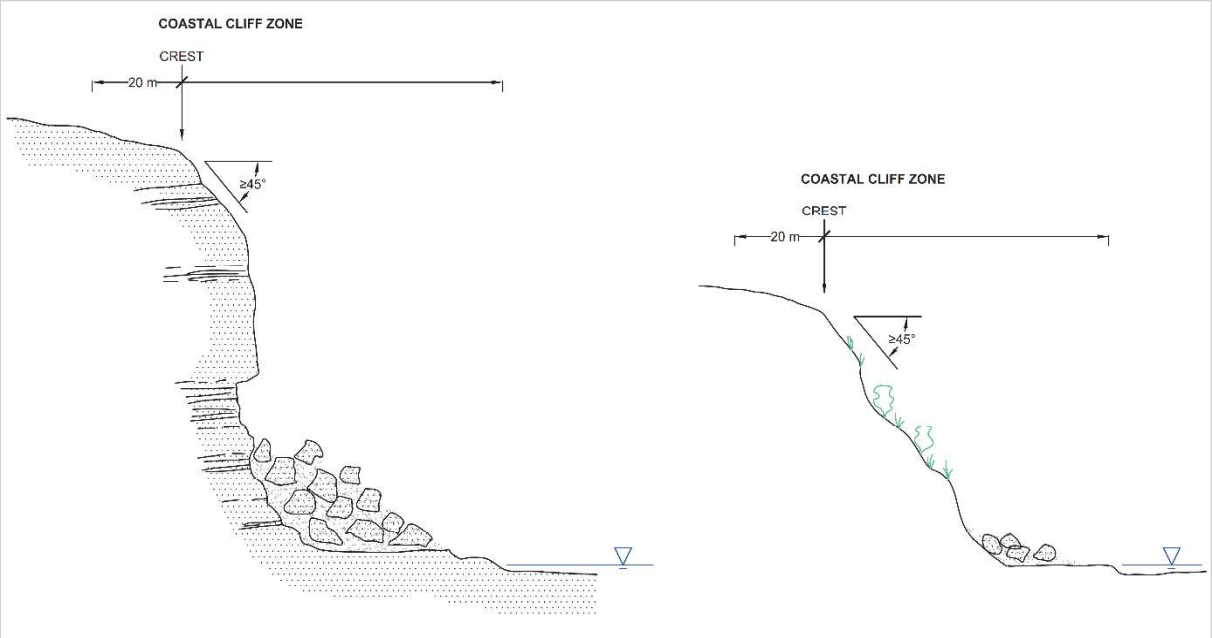

Figure 1: Definition of Coastal Cliff Zone used on maps

6. Preparation of Preliminary Geotechnical Assessments and Detailed Geotechnical Reports

6.1 Level of Geotechnical Investigation

It is the responsibility of the Geotechnical Engineer or Engineering Geologist to determine the level of investigation required for a particular site or proposed development.

At all times any decision regarding the degree of investigations and assessment required must be dictated by consideration of risk to Life and to Property and the recognition by the Geotechnical Engineer or Engineering Geologist that the Council will rely on the Geotechnical Assessment, Report or Opinion as the basis for ensuring that the geotechnical risk management aspects of the site and proposed development have been adequately addressed.

6.2 Minor Development, Minor Alterations and/or Development Separate from a Geotechnical Hazard

For minor development, minor alteration (refer to Definitions) and/or development separate from and not affected by a Geotechnical Hazard, in accordance with Table 2, no geotechnical assessment is required for the Planning Classes C1, C2, C3 C4 or C6.

For Planning Classes C5 and C7 a Geotechnical Engineer or Engineering Geologist must carry out a Preliminary Geotechnical Assessment and may determine that a Detailed Geotechnical Report is not required. This must be justified as a clear professional opinion with the supporting basis on which the opinion was formed presented in a Preliminary Geotechnical Assessment and certified on Form 1.

6.3 Structures Separate from the Primary Development

For structures separated from the primary development, for example, a swimming pool or retaining wall, the Geotechnical Engineer or Engineering Geologist may determine the level of investigation required for a particular site and proposal, particularly where the primary development is pre-existing. This must be justified as a clear professional opinion with the supporting basis on which the opinion was formed presented in a Preliminary Geotechnical Assessment and certified on Form 1.

6.4 Preliminary Geotechnical Assessment

Where a Preliminary Geotechnical Assessment is required, a brief report or letter prepared by a Geotechnical Engineer or Engineering Geologist (refer to Definitions) to be submitted with a Development Application, is to include the following elements:

a) An inspection of the site

b) A review of the regional geology in the area of the site

c) A review of the topographic features in the area

d) An assessment of the likely groundwater levels

e) Identification of any potential geotechnical hazards on the site or on neighbouring properties that may affect this land

f) A review of the proposed development and its impact on the geotechnical and/or groundwater conditions in or around the site

g) A preliminary geotechnical risk assessment for any identified hazards

h) A clear statement as to whether additional geotechnical or hydrogeological investigations or inspections are required.

i) A completed Form 1.

6.5 Detailed Geotechnical Report

Where a Detailed Geotechnical Report prepared by a Geotechnical Engineer or Engineering Geologist (refer to Definitions) is required, the report is to include the following elements:

a) Details of all site inspections and site investigations. A site inspection is required in all cases. Site investigation may require sub-surface investigation; appropriate investigation techniques may involve boreholes and/or test pit excavations or other methods necessary to adequately assess the geotechnical, geological and hydrogeological models for the site. For those sites where a Hydrogeological Report is required, the investigation is to comply with the requirements of the NSW Water Management Act and the guidelines for hydrogeological investigations published by Water NSW and the NSW Department of Planning and Environment- Water.

b) Plans and sections of the site and related land from survey and field measurements with contours and spot levels to AHD. Key features are to be identified, including the locations of the proposed development, buildings/structures on both the subject site and adjoining site, storm water drainage, sub-surface drainage, water supply and sewerage pipelines. Where possible, the survey plan should be augmented by geomorphological mapping.

c) Photographs and/or drawings of the site and related land adequately illustrating all geotechnical features referred to in the Detailed Geotechnical Report, as well as the locations of the proposed development.

d) Presentation of an interpreted geological model of the site and related land showing the proposed development, including an assessment of sub-surface conditions, taking into account thickness of the topsoil, colluvium and residual soil layers, depth to underlying bedrock, and the location and depth of groundwater.

   Hydrogeological conditions including seepage inflows and/or dewatering impacts should also be modelled and assessed, where applicable.

   For Geotechnical Planning Class C7 (Coastal Cliff Zones) the model must also include an assessment of the potential mechanisms of cliff or slope failure and assessment of the potential scale of failure that may affect the site.

e) An assessment of the risk posed by all identifiable Geotechnical Hazards that have the potential to either individually or cumulatively affect people or property upon the site or adjoining properties in accordance with the guidelines set out in AGS 2007(c) and in particular, in the format as outlined in Figure 1 “Framework for Landslide Risk Management” contained therein. Risk of loss of life should be determined quantitatively. Risk of loss of property can be determined quantitatively or in accordance with the qualitative terminologies and matrices presented in AGS 2007(c).

   Specific risk assessment outcomes to be targeted are as follows:

   - For new sites or developments
     - a maximum acceptable Loss of Life Risk of 10^{-6} per annum
     - a Low Risk to Property
   - For existing sites or developments
     - a maximum acceptable Loss of Life Risk of 10^{-5} per annum

- a Low Risk to Property. Moderate Risk may be tolerated in some circumstances provided treatment options are implemented as soon as practical to reduce the risk to Low.

This Policy requires that "Acceptable Risk" Criteria are achieved and maintained for Development Application approval.

f) A conclusion as to whether the site is suitable for the development proposed to be carried out. This must be in the form of a specific statement that *"The site is suitable (or can be made suitable) for the development proposed and the site and/or the development proposal can achieve the Acceptable Risk Management required by this Policy provided that ……".*

g) Details of all geotechnical conditions or information that are required for the different stages of development, including the following:

i. For Development Approval:

- Footing levels and supporting rock quality (where applicable)
- Extent of earth and rock cut and fill (where applicable)
- Recommendations for excavation and batters (where applicable)
- Parameters, bearing capacities and recommendations for use in the design of all structural works with geotechnical components, including footings, retaining walls, surface and sub-surface drainage.
- Recommendations for the selection of building structure systems consistent with the geotechnical risk assessment
- Any other conditions required to ensure the proposal can achieve the "Acceptable Risk Management" level as defined in this Policy.
- Any other conditions required to remove geotechnical risks that can reasonably and practically be addressed.

ii. For Construction Certificate:

- Any structural design relating to the geotechnical aspects of the proposal is to be checked and certified by a suitably qualified and experienced Structural/Civil Engineer and Geotechnical Engineer/Engineering Geologist as being in accordance with the geotechnical recommendations.
- Any other design, excavation or construction conditions required in the design phase in order to ensure the design will achieve the "Acceptable Risk Management" level as defined in this Policy for potential loss of both property and life.

iii. For Construction:

- Constructed works relating to the geotechnical aspects of the proposal that require the sign off by a suitably qualified and experienced Geotechnical Engineer or Engineering Geologist. The report must highlight and detail the inspection regime to provide the builder with adequate notification for all necessary inspections.
- Any other design, excavation or construction conditions including works methodology and temporary works required in the construction phase in order to ensure the design will achieve the "Acceptable Risk Management" level as defined in this Policy for the potential loss of both property and life.

iv. For ongoing management of the site or structure:

- Any conditions that may be required for the ongoing mitigation and maintenance of the site and the proposal, from a geotechnical viewpoint. Such conditions to be in the form of a recommendation for ongoing maintenance to ensure that any owner or future owners are clearly notified of their ongoing responsibility.

v. For Occupation/Subdivision Certificate:

- Any conditions that may be required for the Occupation/Subdivision stage, from a geotechnical viewpoint

h) For bushfire prone lands, as identified as Council Asset Protection Zones, the Detailed Geotechnical Report is to assess the potential geotechnical impacts of any bushfire management, such as clearing of vegetation for fire breaks.

i) A statement with supporting information to the effect that every reasonable and practical step available has been identified to remove any foreseeable geotechnical risk from the site over and above attainment of the "Acceptable Risk Management" criterion.

j) A copy of Form 1 bearing the signature of the Geotechnical Engineer or Engineering Geologist as defined by this Policy, who has either prepared or technically reviewed the Geotechnical Report.

6.6 Geotechnical Report to Support a Building Certificate

Where a geotechnical report prepared by a Geotechnical Engineer or Engineering Geologist (refer to Definitions) is to be submitted in support of a Building Certificate Application, it is the responsibility of the Geotechnical Engineer or Engineering Geologist to determine, from consideration of the site, the structures and the risk to life and property, whether a Detailed Geotechnical Report is required.

Where, in the opinion of the Geotechnical Engineer, the site and structures have been in existence for at least 10 years and have demonstrated a performance at a tolerable risk level, or better, during that period, and there is not a foreseeable reason why this situation should change, the geotechnical report to be submitted with the application for a Building Certificate should at least address the following elements:

a) An assessment of the risk posed by the identifiable Geotechnical Hazards that have the potential to either individually or cumulatively affect people or property upon the site or adjoining properties in accordance with the guidelines set out in AGS 2007 (c) and in particular, in the format as outlined in Figure 1 "Framework for Landslide Risk Management" contained therein. Risk of loss of life should be determined quantitatively. Risk of loss of property can be determined quantitatively or in accordance with the qualitative terminologies and matrices presented in AGS 2007(c).

   This Policy requires that "Tolerable Risk" Criteria are achieved and maintained for Building Certificate approval for sites and structures which have not been altered for at least 10 years. For all other sites and structures "Acceptable Risk" Criteria must be achieved.

b) Details of all site inspections and site investigations and any other information used in preparation of the Geotechnical Report. A site inspection is required in all cases. Site investigation may require sub-surface investigations; appropriate investigation techniques may involve bore holes and/or test pit excavation or other methods necessary to adequately assess

the geotechnical/geological model for the site. It is the responsibility of the Geotechnical Engineer or Engineering Geologist to determine the level of investigation required to adequately address the issues of risk to life and property.

c) Photographs and/or drawings of the site and related land adequately illustrating all geotechnical features referred to in the Geotechnical Report, as well as the existing structure.

d) A conclusion as to whether the site and the existing development achieves the 'Tolerable Risk Management criteria' and if not, what specific actions are required to achieve this criterion to enable a Building Certificate to be issued.

e) Any further reasonable and practical action that should be undertaken to remove risk.

f) Any covenant that would be necessary to ensure the ongoing mitigation and maintenance of the site from a geotechnical viewpoint.

g) A copy of Form 4 bearing the signature of the Geotechnical Engineer or Engineering Geologist as defined by this Policy who has either prepared or technically reviewed the Geotechnical Report.

7. Circumstances in which Council would not support an Application

Council may not support a Development Application or application for a Building Certificate as follows:

a) Where a geotechnical report accompanying a Development Application has been prepared by an engineer(s) with qualifications that do not meet the requirements of this policy, then Council shall refuse to support the development application, until the geotechnical report has been technically reviewed and certified by a Geotechnical Engineer or Engineering Geologist as defined by this policy.

b) Where a geotechnical report accompanying a Building Certificate Application has been prepared by an engineer(s) with qualifications that do not meet the requirements of this policy, then Council shall refuse to support the application, until the geotechnical report has been Technically reviewed and certified by a Geotechnical Engineer or Engineering Geologist as defined by this policy.

c) Where a geotechnical report or an independent review of a geotechnical report accompanying an application, identifies the risk to property and/or life posed by the geotechnical hazard as greater than the level of "Acceptable Risk Management" in the case of a Development Application or "Tolerable Risk Management" in the case of a Building Certificate as defined in this Policy after all feasible measures to reduce the risk have been considered.

8. General Requirements

The following general requirements are also applicable:

a) Northern Beaches Council may, if appropriate, impose conditions on a development consent requiring the lodgement of interim Geotechnical Certificates related to the stages of the construction of any development. The form of any such interim certificate must be consistent with Form 3, amended as required to reflect its status as an interim certificate only.

It is the responsibility of the Geotechnical Engineer or Engineering Geologist preparing the geotechnical report in support of the Development Application submission to ensure the necessary Geotechnical Conditions requiring interim inspections are included in the Detailed Geotechnical Report.

b) All conditions relating to the geotechnical aspects of the proposal for the design and construction phase are to be incorporated in the Detailed Geotechnical Report. Council will rely on those conditions as being the complete set required to ensure the proposed outcome achieves an "Acceptable Risk Management" level as defined in this Policy.

c) Any development application for a development subject to this Policy must incorporate any conditions the Geotechnical Engineer or Engineering Geologist believes are necessary to incorporate into a covenant on title to ensure that the land owner both at the time of application and into the future is aware of their responsibilities for any necessary on-going works or monitoring to ensure the site and the development remain within the "Acceptable Risk Management" level.

9. Other Analysis Requirements

Other analysis requirements are as follows:

a) Where a Preliminary Geotechnical Assessment or a Detailed Geotechnical Report contains a recommendation for a separate analysis of the site to be carried out by another consultant, for example, a flood study to be compiled by a hydrological consultant, this recommendation is to be highlighted to the applicant in the geotechnical report. This would enable the applicant to engage the required consultant and obtain the necessary report prior to the lodgement of the Development Application.

b) This policy requires that the civil or structural engineer, who prepares the structural documentation, is a civil or structural engineer as defined by this Policy. This Policy also requires that the engineer, in preparing the structural documentation, has viewed and where necessary used the recommendations given in the Preliminary Geotechnical Assessment or the Detailed Geotechnical Report for the same development. These requirements need to be verified by accompanying the submission of the structural documentation with a completed copy of Form 2.

c) Northern Beaches Council retains the right to have a geotechnical report submitted with a Development Application peer reviewed by an independent Geotechnical Engineer or Engineering Geologist at the applicant's cost.

10. Community Awareness

10.1 Section 10.7 Certificates

Notification of properties known to be potentially affected by Geotechnical Hazards is to be undertaken by inclusion on the Section 10.7 Certificate (previously known as the Section 149 Certificate). This

provides advice to current owners as to the potential for geotechnical risk and the advice transfers to new owners with the sale of the property.

10.2 88B Instruments

Where there are specific management, maintenance or monitoring requirements to ensure the geotechnical risk is managed within the “Acceptable Risk Management” criterion, and/or reasonable practical steps can be taken to remove risk, then these are to be included as a covenant on the title of the property to ensure current and future owners are aware of their responsibilities.

Any recommendation for inclusion of a covenant on the title of the property must be contained in the Geotechnical Conditions attached to the Geotechnical Report

11. Forms

The forms required to be submitted with different applications to Council are summarised in Table 3. Copies of blank forms are attached to this Policy.

Table 3 – Forms required to be submitted with Applications to Council

Form No.	When is it required?	Prepared & signed by	Why is it necessary?	
1	Development Application	Geotechnical Engineer or Engineering Geologist	Confirms that the geotechnical assessment or geotechnical report has been prepared or technically reviewed by a Geotechnical Engineer or Engineering Geologist (as defined by this policy)	Attached to a Preliminary Geotechnical Assessment, or a Detailed Geotechnical Report accompanying a Development Application
2A	Application for Construction Certificate	Structural Engineer or Civil Engineer	Confirms that the structural design has been prepared by a Structural Engineer (as defined by this policy) in accordance with the recommendations set out in the geotechnical report for the development.	Attached to structural or civil documentation submitted with application for Construction Certificate
2B		Geotechnical Engineer or Engineering Geologist	Confirms that the Geotechnical Engineer has reviewed the structural documentation and agrees that the geotechnical requirements have been correctly interpreted and incorporated. into the design documents.	
3	Application for Occupation Certificate or Subdivision Certificate (at the completion of a project prior to occupation of premises)	Geotechnical Engineer or Engineering Geologist	Confirms that the recommendations in the Geotechnical Report have been complied with during construction, as well as any subsequent geotechnical requirements introduced during construction.	In most cases a Geotechnical Engineer or Engineering Geologist will need to observe foundation materials, excavations, retaining structures and subsoil drainage prior to signing Form 3
4	Application for Building Certificate, or Response to an Order issued by Council	Geotechnical Engineer or Engineering Geologist	Confirms that the site and structures on the site have been assessed by a Geotechnical Engineer or Engineering Geologist and achieve at least a 'Tolerable Risk Management' status. Confirms that reasonable and practical measures to reduce foreseeable geotechnical risk have been identified and suitable recommendations have been included in a geotechnical report accompanying the Building Certificate Application or a response to an Order.	If the Geotechnical Engineer or Engineering Geologist assess that the geotechnical risks on the site and development are not at the 'Tolerable Risk Management' level then the remedial actions required must be identified in a report and indicated on Form 4. If the remedial action requires works that would need Development Approval then a Development Application must be lodged.

12. Definitions

Any terms which are defined in the Environmental Planning & Assessment Act 1979 or the Environmental Planning & Assessment Act Regulations 2000 have the same meaning when used in this Policy.

In this Policy, the following terms have the meanings set out below:

Acceptable Risk – Acceptable Risk includes the risk to life and the risk to property; both must be considered. The guidance for the establishment of acceptable risk criteria in this Policy has been based on the contents of AGS 2007(c & d).

- Acceptable Risk for Loss of Life for the person(s) most at risk, per annum is taken as having a probability of
  - o 1×10^{-6} per annum for new sites or developments, and
  - o 1×10^{-5} per annum for existing sites or developments.
- Acceptable Risk for Loss of Property is taken as "Low" as defined in AGS 2007.

Risk levels for both loss of life and property should be determined in accordance with the methodologies presented in AGS 2007(c). Risk of loss of life should be determined quantitatively. Risk of loss of property can be determined quantitatively or in accordance with the qualitative terminologies and matrices presented in AGS 2007(c).

Acceptable Risk Management – The complete process of risk assessment and control of risk to the level defined as "Acceptable Risk" in this Policy.

AGS – Australian Geomechanics Society.

AGS 2000 – Australian Geomechanics Society 2000, "Landslide Risk Management Concepts and Guidelines", AGS Sub-Committee on Landslide Risk Management, Australian Geomechanics Journal Vol 35 No. 1 March 2000, also reprinted in Australian Geomechanics Journal Vol 37 No. 2, May 2002.

AGS 2007 (a, b, c, d, e) **–** Australian Geomechanics Society 2007, "Landslide Risk Assessment and Management", Australian Geomechanics Journal Vol 42, No 1, March 2007. AGS 2007 may be purchased on www.australiangeomechanics.org

AHD - Australian Height Datum

Application - means any development application which relates to land in the Northern Beaches LGA

BCA - means the Building Code of Australia.

Building - includes any structure or part of a structure.

Building Certificate – A Certificate under Section 6.26 of the EPA Act that, if issued by Council, confirms that:

(a) the building or part thereof is in accordance with a consent or approval, or

(b) no action will be taken by Council in relation to a building or part thereof that was not originally approved.

The issuance of the certificate may be contingent on the carrying out of works.

Building Certificate Geotechnical Report – means a Geotechnical Report associated with the lodgement of a Building Certificate Application. The report must conform to the requirements of AGS 2007 for identification and treatment of risk to the "Acceptable Risk Management" criteria stated in this policy and the requirement to remove risk wherever reasonable and practical. For sites and structures which have been in existence for at least 10 years without change and no foreseeable changes in the future then the "Tolerable Risk Management" criteria may be applied.

Civil Engineer or Structural Engineer - means a civil or structural engineer who is a registered professional engineer and has an appropriate level of professional indemnity insurance.

Covenant – An agreement between the Council and a landowner for the landowner to do, or to refrain from doing, certain acts in relation to the land. A restrictive covenant prevents a proprietor from carrying out specified actions. A positive covenant binds a proprietor to do or complete specified action(s).

Detailed Geotechnical Report - means a report prepared by and/or technically reviewed by a Geotechnical Engineer or Engineering Geologist as defined by this policy, which incorporates each of the elements, where applicable to the type of development, described in the "Detailed Geotechnical Report" section of this policy.

Development - has the same meaning as set out in Part 4 of the Environmental Planning & Assessment Act 1979 or any replacement or substitution of that provision and includes not only that specific development but also the overall site on which the development is located.

Engineering Geologist - means a specialist Engineering Geologist who is a registered professional engineering geologist and has an appropriate level of professional indemnity insurance.

EPA Act 1979 - means Environmental Planning & Assessment Act 1979 (NSW).

Final Geotechnical Certificate - means a certificate of a Geotechnical Engineer or Engineering Geologist in accordance with Form 3.

Geotechnical Engineer - means a specialist Geotechnical Engineer who is a registered professional engineer and has an appropriate level of professional indemnity insurance.

Geotechnical Hazard - means a condition with the potential for causing the movement of rock, debris or earth, which may cause injury or death to persons or damage to, or destruction of property

Geotechnical Maps - means the maps identifying sites subject to Northern Beaches Council's Geotechnical Planning Policy for the Northern Beaches Local Government Area.

Geotechnical Works - means the elements of site modification designed by the geotechnical engineer.

Hydrogeological Report – means a report prepared by and/or technically reviewed by an experienced Hydrogeologist or a Geotechnical Engineer as defined by this policy, which presents details of the existing subsurface flows and the potential impacts of the proposed development. The report should be prepared in accordance with the guidelines published by Water NSW and NSW Department of Planning and Environment to comply with the NSW Water Management Act.

Life of the Structure – This provides the context within which the geotechnical risk assessment should be made. The required 100 year baseline broadly reflects the expectations of the community for the anticipated life of a residential structure and hence the timeframe to be considered when undertaking the geotechnical risk assessment and making recommendations as to the appropriateness of a development, its design and any remedial measures that should be put in place to control risk. It is recognized that in a 100-year period external factors that cannot reasonably be foreseen may affect the geotechnical risks associated with a site. Hence, the Policy does not seek the Geotechnical Engineers to warrant the development for a 100-year period, rather to provide a professional opinion that foreseeable geotechnical risks to which the development may be subjected in that timeframe have been reasonably considered.

Minor Development and/or Minor Alteration – Minor alterations or additions to existing developments that do not affect the geotechnical conditions on or around the site. Some examples include:

- Non-structural alterations to a building;
- Minor structural alterations that do not result in the current load-bearing capacity of the building or its foundations being exceeded;
- A minor addition, verandah, deck, porch, pergola or similar that is fully supported by an existing building;
- The erection of a minor structure or addition that does not require any excavation deeper than 500 mm below existing ground level; and
- Minor earthworks, including landscaping, that does not include any filling in excess of 500 mm in thickness.

Occupation Certificate – means a Certificate under Sections 6.9 and 6.10 of the EPA Act that, if issued by Council or an accredited certifier, authorizes occupation and use of a building or part thereof.

Orders Process – Orders issued under Protection of the Environment Operations Act, 1997; Local Government Act, 1993; Environmental Planning & Assessment Act, 1979; Roads Act, 1993; and the Biosecurity Act 2015.

Policy - means this Geotechnical Planning Policy.

Preliminary Geotechnical Assessment - means a geotechnical report prepared by and/or technically reviewed by a Geotechnical Engineer or Engineering Geologist as defined by this policy, which identifies any geotechnical hazards on or around a site based on a review of available information and the proposed development and a physical inspection of the site, and provides recommendations for any additional geotechnical investigations and reports, if required.

Related Land - means land including roads and thoroughfares that could affect or could be affected by any development proposed on a site.

Remove Risk – It is recognized that, due to the many complex factors that can affect a site, the subjective nature of the science of geotechnical engineering, the risk for a site and/or development cannot be completely removed. It is, however, essential that risk be reduced to at least that which could be reasonably anticipated by the community in everyday life. Further, landowners should be made aware of the reasonable and practical measures available to them to reduce risk as far as possible. Hence where the Policy requires that *"reasonable and practical measures have been identified to remove risk*" it refers to the process of risk reduction. The Policy is not requiring the Geotechnical Engineer to warrant that risk has been completely removed, as this is not meaningfully achievable.

Requirements - include all acts, statutes, regulations, by-laws, ordinances, codes, delegated legislation, all approvals granted under any such instrument, the BCA, any applicable Australian Standard.

Risk - means a measure of the probability and severity of an adverse effect to health, property or the environment.

Site - means the whole of any parcel of land to which the carrying out of any development relates.

Site Classification - means a classification of the site in accordance with AS 2870.1 Australian Standard Residential Slabs and Footings.

Structure – Any building including, but not limited to residences, residential, industrial and commercial buildings, out buildings, pools and retaining walls.

Structural Design - means the selection and proportioning of load carrying elements incorporated in a structure, which require certification by a structural engineer.

Structural Document - means a document (which may be in the form of drawings) from a Structural Engineer or Civil Engineer which makes recommendations in respect of the Structural Design and Structural Works required for any structure to be erected on the site which, under this Policy, requires certification in accordance with Form 2.

Structural Works - means the elements of any structure designed by a structural engineer.

Tolerable Risk – The Tolerable Risk criteria is only applicable to sites with structures that have been in existence in their present form for at least 10 years and have demonstrated a performance at a Tolerable Risk level, or better, during that period and there is not a foreseeable reason why this situation should change. Tolerable risk can only be considered as a criterion for the purpose of Building Certificates and under the Orders process.

Tolerable Risk includes the risk to life and the risk to property; both must be considered. The guidance for the establishment of acceptable risk criteria in this Policy has been based on the contents of AGS 2007(c & d).

- Tolerable Risk for Loss of Life for the person(s) most at risk, per annum is taken as having a probability of
    - o 1×10^{-5} per annum for new sites or developments, and
    - o 1×10^{-4} per annum for existing sites or developments.

- Acceptable Risk for Loss of Property is taken as “Moderate” as defined in AGS 2007.

Risk levels for both loss of life and property should be determined in accordance with the methodologies presented in AGS 2007(c). Risk of loss of life should be determined quantitatively. Risk of loss of property can be determined quantitatively or in accordance with the qualitative terminologies and matrices presented in AGS 2007(c).

Tolerable Risk Management – The complete process of risk assessment and control of risk to the level defined as “Tolerable Risk” in this Policy.

Reviewer - means a Geotechnical Engineer or Engineering Geologist as defined by this policy who technically reviews a geotechnical report or aspects of a geotechnical report.