

Suite 4, 257-259 Central Coast Highway Erina NSW 2250

T (02) 4365 1668 F (02) 4367 6555

E centralcoast@northrop.com.au ABN 81 094 433 100

NL181033

May 23, 2018

Pacific Link Housing Attn: Mark Glew PO BOX 1888 GOSFORD NSW 2250

Dear Mark,

RE: 18 Macleay Avenue, Woy Woy – Civil Engineering Advice.

1. INTRODUCTION

Northrop Consulting Engineers have been engaged to provide preliminary civil engineering advice for the consideration of developing a site located at 18 Macleay Avenue, Woy Woy. A desktop study & site visit has been conducted to investigate flood impacts as well as provide civil and stormwater advice to assist in assessing the feasibility outcomes to identify opportunities and constraints present for the site.

2. FLOOD IMPACT

Regional Flooding

A flood information application was lodged to Central Coast Council to determine if the site was impacted by regional flooding. The flood information letter provided by Council stated that the site was flood prone and affected by flooding from the Woy Woy Peninsula, and may be subject to flood related development conditions. The flood information letter is attached to the rear of this correspondence.

The letter identified that the 1% AEP flood level for the site was RL 1.82 AHD, and a corresponding minimum floor level of RL 2.32 AHD. This minimum floor level will likely be conditioned as the flood planning level for any new developments.

A review of the Gosford Electronic Mapping system (GEMS) was undertaken to assess the potential for additional flooding requirements. Figure 1 shows an extract from the Gosford Electronic Mapping System (GEMS) highlighting the 1% AEP flood extents in the proximity of the site.





Figure 1 – Extract of GEMS Gosford Electronic Mapping System – 1% AEP Flood Extents

Figure 1 indicates the flooding is likely a result of high flow in the existing vegetated channel that traverses the site. This channel is likely to be classified as a riparian corridor and will be subject to the requirements of the NSW Office of Water and the Department of Primary Industries.

It is our opinion that this watercourse exhibits characteristics consistent with that of a 1st order watercourse under the Strahler Classification System utilised by the Office of Water. This will require a vegetated riparian zone of 10 metres from the top of bank/edge of channel. From existing neighboring developments, it is observed similar offsets has been maintained, may be used as a guide for the likely development extents.

Figure 2 illustrates the expected riparian corridor that will need to be maintained as part of any proposed development.



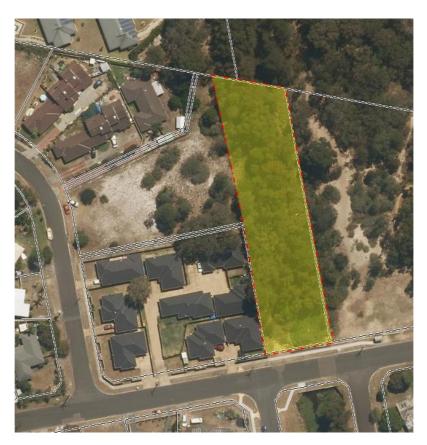


Figure 2 – Approximate extent of the expected Riparian Corridor.

The Office of Water has not provided any information regarding this watercourse and all assumptions discussed are subject to assessment by the Office of Water. There is a risk that during the assessment process, restrictions are implemented for the development which may pose a significant impact on the site layout.

Localised Flooding

An analysis of the local catchment in combination with a visit to site & surrounding areas indicate that the subject site is affected by localised catchment flooding. Due to the topography of the surrounding area it is observed that the property is located at the low point of the catchment.

This is consistent with the Dial Before You Dig (DBYD) information provided by Central Coast Council as the stormwater drainage network traverses the before discharging to the watercourse. The DBYD drawings are attached to the rear of this correspondence.

During a visit to site it was observed that two sag kerb inlet pits are located in the road at the site frontage (one on either side of Macleay Avenue) as well as a surface pit located within the site boundary. Figure 3 depicts the sag kerb inlet pit along the site frontage and Figure 4 shows the surface pit located within the site boundary.





Figure 3 – Photo: Sag Kerb Inlet Pit at site road frontage (MacLeay Avenue)



Figure 4 – Photo: Surface pit located within the site boundary

As the site is located at the outlet of the local catchment and contains an interallotment drainage line, provision will need to be made to ensure that overland flow can be safely conveyed through the site.

A preliminary stormwater flow assessment was conducted using LIDAR information, available council drainage information and information obtained during site inspections to determine the peak flows generated by the upstream catchment. Engineering judgement was used to make assumptions where information was missing or unobtainable.



It was assessed that two sub catchments contribute to the potential stormwater run-off that will affect the subject site. The first catchment consists of the upstream undeveloped hill area to the east of Shoalhaven Drive. Runoff is captured by the inlet pits located in Shoalhaven Drive and is piped to the drainage system, however any additional runoff not captured is expected to be directed north along Shoalhaven Drive towards Railway Street.

The second catchment consists of the local urban catchment bounded by Macleay Avenue, Shoalhaven Drive and Nambucca Drive. Both captured runoff and overland flow will be directed towards the subject site prior to discharge into the watercourse.

A simply hydraulic assessment was performed to assess the conveyance of peak flows through the site. A feasible solution may be to implement a central driveway with a minimum width of 6 metres to act as an overland flow path for the site. The driveway will require typical kerb (or similar) to provide an edge restraint for the surface flows. Estimated peak flows for the 1% AEP storm event results in a flow depth of approximately 120mm, assuming a minimum 1% longitudinal grade is achieved for the driveway. The associated velocity-depth product is within acceptable limits for safety. However, this value is at the upper limit of acceptability and will be highly subject to a detailed assessment.

The minimum floor levels will be required to maintain a 500mm freeboard above this flow depth, resulting in required levels being approximately 620 – 700mm above driveway level. Careful consideration should be taken on the impact this may pose on the development layout when considering vehicle movements, carparking & garage arrangement and accessible paths of travel.

There is a risk that Council will not endorse an overland flow route through the centre of the development, as will require a dedicated interallotment drainage & overland flow route. Should this occur, an alternative drainage arrangement could consist of relocating the existing drainage line traversing the site and providing a dedicated drainage channel along one edge of the site with suitable control measures in place.

If required, this channel will likely be 2-3 metres in width with a depth of 200-300mm. The minimum freeboard of 500mm in addition to the expected maximum flow depth will be required to the minimum floor level for all adjacent developments within the proximity of the channel.

Figure 5 illustrates the likely impact on site layout. Both options will likely involve civil works to relocate the existing interallotment drainage line to suit the proposed driveway location and it is highly likely that the size of the drainage pipe and/or kerb inlet pits will need to be upgraded.





Figure 5 – Overland Flow Provisions – Site Layout Options

If a basement option is considered, suitable preventable measures will need to be incorporated to ensure that the overland flow is directed around the proposed development, and minimum freeboard & driveway access crest are provided.

3. CIVIL ENGINEERING CONSTRAINTS

Existing Sewer

The Dial Before You Dig documentation indicates an existing council sewer main traversing the site, parallel to the watercourse. It is unlikely than any diversion works will be required as part of the development due to the expected riparian corridor requirements as discussed in Section 2. If the Council sewer offsets are maintained, there will likely be no works required to modify the existing sewer main. If the development is proposed to be within these building offsets, council's guidelines and requirements for building over sewer will need to be implemented as part of the design.



Stormwater Management

Given the location of the site within the catchment and its proximity to the outlet, we are of the opinion there will be no significant benefit by providing stormwater detention. However, there is a risk that Council will request this condition which will necessitate the use of above ground storage tanks. We expect that surface ponding detention will be unfeasible for this development given the site constraints and present flooding issues.

If detention storage is conditioned as part of the development, it will be required to limit the peak runoff from the developed site to that of the pre-developed 'greenfield' site. It can be estimated that to achieve this target, 20mm of storage per square metre of impervious area is provided. Assuming an impervious percentage of 80% for the available development footprint, we estimate the storage volume to be approximately 40 kL.

As part of Central Coast Council's DCP requirement retention storage will need to be integrated within the development. Using a similar assumed development footprint, the deemed to comply DCP condition results in a volume of approximately 30 kL.

Note: Minimum reuse tank size is subject to BASIX requirements.

4. CONCLUSION & RECOMMENDATIONS

Northrop Consulting Engineers have conducted a preliminary investigation of the subject site, located at 18 MacLeay Avenue, Woy Woy. The investigation outlined flooding impacts of the site as well as the likely civil engineering constraints to be expected as part of any new development.

The findings from the investigation are summerised as follows:

- The site boundary contains an existing watercourse consisting of a vegetated drainage channel.
 It's likely that the NSW Office of Water will identify this watercourse as a 1st order Riparian Corridor and will condition to maintain a 10 metre Vegetated Riparian Zone from the edge of the existing channel.
- The site was identified as Flood Prone by Central Coast Council as outlined in the Flood Information Letter with the following:
 - 1% AEP Flood Level: RL 1.82 AHD
 - Flood Planning Level (minimum floor level): RL 2.32m AHD.
- It was identified that an overland flow path provision will be required to convey flood waters through the site due to the local catchment topography and the existing interallotment drainage.

There are two likely options that can be incorporated as part of the new development:

A central driveway to act as a conveyance channel which will require a minimum 6
metre with and 1% longitudinal grade. Additionally, kerbs (or similar barriers) will be
required for the majority of the driveway to contain the surface flows.

Or

• A dedicated drainage channel along the boundary of the site approximately 2-3 metres in width with min 300 high hobs and 1% longitudinal grade.

<u>Note:</u> Both options will require freeboard of 500mm, in addition to the flow depth for the minimum floor levels of adjacent structures within the proximity of the channel.

 It is expected that detention storage will not be required as part of any proposed development, however there is a risk that council may condition this as a requirement, resulting in approximately 40 kL of storage.



- Approximately 30 kL of retention (reuse) storage will likely be required as part of any new development (DCP requirement).
- It is unlikely that works to Council's sewer mains will be required provided minimum offsets are maintained.

Given the identified potential issues in relation to the subject site, we highly recommend undertaking a more detailed assessment before progressing the project. Our previous experience with negotiations with council in relation to flooding related matters often results in a large investment of time to achieve a resolution. If the project is to progress, we suggest allocating time to allow for the detailed assessment and discussion with council to reach a resolution on the issues identified, as they may result in significant implications for the proposed development.

Please note that the information contained within this correspondence is preliminary in nature and is subject to detailed assessment & discussion with the relevant authorities.

We trust this meets your requirements, however should you require anything further, please do not hesitate to contact the undersigned.

Yours Sincerely,

Robert Suckling Civil Engineer

R. Suelli

BE Civil (Hons)

Daniel Holland

Civil Engineer

BE Civil (Hons), Dip Civil, MIEAust, CPEng

Malline



APPENDIX A - SUPPLEMENTARY INFORMATION

- Flood Information Letter Central Coast Council 14/05/18
- Dial Before You Dig Council Water & Sewer Issued 10/05/18



14 May 2018

Daniel Holland Northrop Engineers dholland@northrop.com.au

Minimum Floor Level Enquiry:

LOT: 16 DP: 255220 18 Macleay Avenue WOY WOY

Subject: Flood Information L16 DP255220 H18 Macleay Avenue Woy Woy

The above lot has been identified as being flood prone and affected by flooding from Woy Woy Peninsula. As such, flood related development conditions may be relevant for the property.

ENQUIRY DATE:	10 May 2018
5% AEP FLOOD LEVEL:	RL 1.46m AHD
1% AEP FLOOD LEVEL:	RL 1.82m AHD
MINIMUM FLOOR LEVEL:	RL 2.32m AHD

DISCLAIMERS: Council provides you with the above information as general advice only, and you should not rely upon that information when making decisions relating to the purchase or development of the above property. Council **strongly recommends** that you seek site specific flooding advice from a suitably experienced expert prior to making any decisions relating to the purchase or development of the above property. That disclaimer and recommendation is provided for the following reasons:

1. The information in the above table is based on Council's records. Those records do not include a recent flood study or a recent detailed survey of the above property. For example, a recent detailed survey would provide precise ground levels for the subject property as well as identify, with precision, the location of any watercourses, drainage structures and systems, overland flowpaths and built structures that might impact on the extent and degree to which the subject property might flood. Council does not have sufficient information to provide you with accurate prediction of the likelihood and extent to which the above property might flood, and so cannot provide you with accurate





design levels for potential development of that property.

2. Council does not, and cannot, warrant that it will, in its capacity as a consent authority under the *Environmental Planning and Assessment Act 1979*, grant consent to a development application that seeks to erect or use dwellings or other structures on the above property that conform with the levels set out in the above information. As a consent authority, Council is required to consider the suitability of the above property for the specific development proposed as well as consider the requirements of Council's Development Control Plan 2013 – Chapter 6.7 Water Cycle Management (this is available on Council's website).

GLOSSARY OF TERMS

Term	Definition
AHD	The Australian Height Datum (AHD) is the reference level for defining reduced levels adopted by the National Mapping Council of Australia. The level of 0.0 m AHD is approximately mean sea level.
AEP	The Annual Exceedance Probability (AEP) is the chance of a flood of a given or larger size occurring in any one year. Usually expressed as a percentage. Eg a 1% AEP flood event has a 1% chance of occurring in any one year. Equally, it is likely to occur on average once every 100 years.
Minimum Floor Level	The minimum floor level (MFL) provides a freeboard to building within flood prone land. This is also referred to as the Flood Planning Level.
Freeboard	A factor of safety usually expressed as a height above the adopted Flood Level. A freeboard tends to compensate for factors such as wave action and historical and modelling uncertainties.

The information provided in this letter is provided only to you, and is not intended to be provided to any third party.

Should you have any enquiries with regard to this letter, please do not hesitate to contact Fazlul Karim on (02) 4325 8222 during the hours of 8.40 am to 5.00 pm Monday to Friday.

Yours faithfully,

F. Karim

Fazlul Karim

Engineer – Development Assessment

Phone: 02 4325 8222

Internal Reference: 25816120