Consulting Engineers

STRUCTURAL - CIVIL - STORMWATER - REMEDIAL

... STRUCTURALLY SOUND

Hydraulic Capacity Report

165 Penshurst Street, Beverly Hills

Issue A

28 January 2022

Prepared for: Turnbull Planning Pty Ltd

Prepared by: Luke Gerkens

Overland Flow Study

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1. Introduction

At the request of Turnbull Planning Pty Ltd, Luke Gerkens of Northern Beaches Consulting Engineers assessed the hydraulic capacity of the existing stormwater drainage system in relation to the proposed development at 165 Penshurst Street, Beverly Hills. An investigation was undertaken to analyse the hydraulic capacity of the existing stormwater drainage infrastructure which conveys stormwater runoff from the surrounding industrial lots to the trunk drainage system within the housing estate to the north west. The assessment involved constructing a hydraulic model using DRAINS software to determine the hydraulic capacity of the existing stormwater drainage system and comment on the effects of introducing additional runoff from the subject site into to the existing system.

For the undertaking of the analysis, Luke Gerkens of Northern Beaches Consulting Engineers (NBCE) assessed both the proposed architectural plans provided by Turnbull Planning , the stormwater management plans submitted to council as part of the development application prepared by this office (Job Ref 201162), dated December 2020, the survey plan prepared by C&A Surveyors (job ref 11621-19 DET) dated 21 December 2021 and the results from plumbing inspections and testing conducted in December 2021 of the existing stormwater drainage system catering for the localised catchment. The calculations and recommendations presented in this report have been prepared in general accordance with the following policies:

- *Australian Rainfall and Runoff 2016*
- *Georges River Council Stormwater Management Policy (Pol-073-01-01) Dated April 2021*

1.1 Summary of Findings

The existing stormwater drainage easement appears to commence from upstream of the subject site at 3-9 Mercury Street, continues through the subject site and discharges towards Beverly Place. As a result of the investigation, the existing point of connection to this stormwater network from the subject site (that is 165 Penshurst Street) was not identified. Therefore the depth of the easement pipe at the boundary of the subject development was not able to be determined. In order to determine the depth of the existing easement pipe, access for destructive investigation needs to be provided. NBCE was advised that provision of access is not currently possible given that the subject site is currently tenanted and in use for industrial works. Further access to the road and neighbouring properties would require permission from the owners of the housing development. Despite the lack of detail, the stormwater design was able to be updated with further detail as a result of the updated pipe and surface level survey findings and water testing. Further, the proposed development details an On-Site Detention (OSD) tank, which is proposed to detain some 85% of the stormwater runoff captured on the site. The reduction in runoff from the site, as a result of the proposed attenuated OSD outflows, is considered significant and will effectively improve the existing runoff regime into the inter-allotment drainage system.

The existing stormwater drainage network caters for multiple industrial lots (165 Penshurst Street and 159 Penshurst Steet), the commercial and residential lots fronting Stoney Creek Road, and the housing estate lots through to the culvert towards the north. This drainage network collects stormwater runoff from the surrounding lots and discharges this into the culvert. The capacity of the existing stormwater drainage network downstream of the subject site is adequate to cater for the development proposed at 165 Penshurst Street, up to the 20% AEP event, based on the assumptions and calculations outlined in this report. As the downstream properties are located within a Council identified flood-zone (refer Appendix D), it is expected that the system will become inundated and surcharge in higher events, including the 1% AEP event. However, as the OSD system will significantly attenuate flows, no additional adverse flooding effects are envisaged to occur in downstream neighbouring properties as a result of the proposed development utilising the existing stormwater system.

The proposed measures are expected to reduce both the peak flow and quantity of runoff that will enter the existing stormwater drainage network. As a result, we are of the opinion that the proposed development will result in an improvement in the overall capacity of the existing stormwater drainage network downstream of the subject site.

2. Catchment

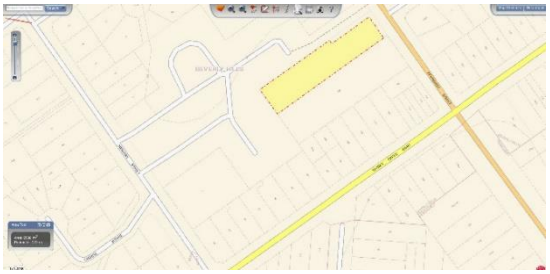
The subject site is on Penshurst Street and naturally slopes away from the street, with the exception of the frontage area, which is proposed to be upgraded such that the existing grated drains and pits drain adequately to the Penshurst Street kerb and gutter. The contributing catchment of the subject site is approximately 2400m^2. The total contributing catchment connecting the surrounding industrial and residential lots to the existing stormwater drainage system has been assumed based on both LiDAR survey information and of the more recent water testing existing stormwater drainage system. The contributing catchment area was measured in the GIS website SIXMAPS (NSW Govt. Spatial Services) and is approximately 1.9Ha. This catchment has been subdivided into several separate sub-catchments. Refer to Table 1 and Figure 1 for details and Figure 4 for catchment layout.

Table 1 - Contributing Sub-Catchments connecting to Existing Stormwater Drainage Network

Sub-Catchment	Area (m^2)	Impervious (%)	Pervious (%)
165 Penshurst Street	2400	100	0
159 Penshurst Street	3643	100	0
82-116 Stoney Creek Rd	8355	80	20
Upper Section of Estate	4588	80	20

***Note:** Impervious ratio assumed due to measurement constraints

Each sub-catchment consists predominately of residential and industrial development. The manning's roughness 'n' values and the catchment slopes used for the analysis have been approximated based on observed site conditions, LiDAR survey information and satellite mapping tools. The anticipated flow behaviour within the contributing catchment was considered for the 1% Annual Exceedance Probability (AEP) storm event in the investigation and the corresponding hydraulic capacity of the existing stormwater drainage system was determined using DRAINS software.



Catchment 165 Penshurst St

Catchment 159 Penshurst St

Catchment Stoney Creek Road

Catchment to Mercury St housing estate upper

Figure 1 - Site Catchment Map. Source: QGIS

3. Analysis

3.1 Methodology

The analysis consisted of calculating the capacity of the existing stormwater drainage system and assessing whether additional flows directly discharging into this system from 165 Penshurst Street would have any adverse impact on the capacity of the system. DRAINS software used to carry out the analysis.

3.2 Assumptions

A number of assumptions were used in the undertaking of this analysis due to various constraints in obtaining relevant information. The site investigation was limited due to the presence of a tenanted factory which prevented access to areas where pipes are suspected to located be without destructive excavation. Further junction pit lids were also suspected to be buried below a layer of asphalt without any access points. The assumptions noted below are based on site observations, LiDAR survey information, satellite mapping tools and the limited findings outlined in the O'Brien Services Report of the existing stormwater drainage network. The assumptions used to carry out the analysis are as follows:

- **Sub-Catchment areas draining to existing stormwater drainage network:** Where we have determined that a particular lot is likely discharging into the existing stormwater drainage system, we have conservatively assumed that the entire lot area is connected to the system. Further, an impervious ratio of 80% has been assumed for each of the sub-catchments draining to the system (unless noted otherwise).

- **Surface levels for stormwater pits and inverts of pipes within drainage system:** For surface pits and pipes which have not been recorded in the survey, or via water testing both surface levels and pipe invert levels have been approximated based on LiDAR survey information as well as satellite mapping tools.
- **Location of Stormwater System:** The location of the stormwater system has been approximated based on the site inspection and satellite mapping information. Further, assumptions have been made about the configuration and size of some of the pits and pipes that form part of the existing stormwater system. These assumptions are based on site observations, site measurements and satellite mapping information. The assumed pipelines within the stormwater drainage system are:-
    - The size and grade of the easement pipe leaving the site
    - The size and grade of the roadway pipe in the upper section of the estate
    - The grade of the roadway pipe in the lower section of the estate (diameter to be confirmed by builder/plumber)

3.3 Results

The results from a DRAINS analysis indicated that the existing stormwater drainage system has an in-adequate hydraulic capacity to cater for the existing stormwater flows with an uncontrolled discharge (i.e. no OSD system restricting flow). However, the DRAINS analysis shows the existing drainage system has a significantly reduced surcharge into the existing flood-zone (with OSD system restricting flow). Therefore, it is not envisaged that the existing stormwater drainage system will experience any additional adverse surcharge flows up to the 1% AEP storm event as a result of the subject site connecting into this system. Refer Appendix A for DRAINS modelling results.

The junction at the base of the housing estate was determined to be the critical section within the stormwater system. Surcharge flows are envisaged at this location as per the modelling. It is most likely that additional drainage elements within the system which discharge to councils stormwater culvert will provide the additional capacity. We note that the culvert essentially crosses diagonally through the site and thus it is suspected that additional pipes are located further to the west of the site draining directly to the culvert. The information used in the DRAINS model for this section was based on survey information provided (refer Appendix C).

4. Recommendations

Based on the assumptions, analysis and results contained within this report, no additional adverse effects as a result of this development are envisaged to occur. The proposed installation of some 77,000 litres of On-Site Detention (OSD) significantly reduces the discharge of stormwater from the site up the 1% AEP storm event. The estate to which the site discharges is subject to flooding, as per the council flooding maps (Georges River Council 100yr-Flood-Maps_10, refer to Appendix D) and as such the overland flow and upwelling of the downstream pit is consistent with this area being relatively flat and flood affected. The development will be reducing surcharge flows into this area and improving the stormwater drainage system from a catchment perspective.

NORTHERN BEACHES CONSULTING ENGINEERS P/L

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APPENDIX A

DRAINS Results

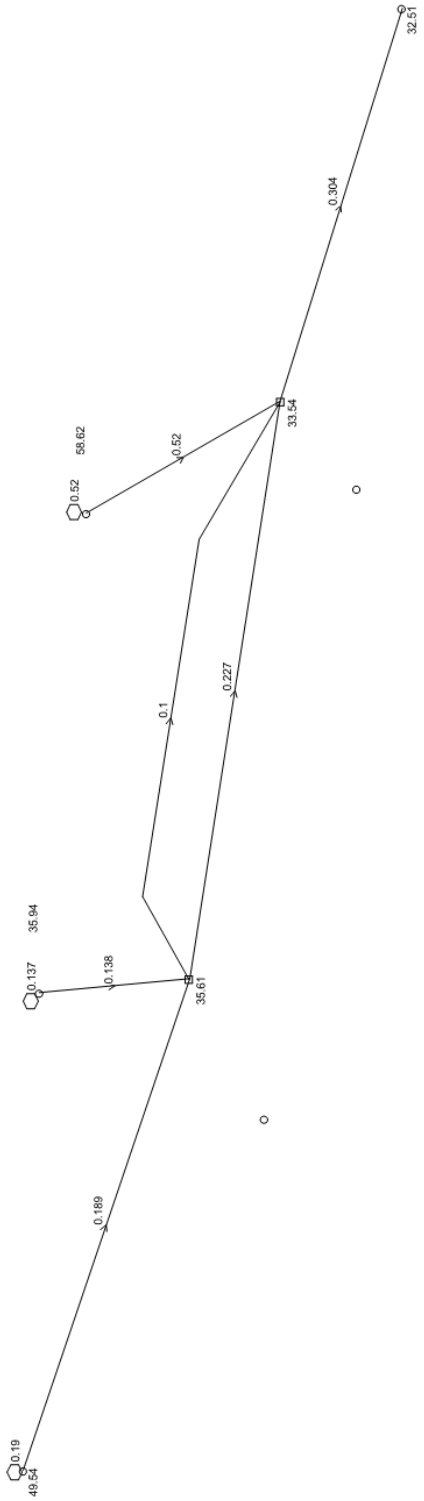

Figure 1 - DRAINS Plan Layout. Source: DRAINS

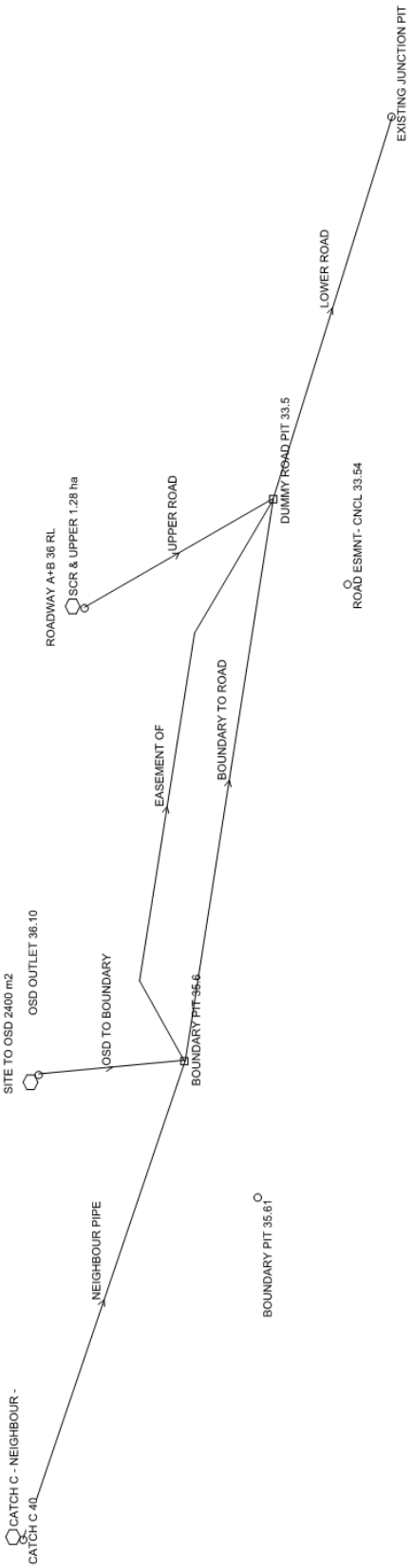

Figure 2 - Pre-Development DRAINS Results. Source: DRAINS

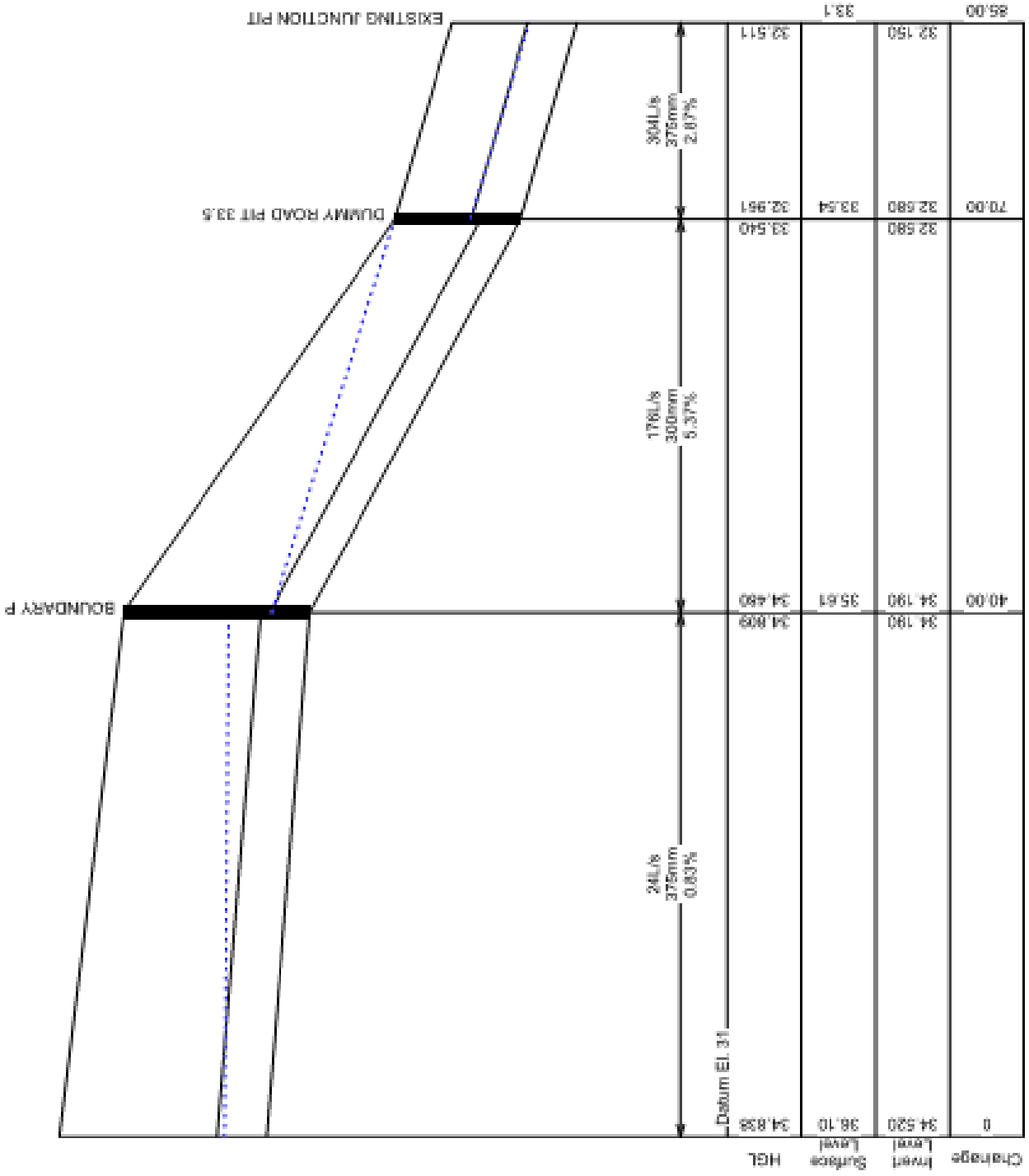

Figure 3 - Post-Development DRAINS Results. Source: DRAINS

APPENDIX B

Proposed Drainage Schematic Plan

Figure 4 –Assumed Drainage Scheme. Source: SIX maps

APPENDIX C

Survey Overlay Schematic Drainage Plan

Figure 5 – Proposed Development overlay. Source: Survey

APPENDIX D

Georges River Council Flood Mapping Plan

Figure 6 – Excerpt from Council Flood Mapping 100 ARI storm

Web address http://www.georgesriver.nsw.gov.au/getmedia/b999d474-eef5-450e-8e50-24b643b0e045/100yr-Flood-Maps_10.aspx