

Legend

CAG	Comms Above Ground	BH	Bore Hole
COMK	Comms Marker	BOL	Bollard
COMP	Comms Pit		Edge Garden
CUG	Comms Under Ground	//	Fence
SWD	Drainage Swug		Retaining Wall
	Drainage Centre Line	IO	Inspection Opening
SWMH	Stormwater MH	MH	Unidentified Manhole
SWGT	Stormwater Gully Trap	PO	Post
SWFI	Field Inlet Pit	SI	Sign
SWKA	Stormwater Kerb Adaptor	TBM	Temporary Bench Mark
UE	Power Line Under Ground	T	Telecom Line
	Power Line Above Ground	TEL	Telecom Pit
ELMK	Electrical Marker	TELBOX	Telecom Telbox
ELP	Electrical Pillar	TEM	Telecom Marker
ELPI	Electrical Pit	TP	Telecom Pole
GW	Guy Wire Anchor		Bottom of Bank
LAMP	Lamp Post		Top of Bank
LP	Light Pole		Change of Grade
PP #	Power Pole		Water Line
PPL	Power Pole with Light	TR 0306	Edge of Vegetation; Tree - 0.3m Dia Trunk & 6m Canopy Spread
PPLT	PP with Light & Transformer	W	Water Main
PPT	Power Pole with Transformer	HR	Fire Hose Reel
G	Gas Main	HY	Water Hydrant
GM	Gas Meter	SPR	Water Sprinkler
GV	Gas Valve	SV	Water Valve
	Road Crown	TAP	Water Tap
	Edge of Bitumen	WBE	Hydrant Booster
	Edge Track	WM	Water Meter
GP	Guide Post	WMK	Water Marker
	Guard Rail		Bitumen
	Road Kerb Invert		Concrete
S	Sewer Main		Dirt
SMH	Sewer Manhole		Garden
SMK	Sewer Marker		Gravel / Rock
SVE	Sewer Vent		Pavers
	Awning / Top of Gutter		Tiles
TOG RL	Top of Gutter		

Drawn:	SS	Date:	05/12/2024
Surveyed:	AJ	Date:	28/11/2024
Checked:	DB	Date:	05/12/2024

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Local Authority: Gold Coast City Council
Authority Ref. No: .
RP Description: Lot 122 on SP284713

Locality: Miami
Date of Survey: 28/11/2024
Level Datum: AHD (der)
Origin: OPM 21031 (RL 4.82)
Level Bk / Fld Bk: Digital
Horizontal Datum: IS306901
Contour Interval: 0.5m

Scale 1:750 @ A3

0 7.5 15 22.5m

1 : 750@A3 (Before Reduction)

Approved: DGB

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A	Original Issue	05/12/24	DGB
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C	Services and Contour Updated	25/03/25	SJM

Client

122 Marine Parade P/L
ATF 122 Marine Parade Unit Trust

122 Marine Parade Miami

Detail Survey Sheet 1 of 6

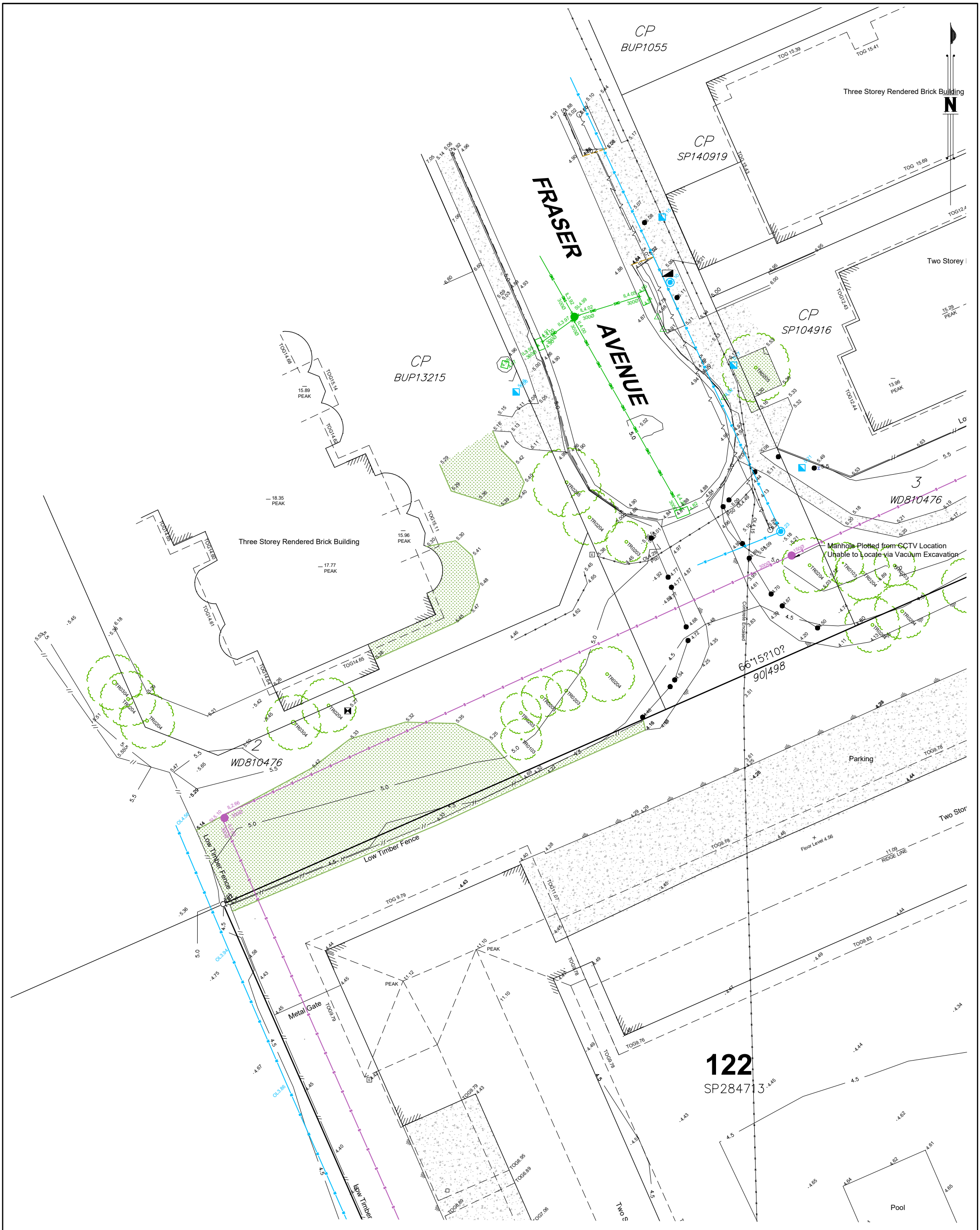
Drawing No.	Issue	Original Size
S-11287-001	C	A3

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122 Marine Parade P/L
ATF 122 Marine Parade Unit Trust

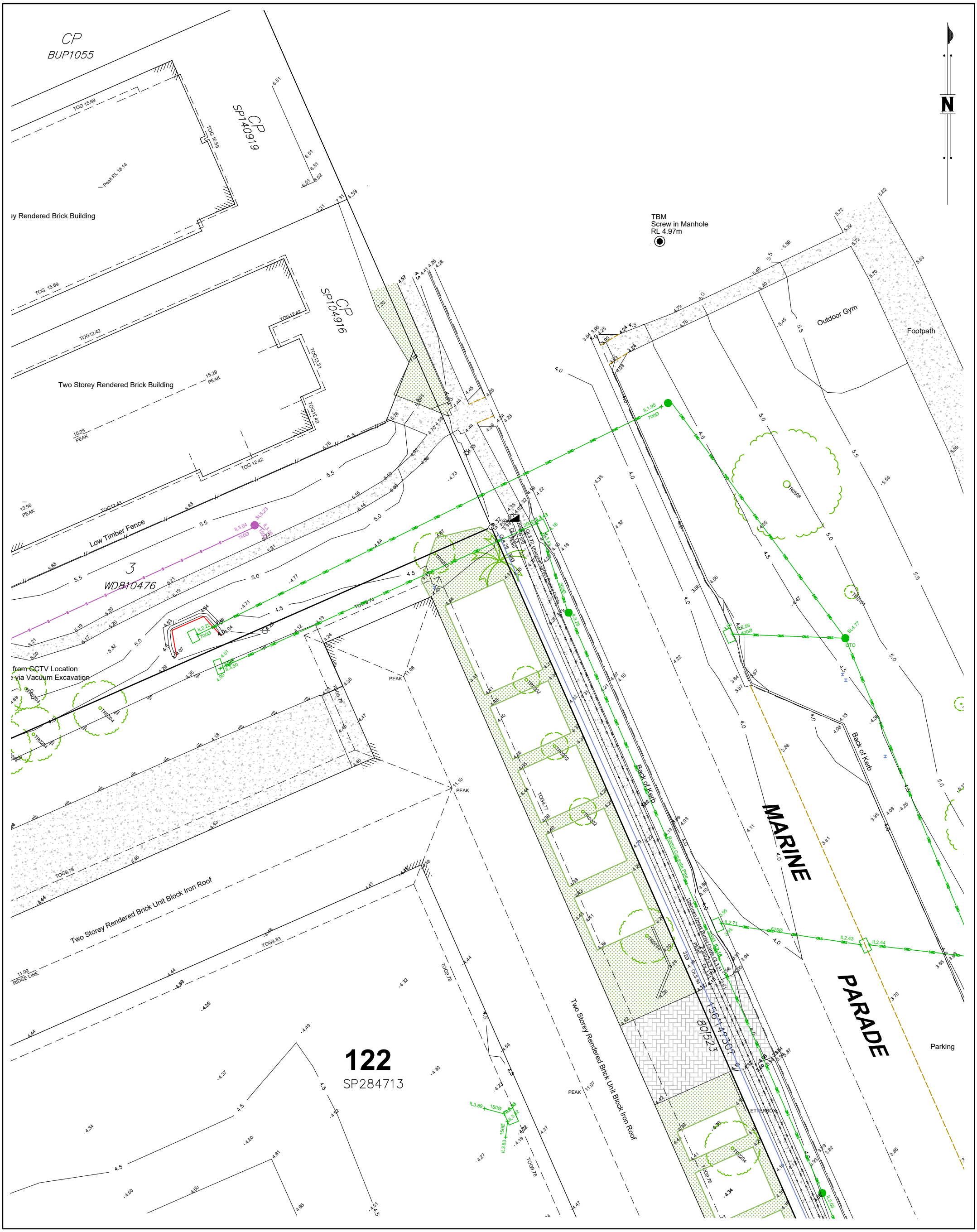
122 Marine Parade Miami

Detail Survey Sheet 2 of 6

Drawing No.	Issue	Original Size
S-11287-001	C	A3

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122 Marine Parade P/L
ATF 122 Marine Parade Unit Trust

122 Marine Parade Miami

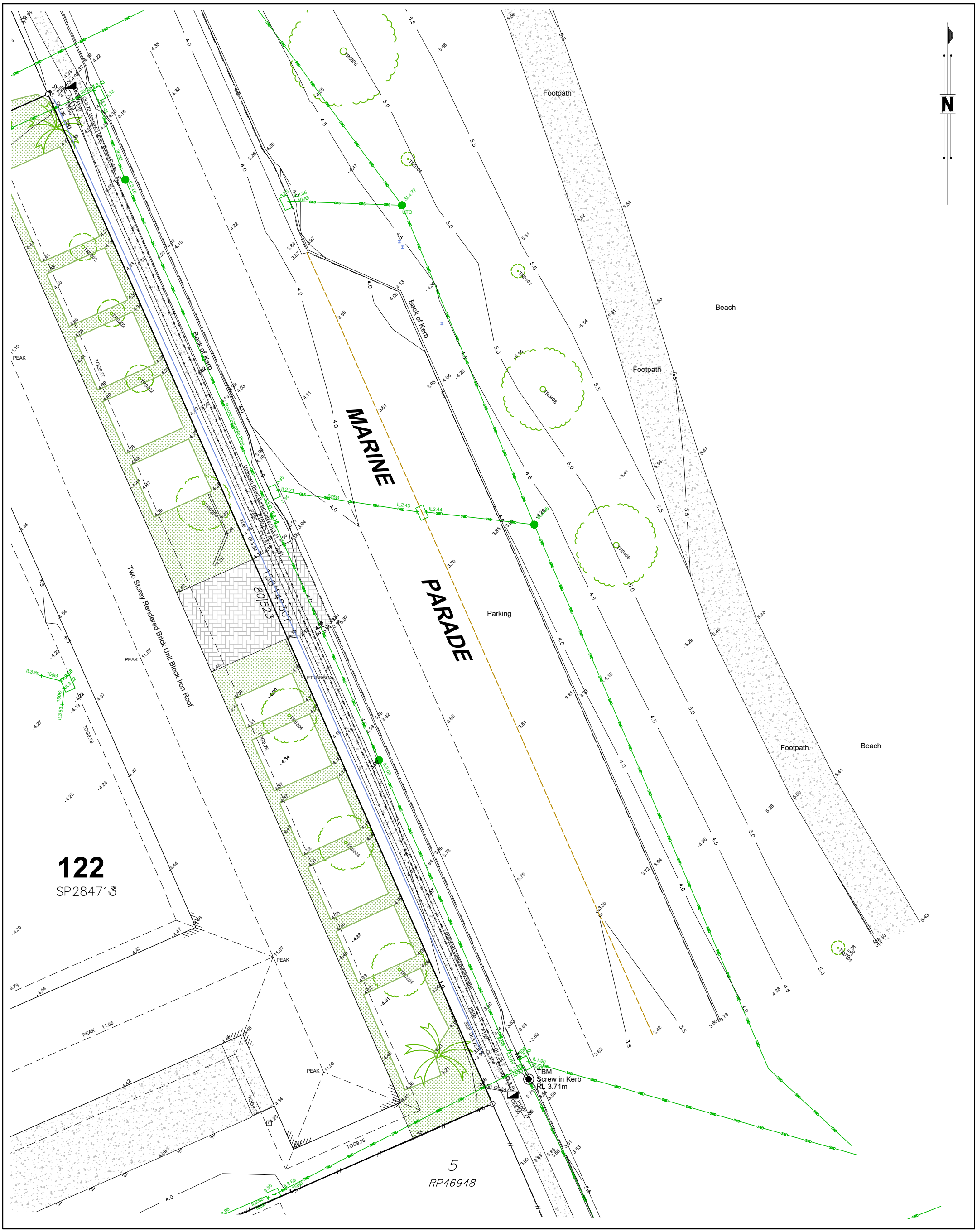
Detail Survey Sheet 3 of 6

Drawing No.	Issue	Original Size
S-11287-001	C	A3

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Client

122 Marine Parade P/L
ATF 122 Marine Parade Unit Trust

122 Marine Parade Miami

Detail Survey Sheet 4 of 6

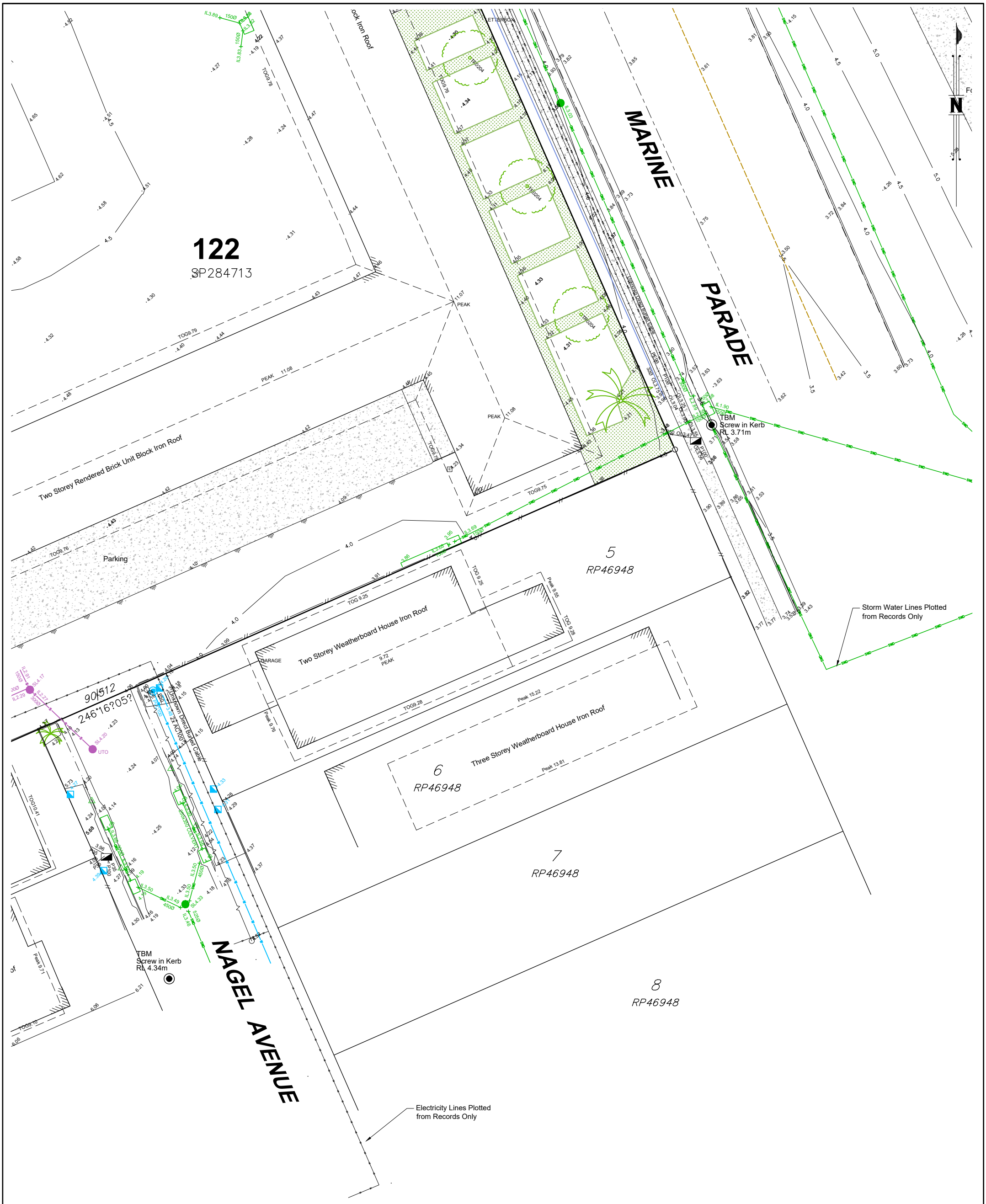
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Client
122 Marine Parade P/L
ATF 122 Marine Parade Unit Trust

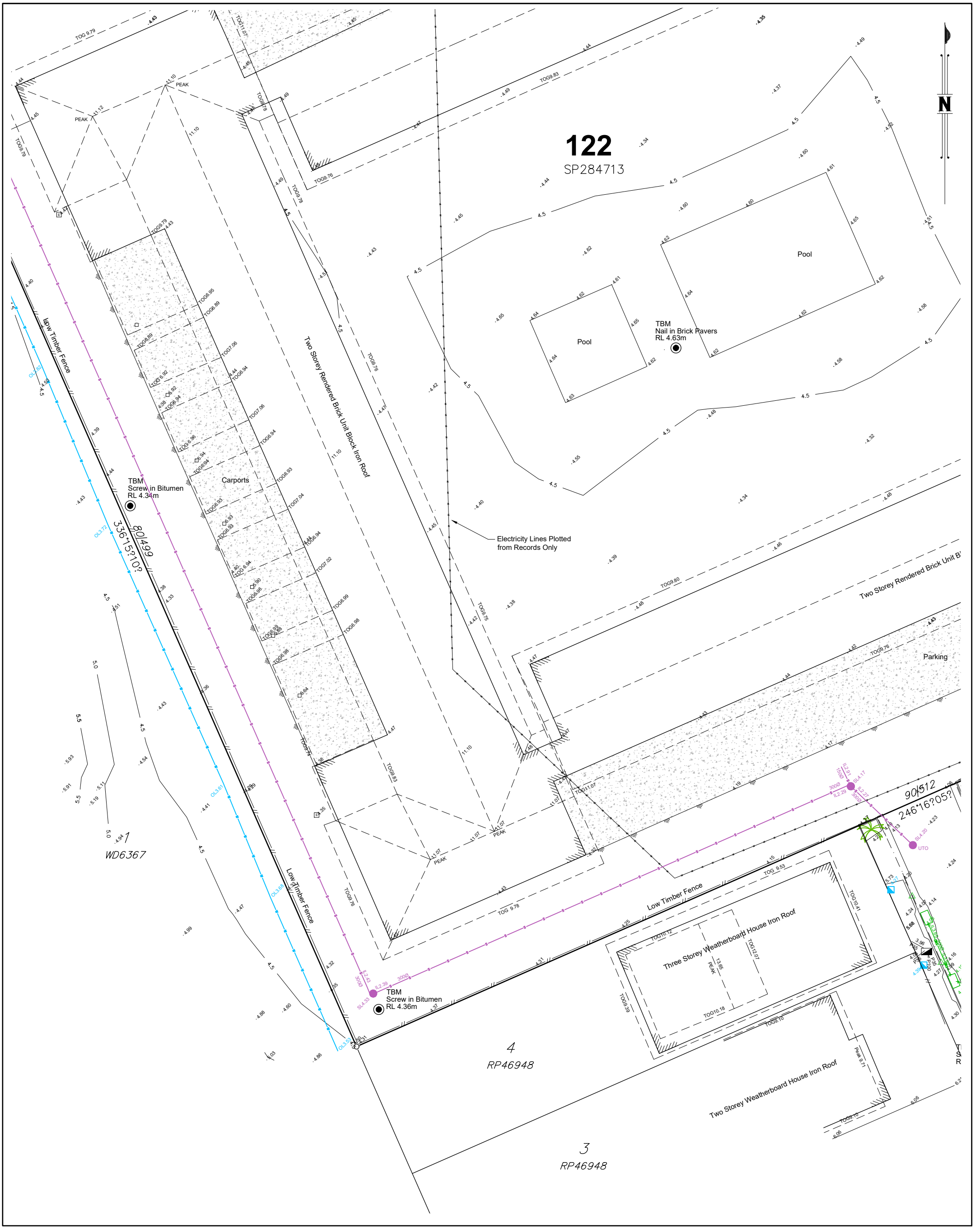
122 Marine Parade Miami

Detail Survey
Sheet 5 of 6

Drawing No.	Issue	Original Size
S-11287-001	C	A3

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Client
122 Marine Parade P/L
ATF 122 Marine Parade Unit Trust

122 Marine Parade Miami

Detail Survey
Sheet 6 of 6

Drawing No.	Issue	Original Size
S-11287-001	C	A3

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SURVEY BRIEF NOTES

SEWER
- Pipe/Pit size, alignment, pit locations inverts and material.
- Surface levels at the structures.
- Internal structure size.
- Provide photos of each manhole.
- CCTV as indicated.

STORMWATER
- Pipe/Pit size, alignment, pit locations inverts and material.
- Surface levels at the structures.

WATER
- Non destructive locating of water main. Confirm measured depth on plan (i.e. to top / invert etc).

INFORMATION TO BE PROVIDED IN THE FORMAT OF ALL OF THE BELOW:
- DWG
- PDF
- CCTV in suitable video format (sewer only)
-12DA (with surface tin)

All information should be complied in a single model.

ACCEPTABLE LEVEL OF DETAIL:
- CLASS A - POTHOLE VERIFICATION
- CLASS B - SUBSURFACE TRACE (FOR APPLICABLE SERVICES)
- CLASS C - SURFACE AND SURVEY PICKUP OF FEATURES
- CLASS D - PLOTS HISTORIC RECORDS/DBYD/ETC

SURVEY AND POTHOLING UNDERTAKEN TO BE COMPLETED TO CLASS A, B AND C QUALITY LEVELS. AT A MINIMUM:
WATER RETICULATION - CLASS A
SEWER RETICULATION - CLASS C
STORMWATER DRAINAGE - CLASS C
ELECTRICAL/COMMS - CLASS B

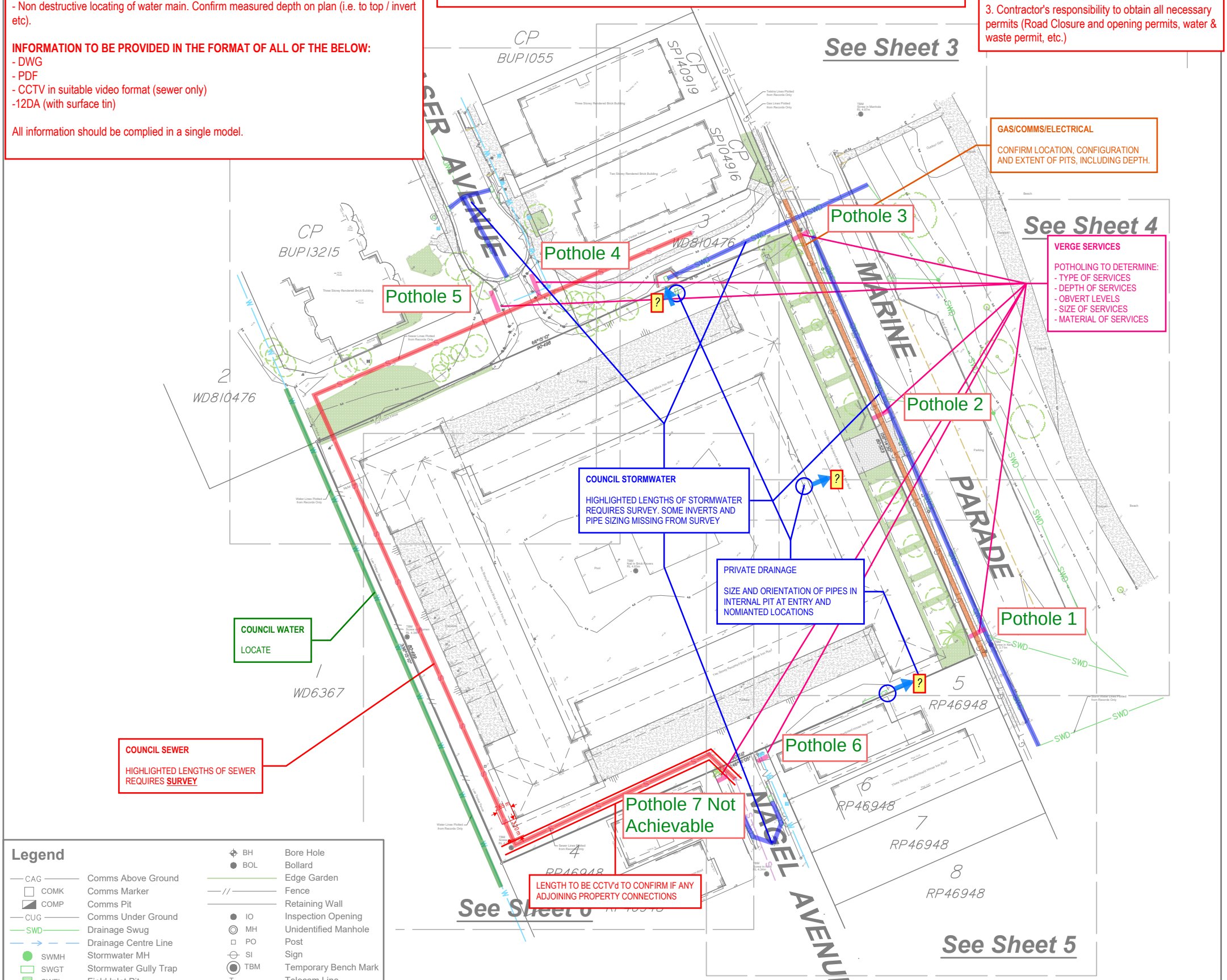
EXISTING SERVICE INFORMATION TO CLASS D QUALITY LEVEL WILL NOT BE ACCEPTED.

POTHOLE NOTES

1. It is imperative that the sewer and water pipe invert or obvert is ascertained. All reasonable effort must be made to obtain this information. Noting that "Lid cannot be lifted" will not be accepted and potholing the sewer main immediately upstream or downstream of the manhole will be required.

2. Sewer may require excavation if manhole lids are not able to be lifted. Contractor to gain appropriate approvals from relevant authority to undertake this work.

3. Contractor's responsibility to obtain all necessary permits (Road Closure and opening permits, water & waste permit, etc.)



Legend

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Client
Monaco Property Group

122 Marine Parade Miami

Detail Survey Sheet 1 of 6

Drawing No.	Issue	Original Size
S-11287-001	A	A3

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POTHOLE NUMBER: PH 1A

Utility	Comms	***Owner:***	Telstra
Material:	PVC	***OD Size of Conduit:***	100mm
Depth (m):	0.48m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 1B

Utility	Comms	***Owner:***	Unknown
Material:	Direct Buried Cable	***OD Size of Conduit:***	Cable
Depth (m):	0.64m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 1C

Utility	Gas	***Owner:***	APA
Material:	PE	***OD Size of Conduit:***	90mm
Depth (m):	0.89m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 1D

Utility	Unknown	***Owner:***	Unknown
Material:	Poly	***OD Size of Conduit:***	32mm
Depth (m):	0.22m	***Configuration:***	0 0
Comments:	Irrigation?		





POTHOLE NUMBER: PH 2A

Utility	Unknown	***Owner:***	Unknown
Material:	Poly	***OD Size of Conduit:***	32mm
Depth (m):	0.21m	***Configuration:***	
Comments:	Irrigation?		





POTHOLE NUMBER: PH 2B

Utility	Gas	***Owner:***	APA
Material:	PE	***OD Size of Conduit:***	90mm
Depth (m):	0.81m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 2C

Utility	Comms	***Owner:***	Telstra
Material:	PVC	***OD Size of Conduit:***	100mm
Depth (m):	0.4m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 2D

Utility	Direct Buried Cable	***Owner:***	Unknown
Material:	PVC	***OD Size of Conduit:***	Cable
Depth (m):	0.58m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 2E

Utility	Storm water	***Owner:***	GCCC
Material:	RCP	***OD Size of Conduit:***	300mm
Depth (m):	0.67m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 3A

Utility	Comms	***Owner:***	Telstra
Material:	PVC	***OD Size of Conduit:***	100mm
Depth (m):	0.38m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 3B

Utility	Unknown	***Owner:***	Unknown
Material:	Direct Buried Cable	***OD Size of Conduit:***	Cable
Depth (m):	0.63m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 3C

Utility	Gas	***Owner:***	APA
Material:	PE	***OD Size of Conduit:***	90mm
Depth (m):	1.30m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 3D

Utility	Unknown	***Owner:***	Unknown
Material:	Poly	***OD Size of Conduit:***	32mm
Depth (m):	0.16m	***Configuration:***	
Comments:	Irrigation?		





POTHOLE NUMBER: PH 4A

Utility	Electrical	***Owner:***	Energex
Material:	PVC	***OD Size of Conduit:***	50mm
Depth (m):	0.65m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 4B

Utility	Electrical	***Owner:***	Energex
Material:	Concrete	***OD Size of Conduit:***	260mmx260mm
Depth (m):	1.00m	***Configuration:***	
Comments:	Concrete incasement		





POTHOLE NUMBER: PH 4C

Utility	Water	***Owner:***	
Material:		***OD Size of Conduit:***	
Depth (m):	m	***Configuration:***	
Comments:	Pothole near water hydrant. No service found to 1.3m		

Concrete and timber found





POTHOLE NUMBER: PH 5A

Utility	Electrical	***Owner:***	Energex
Material:	PVC	***OD Size of Conduit:***	50mm
Depth (m):	0.64m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 6A

Utility	Water	***Owner:***	GCCC
Material:	PVC	***OD Size of Conduit:***	150mm
Depth (m):	0.710	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 6B

Utility	Unknown	***Owner:***	Unknown
Material:	Direct Buried Cable	***OD Size of Conduit:***	Cable
Depth (m):	0.50m	***Configuration:***	
Comments:	Possible earth or power cable		





POTHOLE NUMBER: PH 6C

Utility	Water	***Owner:***	GCCC
Material:	Poly	***OD Size of Conduit:***	50mm
Depth (m):	0.27m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 6D

Utility	Electrical	***Owner:***	Energex
Material:	AC	***OD Size of Conduit:***	100mmx2
Depth (m):	0.84m	***Configuration:***	OO
Comments:	N/A		





POTHOLE NUMBER: PH 6E

Utility	Comms	***Owner:***	Telstra
Material:	PVC	***OD Size of Conduit:***	35mm
Depth (m):	0.32m	***Configuration:***	
Comments:	N/A		





POTHOLE NUMBER: PH 6F

Utility	Unknown	***Owner:***	Unknown
Material:	Direct Buried Cable	***OD Size of Conduit:***	Cable
Depth (m):	0.36m	***Configuration:***	
Comments:	N/A		





ARCADIS

SITE BASED STORMWATER MANAGEMENT PLAN

122 MARINE PARADE, MIAMI

MONACO PROPERTY GROUP PTY LTD



IMPROVING QUALITY OF **LIFE**

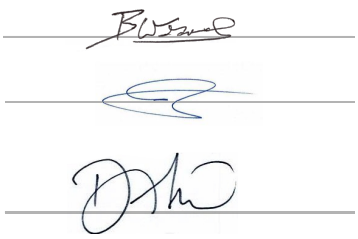
122 MARINE PARADE, MIAMI

SITE BASED STORMWATER MANAGEMENT PLAN

Author Ben Wieser

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RPEQ19918



Project No 30264961-3

Report No GA0002

Revision 02

Date 13/06/2025

This report has been prepared for Monaco Property Group Pty Ltd in accordance with the terms and conditions of appointment. Arcadis Australia Pacific Pty Limited (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

Revision	Date	Description
01	24/04/2025	Issue for Approval
02	13/06/2025	Updated for Information Request Response

Should you require any further information, please contact our Gold Coast office and ask to speak to the report author denoted above.

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GLOSSARY OF TERMS

Australia Rainfall and Runoff (ARR) 2019 recommends adaptation of new terminology relating to storm events summarised in Table A below. As recommended, this report documents data with respect to AEP (%).

The following definitions should be noted:

- EY = Number of exceedances per year.
- AEP = Annual Exceedance Probability.
- AEP (1 in x) = 1/AEP.
- ARI = Average Recurrence Interval (years).

The below table should be refereed to for a comparison of storm events.

Table A – Storm Events Terminology

EY	AEP (%)	AEP (1 in ….)	ARI
1	63.21	1.58	1
0.69	50	2	1.44
0.5	39.35	2.54	2
0.22	20	5	4.48
0.2	18.13	5.52	5
0.11	10	10	9.49
0.05	5	20	20
0.02	2	50	50
0.01	1	100	100

ASSOCIATED MODELLING FILES

For internal reference, the following modelling file packages are associated with this report.

- 30264961-3-EDA0001-01 - DRAINS
- 30264961-3-EDB0001-01 - MUSIC

1 EXECUTIVE SUMMARY

Monaco Property Group Pty Ltd has commissioned Arcadis to prepare a Site Based Stormwater Management Plan (SBSMP) for a development application for the site located over the following allotment(s):

- Lot 122 on SP284713 (122 Marine Parade, Miami).

The proposed development intended for the site involves the construction of a residential apartment building.

This report demonstrates the proposed development will be constructed and operated in accordance with the Water Sensitive Urban Design (WSUD) Requirements of Council, the South-East Queensland State Planning Policy (SPP), the Queensland Development Code, the Queensland Urban Drainage Manual (QUDM), Australian Rainfall and Runoff (2019) and the Environmental Protection (Water) Policy (2009). The primary objectives of this Site Based Stormwater Management Plan (SBSMP) are achieved as follows:

Lawful Point of Discharge (LPoD)

The site proposes to maintain the existing LPoD being Marine Parade. The site proposes to discharge stormwater to Marine Parade after receiving appropriate treatment on site.

The conveyance of potential external flows to Marine Parade is to be maintained or improved.

Stormwater Quantity

This report includes a hydrological assessment using DRAINS software for the quantity of stormwater discharging from the site in the pre-development (existing) and post-development (developed) scenarios. This assessment estimates that the stormwater discharging from the proposed development is generally consistent with the flows discharging from the existing site. Accordingly, no on-site stormwater detention is applied.

Stormwater Quality

A stormwater quality assessment is provided which demonstrates that a specially tailored treatment system will be required in order to meet the pollutant removal targets of City of Gold Coast (CoGC) during the operational phase of the proposed development. An Ocean Protect treatment system is proposed.

All the stormwater quality controls detailed in this document are contained within the development site and will remain a private asset of the property owner. Regular maintenance of the treatment devices must be undertaken to ensure the continuing performance of the stormwater quality treatment train.

Waterway Stability

The development is proposing to discharge into a hard lined kerb, pit and piped stream and therefore waterway stability is not applicable.

Erosion and Sediment Control

Construction phase sediment control devices are to be implemented during construction works in accordance with requirements associated with Type 3 sediment discharge zones, comprising of a vehicle shakedown, sediment fences and gully inlet protection.

1.1 Revision 02

Revision 02 of this report has been prepared to assist the development approval response to Council's request for further information reference MCU/2025/155 dated 28 May 2025. The key updates are:

- Updated Section 5.3 to reflect discussions and clarification of information with Council following meeting and agreement dated 02/06/2025.
  - Email discussions have been included in Appendix G of this report.
- Updated Appendix B drawings to reflect updated development plans.

Importantly, no change to the original submitted discharge strategy and stormwater management device strategy has occurred. Stormwater modelling has remained unchanged. This update provides relevant clarifications to these strategies as described above.

2 SITE CHARACTERISTICS

2.1 Location Details

The subject site is located within Miami, South-East Queensland, Australia over the following allotment(s):

- Lot 122 on SP284713 (122 Marine Parade, Miami).

The site is bordered by Fraser Avenue, as well as residential, open space properties to the north, Marine Parade to the east, Lions Head Park (open space) to the west, and Nagel Avenue, as well as residential properties to the south.

The total area of the site is approximately 7,284m^2.

The City of Gold Coast is the local government authority.

2.2 Land Usage

In its current state, the project site contains a residential apartment building with associated driveways, entries, parking and planting areas. Figure 2-1 below provides a current locality plan of the site.



Figure 2-1 Site Locality Plan (Aerial Imagery Courtesy of Nearmap)

2.3 Topography and Features

The site topography grades towards Marine Parade, east of the site. The site has a high point of approximately RL 4.65m AHD and a low point of RL 3.86m AHD. Refer to the site survey within Appendix A of this report for further information.

3 PROPOSED DEVELOPMENT

The proposed development involves the construction of a residential apartment building, including:

- Residential apartments.
- Residential amenities.
- 1 level of basement parking.

A plan extract of the proposed development has been provided in Figure 3-1.

A full set of Architectural plans are provided within the development application package and should be referred to for further information.

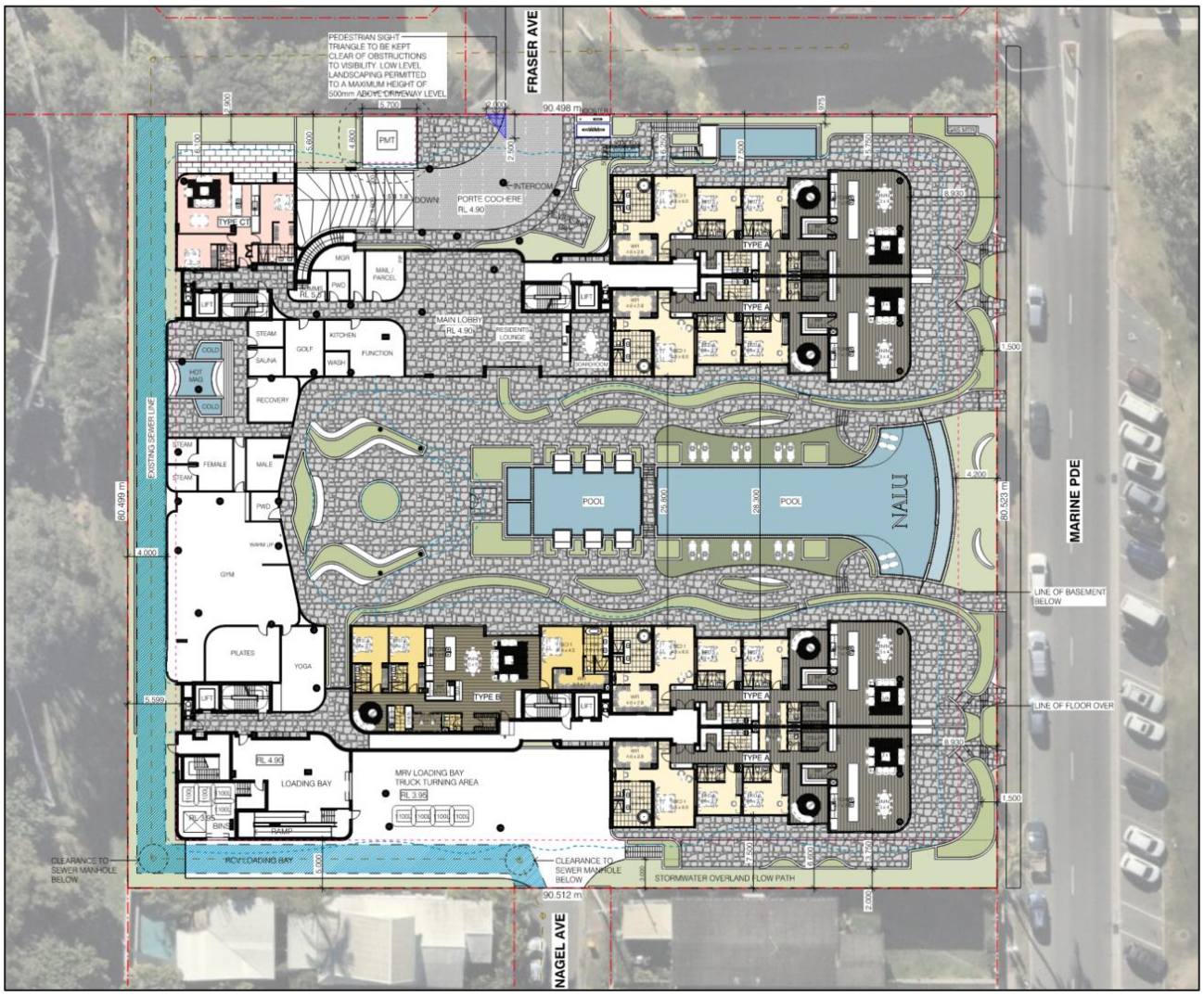


Figure 3-1 Proposed Development Ground Floor

4 STORMWATER MANAGEMENT OBJECTIVES

In accordance with QUDM and the City Plan Healthy Waters code, the following stormwater management components have been investigated.

- Lawful point of discharge (LPOD) | Section 5 of this report.
- Stormwater Quantity, including waterway stability where applicable | Section 5 & 6 of this report.
- Stormwater Quality Operational Phase | Refer to Section 7 of this report.
- Stormwater Quality Construction Phase | Refer to Section 8 of this report.

The Healthy Waters Code has been completed as part of this development application package as a stand-alone document and is also included in Appendix F of this report.

5 LAWFUL POINT OF DISCHARGE AND DRAINAGE

5.1 Existing Stormwater Drainage

Stormwater runoff generated by the site is discharged to Marine Parade via connections to underground drainage and overland flow. Local runoff in Marine Parade, including runoff from the subject site, ultimately arrives in a sag ~20m south of the subject site before discharging via pipe to Miami Beach. The pipe sizes within this network range from DN300 to DN1300.

The following existing stormwater drainage and catchments have been identified adjacent to the development site from both CoGC ArcGIS mapping (online) and 1m DTM, field survey (Appendix A) and site inspection.

1. Fraser Avenue grades south towards the subject site, however, municipal drainage at the cul-de-sac adjacent the site is shown to drain north (backgrading) per Council's online mapping. Currently the VXO at the cul-de-sac head acts as a weir and controls how much runoff can enter the site (if any). Runoff then traverses along the northern boundary within the site & Council's park land Lot 3 on WD810476 before entering an existing drainage pit and conveying to Marine Parade. Runoff in excess of the network's capacity will flow overland to Marine Parade.
2. Nagel Avenue grades north towards the subject site, however, municipal drainage at the site interface is shown to drain south (backgrading) per Council's online mapping. There is potential for runoff (in excess of Council's drainage system capacity) to spill into the subject site before spilling eastbound to Marine Parade. Currently the road stub acts as a constraint controlling how much runoff can enter the site. Runoff then traverses along the southern boundary before passing through to Marine Parade. Based on site inspection, it was determined that water would also pass through the southern adjoining private property Lot 5 on RP46948 due to the existing site topography.
3. A small portion of Lions Head Park to the west grades to the southwest corner of the site before it drains into the site's private infrastructure and out to Marine Parade.

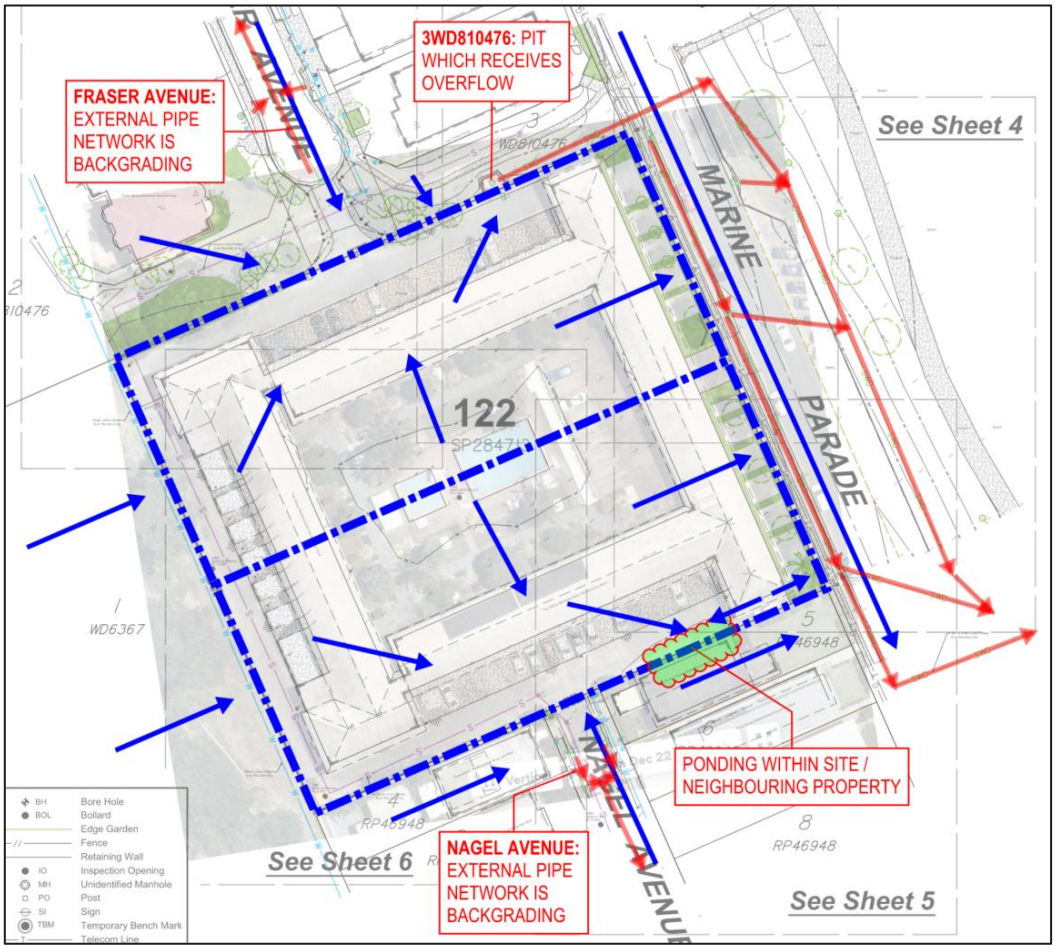


Figure 5-1 General Site Flows

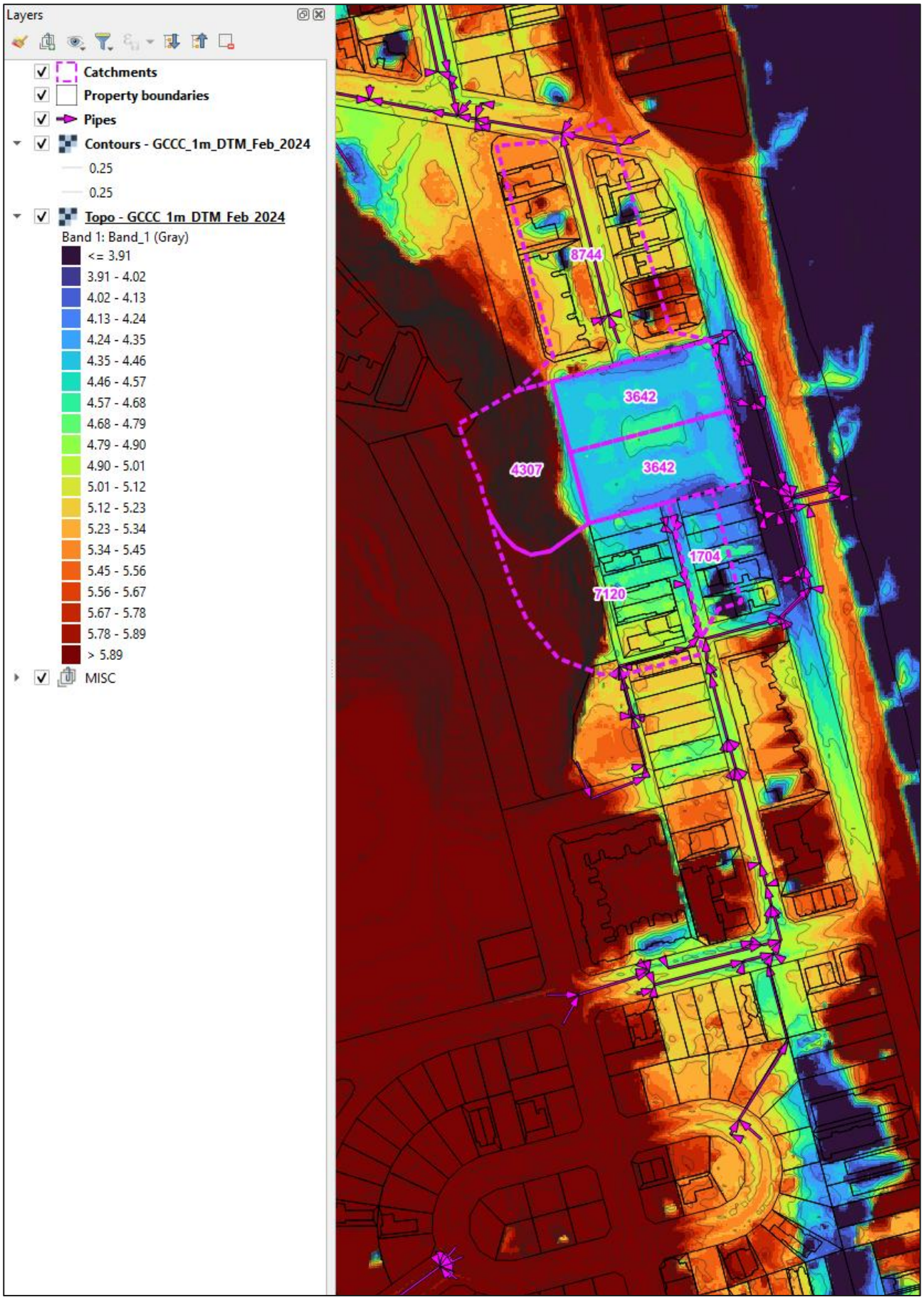


Figure 5-2 External Stormwater Catchments (Overland) and Local Pipe Network

5.2 Proposed Drainage Characteristics and LPOD Test

In the developed case, the site demonstrates compliance with the QUDM as follows:

The location of the discharge is under the lawful control of the local government or other statutory authority from whom permission to discharge has been received. This will include park, drainage or road reserve, stormwater drainage easement.

The proposed development will manage stormwater via the use of private infrastructure to achieve Council's objectives. The site will maintain its discharge location being Marine Parade via connection to underground drainage and overland flow.

Provision for conveyance of runoff from the abovementioned sources, including potential spill areas, to Marine Parade has been made. The adopted strategy is to maintain or improve conveyance of runoff to municipal infrastructure, creating an improvement to existing conditions for the site, Council land and adjacent properties.

Drainage within the subject site will remain private.

At a minimum, 4EY flows from the site catchment areas are to be directed to the stormwater quality treatment system as documented in Section 7 of this report. It should be noted that the design and documentation of private drainage will be addressed by a building hydraulic engineer during the detailed design for Building Approval phase to achieve the objectives of this report.

It is noted that no pumped discharge directed to the kerb is proposed.

Figure 5-3 below illustrates the proposed drainage philosophy for the site, which is adopted for the purposes of detailed calculations in subsequent reporting sections. Further details can be found on Engineering Drawings in Appendix B.

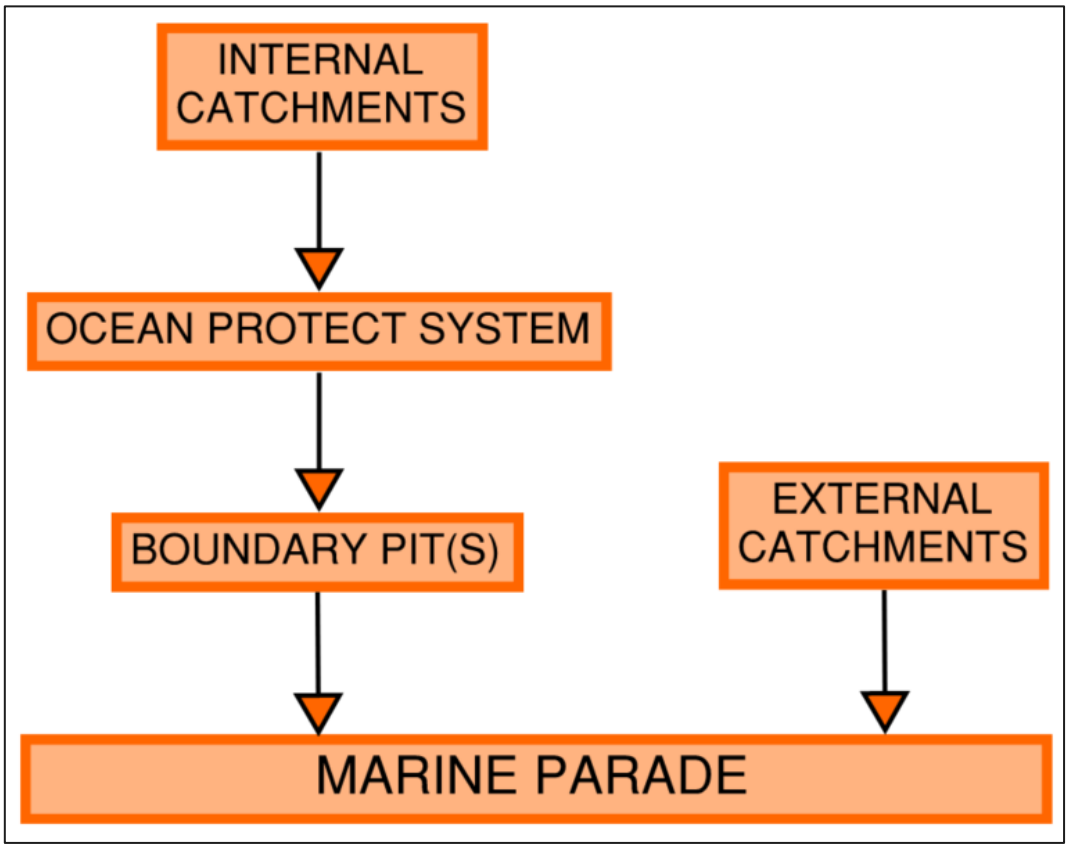


Figure 5-3 Drainage Schematic

That in discharging in that location, the discharge will not cause an actionable nuisance. In general terms this implies no worsening as a result of discharge.

Sections 6, 7 and 8 of this report provide detailed calculations and discussions illustrating no actionable nuisance anticipated.

5.3 External Catchment Conveyance

With reference to the existing drainage identified in Section 5.1, the following outcomes are achieved. These outcomes have been discussed in further detail with Council's hydraulics officer over Teams and email (the latter of which is provided in Appendix G of this report).

1. **Fraser Avenue (flows in excess of Council drainage)**

- The proposed works maintain or improve the current arrangement by:
    - No change to the weir control (therefore no impact to upstream areas).
    - Maintaining overland flow capacity to the existing drainage pit and through to Marine Parade. Minor reshaping of Council's open space (Lot 3 on WD810476) is proposed to improve the free-flowing relief flow path to Marine Parade.
        - The proposed works are in line with the proposed landscape enhancement and improvements to the existing pedestrian footpath connection between Fraser Avenue and Marine Parade, which have been offered by the Applicant as a public benefit following consultation with Council's Open Space and Landscape teams.
        - The reshaping works have the added benefit of removing the retaining wall and fence around the existing drainage pit, mitigating associated fall / trip risks, thereby improving public safety. Additionally. the steepness of the existing batter is reduced, improving usability.
- Accordingly existing sensitive drainage characteristics are preserved and capacity maintained or increased which will not give rise to unacceptable or adverse impacts to private property.
- The figure below provides context of the pre and post development outcomes.



Figure 5-4 Drainage Schematic – Fraser Avenue

2. **Nagel Avenue (flows in excess of Council drainage)**

- The proposed works maintain or improve the current arrangement by:
    - No change to the road stub or increase in site levels within the receiving area.
    - Improving pit and pipe drainage capacity within the site, reducing frequency/severity of pass-through overland flow.
    - Widening and deepening (not lifting) the existing onsite choke point, increasing the site's share of any overland flow. This is achieved by a 2m wide area free from structures, as well as cantilevered flooring for the outdoor areas up to the edge of the basement walls, totalling minimum 3m width. The below supplementary calculations indicate overland flow capacity of the site, not including any pit and pipe infrastructure.
        - On the basis the minor design 10% AEP at minimum is captured via pit and pipe, this results in a difference of 0.389 m^3/s potentially entering the site.
        - Manning's calculations for a 3m wide relief flow path with a 0.15% grade (based on existing levels at the Nagel Avenue interface and southwest side boundary), and assuming a manning's roughness coefficient of 0.05 for landscaped surfaces, indicate this flow can be conveyed at a depth of 0.375m and velocity of 0.35 m/s (resulting in a depth velocity product of 0.13 m^2/s).
- Accordingly existing sensitive drainage characteristics are preserved and capacity maintained or increased which will not give rise to unacceptable or adverse impacts to private property.
- The figure below provides context of the pre and post development outcomes.

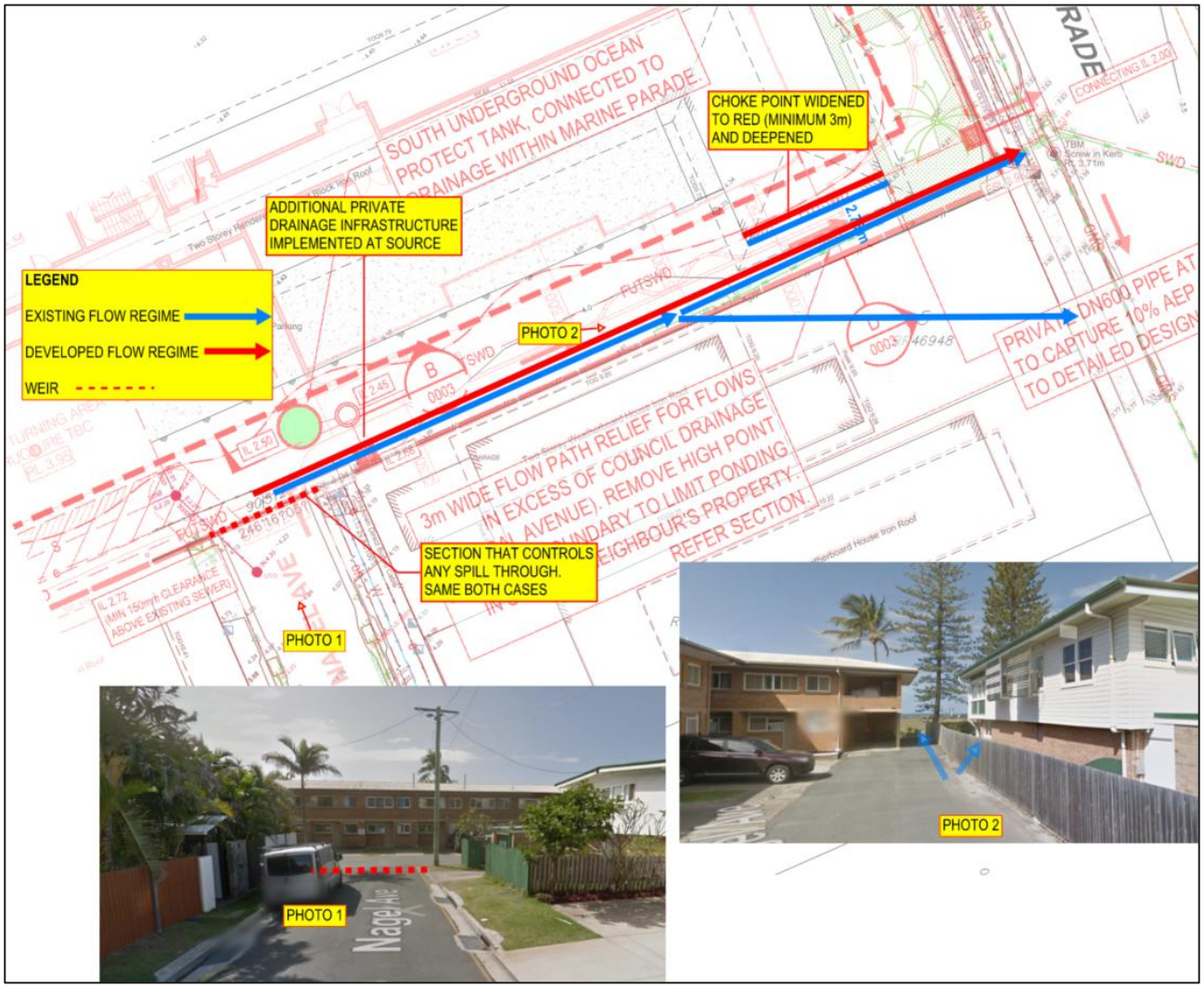


Figure 5-5 Drainage Schematic – Nagel Avenue

3. **Lions Head Park (overland flow)**

- Private drainage is proposed to capture nuisance overland flow from Lions Head Park to the west.
- These flows are to bypass the internal quality treatment system and discharge to Marine Parade. The same at-grade landscaping buffer as mentioned above provides provision for overland flow to Marine Parade.

The Engineering Drawings provided within Appendix B of this report should be referred to for further details for the proposed external catchment conveyance.

6 STORMWATER QUANTITY

6.1 Objective

Stormwater discharge from the development must be detained to pre-development flow rates for the median storm event up to and including the 1% AEP ("no-worsening"). The hydrological assessment undertaken measures the site flow rates up to and including the 1% AEP event for both the pre- and post-development scenarios.

6.2 Methodology and Assessment

The hydrological assessment presented in this report has been undertaken in accordance with the methodology documented in the Australia Rainfall & Runoff 2019. This methodology incorporates an ensemble approach (i.e., 10 temporal distribution per storm duration) and uses the design rainfall inputs sourced from the AR&R (2016) data hub.

For the site catchment identified as having an increase in peak flow rates when developed, a hydrologic model was created using DRAINS. The median storm event was determined via an investigation of multiple storm distributions for durations ranging from 10mins to 3hours.

It should be understood that the median results of each ensemble have been extracted to determine peak flows for the assessed catchments, as is standard practice.

6.2.1 Catchment Locality

In accordance with CoGC's City Plan SC6.12.4.4.3 & ARR2019, Rainfall Intensities Frequency Duration data were obtained from The Bureau of Meteorology (http://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016). The Latitude and Longitude used for the site is summarised in Table 6-1 below.

Table 6-1 Site Latitude and Longitude

Parameter	Value
Latitude	-28.0622
Longitude	153.4419

6.2.2 Catchment Summary

The site was assessed under three cases:

- **Existing Scenario** – The site in its existing state.
- **Developed Scenario** – The site in its developed state per the proposal.

It should be noted that:

- Catchments are represented using the ILSAX hydrological model to represent urbanised catchment conditions per ARR 2019 recommendations.
- Catchment areas only consider deep planting to be pervious. All other planter beds are considered impervious, but with the same depression storage (i.e. no infiltration losses for non-deep planting areas).

The following catchment details in Table 6-2 were determined from the site survey within Appendix A and the architectural plans, which can be found within the full development application package.

Catchment markups have been provided in Appendix C and D for existing and developed scenarios respectively.

Table 6-2 Modelling Catchment Details

Scenario	Catchment Name	Area (ha)	Impervious Fraction (%)	Time of Concentration (min)
Existing	EX_N	0.3642	83	5,7
	EX_S	0.3642	84	5,7
Developed	DEV_N (Impervious & Deep Planting)*	0.3162	90	5,7
	DEV_N_PLANTER (Planter Beds)*	0.0480	100*	5,7
	DEV_S (Impervious & Deep Planting)*	0.3296	89	5,7
	DEV_S_PLANTER (Planter Beds)*	0.0346	100*	5,7

**Detailed assessment for the mitigated scenario (eg. NORTH = DEV_N + DEV_N_PLANTER). Planter beds have been modelled as a separate node with 5mm initial loss as an impervious area (to remove infiltration losses).*

6.2.3 DRAINS Model Setup

An image of the DRAINS model setup has been provided below for ease of reference.

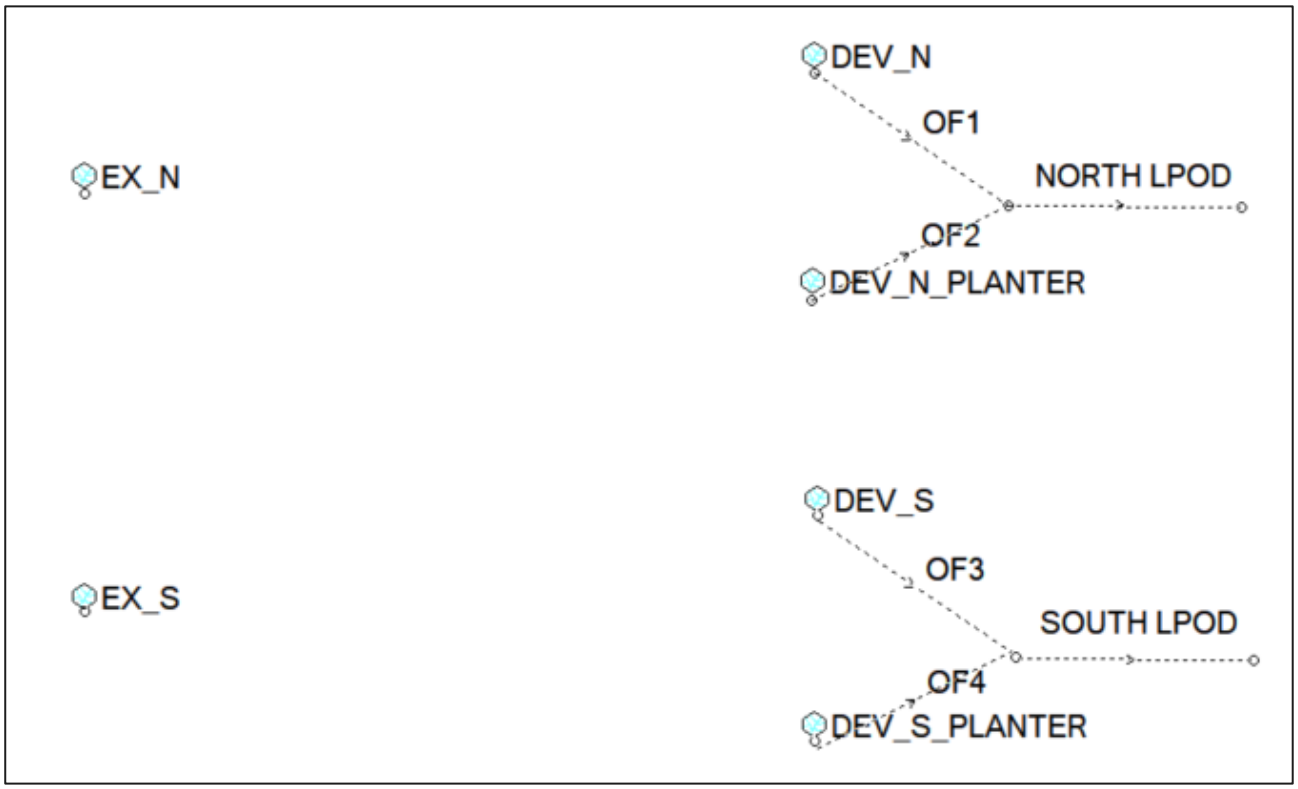


Figure 6-1 DRAINS Model Setup (Existing and Developed Scenarios, Left to Right)

6.2.4 Model Results

The following results have been captured from the DRAINS model. Table 6-3 below summarises the peak flow rates for each identified critical storm across the assessed AEP range at the assessment point for the catchment.

Table 6-3 Summary of DRAINS Hydrologic Results

LPOD	Scenario	AEP (%)	50	20	10	5	2	1
North	Existing	Median Flow (m^3/s)	0.107	0.149	0.184	0.211	0.245	0.271
	Developed	Median Flow (m^3/s)	0.110	0.151	0.187	0.214	0.248	0.274
South	Existing	Median Flow (m^3/s)	0.108	0.150	0.184	0.212	0.245	0.271
	Developed	Median Flow (m^3/s)	0.109	0.152	0.187	0.214	0.247	0.274

6.3 Objective Discussion

The above hydrologic investigation has demonstrated that there is no significant increase in median discharge flow rates being directed off-site to existing infrastructure for 50% AEP events to 1% AEP events in accordance with QUDM and ARR2019.

7 STORMWATER QUALITY (OPERATION)

7.1 Objectives

The following operational water quality objectives are set out by Council:

- Gross Pollutants (>5mm) – 90% reduction in mean annual load.
- Total Suspended Solids (TSS) – 80% reduction in mean annual load.
- Total Phosphorous (TP) – 60% reduction in mean annual load.
- Total Nitrogen (TN) – 45% reduction in mean annual load.

7.2 Proposed Stormwater Treatment Devices

WSUD aims to minimise the impact of a development on the natural water cycle by reducing the export of pollutants, sediments and nutrients from the site into the natural watercourse. To treat the stormwater runoff from the site, various treatment devices can be used throughout the development area and these concepts can be integrated into the overall design of the road layouts, road cross sections, stormwater layouts and water supply reticulation systems. Stormwater from each development stage will follow a specially designed stormwater quality treatment train prior to discharge from the site, which will ensure compliance with the water quality objectives.

A treatment train has been proposed for the site which comprises of several individually designed treatment devices that collectively contribute to the achievement of whole site water quality objectives. It should be noted that pools and transformers have been excluded from the quality treatment areas.

7.3 Modelling

Modelling of the site was undertaken using the 'Model for Urban Stormwater Improvement Conceptualisation (MUSIC)' as promoted by CoGC and the South East Queensland Healthy Waterways Partnership. The development was modelled using the split catchment approach. An appropriate type of land use was applied to all surface types within the developed catchments; where individual treatment devices were assigned the relevant modelling treatment parameters. Consequently, a treatment train was established for each site, ensuring that water discharging from site adheres to the specified Water Quality Objectives.

Meteorological data for input into MUSIC was obtained from Elanora Rainfall Station 40609 from the Bureau of Meteorology. Six-minute time step rainfall data was obtained for the climate period from 1/1/1989 to 31/12/1998. The catchment parameters of the MUSIC modelling are specified within the Water by Design MUSIC Modelling Guidelines Version 3 (2018) and have been modelled as such.

7.3.1 Pollutant Source Node Details

The pollutant source node parameters input into the MUSIC model were determined using the Water by Design MUSIC Modelling Guidelines Version 3 (2018), specifically Tables 3.7 and 3.8 for urban residential surface types. It is noted that all base flow parameters for roof surfaces are adopted as 0.00 or N/A.

Approximate landscape imperviousness was considered for ground areas to ensure an accurate generation of pollutants.

A summary of the source these nodes have been provided in Table 7-1 below. The developed catchment markup provided in Appendix D informed the modelled catchment areas.

Table 7-1 Summary of Source Node Details

LPOD	MUSIC Source Node	Area (ha)*	Imperviousness (%)
North	Roof	0.043	100
	Road	0.005	100
	Ground	0.316	75
South	Roof	0.049	100
	Road	0.018	100
	Ground	0.297	76

7.3.2 Treatment Device Details – Ocean Protect

An Ocean Protect treatment system has been designed specifically to ensure that the site meets the stormwater quality requirements. This treatment system includes a NPSorb StormFilter cartridge system. These are Stormwater Quality Improvement Device Evaluation Protocol (SQIDEP) approved products by Stormwater Australia. Copies of the SQIDEP certification for all proposed devices has been provided in Appendix D of this report.

Once the site is fully developed, the stormwater run-off from sub-catchments will be collected via a private drainage system and directed to the relevant areas per Figure 5-3.

Details of the location and conceptual design of the proposed treatment devices are presented in the Engineering Drawings in Appendix B of this report, which should be referred to for further design information. It is critical to understand that the design provided as part of this report is conceptual in nature, and that further coordination will be required with other consultants and the proprietor during detailed design, prior to construction.

Table 7-2 Ocean Protect Design Parameters

LPOD	Tall (690mm) NPSorb StormFilter Cartridges
North	x12
South	x12

7.3.3 Model Layout and Results

A diagrammatical view and pollutant reduction results can be found in Figure 7-1 below.

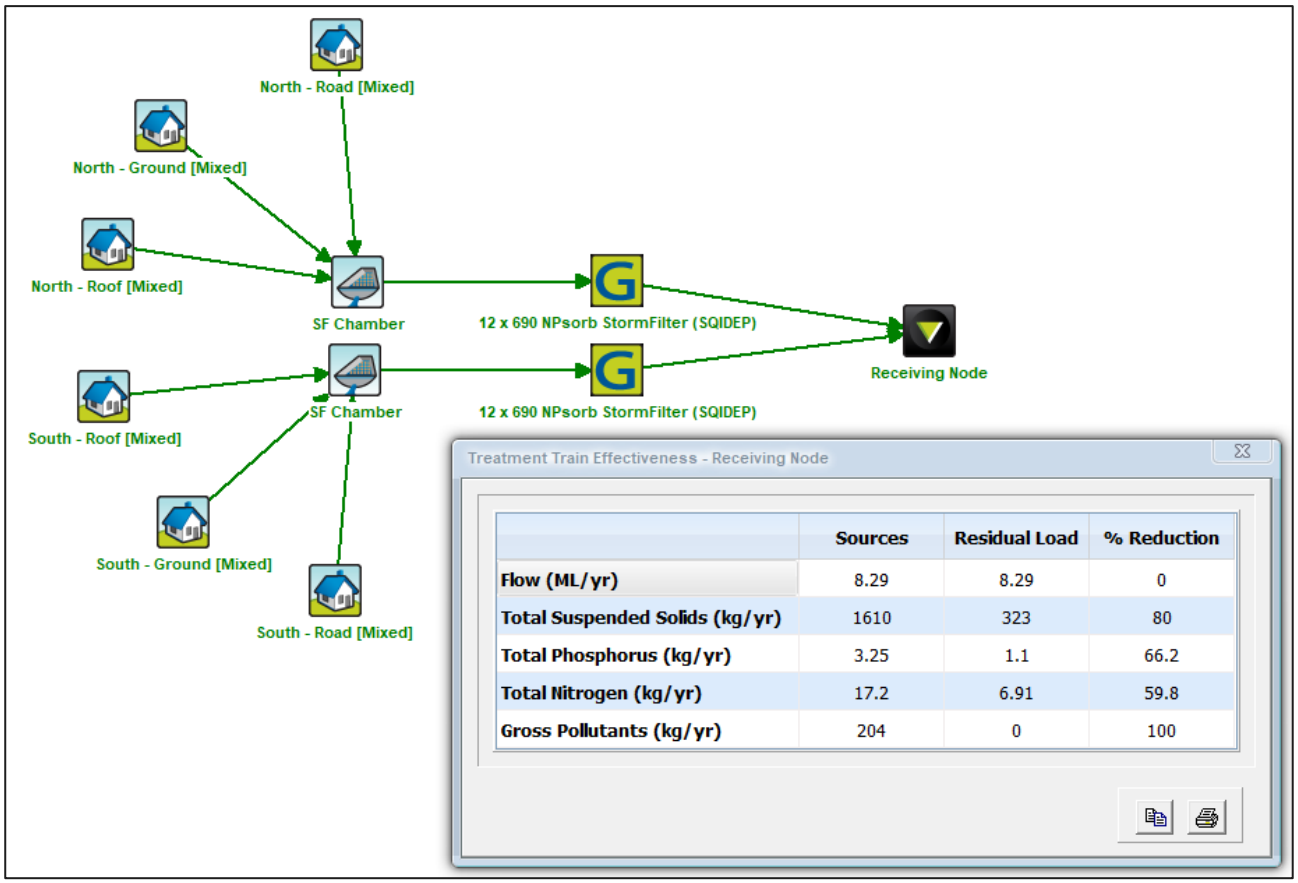


Figure 7-1 MUSIC Model Layout and Results

7.3.4 Hydraulic Performance

A general check for Hydraulic Grade Line (HGL, head) in the downstream pipe systems has been made to verify the performance of the proposed underground treatment systems.

1. **North Ocean Protect System** – The contributing flows to the connection location (450mm pipe) in a 4EY (Q3 month) event is only nuisance runoff the adjacent Council Park areas, totalling less than 0.1ha at ~10% imperviousness (approx. 2 L/s in a 4EY event). No significant tailwater conditions are foreseen for this connection location.
2. **South Ocean Protect System**
    a. **Pipe within the site** – The contributing flows to the connection location (600mm pipe) in a 4EY (Q3 month) event consist of runoff from the Lions Head Park to the west. This area totals approximately 0.431ha at ~60% impervious (approx. 46 L/s in a 4EY event). Based on a Mannings calculation for a 600mm pipe at 1% grade, the pipe would have approximately 111mm depth of water (RL 2.56 at the connection location). The Ocean Protect system invert is at RL 2.50 therefore will operate in the target treatment event per manufacturers requirements.
    b. **Gully pit connection** – The contributing flows to the connection location (750mm pipe) in a 4EY (Q3 month) event consist of runoff from the southern portion of the site, Lions Head Park to the west, some properties to the north and a portion of Marine Parade. This area totals approximately 1.3ha at ~80% impervious (approx. 143 L/s in a 4EY event). Based on a Mannings calculation for a 750mm pipe at 1% grade, the pipe would have approximately 182mm depth of water (RL 2.03 at the connection location). The Ocean Protect system invert is at RL 2.50 therefore will operate in the target treatment event per manufacturers requirements.

8 STORMWATER QUALITY (CONSTRUCTION)

8.1 Water Quality Objectives

Table 8-1 Construction Phase Quality Objectives (SPP and CoGC LDG)

Pollutant	Criteria
Drainage Control	Design life and design storm of temporary drainage works: • Disturbed area open for <12 months—1 in 2 ARI. • Disturbed area open for 12-24 months—1 in 5 ARI. • Disturbed area open for > 24 months—1 in 10 ARI.
Erosion Control	• Minimise exposure of disturbed soils at any time. • Avoid or minimise large construction activities in the wet season. • Divert water run-off from undisturbed areas around disturbed areas. • Use erosion risk ratings to determine appropriate erosion control measures.
Sediment Control	Use soil loss rates to determine appropriate sediment control measures Design storm for sediment control basins should be based on retaining the maximum sediment quantity for the maximum volume of water run-off Site discharge during sediment basin dewatering should not exceed 50 mg/L TSS and pH between 6.5–8.5
Stormwater Drainage / Flow Management	Hydraulics and hydrology—Take all reasonable and practicable measures to minimise significant changes to the natural waterway hydraulics and hydrology from: • peak flow for the one-year and 100-year ARI event (respectively for aquatic ecosystems and flood protection). • run-off frequency and volumes entering receiving waters. • Uncontrolled release of contaminated stormwater.
Water Quality Outcomes	Stormwater flows from undisturbed and disturbed areas—manage to help protect environmental values Coarse sediment—coarse sediment is retained on site Fine sediment—Site discharge during sediment basin dewatering has a TSS concentration less than 50 mg/L Turbidity—Site discharge during sediment basin dewatering has a turbidity (NTU) less than 10% above receiving waters turbidity— measured immediately upstream of the site Nutrients (N & P)—Nitrogen and phosphorus are managed through sediment control. pH—Site discharge during sediment basin dewatering has a pH range 6.5–8.5 Litter and other waste—Prevent litter/waste entering the site, the stormwater system or watercourses that discharge from the site. Also minimise or sufficiently contain on-site litter and waste production and regularly clear waste bins Hydrocarbons and other contaminants—Hydrocarbons and other contaminants are prevented from entering the stormwater system or internal watercourses that discharge from the site. Wash down water—Wash down water is prevented from entering the stormwater system or internal watercourses that discharge from the site Cations and anions—Cations and anions including aluminium, iron and Sulfate are managed as required under an approved acid Sulfate soil management plan

Table 8-1 provides the construction phase stormwater quality objectives outline by the State Planning Policy. Additional relevant acts, policies and information that may be useful for construction phase planning include:

- Environmental Protection Act (1994).
- Environmental Protection (Water) Policy (2009).
- Queensland Development Code, Sediment and Erosion Control (2010).
- Best Practice Erosion and Sediment Control for Building and Construction Sites Guidelines (2008).

8.2 Erosion and Sediment Control Plan Purpose

During the construction phase it shall be the Principal Contractor's responsibility to ensure the objectives of Table 8-1 are achieved.

The following section of this report provides a suggested framework for an Erosion and Sediment Control Plan. This includes recommended actions and responses for specific activities; monitoring and reporting; and construction of specifically designed site-specific sediment basins.

8.3 Specific Activities

8.3.1 Erosion and Sediment Control of Disturbed Land

During the construction phase it shall be the Principal Contractor's responsibility to ensure the following:

- Diversion of any clean water runoff that may interfere with land disturbance by the use of earth bunds, or other control devices deemed appropriate by a suitable supervisor.
- Reduction of sediment migration from disturbed land parcels by implementing silt fences, sediment basins or other control devices as deemed appropriate by a suitable supervisor.
- Where cut to fill operations produce a spoil it is recommended that the excess material be placed upstream of the excavation location to ensure any sediment runoff is directed back into the trench. Earth bunds or sediment fences may be required to control direction of sediment flow should the spoil be placed on the downstream side of the excavation site.
- Control measures such as a gully pit sediment barrier shall be installed around inlet pits where required reducing the potential for sediment discharge into the surrounding stormwater system.
- Any sediment deposited from construction vehicles will be swept up and removed.
- Erosion and sediment control devices may only be removed once disturbed lands which they are protecting are rehabilitated and capable of resisting further erosion.

8.3.2 Spoil and Stockpile Management

It shall be the Principal Contractor's responsibility to oversee the following controls during the construction phase unless otherwise specified:

- The placement of spoil and stockpile material shall be kept at a maximum distance from stormwater inlets, gutters and stormwater pipes to reduce unnecessary sediment migration into nearby infrastructure.
- Spoil and stockpile material shall be placed in a way that reduces the likelihood of sedimentation, erosion and slippage. Advice from an appropriate project manager/representative shall be sought in this instance.
- Spoil or stockpile material that is deemed a contaminant shall be placed on a designated zone of either fill material, plastic or concrete with the installation of appropriate containment devices. Advice from an appropriate project manager/representative shall be sought in this instance as the resulting control will be highly dependent on the severity of contamination.
- It shall be the Project Manager's responsibility to foresee and develop appropriate control measures to prevent the impacts of spoil and stockpile material prior to construction activities. Monitoring and reporting shall also be required during the implementation of any given device associated with spoil and stockpile management.

8.3.3 Erosion Control

It shall be the Principal Contractor's responsibility to oversee the following controls during the construction phase:

- Traffic of any type shall be kept away from areas of rehabilitation to promote stabilisation of the zone.
- Where wind and water are acknowledged as potential erosion sources temporary protection shall be installed. Such measures only apply to zones of spoil, stockpile and land disturbance which are unlikely to receive works within a period of 6-8 weeks. Further advice from an appropriate project manager/representative shall be sought in this instance as the resulting control will be highly dependent on the disturbance type and erosion source.
- Once viable, final landscaping shall be undertaken on applicable zones to increase stability.

8.3.4 Personnel Training

It shall be the Principal Contractor's responsibility to oversee the following training protocols during the construction phase:

- Environmental management and incident reporting is to be included on all site induction courses.
- All personnel are to receive adequate training in workplace health and safety issues, environmental management, best practice erosion and sediment control practices, incident reporting procedures and where applicable site inspection and maintenance procedures.

8.3.5 Miscellaneous

It is the Principal Contractor's responsibility to ensure erosion and sediment controls are operated and maintained in an effective operational condition. These structures are not allowed to accumulate sediment volume in excess of 70% sediment storage design capacity as per Section 6 of the Urban Stormwater Quality Planning Guidelines 2010.

- Sediment removed from control measures must be disposed of in a manner approved by the local Council that does not cause pollution and forms part of the Contractor's obligation.
- Any chemicals, fuel or oil stored on site shall be stored under cover in a bounded area or placed sufficiently above ground level to prevent contamination of surface water.
- A waste concrete receptor (disposal area) must be established if significant concreting is to occur on site. The site must be surrounded by perimeter bunds and be clearly signed.
- A general waste collection area shall be established which is to include appropriate pollutant runoff controls, dependent on the nature of the waste.

8.4 Project Personnel Responsibilities

A description of the key personnel involved with implementing the Erosion and Sediment Control Plan are listed in Table 8-2. It is recommended that all parties involved attend a pre-construction conference to discuss and clarify all issues associated with sediment and erosion control as well as this plan.

Table 8-2 Project Personnel Responsibilities

Project Role	Responsibilities
Superintendent	• Authorisation of this plan; and • Review and monitoring of this plan.
Contractor / Site Manager	• Implementation of this plan; • Monitoring of this plan; • Supervising any activities or requirements required by this plan; • Ensuring all personnel are aware of the contractual agreements associated with this plan.
All Personnel	• Ensuring they are aware of the contractual agreements associated with this plan; and • Informing appropriate personnel of any issues that may arise with respect to the desired sediment and erosion control measures.

8.5 Monitoring and Responsibility

8.5.1 All Personnel

It is the obligation of all personnel to report any failures in the erosion and sediment control works utilised during the project life cycle. Any identified errors within the sediment and erosion control system shall be reported in writing to a relevant project manager. A formal inquiry shall be undertaken in accordance with the reported issue as well as the relevant party procedures (i.e., Principal Contractor).

8.5.2 Contractor/Contractor's Foreman

It shall be the responsibility of the Contractor and Contractor's Foreman to monitor and report on the erosion and sediment control measures utilised in the construction phase. Inspections are to be undertaken:

- On a daily basis during earthworks, land disturbance, spoil or stockpile activities and rain events.
- Weekly during site inactivity.
- Within 24 hours prior to expected rainfall and 18 hours prior to intense rainfall events.

The following shall be inspected or reported on:

- Erosion and sediment control devices are in the correct location and are working as defined by this plan.
- Drainage systems both internal and external to the site are operating effectively or to pre-construction efficiencies.
- Spilled material is removed if it can potentially mobilise via stormwater runoff or wind.
- Stabilisation of disturbed land parcels has been undertaken in an effective manner.
- Excess sediment has been removed from erosion and sediment measures appropriately if the device is operation ineffectively or requires decommissioning.
- It is understood that repairs, maintenance or reinstallation may be required if any control measures are operating inadequately, or if infrastructure is damaged due to inefficient operation of the outlined measures.

8.5.3 Environmental Representative

It shall be the responsibility of the environment representative to periodically inspect and report on the effectiveness of the erosion and sediment controls during the construction phase of the project. Technical advice shall be given to personnel outlying any uncertainty with regards to the applicability, installation, operation, maintenance, removal or rehabilitation of any sediment and erosion control.

8.6 Construction Phase Sediment Control Devices

As the site has been assessed as a single catchment, it is appropriate to approach the assessment of construction phase sediment devices in a similar manner.

In accordance with the Best Practice Erosion and Sediment Control Manual (IECA 2009) the construction phase catchment has been classified to determine the level of sediment and erosion control techniques required. The site is identified as per Table 4.4.6 (IECA 2009) to be closest to the Southport locality and therefore attracts an average monthly rainfall depth of 56m to 205mm.

As the extent of soil disturbance is minimal, Type 3 techniques will be used in accordance with Table 4.5.3. This will require control techniques such as a vehicle shakedown at the site entry, and sediment fences. Specific detailed design plans will be formulated at respective future phases of the development such as operational works.

9 ASSET MAINTENANCE AND HANDOVER

All the stormwater quality controls detailed in this document are contained within the development site and will remain an asset of the development's property owner, Body Corporate or similar internal authority.

The below denotes the anticipated access location for the proposed treatment devices.

- **Ocean Protect cartridge systems:** Access from ground floor driveways.

Additional information including integration drawings and maintenance requirements can be found in Appendix B and on Ocean Protect's website respectively (https://oceanprotect.com.au/stormfilter/).

10 CONCLUSION

This SBSMP has been prepared to provide a design proposal and guide to the stormwater management techniques for the site.

The primary objectives of this report are achieved as follows:

Lawful Point of Discharge (LPoD)

- The site proposes to maintain the LPoD (Marine Parade) after receiving appropriate treatment on site.
- The conveyance of external flows to Marine Parade is to be maintained.

Stormwater Quantity

- The hydrological assessment undertaken has determined that the developed site peak flow rates are generally aligned with the peak existing flow rates.

Stormwater Quality

- An Ocean Protect system is proposed to meet operational phase stormwater quality objectives.

Erosion and Sediment Control

- Type 3 sediment discharge techniques will be used comprising of a vehicle shakedown, sediment fences and gully inlet protection.

APPENDIX A
Survey



Legend

CAG	Comms Above Ground	BH	Bore Hole
COMK	Comms Marker	BOL	Bollard
COMP	Comms Pit		Edge Garden
CUG	Comms Under Ground	//	Fence
SWD	Drainage Swug		Retaining Wall
	Drainage Centre Line	IO	Inspection Opening
SWMH	Stormwater MH	MH	Unidentified Manhole
SWGT	Stormwater Gully Trap	PO	Post
SWFI	Field Inlet Pit	SI	Sign
SWKA	Stormwater Kerb Adaptor	TBM	Temporary Bench Mark
UE	Power Line Under Ground	T	Telecom Line
	Power Line Above Ground	TEL	Telecom Pit
ELMK	Electrical Marker	TELBOX	Telecom Telbox
ELP	Electrical Pillar	TEM	Telecom Marker
ELPI	Electrical Pit	TP	Telecom Pole
GW	Guy Wire Anchor		Bottom of Bank
LAMP	Lamp Post		Top of Bank
LP	Light Pole		Change of Grade
PP #	Power Pole		Water Line
PPL	Power Pole with Light	TR 0306	Edge of Vegetation; Tree - 0.3m Dia Trunk & 6m Canopy Spread
PPLT	PP with Light & Transformer	W	Water Main
PPT	Power Pole with Transformer	HR	Fire Hose Reel
G	Gas Main	HY	Water Hydrant
GM	Gas Meter	SPR	Water Sprinkler
GV	Gas Valve	SV	Water Valve
	Road Crown	TAP	Water Tap
	Edge of Bitumen	WBE	Hydrant Booster
	Edge Track	WM	Water Meter
GP	Guide Post	WMK	Water Marker
	Guard Rail		Bitumen
	Road Kerb Invert		Concrete
S	Sewer Main		Dirt
SMH	Sewer Manhole		Garden
SMK	Sewer Marker		Gravel / Rock
SVE	Sewer Vent		Pavers
	Awning / Top of Gutter		Tiles
TOG RL	Top of Gutter		

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Client

122 Marine Parade P/L
ATF 122 Marine Parade Unit Trust

122 Marine Parade Miami

Detail Survey Sheet 1 of 6

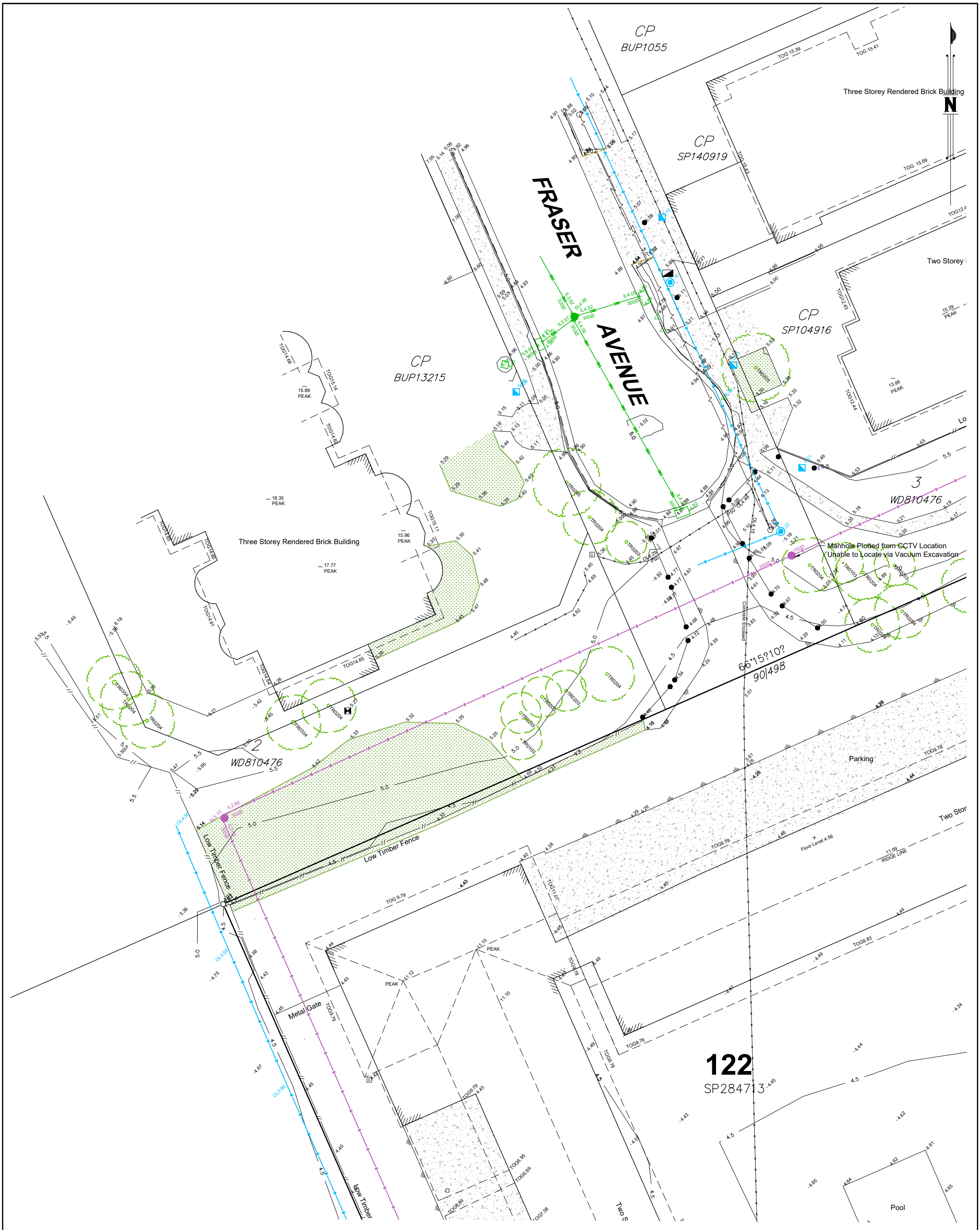
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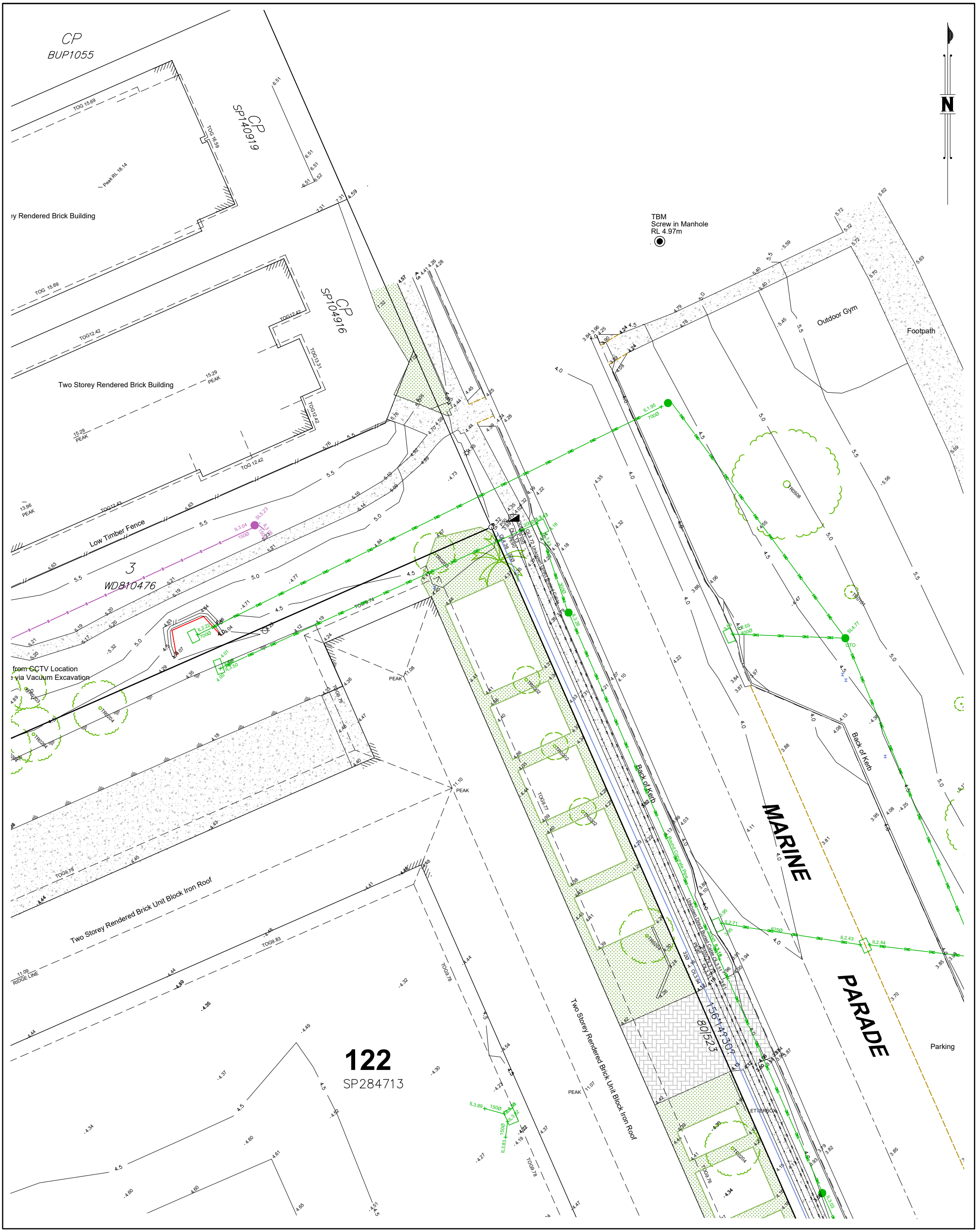
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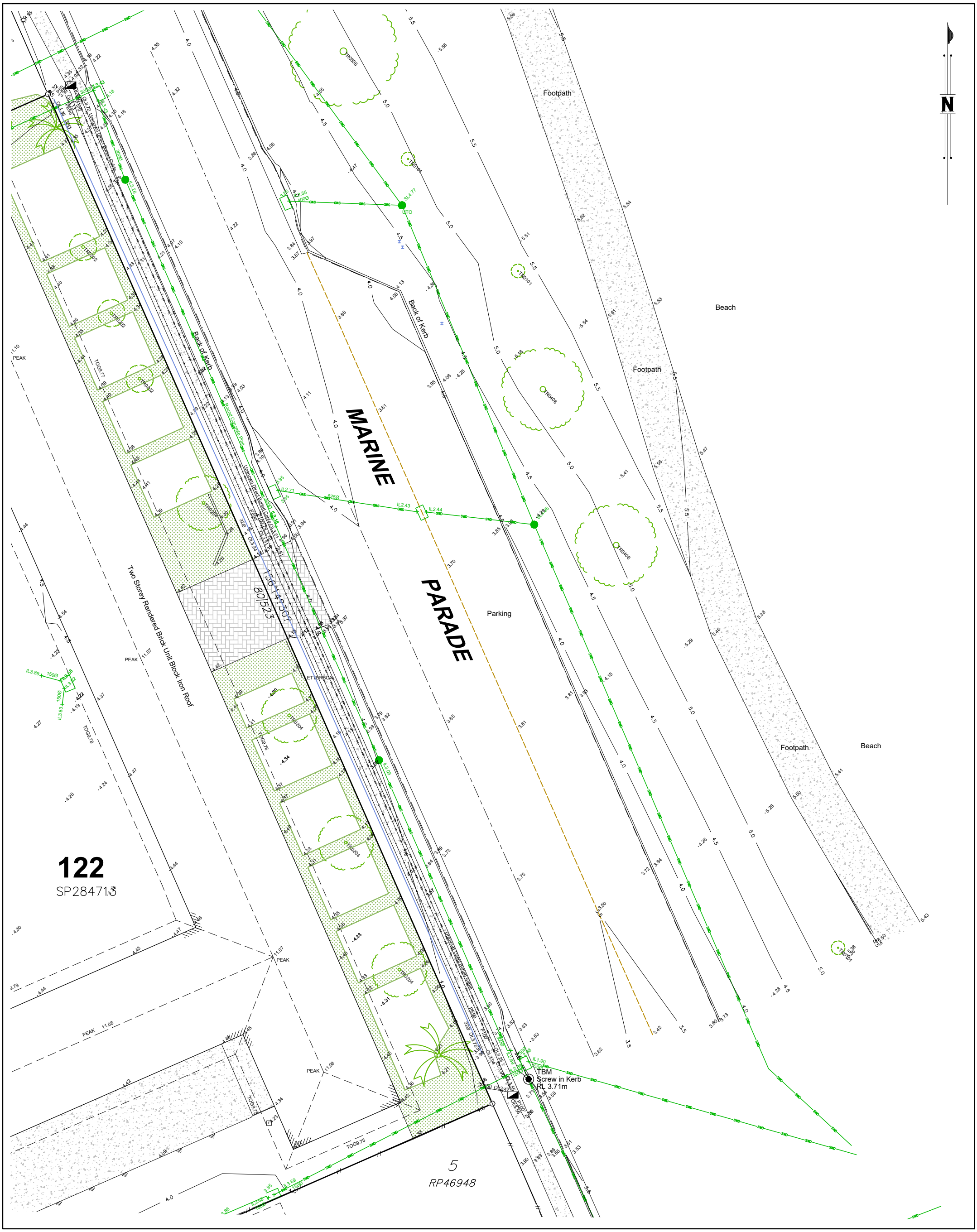
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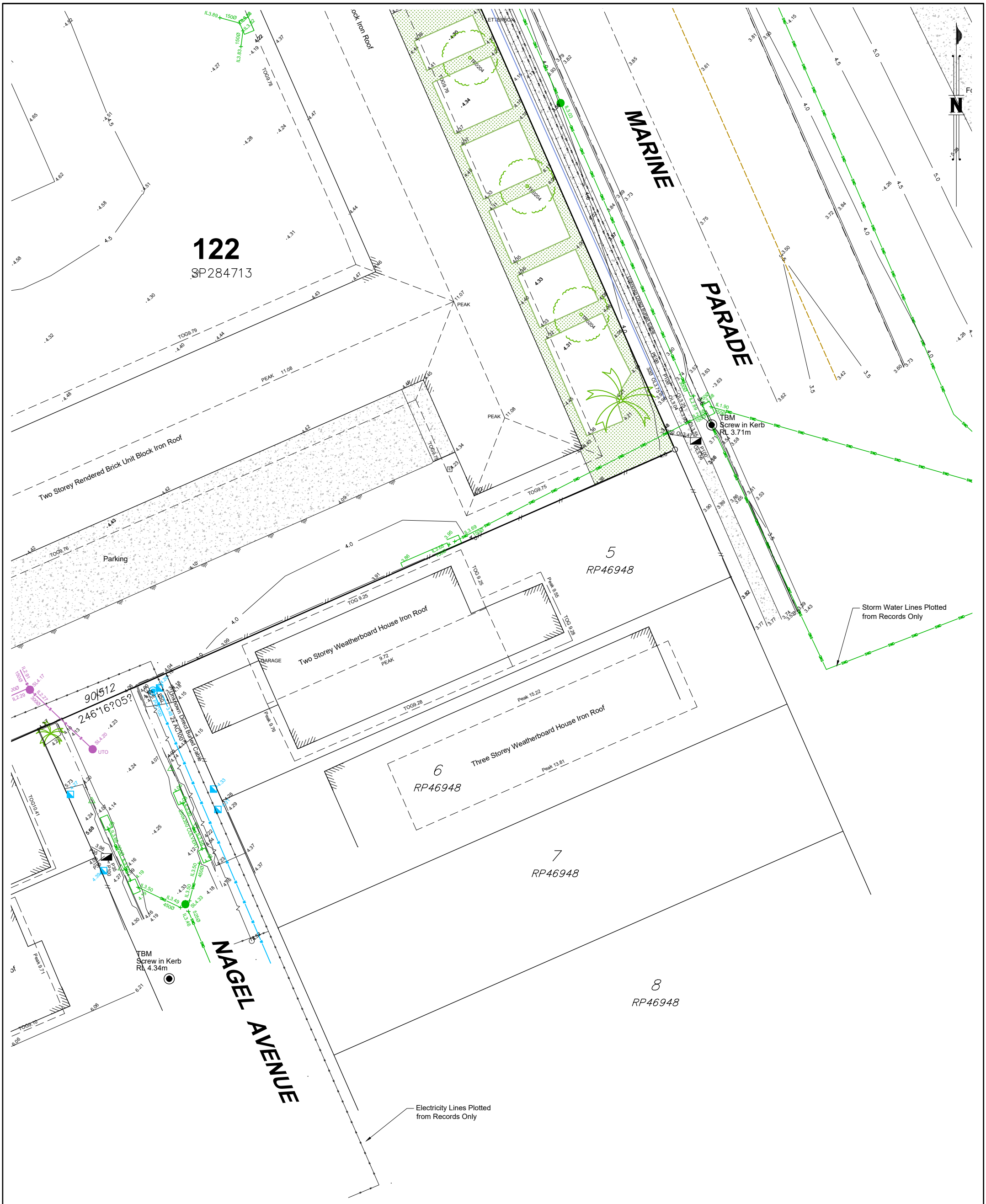
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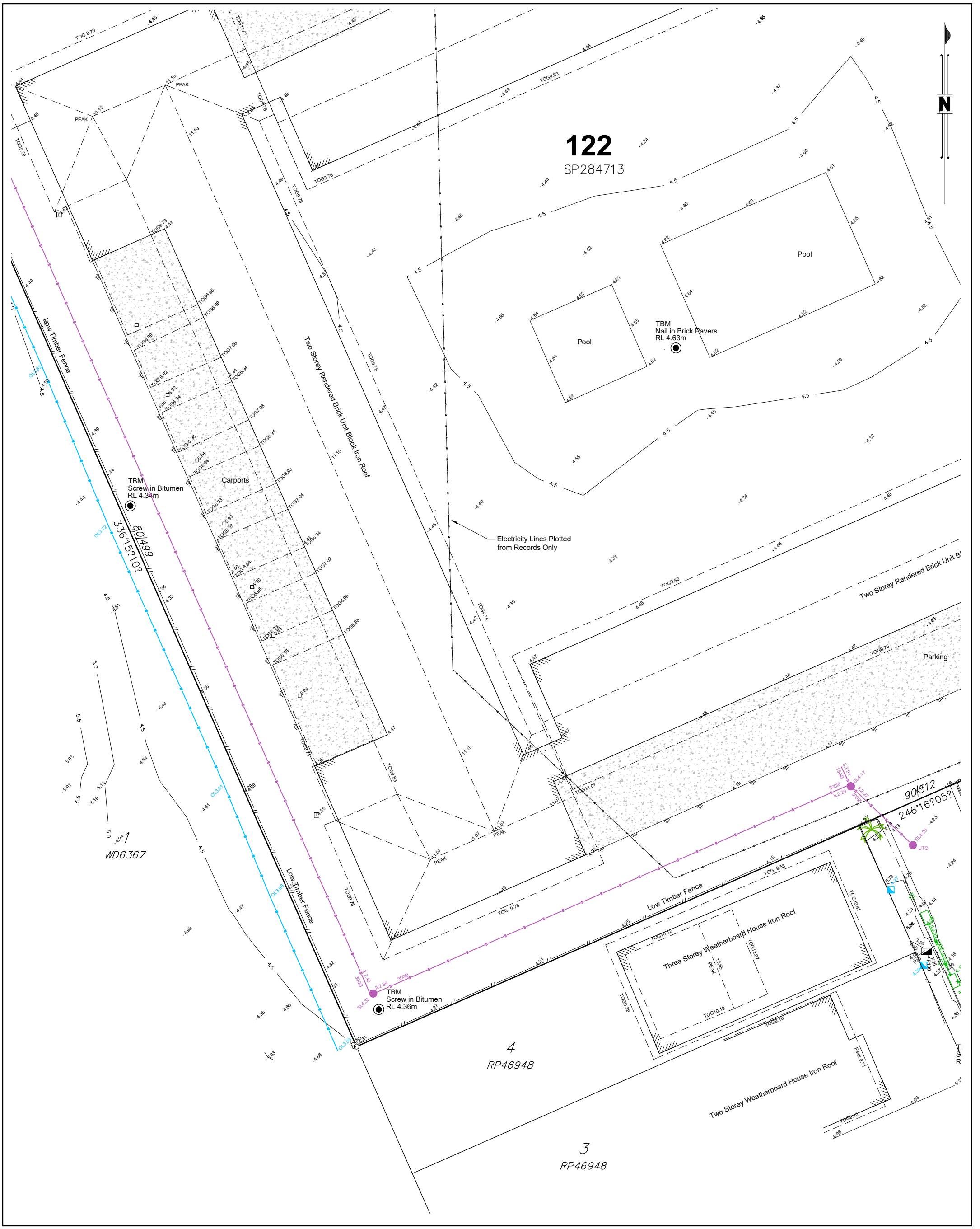
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APPENDIX B
Engineering Drawings

REFER INSET 01 (DRG 0003)

UPGRADED 2m WIDE FOOTPATH, DESIGN SUBJECT TO DA APPROVAL AND FUTURE OPW APPLICATION.

RESHAPING WORK WITHIN PARKS PROPERTY (LOT 3 ON WD810476) TO CONVEY OVERFLOW FROM COUNCIL DRAINAGE NETWORK AND REMOVE FALL RISK STRUCTURES AND STEEP BATTER SLOPES. REFER INSET (DRG 0003) FOR FURTHER DETAILS.

CONCEPT ALTERNATIVE PIPE ALIGNMENT THROUGH BASEMENT (RESULTS IN LAYOUT CHANGES).

NORTH UNDERGROUND OCEAN PROTECT TANK, CONNECTED TO NEW DRAINAGE WITHIN LOT 2 AND 3 ON WD810476 (COUNCIL OPEN SPACE).

EXTERNAL CATCHMENT FROM LIONS HEAD PARK, REFER REPORT FOR FURTHER DETAILS.

PRIVATE INTERNAL DRAINAGE BY BUILDING HYDRAULICS.

AREA TO REMAIN AT GRADE WITH REAR BOUNDARY TO CAPTURE EXTERNAL FLOWS FROM COUNCIL RESERVE. LENGTH OF PIPE SHOWN IS PROVISIONAL.

SOUTH UNDERGROUND OCEAN PROTECT TANK, CONNECTED TO DRAINAGE WITHIN MARINE PARADE.

BOUNDARY PIT TO ENABLE SURCHARGE. SURFACE TO GRADE TO STREET FOR SURCHARGE (>10% AEP).

PRIVATE DRAINAGE SYSTEM TO CAPTURE EXTERNAL FLOWS FROM COUNCIL RESERVE. DN300 PIPE AT 1% GRADE TO CAPTURE 10% AEP, SUBJECT TO DETAILED DESIGN.

PRIVATE TRENCH GRATE.

3m WIDE FLOW PATH RELIEF FOR FLOWS IN EXCESS OF COUNCIL DRAINAGE (NAGEL AVENUE). REMOVE HIGH POINT ADJACENT BOUNDARY TO LIMIT PONDING IN SITE AND NEIGHBOUR'S PROPERTY. REFER SECTION.

PRIVATE DN600 PIPE AT 1% GRADE TO CAPTURE 10% AEP, SUBJECT TO DETAILED DESIGN.

CONNECTION TO EXISTING GULLY PIT WITHIN MARINE PARADE.

NOTES

1. PROPOSED SERVICES SHOWN ARE CONCEPTUAL ONLY AND SUBJECT TO DETAILED FIELD SURVEY, DESIGN AND APPROVAL BY AUTHORITIES.
2. REFER TO PROJECT SURVEY AND OTHER ASSET INFORMATION FOR LOCATION EXISTING SERVICES AND ASSUMPTIONS.
3. INTERNAL DRAINAGE IS INDICATIVE AND SUBJECT TO BUILDING HYDRAULIC ENGINEER DESIGN.
4. REFER TO STORMWATER MANAGEMENT PLAN FOR MANAGEMENT DEVICE DETAILS AND SPECIFICATIONS.

LEGEND

- SITE BOUNDARY
- 4.25 EXISTING SURFACE LEVEL
- SWD EXISTING STORMWATER DRAINAGE
- S EXISTING SEWERAGE RETICULATION
- RM EXISTING SEWER RISING MAIN
- W EXISTING WATER RETICULATION
- c EXISTING COMMS RETICULATION
- e EXISTING ELECTRICAL
- oh EXISTING OVERHEAD ELECTRICAL
- fo EXISTING FIBRE OPTIC
- g EXISTING GAS
- SWD PROPOSED STORMWATER DRAINAGE
- S PROPOSED SEWERAGE RETICULATION
- W PROPOSED WATER RETICULATION
- FUTS FUTURE PRIVATE SEWER
- FUTSWD FUTURE PRIVATE STORMWATER
- FUTW FUTURE PRIVATE WATER
- SERVICE TO BE DECOMMISSIONED
- PROPOSED VXO / FOOTPATH
- 1/1 STORMWATER CATCHMENT AND LABEL
- DIRECTION OF FLOW
- INDICATIVE MAINTENANCE ACCESS
- PROPOSED STORMWATER SWALE
- TREATMENT DEVICE
- BYPASS AREA
- EDGE OF BASEMENT WALL

Issue	Description	DR	CH	VE	Date
02	INFORMATION REQUEST RESPONSE	BW	JS	DC	13.06.25
01	ORIGINAL ISSUE	BW	JS	DC	24.04.25

Scales: 0 5 10 15 20 25m — 1 : 250

Architect: BDA ARCHITECTURE

Surveyor: JENSEN BOWERS

Client: MONACO PROPERTY GROUP PTY LTD

Status: PRELIMINARY
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Original Issue Signatures			
Drawn	B. WIESER	Original Size	A1
Designed	B. WIESER	Height Datum	AHD
Project Manager	J. STOCKWELL	Grid	LOCAL
Verified	D. CASTRO		

Project: 122 MARINE PARADE MIAMI

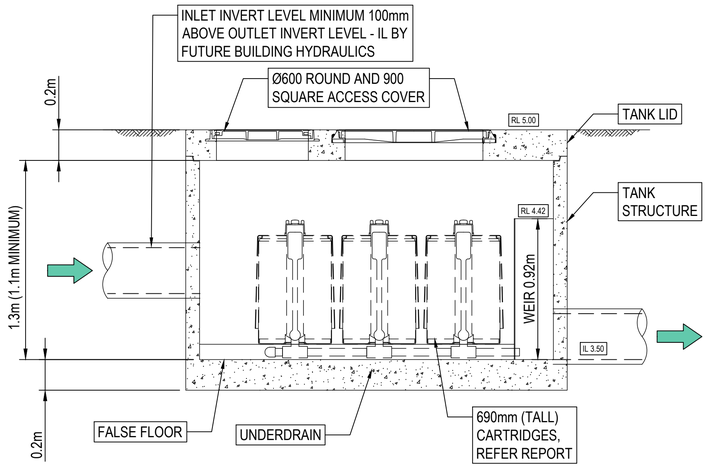
Title: STORMWATER MANAGEMENT LAYOUT PLAN

ARCADIS
Arcadis Australia Pacific Pty Limited
P O Box, 1653
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ABN 76 104 485 289
Tel No: +61 7 5532 3933
Fax No: +61 7 5591 4778
www.arcadis.com

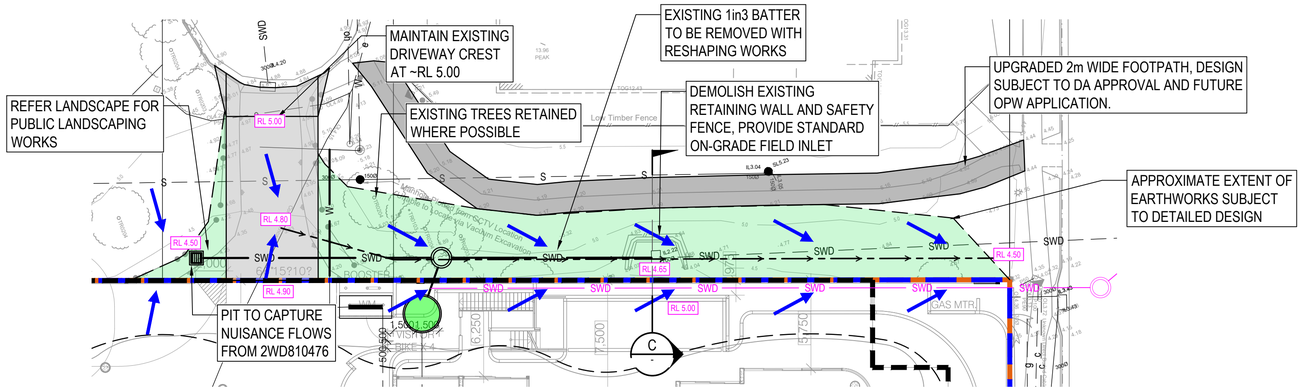
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100mm on Original

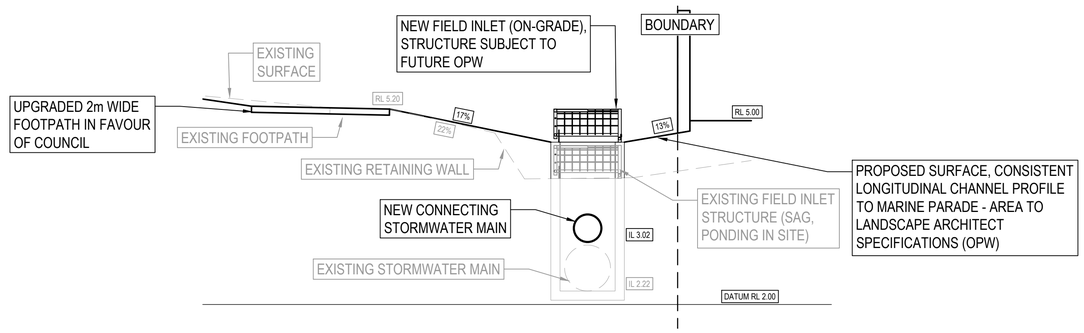
Date Plotted: 13 Jun 2025 - 05:39PM File Name: C:\Users\bw84462\ARCADIS\30264961 - UDR GC FY25 Projects 8 - Project\3 - 122 Marine Parade, Miami\D-DigEng\DA-DA Drawings\30264961-3 - Drawing Set.dwg V1



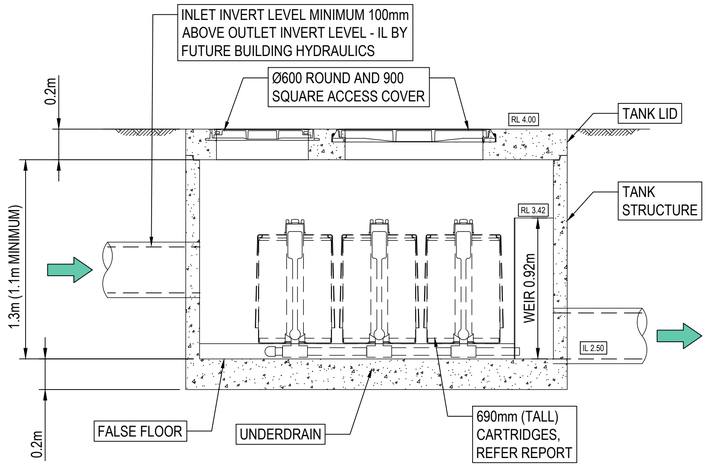
OCEAN PROTECT - NORTH A
1 : 20 0002



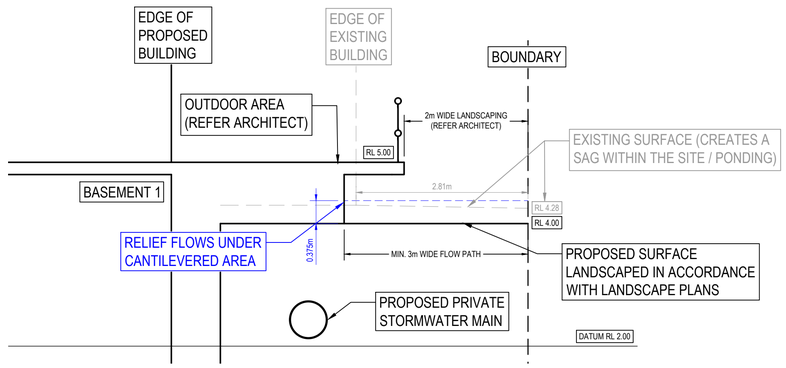
OPEN SPACE WORKS - INSET 01
1 : 200 0002



RESHAPING WORK - OPEN SPACE C
1 : 50 0002



OCEAN PROTECT - SOUTH B
1 : 20 0002



NAGAL AVENUE FLOW RELIEF D
1 : 50 0002

NOTES

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LEGEND

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- 4.25 EXISTING SURFACE LEVEL
- SWD EXISTING STORMWATER DRAINAGE
- S EXISTING SEWERAGE RETICULATION
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- INDICATIVE MAINTENANCE ACCESS
- PROPOSED STORMWATER SWALE
- TREATMENT DEVICE
- BYPASS AREA
- EDGE OF BASEMENT WALL

Issue	Description	DR	CH	VE	Date
02	INFORMATION REQUEST RESPONSE	BW	JS	DC	13.06.25
01	ORIGINAL ISSUE	BW	JS	DC	24.04.25

100mm on Original

Scales
0 0.5 1 1.5 2m
1 : 20
0 0.5 1 2 3 4 5m
1 : 50
0 5 10 15 20m
1 : 200

Architect: BDA ARCHITECTURE
Surveyor: JENSEN BOWERS
Client: MONACO PROPERTY GROUP PTY LTD

Status: PRELIMINARY
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Original Issue Signatures			
Drawn	B. WIESER	Original Size	A1
Designed	B. WIESER	Height Datum	AHD
Project Manager	J. STOCKWELL	Grid	LOCAL
Verified	D. CASTRO		

Project: 122 MARINE PARADE MIAMI
Title: STORMWATER MANAGEMENT DETAILS

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Project No.	Folder Prefix	Zone | Stage | Phase	Discipline	Type	Drawing No.	Issue
30264961-3	DA	- AA01DA -	CV	- DRG -	0003	- 02

Date Plotted: 13 Jun 2025 - 05:39PM File Name: C:\Users\bw84462\ARCADIS\30264961 - UDR GC FY25 Projects 8 - Project\3 - 122 Marine Parade, Miami\D-DigEng\DA-DA Drawings\30264961-3 - Drawing Set.dwg V1

APPENDIX C
Existing Catchment Areas



Legend

CAG	Comms Above Ground	BH	Bore Hole
COMK	Comms Marker	BOL	Bollard
COMP	Comms Pit		Edge Garden
CUG	Comms Under Ground	//	Fence
SWD	Drainage Swug		Retaining Wall
	Drainage Centre Line	IO	Inspection Opening
SWMH	Stormwater MH	MH	Unidentified Manhole
SWGT	Stormwater Gully Trap	PO	Post
SWFI	Field Inlet Pit	SI	Sign
SWKA	Stormwater Kerb Adaptor	TBM	Temporary Bench Mark
UE	Power Line Under Ground	T	Telecom Line
	Power Line Above Ground	TEL	Telecom Pit
ELMK	Electrical Marker	TELBOX	Telecom Telbox
ELP	Electrical Pillar	TEM	Telecom Marker
ELPI	Electrical Pit	TP	Telecom Pole
GW	Guy Wire Anchor		Bottom of Bank
LAMP	Lamp Post		Top of Bank
LP	Light Pole		Change of Grade
PP #	Power Pole		Water Line
PPL	Power Pole with Light		Edge of Vegetation
PPLT	PP with Light & Transformer	TR 0306	Tree - 0.3m Dia Trunk & 6m Canopy Spread
PPT	Power Pole with Transformer	W	Water Main
G	Gas Main	HR	Fire Hose Reel
GM	Gas Meter	HY	Water Hydrant
GV	Gas Valve	SPR	Water Sprinkler
	Road Crown	SV	Water Valve
	Edge of Bitumen	TAP	Water Tap
	Edge Track	WBE	Hydrant Booster
GP	Guide Post	WM	Water Meter
	Guard Rail	WMK	Water Marker
	Road Kerb Invert		Bitumen
S	Sewer Main		Concrete
SMH	Sewer Manhole		Dirt
SMK	Sewer Marker		Garden
SVE	Sewer Vent		Gravel / Rock
	Awning / Top of Gutter		Pavers
TOG RL	Top of Gutter		Tiles

Drawn:	SS	Date:	05/12/2023
Surveyed:	AJ	Date:	28/11/2024
Checked:	DB	Date:	05/12/2023

Associated Consultants

Disclaimer

Any licence, expressed or implied, to use this document for any purpose whatsoever is restricted to the terms of the agreement or implied agreement between Jensen Bowers and the instructing party.

Local Authority: Gold Coast City Council
Authority Ref. No: .
RP Description: Lot 122 on SP284713

Locality: Miami
Date of Survey: 28/11/2024
Level Datum: AHD (der)
Origin: OPM 21031 (RL 4.82)
Level Bk / Fld Bk: Digital
Horizontal Datum: IS306901
Contour Interval: 0.5m

Scale 1:750 @ A3
0 7.5 15 22.5m
1 : 750@A3 (Before Reduction)

Approved: DGB

Notes

The services shown hereon have been located where possible by field survey. Whilst due care and attention have been exercised, T.H. Jensen and Bowers Pty. Ltd. does not warrant that the services have been located in their entirety.

The boundaries shown hereon are for plotting purposes only and are subject to final survey.

The location of underground service lines are approximate only and have been plotted from field survey observations and/or service searches. Should their accurate location be critical to detail design we recommend further investigation.

Issue	Description	Date	Appd.
A	Original Issue	05/02/23	DGB

Client
Monaco Property Group

122 Marine Parade Miami

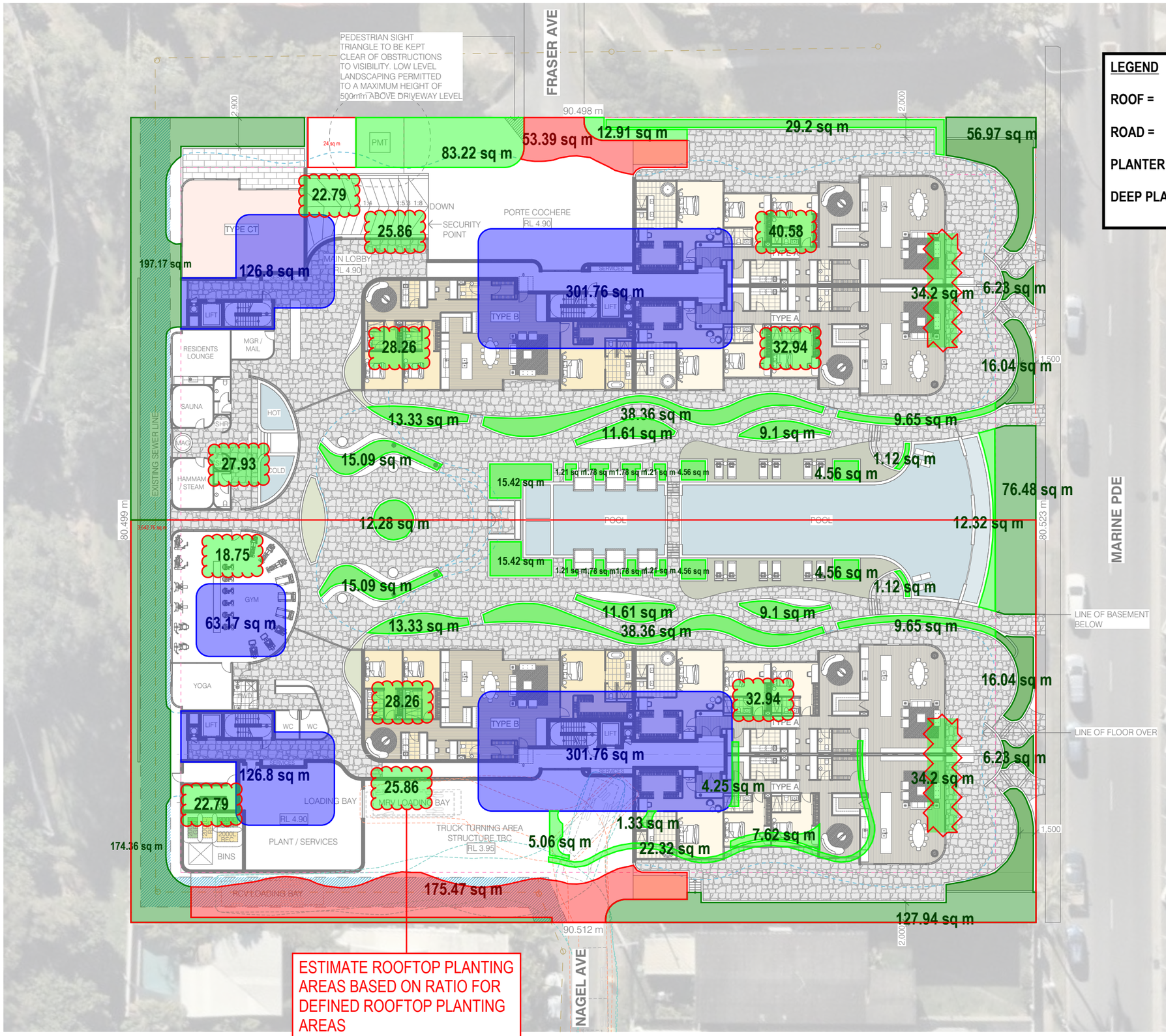
Detail Survey Sheet 1 of 6

Drawing No.	Issue	Original Size
S-11287-001	A	A3

JENSEN BOWERS
SURVEYING
3D SPATIAL SOLUTIONS
DEVELOPMENT ADVISORY
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T.H. Jensen & Bowers Pty. Ltd. (Consulting Surveyors)
ABN. 52 010 872 607

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APPENDIX D
Developed Catchment Areas



ESTIMATE ROOFTOP PLANTING AREAS BASED ON RATIO FOR DEFINED ROOFTOP PLANTING AREAS

LEGEND

ROOF =	24.75 sq m
ROAD =	24.75 sq m
PLANTER BEDS =	24.75 sq m
DEEP PLANTING =	24.75 sq m

MMARY

7,284 m²

1 bed:6.85m² (1:49 code)

Site Cover:	TBC m² (??%)
Total Residential NSA:	TBC m²
Total GBA (Enclosed):	TBC m²
Total GBA (Unenclosed):	TBC m²

CAR PARKING	REQUIRED	PROVIDED
1 x 2 BED UNIT (1.25 CARS PER UNIT)	1.25 Car Parks	2 Car Parks
40 x 3 BED UNIT (1.5 CARS PER UNIT)	60 Car Parks	128 Car Parks
5 x 5 BED UNIT (2 CARS PER UNIT)	10 Car Parks	30 Car Parks
VISITORS (3+1 PER 10 THEREAFTER)	7 Car Parks	8 Car Parks
TOTAL	**79 Car Parks**	**168 Car Parks**
BICYCLES - RESIDENTIAL (1 PER 3 RES. & 1 PER 12 VIS.)	16 Residents 4 Visitors	?? Residents ?? Visitors

RESIDENTIAL

TYPE A	12 Units (26.1%)	3 Bed + Mpr 3.5 Bath, 3 Cars	300 m² Enclosed 90 m² Balcony 390 m² Total
TYPE B	6 Units (13%)	3 Bed + Mpr 3.5 Bath, 3 Cars	261 m² Enclosed 47 m² Balcony 308 m² Total
TYPE B + ROOF	2 Units (4.3%)	3 Bed + Mpr 3.5 Bath, 4 Cars Private Rooftop	288 m² Enclosed 240 m² Balc / Roof 528 m² Total
TYPE C	4 Units (8.7%)	3 Bed + Mpr 3.5 Bath, 3 Cars	245 m² Enclosed 48 m² Balcony 293 m² Total
TYPE C + ROOF	2 Units (4.3%)	3 Bed + Mpr 3.5 Bath, 4 Cars Private Rooftop	272 m² Enclosed 212 m² Balc / Roof 484 m² Total
TYPE D	6 Units (13%)	3 Bed 3.5 Bath, 3 Cars	186 m² Enclosed 45 m² Balcony 231 m² Total
TYPE E	6 Units (13%)	3 Bed + Mpr 3.5 Bath, 3 Cars	273 m² Enclosed 50 m² Balcony 323 m² Total
TYPE F	2 Units (4.3%)	5 Bed + Mpr 5.5 Bath, 6 Cars Private Rooftop	658 m² Enclosed 422 m² Balc / Roof 1,080 m² Total
TYPE G	2 Units (4.3%)	5 Bed + Mpr 5.5 Bath, 6 Cars Private Rooftop	774 m² Enclosed 754 m² Balc / Roof 1,528 m² Total
TYPE H	2 Units (4.3%)	3 Bed + Mpr 3.5 Bath, 4 Cars Private Rooftop	304 m² Enclosed 210 m² Balc / Roof 514 m² Total
TYPE I	1 Unit (2.1%)	5 Bed + Mpr 5.5 Bath, 6 Cars Private Rooftop	712 m² Enclosed 417 m² Balc / Roof 1129 m² Total
TYPE CT	1 Unit (2.1%)	2 Bed, 2 Bath 2 Cars	113 m² Enclosed 46 m² Balcony 159 m² Total
TOTAL	**46 DWELLINGS**	**147 BEDS**	

* NSA Enclosed areas measured to the centre line of party walls, external walls & glazing. Balconies measured to the centre line of party walls, glazing, and balustrades. Areas are approximate and will be subject to change

* GBA measured to the centre line of party walls and the outside face of external walls & glazing. Balconies measured to the centre line of party walls, and the outside face of glazing, and balconies.
Areas are approximate and will be subject to change

GROUND FLOOR PLAN - 1:400 (A3)

PRELIMINARY ISSUE

APPLICANT	DISCLAIMER	COPYRIGHT	PROJECT NAME	DRAWING	PROJECT NO.: 568100	DRAWING NO.	ISSUE
122 MARINE PARADE P/L ATF 122 MARINE PARADE UNIT TRUST	These drawings are conceptual design drawings only. The information contained herewith is subject to design development and further input from independant planning, structural, services and other technical consultants.	Copyright in this drawing is the property of BDA Architecture and may not be retained, copied in whole or in part or used other than for the specific uses, licence and site for which it has been prepared and issued.	122 MARINE PARADE	GROUND FLOOR PLAN	SCALE: 1:400 (A3) DATE: 15/04/2025	SK2.102	D

58 Peerless Avenue, Mermaid Beach QLD 4218
Phone: 07 5555 2600
Email: bda@bdaarch.com.au
bda architecture

APPENDIX E
SQIDEP Approvals

STORMWATER AUSTRALIA

Stormwater Quality Improvement Device Evaluation Protocol (SQIDEP)

VERIFICATION CERTIFICATE

Applicant Information

Applicant Name	**Ocean Protect Pty Ltd**
Applicant Address	60 Lyn Parade, Prestons, NSW 2170
Website	www.oceanprotect.com.au
Contact Email	bradd@oceanprotect.com.au

Verified Technology

Product Title	**StormFilter NPSorb**
SQIDEP Pathway	**Body of Evidence Pathway**
Reviewed Documents	The following documents form the basis of this independent evaluation: • Dalrymple B, Wicks M. (2024). *Performance report for SQIDEP review – StormFilter NPSorb*. Prepared on behalf of Ocean Protect. • Supporting information for the StormFilter NPSorb technology monitoring at the study site at Western Sydney, including plan and section drawings, site photos, sample receipt notifications, chain of custody documentation, certificate of analyses, individual storm reports, and monitoring equipment calibration and maintenance logs. • Statutory declarations from Ocean Protect personnel. • Photos of other StormFilter technology installations. • Dalrymple B, Wicks M. (2021). *A review of the application of StormFilter® in Australia*. Prepared on behalf of Ocean Protect. • Ocean Protect (2019). *StormFilter® Operations & Maintenance Manual*. • Ocean Protect (2020). *StormFilter® Technical Design Guide*.

Technology Information

Applicant's Verified Performance Claims (ER)	**Total Suspended Solids (TSS) 87 %** **Total Phosphorus (TP) 72 %** **Total Nitrogen (TN) 65 %** **Gross Pollutants 100 %**
Test Stormwater Runoff	The presented runoff pollutant test results complied with the SQIDEP typical stormwater pollutant concentrations for urban environments. The device has therefore been tested within the pollutant loading ranges specified by SQIDEP v1.3 for typical urban environments (e.g. urban roads, residential, industrial, commercial).
Test Catchment	Commercial

Maintenance Performed during monitoring	• Zero servicing or maintenance of the StormFilter NPSorb system at the study site was undertaken following the installation of the StormFilter NPSorb cartridges in April 2021 until after the last sampling event (in March 2023). Only visual inspections of the system were undertaken. • The StormFilter NPSorb system at the study site has been maintained in accordance with typical/ standard maintenance procedures for these assets, as described in the Manufacturer's guidelines.

Verified method to model in MUSIC

Modelling a StormFilter NPSorb technology in MUSIC is as follows:

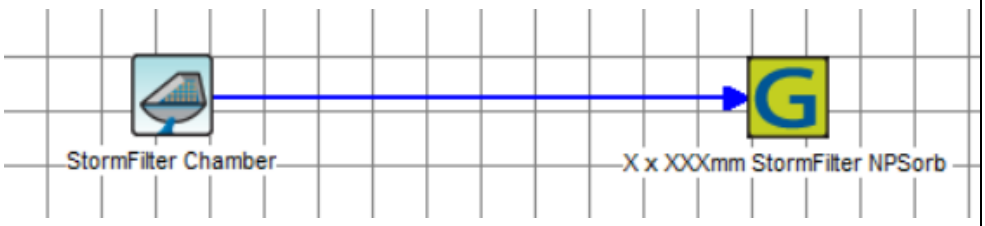


Table 1 – Summary of StormFilter NPSorb cartridge dimensions

Parameter	Cartridge name/ siphon height		
	690	460	310
Physical height (mm)	840	600	600
Typical weir height from outlet (mm)	920	690	540
Treatment flow rate (L/s)*	1.60	1.10	0.70

*: Treatment flow rate based on StormFilter NPsorb technology applied at study site.

Use the detention basin node to hydraulically represent the detention tank (or 'vault'/ storage) 'housing' the StormFilter cartridge system(s), with the properties given in Table 2.

Table 2 – Recommended values for MUSIC Detention Node (StormFilter Chamber) component for StormFilter NPSorb technology modelling

Parameter	Value for given cartridge name/ siphon height			
	690	460	310	Comments
Inlet properties				
Low flow by-pass (m^3/s)	0			No bypass of flows below treatment flow rate occurs.
High flow by-pass (m^3/s)	100			Default (very high value), noting bypass occurs in the Generic (NP Sorb) node and any overflow occurs via the overflow weir in the detention (Stormfilter chamber) node.
Storage properties				
Surface area (m^2)	Varies. Adjust to be equal to value of surface area of chamber housing StormFilter cartridges minus area of cartridges.			
Extended detention depth (m)	0.77	0.54	0.39	Standard 80mm head above top of cartridge media.
Permanent pool volume (m^3)	0			No permanent ponding of water occurs in appropriately functioning StormFilter technologies.
Initial volume (m^3)	0			
Evaporative Loss as % of PET	0			StormFilter cartridges are almost exclusively underground. Any evaporative loss is likely to be minimal.
Outlet properties				
Equivalent pipe diameter (mm)	Varies.			Depends on cartridge height, number, and chamber dimensions. Best to liaise with Ocean Protect.
Overflow weir width (m)	Varies. Adjust to be equal to width of weir structure within system.			
Notional detention time (hrs)	Varies.			
Advanced properties				
k (m/year)	Set to 1 or zero.			Ensures no additional treatment is modelled where none exists.

Use the generic node with the properties given below in Tables 3 and 4.

Table 3 – Recommended treatment flow rate & pollutant removal for StormFilter NPSorb technology (Generic Node)

High flow bypass/ treatment flow rate (TFR)	Pollutant removal up to TFR
Treatment flow rate multiplied by type and number of cartridges*	87% for TSS 72% for TP 65% for TN 100% for gross pollutants

*: Treatment flow rates for available configurations given in Table 1.

Table 4 – Recommended generic node transfer function properties for StormFilter NPSorb technology

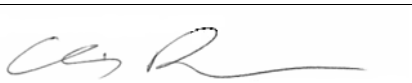
Pollutant	Influent	Effluent	Reduction
Total suspended solids (TSS)	1000	130	87%
Total Phosphorus (TP)	10	2.8	72%
Total Nitrogen	100	35	65%
Gross Pollutants	1000	0	100%

Conditions/Notes

The limitations of the acceptance of these claims include:

- The results lie within acceptable inflow limits for this type of catchment and based on the analysis are found to be representative. The device has been tested within the pollutant loading ranges specified by SQIDEP v1.3. As with the majority of treatment devices, where the influent water is more polluted there would likely be a greater percentage of pollutants removed and a higher residual load in effluent water – and, where the influent water is cleaner (i.e. below limits of detection), there would likely be a lower percentage of pollutants removed and a lower residual pollutant load in effluent water.
- Design and installation should be performed in accordance with the Manufacturer's guidelines. Results are reliant on the design of the device being consistent with the Manufacturer's guidelines.
- Regular inspection and maintenance should be performed in accordance with the Manufacturer's Operation and Maintenance Manuals. Results are reliant on the maintenance of the device being consistent with the Manufacturer's guidelines.

Independent Reviewers

Evaluator Signature	
Damian McCann Director AWC	
Chris Beardshaw Principal Engineer Afflux Consulting	

Issue of Verification Certificate

Acceptance by SQIDEP Governance Panel	16 September 2024
Acceptance by Stormwater Australia Board of Directors	16 September 2024
Verification Issued	9 September 2024
Stormwater Australia Verification Certificate Number Reference	SA-2024/10-VC

Verified under SQIDEP Version 1.3

Body of Evidence Pathway

APPENDIX F
Healthy Waters Code

City Plan code template

This code template supports the preparation of a development application against either the acceptable outcome(s) or performance outcome(s) contained in the code. Development assessment rules are outlined in **Section 5.3.3** of the City Plan.

Please note:

Note: In accordance with Section 2.1 of City Plan, an assessment against State interest - Water quality (policies 4 and 5) of the State Planning Policy 2017 is required as the Healthy water development code does not fully integrate this State interest. A response table for policies 4 and 5 have been included below.

For assessment against the overall outcomes, refer to the appropriate code.

Note: The whole of the planning scheme is identified as the assessment benchmark for impact assessable development. This specifically includes assessment of impact assessable development against this strategic framework. The strategic framework may contain intentions and requirements that are additional to and not necessarily repeated in zone, overlay or other codes. In particular, the performance outcomes in zone codes address only a limited number of aspects, predominantly related to built form. Development that is impact assessable must also be assessed against the overall outcomes of the code as well as the strategic framework.

9.4.5 Healthy waters code

9.4.5.1 Application

This code applies to assessing material change of use, reconfiguring a lot or operational work for development where indicated within:

(1) **Part 5 Tables of assessment**; and

(2) **Table 9.4.5.1-1: Development triggers for applying the Healthy waters code.**

Table 9.4.5.1-1: Development triggers for applying the Healthy waters code

Topic	Assessment triggers	Applicable assessment benchmarks
Erosion and sediment control	All development.	For accepted development subject to requirements: **RO1, RO2**
		For assessable development: **PO1, PO2**
Stormwater quality and	For residential land uses involving one or more of the following:	For accepted development subject to requirements:

Topic	Assessment triggers	Applicable assessment benchmarks
waterway stability	(a) 3 or more dwellings; or (b) a land area greater than 1,200m^2; or (c) a newly constructed road (previously unformed road) exceeding 30m in total length; or (d) 200m^2 or more of uncovered new or refurbished car park area including parking bays and circulation driveways; or (e) the creation of high polluting outdoor activities (including Bulk landscape supplies, Garden centres, Tourist parks, Transport depots, Warehouses and Wholesale nurseries).	**RO3, RO5** For assessable development: **PO3, PO4, PO8 – PO13**
	For non-residential land uses involving one or more of the following: (a) a land area greater than 1,200m^2; or (b) a newly constructed road (previously unformed road) exceeding 30m in total length; or (c) 200m^2 or more of uncovered new or refurbished car park area including parking bays and circulation driveways; or (d) the creation of high polluting outdoor activities (including Bulk landscape supplies, Garden centres, Tourist parks, Transport depots, Warehouses and Wholesale nurseries).	For accepted development subject to requirements: **RO4, RO5** For assessable development: **PO3, PO4, PO8 – PO14**
Stormwater quantity	For residential activities, development associated with the creation of 3 or more dwellings, resulting in either: (a) an increase in the total impervious area; or (b) an alteration of upstream conveyance or change to existing discharge location or condition.	For accepted development subject to requirements: **RO3, RO6, RO7** For assessable development: **PO5 – PO14**
	For all other land uses, development that results in either: (a) an increase in the total impervious area; or (b) an alteration of upstream conveyance or change to existing discharge location or condition.	For accepted development subject to requirements: **RO4, RO6, RO7** For assessable development: **PO5 – PO14**
Woongoolba flood mitigation catchment area	Development that is code or impact assessable, on land within the 'Woongoolba flood mitigation catchment area' on the **Water catchments and dual supply system area overlay map**.	For assessable development: **PO15**

This code does not apply in the following instances:

(1) where the development involves internal works or minor building works to a lawfully established building; or

(2) a sales office.

When using this code, reference should be made to **Section 5.3.2** and, where applicable, **Section 5.3.3**, in **Part 5**.

9.4.5.2 Purpose

(1) The purpose of the Healthy waters code is to:

(a) protect the quality of the city's waters and watercourses by managing the impacts of development on quality and quantity of surface and ground water runoff; and

(b) ensure that development does not cause adverse impact on people and/or property.

(2) The purpose of the code will be achieved through the following overall outcomes:

(a) Total water cycle management and water sensitive urban design (WSUD) principles are:

(i) implemented to contribute to biodiversity areas and green space values within the city and promote co-location of assets; and

(ii) integrated into the landscape so as to maintain watercourse health, biodiversity and ecosystems.

(b) Development avoids or minimises disturbance to existing landforms, surface drainage, watercourses and groundwater.

(c) Impacts to public health and safety hazards are minimised.

(d) Adverse impacts to people and/or property are prevented and stormwater is safely managed within urban areas.

(e) Development protects existing overland flow paths and watercourses of environmental value.

(f) Development limits the quantity of key pollutants discharged in stormwater to protect the quality of receiving waters.

(g) Development avoids adverse impacts to downstream properties or environmental value from stormwater peak discharge.

(h) Development avoids or minimises adverse impacts on the environmental values of receiving waters from the release and mobilisation of nutrients and sediments.

(i) The drainage capacity of the Woongoolba Flood Mitigation Scheme Area for rainfall events up to 1 in 10 year 72 hours is maintained (contained within the Scheme drains within a 4 day period) and this capacity is not to be eroded due to cumulative impact of development.

9.4.5.3 Specific benchmarks for assessment

PART B – ASSESSABLE DEVELOPMENT BENCHMARKS

Table 9.4.5-3: Healthy waters code – for assessable development

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets <u>either</u> the performance outcome or overall outcome	Internal use

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
Erosion and sediment control			
PO1 Stormwater discharge from a development site achieves the construction phase water quality objectives of **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards**.	**AO1** No acceptable outcome provided.	**AO1- COMPLIES** A stormwater management plan has been prepared which addresses the construction phase stormwater quality management for the proposed development. Refer to Section 8 of the SBSMP, report reference 30264961-3-GA0002.	
PO2 Erosion, sediment and dust is appropriately managed during the construction phase.	**AO2** The level of risk for soil erosion and sediment pollution to the environment is determined by an erosion hazard assessment, completed by a suitably-qualified person in accordance with the criteria in **Table 9.4.5-4: Erosion hazard assessment**. Where the erosion hazard assessment has a risk score of: (a) less than or equal to 10: A deemed to comply report is prepared by a suitably qualified person for Council approval, including conceptual location and design drawings of each treatment measure in plan and section views, in accordance with the *Best Practice Erosion and Sediment Control: International Erosion Control Association, (IECA) 2008, Australasia Chapter 2008.* (b) greater than 10 or developments involving multiple stages of disturbance or more than 1.25 ha of land: (i) For material change of use or reconfiguring a lot, a conceptual erosion and sediment control plan (ESCP) is prepared by a	**AO2 – COMPLIES** Section 8 of the stormwater report prepared by Arcadis, '30264961-3-GA0002' discusses appropriate ESC techniques for the site. The erosion hazard assessment has been completed within the table of this code response, and has scored a total of 10.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets **either** the performance outcome or overall outcome	Internal use
	suitably-qualified person for Council approval in accordance with **SC6.12 City Plan policy – Land development guidelines, Section 4 – Stormwater drainage and water sensitive urban design standards**, and the *Best Practice Erosion and Sediment Control: International Erosion Control Association (IECA) 2008, Australasia Chapter 2008*. (ii) For operational work, a detailed ESCP is prepared by a suitably-qualified person in accordance with **SC6.12 City Plan policy – Land development guidelines, Section 4 – Stormwater drainage and water sensitive urban design standards**, and *Best Practice Erosion and Sediment Control: International Erosion Control Association (IECA) 2008, Australasia Chapter 2008*. The ESCP is to detail appropriate treatment measures for the construction phase of development, demonstrating how the minimum design objectives in **Table 9.4.5-5: Stormwater design objectives** are achieved, including: (a) measures to ensure the release of sediment-laden stormwater for the nominated design storm are minimised when the design storm is exceeded; (b) detailed design, installation, construction, monitoring and maintenance requirements of all approved proprietary products in		

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
	accordance with local conditions and manufacturer's recommendations; and (c) details of how the ESCP aligns with the approved development staging plan.		
Stormwater quality			
PO3 Development appropriately manages stormwater quality to: (a) protect natural ecosystems; (b) protect water quality; (c) reduce runoff and peak flows; and (d) meet the water quality objectives and environmental values for Queensland waters. **Note: Water quality objectives and environmental values for Queensland waters are contained within *Schedule 1* of the *Environmental Protection (Water) Policy 2009*. Water quality objectives are locally specific and vary between and within river catchments.** **Note: A stormwater quality management plan prepared by a suitably qualified person in accordance with SC6.12 City Plan policy – Land development guidelines, Section 4 – Stormwater drainage and water sensitive urban design standards, is Council's preferred method for addressing this performance outcome.**	**AO3.1** For post developed sites, the following minimum pollutant reduction targets are achieved: (a) Gross pollutants (>5mm) – 90%; (b) Total Suspended Solids (TSS) – 80%, (c) Total Phosphorus (TP) – 60%; and (d) Total Nitrogen (TN) – 45%.	**AO3.1 – COMPLIES** A stormwater management plan has been prepared which addresses the management of operational phase stormwater quality measures for the proposed development. Refer to Section 7 of the SBSMP, report reference 30264961-3-GA0002.	
	AO3.2 For development on land less than 1.25ha, a deemed to comply solution for stormwater quality is achieved in accordance with **Table 9.4.5-6: Stormwater quality deemed to comply solutions**.	**REFER ABOVE**	
	AO3.3 For development on land greater than 1.25ha, a stormwater quality management plan is to be prepared by a suitably qualified person in accordance with **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards**, is required.	**REFER ABOVE**	
Waterway stability			
PO4 In-stream erosion, downstream of urban	**AO4** Post-development peak 0.632 Annual	**AO4 – COMPLIES** Refer to Section 6 of the SBSMP, report reference	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets **either** the performance outcome or overall outcome	Internal use
development is prevented by controlling the rate (or magnitude) and duration of sediment transporting flows.	Exceedance Probability (AEP) event discharge within receiving waterway is limited to pre-development peak 0.632 AEP event discharge and is in accordance with **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards.**	30264961-3-GA0002 which addresses waterway stability requirements where applicable.	
Stormwater quantity control			
PO5 Stormwater quantity management outcomes demonstrate no adverse impact on stormwater flooding or the drainage of properties external to the subject site.	**AO5** The following is achieved external to the development site: (a) no increase in peak flood flow rate from the development site for all events up to and including the 1% AEP; (b) no increase in peak flood velocities from the development site for all events up to and including the 1% AEP; (c) no increase in peak flood level from the development site for all events up to and including the 1% AEP; and (d) stormwater outfalls or discharge is located to avoid conflict with existing usage of downstream land or impacts on existing watercourse or drainage.	**AO5 – COMPLIES** A stormwater management plan has been prepared which addresses the management of stormwater quantity for the proposed development. Refer to Section 6 of the SBSMP, report reference 30264961-3-GA0002.	
Lawful point of discharge			
PO6 Development ensures the stormwater systems are designed to not cause actionable nuisance that would adversely affect adjoining (upstream or downstream) properties.	**AO6** A lawful point of discharge must be identified and demonstrated that all discharge point/s from the development are in accordance with **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and**	**AO6 – COMPLIES** Refer to Section 5 of the SBSMP, report reference 30264961-3-GA0002 which assesses the LPoD(s) relevant to the subject site.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets **either** the performance outcome or overall outcome	Internal use
	water sensitive urban design standards.		
Overland flow paths			
PO7 Development must not obstruct free open surface flow of stormwater through a site.	**AO7** Overland flowing stormwater is allowed free open surface flow between the street and any waterway at the rear or sides of a property, in accordance with the provisions of the *Building Code of Australia.*	**AO7 – COMPLIES** Provision has been made for the identified potential overland flow paths. Refer to Section 5, Section 6 and Appendix B of the SBSMP prepared by Arcadis, reference 30264961-3-GA0002.	
Whole of life costs			
PO8 Stormwater infrastructure is designed and constructed to: (a) remain fit for purpose for the life of the development and maintains full functionality in the design flood event; (b) be cost effective to maintain; and (c) ensure no structural damage to existing stormwater infrastructure.	**AO8** No acceptable outcome provided.	**AO8 – COMPIES** Private infrastructure will remain the responsibility of the body corp. All other municipal connection works have been designed to relevant standards.	
Landscape integration			
PO9 Stormwater treatment devices and stormwater infrastructure are designed to: (a) integrate with the urban design and landscape outcomes of the development; (b) complement natural environments, wetlands and watercourses; (c) protect environmental values; (d) enhance visual amenity; and (e) incorporate CPTED principles in accordance with **SC6.12 City Plan**	**AO9.1** Where stormwater treatment devices and stormwater infrastructure are integrated into public open space, a Statement of Landscape Intent is to be prepared by a suitably qualified person, for approval by Council. The plan is to demonstrate that the operation of stormwater infrastructure does not compromise the function of any co-located uses and reflect the design principles within **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards.**	**AO9.1 – COMPIES** Refer to Engineering Drawings within Appendix B of the SBSMP, report reference 30264961-3-GA0002 which demonstrates the location of stormwater treatment devices. The architect and landscape architect have integrated this within the proposed design as appropriate.	

Performance outcomes	Acceptable outcomes	Does the proposal meet the acceptable outcome? If not, justify how the proposal meets either the performance outcome or overall outcome	Internal use
policy – Land development guidelines, Section 4 – Stormwater drainage and water sensitive urban design standards.	**Note: A Statement of landscape intent is to be prepared in accordance with SC6.13 City Plan policy – Landscape work.**		
	AO9.2 Stormwater treatment devices are located offline to any upstream catchment. **Note: This provision relates to the integration of stormwater treatment devices and stormwater infrastructure into the landscape. Development identified on the Environmental significance – wetlands and watercourse overlay map will still require assessment against the Environmental significance overlay code.**	**AO9.2 – COMPIES** Refer to Section 5 of the SBSMP, report reference 30264961-3-GA0002 which demonstrates flows which stormwater treatment devices receive.	
	AO9.3 All stormwater outlets that are located adjacent to watercourses, creeks and drainage paths are aligned at a maximum of 45 degrees to the downstream direction of flow, and energy dissipation measures installed to minimise scour.	**NOT APPLICABLE** No outlets to watercourses, creeks or drainage paths are proposed.	
Public safety			
PO10 Stormwater treatment devices and stormwater infrastructure minimise impacts on public health and safety.	**AO10** All stormwater quantity control measures are designed in accordance with **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards**.	**AO10 – COMPIES** Refer to Engineering Drawings within Appendix B of the SBSMP, report reference 30264961-3-GA0002, which details the proposed treatment system including levels and location. The proposed treatment system is not in a location or position where it would pose an abnormal risk to health and safety.	
Maintenance access			

PO11 Maintenance access is provided for all stormwater management systems and considers: (a) the type of vehicle or machinery needed to service particular assets; and (b) the need to ensure a safe working environment for maintenance personnel and the public.	**AO11.1** All weather vehicle access is to be provided to inlet zones of the stormwater treatment systems in accordance with **Table 9.4.5-7: Maintenance access requirements (slope).**	**AO11.1 – COMPIES** Refer to Engineering Drawings within Appendix B of the SBSMP, report reference 30264961-3-GA0002, which illustrates appropriate maintenance access from the site frontage. It should be noted that the proposed asset is a private asset not transferred to Council.	
	AO11.2 Maintenance access is to be provided around the perimeter of all stormwater treatment systems in accordance with **Table 9.4.5-8: Maintenance access requirements (size).**	**REFER ABOVE**	
	AO11.3 A maintenance buffer is provided around the perimeter of all stormwater treatment devices and adjoining private property equal to: (a) 1m in width; or (b) the width of a perimeter maintenance access, as delivered in AO11.2, plus 0.5m. The maintenance buffer is measured from the adjacent allotment boundary to the top of batter around the treatment measure. The maximum slope on the maintenance buffer is 1 in 10.	**REFER ABOVE**	
Fauna movement			
PO12 Stormwater conveyance structures and channels are designed to ensure the safe movement of native fauna and provide for terrestrial and aquatic passage.	**AO12.1** Stormwater drainage structures and channels minimise impacts on aquatic fauna and associated habitats and provide opportunities for beneficial habitat uses of structures in accordance with the *Department of Primary Industries and Fisheries – Fisheries guidelines for Fish-friendly structures (2006).*	**NOT APPLICABLE** The proposed stormwater infrastructure is within an urbanised area which is not occupied by native fauna / does not currently provide aquatic passage.	

	AO12.2 Stormwater drainage structures allow for the safe movement of terrestrial fauna in accordance with: (a) the Queensland Government Fauna Sensitive Road Design Manual Volume 2: Preferred Practices; and (b) the Queensland Government Koala-Sensitive Design Guidelines.	**REFER ABOVE**	

Wastewater management			
PO13 Development does not discharge wastewater to receiving waters or areas external to the site unless demonstrated to be the best-practice environmental management for that site and takes into consideration: (a) the applicable water quality objectives for the receiving waters; and (b) the potential adverse impact on ecosystem health of receiving waters.	**AO13** Where the development involves the discharge of wastewater, a Wastewater Management Plan (WWMP) is prepared, demonstrating compliance with the performance outcome, by a suitably qualified person and submitted to the Council, detailing all of the following: (a) wastewater type; (b) climatic conditions; (c) water quality objectives; (d) best-practice environmental management; (e) waste management hierarchy; and (f) the WWMP provides for the management of wastewater in accordance with a wastewater management hierarchy that: (i) avoids wastewater discharge to watercourses; or (ii) if wastewater discharge to the environment cannot practicably be avoided wastewater discharge to watercourses is minimised through re-use, recycling, recovery and treatment for disposal to sewer, surface water and groundwater.	**NOT APPLICABLE** The site doesn't propose to discharge wastewater into receiving waters.	
Dewatering management			
PO14 Dewatering occurs in accordance with an approved Dewatering management plan.	**AO14** No acceptable outcome provided.	**AO14 – COMPLIES** If relevant requirements are triggered, the proposed development will be required to provide a dewatering plan to facilitate basement construction. Standard condition wording can be provided for the development approval.	
Woongoolba flood mitigation catchment area			

PO15 In the Woongoolba flood mitigation catchment area, shown on the **Water catchments and dual supply system area overlay map**, peak outflow and its timing for Q2, Q5 and Q10 for rainfall events up to 72 hours does not change as a result of development.	**AO15** No acceptable outcome provided.	**NOT APPLICABLE** The site is not within the flood mitigation scheme area.	

State Planning Policy July 2017

Policies	Demonstrate how the proposal meets the policy?	Internal use
State interest – water quality		
ASSESSMENT BENCHMARK 4 (POLICY 4): At the construction phase, development achieves the applicable stormwater management design objectives in table A (appendix 2) of the State Planning Policy.		
ASSESSMENT BENCHMARK 5 (POLICY 5): (5) At the post-construction phase, development: a) achieves the applicable stormwater management design objectives on-site, as identified in table B (appendix 2) of the State Planning Policy; or b) achieves an alternative locally appropriate solution off-site that achieves an equivalent or improved water quality outcome to the relevant stormwater management design objectives in table B (appendix 2) of the State Planning Policy.		

Table 9.4.5-3: Erosion hazard assessment

Controlling factor	Points	Score
Average slope of the whole site prior to operational works		
Slope less than 2%	0	0
More than or equal to 2% but less than 5%	1	
More than or equal to 5% but less than 10%	2	
More than or equal to 10% but less than 15%	4	
More than or equal to 15%	5	High risk
Soil type (to be disturbed)		
Gravels and sandy soils	1	1
Sandy loam	2	
Clays on flood plains	3	
Shallow soils on slopes	4	
Clays on slopes greater than 5%/imported fill or untested fill	5	High risk
Anticipated duration of site disturbance		
Duration less than 2 weeks	0	
More than 2 weeks but less than 3 months	2	
More than 3 months but less than 6 months	4	4
More than 6 months	5	High risk
Anticipated erosive rainfall risk during site disturbance		
Low (monthly average rainfall less than 45 mm)	0	
Moderate (monthly average rainfall 46 - 100 mm)	1	
High (monthly average rainfall 101 - 225 mm)	2	2
Very high (monthly average rainfall 226 - 1500 mm)	4	
Extreme (monthly average rainfall more than 1500 mm)	5	High risk

Controlling factor	Points	Score
Off-site sediment control (down-slope of the soil disturbance)		
Score 1 point if there is no purpose-built sediment trap (e.g. sediment basin, gross pollutant trap or purpose-built wetland).	1	1
Run-off entering the site		
Score 1 point if stormwater run-off is not diverted from entering the site or away from soil disturbance.	1	
Extent of site disturbance		
Score 2 points if the building works requires reshaping of the ground surface.	2	2
Total Score **Note: High erosion risk - if score 11 or greater, or five for any factor.**		

This Erosion Hazard Assessment form is adapted from the *Best Practice Erosion and Sediment Control, International Erosion Control Association (Australasia), IECA 2008 Appendix H - Building Sites, the Brisbane City Council Erosion Hazard Assessment Form* and *Attachment 2 to the QDC Draft Part 16 Erosion and Sediment Control*.

Table 9.4.5-5: Stormwater design objectives

Construction phase stormwater design objectives	Notes
Drainage control	
Design life and design storm of temporary drainage works: (1) Disturbed area open for less than 12 months - 1 in 2 ARI. (2) Disturbed area open for 12-24 months - 1 in 5 ARI. (3) Disturbed area open for more than 24 months - 1 in 10 ARI.	• ARI = Average Recurrence Interval (see Engineers Australia document Australian Rainfall and Runoff). • Design capacity excludes minimum 150mm freeboard. • A higher drainage design objective may be required for temporary drainage structures upslope of occupied properties. • A revised drainage design storm may be required if these design objectives are found to be impracticable.
Erosion control	
(1) Stage clearing and construction works to minimise the area of exposed soil at any one time. (2) Effectively cover or stabilise exposed soils prior to predicted rainfall. (3) Prior to completion of works for the development, and prior to removal of sediment controls, all site surfaces must be effectively stabilised using methods which will achieve effective short-term stabilisation. (4) Avoid or minimise large construction activities in the 'wet season'. (5) Divert water run-off from undisturbed areas around disturbed areas. (6) Use erosion risk ratings to determine appropriate erosion control measures.	• 'Wet season' means the high rainfall months, e.g. the four highest rainfall months. • For point 6, determine the erosion risk rating using local rainfall erosivity, rainfall depth, or soil loss rate or other acceptable method. A rating scale such as very low, low, moderate, high, extreme should be applied. Such ratings should reflect the local area. Example ratings may be shown in local council guidelines or detailed in best-practice guidelines.
Sediment control	
(1) Use soil loss rates to determine appropriate sediment control measures. (2) Direct runoff from exposed site soils to sediment controls that are appropriate to the extent of disturbance and level of erosion risk. (3) All exposed areas greater than 2500 metres must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual	• For point 1, surrogate determinations may be used such as monthly erosion or average monthly rainfall. • A commonly used design storm for basin sizing is 80th percentile five-day event. Depending on the settling characteristics of local soils, a higher 'operational' design storm can be achieved with chemical dosing operated in flow-through mode in a large storm with rainfall-activated auto-flocculent dosing, and advanced hydraulic efficiency features such as floating off-takes,

runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5–8.5).	and a sediment forebay. • TSS = Total Suspended Solids. Turbidity measurements (e.g. 60 Nephelometric Turbidity Units (NTU)) could be used; however, for accuracy, a site-specific relationship should be developed between turbidity and TSS.

Table 9.4.5-6: Stormwater quality deemed to comply solutions

The following deemed to comply solutions are to be documented within a Stormwater quality management plan prepared by a suitably-qualified person in accordance with **SC6.12 City Plan policy – Land development guidelines**, **Section 4 – Stormwater drainage and water sensitive urban design standards**.

Development type			**Stormwater treatment train**		**Land ownership[2]**
Land use	**Scenario**	**Scale**			
Residential	>2 lots up to 20 lots	N/A	Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Bio retention[3] @ 1.3% of impervious catchment area.[1]	Public and/or Private
			No Tanks	Bio retention[3] @ 1.8% of impervious catchment area.[1]	Public and/or Private
			Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Wetland @ 5% of impervious catchment area.	Public and/or Private
			No Tanks	Wetland @ 7% of impervious catchment area.[1]	Public and/or Private
	> 2 dwellings (Townhouse style up to 2 storeys	≤ 12,500m^2	Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Bio retention[3] @ 1.3% of impervious catchment area.[1]	Private
			No Tanks	Bio retention[3] @ 1.8% of impervious catchment area. [1]	Private
			Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Wetland @ 5% of impervious catchment area.[1]	Private
			No Tanks	Wetland @ 7% of impervious catchment area.[1]	Private

	High density multiple dwelling apartments (flats, high-rise)*	≤ 12,500m^2	Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Bio retention[3] @ 1.8% of impervious catchment area.[1]	Private
			No Tanks	Wetland @ 7% of impervious catchment area.[1]	Private
Commercial, Industrial and Retail (including retail at the bottom floors of high rise)[4]	Commercial and/or Industrial uses	≤ 12,500m^2	Tank Volume per dwelling: • Detached 5 kl • Attached 3 kl	Gross pollutant management (GPT) + Bio retention[3] @ 1.8% of impervious catchment area.[1]	Public and/or Private
			No Tanks	Gross pollutant management (GPT) + Wetland @ 8% of impervious catchment area.[1]	Public and/or Private

[1] For developments that results in an increase in less than 15% imperviousness (i.e. roof and ground level impervious), then stormwater management to focus on the impervious areas only.

[2] Ultimate owner of the device and responsible for maintenance.

[3] For bioretention basins larger than 800m^2, an inlet pond will be required.

[4] The City requires gross pollutant management for these land uses. It is preferred that these are located on private property, but in larger scale Reconfiguring a lot applications it is logical to have a single gross pollutant trap for the site. The City will not accept proprietary devices for nutrient management on public/City land.

Table 9.4.5-7: Maintenance access requirements (slope)

Treatment type	Access track slope	Material and width
Stormwater inflows where pipe is 450mm or greater (where there is no forebay or inlet pond)	1 in 4 or flatter	2.5m wide minimum Gravel or reinforced turf from inlet
Coarse sediment forebay	1 in 4 or flatter	2.5m minimum Reinforced concrete in accordance with *IPWEAQ standard drawing RS-051* Concrete paver (subject to City approval), cement treated gravel

		250mm thick may be accepted by the City through negotiation.
Inlet pond (wet) for retention or wetland Sediment basins	1 in 4 or flatter	3m wide Reinforced concrete in accordance with Heavy Vehicle Crossing Industrial (*refer IPWEAQ standard drawing RS-051*). Where this access crosses perpendicular to pedestrian paths, the path must be 200mm thick, double reinforced and 42MPa.
Proprietary devices	1 in 4 or flatter	Reinforced concrete in accordance with Heavy Vehicle Crossing Industrial (refer *IPWEAQ standard drawing RS-051*).

Table 9.4.5-8: Maintenance access requirements (size)

Treatment type	Size	Maintenance access requirements (all paths 1 in 10 cross fall or less and maximum 1 in 4 longitudinal grade)
Bioretention	< 500m^2	Access path to > 40% of perimeter. ≥ 0.75m wide. Grass, mulch, gravel or concrete suitable for access on foot.[1]
	≥ 500m^2	Access path to > 40% of perimeter. ≥ 2.5m wide. Reinforced grass, gravel or concrete for light vehicles.[1] Remainder of perimeter as per < 500m^2 bioretention.
Wetland	<1000m^2	Access path to > 40% of perimeter. ≥ 0.75m wide. Grass, mulch, gravel or concrete

		suitable for access on foot.
	≥ 1000m^2 to < 5000m^2	Access path minimum 40% of perimeter. ≥ 2.5m wide. Reinforced grass, gravel or concrete for light vehicles.[1] Remainder of perimeter ≥ 0.75m wide.
	≥ 5000m^2	Access path 100% of perimeter. ≥ 2.5m wide. Cement treated gravel 200mm or concrete for large vehicles.

[1] Determine access path treatment based on slope, maintenance vehicle and the surrounding landscape. For example, turf is not appropriate where the treatment system is located against conservation open space, and where revegetation for the treatment system complements the surroundings, the use of gravel or concrete is preferred.

APPENDIX G
Council Hydraulics Correspondence

Wieser, Ben

From: KHANDUJA Rohit <RKHANDUJA@goldcoast.qld.gov.au>
Sent: Tuesday, 3 June 2025 9:29 AM
To: Stockwell, James
Cc: Wieser, Ben; Castro, Darlan; AMIR Sharif
Subject: RE: 122 Marine Parade (MCU/2025/155) | Item 21 | Discussion Summary and Actions

Follow Up Flag: Follow up
Flag Status: Flagged

You don't often get email from rkhanduja@goldcoast.qld.gov.au. Learn why this is important

Arcadis Warning: Exercise caution with email messages from external sources such as this message. Always verify the sender and avoid clicking on links or scanning QR codes unless certain of their authenticity.

Hi James,

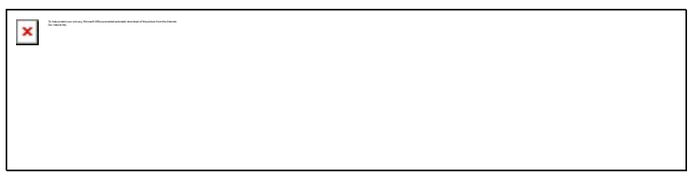
As discussed, Please include the below stated assessment in the updated SWMP. As such, no HIA is required.

Rohit Khanduja
Stormwater and Flood Engineer

Engineering and Landscape Assessment
City Development Branch, Planning & Regulation
Nerang Administration

T: 07 5582 8917
PO Box 5042 Gold Coast Mail Centre Qld 9726
cityofgoldcoast.com.au

CITY OF GOLDCOAST.



From: Stockwell, James <James.Stockwell@arcadis.com>
Sent: Monday, 2 June 2025 4:33 PM
To: KHANDUJA Rohit <RKHANDUJA@goldcoast.qld.gov.au>
Cc: Wieser, Ben <Ben.Wieser@arcadis.com>; Castro, Darlan <Darlan.Castro@arcadis.com>
Subject: 122 Marine Parade (MCU/2025/155) | Item 21 | Discussion Summary and Actions

Hi Rohit,

Thanks for your time today.

Please see below images and points discussed. As we understand Council agree that no further Hydraulic Impact Assessment is required.

We will formalise the below into an updated stormwater management plan / RFI response, but could you please confirm via return this is accepted in-principle.

Please reach out if any further queries, always happy to take a call.

Fraser Avenue (figure 1)

- Fraser Avenue grades towards the subject site with its underground drainage system grading northbound away from the subject site.
- Currently the VXO at the cul-de-sac head acts as a weir and controls how much runoff can enter the site. Runoff then traverses along the northern boundary within the site & Council's park land before entering an existing drainage pit and conveying to Marine Parade. Runoff in excess will move overland to Marine Parade also.
- The proposed works maintain or improve the current arrangement by:
    - No change to the weir control (therefore no impact to upstream areas).
    - Maintaining overland flow capacity to the existing drainage pit and through to Marine Parade.
- There is also the benefit of removing the retaining wall and fence around the existing drainage pit improving safety.
- Accordingly existing sensitive drainage characteristics are preserved and capacity maintained or increased which will not give rise to unacceptable adverse impacts to private property.

Nagal Avenue (figure 2)

- Nagel Avenue grades towards the subject site with its underground drainage system grading southbound away from the subject site, ultimately to Marine Parade.
- Currently the road stub acts as a constraint controlling how much runoff can enter the site. Runoff then traverses along the southern boundary before passing through the subject site and southern adjacent site to Marine Parade.
- The proposed works maintain or improve the current arrangement by:
    - No change to the road stub or increase in site levels within the receiving area.
    - Improving pit and pipe drainage capacity within the site, reducing frequency/severity of pass through overland flow.
    - Widening and deepening (not lifting) the existing onsite choke point increasing the site's share of any overland flow. We have demonstrated our site in isolation could facilitate all runoff per the original SBSMP).
- Accordingly existing sensitive drainage characteristics are preserved and capacity maintained or increased which will not give rise to unacceptable adverse impacts to private property.
- I note we also discussed review and providing extra drainage within the landscape flow path to mitigate flatness. This would further reduce overland flow. We will review and capture in an updated SBSMP as we agree on its benefit.

Figure 1 (Fraser Avenue Notes)

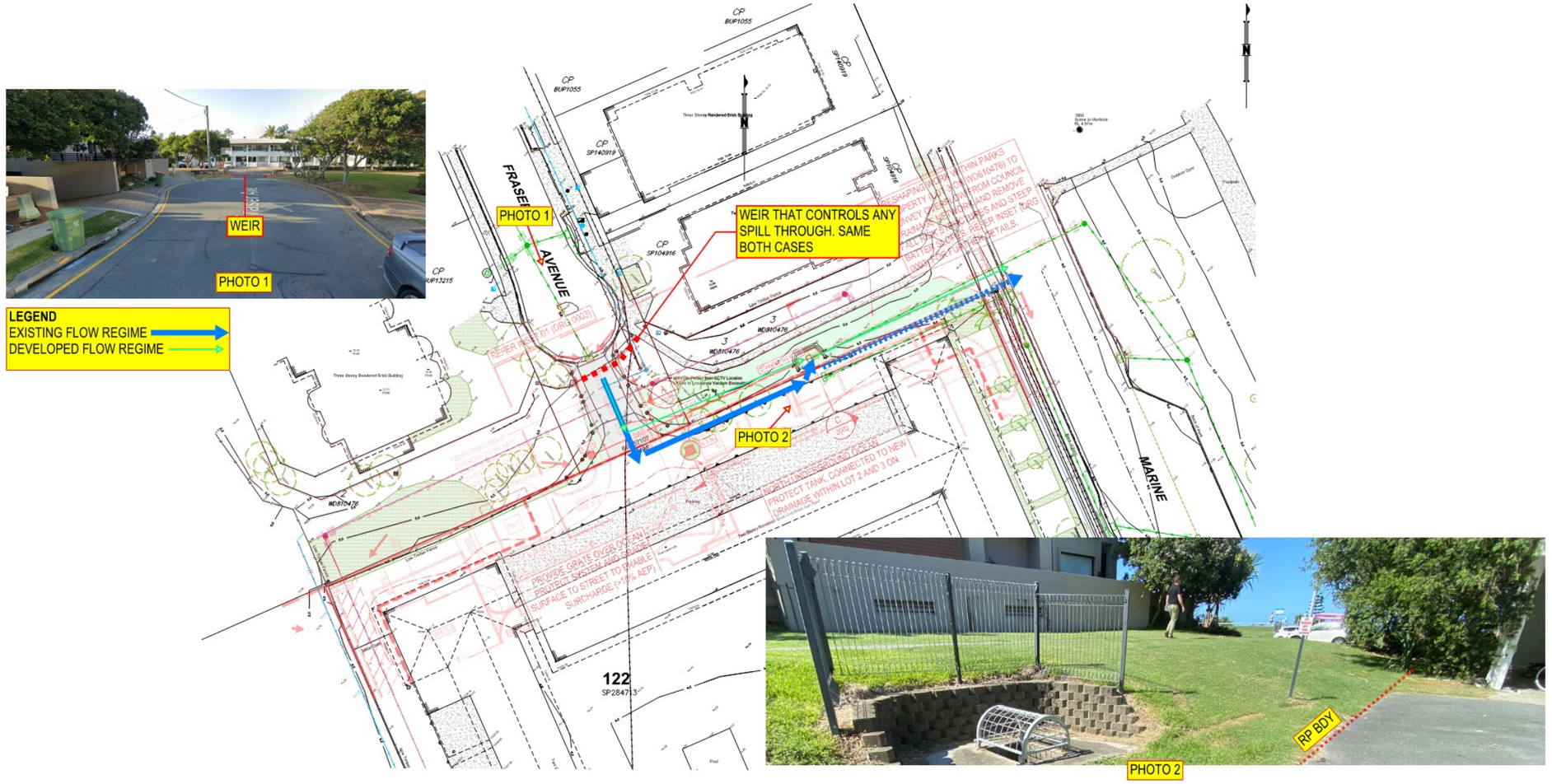
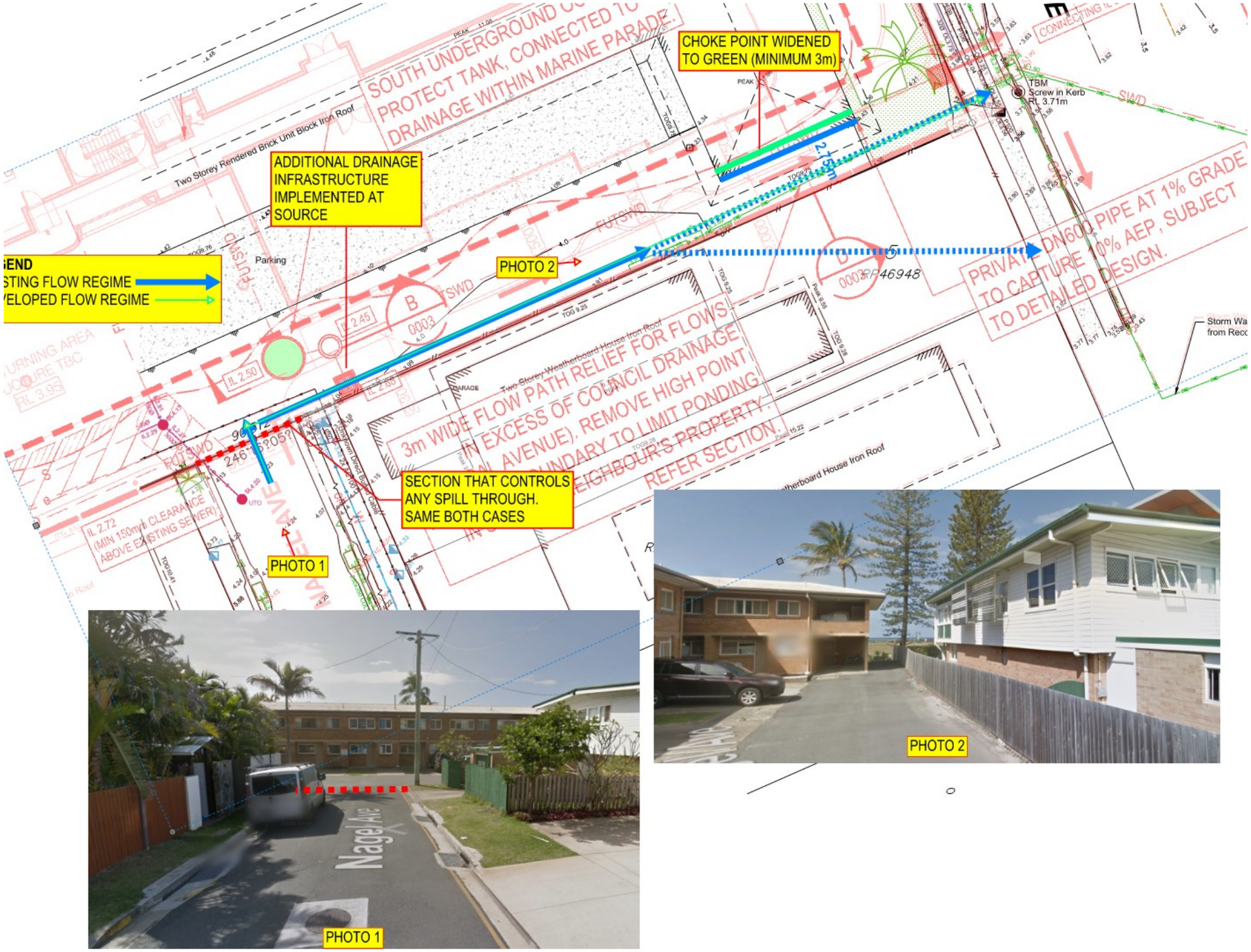


Figure 2 (Nagal Avenue Notes)



James Stockwell
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