

PLANS AND DOCUMENTS
referred to in the PDA APPROVAL

21 MAY 2013

MEDQ

CIVIL ENGINEERING REPORT

**FOR THE PROPOSED
LABORATORY AND OFFICES**

**LOCATED AT
LOT 5 HURWORTH STREET
BOWEN HILLS**

PREPARED FOR: SULLIVAN NICOLAIDES PATHOLOGY

Bornhorst & Ward Project No. **12356**

If you have any queries regarding this report please contact Kris Rensch.

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1. INTRODUCTION

Bornhorst and Ward has been commissioned to investigate and report on the Civil Engineering and servicing requirements pertaining to the proposed Sullivan Nicolaides Pathology Laboratory and Office, located at Lot 5, Hurworth Street, Bowen Hills.

The development site is located within the Bowen Hills Urban Development Area (UDA), however all Engineering requirements for this proposal shall be in accordance with the Brisbane City Council Subdivision and Development Guidelines and the Brisbane City Council City Plan. Stormwater Quality requirements will be in accordance with State Planning Policy 4/10 – Healthy Waters. This is consistent with other developments within and surrounding the UDA.

This report outlines the proposed design methodology and calculations in support of a Development Application to the ULDA and should be read in conjunction with other documents issued by the consultant team.

2. SITE CHARACTERISTICS

2.1 LOCATION

The site is located centrally in the declared Bowen Hills UDA, and is located between Markwell, Hurworth and Best Streets. The site itself has frontage to only Hurworth Street and the currently unformed Best Street road reserve. Although the site fronts the Markwell Street road reserve, the Markwell Street road carriageway is elevated from the site. Refer to the locality plan below.

Street Address: Hurworth Street, Bowen Hills
RP Description: Lot 5, SP213464



Figure 1: Orientation Plan

(Retrieved from Google Maps © on 10 December 2012)

2.2 LANDUSE

2.2.1 EXISTING

The site is currently vacant apart from a QUU operated Odour Scrubber Room and Vent Pole which is associated with the existing 2400mm diameter trunk sewer crossing through the south east corner of the site. This facility consists of a small single story building with a ventilation stack which is currently operational. The building and the stack are each located in volumetric easements, with access directly from Best Street.

The remainder of the site is covered in trees and grass with some debris from former structures. The site was formerly occupied by three houses, all of which have been recently demolished.

2.2.2 PROPOSED

The development proposal consists of a two stage building that addresses Hurworth Street. Stage one is located at the southern end of the site and consists of construction of three basement levels across the entire site, and a new four storey building in the southern 75% of the site. Stage two is located in the northern end of the site and will consist of construction of an additional four storey building over the Stage one basement. The current timing for Stage two is currently unknown, however provision will be made in the Stage one design to accommodate Stage two.

Access to basement parking will be via Best Street and the Markwell Street road reserve. Delivery and garbage truck access will be via the Markwell Street road reserve. A single ground level visitor carpark consisting of 12 carparking spaces will be accessed via Hurworth Street, close to the Best Street intersection.

2.3 TOPOGRAPHY & SITE DRAINAGE

In existing conditions the site falls towards the northeast from the Hurworth and Best Street frontages, with levels ranging from RL 24.25 on the Hurworth Street frontage, to approximately RL 15.00 adjacent Markwell Street. The upper areas of the site adjacent Hurworth Street grade at 3 – 5%, until the site batters down towards the Markwell Street road reserve. There are also a number of retaining walls on the site from its former uses.

Stormwater is currently discharged from the site via sheet flow across the eastern side boundary into the Markwell Street road reserve. Runoff is then conveyed via sheet flow beneath the Markwell Street overpass, prior to discharge into the adjoining Queensland Rail corridor.

It is also noted that a former development proposal for the site to the south adjoining Best Street has ceased during construction. The site has previously been excavated and a retaining wall constructed adjoining the southern boundary of Best Street, which varies in height up to approximately 6m.

3. EXISTING AND PROPOSED CIVIL WORKS AND INFRASTRUCTURE

3.1 ROADWORKS

Completion of external roadworks are required to facilitate the development, as described below.

3.1.1 BEST STREET

Formation of Best Street will be required to access the development site. It is proposed that a 6.5m road carriage way with no on street parking is provided within the existing 10.3m wide road reserve.

As discussed in the previous section, there is a retaining wall constructed adjoining the southern boundary of Best Street, which varies in height up to approximately 6m. The top of the wall currently matches the existing ground level at the Hurworth Street end, and rises to approximately 1.8m from the existing surface at the Markwell Street end of Best Street.

A preliminary road grading of Best Street has been undertaken to determine the potential future levels of the roadway. To achieve appropriate road grades and transitions the southern verge will be in approximately 0.4m of fill. To transition back to existing levels a 1:3 landscaped batter will be provided 0.5m off the southern kerb line. The road centre line has been located towards the development site side of the road reserve to maximise the space on the southern verge to transition back to existing levels.

Fencing will also be provided at this frontage to prevent pedestrian access near the existing retaining wall. It is anticipated that once the site to the south is developed, the southern verge on Best street will be established. A preliminary road alignment has been completed and is indicated on the Roadworks and Drainage Plan SKC-031. Road cross and long sections are provided on drawing SKC-035 attached in Appendix A.

3.1.2 MARKWELL STREET

The Markwell Street road carriageway is elevated from the rear boundary of the site. Batters from the raised carriageway extend within the road reserve. The ULDA has formerly requested that major accesses to the site are not provided from Hurworth Street. As a result of this the main delivery and carpark site accesses will be provided from a new access way constructed within the Markwell Street Road reserve. It is noted that the 2007 BCC Preliminary Approval for the development site supports access in this location.

This access way will be designed as a driveway and have widths varying from 7.1 – 8.3m. The primary purpose of this is to provide access to the site, while also maintaining service access to the Markwell Street overpass. To provide appropriate levels to access the building, up to 2.5m of cut and 2.0m of fill will be necessary.

Retaining walls will also be required to remove part of the existing road batter, retain the QUU easement and retain new areas of fill to form the driveway. Retaining wall heights range from 0.4 – 2.5m in height. These are not proposed to be stepped as per BCC guidelines given space constraints of the area. It is believed that this is acceptable as the walls will not front other properties, creating visual impacts. Maintenance responsibility of the retaining walls and driveway within Markwell Street are to be confirmed with BCC.

The proposed alignment and preliminary cross sections are provided on the drawings SKC-031 and 035 attached in Appendix A.

3.1.3 HURWORTH STREET

Minor works to repair existing sections of kerb will be required in Hurworth Street.

3.2 EARTHWORKS

Excavation within the site will be required for provision of basement levels, and for construction of new roadways external to the site. A cut of up to 10m will be required adjacent to the Hurworth Street road reserve, with shoring walls provided on this boundary. As per the Butler Partners Geotechnical Investigation, the site is underlain with Very High Strength Tuff. As a result of this it is expected that blasting alternative methods such as Penetrating Cone Fracture will be required to aid the excavation.

Excavation and filling will also be required in the Markwell Street road reserve to provide the new access driveway. To achieve access to the basement levels at RL 17.600, a new retaining wall up to 2.5m in height will be required.

Excavation adjacent the existing Markwell Street overpass abutment is also necessary for provision of the access driveway discussed above. Further survey information is required as it is expected that the edge of the abutment is to be integrated into the new retaining wall in this location. The previous design drawings for the overpass have been obtained, which indicate the structure has a strip footing at RL 14.00m AHD. The expected level of cut at this location is approximately 1.2m from RL18.2m to RL17.4m AHD. It is to be noted however that the actual footing level at this location is to be confirmed. Refer to Appendix A for the Markwell Street Overpass drawings.

A preliminary Bulk Earthworks Plan has been prepared for the site and is attached in Appendix A.

3.3 STORMWATER

3.3.1 EXISTING INFRASTRUCTURE

There is existing stormwater infrastructure within the road reserves fronting the development site, and within the site itself. This information has been compiled from BCC Bimap (Refer Appendix A) and design plans for the Brisbane Housing Company property to the north.

- There is a small stormwater gully pit located at the corner of Hurworth Street and Best Street. This inlet is on the same side of the road as the subject site. It is unknown at this stage where this drains to.
- There are two stormwater gully pits with 4.8m lintels and a 375mm diameter stormwater line in Hurworth Street, towards the northern end of the site and opposite the park areas. It is understood from review of the Brisbane Housing Company (BHC) design plans for the recent development to the north, that these are intended to capture Q100 flows from Hurworth Street, prior to discharge to a road sag at the frontage of the BHC Site.
- The above lines connect to a new 600mm diameter stormwater line flowing east through the adjoining parkland towards the north.
- There is an existing unused stormwater pipe that enters the subject site from the northern adjoining parkland. There are no records for this infrastructure and its existence is unknown.

- Markwell Street contains stormwater infrastructure at the raised road surface level, including three gully pits in close proximity to the south-eastern corner of the subject site that drain south through a 375mm pipes.

3.3.2 PROPOSED INFRASTRUCTURE

The site currently drains via sheet flow across the eastern property boundary into the Markwell Street road reserve. It is proposed that the development site continues to drain into the Markwell Street road reserve, via a pipe outlet from the basement level discharging to ground. Appropriate scour protection will be provided at the outlet to spread flows and prevent localised erosion. Prior to discharge, stormwater will pass through appropriately sized stormwater quality and quantity mitigation devices, as discussed in the following sections.

Associated with the works is the formation of Best Street and an access driveway within the Markwell Street road reserve. Road drainage provided here will also be directed to the Markwell Street road reserve, via a new stormwater outlet to ground.

Concept designs have been completed and are indicated on the Roadworks and Drainage Layouts SKC031 – 032 attached in Appendix A.

3.4 SITE FLOODING AND OVERLAND FLOW

A BCC Floodwise Report has been obtained for the site. There is no recorded flood risk for the subject site.

A review of BCC City Plan contours has indicated that there are no external catchments draining into the site. Stormwater within Hurworth Street drains to a sag location located opposite the Brisbane Housing Company development towards the north. The approximate level of the sag is RL15.5, and the lowest site level on the Hurworth Street frontage being RL21.0m AHD. Further to this previous designs completed by ETS Group have been reviewed for the BHC development. It is understood from the design drawings that Q100 drainage was implemented within Hurworth Street to collect runoff prior to discharge to this sag location. It is not expected that the site is impacted from overland flow within Hurworth Street.

3.5 SEWER

3.5.1 EXISTING INFRASTRUCTURE

There is existing sewer infrastructure in the fronting road reserves, the adjacent land and also within the subject site. This infrastructure is summarised below, with Bimap information being attached in Appendix A.

- There is a 150mm diameter sewer in the Hurworth Street road reserve, fronting the site. There are a number of existing property connections from this sewer servicing the site. This sewer connects to a 160mm diameter pipe north of the subject site that flows east through the future park. This sewer then feeds into a 150mm diameter pipe that travels southeast towards the Markwell Street road reserve, crossing through the north eastern corner of the site.
- There is a 2400mm diameter trunk sewer that flows north, crossing through the south eastern corner of the site.
- There is an existing Odour Scrubber Room and Vent pole in an easement located in the south eastern corner of the site.

- Bimap records indicate a redundant sewer within the northern portion of the site. This was not located during site survey.

3.5.2 SEWER LOADING

QUU has been contacted with regards to the proposed development and the capacity of the existing sewers surrounding the site. We have been advised that the existing sewers are of sufficient capacity to service the proposed development. QUU advice has been attached in Appendix C.

3.5.3 PROPOSED INFRASTRUCTURE

It is intended that a new sewer connection is made to either the existing 150mm diameter sewer in Hurworth Street, or the existing 150mm diameter sewer in the adjoining parkland towards the north. The final connection location is to be confirmed during detailed design following coordination with the building Hydraulic Engineer. Discharge from the site will include both sewerage and laboratory discharges (RO Water).

The existing 150mm diameter sewer crossing through the north eastern corner of the site is not of a sufficient grade to permit diversion. As a result of this a Build Over Sewer application is to be lodged to Brisbane City Council and Queensland Urban Utilities for approval. It will be demonstrated during detailed design that the new building will bridge over the existing sewer.

The existing 2400mm diameter sewer crossing through the site has levels at RL-11.30m AHD, resulting in the sewer being approximately 31m deep. It is believed that this is at a depth such that the sewer will not be impacted by the development. A letter has been prepared by Bornhorst & Ward outlining potential structural solutions for the building, not impacting on the sewer infrastructure. This has been attached in Appendix C.

A Preliminary Services plan has been prepared and is attached in Appendix A.

3.5.4 ODOUR SCRUBBER ROOM AND VENT POLE

The architectural layout has been designed such that the QUU Odour Scrubber Room and vent pole is retained within the existing easement and is not impacted by the development. Building construction will occur outside the QUU easement extents. A new retaining wall will be required on the eastern boundary of the easement to facilitate the lower level of the new driveway within Markwell Street. It is expected that this will be approximately 1.2m high.

3.6 WATER

Through discussions with QUU the existing 80mm diameter water main within Hurworth Street road reserve does not have the capacity to supply water to the proposed development under peak demand and fire flow conditions. QUU has advised that the existing 80mm diameter water main is made redundant and a new 150mm diameter water main is constructed with the existing 150mm diameter water main in Campbell Street to the furthest connection point of the site. This will result in approximately 150m of new water main.

There is an existing water main in Best Street, which has been assumed to service the Sewer Odour Scrubber Room. This is to be relocated to a position compatible with the proposed Best Street roadworks.

A new connection is to be provided from the proposed water main to service the development. The final connection location is to be confirmed during detailed design following coordination with the building Hydraulic Engineer.

A Preliminary Services plan has been prepared and is attached in Appendix A.

3.7 NON CIVIL SERVICES

A Dial Before You Dig enquiry has been lodged for this development. Telecommunications, electricity and gas infrastructure are present in the road reserves surrounding the site. It is to be noted that the following items require further investigation with service authorities and actual location on site.

- There are existing electricity services, both overhead and underground, and an electricity pole located within Best Street. It is assumed that these provide service to the Sewer Odour Scrubber Room. These will require relocation / removal as a result of the Best Street works.
- There is an existing 460mm diameter gas main in the centre of Best Street, which has been marked Dormant by APA group records. The actual depth of this main is to be determined and its future use discussed with APA group as it may require relocation or removal. The APA group plan is attached in Appendix C for information.

4. STORMWATER MANAGEMENT PLAN

4.1 STORMWATER OBJECTIVES

Under the Brisbane City Council Land Use Development Guidelines, several design elements were identified in relation to stormwater management issues. Brisbane City Council must be satisfied that:

- The proposed development can be drained;
- The stormwater management system can follow the features and functions of the natural drainage system;
- The volume, timing velocity and pollutant load of stormwater has no adverse effect on any surrounding properties; and
- Suitable provision is made in the design layout to accommodate for major drainage.

4.2 CATCHMENT DESCRIPTION

4.2.1 EXISTING AND PROPOSED

In existing conditions, the site slopes downhill to the northeast from the Hurworth Street and Best Street frontages. Surface water is discharged via sheet flow across the eastern boundary into the Markwell Street road reserve. Currently, the site is covered in overgrown grasses and trees. There were formerly a number of residential dwellings on the site, which have recently been demolished.

The proposed development consists of mainly roof and podium areas. As a result of developed conditions, fraction impervious will increase when compared to developed conditions.

4.3 LEGAL POINT OF DISCHARGE

The existing point of discharge from the site is across the eastern property boundary into the Markwell Street road reserve. It is intended to maintain this discharge location as the legal point of discharge for the development.

5. STORMWATER QUANTITY

5.1 STORMWATER DRAINAGE METHODOLOGY

Modelling of stormwater runoff quantity has been considered for the existing case and operational phase of the development. In order to assess the existing and predicted future (operational phase) discharge rates from the development site, calculations have been conducted based on the Rational Method, according to the methods specified in the Queensland Urban Drainage Manual and Brisbane City Council's Subdivision and Development Guidelines.

Calculations have been undertaken to determine the undeveloped and developed peak run-off rates with the Best Management Practices (BMPs) incorporated into the site layout for stormwater quantity control.

5.2 PEAK FLOW CALCULATIONS

The Rational Method as outlined in the Queensland Urban Drainage Manual was used to determine the peak flow rate corresponding to the minor and major storm events for this development. The fraction impervious for the existing and developed conditions have been estimated based on a review of 2001 aerial photography, as indicated below and the proposed development layout.



Figure 2: 2001 Aerial Photography (Sourced from BCC Bimap Records)

Brisbane City Council Subdivision and Development Guidelines, Table B2.1, "Design Standards for Major/Minor Drainage Systems" was used to identify the design storm events for this development as:

Minor -	1 in 10 year ARI
Major -	1 in 50 year ARI
Major (overland flow) -	1 in 100 year ARI

Flow rates were calculated at the point of discharge from the site for the existing and developed phases of the development. Detailed calculations can be reviewed in Appendix B.

Table 1: Pre & Post Development Peak Flow Calculations

	Parameter	Existing	Proposed
Catchment Details	Area (Ha)	0.77	0.77
	Fraction Impervious	11%	95%
	Coefficient of Runoff (C10)	0.72	0.90
	Time of Concentration (min)	14.0	5.0
	10 year Rainfall Intensity (mm/hr)	146	215
	50 year Rainfall Intensity (mm/hr)	200	292
	100 year Rainfall Intensity (mm/hr)	224	327
Discharge	1 in 10 year ARI (m ³ /s)	0.224	0.411
	1 in 50 year ARI (m ³ /s)	0.354	0.622
	1 in 100 year ARI (m ³ /s)	0.414	0.694

As indicated in the table above, the discharge rates for the proposed development exceed those of the existing conditions and hence stormwater quantity controls are required. This is due to the fact that the proposed development has a much larger fraction impervious than the existing site. Due to the substantial difference in discharge rates, a detention tank will need to be incorporated into the new development to mitigate any impacts caused by the increase in runoff from the site.

5.3 INITIAL DETENTION SIZING

Preliminary detention sizing has been undertaken in accordance with the methods described in the Queensland Urban Drainage Manual. The results show that the required volume for a 100 year ARI event is 230m³. It should be noted that these calculations are preliminary and that final detention basin design will need to be carried out using computer modelling. All supporting calculations can be reviewed in Appendix B.

It is proposed that the required detention volume is provided in an underground stormwater detention tank, located beneath the proposed Stores and Supply area accessed from the Loading Dock on Lower Ground 2. The outlet from the tank will be sized to mitigate flows to existing conditions, and will outlet to ground on the eastern property boundary.

The detention tank itself may consist of a proprietary system such as a Humes Storm Trap or equivalent volume in a structurally designed tank. Maintenance access holes are to be placed between pallet racking to ensure that the tank is accessible.

A preliminary drainage layout has been completed and is indicated on drawing SKC-032 attached in Appendix A. Coordination with the Hydraulic Engineer is required during detailed design to determine final tank and connection locations.

6. STORMWATER QUALITY

The Stormwater Quality requirements for the site have been assessed in accordance with the State Planning Policy 4/10 Healthy Waters. The following is an extract from Section 2.7 of the policy, describing developments that the policy is applicable to:

For stormwater management and management of new or expanded non-tidal artificial waterways, the policy applies to development that is:

- a. *material change of use for urban purposes that involves*
 - i. *greater than 2500m² of land; or*
 - ii. *6 or more additional dwellings; or*
- b. *reconfiguring a lot for urban purposes that*
 - i. *would result in 6 or more residential allotments or that provides for 6 or more dwellings; or*
 - ii. *involves greater than 2500m² of land and results in an increased number of lots; or*
 - iii. *is associated with operational work disturbing greater than 2500m² of land; or*
- c. *operational work for urban purposes that involves*
 - i. *disturbing greater than 2500m² of land.*

As the proposed development includes a material change of use for urban purposes that involves greater than 2500m² of land and operational work for urban purposes that involves disturbing greater than 2500m² of land, the State Planning Policy 4/10 Healthy Waters is applicable to the proposal.

All references to water quality designs and requirements have been made to the Queensland Water Quality Guidelines, the State Planning Policy 4/10 Healthy Waters, and the reference material – Water by Design: MUSIC modelling guidelines.

The Department of Environment and Resource Management's State Planning Policy 4/10 Healthy Waters Development Assessment Code has been completed for this proposed development and is attached in Appendix C.

6.1 POLLUTANTS OF CONCERN

In accordance with Figure 2.5 of the Department of Environment and Resource Management Urban Stormwater Quality Planning Guidelines 2010, the proposed development is located within the South East Queensland region for stormwater quality design objectives. The key pollutants to be targeted and the minimum pollutant concentration removal objectives described in the aforementioned document for the South East Queensland region are outlined in the following table:

Table 2: South East Queensland Water Quality Objectives

Pollutant	Concentration Removal
Total Suspended Solids (TSS)	80%
Total Phosphorus (TP)	60%
Total Nitrogen (TN)	45%
Gross Pollutants (GP)	90%

6.2 MODELLING/ASSESSMENT APPROACH

A quantitative assessment of stormwater runoff quality was considered for the operational phase of the development.

The predicted future (operational phase) discharge concentrations of key pollutants have been identified using the “*Model for Urban Stormwater Improvement Conceptualisation (MUSIC)*”. MUSIC is a stormwater quality modelling program that provides estimates of stormwater pollution generation and the performance of stormwater management measures used in series or parallel to form a ‘treatment train’.

Input parameters and desired Water Quality Objectives (WQOs) were adopted in accordance with the Water by Design MUSIC Modelling Guidelines and the Urban Stormwater Planning Guidelines 2010, respectively.

6.3 METEOROLOGICAL DATA

The first step in creating the MUSIC model was to select the appropriate meteorological data set (period and time step) to be used as the basis for the runoff algorithms. Sections 3.1 – Meteorological Data and Section 3.2 – Modelling Period and time-step, of the reference material details and the Rainfall Data and Time Step process requirements of the model, respectively.

The time step used for the MUSIC modelling process was: Brisbane – 6 minutes.

6.4 SOURCE NODES

The second step taken in creating the MUSIC model was to define ‘Source Nodes’ or Sub-Catchments. Input parameters used for modelling the source nodes and sub-catchments were adopted in accordance with the Water by Design MUSIC Modelling Guidelines.

Based on the proposed architectural design plans, site layout and commercial nature of the development, the MUSIC model consisted of three commercial source node types; roof, road and ground area catchments. The commercial source node input parameters for each of the source node types were adopted in accordance with the Water by Design MUSIC Modelling Guidelines.

6.5 TREATMENT METHODOLOGY

Due to the significant site coverage by roof area proposed as part of the development, there is an opportunity to implement a large rainwater tank to enable roofwater runoff capture and reuse on-site to supplement potable water consumption. As a result, a 175kL rainwater tank is proposed for installation at the southern site extent adjacent to the Lower Ground 1 level. Captured roofwater is proposed to be used for toilet flushing and

outdoor irrigation applications. Due to the location of the proposed rainwater tank and the anticipated staged approach to the development, only the stage 1 roof will drain to the 175kL rainwater tank.

The proposed 175kL rainwater tank by itself will not provide satisfactory pollutant removal for the whole site to comply with the Urban Stormwater Planning Guidelines water quality objectives, and therefore, additional treatment measures are required. A bio-retention system cannot be implemented within the development site due to the proposed site layout and underground basement extents. Therefore, an in-ground storm filtration unit will be required and installed within the Stores and Supply area of the Lower Ground 2 level and will treat runoff from the entire site area, including overflow from the rainwater tank.

Access for maintenance of the storm filtration device will be achieved through the installation of an access hatch in the Stores and Supply area of the Lower Ground level 2 basement floor slab. The access hatch will be positioned in the aisles between pallet racking such that the unit can be accessed and cleaned.

A Humes Water Solutions Jellyfish filter is proposed for this development to provide the additional stormwater quality treatment required to satisfy the target water quality objectives.

6.6 TREATMENT NODES

As described in the section above, a 175kL rainwater tank and a Humes Water Solutions Jellyfish filter device will be implemented within the development site to provide stormwater quality treatment for the proposed commercial development and ensure compliance with the Urban Stormwater Quality Planning Guidelines. Information on these stormwater quality treatment devices has been sourced from Water by Design and Humes Water Solutions. Details of the treatment devices proposed for the development are outlined in the following table.

Table 3: SQBMP Selection Matrix

SQBMP Description	Discussion
Rainwater Tank	Rainwater tanks capture roofwater for onsite reuse to supplement potable water consumption. A rainwater tank with a storage volume of 175kL is proposed for the development and will be positioned as indicated on the architectural design plans. Rainwater reuse for toilet flushing and irrigation purposes has been included in the MUSIC model. Rainwater Tank (as modelled): - Storage Volume = 175kL - Surface Area = 162.5m² - Reuse = 5.165kL/day
Humes Water Solutions Jellyfish Filter	The Humes Water Solutions Jellyfish filter system is a tertiary stormwater treatment device featuring membrane filtration to remove sediments and nutrients from stormwater runoff. A Humes Water Solutions Jellyfish filter model JF-1800-6-1 comprising six high-flow cartridges and one draindown cartridge contained in a 1800mm diameter structure is proposed for the development.

Refer to the Preliminary Roadworks and Drainage Plan SKC-032 attached in Appendix A for location of the treatment train.

6.7 PROPOSED TREATMENT TRAIN

A Best Management Practice 'Treatment Train' was developed from the selected SQBMPs to target each of the pollutants of concern and has been incorporated into the development site layout as discussed above. This treatment train is illustrated in the following figure.

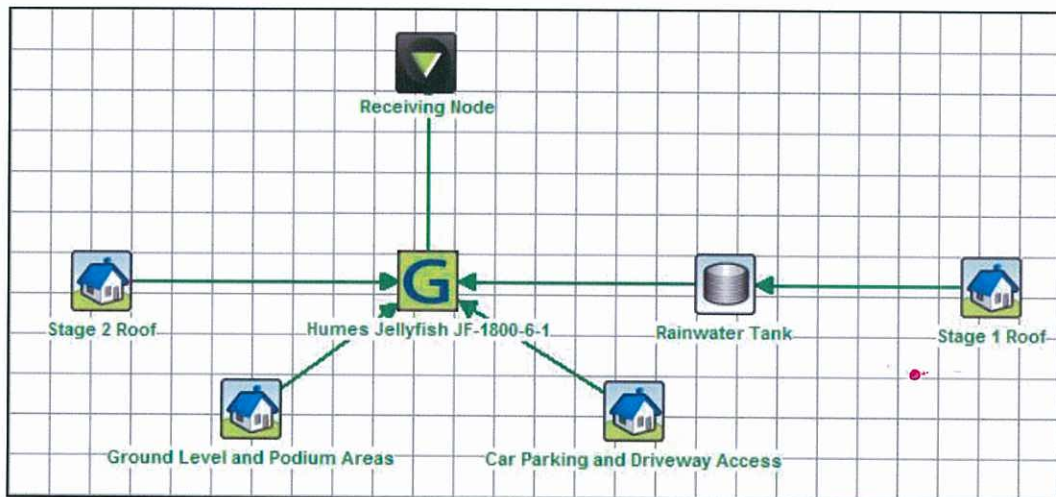


Figure 3: Proposed Stormwater Quality Treatment Train

6.8 RESULTS

The overall pollutant reductions for the development site as a result of the proposed stormwater quality treatment train obtained from the MUSIC model and analysis are tabulated below.

Table 4: Pollutant Removal Rates Discharge

Pollutant	TSS (%)	TP (%)	TN (%)	GP (%)
Treatment Train	81.3	73.2	57.0	98.2
QWQG WQOs	80.0	60.0	45.0	90.0

As indicated in the table above, the removal rates for the target pollutants: total suspended solids (TSS), total phosphorus (TP), total nitrogen (TN) and gross pollutants, are all above the required water quality objectives outlined in the Urban Stormwater Quality Planning Guidelines. On this basis, the treatment train proposed for the development site will provide satisfactory pollutant removal.

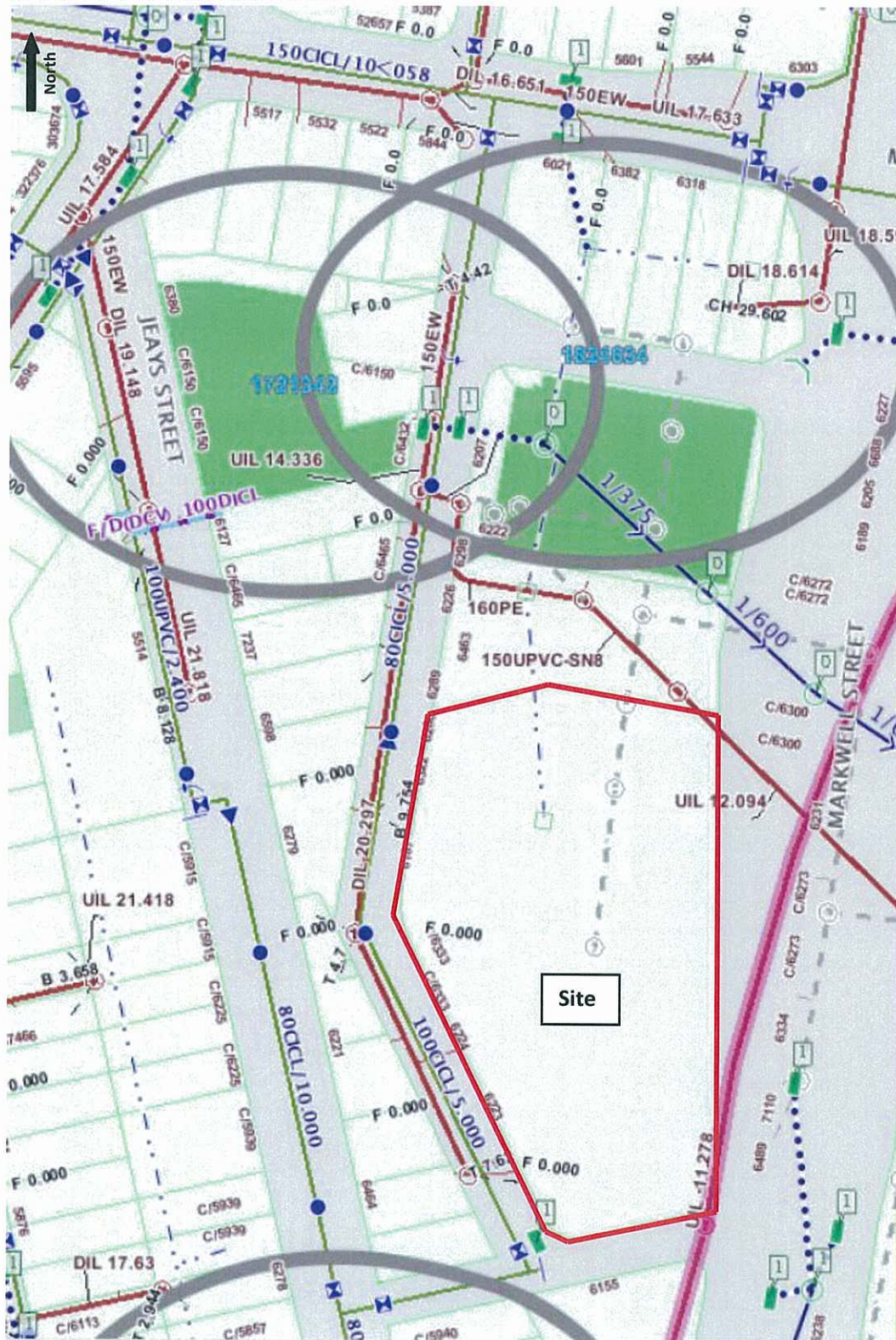
7. SUMMARY

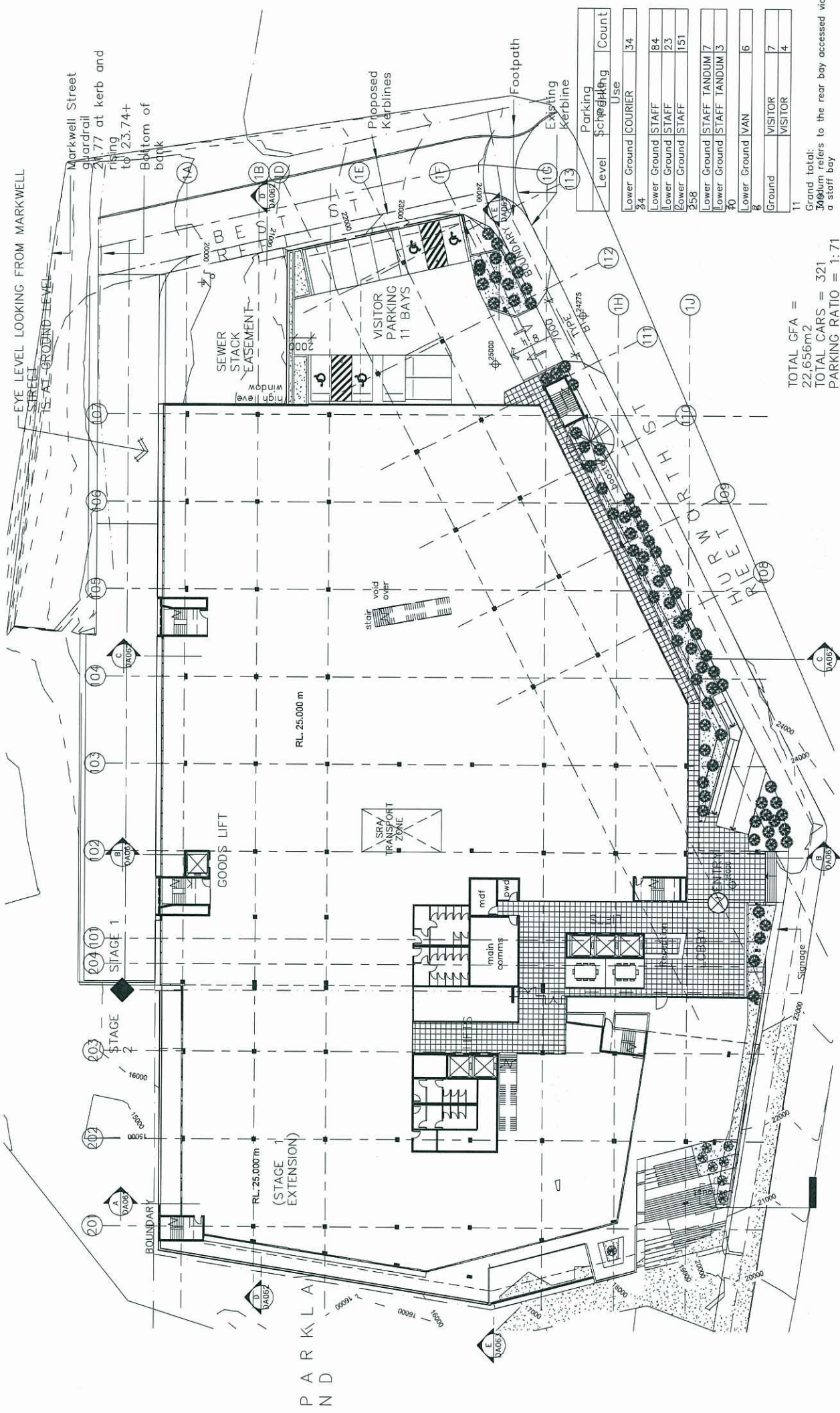
From the investigations conducted, it has been shown that the proposed development located at Lot 5 Hurworth Street, Bowen Hills can be constructed in accordance with the Brisbane City Council requirements. Sufficient consideration of stormwater quantity and quality controls has been made to demonstrate the viability of stormwater management on the proposed development site. Preliminary sizing of stormwater devices has been undertaken for the ultimate development (Stage 1 and Stage 2). Capacity of the services available to the development has been investigated by Queensland Urban Utilities and is also considered acceptable.

APPENDIX A

FIGURES AND DRAWINGS

Brisbane City Council BiMap Records





Level	Use	Count
Lower Ground	COURIER	34
Lower Ground	STAFF	84
Lower Ground	STAFF	23
Lower Ground	STAFF	151
Lower Ground	STAFF TANDUM 7	358
Lower Ground	STAFF TANDUM 3	40
Lower Ground	IVAN	6
Ground	VISITOR	7
Ground	VISITOR	4

TOTAL GFA =
22,656m²
TOTAL CARS = 321
PARKING RATIO = 1:71

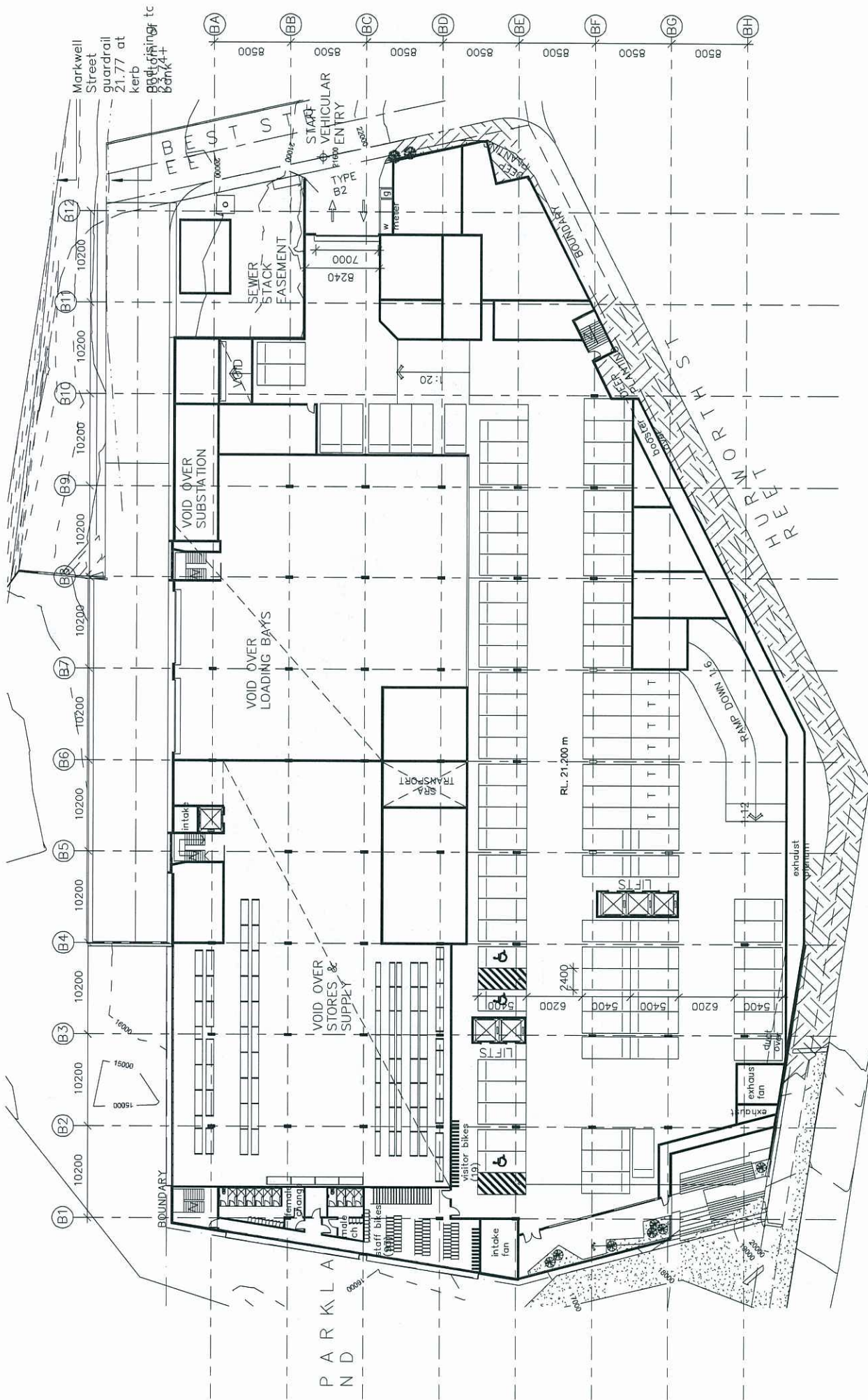
note: room areas are
Grand total:
100m refers to the rear bay accessed via
a staff bay

note: room areas are
PLANS PRELIMINARY ONLY - SUBJECT TO
CHANGE

Ground Floor
Plan
07.02.2013
3232_DAO411
©copyright nettleton tribe partnership
pty ltd



Client
Project
PROPOSED COMMERCIAL DEVELOPMENT
LOT 5, HURWORTH STREET, BOWENS
HILLS



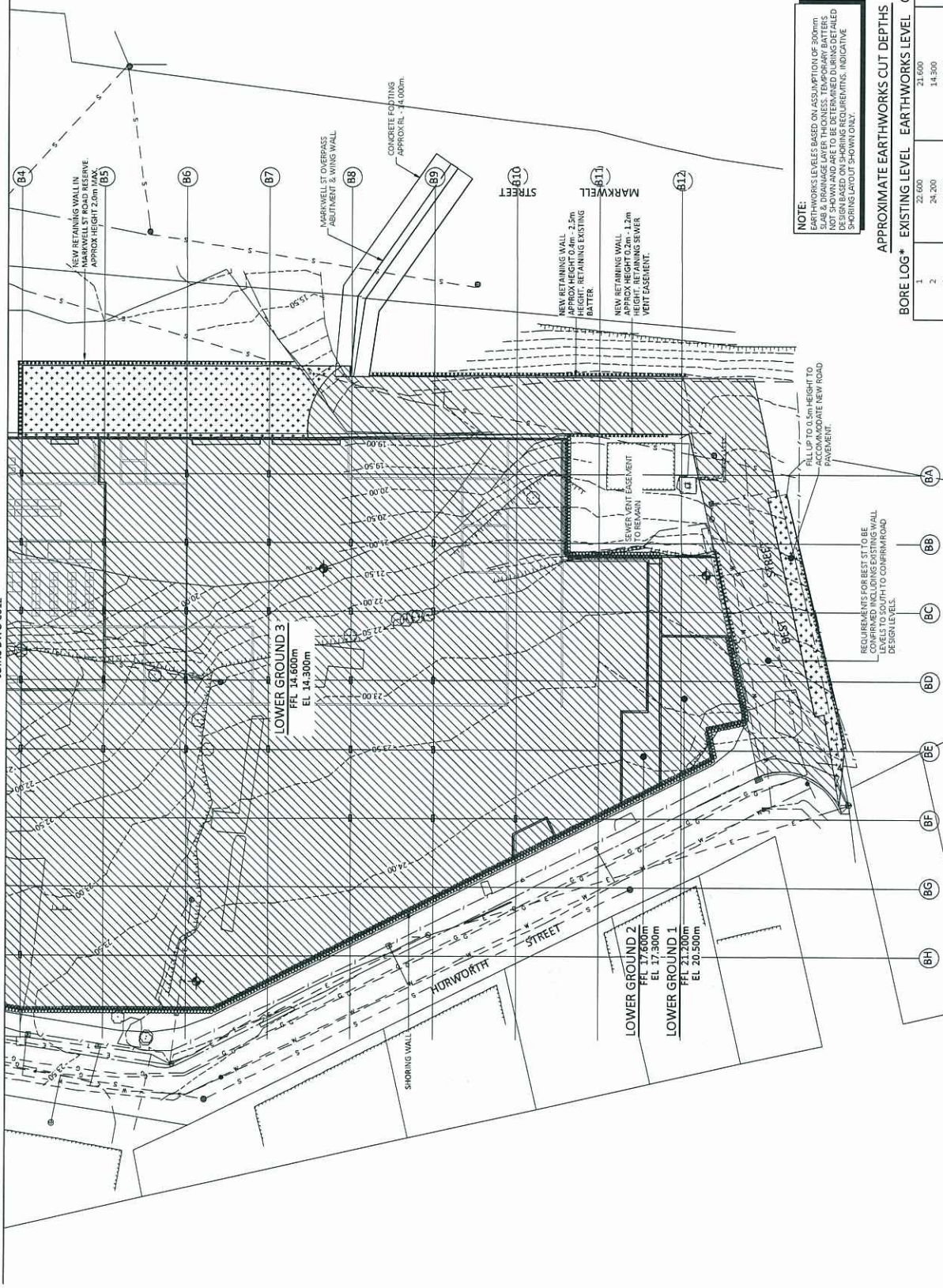
note: room areas are in square metres
 PLANS ARE PRELIMINARY ONLY - SUBJECT TO CHANGE

Client
 Project
 Title
 Scale
 Date
 Number
 Lower Ground
 07.02.2013
 3232_DAO48A
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 pty ltd



PROPOSED COMMERCIAL DEVELOPMENT
 LOT 5, HURWORTH STREET, BOWEN
 HILLS

JOINS DWG C012



LEGEND

- PROPOSED
EXISTING
- KERB AND CHANNEL
 - KERB ONLY
 - KERB FLUSH
 - KERB INVERT
 - EDGE OF BITUMEN
 - EDGE OF SHOULDER
 - EXTENT OF BUILDING
 - PROPERTY BOUNDARY
 - EASEMENT
 - STORMWATER DRAINAGE
 - ROOFWATER DRAINAGE
 - BATTER
 - TOP OF BATTER
 - TOE OF BATTER
 - TOP OF WALL
 - TOE OF WALL
 - RETAINING WALL
 - BUILDING PAD
 - CONTOURS
 - FENCE
 - SEWER
 - SEWER RISING MAIN
 - WATER
 - GAS
 - TELSTRA
 - UNDER GROUND POWER
 - FOOTPATH
 - TREE
 - LINE OF VEGETATION
 - SHORINGS (EXTENTS TO BE CONFIRMED)
 - CUT
 - FILL
 - BORE LOG REFER BUTLER PARTNERS GEOTECHNICAL INVESTIGATION NOVEMBER 2012



PROJECT NORTH

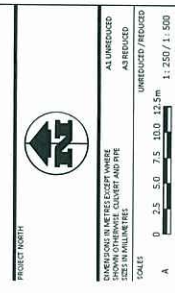
APPROXIMATE EARTHWORKS CUT DEPTHS

BORE LOG #	EXISTING LEVEL	EARTHWORKS LEVEL	CUT/FILL
1	22.000	21.600	-0.100m
2	24.200	14.300	-9.900m
3	21.200	14.300	-6.900m
4	21.800	14.300	-7.500m
5	17.400	17.300	0.100m

* REFER BUTLER PARTNERS GEOTECHNICAL INVESTIGATION NOVEMBER 2012

PRELIMINARY

PROJECT NO. 12356	PROJECT SULLIVAN NICOLAIDES PATHOLOGY HEADQUARTERS	CLIENT SONIC HEALTH CARE LIMITED	DESIGNER BORNHORST + WARD CONSULTING ENGINEERS CIVIL AND STRUCTURAL LEVEL 4, 47 Ashby Terrace, Spring Hill, QLD 4000	CHECKED DATE	APPROVED DATE	ASSOCIATED CONSULTANTS	DATE REV BY APP	AMOUNT/DATE 15/02/2013
REVISION SKC011								



STATUS	PRELIMINARY	PROJECT No.	A
		DRAWING No.	SKC032

JOINS DWG C031

[illegible]



A
 0 1.0 2.0 3.0 4.0 5.0m
 UNREDUCED / REDUCED
 1: 100 / 1: 200
 SCALES
 DIMENSIONS IN METRES EXCEPT WHERE
 SHOWN OTHERWISE. CUMULATIVE AND PIPE
 DIMENSIONS IN MILLIMETRES
 A1 UNREDUCED
 A3 REDUCED

PRELIMINARY

SUBJECT
STORMWATER
LONGITUDINAL SECTION

PROJECT
SULLIVAN NICOLAIDES
PATHOLOGY
HEADQUARTERS

SONIC HEALTH CARE
LIMITED

Barnhart & Ward Pty Ltd
Sydney, Australia
Phone (07) 3013 4639
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Email info@barnhartward.com.au
www.barnhartward.com.au
P.O. Box 5014
Brisbane, QLD 4001, Australia

BORNHORST + WARD
CONSULTING ENGINEERS
CIVIL AND STRUCTURAL
Level 4, 67 Adelaide Terrace, Spring Hill, QLD 4000

DATE	
CHECKED	

APPROVED _____

ASSOCIATED CONSULTANTS

[illegible]

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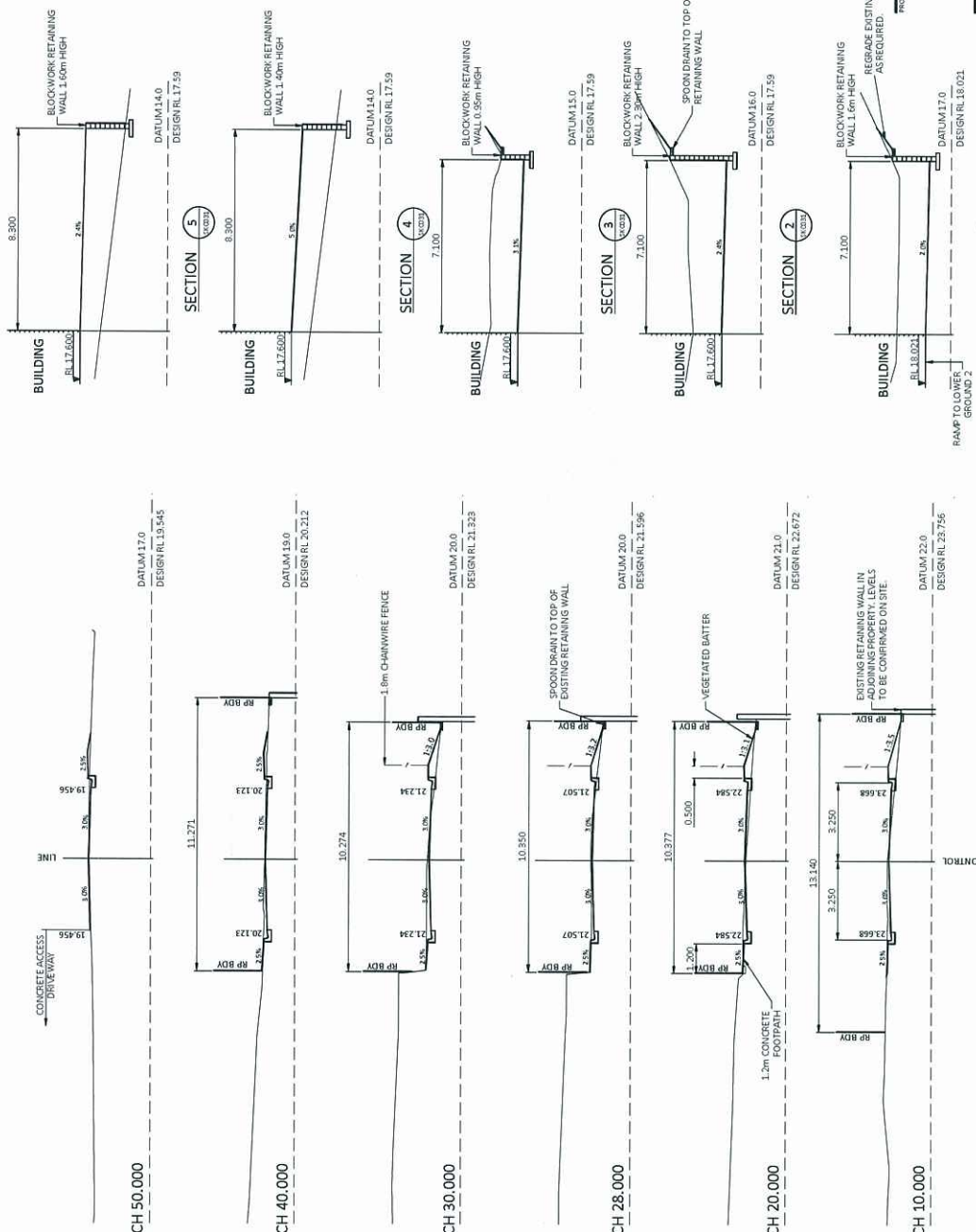
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HORIZONTAL DATA

VERTICAL DATA

DATUM -31.00

EXISTING SURFACE LEVEL

CUT / FILL DEPTH TO EXISTING SURFACE

CONTROL LINE FINISHED LEVEL

CONTROL LINE CHAINAGES

BEST STREET LONGITUDINAL SECTION

HORIZONTAL SCALE 1:1000

VERTICAL SCALE 1:100

BEST STREET CROSS SECTIONS

MARKWELL STREET DRIVEWAY CROSS SECTIONS

PRELIMINARY

PROJECT SULLIVAN NICOLAIDES PATHOLOGY HEADQUARTERS	CLIENT SONIC HEALTH CARE LIMITED	CONSULTANT BORNHORST + WARD CONSULTING ENGINEERS CIVIL AND STRUCTURAL	PROJECT NO. 12356	DRAWING NO. SKC035
DATE 12/02/13		REVISION 1		STATUS PRELIMINARY

APPENDIX B

HYDRAULIC CALCULATIONS