

PLANS AND DOCUMENTS

referred to in the ULDA

APPROVAL dated 10 / 5 / 11

CIVIL ENGINEERING REPORT

**FOR THE PROPOSED
COMMERCIAL & RESIDENTIAL DEVELOPMENT**

**LOCATED AT
5 – 9 HERCULES STREET
HAMILTON**

**PREPARED FOR INTERCAP PTY LTD
BY BORNHORST & WARD PTY LTD**

JULY 2009

July 2009 – 5 – 9 Hercules Street, Hamilton

PLANS AND DOCUMENTS
referred to in the ULDA
APPROVAL dated \ /

Bornhorst & Ward Project No. **09183**

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

Revision	Date	Description	Author	Rev.	App.
A	July 2009	Issue to ULDA	KR	NR	NR

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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 commercial and residential development, located at 5 - 9 Hercules Street, Hamilton. The location of the proposed site is indicated in Figure 3, Appendix A.

The development will involve construction of an 8 level mixed use tower consisting of residential and commercial uses as well as a 15 level residential tower, with associated basement carparks. The proposed development will be constructed across two stages, whereby the office tower will be constructed as part of Stage 1.

The Engineering requirements for this proposal shall be in accordance with the standards listed in Section 4 of the Urban Land Development Authority Development Assessment Certification Procedures Manual, and Brisbane City Council Subdivision and Development Guidelines.

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

2. SITE CHARACTERISTICS

2.1 LOCATION

The proposed site is located on the eastern side of Hercules Street, Hamilton. The site is bounded by road reserve to the west, the existing Sammie's Girl Seafood to the north, and the existing Portside development and DPI site to the south and east.

Street Address: 5 – 9 Hercules Street Hamilton
RP Description: Lot 631 on SL801514
Lot 645 on SL2184

2.2 LANDUSE

2.2.1 Existing

The existing site has an area of approximately 0.32 Ha when combining lots 631 and 645. Lot 631 has been previously subdivided; this has been excluded in the area calculations.

The site is currently occupied by two commercial warehouses, which have been converted to offices. The existing buildings have been constructed close to the boundary and remaining areas consist of concrete. There are existing easements following the northern boundaries of both Lots 631 and 645. There are no council services traversing the site. It is hence assumed that these easements are for access purposes and will be extinguished as part of the development.

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2.2.2 Proposed

The proposal detailed in this report is for the construction of an 8 level mixed use tower and a 15 level residential tower. Two levels of basement carparking will be constructed beneath the mixed use tower, with an additional single level basement being constructed beneath the residential tower.

The proposed site layout is shown on the Noel Robinson Architects Plans attached in Appendix A.

2.3 TOPOGRAPHY AND SITE DRAINAGE

The site is currently developed and is hence flat with a surface level of approximately RL 3.0m. There are two gully pits in Hercules Street directly fronting the site. It is understood from previous site survey, that the existing buildings discharge roofwater to a 300mm diameter stormwater line following the front boundary of the site.

3. EXISTING AND PROPOSED INFRASTRUCTURE

3.1 EXTERNAL STORMWATER

There are two existing gully pits connecting to a 600mm diameter stormwater line in Hercules Street, fronting Lot 631. These collect runoff from Hercules Street, and ultimately discharge into the Brisbane River, via a 2700 x 1800mm box culvert, extending beneath the existing Portside Buildings from the intersection of Hercules Street and Harbour Road. There is also an existing 300mm diameter stormwater line providing connection to lot 645.

The existing gully pits form the legal point of discharge for the site. It is intended to maintain the legal point of discharge for the developed phase of the project. The existing 300mm diameter connection will be utilised where possible. Stormwater quantity and quality measures will be incorporated into the development as indicated on the Conceptual Stormwater Layout attached in Appendix A.

Refer to Section 4.0, "Stormwater Management Plan" for further Stormwater details.

3.2 INTERNAL STORMWATER

Drainage designs for the roofwater and podium drainage will be completed by the Hydraulic Engineer. Any pump systems required for basement drainage will remain property of the development and not be handed over to council. The final location of stormwater quality improvement devices, such as GPT's and grease arrestors will be determined by the Hydraulic Engineer, as this is highly dependant on the internal drainage design. A Conceptual Stormwater Layout showing preliminary locations of internal drainage and water quality devices is attached in Appendix A.

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3.3 EXTERNAL SEWER

- Existing Infrastructure

From previous discussions with Brisbane Water, it is understood that the existing sewer infrastructure in the area is at or nearing capacity. Directly fronting the site, there is an existing 150mm and 225mm diameter sewer in Hercules Street. This line follows Hercules Street and connects into the existing 300mm diameter sewer in Remora Road.

There is also a 400mm diameter PE sewer in Macarthur Avenue, recently constructed as part of the Northshore Hamilton Stage 1 works. This follows Macarthur Avenue, and discharges into the existing pump station at the end of Barcham Street. The sewer has been designed to cater an external catchment, consisting of the Hamilton Harbour and Portside Developments.

In discussions with Brisbane Water, the Hamilton Harbour development is expected to discharge directly to the S1 sewer in Kingsford Smith Drive, hence leaving additional spare capacity in the Northshore Sewer. This line is however limited by the capacity of the exiting pump station, as Brisbane Water has advised that there is spare capacity of approximately 1000 EP. Preliminary designs have been completed for construction of a trunk sewer from the Macarthur Avenue line, connecting directly to the Violet Street Pump Station. The construction timing of this is currently unknown.

- Sewer Loading

A preliminary calculation of sewer loading for the development has been calculated at 7.5 L/s PWWF in Table 1 below. Calculations have been based on the Brisbane City Council Sewerage Standards and the Water Services Australia Sewerage Code.

Table 1: Sewer Flow Calculations

Area Classification	Units	EP Loading / unit	Total EP	PWWF (1200L/EP/day)
Residential	173 units	2.5 EP / unit	433	6.0 L/s
Commercial / Retail	0.702ha GFA	152 EP/ha	107	1.5 L/s
		Total	540	7.5 L/s

- Sewer Options

Options for the sewer connection for the development have been identified as follows. The preliminary location of sewer options is shown on the attached Sewer Reticulation Plan SKC050.

- Option 1

The preferred option is for connection into the existing 225mm diameter sewer directly fronting the site. This is dependant on a capacity assessment and permission from Brisbane Water.

- Option 2

The second option is to connect to the existing Macarthur Avenue sewer by extending a new 150mm diameter sewer along Hercules Street and Remora Road. The total length of new sewer is approximately 500m. Cost sharing of this option between surrounding developers is also an option.

As discussed above this existing line has been designed with sufficient capacity for this catchment, but is however limited by the capacity of the existing downstream pump station, until such time that the trunk infrastructure connecting sewer to the Violet Street Pump Station is constructed.

- Option 3

A section of the Hamilton Harbour site is being resumed for future Kingsford Smith Drive upgrades. Another possible option is extension of a new 150mm diameter line from Hercules Street directly to the S1 sewer in Kingsford Smith Drive.

Discussions with Brisbane Water regarding these options have commenced. It is also expected that written advice from Brisbane Water will be received regarding their preferred sewer connection option and any upgrades / augmentation necessary. This information will be forwarded to the ULDA when received.

3.4 INTERNAL SEWER

Design of the internal sewer will be completed by the Hydraulic Engineer. Any internal pumps required to service basement areas will remain the property of the development and not be handed over to council.

3.5 WATER

There is an existing 150mm diameter potable water main within Hercules Street, along the full frontage of the site. It is the developer's intention to connect into this where required. Flow and pressure tests will be required to determine suitability of this existing main. A preliminary location for the water connection is shown on the attached Water Reticulation Plan SKC060 attached in Appendix A.

Permission is being sought from Brisbane Water for the water connection. Written correspondence from Brisbane Water will be forwarded to the ULDA when received.

3.6 NON CIVIL SERVICES

Non civil services including telecommunications and electricity will be required for the development. There are existing telecommunications services along the Hercules Street site frontage. Overhead power is also present within Hercules Street. The capacity of the existing services on Hercules Street will require assessment by associated consultants.

3.7 ROADS

The proposed entrance from the site is from the future promenade to be constructed as part of the Portside Wharf development. No additional entrance from Hercules Street will be required. The developer will be in negotiations with the Portside Developer regarding construction timing of this promenade.

3.8 EARTHWORKS

Earthworks will be required for excavation of basement levels. A preliminary earthworks plan is attached in Appendix A. All earthworks will be undertaken in accordance with Brisbane City Council guidelines. It is expected that approximately 6.5m of cut will be required for construction of the lower basement area. All excavated material is to be spoiled off site in accordance with Council guidelines.

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3.9 EROSION AND SEDIMENT CONTROL PLAN (ESCP)

A comprehensive Erosion and Sediment Control Plan including a construction process will be prepared for this development during the detailed design phase. The ESCP designs will be in accordance with the Institution of Engineers reference material and Brisbane City Council's Guidelines.

3.10 ASSET HANDOVER

It is the intention of the applicant that the stormwater quantity and quality controls within the development, as detailed in this document, will not be handed over to Council as part of the development's stormwater infrastructure. Maintenance of these will be the responsibility of the Body Corporate.

4. STORMWATER MANAGEMENT PLAN**4.1 STORMWATER OBJECTIVES**

Under the Brisbane City Council Land Use Development Guidelines (2000), 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 or receiving waters; and
- Suitable provision is made in the design layout to accommodate for major drainage.

4.2 CATCHMENT DESCRIPTION**4.2.1 Existing**

The existing site has an area of approximately 0.32 Ha when combining lots 631 and 645. Lot 631 has previously been subdivided. The site is currently occupied by warehouses, which have been converted into commercial tenancies. The site has a very high fraction impervious, as open areas are concreted.

The site is flat with a level around RL 3.0. There is currently minimal surface water runoff, as the existing development has been constructed very close to the boundary. The existing roofwater drainage connects into an existing stormwater 300mm diameter stormwater line within the site following the front boundary. This system drains into the existing 600mm diameter line in Hercules Street.

4.2.2 Proposed

The proposal detailed in this report is for the construction of an 8 level mixed use tower and a 15 level residential tower. Two levels of basement carparking will be constructed beneath the mixed use tower, with an additional single level basement being constructed beneath the residential tower.

As the site is currently developed, no increase in impervious areas will occur as a result of the development.

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4.3 LEGAL POINT OF DISCHARGE

The existing gully pits fronting the site in Hercules Street, form the legal point of discharge for the site. It is intended to maintain the legal point of discharge for the developed phase of the project. The existing 300mm diameter connection crossing Hercules Street will also be utilised where possible. The proposed stormwater connection for the site is indicated on the Stormwater Layout Plan SKC030 attached in Appendix A.

4.4 SURROUNDING PROPERTIES

The proposed development involves construction along each of the boundaries. The existing commercial development sharing the northern boundary and the DPI buildings along the eastern boundary have also been constructed to the boundary. No ponding in this property or surrounding properties will be caused as a result of the development. There are also no overland flow paths through the development.

4.5 OPPORTUNITIES AND CONSTRAINTS

4.5.1 Site Opportunities

The major opportunities identified for the site with respect to the application of stormwater quality and quantity controls are:

- The use of rainwater tanks to capture roofwater runoff for re-use within the internal plumbing of the buildings.

4.5.2 Site Constraints

The major constraints identified for the site with respect to the application of stormwater quality and quantity controls are:

- The size and intensity of the development limits the feasibility of incorporation of water quality treatment devices to achieve the required WSUD guidelines percentage reductions of pollutants.

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 (2007) 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.

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5.2 PEAK FLOW CALCULATIONS

The Rational Method as outlined in the Queensland Urban Drainage Manual (2007) was used to determine the peak flow rate corresponding to the minor and major storm events for this development.

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 points of discharge from the site for the existing and developed phases of the development. Detailed calculations can be reviewed in Appendix B.

Table 2: Pre & Post Development Peak Flow Calculations

	Parameter	Existing	Proposed
Catchment Details	Area (Ha)	0.32	0.32
	Fraction Impervious	100%	70%
	Co-efficient of Runoff (C10)	0.9	0.84
	Time of Concentration (min)	5.0	5.0
	10 year Rainfall Intensity (mm/hr)	215	215
	50 year Rainfall Intensity (mm/hr)	291	291
	100 year Rainfall Intensity (mm/hr)	325	325
Discharge	1 in 10 year ARI (m ³ /s)	0.17	0.16
	1 in 50 year ARI (m ³ /s)	0.26	0.25
	1 in 100 year ARI (m ³ /s)	0.29	0.29

5.3 STORMWATER QUANTITY MITIGATION MEASURES

As indicated within Table 2 above, the development will not result in an increase in stormwater runoff from the site. It is hence not proposed to incorporate detention systems as the pre and post development flows will remain the same as existing conditions. Stormwater detention is also not necessary due to the proximity of the site to the Brisbane River. As the site is located at the base of the catchment it is important to discharge runoff as quickly as possible.

A rainwater tank capturing roof runoff will however be installed in the development. This is to be sized and located by the Hydraulic Engineer. A Conceptual Stormwater Layout, indicating the location of treatment devices, and the general drainage methodology proposed for the site is attached in Appendix A.

5.4 SITE FLOODING

A BCC Floodwise Report has been obtained for the site. The highest defined flood level is RL2.5m AHD as a result of a Storm Tide. In existing conditions, the site is approximately RL3.0m. The ground floor level will hence have a minimum freeboard of 500mm. The lower basement level is at RL -2.80, however this will be provided with immunity from the entrances at approximately RL 3.20m.

6. STORMWATER QUALITY

6.1 BACKGROUND

The water quality discharges from the site can be assessed under a number of guidelines. The South East Queensland Regional Plan 2005 – 2026 Implementation Guideline No. 7 – Water Sensitive Urban Design, as well as Brisbane City Council Subdivision and Development Guidelines have been considered for the development.

As per Section 2.3 of the Implementation Guideline No. 7, the Department of Infrastructure and Planning (DIP) and the EPA have jointly proposed that applying the design objectives outlined in the Implementation Guideline No. 7, will demonstrate consistency with Schedule 1 of the EPP and the Queensland Water Quality Guidelines.

The existing site is situated within the Brisbane River Catchment BN/120 and the nearest affected waterway is the Brisbane River. The site is however, not located within the Brisbane River Corridor, as indicated on the BCC Planning Scheme Map 2 – Waterway Corridors and Wetlands.

For the purposes of stormwater quality modelling, the Brisbane City Council Reference Material: “Guidelines for Pollutant Export Modelling in Brisbane Version 7-Draft for generating pollutant loads and mitigation strategies”, has been applied.

6.2 POLLUTANTS OF CONCERN

The key pollutants generated by various developments are listed by Brisbane City Council. During the operational phase of the development, BCC identifies the following pollutants as being typically generated:

- Litter
- Sediment
- Nutrients (N & P)
- Hydrocarbons

Key pollutants to be targeted for trapping and the reduction percentages outlined in the South East Regional Plan 2005 – 2026 - Implementation Guideline No. 7 are as follows:

Table 3: Water Quality Objectives

Pollutant	Reduction Percentages
Suspended Solids (TSS)	80%
Total Phosphorus	60%
Total Nitrogen	45%
Gross Pollutants	90%

6.3 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, previously identified in section 7.2, has been conducted 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 specific to Brisbane were adopted in accordance with Brisbane City Council Reference Material: “Guidelines for Pollutant Export Modelling in Brisbane Version 7-Draft for generating pollutant loads and mitigation strategies”

6.3.1 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. Section 2.2 – Meteorological Data of the reference material details the Rainfall Data and Time Step process requirements of the model.

The time step used for the Music modelling process was: Brisbane 6 Minutes (1980-89).

6.3.2 Source Nodes

The second step taken in creating the MUSIC model was to define ‘Source Nodes’ or Sub-Catchments of the proposed development. The general areas of the development have been determined based on the architectural layout as consisting of roof areas and podium areas including all hardstand and landscaping runoff as follows:

- Roof Area – 850m²
- Hardstand Areas (including private courtyard areas and communal areas) – 1398m²
- Landscaping Areas – 990m²

Source nodes for modelling Brisbane Catchments were defined as per the reference material: Guidelines for Pollutant Export Modelling in Brisbane Version 7-Draft for generating pollutant loads and mitigation strategies”. In this case, the source nodes identified above have been modelled as ‘Urban Residential Areas’. An urban residential node is used to describe low to high-density residential areas and activities servicing local neighbourhood needs.

Table 4: Source Node Catchment Details

Catchment	Node Type	Area (Ha)	Fraction Impervious
Roof	Urban Residential	0.085	100%
Podium Runoff (landscaping and hardstand areas)	Urban Residential	0.238	60%
	Total	0.323	70%

6.3.3 Treatment Nodes

A range of SQBMPs were considered for inclusion in the development site layout, with information on available SQBMPs primarily sourced from BCC (Ref 4). Each has been reviewed for its suitability for this location. For this particular development the following treatment options have been chosen for incorporation into the development design. A Conceptual Stormwater Layout, indicating the location of treatment devices, and the general drainage methodology proposed for the site is attached in Appendix A.

Figure 1: SQBMP Selection Matrix

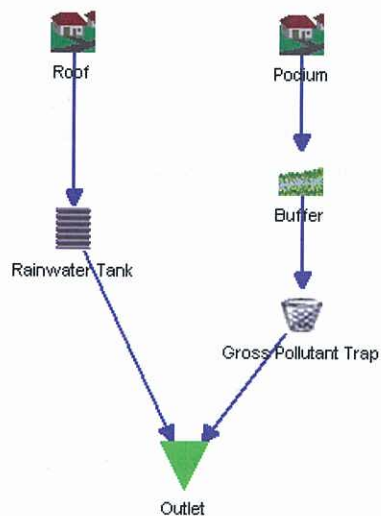
SQBMP Description	Discussion
Gross Pollutant Trap	As the main pollutants generated by this site will be gross pollutants and sediments, a GPT has been specified. A GPT is a treatment device designed to capture coarse sediment, trash, vegetation matter and free oil and grease.
Roof Water Tanks	As the development has significant roof area, an opportunity exists to capture and possibly supplement some forms of water supply requirements of the development. For the purposes of Stormwater Quality Modelling, a 60kL rainwater tank has been assumed, with a 2kL per day reuse. This is to be confirmed by the Hydraulic Engineer, during detailed design.
Buffer Strips	Landscaping areas on the site have been modelled as buffer strips. It is proposed that stormwater runoff from impervious areas will drain towards the landscaped areas and be collected by field inlets. Buffer strips are a source control measure, which are effective in the removal of coarse to medium sized suspended solids.

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6.4 PROPOSED TREATMENT TRAIN

From the available SQBMPs, a BMP 'Treatment Train' was developed to target each of the pollutants of concern and was subsequently incorporated into the development site layout. This treatment train is illustrated below.

Figure 2: Treatment Train



6.5 RESULTS

The pollutant removal rates are summarised below, as calculated by the MUSIC model.

Table 5: Pollutant Export Discharge

Pollutant	Water Quality Objectives Implementation Guideline No. 7	Developed Mitigated Results
Total Suspended Solids (TSS)	80% reduction	90.4% reduction
Total Phosphorus (TP)	60% reduction	66.6% reduction
Total Nitrogen (TN)	45% reduction	46.8% reduction
Gross Pollutants (GP)	90% reduction	98.6% reduction

It is believed that the removal rates for TSS, TP, TN and GP are acceptable as these exceed the Water Quality Objectives indicated in Implementation Guideline No. 7. On this basis we believe the measures provided for this development will yield satisfactory pollutant removal. Music Results are attached in Appendix C.

It is also noted that under Brisbane City Council Guidelines, the proposed development would be classified as 'low risk', for the following reasons:

- The development is not located within a waterway corridor or Brisbane River corridor as indicated on Council Planning Scheme Maps
- The impermeable surface (excluding roof area) is approximately 1400m², less than the 2500m² trigger for high risk developments

- The development is not a subdivision and does not include industrial activities
- There are no uncovered carparks

Based on the above information, best management practices could be adopted for the site. As demonstrated above water quality modelling has been completed, which demonstrates compliance with the South East Queensland Regional Plan 2005 – 2026 – Implementation Guideline No. 7 – Water Sensitive Urban Design guidelines. It is hence believed that the site also complies with local council guidelines.

6.6 WATER QUALITY MONITORING PROGRAM

As this development discharges stormwater into the Brisbane River using stormwater quality Best Management Practices, no proposal for water quality monitoring has been made. The measures proposed for water quality and water quantity treatment are reasonably well understood and demonstrated in Brisbane. It is hence anticipated that they are acceptable here.

7. SUMMARY

From the investigations conducted, it has shown that the proposed development located at 5 – 9 Hercules Street, Hamilton can be constructed and serviced in accordance with Brisbane City Council requirements.

The Stormwater Management Plan has demonstrated that adequate treatment of stormwater quantity and quality is possible under the proposed plan. Sufficient consideration of stormwater controls has been made to demonstrate the viability of the proposed site development.

8. REFERENCES

- 1) South East Queensland Regional Plan 2005 – 2026 Implementation Guideline No. 7 – Draft Water Sensitive Urban Design: Design Objectives for Urban Stormwater Management (December 2008)
- 2) Draft Australian Runoff Quality (IEAust 2003).
- 3) Brisbane City Council (1999) – Draft Design Guidelines for Stormwater Quality Improvement Devices.
- 4) Brisbane City Council (2000) Brisbane City Council's Water Quality Management Guidelines.
- 5) Brisbane City Council (2000) Guidelines on Identifying and Applying Water Quality Objectives in Brisbane City.
- 6) Brisbane City Council (2000) – Guidelines for Sediment Basin design, Construction and Maintenance
- 7) Brisbane City Council - Draft WSRD Guidelines (2003)
- 8) Brisbane City Council - Draft Design Guidelines for Stormwater Quality Improvement Devices (1999)
- 9) Brisbane City Council (October 2003) Guidelines for Pollutant Export Modelling in Brisbane – Version 7.
- 10) Water Quality management Guidelines, Part C of Brisbane City Council (2000) Subdivision and Development Guidelines
- 11) Queensland Urban Drainage Manual (2007).
- 12) Model for Urban Stormwater Improvement Conceptualisation User Manual Version 1.00. (CRC-CH 2002).
- 13) A Bibliography of Urban Stormwater Quality (Duncan 1995)
- 14) Soil Erosion and Sediment Control Guidelines for Queensland Construction Sites (1996). The Queensland Division of the Institution of Engineers, Australia.

APPENDIX A

FIGURES AND DRAWINGS

July 2009 – 5 – 9 Hercules Street, Hamilton

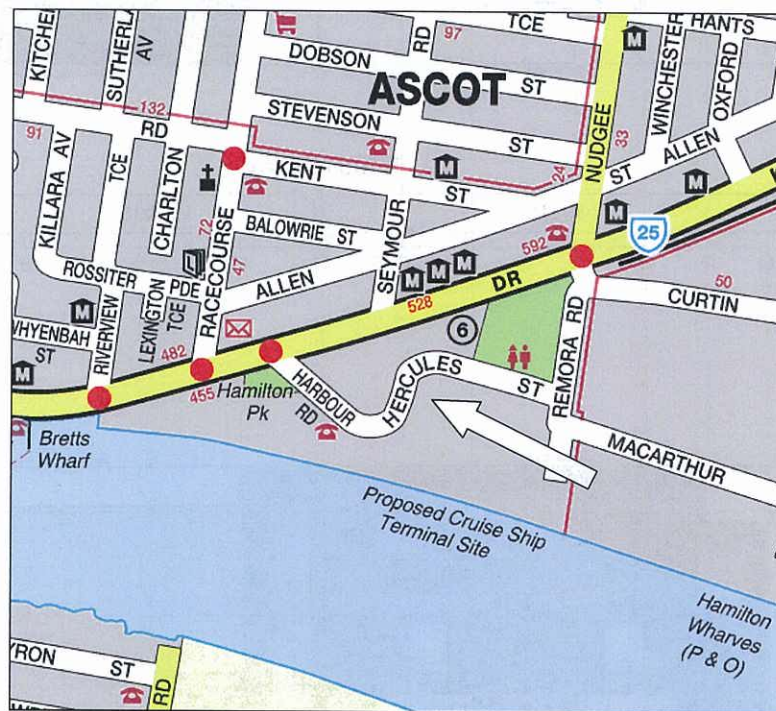
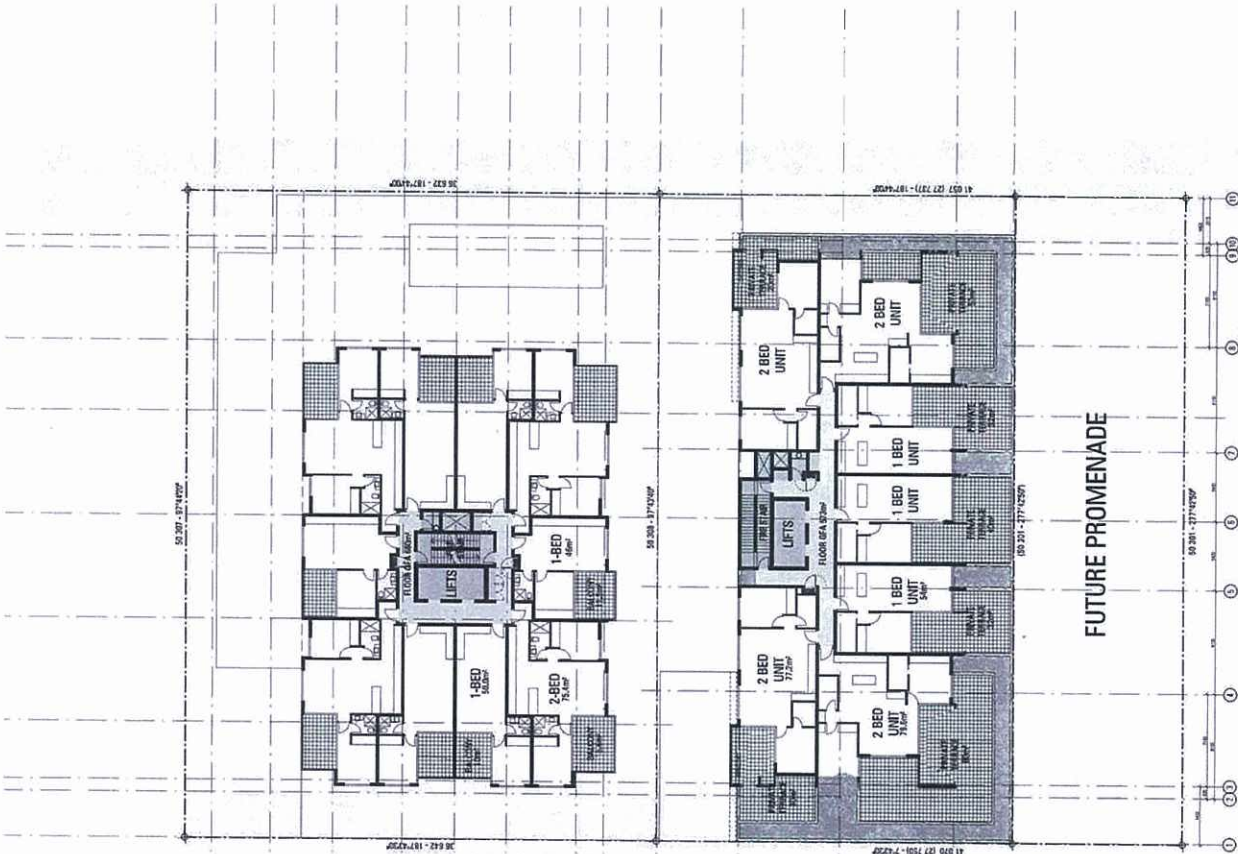
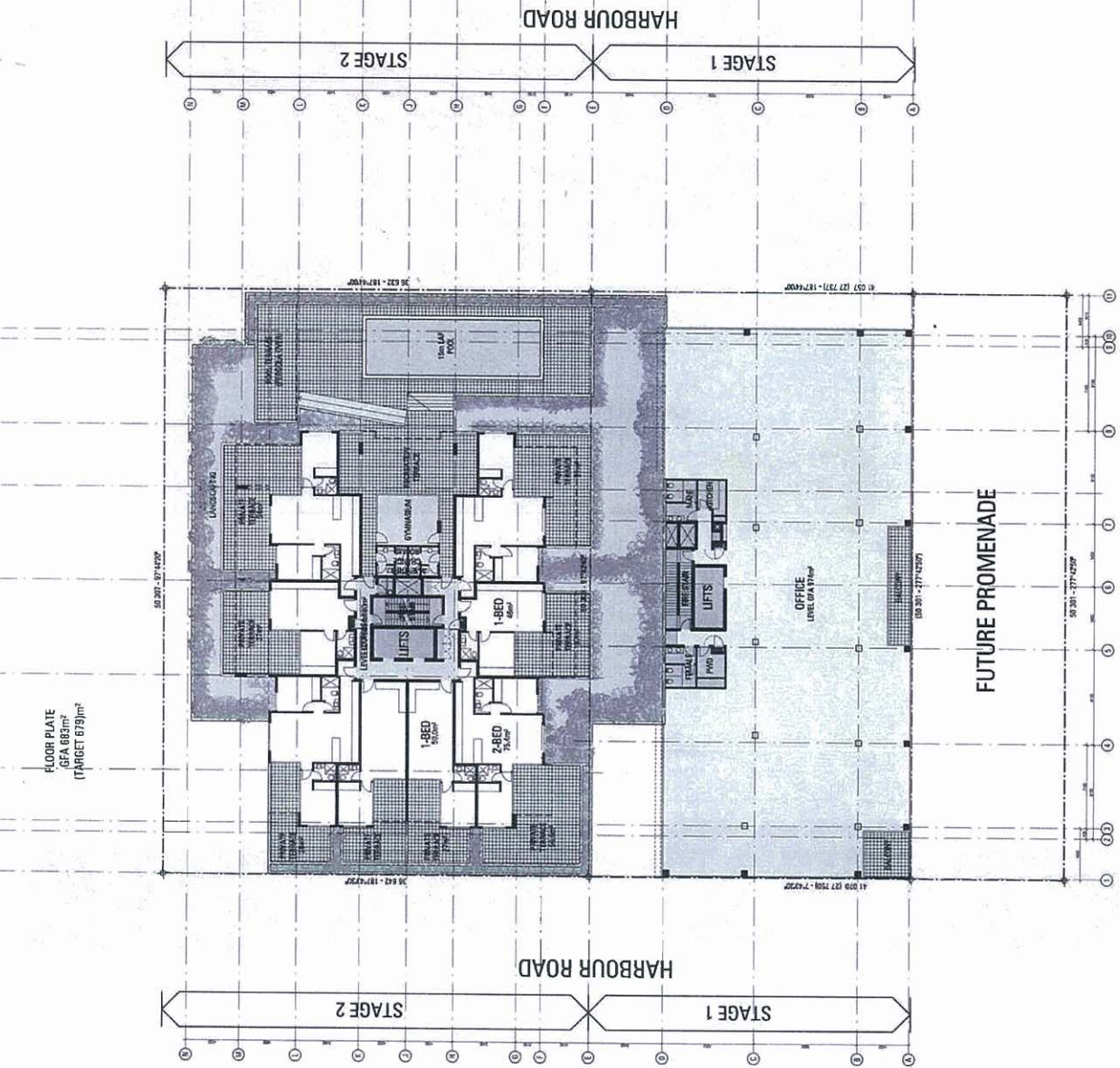


Figure 3: Locality Map

UBD Map: Brisbane UBD, Map 140 – Q18

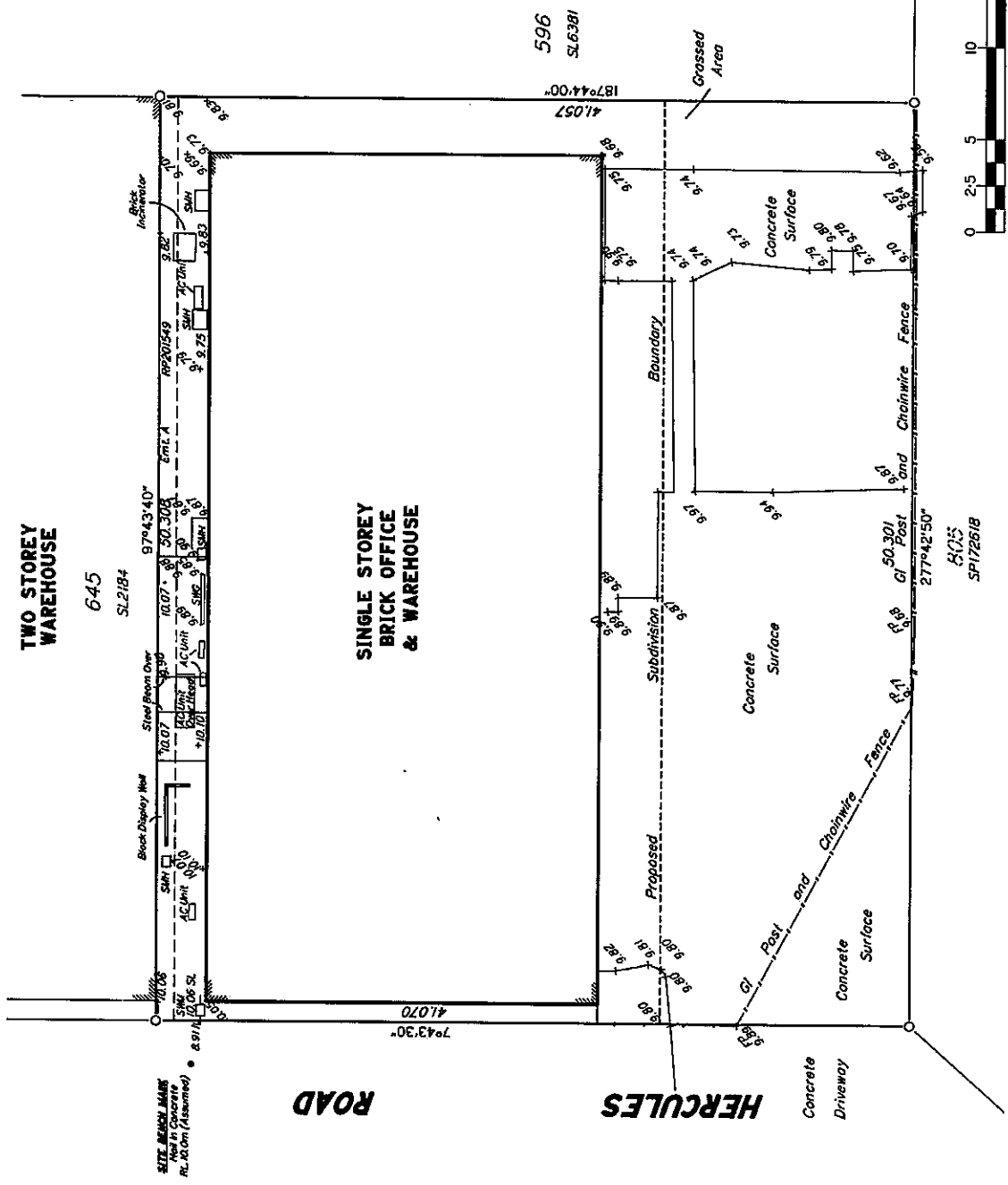


PLAN LEVEL 4
STAGE 1 TERRACE LEVEL, STAGE 2 TYPICAL TOWER

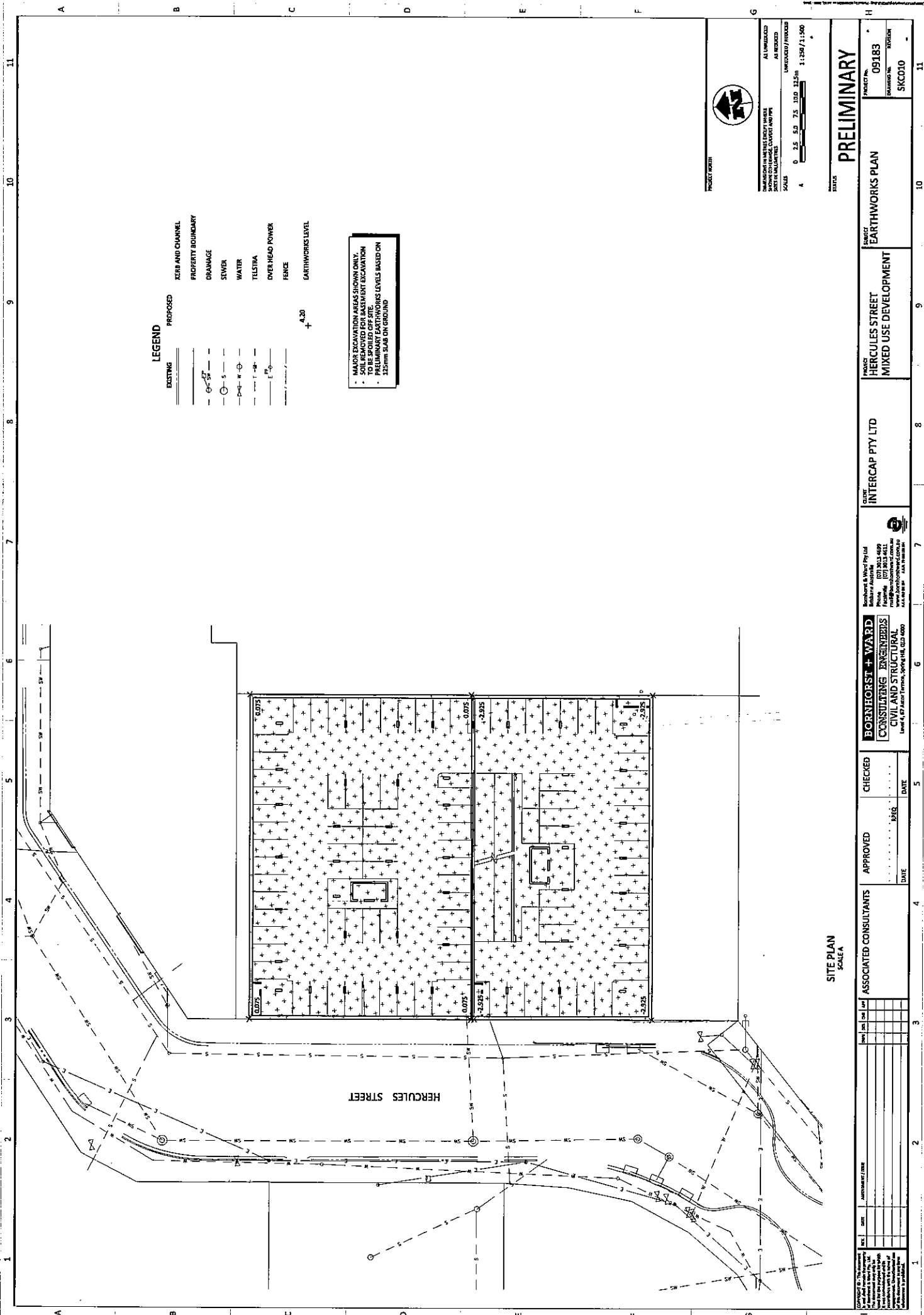


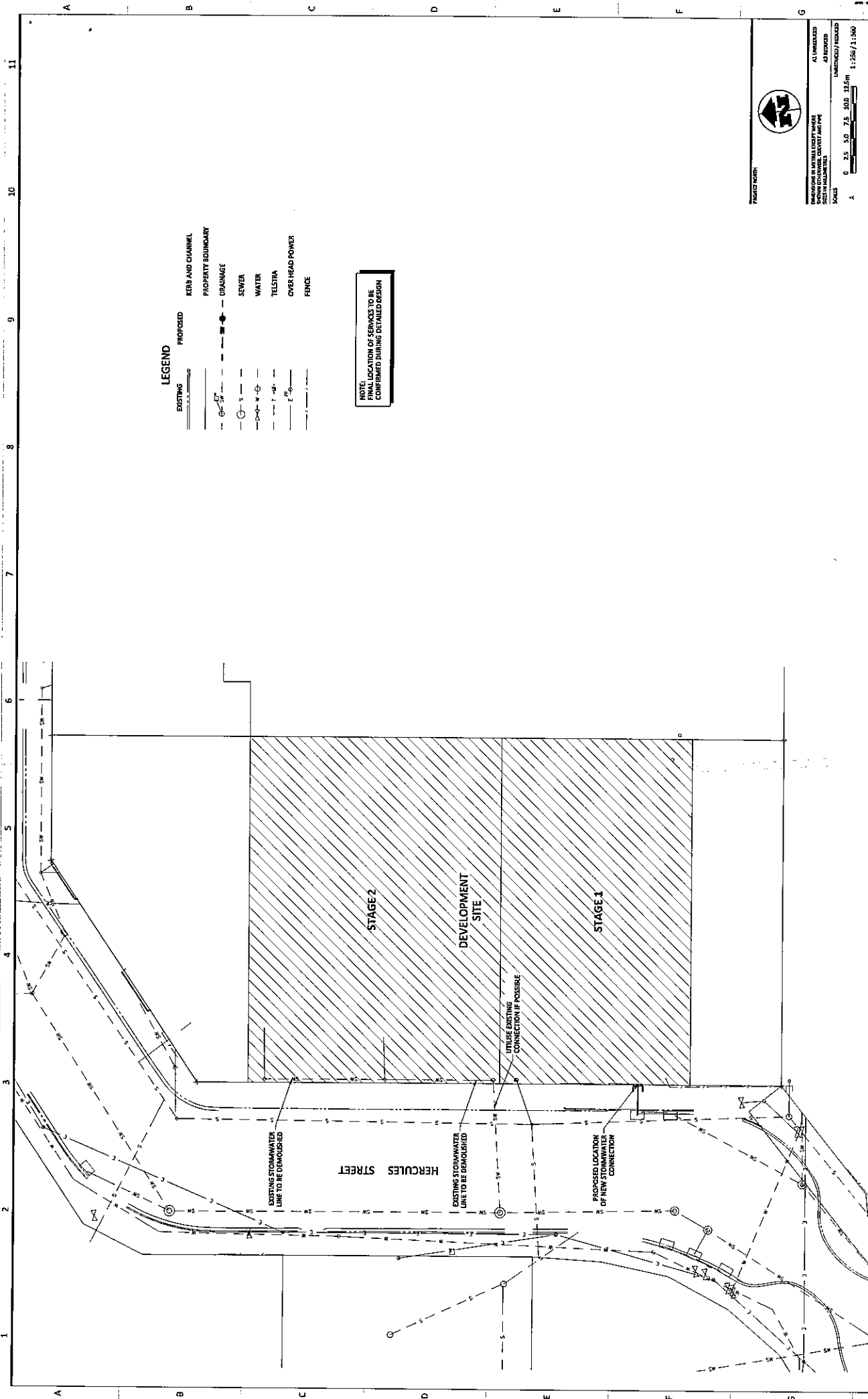
PLAN LEVEL 3
STAGE 1 OFFICES, STAGE 2 TERRACE LEVEL





Client	INTERCAP PTY LTD		Bennett & Francis Pty. Ltd. Surveying, Cartography, Computing, Mapping, Town Planning, ACN. 053 307 172 35 Peel Street, South Brisbane, Q. 4101 Phone (07) 3239 5444 http://www.bisurveys.com.au	Drawn PH F.W. PH F/B-08-010 L/B. NA File 02246501.DWG SCALE PLAN REFERENCE	Date 21/08/2008 Checked Approved Date 29/08/08
	Project 5 Hercules Street Hamilton		1:250 022465.01		





LEGEND

EXISTING	PROPOSED	
—	—	KERB AND CHANNEL
—	—	PROPERTY BOUNDARY
—	—	DRAINAGE
—	—	SEWER
—	—	WATER
—	—	TELSTRA
—	—	OVER HEAD POWER
—	—	ENCE

NOTE:
FINAL LOCATION OF SERVICES TO BE
CONFIRMED DURING DETAILED DESIGN

SITE PLAN
SCALE A

PRELIMINARY

SUBJECT
STORMWATER LAYOUT PLAN
 PROJECT NO. **09183**
 DRAWING NO. **SKC030**

**PROJECT
HERCULES STREET
MIXED USE DEVELOPMENT**

CLINT
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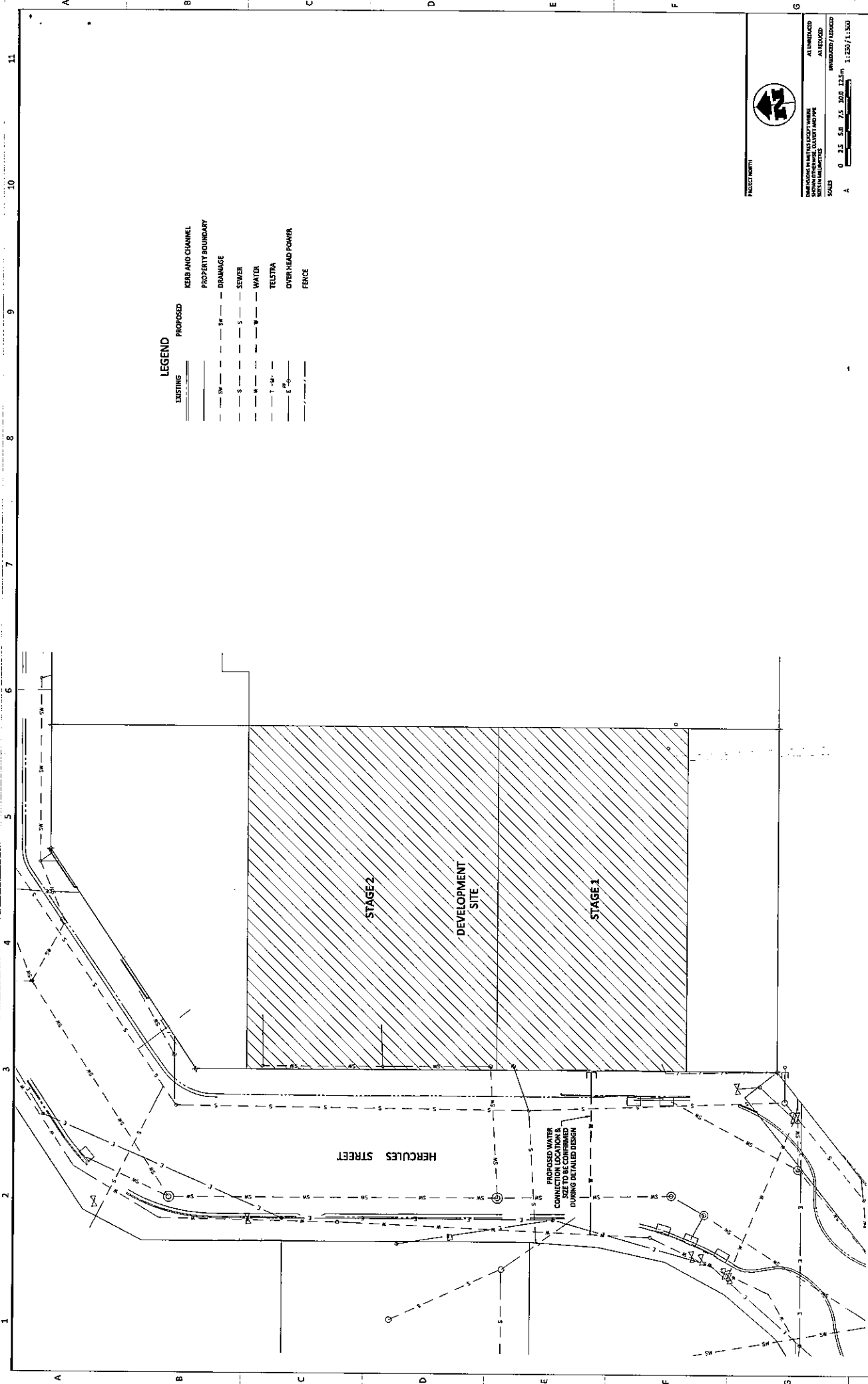
BOERNHORST + WARD
CONSULTING ENGINEERS
CIVIL AND STRUCTURAL
Level 4, 87 Astor Terrace, Spring Hill, QLD 4000

DATE	
CHECKED	

APPROVED

ASSOCIATED CONSULTANTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	52
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LEGEND

EXISTING	PROPOSED	KEYS AND CHANNEL
---	---	PROPERTY BOUNDARY
---	---	DRAINAGE
---	---	SEWER
---	---	WATER
---	---	TELSTRA
---	---	OVER-HEAD POWER
---	---	FENCE

SITE PLAN
SCALE



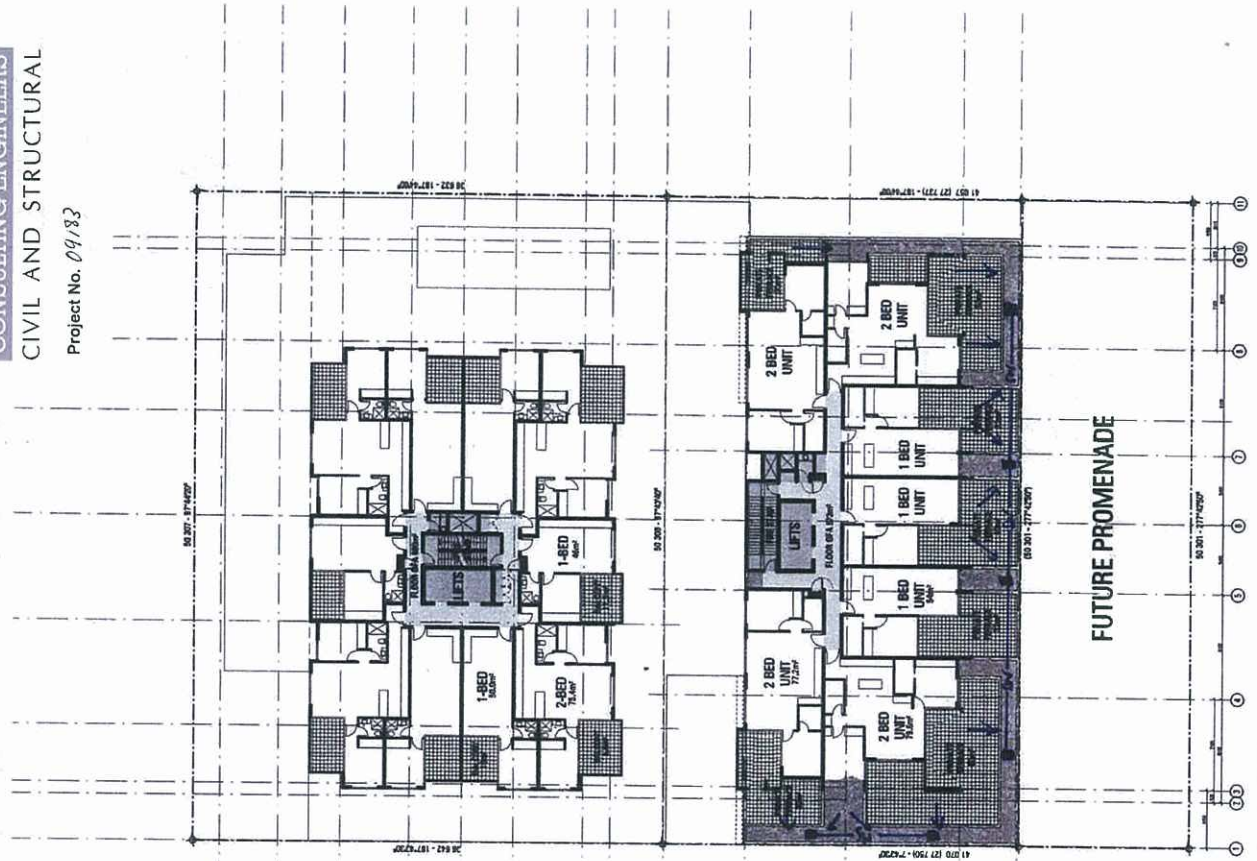
PROJECT NAME: HERCULES STREET WATER RETICULATION PLAN
 DRAWING NO: SKC060
 SCALE: 1:250 / 1:500
 DATE: 11/11/2011

PRELIMINARY

NO.	DATE	REVISION	BY	CHECKED	APPROVED	ASSOCIATED CONSULTANTS	CLIENT	PROJECT	DRAWING NO.	SCALE
1							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500
2							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500
3							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500
4							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500
5							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500
6							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500
7							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500
8							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500
9							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500
10							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500
11							INTERCAP PTY LTD	HERCULES STREET MIXED USE DEVELOPMENT	09183	1:250 / 1:500

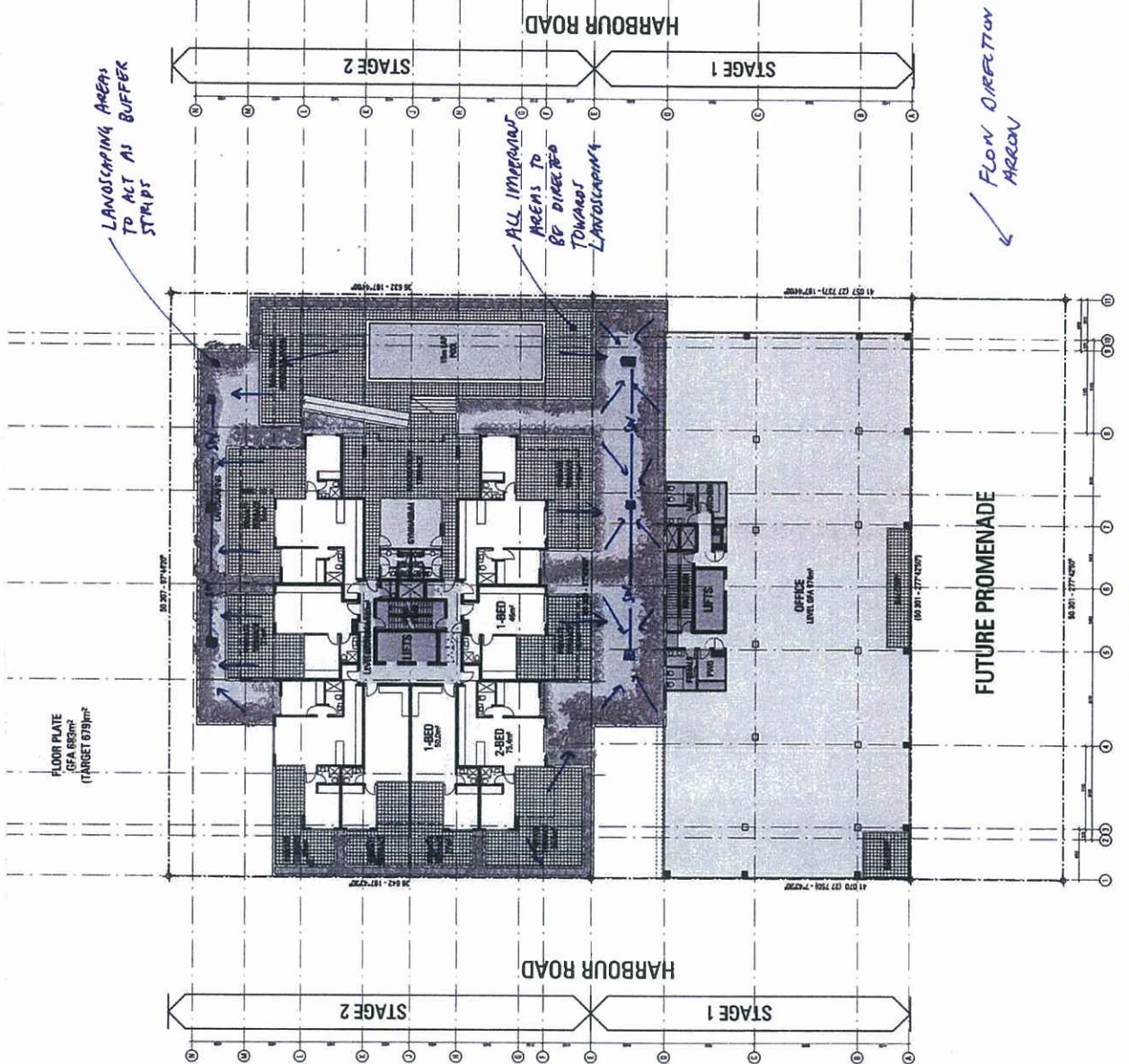
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 Australia
 Tel: (07) 3033 4611
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 Email: info@bornhorstward.com.au
 Web: www.bornhorstward.com.au

PLAN LEVEL 1



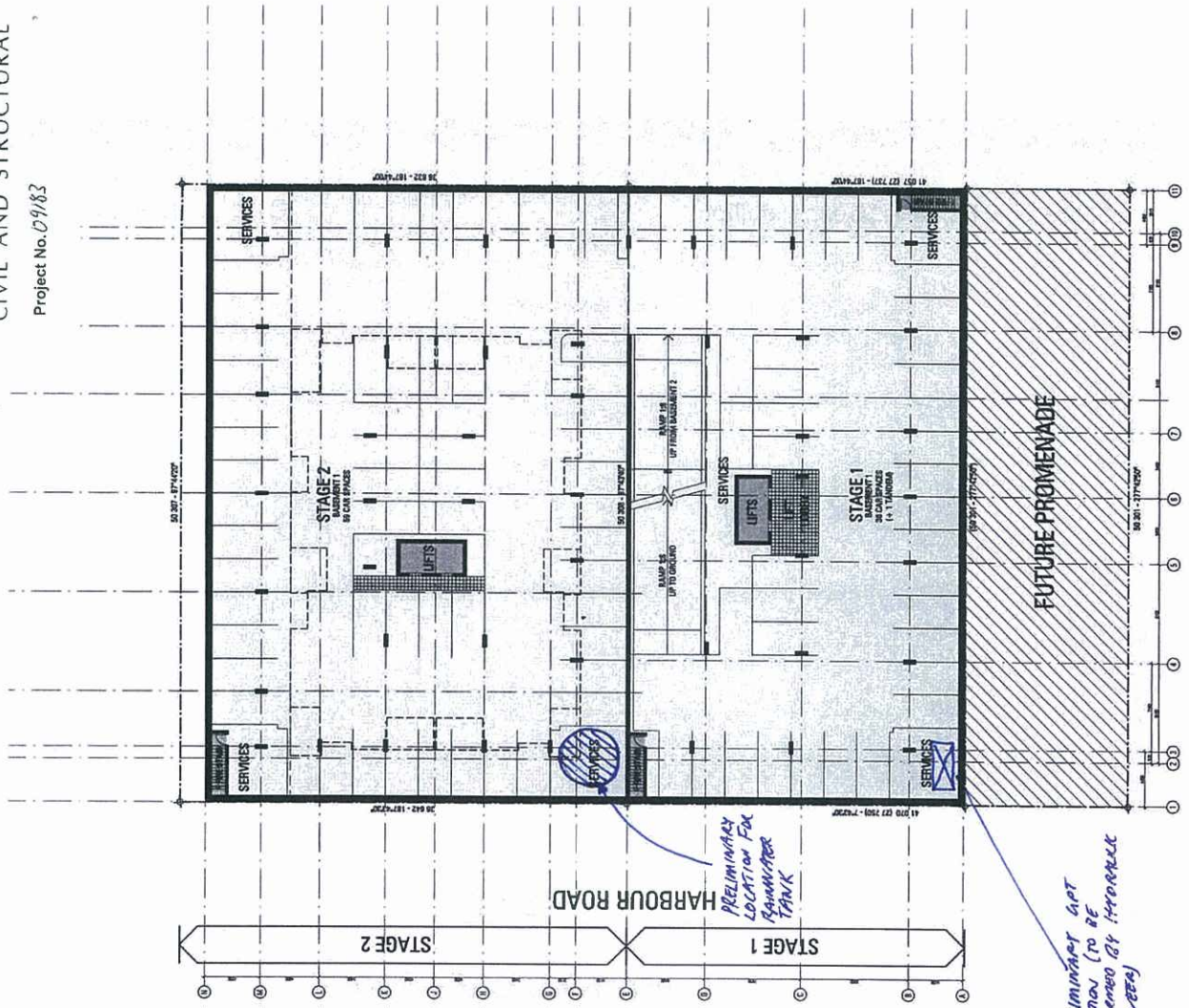
CONCEPTUAL STORMWATER LAYOUT 1

PLAN LEVEL 3

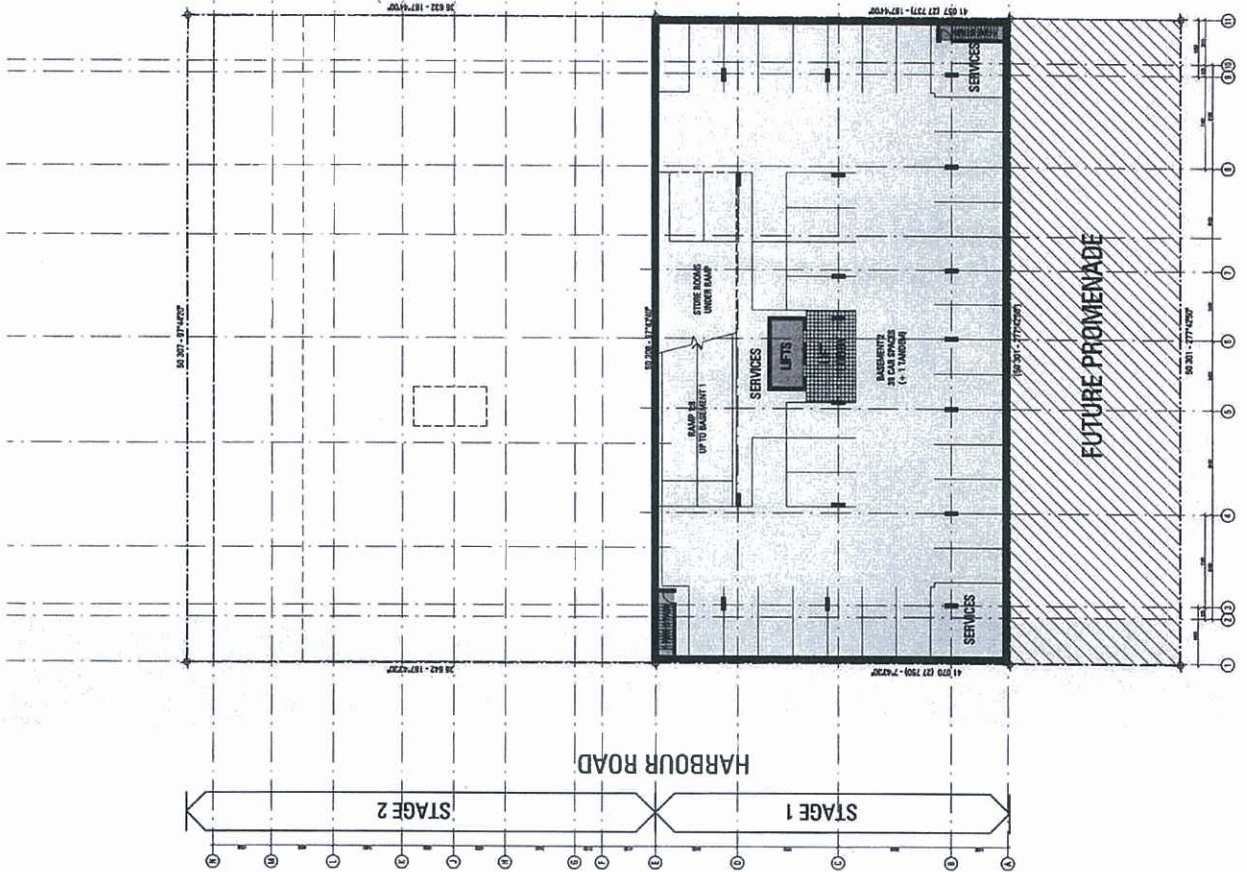


NOTE: LOCATION OF INTERIOR STORMWATER SERVICES TO BE CONFIRMED BY THE HYDRAULIC ENGINEER

BASEMENT 1



BASEMENT 2



CONCEPTUAL STORMWATER LAYOUT 2

APPENDIX B

HYDRAULIC CALCULATIONS

INITIAL PEAK FLOW CALCULATIONS

Based on QUDM 4.00 'Catchment Hydrology'
Written by BB 31/10/08

Job Number: **09183**
Job Name: **5 - 9 Hercules Street Hamilton**

IFD : Brisbane

Designed: **KR**
Checked: **NR**

BORNHORST + WARD
CONSULTING ENGINEERS
CIVIL AND STRUCTURAL

Please note:
User Data to be placed in the
Green Cells only

TOTAL RUNOFF COEFF.						
No.	Sub Catchment Area (Ha)		Runoff Coefficients		Calculated C10	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
1	0.3238	0.099	0.90	0.70		
2		0.085		0.9		
3		0.1398		0.9		
4						
5						
	0.3238	0.3238			0.90	0.84

EXISTING TIME OF CONCENTRATION					
CHANNEL/PIPE FLOW					
	Std Inlet Time				5
	Site Slope (%)				
	Flow Length (m)				
	Horton's "n"				
	Travel Time (min)				
	Travel Length (m)				
	Fall (m)				
	Travel Time (min)				
	Multiplier				
	Travel Time (min)				
	Total Time (Tc)				5.0

DEVELOPED TIME OF CONCENTRATION					
CHANNEL/PIPE FLOW					
	Std Inlet Time				5
	Site Slope (%)				
	Flow Length (m)				
	Horton's "n"				
	Travel Time (min)				
	Travel Length (m)				
	Fall (m)				
	Travel Time (min)				
	Multiplier				
	Travel Time (min)				
	Total Time (Tc)				5.0

PEAK RUNOFF CALCULATIONS

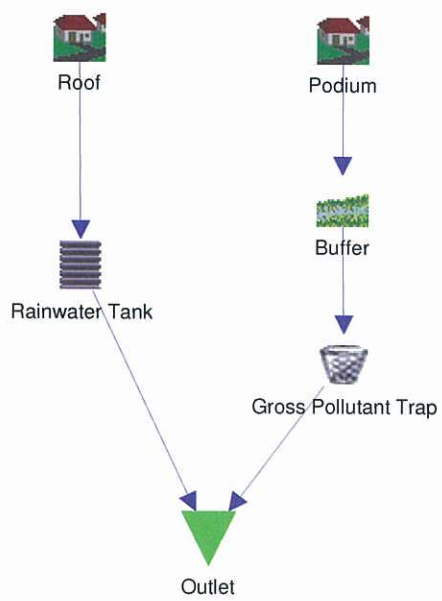
ARI Event yr	Rainfall Intensity (mm/hr)		Coefficient of Runoff		Peak Runoff Rates (m ³ /s)	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
1	117	117	0.72	0.67	0.08	0.07
2	151	151	0.77	0.71	0.10	0.10
5	191	191	0.86	0.80	0.15	0.14
10	215	215	0.90	0.84	0.17	0.16
20	248	248	0.95	0.88	0.21	0.20
50	291	291	1.00	0.96	0.26	0.25
100	325	325	1.00	1.00	0.29	0.29

PEAK FLOWS FOR FREQUENT EVENTS

ARI Event yr	% of Qi	Peak discharge (m ³ /s)	
		Existing	Proposed
1mth	25%	0.02	0.02
2mth	40%	0.03	0.03
3mth	50%	0.04	0.04
4mth	60%	0.05	0.04
6mth	75%	0.06	0.05
9mth	90%	0.07	0.06
12mth	100%	0.08	0.07

APPENDIX C

MUSIC DATA



Outlet

2/07/2009 10:49:43 Z

	Treatment Train Effectiveness				
	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	Gross Pollutants (kg/yr)
Sources	2.70	599	1.16	5.62	67.5
Residual Load	2.05	57.8	0.387	2.99	0.928
% Reduction	24.1	90.4	66.6	46.8	98.6