

Our Ref: B07195.W.01.AMcP.azh

28 February 2011

Daniel Farquhar
Seymour Group Pty Ltd
GPO Box 2487
Brisbane QLD 4001

PLANS AND DOCUMENTS
referred to in the ULDA
APPROVAL dated 2 / 10 / 2012

BROWN

ATTENTION: DANIEL FARQUHAR

Dear Sir,

**PROPOSED MIXED USED DEVELOPMENT 58-66 ABBOTSFORD ROAD BOWEN HILLS
FLOODING & STORMWATER CONSTRAINTS ASSESSMENT**

Brown Consulting (QLD) Pty Ltd was commissioned by Seymour Group to undertake a flood constraints assessment for the proposed mixed used development at 58-66 Abbotsford Road, Bowen Hills.

Assessment of flood conditions was performed with recommendations made to the proposed commercial high rise development. It is noted that the investigations were a desktop analysis based on the available flood data mainly from Brisbane City Council (BCC).

Followed by a site inspection on 21 November 2010, we based our flood analysis on review of the following documents.

- BCC FloodWise Report.
- BCC Flood Flag Map
- BCC Subdivision and Development Guidelines (2008)
- BCC eBIMAP Mapping Service
- Google Earth
- Detail and Level Survey of Lot 2 on RP133342, Lot 1 on RP127538, and Lot 1 RP155441 provided by Aurecon Australia Pty Ltd (Drawing No. 005-SU1) shown in **Attachment A**.

The development site is located to the west of the intersection of Abbotsford Road and Folkestone Street. This intersection is a sag in the road network with minimal stormwater infrastructure. A 750mm diameter RCP drains the intersection. Preliminary investigations indicate the site is beyond the Regional River and Storm Surge level of RL 2.5m AHD.

Local flood conditions for the site and adjacent properties have been determined for this sag and low point Abbotsford Road. This has been undertaken by:

- Determining peak flows for a range of Average Recurrence Intervals (ARIs) using the Queensland Rational Method in accordance with the BCC Subdivision and Development Guidelines (2008);
- Estimate the full pipe capacity of the existing 750mm RCP and determine the overland flow by subtracting the piped flows from the total peak flows derived from the Rational Method; and
- Calculating preliminary flood levels using first order analysis (Manning's and weir calculations).

The catchment to the low point adjacent to the site encompasses an area of 15.25ha. Various land uses are identified in the catchment; multi purpose centre, low medium density residential, and community use area. The peak flows determined at the downstream extent of the site are summarised in **Table 1** below and detail calculations are presented in **Attachment B**. For this analysis, we have ignored the two minor pipelines (300mm diameter) firstly at the intersection of Folkestone Street and Cintra Road and secondly at the southern end of Cintra Road. This is considered conservative assumption.

Table 1: Peak Flows

ARI	Total Peak Flow (m ³ /s)
5	4.33
20	6.28
50	8.01
100	8.94

The capacity of the piped stormwater drainage at the sag in Abbotsford Road was determined from hydraulic grade line calculations based on high tail water level within Perry Park. Using the peak overland flow values the corresponding flood levels over the site and adjacent properties were determined. Analysis occurred at the cross section shown in **Figure 1** below and detailed calculations are presented in **Attachment C**. This cross section corresponds to the fence line along the Perry Park and is considered critical boundary conditions dictating flood levels at the low point in Abbotsford Road. Surface levels for this cross section were extracted from survey provided by Aurecon Australia Pty Ltd.

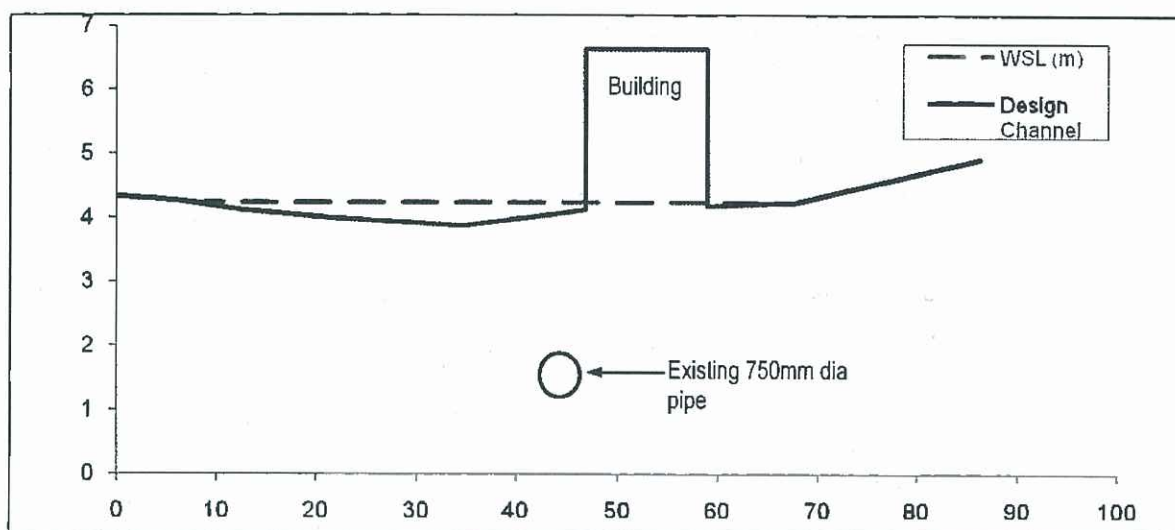


Figure 1. Cross-section of the Weir, showing Flood levels for 50 year ARI

The following preliminary flood levels shown in **Table 2** below were determined from Weir flow calculations. Please note due to high tailwater level and wide weir the flood levels are similar for each scenario with or without pipelines.

Table 2: Preliminary Flood Levels

ARI	Flood Levels		
	With Pipe	Pipe 50% Blocked	Without Pipe
5	4.12	4.14	4.16
20	4.18	4.2	4.21
50	4.22	4.24	4.25
100	4.24	4.26	4.27

Minimum floor levels for the proposed development have been determined in accordance with Section 2 of the Subdivision and Development Guidelines. The proposed development involves the intensification of land use.

Minimum design floor levels have been determined in accordance with Tables A1.2, A1.3 and Section 2.3.3 of the guidelines. Two development proposals are being considered for development site, however in both options, the lower floor levels are commercial development (office and retail) that is class 5 or 6 Building Code. Based on a Building Code, the immunity levels for the proposed building are summarised in **Table 3** below.

Table 3: Flood Impact Building Immunity Levels

Feature	Local Flooding
Building Floor Level (Category C)	RL 4.25m AHD
	50 Year ARI
Underground carpark Entry* (Category C)	RL 4.27m AHD
	100 Year ARI
Vehicular Access/ manoeuvring Areas (Category D)	RL 4.25m AHD
	50 Year ARI
Accessibility Required (Local/Industrial Access)	RL 4.21m AHD
	20 Year ARI

* Basement car parks can be constructed to below the specified levels provided that suitably waterproofed perimeter walls, air vents, and entry/exit ramps at the carpark entrance are above the Define Flood Level (DFL) for Brisbane River and 100 year ARI flood levels for all the other flooding sources (BCC Guidelines).

Concerning accessibility, BCC Guidelines require roadway access within 200m, which achieves the immunity standards Table A1.6. is flood free within 200m of the proposed driveway.

BCC Guidelines indicate the acceptable degrees of hazard are inundation depth $\leq 0.5\text{m}$, flow velocity of $\leq 2.0\text{m/s}$, and depth velocity product $\leq 0.6\text{m}^2/\text{s}$. Abbotsford Road has ponding depth less than 500mm in the 100 year ARI event. The velocity in the sag is near zero and depth velocity product is lower than the criteria. Therefore site complies with the BCC Guideline.

Based on flood criteria for class 5 and 6 building the minimum floor level required is RL 4.25m and there is suitable access to and from the site during flood events. The lowest shop floor level is at 4.8m AHD, therefore, complying with BCC's requirements.

It is revealed from the latest architectural drawing No. 3013-DA 24&25 that the ground level is at RL4.8m, thus, a freeboard of 530mm is provided for the driveway entry for the 100-year ARI flood event. Thus, it is compliant with Council's Subdivision and Development Guidelines.

Building near Stormwater and Sewer Infrastructure

The existing buildings are already situated over existing infrastructure. A 675mm diameter sewer pipeline crosses the site. The pipeline is approximately 10 metres deep. It may be possible to build over the existing sewer line if it can be ensured that no load is placed on the sewer. However Qld Urban Utility may require the existing sewer to be replaced or relocated, depending on age and condition. This would create further constraints for the development due to the proximity of adjacent buildings.

BCC eBIMAP indicates a stormwater pipeline also crosses the site, refer to **Attachment D**. Invert levels of this pipeline however are unknown. This stormwater pipeline may need to be relocated due to possible conflicts with the lower basement levels.

It is recommended before detailed design that further investigation of the stormwater infrastructure be undertaken, this will assist with design and compliance with BCC guidelines. The following details are required as per BCC Subdivision and Development Guidelines, for building over/near stormwater facilities;

1. *Pipe Survey*: Before further development proceeds a CCTV inspection report and video of the pipelines should be compiled to review the current conditions of the pipe drainage network underneath the existing building.
2. Determine levels of pipelines.
3. *Pipe Rehabilitation*: Following the pipe survey pipe rehabilitation works may be required.
4. *Access and Clearance*: Access to the existing and proposed stormwater infrastructure should be maintained.
5. *Foundation Clearance*: During the design of the new infrastructure impact on existing building need to be addressed.

Conclusion

In conclusion, this site is constrained by flooding and existing infrastructure. The development will need to be designed to ensure no adverse impact on adjoining sites and buildings. Minimum floor levels and carparking entry levels shall be design to maintain appropriate flood immunity.

We trust the information provided within this document is satisfactory and await your further instruction.

Yours faithfully

BROWN CONSULTING (QLD) PTY LTD



Andrew McPhail
Manager – Water and Environment

Encl.

List of Attachments

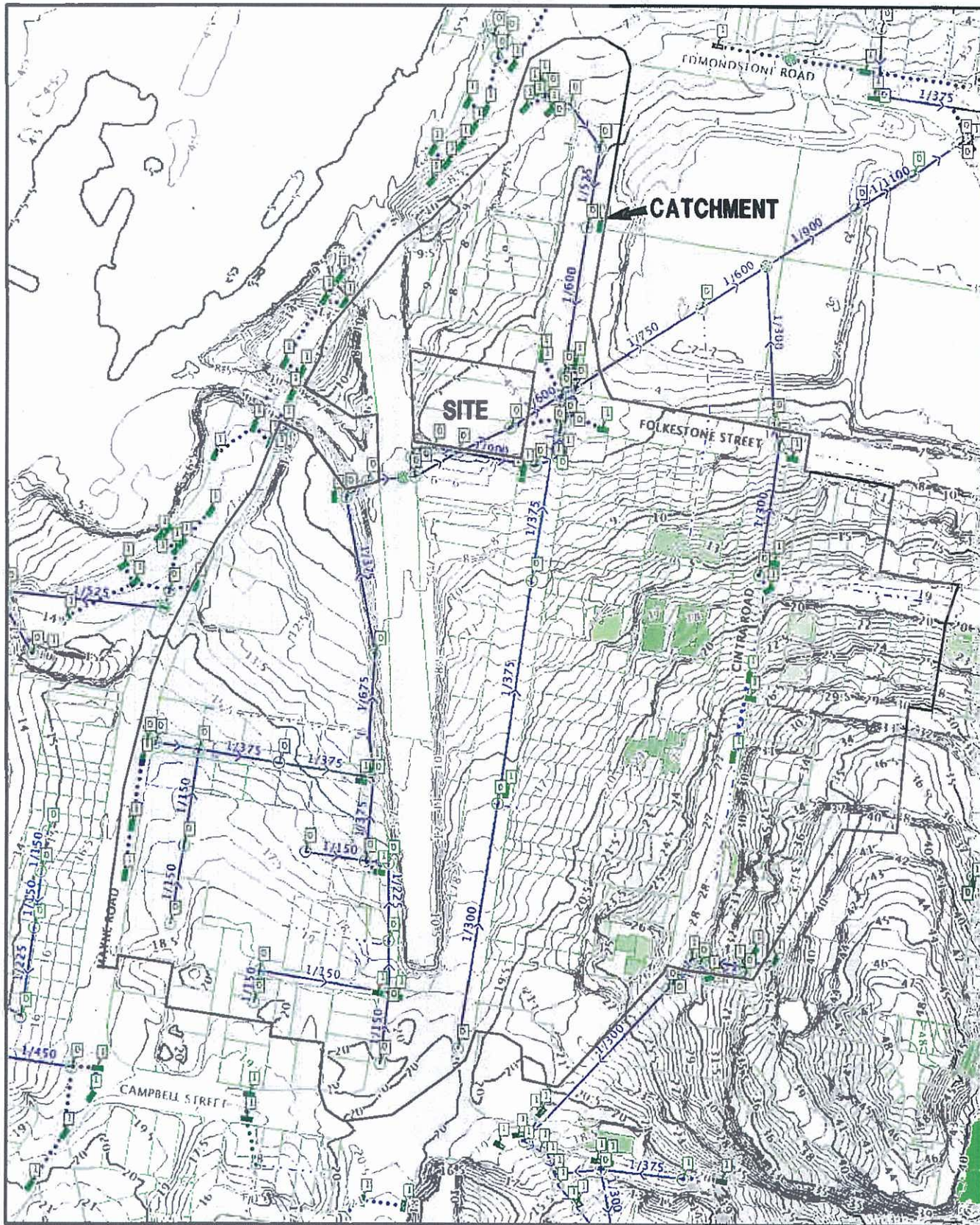
Attachment A:	Survey Plan
Attachment B:	Hydrology Analysis
Attachment C:	Hydraulic Analysis
Attachment D:	BCC e-BIMAP Service Indicating Pipelines under Building

ATTACHMENT A: SURVEY PLAN

ATTACHMENT B: HYDROLOGY ANALYSIS

Catchment Plan

Rational Method Calculations for upstream Catchment



Bowen Hills

Date : 20/12/2010

User : brownbris#414348

Scale = 1:2,000

Metres 50 100

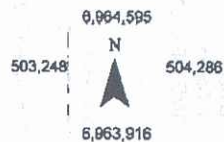
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Location :



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URBAN CHANNEL FLOW CALCULATIONS - CATCHMENT

File: H:\B07\150-199\B07195.W\Stormwater\B07195.W Rational Method Calculations - IFD.xls\Catchment B

Date: 1/03/2011

Job: B07195.W

By: TS

Locality: BCC

IFD Ref: IFD_BCC

IFD Source: BCC Subdivision and Development Guidelines Part B (2008)

TIME OF CONCENTRATION CALCULATIONS

Reference	Equation Type / Method	Area (ha)	Length (m)	Av. Slope (%)	Pipe Diameter (mm)	Velocity (m/s)	Wetted Area (m ²)	Wetted Perimeter (m)	Hydraulic Radius R	Slope Modifier	Roughness (Mannings/ Hortons)	Sub Total (mins)	tc (min)
Table 4.06.1 QUDM	QUDM Standard Inlet Times	15.25		4.4								13	
4.06.3 a(iii) QUDM	Assumed Pipe Flow Velocity		424			2.5						3	16
												Adopted tc	16

C10 VALUE

Select Development Category

Table B2.2 BCC Subdivision and Development Guidelines

SELECT DEVELOPMENT CATEGORY!
Development Category

f_i 0.9
I₁₀ (mm/hr) 70

C10

#N/A

Multi Purpose Centre area in Cat. B (ha) = 6.1
LMR area in Cat. B (ha) = 8.35
Community use in Cat. B (ha) = 0.8
Total Area (ha) = 15.25

C10 Value for Multipurpose area = 0.9
C10 Value for LMR area = 0.87
C10 Value for Community use area = 0.87

Adopted C10 0.882

FLOW CALCULATIONS

4.03.1 QUDM

Queensland Rational Method

Adopted Time of Concentration (mins) 16

ARI	Cy	t _{cy}	A (ha)	Q (m ³ /s)
1	0.71	73	15.3	2.18
2	0.75	95	15.3	3.02
5	0.84	122	15.3	4.33
10	0.88	138	15.3	5.16
20	0.93	160	15.3	6.28
50	1.00	189	15.3	8.01
100	1.00	211	15.3	8.94

ATTACHMENT C: HYDRAULIC ANALYSIS

- C1 Weir Calculation for 50 year ARI with 750mm diameter Pipe
- C2 Weir Calculation for 50 year ARI with 50% blocked 750mm diameter Pipe
- C3 Weir Calculation for 50 year ARI without 750mm diameter Pipe

C1 WEIR CALCULATIONS WITH PIPE

Filename: H:\B07150-199\B07195.W\Stormwater\B07195.W Weir Cals.xls|Weir Calc With Pipe
Date: 1/03/2011
By: TS

58-66 Abbotsford Road, Bowen Hills

50 Y ARI
WSL (m)

4.22

Pipe Details

U/S WSL (m)	Chainage	RL (m)	Weir Coefficient	P (m)	D (m)	Q (m ³ /s)	wA (m ²)	V (m/s)	V D (m ² /s)
4.221	0	4.34				1.57			
2.22	1	6.61							
2.021	2	4.26		4.02	0.05	0.066	0.18	0.36	0.02
77.667	3	4.13		9.60	0.16	0.988	1.51	0.66	0.10
1	4	4		12.78	0.29	3.283	3.67	0.89	0.26
0.75	5	3.87		9.77	0.25	2.065	2.46	0.84	0.21
0.442	6	44.43		4.13	0.12	0.170	0.29	0.58	0.07
	7	46.81		2.38	0.05	0.000	0.00	0.36	0.02
	8	46.82		6.63	0.02	0.000	0.00	0.21	0.00
	9	58.88		4.19	0.02	0.016	0.08	0.21	0.00
0.013	10	58.89		4.25	4.75				
0.5	11	67.77		4.92					
9.81	12	86.36							
	13								
	14								
Q Inlet (m ³ /s)	15								
Q Outlet (m ³ /s)	16								
	17								
	18								
	19								
	20								
	21								
	22								
	23								
	24								
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	48								

Controlling

Pipe Flow (m³/s)

Box 1 Details

Width
No.
Dia (m)
Height (m)
Area (m²)
Invert Level (RL)
Inflow Level (RL)

Box Flow (m³/s)

Box 2 Details

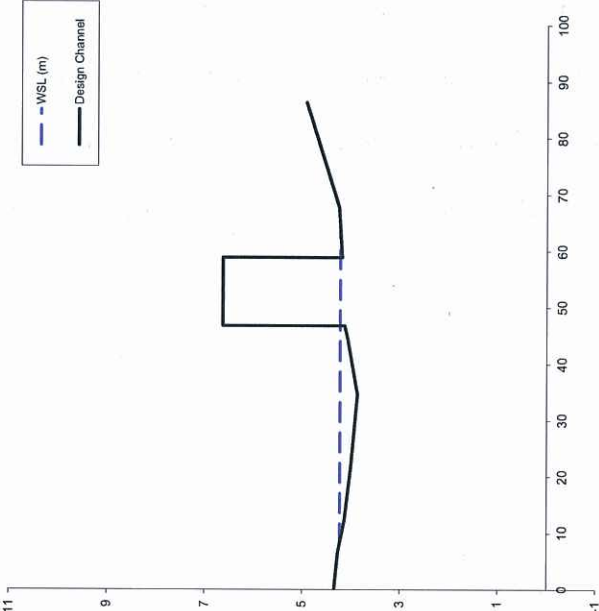
Width
No.
Dia (m)
Height (m)
Area (m²)
Invert Level (RL)
Inflow Level (RL)

Box Flow (m³/s)

Weir Flow (m³/s)

Results

Total Flow (m³/s)
Actual Flow (m³/s)
% Difference



C2 WEIR CALCULATIONS WITH PIPE 50% BLOCKED

Filename: H:\B071150-199\B07195.W\Stormwater\B07195.W Weir Calc.xls Weir Calc With Pipe 50%
Date: 1/03/2011
By: TS

58-66 Abbottsford Road, Bowen Hills

50 Y ARI

WSL (m)

4.24

Pipe Details

U/S WSL (m)

TW (m)

H (m)

L (m)

No. Cells

Dia (m)

A (m²)

U/S IL

D/S IL

n

ke

g (m/s²)

Q Inlet (m³/s)

Q Outlet (m³/s)

Pipe Flow (m³/s)

Box 1 Details

Width

No.

Dia (m)

Height (m)

Area (m²)

Invert Level (RL)

Inflow Level (RL)

Box Flow (m³/s)

Box 2 Details

Width

No.

Dia (m)

Height (m)

Area (m²)

Invert Level (RL)

Inflow Level (RL)

Box Flow (m³/s)

Weir Flow (m³/s)

Results

Total Flow (m³/s)

Actual Flow (m³/s)

% Difference

Weir Details

Chainage

0

6.61

12.28

21.88

34.66

44.43

46.81

46.82

58.88

58.89

67.77

86.36

Weir Coefficient

P (m)

4.74

9.60

12.78

9.77

2.38

0.00

0.00

0.02

7.19

0.02

1.67

Q (m³/s)

0.100

1.160

3.570

2.271

0.205

0.000

0.000

0.046

WA (m²)

0.26

1.67

3.88

2.62

0.33

0.00

0.00

0.00

0.17

V (m/s)

0.39

0.70

0.92

0.87

0.62

0.39

0.26

0.26

VD (m²/s)

0.02

0.12

0.28

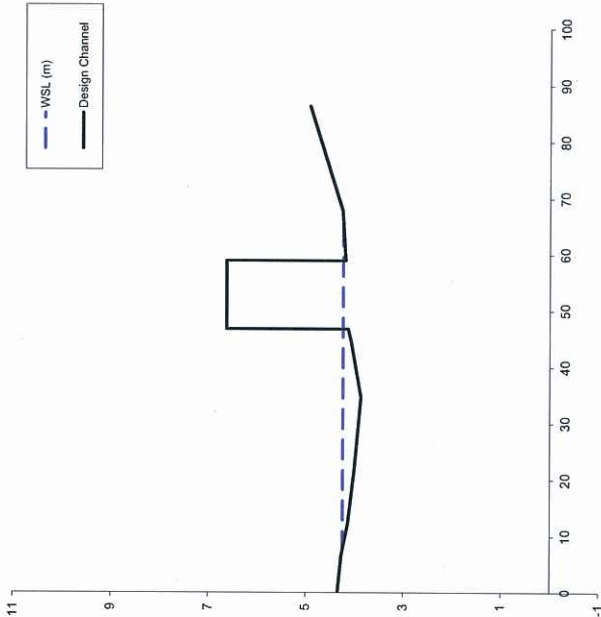
0.23

0.09

0.02

0.01

0.01



C3 WEIR CALCULATIONS WITHOUT PIPE

Filename: H:\B07150-199\B07195.W\Stormwater\B07195.W Weir Calcs.xls\Weir Calcs Without Pipe
Date: 1/03/2011
By: TS

58-56 Abbotsford Road, Bowen Hills

50 Y ARI

WSL (m)

4.25

Pipe Details

U/S WSL (m)	1
TW (m)	2
H (m)	3
L (m)	4
No. Cells	5
Dia (m)	6
A (m ²)	7
U/S IL	8
D/S IL	9
n	10
ke	11
g (m/s ²)	12

Q Inlet (m ³ /s)	13
Q Outlet (m ³ /s)	14

Pipe Flow (m³/s)

0.00

Box 1 Details

Width	20
No.	21
Dia (m)	22
Height (m)	23
Area (m ²)	24
Invert Level (RL)	25
Inflow Level (RL)	26
	27
	28

Box Flow (m³/s)

0.00

Box 2 Details

Width	31
No.	32
Dia (m)	33
Height (m)	34
Area (m ²)	35
Invert Level (RL)	36
Inflow Level (RL)	37
	38
	39
	40
	41
	42
	43
	44
	45
	46
	47
	48

Box Flow (m³/s)

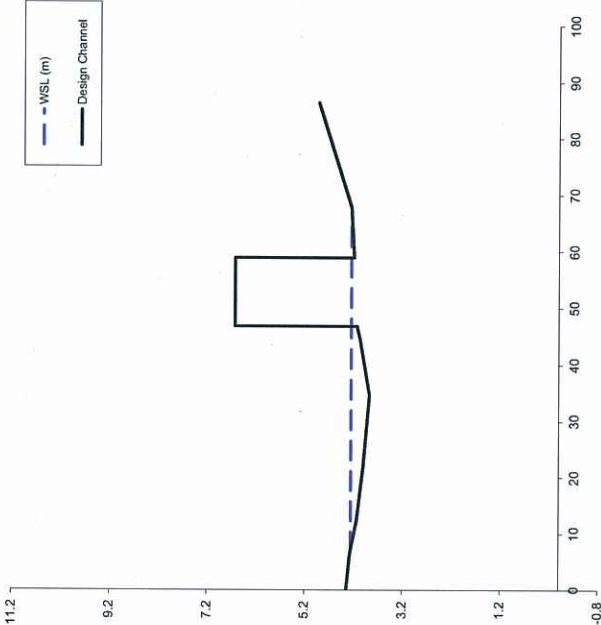
0.00

Weir Flow (m³/s)

8.01

Results	
Total Flow (m ³ /s)	8.01
Actual Flow (m ³ /s)	8.01
% Difference	0.02%

Weir Details		Weir Coefficient		Q (m ³ /s)	wA (m ²)	V (m/s)	V.D (m ² /s)
Chainage	RL (m)	P (m)	D (m)				
0	4.34			1.67			
6.61	4.26	5.33	0.06	0.134	0.33	0.41	0.03
12.28	4.13	9.60	0.19	1.297	1.80	0.72	0.14
21.88	4	12.78	0.32	3.811	4.05	0.94	0.30
34.66	3.87	9.77	0.28	2.445	2.76	0.89	0.25
44.43	4.07	2.38	0.15	0.236	0.36	0.65	0.10
46.81	4.13	0.00	0.06	0.000	0.00	0.41	0.03
46.82	6.63						
58.88	6.63						
58.89	4.19	0.00	0.03	0.000	0.00	0.29	0.01
67.77	4.25	8.88	0.03	0.085	0.29	0.30	0.01
86.36	4.92	0.06	0.00	0.000	0.00	0.05	0.00



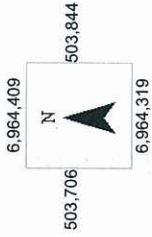
ATTACHMENT D: BCC E-BIMAP SERVICE INDICATING PIPELINES UNDER BUILDING

Abbotsford Rd

Date : 10/01/2011
User : brownbri#418690

Scale = 1:500
Metres 10 20

Location :



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