

APPENDIX M

Limited Flood Study and Stormwater Plans

30 September 2016
Ref: 40813.02

KML Joint Venture
C/o Coeve Design
PO Box 1107
NEWCASTLE NSW 2300

Attention: Mr Charles De Bono

Dear Sir,

Limited Flood Study Investigation

**Re: Lots A and B DP 339105, Lot 8 DP 12898, Lot B
DP 400644 and Lot 1 DP (Unregistered) No 38 – 40
Brooks Parade, Belmont**

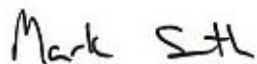
This report presents the results of our Flood Study Investigation undertaken at Lots A and B DP 339105, Lot 8 DP 12898, Lot B DP 400644 and Lot 1 DP (Unregistered) No 38 – 40 Brooks Parade, Belmont.

The purpose of this investigation was to assess the site and surrounding areas in order to determine parameters suitable for use in the estimation of flood levels on and around the subject site. This investigation was undertaken in accordance with Australian Rainfall and Runoff and Lake Macquarie City Council guidelines.

If you have any further enquiries please do not hesitate to contact the undersigned.

Yours faithfully,

Forum Consulting Engineers

A handwritten signature in black ink that reads "Mark Smith".

Mark Smith

Environmental Engineer
B.E. (Environmental)

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1. Photographs 1 – 7
2. Topographic Survey
3. DRAINS Output Files



1. Introduction

At your request Forum Consulting Engineers (Forum) have carried out a Limited Flood Study Investigation at Lots A and B DP 339105, Lot 8 DP 12898, Lot B DP 400644 and Lot 1 DP (Unregistered) No 38 – 40 Brooks Parade, Belmont.

The purpose of this investigation was to determine:

- Upslope developed catchment areas;
- Calculate flowrates for various storm events;
- Determine existing flood levels on and within the area surrounding the site for various storm events and tailwater levels;
- Determine flood levels for the proposed development for various storm events and tailwater levels.
- Determine the influence the proposed development will have on current flood characteristics and surrounding properties.

The catchment runoff volumes and velocities along with the determination of flood levels on and around the site was undertaken using the DRAINS software program version 2014.04

2. Site Survey

A topographical survey of the site and surrounding area was undertaken by Bernie de Witt Consulting and details were provided in their drawing 018DET4/1 dated 2 April 2003.

As required, further topographic survey was undertaken by Forum Engineering.

3. Site and Surrounding Area Description

The subject site was located on the eastern side of Brooks Parade, Belmont. The site is bordered by Brooks Parade to the west, Edgar Street to the east, by a concrete lined open drain and commercial/residential buildings to the north and by residential dwellings to the south. The concrete lined open drain was also located in the northwestern portion of the site and adjacent to the northern site boundary.

At the time of the catchment analysis, the site supported a series of commercial and residential buildings, associated buildings and maintained and unmaintained gardens.

The concrete lined open drain conveyed stormwater flows from the upslope catchment to Lake Macquarie, approximately 30 – 40m to the west of the subject site. Approximately 100m



upslope of the site, the concrete lined open drain was located within an open easement approximately 15m in width before being confined to only the width of the concrete lined drain adjacent to the northwestern boundary of the subject site.

Three 600mm high x 1300mm wide concrete culverts are located beneath the Edgar Street road pavement. Localised surface slopes direct overland flow upslope of and within the Edgar Street road reserve towards the concrete lined open drain and along Edgar Street road pavement to the south of the site.

Adjacent to the existing site, flows were restricted by existing residential dwellings and other infrastructure within private properties and public lands on either side of the concrete lined open drain. To provide worst case flood levels, it was modelled with structures remaining to constrict flows.

Figure 1 below shows the location of the site and the concrete lined open drain upslope of and adjacent to the subject site.

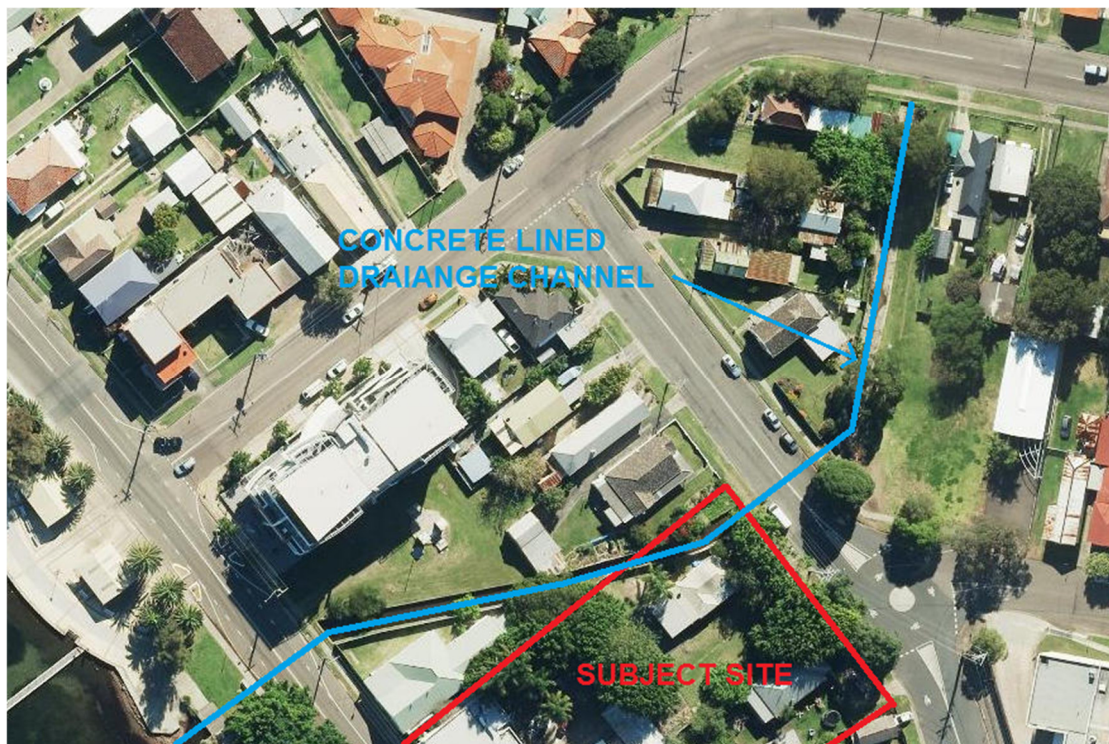


Figure 1: Concrete lined open drain

4. Catchment Description

Estimation of upslope catchment areas was undertaken using NSW Government Land and Property Management Authority's "Swansea Topographic and Orthophoto Map 1:25,000" and



“Six Maps” as well as a visual assessment of the site, surrounding areas and catchment areas.

The catchment area upslope of the site contains primarily residential developments with a small portion containing Belmont High School and isolated commercial buildings. The upslope catchment was estimated to be approximately 28.9 hectares. Based on the primarily residential use, it was assumed that the catchment would be approximately 60% impervious.

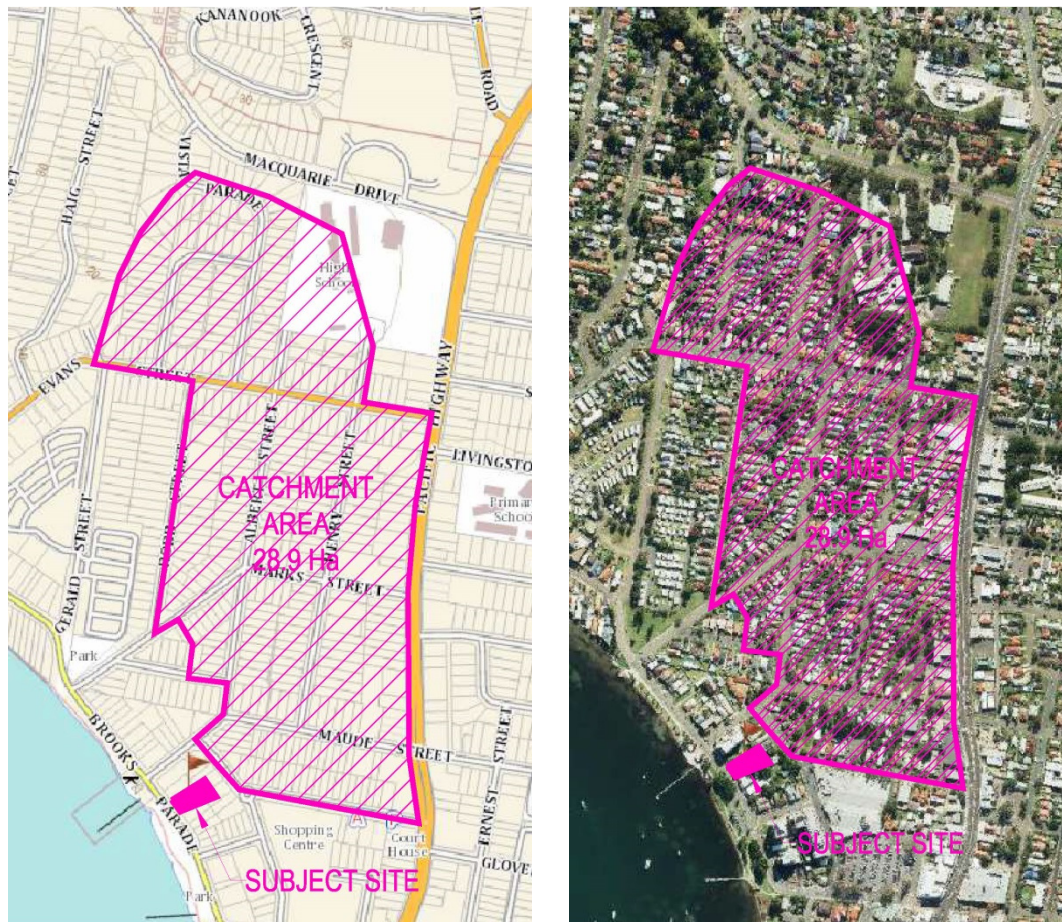


Figure 2: Catchment area

5. Computer Modelling

Table 1 below shows the calculated flow rates for the upslope catchment. Flow rates for the peak storm events have been shown for various storm intensities.

Table 2 shows adopted Lake Macquarie flood levels for various storm events. These levels were adopted as a fixed tailwater level in the DRAINS model.



Table 3 below shows the subject site's Lake Macquarie peak flood levels for various storm intensities.

Table 1: Storm events and catchment flowrates

ARI Storm Event (year)	Time of Concentration (min)	Flow Rate (m ³ /s)
1 in 1	30	3.11
1 in 20	20	8.68
1 in 100	18	11.20

Table 2: Lake Macquarie Flood Levels

	1 in 1 year	1 in 20 year	1 in 100 year
Tailwater – Baseline Lake Macquarie Flood Level (m AHD) ¹	0.1	1.23	1.5

¹ – flood levels adopted from WMAwater "Lake Macquarie Flood Study" June 2012

Table 3: Calculated flood levels for the subject site

Tailwater – Baseline Lake Macquarie Flood Level (m AHD) ¹		Site Flood Level (m AHD) ²		
		1 in 1 year	1 in 20 year	1 in 100 year
0.1	Existing site	0.69	1.12	1.17
	Developed site	0.69	1.16	1.24
1.23	Existing site	1.26	1.28	1.28
	Developed site	1.28	1.29	1.32
1.50	Existing site	1.56	1.56	1.56
	Developed site	1.58	1.58	1.58

¹ – flood levels adopted from WMAwater "Lake Macquarie Flood Study" June 2012

² – Flood levels obtained using DRAINS software.

Flow rates and flood levels were calculated using DRAINS computer software. Output files can be seen attached. DRAINS computer files can be supplied upon request

6. Development Recommendations

Based on findings of the Limited Flood Study Investigation, it was determined that:

- Storm events up to and including the 1 in 1 year ARI storm can be conveyed within the concrete lined drain with the remainder conveyed as overland flow;



- Stormwater flows outside of the concrete lined channel are choked by existing buildings to the north and south of the concrete lined channel. To provide conservative flood level heights, it was assumed that these buildings would remain during all storm events;
- Flood levels on the site are dependent on tailwater levels within Lake Macquarie;
- There was no notable increase in flood level when assessing the existing and proposed developments on the subject site. It could be determined that the proposed development would not have a noticeable effect on localised flood levels immediately adjoining the subject site;
- Future developments on the subject site should take into account forces imposed by water flow in the concrete lined drain and overland flow paths;
- Lake Macquarie flood levels provided by Lake Macquarie City Council be adopted for the site.

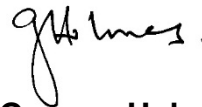
Yours faithfully,

Forum Consulting Engineers



Mark Smith

Environmental Engineer
B.E. (Environmental)



Graeme Holmes

CPeng Civil Engineer
Director



Attachments



Photograph 1 – Approximately 100m upslope of site looking upslope



Photograph 2 – Approximately 70m upslope of site looking upstream



Photograph 3 – downslope of Edgar Street crossing looking upstream



Photograph 4 – to the north of the site looking upstream



Photograph 5 - to the north of the site looking downstream



Photograph 6 – upstream of Brooks Street crossing looking downstream



Photograph 7 – downstream of Brooks Street crossing looking upstream

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PHOTO 1

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PHOTO 7

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PHOTO 9

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PHOTO 2

PHOTO 8

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PHOTO 3

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PHOTO 4

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PHOTO 5

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PHOTO 6

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PHOTO 10

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PHOTO 11

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PHOTO 12

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PHOTO 13

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PHOTO 15

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PHOTO 18

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PHOTO 19

PHOTO 16

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PHOTO 14

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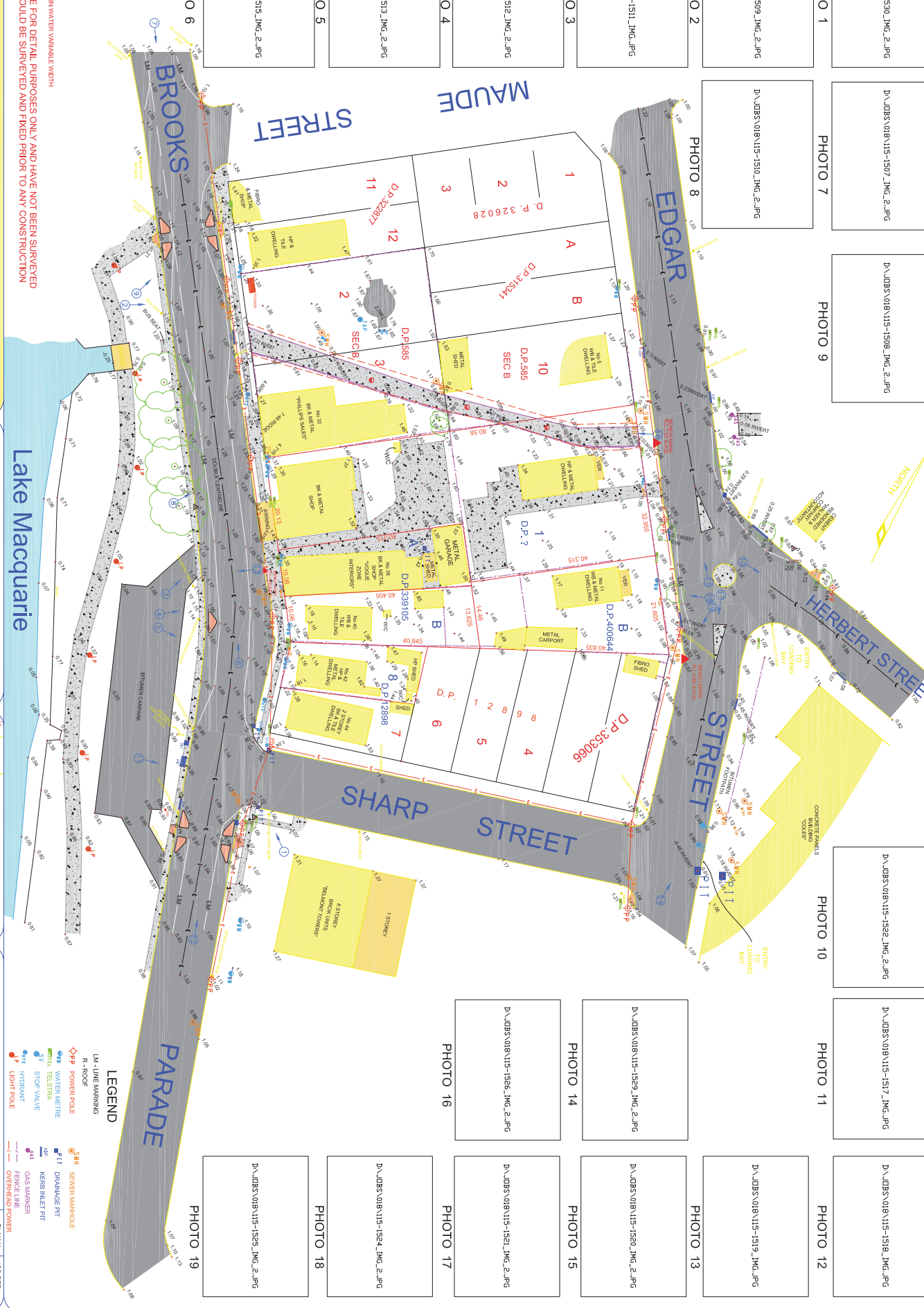
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LEGEND

- LM - LINE MARKING
- R - ROOF
- PP - POWER POLE
- W - WATER METRE
- TE - TELESTR
- SV - STOP VALVE
- HY - HYDRANT
- LP - LIGHT POLE
- SH - SEWER MANHOLE
- PT - DRAINAGE PIT
- MI - KERB INLET PIT
- GM - GAS MANGER
- FL - FENCE LINE
- OP - OVERHEAD POWER

JOB ADDRESS: BROOKS PARADE BELMONT

CLIENT: ED KOPANDY

SCALE: 1:400 A1

DATE: 2-4-03

CML/LOAD REF: 018DET14

DRAWING REF: JOBS\018\018DET-2-4-03

JOB REF: 018

SHEET NO: 1

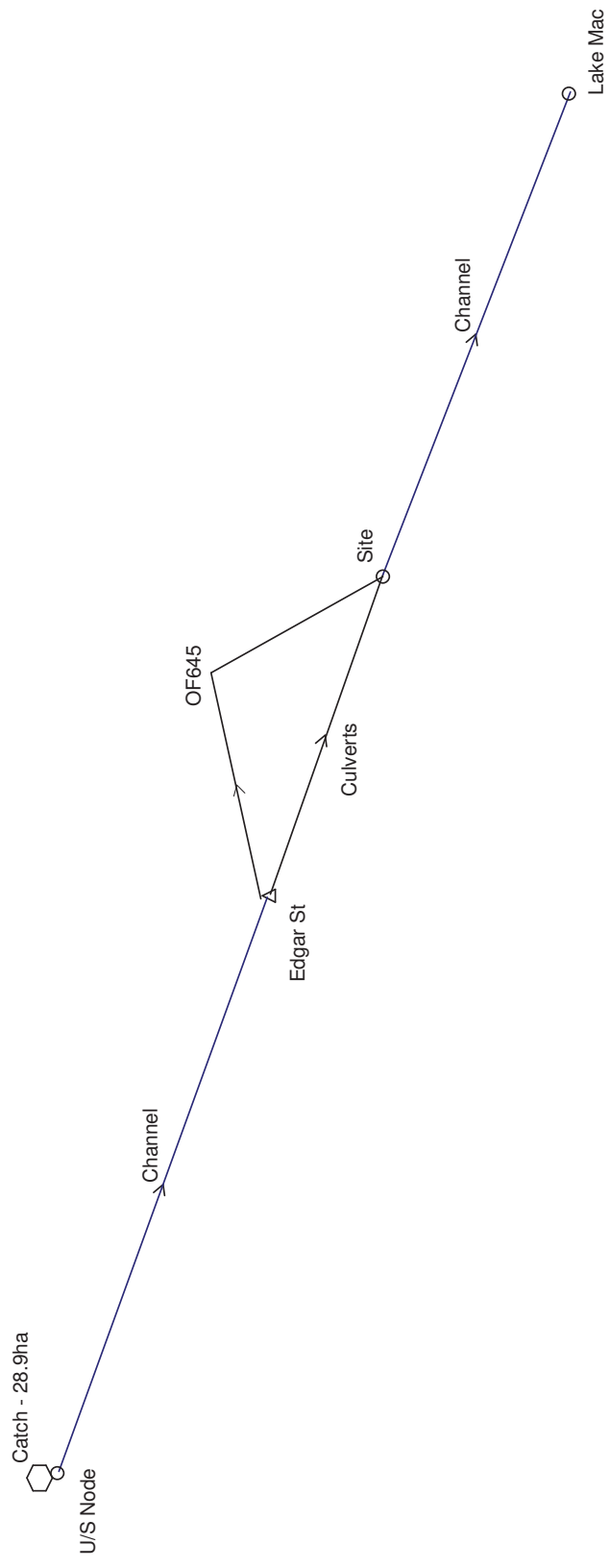
BERNIE de WIT CONSULTING

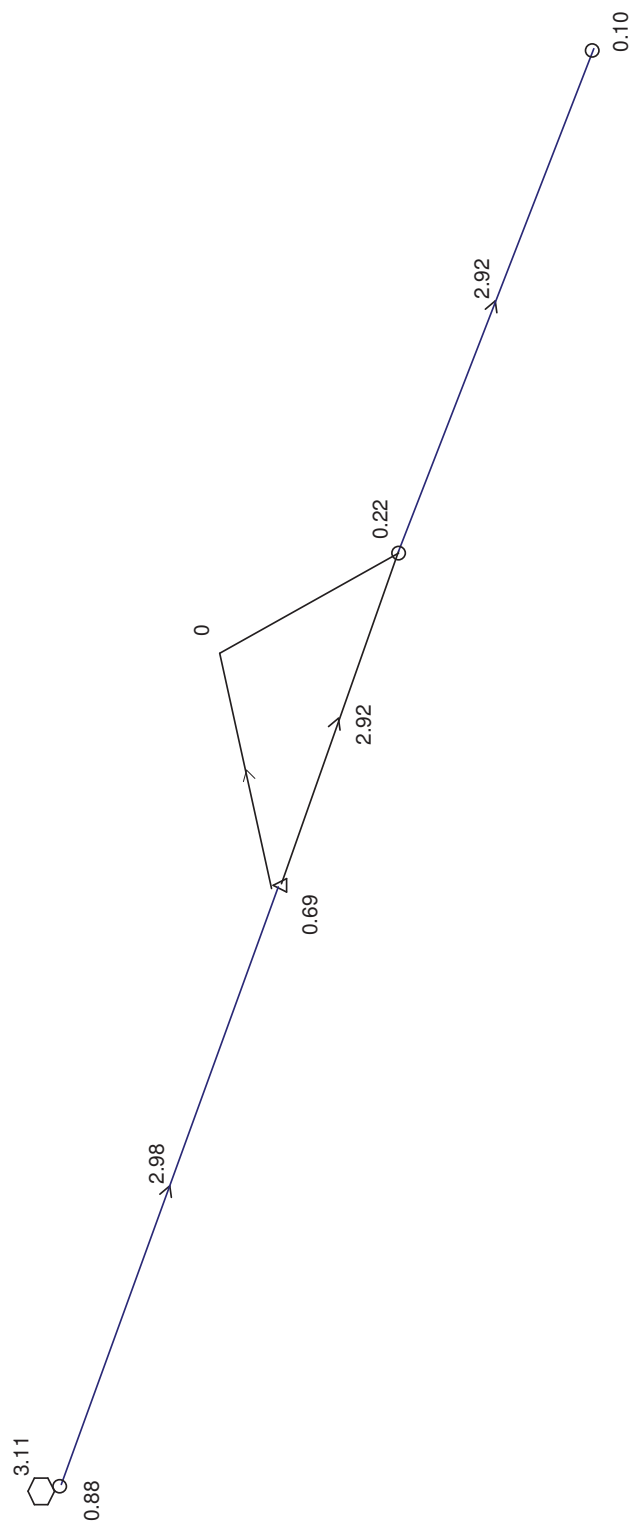
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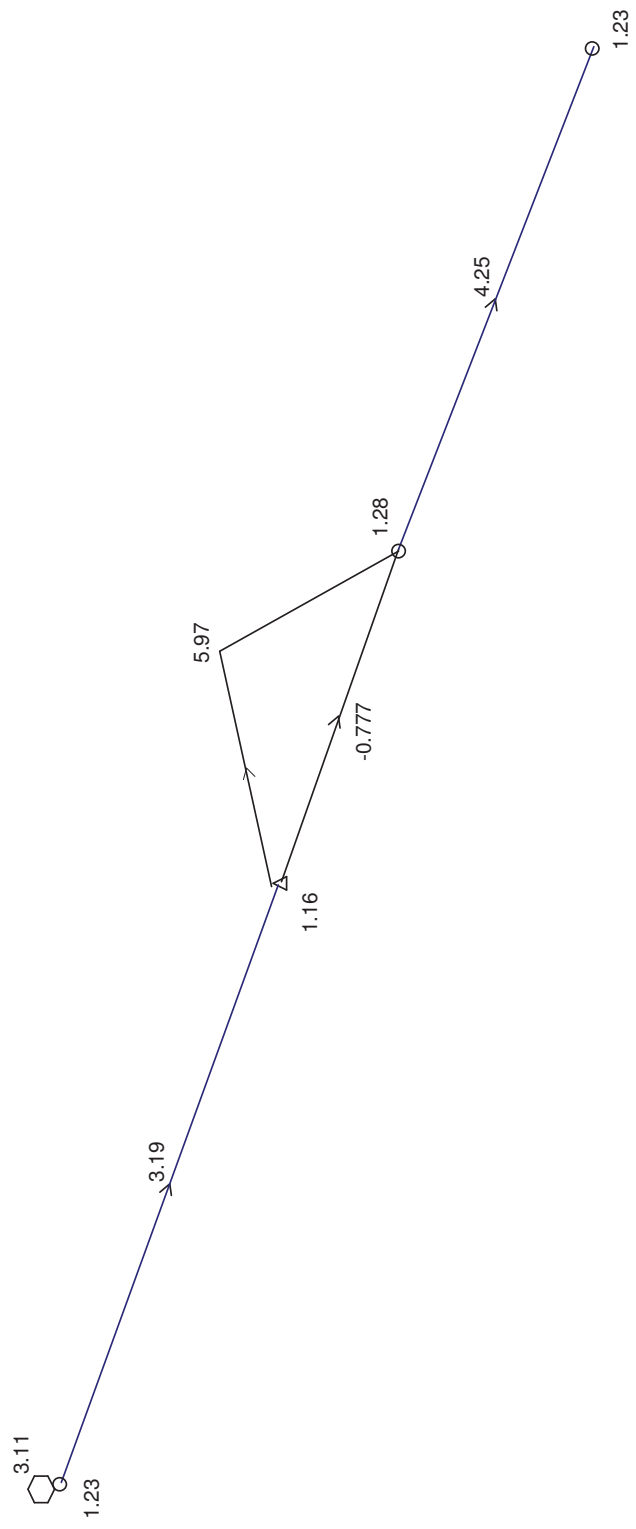
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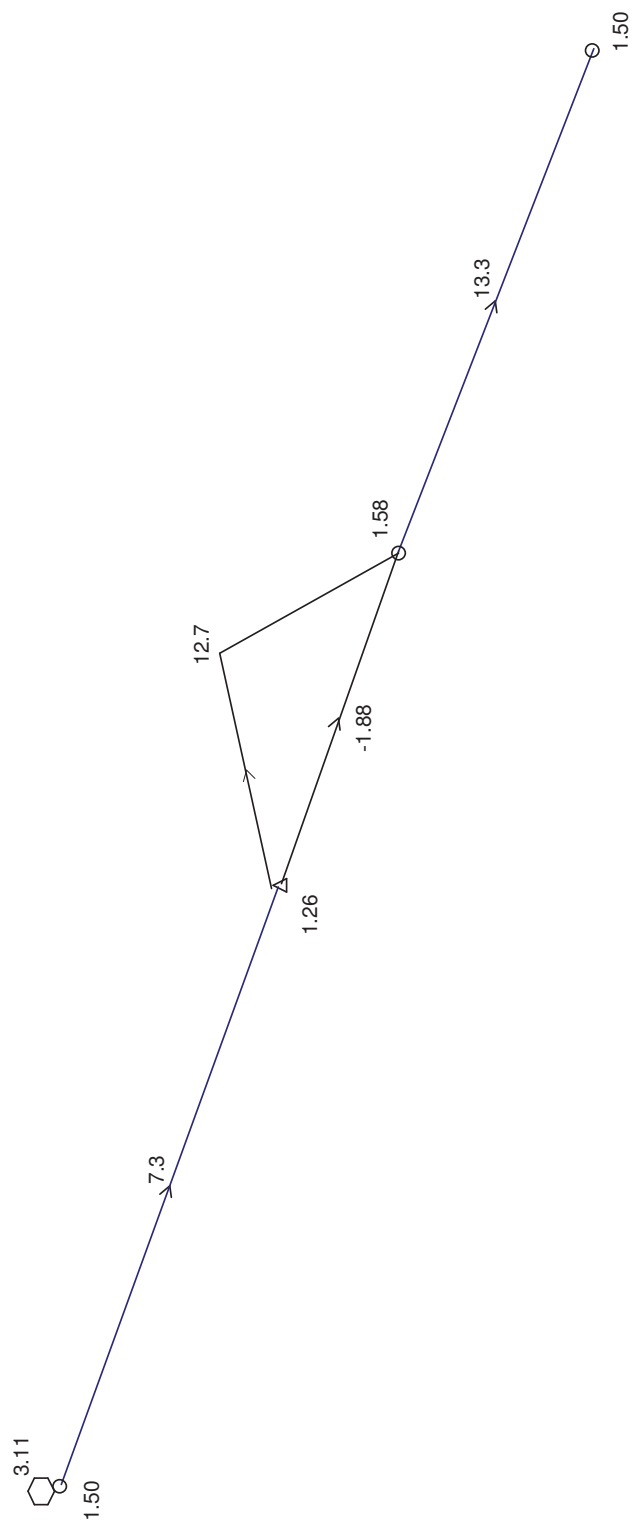
Email Address: dewitb@hunterlink.net.au

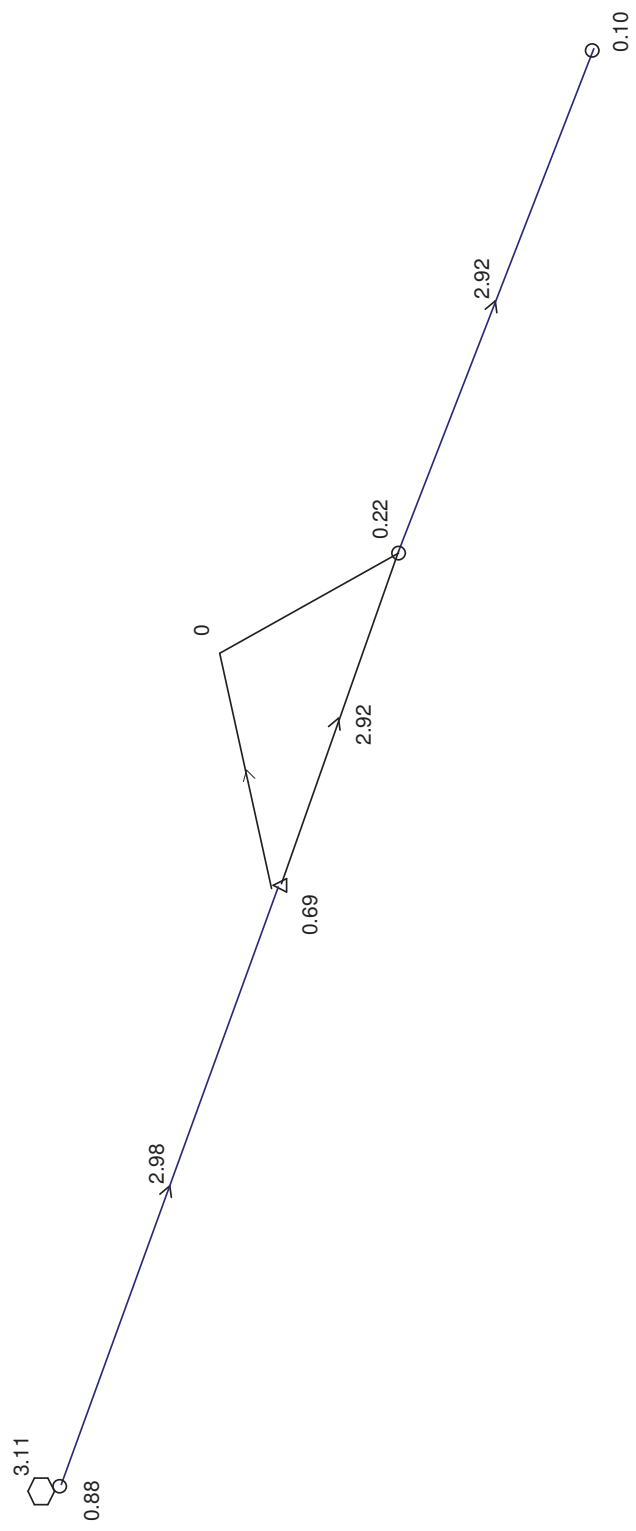
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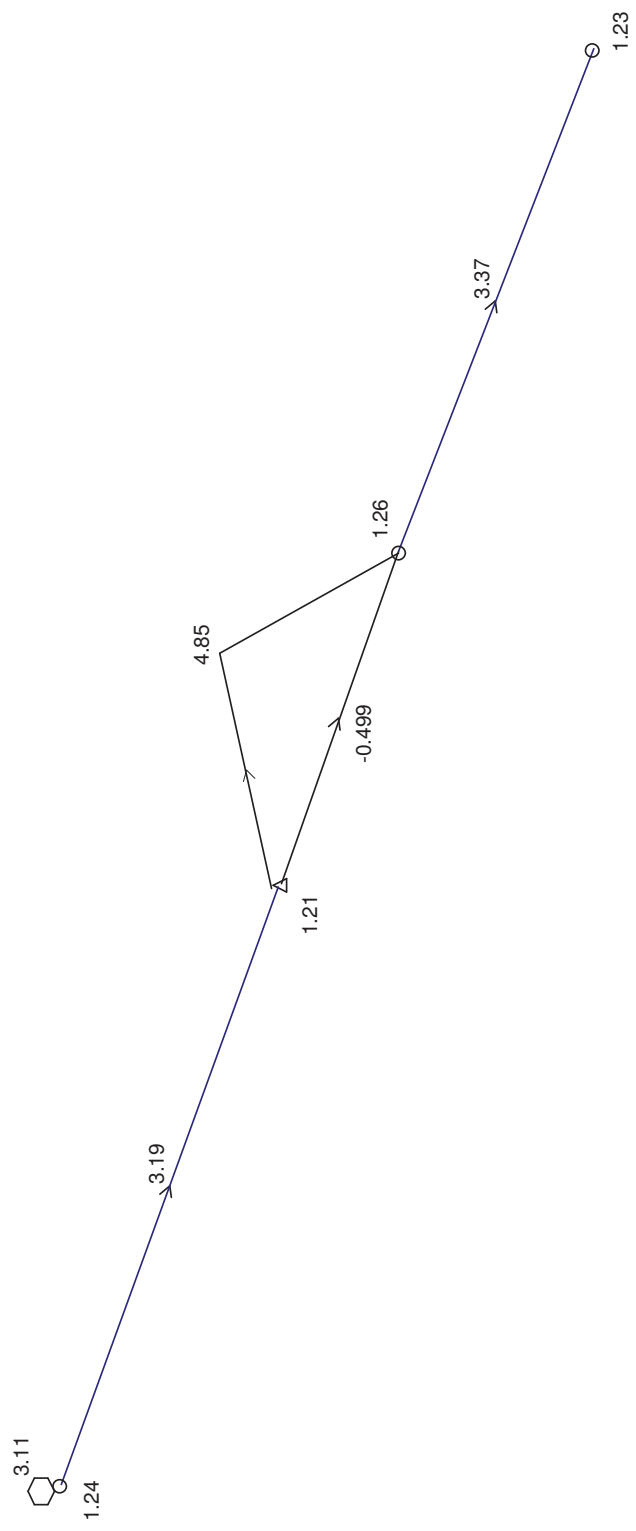


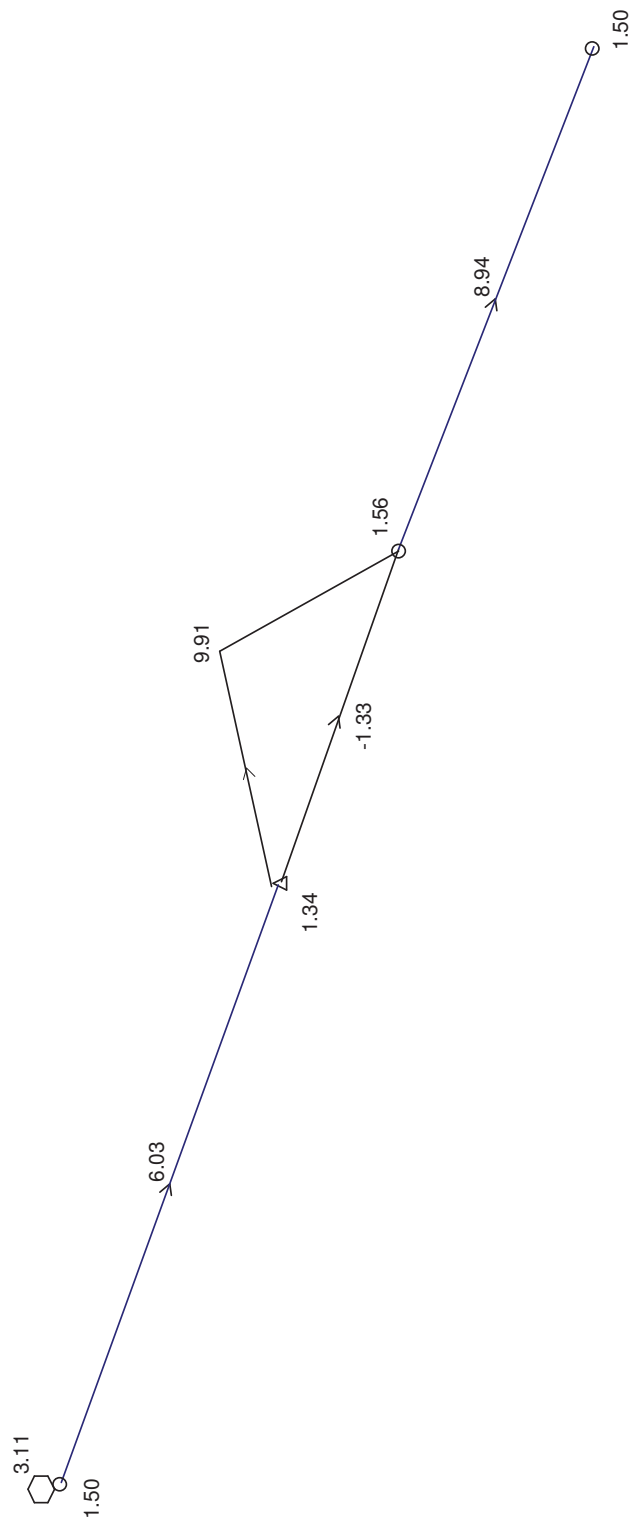


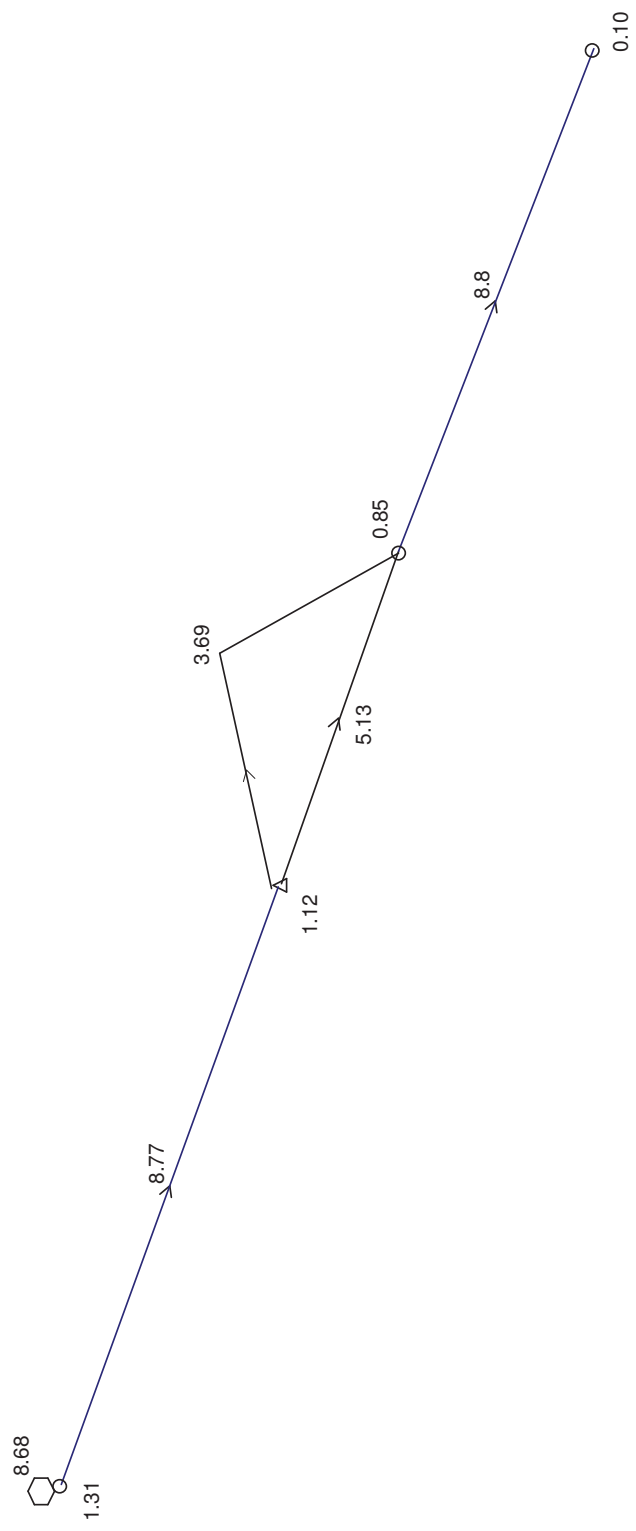


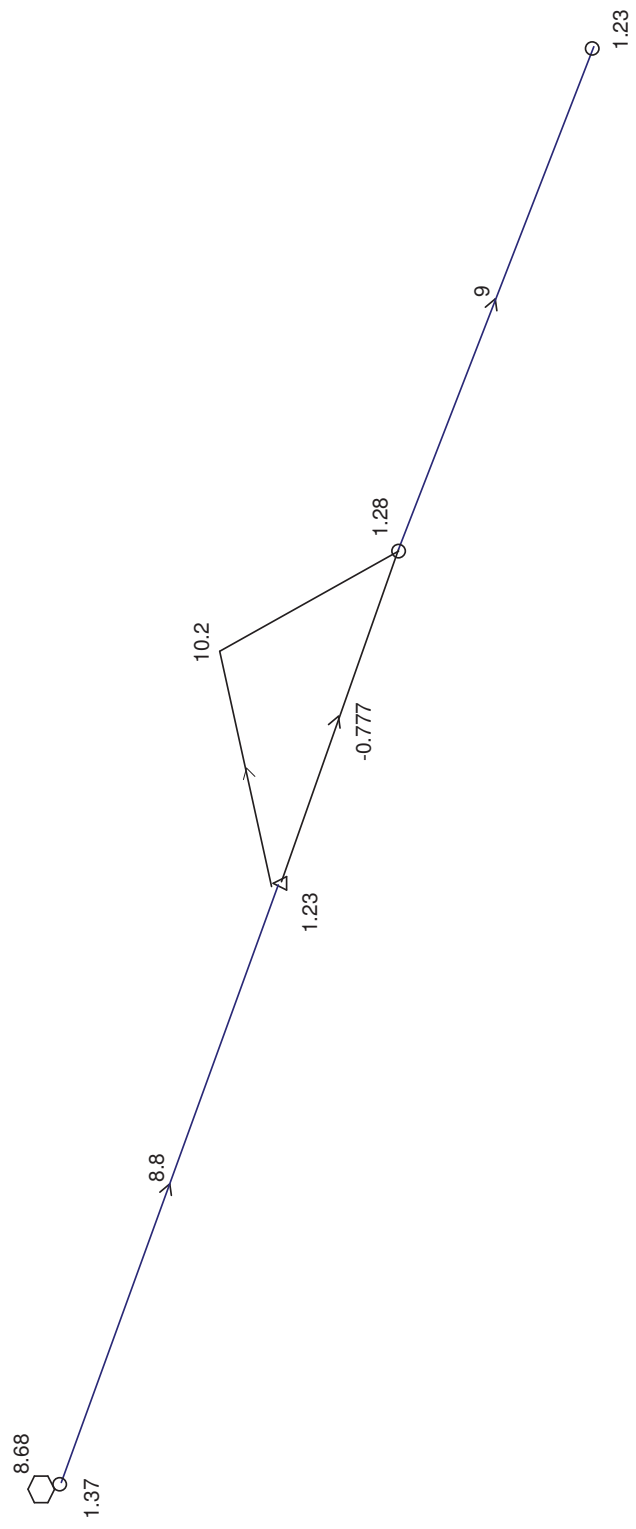


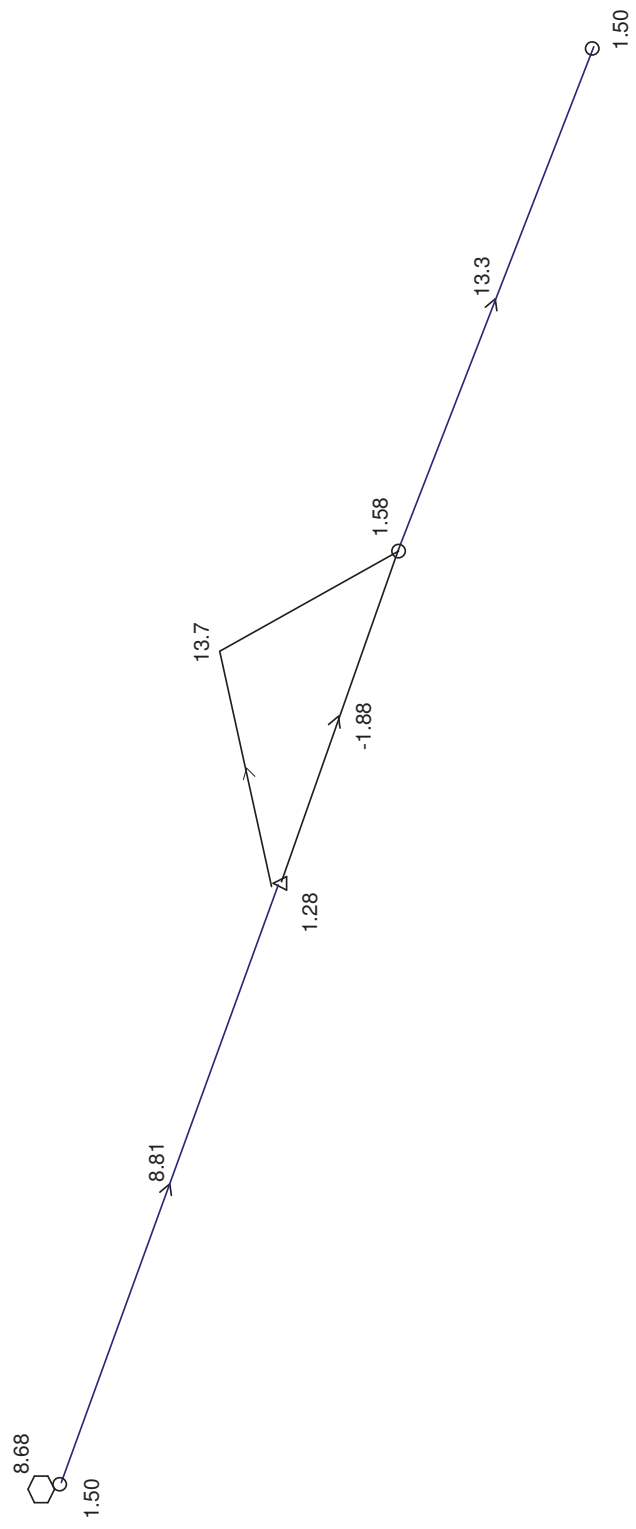


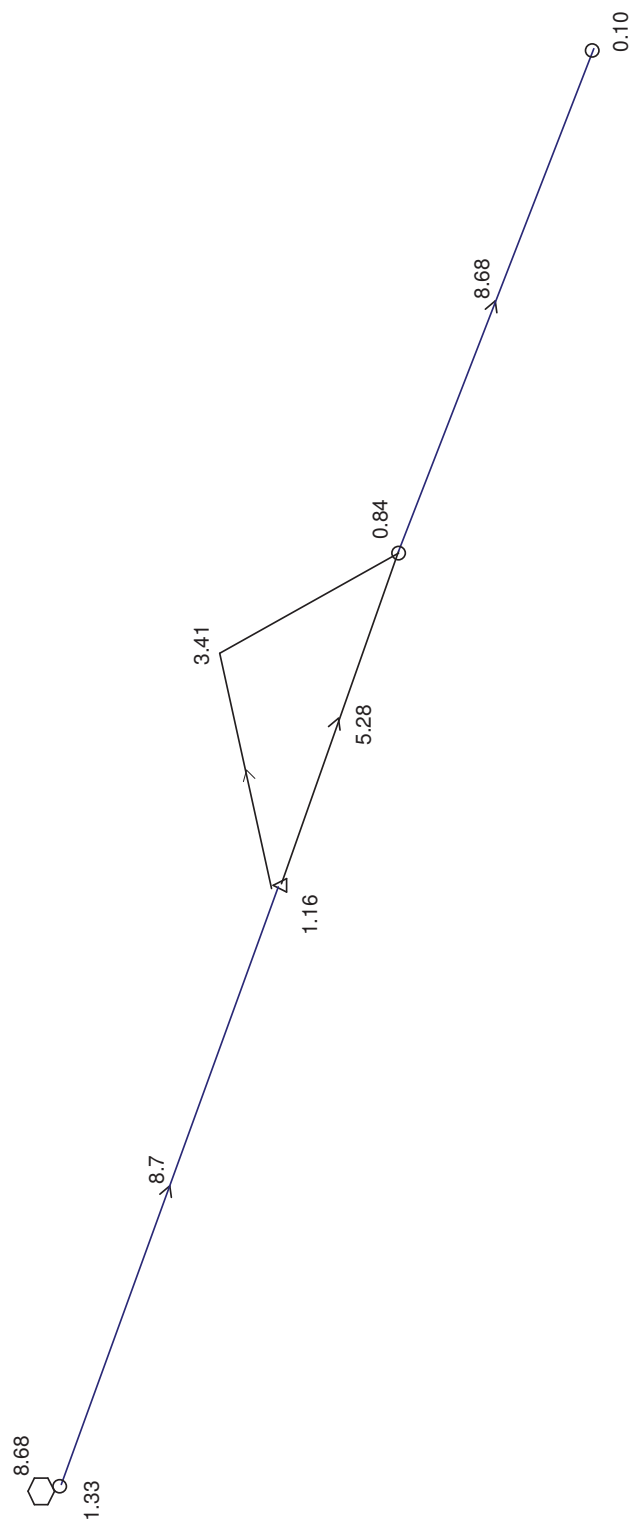


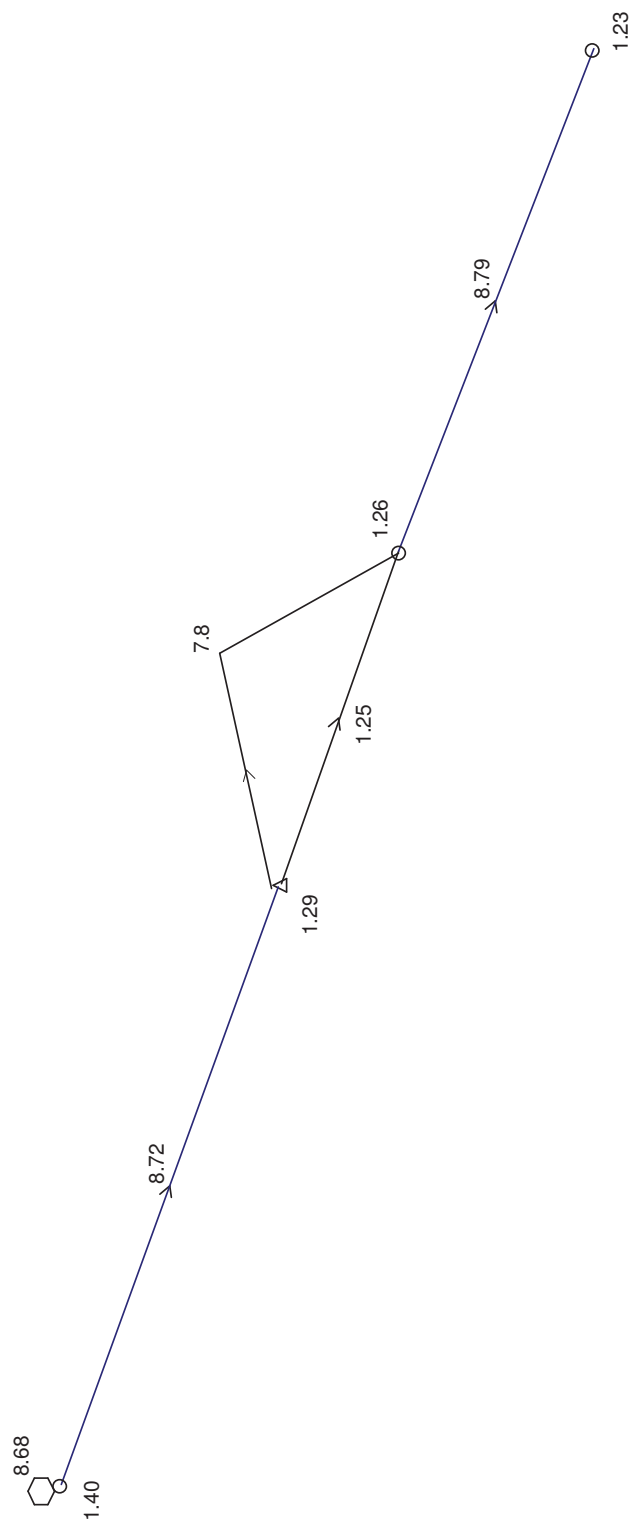


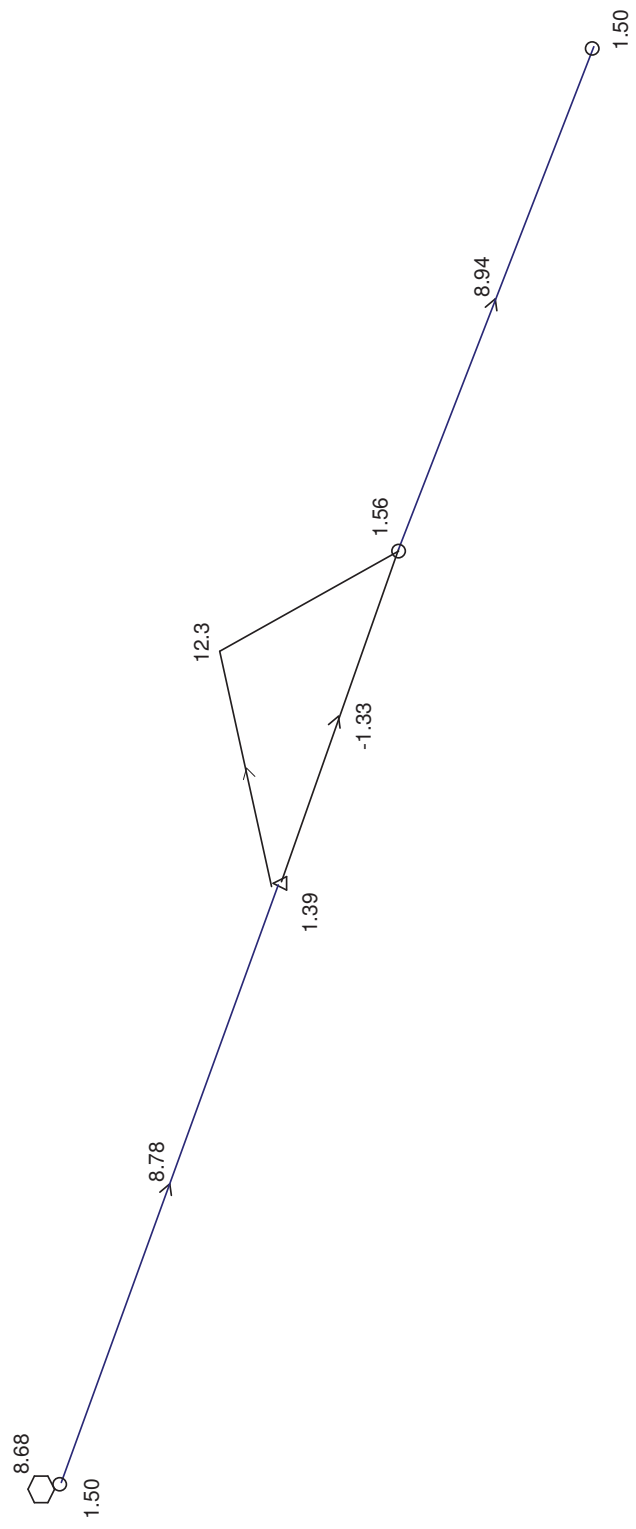


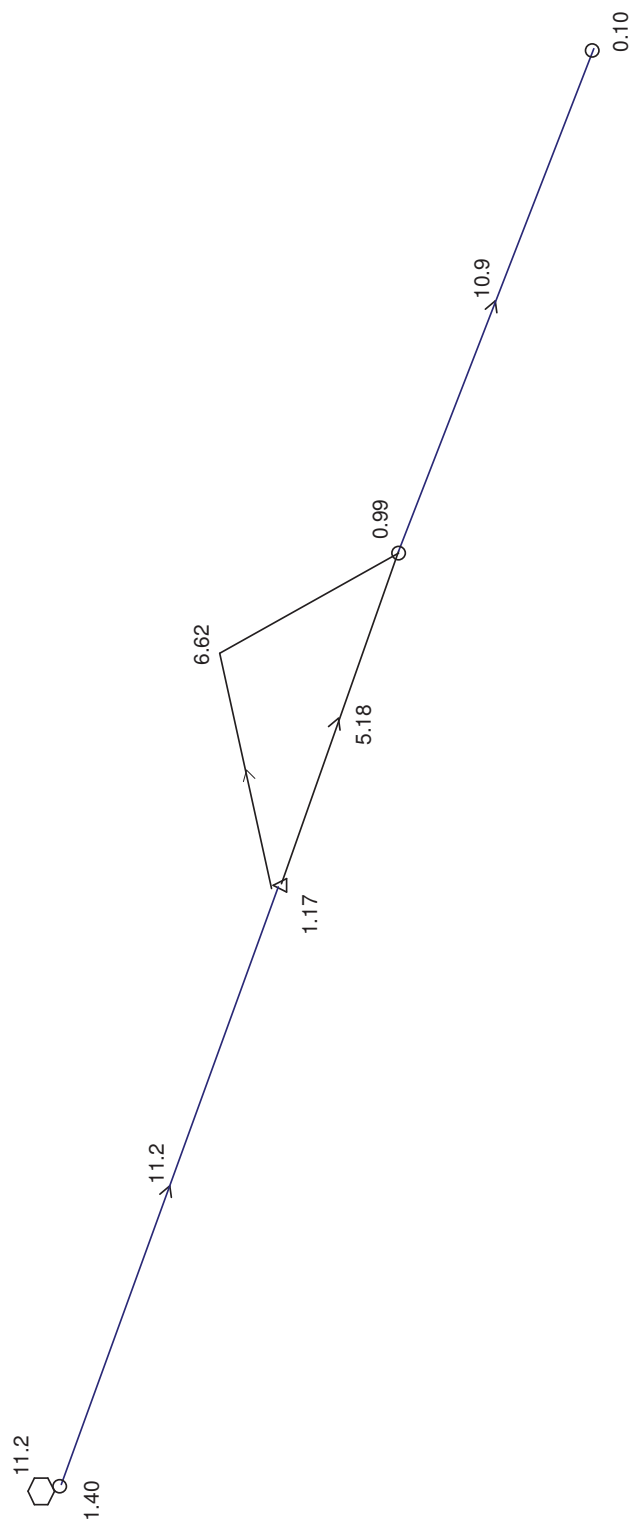


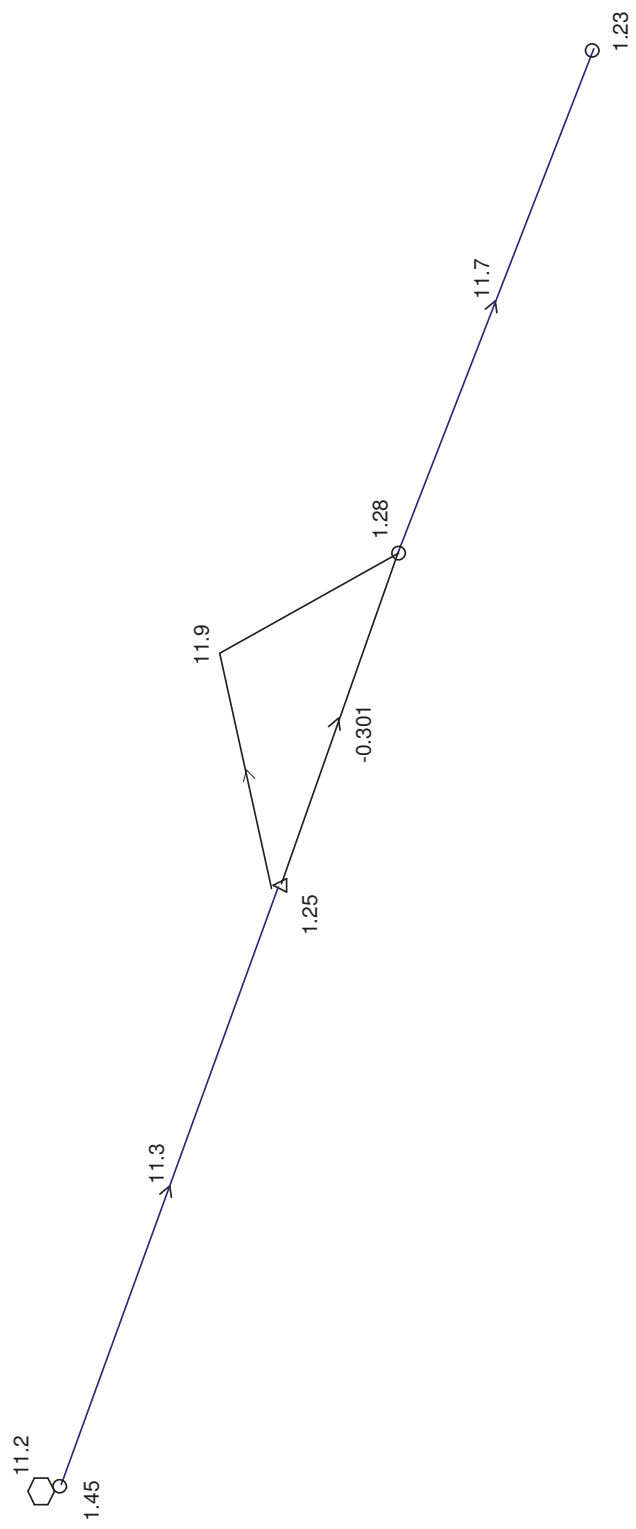


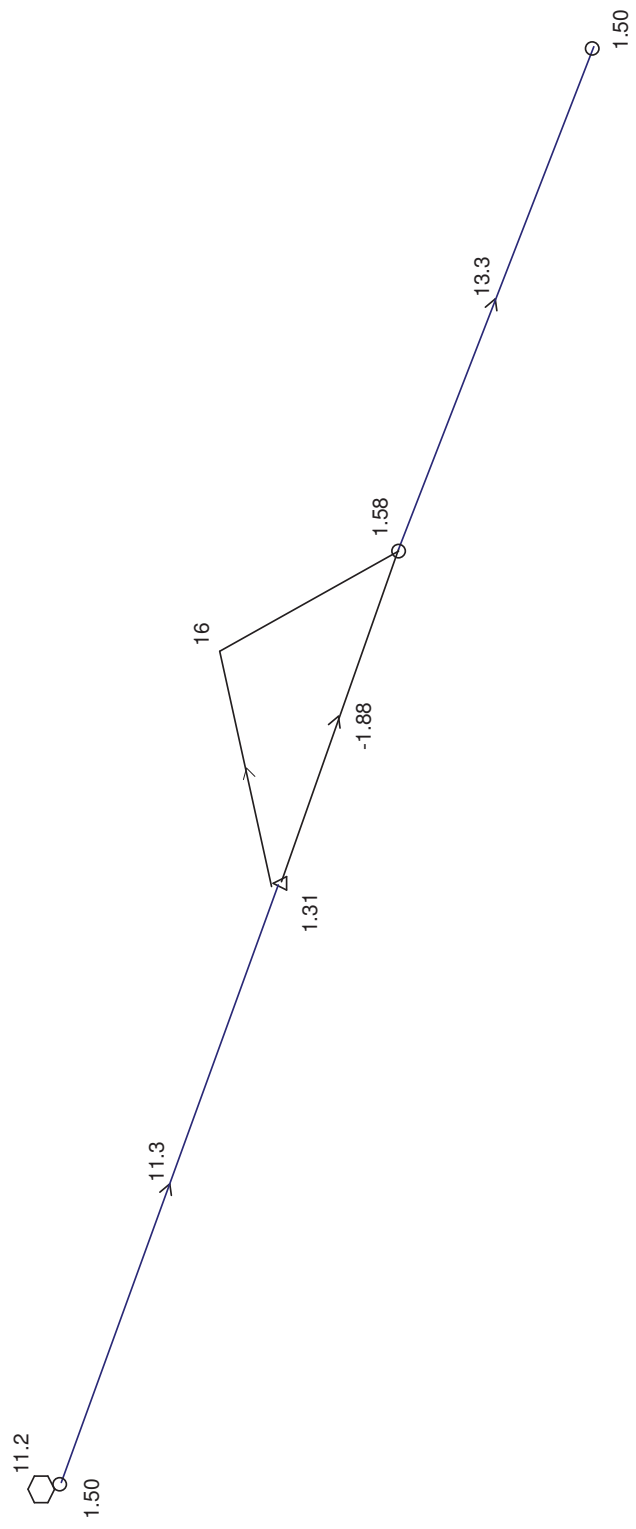


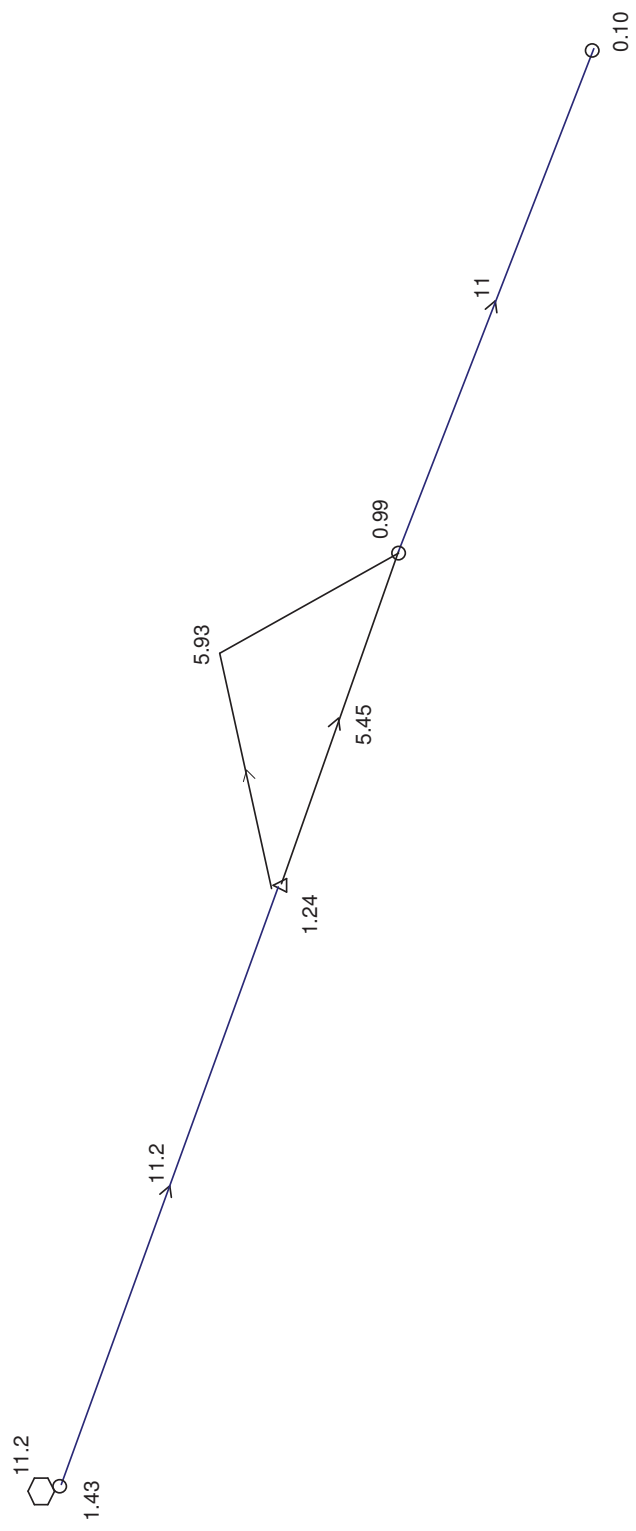


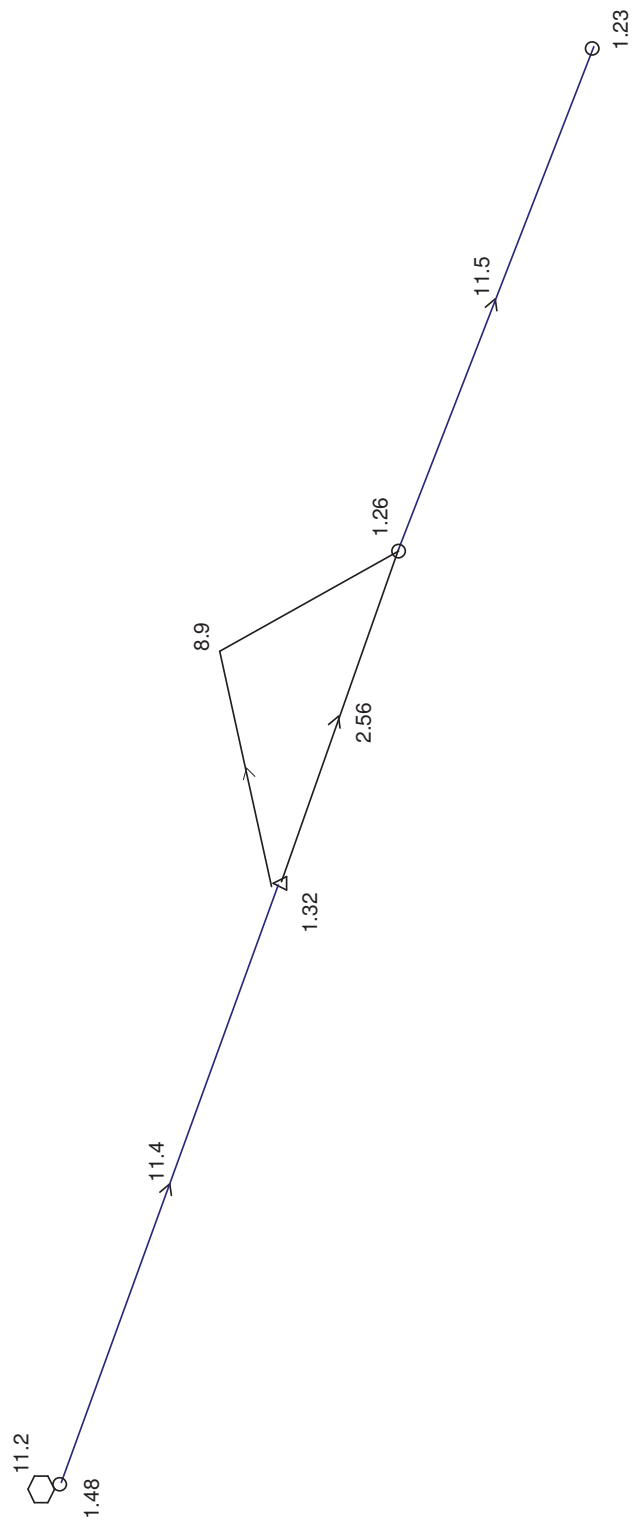


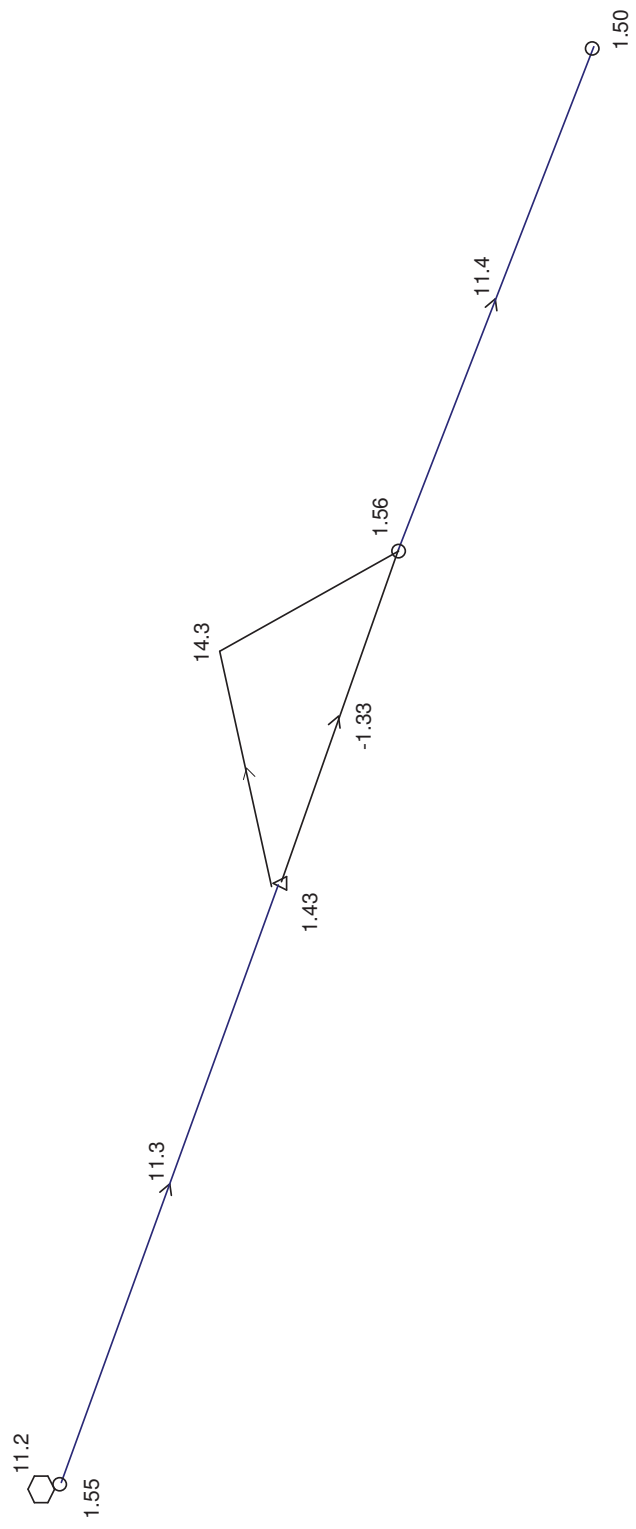


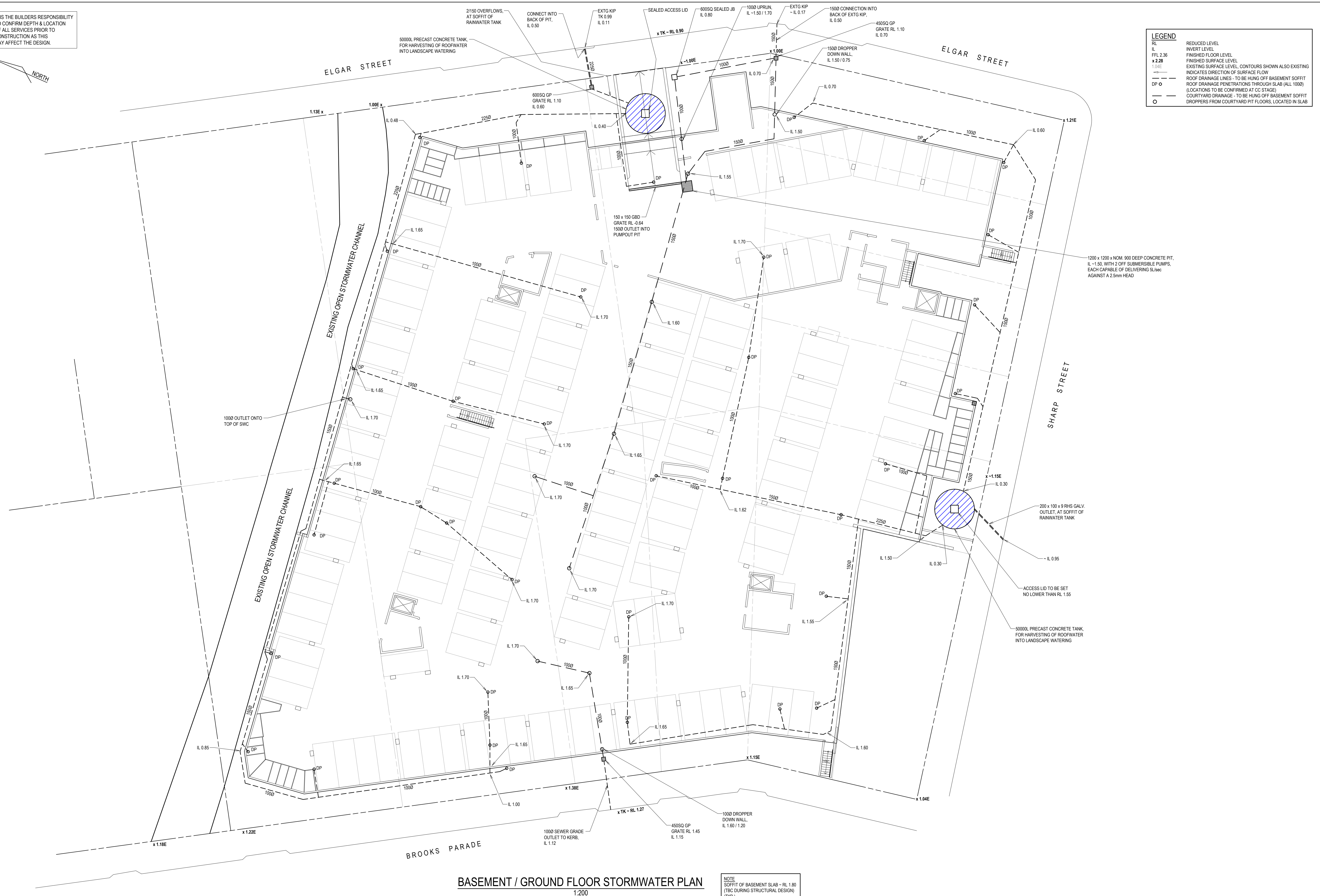
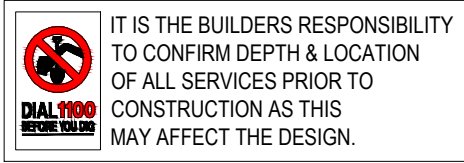












BASEMENT / GROUND FLOOR STORMWATER PLAN
1:200

NOTE
SOFFIT OF BASEMENT SLAB ~ RL 1.80
(TBC DURING STRUCTURAL DESIGN)
(TYP.)

REVISIONS					
	8	E.R.	12.10.16	TANK LOCATIONS AMENDED	G.H.
	A	E.R.	08.09.16	ORIGINAL ISSUE	G.H.
	Rev.	By	Date	Description	Des'd



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3	Client	KML JOINT VENTURE
u	Project	PROPOSED DEVELOPMENT BROOKS PARADE BELMONT

Approved by 

B.E. MIE (Aut) (P) Eng	Drawing No. 40813-SWD - 01 OF 02
------------------------	-------------------------------------

Division

Sheet

B

A1



IT IS THE BUILDERS RESPONSIBILITY
TO CONFIRM DEPTH & LOCATION
OF ALL SERVICES PRIOR TO
CONSTRUCTION AS THIS
MAY AFFECT THE DESIGN.

LEGEND

RL
FFL 2.36
x 2.28
1.04E

REDUCED LEVEL
INVERT LEVEL
FINISHED FLOOR LEVEL
FINISHED SURFACE LEVEL
EXISTING SURFACE LEVEL, CONTOURS
SHOWN ALSO EXISTING
INDICATES DIRECTION OF SURFACE FLOW

NORTH

ELGAR STREET

DRIVEWAY CREST
AT RL 1.55

LANDSCAPE AREAS CLEAR
OF BASEMENT CARPARK
ENVELOPE TO DRAIN BY
NATURAL INFILTRATION
INTO INSITU SANDS (TYP.)

LANDSCAPE AREAS CLEAR
OF BASEMENT CARPARK
ENVELOPE TO DRAIN BY
NATURAL INFILTRATION
INTO INSITU SANDS (TYP.)

LINE OF
BASEMENT
UNDER
SHARP STREET

ENSURE ENTRIES TO ALL ACCESS
TO BASEMENT CARPARK HAVE
EXTERNAL SURFACES GRADING
AWAY FROM ENTRY (TYP.)

GROUND FLOOR STORMWATER & SITE LEVEL PLAN

1:200

NOTE
DP (DOWNPIPE LOCATIONS/PENETRATIONS) ARE
SCHEMATIC ONLY & WILL BE CONFIRMED AT CC



FORUM CONSULTING
ENGINEERS

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Client KML JOINT VENTURE
Project PROPOSED DEVELOPMENT
BROOKS PARADE
BELMONT

Approved by

B.E. MBE (Arch) CPENG

Drawing No.
40813-SWD - 02 of 02

Revision
A

Sheet
A1

Rev.	By	Date	Description	Des'd
A	E.R.	08.09.16	ORIGINAL ISSUE	G.H.