DEVELOPMENT OF BLOU HUIS: PORTION 67 OF THE FARM 832, PAARL: FLOODLINES

Prepared for:

PO BOX 37,
WELLINGTON, 7654
Phone: (021) 862 1973
Fax: (021) 862 1975
Email: info@jvzconstruction.co.za

Prepared by:

PO Box 332
Durbanville 7551
Tel: 021 976 0386
Mobile: 082 550 9108
Fax: 086 517 6574
graeme@mcgillconsulting.co.za

Report No.: MC218-01
Revision: 0
Date: 2017-03-29

DEVELOPMENT OF BLOU HUIS:

PORTION 67 OF THE FARM 832, PAARL: FLOODLINES

CONTENTS

NO.		PAGE
1	SCOPE	3
2	FLOOD PEAK FLOWS	4
2.1	CATCHMENTS	4
2.2	STORM DATA	6
2.3	FLOOD PEAKS	6
3	FLOODLINES	8
3.1	FIELD OBSERVATIONS	8
3.2	SURVEY	8
3.3	FLOODLINE DETERMINATION	8
4	CONCLUSIONS	9

DRAWINGS

17066_blouhuis	JOUBERT AND BRINK LAND SURVEYORS VAN WYKS RIVER SURVEY
MC218-C900	1:50 AND 1:100 YEAR FLOODLINES

ANNEXURES

A	SINSKE CONSULT: FLOODLINE INVESTIGATION VAN WYKS RIVER PORTION 10 OF FARM VAN WYKS RIVER NO.787, PAARL, SEPT 2009
B	VAN WYKS RIVER HEC-HMS RESULTS
C	VAN WYKS RIVER HEC-RAS WATER PROFILE RESULTS

DEVELOPMENT OF BLOU HUIS: PORTION 67 OF THE FARM 832, PAARL: FLOODLINES

1. SCOPE

Graeme McGill Consulting was appointed for the determining of the 1:50 and 1:100 floodlines for Portion 67 of the farm 832, Paarl, known as Blou Huis. The location of the property is shown in Figure 1.

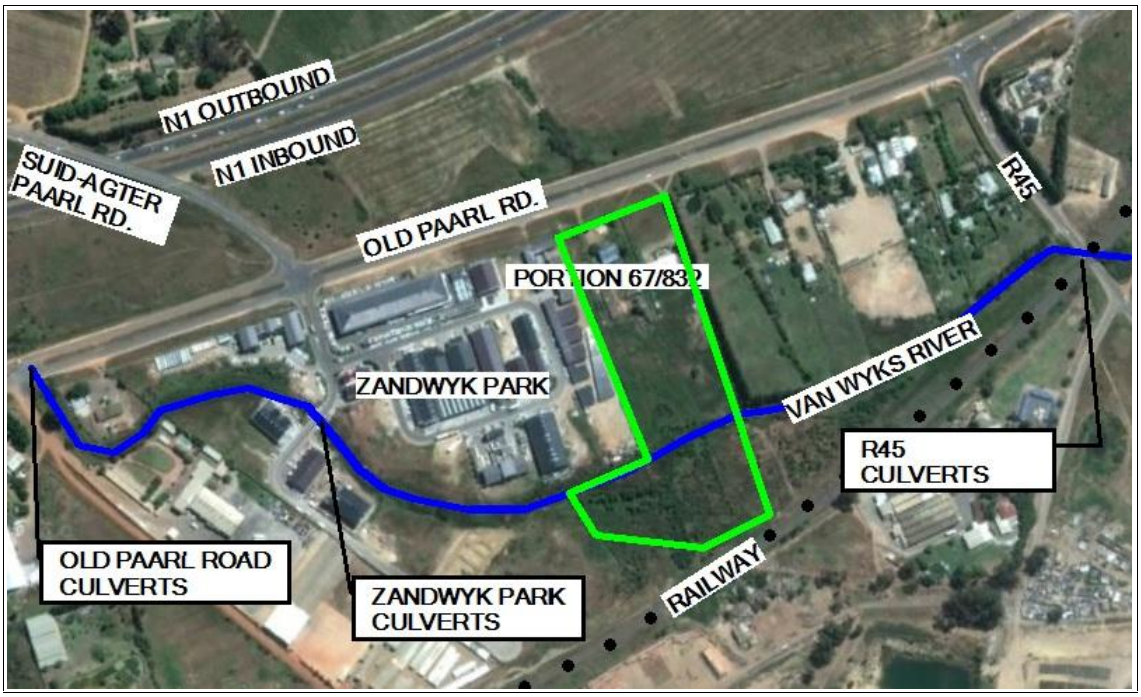

FIGURE 1 LOCALITY OF BLOU HUIS PORTION 67 OF THE FARM 832, PAARL

The study undertaken comprised of the following:

FLOOD HYDROLOGY

Determination of flow peaks for return periods of 1:50 year and 1:100 year, using the SCS Runoff Method.

RIVER HYDRAULICS

Modelling the van Wyk's River reach using the water surface profile software package HEC-RAS. This required inputs from field observations, the survey data, any constraints and the peak flows, for floods of various return intervals.

Water surface profiles and flow velocities for a range of flows in the river are to be determined.

Determination of floodlines and demarcating these in plan on drawings.

2. FLOOD PEAK FLOWS

2.1 PREVIOUS FLOOD STUDIES

An earlier flood study for the van Wyk's River up to Old Paarl Road (R101) was prepared by Dr BH Sinske (Sinske Consult: FLOODLINE INVESTIGATION VAN WYKS RIVER PORTION 10 OF FARM VAN WYKS RIVER NO.787, PAARL, Sept 2009). The computed peak flows from this report are:

Q_{50} = 45 m^3/s

Q_{100} = 57 m^3/s

The report is included in Annexure A.

In 2011 Graeme McGill Consulting analysed this same catchment using the HEC-HMS flood modelling software package, with SCS runoff parameters, and confirmed Sinske's results.

For the present study, the HEC-HMS model which was used previously, has been extended downstream to the R45, which includes the reach through the subject property, Portion 67/832.

2.2 CATCHMENTS

The floodline study for Portion 67/832 used a catchment area (SC1: 31.00km^2) as determined in the previous study (Section 2.1) and added the catchment area between the R101 and the R45 (SC2: 3.75km^2),

Graeme McGill Consulting was appointed to do a river investigation on the Van Wyk's River which was submitted as report, 'Development of Portion 10 of Farm 787 Paarl', dated 2011-08-03. The river investigation determined the 1:50 and 1:100 year floodlines for the section of the van Wyk's River that flowed passed portion 10 of Farm 787 up to the culverts below the Old Paarl Road (Figure 1). The investigation made use 4 sub-catchment areas (Table 1). The total catchment area used for the report was (SC1).

The total contributing catchment area for the river investigation of the van Wyk's River for Portion 67/832 is 34.75km^2

The catchments which drain to the site are shown in Figure 2 and the parameters listed in Table 1.

TABLE 1 SUB-CATCHMENT PARAMETERS

PARAMETER		SC1				SC2
		SUBBASIN-A	SUBBASIN-B	SUBBASIN-C	PORTION 10	BLOU HUIS
AREA (km²)		12.02	9.22	9.64	0.11	3.75
AVERAGE SLOPE	UPPER/ENTIRE REACH	5.69%	1.42%	6.20%	0.50%	1.99%
	MIDDEL REACH					1.50%
	LOWER REACH					0.53%
LENGTH OF LONGEST COLLECTOR (km)	UPPERREACH	6.02	5.15	6.00	1.00	1.49
	MIDDEL REACH					1.01
	LOWER REACH					2.21
	TOTAL	6.02	5.15	6.00	1.00	4.71
TIME OF CONCENTRA-TION (min)	UPPER REACH	91.21	156.06	86.96	50.51	13.38
	MIDDEL REACH					17.80
	LOWER REACH					65.66
	TOTAL	91.21	156.06	86.96	50.51	96.83
BASIN LAG (min)	UPPER REACH					8.03
	MIDDEL REACH					10.68
	LOWER REACH					39.39
	TOTAL	54.73	93.64	52.17	30.30	58.10
RUNOFF FACTOR CN (SCS METHOD)		50	50	50	50	50

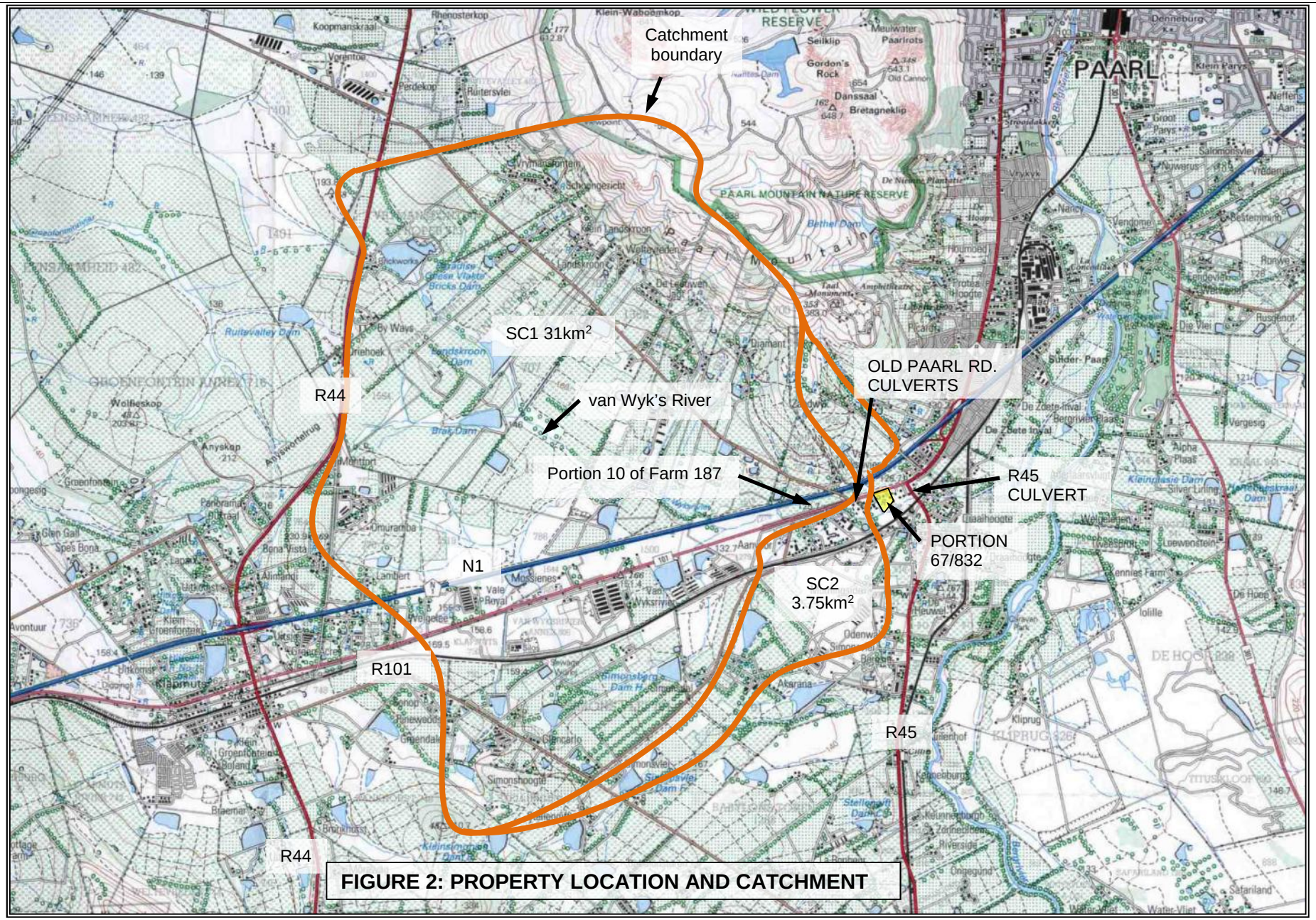

FIGURE 2: PROPERTY LOCATION AND CATCHMENT

2.3 STORM DATA

The City of Cape Town commissioned the University of Kwazulu Natal to investigate the likely effect of climate change on storm intensities in the Western Cape. The recommendation from this investigation was that an increase of 15% over the existing IDF curves be allowed for. This was accepted by the City and a set of point storm rainfall depths has been prepared for a one minute by one minute grid covering the Western Cape

The point rainfall figures applicable to the development site have been extracted from the Western Cape database and are set out in Table 2.

TABLE 2: POINT STORM RAINFALL DEPTHS FOR THE DEVELOPMENT SITE EXTRACTED FROM CITY OF CAPE TOWN DESIGN GRID INCORPORATING A CLIMATE CHANGE FACTOR

RETURN PERIOD (YR)	EVENT DURATION/RAINFALL (mm) (INC CC FACTOR)							
	5 min	15 min	60 min	120 min	240 min	360 min	720 min	1440 min
0.5	3.50	7.00	13.60	19.50	24.50	29.00	39.00	45.00
1	4.80	8.85	17.00	24.50	31.00	37.00	49.00	60.00
2	6.21	10.70	21.16	29.79	38.76	45.20	58.88	76.59
5	7.82	13.57	26.80	37.61	48.99	57.16	74.29	96.72
10	8.97	15.53	30.59	43.01	56.01	65.32	84.99	110.63
20	10.12	17.37	34.39	48.42	62.91	73.49	95.57	124.43
50	11.62	20.01	39.45	55.55	72.34	84.30	109.71	142.83
100	12.77	21.97	43.47	61.18	79.58	92.81	120.87	157.21

NOTE: The 1:0.5 YEAR AND 1:1 YEAR RETURN PERIOD RAINFALL DEPTHS HAVE BEEN EXTRAPOLATED.

2.4 FLOOD PEAKS

2.4.1 METHODOLOGY

The flood peak flows have been computed using the SCS runoff method in the HEC-HMS software package (US Army Corps of Engineers).

The SCS runoff unit hydrograph method defines a curvilinear hydrograph, infiltration is defined by the runoff coefficient CN and the catchment response is determined the basin lag time.

2.4.2 RESULTS

The results of the analysis are included in Annexure B. and are summarised in Table 3 below.

TABLE 3 HEC-HMS RUNOFF RESULTS

RI (YEARS)	PEAK RUNOFF FLOW (m^3/s)					
	SC1				SC2	BLOU HUIS
	SUBBASIN-A	SUBBASIN-B	SUBBASIN-C	PORTION 10		
50	28.0	16.1	23.1	1.4	8.5	**55.8**
100	34.5	19.9	28.4	1.6	10.5	**68.4**

3 FLOODLINES

3.1 FIELD OBSERVATIONS

A site visit was carried out to assess conditions of the area. This included inspecting the van Wyk's River between Zandwyk Park and the R45, Erf 67/832, bridges, culverts and the catchments. Obstructions and sudden changes within the van Wyk's River were noted and hydraulic roughness factors were estimated.

3.2 SURVEY

Joubert and Brink Land Surveyors were appointed to undertake the survey of the van Wyk River between the Zandwyk Park culverts and 30m downstream of the R45 culverts (drawing 17066_blouhuis).

The survey comprised a topographical survey and a survey of natural features in the catchment. The survey was received on 2016-03-07.

3.3 FLOODLINE DETERMINATION

The software package HEC-RAS (Ver 5.0.2) was used to compute the water surface profiles for the 1:50 and 1:100 year recurrence intervals.

Based on field observations, the upstream and downstream boundary conditions were deemed to be the normal depth as defined by the river grade at the upper and lower cross-sections respectively.

The estimated Manning roughness coefficients applied were n = 0.030 for the main channel and n = 0.035 for the overbank sections.

The results of the water surface profiles analyses are contained in Annexure C From these results the floodline levels have been plotted on the accompanying drawing MC218-C900.

4. CONCLUSIONS

This river investigation of the van Wyk's River examined the river conditions between the culverts at Zandwyk Park and 30m downstream of the culverts at the R45. The total catchment area contributing to this section of the van Wyk's River is 34.75km².

Using the point storm rainfall depths for the development site extracted from City of Cape Town design grid incorporating a climate change factor (Table 2) the flow peaks for the 1:50 and 1:100 year could be determined using the SCS Runoff Method. The computation is done using software HEC-HMS (US Army Corps of Engineers).

The catchment parameters used in the HEC-HMS simulation are given in Table 1. The runoff flows for each sub-catchment for the 1:50 and 1:100 year flood are given in Table 3 and Annexure B.

Modelling the van Wyk's River reach was done by using the water surface profile software package HEC-RAS. The water surface results are given in Annexure C.

GA McGILL Pr Eng
2017-03-29

ANNEXURE A

SINSKE CONSULT: FLOODLINE INVESTIGATION VAN WYKS RIVER PORTION 10 OF FARM VAN WYKS RIVER NO.787, PAARL, SEPT 2009

ANNEXURE B

HEC-HMS RESULTS

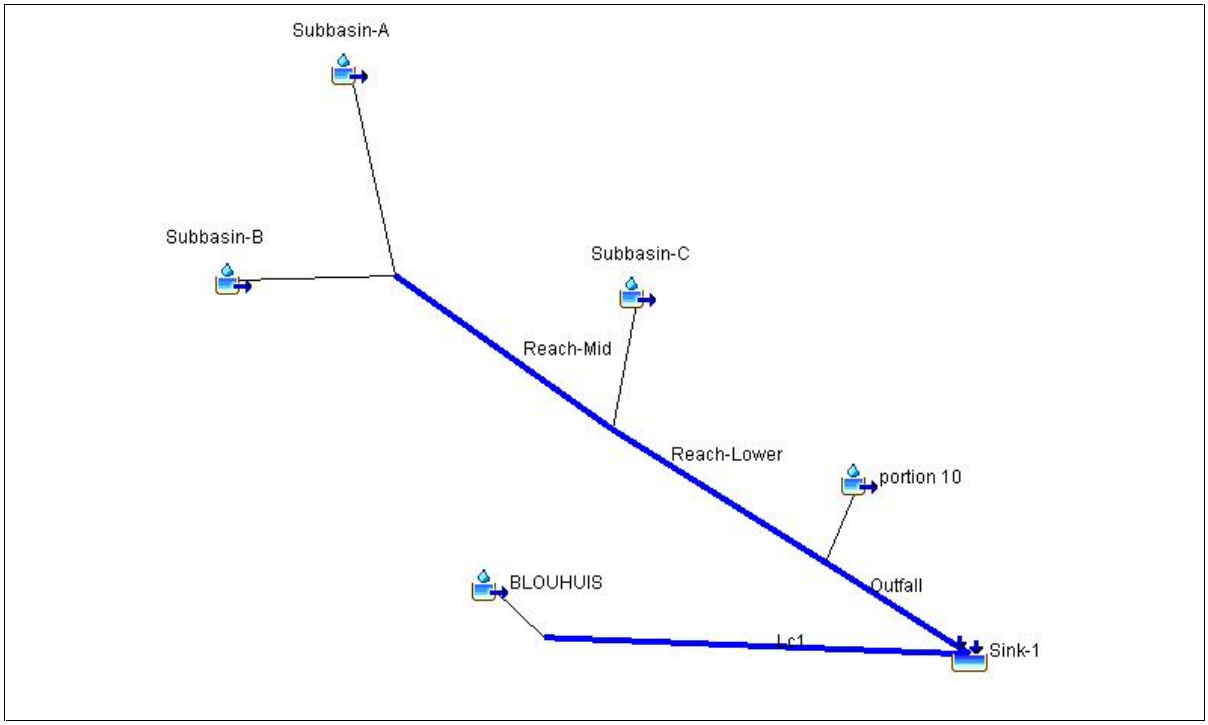

FIGURE B1: SCS HEC-HMS MODEL LAYOUT

TABLE B1: SCS HEC-HMS 1:50 YEAR RESULTS

Project: MC218 BLOUHUIS Simulation Run: 50YR

Start of Run: 25Apr2011, 12:00 Basin Model: MC218 Blouhuis
End of Run: 27Apr2011, 12:00 Meteorologic Model: 50YR
Compute Time: 22Mar2017, 12:39:33 Control Specifications: Control 1

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Subbasin-A	12.02	27.98521	26Apr2011, 01:05	430.8665
Subbasin-B	9.22	16.14275	26Apr2011, 01:55	330.4982
Reach-Mid	21.24	40.98286	26Apr2011, 02:55	761.3647
Subbasin-C	9.64	23.08576	26Apr2011, 01:05	345.5535
Reach-Lower	30.88	50.34003	26Apr2011, 03:40	1106.9182
portion 10	0.114	1.44659	26Apr2011, 00:15	13.0267
Outfall	30.994	50.43728	26Apr2011, 03:45	1119.9449
BLOUHUIS	3.751	8.50355	26Apr2011, 01:10	134.4576
Lc1	3.751	8.49880	26Apr2011, 02:40	134.4576
Sink-1	34.745	55.79934	26Apr2011, 03:40	1254.4025

TABLE B2: SCS HEC-HMS 1:100 YEAR RESULTS

Project: MC218 BLOUHUIS Simulation Run: 100YR

Start of Run: 25Apr2011, 12:00 Basin Model: MC218 Blouhuis
End of Run: 27Apr2011, 12:00 Meteorologic Model: 100YR
Compute Time: 22Mar2017, 12:40:16 Control Specifications: Control 1

Show Elements: All Elements Volume Units: MM 1000 M3 Sorting: Hydrologic

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (1000 M3)
Subbasin-A	12.02	34.49158	26Apr2011, 01:05	523.2498
Subbasin-B	9.22	19.86130	26Apr2011, 01:50	401.3613
Reach-Mid	21.24	50.49304	26Apr2011, 02:55	924.6111
Subbasin-C	9.64	28.41526	26Apr2011, 01:05	419.6446
Reach-Lower	30.88	61.80803	26Apr2011, 03:40	1344.2557
portion 10	0.114	1.60689	26Apr2011, 00:15	14.4544
Outfall	30.994	61.90603	26Apr2011, 03:40	1358.7101
BLOUHUIS	3.751	10.47455	26Apr2011, 01:10	163.2870
Lc1	3.751	10.46488	26Apr2011, 02:40	163.2870
Sink-1	34.745	68.41485	26Apr2011, 03:40	1521.9972

ANNEXURE C

VAN WYK'S RIVER
HEC-RAS WATER PROFILE RESULTS

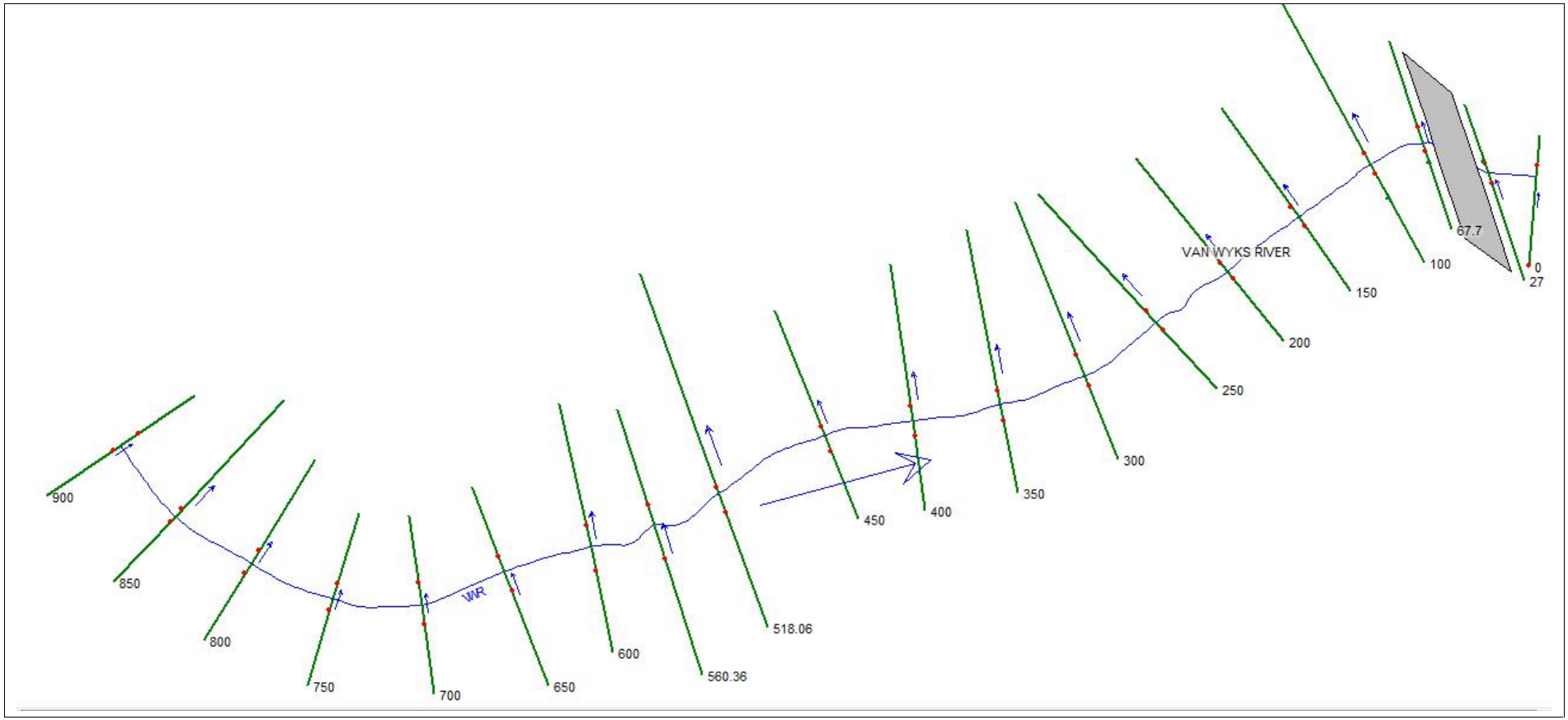

FIGURE C1: HEC-RAS MODEL LAYOUT

TABLE C1: VAN WYKS RIVER WATER SURFACE RESULTS

RIVER STATION	1:50 YEAR			1:100 YEAR		
	FLOW (m^3/s)	W.S. ELEV. (RLm)	E.G. ELEV. (RLm)	FLOW (m^3/s)	W.S. ELEV. (RLm)	E.G. ELEV. (RLm)
900	55.80	123.54	123.72	68.41	123.27	123.91
850	55.80	123.36	123.58	68.41	123.46	123.67
800	55.80	122.17	123.20	68.41	122.48	123.34
750	55.80	122.22	122.79	68.41	122.44	123.03
700	55.80	122.23	122.44	68.41	122.38	122.62
650	55.80	122.14	122.31	68.41	122.29	122.49
600	55.80	122.12	122.22	68.41	122.28	122.39
560	55.80	122.10	122.17	68.41	122.25	122.34
518	55.80	121.87	122.09	68.41	122.02	122.26
450	55.80	121.55	121.86	68.41	121.66	122.02
400	55.80	121.41	121.64	68.41	121.43	121.74
350	55.80	121.01	121.38	68.41	121.09	121.45
300	55.80	120.97	121.06	68.41	121.10	121.18
250	55.80	120.65	120.92	68.41	120.73	121.05
200	55.80	120.47	120.70	68.41	120.54	120.80
150	55.80	120.37	120.49	68.41	120.53	120.64
100	55.80	120.17	120.38	68.41	120.37	120.54
68	55.80	120.17	120.30	68.41	120.34	120.49
43	Culvert			Culvert		
27	55.80	119.38	119.92	68.41	119.42	120.19
0	55.80	119.35	119.66	68.41	119.33	119.83