

EXXARO MINING

CIVIL DESIGN REPORT FOR THE SURFACE WATER MANAGEMENT PLAN

FOR THE

PROPOSED NEW DEVELOPMENT OF A TOWNSHIP ON A PORTION OF THE FARM NELSONSKOP

26 JUNE 2016

REPORT No: E0505-SWMP / Rev 0

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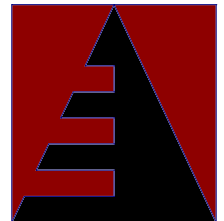
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STORMWATER REPORT FOR THE PROPOSED TOWNSHIP DEVELOPMENT ON THE FARM NELSONSKOP, LEPHALALE

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STORMWATER REPORT FOR THE PROPOSED TOWNSHIP DEVELOPMENT ON THE FARM NELSONSKOP, LEPHALALE

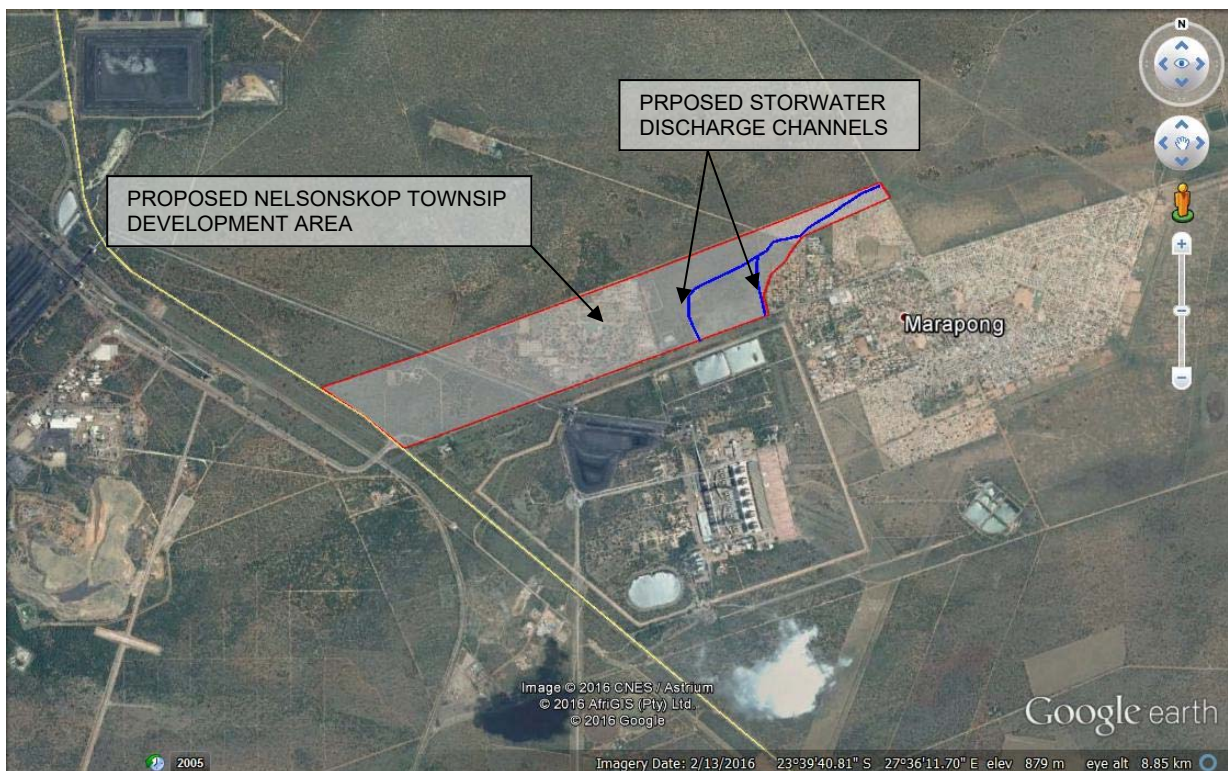
1. INTRODUCTION

Exxaro has embarked a township development on a Portion of the farm Nelsonskop 464LQ located to the west of Lephalale and adjacent to Marapong Town. The proposed development area has a gentle slope to the east with no defined natural drainage channel, except for the manmade channels created to discharge stormwater from both the Matimba Power Station and Marapong Town.

In order for the development of the proposed township on Nelsonskop to proceed, the recently constructed stormwater channels will need to be incorporated within the proposed Nelsonskop Township development.

As the catchment area upstream of the proposed development area is less than 5km² and there is no real defined natural drainage channel (except for the recently constructed stormwater drainage channels) located on the development area, no 1:50 year and 1:100 year floodline delineation will be required according to the Water Act.

The center coordinates of the study area analyzed are at approximately Latitude 23°39'17.48"S and Longitude 27°36'38.01"E (WGS84 Lo27).



For the surface stormwater management, an electronic 0,5m-interval contour layout DTM base map was used to generate current stormwater drainage management plan as will be described later in the report.

2. HYDROLOGY

2.1 CATCHMENT PARAMETERS

One global catchment was identified in the study area for the hydrology calculations in order to determine the expected stormwater peak flows for the development area.

Homogeneous catchment characteristics were applied for calculation purposes as obtained from the appropriate 1:50 000 topographical maps (2337DA). The catchment characteristics are summarized in Item 2.3 below.

The mean annual precipitation (MAP) for the polygon grid covering the study area (development area), based on the GISap software, is given as 470mm.

2.2 METHOD USED FOR STORMWATER RUN-OFF CALCULATIONS

Due to the small catchment area of the study area, the Rational Method was used to calculate the stormwater run-off peak.

2.3 CATCHMENT CHARACTERISTICS

Catchment area (km ²)	2,147 km ²
10/85 vertical difference of catchment (m)	32m
Flow length of longest watercourse (km)	3 188km
Average slope of catchment (10/85)	1,01%
Time of concentration (T _c)	31,5 min

3. SUMMARY OF HYDROLOGY

Table 1 below provides the results of the hydrology calculations for both the pre and post development scenarios.

TABLE 1: HYDROLOGY SUMMARY

FLOW PEAKS DERIVED						
<i>V (M³/S)</i>	<i>Q2</i>	<i>Q5</i>	<i>Q10</i>	<i>Q20</i>	<i>Q50</i>	<i>Q100</i>
<i>PRE-DEVELOPMENT</i>	4,9	7,7	8,9	12,5	17,1	20,7
<i>POST-DEVELOPMENT</i>	5,7	9,1	10,5	14,8	20,2	24,5

4. STORMWATER MANAGEMENT PLAN

4.1 EXISTING MAIN STORMWATER CHANNEL

The proposed development area currently has an existing stormwater diversion channel running across the proposed development area as indicated on the drawing E0505/000/A attached to this report as Annexure B. The discharge into this main stormwater channel originates from the Matiba Power Station. It has also been confirmed that all stormwater originating from the Matimba Power Station is now collected in pollution control dams on Matimba Power Station property and is not discharged into the main stormwater channel any longer.

The current capacity of the channel section of the existing stormwater channel is calculated to be approximately 210m³/s, which is considerably more than the post-development 1:50 year run-off of 24,5 m³/s from the proposed development area.

Detail of the existing (and proposed new) stormwater channel is attached to this report as Annexure B

4.2 EXTENSION OF EXISTING MAIN STORMWATER CHANNEL

It is proposed to extend the existing stormwater diversion channel as depicted on the drawing E0505/000/A attached to this report as Annexure B, in order to accommodate and manage stormwater generated from the proposed new township development.

This channel must be incorporated into the surface stormwater management plan of the proposed new Nelsonskop Township development. Discharge of stormwater from the secondary stormwater systems in the proposed development area can be planned, as the capacity of the existing and new stormwater channel will be sufficient to accommodate such stormwater generated on the post development area.

4.3 EXISTING SECONDARY STORMWATER CHANNEL

The proposed development area currently also has an existing secondary stormwater diversion channel running south to north across the proposed development area and which originates from Marapong Town and is indicated on the drawing E0505/000/A attached to this report as Annexure B.

The current capacity of the channel section of the existing stormwater channel is calculated to be approximately 75m³/s, which is considerably more than the post-development 1:50 year run-off of 24,5 m³/s from the post-development area.

Detail of the existing (and proposed new) secondary stormwater channel is attached to this report as Annexure B

4.4 EXTENSION OF EXISTING SECONDARY STORMWATER CHANNEL

It is proposed to extend both the existing main stormwater and secondary diversion channels as depicted on the drawing E0505/000/A and which is attached to this report as Annexure B in order to accommodate and manage stormwater generated from the proposed new township development.

5. DETAIL DESIGN DRAWINGS FOR STORMWATER CHANNELS

The detailed design drawings are attached as Annexure B for further information and if required for the upgrading of the stormwater channels.

6. CONCLUSIONS

- 6.1 A detailed electronic digital terrain model (DTM,) with a 0,5 m contour interval layout, was used for the analysis of the stormwater peak flow calculations.
- 6.2 The detailed analysis of the development revealed that the total catchment upstream is approximately 2,5km². This implies that the delineation of the 1:50 & 1:100 year floodlines is not required as set out in the National Water Act (Act No. 36, 1998), as the catchment is less than 5km².
- 6.3 The existing stormwater discharge from the Matimba Power Station and the Marapong Town must be accommodated in the township layout to be development by the appointed Town Planner as set out in the detail design drawings attached as Annexure B to this report.
- 6.4 It is hereby certified that the development area will be not be affected by both the 1:50 year & 1:100 year flood events.

Compiled by:

A J SMITH Pr.Eng (Reg No 900262)

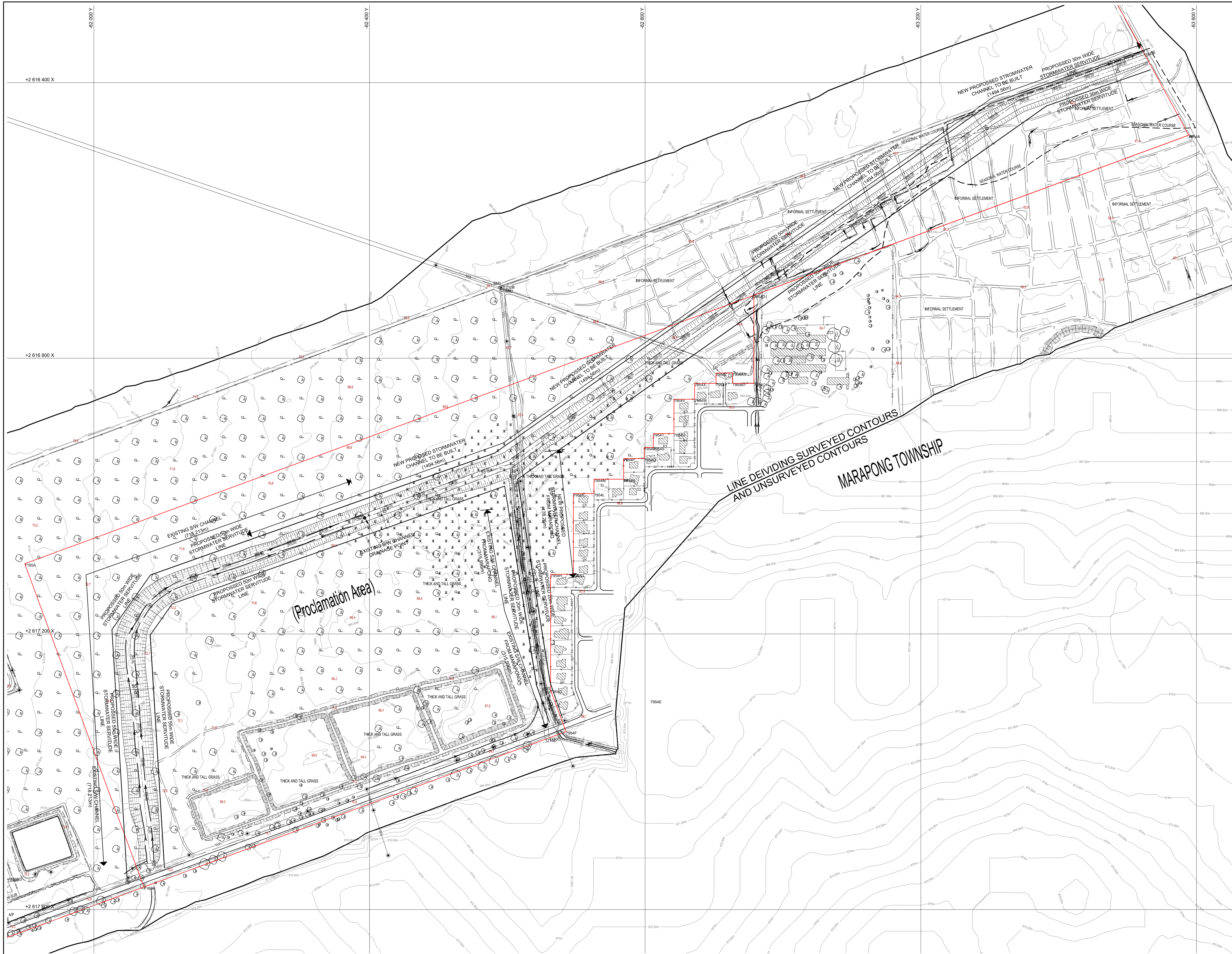
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ANNEXURE A
LOCALITY PLAN



LOCALITY PLAN

ANNEXURE B
DESIGN DRAWINGS



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Revisions			

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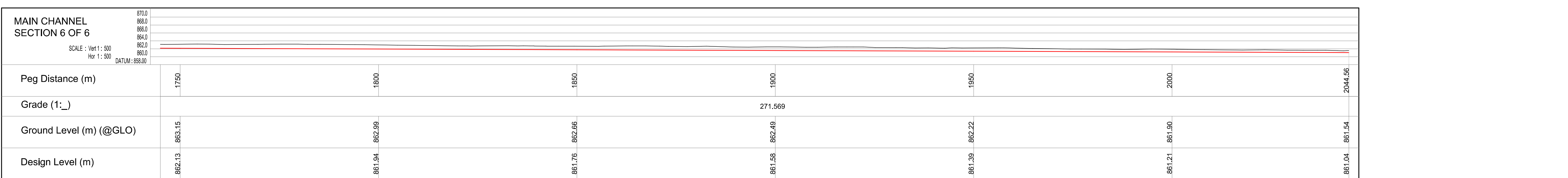
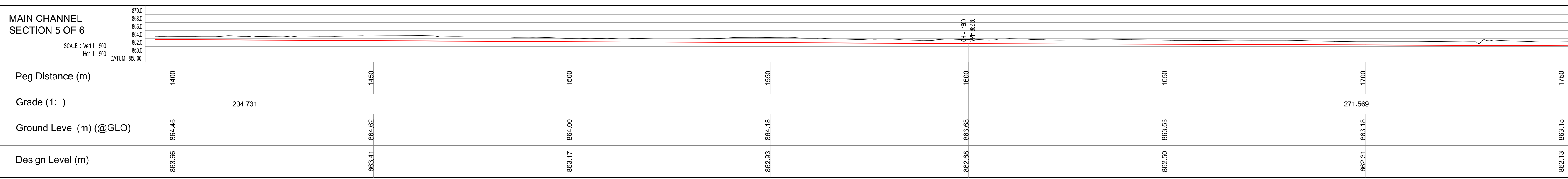
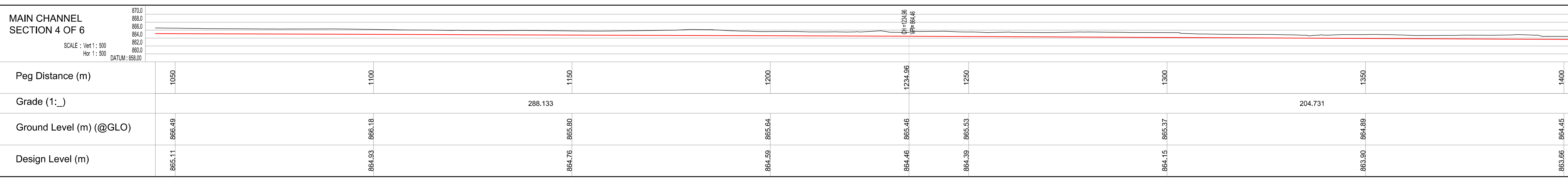
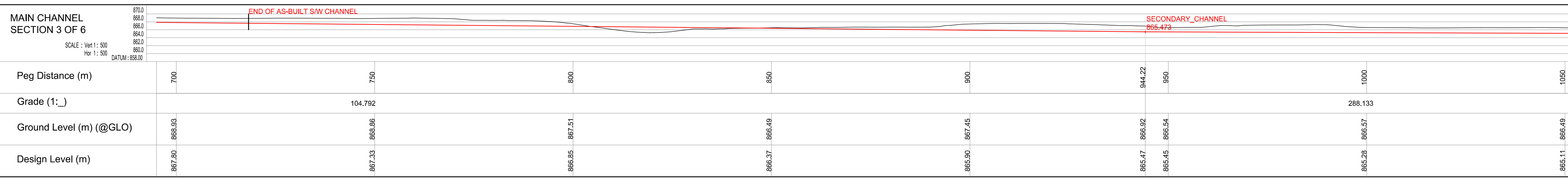
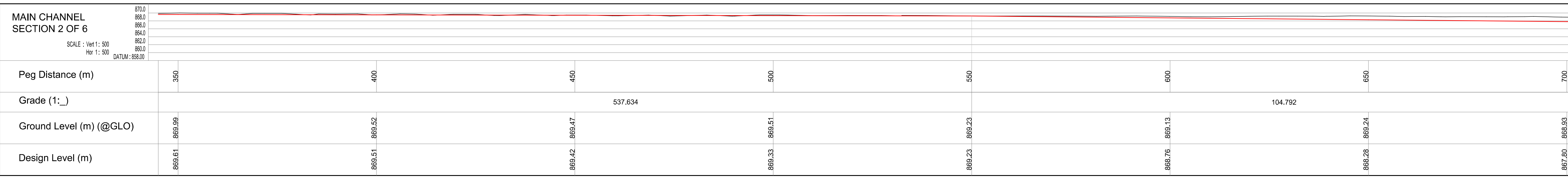
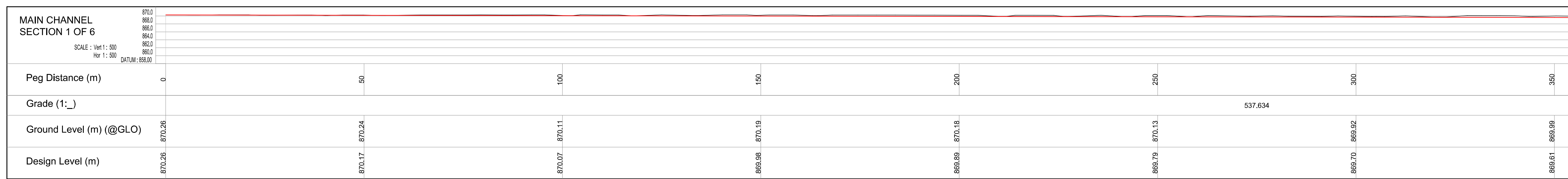
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Project Title: NELSONSKOP TOWNSHIP DEVELOPMENT

Drawing Title: CHANNEL LAYOUT PLAN

Designed	Drawn	Checked
A.J. Smith	WCA VAN STADEN	
Scale	Date	
1:2500	13-06-2016	

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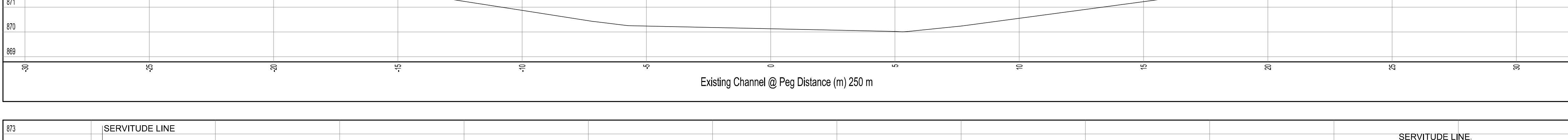
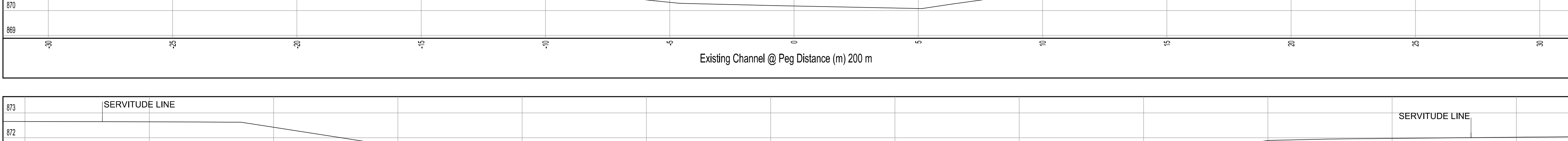
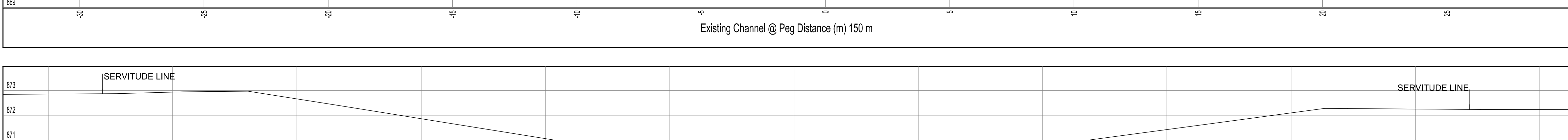
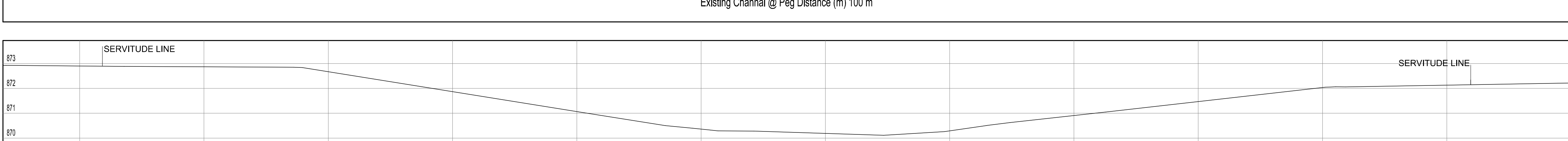
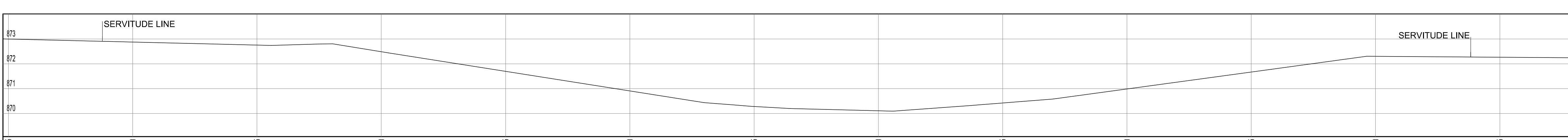
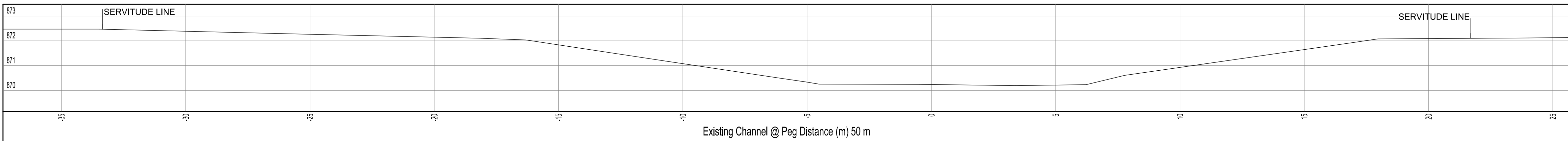
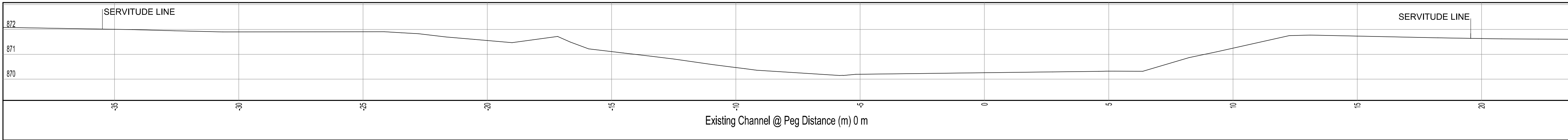
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NELSONSKOP TOWNSHIP DEVELOPMENT

Drawing Title
MAIN CHANNEL LONG SECTIONS

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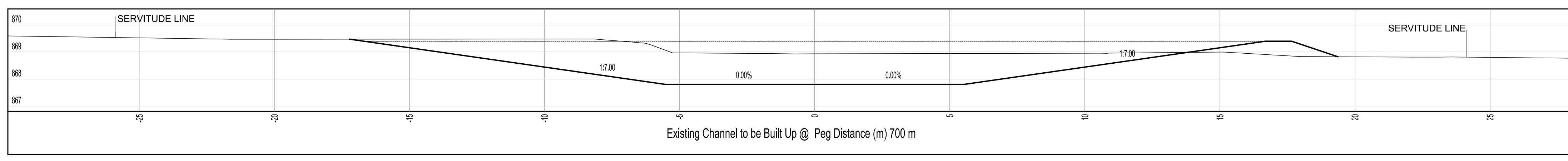
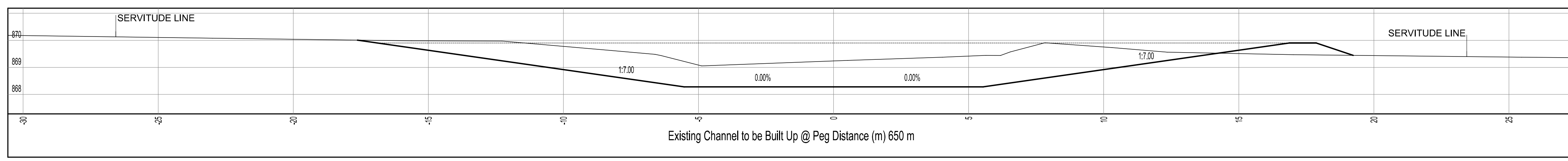
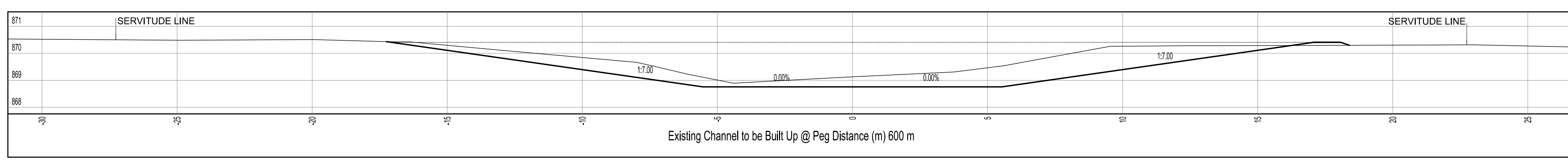
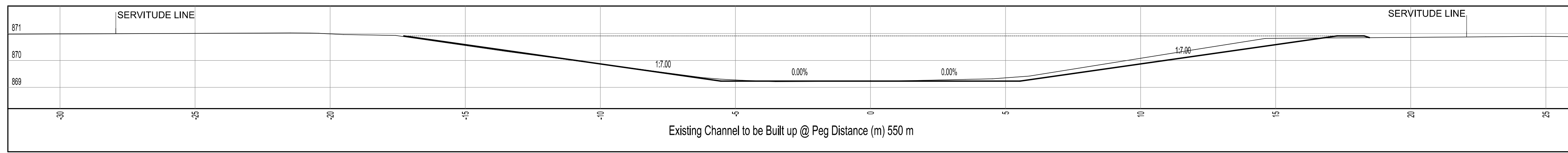
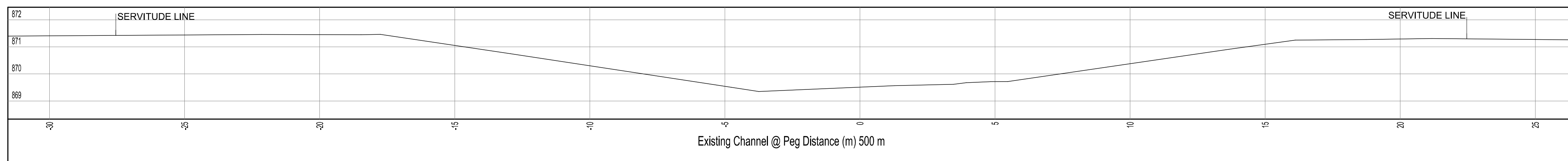
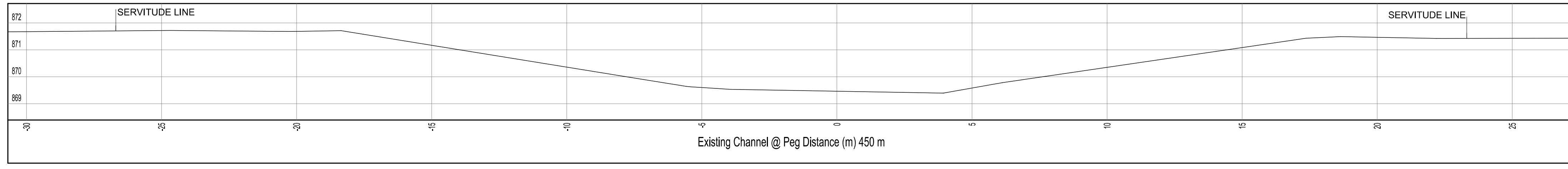
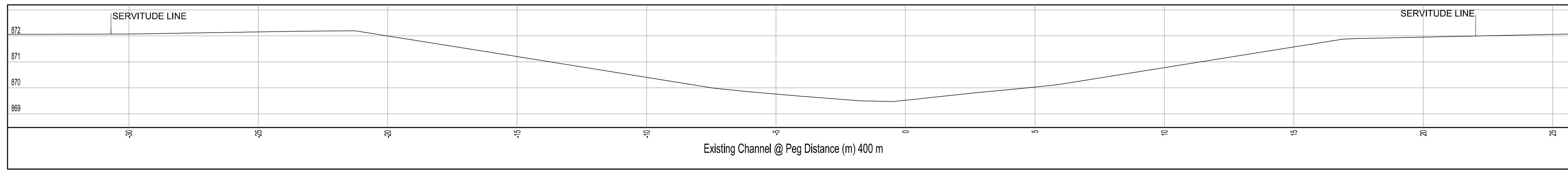
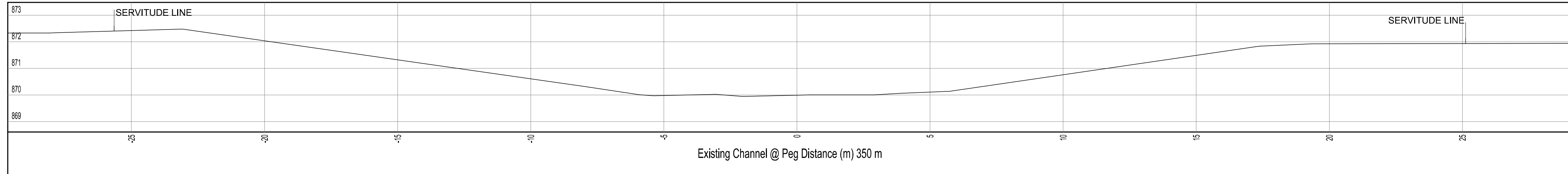
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NELSONSKOP TOWNSHIP DEVELOPMENT

Drawing Title
MAIN CHANNEL CROSS SECTIONS SHEET 1 OF 5

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Project Title: NELSONSKOP TOWNSHIP DEVELOPMENT

Drawing Title: MAIN CHANNEL CROSS SECTIONS SHEET 2 OF 5

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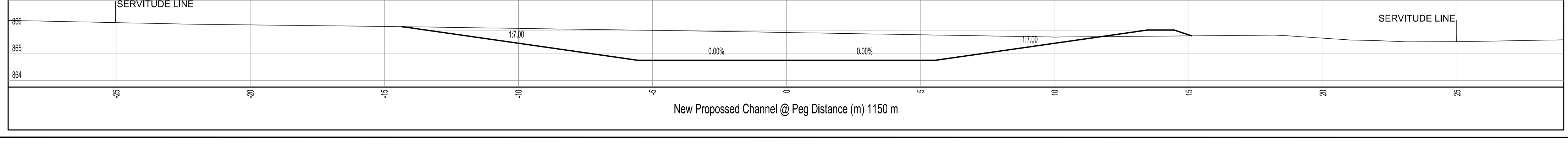
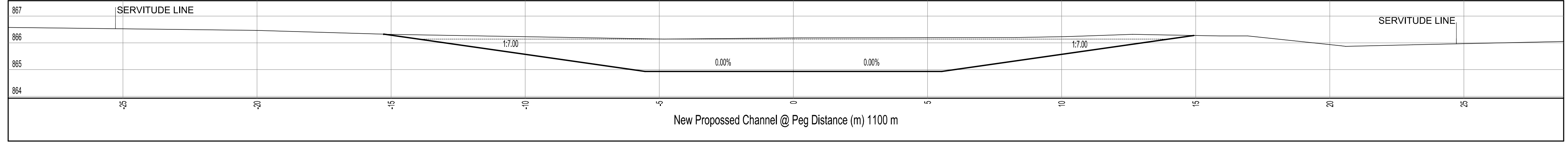
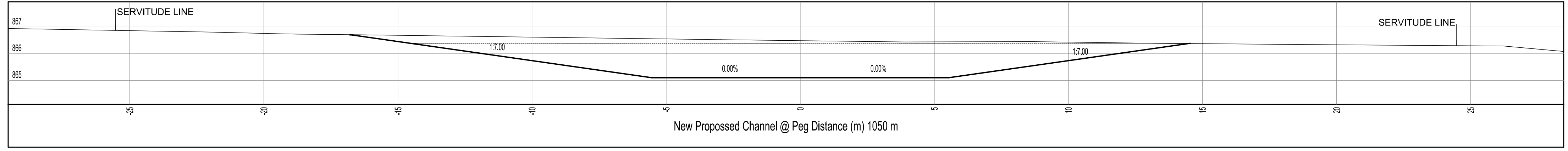
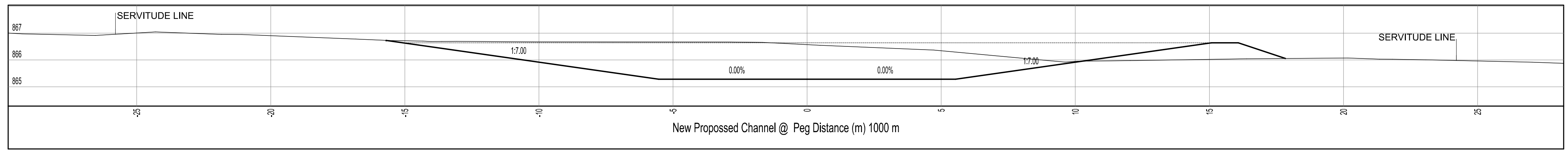
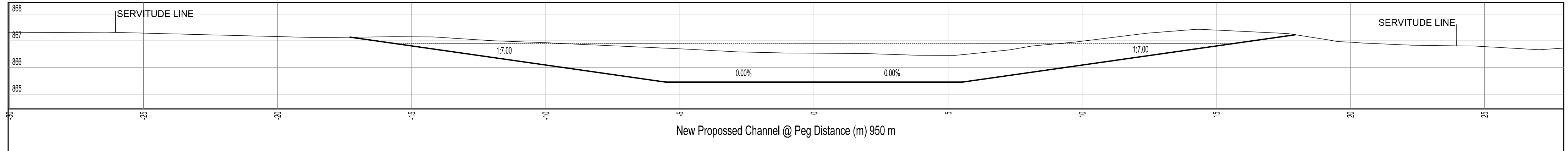
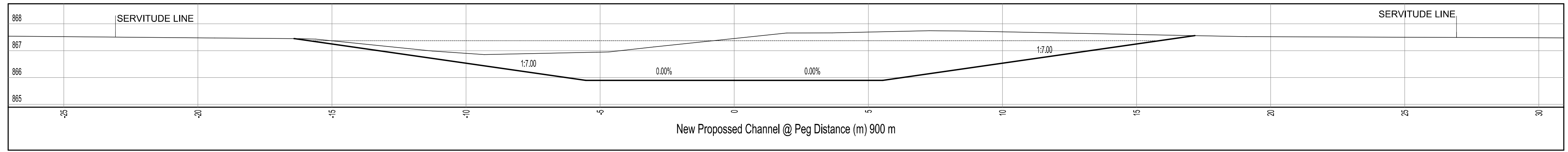
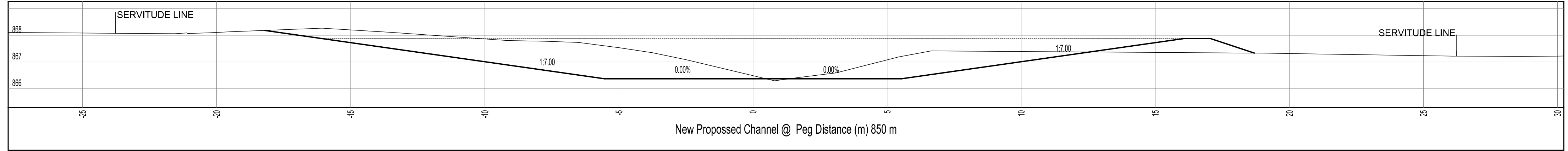
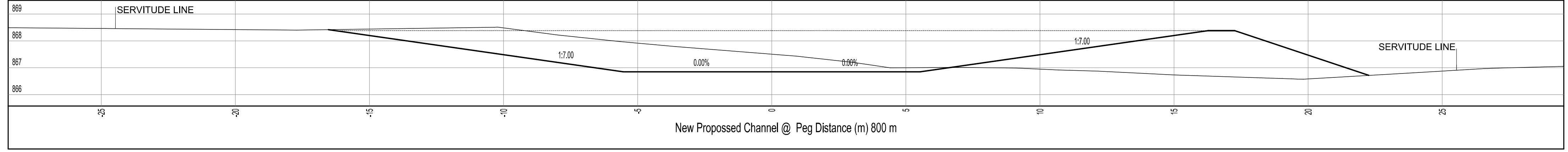
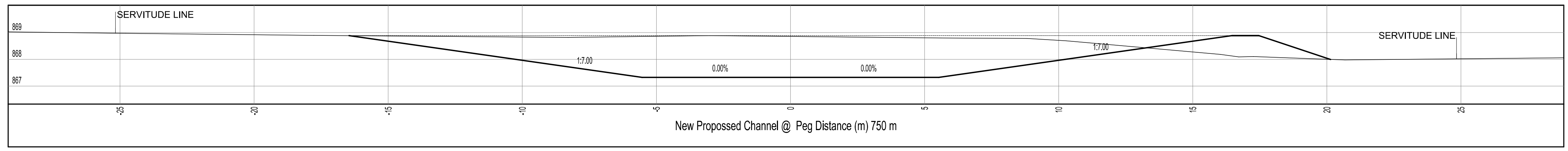
NELSONSKOP TOWNSHIP DEVELOPMENT

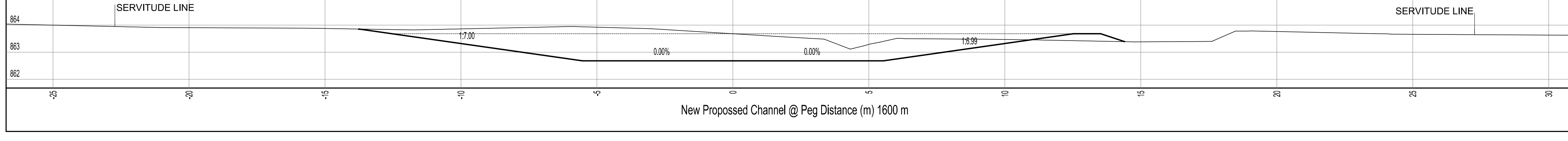
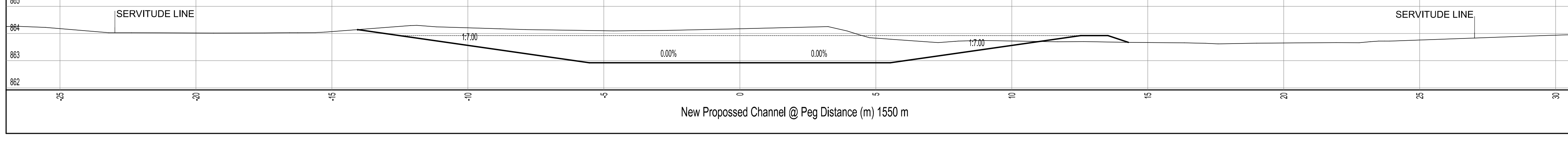
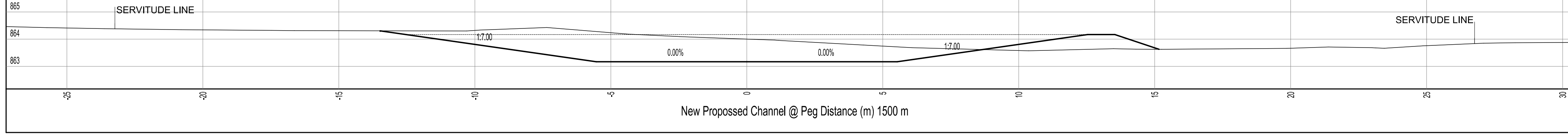
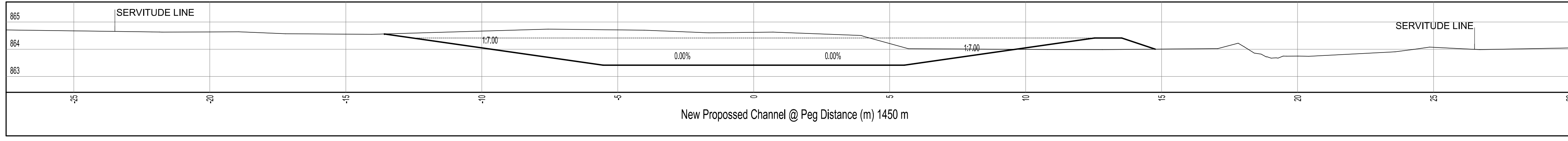
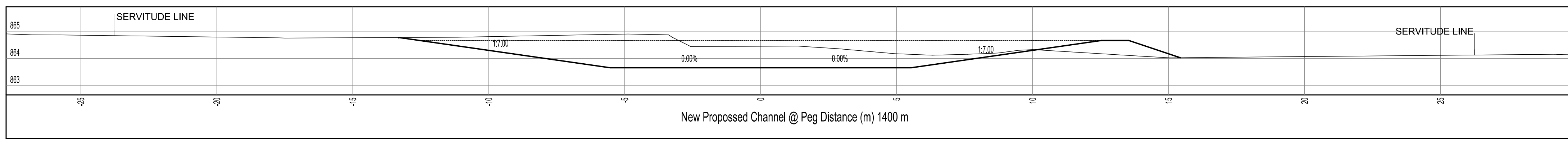
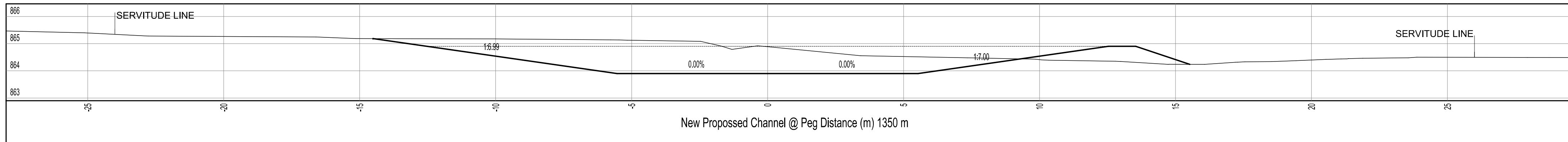
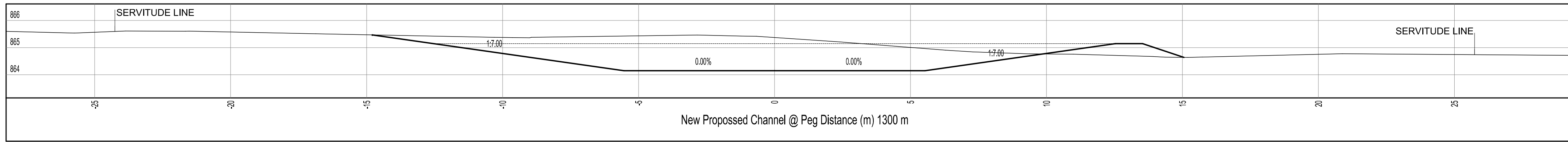
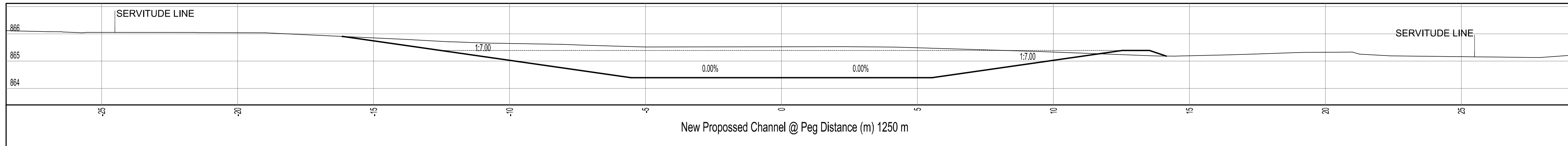
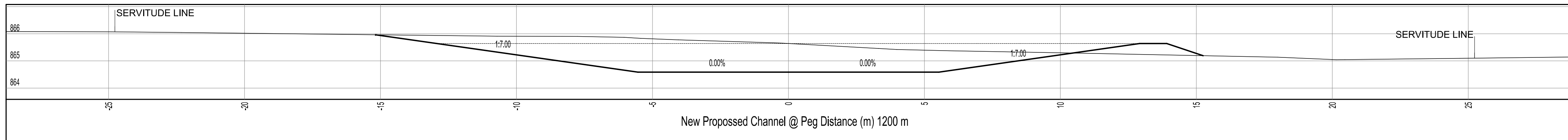
Drawing Title

MAIN CHANNEL CROSS SECTIONS SHEET 3 OF 5

Designed	Drawn	Checked
A.J. Smith	WCA VAN STADEN	
Scale	Date	
AS SHOWN	27-06-2016	

Project No	Drawing No.	Rev.
E0505	002.3	A





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GENERAL NOTES:

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Revisions			

CONCEPT DRAWING	NAME	A.J. SMITH P.ENG. (900262)
	SIGNATURE	27-06-2016 DATE
TENDER DRAWING	NAME	
	SIGNATURE	DATE
APPROVED FOR CONSTRUCTION DRAWING	NAME	
	SIGNATURE	DATE
AS BUILT DRAWING	NAME	
	SIGNATURE	DATE

80mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SIZE A1

Client

EXXARO

AVON ENGINEERS (Pty) Ltd
 CONSULTING CIVIL & STRUCTURAL ENGINEERS

PRETORIA HERMANUS
 473 KAY AVENUE POSTNET SUITE 28
 MENLO PARK 0096 PRINATREK 116
 PO BOX 3638 HERMANUS 7200
 MENLO PARK 0102 Tel: 082 406 5145
 TEL: (012) 348 5066 Fax: (086) 685 4303

Project Title

NELSONSKOP TOWNSHIP DEVELOPMENT

Drawing Title

MAIN CHANNEL CROSS SECTIONS SHEET 4 OF 5

Designed	Drawn	Checked
A.J.Smith	WCA VAN STADEN	
Scale	Date	
AS SHOWN	27-06-2016	

Project No	Drawing No.	Rev.
E0505	002.4	A

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GENERAL NOTES:

A	27/06/2016	FOR APPROVAL	A.J.S
No	Date	Details	Checked
Revisions			

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<input type="checkbox"/>	AS BUILT DRAWING		

80mm ON ORIGINAL DRAWING

ORIGINAL DRAWING SIZE: A1

Client: EXXARO

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 CONSULTING CIVIL & STRUCTURAL ENGINEERS

PRETORIA: 473 KAY AVENUE, MENLO PARK 0096
 HERMANUS: POSTNET SUITE 28, PRINATREK 116, HERMANUS 7200

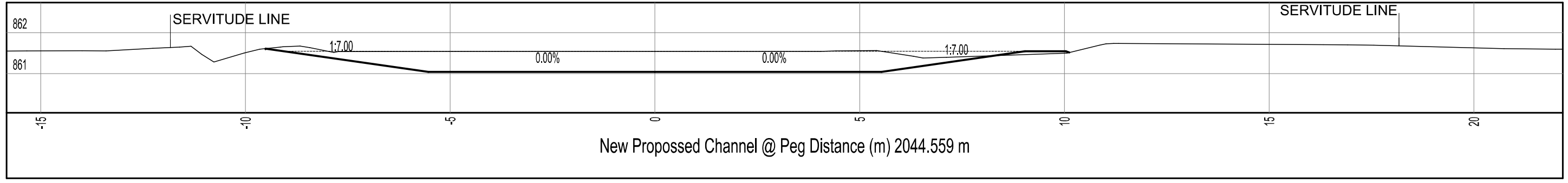
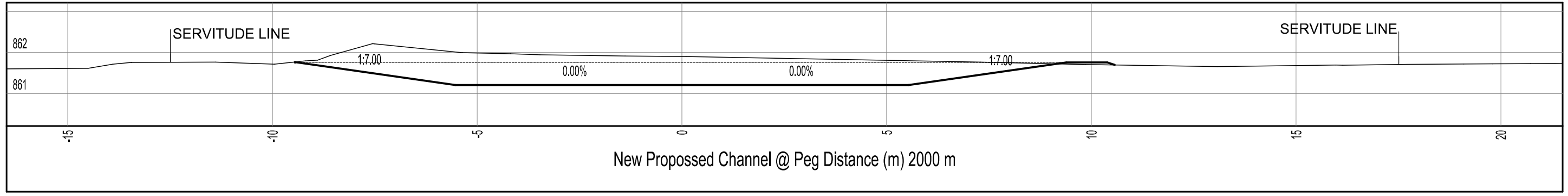
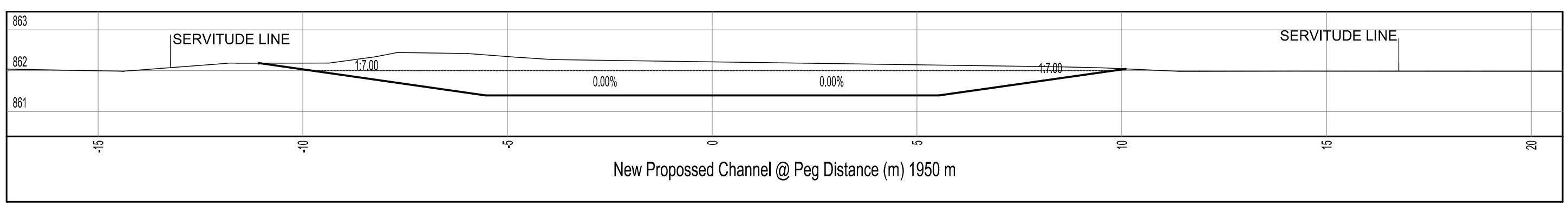
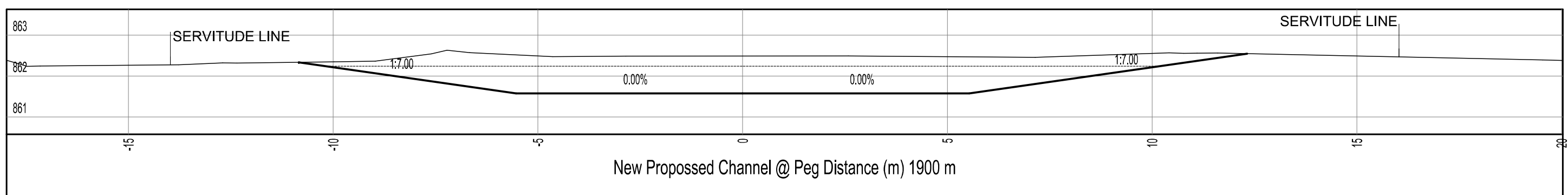
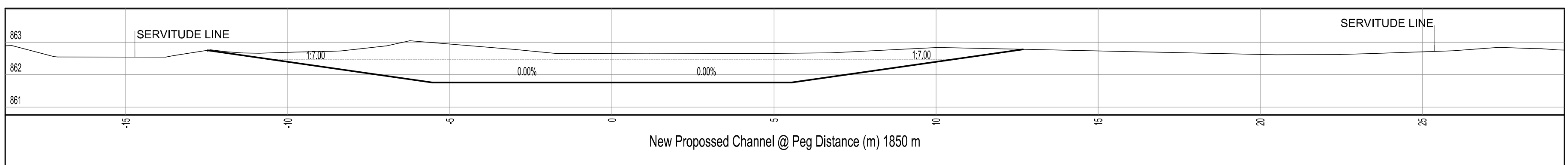
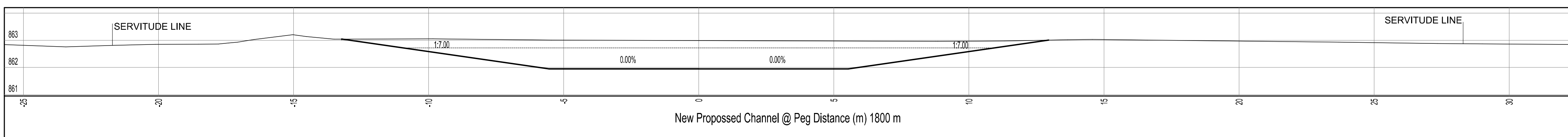
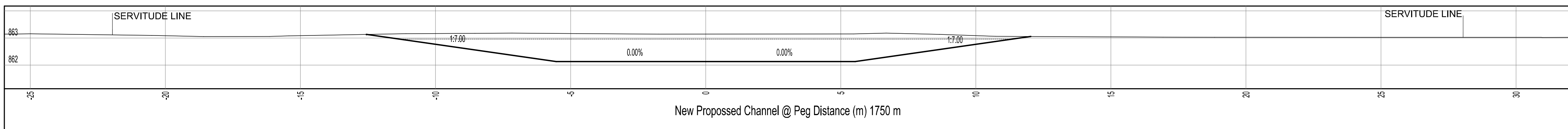
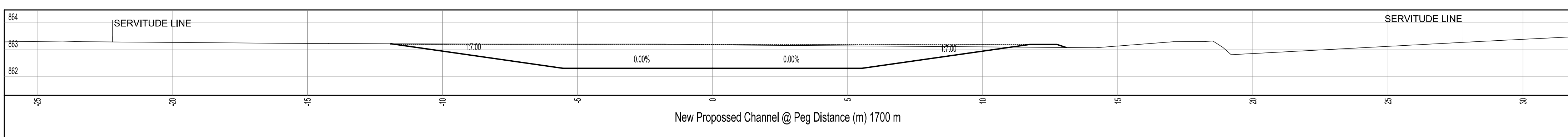
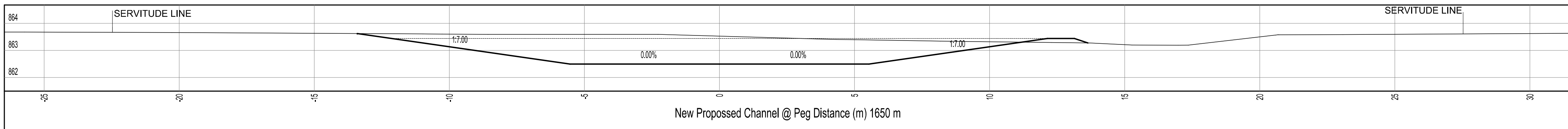
PO BOX 36384, MENLO PARK 0102
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Project Title: NELSONSKOP TOWNSHIP DEVELOPMENT

Drawing Title: MAIN CHANNEL CROSS SECTIONS SHEET 5 OF 5

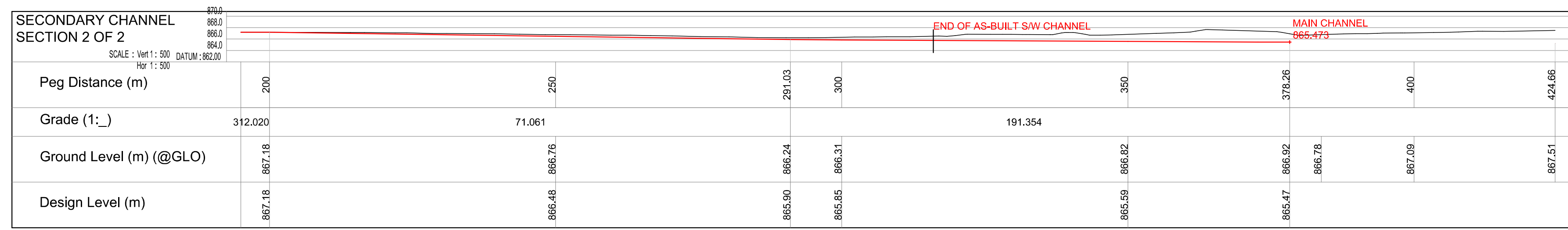
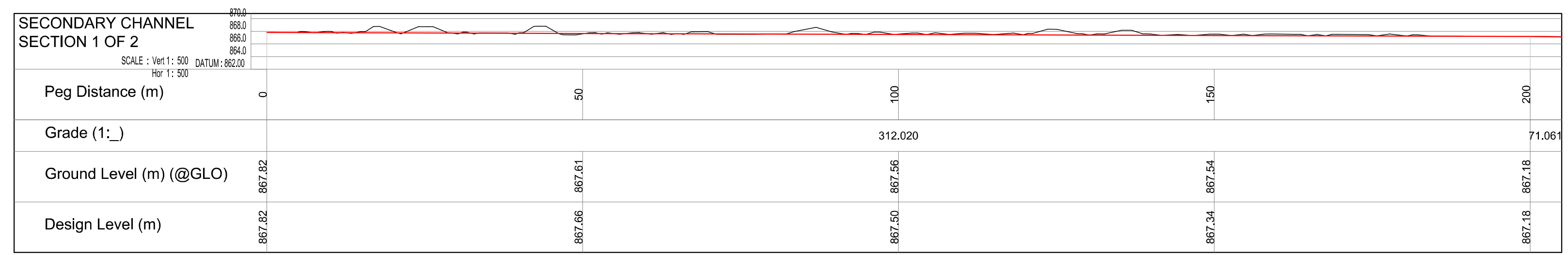
Designed: A.J.Smith	Drawn: WCA VAN STADEN	Checked:
Scale: AS SHOWN	Date: 27-06-2016	

Project No: E0505	Drawing No: 002.5	Rev: A
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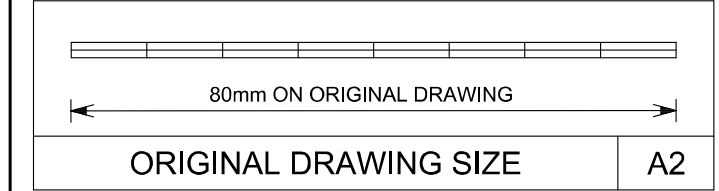


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A	27-06-2016	FOR APPROVAL	A.J.S
No	Date	Details	Checked
Revisions			



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	SIGNATURE	27-06-2016 DATE
TENDER DRAWING	NAME	
	SIGNATURE	DATE
APPROVED FOR CONSTRUCTION DRAWING	NAME	
	SIGNATURE	DATE
AS BUILT DRAWING	NAME	
	SIGNATURE	DATE



Client **EXXARO**

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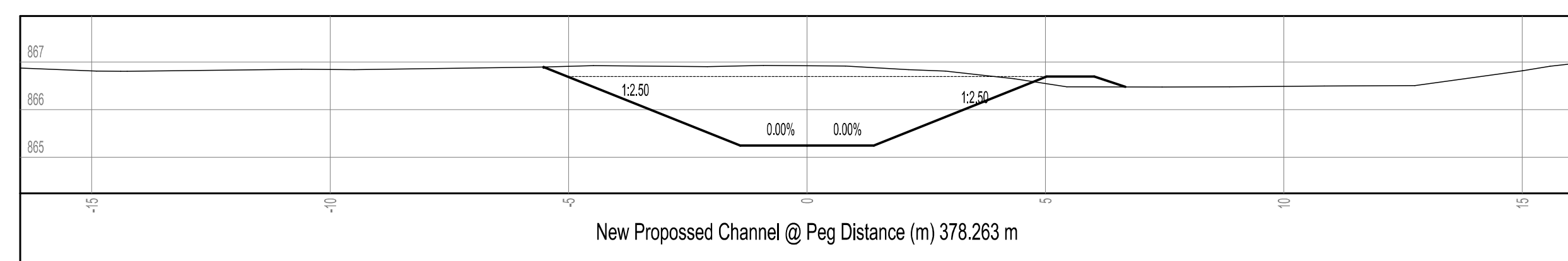
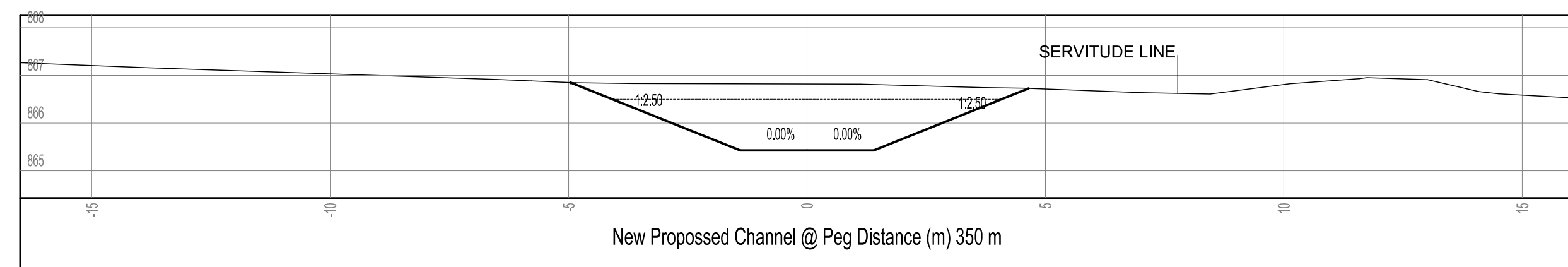
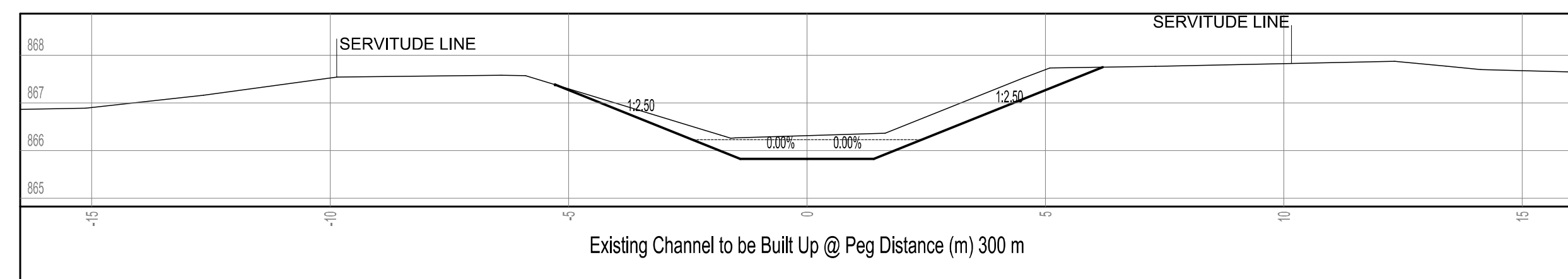
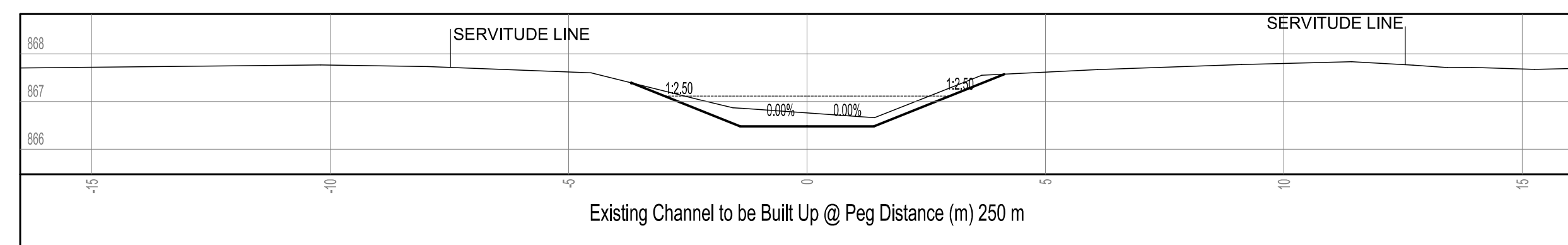
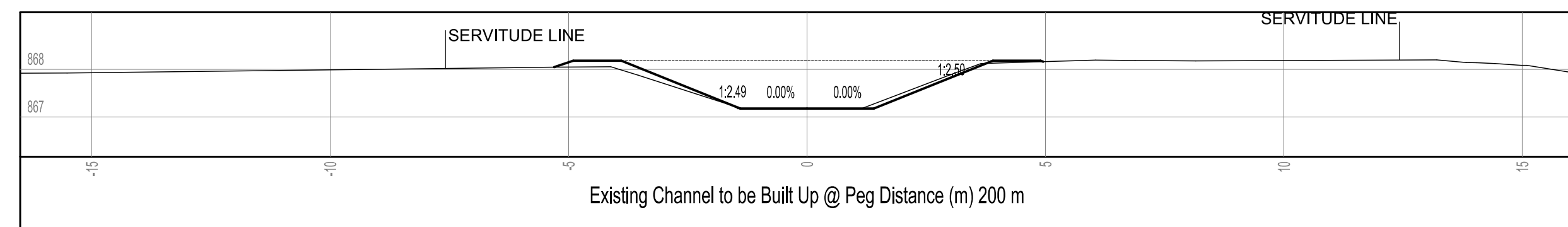
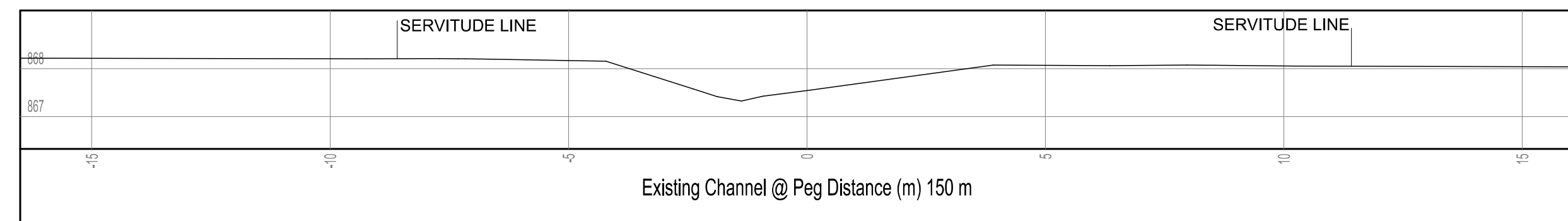
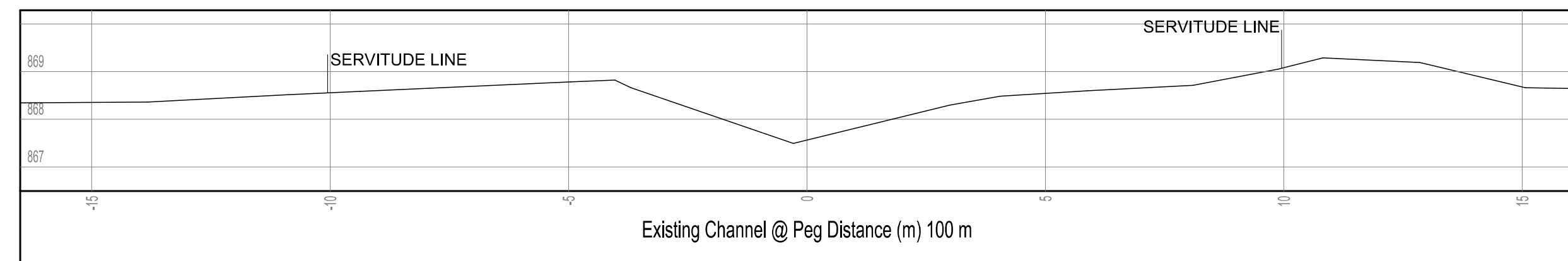
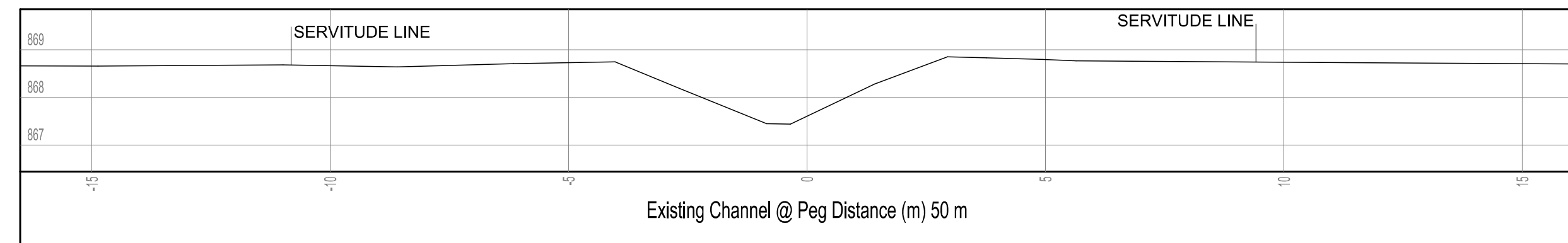
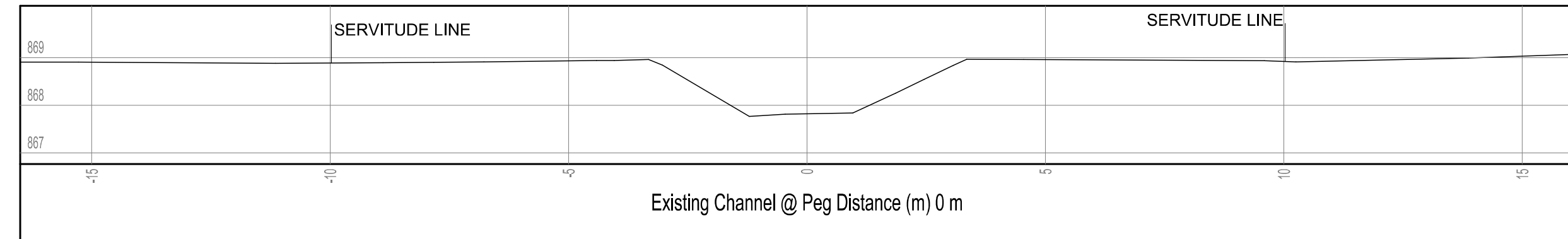
HERMANUS
POSTNET SUITE 26
PRIVATBAG X16
HERMANUS 7200
Tel: 082 456 5145

Project Title
NELSONSKOP TOWNSHIP DEVELOPMENT

Drawing Title
SECONDARY CHANNEL LONG SECTIONS

Designed	Drawn	Checked
A.J.Smith	WCA VAN STADEN	
Scale	Date	
AS SHOWN	27-06-2016	

Project No	Drawing No.	Rev.
E0505	003	A

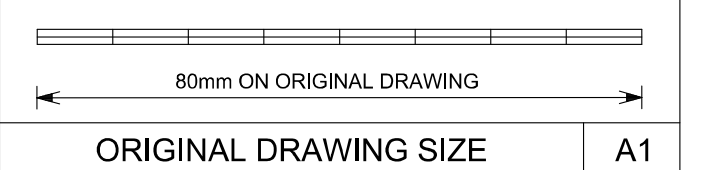


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Revisions			

CONCEPT DRAWING	NAME	A.J. SMITH PHENG. (900262)
	SIGNATURE	27-06-2016 DATE
TENDER DRAWING	NAME	
	SIGNATURE	DATE
APPROVED FOR CONSTRUCTION DRAWING	NAME	
	SIGNATURE	DATE
AS BUILT DRAWING	NAME	
	SIGNATURE	DATE



Client
EXXARO

AVON ENGINEERS (Pty) Ltd
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HEMBANUS
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PRINATREK 116
HEMBANUS 1209
TEL: 082 406 5145

Project Title
NELSONSKOP TOWNSHIP DEVELOPMENT

Drawing Title
SECONDARY CHANNEL CROSS SECTIONS'

Designed A.J.Smith	Drawn WCA VAN STADEN	Checked
Scale AS SHOWN	Date 27-06-2016	

Project No	Drawing No.	Rev.
E0505	004	A

ANNEXURE C
***RATIONAL DESIGN FOR
STORMWATER RUN-OFF***

Description of Catchment:	NELSONSKOP
Project No:	E0505
Calculated By:	A J Smith
Date:	26-Jun-16
	PRE-DEVELOPMENT

AVON ENGINEERS (Pty) Ltd
 Reg No 1998/020129/07
 CONSULTING CIVIL & STRUCTURAL ENGINEERS



Physical Characteristics

Mean annual rainfall (P)	P =	470	mm
Size of Catchment	A =	2147060	m ²
Longest water course	L =	3188	m
Height Difference	=	32.0	m
Average slope of water cours	S =	0.0100	m/m

Area Distribution Factors

$\alpha + \beta + \gamma = 1$		
Rural	Urban	Lakes
$\alpha =$	$\beta =$	$\gamma =$
1.00	0.00	0.00

Table 3: Suggested values of r

Paved area	0.02
Clean soil	0.1
Sparse grass	0.3
Moderate grass	0.4
Thick bush	0.8
Use r =	0.03

Overland flow	=	0.591	Hours	Use Tc =	0.591	Hours
Watercourse	=	0.952	Hours			

Rural C1								Urban C2			
Surface Slope	%	C _s	Permeability	%	C _p	Vegetation	%	C _v	Use	%	C ₂
Vlei's and pans	10%	0.03	Very Permeable			Thick bush and plantation			Lawns and parks		
Fiat areas	90%	0.08	Permeable	40%	0.08	Light bush and farm-lands	20%	0.11	Industrial areas		
Hilly	0%	0.16	Semi-Permeable	50%	0.16	Grass-lands	80%	0.21	City/Residential		
Steep areas			Impermeable	10%	0.26	No vegetation			Streets		
TOTAL	1.00		TOTAL	1.00		TOTAL	1.00		TOTAL	0.00	

Table 1: Rural runoff-coefficients

Component	Classification	MAR (mm)		
		600	600-900	900
Surface slope C _s	Vleis and pans (<3%)	0.01	0.03	0.05
	Flat areas (3-10%)	0.06	0.08	0.11
	Hilly (10-30%)	0.12	0.16	0.20
	Steep areas (>30%)	0.22	0.26	0.30
Surface slope C _p	Very permeable	0.03	0.04	0.05
	Permeable	0.06	0.08	0.10
	Semi permeable	0.12	0.16	0.20
	Impermeable	0.21	0.26	0.30
Surface slope C _v	Thick bush and plantation	0.03	0.04	0.05
	Light bush and farm-lands	0.07	0.11	0.15
	Grass-lands	0.17	0.21	0.25
	No vegetation	0.26	0.28	0.30

Table 2: Urban runoff-coefficients

Use	Coefficient
Lawns & Parks	
Sandy, flat (<2%)	0.05-0.10
Sandy, steep (>7%)	0.15-0.20
Heavy soil, steep (>7%)	0.13-0.17
Heavy soil, flat (<2%)	0.25-0.35
Residential areas	
Houses	0.30-0.50
Flats	0.50-0.70
Industry	
Light Industry	0.50-0.80
Heavy Industry	0.60-0.90
Business	
City centre	0.70-0.95
Suburban	0.50-0.70
Streets	0.70-0.95

Summer rainfall region

Return period T (years)	2	5	10	25	50	100
Point rainfall (mm)	12	19	22	31	42	51
Point intensity (mm/h)	20	32	37	52	71	86

Run-off factor

Return period T (years)	2	5	10	25	50	100
Rural C1	0.40	0.40	0.40	0.40	0.40	0.40
Urban C2	0.00	0.00	0.00	0.00	0.00	0.00
Lakes C3	1.00	1.00	1.00	1.00	1.00	1.00
Combined C = C1 + C2 + C3	0.40	0.40	0.40	0.40	0.40	0.40

Peak flow -Catchments

Return period T (years)	2	5	10	25	50	100
Peak flow Q = CIA/3600 (l/s)	4807	7691	8893	12498	17065	20670

Notes:

No Dolomitic areas present in Catchment
 Pre-Development Stormwater drainage
 Catcment is in a summer rainfall region

Description of Catchment:	NELSONSKOP
Project:	E0505
Calculated By:	A J Smith
Date:	26-Jun-16
	POST-DEVELOPMENT

AVON ENGINEERS (Pty) Ltd
 Reg No 1998/020126/07
 CONSULTING CIVIL & STRUCTURAL ENGINEERS



Physical Characteristics

Mean annual rainfall (P)	P =	470	mm
Size of Catchment	A =	2147060	m ²
Longest water course	L =	3188	m
Height Difference	=	32.0	m
Average slope of water cours	S =	0.0100	m/m

Area Distribution Factors

$\alpha + \beta + \gamma = 1$		
Rural	Urban	Lakes
$\alpha =$	$\beta =$	$\gamma =$
0.00	1.00	0.00

Table 3: Suggested values of r

Paved area	0.02
Clean soil	0.1
Sparse grass	0.3
Moderate grass	0.4
Thick bush	0.8
Use r =	0.03

Overland flow	=	0.591	Hours	Use Tc =	0.591	Hours
Watercourse	=	0.952	Hours			

Rural C1									Urban C2		
Surface Slope	%	C _s	Permeability	%	C _p	Vegetation	%	C _v	Use	%	C ₂
Vlei's and pans			Very Permeable			Thick bush and plantation			Lawns and parks	0.45	0.20
Flat areas			Permeable			Light bush and farm-lands			Industrial areas		
Hilly			Semi-Permeable			Grass-lands			City/Residential	0.30	0.50
Steep areas			Impermeable			No vegetation			Streets	0.25	0.95
TOTAL	0.00		TOTAL	0.00		TOTAL	0.00		TOTAL	1.00	

Table 1: Rural runoff-coefficients

Component	Classification	MAR (mm)		
		600	600-900	900
Surface slope C _s	Vleis and pans (<3%)	0.01	0.03	0.05
	Flat areas (3-10%)	0.06	0.08	0.11
	Hilly (10-30%)	0.12	0.16	0.20
	Steep areas (>30%)	0.22	0.26	0.30
Surface slope C _p	Very permeable	0.03	0.04	0.05
	Permeable	0.06	0.08	0.10
	Semi permeable	0.12	0.16	0.20
	Impermeable	0.21	0.26	0.30
Surface slope C _v	Thick bush and plantation	0.03	0.04	0.05
	Light bush and farm-lands	0.07	0.11	0.15
	Grass-lands	0.17	0.21	0.25
	No vegetation	0.26	0.28	0.30

Table 2: Urban runoff-coefficients

Use	Coefficient
Lawns & Parks	
Sandy, flat (<2%)	0.05-0.10
Sandy, steep (>7%)	0.15-0.20
Heavy soil, steep (>7%)	0.13-0.17
Heavy soil, flat (<2%)	0.25-0.35
Residential areas	
Houses	0.30-0.50
Flats	0.50-0.70
Industry	
Light Industry	0.50-0.80
Heavy Industry	0.60-0.90
Business	
City centre	0.70-0.95
Suburban	0.50-0.70
Streets	0.70-0.95

Summer rainfall region

Return period T (years)	2	5	10	25	50	100
Point rainfall (mm)	12	19	22	31	42	51
Point intensity (mm/h)	20	32	37	52	71	86

Run-off factor

Return period T (years)	2	5	10	25	50	100
Rural C1	0.00	0.00	0.00	0.00	0.00	0.00
Urban C2	0.48	0.48	0.48	0.48	0.48	0.48
Lakes C3	1.00	1.00	1.00	1.00	1.00	1.00
Combined C = C1 + C2 + C3	0.48	0.48	0.48	0.48	0.48	0.48

Peak flow -Catchments

Return period T (years)	2	5	10	25	50	100
Peak flow Q = CIA/3600 (l/s)	5696	9113	10537	14809	20220	24491

Notes:

No Dolomitic areas present in Catchment
 Post-Development Stormwater drainage
 Catcment is in a summer rainfall region

Return period T (years)	2	5	10	25	50	100
Point rainfall (mm)	12	19	22	31	42	51

