

## National Grid Yaxley 400kV Substation, Leys Lane, Yaxley IP23 8DX Planning ref: DC/23/05363 - Condition 6 (Surface Water Drainage)

This document has been prepared in response to the refusal to discharge condition 6 (Surface Water Drainage) of planning application reference DC/23/05363, outlined in email correspondence dated 21.11.2024 from Suffolk County Council (SCC).

SCC's action required to overcome the current refusal, along with the Haydn Evans (HE) response, are provided below:

### SCC comment no.1:

1. *Cv value is to be 1.0 as per the LLFA Suffolk SuDs Guide March 2023*

**HE response:** Patterson Reeves & Partners (PRP) have undertaken calculations for the drainage design using InfoDrainage, the Drainage Calculations document D069-SEL-V00-400-CA-C-0005 Rev P06 dated January 2024 is attached showing the Cv values set at 1.0.

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### SCC comment no.2:

2. *Applicant will need to submit the following documents/information.*
  - a. *Cross section of the attenuation basin, depicting side slopes no greater than 1:4, 1.5m wet/dry benches every 0.6m depth of water, freeboard min 300mm, 3m maintenance strip and indicate depths for 1:2, 1:30 & 1:100+CC rainfall events. Water depth shall be no greater than 1.0m*
  - b. *Flood flow exceedance plan*
  - c. *Management and Maintenance Plan/schedule of the surface water drainage system*

**HE response:** The PRP Drainage Calculations document and drawing D069-SEL-C00-400-DD-C-0028 'Details 2 Drainage' (appended) provide clarification that 1:4 side slopes, 1.5m wet/dry benches every 0.6m of water depth (note the permanent water level of 300mm) and 300mm minimum freeboard have been included in the drainage design. A 3 metre maintenance strip is also provided and the water depths for the 1:2, 1:30 and 1:100 +45% climate change rainfall events are provided in the calculations and on the drawing. The water depth does not increase by more than 1 metre in the critical storm event.

Exceedance flow routes are shown on drawing 306-006-D300, attached.

A Surface Water and SuDS Management and Maintenance Plan is attached.

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### SCC comment no.3:

3. *Submit a landscaping plan for the attenuation basin.*

**HE response:** DRaW (UK) Ltd have produced a landscaping plan, see drawing 059-12-01(S73) B attached. The basin is planted with Pond Edge Seed Mix (Emorsgate EP1) which contains 80% grasses, including Bents and Fescues; it is a commercially available mix designed specifically for water bodies/pond margins.



HAYDN  
EVANS

Reference: 306-006-RP07  
Revision: -

### Attachments:

PRP Drainage Calculations document D069-SEL-V00-400-CA-C-0005 Rev P06 dated February 2024  
PRP drawing D069-SEL-C00-400-DD-C-0028 - Details 2 Drainage  
PRP drawing D069-DEL-V00-400-LY-C-0016 - Overview & Philosophy Drainage  
PRP drawing D069-SEL-V00-400-SH-C-0006 - Schedules Drainage  
HE drawing 306-006-D301 - Exceedance Flow Route Plan  
HE document 306-006-RP08 - SuDS & Surface Water Management & Maintenance Plan  
DRaW UK Ltd drawing 059-12-01(S73) C - Landscape Mitigation - Soft Works



# Patterson Reeves & Partners

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## DRAINAGE CALCULATIONS

### EYE 400kV SUBSTATION

**Engineer:** Patterson Reeves & Partners Ltd  
**Client:** Siemens Energy Ltd  
**Date:** February 2024  
**Internal Ref:** J5656 / DC02  
**Client Ref:** D069-SEL-V00-400-CA-C-0005  
**Revision:** P06 – FOR CONSTRUCTION

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Certificate Number 8269  
ISO 9001

**Calculation Issue/Revision Log**

Revision / Issue	Date	Comment	By	Checked
01	July 2023	First Issue	MDP	NP
02	October 2023	Revised to comments	MDP	NP
03	October 2023	Drainage Philosophy Revised	MDP	NP
04	January 2024	Detention Basin levels added.	MDP	NP
05	February 2024	CV value, results for the 30 year and 2 year storms added.	MDP	NP
06	February 2024	Site Drainage Layout revised to show landscaping.	MDP	NP



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Project Eye 400kV Substation				Job Ref. J5657	
Section Drainage Calculations				Sheet no./rev. DC02 / iii	
Calc. by MDP	Date 03/02/2024	Chk'd by PJR	Date 03/02/2024	App'd by NP	Date 03/02/2024

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Project Eye 400kV Substation				Job Ref. J5657	
Section Drainage Calculations				Sheet no./rev. DC02 / 1	
Calc. by MDP	Date 19/10/2023	Chk'd by PJR	Date 19/10/2023	App'd by NP	Date 19/10/2023

## 1.0 Drainage Design Philosophy

### Normal Substation Operation

The green field site area lost to new development has been calculated as 9,006m<sup>2</sup>.

As a minimum the surface water drainage system will fully manage surface water flows resulting from the developed site, up to the 100 year return period peak rainfall event, plus a minimum of 45% to allow for the impacts of climate change.

The predeveloped greenfield site falls towards a nearby watercourse. an analysis has identified the flows from the green field site (the area inside the substation security fence line) as 2.6 l/s during a 1 in 1 year return period storm. (mean annual flood flow, Qbar). this rises up to 9.4 l/s during a 100 year event.

The proposal is to undertake a cut and fill of the existing ground in order to form a level platform prior to undertaking the construction of the substation. Following completion of the development, it is proposed to limit the maximum flow to downstream watercourses to 2.3 l/s by means of a hydro-brake. This is less than Qbar and significantly less than the existing greenfield runoff rate during a 1 in 100 year event of 9.4 l/s. Calculations demonstrates that in order to achieve this it will be necessary to provide an attenuation volume of 294.3m<sup>3</sup>. The proposal is to construct a wetland/detention basin capable of containing this volume with an additional 300mm of freeboard (which will provide an additional 75m<sup>3</sup> of storage volume).

### Surface Water – Substation Platform

Historically substation platforms for electrical substations were made up of 300mm of compacted type 1 mot stone with a layer of 75mm single sized stone chippings on top. The type 1 layer was largely impervious and thus rainfall would tend not to penetrate below the chipping layer. More recently it has become common practice to replace the type 1 stone layer with a free draining stone such as type 3. This is the most used sub-base where suds is required. It will act as a “drainage blanket” and allow paved areas to drain directly into the platform. The platform will have the capacity to absorb over 500m<sup>3</sup> of rainfall. It should be noted that even during the most intense 100 year rainfall event only half of the storage in the drainage blanket will be utilised. Although filter drains are provided around the perimeter of the substation it will take some time for rainfall to pass through the stone layer before reaching these drainage routes, particularly as it is a horizontal surface. As an example, a 100 year rainfall event will take at least 7 days to drain through the system and into the detention basin. This will produce a flow rate from the platform of only 0.3 l/s and will only commence sometime after the rainfall event has finished. In reality some of this volume will soak into the underlying strata and some will evaporate so this flow rate is conservative.

### Surface Water – Buildings

Run off from building roofs will be directed into the filter drains. The calculations have assumed that the roads and paved areas will also drain into the system, although a time of concentration of 30 minutes has been allowed. The calculations have assumed that the flow will pass quickly into the detention basin however in reality this will be considerably slowed as flows will be absorbed into the filter drain stone and to some degree into the stone platform.

In addition, it is a requirement of the environment agency to follow the principals set out in the suds manual in providing levels of treatment to surface water flows, whilst at the same time providing a natural and stable habitat for plants and wildlife. Flows from the site will be initially given some filtration



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Project				Job Ref.	
Eye 400kV Substation				J5657	
Section				Sheet no./rev.	
Drainage Calculations				DC02 / 2	
Calc. by	Date	Chk'd by	Date	App'd by	Date
MDP	19/10/2023	PJR	19/10/2023	NP	19/10/2023

whereby flows pass through a geotextile membrane prior to passing into a perforated land drainage system. This will remove silts and other suspended contaminants. Flows from bunds, where oils may be present, are firstly protected by intelligent pumping systems which will detect the presence of oil and if so cease operation. In addition, flows from these locations will pass through an oil separator, before passing downstream.

The outgoing invert level from the pond will be set 300mm above the pond base. This will provide an environment for wildlife and plants, as flows pass through the wetland pond, they will get further treatment with the interaction of selected plants which will assist in removing dissolved contaminants. The area of the pond will be sized so during the most intense storm the water level in the pond will rise by approximately 0.9m. The pond will return back to its normal level in approximately 28 hours. The above proposal is a recognised standard way of achieving the principals outlined in the suds manual.

### **2.0 Drainage Management during the Construction Phase**

It is proposed that the wetland/attenuation pond is constructed at an early stage so that it can be used as a means to control silt flows to the watercourse. It is recommended that cut-off ditches are constructed which will direct flows during construction into the pond. the pond will have a minimum depth of 300mm which will provide sufficient room for silts to settle. The pond will be subject to regular inspection to ensure that any buildup of silts is removed promptly. With this mitigation in place, the water being discharged will remain in compliance with the environmental quality standard for surface water, i.e. 40 mg/l of sediment. In addition to the above, an oil absorption and debris boom will be placed in front of the pond outfall.

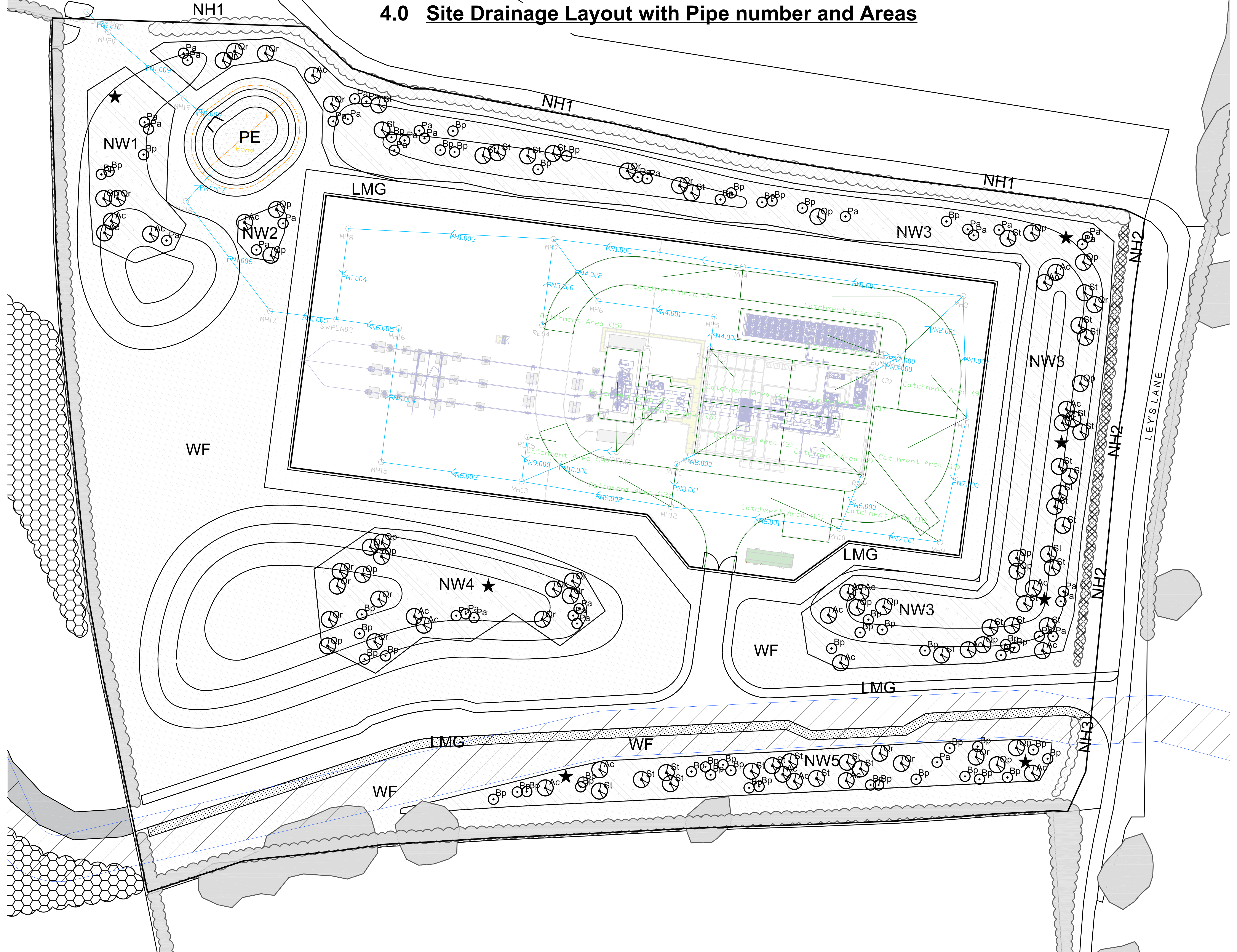
A monitoring regime will be developed for the water being discharged in order to track turbidity, ph and overall quality. in the event that quality decreases further, treatment measures can then be put in place.

### **3.0 Foul Water**

All foul water will be gravity drained to a 9,000 litre cess pit which will have a high-level alarm. The cess pit will require manual emptying and discharge off site.



### 4.0 Site Drainage Layout with Pipe number and Areas





### 5.0 Junction Levels

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by: NP	Approved By: NP
Report Details: Type: Junctions Storm Phase: Phase	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		



Name	Junction Type	Easting (m)	Northing (m)	Cover Level (m)	Depth (m)	Invert Level (m)	Sump Depth (m)	Chamber Shape
MH2	Manhole			46.600	1.261	45.339	0.300	Circular
MH3	Manhole			46.600	1.360	45.240	0.300	Circular
MH4	Manhole			46.600	1.595	45.005	0.300	Circular
MH7	Manhole			46.600	1.798	44.802	0.300	Circular
MH6	Manhole			46.600	1.364	45.236	0.300	Circular
MH5	Manhole			46.600	1.237	45.363	0.300	Circular
MH1	Manhole			46.600	1.228	45.372	0.300	Circular
MH9	Manhole			46.600	1.366	45.234	0.300	Circular
MH10	Manhole			46.600	1.472	45.128	0.300	Circular
MH12	Manhole			46.600	1.651	44.949	0.300	Circular
MH11	Manhole			46.600	1.124	45.476	0.300	Circular
SWPEN01	Manhole			46.600	1.433	45.167	0.300	Circular
MH13	Manhole			46.600	1.810	44.790	0.300	Circular
MH15	Manhole			46.600	1.959	44.641	0.300	Circular
MH16	Manhole			46.600	2.101	44.499	0.300	Circular
SWPEN02	Manhole			46.600	2.360	44.240	0.300	Circular
MH8	Manhole			46.600	2.016	44.584	0.300	Circular
MH17	Manhole			45.500	1.332	44.168	0.300	Circular
MH18	Manhole			45.200	1.438	43.762	0.300	Circular
MH19	Manhole			45.100	1.700	43.400	0.300	Circular
MH20	Manhole			44.700	1.409	43.291	0.300	Circular
BUND	Simple Junction							
RWP (3)	Simple Junction							
RWP	Simple Junction							
RWP (1)	Simple Junction							
RWP (2)	Simple Junction							
RE04	Simple Junction							
RE05	Simple Junction							
Simple Junction	Simple Junction							

### 5.1 Detention Basin Levels

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by: NP	Approved By: NP
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		



Pond

Type : Pond

#### Dimensions

Exceedance Level (m)	44.800
Depth (m)	1.200
Base Level (m)	43.600
Freeboard (mm)	300
Initial Depth (m)	0.300
Porosity (%)	100
Average Slope (1:X)	4.00
Total Volume (m³)	191.405

Depth (m)	Area (m²)	Volume (m³)
0.000	127.15	0.000
1.200	391.40	296.654

#### Inlets

##### Inlet (1)

Inlet Type	Point Inflow
Incoming Item(s)	PN1.007
Bypass Destination	(None)
Capacity Type	No Restriction

#### Outlets


##### Outlet

Outgoing Connection	PN1.008
Outlet Type	Free Discharge

#### Advanced

Perimeter	Circular
Length (m)	15.066
Friction Scheme	Manning's n
n	0.03

### 5.2 Connection Levels

Project: Eye 400kV Substation		Date: 24/01/2024			
		Designed by: MDP	Checked by: NP	Approved By: NP	
Report Details: Type: Connections Storm Phase: Phase		Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ			

Name	Length (m)	Connection Type	Slope (1:X)	Manning's n	Colebrook-White Roughness (mm)	Diameter / Base Width (mm)	Upstream Cover Level (m)	Upstream Invert Level (m)
PN2.001	19.327	Pipe	200.000		0.6	150	46.600	45.639
PN2.000	3.716	Pipe	200.000		0.6	150	46.600	46.047
PN3.000	5.722	Pipe	200.000		0.6	150	46.600	45.991
PN1.001	48.057	Pipe	200.000		0.6	375	46.600	45.545
PN1.003	44.452	Pipe	200.000		0.6	375	46.600	45.106
PN6.000	12.465	Pipe	200.000		0.6	150	46.600	45.891
PN7.001	21.933	Pipe	200.000		0.6	375	46.600	45.538
PN6.001	36.792	Pipe	200.000		0.6	150	46.600	45.433
PN7.000	27.502	Pipe	200.000		0.6	375	46.600	45.672
PN1.000	26.353	Pipe	200.000		0.6	375	46.600	45.672
PN8.000	4.802	Pipe	200.000		0.6	150	46.600	45.800
PN8.001	9.344	Pipe	200.000		0.6	150	46.600	45.778
PN4.000	7.060	Pipe	200.000		0.6	150	46.600	45.991
PN4.001	25.311	Pipe	200.000		0.6	375	46.600	45.663
PN4.002	16.594	Pipe	200.000		0.6	150	46.600	45.540
PN5.000	18.787	Pipe	200.000		0.6	375	46.600	45.672
PN6.002	32.765	Pipe	200.000		0.6	375	46.600	45.254
PN9.000	9.735	Pipe	200.000		0.6	375	46.600	45.672
PN10.000	21.933	Pipe	200.000		0.6	150	46.600	45.467
PN6.003	30.676	Pipe	200.000		0.6	375	46.600	45.094
PN6.004	29.220	Pipe	200.000		0.6	375	46.600	44.945
PN6.005	13.650	Pipe	200.000		0.6	375	46.600	44.803
PN1.005	14.424	Pipe	200.000		0.6	225	46.600	44.540
PN1.004	19.815	Pipe	200.000		0.6	375	46.600	44.889
PN1.006	29.979	Pipe	200.000		0.6	225	45.500	44.468
PN1.009	21.861	Pipe	200.000		0.6	150	45.100	43.700
PN1.002	41.430	Pipe	200.000		0.6	375	46.600	45.309
PN1.010	6.408	Pipe	200.000		0.6	150	44.700	43.591
PN1.007	9.394	Pipe	200.000		0.6	225	45.200	44.062
PN1.008	7.383	Pipe	205.079		0.6	150	44.800	43.900



Project: Eye 400kV Substation		Date: 24/01/2024		
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Report Details: Type: Connections Storm Phase: Phase		Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		




Name	Downstream Cover Level (m)	Downstream Invert Level (m)	Lock	Flow Restriction (L/s)
PN2.001	46.600	45.542	All	
PN2.000	46.600	46.028	All	
PN3.000	46.600	45.962	All	
PN1.001	46.600	45.305	All	
PN1.003	46.600	44.884	All	
PN6.000	46.600	45.829	All	
PN7.001	46.600	45.428	All	
PN6.001	46.600	45.249	All	
PN7.000	46.600	45.534	All	
PN1.000	46.600	45.540	All	
PN8.000	46.600	45.776	All	
PN8.001	46.600	45.731	All	
PN4.000	46.600	45.956	All	
PN4.001	46.600	45.536	All	
PN4.002	46.600	45.457	All	
PN5.000	46.600	45.578	All	
PN6.002	46.600	45.090	All	
PN9.000	46.600	45.623	All	
PN10.000	46.600	45.357	All	
PN6.003	46.600	44.941	All	
PN6.004	46.600	44.799	All	
PN6.005	46.600	44.735	All	
PN1.005	45.500	44.468	All	
PN1.004	46.600	44.790	All	
PN1.006	45.200	44.318	All	
PN1.009	44.700	43.591	All	2.3
PN1.002	46.600	45.102	All	
PN1.010	45.200	43.559	All	
PN1.007	44.800	44.015	All	
PN1.008	45.100	43.864	All	

### 5.3 Catchment Areas

Project: Eye 400kV Substation		Date: 24/01/2024			
		Designed by: MDP	Checked by: NP	Approved By: NP	
Report Details: Type: Inflow Summary Storm Phase: Phase		Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ			

Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Catchment Area	BUND		Time of Concentration	0.021	100	0	100	0.021
Catchment Area (1)	RWP (3)		Time of Concentration	0.021	100	0	100	0.021
Catchment Area (2)	RWP		Time of Concentration	0.021	100	0	100	0.021
Catchment Area (3)	RWP (1)		Time of Concentration	0.021	100	0	100	0.021
Catchment Area (4)	RWP (2)		Time of Concentration	0.021	100	0	100	0.021
Catchment Area (5)	SWPEN01		Time of Concentration	0.007	100	0	100	0.007
Catchment Area (6)	SWPEN01		Time of Concentration	0.012	100	0	100	0.012
Catchment Area (7)	MH4		Time of Concentration	0.022	100	0	100	0.022
Catchment Area (8)	MH3		Time of Concentration	0.028	100	0	100	0.028
Catchment Area (9)	MH1		Time of Concentration	0.022	100	0	100	0.022
Catchment Area (10)	MH1		Time of Concentration	0.029	100	0	100	0.029
Catchment Area (11)	MH9		Time of Concentration	0.014	100	0	100	0.014
Catchment Area (12)	MH10		Time of Concentration	0.043	100	0	100	0.043
Catchment Area (13)	MH12		Time of Concentration	0.014	100	0	100	0.014
Catchment Area (14)	RE05		Time of Concentration	0.005	100	0	100	0.005
Catchment Area (15)	RE04		Time of Concentration	0.008	100	0	100	0.008
<b>TOTAL</b>		<b>0.0</b>		<b>0.308</b>				<b>0.308</b>

6.0 Rainfall Analysis Criteria

Project: Eye 400kV Substation	Date: 24/01/2024			
	Designed by: MDP	Checked by: NP	Approved By: NP	
Report Title: Rainfall Analysis Criteria	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ			

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Prefill Manhole Sumps	<input type="checkbox"/>
Perform No Discharge Analysis	<input type="checkbox"/>

Rainfall

FEH	Type: FEH	
Site Location	EYE	
Rainfall Version	1999	
C (1km)	-0.023	
D1 (1km)	0.279	
D2 (1km)	0.319	
D3 (1km)	0.285	
E (1km)	0.312	
F (1km)	2.469	
Summer	<input type="checkbox"/>	CV 1.000
Winter	<input checked="" type="checkbox"/>	CV 1.000

Return Period

Return Period (years)	Increase Rainfall (%)
100.0	45.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880
2880	5760



6.1 Inflows Summary

Project: Eye 400kV Substation		Date: 24/01/2024		
		Designed by: MDP	Checked by: NP	Approved By: NP
Report Details: Type: Inflows Summary Storm Phase: Phase		Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		



Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	FEH: 100 years: +45 %: 15 mins: Winter	0.02	25.5	11.814
Catchment Area (1)	FEH: 100 years: +45 %: 15 mins: Winter	0.02	25.6	11.847
Catchment Area (2)	FEH: 100 years: +45 %: 15 mins: Winter	0.02	25.6	11.856
Catchment Area (3)	FEH: 100 years: +45 %: 15 mins: Winter	0.02	25.6	11.856
Catchment Area (4)	FEH: 100 years: +45 %: 15 mins: Winter	0.02	25.6	11.856
Catchment Area (5)	FEH: 100 years: +45 %: 15 mins: Winter	0.01	9.1	4.196
Catchment Area (6)	FEH: 100 years: +45 %: 15 mins: Winter	0.01	14.5	6.724
Catchment Area (7)	FEH: 100 years: +45 %: 15 mins: Winter	0.02	26.3	12.189
Catchment Area (8)	FEH: 100 years: +45 %: 15 mins: Winter	0.03	30.3	14.037
Catchment Area (9)	FEH: 100 years: +45 %: 15 mins: Winter	0.02	23.9	11.070
Catchment Area (10)	FEH: 100 years: +45 %: 15 mins: Winter	0.03	32.1	14.888
Catchment Area (11)	FEH: 100 years: +45 %: 15 mins: Winter	0.01	15.5	7.186
Catchment Area (12)	FEH: 100 years: +45 %: 15 mins: Winter	0.04	47.7	22.075
Catchment Area (13)	FEH: 100 years: +45 %: 15 mins: Winter	0.01	15.5	7.165
Catchment Area (14)	FEH: 100 years: +45 %: 15 mins: Winter	0.01	5.8	2.672
Catchment Area (15)	FEH: 100 years: +45 %: 15 mins: Winter	0.01	9.2	4.271


6.2 Junctions Summary

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by: NP	Approved By: NP
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		



Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH2	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	45.33 9	45.818	0.479	50.6	0.305	0.000	49.2	23.199	OK
MH3	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	45.24 0	45.782	0.542	98.4	0.345	0.000	92.2	50.763	OK
MH4	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	45.00 5	45.704	0.700	118.5	0.445	0.000	113.1	62.403	Surcharged
MH7	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	44.80 2	45.625	0.823	144.5	0.524	0.000	111.6	77.162	Surcharged
MH6	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	45.23 6	45.649	0.412	24.4	0.262	0.000	22.7	11.035	OK
MH5	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	45.36 3	45.775	0.412	25.2	0.262	0.000	24.4	11.357	OK
MH1	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	45.37 2	45.797	0.425	56.0	0.271	0.000	53.4	25.843	OK
MH9	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	45.23 4	45.764	0.530	49.9	0.337	0.000	40.9	18.494	OK
MH10	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	45.12 8	45.752	0.624	113.5	0.397	0.000	94.5	51.361	OK
MH12	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	44.94 9	45.713	0.764	134.6	0.486	0.000	111.3	69.470	Surcharged
MH11	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	45.47 6	45.893	0.417	25.4	0.265	0.000	24.7	11.483	OK
SWPEN01	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	45.16 7	45.647	0.480	23.6	0.542	0.000	20.0	10.382	OK
MH13	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	44.79 0	45.644	0.854	136.9	0.543	0.000	117.8	82.074	Surcharged
MH15	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	44.64 1	45.544	0.904	117.8	0.575	0.000	105.2	81.857	Surcharged
MH16	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	44.49 9	45.445	0.946	105.2	0.602	0.000	106.3	81.999	Surcharged
SWPEN02	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	44.24 0	45.385	1.145	219.1	1.295	0.000	220.2	158.622	Surcharged
MH8	FEH: 100 years: +45 %: 15 mins: Winter	46.60 0	44.58 4	45.470	0.886	111.6	0.564	0.000	112.8	77.419	Surcharged
MH17	FEH: 100 years: +45 %: 15 mins: Winter	45.50 0	44.16 8	45.117	0.949	220.2	0.604	0.000	220.9	157.857	Surcharged
MH18	FEH: 100 years: +45 %: 960 mins: Winter	45.20 0	43.76 2	44.794	1.032	15.1	0.656	0.000	14.9	336.298	Surcharged


Project: Eye 400kV Substation		Date: 24/01/2024				
Report Details: Type: Junctions Summary Storm Phase: Phase		Designed by: MDP	Checked by: NP	Approved By: NP		
		Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ				

MH19	FEH: 100 years: +45 %: 960 mins: Winter	45.10 0	43.40 0	44.793	1.393	2.0	2.801	0.000	2.0	188.353	Surcharged
MH20	FEH: 100 years: +45 %: 960 mins: Winter	44.70 0	43.29 1	43.633	0.343	2.0	0.218	0.000	2.0	187.877	OK
BUND	FEH: 100 years: +45 %: 15 mins: Winter		46.04 7	46.166	0.119	25.5			25.3	11.811	OK
RWP (3)	FEH: 100 years: +45 %: 15 mins: Winter		45.99 1	46.109	0.118	25.6			25.3	11.844	OK
RWP	FEH: 100 years: +45 %: 15 mins: Winter		45.89 1	46.006	0.115	25.6			24.9	11.853	OK
RWP (1)	FEH: 100 years: +45 %: 15 mins: Winter		45.80 0	45.925	0.125	25.6			25.4	11.852	OK
RWP (2)	FEH: 100 years: +45 %: 15 mins: Winter		45.99 1	46.109	0.118	25.6			25.2	11.853	OK
RE04	FEH: 100 years: +45 %: 15 mins: Winter		45.67 2	45.738	0.066	9.2			8.8	4.207	OK
RE05	FEH: 100 years: +45 %: 15 mins: Winter		45.67 2	45.725	0.053	5.8			5.6	2.647	OK
Simple Junction	FEH: 100 years: +45 %: 960 mins: Winter		43.55 9	43.599	0.040	2.0			2.0	187.877	OK



**6.3 Detention Basin Summary**

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by: NP	Approved By: NP
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		




Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residant Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FEH: 100 years: +45 %: 960 mins: Winter	44.794	44.794	1.194	1.194	14.9	294.295	0.000	0.000	2.0	190.658	-53.755	Flood Risk

7.0 Rainfall Analysis Criteria

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by:	Approved By:
Report Title: Rainfall Analysis Criteria	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		



Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Prefill Manhole Sumps	<input type="checkbox"/>
Perform No Discharge Analysis	<input type="checkbox"/>

Rainfall

FEH	Type: FEH	
Site Location	EYE	
Rainfall Version	1999	
C (1km)	-0.023	
D1 (1km)	0.279	
D2 (1km)	0.319	
D3 (1km)	0.285	
E (1km)	0.312	
F (1km)	2.469	
Summer	<input type="checkbox"/>	CV 1.000
Winter	<input checked="" type="checkbox"/>	CV 1.000

Return Period

Return Period (years)	Increase Rainfall (%)
30.0	0.000

Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880
2880	5760

7.1 Inflows Summary

Project: Eye 400kV Substation		Date: 24/01/2024		
		Designed by: MDP	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase		Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		



Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	FEH: 30 years: +0 %: 15 mins: Winter	0.02	11.6	5.365
Catchment Area (1)	FEH: 30 years: +0 %: 15 mins: Winter	0.02	11.6	5.380
Catchment Area (2)	FEH: 30 years: +0 %: 15 mins: Winter	0.02	11.6	5.380
Catchment Area (3)	FEH: 30 years: +0 %: 15 mins: Winter	0.02	11.6	5.383
Catchment Area (4)	FEH: 30 years: +0 %: 15 mins: Winter	0.02	11.6	5.380
Catchment Area (5)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	4.1	1.904
Catchment Area (6)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	6.6	3.053
Catchment Area (7)	FEH: 30 years: +0 %: 15 mins: Winter	0.02	12.0	5.536
Catchment Area (8)	FEH: 30 years: +0 %: 15 mins: Winter	0.03	13.8	6.372
Catchment Area (9)	FEH: 30 years: +0 %: 15 mins: Winter	0.02	10.8	5.023
Catchment Area (10)	FEH: 30 years: +0 %: 15 mins: Winter	0.03	14.6	6.756
Catchment Area (11)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	7.0	3.260
Catchment Area (12)	FEH: 30 years: +0 %: 15 mins: Winter	0.04	21.6	10.022
Catchment Area (13)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	7.0	3.254
Catchment Area (14)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	2.6	1.215
Catchment Area (15)	FEH: 30 years: +0 %: 15 mins: Winter	0.01	3.8	1.745



7.2 Junctions Summary

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		




Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH2	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	45.33 9	46.009	0.670	22.7	0.426	0.000	20.0	10.264	Surcharged
MH3	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	45.24 0	45.729	0.489	70.1	0.311	0.000	58.3	30.022	OK
MH4	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	45.00 5	45.576	0.571	70.3	0.363	0.000	56.7	34.957	OK
MH7	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	44.80 2	45.558	0.756	69.5	0.481	0.000	59.4	40.830	Surcharged
MH6	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	45.23 6	45.644	0.407	11.0	0.259	0.000	9.3	4.600	OK
MH5	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	45.36 3	45.733	0.370	11.4	0.235	0.000	11.0	4.912	OK
MH1	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	45.37 2	45.809	0.437	41.3	0.278	0.000	20.5	15.853	OK
MH9	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	45.23 4	45.818	0.583	21.4	0.371	0.000	7.2	7.453	OK
MH10	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	45.12 8	45.820	0.691	32.9	0.440	0.000	18.6	17.807	Surcharged
MH12	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	44.94 9	45.537	0.588	36.5	0.374	0.000	35.7	22.927	OK
MH11	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	45.47 6	45.893	0.417	11.3	0.265	0.000	10.8	5.035	OK
SWPEN01	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	45.16 7	45.574	0.407	10.7	0.460	0.000	9.8	4.506	OK
MH13	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	44.79 0	45.532	0.742	48.1	0.472	0.000	46.1	28.236	Surcharged
MH15	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	44.64 1	45.524	0.884	46.1	0.562	0.000	46.1	27.929	Surcharged
MH16	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	44.49 9	45.519	1.020	46.1	0.648	0.000	33.3	27.823	Surcharged
SWPEN02	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	44.24 0	45.515	1.275	72.6	1.443	0.000	71.7	68.176	Surcharged
MH8	FEH: 30 years: +0 %: 15 mins: Winter	46.60 0	44.58 4	45.531	0.947	59.4	0.602	0.000	48.7	40.829	Surcharged
MH17	FEH: 30 years: +0 %: 15 mins: Winter	45.50 0	44.16 8	45.183	1.015	71.7	0.646	0.000	71.9	67.853	Surcharged
MH18	FEH: 30 years: +0 %: 15 mins: Winter	45.20 0	43.76 2	44.487	0.725	71.9	0.461	0.000	71.9	67.074	Surcharged
MH19	FEH: 30 years: +0 %: 480 mins: Winter	45.10 0	43.40 0	44.383	0.983	1.7	1.977	0.000	1.6	72.398	Surcharged
MH20	FEH: 30 years: +0 %: 480 mins: Winter	44.70 0	43.29 1	43.628	0.338	1.6	0.215	0.000	1.6	71.938	OK
BUND	FEH: 30 years: +0 %: 15 mins: Winter		46.04 7	46.165	0.118	11.6			11.4	5.361	OK
RWP (3)	FEH: 30 years: +0 %: 15 mins: Winter		45.99 1	46.110	0.119	11.6			11.4	5.376	OK
RWP	FEH: 30 years: +0 %: 15 mins: Winter		45.89 1	46.010	0.119	11.6			11.2	5.376	OK
RWP (1)	FEH: 30 years: +0 %: 15 mins: Winter		45.80 0	45.929	0.129	11.6			11.3	5.379	OK
RWP (2)	FEH: 30 years: +0 %: 15 mins: Winter		45.99 1	46.111	0.120	11.6			11.4	5.376	OK
RE04	FEH: 30 years: +0 %: 15 mins: Winter		45.67 2	45.714	0.042	3.8			3.5	1.743	OK
RE05	FEH: 30 years: +0 %: 15 mins: Winter		45.67 2	45.708	0.036	2.6			2.5	1.213	OK
Simple Junction	FEH: 30 years: +0 %: 480 mins: Winter		43.55 9	43.595	0.036	1.6			1.6	71.938	OK

7.3 Detention Basin Summary

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		




Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residant Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FEH: 30 years: +0 %: 480 mins: Winter	44.384	44.384	0.784	0.784	13.2	156.865	0.000	0.000	1.7	74.152	18.045	OK

## 8.0 Rainfall Analysis Criteria

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by:	Approved By:
Report Title: Rainfall Analysis Criteria	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		



Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Prefill Manhole Sumps	<input type="checkbox"/>
Perform No Discharge Analysis	<input type="checkbox"/>

### Rainfall

<b>FEH</b>	Type: FEH	
Site Location	EYE	
Rainfall Version	1999	
C (1km)	-0.023	
D1 (1km)	0.279	
D2 (1km)	0.319	
D3 (1km)	0.285	
E (1km)	0.312	
F (1km)	2.469	
Summer	<input type="checkbox"/>	CV 1.000
Winter	<input checked="" type="checkbox"/>	CV 1.000

### Return Period

Return Period (years)	Increase Rainfall (%)
2.0	0.000

### Storm Durations

Duration (mins)	Run Time (mins)
15	30
30	60
60	120
120	240
240	480
360	720
480	960
960	1920
1440	2880
2880	5760

8.1 Inflows Summary

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		



Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m³)
Catchment Area	FEH: 2 years: +0 %: 15 mins: Winter	0.02	4.6	2.125
Catchment Area (1)	FEH: 2 years: +0 %: 15 mins: Winter	0.02	4.6	2.128
Catchment Area (2)	FEH: 2 years: +0 %: 15 mins: Winter	0.02	4.6	2.128
Catchment Area (3)	FEH: 2 years: +0 %: 15 mins: Winter	0.02	4.6	2.128
Catchment Area (4)	FEH: 2 years: +0 %: 15 mins: Winter	0.02	4.6	2.128
Catchment Area (5)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	1.6	0.755
Catchment Area (6)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	2.6	1.211
Catchment Area (7)	FEH: 2 years: +0 %: 15 mins: Winter	0.02	4.7	2.191
Catchment Area (8)	FEH: 2 years: +0 %: 15 mins: Winter	0.03	5.4	2.521
Catchment Area (9)	FEH: 2 years: +0 %: 15 mins: Winter	0.02	4.3	1.990
Catchment Area (10)	FEH: 2 years: +0 %: 15 mins: Winter	0.03	5.8	2.676
Catchment Area (11)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	2.8	1.289
Catchment Area (12)	FEH: 2 years: +0 %: 15 mins: Winter	0.04	8.6	3.971
Catchment Area (13)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	2.8	1.289
Catchment Area (14)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	1.0	0.480
Catchment Area (15)	FEH: 2 years: +0 %: 15 mins: Winter	0.01	1.7	0.770

8.2 Junctions Summary

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		



Critical Storm Per Item: Rank By: Max. Depth

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH2	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	45.33 9	45.736	0.397	9.0	0.253	0.000	8.6	3.806	OK
MH3	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	45.24 0	45.636	0.395	18.9	0.251	0.000	17.0	7.907	OK
MH4	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	45.00 5	45.400	0.396	21.8	0.252	0.000	17.0	9.588	OK
MH7	FEH: 2 years: +0 %: 30 mins: Winter	46.60 0	44.80 2	45.199	0.397	18.5	0.253	0.000	18.5	14.482	OK
MH6	FEH: 2 years: +0 %: 30 mins: Winter	46.60 0	45.23 6	45.590	0.353	2.8	0.225	0.000	2.8	1.840	OK
MH5	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	45.36 3	45.707	0.344	4.5	0.219	0.000	4.0	1.687	OK
MH1	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	45.37 2	45.719	0.347	10.1	0.220	0.000	9.7	4.219	OK
MH9	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	45.23 4	45.597	0.363	7.5	0.231	0.000	5.9	3.060	OK
MH10	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	45.12 8	45.598	0.470	17.6	0.299	0.000	14.0	8.696	Surcharged
MH12	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	44.94 9	45.354	0.405	21.1	0.257	0.000	20.4	11.182	OK
MH11	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	45.47 6	45.842	0.366	4.5	0.233	0.000	4.2	1.779	OK
SWPEN01	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	45.16 7	45.526	0.359	4.2	0.406	0.000	3.8	1.609	OK
MH13	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	44.79 0	45.198	0.408	25.2	0.259	0.000	21.2	12.777	OK
MH15	FEH: 2 years: +0 %: 30 mins: Winter	46.60 0	44.64 1	45.043	0.402	20.0	0.256	0.000	19.9	15.732	OK
MH16	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	44.49 9	44.927	0.428	20.6	0.272	0.000	23.0	12.305	OK
SWPEN02	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	44.24 0	44.913	0.673	42.6	0.761	0.000	45.3	22.934	Surcharged
MH8	FEH: 2 years: +0 %: 15 mins: Winter	46.60 0	44.58 4	44.986	0.402	17.4	0.256	0.000	19.6	11.261	OK
MH17	FEH: 2 years: +0 %: 15 mins: Winter	45.50 0	44.16 8	44.776	0.608	45.3	0.387	0.000	45.6	22.723	Surcharged
MH18	FEH: 2 years: +0 %: 15 mins: Winter	45.20 0	43.76 2	44.313	0.551	45.6	0.350	0.000	45.8	22.309	Surcharged
MH19	FEH: 2 years: +0 %: 480 mins: Winter	45.10 0	43.40 0	44.121	0.721	1.6	1.450	0.000	1.3	53.114	Surcharged
MH20	FEH: 2 years: +0 %: 1440 mins: Winter	44.70 0	43.29 1	43.625	0.335	1.3	0.213	0.000	1.3	93.728	OK
BUND	FEH: 2 years: +0 %: 15 mins: Winter		46.04 7	46.114	0.067	4.6			4.5	2.122	OK
RWP (3)	FEH: 2 years: +0 %: 15 mins: Winter		45.99 1	46.058	0.067	4.6			4.5	2.125	OK
RWP	FEH: 2 years: +0 %: 15 mins: Winter		45.89 1	45.956	0.065	4.6			4.4	2.125	OK
RWP (1)	FEH: 2 years: +0 %: 15 mins: Winter		45.80 0	45.869	0.069	4.6			4.5	2.125	OK
RWP (2)	FEH: 2 years: +0 %: 15 mins: Winter		45.99 1	46.058	0.067	4.6			4.5	2.125	OK
RE04	FEH: 2 years: +0 %: 15 mins: Winter		45.67 2	45.700	0.028	1.7			1.5	0.768	OK
RE05	FEH: 2 years: +0 %: 15 mins: Winter		45.67 2	45.695	0.023	1.0			1.0	0.478	OK
Simple Junction	FEH: 2 years: +0 %: 1440 mins: Winter		43.55 9	43.592	0.033	1.3			1.3	93.728	OK



8.3 Detention Basin Summary

Project: Eye 400kV Substation	Date: 24/01/2024		
	Designed by: MDP	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address: Patterson Reeves & Partners 85 Leigh Road, Eastleigh SO50 9DQ		



Critical Storm Per Item: Rank By: Max. Avg. Depth

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residant Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FEH: 2 years: +0 %: 480 mins: Winter	44.122	44.122	0.522	0.522	6.5	90.504	0.000	0.000	1.6	54.308	52.716	OK



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Eastleigh  
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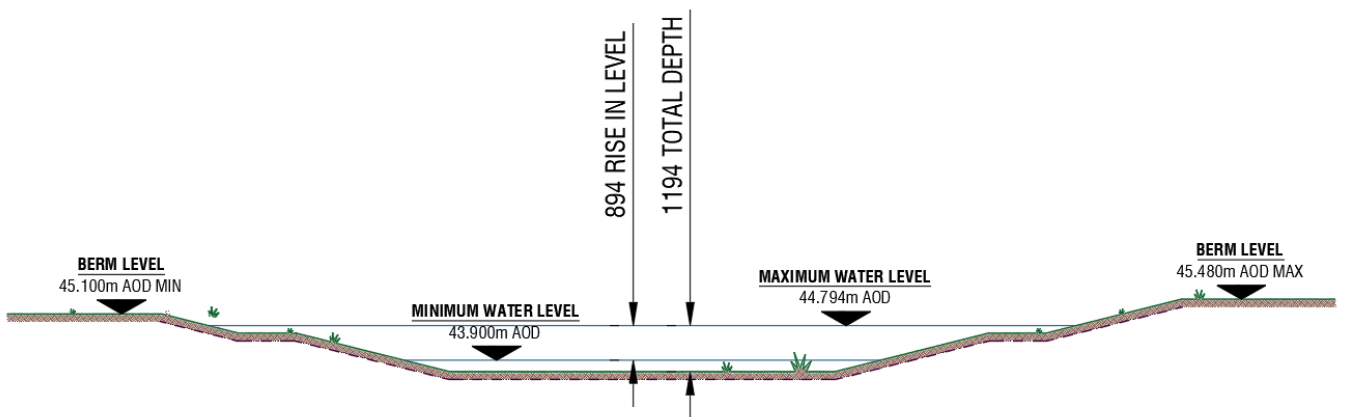
Project Eye 400kV Substation				Job Ref. J5657	
Section Drainage Calculations				Sheet no./rev. DC02 / 22	
Calc. by MDP	Date 16/10/2023	Chk'd by PJR	Date 16/10/2023	App'd by NP	Date 16/10/2023

## 9.0 Detention Basin Levels

### 1 in 100 years + 45% Climate Change

#### Critical Storm

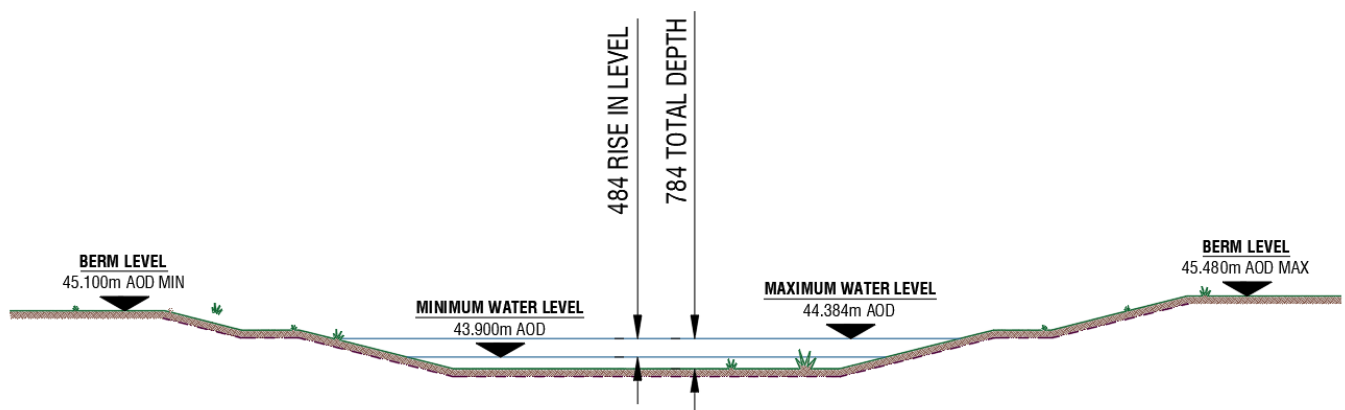
Phase	Item Label	Storm Event	Max. Inflow (L/s)	Max. Depth (m)	Max. Resident Volume (m <sup>3</sup> )	Max. Flooded Volume (m <sup>3</sup> )	Max. Outflow (L/s)	Total Discharge Volume (m <sup>3</sup> )
Phase	Pond	100 years: +45 %: 960 mins: Winter	14.9	1.194	294.295	0.000	2.0	190.658



### 1 in 30 years

#### Critical Storm

Phase	Item Label	Storm Event	Max. Inflow (L/s)	Max. Depth (m)	Max. Resident Volume (m <sup>3</sup> )	Max. Flooded Volume (m <sup>3</sup> )	Max. Outflow (L/s)	Total Discharge Volume (m <sup>3</sup> )
Phase	Pond	30 years: 480 mins: Winter	13.2	0.784	156.930	0.000	1.7	74.194





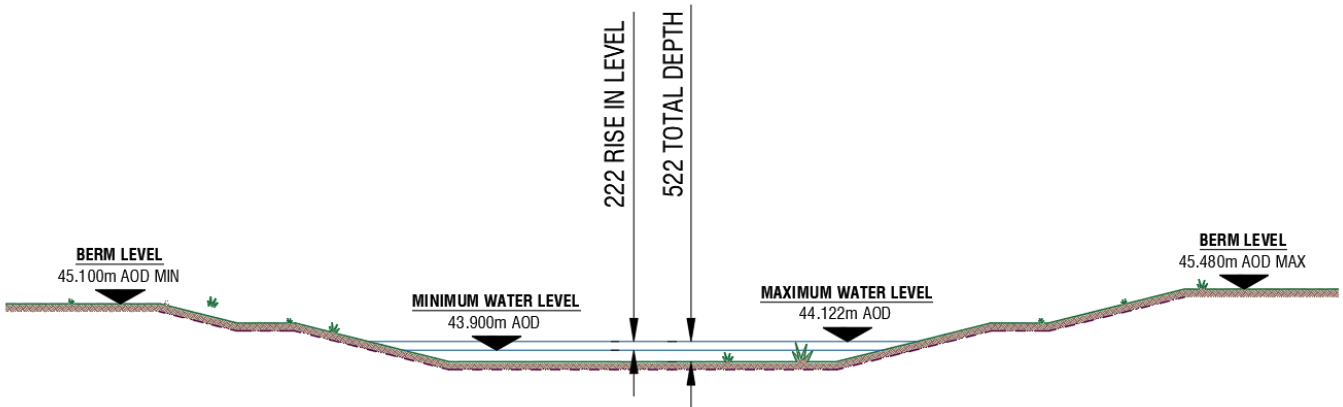
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SO50 9DQ

Project Eye 400kV Substation				Job Ref. J5657	
Section Drainage Calculations				Sheet no./rev. DC02 / 23	
Calc. by MDP	Date 16/10/2023	Chk'd by PJR	Date 16/10/2023	App'd by NP	Date 16/10/2023

## 1 in 2 years

### Critical Storm

Phase	Item Label	Storm Event	Max. Inflow (L/s)	Max. Depth (m)	Max. Resident Volume (m <sup>3</sup> )	Max. Flooded Volume (m <sup>3</sup> )	Max. Outflow (L/s)	Total Discharge Volume (m <sup>3</sup> )
Phase	Pond	2 years: 480 mins: Winter	6.5	0.522	90.486	0.000	1.6	54.310





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Project Eye 400kV Substation				Job Ref. J5657	
Section Drainage Calculations				Sheet no./rev. DC02 / 24	
Calc. by MDP	Date 29/01/2024	Chk'd by PJR	Date 29/01/2024	App'd by NP	Date 29/01/2024

## **10.0 Summary of Results**

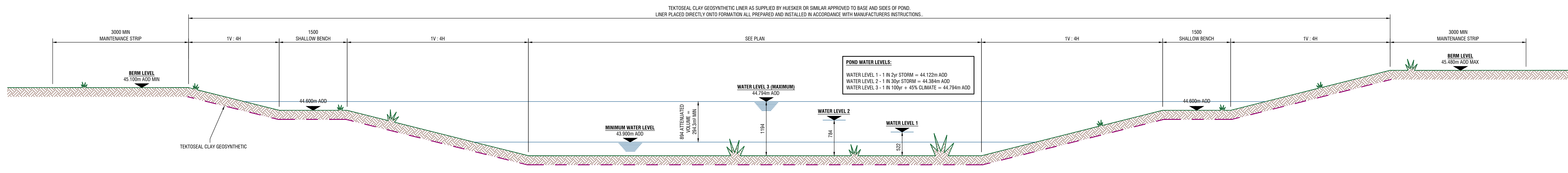
Several storm durations were modelled from 15 minutes to 2 days duration. The total required volume for the SUDS attenuation Basin for a 1 in 100 Year Return Period Storm + 45% Climate Change so that flooding does not occur in any part of the site is 294m<sup>3</sup> (this includes the 300mm minimum depth of retained water volume).

It is proposed that flows leaving the developed site would be best attenuated in a wetland pond. This will be constructed to the north west of the substation. Flows from the wetland pond will be limited to 2.3 l/s by means of a hydrobrake and will discharge to a nearby watercourse.

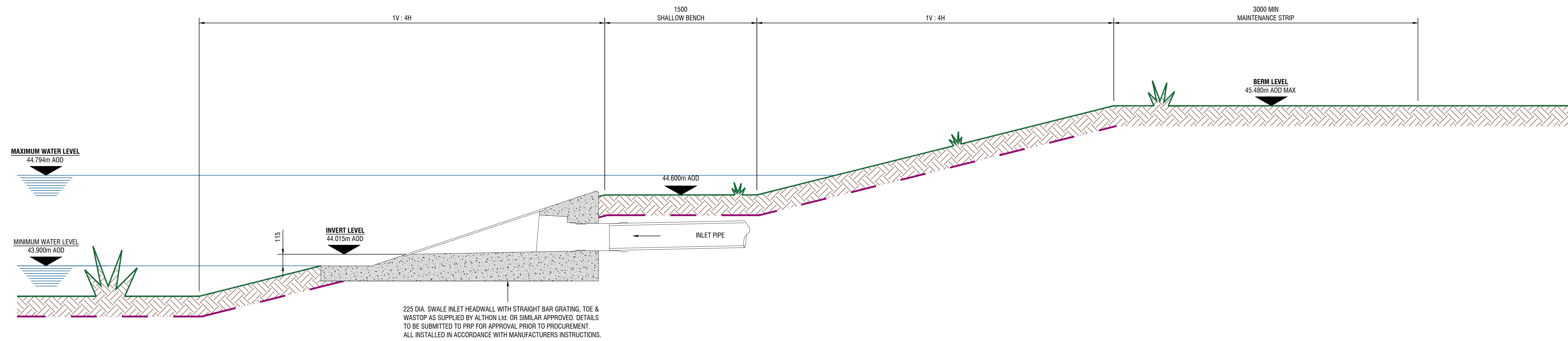
The outgoing invert level from the pond will be set such that there will always be a minimum depth of 300mm of water in the pond. This will ensure a suitable environment for wildlife and plants. As flows pass through the wetland pond, they will get further treatment with the interaction of carefully selected plants which will assist in removing dissolved contaminants etc. The area of the pond will be sized so that during the most intense storm the water level in the pond will rise by 894mm. This level will return back to normal in approximately 31 hours.

All oil containing plant is located within bunded areas. Flows from bunds, where oils may be present, are firstly protected by intelligent pumping systems which will detect the presence of oil and if so, cease operation. In addition, flows from these locations will pass through an oil separator, before passing downstream.

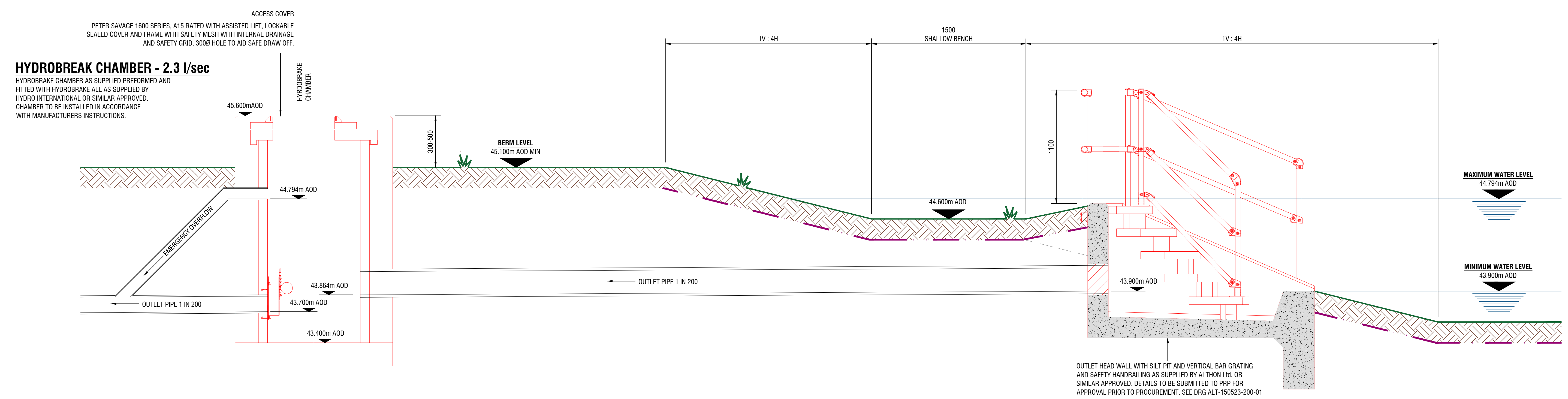
All foul water shall be gravity drained to a 9,000 Litre cess pit which will have a high-level alarm and will require manual emptying.



TYPICAL SECTION ON SUDS POND  
SCALE 1:33



TYPICAL SECTION ON SUDS POND - INLET  
SCALE 1:20



TYPICAL SECTION ON SUDS POND - OUTFALL  
SCALE 1:20

- DO NOT SCALE. WORK TO DIMENSIONS SHOWN. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
- THE CONTRACTOR IS RESPONSIBLE FOR THE LOCATION OF ALL EXISTING SERVICES WITHIN THE WORKS AREA AND FOR THE STRUCTURAL STABILITY THROUGHOUT THE WORKS.
- CONTRACTORS ARE TO BE AWARE OF THEIR RESPONSIBILITIES UNDER THE COM REGULATIONS & COMPLY WITH THEM AT ALL TIMES. NOTE THAT ANY HAZARDS IDENTIFIED ON THE DRAWINGS ARE ONLY THOSE WHICH MAY NOT BE OBVIOUS TO COMPETENT PERSONS OR ARE USUAL OR WHICH MIGHT BE DIFFICULT TO MANAGE.
- WORKING AREAS AND METHODS TO BE AGREED BEFORE WORK COMMENCES.
- THE TERM ENGINEER REFERS TO PATTERSON REEVES & PARTNERS.
- THE TERM CONTRACTOR REFERS TO THE CONTRACTOR RESPONSIBLE FOR THE INDIVIDUAL ELEMENT OF THE WORKS.
- ANY CONTRACTOR RESPONSIBLE FOR THE PLANNING AND EXECUTION OF ANY EXCAVATION WORKS SHOULD BE AWARE OF HSG47 - AVOIDING DANGER FROM UNDERGROUND SERVICE.
- FOR ADDITIONAL CONSTRUCTION NOTES REFER TO DRAWING D069-SEL-V00-400-DD-C-0027.

REVISION:	01	02	03
DRAWN:	A.Godding 13.09.2023	A.Godding 19.10.2023	A.Godding 01.02.2024
CHECKED:	G.Hooper 13.09.2023	G.Hooper 19.10.2023	G.Hooper 01.02.2024
APPROVED:	N.Patterson 13.09.2023	N.Patterson 19.10.2023	N.Patterson 01.02.2024



**CDM REGULATIONS:**  
RESIDUAL HAZARDS IDENTIFIED BELOW  
300-500mm RAISED CHAMBER COVERS WERE IDENTIFIED BY PATTERSON REEVES & PARTNERS AS A REQUIREMENT TO REDUCE RISK - PERSONAL INJURY/LIFE. THIS RISK WOULD BE PRESENT IN THE EVENT OF COVER FAILURE OR DISPLACEMENT IN VEGETATED GROUND OUTSIDE THE SUBSTATION SECURITY FENCE.

DRAWING TITLE	DRAWING No.
OVERVIEW & PHILOSOPHY	D069-SEL-V00-400-LY-C-0016
LAYOUT 1	D069-SEL-V00-400-LY-C-0017
LAYOUT 2	D069-SEL-V00-400-LY-C-0018
LAYOUT 3	D069-SEL-V00-400-LY-C-0019
SCHEDULES	D069-SEL-V00-400-SH-C-0006
DETAILS 1 - GENERAL	D069-SEL-V00-400-DD-C-0027
DETAILS 2 - POND	D069-SEL-V00-400-DD-C-0028
DETAILS 3 - OIL SEPARATOR	D069-SEL-V00-400-DD-C-0029
DETAILS 4 - BUND DRAINAGE	D069-SEL-V00-400-DD-C-0030

**DRAWING REFERENCE SCHEDULE**

**CDM REGULATIONS:**  
SIGNIFICANT OR UNUSUAL HAZARDS HIGHLIGHTED BELOW:  
THERE ARE NO RISKS UNFAMILAR TO A COMPETENT CONTRACTOR.  
SAFE METHODS OF WORK ARE THE RESPONSIBILITY OF THE CONTRACTOR AND ARE TO BE IDENTIFIED IN THE HEALTH AND SAFETY PLAN.

DRAWING STATUS: **FOR CONSTRUCTION**

Customer	CONRAD ENERGY	Site	EYE 400KV SYNCHRONOUS SUBSTATION
Contractor	SIEMENS energy	Title	DETAILS 2 DRAINAGE
Subcontractor	Patterson Reeves & Partners	Contractor Drawing No.	D069-SEL-V00-400-DD-C-0028
Customer Drawing No.		Customer Drawing No.	D069-SEL-V00-400-DD-C-0028
Designed	M.Patterson	Drawn	S.Parr
Checked	G.Hooper	Approved	N.Patterson
Date	May 2023	Scale	SHOWN
Size	A0	Sheet	01
Revision	01	Revision	01