LOWER HARE INERT LANDFILL

Lower Hare Farm

SURFACE WATER RISK ASSESSMENT

STATUS: JULY 2024

213189/SWRA

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1.0 INTRODUCTION

1.1 Lower Hare Farm is located 800 m west of Whitestone village, at Lower Hare Farm, Hare Lane, EX4 2HW. The site is centred at National Grid Reference SX 85762 93431. The site location is shown in drawing 213189/D/001. The site is circa 8 km west of Exeter.

1.2 The site has planning permission for an inert landfill, as part of which there will be a permanent surface water attenuation lagoon on the western boundary. The lagoon is already in place. Improvements will be made to control the outflow from the lagoon to the tributary of the Alphin Brook. This will include a hydrobrake and a penstock.

1.3 This report assesses the risks to the surface waters of the Alphin Brook from the discharge made from the permanent lagoon.

2.0 DISCHARGE DETAILS

Location

2.1 The location of the discharge point will be on the southwest corner of the permanent attenuation lagoon. This is shown on AAe drawing 213189/D/008. The National Grid reference of the discharge point is SX 85574 93328.

2.2 The discharge will flow south into the tributary of the Alphin Brook, which is approximately 15 m south west of the discharge point.

2.3 Approximately 125 m further south the tributary joins the main Alphin Brook, flowing from the west and turning to flow southwards.

Surface Water Quality

2.4 Surface water quality monitoring to data has been undertaken in the following locations:

- SW1 – upgradient of the attenuation pond in the tributary of the Alphin Brook;
- SW2 – in the Alphin Brook to the west;
- SW3 – just below the confluence of the Alphin Brook and tributary, south of the proposed landfill; and
- SW4 – from the attenuation pond itself.

The water quality data is presented in Appendix A.

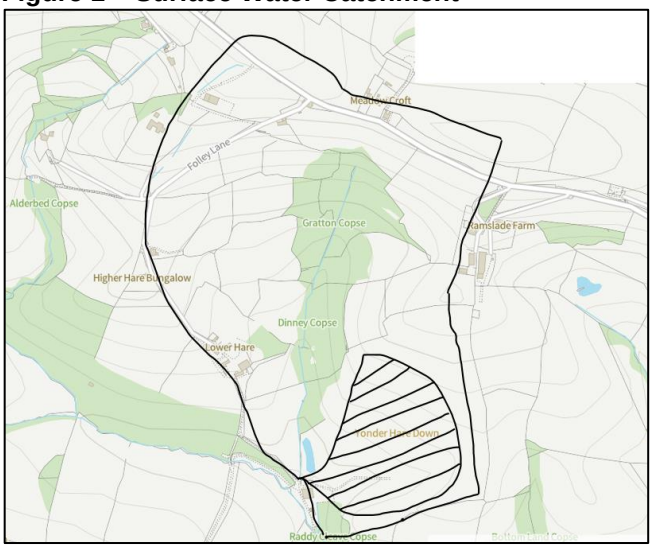
Discharge Rate

2.5 The discharge rate has been estimated within the AAe 2022 Detailed Drainage Design as 24.9 l/s, the 1 year greenfield runoff rate.

River Flow Rate

2.6 The river flow rate has been estimated using data for catchment size. The area of the landfill draining to the permanent drainage pond is 11.5 ha. The landfill forms most of the downgradient portion of the wider catchment area contributing to the tributary of the Alphin Brook, refer to Figure 1. The full catchment area is 45 ha, therefore, the landfill area contributes a quarter of the flow to the tributary of the Alphin Brook. The flow in the tributary upgradient of the landfill (monitoring location SW1) can, therefore, be assumed to have three quarters of the catchment flow, which would equate to 74.7 l/s.

Figure 1 – Surface Water Catchment



Discharge Quality

2.7 The background quality of the existing attenuation lagoon has been established through monitoring, refer to Appendix A. As the landfilling proceeds there will be stripping of topsoils, which will lead to temporary increases to suspended solids. There will be two further temporary attenuation lagoons constructed within the final landfill phase, used to control settlement of runoff during landfilling. Details are shown in drawing 213189/PL/D/012.

2.8 The imported waste materials will be of a restricted number of EWC codes, refer to Table 1. They will be inert and locally sourced, giving low potential for contamination. Runoff form the operational landfill will pass through two attenuation lagoons before reaching the permanent lagoon for a further phase of settlement. This lagoon will be regularly monitored for water quality.

Table 1 – Waste Codes

Waste description	EWC code
Acceptable Inert Materials	
Concrete	17 01 01
Bricks	17 01 02
Tiles and ceramics	17 01 03
Mixtures of concrete, bricks, tiles and ceramics	17 01 07
Soils and stones (excluding topsoil and peat)	17 05 04 or 20 02 02
Potentially Acceptable Materials	
Soils and stones (excluding topsoil and peat)	17 05 04 or 20 02 02

2.9 The quality of the discharge has the potential to vary during landfilling and measures need to be taken to protect the quality of the waters in the receiving tributary of the Alphin Brook. The section below assesses the thresholds for water quality that should not be exceeded in order to remain protective of the tributary.

3.0 SURFACE WATER RISK ASSESSMENT

3.1 The surface water risk assessment uses the principles of the Environment Agency guidance https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit

3.2 In accordance with the guidance, available water quality data is screened against Water Framework Directive freshwater environmental quality standards (EQS). Test 1 within the guidance assesses whether concentrations within the discharge will exceed 10% of the EQS. Test 2 assesses dilution in the receiving water against 4% of the EQS. Test 3 assesses background concentration in the receiving water in relation to the proposed discharge. The predicted environmental concentration in the water downstream of the discharge should not exceed 10% of the EQS.

3.3 In this instance the quality of the discharge from the operational landfill is not known and therefore, the calculations are used in reverse in order to determine the maximum permissible concentrations within the discharge to meet the criteria of Test 3. The calculations are presented in Appendix B and the maximum discharge concentrations are highlighted.

4.0 MONITORING

4.1 The key determinands within the Hydrogeological Risk Assessment (HRA) are arsenic, toluene, chloride, nickel and suspended solids. Thresholds have been set within the HRA for the downgradient compliance point SW3.

4.2 Monitoring for the key determinands will be undertaken monthly together with ammoniacal nitrogen. All attenuation ponds on site will be visually assessed weekly for signs of any visible oils or grease.

5.0 CONCLUSIONS

5.1 The site has an existing attenuation pond that discharges to a tributary of the Alphin Brook. During landfilling two new attenuation ponds will be constructed on the southern, final phase of landfilling. This will maximise the time they are operational before infilling in the final stages of landfilling. These two ponds will discharge into the permanent attenuation lagoon. The permanent lagoon and discharge therefore, have the potential to be affected by residual suspended solids resulting from landfill development.

5.2 Water quality thresholds for the permanent attenuation lagoon have been derived using Environment Agency guidance on surface water pollution risk assessment. A monitoring regime will be implemented to ensure these thresholds are not breached. In the event of an incident a manual penstock fitted to the discharge point will be closed until such time as surface water has been remediated.

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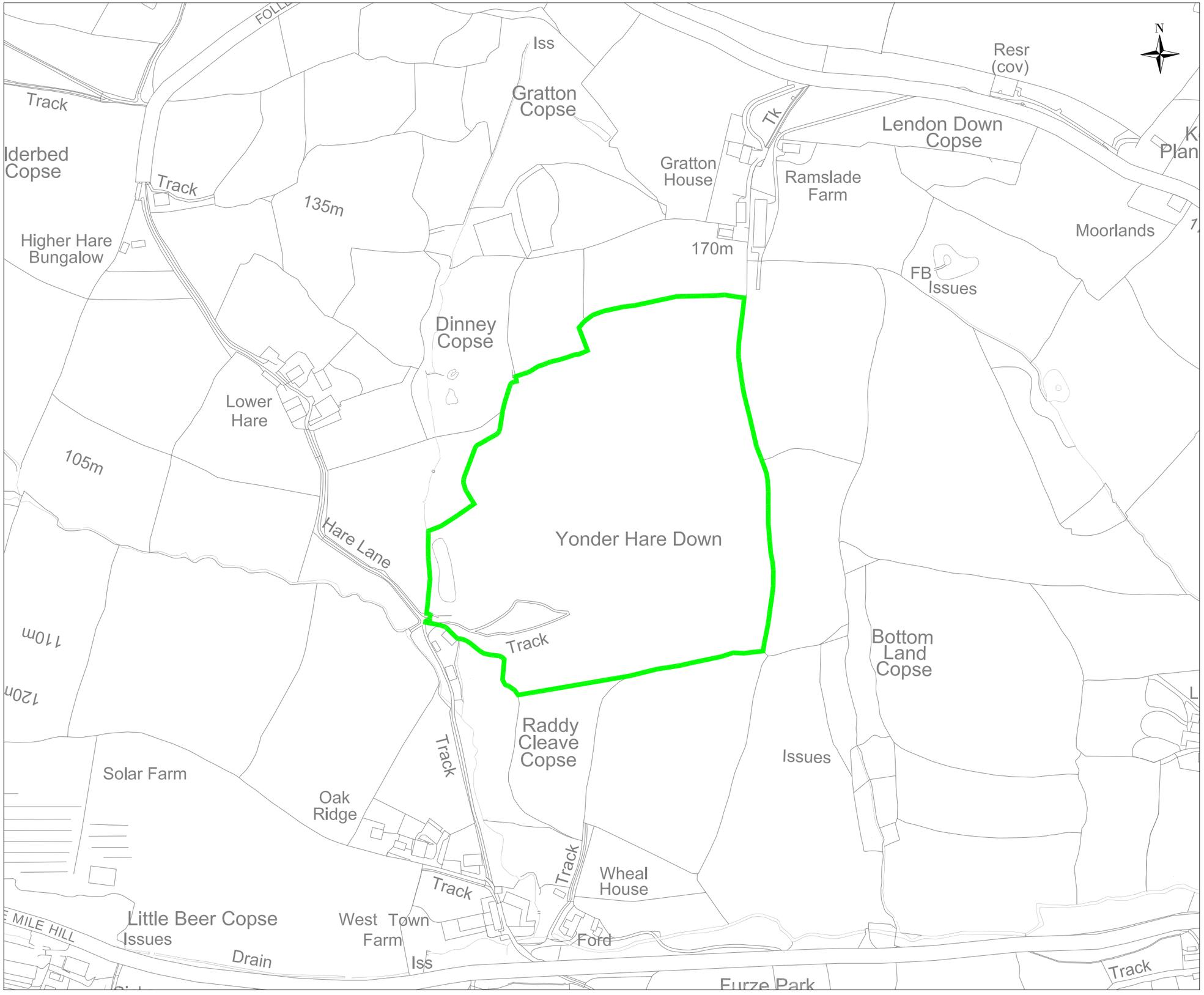
Review by: Edward Brown BSc MCIWM

Approved by: Matthew Lawman BSc MSc

July 2024

DRAWINGS



Key:

Permit Site Boundary

Rev.	Details	Drawn / Chkd.	Date

Project

213189
Lower Hare Farm

Title

Permit Boundary Plan

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Environmental Consultants

Scale	Date	Drawn	Chkd.	Drg. No.	Rev.
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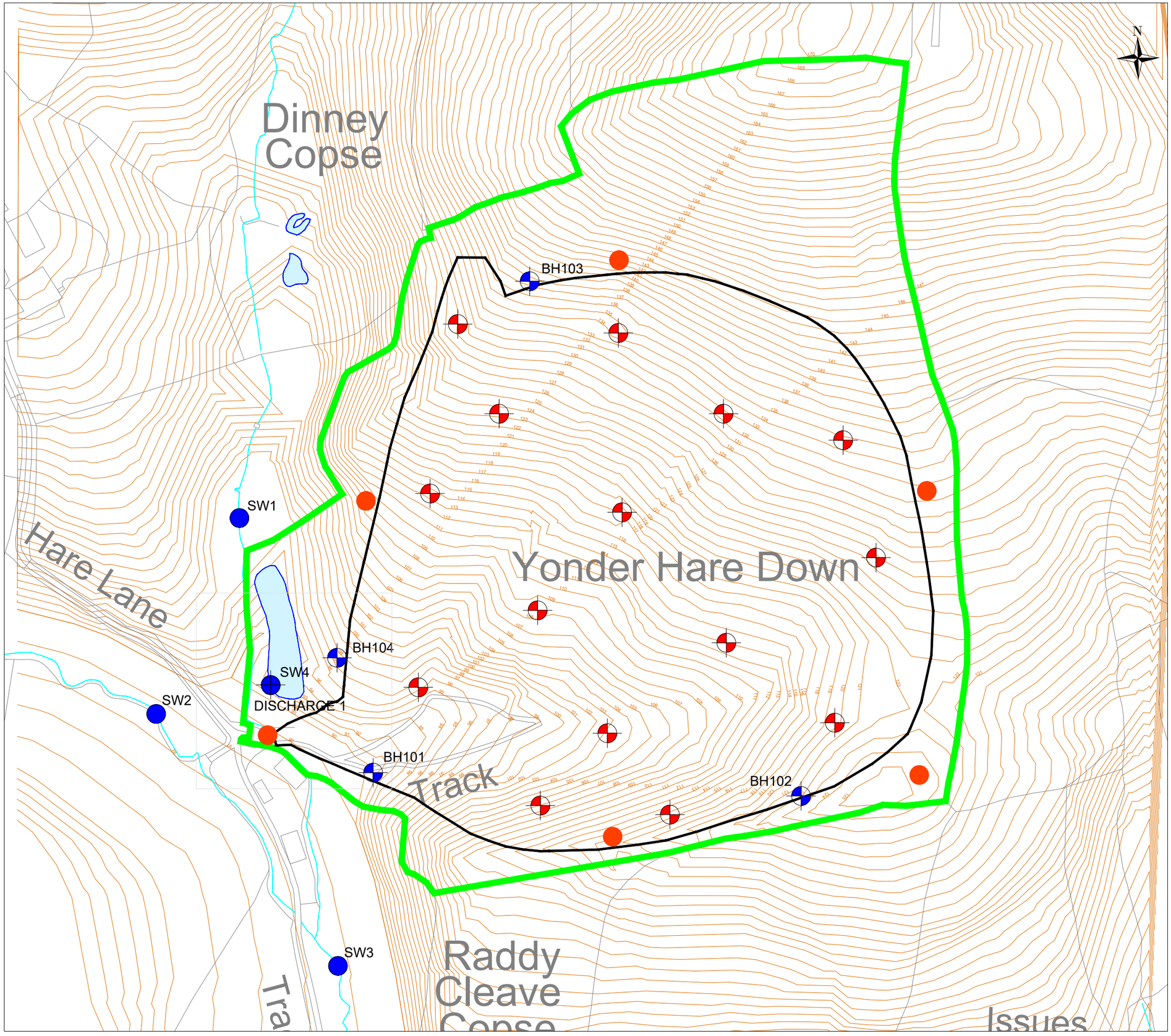

Key:

- Permit Site Boundary
- Existing Ground Level (m AOD)
- Extent of Earthworks
- Groundwater Monitoring Boreholes
- Surface Water Monitoring Location
- Visual Dust Monitoring Location
- Surface Water Pond
- Surface Water Course
- Post in-waste gas monitoring locations

Surface Water Monitoring Point Coordinates		
ID	X	Y
SW1	285558	93422
SW2	285516	93313
SW3	285609	93184
SW4 (Discharge Point)	285574	93328

Rev.	Details	Drawn / Chkd.	Date

Project
213189
Lower Hare Farm

Title
Monitoring Plan

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Scale	Date	Drg. No.	Rev.
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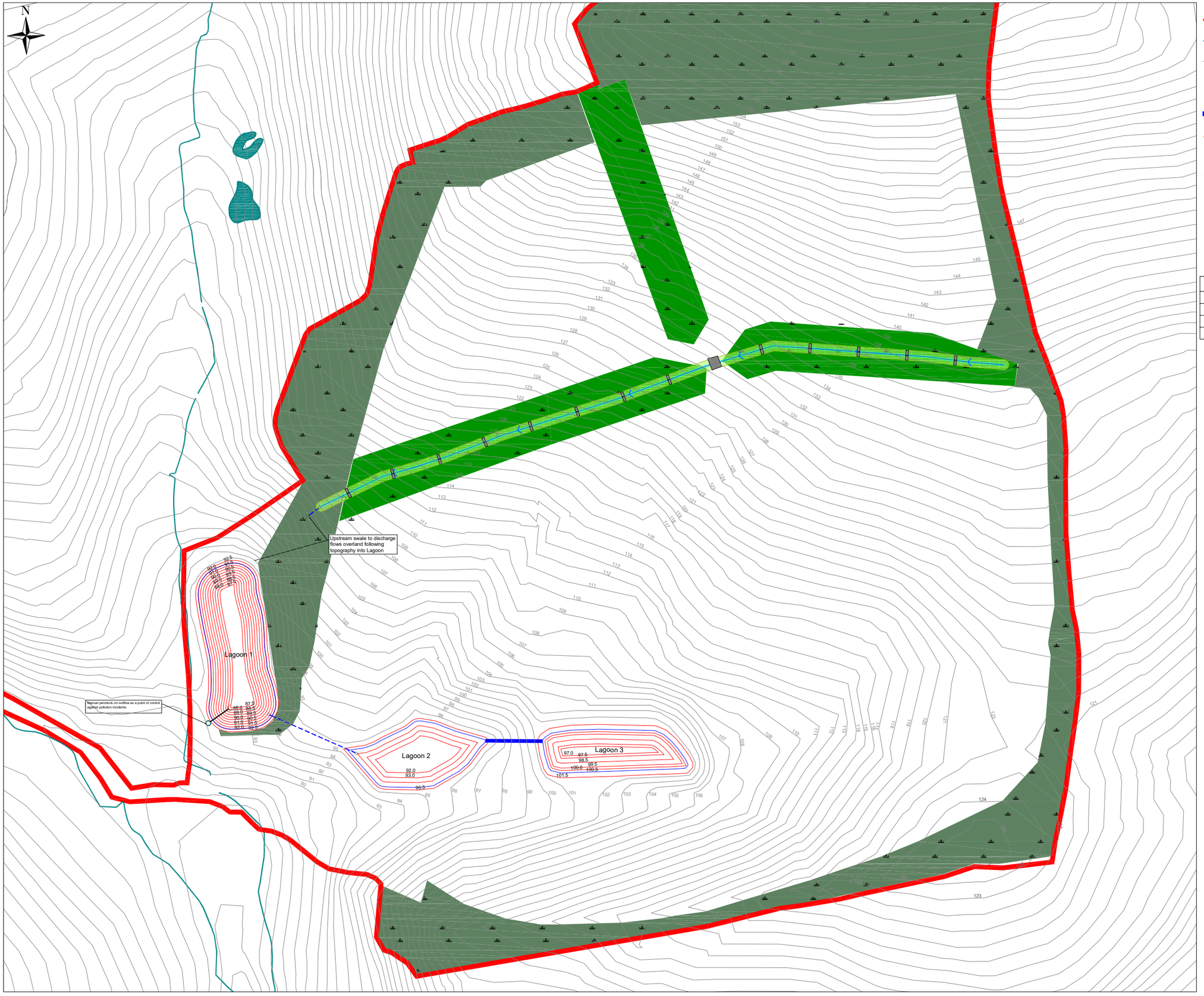
	Drawn: EF / Chkd.: EB		



Key:

- Site Boundary
- Surface Water Features
- Existing Topographical Level Contours (including contour changes for drainage lagoons) (m AOD)
- Permanent Drainage Swale
- Temporary Drainage Swale
- Lagoon Topographical Level Contours (m AOD)
- Lagoon Water Level Contours (m AOD)
- Headwall to Manhole Drainage Outlets
- Headland (Lowland Meadow Habitat) Buffer Zone
- Headland (Neutral Grassland Habitat) Buffer Zone
- Culvert
- DN450 Twinwall Pipe

Lagoon Details		
ID	Water Level (mAOD)	Water Volume (m^3)
Lagoon 1	91.95	4,040
Lagoon 2	95	1849
Lagoon 3	100.5	1486

Rev.	Details	Drawn / Chkd.	Date

Project

213189
Lower Hare Farm

Title

Temporary Drainage Solution

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Scale	Date	Drg. No.	Rev.
1:1,500@A3	Jul'24	213189/PL/D/012	
	Drawn: KW / Chkd.: ML		

APPENDIX A

APPENDIX B

Values for discharge permit

Effluent flow rate (EFR) = greenfield runoff from permanent attenuation pond 0.0249 m3/s 24.9 l/s

River flow rate (RFR) = flow in watercourse directly downgradient of pond = 3xEFR based on catchment size 0.0747 m3/s 74.7 l/s RC= (((10%EQS+BC)*(EFR+RFR))-(RFR*BC))/EFR

Data from SW1 to September 2023

								Test 1	Test 2				Test 3			
				Background concentration BC		EQS	EAL	RC = 10% of EQS/EAL	4% of EQS/EAL	EFR + RFR	4%EQS x (EFR+RFR)	RC = (4%EQS x (EFR+RFR))/EFR	10%EQS +BC	EFR + RFR	RFRxBC	MAX RC = (((10%EQS+BC)*(EFR+RFR))-(RFR*BC))/EFR
Determinand	Units	Min	Max	Average	95th %ile											
pH		7.1	8.6	7.89	8.47	6-9										
Electrical Conductivity	µS/cm	220	1300	466.43	903.50											
Suspended Solids At 105C	mg/l	5	370	50.23	184.60											
Biochemical Oxygen Demand	mg O2/l	4	8	4.29	5.40											
Chemical Oxygen Demand	mg O2/l	10	53	19.29	35.45											
Chloride	mg/l	25	76	37.00	56.50	250		25	10	0.0996	0.996	40	62.00	0.0996	2.76	137.00
Fluoride	mg/l	0.14	0.35	0.23	0.32	1		0.1	0.04	0.0996	0.003984	0.16	0.33	0.0996	0.02	0.63
Ammoniacal Nitrogen	mg/l	0.05	42	3.31	12.98		0.39	0.039	0.0156	0.0996	0.0015538	0.0624	3.35	0.0996	0.25	3.46
Sulphate	mg/l	22	39	29.21	37.70	400		40	16	0.0996	1.5936	64	69.21	0.0996	2.18	189.21
Cyanide (Total)	mg/l	0.05	0.05	0.05	0.05	1		0.1	0.04	0.0996	0.003984	0.16	0.15	0.0996	0.00	0.45
Total Hardness as CaCO3	mg/l	83	240	146.71	214.00											
Arsenic (Dissolved)	µg/l	0.23	1.3	0.43	1.11	50		5	2	0.0996	0.1992	8	5.43	0.0996	0.03	20.43
Boron (Dissolved)	µg/l	14	760	107.01	403.00	2000		200	80	0.0996	7.968	320	307.01	0.0996	7.99	907.01
Cadmium (Dissolved)	µg/l	0.11	0.27	0.12	0.17	0.15		0.015	0.006	0.0996	0.0005976	0.024	0.14	0.0996	0.01	0.18
Chromium (Dissolved)	µg/l	0.5	8.7	2.32	7.47	4.7		0.47	0.188	0.0996	0.0187248	0.752	2.79	0.0996	0.17	4.20
Copper (Dissolved)	µg/l	0.5	3.8	1.67	3.74	1		0.1	0.04	0.0996	0.003984	0.16	1.77	0.0996	0.12	2.07
Mercury (Dissolved)	µg/l	0.05	0.05	0.05	0.05	0.07		0.007	0.0028	0.0996	0.0002789	0.0112	0.06	0.0996	0.00	0.08
Nickel (Dissolved)	µg/l	0.88	5.6	2.85	4.76	4		0.4	0.16	0.0996	0.015936	0.64	3.25	0.0996	0.21	4.45
Lead (Dissolved)	µg/l	0.5	0.5	0.50	0.50	1.2		0.12	0.048	0.0996	0.0047808	0.192	0.62	0.0996	0.04	0.98
Selenium (Dissolved)	µg/l	0.5	11	1.25	4.19											
Vanadium (Dissolved)	µg/l	0.5	0.5	0.50	0.50	20		2	0.8	0.0996	0.07968	3.2	2.50	0.0996	0.04	8.50
Zinc (Dissolved)	µg/l	2.5	7.6	3.86	7.60	10.9		1.09	0.436	0.0996	0.0434256	1.744	4.95	0.0996	0.29	8.22
Chromium (Hexavalent)	µg/l	2.7	20	18.85	20.00	3.4		0.34	0.136	0.0996	0.0135456	0.544	19.19	0.0996	1.41	20.21
Aliphatic TPH >C5-C6	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aliphatic TPH >C6-C8	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aliphatic TPH >C8-C10	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aliphatic TPH >C10-C12	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aliphatic TPH >C12-C16	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aliphatic TPH >C16-C21	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aliphatic TPH >C21-C35	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aliphatic TPH >C35-C44	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Total Aliphatic Hydrocarbons	µg/l	5	5	5.00	5.00		10	1	0.4	0.0996	0.03984	1.6	6.00	0.0996	0.37	9.00
Aromatic TPH >C5-C7	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aromatic TPH >C7-C8	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aromatic TPH >C8-C10	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aromatic TPH >C10-C12	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aromatic TPH >C12-C16	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aromatic TPH >C16-C21	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aromatic TPH >C21-C35	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Aromatic TPH >C35-C44	µg/l	0.1	0.1	0.10	0.10		10	1	0.4	0.0996	0.03984	1.6	1.10	0.0996	0.01	4.10
Total Aromatic Hydrocarbons	µg/l	5	5	5.00	5.00		10	1	0.4	0.0996	0.03984	1.6	6.00	0.0996	0.37	9.00
Total Petroleum Hydrocarbons	µg/l	10	10	10.00	10.00		10	1	0.4	0.0996	0.03984	1.6	11.00	0.0996	0.75	14.00
Benzene	µg/l	1	1	1.00	1.00		10	1	0.4	0.0996	0.03984	1.6	2.00	0.0996	0.07	5.00
Toluene	µg/l	1	1.3	1.02	1.11		74	7.4	2.96	0.0996	0.294816	11.84	8.42	0.0996	0.08	30.62
Ethylbenzene	µg/l	1	1	1.00	1.00											
m & p-Xylene	µg/l	1	1	1.00	1.00		30	3	1.2	0.0996	0.11952	4.8	4.00	0.0996	0.07	13.00
o-Xylene	µg/l	1	1	1.00	1.00		30	3	1.2	0.0996	0.11952	4.8	4.00	0.0996	0.07	13.00
Naphthalene	µg/l	0.1	0.97	0.16	0.40		2	0.2	0.08	0.0996	0.007968	0.32	0.36	0.0996	0.01	0.96
Acenaphthylene	µg/l	0.1	0.1	0.10	0.10											
Acenaphthene	µg/l	0.1	0.1	0.10	0.10											
Fluorene	µg/l	0.1	0.1	0.10	0.10											
Phenanthrene	µg/l	0.1	0.1	0.10	0.10											
Anthracene	µg/l	0.1	0.1	0.10	0.10		0.1	0.01	0.004	0.0996	0.0003984	0.016	0.11	0.0996	0.00747	0.14
Fluoranthene	µg/l	0.1	0.1	0.10	0.10		0.0063	0.00063	0.000252	0.0996	2.51E-05	0.001008	0.10	0.0996	0.00747	0.1025
Pyrene	µg/l	0.1	0.1	0.10	0.10											
Benzo[a]anthracene	µg/l	0.1	0.1	0.10	0.10											
Chrysene	µg/l	0.1	0.1	0.10	0.10											
Benzo[b]fluoranthene	µg/l	0.1	0.1	0.10	0.10											
Benzo[k]fluoranthene	µg/l	0.1	0.1	0.10	0.10											
Benzo[a]pyrene	µg/l	0.1	0.1	0.10	0.10		0.00017	0.000017	6.8E-06	0.0996	6.773E-07	0.0000272	0.10	0.0996	0.00747	0.1001
Indeno(1,2,3-c,d)Pyrene	µg/l	0.1	0.1	0.10	0.10											
Dibenz(a,h)Anthracene	µg/l	0.1	0.1	0.10	0.10											
Benzo[g,h,i]perylene	µg/l	0.1	0.1	0.10	0.10											
Total Of 16 PAH's	µg/l	2	2	2.00	2.00											
Total Phenols	mg/l	0.03	0.03	0.03	0.03		0.0077	0.00077	0.000308	0.0996	3.068E-05	0.001232	0.03	0.0996	0.002241	0.0331