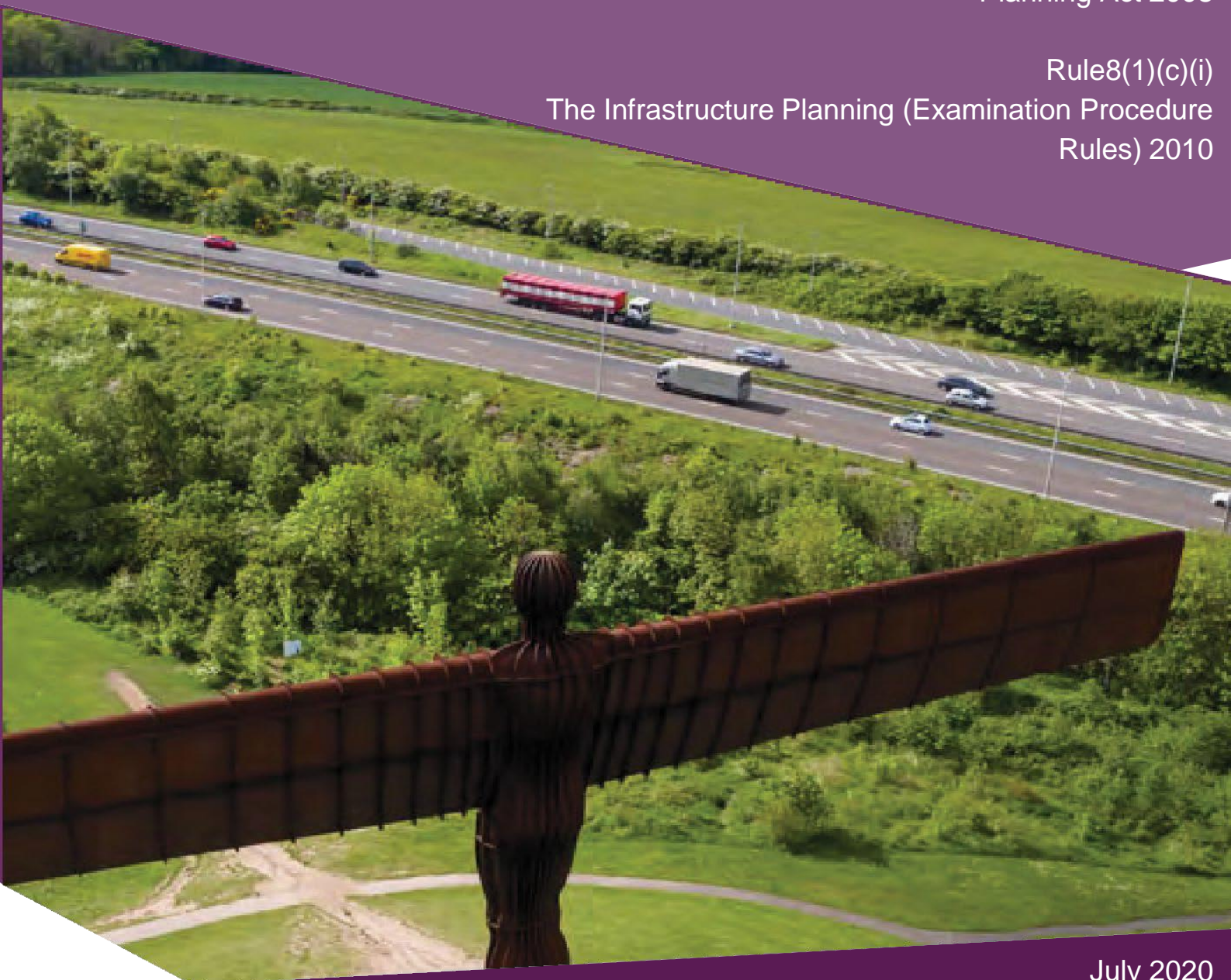


A1 Birtley to Coal House
Scheme Number: TR010031
Vortex Separators Assessment

Planning Act 2008

Rule8(1)(c)(i)
The Infrastructure Planning (Examination Procedure
Rules) 2010



Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning
(Examination Procedure Rules) 2010**

**The A1 Birtley to Coal House
Development Consent Order 20[xx]**

**Vortex Separators
Assessment**

Rule Number:	Rule 8(1)(c)(i)
Planning Inspectorate Scheme Reference	TR010031
Application Document Reference	Vortex Separators Assessment
Author:	A1 Birtley to Coal House Project Team, Highways England

Version	Date	Status of Version
Rev 0	09 June 2020	For Issue
Rev 1	13 July 2020	Deadline 10: Updated to add previously omitted details in Table 5-1

CONTENTS

1.	INTRODUCTION	1
2.	MITIGATION NEED	3
3.	MITIGATION OPTIONS	4
4.	MITIGATION APPROACH	6
5.	OUTFALL ASSESSMENT	7
6.	CONCLUSIONS	9

TABLES

Table 3-1 - Mitigation Indices	5
Table 5-1 - Surface Water Outfall Locations	7

APPENDICES

APPENDIX A	
DOWNSTREAM DEFENDER TECHNICAL SHEET	
APPENDIX B	
OUTFALL SUMMARY SHEETS	

1. INTRODUCTION

- 1.1.1. The Development Consent Order (DCO) application for the A1 Birtley to Coal House Scheme (“the Scheme”) was submitted in August 2019. The Examination of the Scheme started on 21 January 2020 and is due to complete on 19 July 2020. The DCO Application included a Flood Risk Assessment (FRA) which incorporated the surface water drainage strategy [APP-164] and, as part of the submitted Environmental Statement (ES): **Chapter 13 (Road Drainage and the Water Environment) [APP-034]**, an assessment of the potential impacts on the water environment from the surface water runoff from the highway.
- 1.1.2. The drainage design within the Surface Water Drainage Strategy (**Appendix C** of the FRA [APP-164]) includes oil/petrol separators on every outfall (**Paragraph 13.9.12.b**). A commitment has also been made in **Paragraph 13.9.12.c** of **Chapter 13 (Road Drainage and the Water Environment) [APP-034]** of the ES to assess the potential to include silt control vortex separators at every outfall during detailed design as the Environment Agency have stated is a requirement to demonstrate Water Framework Directive (WFD) compliance within this catchment:
- “In addition, silt control vortex separators would be incorporated into the outfalls to Longacre Dene to minimise sediment issues. The potential to include further silt control measures on all other outfalls would be investigated at detailed design to minimise sediment issues.”*
- 1.1.3. The importance of the inclusion of silt control vortex separators at every outfall to the statutory consultees has been raised several times, most recently during the DCO Examination. This includes the following response from Gateshead Council to the Examiner’s written questions submitted at Deadline 2:
- “Silt control vortex separators: There is only a firm commitment to provide a silt control mechanism at Long Acre Dene. A firm commitment to protect all affected watercourses should be made at this stage (prior to detail design) in order to avoid negative impact, and ideally provide betterment in water quality in line with WFD and local policy requirements.”*
- 1.1.4. Undertaking this assessment as part of the detailed design stage had been agreed with the statutory consultees and is evidenced in the Environment Agency Statement of Common Ground [REP2-054] and is under discussion with Gateshead Council as evidenced in the Gateshead Council Statement of Common Ground [REP2-052].
- 1.1.5. However, in order to address the issues raised during Examination and in light of the recent update of HD45/09 of the Design Manual for Roads and Bridges (DMRB) to LA113¹ (the impacts of which are addressed in a separate Technical Note [REP4-043 – Deadline 4

¹ <https://www.standardsforhighways.co.uk/dmrb/>

Submission - Written Question 2.0.12 Appendix 2.0P - DMRB updates Water HEWRAT Assessment²], Highways England have decided to bring this aspect of work should forward to support the DCO Application during Examination of the Scheme.

- 1.1.6. This Technical Note therefore assesses the possibility of installing a Vortex Grit Separator at each outfall.

² [https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010031/TR010031-000923-Appendix%202.0%20P%20-%20DMRB%20Updates%20Water%20HEWRAT%20Assessment%20\(WQ%202.0.12\).pdf](https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010031/TR010031-000923-Appendix%202.0%20P%20-%20DMRB%20Updates%20Water%20HEWRAT%20Assessment%20(WQ%202.0.12).pdf)

2. MITIGATION NEED

- 2.1.1. The need for mitigation has been assessed within the Highways Agency Water Risk Assessment Tool (HAWRAT) and Highways England Water Risk Assessment Tool (HEWRAT) assessments. Extensive consultation has also taken place with the Environment Agency who consider that the Scheme should demonstrate that it meets WFD compliance requirements and provides a degree of betterment, within the catchment. Mitigation in the form of hydrocarbon interceptors and sediment vortex separators has been stipulated by both the Environment Agency and Gateshead Council throughout the Environment Impact Assessment (EIA) process and during examination.
- 2.1.2. The design submitted as part of the DCO application, which was approved by Highways England, included hydrocarbon interceptors and a commitment to incorporate, where feasible, sediment vortex separators, subject to an assessment during detailed design.

2.2. HEWRAT ASSESSMENT

- 2.2.1. The findings of the HEWRAT assessment, as detailed in a separate Technical Note [REP4-043 – Deadline 4 Submission - Written Question 2.0.12 Appendix 2.0P - DMRB updates Water HEWRAT Assessment], concluded that no mitigation would be required at the outfalls, although the groundwater assessment for the ephemeral streams indicate that three of these outfalls are at medium risk.
- 2.2.2. Paragraphs 13.9.12b to 13.9.12.d of **Chapter 13 (Road Drainage and the Water Environment)** [APP-034] detail that:
- “b. Oil interceptors would be installed at all the outfalls to improve the water quality of the road discharge.*
- c. In addition, silt control vortex separators would be incorporated into the outfalls to Longacre Dene to minimise sediment issues. The potential to include further silt control measures on all other outfalls would be investigated at detailed design to minimise sediment issues.*
- d. Catchpits have been specified instead of manholes to aid sediment retention within the drainage system.”*
- 2.2.3. Therefore, whilst the HAWRAT and HEWRAT assessments did not identify a need for mitigation at the outfalls, during preliminary design and through to Examination, consultees, specifically the Environment Agency and Gateshead Council, have requested that mitigation is implemented to provide environmental benefits. In WFD terms this has been requested to demonstrate that the Scheme achieves a neutral balance. These requests are documented in the Environment Agency letter dated 8 April 2019 (**Appendix F** of the Statement of Common Ground between Highways England and the Environment Agency [REP2-054]).

3. MITIGATION OPTIONS

- 3.1.1. A comparison of the capabilities of oil interceptors and vortex grit separators has been undertaken to inform this assessment. This has been completed through a review of pertinent parts of the DMRB as detailed below), as well as reference to the Sustainable Urban Drainage Systems (SUDS) manual and liaison with potential suppliers of proprietary equipment. It is important to note that the DMRB guidance was updated following completion of the Scheme design. The findings of this review are detailed in the sections below.

3.2. DMRB

CG 501 - DESIGN OF HIGHWAY DRAINAGE SYSTEMS

- 3.2.1. Table 8.6.4N3 of CG 501 outlines that Vortex Grit Separators will provide spillage control and sediment pollutant removal with a 40% removal of suspended solids and 15% Dissolved Zinc removal.

CD 528- VORTEX SEPARATORS FOR USE WITH ROAD DRAINAGE SYSTEMS

- 3.2.2. CD 528 was published in February 2020 (i.e. during the DCO determination process) and paragraph A1 is key to this assessment, this states:

“Following the introduction of CD 527 [Ref 2.I] the drainage philosophy is to reduce maintenance where practical and improve the quality of surface water runoff discharging from the carriageway. The elimination of the gully sump may lead to an improvement in water quality. However, this can potentially increase the amount of sediment entering the drainage system. CD 523 [Ref 2.N] provides guidance on the design of the pipeline to transport sediment and the assessment of the volumes of sediment that a road might generate. There is scope to further reduce maintenance activity by reducing the number or frequency of catchpits and instead trap sediment at more centralised locations, remote from the carriageway.”

3.3. SUDS MANUAL C753

- 3.3.1. The SuDS Manual (Table 14.1) outline that Vortex Separators are:

“structures that use gravity and centrifugal force to separate out and collect medium-sized (63 to 250 μm) sediments and other litter or debris; smaller particles may be able to be removed by varying the flow rate into the system.”

- 3.3.2. Section 14.2.3 goes on to state:

“Vortex Separators are most efficient where the materials to be removed from runoff are able to be settled or floatables (which can be captured). They cannot remove small diameter solids (e.g. <115 μm) with poor settleability, emulsions or dissolved pollutants.”

3.4. MITIGATION INDICES

- 3.4.1. A summary of how the mitigation options (petrol interceptor and vortex grit separator) compare in terms of the mitigation indices / pollutant removal efficiencies are detailed in **Table 3-1** below.

Table 3-1 - Mitigation Indices

Element	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Oil Interceptor (Class 1)*	0.40	0.40	0.80
Vortex Separator (Hydro International – First Defence)	0.50	0.40	0.80

Notes:

*Petrol Interceptor Indices obtained from Kingspan Ltd

(<https://www.kingspan.com/gb/en-gb/products/wastewater-management/fuel-and-oil-separators/klargester-full-retention-separators>)

**Vortex Separator Indices obtained from Hydro International

(<https://www.hydro-int.com/en-gb/products>)

- 3.4.2. Based on the mitigation indices it is considered likely that a vortex grit separator would perform slightly better than an oil interceptor with improved total suspended solid removal. Further, detail is provided in the Hydro International Downstream Defender Design Sheet (**Appendix A**) which states that vortex grit separators can remove:
- a. Fine and coarse particles / total suspended solids (TSS)
 - b. Floatable trash and debris
 - c. Liquid- and sediment-bound oils and hydrocarbons
 - d. Sediment-bound heavy metals
 - e. Sediment-bound nutrients
- 3.4.3. Furthermore, when compared to a hydrocarbon separator sediment vortex's have internal components designed such that the pollutant storage zones are isolated to protect them from high flows that could cause pollutant re-entrainment or wash out.

4. MITIGATION APPROACH

- 4.1.1. In light of the findings of the previous section and the HEWRAT assessment outlined above, it is deemed that there is no requirement to have a train of mitigation measures. Therefore, it is considered that replacing the oil interceptors with Vortex Grit Separators will provide the environmental betterment and enhance the drainage solution proposed in **Chapter 13 (Road Drainage and the Water Environment) [APP-034]**. This approach is also in accordance with the updates to the DMRB, which since the Scheme design was completed, has been revised and now states “*Oil separators shall not be used*” (paragraph 8.7 of LA 113), the Environment Agency were involved in the development of LA 113 and can therefore be considered to agree with this position.
- 4.1.2. Additionally, the inclusion of Vortex Grit Separators will enable the detailed design stage to consider the removal / reduction in the number of catch pits (but not the filter drains) provided in the previously submitted design (**13.9.12d of Chapter 13 (Road Drainage and the Water Environment) [APP-034]**) as the vortex separators enable the sediment load to be more appropriately managed at centralised locations (i.e. prior to each outfall).
- 4.1.3. The remainder of the assessment considers the practicality of replacing the oil interceptors currently included within the outline surface water drainage strategy (**Appendix C of the FRA [APP-163]**) with vortex grit separators. In order to carry out the assessment, a specific product was required to be used. The Hydro International Downstream Defender³ chosen for this purpose and is utilised to achieve the requirements set out in points b, c and c of paragraphs 13.9.12b to 13.9.12.d of **Chapter 13 (Road Drainage and the Water Environment) [APP-034]**, noting that the specific manufacturer and model would be confirmed at detailed design.

³ https://hydro-int.com/en/products/downstream-defender?gclid=CjwKCAjwwMn1BRAUEiwAZ_jnEllorQ8Q-Y3bLslohcyoPgUw27zGL94_zKggvcidqjwTgTzY6wQMuRoCYb0QAvD_BwE

5. OUTFALL ASSESSMENT

- 5.1.1. The assessment has reviewed the key design information regarding outfall locations, potential locations for vortex grit separator, pipe sizes and design flow rates against the treatment flow rates for a 1 in 1 year event, which has been used to size the vortex grit separators, with the hydraulic capacity flow rate for each vortex separator exceeding the modelled 1 in 5 year flows.
- 5.1.2. The 14 outfalls assessed are as set out in **Table 13-5** of the **Chapter 13 (Road Drainage and the Water Environment)** [APP-034], reproduced below for ease, it is noted that Outfall 10 will no longer be utilised and has therefore not been included. Reference was made to the Highways England document CD 528 “Vortex separators for use with road drainage systems”⁴ which provides the requirements and advice for vortex separators.

Table 5-1 - Surface Water Outfall Locations

Outfall	Discharge Location
1	Exact location of this outfall could not be confirmed during CCTV survey and is assumed to be the Highway Authority's Drainage Network
2	Leyburnhold Gill
3	Bowes View
4	Leyburnhold Gill
5	Discharges into the Eighton Lodge Culvert then into the ordinary watercourse in Longacre Dene (Ancient Woodland)
6 and 7A	Ordinary watercourse near to Smithy Lane
8	Ditch leading to the Allerdene Culvert
9 – 13*	The River Team

Note:

*Outfall 10 will cease to be used as a result of the Scheme.

- 5.1.3. This demonstrates that vortex separators can be incorporated at each outfall, bar outfall 8, although some minor changes to the pipe alignments are required in some instances. The findings of this assessment are detailed in **Appendix B**. It was identified that changes to the pond upstream of outfall 8 could be made to enhance the performance of the pond, with regards to sediment reduction and therefore there is no requirement for a vortex at this

⁴ <https://www.standardsforhighways.co.uk/dmrb/>

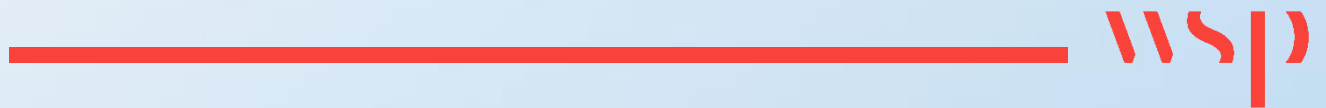
location. The modification to the pond, is relocating the inlet feature to the eastern end of the pond, to increase the flow time through the pond.

6. CONCLUSIONS

- 6.1.1. The review of the mitigation performance finds that a Vortex Grit Separator will perform slightly better than an oil interceptor with regard to the removal of total suspended sediments and will perform to the same standard in terms of hydrocarbon removal) therefore the oil interceptors can be removed from the Scheme in accordance with the updates to the DMRB and the findings of both the HAWRAT and HEWRAT assessments.
- 6.1.2. This assessment finds that Vortex Grit Separators could be constructed at each of the outfalls (except Outfall 8, where the pipe work to the pond has been realigned to enhance the performance of the SuDS pond to enable it to fully provide these benefits) in place of the oil interceptor to provide an enhanced benefit. In some cases, the proposed oil separators could be directly replaced with a vortex grit separator, in other cases the proposed pipework in the vicinity of the separator / vortex will need minor changes.
- 6.1.3. This assessment has been undertaken in discussion with Hydro-International but other vortex grit separator companies should be considered as part of the detailed design.
- 6.1.4. The use of a Vortex Grit Separators will also enable the detailed design stage to consider the removal / reduction in the number of catch pits provided (**13.9.12d of Chapter 13 (Road Drainage and the Water Environment) [APP-034]** as the sediment load would be managed at centralised locations (i.e. prior to each outfall).

Appendix A

DOWNSTREAM DEFENDER TECHNICAL SHEET



Downstream Defender® Advanced Hydrodynamic Vortex Separator

The Downstream Defender® is an advanced hydrodynamic vortex separator for the effective and reliable removal of fine particles, oils and other floatable debris from surface water runoff.

Its innovative design delivers high efficiency across a wide range of flows in a much smaller footprint than conventional or other swirl-type devices and it is the perfect choice for any catchment likely to convey high quantities of contamination.

1. Access for removal of floatables and sediments.
2. Inlet pipe.
3. Inlet chute.
4. Centre shaft.
5. Dip plate.
6. Centre cone.
7. Benching skirt.
8. Floatables and oil storage.
9. Isolated sediment storage zone.
10. Outlet pipe.

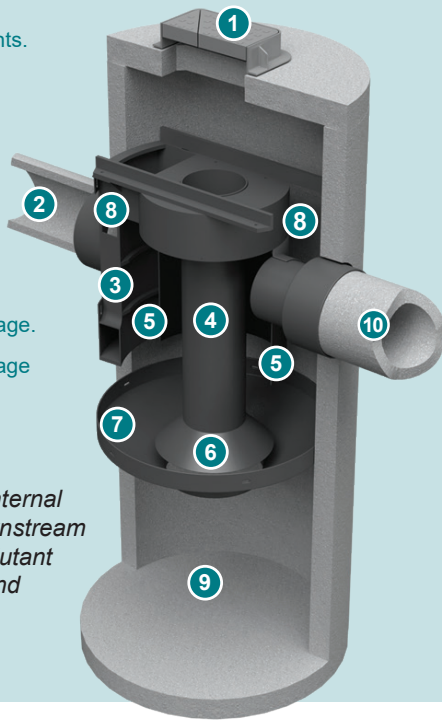


Figure 1 - The unique internal components of the Downstream Defender® enhance pollutant removal performance and prevent wash out.

Unique Flow Modifying Components

The Downstream Defender® consists of a choice of concrete or HDPE chamber with unique flow modifying internal components. It is these internal components that differentiate the Downstream Defender® from catchpits, sedimentation basins or sedimentation sumps. They facilitate advanced hydrodynamic vortex separation by reducing turbulence, lengthening the flow path to increase chamber residence time and introducing shear planes.

The internal components also ensure that the pollutant storage zones are isolated and protected from high flows that could cause pollutant re-entrainment or wash out.

Compared to devices that have poorly designed internal components, the Downstream Defender® captures and retains more of the annual pollutant load.

Watch a short video showing the Downstream Defender® components and operation at:

<http://www.hydro-int.com/en-gb/products/downstream-defender-0>



Repeatable, Reliable Performance

The Downstream Defender® delivers high removal of pollutants through advanced, hydrodynamic separation across a wide range of flows. The device has a proven track record of tackling an assortment of pollutants including:

Sediment (or Total Suspended Solids)



The Downstream Defender® is a highly effective sediment/TSS removal device. It can be sized in a number of ways to suit the application and level of protection required (see Table 1). **SuDS Mitigation Index = 0.5.**

Sediment Bound Hydrocarbons (including Polycyclic Aromatic Hydrocarbons - PAHs)



PAHs have low solubility in water and are readily adsorbed onto sediment particles. Effective removal of sediment particles will also ensure the removal of many PAHs.

Gross Pollutants



100% removal of floatable debris, such as food wrappers, Styrofoam cups and drinks cartons

Sediment Bound Heavy Metals and Nutrients



As an efficient device for removal of fine sediment, the Downstream Defender® is also effective for the removal of sediment bound pollutants. **SuDS Mitigation Index (Metals) = 0.4.**



Liquid Hydrocarbons



Effective spill containment device that meets the BS EN 858-1:2002 Class I and Class II effluent targets at low flow rates. Note these systems are not considered oil separators according to the BS EN 858-1 and must not be used in applications where full certification is required. **SuDS Mitigation Index = 0.8.**

Design Data

Downstream Defender®

Advanced Hydrodynamic Vortex Separator

No Risk of Pollutant Wash Out

The Downstream Defender® has been specially designed to isolate the pollutant storage zones and is proven to prevent pollutant wash out.

Sizing

The Downstream Defender® can be sized for different treatment goals and objectives.

For design purposes, the selected model's Treatment Flow Rate should be greater than or equal to the site's Water Quality Flow Rate.

The hydraulic capacity of the selected model should be considered with respect to the peak discharge flow rate from the site.

Model Diameter (m)	Treatment Flow Rate - Fine (l/s) ^(a)	Treatment Flow Rate - Coarse (l/s) ^(b)	Hydraulic Capacity (l/s) ^(c)	Minimum Oil Storage Capacity (l)	Minimum Sediment Storage Capacity (m ³) ^(e)	Maximum Headloss at Treatment Flow Rate - Coarse (mm)
1.2	30	38	120	283	0.39	150
1.8	69	85	270	1356	0.73	225
2.55	138	171	542	2535	2.89	300
3.0	190	237	750	4693	3.10	375

Notes:

- Treatment Flow Rate - Fine is based on an annualised removal efficiency of >50% of all particles up to 1000 microns with a mass-median particle size (D_{50}) of 75 microns and a specific gravity of 2.65.
- Treatment Flow Rate - Coarse is based on an annualised removal efficiency of >80% of all particles between 50 and 1000 microns with a mass-median particle size (D_{50}) of 146 microns and a specific gravity of 2.65.
- Maximum flow rate that can pass through the chamber with a maximum headloss of 500mm.
- Alternative sizing based on different sediment grades available on request.
- Additional sediment storage capacity can be provided to extend maintenance intervals if required.

Table 1 - Downstream Defender® design information.

Expert Design Service

Hydro International's professional engineers are on hand to provide free support with the correct sizing and selection of the Downstream Defender® within each drainage design.

We can also provide estimated maintenance intervals, whole life cost estimates and predicted pollutant removal performance.

Call the StormTrain® Hotline on: 01275 337955 or email stormtrain@hydro-int.com

Design Data

Downstream Defender®

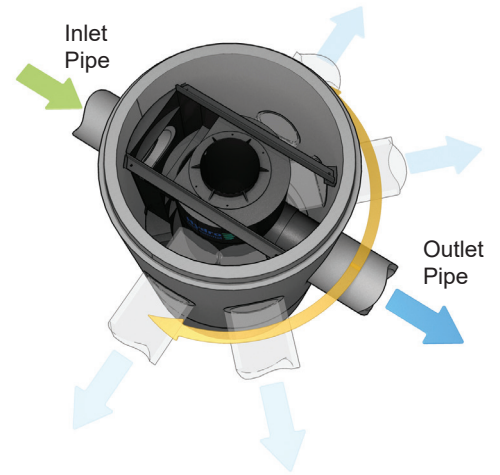
Advanced Hydrodynamic Vortex Separator

Setting Out

The Downstream Defender® can accommodate a change in pipe direction to suit site specific requirements. Combined with the high rate internal bypass, this helps to avoid the need for additional manholes on site. Head loss across the chamber is kept to a minimum (see Table 1). The inlet and outlet pipes should be sized in accordance with Table 2 (opposite), and a minimum of 90 degrees between inlet and outlet is required.

Inlet and outlet pipe connections are at the same invert level.

Additional manhole sections can be provided to extend the chamber to meet site cover and invert levels or provide additional pollutant storage where required.



Easy to Install

The Downstream Defender® is delivered to site as a near finished manhole with internal components already installed. Installation is therefore similar to any other manhole installation on site. Full installation guidelines are available.

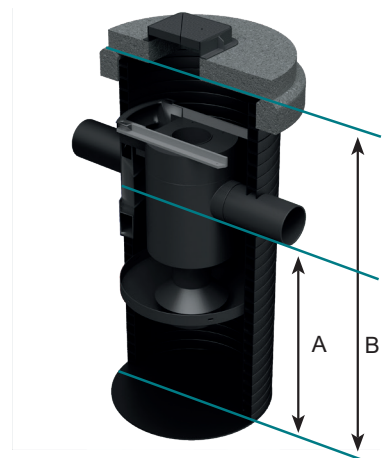
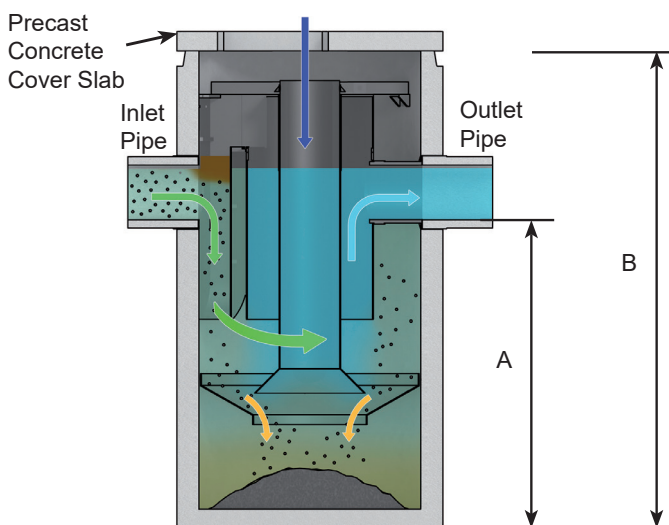
We can provide structural concrete systems for simple plug-and-play installation or choice of lightweight single and twin wall plastic chambers.

Easy to Maintain

Maintenance of the Downstream Defender® is simple, safe and cost-effective. Maintenance is carried out from the surface, using a standard vacuum tanker and personnel are not required to enter the device.

With a large capacity to store sediments and oils (see Table 1), and with a proven ability to prevent wash out, maintenance intervals can be years rather than months - depending on site conditions. The unit can also be fitted with a [Hydro-Logic™ Smart Monitoring](#) system to alert the site operator when maintenance is required and provide peace of mind that the unit is operating normally at other times.

Additional pollutant storage can be built into the chamber to extend maintenance intervals if required.



Dimensions and Weights

General arrangement drawings of all units are available for download from:
<http://www.hydro-int.com/en-gb/products/downstream-defender-0>

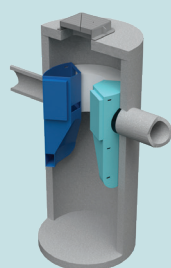
Model	Material	Chamber Diameter - Internal (mm)	Chamber Diameter - External (mm)	Inlet and Outlet ID (mm)	Depth to invert (m) (A) ⁽¹⁾	Chamber Depth (m) (B) ⁽²⁾	Max Component Lift Weight (kg)
PQL1320.1000	Concrete	1200	1460	300	1.916	2.830	2200
PQL1320.1030	Concrete	1800	2160	450	2.495	4.029	5450
PQL1320.1060	Concrete	2550	2850	600	2.95	4.95	8700
PQL1320.1090	Concrete	3000	3350	750	3.12	5.20	12100
PQL1320.1020	HDPE Single Wall	1188	1200	300	1.55	2.3	140
PQL1320.1051	HDPE Single Wall	1776	1812	500	2.11	3.41	460
PQL1320.1081	HDPE Single Wall	2530	2570	600	2.94	4.8	900
PQL1320.1111	HDPE Single Wall	2974	3000	800	3.13	5.3	1300
PQL1320.1025	HDPE Twin Wall	1200	1300	300	1.56	2.22	400
PQL1320.1055	HDPE Twin Wall	1800	2200	560	2.467	3.75	1100

Notes:
 1) Minimum depth to invert shown. Depth to invert can be increased if required.
 2) Minimum chamber depth shown. Additional sediment storage capacity or increased depth to invert can be provided if required.

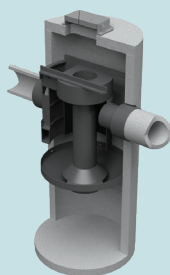
Table 2 - Downstream Defender® unit types, dimensions and weights.

The Hydro StormTrain® Series of Surface Water Treatment Devices

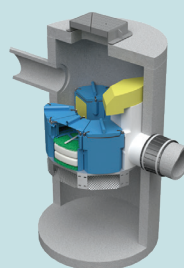
The Downstream Defender® is one of the Hydro StormTrain® Series of surface water treatment devices. Each device delivers proven, measurable and repeatable surface water treatment performance. Each can be used independently to meet the specific needs of a site or combined to form a management train. They can be used alongside natural SuDS features to protect, enable or enhance them.



First Defense®
Vortex Separator



Downstream Defender®
Advanced Hydrodynamic
Vortex Separator



Up-Flo™ Filter
Fluidised Bed Up Flow
Filtration System



Hydro Biofilter™
Biofiltration System

Patent: www.hydro-int.com/patents

Tel: +44 (0)1275 337955 stormtrain@hydro-int.com

Hydro International
 Shearwater House, Clevedon Hall Estate, Victoria Road, Clevedon, BS21 7RD

Downstream Defender® Design Data O/0819

hydro-int.com/stormtrain

Appendix B

OUTFALL SUMMARY SHEETS



OUTFALL 1

Discharge Location	Unknown (possible connection to Gateshead Council highway drains)
Network Reference	Portobello Outfall
Review Summary	<p>A Vortex Grit Separator (VS) could be built to replace the proposed Oil Interceptor O1-2-4. The VS could be built at the location of EX-AG33 or downstream of it.</p> <p>Typical Vortex Separator - DD3_1.2M_300DN From Hydro-International. Max. Treatment Flow Rate (l/s) 38 - Hydraulic Capacity Flow Rate (l/s) 120. 2.83 m deep x 1.2m dia, out/inlet 300mm.</p>

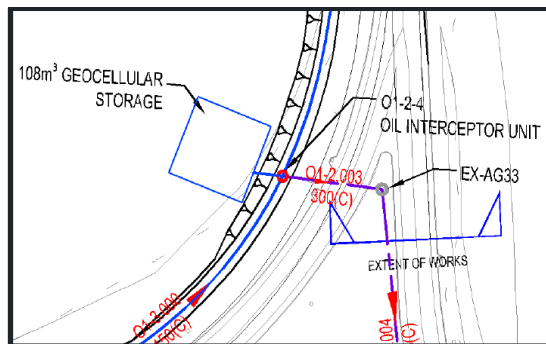


Figure 1: Outfall 1 Network Location Plan

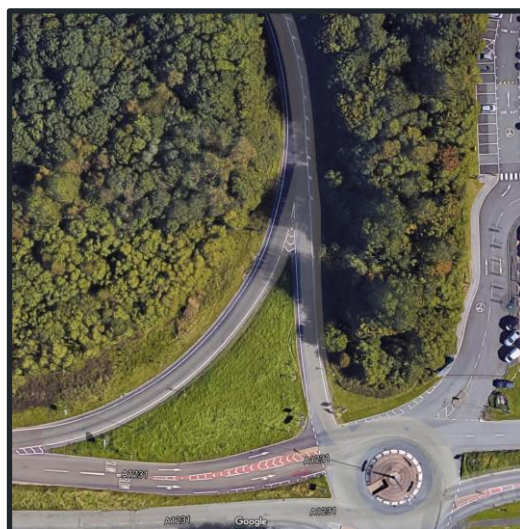


Figure 2: Outfall 1 Aerial View (Google)



Figure 3: Outfall 1 Street View (Google)

OUTFALL 2

Discharge Location	Leyburnhold Gill
Network Reference	Northdene NB Outfall
Review Summary	<p>A Vortex Grit Separator could be built to replace the proposed Oil Interceptor at O2-21.</p> <p>Typical Vortex Separator - DD3_3M_750DN From Hydro-International.</p> <p>Max. Treatment Flow Rate (l/s) 237 - Hydraulic Capacity Flow Rate (l/s) 750.</p> <p>5.2m deep x 3m dia, out/inlet 750mm.</p>

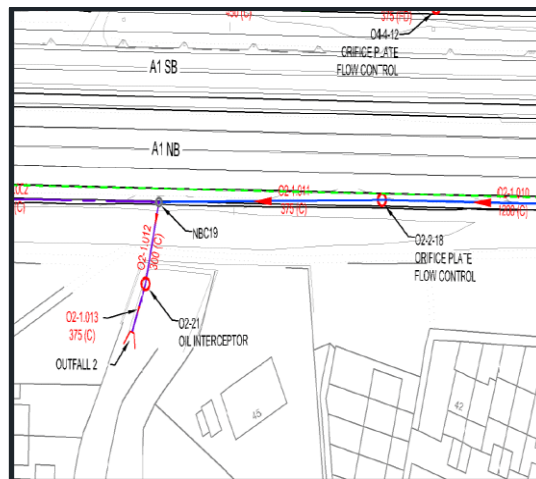


Figure 4: Outfall 2 Network Location Plan



Figure 5: Outfall 2 Aerial View (Google)



Figure 6: Outfall 2 Street View (Google)



Figure 9: Outfall 3 Street View (Google)



Figure 12: Outfall 4 Street View (Google)

OUTFALL 5

Discharge Location	Longacre Dene via Eighton Lodge Culvert
Network Reference	Longacre Dene Outfall
Review Summary	<p>A Vortex Grit Separator could be built to replace the proposed Oil Interceptor IRG71. The VS could be built on the pipeline downstream of the chamber IRG71.</p> <p>Typical Vortex Separator - DD3_3M_750DN From Hydro-International.</p>

Max. Treatment Flow Rate (l/s) 237 - Hydraulic Capacity Flow Rate (l/s) 750.
5.2m deep x 3m dia, out/inlet 750mm.

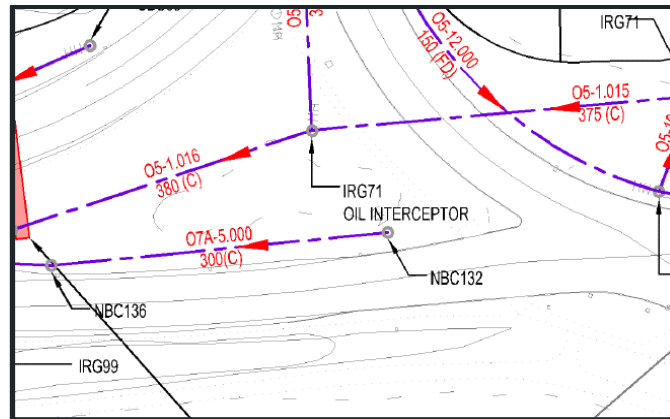


Figure 13: Outfall 5 Network Location Plan



Figure 14: Outfall 5 Aerial View (Google)



Figure 15: Outfall 5 Street View (Google)

OUTFALL 6

Discharge Location	Ordinary watercourse near Smithy Lane
Network Reference	Allerdene Outfall 1
Review Summary	<p>A Vortex Grit Separator could be built to replace the proposed Oil Interceptor O6-1-7. The VS could be built on the pipeline downstream of O6-1-7.</p> <p>Typical Vortex Separator - DD3_2.55M_600DN From Hydro-International.</p> <p>Max. Treatment Flow Rate (l/s) 171 - Hydraulic Capacity Flow Rate (l/s) 542.</p> <p>4.95m deep x 3m dia, out/inlet 600mm.</p>

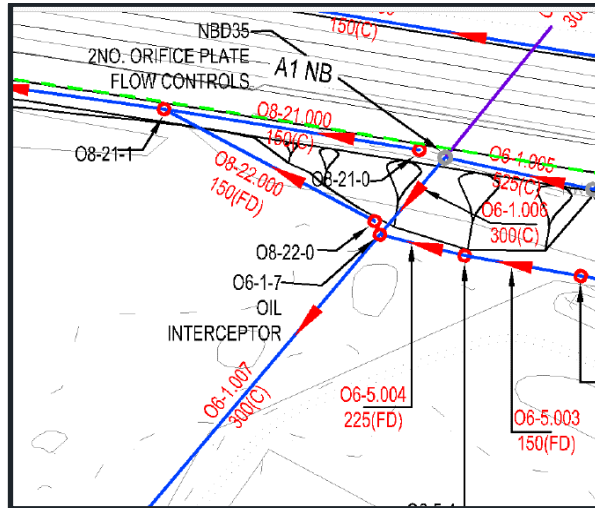


Figure 16: Outfall 6 Network Location Plan



Figure 17: Outfall 6 Aerial View (Google)



Figure 18: Outfall 6 Street View (Google)

OUTFALL 7

Discharge Location	Ordinary watercourse near Smithy Lane
Network Reference	Allerdene Outfall 3
Review Summary	<p>A Vortex Grit Separator could be built on the pipeline from the chamber O7-16-7 to the outfall.</p> <p>Need to amend pipework to move chamber O7-17-4 to provide additional space for construction.</p> <p>Typical Vortex Separator - DD3_1.2M_300DN From Hydro-International.</p> <p>Max. Treatment Flow Rate (l/s) 38 - Hydraulic Capacity Flow Rate (l/s) 120.</p> <p>2.83m deep x 1.2m dia, out/inlet 300mm.</p>

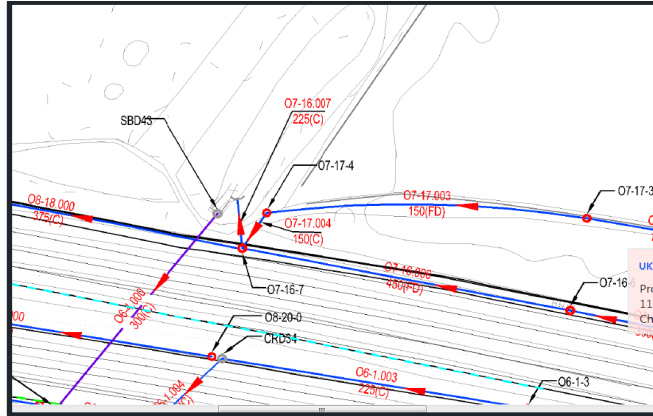


Figure 19: Outfall 7 Network Location Plan

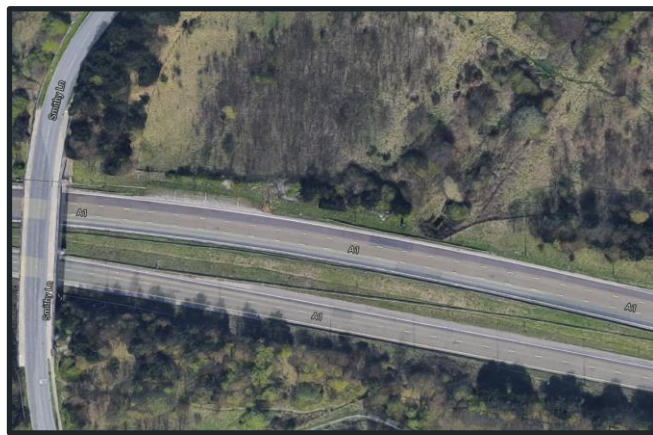


Figure 20: Outfall 7 Aerial View (Google)



Figure 21: Outfall 7 Street View (Google)

OUTFALL 7A – VS1 & VS2

Discharge Location	Ditch leading to ordinary watercourse near Smithy Lane
Network Reference	Allerdene Outfall 2
Review Summary	<p>Due to the large flows here, it is recommended that the proposed drainage network is re-configured to allow the use of Vortex Grit Separators. Flow controls are required here.</p> <p>The total flow arriving at Outfall O7A-1-11 can be partially discharged into VS1 (147l/s) and partially passing downstream (381l/s).</p> <p>This would be partially discharged into VS2(234l/s) and partially passing downstream (147l/s) to join Network 7.</p> <p><u>VS1</u></p> <p>Typical Vortex Separator - DD3_2.55M_600DN From Hydro-International.</p> <p>Max. Treatment Flow Rate (l/s) 171 - Hydraulic Capacity Flow Rate (l/s) 542.</p> <p>4.95m deep x 3m dia, out/inlet 600mm.</p> <p><u>VS2</u></p> <p>Typical Vortex Separator - DD3_3M_750DN From Hydro-International.</p> <p>Max. Treatment Flow Rate (l/s) 237 - Hydraulic Capacity Flow Rate (l/s) 750.</p> <p>5.2m deep x 3m dia, out/inlet 750mm.</p>



Figure 22: Outfall 7a (VS1 & VS2) Network Location Plan & Aerial View (Google)



Figure 23: Outfall 7a (VS1 & VS2) Street View (Google)

OUTFALL 8

Discharge Location	Culvert leading to Allerdene Culvert
Reference	Allerdene Outfall 3
Review Summary	<p>There is no requirement to provide a Vortex Grit Separator at this location, given the presence of a SuDS Pond. However, this pond inlet connection requires modification to enable an increase in residence time to facilitate sediment deposition. This has been achieved through the realignment of the inlet to the eastern side of the pond, as shown in the red dotted line in Figure 24. Detailed design will give consideration to enhancing the pond through the incorporation of sediment forebays.</p>

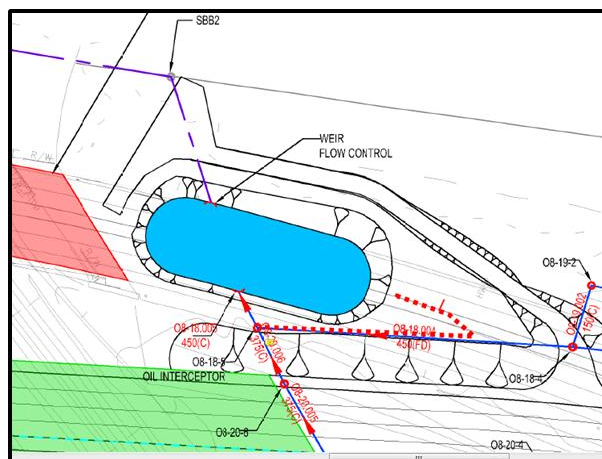


Figure 24: Outfall 8 Network Location Plan



Figure 25: Outfall 8 Aerial View (Google)



Figure 26: Outfall 8 Street View (Google)

OUTFALL 9

Discharge Location	River Team
Network Reference	Coal House Outfall 1
Review Summary	<p>A Vortex Grit Separator could be built to replace the proposed Oil Interceptor SB021. The VS could be built on the pipeline downstream of the chamber SB021.</p> <p>Typical Vortex Separator - DD3_2.55M_600DN From Hydro-International.</p> <p>Max. Treatment Flow Rate (l/s) 171 - Hydraulic Capacity Flow Rate (l/s) 542.</p> <p>4.95m deep x 3m dia, out/inlet 600mm.</p>

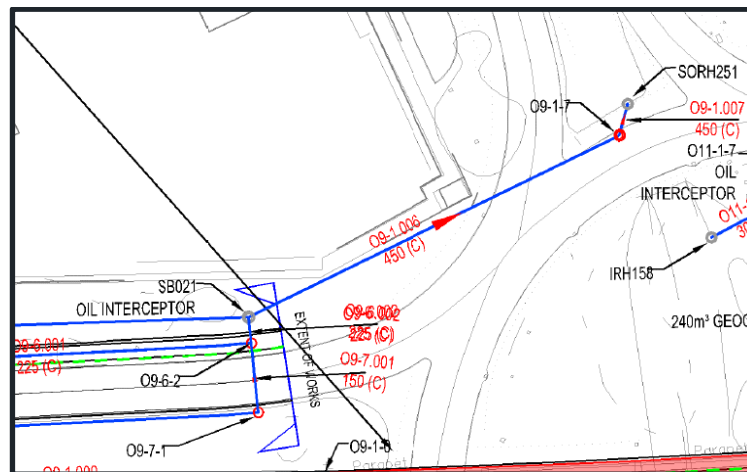


Figure 27: Outfall 9 Network Location Plan

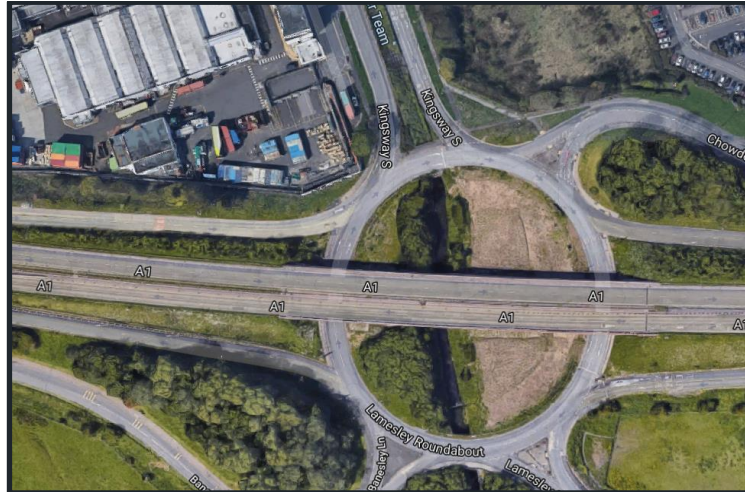


Figure 28: Outfall 9 Aerial View (Google)



Figure 29: Outfall 9 Street View (Google)

OUTFALL 11

Discharge Location	River Team
Network Reference	Coal House Outfall 3
Review Summary	<p>A Vortex Grit Separator could be built to replace the proposed Oil Interceptor O11-1-7.</p> <p>Typical Vortex Separator - DD3_1.2M_300DN From Hydro-International.</p> <p>Max. Treatment Flow Rate (l/s) 38 - Hydraulic Capacity Flow Rate (l/s) 120.</p> <p>2.83m deep x 1.2m dia, out/inlet 300mm.</p>

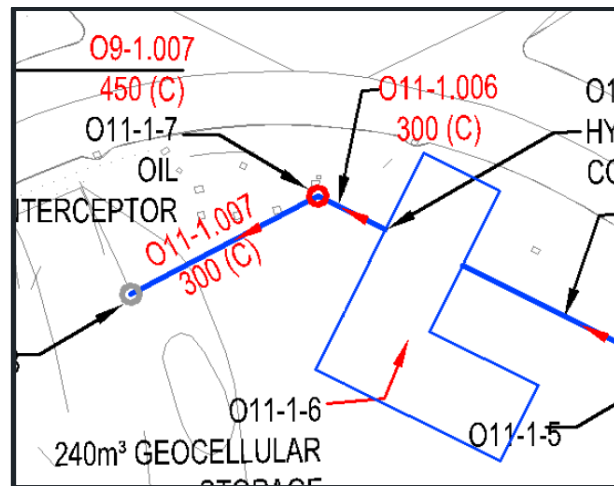


Figure 30: Outfall 11 Network Location Plan

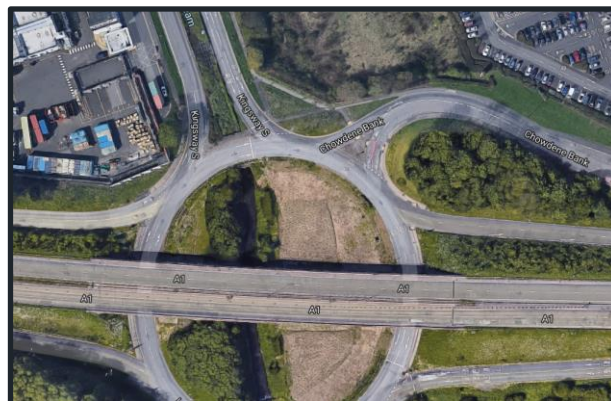


Figure 31: Outfall 11 Aerial View (Google)



Figure 32: Outfall 11 Street View (Google)

OUTFALL 12

Discharge Location	River Team
Network Reference	Coal House Outfall 4
Review Summary	<p>A Vortex Grit Separator could be built to replace the proposed Oil Interceptor O12-1-9.</p> <p>Typical Vortex Separator - DD3_2.55M_600DN From Hydro-International.</p> <p>Max. Treatment Flow Rate (l/s) 171 - Hydraulic Capacity Flow Rate (l/s) 542.</p> <p>4.95m deep x 3m dia, out/inlet 600mm.</p>

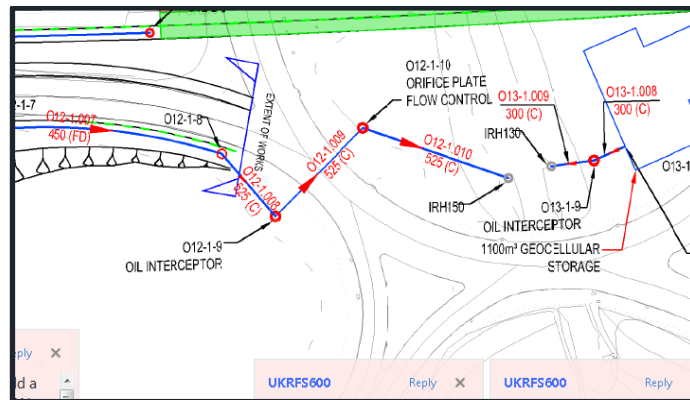


Figure 33: Outfall 12 Network Location Plan

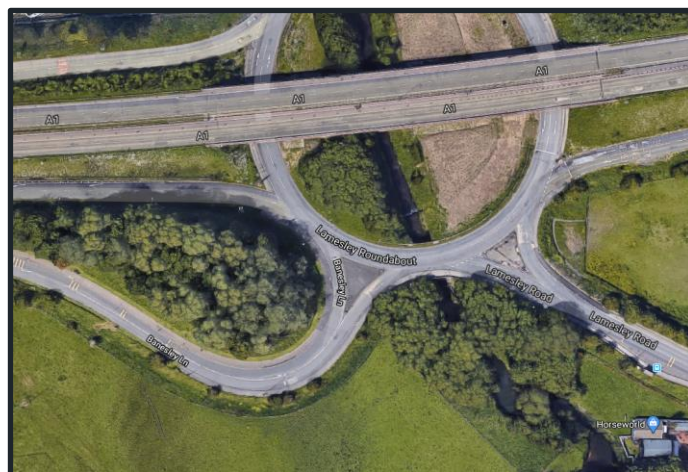


Figure 34: Outfall 12 Aerial View (Google)



Figure 35: Outfall 12 Street View (Google)

OUTFALL 13

Discharge Location	River Team
Network Reference	Coal House Outfall 5
Review Summary	<p>A Vortex Grit Separator could be built to replace the proposed Oil Interceptor O13-1-9.</p> <p>Typical Vortex Separator - DD3_1.8M_450DN From Hydro-International.</p> <p>Max. Treatment Flow Rate (l/s)85 - Hydraulic Capacity Flow Rate (l/s) 270.</p> <p>4.0m deep x 1.8m dia, out/inlet 450mm.</p>

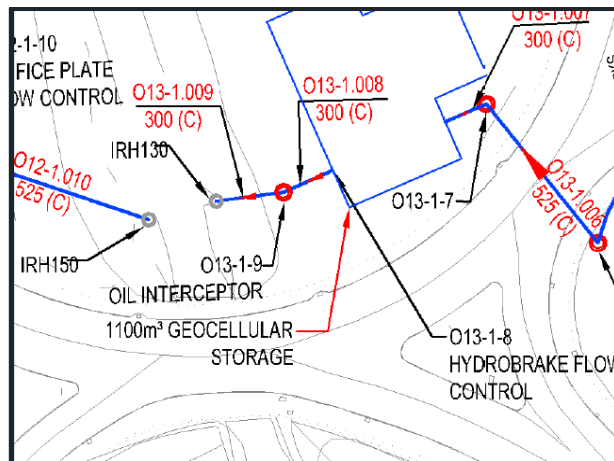


Figure 36: Outfall 13 Network Location Plan



Figure 37: Outfall 13 Aerial View (Google)



Figure 38: Outfall 13 Street View (Google)

If you need help accessing this or any other Highways England information, please call **0300 470 4580** and we will help you.

© Crown copyright 2020.

You may re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence:

visit www.nationalarchives.gov.uk/doc/open-government-licence/

write to the **Information Policy Team, The National Archives,**

Kew, London TW9 4DU, or email

psi@nationalarchives.gsi.gov.uk.

This document is also available on our website at www.gov.uk/highways

If you have any enquiries about this document A1BirtleytoCoalhouse@highwaysengland.co.uk or call **0300 470 4580***.

*Calls to 03 numbers cost no more than a national rate call to an 01 or 02 number and must count towards any inclusive minutes in the same way as 01 and 02 calls.

These rules apply to calls from any type of line including mobile, BT, other fixed line or payphone. Calls may be recorded or monitored.

Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ

Highways England Company Limited registered in England and Wales number 09346363