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Appendix 10.1

Photographs of Existing Hydrological Features

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114

Hydrology feature: GCR-WCC1

Description:

300mm PE pipe

Hydrology feature: GCR-WCC2

Description:

450mm PE pipe
and
300mm PE pipe

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114

Hydrology feature: GCR-WCC3

Description:

300mm concrete pipe.

Hydrology feature: GCR-WCC4

Description:

1000mm concrete pipe

Client Name: Ballinagree Wind DAC	Site Location: Ballynagree, Co. Cork	Project Number: P2114

Hydrology feature: GCR-WCC5

Description:

450mm concrete pipe

Hydrology feature: GCR-WCC6

Description:

450mm PE pipe

PHOTOGRAPHIC LOG	Consultants in Engineering, Environmental Science & Planning FEHILY TIMONEY

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114

Hydrology feature: GCR-WCC7 **Description:** 450mm concrete pipe	
Hydrology feature: GCR-WCC8 **Description:** Arch bridge	

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: GCR-WCC9 **Description:** Arch bridge		
Hydrology feature: GCR-WCC15 **Description:** 750mm concrete pipe		

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: GCR-WCC19 **Description:** Box culvert, 1200mm wide		
Hydrology feature: GCR-WCC20 **Description:** 300mm PE pipe		

Hydrology feature:
GCR-WCC21

Description:

300mm PE pipe

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: WF-HF1		
Description: 450mm concrete pipe		
Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: WF-HF2		

Description:

450mm PE pipe

Hydrology feature: WF-HF3

Description:

450mm concrete pipe

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: WF-HF4		

Description: Proposed location of a single span bridge	

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: WF-HF5		
Description: Proposed location of a box culvert		
Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: WF-HF6		

Description:	
Proposed location of a box culvert	

PHOTOGRAPHIC LOG	Consultants in Engineering, Environmental Science & Planning FEHILY TIMONEY

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: WF-HF7 **Description:** 1000mm concrete pipe		
Hydrology feature: WF-HF8		

Description: Stone bridge	

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: WF-HF9		
Description: Ford crossing		
Hydrology feature: WF-HF10		

PHOTOGRAPHIC LOG	Consultants in Engineering, Environmental Science & Planning FEHILY TIMONEY

Description: 450 PE pipe:	

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: WF-HF11		
Description: 450 PE pipe:		
Hydrology feature: WF-HF12		

Description: 450 PE pipe:	

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: WF-HF13		
Description: 450 PE pipe:		
Hydrology feature: WF-HF14		

Description: 450 PE pipe:	

Client Name: Ballinagree Wind DAC	**Site Location:** Ballynagree, Co. Cork	**Project Number:** P2114
Hydrology feature: WF-HF15		
Description: 450 PE pipe		
Hydrology feature: WF-HF16		

Description: Ford crossing	

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Appendix 10.2

Surface Water Management Plan

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED BALLINAGREE WIND FARM

SURFACE WATER MANAGEMENT PLAN

Prepared for: **Ballinagree Wind DAC**

Ballinagree Wind farm

Date: **January 2022**

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TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

Page

LIST OF TABLES

1. INTRODUCTION

This Surface Water Management Plan shall be read in conjunction with the Ballinagree Wind Farm EIAR. The Surface Water Management Plan for the construction stage of the project shall be finalised in accordance with this plan following the appointment of the contractor for the works.

1.1 Existing Environment

The wind farm site is situated within three sub-catchments as defined by the WFD and shown on Figure 10 2 of the EIAR. These waterbodies are known as:

- Sullane_SC_020 (19_7)
- Blackwater (Munster)_SC_050 (18_4)
- Blackwater (Munster)_SC_070 (18_7).

Greenfield runoff from the southern extent of the wind farm site ultimately drains to the Laney River and its tributaries. The northern part of the site drains into the Nadanuller Beg Stream and its tributaries.

Existing tracks are present throughout the site. Some of these tracks are access tracks for the forestry inspection and tree felling which are approximately 5m in width. The majority of the access tracks are made up of sandstone/siltstone hardcore. The existing track drainage consists of ‘over the edge’ drainage to roadside drains.

Detailed description of existing drainage is provided in Section 10.3.6 of the EIAR.

1.2 Daily Preparation during the Implementation of the Surface Water Management Plan

The Drainage Engineer appointed by the contractor shall conduct regular meetings with the Construction Management Team to discuss the phasing of construction and drainage as the work progresses. The focus of these meetings will be on establishing an operational drainage system in advance of the progression of the works.

Particular regard will be taken of daily weather conditions and long-range forecasts. The Drainage Engineer will have the authority to suspend the works if weather conditions are deemed too extreme for the effective protection of receiving watercourses. Mitigation measures to protect receiving watercourses will be put in place as directed by the Drainage Engineer in response to extreme forecasts.

1.3 Personnel Qualifications and Key Contacts

All those carrying out work on site must have a FÁS/Solas Safe Pass Card. All works must be supervised by a competent supervisor. Workers must be adequately trained in the tasks they are required to carry out. The key contact names and contact details shall be supplied to all personnel entering the site. All site staff shall be informed of the emergency procedures for the site.

2. POTENTIAL IMPACTS

2.1 Construction Stage Impacts

During the construction period, the development has the potential to lead to impacts on hydrology and water quality unless appropriate mitigation is applied.

Tree felling, new site access roads, turbine hardstanding areas, the on-site substation and other new, hard surfaces have the potential to contribute to an increase in runoff, release of sediments, hydrocarbons, and pollutants in the watercourses.

During construction, the transport of both dissolved and sediment-bound nutrients from soil to water could deleteriously affect water quality downstream, in the absence of mitigation measures.

A detailed description of the potential construction stage impacts on hydrology and water quality can be found in Chapter 10 of the EIAR.

2.2 Operational Phase Impacts

Due to the grassing over the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of operations, there is a negligible risk of sediment release to the watercourses during the operational stage.

During the operation stage, small quantities of oil will be used in cooling the transformers associated with the facility. There is therefore a potential for small oil spills.

It is not envisaged that the operation period will involve significant impacts on the water quality of the area. There is a potential risk of some hydrocarbons polluting the watercourses following run-off from the impermeable trafficked areas.

2.3 Decommissioning Stage Impacts

The potential impacts associated with decommissioning will be similar in nature to those associated with construction of the wind farm albeit to a lesser extent.

It is proposed that turbine foundations and hardstanding areas are left in place and covered with local topsoil and revegetated. Removal of this infrastructure would result in considerable disruption to the local environment in terms of an increased possibility of sedimentation. It is considered that leaving the turbine foundations hardstanding areas in-situ will cause less environmental damage than removing them. Access tracks will continue to be used for recreation, forestry and agriculture.

Grid connection cables will be left in the ground, therefore no potential impacts during decommissioning stage are likely to occur.

A detailed description of the potential decommissioning stage impacts on hydrology and water quality can be found in Chapter 10 of the EIAR.

3. DRAINAGE OF WIND FARM DURING THE CONSTRUCTION AND OPERATION PHASES

The proposed surface water drainage system utilises sustainable drainage devices and methods where appropriate. The proposed layout of the drainage system is provided in Planning Drawings Series 0100.

Where required, on the upslope side of new sections of access track and hardstanding areas, overland flows will be intercepted in channels. The flow will then be discharged diffusely over vegetated areas. The roadside drains will therefore only carry the site access track runoff. This will ensure that there will be no mixing of 'clean' and 'dirty' water as shown on Figure 3-1, and will avoid a large concentration of flows. Thus, erosion risks will be reduced and the quantity of water requiring treatment will be minimised.

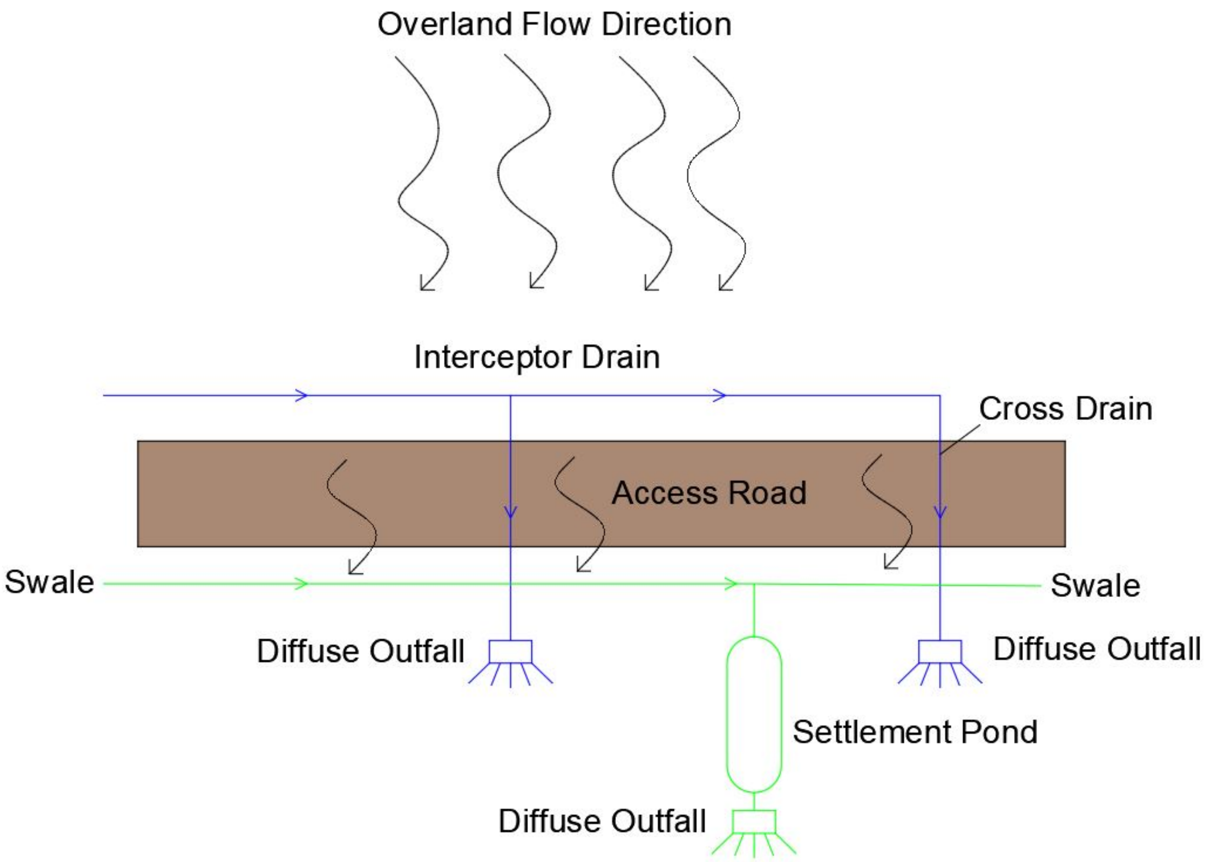


Figure 3-1: Drainage Design Principles

The main components of the proposed drainage network are:

- Interceptor Drains
- Swales
- Settlement Ponds

The surface water drainage is designed to capture surface water run-off from the roads and other hardstanding areas in swales and discharge into settlement ponds specifically constructed for managing surface water runoff generated from the wind farm infrastructure. After passing through the settlement pond, surface run-off will be permitted to spread across the adjacent lands.

This treated water will ultimately percolate to groundwater or travel over ground and be assimilated into the existing drainage network. There will be no direct discharges from the wind farm to any existing natural watercourse.

The internal access tracks will be constructed using unbound aggregate materials such that they will permit some degree of infiltration and reduce the volume of runoff generated.

90 no. temporary settlement ponds will be established during construction works in areas of high construction activity and groundworks. The locations of temporary settlement ponds will be adjacent to significant earthworks, as close as possible to the source of sediment while maintaining a minimum 50m buffer distance from existing watercourses. These additional temporary ponds will be decommissioned and reinstated on completion of the construction works. The settlement ponds will also provide containment capacity in the event of a spill or leak on the installed infrastructure and the outflow can be closed off to contain any potential pollutants within the settlement ponds. In the event of contaminated runoff being contained in a settlement pond, the incident will be reported as set out in Section 4.7, samples taken of the contaminated liquid for classification, as required, and the liquid pumped out of the pond using a suitable vacuum truck and disposed of at a licensed waste facility off-site.

The surface water management system will be visually inspected on a daily basis during construction works by the SHEQ Officer (or equivalent appointed person) to ensure that it is working optimally. The frequency of inspection will be increased at settlement ponds adjacent to areas where earthworks are being carried out and at the borrow pits during excavations. Where issues arise, construction works will be stopped immediately, and the source of the issue will be investigated. Records of all maintenance and monitoring activities associated with the surface water network will be retained by the Contractor on-site, including results of any discharge testing requirements.

The Contractor will implement temporary control measures such as silt fences, silt bags, temporary settlement tanks, as required. These are further explained in this section.

The works programme for the initial construction stage of the proposed development will take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The drainage system outlined below provides for a multi-stage treatment train of the discharges from the development, as recommended in the SUDS manual:

- grassed swales removing some of the sediment borne contaminants,
- settlement ponds providing retention and treatment of discharges,
- diffuse outflow from settlement ponds providing for further retention and settlement of suspended solids by reducing the velocities of flows and increasing the flow path of discharges,
- continuation of flows by natural flow paths over vegetated areas before entering the watercourse, providing further retention and treatment of discharges.

Interceptor Drains

Interceptor drains will be installed ahead of the main earthworks activities to minimise the effects of collected water on the stripped/exposed soils once earthworks commence. These drainage ditches will be installed on the upgradient boundary of the areas affected by the access track earthworks operations and installed ahead of the main track construction operations commencing.

They will generally follow the natural flow of the ground. The interceptor drains will intercept any storm water surface runoff and collect it to the existing low points in the ground, allowing the clean water flows to be transferred independently through the works without mixing with the construction drainage. Collected runoff will be discharged over the roads via cross drains. It will then be directed to areas where it can be redistributed over the ground. The overland flow will then discharge diffusely on the downslope side over vegetated areas within the site boundary.

Swales

Swales along access tracks will be installed in parallel of the main construction phase. Swales will provide additional storage of storm water where located along gradient. Given the steep longitudinal gradients on some sections of access track, regular check dams will be employed within the trackside swale on these sections to reduce the flow velocity and provide settlement opportunity. Check dams will be constructed from course gravel/ crushed rock.

The swales will be 0.3 m in depth with a bottom width of 0.5 m and side slopes of 1 in 3. A grassed swale is shown on Figure 3-2.

The swales will be constructed in accordance with CIRIA C698 Site Handbook for the Construction of SUDS.

Figure 3-2: Grassed swale along access track

Settlement Ponds

Settlement ponds will be put in place as construction progresses across the site. Settlement ponds will have a diffuse stone filled outflow which will encourage the diffuse spread of flows overland and back into natural drains down slope of the settlement ponds. Drainage stone will be placed at the inlet to the ponds to filter the flows before they enter the ponds. The proposed layout will utilize 90 settlement ponds.

After passing through the settlement ponds, the concentration of suspended solids in the surface water run-off due to the excavations will be reduced.

The following shall apply to construction of settlement ponds at the site:

- Pond depths generally to be excavated to less than 1.5m;
- Side slopes to be shallow, nominally at a 1 in 3 side slope (maximum); and
- Material excavated from the settlement pond should be compacted around the edge of the pond.

The settlement pond design is based on primary settling out of suspended solids from aqueous suspension. The theory behind the design of the settlement lagoons is the application of Stoke's Law. The settlement lagoons will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to allowing the water to outfall to the receiving environment. Flow rates for storm events will be maintained at or below greenfield run-off rates.

Settlement ponds will be installed concurrently with the formation of the road and will be fenced off for safety. They will be located as close to the source of sediment as possible and maintain a buffer of 50m from existing watercourses. Machine access will be required at settlement ponds to remove accumulated sediment.

Further sediment pond control measures include:

- Settlement pond maintenance and/or cleaning will not take place during periods of extended heavy rain;
- Settlement ponds will, where practicable, be constructed on even ground and not on sloping ground and where possible will discharge into vegetation areas to aid dispersion; and
- Settlement ponds will be monitored closely over the construction timeframe to ensure that they are operating effectively.

In the event of an emergency, the settlement ponds will provide a temporary holding area for any accidental spills on site as it will be possible to block off the outflow from these ponds for a limited period. Erosion control and retention facilities, including settlement ponds will be regularly maintained during the construction phase.

The drainage system will remain operational and will be utilised for the decommissioning phase to treat any surface water from exposed areas as a result of decommissioning at the site. During the decommissioning of the turbine base, hardstanding areas and access tracks shall remain in place and be covered with local soil/topsoil to minimise disturbance to soils.

Swale draining to settlement pond is shown on Figure 3-3.

The proposed volume of settlement ponds is provided in

Table 3-1: Settlement Pond – Dimension

	Area		Inflow (Rational Equation)	CIRIA 648			
Pond ID	Contributing Area (m2)	Imp. Contributing Area (m2)	Inflow (m3/s)	Retention time (h)	Pond Volume Required (m3)	Depth (m)	Top Area (m2)
SP1	9333	4200	0.036	2	261	1	261
SP2	1060	477	0.004	2	30	1	30
SP3	8384	3773	0.033	2	234	1	234
SP4	905	407	0.004	2	25	1	25
SP5	10071	4532	0.039	2	281	1	281
SP6	925	416	0.004	2	26	1	26
SP7	1166	525	0.005	2	33	1	33
SP8	1300	585	0.005	2	36	1	36
SP9	1035	466	0.004	2	29	1	29
SP10	5097	2294	0.020	2	142	1	142
SP11	9121	4104	0.035	2	255	1	255
SP12	1242	559	0.005	2	35	1	35
SP13	7960	3582	0.031	2	222	1	222
SP14	1675	754	0.006	2	47	1	47
SP15	9587	4314	0.037	2	268	1	268
SP16	7505	3377	0.029	2	210	1	210
SP17	1191	536	0.005	2	33	1	33
SP18	975	439	0.004	2	27	1	27
SP19	3471	1562	0.013	2	97	1	97
SP20	4425	1991	0.017	2	124	1	124
SP21	1925	866	0.007	2	54	1	54
SP22	9450	4253	0.037	2	264	1	264
SP23	2893	1302	0.011	2	81	1	81
SP24	1655	745	0.006	2	46	1	46
SP25	4820	2169	0.019	2	135	1	135

	Area		Inflow (Rational Equation)	CIRIA 648			
Pond ID	Contributing Area (m2)	Imp. Contributing Area (m2)	Inflow (m3/s)	Retention time (h)	Pond Volume Required (m3)	Depth (m)	Top Area (m2)
SP26	1339	603	0.005	2	37	1	37
SP27	1905	857	0.007	2	53	1	53
SP28	1650	743	0.006	2	46	1	46
SP29	2055	925	0.008	2	57	1	57
SP30	3062	1378	0.012	2	85	1	85
SP31	9539	4293	0.037	2	266	1	266
SP32	1127	507	0.004	2	31	1	31
SP33	1735	781	0.007	2	48	1	48
SP34	2070	932	0.008	2	58	1	58
SP35	1000	450	0.004	2	28	1	28
SP36	1280	576	0.005	2	36	1	36
SP37	9243	4159	0.036	2	258	1	258
SP38	4350	1958	0.017	2	121	1	121
SP39	1400	630	0.005	2	39	1	39
SP40	1765	794	0.007	2	49	1	49
SP41	9325	4196	0.036	2	260	1	260
SP42	1940	873	0.008	2	54	1	54
SP43	1959	882	0.008	2	55	1	55
SP44	500	225	0.002	2	14	1	14
SP45	650	293	0.003	2	18	1	18
SP46	9407	4233	0.036	2	263	1	263
SP47	9785	4403	0.038	2	273	1	273
SP48	1437	647	0.006	2	40	1	40
SP49	840	378	0.003	2	23	1	23
SP50	1545	695	0.006	2	43	1	43
SP51	9058	4076	0.035	2	253	1	253
SP52	1760	792	0.007	2	49	1	49
SP53	1325	596	0.005	2	37	1	37

	Area		Inflow (Rational Equation)	CIRIA 648			
Pond ID	Contributing Area (m2)	Imp. Contributing Area (m2)	Inflow (m3/s)	Retention time (h)	Pond Volume Required (m3)	Depth (m)	Top Area (m2)
SP54	2615	1177	0.010	2	73	1	73
SP55	11210	5045	0.043	2	313	1	313
SP56	950	428	0.004	2	27	1	27
SP57	1165	524	0.005	2	33	1	33
SP58	1250	563	0.005	2	35	1	35
SP61	1950	878	0.008	2	54	1	54
SP62	1825	821	0.007	2	51	1	51
SP63	9043	4069	0.035	2	253	1	253
SP65	2035	916	0.008	2	57	1	57
SP66	11186	5034	0.043	2	312	1	312
SP67	1750	788	0.007	2	49	1	49
SP68	3060	1377	0.012	2	85	1	85
SP69	4041	1818	0.016	2	113	1	113
SP70	1250	563	0.005	2	35	1	35
SP71	1627	732	0.006	2	45	1	45
SP72	1000	450	0.004	2	28	1	28
SP73	1545	695	0.006	2	43	1	43
SP74	2178	980	0.008	2	61	1	61
SP75	9810	4415	0.038	2	274	1	274
SP76	1605	722	0.006	2	45	1	45
SP78	4418	1988	0.017	2	123	1	123
SP79	2100	945	0.008	2	59	1	59
SP80	5677	2555	0.022	2	159	1	159
SP81	10802	4861	0.042	2	302	1	302
SP82	2160	972	0.008	2	60	1	60
SP83	9245	4160	0.036	2	258	1	258
SP84	3100	1395	0.012	2	87	1	87
SP85	2831	1274	0.011	2	79	1	79

	Area		Inflow (Rational Equation)	CIRIA 648			
Pond ID	Contributing Area (m2)	Imp. Contributing Area (m2)	Inflow (m3/s)	Retention time (h)	Pond Volume Required (m3)	Depth (m)	Top Area (m2)
SP86	9020	4059	0.035	2	252	1	252
SP87	2855	1285	0.011	2	80	1	80
SP88	10905	4907	0.042	2	304	1	304
SP89	1675	754	0.006	2	47	1	47
SP90	1770	797	0.007	2	49	1	49
SP91	9248	4162	0.036	2	258	1	258
SP92	8626	3882	0.033	2	241	1	241
SP93	2638	1187	0.010	2	74	1	74
SP94	2470	1112	0.010	2	69	1	69

Figure 3-3: Swale draining to Settlement pond

Check Dams

At slopes greater than 2%, check dams will be required in the swales and interceptor drains to slow down the velocities of flows and prevent erosion occurring, as shown in Figure 3-4. These check dams will be in stone of minimum size 37.5 mm and will be laid at a spacing of between 10 and 30 m dependent on the slope.

All check dams, etc will be checked at least once weekly via a walkover survey during the full period of construction. All excess silts will be removed and placed in borrow pit reinstatement or embankments. Where check dams have become fully blocked with silt, they will be replaced.

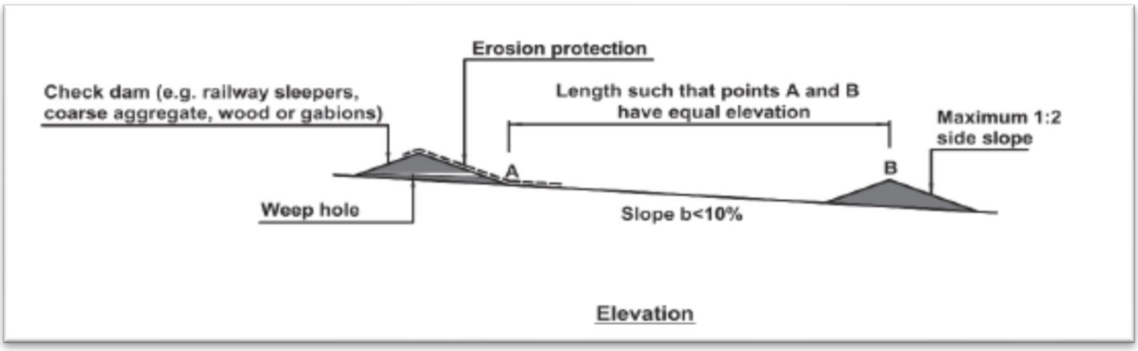


Figure 3-4: Check Dam Detail

Silt Traps and Silt Fences

Silt traps will be provided in swales which will consist of geotextile staked across the swale at regular intervals. The geotextile will be weighed down on the upstream side with clean filter stone to provide further filtration and stability to the silt trap, as shown in Figure 3-5 to Figure 3-7.

Silt fencing will be kept on site and erected as required during construction to provide further protection to prevent the ingress of silt into the watercourses. The silt fencing will be kept in place until the natural vegetation has been re-established.

Figure 3-5: Silt trap across grassed swale

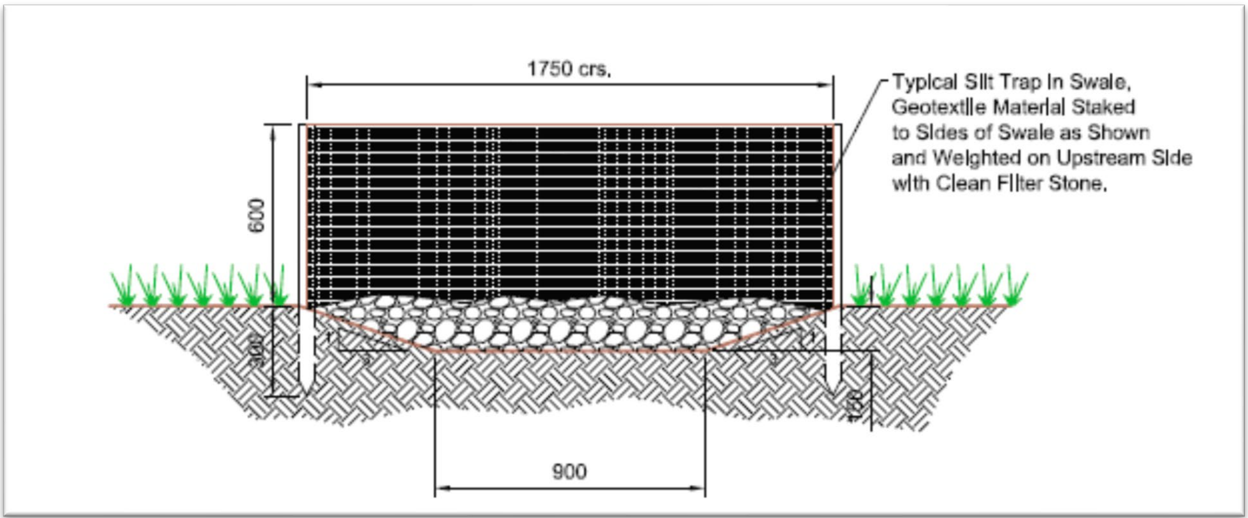


Figure 3-6: Trap Details

Figure 3-7: Silt Fence

Drainage of Turbine Bases and Hardstanding

The excavations for turbines will be pumped into the site drainage system (including settlement ponds), which will be constructed at site clearance stage, in advance of excavations for the turbine bases.

As discussed above, the new turbine hard-standing areas will be drained via shallow swales with suitably designed settlement ponds. The settlement ponds will remain in place following the construction period.

If cross-drains are required to convey the drainage across the hardstanding area, the diameters will be suitably designed in advance.

Drainage of Temporary site compounds

The compound will be set back a minimum of 50m from streams. Drains around the hard-standing areas of the site compounds will be in the form of shallow grassed swales to minimise the disturbance to sub-soils.

Concrete washout will be carried out in a dedicated area of the temporary compounds or at a designated washout pit on site. Only the washing of chutes will be permitted. Chutes will be washed out at the designated area with a settlement lagoon provided to receive all run-off.

Any diesel or fuel oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity. Where there is more than one tank within the bund, the capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total maximum capacities of all tanks, whichever is the greater. Design and installation of fuel tanks will be in accordance with best practice guidelines BPGCS005 (Oil Storage Guidelines).

Portaloos and/ or containerised toilets and welfare units with storage tanks will be used to provide toilet facilities for site personnel during construction. The sanitary waste will be removed from site by a licensed waste disposal contractor. All portaloo units located on site during the construction phase will be operated and maintained in accordance with the manufacturer's instructions, and will be serviced under contract with the supplier. All such units will be removed off-site following completion of the construction phase. Potable water will be brought onsite in bottles.

Temporary petrol and oil interceptors will be installed at the site compounds and at all locations dedicated for plant repairs/storage of fuel/temporary generator installation. Surface water run-off from the compound will be directed through a Class 1 Full Retention Oil Interceptor before discharge to the surface water drainage system for the site. This surface water drain flows to a settlement pond before final discharge over land. A trained and dedicated environmental and fuel spill emergency response team will be set up on site before commencement of construction on-site. An example of Oil Interceptor Class 1 is provided in the Appendix 1.

Drainage of Substation

The permitted on-site substation will be drained using shallow swales, with a suitably designed settlement pond. The settlement pond will remain in place following the construction period. At the upslope side of the sub-station overland flows will be intercepted in channels and discharged diffusely over vegetated areas.

In operation stage, the substation drainage will consist of an underground surface water pipe system. This system will include a number of surface water manholes, rain water pipes for the compound building roof, Class 1 Full Retention Oil Separator, an oil sensitive bund dewatering system, attenuation tank, ACO drains and filter drains. The system will discharge overland limited to the greenfield runoff.

In accordance with SuDs best practice, it is proposed to include a rainwater harvesting tanks with within the surface water system which will comprise of a filter, an underground tank and a pump. The system allows rainwater to run down the roof and into the guttering and downpipes in the normal way before passing through the filter, which removes any leaves and debris. Rainwater is then stored in the underground tank for reuse. Potable water will be brought onsite in bottles.

A foul system is proposed within the station to cater for the wastewater generated in the welfare facilities of the control building. The foul system will consist of an underground pipe network, foul manholes and an 18m3 full retention foul effluent storage tank. The tank will have an associated high level alarm which will be connected to the control building.

A foul holding tank to be maintained and emptied bi-annually is the most preferable means of treating and disposing of foul waste from the site. The licensed contractor charged to empty and dispose of the waste will be the holder of a valid waste collection permit. It is not proposed to treat wastewater onsite.

Drainage of Cable Trenches

Cables running throughout the wind farm site will be installed in trenches adjacent to site access tracks, where possible. Cable trenches will be excavated using a mechanical excavator and the excavated materials placed in small bunds adjacent to the trenches for back filling, as shown in Figure 3-8.

The seed bank is to be retained for placing back as the top layer of backfill to the trench, to aid successful restoration of vegetation in disturbed areas.

Cable trenches will be excavated during dry periods where possible, in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows.

Figure 3-8: Backfill over cable trench

Procedure for Dewatering of Excavations

Standing water, which could arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. Water in the excavations for turbines will be pumped into the site drainage system which will be constructed at site clearance stage, in advance of excavations for the turbine bases. Pumped water will be treated via settlement ponds. There will be no direct discharge to the existing drainage network.

Drainage of Stockpiled Material

During the construction period, the excavated material will be used to reinstate the turbine bases. All excavations shall be constructed and backfilled as quickly as possible. Excavation will stop during or immediately after heavy rainfall.

Excavation will precede the turbine base construction, cable trench and access track construction. Soil will be excavated and replaced with granular fill where required. Excavation will be carried out from access tracks where possible in order to reduce the compaction of topsoil.

During the construction period, spoil heaps from the excavations for the turbine bases will be stored temporarily. These temporary spoil heaps will be covered if required and surrounded by silt fences to filter sediment from the surface water run-off from excavated material. The silt fences will be inspected weekly and after rainfall events by Environmental Clerk of Works (ECOW).

It shall be noted that any stockpiling will be short-term and temporary and will occur only within the site boundary as the construction proceeds. The site drainage system will be put in place prior to excavation, therefore the discharge routes from any temporary stockpiling will be via the site drainage system. A minimum buffer of 50m will be provided between temporary stockpiles and the nearest watercourse.

Wash Down from Concrete Trucks and Cement Mixers

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. The use of ready-mixed concrete will eliminate any potential environmental risks of onsite batching.

Concrete washout will be carried out in a dedicated area of the temporary compounds. The small volume of water that will be generated from washing of the concrete trucks chute will be directed into a temporary lined impermeable containment area as shown in Figure 3-9, or a concrete wash unit.

Regular inspections of the wash down areas and associated settlement lagoons shall be carried out and adequate records kept.

The settlement lagoon shall be lined using a 1mm LLDPE impermeable liner. A sump will be provided at this location which will collect the wash water from the concrete trucks. The excavated material will be kept on site for reinstatement following the construction period.

Figure 3-9: Lined Settlement Lagoon for Concrete Washout Facility

During construction, wash water and any solids in the sump will be removed periodically to an appropriate licensed facility. The sump can be emptied daily if required. Following construction, any solids, the liner, and any remaining wash water in the sump will all be removed to an appropriate licensed facility for disposal. The sump will then be reinstated.

Watercourse Crossings

There are four stream crossings required for the proposed new internal access road network. This crossing locations are shown on Figure 10-5 of the EIAR. It is proposed to install one single-span bridge and three box culverts. The crossing structures will be installed with a minimum 300mm freeboard elevation for 1% AEP MRFS flows (annual exceedance probability, medium range future scenario).

Existing stream crossings will be protected using silt fencing. Minor drains such as manmade agricultural and field drains will be crossed using suitably designed pipe culverts.

Turbine delivery will not take place during extreme weather conditions.

The proposed mitigation measures are provided in Section 10.7 of the EIAR.

4. MITIGATION MEASURES

4.1 Mitigation Measures for Pollution Control to Protect Water Quality in Downstream Receptors

All personnel working on site will be trained in pollution incident control response. An emergency response procedure is prepared herein which will ensure that appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt.

Silt Protection Controls (SPCs) are proposed at the location of watercourse crossings and where haul roads pass close to watercourses, silt fencing will be used to protect the streams.

Silt traps will also be provided at outfalls from roadside swales. Silt traps will be kept upstream of outfalls to allow a buffer zone to the outfall. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off.

Settlement ponds will be put in place in advance as construction progresses across the site. The settlement ponds with a diffuse outflow detail will mitigate any increase in runoff and treat suspended solids in the surface water runoff. Erosion control and retention facilities, including settlement ponds will be regularly maintained during the construction phase.

All stockpile material will be bunded adequately and protected from heavy rainfall to reduce silt runoff, where necessary. Adequate security will be provided to prevent spillage as a result of vandalism.

Drains around hardstanding areas will be shallow to minimize the disturbance to sub-soils.

Suitably sized cross-drains will be provided for drainage crossings to convey flows from agricultural drains and forestry drains across the access tracks, to prevent a risk of clogging.

Tracks will be capped as soon as practicably possible to cover exposed subsoils and as such reduce the concentration of suspended solids in the run-off.

All open water bodies adjacent to proposed construction areas will be protected by fencing, including the proposed settlement ponds.

Additional protection will be provided in the form of silt fencing downslope where required and at existing stream crossings during construction, to further ensure that there is no impact from the development to streams and rivers crossing the site.

Where haul roads pass close to watercourses, silt fencing will be used to protect the streams. Silt traps will also be provided at outfalls from roadside swales. Silt traps will be kept upstream of outfalls to allow a buffer zone to the outfall.

Refuelling of plant during construction will be carried out at the temporary compounds, which will be located a minimum of 50m from any watercourse. The station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. In addition to the above, onsite re-fuelling of machinery will be carried out 50m from watercourses using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site or at the designated refuelling area and will be towed by a 4x4 jeep to designated re-fuelling areas near to where machinery is located but at distances of greater than 50m from watercourses.

Drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site.
Concrete washout will be carried out in a dedicated area of the temporary compounds. Only the washing of chutes will be permitted. Chutes will be washed out at the designated area with a settlement lagoon provided to receive all run-off. During construction concrete will be kept out of all watercourses and drains.

Any diesel, fuel or hydraulic oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity.

Vehicles entering the site shall be in good working order, free from leakage of fuel or hydraulic fluid.

A wheel wash will be provided at the site entrance draining to a silt trap to avoid any silt laden run-off flowing on to the public road and entering roadside drains.

Portaloos and/or containerised toilets and welfare units will be used to provide toilet facilities for site personnel during construction. Sanitary waste will be removed from site via a licenced waste disposal contractor.

Silt fencing will be erected at the location of stream crossings along the cable route.

4.2 Construction Stage Mitigation Measures

Long range weather forecasts shall be examined, and the construction phases planned taking cognisance of expected weather conditions. Regular meetings shall be held to re-assess construction phases with weather conditions as the project progresses.

Regular meetings shall be held between the Drainage Engineer appointed by the contractor and the contractor's Project Manager. The planning of traffic routes through the site shall be agreed in advance, in order to plan appropriate construction drainage management.

The proposed mitigation measures are listed in Chapter 10 of EIAR.

A detailed water quality monitoring programme will be undertaken during the construction phase of the proposed development, in addition to the visual inspections outlined above, so as to ensure the effective implementation of the proposed mitigation measures. A water quality monitoring plan is detailed below.

4.3 Operational Phase Mitigation Measures

It is not envisaged that the operation of the wind farm will result in significant impacts on the hydrological regime or water quality of the area, as there will be no further disturbance of soils post-construction, and only a minimum of traffic movement.

Oil used in transformers (at the substation and within each turbine) and storage of oils in tanks at the substation could leak during the operational phase and impact on groundwater quality. The substation transformer and oil storage tanks will be in a concrete bunded capable of holding 110% of the oil in the transformer and storage tanks. Turbine transformers are located within the turbines, so any leaks would be contained.

Visual inspections will be continued during the operational period until satisfactory vegetation is established on site at intervals to be agreed with Local Authority/IFI.

It is not envisaged that the maintenance period will involve any significant impacts on the hydrological regime of the area. The maintenance of the development will incorporate effective maintenance of the drainage system. Visual inspections will be undertaken during the maintenance period in accordance with maintenance schedule in CIRIA C753. The maintenance regime will include inspecting the following:

- Drains, cross-drains and culverts for any blockages,
- Outfalls to existing field drains and watercourses,
- Existing roadside swales for any obstructions,
- Swales,
- Progress of the re-establishment of vegetation.

The maintenance regime will also include implementing appropriate remedial measures as required after the above inspections and testing the water quality at the outfalls at appropriate intervals.

4.4 Decommissioning Stage and Mitigation Measures

As in the construction phase silt protection controls would again be put in place. The drainage system will remain operational during the decommissioning phase and will serve to treat any sediment laden surface water runoff due to a renewed disturbance of soils. Revegetation following the backfilling of hardstanding areas will be monitored. If it is deemed necessary, erosion control matting will be used to assist in the re-establishment of vegetation.

4.5 Mitigation Measure for Flooding

Settlement ponds are to be provided as part of the drainage system for the development. The settlement ponds, together with the swales, will serve to reduce velocities in the surface water runoff draining from the access tracks and hardstanding areas and will provide retention of the flows. This will also mitigate any increase in the risk of flooding.

No construction personnel, operation or maintenance personnel will be permitted on site during extreme flood events. Landowners will carry on their normal activities in the vicinity of the development and will take the usual precautionary measures as far as practicable during flood events.

4.6 Water Quality Monitoring Plan

A monitoring programme will be established to ensure that the water quality is maintained. This programme will ensure that designed measures are working to ensure water quality is not affected. The details of this programme are outlined below.

Daily visual inspections of drains and outfalls will be performed during the construction period to ensure suspended solids are not entering the streams and rivers of the site, to identify any obstructions to channels, and to allow for appropriate maintenance of the drainage regime. If excessive suspended solids are noted, construction work will be stopped, and remediation measures will be put in place immediately.

Visual inspections will be continued during the operational period until vegetation is established on site at intervals to be agreed with Local Authority/IFI.

A detailed water quality monitoring programme will be undertaken during the construction phase of the proposed development, in addition to the visual inspections outlined above, so as to ensure the effective implementation of the proposed mitigation measures. Field measurements and grab samples will be taken at suitable locations, which will be decided prior to the construction phase commencing. The field measurements will be recorded at the site and will include measurement of the following parameters, electrical conductivity (µs/cm), pH, temperature (ºC), suspended solids (mg/l) and dissolved oxygen (mg/l). The field measurements will be taken on a weekly basis during the site clearance and earthworks stage of the construction period. An ECOW will compare the results with the pre work levels and ensure that designed mitigation measures are working. An ECOW will propose new mitigation measures if results exceed pre work levels.

4.7 Emergency Silt Control and Spillage Response Procedures

All personnel working on site will be trained in pollution incident control response. An emergency response plan will be updated by the Contractor ensure that appropriate information will be available on site outlining the spillage response procedures and a contingency plan to contain silt. An emergency response plan can be found in the CEMP in Appendix 3.1 of this EIAR which details measures to be included in any final plan for the construction of the project. A regular review of forecasts of heavy rainfall is required and a contingency plan will be prepared for before and after such events. A record will be kept of daily visual examinations of watercourses which receive flows from the permitted development, during and for an agreed period after the construction phase. Procedures for particular accidental spillages, from leaking or damaged fuel lines or a break-out of silt are outlined below.

Oils, Fuels and Site Vehicles

Construction vehicles will be refuelled off-site, wherever possible. This will primarily be the case for road vehicles such as vans and trucks. Refuelling of mobile plant during construction will be carried out at the temporary compound. Any additional fuel containers, other than the fuel bowser, used for smaller equipment (such as generators, lights etc.) will be stored within additional secondary containment e.g. bund for static tanks or drip trays for smaller mobile containers. Taps/nozzles for fuels and storage containers for oils will be fitted with locks to ensure their use is controlled. Only designated trained and competent operatives will be authorised to refuel plant on site.

All tank and drum storage areas shall, as a minimum, be bunded, either locally or remotely, to a volume not less than the greater of the following:

a. 110% of the capacity of the largest tank or drum within the bunded area; or

b. 25% of the total volume of substance which could be stored within the bunded area.

On-site refuelling of non-mobile machinery (such as cranes, excavators, dozers, dumpers etc.) will be carried out using a mobile double skinned fuel bowser typical of that shown in Figure 4-1. Refuelling will be carried out at least 50m from any watercourse. The fuel bowser, typically a double-axle custom-built refuelling trailer, will be re-filled off-site, where possible, or at either of the two construction compounds and will be towed as required within the site by a 4x4 vehicle to where machinery is located.

It is not practical or preferable for most heavy construction vehicles to travel back to the refuelling point in the construction compound given the size of the proposed wind farm site. The 4x4 vehicle will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level impermeable area in either of the construction compounds when not in use.

The station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site.

Figure 4-1: Typical Mobile Fuel Boswer

Accidental spillage from leaking or damaged fuel lines

Emergency spill kits with oil boom and absorbent materials will be kept on-site in the event of an accidental spill. Spill kits will be kept in construction compound, the 4x4 vehicle transporting the fuel bowser and smaller spill control kits will be kept in all construction machinery. All construction personnel will be notified of where the spill kits are located as part of the site induction and will be trained on the site procedures for dealing with spills.

In the event of a leak or a spill in the field, the spill kits will be used to contain and absorb the pollutant and prevent any further potential contamination. The absorbed pollutants and contaminated materials will be placed into leak proof containers and transferred to a suitable waste container for hazardous materials in the construction compound. Where a leak has occurred from machinery, the equipment will not be permitted to be used further until the issue has been resolved.

The SHEQ Officer (or equivalent appointed person) will be notified of any spills on-site and will determine the requirement to notify the authorities.

Typically, the following procedures will be followed in the event of an incident:

- Works will stop immediately where safe to do so,
- The SHEQ Officer (or equivalent appointed person) will be contacted,

- The size of the incident will be assessed and determined if it can be controlled by site staff or if emergency services are required to attend,
- The appropriate enforcing authority will be contacted,
- The SHEQ Officer (or equivalent appointed person) will investigate after the incident,
- The findings will be sent to the appropriate authority; and
- An action plan will be prepared to set out any modifications to working practices required to prevent a recurrence.

Accidental break out of silt from settlement ponds

Following an accidental break out of silt, emergency measures will be put in place. During the construction period an emergency facility will be provided with sand bags to block off the outlet in the sedimentation ponds to prevent discharge from the sedimentation ponds in the event of a break out of the silt.

Additional silt fencing will be available on site for use in emergencies.

The drainage engineer shall be contacted if there is an accidental spillage or break out of silt on the site.

4.8 Maintenance of Site Drainage Systems

The drainage system for the development shall be maintained regularly to keep it operating effectively. The maintenance shall include the following:

- inspection and maintenance of swales,
- inspecting cross-drains for any blockages,
- inspecting settlement ponds and outfalls,
- inspecting the stream crossings and piped crossings for obstructions,
- inspecting the progress of the re-establishment of vegetation,
- implementing appropriate remedial measures as required after the above inspections.

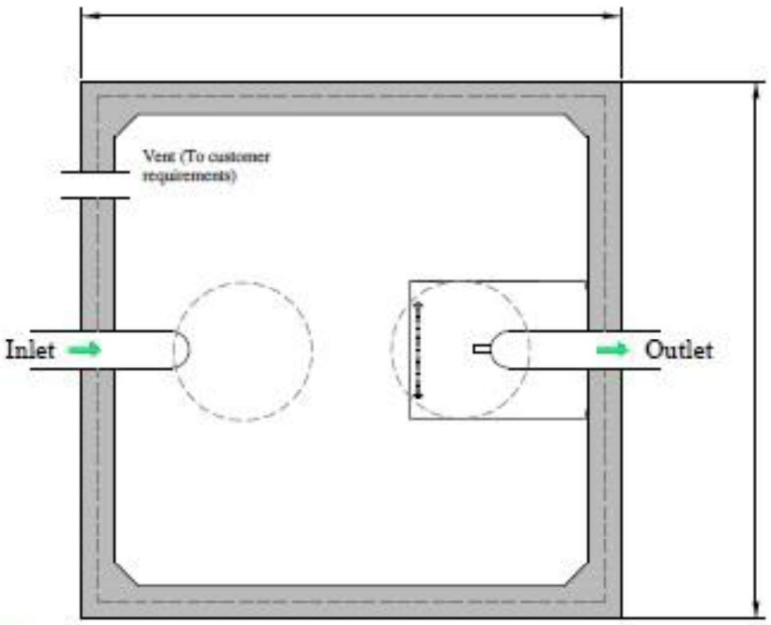
FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 1

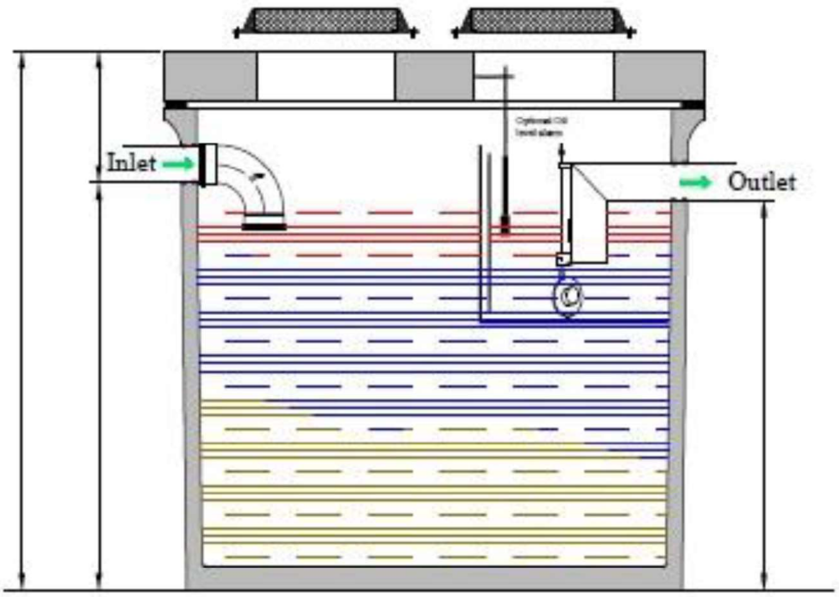
Class 1 Oil Interceptor – example

Full Retention Interceptor Class 1



All the tanks must be placed on a perfectly level and firm suitable base.
Typical layout, variations as required per customer.

An anti-syphon vent is required for long run outflows



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Note: Observe all safety regulations in regard to excavation and lifting requirements. Never leave opening uncovered or unattended at any time.
Note: Specify any specific requirements prior to ordering. All civil works by customer.
Note: Do not scale from this drawing. Only for illustration purposes.

Tank Type: C Full Retention Interceptor	**Title:** Full Retention Interceptors
Tank Size:	**Date:**
Height:	**Drg. No.:**
Volume:	**Drawn By:**
Weight:	