311800 311900 312000 312100 312200 312300 312400

420200 420100 420000 419900 419800 419700

Basin ID	Outfall	Drained Area sqm	Discharge Rate lps	Volume cu.m	Dimensions (LxWxD) m
6	DISCHARGE TO DRAIN / WATERCOURSE	5697	5.7	168	26 x 8 x 0.8
8	DISCHARGE TO DRAIN / WATERCOURSE	2535	2.5	75	25 x 5 x 0.6
10	DISCHARGE OVERLAND OVER HEATH	4300	4.3	127	26 x 8 x 0.6

NOTES

GENERAL

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2. ALL LOCATIONS OF SUDS FEATURES IDENTIFIED ARE APPROXIMATE AND ARE LIMITED BY THE LEVEL OF INFORMATION AVAILABLE. DETAILED SITING OF SUDS FEATURES SHALL BE UNDERTAKEN ON AN OBSERVATIONAL BASIS DEPENDANT ON LOCAL TOPOGRAPHY AND CHANGES IN ROAD ALIGNMENT DESIGN.
3. ADDITIONAL TEMPORARY DRAINAGE / MITIGATION WILL BE PROVIDED DURING THE CONSTRUCTION PHASE ON AN OBSERVATIONAL BASIS.
4. BACKGROUND MAPPING REPRODUCED © OPENSTREETMAP CONTRIBUTORS
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POLLUTION PREVENTION

6. ALL SETTLEMENT FEATURES SUBJECT TO DETAILED DESIGN.
7. DRAINAGE / SILT MANAGEMENT FEATURES INCLUDING SETTLEMENT FEATURES AND DRAINAGE CROSSINGS TO BE INSTALLED PRIOR TO OR IN PARALLEL WITH ROAD CONSTRUCTION.
8. INTERIM MEASURES TO BE EMPLOYED IN ALL INSTANCES WHERE WORK CARRIED OUT TO CONSTRUCT THE ACCESS ROAD IS LIKELY TO CAUSE ADVERSE ENVIRONMENTAL IMPACTS THROUGH INCREASED SILT LOADINGS BEING GENERATED DURING THE CONSTRUCTION PHASE.
9. SUITABLE PREVENTION MEASURES SHOULD BE IN PLACE AT ALL TIMES TO PREVENT THE CONVEYANCE OF SILTS TO RECEIVING WATERCOURSES.
10. OIL FUEL SHOULD BE STORED WITHIN CONTAINMENT AND CEMENT SHOULD BE MIXED WITHIN COMPOUND / CONTAINMENT, TOOLS WASHED IN THE SAME AREA AND WATER RECYCLED (IN THE CEMENT MIX).

TRACK / INFRASTRUCTURE DRAINAGE

11. TEMPORARY UPSLOPE CUTOFF / DIVERSION DRAINAGE TO BE INSTALLED IN ADVANCE OF MAIN EARTHWORKS IN AREAS INDICATED IN ORDER TO MINIMISE SURFACE WATER INGRESS TO EXCAVATIONS
12. SETTLEMENT/ATTENUATION PONDS ARE RETAINED FOLLOWING COMPLETION OF CONSTRUCTION ACTIVITIES.
13. BATTERS OF SWALES TO HAVE DIMENSIONS AS PER SEPARATELY ISSUED TYPICAL DETAIL DRAWING. SWALE TO BE RE-VEGETATED WITH LOCAL SPECIES.
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16. SPACING AND FREQUENCY OF CHECK DAMS WILL BE DEPENDANT UPON LONGITUDINAL GRADIENT OF SWALE, TO BE DETERMINED AT DETAILED DESIGN.

WATERCOURSE & TRACK DRAINAGE CROSSINGS

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18. ALL HDPE PIPES SHALL BE TWINWALL TYPE, BBA HAPAS APPROVED.
19. ALL CROSSINGS TO BE INSTALLED MIN. 0.15M BELOW EXISTING BED LEVEL AND TO SUIT EXISTING STREAM CHANNEL GRADIENTS.

MAINTENANCE

20. THE LEVEL OF SILT IN RUNOFF DURING CONSTRUCTION IS TO BE MONITORED VISUALLY AND EXCESSIVE SILT LEVELS IN ANY AREA TO BE TEMPORARILY MANAGED THROUGH USE OF SILT FENCES / ALUM FLOCCULANT / CONSTRUCTED SETTLEMENT FEATURES.
21. BUILD UP OF SILT LEVELS AT CHECK DAMS TO BE REMOVED AND DISPOSED OF APPROPRIATELY. SILT LEVELS AT CHECK DAMS TO BE VISUALLY INSPECTED AS PART OF AN ONGOING MAINTENANCE PROGRAMME DURING THE CONSTRUCTION PHASE. WHERE CHECK DAMS BECOME CLOGGED WITH SILT OR VEGETATION, STONE CHECK DAM TO BE REMOVED AND REPLACED SUBSEQUENT TO THE REMOVAL OF SILT

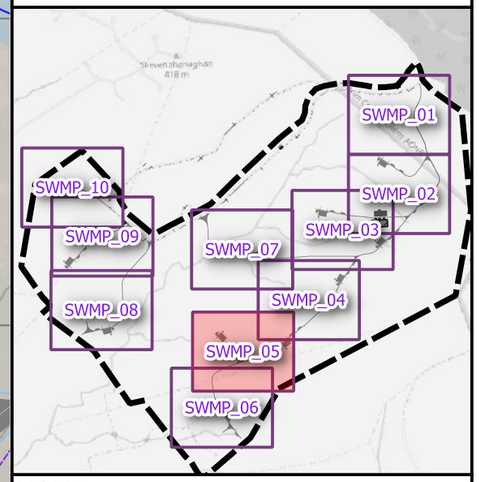
N

T4
Basin 10
T6
Basin 6
WX07
Basin 8
WX08
285 290 295 300 305 310 315 320 325 330

0 50 100 150 200 m

REF	DESCRIPTION
WX07	NEW MIN. 0.75 M DIA CIRCULAR (CLASS 120 CONCRETE OR EQUIVALENT) SUBJECT TO DESIGN POST PLANNING APPROVAL.
WX08	NEW MIN. 0.75 M DIA CIRCULAR (CLASS 120 CONCRETE OR EQUIVALENT) SUBJECT TO DESIGN POST PLANNING APPROVAL.

KEY PLAN



LEGEND

The Development
- Preliminary Site Boundary

Wind Farm Infrastructure
- COMPOUND, SUBSTATION
- TRACKS, CRANEPADS
- EXISTING GRUIG WIND FARM
- INDICATIVE AREAS FOR FLOATED TRACK - SUBJECT TO DESIGN
- SPOIL STORAGE AREAS

Existing Hydrology

Water Features
- Significant Watercourse
- Minor Watercourse
- Other Ephemeral / Minor drainage
- Hydrological buffers (10m/50m)

Track Drainage Features
- Trackside Drain & Checkdam
- Clean Cutoff Drain
- Clean Drainage Pipe
- Dirty Track Drainage Pipe
- Outfall, Flow Control
- Track Drainage Breakout
- Attenuation Basin
- Settlement Basin
- Indicative pumped dewatering
- Temporary Silt Fence
- Watercourse Crossings

PRELIMINARY

POLLUTION PREVENTION GUIDANCE NOTES:

1. Suitable SUDS prevention measures should be in place at all times to prevent the conveyance of silts to receiving watercourses.

2. Temporary or permanent SuDS features should be installed BEFORE or adjacent to construction of new access road and hardstanding.

3. Clean water cutoff ditch and crossing should be planned and installed BEFORE construction. Clean water management must consider spoil deposition on the site.

4. Direct discharge of road drainage to watercourses shall not be permitted.

5. Buffer zones are to be maintained around all relevant watercourses as indicated on this drawing. No excavated material is to be stored within the buffer zone.

6. DO NOT pump water direct to watercourses.

7. DO NOT strip vegetation from existing ditches unless absolutely necessary.

8. If water pollution is identified the following steps should be adhered to:

STOP - Work in the immediate area should be stopped and the source of the pollution identified

CONTAIN - The source of the pollution should be bunded using a suitable method. Natural watercourses should be temporarily diverted around the source of pollution.

NOTIFY - The relevant authorities (Site Manager / NIEA) and Client/Developer should be notified immediately to ensure that measures can be implemented downstream to protect fisheries and other sensitive areas.

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DESCRIPTION
CARNBUCK WIND FARM - DRAINAGE LAYOUT SHEET 5

PROJECT / FIGURE NO.
M01616-08_SWMP_05

DRAWN BY	SCALE	REVISION	DATE
DKS	1:2000	1	08/07/2022

res

311700 311800 311900 312000 312100 312200

419800 419700 419600 419500 419400

Basin ID	Outfall	Drained Area sqm	Discharge Rate lps	Volume cu.m	Dimensions (LxWxD) m
8	DISCHARGE TO DRAIN / WATERCOURSE	2535	2.5	75	25 x 5 x 0.6
9	DISCHARGE TO DRAIN / WATERCOURSE	5824	5.8	172	27 x 8 x 0.8

NOTES

GENERAL

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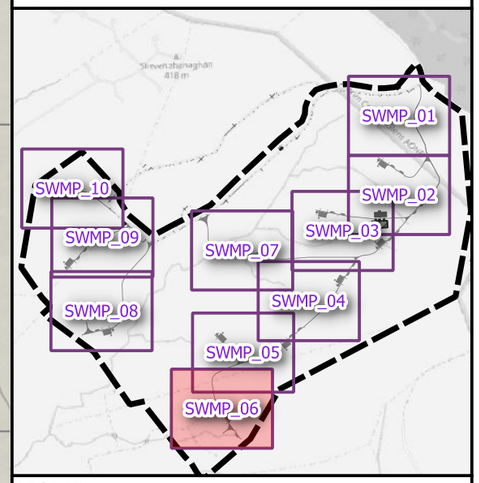
Basin 8
WX08
Basin 9
WX09
T5

REF	DESCRIPTION
WX08	NEW MIN. 0.75 M DIA CIRCULAR (CLASS 120 CONCRETE OR EQUIVALENT) SUBJECT TO DESIGN POST PLANNING APPROVAL.
WX09	NEW MIN. 0.75 M DIA CIRCULAR (CLASS 120 CONCRETE OR EQUIVALENT) SUBJECT TO DESIGN POST PLANNING APPROVAL.

0 50 100 150 200 m

KEY PLAN



LEGEND

The Development
- Preliminary Site Boundary

Wind Farm Infrastructure
- COMPOUND, SUBSTATION
- TRACKS, CRANEPADS
- EXISTING GRUIG WIND FARM
- INDICATIVE AREAS FOR FLOATED TRACK - SUBJECT TO DESIGN
- SPOIL STORAGE AREAS

Existing Hydrology

Water Features
- Significant Watercourse
- Minor Watercourse
- Other Ephemeral / Minor drainage
- Hydrological buffers (10m/50m)

Track Drainage Features
- Trackside Drain & Checkdam
- Clean Cutoff Drain
- Clean Drainage Pipe
- Dirty Track Drainage Pipe
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- Track Drainage Breakout
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- Watercourse Crossings

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Lower Ground (West),
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DESCRIPTION
CARNBUCK WIND FARM - DRAINAGE LAYOUT SHEET 6

PROJECT / FIGURE NO.
M01616-08_SWMP_06

DRAWN BY	SCALE	REVISION	DATE
DKS	1:2000	1	08/07/2022

res

311800 311900 312000 312100 312200 312300 312400

420800 420700 420600 420500 420400

Basin ID	Outfall	Drained Area sqm	Discharge Rate lps	Volume cu.m	Dimensions (LxWxD) m
7	DISCHARGE TO DRAIN / WATERCOURSE	9518	9.5	281	35 x 10 x 0.8
11	DISCHARGE TO DRAIN / WATERCOURSE	2620	2.6	77	26 x 5 x 0.6

NOTES

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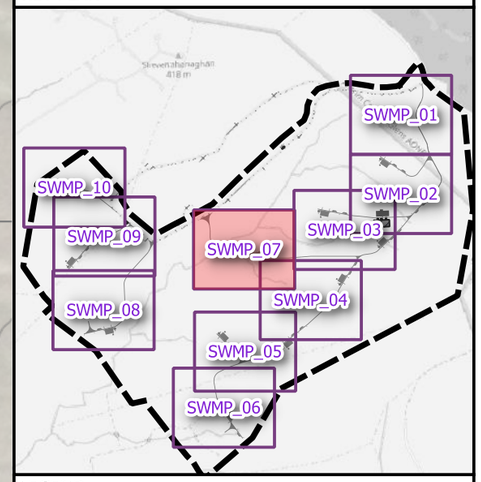
Basin 11
Basin 7
WX01
T7
275
280
285
290
295
300
305
310

REF	DESCRIPTION
WX01	NEW 1.2M (H) X 3M (SPAN) CLEAR SPAN BOTTOMLESS CULVERT OR SPRUNG ARCH EQUIVALENT - INLET SOFFIT ELEVATION MIN. 272.44 mOD

0 50 100 150 200 m

N

KEY PLAN



LEGEND

The Development
- Preliminary Site Boundary

Wind Farm Infrastructure
- COMPOUND, SUBSTATION
- TRACKS, CRANEPADS
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DESCRIPTION
CARNBUCK WIND FARM - DRAINAGE LAYOUT SHEET 7

PROJECT / FIGURE NO.
M01616-08_SWMP_07

DRAWN BY	SCALE	REVISION	DATE
DKS	1:2000	1	08/07/2022

res

Basin ID	Outfall	Drained Area sqm	Discharge Rate lps	Volume cu.m	Dimensions (LxWxD) m
12	DISCHARGE OVERLAND OVER HEATH	8541	8.5	252	31 x 10 x 0.8
13	DISCHARGE OVERLAND OVER HEATH	5631	5.6	166	26 x 8 x 0.8

NOTES
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14. SLOPES OF SWALES TO BE VEGETATED OR PROTECTED FROM EROSION UNTIL VEGETATION HAS BEEN ESTABLISHED. STRIPPED VEGETATIVE LAYER FROM EXCAVATIONS TO BE STORED LOCALLY AND USED TO LINE SLOPES AND BASE OF SWALE. VEGETATIVE LAYER TO BE PLACED INTO SWALE AFTER CONSTRUCTION OF THE SWALE.
15. CLEAN STONE CHECK DAMS TO BE INSTALLED IN ALL DRAINAGE CHANNELS IN ORDER TO PROMOTE SETTLEMENT OF SUSPENDED SOLIDS AND CONTROL FLOW RATES. CHECK DAMS GENERALLY TO BE LOCALLY WON WELL GRADED STONE. AGGREGATE SIZE FOR STONE CHECK DAMS TO BE TYPICALLY 5-40MM CLEAN STONE. ON STEEP SECTIONS SMALL STONE TO BE ANCHORED THROUGH THE PLACEMENT OF 100MM STONE ON THE DOWNHILL FACE OF THE CHECK DAM
16. SPACING AND FREQUENCY OF CHECK DAMS WILL BE DEPENDANT UPON LONGITUDINAL GRADIENT OF SWALE, TO BE DETERMINED AT DETAILED DESIGN.

WATERCOURSE & TRACK DRAINAGE CROSSINGS
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18. ALL HDPE PIPES SHALL BE TWINWALL TYPE, BBA HAPAS APPROVED.
19. ALL CROSSINGS TO BE INSTALLED MIN. 0.15M BELOW EXISTING BED LEVEL AND TO SUIT EXISTING STREAM CHANNEL GRADIENTS.

MAINTENANCE
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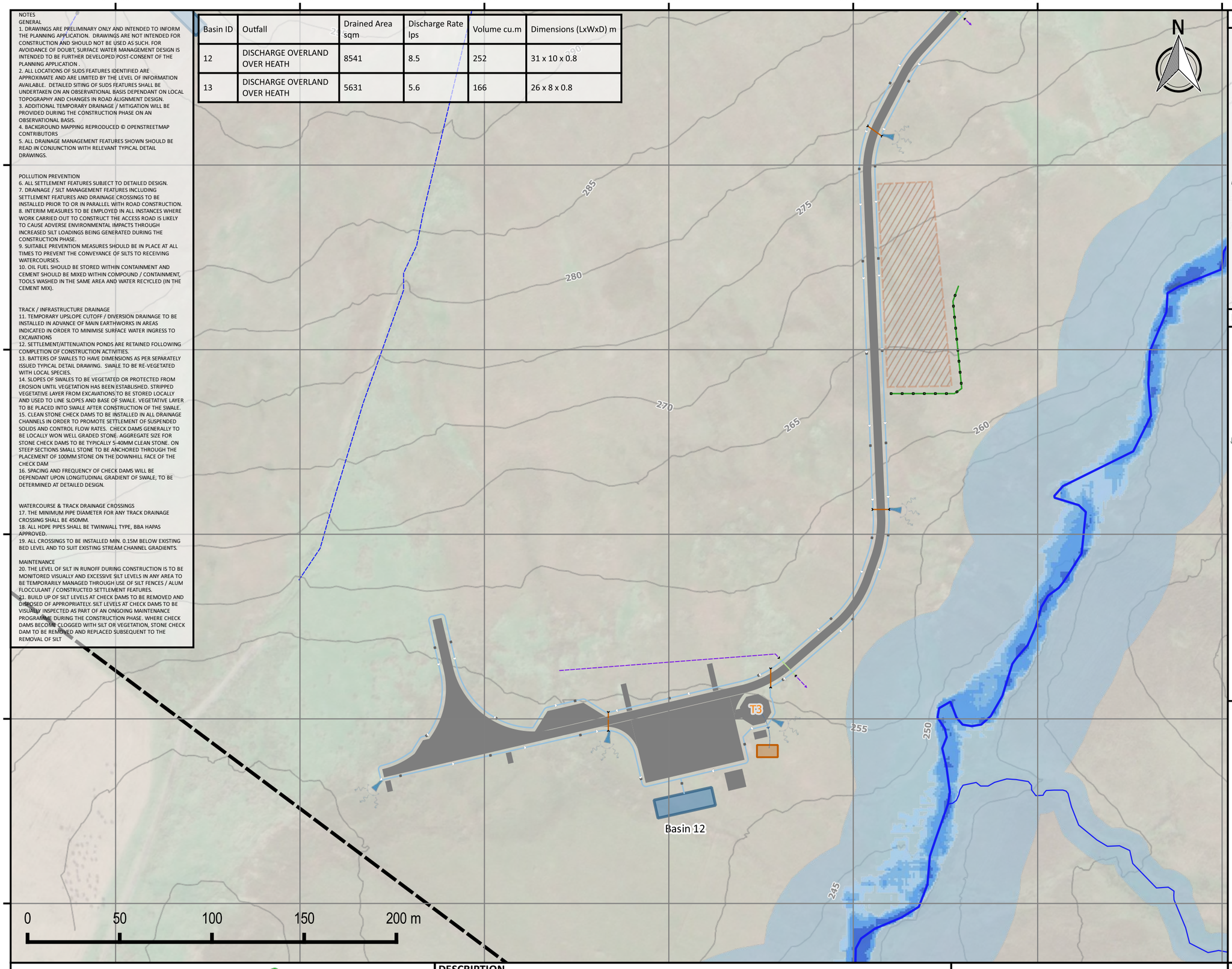
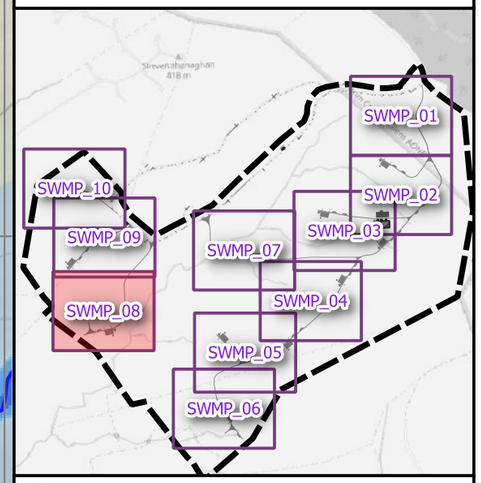
21. BUILD UP OF SILT LEVELS AT CHECK DAMS TO BE REMOVED AND DISPOSED OF APPROPRIATELY. SILT LEVELS AT CHECK DAMS TO BE VISUALLY INSPECTED AS PART OF AN ONGOING MAINTENANCE PROGRAMME DURING THE CONSTRUCTION PHASE. WHERE CHECK DAMS BECOME CLOGGED WITH SILT OR VEGETATION, STONE CHECK DAM TO BE REMOVED AND REPLACED SUBSEQUENT TO THE REMOVAL OF SILT



KEY PLAN



LEGEND

The Development
- Preliminary Site Boundary

Wind Farm Infrastructure
- COMPOUND, SUBSTATION
- TRACKS, CRANEPADS
- EXISTING GRUIG WIND FARM
- INDICATIVE AREAS FOR FLOATED TRACK - SUBJECT TO DESIGN
- SPOIL STORAGE AREAS

Existing Hydrology

Water Features
- Significant Watercourse
- Minor Watercourse
- Other Ephemeral / Minor drainage
- Hydrological buffers (10m/50m)

Track Drainage Features
- Trackside Drain & Checkdam
- Clean Cutoff Drain
- Clean Drainage Pipe
- Dirty Track Drainage Pipe
- Outfall, Flow Control
- Track Drainage Breakout
- Attenuation Basin
- Settlement Basin
- Indicative pumped dewatering
- Temporary Silt Fence
- Watercourse Crossings

PRELIMINARY

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1. Suitable SUDS prevention measures should be in place at all times to prevent the conveyance of silts to receiving watercourses.

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3. Clean water cutoff ditch and crossing should be planned and installed BEFORE construction. Clean water management must consider spoil deposition on the site.

4. Direct discharge of road drainage to watercourses shall not be permitted.

5. Buffer zones are to be maintained around all relevant watercourses as indicated on this drawing. No excavated material is to be stored within the buffer zone.

6. DO NOT pump water direct to watercourses.

7. DO NOT strip vegetation from existing ditches unless absolutely necessary.

8. If water pollution is identified the following steps should be adhered to:

STOP - Work in the immediate area should be stopped and the source of the pollution identified

CONTAIN - The source of the pollution should be bunded using a suitable method. Natural watercourses should be temporarily diverted around the source of pollution.

NOTIFY - The relevant authorities (Site Manager / NIEA) and Client/Developer should be notified immediately to ensure that measures can be implemented downstream to protect fisheries and other sensitive areas.

McCloy Consulting
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Lower Ground (West),
Carnmoney Road North,
Newtownabbey BT36 5QA
T: 028 9084 8694
E: info@mccloyconsulting.com
w: www.mccloyconsulting.com

DESCRIPTION
CARNBUCK WIND FARM - DRAINAGE LAYOUT SHEET 8

PROJECT / FIGURE NO.
M01616-08_SWMP_08

DRAWN BY	SCALE	REVISION	DATE
DKS	1:2000	1	08/07/2022

res

NOTES
GENERAL
1. DRAWINGS ARE PRELIMINARY ONLY AND INTENDED TO INFORM THE PLANNING APPLICATION. DRAWINGS ARE NOT INTENDED FOR CONSTRUCTION AND SHOULD NOT BE USED AS SUCH. FOR AVOIDANCE OF DOUBT, SURFACE WATER MANAGEMENT DESIGN IS INTENDED TO BE FURTHER DEVELOPED POST-CONSENT OF THE PLANNING APPLICATION.
2. ALL LOCATIONS OF SUDS FEATURES IDENTIFIED ARE APPROXIMATE AND ARE LIMITED BY THE LEVEL OF INFORMATION AVAILABLE. DETAILED SITING OF SUDS FEATURES SHALL BE UNDERTAKEN ON AN OBSERVATIONAL BASIS DEPENDANT ON LOCAL TOPOGRAPHY AND CHANGES IN ROAD ALIGNMENT DESIGN.
3. ADDITIONAL TEMPORARY DRAINAGE / MITIGATION WILL BE PROVIDED DURING THE CONSTRUCTION PHASE ON AN OBSERVATIONAL BASIS.
4. BACKGROUND MAPPING REPRODUCED © OPENSTREETMAP CONTRIBUTORS
5. ALL DRAINAGE MANAGEMENT FEATURES SHOWN SHOULD BE READ IN CONJUNCTION WITH RELEVANT TYPICAL DETAIL DRAWINGS.

POLLUTION PREVENTION
6. ALL SETTLEMENT FEATURES SUBJECT TO DETAILED DESIGN.
7. DRAINAGE / SILT MANAGEMENT FEATURES INCLUDING SETTLEMENT FEATURES AND DRAINAGE CROSSINGS TO BE INSTALLED PRIOR TO OR IN PARALLEL WITH ROAD CONSTRUCTION.
8. INTERIM MEASURES TO BE EMPLOYED IN ALL INSTANCES WHERE WORK CARRIED OUT TO CONSTRUCT THE ACCESS ROAD IS LIKELY TO CAUSE ADVERSE ENVIRONMENTAL IMPACTS THROUGH INCREASED SILT LOADINGS BEING GENERATED DURING THE CONSTRUCTION PHASE.
9. SUITABLE PREVENTION MEASURES SHOULD BE IN PLACE AT ALL TIMES TO PREVENT THE CONVEYANCE OF SILTS TO RECEIVING WATERCOURSES.
10. OIL FUEL SHOULD BE STORED WITHIN CONTAINMENT AND CEMENT SHOULD BE MIXED WITHIN COMPOUND / CONTAINMENT, TOOLS WASHED IN THE SAME AREA AND WATER RECYCLED (IN THE CEMENT MIX).

TRACK / INFRASTRUCTURE DRAINAGE
11. TEMPORARY UPSLOPE CUTOFF / DIVERSION DRAINAGE TO BE INSTALLED IN ADVANCE OF MAIN EARTHWORKS IN AREAS INDICATED IN ORDER TO MINIMISE SURFACE WATER INGRESS TO EXCAVATIONS
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13. BATTERS OF SWALES TO HAVE DIMENSIONS AS PER SEPARATELY ISSUED TYPICAL DETAIL DRAWING. SWALE TO BE RE-VEGETATED WITH LOCAL SPECIES.
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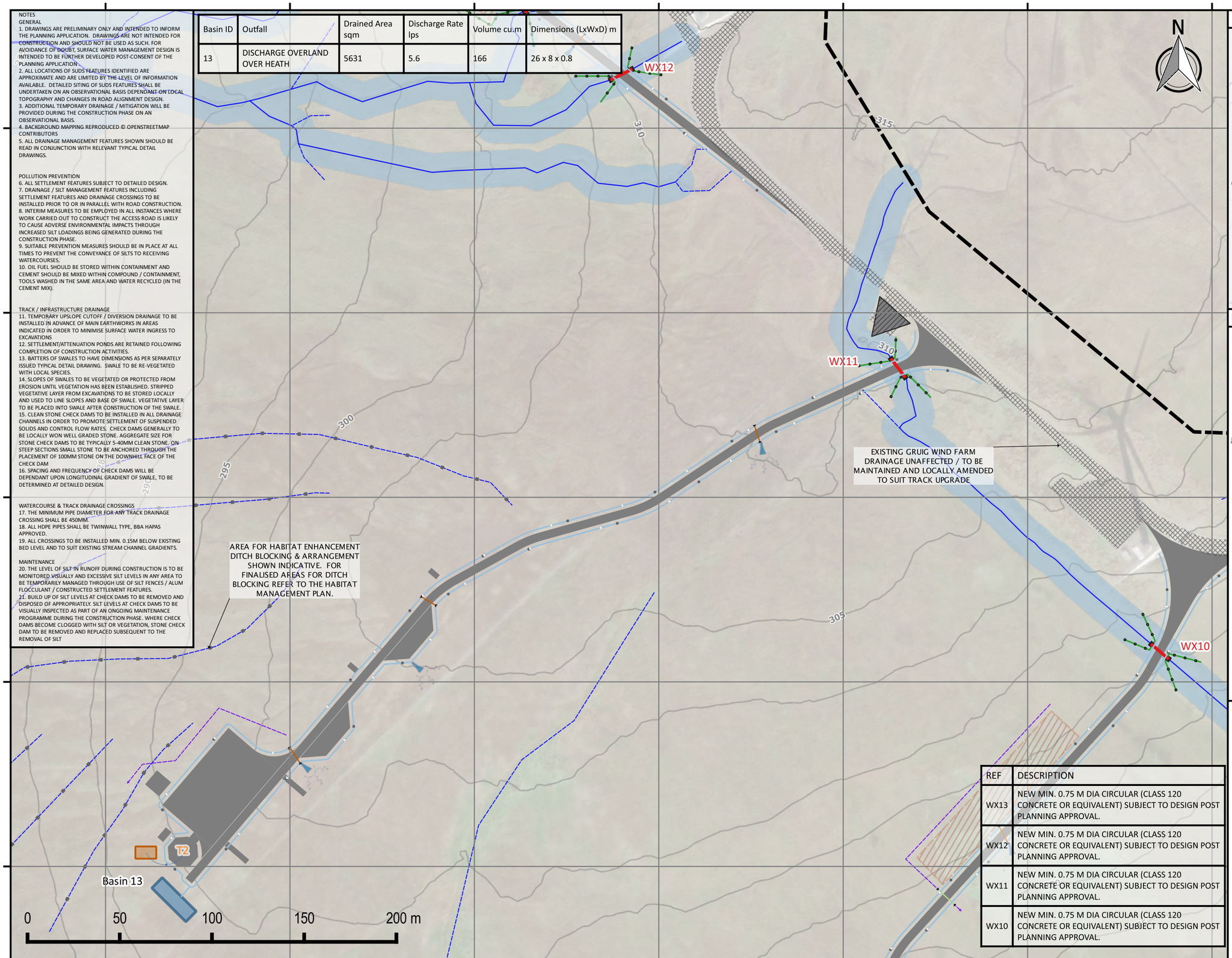
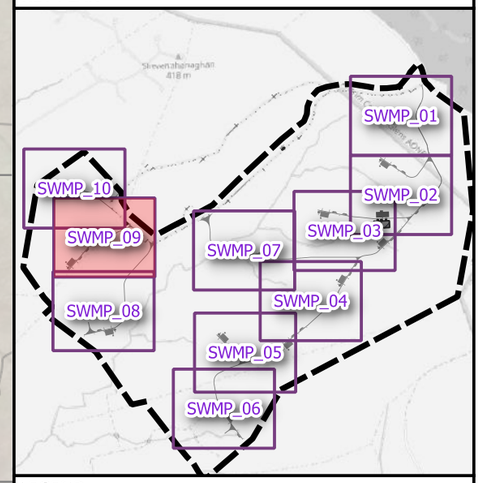
Basin ID	Outfall	Drained Area sqm	Discharge Rate lps	Volume cu.m	Dimensions (LxWxD) m
13	DISCHARGE OVERLAND OVER HEATH	5631	5.6	166	26 x 8 x 0.8



REF	DESCRIPTION
WX13	NEW MIN. 0.75 M DIA CIRCULAR (CLASS 120 CONCRETE OR EQUIVALENT) SUBJECT TO DESIGN POST PLANNING APPROVAL.
WX12	NEW MIN. 0.75 M DIA CIRCULAR (CLASS 120 CONCRETE OR EQUIVALENT) SUBJECT TO DESIGN POST PLANNING APPROVAL.
WX11	NEW MIN. 0.75 M DIA CIRCULAR (CLASS 120 CONCRETE OR EQUIVALENT) SUBJECT TO DESIGN POST PLANNING APPROVAL.
WX10	NEW MIN. 0.75 M DIA CIRCULAR (CLASS 120 CONCRETE OR EQUIVALENT) SUBJECT TO DESIGN POST PLANNING APPROVAL.

KEY PLAN



LEGEND

The Development
- Preliminary Site Boundary

Wind Farm Infrastructure
- COMPOUND, SUBSTATION
- TRACKS, CRANEPADS
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- Significant Watercourse
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- Hydrological buffers (10m/50m)

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- Trackside Drain & Checkdam
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Mossley Mill,
Lower Ground (West),
Carnmoney Road North,
Newtownabbey BT36 5QA
T: 028 9084 8694
E: info@mccloyconsulting.com
w: www.mccloyconsulting.com

DESCRIPTION
CARNBUCK WIND FARM - DRAINAGE LAYOUT SHEET 9

PROJECT / FIGURE NO.
M01616-08_SWMP_09

DRAWN BY	SCALE	REVISION	DATE
DKS	1:2000	1	08/07/2022

res

NOTES
GENERAL
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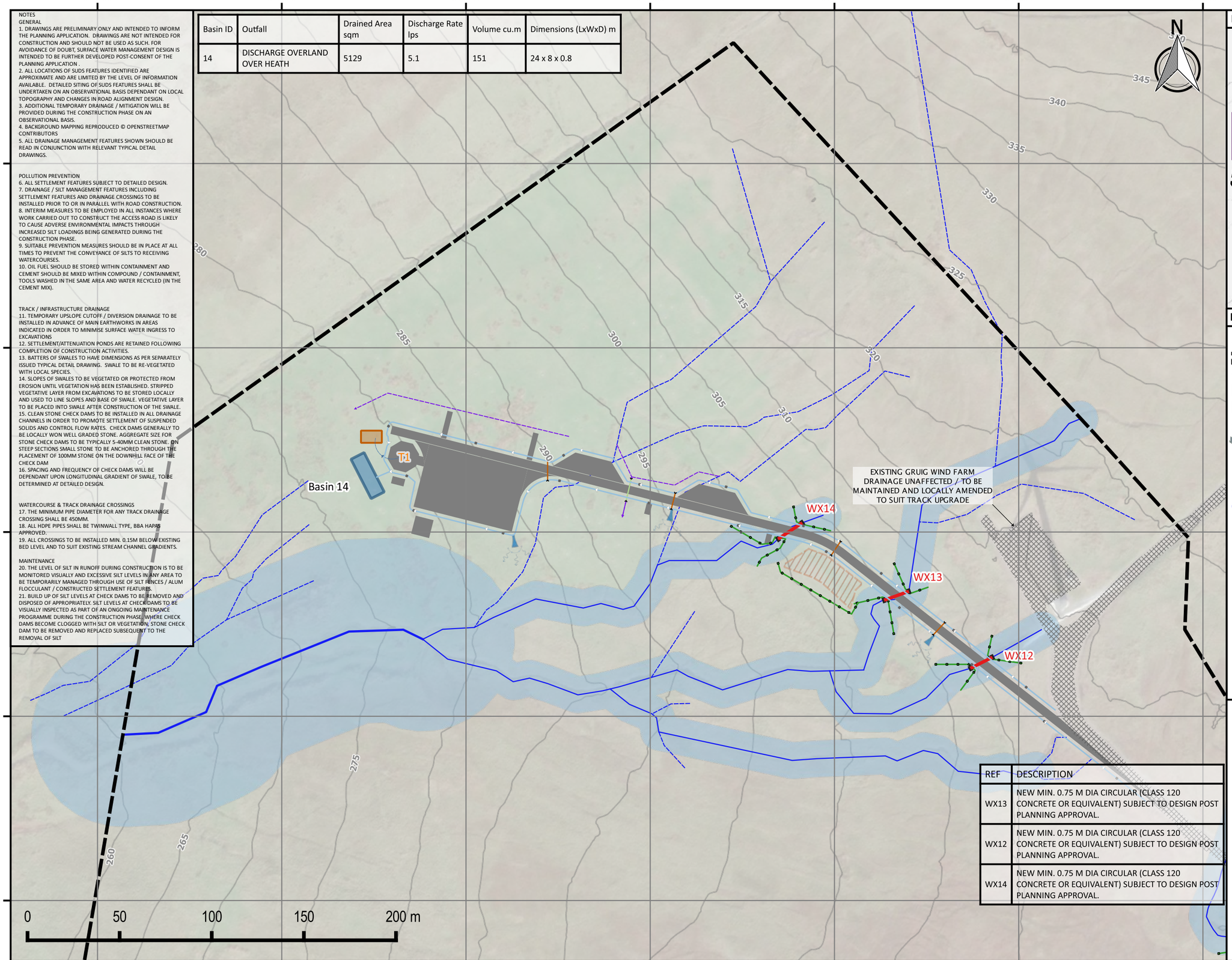

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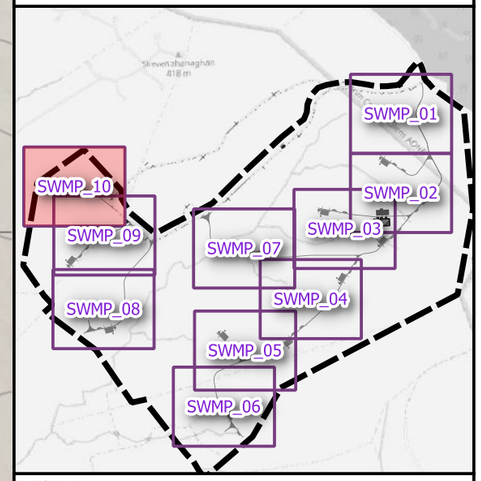
WX14	NEW MIN. 0.75 M DIA CIRCULAR (CLASS 120 CONCRETE OR EQUIVALENT) SUBJECT TO DESIGN POST PLANNING APPROVAL.

KEY PLAN



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Newtownabbey BT36 5QA
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E: info@mccloyconsulting.com
w: www.mccloyconsulting.com

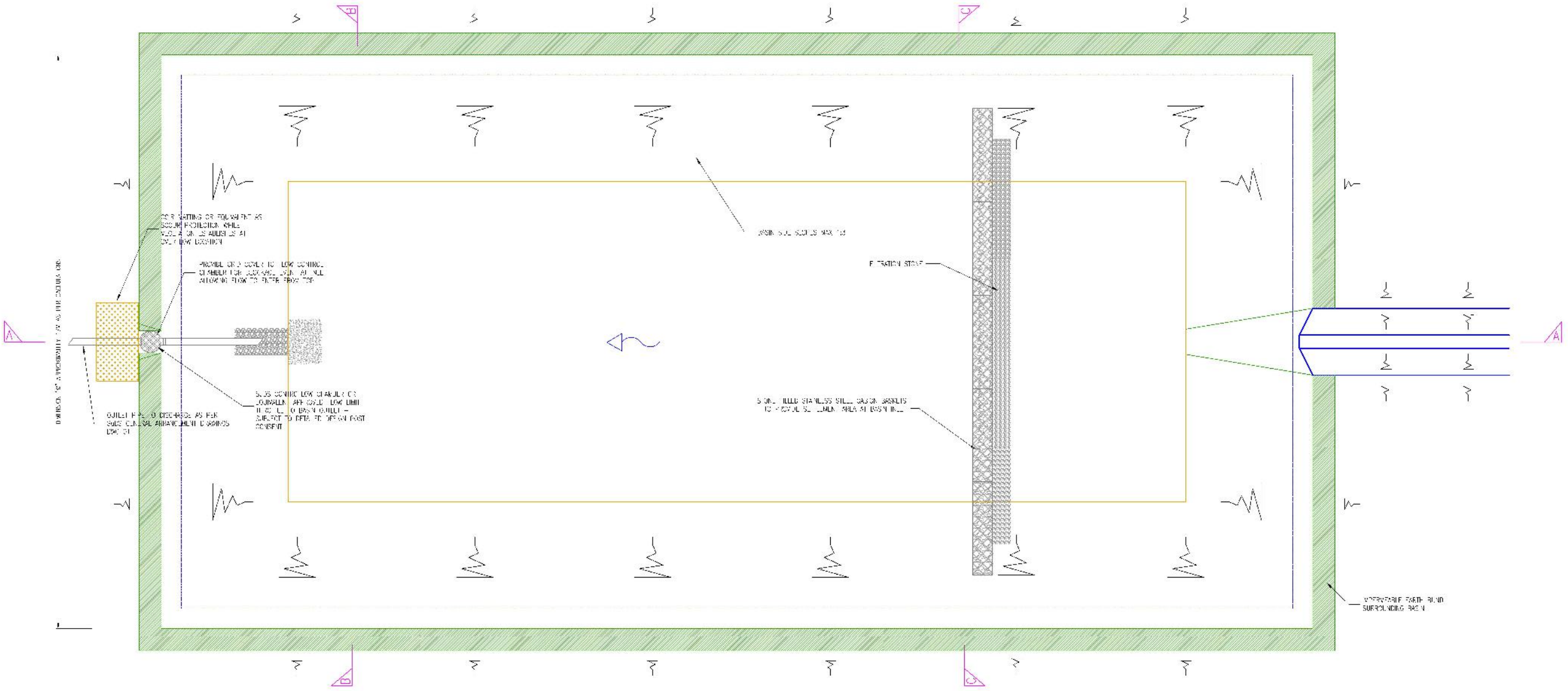
DESCRIPTION
CARNBUCK WIND FARM - DRAINAGE LAYOUT SHEET 10

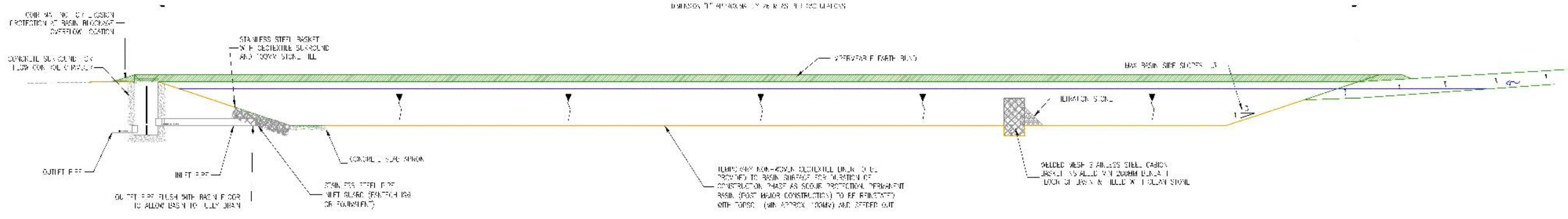
PROJECT / FIGURE NO.
M01616-08_SWMP_10

DRAWN BY	SCALE	REVISION	DATE
DKS	1:2000	1	08/07/2022

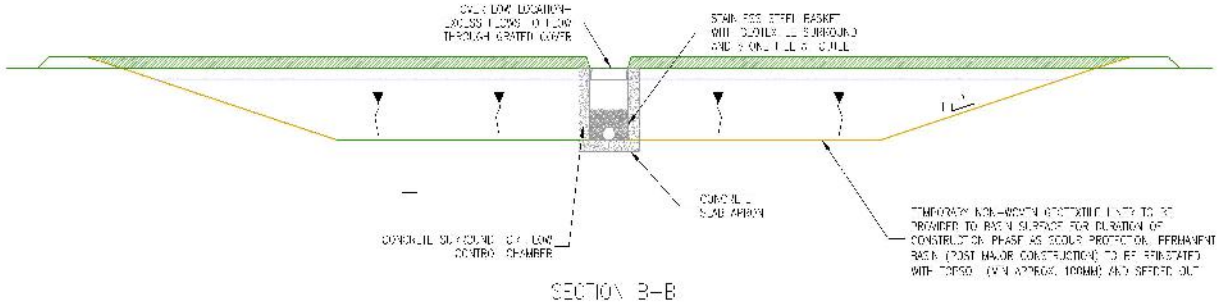
SUDS ATTENUATION / DETENTION BASIN PLAN

INDICATIVE DESIGN

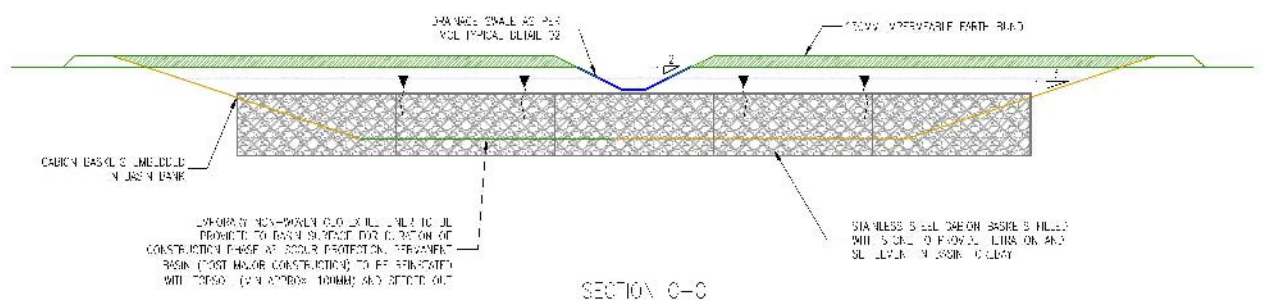




SECTION A-A



SECTION B-B



SECTION C-C

NOTE: THE DRAWING CONTENTS ARE PROPRIETARY AND MUST NOT BE REPRODUCED WITHOUT PERMISSION

N/A

REV	DRN	APP	DATE	NOTES / DESCRIPTION
1	JL	M	04/04/2022	PLANNING

STATUS: FOR PLANNING

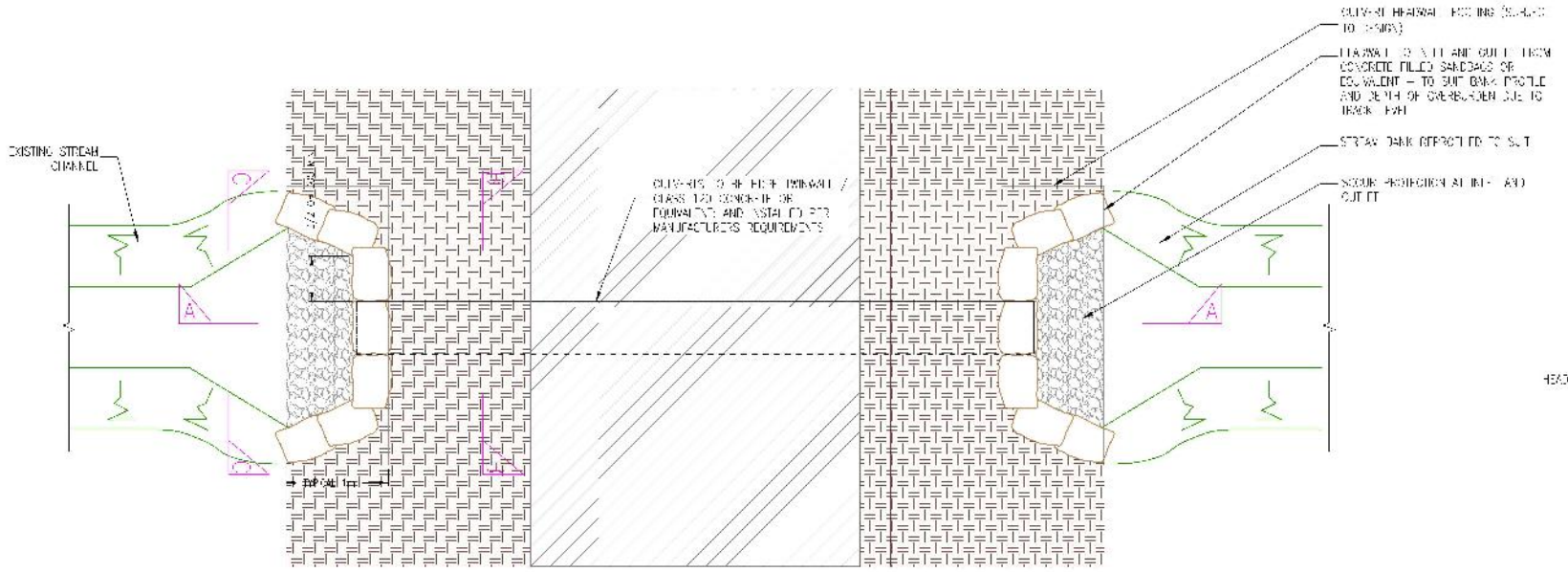
McCloy Consulting
T 028 9084 8566
F 028 9084 1535
Mossley Mill, Lower Ground Floor, Commerce Road North, Newtownabbey, BT36 5PY
www.mccloyconsulting.com

PROJECT: CARNDUCK WINDFARM

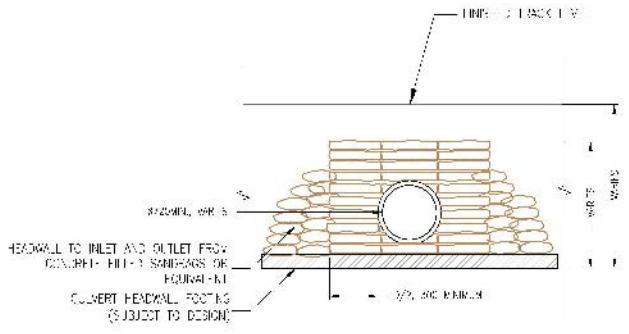
CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SUDS) OUTLINE MANAGEMENT DETAILS DETENTION BASIN/ ATTENUATION POND

SCALE	CHECKED SIZE	
AS SHOWN	A1	
DRAWN: JL	CHECKED: M	DATE: 05/01/2022
PROJECT NO.: V01618_08	DRAWING NO.: SWM_24	ISSUE: 00



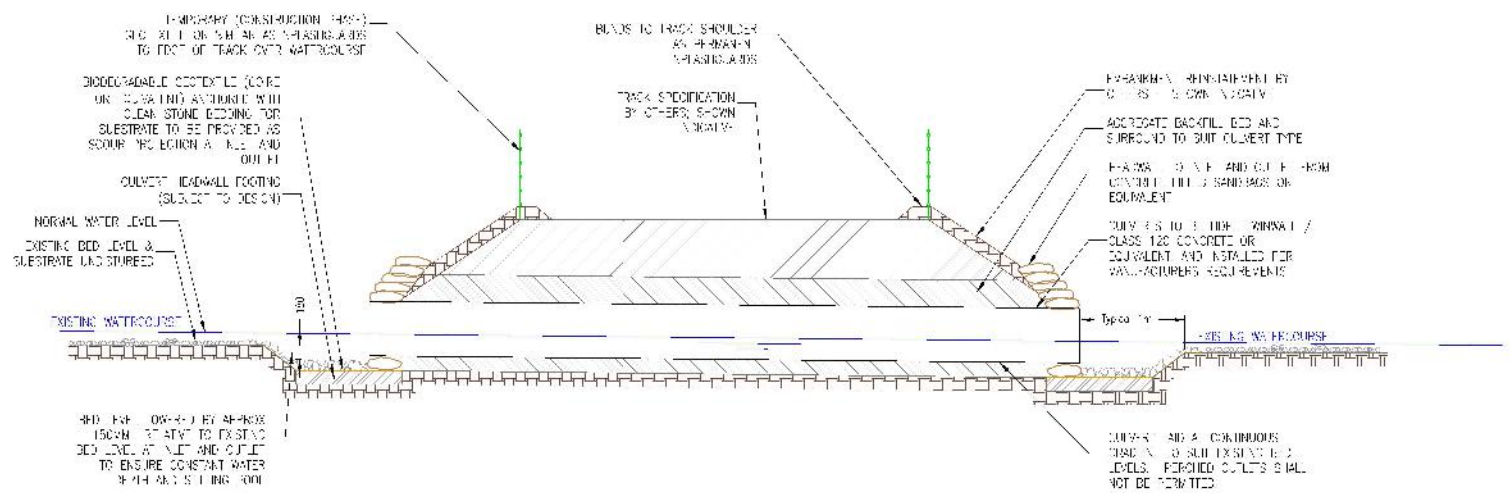
PLAN
SCALE 1:50



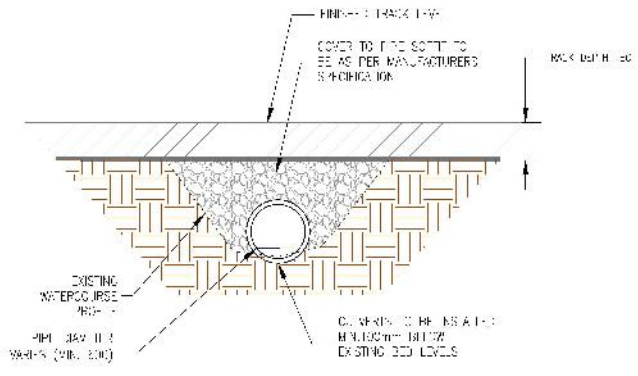
ELEVATION C-C (WITH HEADWALL)
1:20

NOTES FOR CONSTRUCTION METHODS & ENVIRONMENTAL PROTECTION

1. WORKS TO BE PROGRAMMED TO SUIT PERIODS OF LOW RIVER FLOW AND RAINFALL DUE COGNISANCE GIVEN TO THE PREVAILING GROUND CONDITIONS AND SEASONAL WEATHER CONDITIONS.
2. CULVERT LOCATION TO BE DAMMED UPSTREAM BY USE OF SANDBAGS OR EQUIVALENT AND OVERPUMPED IN ORDER TO PROVIDE A DRY WORKING ENVIRONMENT.
3. IN CHANNEL SILT FENCING TO BE INSTALLED DOWNSTREAM OF THE WORKS AND DOWNSTREAM OF OVERPUMPING FOR THE DURATION OF THE CULVERT INSTALLATION WORKS.



SECTION A-A
SCALE 1:20



SECTION B-B
SCALE 1:10

INDICATIVE DESIGN

NOTE: THIS DRAWING IS BASED ON SURVEY INFORMATION / PRELIMINARY DRAWINGS

N/A

1	JL	M	05/07/2022

ISSUE | DATE | APP. DATE | NOTES / DESCRIPTION

STATUS: FOR PLANNING

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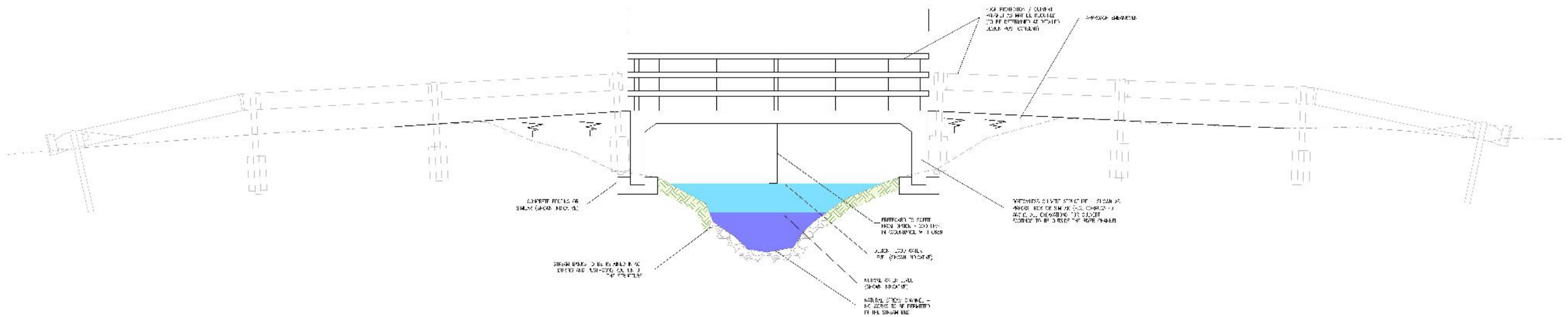
PROJECT
CARNBUCK WINDFARM

CLIENT
res

DRAWING TITLE
DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS PIPED CULVERTS

SCALE	CHECKING SIZE
AS SHOWN	A1
DRAWN: JL	CHECKED: M
DATE: 05/07/2022	
PROJECT No.: V01616_08	DRAWING No.: SWMP_16
ISSUE REV.: 00	



TYPICAL BOTTOMLESS CULVERT
WATERCROSSING
N.S.

INDICATIVE DESIGN

NOTE: THESE DRAWINGS SHOULD BE READ IN CONJUNCTION WITH ARCHITECTURAL / STRUCTURAL DRAWINGS
N/A

ISSUE	DATE	APP. DATE	NOTES / DESCRIPTION
1	JL	M	04/04/2022 ISSUED

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PROJECT:
CARNDUFF
WINDFARM

CLIENT:
res

DRAWING TITLE:
DRAINAGE MANAGEMENT (SUDS)
INDICATIVE TYPICAL DETAILS
BOTTOMLESS CULVERT

SCALE	ORIGINAL SIZE
AS SHOWN	A1

DRAWN	CHECKED	DATE
JL	M	05/04/2022

PROJECT NO.	DRAWING NO.	ISSUE NO.
V01616_68	SWMP_17	00

Appendix C

Correspondence

Dfl Rivers Lisburn

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Lower Ground (West)
Carnmoney Road North
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BT36 5QA

Ravarnet House
36 Altona Road
Lisburn
BT27 5QB
Tel: 028 9260 6100

Your Ref: M01616-23
Our reference: IN1-22-6412

07 June 2022

Dear Kyle

RE: SCHEDULE 6 APPLICATION FOR STORM DISCHARGE TO A WATERCOURSE

CARNBUCK WIND FARM, ADJACENT TO GLASMULLAN ROAD AND 1500M WEST OF OLD CUSHENDALL ROAD, MARTINSTOWN

I refer to your e-mail and application dated 5th April 2022 along with accompanying details regarding the above.

Following assessment by Dfl Rivers' environment section regarding the above in relation to the Habitats Regulations, my comments are as follows:

Dfl Rivers is satisfied with your proposals for storm discharge at your stated total max. attenuated Greenfield run-off rate of 86.3 litres/sec from the above site to the various watercourses, as shown on your submitted maps. These watercourses are undesignated under the terms of the Drainage (Northern Ireland) Order 1973.

Responsibility for the accuracy of the Greenfield calculations at each discharge location within the various catchments, lies with the applicant and his/her professional advisers.

The outfall structures should be made to the required specification as shown on your submitted drawing, to provide bed and bank protection to the watercourse and angled in the direction of flow.

Attenuation methods are to be by using appropriate storage systems within the site, as shown on your submitted drawing no. SWMP_24.

The Department would stress that it is the applicant's responsibility to ensure that the proposed works does not result in any obstruction to flow arising from a blockage, structural failure, poor workmanship or any other reasons.

Riparians/developers should fully satisfy themselves that any proposal will not in any way increase the flood risk within the catchment.

It is the applicant's responsibility also to obtain all necessary wayleaves/landowner permissions to carry out the works.

You should note that, in accordance with Paragraph 11 of Schedule 6 of the Drainage (Northern Ireland) Order 1973, any consents/ approvals given by DfI Rivers under Schedule 6 shall not affect the liability of any riparian/developer to comply with other legislation. It is your responsibility to contact any other parties which may have an interest in your proposals e.g. NIEA, Landowners, Fisheries etc.

This consent is valid for a period of 24 months from the date of this letter. If proposals are not completed within this period of time they should be resubmitted for further appraisal.

Please see the below link for guidance on pollution prevention when working in or near water.

https://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf?utm_source=website&utm_medium=social&utm_campaign=GPP5%2027112017

Please feel free to contact me if you have any queries and quote the reference number at the top of this letter in any future correspondence.

Yours sincerely

Kevin Scullion

Appendix D

Flood Model Summary

MODEL PARAMETERS

Introduction

As no existing modelled data was available for the undesignated watercourse at the site, a coarse hydraulic model suitable to the scale and nature of the proposed development and associated risk, was developed for the site. An Infoworks ICM linked 1D-2D model has been developed for the site, allowing more accurate determination of flood levels and extents at the site.

HYDROLOGICAL ASSESSMENT

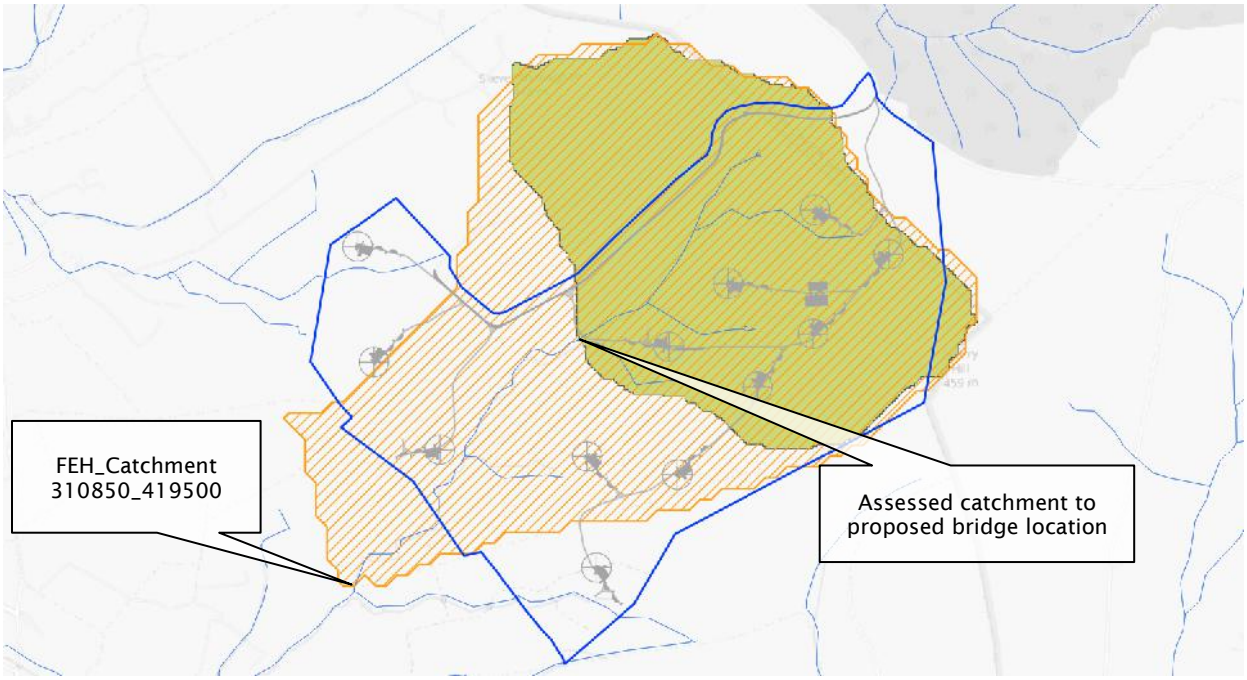
The estimation of peak flow for the required design annual probability has been necessary to determine the peak inflow and hydrograph for input to an unsteady state hydraulic model.

The derivation of the 1% AEP peak flow and hydrograph for the undesignated watercourse was assessed using the FEH Revitalised Flood Hydrograph (ReFH) Method. The method is deemed appropriate where best practice guidance directs practitioners to FEH-based methods in all instances, and where catchments investigated are small and there is little useful local or comparable data to inform a Statistical analysis.

Site-specific flow-accumulation raster analysis based on site survey and the OSNI Northern Ireland 10m DTM was used to determine a conservative estimate of the catchments draining to the areas of interest, and the ReFH2 flow for the FEH catchment scaled pro-rata by areal extent.

As per DfI guidance[3], an effect of climate change has been derived by applying an uplift of +20% to the estimated flow.

Hydrological Catchment



[3] DfI. (2019). Technical Flood Risk Guidance in relation to Allowances for Climate Change in Northern Ireland. Available from: https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/technical-flood-risk-guidance-in-allowances-for-climate-change-6feb19.PDF. [Accessed: 15/04/2022].

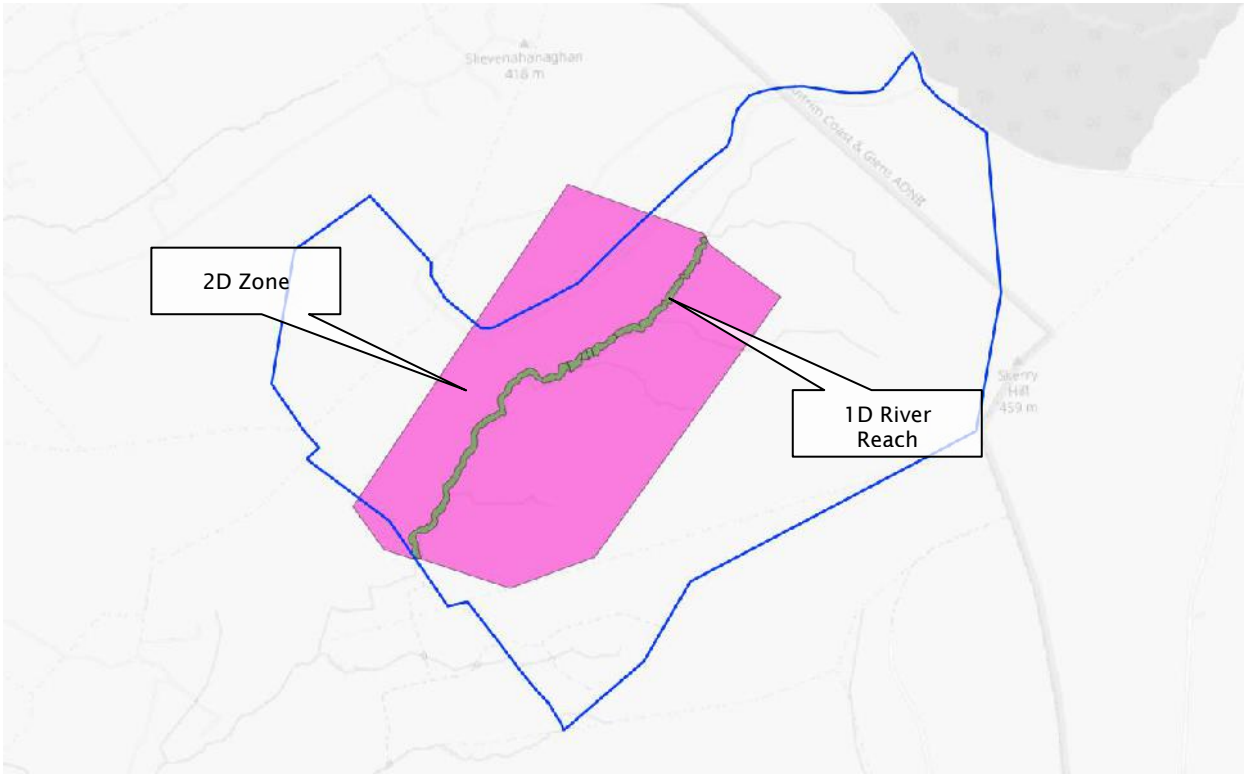
Hydrology Summary

Analysis Method	1% AEP Design Flow (m3/sec)
FEH ReFH2 Method	16.92

Detailed calculations for the determination of the flows are contained within Appendix E.

MODEL GEOMETRY

Model Extents



2-Dimensional Surface Model Areas

Topography

Model topography was based on a detailed site-specific LiDAR survey. The survey was cleaned to a "bare earth" digital terrain model (DTM) and exported for use at a 1m grid resolution.

The use of LiDAR survey data is likely to underrepresent channel capacity and overestimate flooding due to it underestimating below-water ground levels and levels under vegetation, and as such is precautionary and suitable for planning purposes.

2D Zone

The terrain model was loaded into InfoWorks ICM as a ground model, and subsequently converted into 2D mesh elements (the surface used to simulate flows across the topography within the model). The 2D zone has a maximum triangle area of 100m^2, minimum area of 25m^2.

Boundary Conditions

The boundary condition for 1D and 2D elements is set as the normal depth of flow for the element gradient at that location. The downstream boundary is sited at an elevation >5m lower than the area of interest in order to ensure that variance in the boundary condition could have no backwater effect that would affect prediction of water levels at the bridge location.

Surface Roughness

A Manning's n Roughness value of 0.07 has been conservatively applied to the whole 2D zone to represent the area over which water would flow which comprises a combination of rough grass.

Surface Infiltration

It is noted that no infiltration has been included in the model in keeping with the approach used in similar DfI Rivers SFRA detailed models. The absence of infiltration in the model is likely to present conservative results.

1-Dimensional Model Elements

Cross sections

The river reach is derived from discrete cross sections sampled from the DTM formed from height data described previously.

Channel Roughness

An in-channel roughness Manning's n of 0.06 is adopted as representative of the observed channel conditions.

Structures

No structures are represented in the present-day scenario.

Proposed Scenario

The proposed scenario is represented by inclusion of an embankment at the crossing location imposed on the 2D zone as a mesh level zone. Conservative crest heights in excess of actual heights likely required have been adopted to provide conservative upstream peak flood levels.

The main river culvert is included as a conduit on the river reach with roughness 0.06 (representative of stream substrate) and upper roughness of 0.016 (representative of precast concrete). Inlet losses are represented by the FHWA methodology per industry norms.

Assumptions and Limitations of Modelling

The representation of any complex system by a model requires a number of assumptions to be made. In the case of the hydraulic model developed for the purposes of the study it is assumed that:

- The terrain model sufficiently accurately represents the surface topography and associated flow paths.
- The design flows are an accurate representation of flows of a given return period.
- Roughness does not vary with time.

The primary limitations of the study are noted as follows:

- No allowance for infiltration has been made within the model;
- The model does not represent any topographic features smaller than the minimum resolution of the underlying terrain model derived for the site.

MODEL SENSITIVITY

Model roughness is intentionally precautionary and at the higher end of permissible Manning's N roughness values for the conditions observed. Sensitivity testing for further increases in roughness would be an unreasonable requirement.

Flows are conservative and include uplifts for climate change for the default scenario and are taken for a flow extraction point downstream of the area of interest and so are likely to represent a sufficiently precautionary estimate without need for further stress testing.

The model boundary condition is sited >5m downgradient of the site and so further stress testing of boundary condition on the area of interest can be discounted.

The model can therefore be deemed reliable / conservative and is and fit for its intended purpose of a precautionary evaluation of flood risk and culvert opening sizes at the site.

Appendix E

Hydrology Calculation Summaries

UK Design Flood Estimation

Generated on 16 January 2020 09:49:08 by Iain.muir
Printed from the ReFH2 Flood Modelling software package, version 3.0.7275.28566

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details Checksum: CB4C-4575

Site name: FEH_Catchment_Descriptors_310850_419500

Easting: 310850

Northing: 419500

Country: England, Wales or Northern Ireland

Catchment Area (km²): 4.77 [4.73]*

Using plot scale calculations: No

Model: ReFH2.3

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 model (mm):	59.40	Total runoff (ML):	162.02
Total Rainfall (mm):	46.25	Total flow (ML):	220.58
Peak Rainfall (mm):	9.02	Peak flow (m³/s):	16.92

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	03:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.81	No
ARF (Areal reduction factor)	0.96	No
Seasonality	Winter	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	122.43	No
Cmax (mm)	198.18	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.28	No
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0.39	No
BL (hr)	21.22	No
BR	0.36	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No
Exporting drained area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes