APPENDIX 4-2

Drainage Drawings

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4. Water containing silt will not be discharged or pumped directly to any natural watercourse. All discharges will be made over open ground or into existing drain with silt trap at a minimum of 20m from nearest watercourse unless otherwise stated.
5. No excavated material will be stored within any surface water buffer zone.
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7. Pumping of clean water from excavations / or over-pumping in drains/ditches/streams will be completed in a manner that will not cause scour or erosion at the point of release/discharge. This will be done by reducing the flow velocities or by use of suitable splash plates, and/or other similar discharge controls.
8. Vegetation will NOT be stripped from existing drains/ditches unless absolutely necessary.

Excavations

9. Where (temporary) deep excavations are proposed, cut-off drains will be used to reduce the amount of surface water entering the excavation. This will be the case around turbine base excavations.

Exposed Ground & Stockpiles

10. The amount of temporary exposed ground and temporary stockpiles open/exposed at any time will be minimised.

Site Tracks

11. Use of track side swales with check dams, and/or filtration check dams will reduce silt in runoff water as required.
12. Check dams to be inspected and cleaned regularly.

Refueling

13. Refuelling of mobile plant will be completed in designated refueling areas only, on an impermeable surface and away from field drains / ditches and watercourses/waterbodies.
14. Spill kits and drip trays will be available on site for use as required.

Concrete

15. Concrete pours will be managed and supervised to ensure there will be no leakage/seepage/discharge of concrete or concrete water during the construction phase.
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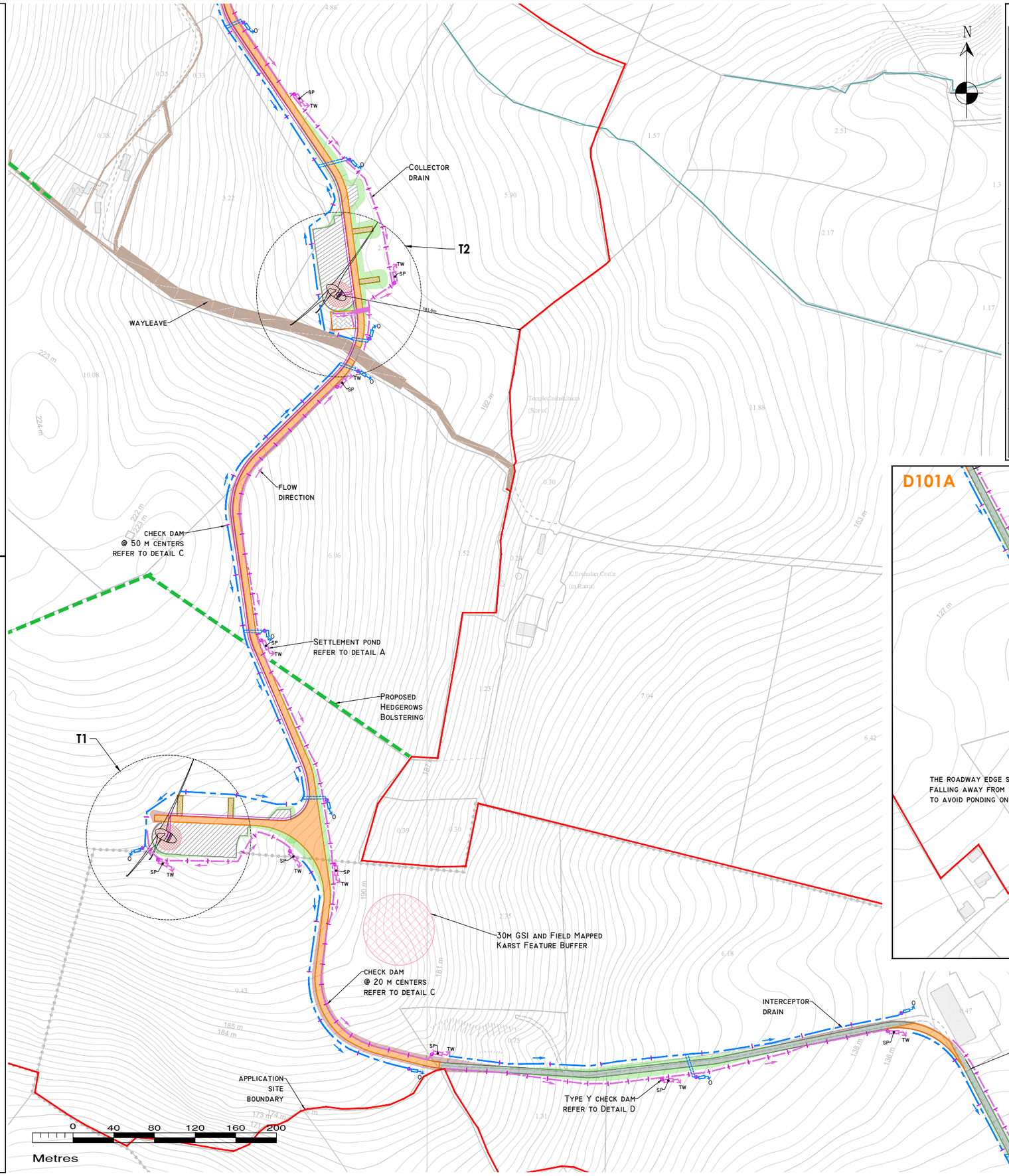
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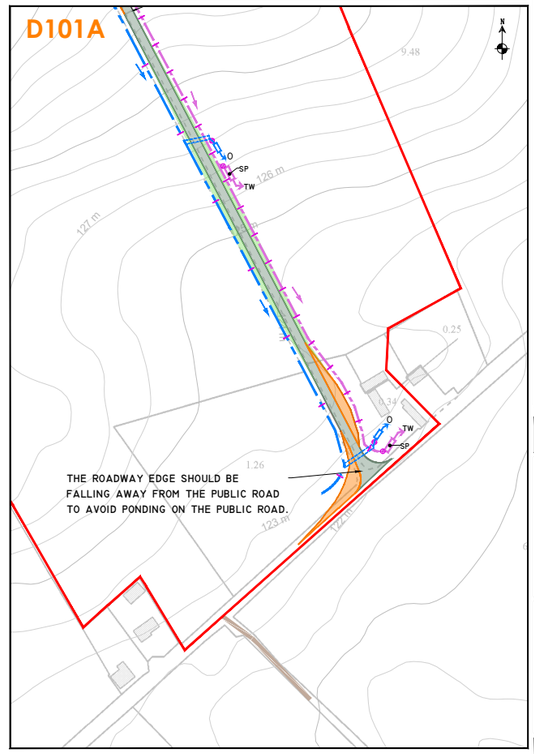
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3. SUDS drainage system to be constructed prior to, or at the same time as the access tracks. Interim measures such as the placement of straw bales/silt fencing/or similar approved method or additional check dams to be employed in all instances where work carried out to construct the access tracks is likely to cause adverse environmental effects through increased silt loadings being generated during the construction phase.
4. Suitable prevention measures will be in place at all times to prevent the conveyance of significant volumes of silt to receiving watercourses. See notes on pollution prevention.
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7. A buffer zone of >20m to any existing watercourse will be required where overland discharges are proposed from access track swales / ditches. This buffer will not be possible at river/stream crossings, but other suitable controls are proposed in those areas (i.e. additional silt fencing).
8. Batters of all proposed swales / ditches to have a slope of between 1 : 1.5 to 1 : 2 depending upon depth of swale/ditch and will be left as cut to re-vegetate with local species.
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10. Settlement ponds to be constructed for silt removal at turbine bases and hard stand areas. Pond sizes depend on the catchment area being served. Sample pond sizes for various catchment areas are shown on Drawing D501.
11. Straw bales or similar and silt fences to be used also around spoil heaps to mitigate silt runoff. Silt fences may be removed when suitable vegetation cover is established.
12. Silt fences to be provided along the edge of existing watercourses where works comes within <20m of edge of any ditch / drain / ephemeral channel.
13. Slopes of the swales / ditches 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 swales / ditches or longitudinal mounds of vegetation swales at field drain discharge points.
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15. Clean stone flow control check dams to be made of locally won / geologically similar well graded stone. Aggregate size for stone check dams to be typically 20-40mm clean stone. On sloping sections of the access tracks, 40mm check dams to be protected from washing away through the placement of 100mm stone on the downhill face of the check dam and by wrapping in geotextile.
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MITIGATION / DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE

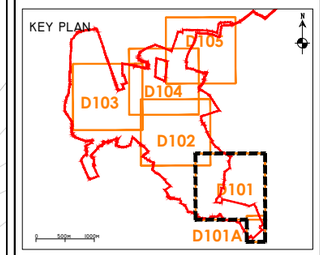
Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses (except at crossings where additional mitigation will be added) 2) Using small working areas 3) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) Erosion and velocity control measures such as: A) Sand bags B) Oyster bags filled with gravel C) Filter fabrics D) and other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) Weathering off / sealing spoil stockpiles
In-Line Controls:	1) Interceptor drains, oversized swales/collector drains 2) Erosion and velocity control measures such as: A) Sand bags B) Oyster bags filled with gravel C) Filter fabrics D) Straw bales E) Flow limiters F) Weirs or baffles G) and/or other similar/equivalent or appropriate systems. 3) Silt fences, filter fabrics 4) In stream Sedimats 5) Collection sumps, temporary sumps, pumping systems 5) Attenuation ponds 6) Sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) Attenuation ponds 3) Temporary storage ponds 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs 6) Hydrocarbon Interceptors



Drawing Legend :

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  - watercourses
  - watercourses 50m buffer
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  - redirected drains
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- application site boundary
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- soft levelled area
- proposed new roads
- Existing Roads/Tracks to be Upgraded
- 110kV underground cabling
- 33kV Underground Cable Route
- Proposed 110kV Onsite Substation
- temporary construction compound
- borrow pit
- met mast
- spoil management area
- wayleave
- cut area
- fill area
- 30m GSI and Field Mapped Karst Feature Buffer
- Proposed Hedgerows Bolstering
- Proposed New Hedgerows

KEY PLAN



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Date	Description	Chkd	Signed
Revisions			

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email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: Killoshulan Renewable Energy Limited

Job: Killoshulan Wind Farm, Co. Kilkenny

Title: Proposed Drainage Layout

Figure No: D101

Drawing No: P1587-0-1026-A1-D101-00B	
Sheet Size: A1	Project No.: P1587-0
Scale: 1:2,000 (A1)	Drawn By: GA
Date: 26/10/2026	Checked By: MG

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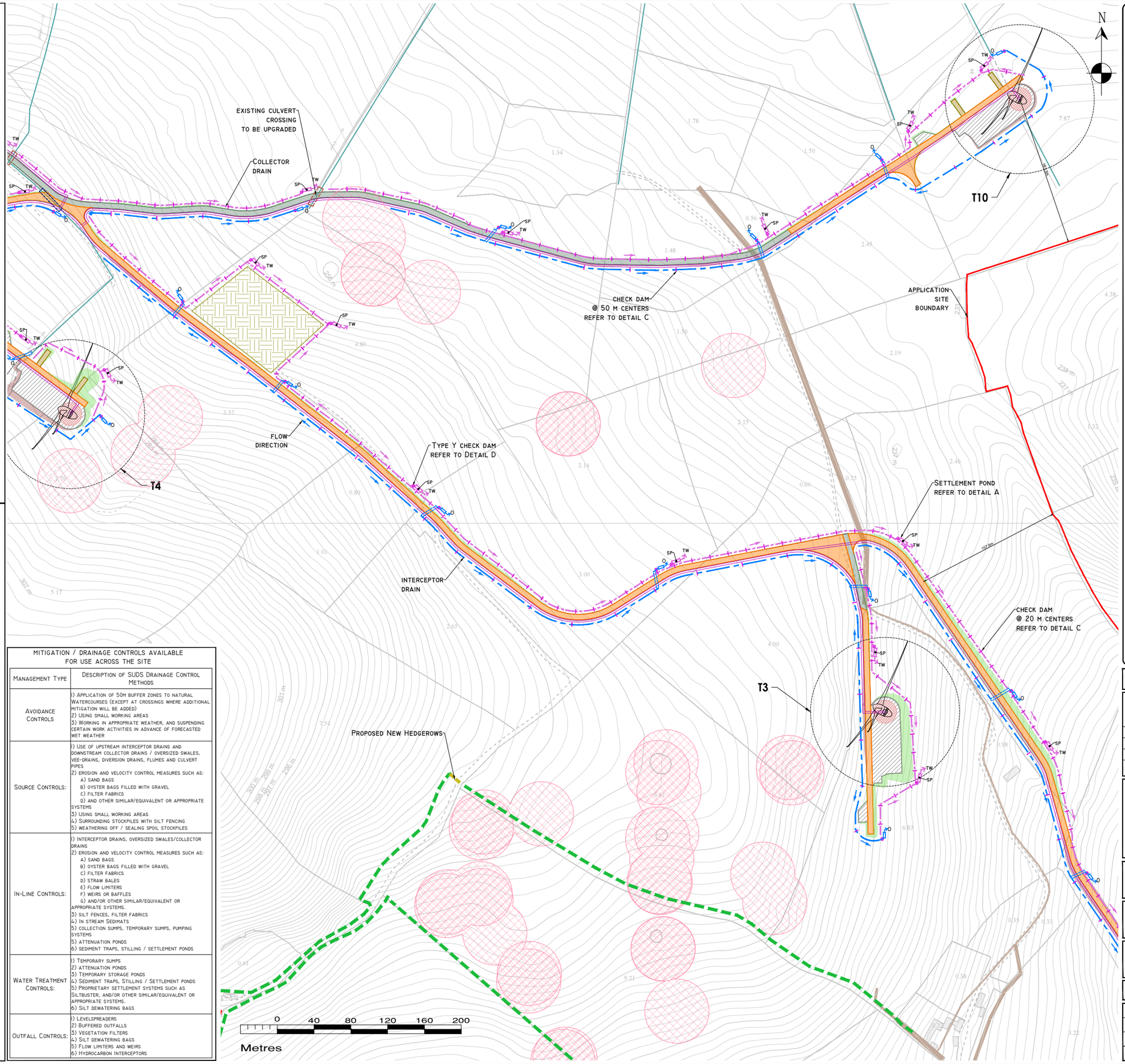
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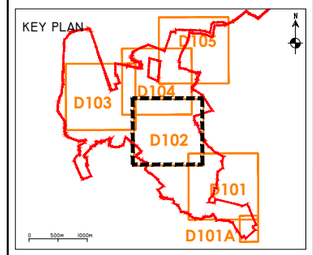
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Date	Description	Chkd	Signed

Revisions

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email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client:
Killoshulan Renewable Energy Limited

Job:
Killoshulan Wind Farm, Co. Kilkenny

Title:
Proposed Drainage Layout

Figure No: D102

Drawing No: P1587-0-1026-A1-D102-00B	
Sheet Size: A1	Project No.: P1587-0
Scale: 1:2,000 (A1)	Drawn By: GA
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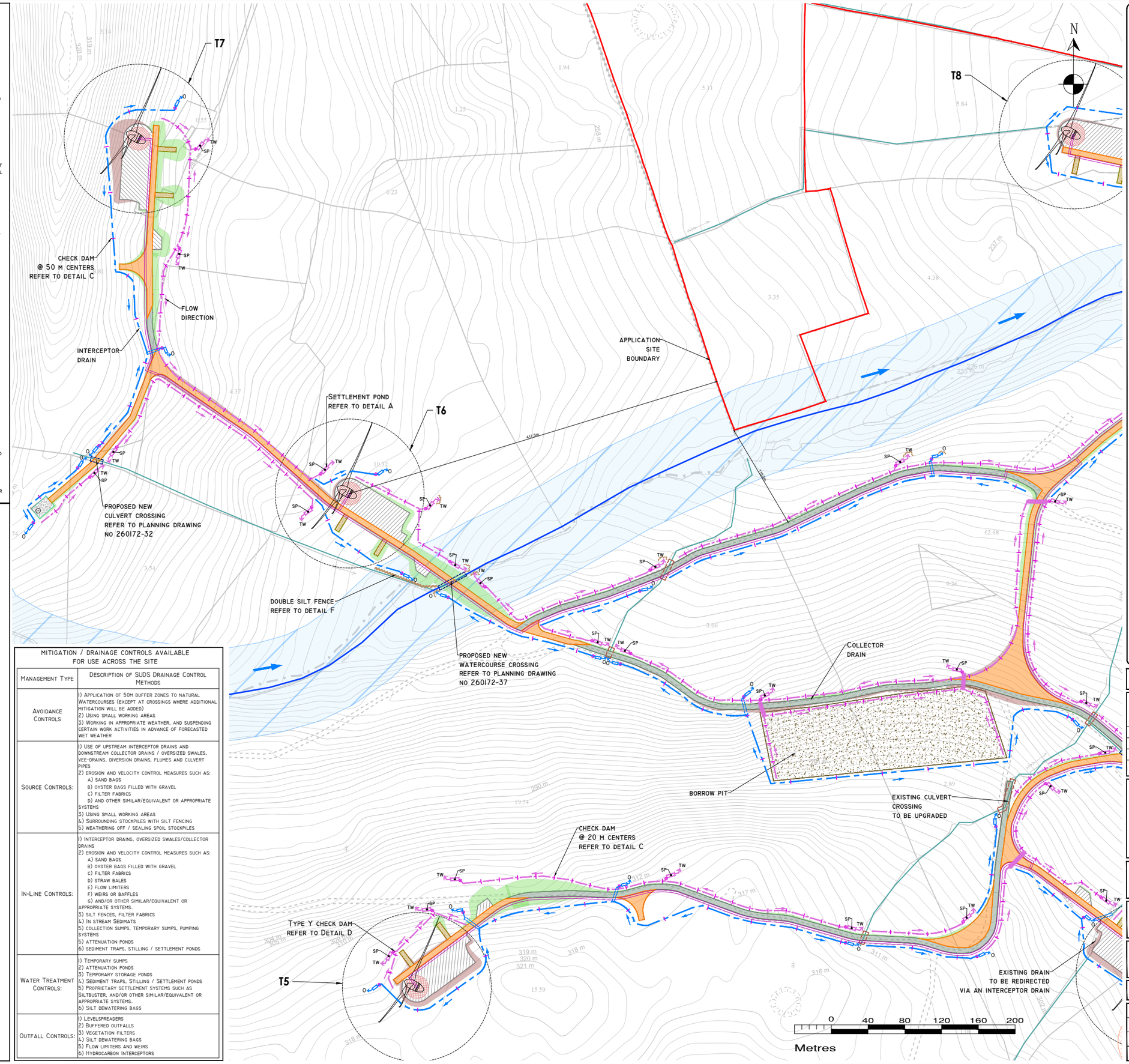
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13. Slopes of the swales / ditches to be vegetated or protected from erosion until vegetation has been established. Stripped vegetative layer from excavations to be stored locally and used to line slopes and base of swales / ditches or longitudinal mounds of vegetation swales at field drain discharge points.
14. Areas stripped of vegetation will be kept to a minimum.
15. Clean stone flow control check dams to be made of locally won / geologically similar well graded stone. Aggregate size for stone check dams to be typically 20-40mm clean stone. On sloping sections of the access tracks, 40mm check dams to be protected from washing away through the placement of 100mm stone on the downhill face of the check dam and by wrapping in geotextile.
16. 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 drainage 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.
17. Spacing and frequency of check dams will be dependent upon longitudinal gradient of swale.
18. Location of filtration check dams (if required) to be agreed on site with Engineer. Settlement ponds to be constructed in a manner where they may be easily infilled at a later date (post completion of the turbine base and hardstand construction). Only suitable materials excavated from the pond to be used to form part of the embankment around the pond.
19. Oil and fuel will only be stored within bunded containment structures.
20. Temporary use of silt bags will be deployed on site where pumping from excavations is required.

MITIGATION / DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE

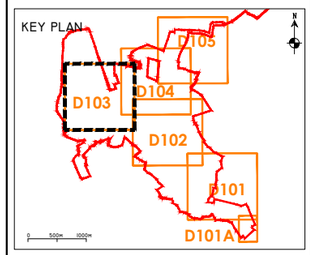
Management Type	Description of SUDS Drainage Control Methods
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Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) Erosion and velocity control measures such as: A) Sand bags B) Oyster bags filled with gravel C) Filter fabrics D) and other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) Weathering off / sealing spoil stockpiles
In-Line Controls:	1) Interceptor drains, oversized swales/collector drains 2) Erosion and velocity control measures such as: A) Sand bags B) Oyster bags filled with gravel C) Filter fabrics D) Straw bales E) Flow limiters F) Weirs or baffles G) and/or other similar/equivalent or appropriate systems. 3) Silt fences, filter fabrics 4) In stream Sediments 5) collection sumps, temporary sumps, pumping systems 5) attenuation ponds 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage ponds 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs 6) Hydrocarbon interceptors



DRAWING LEGEND :

- Existing Drainage
  - Watercourses
  - Watercourses 50m buffer
  - Stream flow direction
  - Mapped drains
  - Redirected drains
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  - Check Dam 'type A'
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KEY PLAN



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Date	Description	Chkd	Signed
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Client: Killoshulan Renewable Energy Limited

Job: Killoshulan Wind Farm, Co. Kilkenny

Title: Proposed Drainage Layout

Figure No: D103

Drawing No: P1587-0-1026-A1-D103-00B	
Sheet Size: A1	Project No.: P1587-0
Scale: 1:2,000 (A1)	Drawn By: GA
Date: 26/10/2026	Checked By: MG

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2. Suitable drainage control measures will be maintained throughout the works to prevent conveyance of significant volumes of silt to off site receiving watercourses.
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Discharges

4. Water containing silt will not be discharged or pumped directly to any natural watercourse. All discharges will be made over open ground or into existing drain with silt trap at a minimum of 20m from nearest watercourse unless otherwise stated.
5. No excavated material will be stored within any surface water buffer zone.
6. Pumped water will be directed into track side ditches and treated in settlement ponds and vegetation swales prior to overland discharge.
7. Pumping of clean water from excavations / or over-pumping in drains/ditches/streams will be completed in a manner that will not cause scour or erosion at the point of release/discharge. This will be done by reducing the flow velocities or by use of suitable splash plates, and/or other similar discharge controls.
8. Vegetation will NOT be stripped from existing drains/ditches unless absolutely necessary.

Excavations

9. Where (temporary) deep excavations are proposed, cut-off drains will be used to reduce the amount of surface water entering the excavation. This will be the case around turbine base excavations.

Exposed Ground & Stockpiles

10. The amount of temporary exposed ground and temporary stockpiles open/exposed at any time will be minimised.

Site tracks

11. Use of track side swales with check dams, and/or filtration check dams will reduce silt in runoff water as required.
12. Check dams to be inspected and cleaned regularly.

Refueling

13. Refuelling of mobile plant will be completed in designated refueling areas only, on an impermeable surface and away from field drains / ditches and watercourses/waterbodies.
14. Spill kits and drip trays will be available on site for use as required.

Concrete

15. Concrete pours will be managed and supervised to ensure there will be no leakage/seepage/discharge of concrete or concrete water during the construction phase.
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IF WATER POLLUTION IS IDENTIFIED THE FOLLOWING STEPS WOULD BE ADHERED TO:

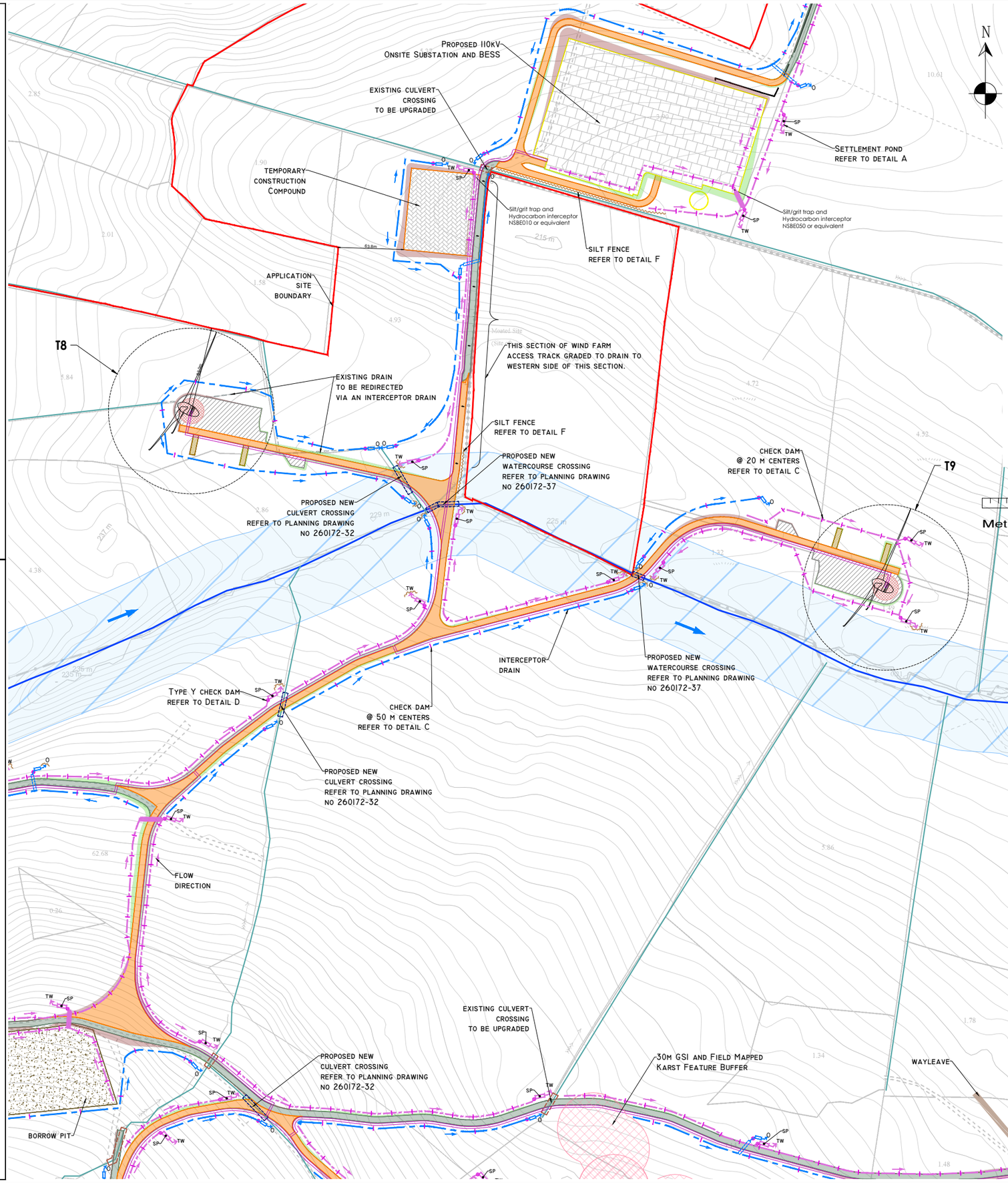
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CONTAIN - the source of the pollution should be bunded using a suitable method. Natural watercourses should be temporarily diverted around any source of pollution.

NOTIFY - The relevant authorities (Site Manager / Fisheries / NPWS / Local Authority etc.) should be notified immediately to ensure that measures can be implemented downstream to protect fisheries and other sensitive receptors.

DRAINAGE NOTES:

1. Site Tracks and Roadway surfacing design and construction to Engineer's Specification (i.e. by others).
2. Spare straw bales/silt fencing or similar, will be stored on site. The level of silt in runoff during construction is to be monitored visually and excessive silt levels in any area to be temporarily managed by placing silt fences, straw bales / or similar or additional check dams at the problem areas. Mobile Siltbuster system to be made available on-site for use as required also.
3. SUDS drainage system to be constructed prior to, or at the same time as the access tracks. Interim measures such as the placement of straw bales/silt fencing/or similar approved method or additional check dams to be employed in all instances where work carried out to construct the access tracks is likely to cause adverse environmental effects through increased silt loadings being generated during the construction phase.
4. Suitable prevention measures will be in place at all times to prevent the conveyance of significant volumes of silt to receiving watercourses. See notes on pollution prevention.
5. Interceptor swales / ditches will be used to collect upstream surface water flows. Regular cross drains / discharge to ditches/drains will be installed to transfer / discharge surface water in interceptor drains to suitable drain outfall points.
6. Drainage swales / ditches to be excavated adjacent to the access tracks. Regular cross drains to be located along access tracks to prevent excessive volumes of water collecting in the swales / ditches. Optimum locations of cross drains to be agreed with the Engineer on site. Surface water will not be allowed to discharge directly into any existing watercourses.
7. A buffer zone of >20m to any existing watercourse will be required where overland discharges are proposed from access track swales / ditches. This buffer will not be possible at river/stream crossings, but other suitable controls are proposed in those areas (i.e. additional silt fencing).
8. Batters of all proposed swales / ditches to have a slope of between 1 : 1.5 to 1 : 2 depending upon depth of swale/ditch and will be left as cut to re-vegetate with local species.
9. Track side swales / ditches to be shallow with moderate gradients to prevent scouring. In steep areas check dams will be installed to reduce flow velocities and provide source control of silt containment. These have been designed in conjunction with settlement ponds and silt traps, prior to discharge.
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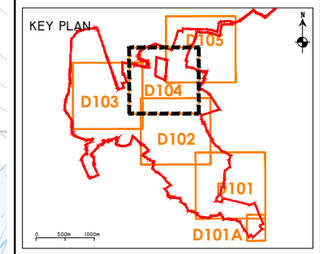
MITIGATION / DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses (except at crossings where additional mitigation will be added) 2) Using small working areas 5) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) Erosion and velocity control measures such as: A) Sand bags B) oyster bags filled with gravel C) filter fabrics D) and other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) weathering off / sealing spoil stockpiles
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Drawing Legend :

- Existing Drainage: watercourses; watercourses 50m buffer; stream flow direction; mapped drains; redirected drains
- Proposed Drainage: upstream interceptor drain; swales/downstream collector drain; direction of flow; silt fences; double/triple silt fences; settlement pond - level spreader; check dam 'type A'; check dam 'type B'; proposed wc crossing/culvert; existing wc crossing to be upgraded; interceptor ditch culvert; collector ditch culvert; O overland flow discharge; TW treated water discharge; SP settlement pond; VS semi-natural vegetation swale / filter bed /secondary sp; pumping sump
- application site boundary; existing ground surface minor contour (1m interval); existing ground surface major contour (10m interval); turbine foundation; hardstand; soft levelled area; proposed new roads; existing roads/tracks to be upgraded; 110kv underground cabling; 33kv underground cable route; proposed 110kv onsite substation; temporary construction compound; borrow pit; met mast; spoil management area; wayleave; cut area; fill area; 30m GSI and Field Mapped Karst Feature Buffer; proposed hedgerows bolstering; proposed new hedgerows

KEY PLAN



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web: www.hydroenvironmental.ie

Client: Killoshulan Renewable Energy Limited

Job: Killoshulan Wind Farm, Co. Kilkenny

Title: Proposed Drainage Layout

Figure No: D104

Drawing No: P1587-0-1026-A1-D104-00B	
Sheet Size: A1	Project No.: P1587-0
Scale: 1:2,000 (A1)	Drawn By: GA
Date: 26/10/2026	Checked By: MG

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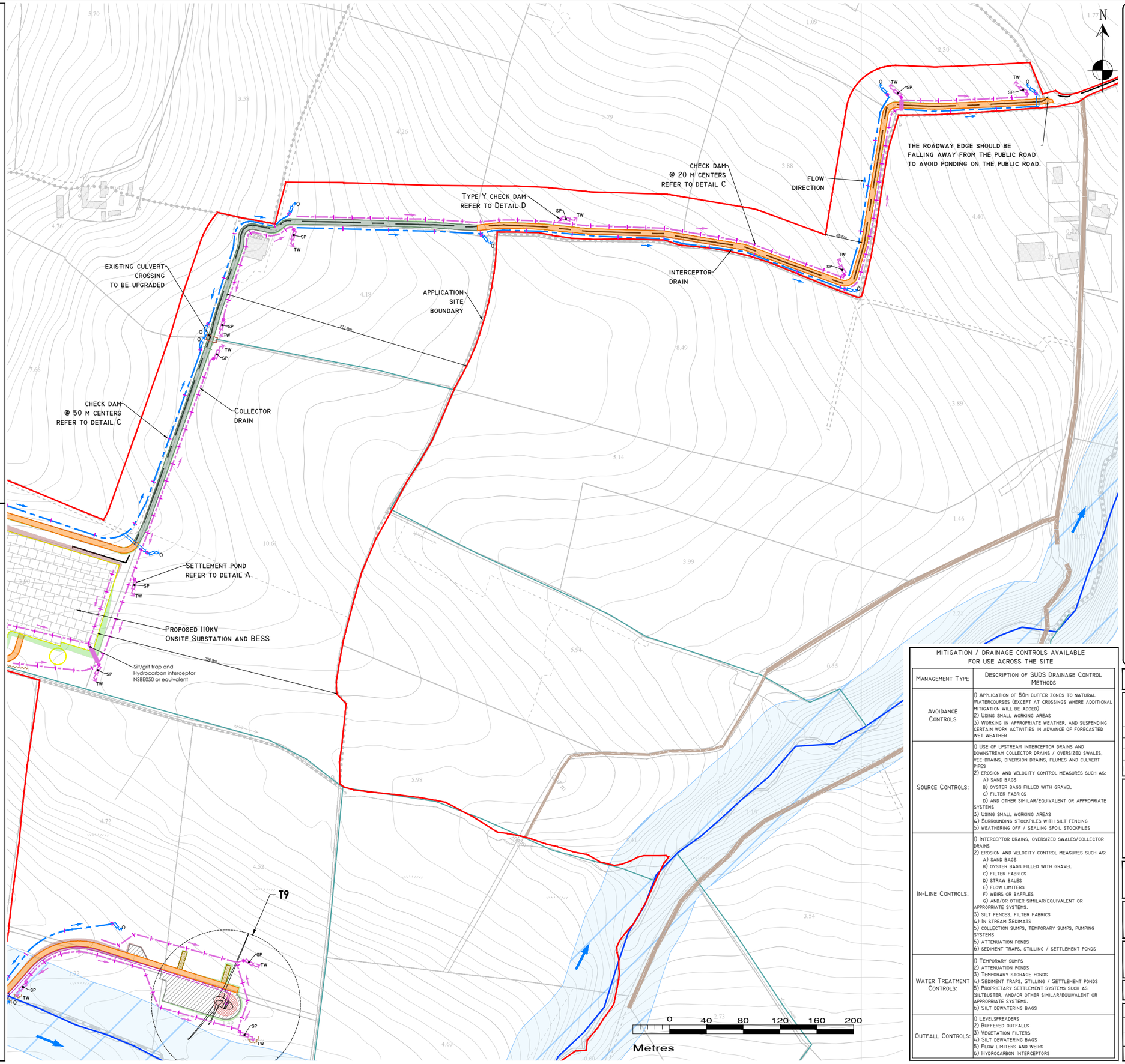
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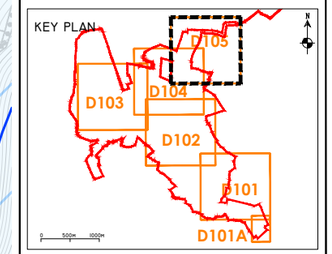
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Revisions

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Client:
Killoshulan Renewable Energy Limited

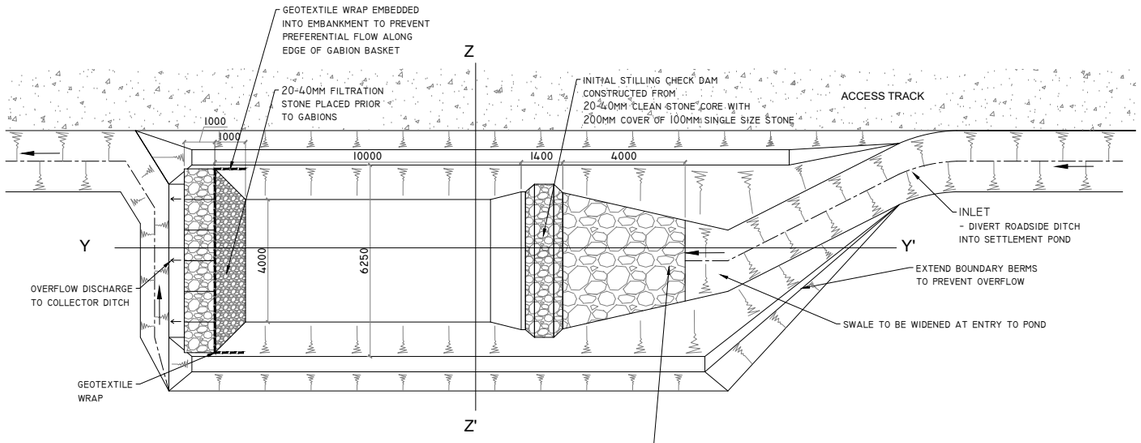
Job:
Killoshulan Wind Farm, Co. Kilkenny

Title:
Proposed Drainage Layout

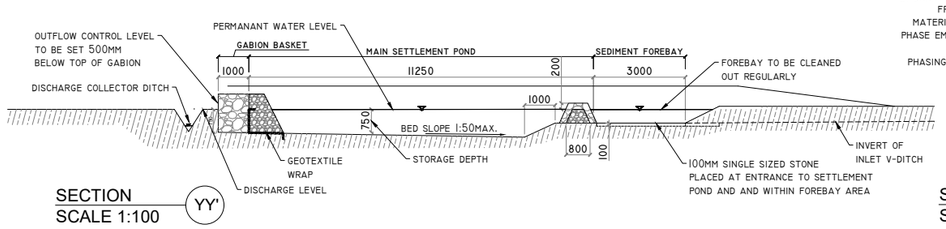
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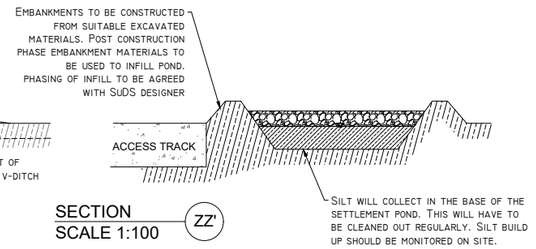
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Scale: 1:2,000 (A1)	Drawn By: GA
Date: 26/10/2026	Checked By: MG

DETAIL A1

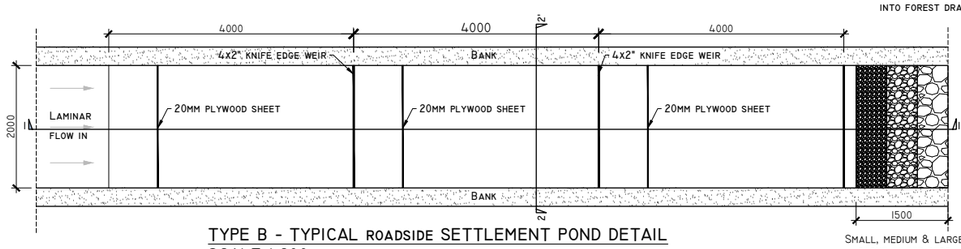


TYPE A - ROADSIDE SETTLEMENT POND DETAIL
SCALE 1:100 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE - SEE ATTACHED TABLE)

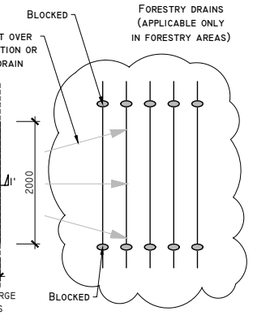


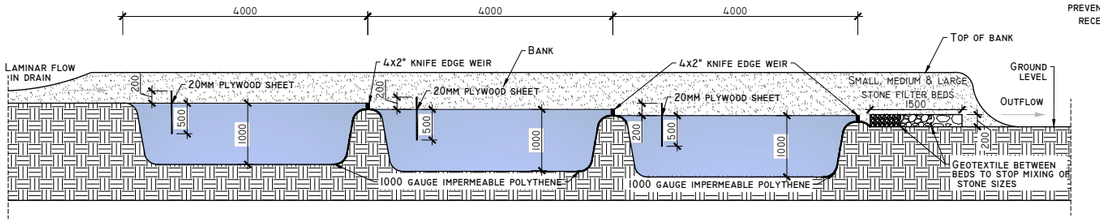


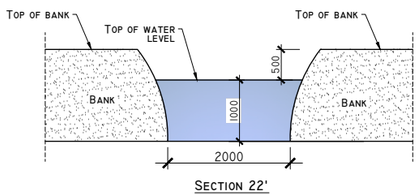
DETAIL A2



TYPE B - TYPICAL ROADSIDE SETTLEMENT POND DETAIL
SCALE 1:200 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE - SEE ATTACHED TABLE)

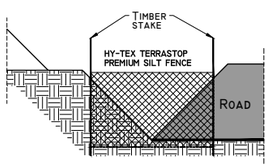






SECTION 22'

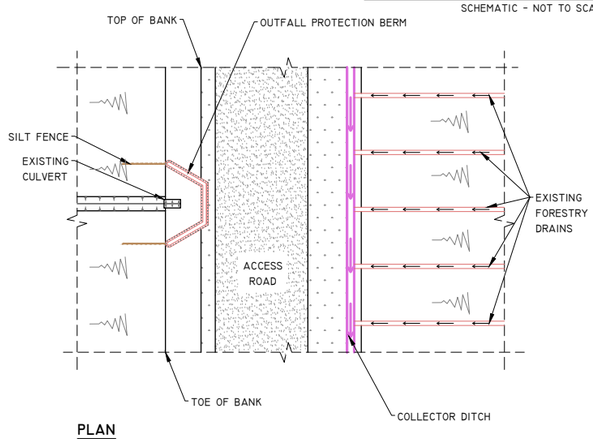
SECTION 11'
SEDIMENT FENCE/CHECK DAM DETAIL



POND SIZE W [m] x L [m] x D [m]			TRACK/HARDSTAND CATCHMENT SIZE (m²)		
RETURN PERIOD	*10 YRS*	STORM DURATION	500	1000	2000
6HR RETENTION FOR COARSE SILT		6 HRS	2.5 x 8.0 x 1 m	3.6 x 11.0 x 1 m	5.1 x 16.6 x 1 m
12HR RETENTION FOR MEDIUM SILT		12 HRS	3.8 x 11.8 x 1 m	5.4 x 16.5 x 1 m	7.7 x 23.2 x 1 m
24HR RETENTION FOR FINE SILT		24 HRS	6.5 x 19.5 x 1 m	9.2 x 27.6 x 1 m	13.0 x 39.1 x 1 m

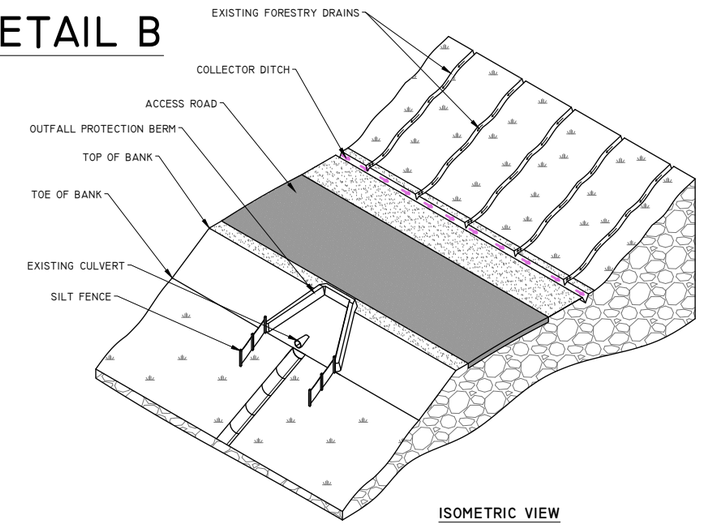
CULVERT - OUTFALL PROTECTION DETAIL

SCHEMATIC - NOT TO SCALE



PLAN

DETAIL B



ISOMETRIC VIEW

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Date	Description	Chkd	Signed
Revisions			

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tel: +353 (0) 58-44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: KILLOSHULAN RENEWABLE ENERGY LIMITED

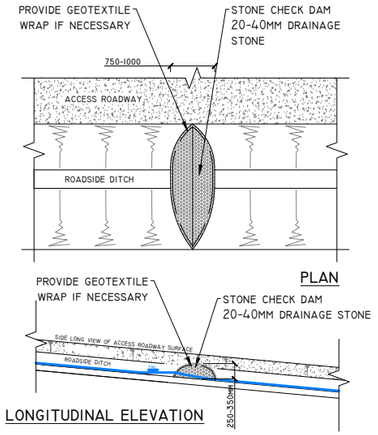
Job: KILLOSHULAN WIND FARM, CO. KILKENNY

Title: DRAINAGE DETAILS 1

Figure No: D501

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Sheet Size: A1	Project No.: P1587-0
Scale: as shown (A1)	Drawn By: GA
Date: 23/10/2026	Checked By: MG

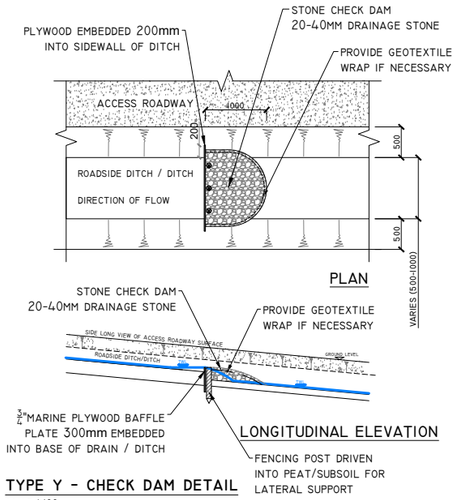
DETAIL C



TYPE X - CHECK DAM DETAIL

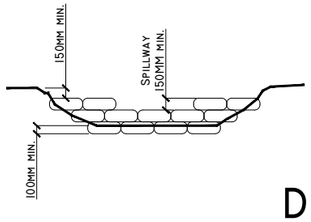
SCALE 1:50

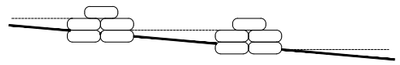
DETAIL D



TYPE Y - CHECK DAM DETAIL

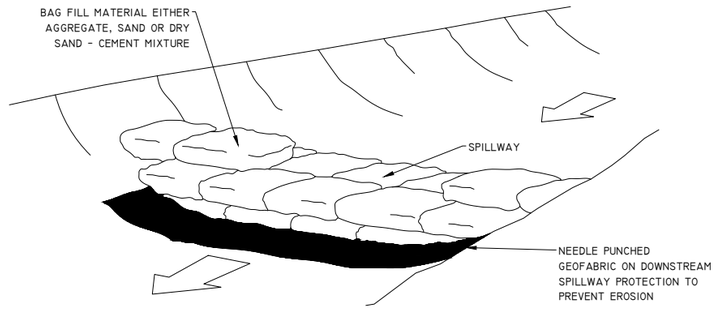
SCALE 1:100





NOTE: SPACING OF CHECK DAMS ALONG CENTRELINE AND SCOUR PROTECTION BELOW EACH CHECK DAM

DETAIL CI



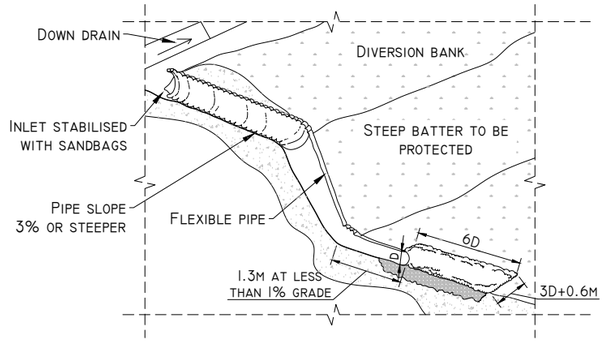
TEMPORARY CHECK DAM / SETTLEMENT POND OVERFLOW
SAND FILLED BAG CONSTRUCTION

SCHEMATIC - NOT TO SCALE

DETAIL E

TYPICAL PIPE SPILLWAY DETAIL

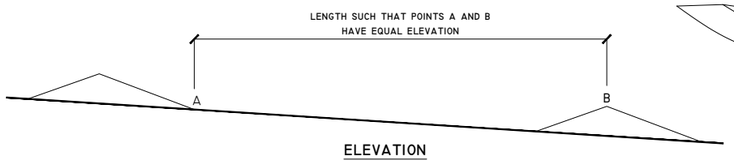
SCHEMATIC - NOT TO SCALE



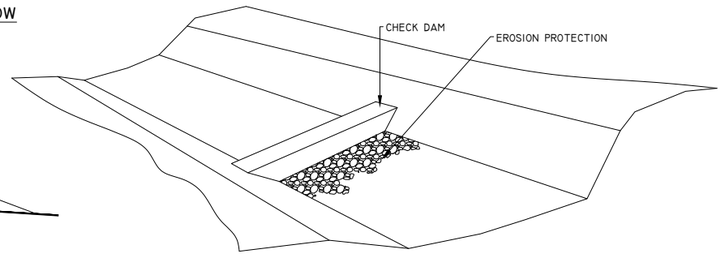
DETAIL C2

TEMPORARY CHECK DAM / SETTLEMENT POND OVERFLOW

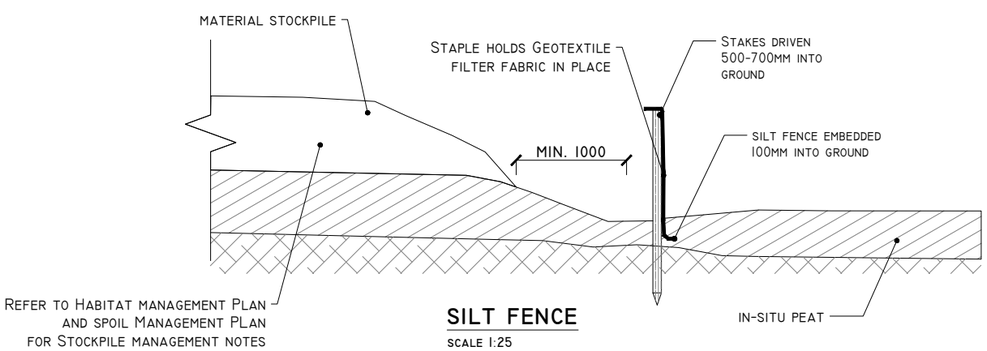
SCHEMATIC - NOT TO SCALE



ELEVATION



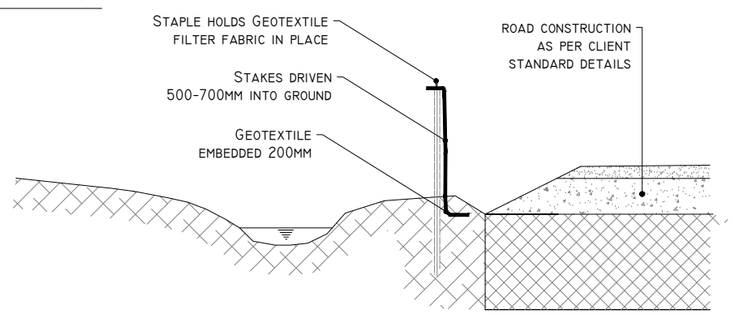
DETAIL F-I



SILT FENCE

SCALE 1:25

DETAIL F-II



SILT FENCE FOR WATERCOURSE PROTECTION

SCALE 1:25

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Date	Description	Chkd	Signed

Revisions

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tel: +353 (0) 58-44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: KILLOSHULAN RENEWABLE ENERGY LIMITED

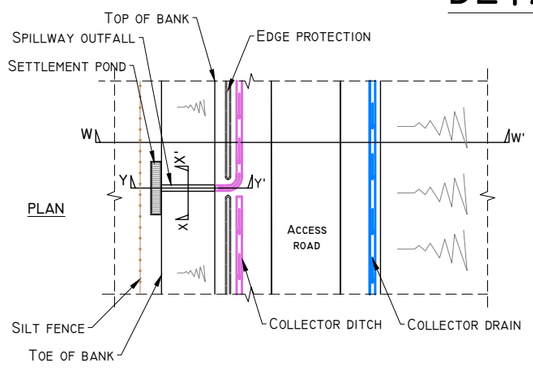
Job: KILLOSHULAN WIND FARM, CO. KILKENNY

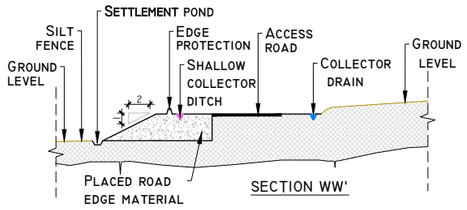
Title: DRAINAGE DETAILS 2

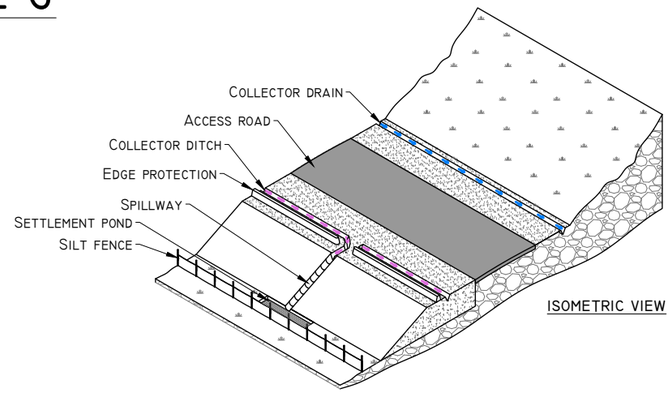
Figure No: D502

Drawing No: P1587-0-1026-A1-D502-00A	
Sheet Size: A1	Project No.: P1587-0
Scale: as shown (A1)	Drawn By: GA
Date: 23/10/2026	Checked By: MG

DETAIL G







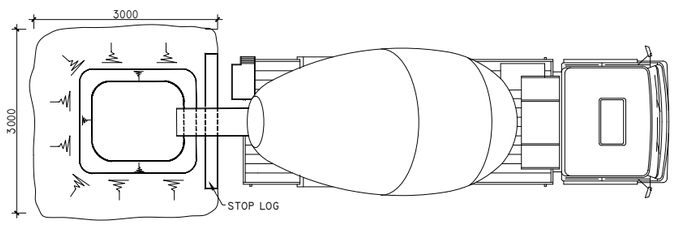
SPILLWAY OUTFALL PLAN
SCHEMATIC - NOT TO SCALE

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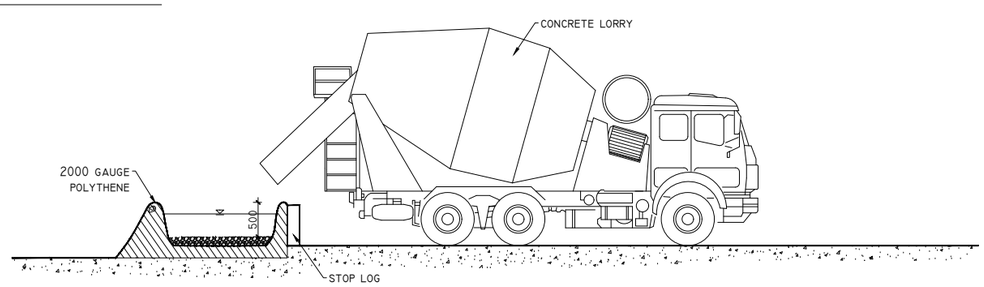
DETAIL J-1

TEMPORARY CONCRETE WASHOUT PIT
SCALE 1:50

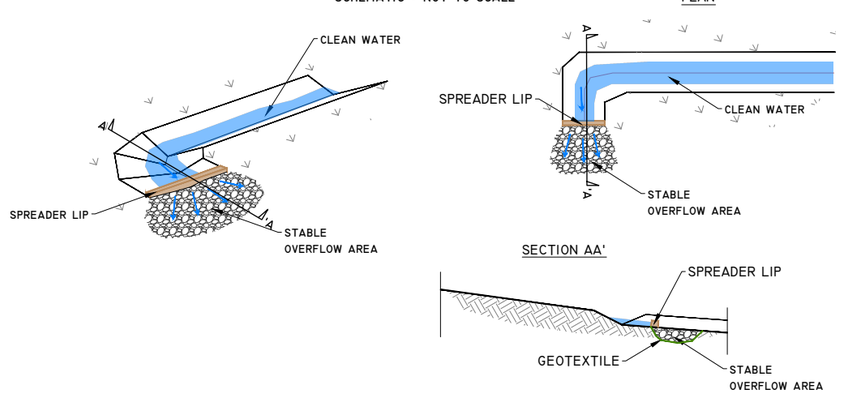
PLAN



ELEVATION



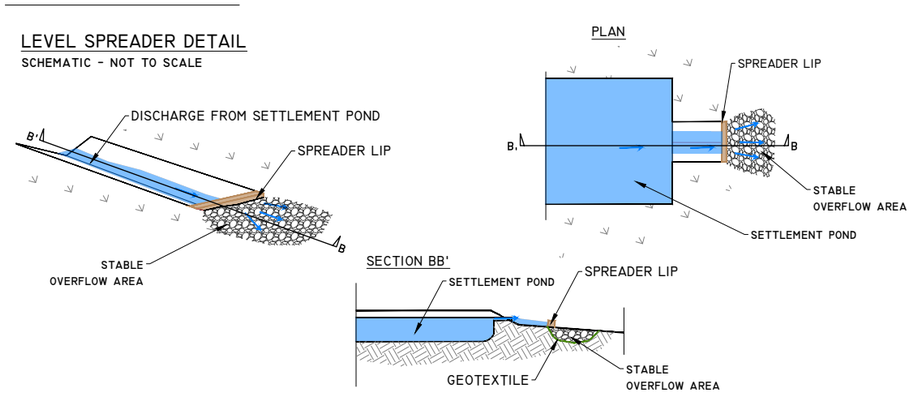
LEVEL SPREADER DETAIL
SCHEMATIC - NOT TO SCALE



DETAIL H

DETAIL J-2

LEVEL SPREADER DETAIL
SCHEMATIC - NOT TO SCALE



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Revisions			

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Client: KILLOSHULAN RENEWABLE ENERGY LIMITED

Job: KILLOSHULAN WIND FARM, CO. KILKENNY

Title: DRAINAGE DETAILS 3

Figure No: D503

Drawing No: P1587-0-1026-A1-D503-00A	
Sheet Size: A1	Project No.: P1587-0
Scale: as shown (A1)	Drawn By: GA
Date: 23/10/2026	Checked By: MG