wardell-armstrong.com

ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
LAND AND PROPERTY
MINING AND MINERAL PROCESSING
MINERAL ESTATES
WASTE RESOURCE MANAGEMENT

**PEEL WIND FARMS (YELL) LTD**

# Beaw Field Wind Farm – Environmental Statement

## Appendix 3.1: Watercourse Crossings

**March 2016**

your earth our world

wardell armstrong

**Wardell Armstrong LLP**
City Quadrant, 11 Waterloo Square, Newcastle upon Tyne, NE1 4DP, United Kingdom
Telephone: +44 (0)191 232 0943 Facsimile: +44 (0)191 261 1572 www.wardell-armstrong.com

wardell armstrong
*your earth our world*

**DATE ISSUED:** March 2016
**JOB NUMBER:** **NT12001**
**REPORT NUMBER:** **001**

**PEEL WIND FARMS (YELL) LTD**

# Beaw Field Wind Farm – Environmental Statement

## Appendix 3.1: Watercourse Crossings

March 2016

**PREPARED BY:**

Joe Haley Engineer

Stephen Miller Principal Civil Engineer

**APPROVED BY:**

David Brignall Regional Director

[redacted]



Wardell Armstrong is the trading name of Wardell Armstrong LLP, Registered in England No. OC307138.

Registered office: Sir Henry Doulton House, Forge Lane, Etruria, Stoke-on-Trent, ST1 5BD, United Kingdom

UK Offices: Stoke-on-Trent, Birmingham, Cardiff, Carlisle, Edinburgh, Greater Manchester, London, Newcastle upon Tyne, Penryn, Sheffield, Truro, West Bromwich. International Offices: Almaty, Moscow

ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
LAND AND PROPERTY
MINING AND MINERAL PROCESSING
MINERAL ESTATES AND QUARRYING
WASTE RESOURCE MANAGEMENT

**CONTENTS**



**TABLES**



**PLATES**



**ANNEXES**



**FIGURES**

# 1 INTRODUCTION

1.1.1 This report details the findings of the Site walkover carried out in the week commencing 29th June 2015 with regards to watercourse crossings. This report only considers crossings within the Site. No existing or proposed crossings outside of the Application Boundary have been considered.

1.1.2 All crossings outlined in this report are subject to agreement with SEPA, and are to be designed in accordance with SEPA's best practice guidance for watercourse crossing and are subject to detailed design.

1.1.3 Watercourse catchments have been estimated using 5m accuracy LIDAR data of the area, and flows estimated using the IH124 method of calculating Greenfield runoff. Due to the steep topography of the Site and its ground conditions (shallow rock covered by saturated peat) the runoff coefficient for the land has been estimated at 75%.

1.1.4 All crossings are to have capacity for the $Q_{200}$ Greenfield runoff rate.

1.1.5 During the Site walkover it was noted that numerous unmapped watercourses cross the proposed access route. These are minor in size with small catchments and are mainly drain routes from the areas of peat. These water crossings should be culverted using a 450mm diameter concrete pipe as a minimum to prevent and reduce the risk of blockage.

# 2 WATERCOURSE CROSSINGS

## 2.1 Overview of Watercourse Crossings

2.1.1 Following a review of the watercourse crossings along the route of the proposed access, track it has been determined that there are five major and one minor water crossings to be considered[1]. These are detailed in Table 1.

[1] Any crossing on a watercourse shown on the 1: 250,000 scale OS map has been classified as a major crossing and crossings on any other watercourses have been classified as minor watercourse crossing.

| Table 1: Summary of Proposed Watercourse Crossings | | | | |
|---|---|---|---|---|
| **Watercourse** | **National Grid Reference** | **Major / Minor Crossing** | **Chainage** | **Reference** |
| Burn of Hamnavoe | HU 49722 81310 | Major | 1145m | WX1 |
| Burn of Evrawater | HU 50401 81384 | Major | 2048m | WX2 |
| Unnamed tributary of the Burn of Kettlester | HU 50961 81621 | Major | 2683m | WX3 |
| Unnamed tributary of the Burn of Kettlester | HU 51011 81661 | Minor | 2748m | WX4 |
| Burn of Horsewater | HU 50746 83017 | Major | 4386m | WX5 |
| Unnamed tributary to Burn of Hamnavoe | HU 50471 83476 | Major | 2000m | WX6 |

## 2.2 Burn of Hamnavoe (Ref: WX1)

2.2.1 The first major watercourse that the proposed access track crosses is the Burn of Hamnavoe. This crossing is also the largest crossing on the access route.

2.2.2 The location of the crossing point can be found at National Grid Reference (NGR) HU 49722 81310 and at chainage 1145m of the main access route (A001). This point has been determined as the preferred crossing point as the topography either side of the channel is at a shallow grade, allowing for the approach to the crossing to be at right angles to the direction of flow / channel as per the SEPA best practice guidance. The channel at this location is also linear with no meanders as shown in Plate 1.

**Plate 1: Location of the Burn of Hamnavoe Watercourse Crossing WX1 (Upstream)**

2.2.3 This watercourse has already been crossed by the B9081, approximately 500m downstream of the proposed watercourse crossing location. It is assumed that this crossing was designed and constructed by the local authority, and appears to have been constructed within the last 5 years.

2.2.4 The crossing constructed for the B9081 consists of two 1.5m diameter PVC pipes laid at approximately 1 in 500, with a cast in situ 200mm thick concrete headwall at either side of the culvert. The culvert is approximately 10m in length and is shown in Plate 2. It has been calculated that this culvert has a capacity of 6,750 litres per second.

2.2.5 This crossing is not preferred by the guidance set out in the SEPA watercourse crossing best practice guidance, which states that pipe culverts are not preferred due to the restriction caused to fish and to mammals.

**Plate 2: Existing Burn of Hamnavoe Crossing (Upstream)**

2.2.6 From studying the OS mapping, it has been determined that Burn of Hamnavoe at the point of the proposed watercourse crossing has a catchment area of 457.775ha. Using the IH124 method to calculate Greenfield runoff, a $Q_{200}$ flow rate of 8519.1l/s has been calculated at the point of watercourse crossing. The proposed watercourse crossing is to have a capacity of this or greater.

2.2.7 Due to the size of the watercourse crossing, and to maintain an ecological corridor, it is proposed that a portal frame pre-cast bridge is used instead of large diameter pipes already used on the watercourse. This bridge would have no effect on the channel and would leave the existing watercourse bank as existing with a small verge either side of the channel. Two pads will be constructed either side of the watercourse to provide the required bearing capacity. It is estimated that the unit will be 3.3m wide by 1.2m in height by 15m in length. The structure is to be designed to the standards set out in the Design Manual for roads and Bridges, Part 12. An example of a large span portal frame bridge is shown in Plate 3.

**Plate 3: Example of a large span portal frame bridge**
(Image courtesy of Banagher Precast)

### 2.3 Burn of Evrawater (Ref: WX2)

2.3.1 This watercourse crossing can be found at grid reference NGR HU 50401 81384 and is on chainage 2048m of the main access route (A001) and is shown on Plate 4.

2.3.2 The Burn of Evrawater is fed by the outlet from Evra Water loch and the surrounding catchment area is estimated to be approximately 51.882ha. The $Q_{200}$ rate for this location has been calculated to be 1226.8 l/s, calculations for this can be found in Annex 1.

2.3.3 The location of the watercourse crossing has been chosen to utilise an existing ford crossing, shown in Plate 4. The access road alignment between chainage 1400m and 3400m follows the route of an existing access track as shown on OS mapping. This access track could not be found on the ground, however there was a disturbed route following a new water main, which has been installed. It is unknown if this water main route follows a previous access route.

2.3.4 It is proposed that the existing ford crossing is upgraded. Following SEPA guidance, a ford is not preferred due to its ecological impacts, and therefore this watercourse crossing will be upgraded to a culvert.

**Plate 4: Existing ford crossing of the Burn of Evrawater (Upstream)**

2.3.5 The culvert proposed is to be a 1.8m by 0.6m height precast concrete box section, complete with low flow channel and mammal ledge, as shown in Plate 5. Scour protection is to be provided either side of the culvert in the form of rock armour on the bank sides, and gabion mattress on the bed following the culvert. The culvert will be approximately 13m in length at this location.

2.3.6 This culvert provides an improvement to the existing crossing as outlined in the SEPA guidance for watercourse crossings.


**Plate 5: Typical box section with animal crossing ledge**
(Image courtesy of Hanson Precast)

### 2.4 Unnamed tributary of Burn of Kettlester (Ref: WX3)

2.4.1 This crossing can be found at NGR HU 50961 81621 and at chainage 2683m of the main access route (A001) and is shown on Plate 6.

2.4.2 As per the previous crossing, the track at this location is following an existing mapped track. There is an existing crossing point along the track, which is indicated to be a ford crossing on 10k OS mapping. A Site survey found that this area is an area of disturbed ground, and the condition of the Site would indicate that the crossing is no longer a serviceable ford crossing. The crossing point was found to be in a poor condition with significant bankside erosion occurring.

2.4.3 The catchment area at this location has been estimated to be 1.043ha. The $Q_{200}$ rate has been calculated to be 37.9 l/s, which equates to a 275mm pipe culvert.

2.4.4 Following best practice guidance, the minimum culvert diameter should be a 450mm circular pipe to prevent risk of blockage. Therefore, it is proposed that a 450mm concrete pipe is utilised as a culvert for this crossing. An 8m section will be required to pass under the track and its associated earthworks. Suitable scour protection is to be provided up and downstream of the culvert and the bankside will be reinstated to provide betterment to the watercourse.

**Plate 6: Unnamed tributary of the Burn of Kettlester at Watercourse Crossing WX3 (Downstream)**

## 2.1 Unnamed tributary of Burn of Kettlester (Ref: WX4)

2.1.1 This water crossing can be found at NGR HU 51011 81661 and at chainage 2748m of the main access route (A001) and is shown on Plate 7.

2.1.2 The watercourse crossing is not shown on 1:250k map, therefore can be classified as a minor crossing. The crossing is shown on a 1:10k OS mapping and can be designed accordingly as the location is known.

2.1.3 As per the previous crossing, the access road along this section follows an existing access track and the crossing location utilises an existing ford, which is to be upgraded.

2.1.4 The ford is in a poor condition with bank side erosion occurring due to disturbed ground.

2.1.5 The catchment area contributing to this location has been estimated to be 0.451ha. The $Q_{200}$ rate for this location has been calculated as 18.0l/s, which equates to a 225mm pipe culvert.

2.1.6 As per the previous crossing, it is proposed that the ford is upgraded to a 450mm concrete pipe culvert, estimated to be 9m in length to pass under the access road and associated earthworks. Scour protection is to be provided up and downstream of the culvert, providing betterment to the crossing.

**Plate 7: Unnamed tributary of Burn of Kettlester Crossing Location WX4 (Upstream)**

## 2.2 Burn of Horsewater (Ref: WX5)

2.2.1 The location of the watercourse crossing point can be found at NGR HU 50746 83017 and at chainage 4386m of A001 and is shown on Plate 8. This point has been determined as the preferred crossing point as the topography either side of the channel is at a shallow grade, allowing for the approach to the crossing to be at a right angles to the direction of flow/channel as per the SEPA best practice guidance. The channel at this location is also linear with no meanders.

**Plate 8: Location of Burn of Horsewater Watercourse Crossing WX5 (Upstream)**

2.2.2 From studying the OS mapping, it has been determined that this watercourse at the point of the proposed watercourse crossing has a catchment area of 22.478ha. Using the IH124 method to calculate Greenfield runoff, a $Q_{200}$ flow rate of 582.7l/s has been calculated at the point of watercourse crossing. The proposed watercourse crossing is to have a capacity of this or greater.

2.2.3 Due to the relatively small size of the catchment area and watercourse, a bridge would not be cost-beneficial. It is recommended that to maintain an ecological corridor, a box culvert is used, similar to that proposed at WX2.

2.2.4 The culvert proposed is to be a 1.0m by 0.6m height precast concrete box section, complete with low flow channel and mammal ledge. Scour protection is to be provided either side of the culvert in the form of rock armour on the bank sides, and gabion mattress on the bed following the culvert. The culvert will be approximately 13.5m in length at this location.

## 2.3 Unnamed tributary of Burn of Hamnavoe (Ref: WX6)

2.3.1 This crossing can be found at NGR HU 50471 83476 and is on chainage 2000m of alignment A002 and is shown on Plate 9.

2.3.2 The burn of Hamnavoe is fed by several tributaries; A002 crosses one of the largest of these. The contributing catchment area for the watercourse is 24.414ha. The $Q_{200}$ rate for this location has been calculated to be 627.2l/s, calculations for this can be found in Annex 1.

2.3.3 The location of the watercourse crossing has been chosen based on the horizontal and vertical constraints of the geometric access track design, the point has also been determined as the topography either side of the channel is at a shallow grade, allowing for the approach to the crossing to be at a right angles to the direction of flow / channel as per the SEPA best practice guidance. The channel at this location is also linear with no meanders.

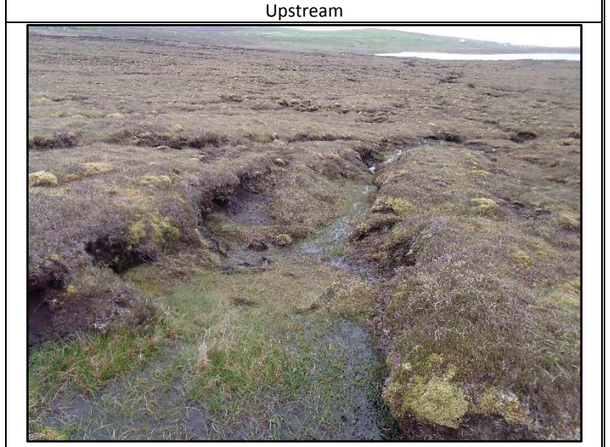
2.3.4 The culvert proposed is to be a 1.0m by 0.6m height precast concrete box section, complete with low flow channel and mammal ledge. Scour protection is to be provided either side of the culvert in the form of rock armour on the bank sides, and gabion mattress on the bed following the culvert. The culvert will be approximately 9.5m in length at this location.

**Plate 9: Location of Unnamed Tributary of the Burn of Hamnavoe Watercourse Crossing WX6 (Upstream)**

## 3 SUMMARY

3.1.1 A summary of all the watercourse crossings can be found in Table 2. All flow calculations can be found in Annex **1**. Watercourse catchment areas can be found in Figure A3.1.1.

**Table 2: Watercourse Crossing Summary Table**

| Figure 3.13 Ref | Approximate NGR | Chainage | Watercourse Dimensions | Catchment Area | $Q_{200\ Flow}$ | Crossing Type | CAR Authorisation Level | Justification for Works | Mitigation | Photograph |
|---|---|---|---|---|---|---|---|---|---|---|
| **Major Watercourses** | | | | | | | | | | |
| WX1 Burn of Hamnavoe | HU 49722 81310 | 1145m | Approximate Right Bank Height: 0.8m Approximate Left Bank Height: 0.8m Approximate Channel Width: 2.0m | 457.774ha | 8519.1l/s | 3.3m x 1.2m height precast portal bridge | A registration would be required because the structure is a bridge with no construction on the bed and less than 20m length of the banks would be affected. | Due to the size of the watercourse and its catchment, a portal bridge is recommended to disturb the watercourse as little as possible. Foundations and abutments can be constructed away from the banks of the watercourse, and the precast bridge can be installed with relatively little disturbance to the watercourse and any potential wildlife in the area compared to in-situ construction. | Avoidance of unnecessary vegetation clearance.<br><br>Only strip vegetation/ peat in the part of the Site to be worked on in the near future (taking a phased approach).<br><br>Use of peat protection measures for exposed peat such as geotextiles, mulching/binders/hydro-seeding, use of turf and surface roughening/benching.<br><br>Treatment and containment of polluted runoff by diversion drains, silt fences, fibre rolls, filter bunds and silt traps.<br><br>See Chapter 15: Hydrology and Hydrogeology for further information. |  <br>Upstream |
| WX2 Burn of Evrawater | HU 50401 81384 | 2048m | Approximate Right Bank Height:0.2m Approximate Left Bank Height:0.1m Approximate Channel Width:0.9m | 51.882ha | 1226.8l/s | 1.8m x 0.6m height box culvert | A simple licence would be required because the structure is a closed bottom culvert. | Due to the size of the watercourse and its catchment, a precast box culvert is recommended. This is the most economically and environmentally effective solution. A box culvert would be betterment to the existing ford crossing present at the site of the proposed crossing, for both traffic and for wildlife, providing a safe means of crossing the watercourse for both parties. | |  <br>Upstream |
| WX3 Unnamed Tributary of Burn of Kettlester | HU 50961 81621 | 2683m | Approximate Right Bank Height:0.7m Approximate Left Bank Height:0.7m Approximate Channel Width:2.7m | 1.043ha | 37.9l/s | 450mm diameter concrete pipe | A simple licence would be required because the structure is a closed bottom culvert. | Due to the size of the watercourse, a 450mm diameter culvert is recommended. This provides the best cost-effectiveness as well as limiting environmental impacts of installing a smaller pipe.<br>Pipe culvert will be betterment to existing ford crossing, for both traffic and for wildlife, providing a safe means of crossing the watercourse for both parties. | |  <br>Downstream |

| Table 2: Watercourse Crossing Summary Table | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Figure 3.13 Ref** | **Approximate NGR** | **Chainage** | **Watercourse Dimensions** | **Catchment Area** | **$Q_{200\ Flow}$** | **Crossing Type** | **CAR Authorisation Level** | **Justification for Works** | **Mitigation** | **Photograph** |
| Burn of Horsewater WX5 | HU 52249 81312 | 4386m | Approximate Right Bank Height:05m Approximate Left Bank Height:0.4m Approximate Channel Width:0.7m | 22.478ha | 582.7l/s | 1.0m x 0.6m height box culvert | A simple licence would be required because the structure is a closed bottom culvert. | Due to the size of the watercourse and its catchment, a precast box culvert is recommended. This is the most economically and environmentally effective solution. | |  Downstream |
| Unnamed Tributary of Burn of Hamnavoe WX6 | HU 50746 83017 | 2000m | Approximate Right Bank Height:0.5m Approximate Left Bank Height:0.4m Approximate Channel Width:0.6m | 24.414ha | 627.2l/s | 1.0m x 0.6m height box culvert | A simple licence would be required because the structure is a closed bottom culvert. | Due to the size of the watercourse and its catchment, a precast box culvert is recommended This is the most economically and environmentally effective solution.<br>Attempts to cross at the best point according to SEPA guidance have been made through the horizontal and vertical alignment of the access track. | |  Upstream |
| **Minor Watercourse** | | | | | | | | | | |
| Unnamed Tributary of Burn of Kettlester WX4 | HU 51013 81662 | 2748m | Approximate Right Bank Height:1.0m Approximate Left Bank Height:1.0m Approximate Channel Width:0.4m | 0.451ha | 18l/s | 450mm diameter concrete pipe | A simple licence would be required because the structure is a closed bottom culvert. | Due to the size of the watercourse, a 450mm diameter culvert is recommended. This provides the best cost-effectiveness as well as limiting environmental impacts of installing a smaller pipe.<br>Attempts to cross at the best point according to SEPA guidance have been made through the horizontal and vertical alignment of the access track. | Avoidance of unnecessary vegetation clearance.<br>Only strip vegetation/ soil/peat in the part of the Site to be worked on in the near future (taking a phased approach).<br>Use of soil protection measures for exposed soil such as geotextiles, mulching/binders/hydro-seeding, use of turf and surface roughening/benching.<br>Treatment and containment of polluted runoff by diversion drains, silt fences, fibre rolls, filter bunds and silt traps.<br>See Chapter 15: Hydrology and Hydrogeology for further information. |  Upstream |

| Wardell Armstrong | | Page 1 |
|---|---|---|
| City Quadrant<br>11 Waterloo Square<br>Newcastle upon Tyne NE1 4DP | Beaw Field Wind Farm<br>Run-Off Calculation<br>Crossing WX1 | |
| Date 06/10/2015<br>File | Designed by JH<br>Checked by SM | |
| XP Solutions | Source Control 2014.1.1 | |

## IH 124 Mean Annual Flood

Input

| | | | |
|---|---|---|---|
| Return Period (years) | 200 | Soil | 0.450 |
| Area (ha) | 457.775 | Urban | 0.750 |
| SAAR (mm) | 800 | Region Number | Region 1 |

**Results l/s**

| | |
|---|---|
| QBAR Rural | 1842.9 |
| QBAR Urban | 4718.1 |
| Q200 years | 8519.1 |
| Q1 year | 4010.4 |
| Q2 years | 4752.1 |
| Q5 years | 5888.2 |
| Q10 years | 6480.8 |
| Q20 years | 6978.1 |
| Q25 years | 7106.4 |
| Q30 years | 7208.1 |
| Q50 years | 7523.5 |
| Q100 years | 8082.5 |
| Q200 years | 8519.1 |
| Q250 years | 8662.5 |
| Q1000 years | 9564.2 |

## IH 124 Mean Annual Flood

Input

| | | | |
|---|---|---|---|
| Return Period (years) | 200 | Soil | 0.450 |
| Area (ha) | 51.882 | Urban | 0.750 |
| SAAR (mm) | 800 | Region Number | Region 1 |

| **Results** | **l/s** |
|---|---|
| QBAR Rural | 265.4 |
| QBAR Urban | 679.4 |
| Q200 years | 1226.8 |
| Q1 year | 577.5 |
| Q2 years | 684.3 |
| Q5 years | 847.9 |
| Q10 years | 933.3 |
| Q20 years | 1004.9 |
| Q25 years | 1023.4 |
| Q30 years | 1038.0 |
| Q50 years | 1083.4 |
| Q100 years | 1163.9 |
| Q200 years | 1226.8 |
| Q250 years | 1247.5 |
| Q1000 years | 1377.3 |

## IH 124 Mean Annual Flood

Input

| | | | |
|---|---|---|---|
| Return Period (years) | 200 | Soil | 0.450 |
| Area (ha) | 1.043 | Urban | 0.750 |
| SAAR (mm) | 800 | Region Number | Region 1 |

**Results l/s**

| | |
|---|---|
| QBAR Rural | 8.2 |
| QBAR Urban | 21.0 |
| Q200 years | 37.9 |
| Q1 year | 17.8 |
| Q2 years | 21.1 |
| Q5 years | 26.2 |
| Q10 years | 28.8 |
| Q20 years | 31.0 |
| Q25 years | 31.6 |
| Q30 years | 32.1 |
| Q50 years | 33.5 |
| Q100 years | 36.0 |
| Q200 years | 37.9 |
| Q250 years | 38.5 |
| Q1000 years | 42.6 |

Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required area. The ICP SUDS tab will do this automatically.

## IH 124 Mean Annual Flood

Input

| | | | |
|---|---|---|---|
| Return Period (years) | 200 | Soil | 0.450 |
| Area (ha) | 0.451 | Urban | 0.750 |
| SAAR (mm) | 800 | Region Number | Region 1 |

**Results l/s**

| | |
|---|---|
| QBAR Rural | 3.9 |
| QBAR Urban | 10.0 |
| Q200 years | 18.0 |
| Q1 year | 8.5 |
| Q2 years | 10.0 |
| Q5 years | 12.4 |
| Q10 years | 13.7 |
| Q20 years | 14.7 |
| Q25 years | 15.0 |
| Q30 years | 15.2 |
| Q50 years | 15.9 |
| Q100 years | 17.1 |
| Q200 years | 18.0 |
| Q250 years | 18.3 |
| Q1000 years | 20.2 |

Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required area. The ICP SUDS tab will do this automatically.

## IH 124 Mean Annual Flood

Input

| | | | |
|---|---|---|---|
| Return Period (years) | 200 | Soil | 0.450 |
| Area (ha) | 22.478 | Urban | 0.750 |
| SAAR (mm) | 800 | Region Number | Region 1 |

**Results l/s**

| | |
|---|---|
| QBAR Rural | 126.1 |
| QBAR Urban | 322.7 |
| Q200 years | 582.7 |
| Q1 year | 274.3 |
| Q2 years | 325.1 |
| Q5 years | 402.8 |
| Q10 years | 443.3 |
| Q20 years | 477.3 |
| Q25 years | 486.1 |
| Q30 years | 493.1 |
| Q50 years | 514.6 |
| Q100 years | 552.9 |
| Q200 years | 582.7 |
| Q250 years | 592.6 |
| Q1000 years | 654.2 |

Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required area. The ICP SUDS tab will do this automatically.

## IH 124 Mean Annual Flood

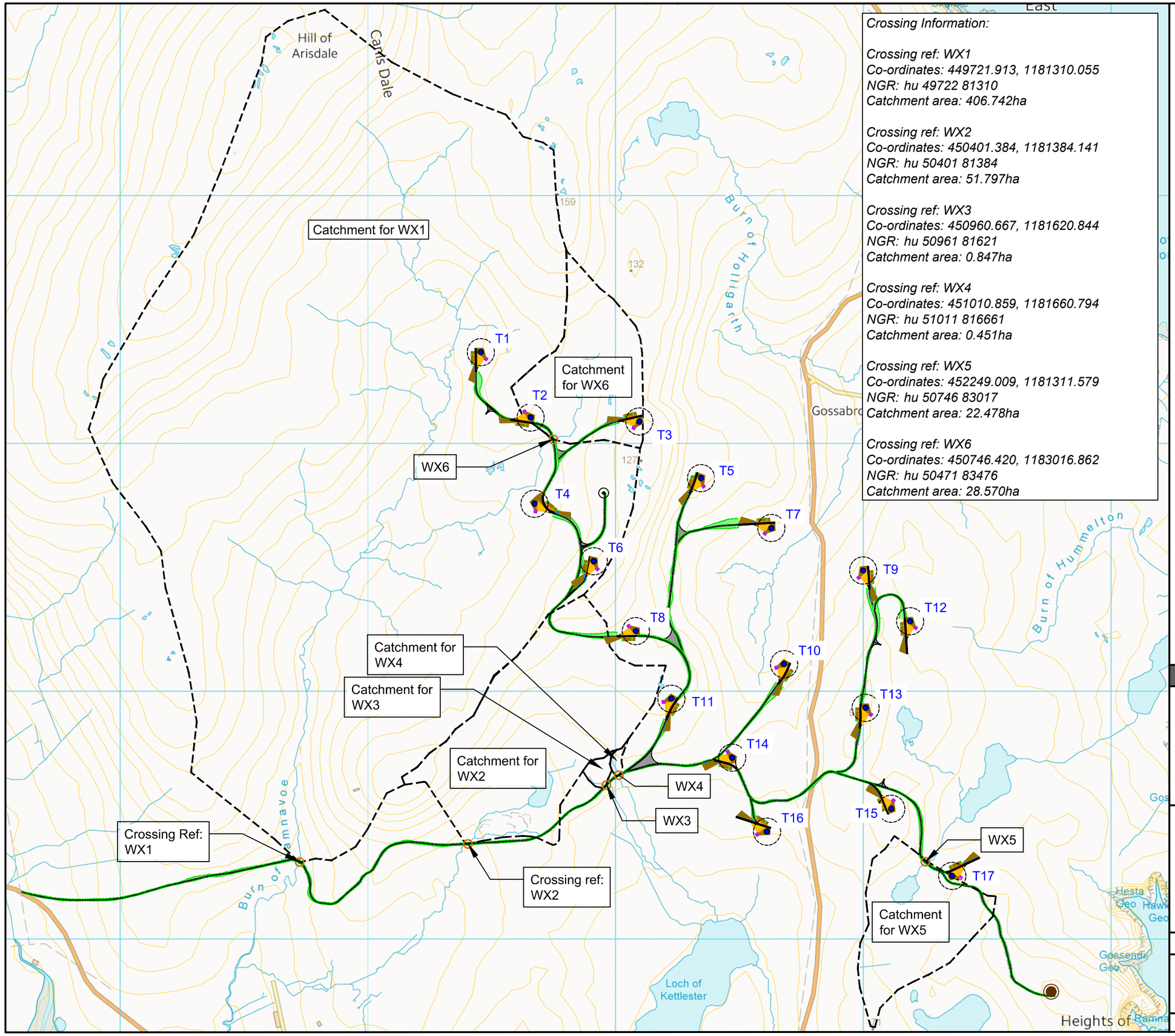
Input

| | | | |
|---|---|---|---|
| Return Period (years) | 200 | Soil | 0.450 |
| Area (ha) | 24.414 | Urban | 0.750 |
| SAAR (mm) | 800 | Region Number | Region 1 |

**Results l/s**

| | |
|---|---|
| QBAR Rural | 135.7 |
| QBAR Urban | 347.4 |
| Q200 years | 627.2 |
| Q1 year | 295.3 |
| Q2 years | 349.9 |
| Q5 years | 433.5 |
| Q10 years | 477.1 |
| Q20 years | 513.8 |
| Q25 years | 523.2 |
| Q30 years | 530.7 |
| Q50 years | 553.9 |
| Q100 years | 595.1 |
| Q200 years | 627.2 |
| Q250 years | 637.8 |
| Q1000 years | 704.2 |

Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required area. The ICP SUDS tab will do this automatically.




*Crossing Information:*

*Crossing ref: WX1*
*Co-ordinates: 449721.913, 1181310.055*
*NGR: hu 49722 81310*
*Catchment area: 406.742ha*

*Crossing ref: WX2*
*Co-ordinates: 450401.384, 1181384.141*
*NGR: hu 50401 81384*
*Catchment area: 51.797ha*

*Crossing ref: WX3*
*Co-ordinates: 450960.667, 1181620.844*
*NGR: hu 50961 81621*
*Catchment area: 0.847ha*

*Crossing ref: WX4*
*Co-ordinates: 451010.859, 1181660.794*
*NGR: hu 51011 816661*
*Catchment area: 0.451ha*

*Crossing ref: WX5*
*Co-ordinates: 452249.009, 1181311.579*
*NGR: hu 50746 83017*
*Catchment area: 22.478ha*

*Crossing ref: WX6*
*Co-ordinates: 450746.420, 1183016.862*
*NGR: hu 50471 83476*
*Catchment area: 28.570ha*

Key

- Location of Turbines T1 to T17 and 104m Wind Turbine Rotor Diameter
- Watercourse crossing
- Proposed Access Track (with earthworks)
- Hardstanding and Area Clear of Obstruction for Crane Operation
- Anemometry Mast
- Radio Communications Tower
- Contour (10m)
- Contributing Catchment Area

Notes:

All catchment areas estimated based on 5m lidar data and OS Map.

**Beaw Field Wind Farm**

N

PEEL

TITLE:

*Watercourse Crossing Catchment Areas*

*Fig A3.1.1*

Scale: 1:15,000 @ A3 Date:28/01/2016



Ref: