Dunkellin River and Aggard Stream Flood Relief Scheme

Response to Department of Arts, Heritage and the Gaeltacht – Development Applications Unit

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INTRODUCTION

RPS was commissioned by Galway County Council in 2011 to prepare an Environmental Impact Statement (EIS) for the Dunkellin River and Aggard Stream Flood Relief Scheme, hereafter called the "scheme", in south County Galway. The Dunkellin River and the Aggard Stream form part of the Dunkellin Drainage District which was constructed in or around 1857 and Galway County Council has a statutory maintenance responsibility for these works.

The scheme was submitted to An Bord Pleanála (ABP) in October 2014 for planning approval in line with Section 175 of the Planning and Development Act 2000, as amended. In February 2015, the Board, in accordance with Section 175(5)(a) of the Planning and Development Act, 2000, as amended, requested further information in relation to the proposed development.

Item 7 of the Board's letter stated that, "*The applicant is invited to respond in detail to the written submissions made by parties including local residents, prescribed bodies and others.*"

The purpose of this document is to provide a response to the issues raised by the Development Applications Unit of the Department of Arts, Heritage and the Gaeltacht in their submission.

1. ITEM 1 - PROJECT DETAILS

1.1 The project includes the following elements where the locations and works areas involved are not shown or are unclear:

a. Site Compounds (four in total) and all works areas required

Response

Section 7.1 of the Works Description Report included in the EIS, Volume 3, Appendix A, envisages that the construction of the proposed flood relief works will require site compounds at the following locations;

1. Killeely Beg Bridge,
2. Dunkellin Bridge,
3. Rinn Bridge, and
4. Craughwell Village.

As noted, it is envisaged that there will be four main site compounds, varying in size to reflect the extent of works being undertaken at each location, which include short term staff welfare facilities and plant & materials storage for the proposed works. The final location of these compounds is unknown at the present time and will be confirmed by the Works Contractor following direct Contractor liaison with each relevant landowner. It is envisaged that these compounds will be located, a minimum of 50m to 100m from the Dunkellin River, as follows:

1. **Site compound at Killeely Beg Bridge.** It is envisaged that this compound will be located on lands to the north of the channel and adjacent to Killeely Beg Bridge. These lands are coloured green on Drawing No. 6408-2203 Rev G at cross section “DK33”. This area is noted, in Chapter 10 of the EIS, as being “improved agricultural grassland”.
2. **Site compound at Dunkellin Bridge.** It is envisaged that this compound will be located on lands adjacent to Dunkellin Bridge. These lands are coloured green on Drawing No. 6408-2203 Rev G at cross section “DK30”. This area is noted, in Chapter 10 of the EIS, as being “improved agricultural grassland”.
3. **Site compound at Rinn Bridge.** It is envisaged that this compound will be located on lands to the east of Rinn Bridge. These lands are coloured green on Drawing No. 6408-2204 Rev G at cross section “DK25”. This area is noted, in Chapter 10 of the EIS, as being “improved agricultural grassland”.
4. **Site compound at Craughwell Village.** It is envisaged that this compound may be placed at a number of locations in the village of Craughwell. A number of the possible locations are shown as a red circle in the following aerial view of the village. These are noted, in Chapter 10 of the EIS, as being “improved agricultural grassland”, “scrub” and “Buildings and Artificial Surfaces”. The potential locations of the site compounds at Craughwell are provided in **Figure 1.1** below.

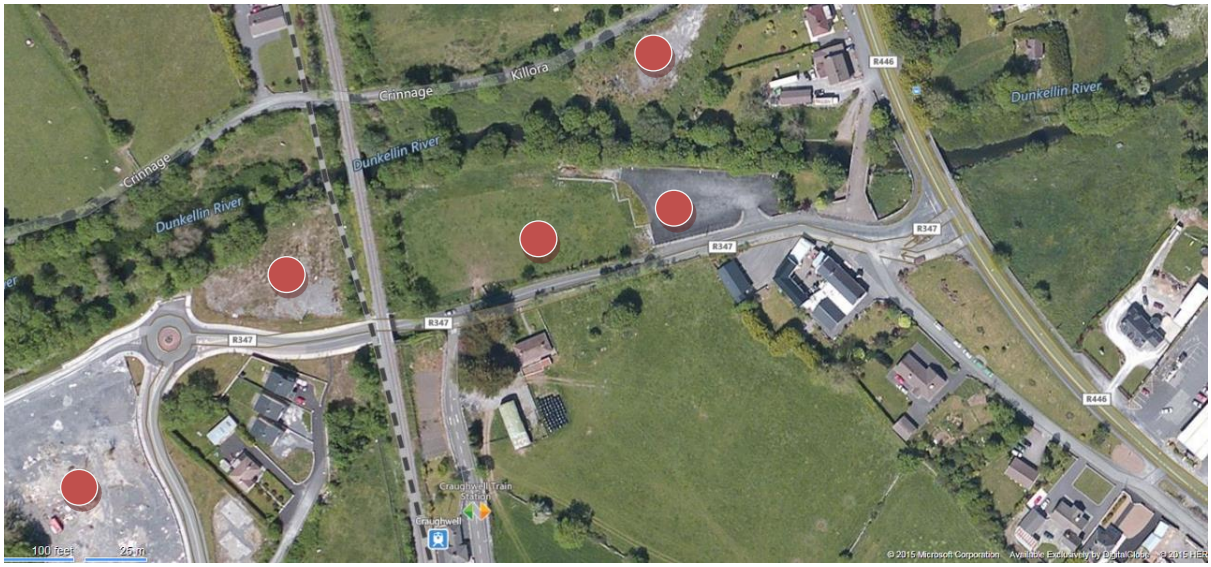


Figure 1.1 - Potential Site Compounds Locations at Craughwell

Any surface topsoil within the proposed site compounds will be removed and temporarily stored for reinstatement of all lands once work is completed. Following clearing of topsoil from the compound area it is envisaged that the working surface will be formed from imported clean stone laid on a temporary geomembrane.

The site compounds will not be located within or adjacent to sensitive karst features. All karst features within the study area and its environs are shown in the **EIS Figure 9.5** and **NIS Figure 5.5** and presented in **EIS Table 10.13** and **NIS Table 5.2**. The karst features have been identified by the GSI and supplementary karst mapping has been conducted during the hydrogeologist site walk over completed in April 2015 and the geophysical survey completed in June 2015. A number of discrete karst features such as springs, areas of weathered rock (epikarst) and some deeper sediment filled fissures were identified during these surveys (see **Figures 4.1** in this response).

The exact location and extent of the site compounds will also be agreed between Galway County Council, their engineering and ecological representatives and the Contractor's appointed ecologist.

b. Spoil disposal areas (noting mapped lands and Table 6.1: "estimated volumes of excavated materials" and the column of areas available for spreading spoil, and any inconsistencies between mapped areas in project documentation)

Response

The extent of envisaged soil disposal areas are discussed in Section 6 of the Works Description Report (EIS Volume 3, Appendix A). The approximate location of lands required for temporary storage is shown in Section 6 of the Works Description Report. See Figures 6-3, 6-4, 6-5, 6-6, and 6-7 of the Works Description Report (EIS, Volume 3, Appendix A).

Temporary storage or excavated materials for reuse as part of the river enhancement works, particularly in the village of Craughwell is also discussed in Section 3.7 and soil disposal areas are discussed in Section 6 of the Works Description Report (EIS, Volume 3, Appendix A).

c. Areas for temporary storage, including of river materials for subsequent replacement.

Response

The approximate location of lands required for temporary storage is shown in Section 6 of the Works Description Report (EIS, Volume 3, Appendix A). See Figures 6-3, 6-4, 6-5, 6-6, and 6-7 of the Works Description Report. Temporary storage or excavated materials for reuse as part of the river enhancement works, particularly in the village of Craughwell is also discussed in Section 3.7 of the Works Description Report (EIS, Volume 3, Appendix A).

d. Access routes for machinery and equipment, including temporary access during construction

Response

Section 7.1 of the Works Description Report (EIS, Volume 3, Appendix A) discusses site access routes for machinery and equipment.

The technical description of the proposed scheme provides an outline detail of the envisaged access points to the proposed Works Areas and these are summarised as follows and detailed on the relevant Drawings accompanying the EIS.

- Access Point No. 1 (Refer to Drawing No. 6408-2202) - Provision of an access point into the Dunkellin River downstream of Killeely Beg Bridge.
- Access Point No. 2 (Refer to Drawing No. 6408-2202) - Provision of an access point into the Dunkellin River for works downstream of Killeely Beg Bridge to Kilcolgan Bridge.
- Access Point No. 3 (Refer to Drawing No. 6408-2202) - Provision of an access point into the Dunkellin River for works upstream of Killeely Beg Bridge to Dunkellin Bridge.
- Access Point No. 4 (Refer to Drawing No. 6408-2203) - Provision of an access point into the Dunkellin River for works downstream of the Dunkellin Beg Bridge to Killeely Beg Bridge.
- Access Point No. 5 (Refer to Drawing No. 6408-2203) - Provision of an access point into the Dunkellin River for works upstream of the Dunkellin Beg Bridge.
- Access Points No. 6 and 7 (Refer to Drawing No. 6408-2204) - Provision of an access point into the Dunkellin River for works at Rinn Bridge.
- Access Point No. 8 (Refer to Drawing No. 6408-2208) - Provision of an access point into the Dunkellin River for works downstream of the Railway Bridge at Craughwell Village.
- Access Point No. 9 (Refer to Drawing No. 6408-2208) - Provision of an access point into the Dunkellin River for works upstream of the Railway Bridge in Craughwell Village.
- Access Point No. 10 (Refer to Drawing No. 6408-2208) - Provision of an access point into the Dunkellin River for works upstream of the R446 at Craughwell Village.

e. Detailed site investigations, including methods, equipment involved and locations

Response

Site investigation works were carried out in August and October 2014 to facilitate the future design of the scheme. The SI location drawings are included in **Appendix A** to this response. These site investigation works included a geophysical, p-wave seismic refraction, survey to prove the top of bedrock. The geophysical survey has been completed and is provided in **Appendix B** to this response. The survey included a seismic, conductivity and EM61 resistivity surveys. The conductivity and resistivity surveys were completed on areas mapped as having a higher potential for karst features based on the hydrogeologist walkover. The survey identified a number of karst anomalies at surface and at greater depths. These anomalies have been reviewed by the hydrogeologist in the context of the site walkover and other site investigation areas. Additional karst features are shown in **Figure 4.1** in this response.

f. River enhancement works

Response

Section 3.7 of the Works description report (EIS, Volume 3, Appendix A) which discusses the River Enhancement Programme. The proposed locations of river enhancement works are shown in Figure 3.14 of the Works Description Report (EIS, Volume 3, Appendix A). The nature of these works will be finalised at detailed design stage.

During the NIS consultation phase (see Section 1.2, p.4, of the NIS) Inland Fisheries Ireland (IFI) identified use of the OPW's Environment River Enhancement Programme (EREP) methods in which the natural features of the riparian and instream environment would be protected as far as possible. As outlined in Section 4.3.2 (Environmental River Enhancement Programme), p.23, of the NIS, the initial River Enhancement Programme proposed by the IFI was included in the NIS, Appendix A, Appendix No. 3 (first section). This programme was based on general good practice recommendations having knowledge of the study area concerned and was subject to a detailed design stage. Further to this a detailed river enhancement programme was proposed by the IFI which took into consideration the detailed design measures being proposed as part of the scheme. Details on these enhancement measures and how they are to be incorporated into the proposed flood relief scheme are set out in the NIS, Appendix A, Appendix No. 3 (second section).

g. Lands for compensatory tree planting

Response

Section 11.5.2, p.193, of the EIS, Volume 2, provides the following commentary on tree planting to offset the loss of tree felling and removal as part of the flood relief works.

"Riparian Vegetation Enhancement - Additional broadleaved tree planting and, perhaps fencing, of the right bank riparian corridor is recommended to offset loss of riparian vegetation (and ecological function provided by riparian cover) on the left bank."

2. ITEM 2 - OTHER PLANS AND PROJECTS

2.1 ***The Board is advised that potential cumulative or in combination effects may arise from the N18/M17 road schemes which is due to commence construction and intersects the Dunkellin along part of the current scheme. Depending on scheduling, this could lead to increased silt release and contamination of surface waters, increased disturbance of species, and increased combined habitat loss and fragmentation of species. Other plans and projects requiring consideration include: past flood relief measures and drainage maintenance, repair/replacement of the N18 Kilcolgan Bridge, infilling of the floodplain at Kilcolgan, Craughwell local area plan, CFRAMS, Craughwell wastewater treatment (new plant previously proposed), water supply pipe crossing of the Aggard near Craughwell, and railway line improvements (Ardrahan to Craughwell).***

Response: All

It is our understanding that there are nine key queries in this section. These are answered sequentially as follows:

1. M17/N18

Response

The potential in-combination effects and cumulative effects of the of the M17/N18 road scheme is considered in the EIS, Volume 2, Section 18.2, pp.327-329, and the NIS, Table 7.1, pp.68-77. An extract of the text from Table 7.1 is provided below.

> *"The proposed M18 route corridor crosses the Dunkellin River between the Rinn Bridge and the Dunkellin Bridge. As the works will be carried out downstream of Rahasane Turlough, no impacts in the form of water pollution are expected on the SAC/SPA. At a distance of approximately 1.2km, it is highly unlikely that these works will have a cumulative impact on Rahasane Turlough SAC in terms of visual impact or disturbance to birds. It is possible that the works will have a cumulative impact on the Galway Bay SAC and Inner Galway Bay SPA in the form of release of contaminants to the aquatic environment, however mitigation measures have been developed for this scheme and therefore this impact is not considered to be significant.*
>
> *The construction of the N18 embankment at this location will result in the infill of approximately 1.5ha of floodplain which will reduce the extent of Dunkellin Turlough. The M18 EIS identifies that the flooding at Dunkellin Turlough is also linked to the Rahasane SAC and SPA. Appendix 2.5 of the EIS states that: 'The flooding occurs when the flow rate of the river and of groundwater exceeds the capacity of the channel and the capacity of the underlying Weathered Limestone and Fractured Limestone aquifer to transmit the water. Groundwater and surface water in the system then backs-up until water levels are sufficient to inundate the flood plain of the Dunkellin River and the Rahasane Turlough.*
>
> *Dunkellin Turlough was identified in the EIS for M18 as being of low importance for birds and is unlikely to support significant numbers of the populations of birds which winter at Rahasane Turlough.*

However, there is potential for in-combination impacts to species which might migrate between Rahasane Turlough SPA and Inner Galway Bay SPA. If construction of these schemes were to occur concurrently or consecutively, disturbance impacts could apply to both the Rahasane Turlough and the Inner Galway SPAs if there is a flightline between the two sites which is likely to follow the Dunkellin River. The bird species that could potentially fly between the two include Wigeon, Golden Plover, Black-tailed Godwits and Lapwing. All construction works with the potential to cause disturbance impacts will be restricted to the Dunkellin River downstream of the Turlough and concentrated in the area upstream of Dunkellin Bridge where it is proposed that the M18 cross this river.

It is stated in the EIS for this scheme that construction periods and techniques will be agreed with the IFI to ensure no damage to fish stocks occurs. It is also stated in relation to fisheries protection that a pollution-prevention plan should be drafted and a designated member of the construction team assigned to monitor the pollution prevention / control measures that are operational. This person should liaise with interested third parties (IFI, Angling Clubs etc.). It is likely that construction works will commence on the M18 prior to the Dunkellin FRS, therefore cumulative impacts on bird species migrating between Rahasane Turlough SAC and Inner Galway Bay SAC should be minimised.

The implementation of a pollution prevention plan in agreement within Inland Fisheries Ireland is considered to be adequate in order to prevent suspended sediments and other pollutants entering the Dunkellin River as a result of the M18 scheme and therefore in-combination impacts on water quality, and consequently on Galway Bay SAC and Inner Galway SPA, as a result of the two projects are considered unlikely."

Robust and effective mitigation measures have been prescribed for the proposed Flood Relief Scheme (FRS). A draft construction management plan (CMP) has been prepared addressing details of construction methods and all recommendations for mitigation presented in the EIS and the NIS (see Appendix C to this response). Assuming that appropriate measures are put in place for the road scheme, we predict that in-combination effects caused by the N18/M17 road scheme will be unlikely.

2. Past flood relief measures and drainage maintenance

Response

Past flood relief measures were considered as part of the scheme. EIS, Volume 2, Appendix A Works Description report, Sections 1.2 and 1.3 discusses the Arterial Drainage Scheme completed during the 1850s.

3. Repair/replacement of the N18 Kilcolgan Bridge

Response

There are no proposals to replace or modify the N18 Kilcolgan Bridge as part of this scheme. Table 6.1, pp.27-28, of the EIS document presents a summary of the Proposed Flood Alleviation Measures for the Dunkellin River and Aggard Stream Flood Relief Scheme.

4. Infilling of the floodplain at Kilcolgan

Response

There are no proposals to infill the floodplain at Kilcolgan as part of this scheme. It is however proposed to undertake landspreading within those areas fringing the Dunkellin River, between Kilcolgan Bridge and Kileely Beg Bridge. Landspreading efforts will be restricted to areas that support low ecological or negligible biodiversity value, predominantly areas of improved agricultural grassland (GA1).

5. Craughwell LAP

Response

The Craughwell Local Area Plan (2009-2015) was considered as part of this scheme. The NIS Table 7.1, pp.68-77, considers Potential In-combination Effects of Other Plans and Projects, one of which is the Craughwell Local Area Plan (2009-2015).

6. CFRAMS

Response

The Catchment Flood Risk Assessment and Management (CFRAM) study did not identify the Dunkellin River as an Area for Further Assessment (AFA).

7. Craughwell WWTP (proposed)

Response

The proposed Craughwell WWTP has not proceeded and will be the subject of further studies and planning procedures if such a scheme is to proceed. Considering potential impacts, cumulative or otherwise, associated with a proposed development that has not been through the planning process was outside of the scope of the assessments undertaken.

8. Water supply pipe crossing the Aggard near Craughwell

Response

The scheme will not impact on the existing water supply pipelines.

9. Railway line improvements (Ardrahan to Craughwell)

Response

Railway line improvements between Ardrahan and Craughwell were completed in 2009, including the railway station at Ardrahan, agricultural access and over bridges. None of the works were located within or immediately adjacent to European Sites. However, Ardrahan railway station is within 500m of Ardrahan Grassland SAC and the railway line crosses the Aggard Stream, which is a tributary of the Dunkellin River and flows into Rashane Turlough SAC. No significant effects on the proximal European sites have been documented from these works. Therefore no in combination effects are likely from this project and the Dunkellin FRS.

3. ITEM 3 - NIS AND EUROPEAN SITES

3.1 In particular, the department notes that the scientific analysis to support the conclusion that the hydrological regime of the turlough will not be affected by the scheme during construction is not presented in the NIS Table 8.2; the effects of the operational stage of the scheme appear not to have been considered in the NIS. The scheme will be altering flow rates and water volumes entering the turlough during flood conditions, as well as altering discharge rates through the provision of new flood eyes downstream of the turlough.

Response

Table 8.2, pp.81-82, of the Natura Impact Statement (NIS) addresses potential impacts associated with the project's construction phase.

Section 8.2.2, pp.85-90, considers potential impacts to Natura 2000 sites during the operational phase, longterm. Table 8.4, p.86-87, considers Potential Impacts of Change in Flooding Regime on Rahasane Turlough SAC Targets[1] while Table 8.5, p.89, considers Potential Impacts of Increased Flow/Volume of Dunkellin River on Galway Bay Complex SAC Targets. Both tables specifically address potential impacts to these Natura 2000 sites during the project's operational phase in relation to changes in flooding regime for Rahasane turlough and increased flow / volume on the Dunkellin River to Galway Bay.

Potential impacts to Rahasane Turlough SPA are addressed as follows:

"Operational impacts which may affect bird species within the SPA include changes in hydroperiod and alteration of turlough habitat which bird species depend on. Changes in water depths may alter usage by different species; e.g. diving duck numbers may decline if standing water is too shallow. These may be replaced by shallow feeding species such as dabbling ducks.

*If there are no changes in hydroperiod or level of flooding at the lake then there will be no impacts on the bird species listed as qualifying interests of Rahasane Turlough SAC. The main potential impact during operation is if there is a change in the hydrology which has a knock on effect on the change in the habitats within the turlough. The model report (**Appendix A**) states that there won't be any alteration to the hydrological regime, therefore there will be no subsequent change to habitats and their usage by bird species."*

Scientific analysis on the Hydrological regime of Rahasane turlough

Potential impacts on the hydrological regime of Rahasane turlough, as indicated by changes to its vegetation community is presented within the below text.

Work around the turloughs in South Galway (Peach et al., 1997; Goodwillie in Otte, 2003) suggested that the length of time the vegetation was flooded and the date of release from floods in the spring were the most important factors in controlling the vegetation of turloughs. This seemed likely to be because many plants are susceptible to a lack of oxygen in the soil which occurs after a few weeks of

[1] The attributes and targets extrapolated from NPWS (2013) Galway Bay Complex SAC (000268) Conservation Objectives Supporting Document - Turlough Habitats

flooding. The tolerant ones grow in the middle of the basin and the less tolerant one towards the margins. Subsequently in a more systematic Ph.D. study of turlough vegetation Sharkey (2012) summarised that '*a wide range of environmental and management factors were found to affect the species composition of turlough vegetation. Soil type, nutrient status, grazing and hydrology were all found to affect turlough vegetation, and the conditions associated with each vegetation community were identified. Duration of flooding and nutrient status (notably phosphorus) were found to be the most important drivers of turlough vegetation*'.

The pattern of flooding is highly variable from year to year in a turlough and the actual top edge of the turlough zone is in a continual state of change; either the plant communities are spreading towards the centre in response to a dry year or are recovering from the effects in a wet year with a longer flooding period. It is safe to say that no two years are the same in their effects on plant life in the turlough basin and that the edge vegetation which may only be flooded for a week or two is in constant change. This makes the designation of a top level in a basin that does not overflow inherently difficult. There is in fact, no strict edge, only a level at which a few days of flooding does not have an appreciable effect on the species composition of the vegetation. The comparison of a turlough edge with that of a floodplain is apt and would be called an ecotone, a zone of interaction between wet and dry communities.

The black moss *Cinclidotus* is often said to indicate flooding but it grows also in the wave splash zone so may reach 30cm higher than the water level on the exposed side of the basin. Woody species and the bark-dwelling lichens on them were reckoned to be the best indicators of top flood height around Coole Lough (Peach et al., 1997) but cannot be much used at Rahasane because of the high level of grazing pressure and the absence of woodland. Associated with this boundary was the appearance of yellow mosses, e.g. *Eurhynchium, Brachythecium, Holmalothecium* and, in grassland creeping thistle *Cirsium arvense*, wild thyme *Thymus polytrichus* and bulbous buttercup *Ranunculus bulbosus*. It was this level that was chosen at Rahasane and was found to be 16.5m O.D. on two sides of the basin, during a site survey on Thursday 5th April 2012, when Mr. Goodwillie was accompanied by a topographical surveyor and members of the ecological and hydrological team. The two areas identified include the following;

- Area 1: Killeeneenmore (M46891966) where the field wall showed an edge in the higher plants, about 10cm below the last traces of *Cinclidotus* moss (maintained here by wavespray), and
- Area 2: The other site was on the southern side somewhat upstream, in Carrigeen East (M49081938, M49031927, M48961928). Here three levels were considered, one marking the transition of *Ranunculus repens/Galium palustre* to yellow moss, one at the base of lichen growth on exposed *Prunus spinosa* and one in a grazed field where a flood line nicely separated a *Festuca rubra* grassland from a damper version with *Phleum*.

Images 3.1 to 3.4 below show the locations used in this site visit to establish this upper flood level.

Image 3.1 - Killeeneenmore (Northern Part of Turlough)

Image 3.2 - Killeeneenmore (Northern Part of Turlough)

Image 3.3 - Carrigeen East (Southern Part of Turlough)

Image 3.4 - Carrigeen East (Southern Part of Turlough)

It was considered that this 'top' height of Rahasane turlough was essential to maintain so this was built into the final design of the project. All the ground out to 16.5m will therefore continue to be inundated. The inundation period must change to some extent in view of the fact that water speed through the catchment will be increased by 1% but the scale of the change will be analogous to a series of slightly drier years and, it is thought, will result in minimal changes to the vegetation of the

margins. Plant cover here does not have a particularly 'turlough' composition and similar stands are found in many seasonally damp locations in limestone country. There is no likelihood of changes to the typical turlough communities of deeper levels such as those containing rare or protected plants (In Rahasane these are mudwort *Limosella aquatica* (protected), turlough violet *Viola persicifolia*, needle spike rush *Eleocharis acicularis*, fat duckweed *Lemna gibba*, Northern yellow cress *Rorippa islandica*). These will continue to be inundated for similar periods as they are today and will continue to be used as before by wildfowl and other fauna.

Sharkey (2012) suggests that the mean duration of flooding for these upper levels is 50-90 days per year but this does not occur as a single period, more as a series of rises and falls in response to water levels in the basin. It should be pointed out that her experimental sites were all located in groundwater-fed basins so that a greater degree of fluctuation would be expected in a riverine site such as Rahasane in response to catchment rainfall. It was a general finding at Rahasane during surveys that the shoreline accumulation of debris, i.e. the 'high tide mark', was 10-20cms lower after winter 2014-15 than after 2013-14 which implies that the higher water level, if achieved at all in 2014-15, was fleeting.

The Targets to Maintain the Favourable Conservation Status of '3180 Turlough' at Rahasane Turlough SAC were extracted and adapted from Galway Bay SAC conservation objectives[2] in the NIS Section 3.1.6, pp.13-19, and are reproduced in **Table 3.1** below for clarity. Taking cognisance of the targets set for Vegetation Composition (area of vegetation communities) and typical species (invertebrates) maintenance is a critical factor and there can be no change other than natural processes. Therefore the maintenance of the hydrology to its current regime is critical to achieving these targets. The distribution of vegetation communities within Rahasane Turlough are provided in **Figure 3.1**.

Table 3.1 - Targets to Maintain the Favourable Conservation Status of '3180 Turlough' at Rahasane Turlough SAC

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable at c. ***203.3*** ha or increasing/changing subject to natural processes.	The upper limit of turlough habitat at Rahasane has been assessed by Goodwillie (2012) as being at 16.5 mOD. Maintenance of flood duration and extent at this level will maintain the turlough vegetation communities at Rahasane Turlough SAC.
Habitat distribution	Occurrence	No decline, subject to natural processes.	Turlough habitat is distributed throughout the two main basins, the main north basin and the smaller Rinn basin. Maintenance of turlough habitat over these areas will maintain habitat distribution.
Hydrological regime: flood duration, frequency, area, depth; permanently flooded area	Various	Appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat.	**Hydrological regime: groundwater contribution** Maintain appropriate groundwater contribution necessary for the natural functioning of the habitat. **Hydrological regime: flood duration** Maintain hydrological regime within current range of variation for the natural functioning of the habitat. The extent of turlough habitat at Rahasane has been assessed by Goodwillie (2012) as being at 16.5 mOD therefore flood duration levels at this altitude should be maintained. **Hydrological regime: flood frequency**

[2] NPWS (2013) Conservation Objectives: Galway Bay Complex SAC 000268. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

Attribute	Measure	Target	Notes
			Maintain current seasonal temporal patterns in flood frequency. **Hydrological regime: flood area** Maintain natural temporal pattern in flood area. **Hydrological regime: flood depth** Maintain natural temporal and spatial patterns in flood depths. **Hydrological regime: permanently flooded/wet areas** Maintain any areas of permanent or semi-permanent flooding or water-logging. The northern side of the main basin remains wet throughout the year which should be maintained.
Soil type: area	Hectares	Maintain variety, area and extent of soil types necessary to support current turlough vegetation and other biota.	The maintenance of geology, morphology and hydrology will maintain soil type. Grazing pressure or other farming management could alter soil type locally.
Soil nutrient status: nitrogen and phosphorous	N and P concentration in soil	Maintain nutrient status appropriate to soil types.	Changes in concentrations of supply of nutrients, through groundwater, surface water or land management practices, including channel improvement in the Aggard Stream, may alter the N and P concentration in turlough soil.
Physical structure: bare ground	Presence	No decline in wet bare ground, as appropriate.	Maintenance of flood duration and any trampling by grazers will maintain bare ground. The location may change in response to grazing.
Chemical processes: calcium carbonate deposition and concentration	CaCO3 deposition rate/soil concentration	Maintenance of appropriate $CaCO_3$ deposition rates and concentration in soil.	$CaCO_3$ deposition rates and concentration in soil may be affected by hydrological changes in the turlough and by drainage activities in the zone of contribution (groundwater catchment and surface water catchment). These will affect the CaCO3 concentration in the floodwater, or change biological communities, impacting the precipitation processes.
Water quality: nutrients; colour; phytoplankton; epiphyton	Various	Maintain appropriate water quality to support the natural structure and functioning of the habitat.	**Water quality: nutrients** Maintain average annual TP concentration of ≤10µg l-1 TP, or ≤20µg l-1 TP, as appropriate. **Water quality: colour** Maintain appropriate water colour. **Water quality: phytoplankton biomass** Maintain appropriate chlorophyll a concentrations as follows: Annual mean/maximum chlorophyll a concentration <8µg l-1/<25µg l-1 **Water quality: epiphyton biomass** Maintain trace/ absent epiphyton as algal mats (< 2% cover).
Active peat formation	Flood duration	Active peat formation, where appropriate.	There is no peat formation at Rahasane Turlough.

<table>
<tr><th>Attribute</th><th>Measure</th><th>Target</th><th>Notes</th></tr>
<tr><td>Vegetation composition: area of vegetation communities</td><td>Hectares</td><td>Maintain area of sensitive and high conservation value vegetation communities/units at each turlough.</td><td>The Turlough Vegetation Communities in accordance with the system developed by Goodwillie, 1992, identified in the Galway Bay Complex SAC Conservation Objectives backing document for Turloughs as being sensitive and positive indicator communities include 2A, 2B, 3A, 3B, 4B, 6A, 6B, 7B and 8E. However further consultation with Roger Goodwillie has suggested that the communities listed below might be more appropriately considered to be sensitive with regard to nutrient enrichment and hydrology of Rahasane Turlough.

<table><tr><th>Vegetation Community</th><th>Area (ha)</th></tr><tr><td>2B</td><td>10.2</td></tr><tr><td>3B</td><td>1.4</td></tr><tr><td>6A</td><td>25.0</td></tr><tr><td>9A</td><td>26.6</td></tr><tr><td>10A</td><td>11.4</td></tr><tr><td>10B</td><td>3.4</td></tr><tr><td>11B</td><td>14.25</td></tr></table></td></tr>
<tr><td>Vegetation composition: vegetation zonation</td><td>Distribution</td><td>Maintain vegetation zonation/mosaic characteristic of each turlough.</td><td>Zonation as per mapping carried out by Goodwillie (1992) to be maintained. 17 vegetation communities to be retained with the same general distribution throughout the site.</td></tr>
<tr><td>Vegetation structure: sward height</td><td>Centimetres</td><td>Maintain a variety of sward heights across each turlough.</td><td>Sward height is controlled by grazing. The current proposal will not significantly impact on sward height.</td></tr>
<tr><td>Typical species: terrestrial, wetland and aquatic plants, invertebrates, birds</td><td>Presence</td><td>Maintain typical species within Rahasane.</td><td>Typical species: terrestrial, wetland and aquatic plants
Typical species are identified by cross-referencing the species listed in Goodwillie (1992) with those listed in Table 3 and Table 4 of NPWS (2013).</td></tr>
<tr><td>Fringing habitats: area</td><td>Hectares</td><td>Maintain marginal fringing habitats that support turlough vegetation, invertebrate, mammal and/or bird populations.</td><td>Most areas outside of those habitats mapped by Goodwillie (1992) could potentially support vegetation, invertebrate, mammal and/or bird populations associated with the turlough. Therefore any changes in the other attributes listed in this table could lead to a decrease in area of fringing habitats.</td></tr>
<tr><td>Vegetation structure: turlough woodland</td><td>Species diversity and woodland structure</td><td>Maintain appropriate turlough woodland diversity and structure.</td><td>Goodwillie (1992) states that the actual area of flooded woodland is too small to map at Rahasane Turlough. An increase would add to the biodiversity of the site.</td></tr>
</table>

Figure 3.1 - Vegetation Communities, Transect Lines and 16.5 mO.D. Contour

To further investigate the 'ecologically critical turlough levels', a field visit was conducted on 10th June 2015 with Mr. Goodwillie and members of the RPS ecological team to identify further monitoring stations, in addition to the nine longitudinal transects identified in the EIS and NIS and to further validate the 16.5 mO.D. level. Three further transects were identified which were topographically surveyed on the 23rd June 2015.

From LiDAR mapping a 16.5 mO.D. contour map has been produced and shown on the Vegetation Communities Map (see **Figure 3.1**). From this figure it can be seen that the 16.5 mO.D. contour, largely charts the boundaries of the turlough edge vegetation, which was verified through topographical surveys and which further validates the ecologically critical water level of 16.5 mO.D. level.

The overflow, during summer, from the river into the northern part of the turlough which sustains much of the aquatic flora that is not in the main channel, occurs at 14.70 mO.D.

4. ITEM 4 - OTHER ECOLOGICAL ISSUES

a. Details of Otter surveys undertaken, including methodology, areas surveyed, survey dates, and findings.

Otter surveys were carried out between the 14th and 16th November, 2011. Otter slides and spraints were also recorded during the multidisciplinary surveys in 2011, 2014 and 2015 during the spring/summer months all signs of otter were recorded.

Otters are largely solitary, territorial and nocturnal animals and in many areas their distribution is scarce. They are rarely found far from water and tend to occupy linear home ranges along watercourses and coasts. They require suitable bankside vegetation as cover for their underground burrows termed 'holts' or above ground rest sites which are termed 'couches'. Otters mark their home ranges by depositing their droppings termed 'spraint', at distinct landmarks such as grassy mounds, large rocks or ledges under bridges. These favoured sites are known as seats and are usually found at important locations, e.g. access points to the water, good fishing grounds, etc.

The surveys were focused on the banks of rivers and streams and extended beyond the river bank to identify the source of the otter activity. Signs were searched for on the banks of rivers and streams during terrestrial surveys. Holts and signs were searched for in the banks of the rivers and islands within the watercourses during aquatic surveys.

It is highly likely that otter routinely utilise the Dunkellin River in addition to the lower reaches of the Aggard Stream near the confluence of both watercourses. Site walkover surveys of Rahasane Turlough in June 2015 confirmed the presence of otter scat on the southern turlough boundary wall. These remains predominantly supported white-clawed crayfish. The observations of otter activity within the study area are provided in the NIS, Section 6.2.1.1, p.56, and EIS Table 10.16, p.104, and updated in **Table 4.1** below to include the signs on the Aggard Stream.

Table 4.1 - Observations of Otter Activity within Study Area

Ref. on Drawings	Type of Sign	Location and Activity
OS1	Otter Slide & Spraint.	280m west of Craughwell Railway Bridge (M 50597, 19820) on southern bank of Dunkellin River.
OS2	Otter Spraint & Prints.	Carrigeen West, Rahasane Turlough southern basin (M 47706, 19402). Otter prints and signs recorded at edge of woodland.
OS3	Otter Slide & Spraint.	340m upstream of Killeely Beg Bridge (M 43484, 18438) on southern bank of river.
OS4	Spraint.	Otter spraint with crayfish remains on southern bank, 620m downstream of Killeely Beg Bridge (M 42580, 18691).
OS5	Spraint.	Otter spraint with crayfish remains on northern bank, 720m downstream of Killeely Beg Bridge (M 42469, 18685).
OS6	Prints and Spraint	Confluence of Aggard Stream and Dunkellin River

b. Likely effects on local Otter populations, particularly in view of the potential cumulative effects of the imminent commencement of construction of the N17/M18 road scheme

Response

Effects and impacts to local otter populations are considered in Chapter 10 of the EIS. Otter is listed as Ecological Receptor 6 in EIS Table 10.19, p.112-113, where direct and indirect impacts are considered in addition to the Ecological Significance of Impact in the absence of Avoidance or Mitigation Measures. Potential impacts to otter have been extracted and are presented in **Table 4.2** below.

Table 4.2 - Ecological Receptors Potentially Subject to Impacts from the Scheme (extract)

Ecological Receptors	Direct Effects of Proposed Works	Indirect Effects of Proposed Works	Ecological Significance of Impact in the Absence of Avoidance or Mitigation Measures
ER6: Otter Annex IV species (EU Habitats Directive) Otter (Lutra lutra) is the only species listed on Annex IV of the EU Habitats Directive while there are two non-aquatic species listed on Annex I of the EU Birds Directive which occur within the study area.	The proposed works will involve in stream works and the probable direct removal of riparian habitat used by otter. There is also the possibility for the removal and / or degradation of suitable foraging habitat as a result of the proposed works. Another direct impact is the land spreading or stockpiling of material removed from the Dunkellin River, which may directly impact on foraging or resting locations for otter. Any impacts on otter in this regard are likely to be Temporary Negative.	**Indirect** impacts include alteration of flow, interruption of food chains including removal of prey items and removal and degradation of suitable habitat for otter. Any impacts on otter in this regard are likely to be 'Temporary Negative'.	Without mitigation it is likely that there will be direct and indirect impacts on the otter population on the Dunkellin River. However these impacts are likely to be on a local scale and the population is highly likely to recover in the short term after any impacts. Therefore in the absence of avoidance or mitigation measures any impact on otter is likely to be 'Significant on a Local Level.

Cumulative impacts on otters from the imminent N17/ M18 road development are considered in greater detail in the NIS Table 7.1, pp.68-77.

c. Details of bat surveys undertaken, including methodology, areas surveyed, survey dates, and findings. It is noted that no results of bat surveys are reported in the main text of the EIS

Response

A bat suitability survey was completed for bridge structures and treeline habitats within the study area, which could potentially be used by roosting or foraging bats (see EIS, Volume 3, Appendix B.2). The findings of desktop analysis is provided in greater detail in **Section 10.4.9.4**.

Appendix B.2 of the EIS provides an assessment for all bridge structures and trees within the study area which could potentially be used by roosting or foraging bats. In addition, bridges within the study area found to be suitable for roosting bats include Killeely Bridge, Dunkellin Bridge and the Masonry Arch Pedestrian Bridge at Craughwell.

d. Likely effects on local bat populations, particularly in view of the cumulative loss and fragmentation of linear habitat, particularly treelines and hedgerow, and the impacts to structures that may support bat roosts

Response

Bats are considered as an Ecological Receptor potentially subjected to impacts from the scheme. Bats are considered under ER8c as a faunal species protected under the Irish Wildlife Acts potentially subject to impacts associated with the proposed flood relief scheme. Seven bat species have been recorded within or in the vicinity of the study area. The key locations of importance for bats for commuting and foraging within the proposed flood relief works area include water bodies, watercourses, woodlands, treelines and hedgerows. Additional habitats include areas of scrub and scattered trees. Older, mature trees in the area also offer roosting opportunities for bats. Some of these and indeed younger trees which have ivy cover may be used for roosting by bats on occasion. Older buildings and structures such as bridges offer potential for summer and winter roosting and underground structures have potential as hibernation roosts.

Furthermore, potential impacts on fauna, including bats were considered in greater detail in Table 10.20, pp.119-127, an extract from which is provided in **Table 4.3** below.

Table 4.3 - Characterisation of Ecological Receptors and Determination of Significance of Impacts

Ecological Receptors	Direct Effects of Proposed Works	Indirect Effects of Proposed Works	Ecological Significance of Impact in the Absence of Avoidance or Mitigation Measures
ER8: Faunal Species protected under the Irish Wildlife Acts. Species protected under Schedule 5 Wildlife Act 1976 (as amended), include Badger, Bat species, Hare, Stoat, Hedgehog. Therefore, ER8 has been subdivided to adequately assess each of these species separately.	The proposed works will involve instream works and the probable direct removal of habitat and possible mortality of individuals, for a number of Schedule 5 species. Direct impacts may also include removal of treelines and hedgerows which interrupts migratory routes for species in particular species such as bats and badgers. Removal of bankside material and landspreading or stockpiling may interfere with Badger Setts. Bats: The installation of flood eyes or bypass/over culverts at the Dunkellin Bridge and Rinn Bridge and the removal of mature trees at various locations in the study area could result in mortality of individual bats roosting at these bridges. There are likely to be mortalities of frog and smooth newt during the works in areas where riparian vegetation is to be removed and where sluggish waters are proposed for some silt removal.	Species protected under Schedule 5 of the Wildlife Act 1976 may be indirectly affected by the landspreading of material removed from the Dunkellin River, which may impact on breeding or resting locations. Species dependent on the Dunkellin River as a source of prey e.g. Daubenton's bat, will be impacted through interruption or degradation of current food chains. There are likely to be indirect impacts on aquatic and semi-aquatic species following the release of suspended sediment. Impacts on aquatic species are discussed in Chapter 11.	Without mitigation it is likely that there will be direct and indirect impacts on the faunal species protected under the Irish Wildlife Acts. In particular it is considered that bat species, frog and newt are the most likely to be impacted as a result of the proposed works. However these impacts are likely to be on a local scale and the population is highly likely to recover in the short term after any impacts. Therefore in the absence of avoidance or mitigation measures any impact on kingfisher is likely to be 'Significant on a Local Level.

e. Likely effects on White-clawed Crayfish, noting particularly the residual effects anticipated (EIS Section 11.6.5), and the need for licences from this Department to disturb the species and its habitat

Response

Chapter 11 of the EIS (Aquatic Ecology and Water Quality) provides comprehensive information on White-clawed crayfish that covers all aspects of distribution and abundance, assessments of habitat potential for crayfish, as well as potential impacts and mitigation. The EIS presented details of dedicated crayfish surveys and habitat assessments carried out over four days. The results were

reported in great detail in Section 11.3.8 (p166/167) and distribution of the species was illustrated on Figure 11.2 of the EIS. The species was found to be widespread throughout the catchment as shown in Figure 11.2. In addition, the habitat potential and survey presence/absence information was described in detail in Sections 11.3.2 to 11.3.4, pp.154-160, of the EIS, for each reach of the Craughwell and Dunkellin Rivers, Rahasane Turlough and Aggard Stream.

Potential impacts on White-clawed crayfish were clearly identified in Section 11.4, pp.173-188, of the EIS which identified the greatest potential for negative impact on this species in the reach of the Craughwell River between just upstream of Aggard confluence and Craughwell Village. This is where channel deepening over 950m is proposed, and is the only reach where invasive in-stream works would occur as part of the proposed scheme. There is a highly abundant crayfish population in this part of Craughwell River and, given the channel will be subject to dewatering over long reaches to facilitate works in the dry there would be potential, in the absence of appropriate mitigation, for a high level of direct impact (mortality) on crayfish.

The EIS then presented, in Section 11.5, a range of focused mitigations that apply to protect crayfish and their habitats. Section 11.5.6, pp.196-197, specifically addressed the mitigation requirements for the aforementioned channel deepening works, with a detailed explanation of how crayfish rescue and relocation during channel dewatering should be approached. This will be planned and supervised by an appropriately qualified ecologist with experience in crayfish rescue and relocation operations and any such operation will require consultation with, and appropriate licencing from, NPWS.

The residual impacts Section 11.6.5, p.200, of the EIS opened by explaining that some level of crayfish mortality can be expected during any channel dewatering operation owing to the impossible task of locating all tiny juveniles. However, the section went on to explain, with support from the scientific literature that crayfish will successfully recolonise a river reach so long as there is appropriate habitat.

Habitat reinstatement was addressed in detail through consultation with IFI's Senior Research Officer, fisheries biologist and Environmental River Enhancement Programme (EREP) designer, Dr Martin O'Grady. He prepared a report detailing the EREP approach that will be taken in the Craughwell River reach – the design of which will be implemented during the deepening works to ensure that upon re-watering there will be habitat in-situ. Appendix A of the EIS contains an official IFI report by Dr O'Grady: "An Ecological Evaluation of the likely impacts of a proposed Flood Relief Scheme on a reach of the Craughwell River at Craughwell, Co. Galway" which concluded that the design, as specified in this report, will address some of the current morphological and ecological deficiencies in the Craughwell River reach in question, and that the likely impact of the design and works would be long term and positive for fish and invertebrates (includes crayfish). Based on this assessment, made by Ireland's leading fisheries researcher with over 30 years' experience in designing and monitoring fisheries and river habitat enhancement projects, the freshwater ecology team was satisfied that there will be appropriate habitat reinstatement for successful crayfish recolonisation in the affected reach. The residual impact after a recolonisation period, was then stated in the EIS to be: "neutral or even positive and long-term or permanent for fish and aquatic invertebrates, including crayfish" (see p.201, Residual Habitat and EREP). The authors of the Aquatic Ecology Chapter consider that fully comprehensive baseline information, mitigation recommendations and residual impact explanations were provided with regards to White-clawed crayfish in relation to the proposed scheme and these can all be found upon careful reading of Chapter 11 of the EIS.

Any disturbance to crayfish habitat as part of the channel deepening measure of the proposed scheme will only be carried out following further consultation with NPWS and would take place with the appropriate Section 23 wildlife licence in place. The licencing procedure ensures that local and regional NPWS staff are contacted for their approval prior to works occurring, and specific licence conditions can be put in place at that time if necessary.

Fisheries monitoring, to include Crayfish is recommended to include, pre-works (baseline) and post-works (Year 1 and 3) surveys.

f. Likely cumulative effects on turloughs outside European sites, taking the N17/M18 road scheme in the area into account. It would assist if a map showing the location and extent of turloughs relative to scheme was provided

Response

All turloughs providing hydrological connectivity (potential or confirmed) to the scheme were listed and considered under EIS Section 10.4.7.1 – Turloughs, p.77. This section lists all Turloughs within the study area, whether designated as sites of Conservation Importance, Sites of National Importance or sites not designated under any part of nature conservation. In addition, all karst features within the study area and its environs are shown in Figure 9.5 and presented in Table 10.13 of the EIS. In addition, Table 10.19 and Table 10.20 of the EIS list two turlough sites being potentially subject to impacts from the scheme. These sites are not designated as European sites but are located within the projects zone of influence, i.e. Dunkellin Turlough and Castlegar Turlough. The cumulative impacts associated with the proposed scheme and those associated with the proposed N17/ M18 road scheme are discussed in the EIS Volume 2, Section 18.2 and NIS Table 7.1, and discussed under **Item 2** of this response.

From the EIS Volume 2 Section 10.7.1, the residual impact on Castlegar Turlough for the proposed works is discussed as follows:

> *'It proposed to remove 0.05 ha of Castlegar Turlough along its southern bank boundary where it crosses the Dunkellin River. Although the proposed works are considered to reduce surface water flooding (both extent and duration) at Castlegar Turlough they are not predicted to impact on the hydrogeology of the feature (see Chapter 9). To this end, the groundwater flooding of the turlough will be maintained at the same levels as this will be driven by recharge and up-stream hydraulic gradient acting on the bedrock fissures. Therefore, the flood waters contained within the turlough as a result will be more representative of groundwater (e.g. high calcium, harder water and more mineralised). This could influence an expansion of calcicole flora within those turlough sections that remain flooded*."

The construction of the N18 embankment for the bridge over the Dunkellin River will result in the infill of approximately 1.5ha of floodplain which will reduce the extent of Dunkellin Turlough.

A map of the turloughs outside European sites, karst features, the N17/N18 alignment and proposed scheme works are provided in **Figure 4.1**.

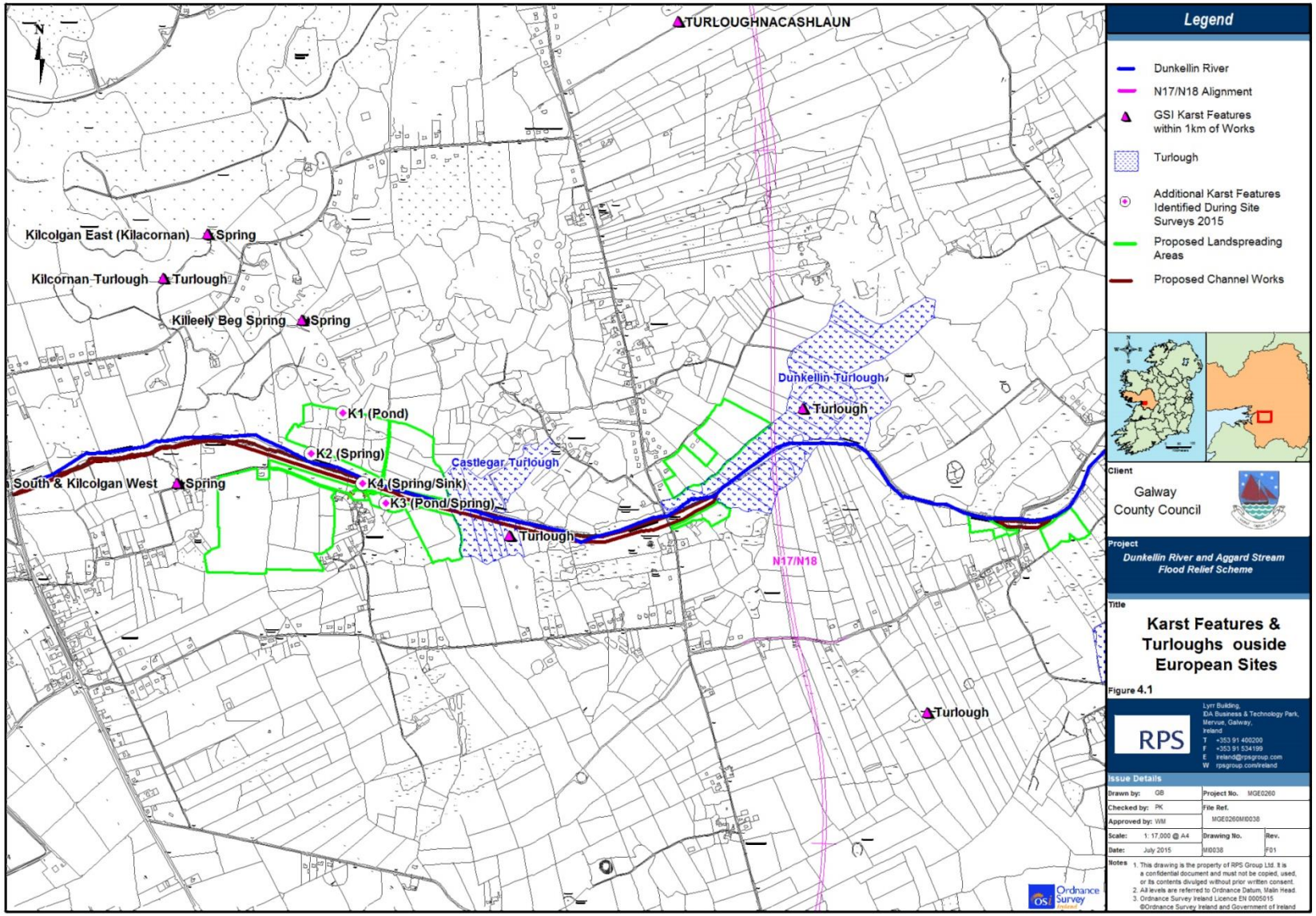


Figure 4.1 - Karst Features and Turloughs outside European Sites

g. The details of the "zone of influence" as used as the basis for the assessments undertaken, and how it was delimited. It would assist if a map showing the extent of the "zone of influence" was provided

Response

The zone of influence used to determine the assessments undertaken was delineated to include those Environmental Resources and Receptors located outside of the study area likely to be affected by the biophysical changes caused by the project. As part of the assessment, the ecological areas and features (i.e. the ecological receptors) likely to be affected by the biophysical changes caused by the project, however remote from the proposed Flood Relief Scheme (FRS), were assessed. To this end, the study area's Zone of Influence was chosen arbitrarily to allow for adequate flexibility to consider sensitive receptors that are connected to the study area via various avenues of ecological connectivity.

Section 10.2, p.56, of the EIS defines the study areas Zone of Influence as follows:

> *"The study area encompasses the course of the Aggard Stream from its source to its confluence with the Dunkellin River and the floodplain and surrounding lands of the Dunkellin River from just upstream of Craughwell Village to its discharge to Galway Bay just west of Kilcolgan.*
>
> *The Zone of Influence (ZOI) extends beyond the study area to include those Environmental Resources and Receptors outside the study area that is likely to be affected by the biophysical changes caused by the project. As part of the assessment, the ecological areas and features (i.e. the ecological receptors) likely to be affected by the biophysical changes caused by the project, however remote from the proposed Flood Relief Scheme (FRS) are assessed."*

h. Details of the bird surveys undertaken, and whether the bridge structures themselves were surveyed and what species, if any, were present

Response

During the course of the Phase 1 Habitat Survey, the birds and mammals encountered were recorded, and any bird or mammal species of conservation concern which were found was investigated and noted. A Kingfisher habitat suitability survey was carried out between the 14th and 16th November, 2011. A breeding bird survey for the scheme was not completed but species identified during the various mammal surveys and the habitat surveys during the early spring and summer periods were noted and collated.

Furthermore, Rahasane Turlough is recognised as the most important turlough site in the country for over-wintering wildfowl (NPWS, 2004). As a result, the turlough and its seasonally resident birds have been routinely surveyed under the Irish Wetland Bird Survey (IWeBS). This represents a back catalogue of more than 20 years data on over-wintering avifauna utilising Rahasane Turlough and its environs. The findings of these ongoing and historic IWeBS surveys and those individuals involved in undertaking these surveys were consulted during this assessment process. It is thought that the level of historic, baseline and ongoing bird wintering bird survey data for the Rahasane Turlough is such that it did not require supplemental surveys as part of this assessment. Furthermore, extensive data

source requests from BirdWatch Ireland and consultation with the site's Irish Wetland Bird Survey counter and co-ordinator were also garnered for this impact assessment.

Bridges within the study area were surveyed as part of the bat surveys completed for the scheme. Incidental bird nesting records, gleaned from these surveys were relayed back to the project team to inform the avifaunal section of the EIS. The EIS considered that the bridges within the study area are likely to be of importance for nesting birds, especially the Masonry Arch Pedestrian Bridge downstream of the R446 road crossing. Given the likely lag between the field surveys being completed and the initiation of construction works, it was considered that bridges are checked by a suitably qualified ecologist for nesting birds prior to the initiation of the drainage maintenance works on these bridges. Should the project commence, best practice would ensure that bridge structures along the scheme were investigated prior to the construction phase. Such investigations would provide informed and current analysis of these structures, in particular their ongoing or potential to support nesting / breeding birds.

A targeted breeding bird survey was completed for the scheme along the Dunkellin River main channel and the Aggard Stream, upstream of Ballynamannin Bridge. These surveys were completed in April, May and June 2015 and the findings are presented below. The surveys focused on those areas where the proposed flood relief works may impact upon, directly or indirectly, suitable nesting habitat for breeding birds, in particular mature woodland and scrub. They reflect the diversity and abundance of breeding bird species both within the footprint of the proposed flood relief works in addition to those areas adjoining and bordering the flood relief works. The extent of those transect sections selected were based on habitat homogeny. To this end a select number of transect were chosen to represent the various habitat types supported by and fringing the Dunkellin River and the Aggard Stream.

The findings of the 2015 breeding bird results are presented in **Appendix D** to this response.

Fifty-five species were identified during the breeding bird surveys completed along the Dunkellin River and Aggard Stream between April and June 2015.

Four species of High Conservation Concern (Red listed) were identified during the breeding bird surveys, i.e. Meadow Pipit, Grey Wagtail, Curlew and Lapwing. The most recent analysis of breeding bird conservation in Ireland has categorised Meadow Pipit from Green listed (Lynas et al., 2007) to Red listed due to a short-term decline in breeding population, i.e. a decline >50% (Colhoun and Cummins, 2013). This is most likely due to a sharp decline in populations following the harsh winter conditions of 2009 and 2010. From the evidence of this breeding bird survey, it seems that Meadow Pipit abundances are recovering locally. Grey wagtail was identified at Ballynamannin Bridge during the May breeding bird survey associated with the bridge structure and the nearby stretches of the Aggard stream. Lapwing, another Red listed species was also recorded upstream of Ballynammin Bridge, in the townland of Emlagh within open, expansive, and relatively poor draining tussocky grassland. This species was noted in this area during May and June and it is considered probable that Lapwing breed within this area. Curlew was noted overflying the study area during the June 2015 survey, possibly on route to / from roosting and feeding grounds within Galway Bay.

Nineteen Amber listed species considered to be of Moderate conservation concern were identified during the breeding bird surveys, the majority of which were considered to be probably or possibly breeding. Species such as Goldcrest and Robin were identified within those areas of mature woodland and scrub bordering the Dunkellin River and Aggard Stream. Other Amber listed species

such as Skylark, Stonechat, Wheatear Linnet, Snipe and Jack Snipe are associated with more open expansive areas bordering both watercourse, with Snipe and Jack Snipe associated with poor draining areas upstream of Kilcolgan Bridge and those areas bordering the Aggard Stream at Emlagh. Amber listed species identified, but not considered to be breeding within the study area include Lesser Black-backed Gull and Common Gull. These were recorded overflying the Aggard Stream areas at Emlagh, upstream of Ballynamannin Bridge. Other Amber listed species noted as overflying, but not breeding within the footprint of the Dunkellin River, the Aggard Stream or their immediate environs include House Martin and Swallow. Both species were noted foraging within the study area but are likely to be roosting and nesting within other areas locally, such as farmyard structures and buildings associated with nearby towns and villages. Sand Martin were identified foraging over the Aggard Stream, upstream of Ballynamannin Bridge at Emlagh. This area of the Aggard Stream supports unsuitable nesting habitat for Sand Martin, which prefers exposed vertical sandy or loamy banks.

The remaining thirty-two breeding bird species are Green listed and comprise a range of relatively common species typically associated those woodland, scrub and linear woodland habitats fringing the Dunkellin River and Aggard Stream in addition to those surrounding pastoral habitats. The majority of those Green listed species were considered to be possibly, possibly or confirmed as breeding within the proposed road scheme and its general environs. Dipper, a semi-aquatic species typically associated with fast-flowing upland stream and lake margins was identified along the Dunkellin River at Craughwell Bridge. The Dunkellin River downstream of Craughwell Bridge provides suitable foraging habitat for this species. Kingfisher, another riparian species was not identified during the breeding bird surveys. The structure and cover of those habitats comprising both the Dunkellin River and the Aggard Stream is not suitable as Kingfisher nesting habitat, which require vertical and somewhat exposed river banks and shallow watercourse ledges.

Habitats fringing both watercourses dictated the avifaunal species assemblage, in addition to their abundance and diversity. Areas of the Dunkellin River and Aggard Stream fringed by mature woodland or dense scrub supported routine occurrences of passerine species, both resident and migrant including Willow Warbler, Blackcap, Wren, Robin, Blackbird, Dunnock, Chaffinch, Goldfinch, Woodpigeon, Blue Tit, Long-tailed Tit and Great Tit. Woodland areas supporting tall and maturing trees typically supported Chiffchaff, Song Thrush, Coal tit and Goldcrest.

Avifaunal diversity and abundance differs in the open areas fringing both watercourses. Wetter areas such as those upstream of Kilcolgan bridge, supported Snipe, Jack Snipe, Reed Bunting and Sedge Warbler while those slightly drier, open and expansive field systems upstream of Ballynamannin Bridge supported species such as Meadow Pipit, Skylark, Stonechat, Wheatear and Lapwing.

Riparian or waterside specialist species identified within both watercourses or within the footprint of the stream included Grey Heron, Dipper, Grey Wagtail and Moorhen.

Full details on the mitigation measure for birds is provided in the EIS Section 10.6.4.3, p.138-140, which include measures advocated by the RSPB/ NRA/ RSNC (1994) which may be implemented to benefit riparian wildlife. A number of similar environmentally friendly measures have also been advocated by the OPW (OPW, 2007) in order to comply with its commitments to the European Communities (Natural Habitat) Regulations 1997, and by the Central Fisheries Board aimed at minimising the impacts of arterial drainage maintenance on fish (King et al., 2002). These measures are largely aimed at minimising damage to habitats and improving habitat quality through the construction of river features, and are particularly beneficial to birds, especially during the breeding

season, when most birds are constrained to nesting areas. Many of these measures have been implemented by OPW as standard procedure. The overarching measures are that no scrub clearance, tree felling or other removal of vegetation will occur during the bird breeding season from 1st March to 31st August and in order to avoid impacts on wintering birds no works will be carried out in proximity to Rahasane Turlough or at Rinn Bridge during the period 1st September to 31st March.

i. Details of the impacts on habitats arising from the project at construction stage, including as a result of land spreading of excavated material

Details of the impacts on habitats arising from the project at construction stage are addressed in NIS Section 8.2.1, pp.79-85, and EIS Sections 10.5, 10.7, 11.4 and 11.7.

As outlined in Section 4.4.2 of the NIS, suitable lands, i.e. lands of low or negligible ecological value or importance (predominantly improved agricultural grassland) have been identified for land spreading. The lands were identified having consideration for environmental constraints including sensitive habitats, archaeology and views.

Table 10.20 of the EIS considers the potential impacts associated with landspreading on a number of sensitive ecological receptors, including sensitive semi-natural grassland habitat, dry calcareous grassland, wet grassland and marsh. The majority of those lands that will support landspreading will be improved or modified habitats of low ecological value that are accustomed to routine disturbances such as mowing, reseeding, tilling and fertilisation. Landspreading on these habitats will not impact the ecological their botanical composition and / or structure and function.

Section 10.7.1 of the EIS details residual impacts to habitat within the scheme, in particular residual impacts to habitats removed during land spreading as follows;

Habitats Removed During Land Spreading

Wetland Habitats: GS4 Wet Grassland - 0.8 ha of Wet Grassland will not be replaced and therefore there will be a residual impact '**Permanent Negative**' impact on this habitat. However these impacts are considered to be '**Not Significant'** as Wet Grassland is widespread within the study area.

Improved Habitat: GA1 Improved Agricultural Grassland - It is proposed that this habitat be returned to the existing use therefore an agricultural grass seed mix will be used to revegetate land spread grounds on these habitats. There will be a '**Temporary Negative**' impact on this habitat but this will be '**Not Significant**' and will not persist over the long term.

GS1 Dry Calcareous and Neutral Grassland - 1.3 ha of this habitat will not be replaced due to landspreading and will therefore present a '**Permanent Negative**'. This is not however considered **Not Significant** as this habitat is widespread within the study area.

j. There is potential for interaction with downstream designations (e.g., Galway Bay Complex) from the changed hydrodynamic regime. Further information is required to examine potential interaction with Annex I habitats which includes Mudflat and sandflats not covered by seawater at low tide and the noted communities in vicinity including Intertidal sandy mud community complex and might include some

Reef habitats. The potential change to these habitats must be examined in terms of increased water flow, potential greater throughput volumes and the changed constituent load of the exiting water (sediments, contaminants etc.)

The conclusion of the NIS (Section 10.5) is that there will be no potential for cumulative impacts arising in combination with any other plans or proposals. With the implementation of best practice and the recommended mitigation measures, it is considered that the proposed Dunkellin River and Aggard Stream Flood Relief Scheme will not adversely affect the integrity of Rahasane Turlough SAC/SPA, Galway Bay Complex SAC and Inner Galway Bay SPA.

Potential impacts for increased sediment loads during the construction phase are considered in Section 8.2.1.3 and Table 8.3 of the NIS. Both of these areas address potential impacts to the marine/ intertidal habitats associated with Galway Bay Complex SAC. In addition, Table 8.5 considers an assessment of potential effects of any change in flow/volume of the Dunkellin River on Galway Bay Complex in relation to the targets set for the qualifying interest.

An extract from **Table 8.5** of the NIS reads as follows:

Objective	Target	Potential for Impact during Operational Phase
To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Galway Bay Complex SAC, which is defined by the following list of attributes and targets.	**Target 1** The permanent habitat area is stable or increasing, subject to natural processes - •This target refers to activities or operations that propose to permanently remove habitat from a site, thereby reducing the permanent amount of habitat area. It does not refer to long or short term disturbance of the biology of a site.	There are no operations proposed to permanently remove this habitat from the site.
	Target 2 Conserve the following community types in a natural condition: • Intertidal sandy mud community complex – 513ha • Intertidal sand community complex – 232ha	Any release of suspended sediment is unlikely to significantly impact on the estimated area of intertidal community complexes. The construction phase will not involve significant continuous or on-going disturbance of communities. Without mitigation however there may be smothering, short term changes in sediment granulometry. No long term effects are considered likely.

A comparative salinity modelling study (see **EIS, Volume 3, Appendix E**) was carried out to determine if the scheme would result in decreases in salinity in the receiving waters. The model demonstrated that in times of flood (such as the 2009 event) the peak discharge rate into Galway

Bay would increase by < 1% with an associated decrease in peak flow (Tp) time from 95 hours to 93 hours. It was concluded in in Section 8.2.2.4 of the NIS (Impacts on Inner Galway Bay SPA) that "*any slight increase in peak discharge by 1% and reduction in time to peak flow is not likely to cause the transport of significant additional quantities of* ***suspended sediment and nutrients*** *to the Dunkellin Estuary*."

5. ITEM 5 - MITIGATION MEASURES

The Department is of the view that there are deficiencies in the details of the mitigation measures that are specified in the EIS and NIS, including in respect of the following;

a. Details of construction methods and mitigation to be developed and agreed at the post-consent, including with the need to consult and get the approval of the National Parks and Wildlife Service (NPWS) of this Department: a) EIS section 10.6.3.1: "in stream works will only be undertaken with advance approval of IFI and NPWS" b) EIS section 10.8: there will be ongoing consultation by Galway County Council with IFI and NPWS throughout all phases of the works which will include attendance at progress meetings agreed in advance by Galway County Council and representatives if IFI and NPWS.

Response

Given the nature, scale and duration of the works, it remains best practice to adapt this consultative/ continual liaison process as certain environmental factors may dictate individual works methods.

Nonetheless, both the EIS and NIS documents provide specific details of mitigation measures to be included in detailed construction method statements. There are no further mitigation measures to be developed post-consent from an aquatic ecology perspective. In relation to aquatic ecology, an application will be made to NPWS at the pre-construction stage prior to in-stream works commencing in association with channel deepening in the Craughwell River. The application will be made by a qualified aquatic ecologist with experience in crayfish rescue and relocation which will be necessary when the river is de-watered to facilitate in-stream works in the dry. See the above section which considers likely effects to white-clawed crayfish, for details.

b. Details of the method statement for removal and construction of a fish counter, including managing use of wet concrete;

Response

Addressing 1a, 1b and 2: A draft construction management plan (CMP) has been prepared addressing details of construction methods and all recommendations for mitigation presented in the EIS and the NIS (see **Appendix C** to this response).

As stated in the EIS Section 10.6, the detailed method statement will be drawn up at the post consent stage and will include all general mitigations as set out in Section 10.6.1 of the EIS, informed by detailed mitigations set out in Sections 10.6.3.2 and 11.5 of the EIS with respect to water quality protection. Section 10.6.3.2 (Pollution of Watercourses) specifically addresses mitigations required for any use or removal of concrete in relation to proposed the fish counter relocation as follows:

"Concrete:

- Measures relating to concrete management will mostly apply to the construction of the proposed salmon counter, upstream of Killeely Beg Bridge.
- Wet concrete and cement are very alkaline and corrosive and can cause serious pollution to watercourses.
- The contractor will draw up a detailed method statement that addresses Best Practice in liquid and/or mortar management addressing batching on site (if that is proposed), pouring and handling, secure shuttering / form-work, adequate curing times and management of spills. No washings will be allowed to enter nearby drains. Works will occur in the dry.
- Disposal of raw or uncured waste concrete will be controlled to ensure that the watercourse or karst features will not be impacted.
- Best practice will be employed in bulk-liquid concrete management addressing pouring and handling, secure shuttering / form-work, adequate curing times.
- Where shuttering is used, measures will be put in place to prevent against shutter failure and control storage, handling and disposal of shutter oils.
- Wash water from cleaning ready mix concrete lorries and mixers may be contaminated with cement and is therefore highly alkaline. Due to the size of the site and the proximity of sensitive watercourses, it is recommended that lorries and mixers are washed out offsite at a predetermined washout area.
- Cement dust must be controlled as it is alkaline and harmful to the site's surrounding ecology. Activities which result in the creation of cement dust will be controlled by dampening down areas.
- The timing of the works must be specified and agreed in advance with the IFI in relation to fish migration and spawning periods."

In addition, there will be post-consent consultation in the form of a meeting between Galway County Council, contractor(s) and IFI with regards to relocation of the fish counter, as per IFI request addressed under IFI Item_C07, below.

EIS, Volume 2, Section 11.5.4 provides the following commentary for works at the salmon counter:

> *"Most importantly, the design of the salmon counter weir structure must be carefully reviewed with regard to the ability of lampreys and eels to pass this potential upstream migration barrier. Although a sea lamprey has been observed passing the existing counter, the level of lamprey passage success, overall, is unknown. Recent literature and information on passage efficiency for lamprey and eels at similar structures must be consulted before agreeing on a design that ensures a high level of passage for Annex II protected and red-listed fish species (lampreys and eel), e.g. Russon et al. (2011) Reinhardt, et al. (2009) and, for instance, publications from the International Centre for Ecohydraulics Research (ICER).*
>
> *With regard to the weir construction it is proposed to use cofferdams to isolate the instream works, allow construction in the dry and to prevent solids and cement from entering the channel. These mitigations should be carefully monitored while underway to ensure that they are operating correctly. Particular care will be required when discharging bulk liquid concrete from the bank in order to avoid accidental spills. The operation should be monitored by IFI or an agent to ensure that all mitigation measures are being adhered to. All contaminated waters which enter the coffer dams will need to be pumped to settlement*

facilities before they are discharged. See standard mitigations (Section 11.5.1) in relation to sediment control and prevention of release of cement and hydrocarbons."

A Construction Method Statement for these works will be provided by the appointed contractor prior to the initiation of these works.

c. Details of the fisheries enhancement measures to be delivered;

Point (3): During detailed site investigations conducted during baseline studies for this proposed flood relief scheme, the freshwater ecology team established that, in the absence of detailed and significant mitigation by design, there was potential for moderate to significant impact on fisheries and white-clawed crayfish as a result of channel deepening in the Craughwell River in the reach from just upstream of Rahasane Turlough to Craughwell Village.

For that reason, IFI was approached and a meeting was held between the freshwater ecology team for this project (ASU, UCC); staff of the project consulting engineers (Tobin); local IFI staff, and IFI's Senior Research Officer, fisheries biologist and EREP designer, Dr Martin O'Grady. Subsequent to this meeting, a site visit and site-specific assessment was carried out by Dr O'Grady at Dunkellin and Craughwell Rivers. Further discussions took place between Dr O'Grady and the project consulting engineers with regards to what was necessary to achieve the goals of the EREP and the feasibility of same in these rivers.

As a result, a report was prepared by Dr O'Grady detailing the EREP approach, measures and specific locations of works. This detail is shown in Appendix 3 of Appendix A of the EIS. Within this Appendix are site photographs with overlain designs for EREP features at specific locations on the Dunkellin River downstream of Rahasane Turlough. The approach for the reach upstream of the turlough was also detailed and assessed in this Appendix in a headed IFI report by Dr O'Grady: "An Ecological Evaluation of the likely impacts of a proposed Flood Relief Scheme on a reach of the Craughwell River at Craughwell, Co. Galway". This assessment concluded that the design, as specified in his report, will address some of the current morphological and ecological deficiencies in the Craughwell River reach in question, and that the likely impact of the design and works would **be long term and positive** for fish and invertebrates (includes crayfish). Based on this assessment, made by Irelands leading fisheries biologist with over 30 years' experience in designing and monitoring fisheries enhancement projects, the freshwater ecology team was satisfied that there is sufficiently detailed mitigation to address any formerly identified potential impacts on fisheries values of the river reaches involved.

Chapter 11 of the EIS outlines that the design of the river enhancement works together with the associated construction works method statements will be the subject of detailed design between Galway County Council, the OPW and Inland Fisheries Ireland upon conclusion of the planning process. It is considered that such works and methodologies are subject to an iterative process during and following the projects construction phase, where site and area / niche specific mitigation can be adequately scoped and implemented by those relevant parties, who at that stage, will have attributed considerable knowledge of the site, during and post the construction period.

During the NIS consultation phase (see Section 1.2) Inland Fisheries Ireland (IFI) identified use of the OPW's Environment River Enhancement Programme (EREP) methods in which the natural features of the riparian and instream environment would be protected as far as possible. As outlined in Section 4.3.2 (*Environmental River Enhancement Programme*) of the NIS, the initial proposed River

Enhancement Programme proposed by the IFI was included in the NIS at Appendix A, Appendix No. 3 (first section)]. This programme was based on general good practice recommendations having knowledge of the study area concerned and was subject to a detailed design stage. Further to this a detailed river enhancement programme was proposed by the IFI which took into consideration the detailed design measures being proposed as part of the scheme. Details on these enhancement measures and how they are to be incorporated into the proposed flood relief scheme are set out in the NIS at Appendix A, Appendix No. 3 (second section). The final design and location of works will be confirmed following after further consultation with the IFI.

d. The areas of land to be replanted with trees, treelines or woodland to compensate for permanent losses (EIS section 10.7.1);

It is proposed to replace the removed woodland habitats with planting of native species similar to those which occur prior to removal. Although these habitats will not be replaced within the footprint of where they have been removed they will be planted on habitats of low ecological value, e.g. GA1 Improved Agricultural Grassland, thereby providing an adequate medium to long-term replacement of these habitats. Residual impacts therefore on these habitats are 'Temporary Negative' over a period of decades until the trees and shrubs have matured to the level at which previous vegetation existed.

e. The details of all the timing or seasonal restrictions that will apply for various species and other sensitive ecological receptors, and whether these can be achieved within the work programme envisaged, and how any conflicts will be addressed.

Point (5) In terms of aquatic ecology - details of all the timing / seasonal restrictions that apply for various species is specified in full in Table 11.11 of the EIS (p191). This addresses restrictions for salmonids, lampreys and white-clawed crayfish. Restrictions apply mainly in relation to works in the Craughwell River upstream of Rahasane Turlough which are the only in-stream works proposed for the project. To clarify further, it is considered that the reach where restrictions on in-stream works is most critical is that in the 350m reach of the Craughwell River between the inlet and outflow of the Craughwell flood water bypass channel. This reach will be dried out completely when main channel flows are diverted through the bypass channel to facilitate channel deepening along the reach. This phase of works will occur between mid-July and September 30th. The outline phasing of works (Fig 5.1, Appendix A of the EIS) indicates August/September for these works, which complies with the restrictions as set out in Table 11.11.

Other instream works in this reach will be carried out using cofferdams covering half the river leaving flows to continue down the opposing half of the channel. The indicative programme of works (Fig 5.1, Appendix A of the EIS) shows these works occurring in the August/September period which complies with restrictions in relation to fish and crayfish. Given that reasonably short sections (50m) of river are affected by each cofferdam construction and that only half the channel is affected, it would be feasible that these works could commence in mid-July without any significant impacts on crayfish, so long as rescue and relocations were carried out during each dewatering. It is considered that the potential of sea lamprey spawning in the Craughwell River reach is very low, so July could be open from that perspective also.

As stated in the EIS text (p.190), restrictions with regards to salmonid spawning would also apply between October 1st and April 30th (Table 11.11, p.191, of the EIS) with regards to earthworks along the Dunkellin River in association with channel widening. This is to avoid potentially negative impacts of sediment loss on salmonid spawning.

IFI have requested a meeting at the post-consent, pre-construction stage to review: 1) Pollution mitigation measures; 2) Pollution incident reporting mechanisms & Emergency Response Plan, and; 3) Water quality monitoring programme. It would be envisaged that the issue of seasonal restrictions with regards to fisheries values would underpin such a meeting as this is core to the protection of the salmonid fishery in Ireland.

As ecologists, we cannot comment on the feasibility of these time-frames from an engineering works perspective, nor how conflicts would be addressed, but it may be advisable that an aquatic ecologist be consulted to review the construction method statement(s) and works programme to help identify and resolve any apparent conflicts regarding seasonal restrictions recommended in Table 11.11.

Table 4.3 of the NIS provides a comprehensive overview of the outline Construction Programme. To a large extent, this programme is dictated by seasonal constraints, in particular the growing season and the associated restrictions in clearance / disturbance under the Wildlife Act 1976 and 2000, as amended.

Table 11.11 (p.191) of the EIS provides Timing Restrictions associated with all protected aquatic in the study area as follows:

Species	Period of no instream disturbance (inclusive)	Likelihood of presence in the affected areas and comments	Period instream works allowed (inclusive)
Salmon.	October to April - spawning, nursery (IFI).	Distributed throughout study area: Craughwell River instream deepening works – very sensitive - spawning, nursery, holding area. Dunkellin River – no instream works proposed/migration – less sensitive – limited spawning, but good nursery habitat. Aggard Stream – few salmon – no deep dredging works proposed.	May to September.
Brook and River Lamprey.	March to May - spawning / hatching (Igoe et al., 2004).	Distributed throughout study area, depending on localised habitat, i.e. spawning in riffles, nursery in silty deposits.	June to February.
Sea Lamprey.	Mid June to July - peak spawning period (Igoe *et al*., 2004).	Presence confirmed on lower Dunkellin River at least. Spawning and juvenile nursery habitat abundant throughout the study area, depending on localised habitat, i.e. spawning in riffles, nursery in silty deposits.	August to April.
White clawed crayfish.	November to late June (breeding / berried females + hatching) (Peay, 2000).	Population abundant on Craughwell River and Aggard Stream upstream of Rahasane Turlough. Present / moderate abundance on Dunkellin River between Dunkellin Bridge and Rahasane Turlough, inconclusive evidence of presence downstream of Dunkellin	July to October.

Species	Period of no instream disturbance (inclusive)	Likelihood of presence in the affected areas and comments	Period instream works allowed (inclusive)
		Bridge.	
Trout.	October to May - spawning, nursery (IFI).	Distributed throughout study area.	June to September.
Combined/ overall timing restrictions.	No instream works allowed between October and July.		Instream works allowed August to September.

The timing and sequencing of upstream flood relief scheme measures coupled with mitigation applied with respect to each measure will reduce the potential for silt generation at source and stem the potential for losses. Moreover, all of the instream works will be undertaken during the May to September low flow period but even then only when water levels allow. It is worth noting that all of the study area has a low gradient so that a substantial amount of silt generated by instream works associated with drainage channel cleaning and regrading will tend to settle within the channels themselves.

Further commentary on seasonal restrictions on works, especially in relation to instream works are also outlined in the EIS as follows:

11.4.6.2 Construction phase

> *"The main issues during construction are (i) sediment and silt release from the newly excavated channel, and, (ii) release of cement and hydrocarbons. Both (i) and (ii) will wash out to the Craughwell River if not properly managed. Increased suspended solids and release of concrete and hydrocarbons would give rise to the impacts already described in Section 11.4.2. This measure will be timed for May to October, but should occur in the earlier of these months to allow for settling of any loose sediment prior to the winter spawning period in the Craughwell channel. High levels of sediment or uncured concrete washout could have* ***significant, negative*** *impacts on the Craughwell River fishery and crayfish downstream of the bypass exit."*

11.4.7.2 Mortality of Fish and Invertebrates as a Result of Cofferdam Insertion

> *"Isolation and death of potentially large numbers of white-clawed crayfish, lamprey ammocoetes (only in limited silty reaches) and thousands of aquatic macroinvertebrates will occur within the footprint of each cofferdam (50 m length x half river width). The impact on salmonid fish, eel and adult lampreys is likely to be* ***slight*** *provided they can move out of the area during draw downs and provided instream works do not occur during salmonid and lamprey spawning periods (i.e. October to April and March to July). It is noted that there is likely to be just one location (a short distance upstream of the Aggard Stream confluence) where sea lamprey could spawn up to the month of July and as long as this area is not directly impacted by channel deepening and stringent sediment control measures are used upstream, instream works could occur in the Craughwell reach between June and September, inclusive. Drying out of sections of the channel will cause crayfish to emerge from refuges and these will need to be collected as they emerge during the drawdown and relocated to*

*suitable habitat upstream of the works. The impact on crayfish, without mitigation, would be **significantly negative**."*

Fisheries Restrictions

*"The scheduling of works observes salmonid spawning restricted periods (October to April), but overlaps with sea lamprey spawning period that peaks mid-June to July (Igoe et al., 2004). A short reach of potential sea lamprey spawning habitat occurs just upstream of the Aggard Stream confluence, however, this reach is not subject to deepening and it is not known for certain whether lamprey spawn here. So long as localised disturbance and suspended sediment levels associated with upstream works are kept low, as they are expected to be considering works occur in the dry, the potential for impact on sea lamprey spawning is considered to be a **short-term, slight, negative** locally."*

Avifaunal Restrictions

Section 10.6.4.3, p.138-140, of the EIS considers timing of works and potential impacts to over-wintering avifauna as follows;

No scrub clearance, tree felling or other removal of vegetation will occur during the bird breeding season from 1st March to 31st August.

In order to avoid impacts on wintering birds no works will be carried out in proximity to Rahasane Turlough or at Rinn Bridge during the period 1st September to 31st March.

6. ITEM 6 - ARCHAEOLOGICAL MONITORING

6.1 "Archaeological Monitoring shall consist of the following:

1) In order to ensure the preservation of potential archaeological sites, wrecks and features the applicant is required to engage the services of a suitably qualified archaeologist to monitor all river bed and river bank disturbance works associated with the development. The archaeological monitoring shall be licensed under the National Monuments Acts 1930 - 2004.

2) A detailed method statement shall accompany the licence application and shall include details on the proposed works duration of works; archaeological monitoring team proposed and a find's retrieval strategy.

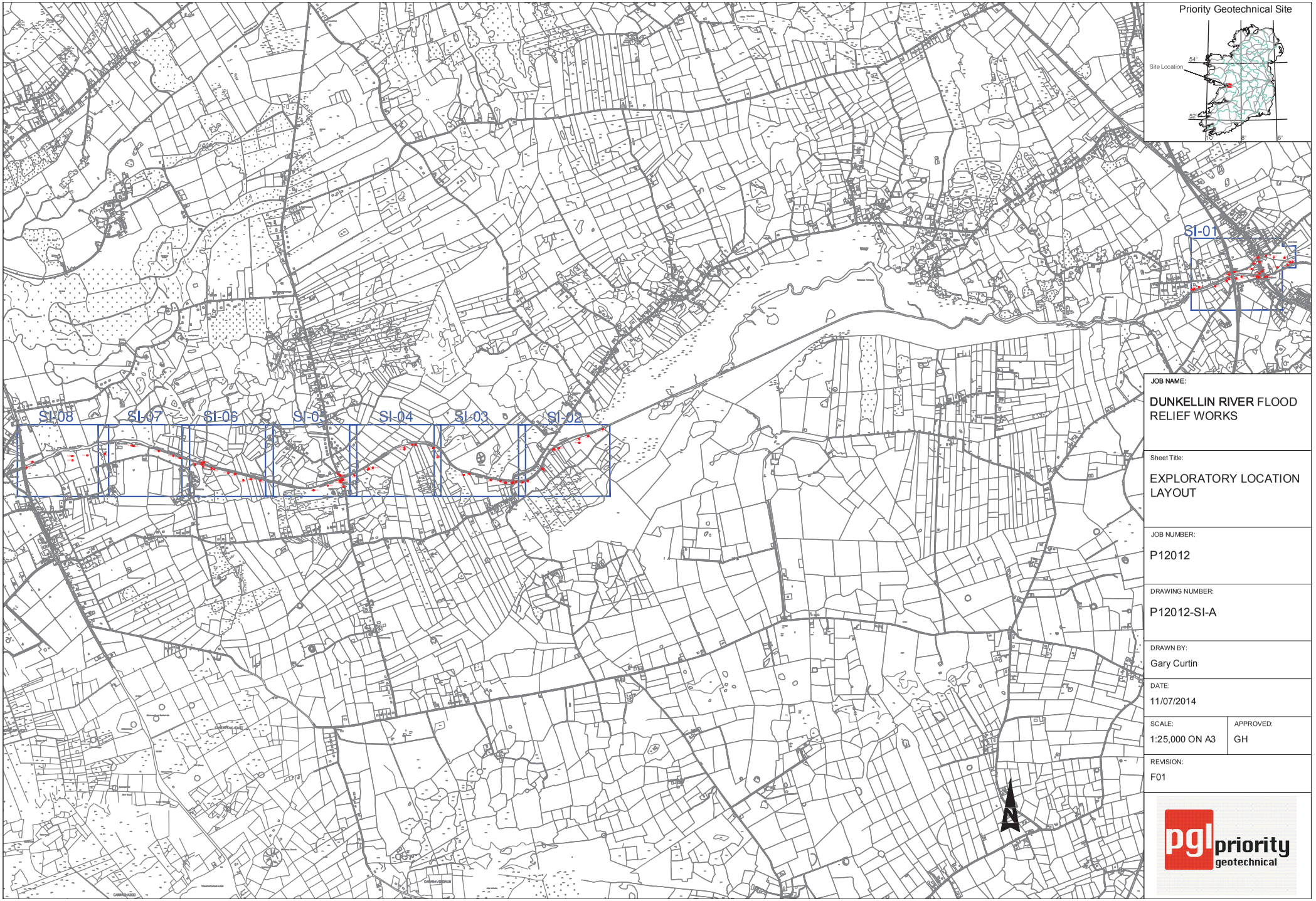
3) Should archaeological material be found during the course of monitoring, the archaeologist may have work on in that area suspended, pending a decision as to how best to deal with the archaeology. The developer shall be advised by the Department of Arts, Heritage and the Gaeltacht with regard to any necessary mitigating action (e.g. preservation in situ or excavation). The applicant shall facilitate the archaeologist in recording any material found.

4) The Department of Arts, Heritage and the Gaeltacht shall be furnished with a report describing the results of the monitoring"

Archaeological monitoring shall be carried out with the proposed works.

APPENDIX A

SITE INVESTIGATION DRAWINGS



JOB NAME:

DUNKELLIN RIVER FLOOD RELIEF WORKS

Sheet Title:

EXPLORATORY LOCATION LAYOUT

JOB NUMBER:

P12012

DRAWING NUMBER:

P12012-SI-A

DRAWN BY:

Gary Curtin

DATE:

11/07/2014

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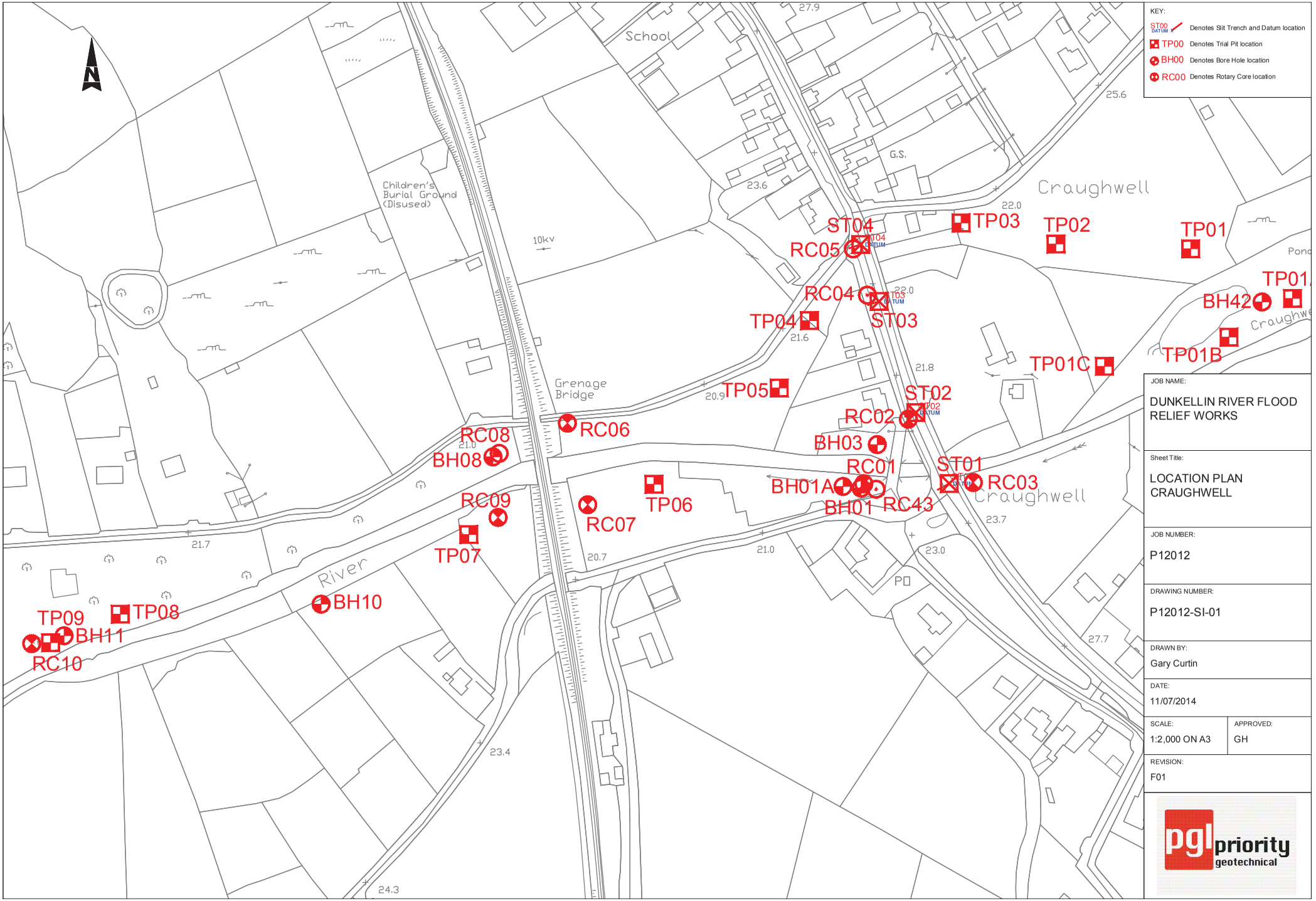

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DUNKELLIN RIVER FLOOD RELIEF WORKS

Sheet Title:
LOCATION PLAN CRAUGHWELL

JOB NUMBER:
P12012

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P12012-SI-01

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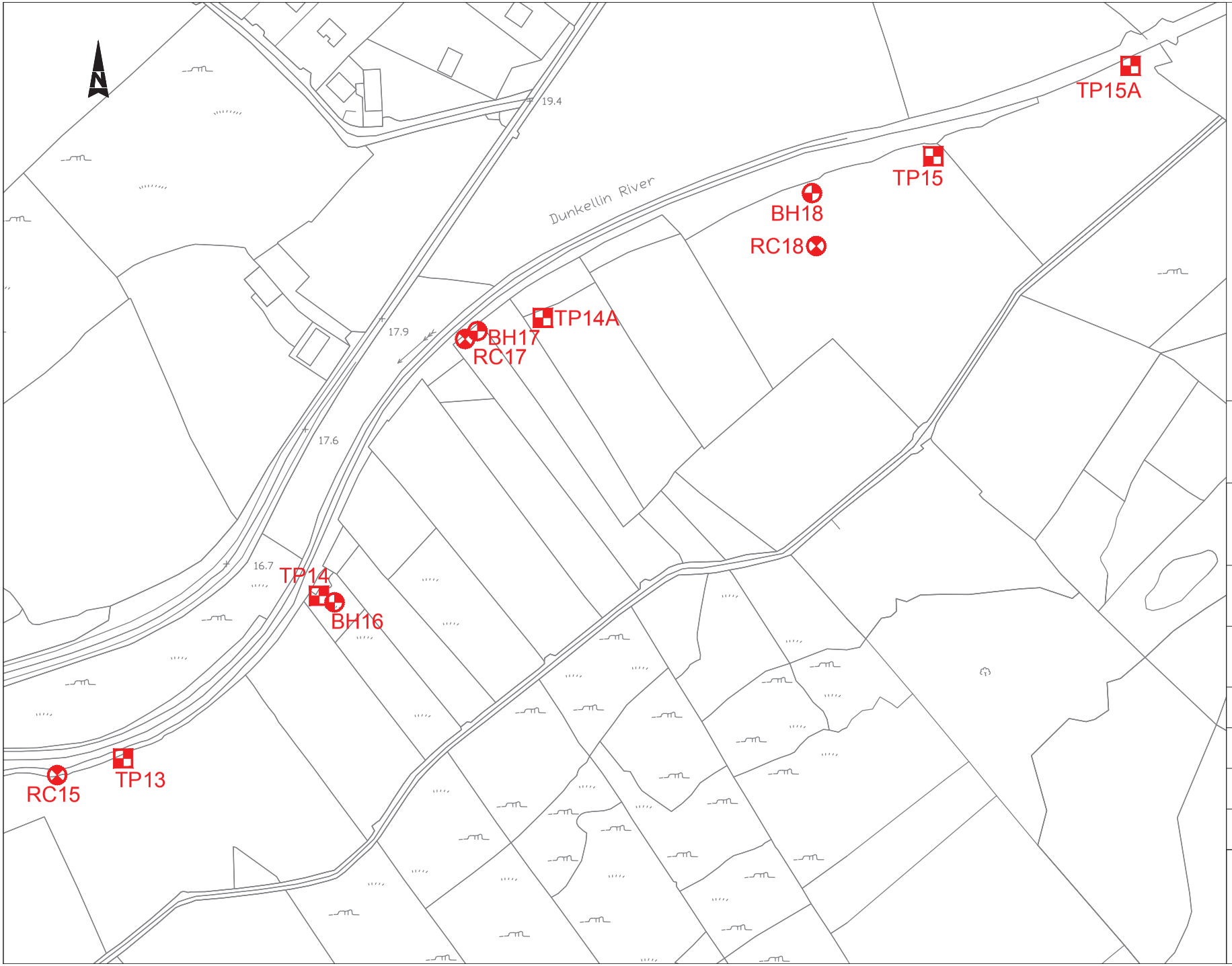

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- TP00 — Denotes Trial Pit location
- BH00 — Denotes Bore Hole location
- RC00 — Denotes Rotary Core location

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DUNKELLIN RIVER FLOOD RELIEF WORKS

Sheet Title:
LOCATION PLAN

JOB NUMBER:
P12012

DRAWING NUMBER:
P12012-SI-02

DRAWN BY:
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11/07/2014

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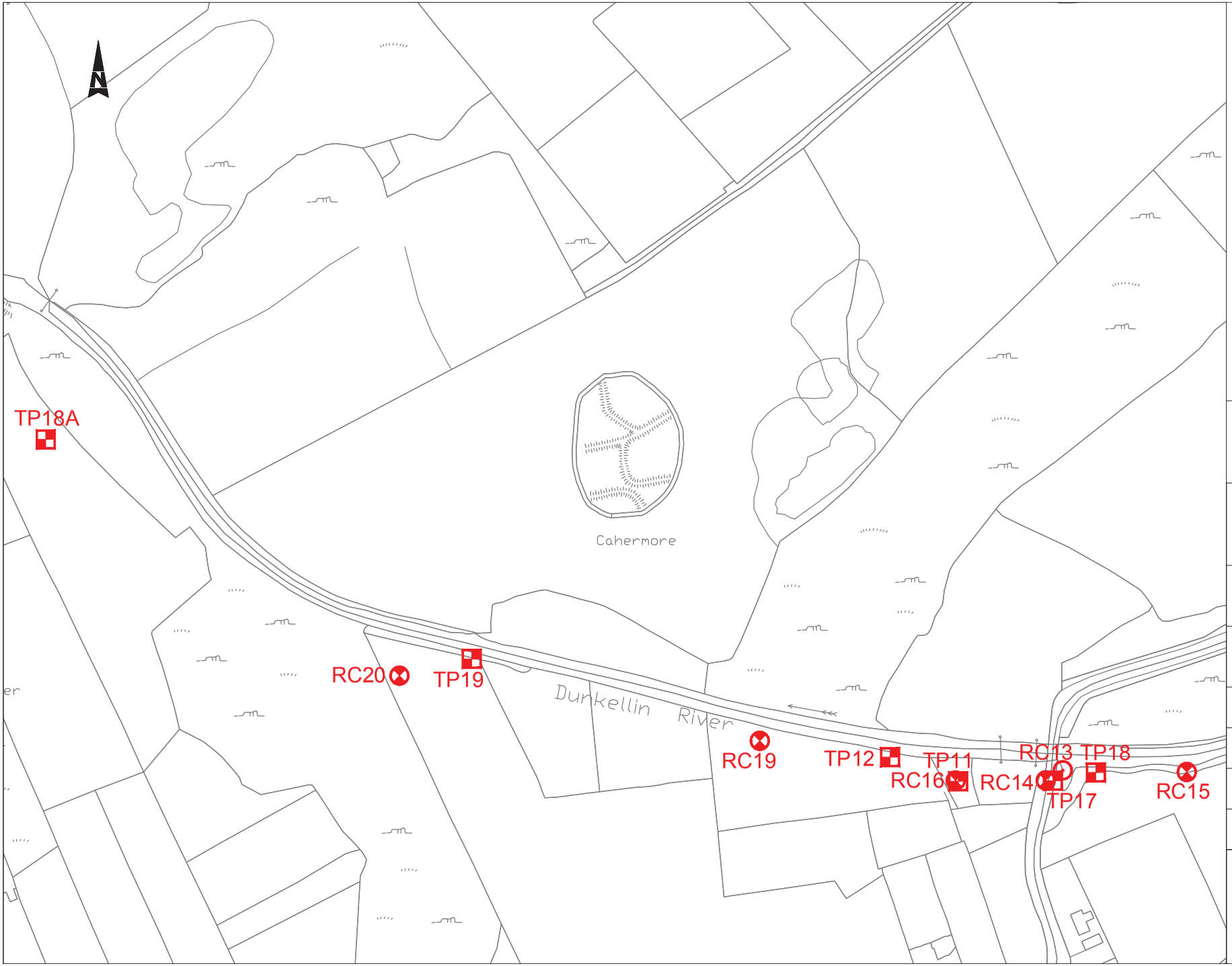

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DUNKELLIN RIVER FLOOD RELIEF WORKS

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Gary Curtin

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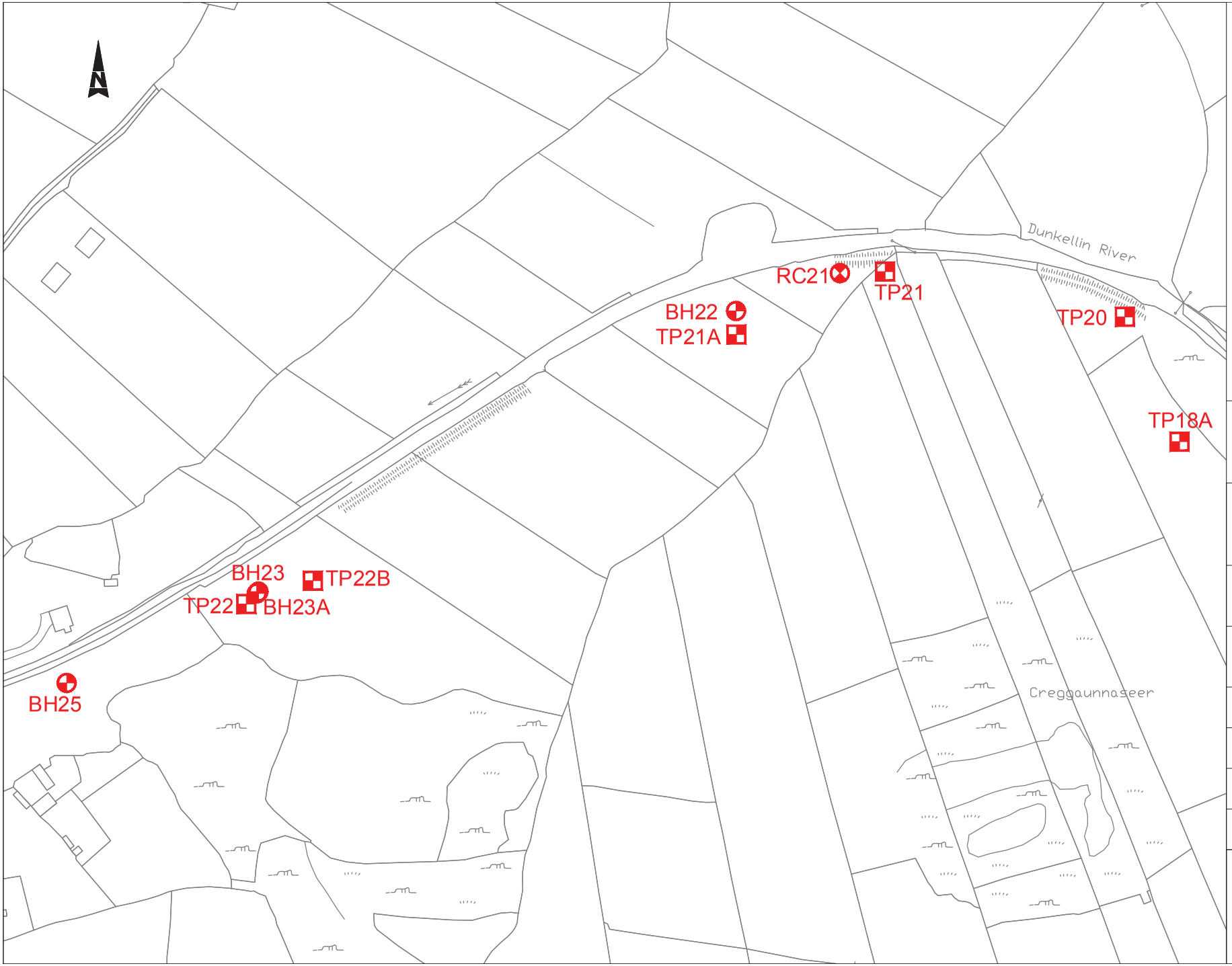

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DUNKELLIN RIVER FLOOD RELIEF WORKS

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LOCATION PLAN

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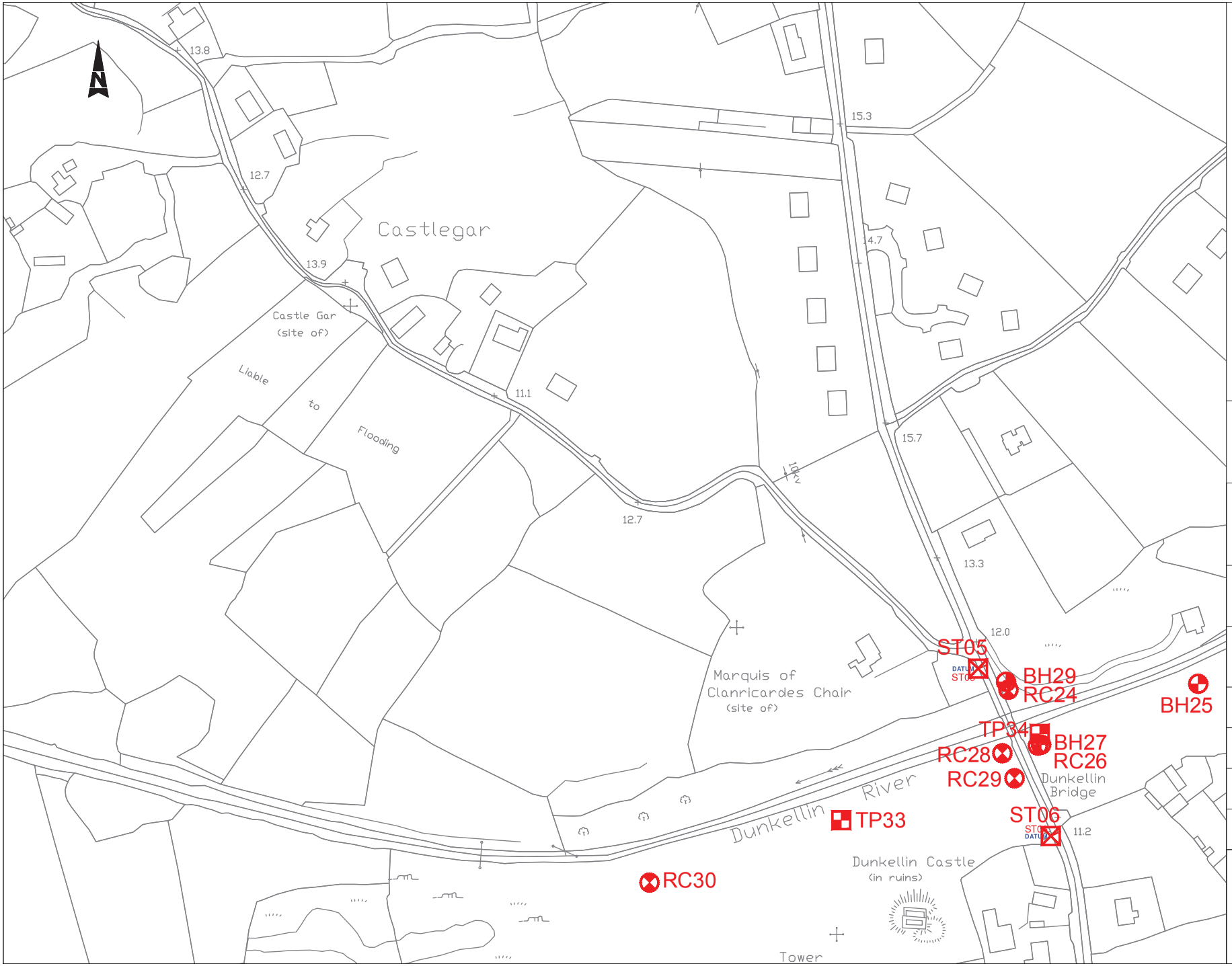

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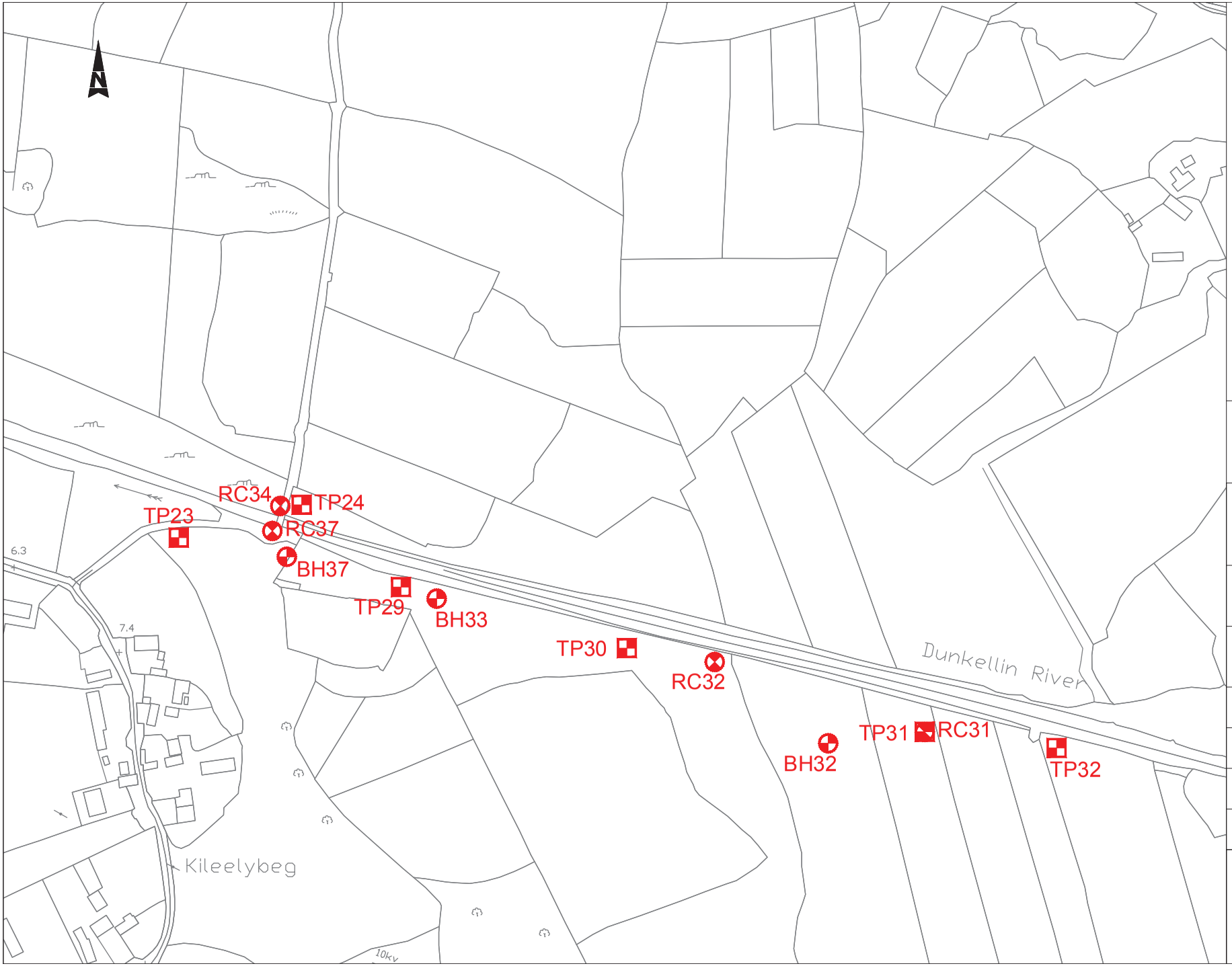

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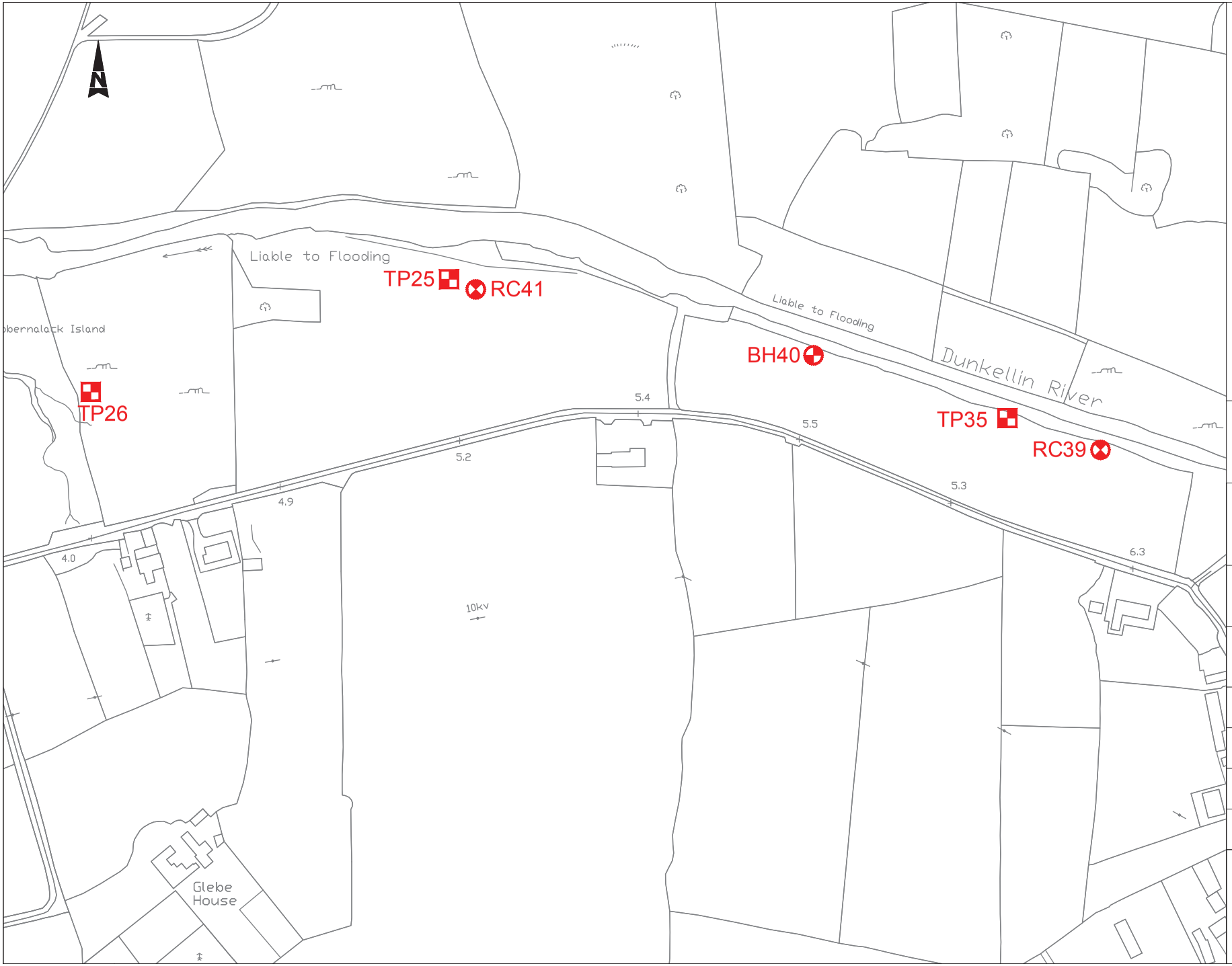

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JOB NUMBER:

P12012

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APPENDIX B

GEOPHYSICAL SURVEY REPORT

Dunkellin River Flood Relief Scheme

County Galway

Geophysical Survey 2015

Report Status: Final

MGX Project Number:5945

MGX File Ref: 5945d-005.doc

22nd June 2015

Confidential Report To:

Priority Geotechnical Ltd.
Unit 12
Owenacurra Business Park
Midleton
Co. Cork

Report submitted by :
Minerex Geophysics Limited

Unit F4, Maynooth Business Campus

Maynooth, Co. Kildare
Ireland
Tel.: 01-6510030
Fax.: 01-6510033
Email: info@mgx.ie

Issued by:

Ruth Jackson (Senior Geophysicist)

Hartmut Krahn (Senior Geophysicist)

Minerex
Geophysics Limited

Subsurface Geophysical Investigations

EXECUTIVE SUMMARY

1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey in 2014 for the Dunkellin River Flood Relief Scheme consisting of seismic refraction (p-wave) surveying. The main objectives of the survey were to determine the ground conditions, estimate the depth to rock and establish the overburden thickness (MGX 2014).
2. The current 2015 survey consisted of 2D-Resistivity and EM31 Ground Conductivity. The main objective of this survey was to check for the presence of karst features at selected zones along the Dunkellin River and on some land areas that are intended for depositing and spreading geological material gained form the river channel widening.
3. The locations for the survey were first selected after a desk study and walk over by the hydrogeologist for the scheme. The main targets were areas where possible karst features are existing or may be found. During the survey the results were processed and discussed among the team and some further locations were checked.
4. The precious seismic refraction survey results modelled the ground with four layers that represent the transition from soft/loose overburden to strong rock. Layers 3 (Weathered broken rock) and layers 4 (strong fresh rock) will mainly require breaking and blasting for removal, though some rock of layer 3 may be removed by ripping. Results from the direct ground investigation were available report and had been added to the sections where relevant to the geophysical survey.
5. Generally the resistivity values are very high and indicate a clean limestone as the bedrock type. In the survey areas investigated by conductivity and resistivity survey there are relatively few anomalies typical for karst features in the limestone. Most areas do not show anomalies that indicate karstification, faults, fracture zone or thick weathered rock.
6. R3 has the strongest anomalous resistivity and conductivity values of the entire survey. There is a notable karstified rock and clay-water infilled zone on this profile.
7. Some resistivity profiles (R8, R9) show weak anomalies interpreted as near-surface shallow slightly karstified and weathered rock. The localised extent can be seen in the vertical resistivity and horizontal conductivity data.
8. The individual profiles and areas are discussed in details in chapter 4.

CONTENTS

List of Tables, Maps and Figures:

1. INTRODUCTION

1.1 Background

Minerex Geophysics Ltd. (MGX) carried out two geophysical surveys for the Dunkellin River Flood Relief Scheme in 2014 and 2015. The first survey consisted of seismic refraction (p-wave) measurements in water and on land (MGX 2014). The second survey was done by using 2D-Resistivity and EM31 Ground Conductivity measurements.

The second survey had the main objective to locate karst zones/features or thick weathered rock zones. The survey was employed at locations where such features may exist based on existing ground investigation data, a desk study or a walk over by the project hydrogeologist.

The main construction objective is the removal of overburden and rock for the deepening of the river in Craughwell and for the widening of the river channel west of the Rinn Bridge towards the N18 near Kilcolgan. It is intended to spread the geological material gained from excavations on fields. The survey intention was to check for the presence of karst features in order to prevent a possible collapse of ground, subsidence of spread material and possible changing of the ground water flow regime.

1.2 Objectives

The main objectives of the geophysical survey were:

- To check for the presence of karst zones/features in the subsurface
- To check for layers of thick weathered rock
- To determine areas of anomalous rock

1.3 Site Description

The survey areas are located along the Craughwell River and Dunkellin River between Craughwell and the N18 near Kilcolgan. Most survey profiles (R1, R2 and R5 to R10) are close to the river though some (R3, R4, R5a, R8a and R9a) are further away in fields that are intended for spreading material.

1.4 Geology

The bedrock geological map of Galway Bay (GSI, 2003) indicates that the survey area is underlain by Carboniferous lithologies, Visean Limestone and Burren Formation. The Visean Limestone is described as an undifferentiated limestone and the Burren Formation as pale grey clean skeletal limestone. Both formations can be karstified and show a ‘limestone pavement’ (Epikarst) weathering pattern near the surface of the rock.

1.5 Report

This report includes the results and interpretation of the geophysical survey. Plans and tables are included to illustrate the results of the survey. More detailed descriptions of geophysical methods and measurements can be found in GSEG (2002), Milsom (1989) and Reynolds (1997).

The client provided maps of the site and the digital version were used as the background map in this report. Elevations were surveyed and are included in the vertical sections.

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Minerex Geophysics Limited, while using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface.

2. GEOPHYSICAL SURVEY

2.1 Methodology

The methodology consisted of 2D-Resistivity Profiles and EM31 Ground Conductivity.

The survey locations are indicated on the overview plan (Plan 1) and on the individual plans 3a – 3g.

All geophysical surveys are acquired, processed and reported in accordance with British Standards BS 5930:1999 +A2:2010 'Code of Practice for Site Investigations'.

2.2 EM31 Ground Conductivity

The EM31 ground conductivity survey was carried out over the areas indicated in Plan 1 on lines nominally 10 m apart. Along each line a reading of ground conductivity was taken every second while walking along, thereby resulting in a survey grid of nominally 10 x 2 m. The locations were measured with a sub-meter accuracy SERES DGPS system attached to the EM31 and all data was jointly stored in a data logger. The conductivity meter was a GEONICS EM31 with Allegro data logger and NAV31 data acquisition software. The instrument was checked at a base station, the readings were stable and no drift occurred.

The conductivity is typical for certain geological material types. Dry and clean Sand/Gravel and most clean limestone rock types have relatively low conductivities while peat, clay and clay-rich rock types (mudstone, shale) have high conductivities.

EM31 ground conductivity determines the bulk conductivity of the subsurface over a typical depth between 0 and 6 m bgl. and over a radius of approx. 5m around the instrument. When looking for clay, silt and water infill within rock occurring at relatively shallow depth the EM31 can find anomalous rock zones with a vertical extent of approx. 3m. The measurements are disturbed by metal and other conductive objects within the range of the instrument and therefore no geological interpretations can be made in the vicinity of such man-made objects. Either readings were not taken near sources of interference in the first place or notes were taken by the operator in order to remove these during processing or to account for these in the interpretation.

The combined survey area has a size of 22.45 ha.

2.3 2D-Resistivity

2D-Resistivity profiles were surveyed with electrode spacing of 5m, up to 64 electrodes per set-up and a maximum length of 315m per set-up. The longest of the 13 profiles was 475 m long. The readings were taken with a Tigre Resistivity Meter, Imager Cables, stainless steel electrodes, laptop and ImagerPro acquisition software.

During 2D-Resistivity surveying data is acquired in the form of linear profiles using a suite of metal electrodes. A current is injected into the ground via a pair of electrodes while a potential difference is measured across a second pair of electrodes. This allows for the recording of the apparent resistivity in a two-dimensional arrangement below the profile. The data is inverted after the survey to obtain a model of subsurface

resistivities. The generated model resistivity values and their spatial distribution can then be related to typical values for different geological materials.

2D-Resistivity has proven zones of anomalous rock/karstified rock with lateral extents of 5 m and more.

The combined length of all survey profiles was 3890 m.

2.4 Site Work

The data acquisition was carried out between the 2nd and 18th of June 2015. The weather conditions were variable throughout the acquisition period. Health and safety standards were adhered to at all times.

The locations and elevations were surveyed with a TRIMBLE RTK-GPS to accuracy < 0.02m.

3. RESULTS AND INTERPRETATION

The interpretation of geophysical data was carried out utilising the known response of geophysical measurements, typical physical parameters for subsurface features that may underlay the site, and the experience of the authors.

3.1 EM31 Ground Conductivity

The EM31 ground conductivity values were merged into one data file for each survey area and contoured and gridded with the SURFER contouring package. The contours are created by gridding and interpolation and care must be taken when using the data. The contour maps are overlaid over the location and base maps (Plans 3a – 3g) and the values in milliSiemens/metre (mS/m) are indicated on the colour scale bar.

With the exception of the westernmost survey at R1 all other EM31 areas have the same colour scale (1-15 mS/m). Only the survey at the centre of profile R1 has a doubled scale (1-30 mS/m) because the range of values is much larger.

The EM31 values for ground conductivity indicate the conductivity to a depth of approx. 6m. Therefore the values indicate the material type over an area at a shallow level. Low conductivities indicate either shallow bedrock or dry sandy and gravely overburden while higher conductivities indicate thicker overburden, shallow zones of bedrock karstification and clay-rich overburden. Very high or very low conductivities indicate noise from man-made metal objects and are ignored in the interpretation. High interference typically occurs along field boundaries and fences and close to the railway line and bridges.

The colour scale is designed such that the colours indicate certain geological material types. Blue colours indicate shallow bedrock, thin overburden and generally an absence of anomalous ground conditions.

Green colours indicate an increase in overburden thickness because there are more clay minerals contained within the soil and subsoil matrix. Yellow to red indicates thick overburden with clay-rich material. These area can contain anomalies with relevance to karst features as solution voids in shallow bedrock can be filled with clay and other products that increase the conductivity.

3.2 2D-Resistivity Profiles

The 2D-Resistivity data was positioned and inverted with the RES2DINV inversion package. Overlapping profiles were concatenated for a joint inversion. The programme uses a smoothness constrained least-squares inversion method to produce a 2D model of the subsurface model resistivities from the recorded apparent resistivity values. Three variations of the least squares method are available and for this project the Jacobian Matrix was recalculated for the first three iterations, then a Quasi-Newton approximation was used for subsequent iterations. Each dataset was inverted using seven iterations resulting in a typical RMS error of < 5.0%. The resulting models were colour contoured with the same resistivity scale for all profiles and they are displayed as cross sections (Plans 3a – 3g).

The resistivities cover a range typical for materials from clay overburden to clean limestone bedrock. Low resistivity values (<400 Ohmm with red – yellow colours) typically indicate presence of clay and water in the overburden or within fractured rock. Medium values (400 – 1200 Ohmm with green colours) show sand/gravel/boulders rather than clay in the overburden and weathered limestone bedrock. High resistivities (> 1200 Ohmm) indicate bedrock type like clean limestone.

Generally the resistivity values are very high and indicate a clean limestone as the bedrock type. Clean limestone is liable to karstification and is known to be highly karstified in many places like County Galway. In the survey area there are relatively few anomalies typical for karst features in the limestone.

Where low to medium values occur at depth within the high resistivity limestone they indicate karstification, faulting or fracturing of the limestone. The void space is filled with clay, silt and weathering products and water saturated. All of these material lower the resistivities when present within the limestone.

3.3 Relation with previous Seismic Survey

The 2D-Resistivity Images are overlaid with the seismic survey and the data can be jointly interpreted. The seismic refraction method determines the strength/stiffness/rock quality through the seismic velocity while resistivities and conductivities depend on the material and mineral composition of the ground. Therefore resistivity/conductivity is more diagnostic for karst features, especially where these are infilled with clay and water.

At R7 the overburden is very shallow as indicated by both methods towards the slight rise in the east.

Good correlations can be seen at R8 where the seismic surface layers thicken in the west, and also the resistivities show some smaller anomalies here.

At R9 at around 120 m the seismic interpreted layers indicated some thick weathering of rock and the resistivities mirror this trend with green colours and mid-range resistivities indicating thicker weathered rock.

The seismic interpretation follow generally the resistivity values in terms of thicker/thinner overburden. Only at R10 there is a larger difference which can be explained by the seismic profile having been in the river while the R10 was offset on land.

4. CONCLUSIONS

Several areas along the Dunkellin River were investigated by resistivity and conductivity survey and the conclusions and results can be summarised by areas:

R1 is the furthest profile to the west and sea along the Dunkellin River and overburden sediments are containing clay deposited in the flood plain. The overburden is characterised by the lowest resistivities and highest conductivities of the survey. The overburden thickness is approx. 3 – 5m. At the centre of R1 the lowest resistivities stretch to a depth of around 10m. The seismic layers continue relatively horizontal, therefore it is interpreted that the rock near its surface has been karstified and weathered but that it is filled quite tightly with clay and other products. The anomalous zone is also reflected on the EM31 conductivity but it is limited to a roughly rectangular zone. At depth the resistivities are very high indicating the continuous high quality limestone.

The conductivity between area R1 and R2 was done around rotary corehole RC42 which showed an area of clay infill of a cavity/fracture between 3.8 and 4.8m. This type of anomaly is also expected at the location of R1 as discussed in the previous paragraph. The EM31 conductivities show that RC42 is located at the edge of high conductivities that stretch along the river but get smaller at a larger distance from the river. The zone continues west and south-west.

R2 is located along a small contributory river and shows increasing resistivity values from northwest to southeast. This is also reflected in the ground conductivities which decrease away from the Dunkellin River. Anomalous conditions here are interpreted to consist of clay and water rich overburden near the river rather than karstification. At depth the resistivities are very high indicating the continuous high quality limestone.

R3 and R4 are located north of the river in a wider area marked for land spreading. There is a spring located close to the river. R3 shows the strongest anomalous resistivities measured anywhere during this survey. A shallow red area between 50 and 150 m shows clay rich and saturated overburden. This area is in a small depression which is not used for pasture, unlike all surrounding fields. A deep red zone exists at 40 – 70 m with a depth of 8 – 18 m. This is a typical anomaly for a clay and water infilled area and karstified rock. Two weaker zones exist within the rock at 170 and 260 m along the profile. R4 shows thin overburden, no anomalies and at depth the resistivities are very high indicating the continuous high quality limestone. The EM31 ground conductivities indicate the outline of the depression on R3 but otherwise there is shallow rock all over this survey area.

R5 is in an area of small visible karst features looking like pools where the water drains away. The resistivities and ground conductivities only show small medium anomalies and all those are occurring close to the surface with no indications at larger depths.

R6, R7 and R9a all indicate shallow overburden and no anomalous ground either at shallow or large depth.

R8 and R9 indicate some small isolated locally anomalous resistivities and conductivities that do not stretch deeper than 10 – 15m. These weak anomalies typical for slightly karstified and weathered rock in the vertical resistivity data are mirrored in the lateral EM31 ground conductivities.

R10 resistivities indicate slightly anomalous conditions towards both ends of the profiles. At the western end this likely due to clay rich overburden at the extreme profile end. At the eastern end the medium resistivities stretch into the rock. The EM31 ground conductivity covers a wider area to the northeast from the end of R10 and the anomalous zone gains higher conductivities close to the river. This features is likely a weathered/karstified rock zone that terminates in the Northeast at the Dunkellin River.

5. REFERENCES

1. **GSEG 2002.** Geophysics in Engineering Investigations. Geological Society Engineering Geology Special Publication 19, London, 2002.

2. **GSI, 1995.** Geology of Galway Bay. Geological Survey of Ireland 1995.

3. **MGX, 2014**. Dunkellin River Flood Relief Scheme. County Galway. Geophysical Survey. Final Report, 2014.

4. **Milsom, 1989.** Field Geophysics. John Wiley and Sons.

5. **Reynolds, 1997.** An Introduction to Applied and Environmental Geophysics. John Wiley and Son.

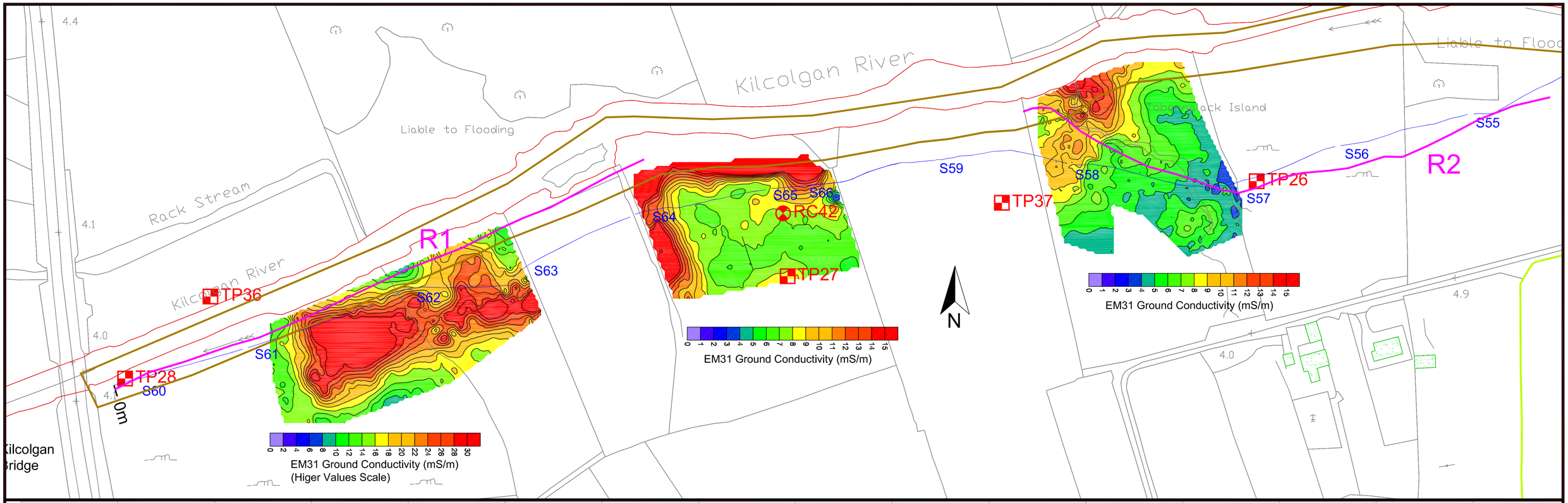
Minerex Geophysics Limited	Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Fax. (01) 6510033 Email: info@mgx.ie Web: www.mgx.ie
CLIENT	Priority Geotechnical Ltd
PROJECT	Dunkellin River Flood Relief Geophysical Survey 2015
TITLE	Plan 1: Overview Plan

SCALE:	1:10000 @ A1
PROJECT:	5945
DRAWN:	JC
DATE:	22/06/2015
MGX FILE:	5945d_Plans.dwg
STATUS:	Final

LEGEND: **Geophysical Survey Locations:**

- S1 — Seismic Refraction Profile
- R1 — 2D-Resistivity Profile
- EM-31 Ground Conductivity
- Proposed Material Depositing

Locations are in ITM, Elevations are in mOD (Malin Head)



Minerex Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Fax. (01) 6510033
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Priority Geotechnical Ltd
PROJECT	Dunkellin River Flood Relief Geophysical Survey 2015
TITLE	Plan 3a: 2D-Resistivity Models and Ground Conductivity Contour Maps

SCALE:	Hor 1:1000 @ A1, Ver 1:200, VE x 5
PROJECT:	5945
DRAWN:	JC
DATE:	22/06/2015
MGX FILE:	5945d_Plans.dwg
STATUS:	Final

LEGEND: Geophysical Survey Locations:

- S1 — Seismic Refraction Profile
- R1 — 2D-Resistivity Profile
- EM-31 Ground Conductivity
- Proposed Materlal Depositing

Locations are in ITM, Elevations are in mOD (Malin Head)

Geothechnical Survey Locations:

- BH01 — Borehole Location
- RC01 — Rotary Core Location
- TP01 — Trial Pit Location

Layers and Interpretation from Seismic Refraction Model:

- 1800 — Seismic Velocity in m/s
- Layers from Seismic Refraction Model:
- Ground Land Surface/Top of Layer 1 (300-500 m/s) Soft/loose Topsoil/Overburden
- River Bottom and Top of Layer 2 (1500 m/s) Saturated Overburden
- Top of Layer 2 (1100 - 1500 m/s) Firm - Stiff/Dense Overburden
- Top of Layer 3 (2100-2200 m/s) Weathered Broken Rock
- Top of Layer 4 (4400-4800 km/s) Strong Fresh Rock

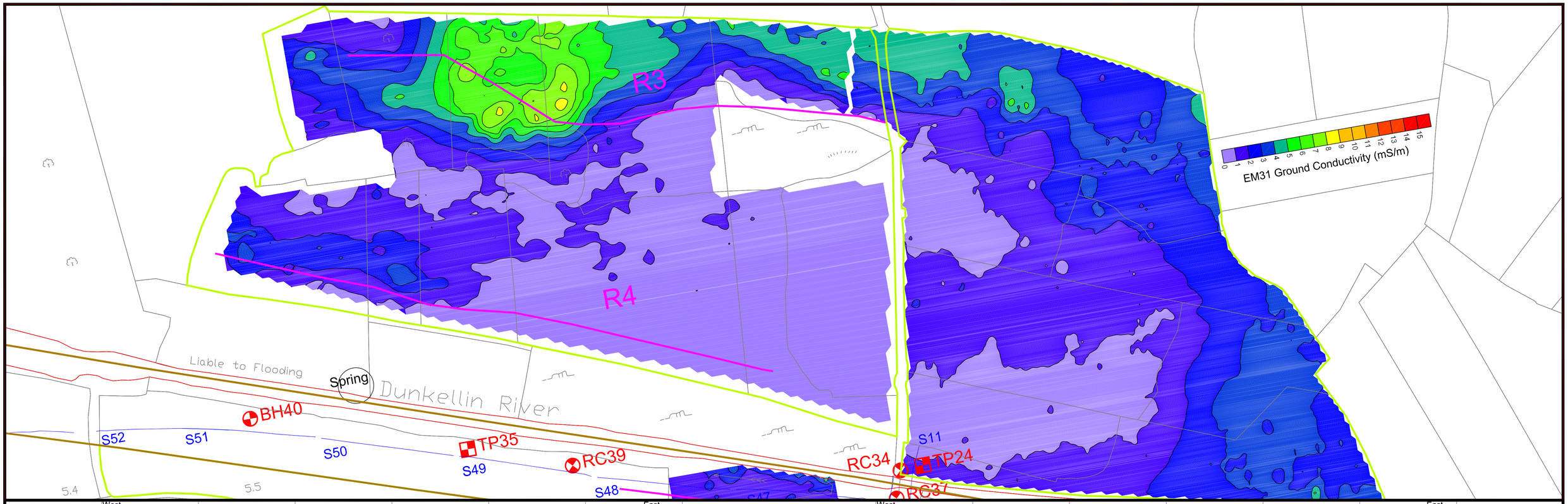
Legend for Abbreviated Borehole Logs:

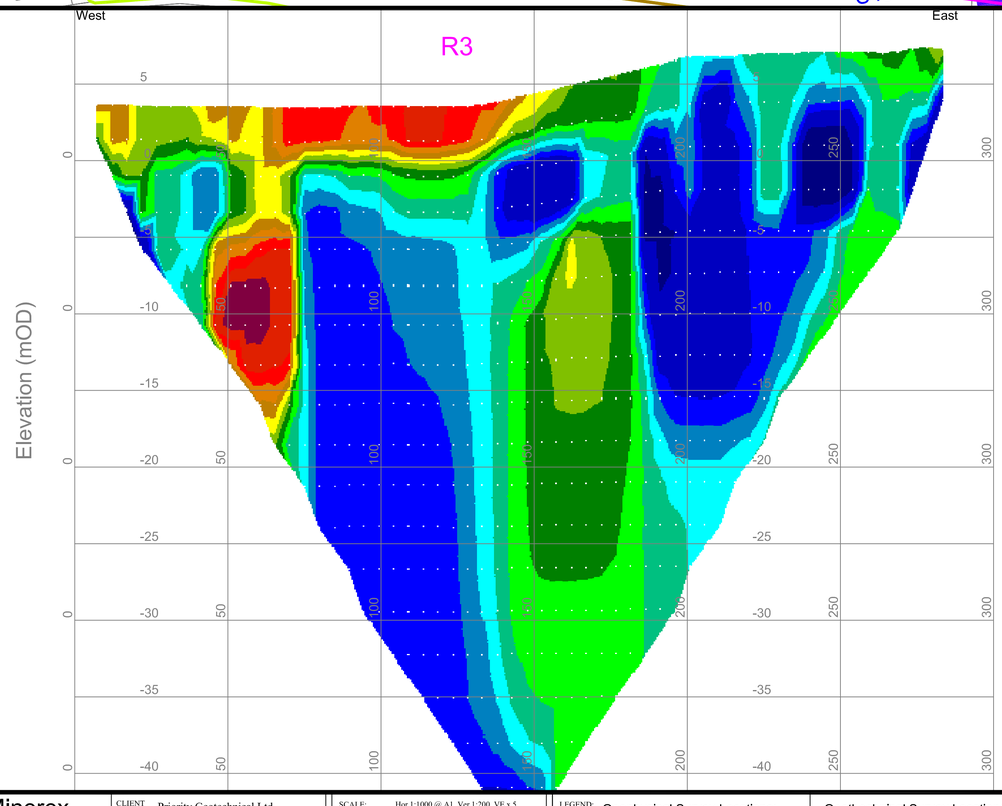
RC01	Borehole location
(8mN)	Distance >5m and direction from line
OB	Overburden
WLST	Weathered Limestone
LST	Limestone

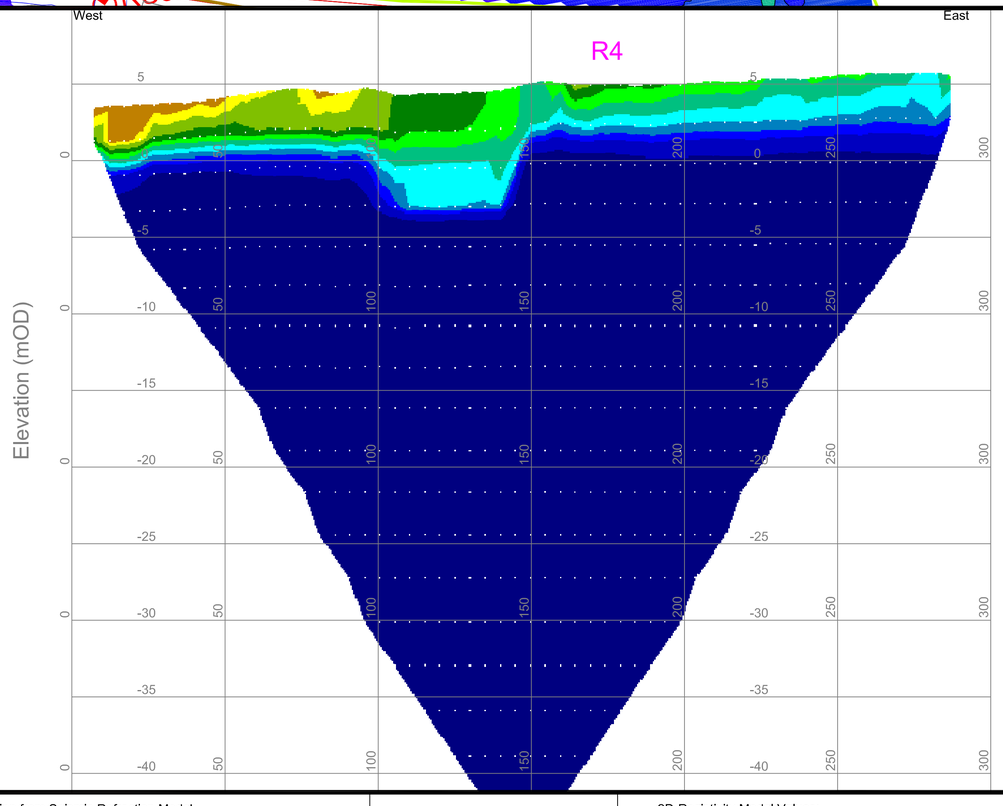
2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

50.0 | 100 | 200 | 400 | 800 | 1600 | 3200 | 6400







Minerex
Geophysics Limited
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Tel. (01) 6510030
Fax. (01) 6510033
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CLIENT	Priority Geotechnical Ltd
PROJECT	Dunkellin River Flood Relief Geophysical Survey 2015
TITLE	Plan 3b: 2D-Resistivity Models and Ground Conductivity Contour Maps

SCALE:	Hor 1:1000 @ A1, Ver 1:200, VE x 5
PROJECT:	5945
DRAWN:	JC
DATE:	22/06/2015
MGX FILE:	5945d_Plans.dwg
STATUS:	Final

LEGEND:

Geophysical Survey Locations:

S1	Seismic Refraction Profile
R1	2D-Resistivity Profile
	EM-31 Ground Conductivity
	Proposed Material Depositing

Locations are in ITM, Elevations are in mOD (Malin Head)

Geothechnical Survey Locations:

BH01	Borehole Location
RC01	Rotary Core Location
TP01	Trial Pit Location

Layers and Interpretation from Seismic Refraction Model:

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	Layers from Seismic Refraction Model:
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2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

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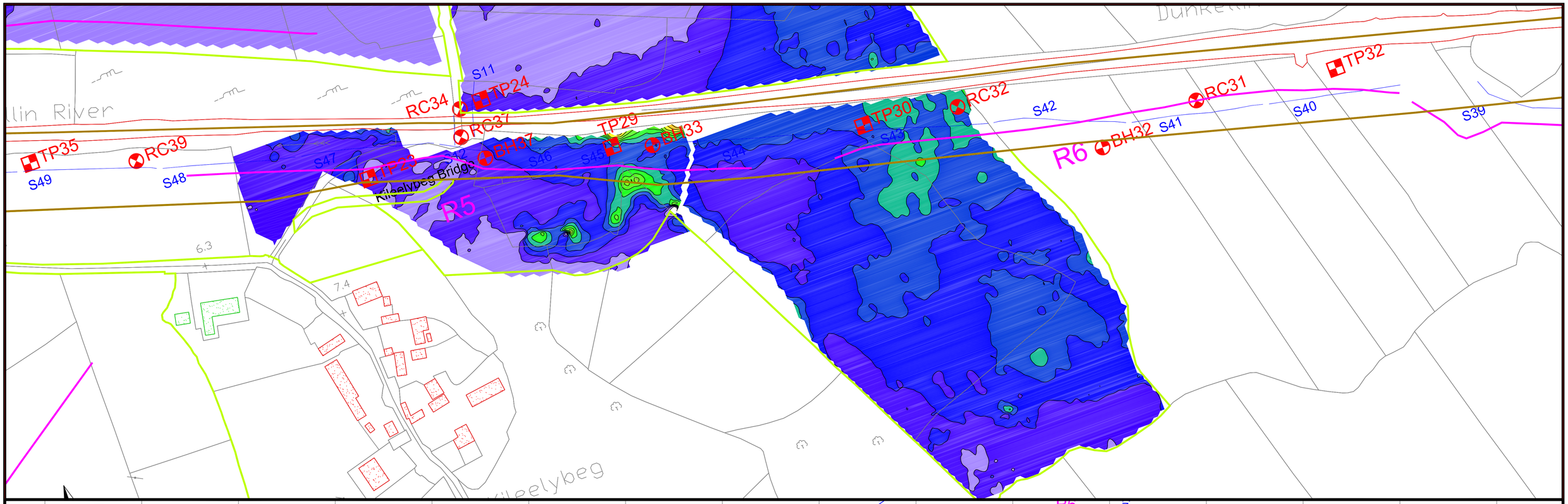

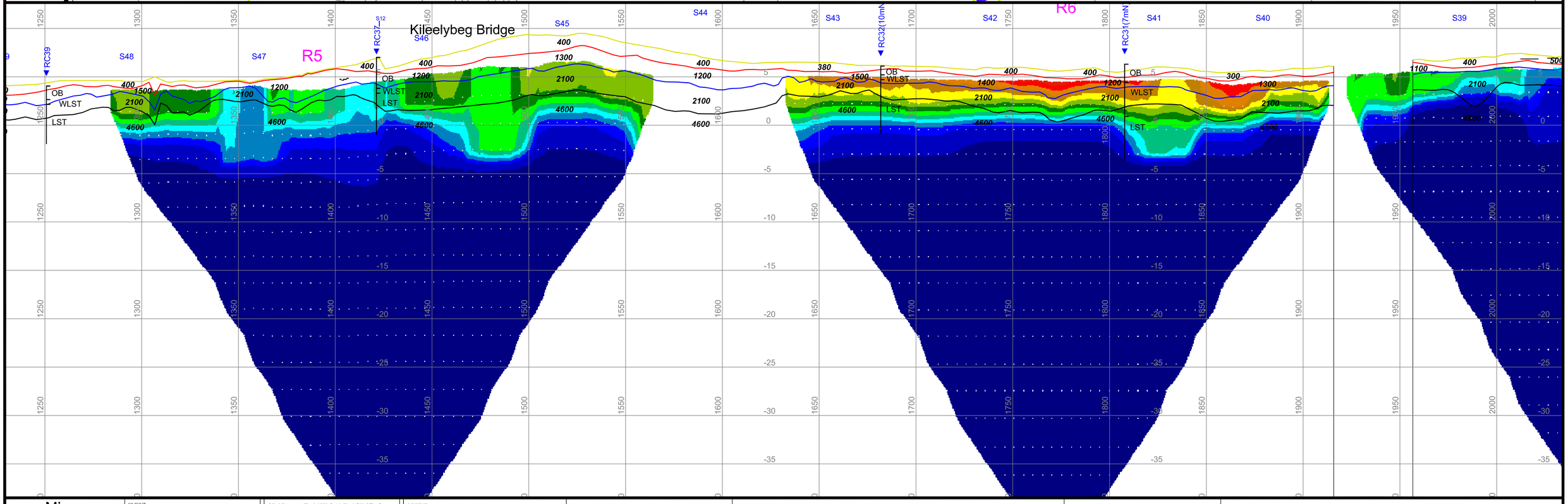

Minerex
Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Fax. (01) 6510033
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Web: www.mgx.ie

CLIENT	Priority Geotechnical Ltd
PROJECT	Dunkellin River Flood Relief Geophysical Survey 2015
TITLE	Plan 3c: 2D-Resistivity Models and Ground Conductivity Contour Maps

SCALE:	Hor 1:1000 @ A1, Ver 1:200, VE x 5
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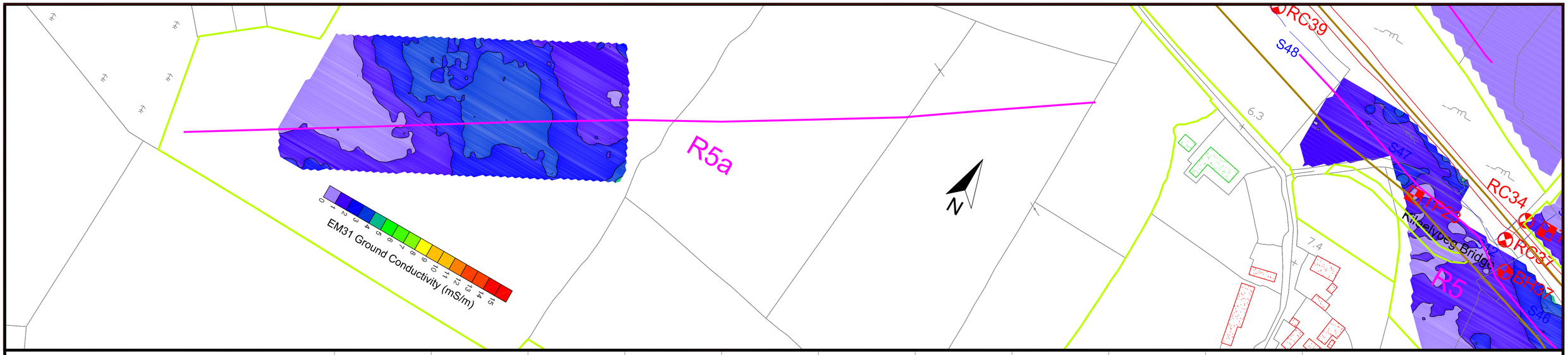

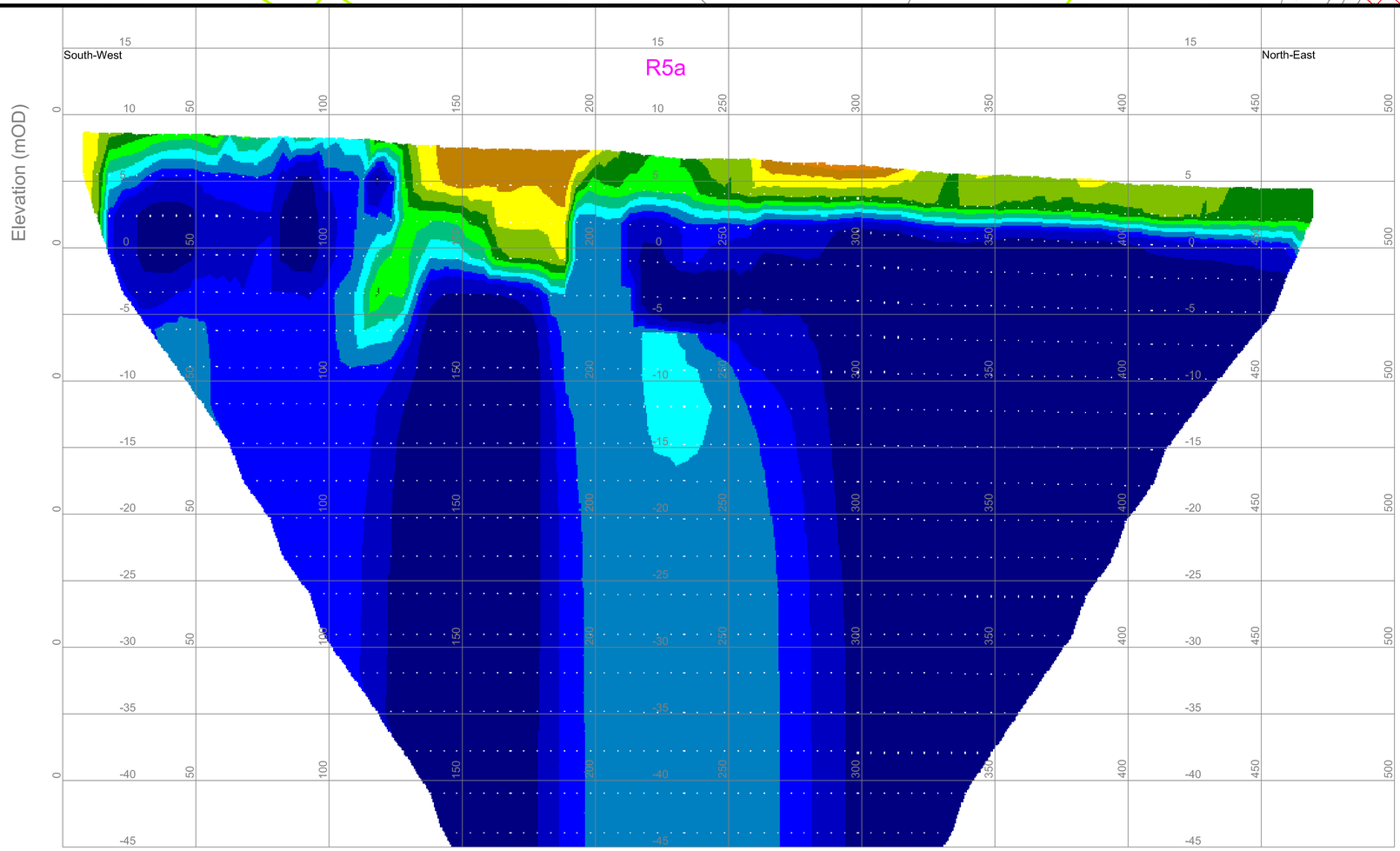

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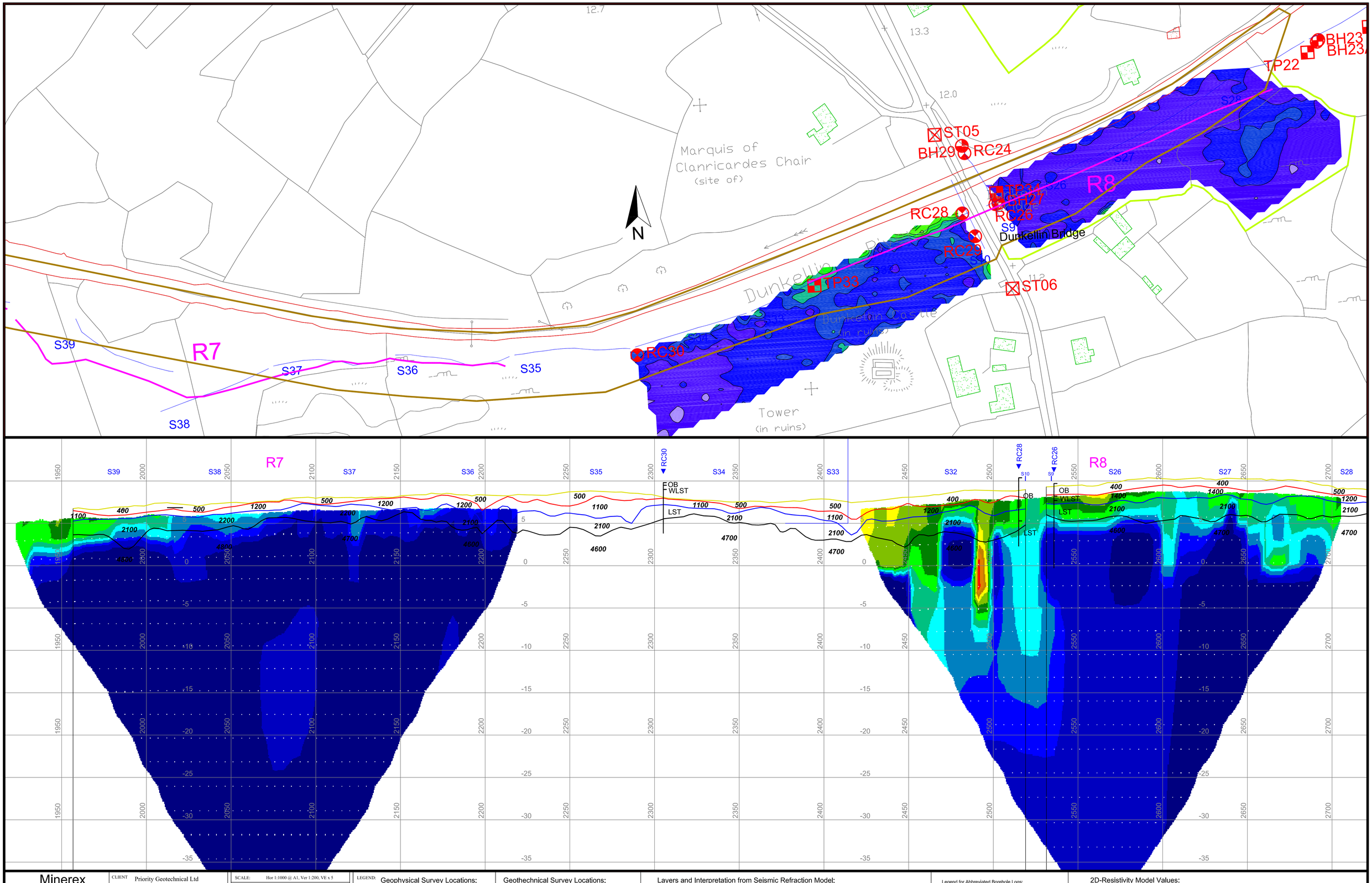

Minerex
Geophysics Limited

Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Fax. (01) 6510033
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DRAWN:	JC
DATE:	22/06/2015
MGX FILE:	5945d_Plans.dwg
STATUS:	Final

LEGEND:

Geophysical Survey Locations:

S1	Seismic Refraction Profile
R1	2D-Resistivity Profile
	EM-31 Ground Conductivity
	Proposed Material Depositing

Locations are in ITM, Elevations are in mOD (Malin Head)

Geothechnical Survey Locations:

BH01	Borehole Location
RC01	Rotary Core Location
TP01	Trial Pit Location

Layers and Interpretation from Seismic Refraction Model:

1800 Seismic Velocity in m/s

Layers from Seismic Refraction Model:

- Ground Land Surface/Top of Layer 1 (300-500 m/s) Soft/loose Topsoil/Overburden
- River Bottom and Top of Layer 2 (1500 m/s) Saturated Overburden
- Top of Layer 2 (1100 - 1500 m/s) Firm - Stiff/Dense Overburden
- Top of Layer 3 (2100-2200 m/s) Weathered Broken Rock
- Top of Layer 4 (4400-4800 km/s) Strong Fresh Rock

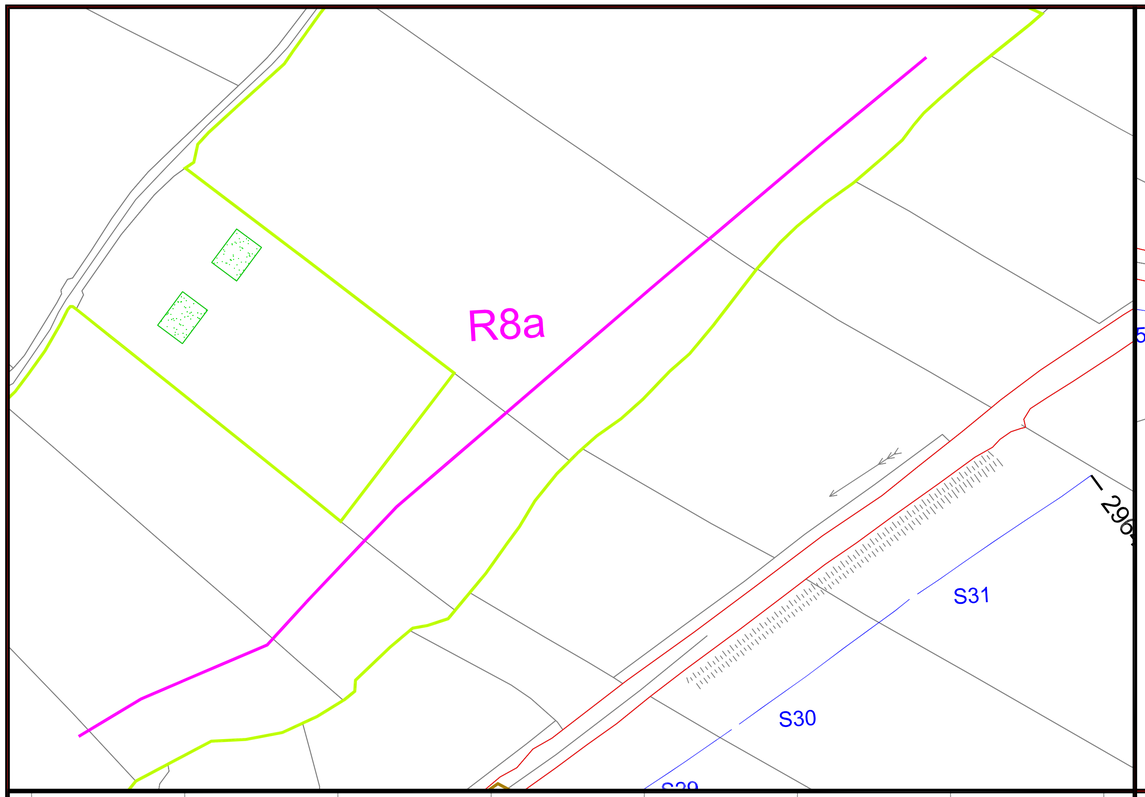
Legend for Abbreviated Borehole Logs:

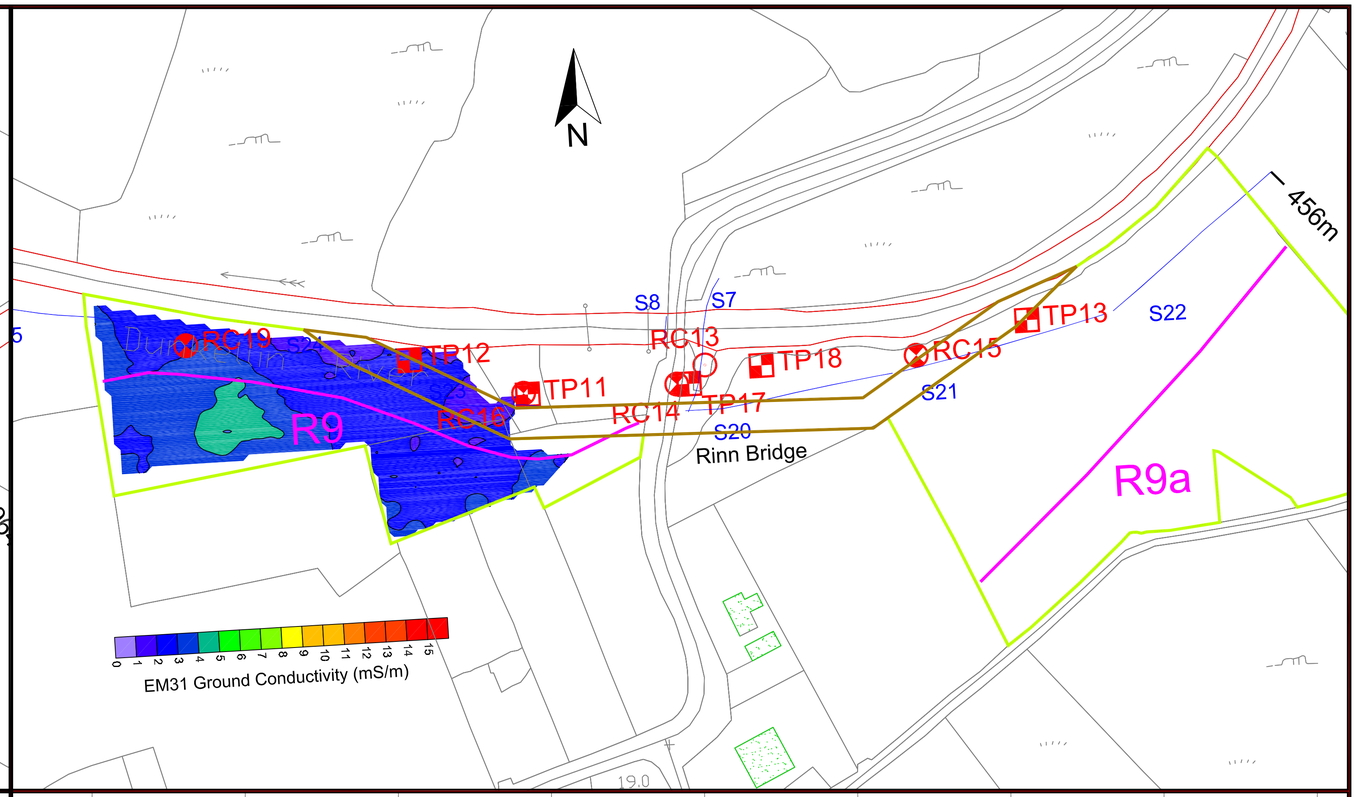
RC01	Borehole location
(8mN)	Distance >5m and direction from line
OB	Overburden
WLST	Weathered Limestone
LST	Limestone

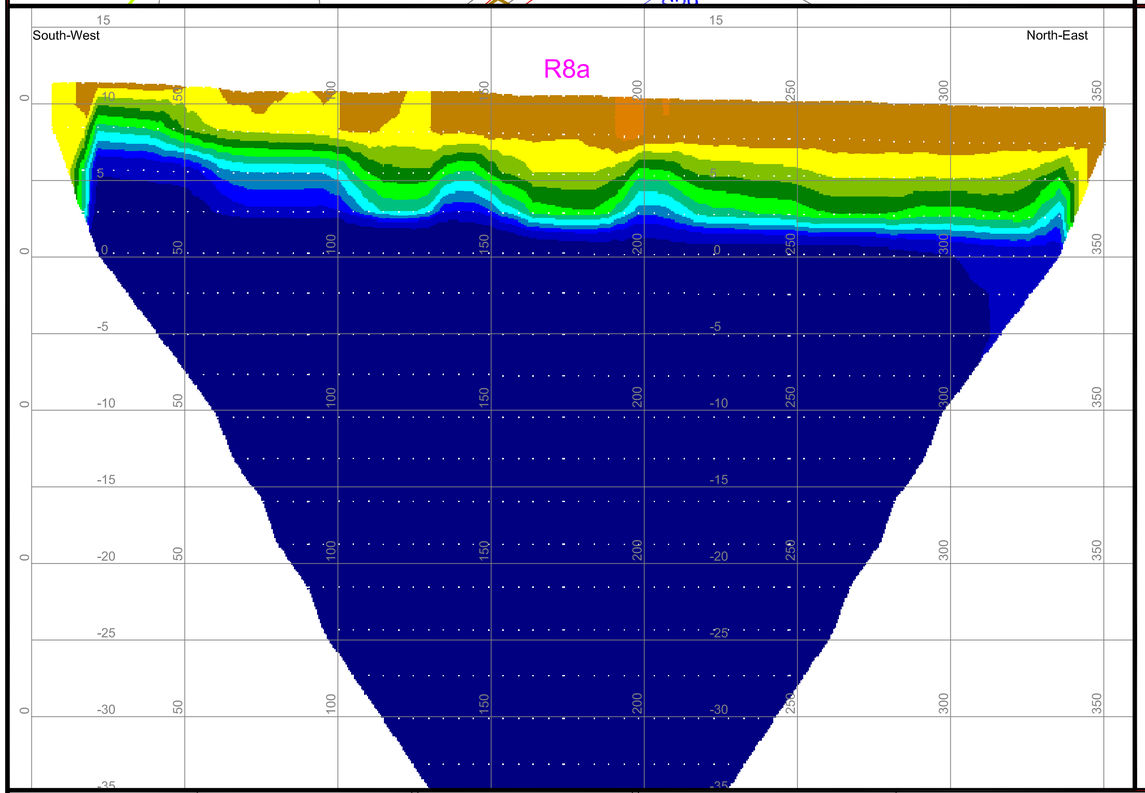
2D-Resistivity Model Values:

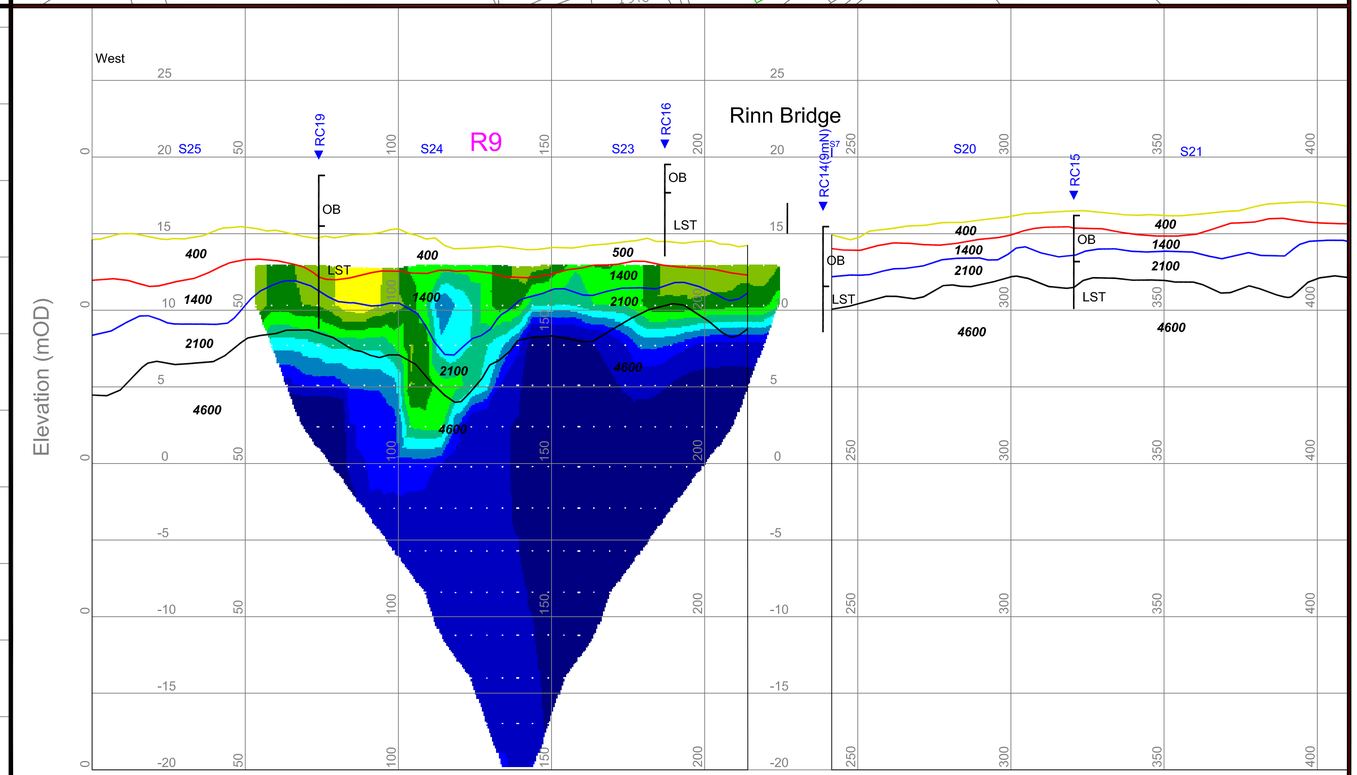
Resistivities (Ohmm) for 2D-Resistivity Model

50.0 100 200 400 800 1600 3200 6400









Minerex
Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Fax. (01) 6510033
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Priority Geotechnical Ltd
PROJECT	Dunkellin River Flood Relief Geophysical Survey 2015
TITLE	Plan 3f: 2D-Resistivity Models and Ground Conductivity Contour Maps

SCALE:	Hor 1:1000 @ A1, Ver 1:200, VE x 5
PROJECT:	5945
DRAWN:	JC
DATE:	22/06/2015
MGX FILE:	5945d_Plans.dwg
STATUS:	Final

LEGEND:

Geophysical Survey Locations:

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R1	2D-Resistivity Profile
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Locations are in ITM, Elevations are in mOD (Malin Head)

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Layers from Seismic Refraction Model:

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Resistivities (Ohmm) for 2D-Resistivity Model

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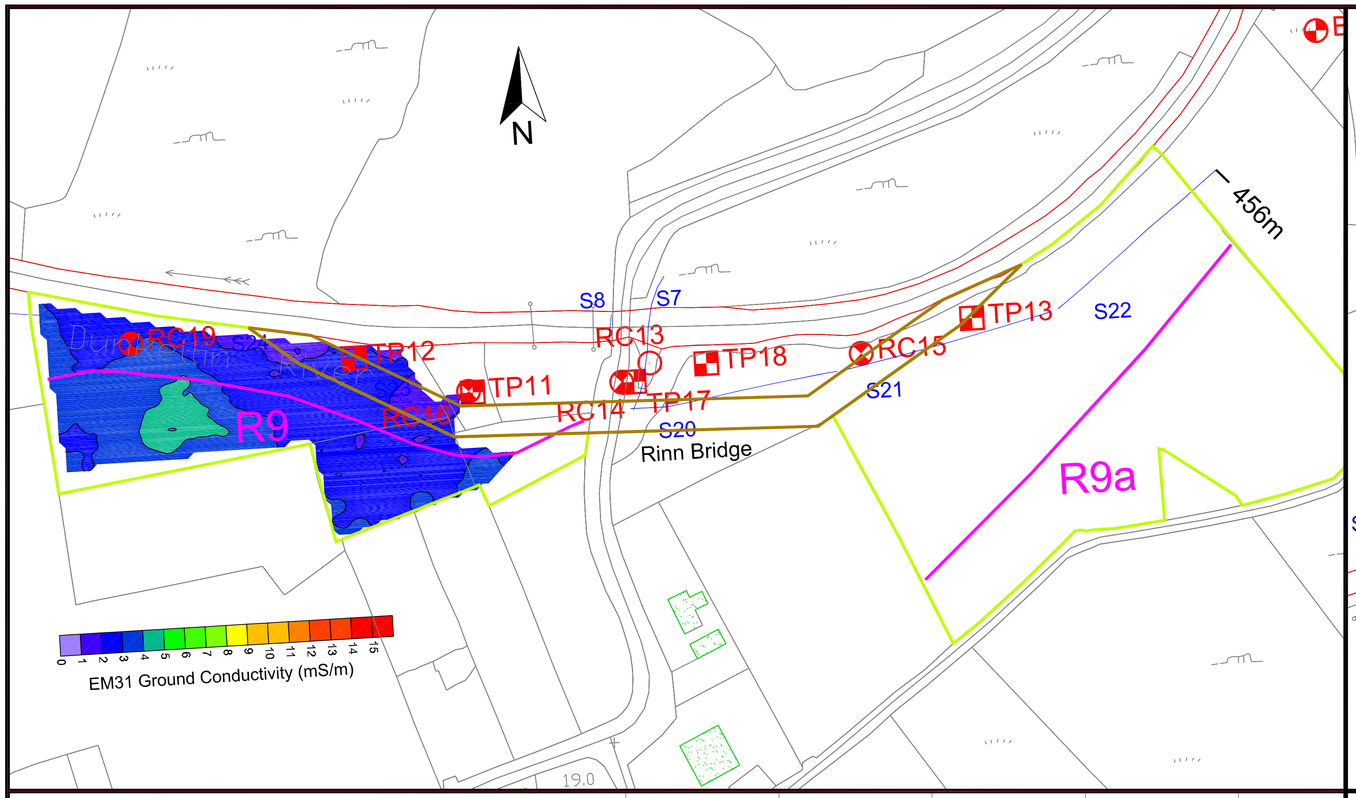

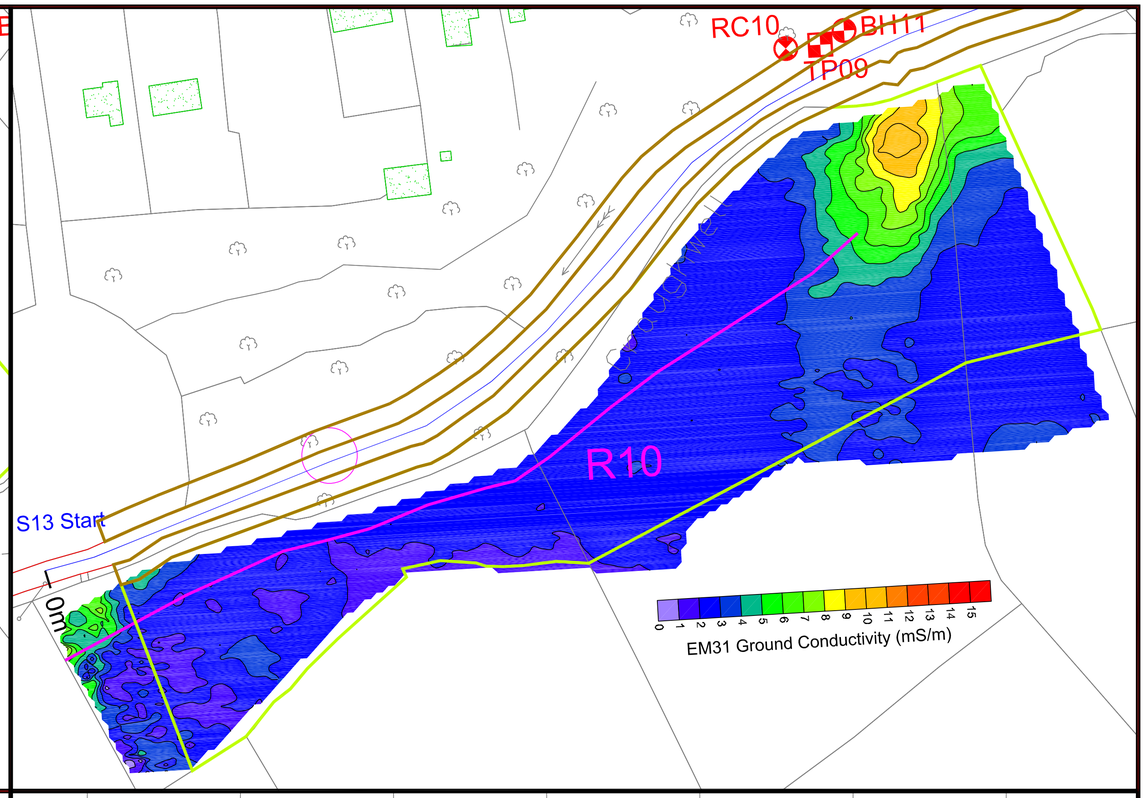

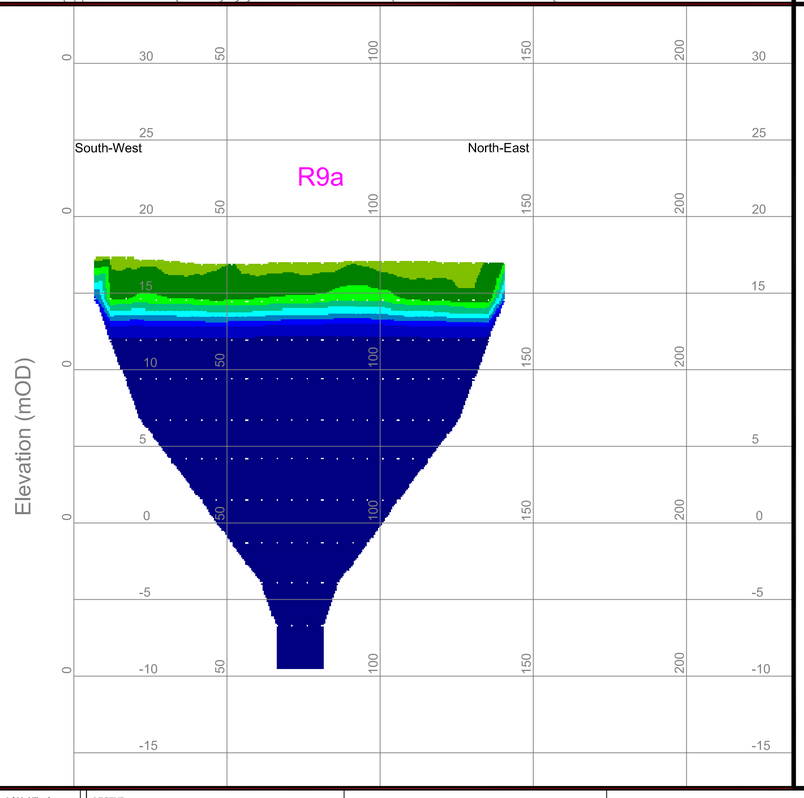

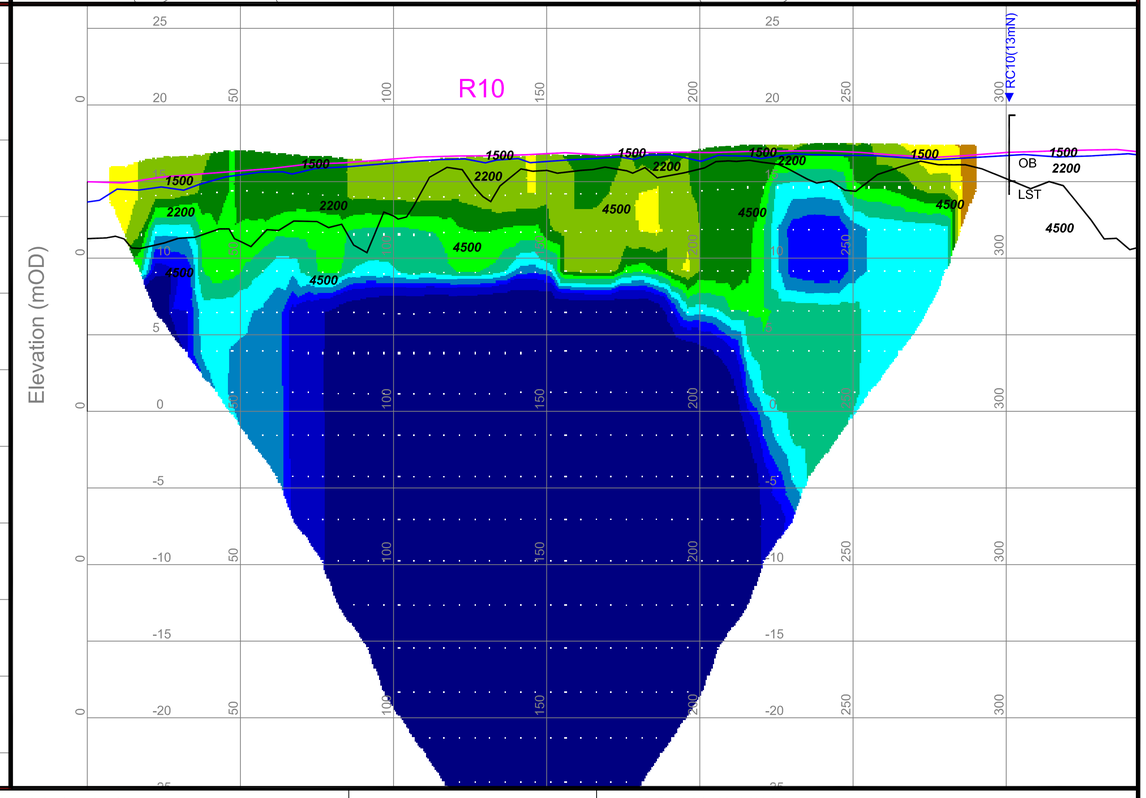

Minerex
Geophysics Limited
Unit F4, Maynooth Business Campus
Maynooth, Co. Kildare
Tel. (01) 6510030
Fax. (01) 6510033
Email: info@mgx.ie
Web: www.mgx.ie

CLIENT	Priority Geotechnical Ltd
PROJECT	Dunkellin River Flood Relief Geophysical Survey 2015
TITLE	Plan 3g: 2D-Resistivity Models and Ground Conductivity Contour Maps

SCALE:	Hor 1:1000 @ A1, Ver 1:200, VE x 5
PROJECT:	5945
DRAWN:	JC
DATE:	22/06/2015
MGX FILE:	5945d_Plans.dwg
STATUS:	Final

LEGEND:

Geophysical Survey Locations:

- S1 — Seismic Refraction Profile
- R1 — 2D-Resistivity Profile
- EM-31 Ground Conductivity
- Proposed Material Depositing

Locations are in ITM, Elevations are in mOD (Malin Head)

Geothechnical Survey Locations:

- BH01 — Borehole Location
- RC01 — Rotary Core Location
- TP01 — Trial Pit Location

Layers and Interpretation from Seismic Refraction Model:

- 1800 — Seismic Velocity in m/s
- Layers from Seismic Refraction Model:
- Ground Land Surface/Top of Layer 1 (300-500 m/s) Soft/loose Topsoil/Overburden
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2D-Resistivity Model Values:

Resistivities (Ohmm) for 2D-Resistivity Model

50.0 100 200 400 800 1600 3200 6400

Marquis of Clanricardes Chair (site of)

Tower (in ruins)

Dunkellin Bridge

Cahermore

Rinn Bridge

Rinn

Kilcolgan River

Liable to Flooding

Dunkellin River

Spring

Glebe House

Kileelybeg

Well

10kv

E.S.

R1

R2

R3

R4

R5a

R6

R8

R9

R9a

R10

S13 Start

S13 End

EM31 Ground Conductivity (mS/m)

0 - 2 2 - 4 4 - 6 6 - 8 8 - 10 10 - 12 12 - 14 14 - 16 16 - 18 18 - 20 20 - 22 22 - 24 24 - 26

N

Minerex Geophysics Limited	
Unit F4, Maynooth Business Campus Maynooth, Co. Kildare Tel. (01) 6510030 Fax. (01) 6510033 Email: info@mgx.ie Web: www.mgx.ie	
CLIENT	Priority Geotechnical Ltd
PROJECT	Dunkellin River Flood Relief Geophysical Survey
TITLE	Plan 3: EM31 Ground Conductivity
SCALE:	1:2000 @ A1
PROJECT:	5825
DRAWN:	JC
DATE:	31/07/2014
MGX FILE:	5825f_Plans.dwg
STATUS:	Final

LEGEND: Geophysical Survey Locations:

S1 Seismic Refraction Profile

R1 2D-Resistivity Profile

Locations are in ITM, Elevations are in mOD (Malin Head)

APPENDIX C

DRAFT CONSTRUCTION MANAGEMENT PLAN

Galway County Council

Dunkellin River & Aggard Stream Flood Relief Scheme

Draft Construction Management Plan for Planning Purposes

TOBIN CONSULTING ENGINEERS

Galway County Council,
Aras An Chontae,
Prospect Hill,
Galway

Tobin Consulting Engineers,
Fairgreen House,
Fairgreen Road, Galway

TOBIN
Patrick J. Tobin & Co. Ltd.

Document Amendment Record

Client:	**Galway County Council**
Project:	**Dunkellin & Aggard Stream Flood Relief Scheme**
Title:	**Draft Construction Management Plan**

PROJECT NUMBER: 6408				**DOCUMENT REF: 6408-Draft CMP for Planning Purposes**			
A	For Planning Purposes	MMcD	May 15	PC	June 15	MMcD	Jun 15
Revision	**Description & Rationale**	**Originated**	**Date**	**Reviewed**	**Date**	**Authorised**	**Date**
TOBIN Consulting Engineers							

1 INTRODUCTION

This document is an initial draft Project Specific Construction Management Plan which has been prepared as part of Request for Further Information by An Bord Pleanala. This document has been prepared in advance of the Construction Stage of proposed *Dunkellin River and Aggard Stream Flood Relief Scheme* and the appointment of a competent Contractor to complete the Works.

The description of the proposed plan is subject to detailed design and finalisation by the appointed Contractor(s) and should not be taken as definitive but as a minimum requirement. It is not the purpose of this Plan to reproduce or replace arrangements and procedures that will be produced by a Contractor which will be appointed to the Construction Stage (as PSCS), and where appropriate this Plan shall be considered in that light and will updated or even replaced by a more detailed and further considered document used by the appointed Contractor to manage safety, health and the environment.

Note: the term Contractor in this Draft Plan refers to the appointed Contractor or Contractors and the term Site Representative (SR) is used throughout the Plan to represent the Contractor's person in charge of the project i.e. the Project Manager, Construction Manager, Site Manager, Site Agent or Environmental Officer as appointed by the Contractor.

Any safety and health component of this Plan has been prepared in accordance with the Safety, Health and Welfare At Work (Construction) Regulations. The headings used to cover safety and health matters correspond to those recommended by the Health and Safety Authority *Guidelines to the Construction Regulations 2006: Suggested Contents of the Safety and Health Plan.* **It is noted that the HSA are *"currently reviewing our publications to take account of the Safety, Health and Welfare at Work (Construction) Regulations 2013 which came into effect on the 1st August 2013."***

In addition to describing arrangements for the management of safety and health, this Plan also addresses requirements in relation to the protection of the environment and the avoidance of pollution; hence the title: **Construction Management Plan.**

The environmental and waste management components of this Plan are based on documentation which includes:

1. Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects as published by the Department of the Environment, Communications and Local Government (2006).
2. CIRIA Report No. 133 Waste Minimisation in Construction.
3. NRA Guidelines for the Management of Waste from National Road Construction Projects.
4. *OPW Standard Operating Procedures in particular the techniques and procedures set out in "The Office of Public Works Arterial Drainage Maintenance Environmental Management Protocols & Standard Operating Procedures" April 2011.*
5. CIRIA (Construction Industry Research and Information Association) guidance on '*Control of Water Pollution from Construction Sites' (CIRIA Report No C532, 2001); and*
6. CIRIA (Construction Industry Research and Information Association) guidance on '*Control of Water Pollution from Linear Construction Projects*' (CIRIA Report No. C648, 2006).

The Final Construction Management Plan will be submitted to Galway County Council for review and agreed prior to work commencing and shall include drawings detailing all proposed arrangements including, as a minimum, those listed as follows :

- Locations and layout of all site compounds including all environmental management and impact mitigation techniques.
- The location and details and durations of any proposed road and lane Closures/blockages.
- Provision for pedestrians and local access. Pedestrian facilities shall be provided in accordance with Chapter 8 of the Traffic Management Guidelines.
- The location and details of all temporary signage to be erected.
- Details of any arrangements for the delivery and storage of materials.
- Advance advertising in local press, local radio, advisory road signs and leaflet drops will be required to notify the general public of any changes to be implemented in the management of traffic in and around the sites.

In all aspects of the management of traffic the following parties will be liaised with;

- Galway County Council Roads Department.
- Garda Síochána, ambulance & fire services.
- Employer's Representative.

2 DESCRIPTION OF THE SCHEME AND EXISTING ENVIRONMENT

The extent of the overall study area for the proposed *Dunkellin River and Aggard Stream Flood Relief Scheme* has been divided into two distinct channels. These channels are:

1. the Dunkellin/Craughwell River from approximately 200m upstream of Craughwell Village to the sea at Kilcolgan just upstream of where the river enters Galway Bay.

2. the Aggard Stream and Monksfield River from the townland of Cregaclare (near Ardrahan), to its outfall at the confluence of the Dunkellin and Craughwell Rivers.

It is proposed to undertaken flood relief works along the Dunkellin in three reaches of the river:

a. in the vicinity of Craughwell Village,
b. locally at Rinn Bridge and
c. from a location just upstream of the Dunkellin Bridge to the N18 at Kilcolgan.

The works consist of channel deepening (not widening) in Craughwell village to the confluence of the Aggard Stream, local channel widening at Rinn Bridge, out of channel maintenance downstream of the Rahasane Turlough to Rinn Bridge (i.e., limited to trimming back of terrestrial bank vegetation such as trees and low hanging branches and removal of encroaching vegetation such as brambles and scrub) and channel widening from the Dunkellin Bridge to the N18.

It is not proposed to undertake any significant arterial drainage works along the Aggard Stream. The proposed works associated with the Aggard Stream will be limited to the replacement of field wall crossings which are blocked or have collapsed, together with maintenance works, including the non-invasive trimming of bank-side vegetation and the removal of areas of accumulated silt along the full length of the channel.

It is not proposed to undertake works within or adjacent to the Rahasane Turlough cSAC, NHA and SPA or within the Galway Bay Complex SAC.

The requirement for the proposed works are to relieve flooding generated from rainfall events similar to those that occurred in January 2005 and November 2009 which flooded properties in Craughwell Village and a number of townlands along the river including Rinn, Dunkellin and Killeely Beg. Table 1, extracted from the Technical Description of the proposed Works, as contained in the EIS, provides a summary of the proposed works.

Table 1 – Summary of the proposed Proposed Scheme

Location	Proposed Scheme
Main Channel (Craughwell Village)	The main channel shall in general be deepened by 0.6m with a localised maximum excavation of 1.0m.
Bridge Work in Craughwell	Both existing road bridges will require engineering works on each abutment to facilitate proposed channel deepening. Similarly the railway bridge will also require foundation works for the same purposes.
Bypass Channel (Craughwell Village)	The bypass channel is to be cleaned and excavated to alleviate flooding in Craughwell Village.
Rahasane Turlough	It is Not Proposed to Complete any Works within or adjacent to the main body of the Rahasane Turlough cSAC.
Channel Works between the Rahasane Turlough and Rinn Bridge and Works at Rinn	Out of channel maintenance downstream of the Rahasane Turlough to Rinn Bridge (i.e., limited to trimming back of terrestrial vegetation such as trees and low hanging branches and removal of encroaching vegetation such as brambles and scrub) with provision of new flood relief eyes to be constructed on one bank of the river in association with two stage channel widening 50m upstream and 50m downstream of the existing Rinn Bridge.
Channel Works beginning upstream of Dunkellin bridge	Works will commence approximately 175m upstream of the Dunkellin bridge and consist of the construction of a high level channel typically 20m in width along the left bank (as one looks downstream) of the river.
Channel Works from Dunkellin Bridge to Kilcolgan Bridge	Out of channel maintenance (limited to trimming back of bank side terrestrial vegetation to 1.0m to 1.5m above high flood levels) in association with the higher level “Two stage channel works” will continue from Dunkellin Bridge to Kilcolgan Bridge with a typical additional channel width of up to 20m.
Works at Dunkellin Bridge	In conjunction with localised channel widening the existing flood eyes shall be replaced with 2 new box culverts each measuring 13m wide x 2.3m deep. Existing stone from the bridge will be reused to match the retained main stone arch.
Works at Killeely Beg Bridge	In conjunction with channel widening a new bridge shall be provided with an 18m span.
Salmon Counter	The salmon counter will be relocated to a position upstream of Killeely Beg bridge as part of the river enhancement works

The extent of the overall study area, as shown in Figure 2.1, has been divided into areas contributing to two distinct channels. These channels are:

3. the Dunkellin/Craughwell River from approximately 200m upstream of Craughwell Village, through the Rahasane Turlough cSAC, NHA and SPA, to the sea at Kilcolgan just upstream of where the river enters the Galway Bay Complex SAC.

4. the Aggard Stream and Monksfield River from the townland of Cregaclare (near Ardrahan), to its outfall at the confluence of the Dunkellin and Craughwell Rivers.

Whilst the Dunkellin River drains a significant area of lands to the east, northeast and south of Craughwell village (>200km^2), the particular reaches of river considered in this project are:

1. approximately 11km of the Dunkellin River which runs in a westerly direction from Craughwell Village to the sea at Kilcolgan.
2. approximately 7.5km of the Aggard Stream which flows in a northerly direction from Ardrahan to Craughwell.

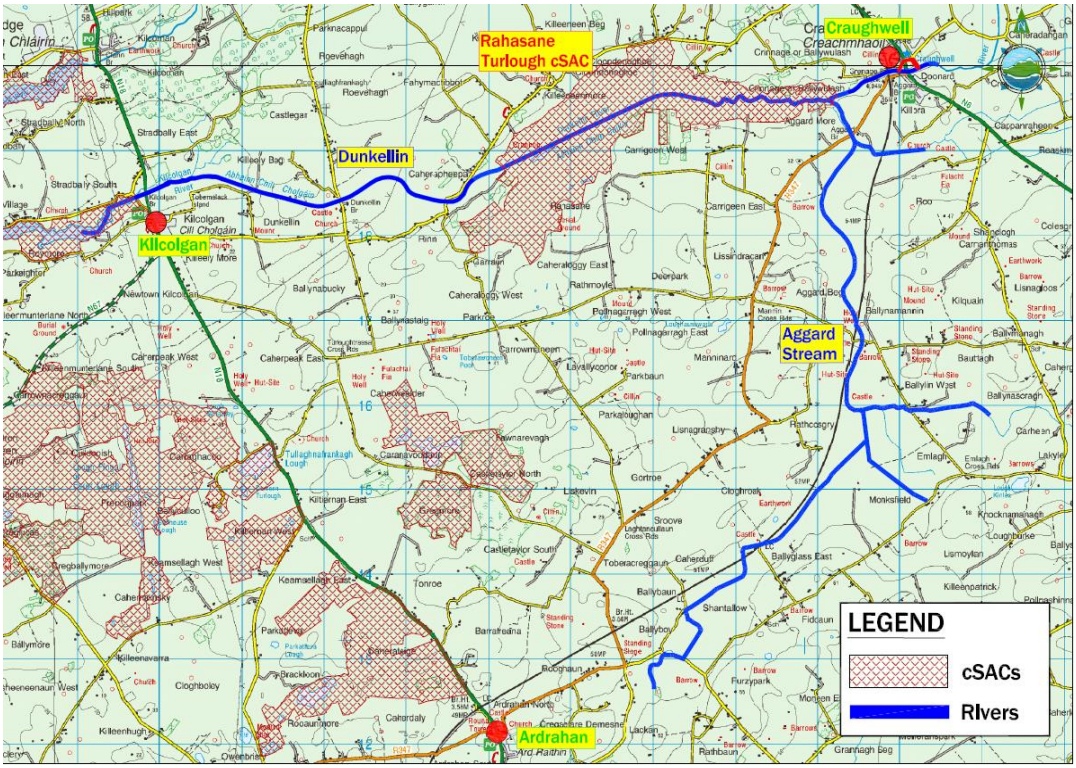


Figure 2.1 – Extent of the Study Area

The depth of the main Dunkellin River channel varies quite considerably throughout its course. Natural embankments formed from excavated spoil, significant rock cuts and large flat flood plains, are predominant physical features of this channel.

The bed profile of the Dunkellin River, from Craughwell to Kilcolgan ranges from a level of 22.29mOD (Malin Head) in Craughwell village, to 0.88mOD at Kilcolgan Bridge, and has three (3) zones along its length.

Zone 1 – Craughwell River, which has a relatively steep gradient in bed level at Craughwell Village.

Zone 2 – Rahasane Turlough cSAC, NHA and SPA, which has a gentle undulating bed level.

Zone 3 – Lower reach of the Dunkellin River, which has steep gradients in bed level from upstream of Rinn Bridge, to the sea at Kilcolgan.

These zones are described in more detail in the following sections and are used throughout this section to discuss the proposed flood relief measures.

2.1 ZONE 1 – CRAUGHWELL RIVER

This particular stretch of the Craughwell River in the village of Craughwell, consists of two distinct channels, namely,

a. the main channel and
b. the bypass or overflow channel.

During normal flow conditions, surface water flows are restricted to the main Craughwell River and pass under two bridge crossings namely; the main R446 Bridge (formerly N6) and the old multi-arched stone bridge.

However, when flow conditions dictate excess surface water flow is directed around the main bridge crossing via an overflow channel and a further bridge crossing of the R446.

The channel along this stretch of the Dunkellin River, is of the order of 1.4m to 2.0m deep and the bed level gradient varies considerably, with a change in bed level occurring within Craughwell Village at the three bridge crossings.

There are a number of hydraulic controls along this stretch of the river. These controls are shown in the following photography and are :

a. The overflow or bypass channel within Craughwell Village,
b. The two road bridges,
c. The old multi-arched stone bridge and
d. The railway bridge.

2.2 ZONE 2 – RAHASANE TURLOUGH

Water passing downstream of Craughwell Village, flows in a westerly direction for a distance of approximately 1km, where the Craughwell River and Aggard Stream combine to form the Dunkellin River.

During low flow conditions, surface water flows are restricted to the main Dunkellin River, which, following an Arterial Drainage Scheme in the 1850's, can be described as being "canalised" for a significant portion of its length. Along this particular stretch of the Dunkellin River, the gradient of the channel bed is relatively flat, approximately 1 in 3,000.

During low flows, the channel varies in width from 10m to 30m. However, during periods of high flow, the Dunkellin River overflows its banks and floods the adjoining lands to form the Rahasane Turlough cSAC. The Rahasane Turlough cSAC is considered to be one of the largest turloughs in Europe and is of particular significance in an ecological context in that it is "one of only two large turloughs which still function naturally" (Site 000322 – Site Synopsis). The Rahasane Turlough cSAC is a rare habitat type of major conservation importance. This habitat type (turloughs) is listed in Annex 1 of the Habitats Directive.

The Rahasane Turlough (circa 4km in length) lies in gently undulating land and consists of two basins which are connected at times of flood but separated as the waters decline (Drew & Daly, 1996). During flood conditions the width of the "Dunkellin River", or the flood plain, increases quite significantly.

In a number of locations along Rahasane Turlough cSAC, the flood plain can be greater than 1km wide and, at its highest levels, can extend to cover an area of over 300ha.

Typical bed levels of the channel within the Rahasane Turlough cSAC are of the order of 13.0mOD Malin Head (TOBIN Topographical Survey 2010) with other localised depressions, or sinkholes, having levels of 11.0m OD Malin Head (Drew 1986).

Downstream of the Rahasane Turlough cSAC, flow is westerly toward Rinn Bridge, through a well defined canalised channel, measuring up to 3.3m in depth, and 15 to 20m in width. This section of the channel is formed in a rock cut, for a significant portion of its length, and the gradient of the channel bed is typically 1 in 200.

2.3 ZONE 3 – RINN BRIDGE TO KILCOLGAN

The main channel exiting the Rahasane Turlough and the Rinn Bridge, which is located approximately 800m downstream of the turlough, are the main downstream features impacting on the hydraulic control of the river.

Downstream of the Rinn Bridge, and during low flow conditions, surface water flows are restricted to the main Dunkellin River, which again, following the Arterial Drainage Scheme completed in the 1850's, can be described as being "canalised" for a significant portion of its length. During these low flows, this particular stretch of the river varies in width from 10m to 15m and, the gradient of the channel bed is approximately 1 in 300.

During high flows, the Dunkellin River also overtops its banks approximately 750m downstream of the Rinn Bridge and flood waters enter the Dunkellin Turlough.

Downstream of the Dunkellin Bridge, the Dunkellin River continues for a further 2.5km to the sea via the Killeely Beg Bridge, the Kilcolgan Road (N18) Bridge and a local road bridge (stone arch). The lands and main channel within the vicinity of the Kilcolgan Road Bridge are tidal. Downstream of Dunkellin Bridge, the Dunkellin River continues to follow a well defined canalised channel, with gradients of between 1 in 300, and widths ranging from 10 to 30m, until it reaches the sea at Kilcolgan.

2.4 AGGARD STREAM

The Aggard Stream, discharges into the main Dunkellin channel at the confluence of the Craughwell and Dunkellin rivers approximately 1km downstream of Craughwell Village. The stream rises in the townland of Cregaclare, where water entering the channel, via surface contributions and ground water springs, flows in a northerly direction for a distance of approximately 4km in the townland of Monksfield. At this location, the channel discharges into the Monksfield River which, after a further 3.5km, enters the Aggard Stream. The channel flows almost parallel to the western railway corridor and crosses this railway at three locations.

Unlike the Dunkellin River, there are no designated sites (cSAC's, NHA's or SPA's) along the route of the Aggard Stream and Monksfield River.

Along this channel, the bed profile ranges from a level of 32.5mOD (Malin Head) in its upper reaches, in the townland of Cregaclare, to 16.6mOD at the confluence with the Dunkellin River approximately 1km downstream of Craughwell.

The base width and side slopes of the Monksfield River and Aggard Stream are quite variable throughout its length.

In its upper reaches, along the Cregaclare Channel, the width of the stream is relatively narrow with some sections being 2.0 to 2.5m wide where the water depth is also quite shallow and stagnant as a result of the very flat gradient in bed level.

Downstream of the Cregaclare Channel, in the townland of Ballyglass and Monksfield, the channel width becomes more pronounced and is typically 3.0 to 5.0m. The bed profile also steepens to a gradient of approximately 1 in 500. Along this stretch of the Monksfield River, the hydraulic control features are also more defined with concrete culverts and stone arch bridges used to traverse the railway line.

3 OUTLINE CONSTRUCTION METHODOLOGY AND PROGRAMME

The construction of the proposed scheme will require a variety of construction methodologies as described in the EIS and EIS Volume 3 Appendix A Section 3 of the Technical Description of the Proposed Works. It is envisaged that phasing of construction activities will be as follows:

1. Site Preparation
2. Establishing site offices, compounds and security
3. Minor Utility Diversions/Protection (watermains and telecommunication cables in Craughwell Village)
4. Excavation works within Craughwell which includes the provision of temporary cofferdams.
5. Bridge underpinning in Craughwell.
6. Railway Bridge protection and scour protection in Craughwell.
7. Channel Widening and Bridge construction at Rinn Bridge, Dunkellin Bridge and Killeely Beg Bridge.
8. Channel Maintenance along the Aggard Stream
9. Finishing/Rehabilitation works to all disturbed lands.

There are a number of constraints on the phasing and methods of construction works. The most significant constraint is that, in general, in-river work is only permitted between May and September each year.

This is a requirement resulting from the recommendations of a number of statutory bodies which were consulted during the early scoping stage of the planning stage. These include the Inland Fisheries Ireland, the NPWS and the timing restrictions are required to ensure that fish migration is not impeded during spawning seasons and that works do not impact on the crayfish populations who seek refuge within river banks during the winter months.

This programme is summarised in
of the Technical Description which accompanies the EIS (and is reproduced here) and it must be noted that this is an outline programme of works and may be subject to alterations subject to the timing of planning approvals, the final detailed design stage programme and following the appointment of a Works Contractor.

	No. of Employees	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
Advanced Works																						
Vegetation Clearance		Vegetation Clearance			No Vegetation Clearance Permitted March to Sept					Vegetation Clearance Permitted Sept to February						No Vegetation Clearance Permitted March to Sept						
Out Of River Works downstream of the Rahasane Turlough																						
River Works Crew No. 1 – Out of River Works or Channel Widening of the Dunkellin River from Kilcolgan Bridge to Killeely Beg Bridge.	6																					
Channel Widening of the Dunkellin River from Killeely Beg Bridge to Dunkellin Bridge.	6																					
River Works Crew No. 1 – Out of River Works or Channel Widening of the Dunkellin River from Dunkellin Bridge to Rinn Bridge.	6																					
River Works Crew No.2 - Out of River Works or Channel Widening of the Dunkellin River from Rinn	6																					
Bridge Works Crew A – Bridge Works at Killeely Beg Bridge.	8																					
Bridge Works Crew B – Out of River Bridge (Left Bank Works) /Culvert Works at Dunkellin Bridge.	8																					
Bridge Works Crew C – Out of River Bridge (Left Bank Works) /Culvert Works at Rinn Bridge.	8																					
In River Works upstream of the Rahasane Turlough																						
Bridge Works Crew D– In River Works or Channel Deepening downstream of the Railway Bridge (Rock Removal).	4																					
Bridge Works Crew E– In River Works or Channel Deepening in Craughwell.	4																					
Bridge Works Crew F – In River Works or Underpinning at the Railway Bridge in Craughwell.	4																					
Out Of River Works on the Bypass Channel followed by works on main R446 bridge & Multi-Arched Bridge																						
Works Crew No. 1 – Out of River Works or Channel deepening and underpinning along the bypass channel and retaining walls	4																					
Works Crew No. 2 – Out of River Works or Underpinning of the Old Stone Multi-arched bridge (Extended Programme to cater for variability in river flows)	4											Restrictions Apply to Works within this Time Period									
Works Crew No. 3 – Out of River Works or Underpinning of the main R446 bridge in Craughwell (Extended Programme to cater for variability in river flows).	4																					
Landscaping																						
Completion/Snagging and Handover																						

Estimated Max Number of Employees on Site	**44**

Figure 3.1 Outline Construction Programme (refer to Section 5 of the Technical Description)

4 ENVISAGED CONSTRUCTION METHODOLOGIES

The Description of the Proposed Works as contained in the EIS can be summarised across three zones as follows:

Zone 3 – Rinn Bridge to Kilcolgan:

Works to be undertaken downstream of Rahasane Turlough from the townland of Rinn to the N18 at Kilcolgan.

Zone 2 – Rahasane Turlough:

No works to be undertaken along/within Rahasane Turlough.

Zone 1 – Craughwell Village:

Works to be undertaken from Craughwell Village to the confluence of the Aggard Stream.

The following sections summarise the construction methodologies that have been envisaged and in addition to the engineering measures also describes additional works that will be undertaken within the river channel to aid the passage of fish up the river.

4.1.1 Aggard Stream

Referring to section 11.5 of the EIS, general mitigation associated with works along the Aggard Stream will involve implementation of the OPW's ten point environmental training programme (OPW, 2011) and Environmental Drainage Maintenance (EDM). Further measures set out under OPW's Environmental Management Protocols & Standard Operating Procedures (EMPs & SOPs) with respect to white-clawed crayfish and lamprey species, will be used, including the requirement to record and report presence of Annex II species (OPW, 2011) and rescue / return any removed fauna to the stream.

In the case that some localised silt and vegetation removal is essential, the general strategy will include:

- 'Minimalist' approach, i.e. remove major obstructions to main channel flow only.
- Work with natural fluvial geomorphic principles rather than against them, i.e. maintain the meander that the river has created through self-narrowing. Retain low flow channels within the stream cross-section.
- Retain low flow channels within the stream cross-section.
- Reprofile only to minimum low water line.
- Never remove hard substrates from below the water line.
- Maintain bankside vegetation and marginal, overhanging cover of Canary grass (*Phalaris arundinacea*) where possible. This is important for crayfish and for fisheries.
- Leave stretches with no apparent conveyance issues alone, especially stony riffles which often have the highest fisheries and crayfish value - these will act as restocking areas.
- Retain tree cover – cutting lower branches where obstruction is evident.
- Do not remove bank vegetation on working bank.
- Leave far bank untouched as natural refugia and restocking areas.
- Work in an upstream direction.
- Collect crayfish and lamprey from spoil and release them to suitable habitat upstream of works.

It is acknowledged that the degree of sediment deposition in flowing channels is a key factor for juvenile lamprey. Areas where sediment can accumulate and where juvenile lampreys are likely to accumulate are often targets for removal in channel maintenance and some of these will be left in situ along the river corridor.

Pre-works consultation between the IFI and OPW will be undertaken to confirm which stretches of the Aggard Stream should remain completely untouched, apart perhaps from bank-side terrestrial vegetation trimming. In other sections which require localised cleaning, the stretches and approaches will be agreed in detail between both bodies and follow the OPW's Standard Operating Procedures. An ecologist will be present on site to monitor the extent of lamprey and crayfish rescue work undertaken during in-stream maintenance on the lower Aggard.

The replacement of the culverts along the Aggard Stream shall be inserted only during summer low flows. The drains will be bypassed, piped around or pumped over, so that the culverts can be installed in the dry. Works shall occur before any vegetation is cleaned from the drains so that any silt arising from culvert insertion can be trapped in the vegetation in the sections of drainage channel between each Works area. Culverts will be inserted in an upstream to downstream sequence and no Works will take place during or after heavy rainfall.

4.1.2 Zone 3 - Channel and Bridge Works from Kilcolgan (N18 Bridge) to Rinn Bridge

The proposed works from upstream of the Kilcolgan Bridge at the N18 to the Dunkellin Bridge will consist of two-stage channel works whereby the top width of the channel will be increased from a typical top channel width of 13m to 14m to a proposed width of 34m to 37m. An embankment shall also be constructed on the left bank, from Killeely Beg Bridge with a maximum height of 3.0m above existing ground level.

This embankment shall be used to mitigate against or eliminate the need to transport excavated material from the site and to also minimise the need for importation of fill material to site.

The proposed works will not require excavation within the existing channel (in river works) and excavation equipment, for the purposes of channel widening, will not be allowed access to the existing river bed. This method of construction means that average annual flow can be contained within the existing channel and excavation can be undertaken along the bank (in dry conditions) with minimal interference to the water quality.

Maintenance works aimed at the removal of encroachment of terrestrial vegetation, removal of fallen trees and other obstacles will be undertaken along the river bank where flood relief works are not undertaken. Terrestrial vegetation along the river banks would be managed (i.e. trimming back to 1.0m to 1.5m above high flood levels) rather than being removed.

Engineering works in the townland of Killeely Beg will include the complete replacement of the existing stone arched bridge. The existing bridge is approximately 8.2m wide and is a hydraulic constraint causing flooding upstream of the existing bridge.

It is proposed to replace this existing structure with a new bridge with a clear span of up to 18m and the proposed indicative bridge works are illustrated on the following **Figure 4.1**.

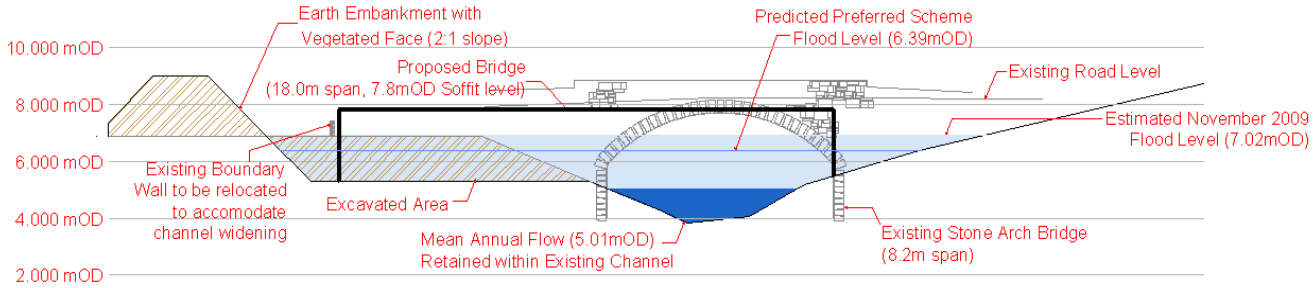


Figure 4.1 - Proposed Works at Killeely Beg Bridge

It is expected that the new bridge will be constructed from precast bridge beams resting on new concrete abutments on each river bank. It is also proposed to retain stone from the existing facades to construct the parapets of the proposed precast bridge.

The works at Rinn Bridge will require the closure of the existing access road which is utilised for land access only and traffic disruption will be minimal. The proposed channel widening and bridge works will also require the realignment of the existing access road where suitable excavated material from the channel works can be utilised as fill material.

Engineering works in the townland of Dunkellin will include the provision of bypass culverts to one side of the existing main stone arch. The existing structures at this location consist of a stone arched bridge spanning the main channel with five flood eyes located along the left bank of the channel. The existing flood eyes are insufficiently sized to cater for predicted flood flows and as such it is proposed to provide two new bridge structures each with a clear span of 13m and both located on the left bank. The construction of the proposed structures will require demolition of the existing flood eyes on the left bank and it is proposed to retain stone from the existing facades to construct the parapets of the proposed precast bridges as indicated in the following **Figure 4.2**.

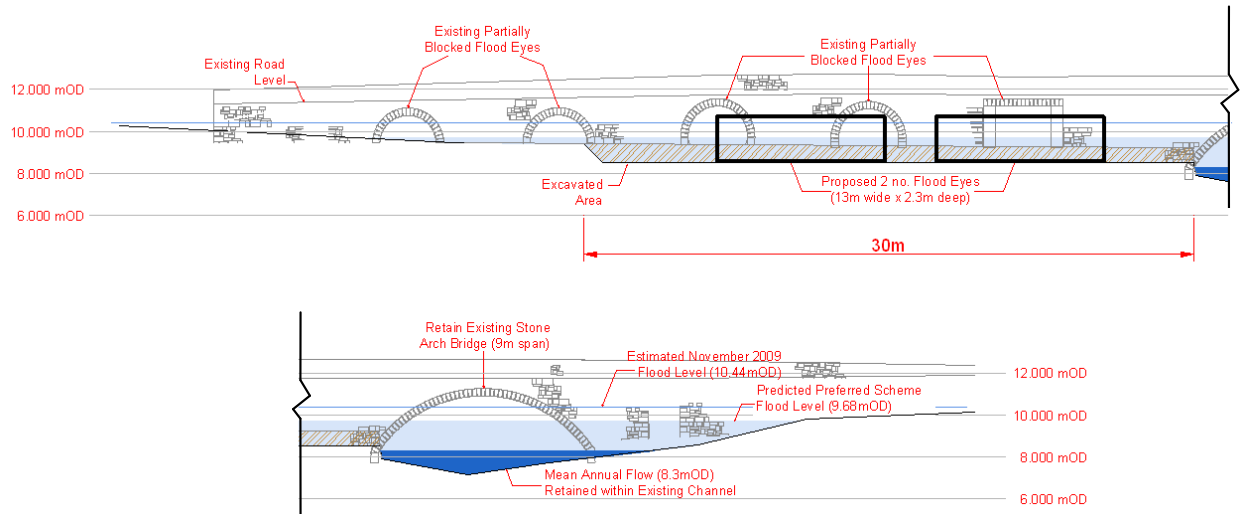


Figure 4.2 - Proposed Works at the Dunkellin Bridge

It is expected that the new bridge structures will be constructed from precast bridge beams resting on new concrete abutments.

The works will require the closure of the existing public road and therefore traffic disruption will be encountered. However road diversions can be put in place on the northern approaches at

Roveagh and along the southern approaches at Madden's Forge with local access, to the northern and southern sides of the river, being maintained throughout the works.

The proposed indicative bridge works at Rinn are illustrated in the following **Figure 4.3**.

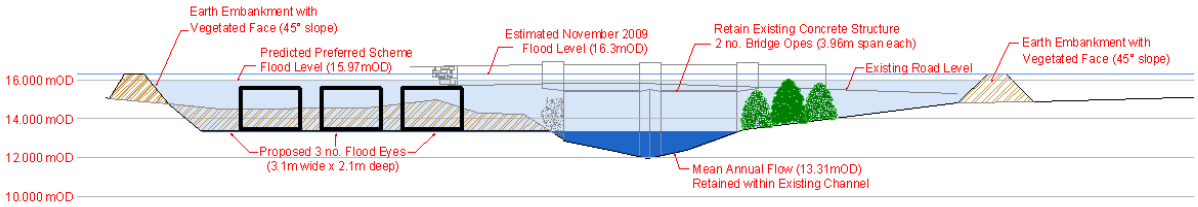


Figure 4.3 - Proposed Works at the Rinn Bridge

The construction of the proposed structures will require excavation of the existing road and will therefore require the closure of the existing public road and traffic disruption will be encountered.

However road diversions can be put in place on the northern approaches at Craughwell and along the southern approaches at Rinn and Madden's Forge with local access, to the northern and southern sides of the river, being maintained throughout the works.

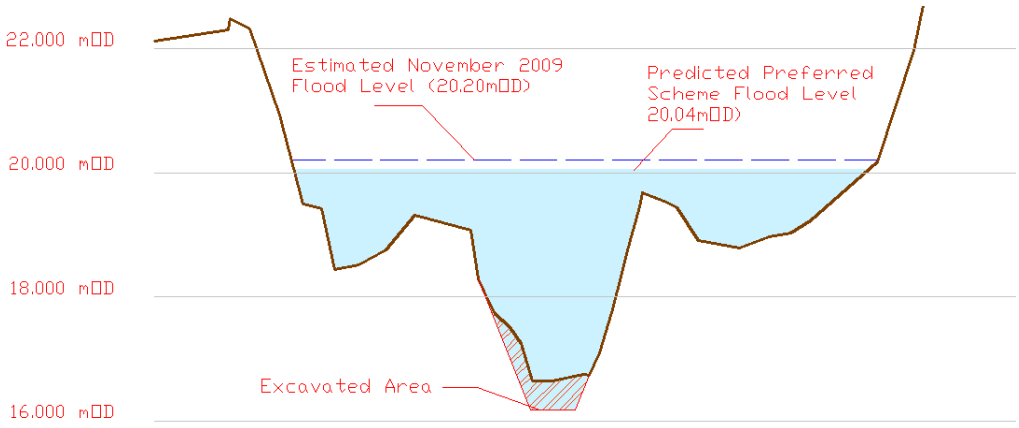
4.1.3 Zone 2 – Rahasane Turlough

No works to be undertaken along/within the Rahasane Turlough.

4.1.4 Zone 1 – Channel and Bridge Works from the Aggard Stream to Craughwell Village

The proposed works, from a location approximately 600 metres downstream of the Railway Bridge in Craughwell to a point 35m upstream of the R446 Road Bridge in Craughwell, will consist of channel regrading whereby the existing bed level will be lowered by 1.0 to 1.5 m over an approximate length of 950m. A summary of these works is given in **Error! Reference source not found.** of the Works Description.

It is envisaged that excavation of the channel in this location will be dependent on the phasing of works along the bypass channel, low flow conditions in the river and the extent to which flow in the river can be diverted or restricted to one half of the existing channel.



Cross-Section Ref: 9848 (Adjacent to DK10)
Location: 183m d/s of Railway Bridge
Proposed Works: Deepen Channel by approx. 0.6m

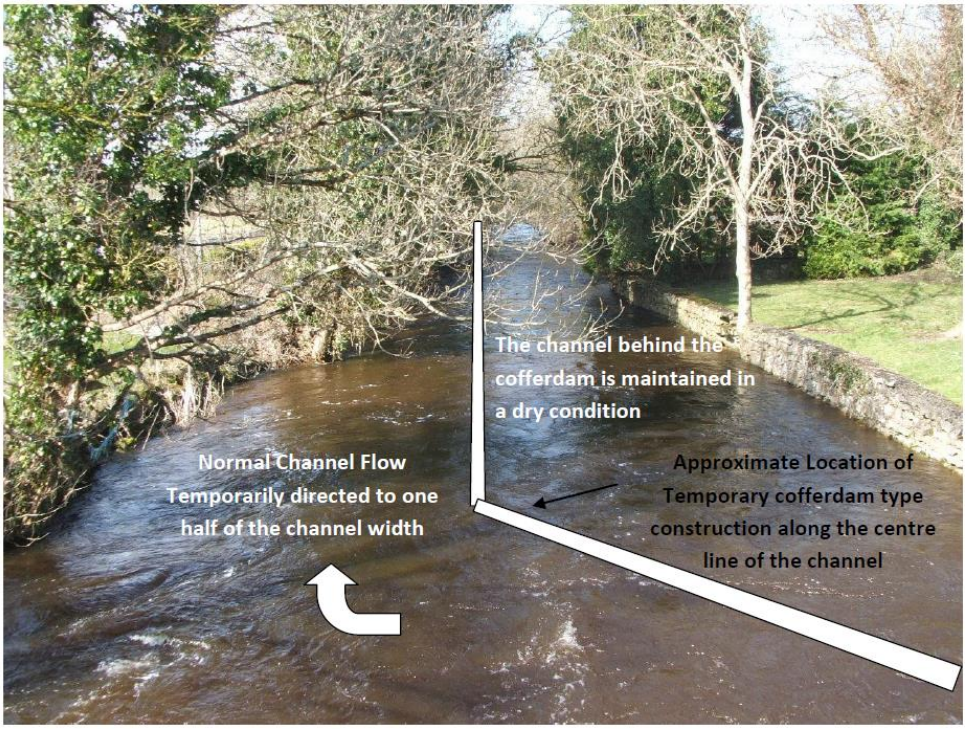


Figure 4.4 - Proposed Works Channel Works in the vicinity of Craughwell Village and sketch of cofferdam location

River enhancement works along this stretch of the river will aim to restore the natural morphological form (C type) of this channel at the new river bed level and develop a series of riffle, glide and pool structures. This process involves the reintroduction of some excavated material to create weirs or paired deflectors, excavation of pools and the introduction of salmonid spawning beds.

It is also proposed that the river enhancement works will be undertaken in tandem with the main excavations works within each cofferdam enclosure so that the short term ecological impact is minimised.

Regrading of the channel also requires the deepening of the bed level at the three main bridges in Craughwell, namely; the Railway Bridge, the old stone multi-arched pedestrian bridge and the bridge crossing on the R446. The required depths of underpinning will be as follows:

1) Up to 0.50m of underpinning or scour protection required at the Railway Bridge
2) Up to 0.70m of underpinning at the old stone multi-arched pedestrian bridge and
3) Up to 0.60m of underpinning at the bridge crossing on the R446.

Underpinning or scour protection involves one of two main techniques whereby:

a) material is excavated from beneath the foundations of the existing bridge and replaced with mass concrete. The sequence of work is such that that the stability of the existing structure is not compromised. The work tends to be labour intensive and is normally undertaken in partial but sequential excavations under the bridge abutment.
b) a secant or contiguous piled wall is constructed along the foundation of the existing bridge to allow the deepening or regrading to take place.

It is envisaged that the foundations of the existing R446 road bridge and the stone arched pedestrian bridge will be supported through the use of direct underpinning i.e., item (a) above, where all of the work can be undertaken in the dry when the existing bypass channel is deepened and temporarily used as the main river channel for the duration of the underpinning and channel deepening. The underpinning of these structures will be labour intensive as the works will be undertaken by hand because headroom beneath each bridge soffit is minimal and access for heavy plant is limited.

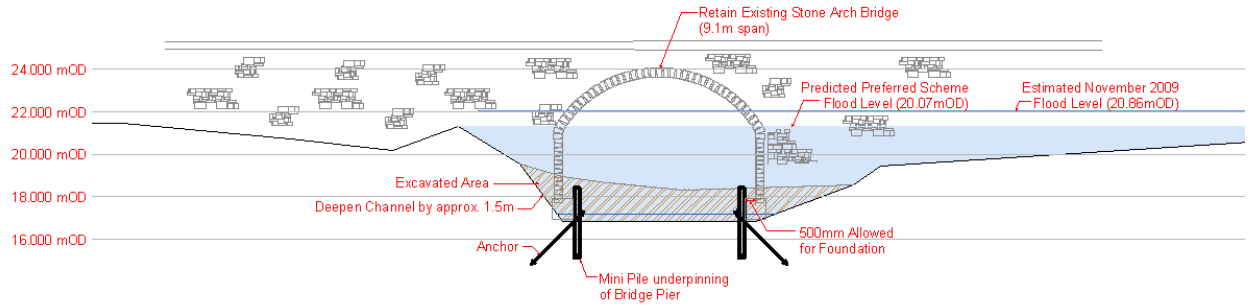


Figure 4.5 - Proposed Works at the Railway Bridge in Craughwell

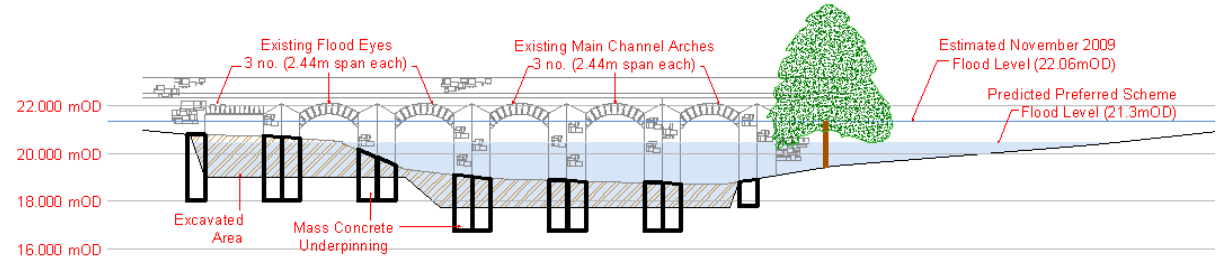


Figure 4.6 - Proposed Works at the Old Pedestrian Bridge in Craughwell

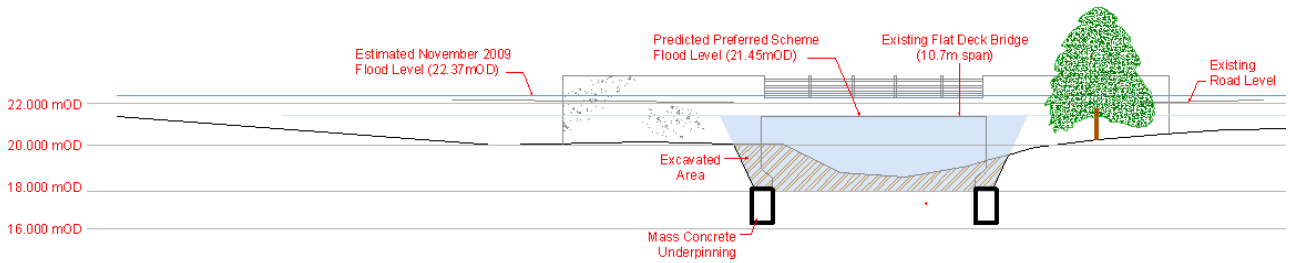


Figure 4.7 - Proposed Works at the R446 Road Bridge in Craughwell

It is also proposed to regrade the entire length of the bypass channel in Craughwell, from 18.5mOD upstream to 18.0mOD downstream. The regrading works will include a reduction in bed level of approximately 1.5m at the bypass bridge on the R446 road. This deepening will require underpinning of the existing bridge and it is envisaged that this will involve the excavation of material from beneath the foundations of the existing bridge and replacing this with mass concrete. The sequence of work is such that that the stability of the existing structure is not compromised. The work tends to be labour intensive and is normally undertaken in sequential excavations under the bridge abutment.

It is envisaged that this underpinning work can be undertaken in the dry as the bypass channel is normally only utilised when the main channel is in flood. The underpinning of this structure will again be labour intensive as the works will be undertaken by hand because headroom beneath the bridge soffit is minimal and access for heavy plant will be extremely limited.

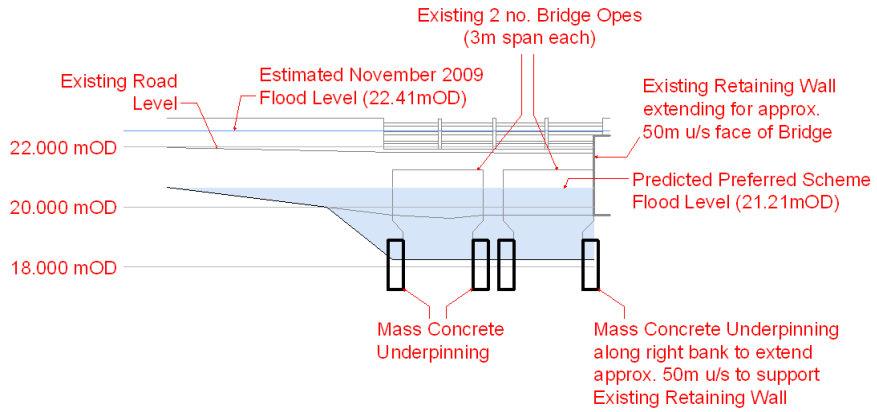


Figure 4.8 - Proposed Works at the By-Pass Channel Bridge in Craughwell

5 RESTRICTIONS PLACED ON CONSTRUCTION TECHNIQUES

The construction of the proposed scheme will require a variety of construction methodologies which will require careful consideration of the following restrictions described in the EIS and Technical Description of the Works.

5.1 WORKING HOURS AND SECURITY OF THE SITE

Normal working hours shall be 0800 and 1800 Monday to Friday and 0800 and 1300 on Saturdays. No work shall be executed outside normal working hours, on Sundays or Public Holidays without the prior written acceptance of the Employer's Representative. Such acceptance will be influenced by the time of sunset/sunrise, anticipated noise, odour and artificial light emissions from the Works, use of public roads and any other considerations that could cause disturbance to members of the public.

However in relation to sections of the works which impact on traffic working hours where lane closures are not required are 7am to 7pm Monday to Friday and 7am to 1pm on Saturdays. Working hours where short term lane closures are required (Rinn Bridge to construct the bypass culvert) are 8pm to 7am Monday to Thursday and 8pm Friday to 11am Saturday. However written approval for these works must be obtained from the Employer.

No machinery shall be left in the river overnight or outside of normal working hours.

With regard to security of the site, temporary fencing and gates to the working areas will be provided to ensure the protection of equipment, materials, operatives, as well as prevention of vandalism, public hazard and disturbance to adjacent land/ vegetation to be protected and retained. Temporary fencing and gates will be agreed with landowners and shall also be sufficient to meet obligations under the Contract and Health and Safety legislation.

All plant and equipment will be "parked-up" in designated areas outside of working hours and will be locked. Special machine parking areas (above flood level) will be designated and in the event of a flood, machinery will be moved to these areas and secured.

5.2 ACCESS POINTS/COMPOUNDS

Prior to the commencement of construction, a draft Construction Traffic Management Plan (CTMP), will be prepared by the Contractor and submitted to the local authority for approval.
The aim of a CTMP is to put in place procedures to manage construction traffic effectively. Any such plan will consider construction traffic accessing the site via the public road network as well as traffic circulation within the construction site. It will also outline measures to enhance the efficient transportation of construction materials and machinery whilst minimising delay and disruption to the general traffic. Mitigation measures relating to the minimisation of impacts on local road users are contained within the EIS for the project and these will be adhered to at a minimum. A typical Traffic Management Plan will:-

- Identify sensitive areas (e.g. schools and homes);
- Be aware of road restrictions, e.g., narrow roads, bridges with restrictions, etc.;
- Identify the location of suitable parking facilities for private cars and plant;
- Ensure there are designated vehicular routes in site with speed restrictions;
- Ensure safe access and egress from site;
- Gain permissions for any required road closures, diversions etc from the relevant bodies;
- Consult with An Garda Síochána and relevant local authorities;

- Schedule site deliveries outside of times of peak traffic volume; and
- Ensure erection of the required signage as per Chapter 8 of the Traffic Signs Manual.

Should a Construction Traffic Management Plan need to be prepared for the proposed development, this should take into account any planned intensive period of traffic volumes associated with the flood relief scheme. All relevant measures as set out in the EIS will be included. These will include the following:

- In order to minimise the level of construction traffic all materials where possible will be sourced locally;
- Machinery deliveries and construction vehicle movements to the site will be scheduled so as to spread the arrival and departures of construction vehicles over the day and avoid peak traffic on the local road network;
- During the construction of the access road, the delivery of material to the site will be restricted to non-peak hour traffic in order to minimise disturbance to local road users;
- Should the local authority require it, both the local authority and road users will be notified of the dates and times that material will be transported to the site; and
- Road conditions will be reviewed prior to construction and any necessary repairs carried out prior to transport.

The technical description of the proposed scheme provides an outline detail of the envisaged access points to the proposed Works Areas and these are summarised as follows and detailed on the relevant Drawings accompanying the EIS.

- Access Point No. 1 (Refer to Drawing No. 6408-2202) - Provision of an access point into the Dunkellin River downstream of Killeely Beg Bridge.

- Access Point No. 2 (Refer to Drawing No. 6408-2202) - Provision of an access point into the Dunkellin River for works downstream of Killeely Beg Bridge to Kilcolgan Bridge.

- Access Point No. 3 (Refer to Drawing No. 6408-2202) - Provision of an access point into the Dunkellin River for works upstream of Killeely Beg Bridge to Dunkellin Bridge.

- Access Point No. 4 (Refer to Drawing No. 6408-2203) - Provision of an access point into the Dunkellin River for works downstream of the Dunkellin Beg Bridge to Killeely Beg Bridge.

- Access Point No. 5 (Refer to Drawing No. 6408-2203) - Provision of an access point into the Dunkellin River for works upstream of the Dunkellin Beg Bridge.

- Access Points No. 6 and 7 (Refer to Drawing No. 6408-2204) - Provision of an access point into the Dunkellin River for works at Rinn Bridge.

- Access Point No. 8 (Refer to Drawing No. 6408-2208) - Provision of an access point into the Dunkellin River for works downstream of the Railway Bridge at Craughwell Village.

- Access Point No. 9 (Refer to Drawing No. 6408-2208) - Provision of an access point into the Dunkellin River for works upstream of the Railway Bridge in Craughwell Village.

- Access Point No. 10 (Refer to Drawing No. 6408-2208) - Provision of an access point into the Dunkellin River for works upstream of the R446 at Craughwell Village.

It is envisaged that there will be four main site compounds, varying in size to reflect the extent of works being undertaken at each location, which include short term staff welfare facilities and

plant & materials storage for the proposed works. The final location of these compounds is unknown at the present time and will be confirmed by the Works Contractor following direct Contractor liaison with each relevant landowner. It is envisaged that these compounds will be located a minimum of 50m to 100m from the Dunkellin River. This can be seen in **Figure 5.1.**

1. Site compound at Killeely Beg Bridge. It is envisaged that this compound will be located on lands to the north of the channel and adjacent to Killeely Beg Bridge. These lands are coloured green on Drawing No. 6408-2203 Rev G at cross section “DK33”. This area is noted, in Chapter 10 of the EIS, as being “improved agricultural grassland”.
2. Site compound at Dunkellin Bridge. It is envisaged that this compound will be located on lands adjacent to Dunkellin Bridge. These lands are coloured green on Drawing No. 6408-2203 Rev G at cross section “DK30”. This area is noted, in Chapter 10 of the EIS, as being “improved agricultural grassland”.
3. Site compound at Rinn Bridge. It is envisaged that this compound will be located on lands to the east of Rinn Bridge. These lands are coloured green on Drawing No. 6408-2204 Rev G at cross section “DK25”. This area is noted, in Chapter 10 of the EIS, as being “improved agricultural grassland”.
4. Site compound at Craughwell Village. It is envisaged that this compound may be placed at a number of locations in the village of Craughwell. A number of the possible locations are shown as a red circle in the following aerial view of the village. These are noted, in Chapter 10 of the EIS, as being “improved agricultural grassland”, “scrub” and “Buildings and Artificial Surfaces”.

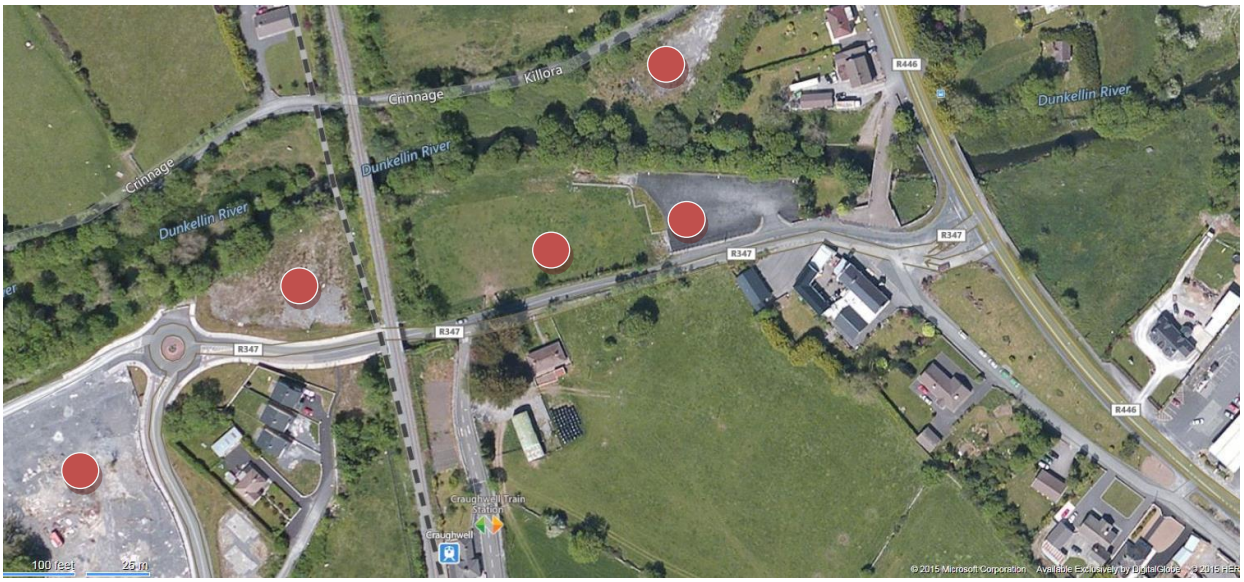


Figure 5.1 – Locations for Site Compounds Storage

Any surface topsoil within the proposed site compounds will be removed and temporarily stored for reinstatement of all lands once work is completed. Following clearing of topsoil from the compound area it is envisaged that the working surface will be formed from imported clean stone laid on a temporary geomembrane.

Any surface topsoil along the route of the proposed works will be removed and temporarily stored for reinstatement of all lands after work is completed. Following the clearing of topsoil from the works area it is envisaged that the working surface will be formed from stone excavated from the proposed works and will be constructed ahead of the excavation plant as work progresses. Imported construction materials will be stored at the compounds and delivered to the particular section of works as required.

The following public roads will be directly affected by the works:

- R446 (formerly known as the N6 at Craughwell)
- R347 Ardrahan Road
- Grenage Local Road
- Kilcolgan to Craughwell (via the Rinn and Dunkellin Bridges) Local Road
- N18 at Kilcolgan
- Local access roads particularly at the townland of Killeely Beg

The following measures shall be undertaken in relation to construction access and haul routes:

1. Advance warning signage of construction access points shall be signed on the local road i.e. construction vehicle access ahead.
2. Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary.

Other measures that will be adhered to when developing access tracks along the Dunkellin River and Aggard Stream banks include:

a) all access tracks will be situated near aquatic zones, therefore care should be taken to control sediment run-off and visual impacts;
b) under no circumstances are machines permitted to enter the wet portion of the river channel (access restricted to access platforms/pontoons or dry areas only);
c) refuelling, maintenance and storage areas will be located at least 50 metres from the nearest aquatic zone;
d) construction of access tracks will only be carried out during the months when river bank works and in-river works are permitted during the period of May to September.

5.3 WORKING IN DRY CONDITIONS ALONG THE RIVER CHANNEL

The proposed works along the **length of channel from Rinn Bridge to Kilcolgan** will not require excavation within the existing channel (in river works) and excavation equipment, for the purposes of channel widening, will not be allowed access to the existing river bed. This method of construction means that average annual flow can be contained within the existing channel and excavation can be undertaken along the bank (in dry conditions) with minimal interference to the water quality.

It is envisaged that excavation of the **channel in the vicinity of Craughwell Village** will be dependent on the phasing of works along the bypass channel, low flow conditions in the river and the extent to which flow in the river can be diverted or restricted to one half of the existing channel. In addition it is also proposed to retain existing bankside trees (if healthy and suitable for retention) provided that their retention does not pose a concern with regard to the safe construction of the works, safe recreational use of the channel and safe maintenance of the channel. A qualified arborist will be retained at the detailed design stage to examine and determine the most appropriate trees that can be retained or if necessary make recommendations with regard to the replacement of trees that require removal.

Works associated with **channel deepening in the vicinity of the old stone bridge and the bridge crossings of the R446** can be undertaken in dry conditions whereby the bypass channel can be utilised a diversion route once the proposed channel works and underpinning on the bypass channel are complete.

The remaining **channel works downstream of the proposed confluence of the bypass channel and the Dunkellin River** will be undertaken along the length of the channel in segmented sections using cofferdam type temporary works construction. It is envisaged that temporary cofferdam type construction or temporary sheet pile walls (with a length of 50 to 100m depending on the depth of water and ground conditions) will be used. This process allows river water to be directed to one half of the channel width allowing the civil engineering works to be undertaken, in relatively dry conditions, on the other side of the channel. Once this half of the proposed channel works is excavated, within the confines of the cofferdam, it is expected that river water will be directed to the new section allowing the adjacent excavations to be completed. This sequence of construction is expected to commence at the lower downstream point of the works and continue upstream in this "*leap-frog*" type construction method. This method of construction reduces the risk of construction debris and silt entering the river.

It is envisaged that the **foundations of the existing railway bridge** will require scour protection through the use of a secant or contiguous piled wall along each side of the bridge piers or abutments. However, this work will require the use of either a floating barge or construction of a temporary cofferdam to facilitate access to the bridge piers. The use of temporary cofferdams allows the works to be undertaken, under dry conditions, in two phases, whereby flow can be restricted to one half of the channel width allowing the civil engineering works to be undertaken in the dry conditions which exist within the other half of the channel.

It is also proposed to store excavated material, such as the natural gravels, boulders and cobbles found on the existing river bed, so that such material can be reused in the development of the river enhancement works. The design of the river enhancement works together with the associated construction works method statements will be the subject of detailed design between Galway County Council, the OPW and Inland Fisheries Ireland upon conclusion of the planning process.

5.4 FLOODING OF THE WORKS

Due to the nature of the proposed project the risk of flooding to the Works Area during construction needs to be considered. To ensure flood protection and mitigation is available the Contractor will be required to have procedures in place, and agreed with the Employer before any works can take place, to ensure availability of critical personnel 24hrs a day and any day for the duration of the Works. The likelihood of a flood event occurring during construction is the same as in any other year. Although existing drainage channel will not be removed restrictions on existing structures may result in a short term localised increased risk of flooding. The Contractor will be required to put emergency procedures in place to minimise flooding of the works if required by the onset of a flood emergency.

It is envisaged that an "Advanced Weather Warning System" (based on short term forecasts published by Met Éireann) will be in operation for the duration the Works. Such a system shall require the Site Agent/Manager to review, on a daily basis, the current 3 to five day forecasts to ensure that an adequate response time for flash floods or similar adverse conditions can be prepared thus reducing impacts that may pose health and safety risks to those carrying out these works, as well as risks to the working environs and to the public in general.

It is envisaged that the Weather Monitoring Procedure will contain:

1. Weather forecasts from Met Eireann to be logged daily 1 week ahead of time.
2. Atmospheric pressure forecasts monitored 1 week ahead of time.
3. Wind direction to be monitored 1 week ahead of time.
4. Tide levels at Kilcolgan and Water Levels within the Turlough to be monitored weekly.
5. The person(s) responsible for the Weather Monitoring.

6. A rota system will be drawn up to ensure that the monitoring procedure is in operation at all times during holidays.

5.5 LIAISON WITH STATUTORY BODIES

The following table lists the statutory bodies that the Contractor will be required to liaise with in relation to the works.

	Description	Authority
1.	Traffic and Roads	Galway County Council, Gardai
2.	Water Supply	Irish Water and Galway Co Co as Agents to Irish Water
3.	Foul Sewers	Irish Water and Galway Co Co as Agents to Irish Water
4.	Electricity	Electricity Supply Board
5.	Telecoms	Eircom, UPC, BT, etc
6.	Gas Supply	Bord Gais
7.	Works in and in the vicinity of a Water Course , Water Quality, Fish, etc	Inland Fisheries Ireland
8.	Works in Vicinity of Railway Bridge	Iarnrod Eireann
9	Works in Vicinity of Road Bridges	Galway County Council, Gardai
10	Aquatic Ecology	Inland Fisheries Ireland
11	Terrestrial Ecology	National Parks & Wildlife Service
12	Archaeology	National Monuments Service
13	Public Transport	Bus Eireann , Iarnrod Eireann

5.6 SEQUENCING OF THE WORKS

There are a number of constraints on the phasing and methods of construction works. The most significant constraint is that in general in-river work is only permitted between May and September each year. Construction works must commence from the upstream end of the works and progress the works towards the downstream end.

The Works are divided into two distinct areas (Craughwell Village and works downstream of the Rahasane Turlough) and the works must be completed in one area insofar as is practical prior to commencing works in the next area.

The extent to which the works must be completed prior to moving to the next area will be agreed on a case by case basis with the Employer's Representative, Galway County Council, NPWS and Inland Fisheries Ireland.

5.7 MITIGATION MEASURES AND ECOLOGICAL CONSTRAINTS

Potential construction stage impacts are outlined in Sections 9 to 19 of the EIS and in Section 8.2 of the Natura Impact Statement, which accompanies the EIS.

It is considered that the main construction phase effects will involve the potential release of pollutants to the Dunkellin River which could impact qualifying habitats and species and disturbance which could lead to impacts on qualifying species of Rahasane Turlough SAC/SPA, Galway Bay Complex SAC and Inner Galway Bay SPA.

The main potential disturbances can be summarised as follows:

1. Disturbance to adjacent lands and riparian zones (Soils).
2. Disturbance to terrestrial ecology.
3. Disturbance to aquatic ecology such as waterborne pollutants.
4. Air Quality and airborne pollutants.
5. Disturbance associated with Noise and Vibration.
6. Archaeological impacts.
7. Visual and Landscape Impacts.
8. Disturbance to Material Assets and Human Beings.
9. Traffic impacts

The potential impact of the individual engineering items to Geological and Hydrogeological features are summarised in **Table 9.6 of the EIS**.

The potential impacts to **adjacent lands and terrestrial ecology** as they relate to the proposed activities are summarised as follows:

a. There is a potential for **accidental soil and groundwater contamination** due to spills and leaks of oils and other contaminants during the construction stage of the proposed works. The potential for these impacts to occur is minimised by adhering to the relevant construction guidelines (CIRIA C532 and C648).
b. The proposed works include the **excavation of soil materials along the banks of the river**. The excavated material will be reused for side-slope protection, creation of bankside spoil embankments and the creation of extended spoil heaps. It is expected that where this material is spread on adjacent lands the material will be between 0 and 0.5 m thick. Initial treatment will require removal and storage of topsoil, spreading of excavated material and reinstatement of the topsoil. This will minimise the transport of material offsite and aim to return the soils to the pre-works quality. It is proposed to complete **in-channel works using cofferdam type construction** whereby flow can be

restricted allowing the civil engineering works to be undertaken in the dry conditions. It is proposed to use surface dewatering pumps to dewater the section of the channel under construction. It is possible that during such works significant groundwater inflows from the channel bed could occur where fractured limestone is exposed. Where groundwater inflows are significant water management controls will be required. This may involve aquifer dewatering to lower the water table below the base of the channel in the vicinity of the works. Dewatering would constitute a temporary, slight negative impact on the groundwater flow regime and potentially affect adjacent groundwater supplies if present. In-channel regrading works can lead to river sediment disturbance with subsequent siltation and deposition downstream of the location which is considered a slight impact on soils and geology.

All construction works will be completed in accordance with the following best practice guidelines to ensure the potential for accidental **soil and groundwater contamination is minimised:**

CIRIA (Construction Industry Research and Information Association) guidance on '*Control of Water Pollution from Construction Sites' (CIRIA Report No C532, 2001); and*

CIRIA (Construction Industry Research and Information Association) guidance on '*Control of Water Pollution from Linear Construction Projects*' (CIRIA Report No. C648, 2006).

Spreading of excavated materials will not be undertaken in the immediate vicinity of karst features. A large number of karst features have been documented in the region, however, the GSI karst database is incomplete and many field scale karst features are not included. This data has been supplemented by the use of a geophysical survey of deposition areas to minimise the impact on karst features.

The effective protection of **water quality** within the scheme during the construction and operation phases will minimise the risk to the qualifying interests of this site. Release of suspended solids to all surface waters will be controlled by interception and management of site run-off. Dewatering and surface water runoff discharges from the excavation and landspreading areas will be controlled, collected and routed via appropriate treatment measures. These measures will be in accordance with:

CIRIA publication C648, *'Control of Water from Linear Construction Project'* (CIRIA, 2006).

Silty water shall be treated using ponds and temporary interceptors and silt traps will be installed. An interceptor drain will be located at the edge of access tracks to intercept runoff. These facilities will be maintained on a daily basis and the maintenance record will be maintained and available for inspection by Galway County Council and other statutory organisations.

Standard pollution control and mitigation measures, will be employed when working in and near the watercourse affected by the scheme to prevent the transport of deleterious substances to the Dunkellin River and connected Natura 2000 sites and associated water-dependent habitats and species. All two-stage channel works are proposed to be carried out outside of the existing channel thereby retaining the average annual flow within the existing channel. Excavation is to be undertaken along the bank with minimal interference with water quality.

A detailed design and method statement will be drawn up by the Contractor indicating what standard measures will be taken to avoid items such as:

i. sediment or soil loss and
ii. cement and hydrocarbon release associated with all aspects of the construction phase,
iii. spillage of hydrocarbons,

and the following precautions will be put in place in this regard.

- Disposal of raw or uncured waste concrete must be controlled to ensure that the watercourse or karst features will not be impacted.
- Best practice in bulk-liquid concrete management addressing pouring and handling, secure shuttering / form-work, adequate curing times.
- Where shuttering is used, measures should be put in place to prevent against shutter failure and control storage, handling and disposal of shutter oils.
- Wash water from cleaning ready mix concrete lorries and mixers may be contaminated with cement and is therefore highly alkaline. Due to the size of the site and the proximity of sensitive watercourses, all lorries and mixers shall be washed out off site.
- Cement dust shall be controlled as it is alkaline and harmful to the surrounding ecological receptors. Activities which result in the creation of cement dust must be controlled by dampening down areas.
- The timing of the works shall be agreed with the IFI in relation to fish migration and spawning periods.
- The rock type underlying much of the site is karstified limestone. Where rock fill is required, such as at Rinn Bridge, it should be recovered and reused from any excavations within the site. The importation of foreign material should be limited, however if it is required it should be the same rock type as found on site.
- Fuel and hydraulic fluids should not be stored on site, but if absolutely necessary, they must be stored in a locked and bunded container. Refuelling should only take place in the site compounds. All stationary plant materials should be placed on drip trays to prevent leaking oils reaching the river or entering groundwater. No washings or waste materials of any kind can be directed into watercourses; i.e. the Dunkellin River or any channels or ditches supporting connectivity with the Dunkellin River. Any machinery on site must have pollution control kits on hand in the event of an emergency.

Materials that will be stored and used on site and which may pose a pollution risk are listed in the following tabulation.

Type of Polluting Material	How or Where it will be Stored
Cement	Within a dry container within the Secure Compound
Bentonite	Within a dry container within the Secure Compound
Diesel	Within a bunded tank in the Secure Compound
Petrol	Compound in marked containers (bunded containers)
Oil	Compound in marked containers (bunded containers)
Concrete repair products	Within a dry container within the Secure Compound

Similarly, the Contractor's Method statement shall contain measures for controlling **sediment transport.** Mitigation for the construction of the two stage channel will essentially be the same for each reach of the channel between the N18 and Rinn Bridge. As identified in Section 8 of the Ecological Impact Assessment, the principle risk will be from solids washout either directly from the edge of the bank or via drains traversing the new two-step channels. Control measures will include, for example, that excavations begin away from, and work towards the channel with a buffer zone left between the excavation area and the channel to prevent diffuse wash off. Flow paths to the river, in that case, can be more adequately protected with appropriate sediment control measures. If the water table rises to the level of the works area then all works should cease in the affected areas until it drops again. The advance warning of flood events is possible through the use of an "Advanced Weather Warning System" and the appointed contractor will be required to monitor both long and short term weather forecasts so that machinery and personnel can be prevented from entering the channel during periods of peak flow.

All construction borne water (**from dewatering techniques**) will be passed through settlement ponds which can be formed by constructing bunds and placing an appropriate geotextile liner on top. Details of typical techniques are contained in Section 9 of the EIS.

- Mitigation measures are proposed, in the EIS, to address the adverse effect, of **airborne pollutants**, on the ecological receptors identified within the zone of influence of the works. The contractor will prepare a Dust Minimisation Plan if required. This Plan may include and incorporate the following mitigation measures among others:-

    - Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while any un-surfaced roads shall be restricted to essential site traffic only;

- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions (also applies to vehicles delivering material with dust potential);

- Bed of gravel at site exit points to remove caked on dirt from tyres and tracks;

- Speed restrictions should be put in place for any on-site vehicles in order to avoid increased agitation of dust particles;

- Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary;

- Prevention of on-site burning;

- Unsurfaced roads will be restricted to essential site traffic only;

- Use of wind breaks and barriers;

- Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind;

- Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods. This may require the use of a Dust Suppression Bowser unit;

- Any accidental or observed increases in dust levels will be recorded and brought to the attention of the Site Manager and the Ecological Clerk of Works; and

- All complaints to be reported to the Site Manager and Project Manager, and also logged within an on-site register.

With regard to the minimisation of the impact of **construction related noise**, all works at the watercourse will make a 'short-start' to activities to allow salmon and other fish to move away before the full intensity of works begins. The following restrictions, as detailed in Table 11.11 of the EIS, will be put in place for the duration of the project.

Species	Period of no instream disturbance (inclusive)	Likelihood of presence in the affected areas and comments	Period instream works allowed (inclusive)
Salmon.	October to April - spawning, nursery (IFI).	Distributed throughout study area: Craughwell River instream deepening works – very sensitive - spawning, nursery, holding area. Dunkellin River – no instream works proposed/migration – less sensitive – limited spawning, but good nursery habitat. Aggard Stream – few salmon – no deep dredging works proposed.	May to September.
Brook and River Lamprey.	March to May - spawning / hatching (Igoe et al., 2004).	Distributed throughout study area, depending on localised habitat, i.e. spawning in riffles, nursery in silty deposits.	June to February.
Sea Lamprey.	Mid June to July - peak spawning period (Igoe *et al.*, 2004).	Presence confirmed on lower Dunkellin River at least. Spawning and juvenile nursery habitat abundant throughout the study area, depending on localised habitat, i.e. spawning in riffles, nursery in silty deposits.	August to April.
White clawed crayfish.	November to late June (breeding / berried females + hatching) (Peay, 2000).	Population abundant on Craughwell River and Aggard Stream upstream of Rahasane Turlough. Present / moderate abundance on Dunkellin River between Dunkellin Bridge and Rahasane Turlough, inconclusive evidence of presence downstream of Dunkellin Bridge.	July to October.
Trout.	October to May - spawning, nursery (IFI).	Distributed throughout study area.	June to September.
Combined/ overall timing restrictions.	No instream works allowed between October and July.		Instream works allowed August to September.

Work will be undertaken during daylight hours, starting no earlier than two hours after dawn and finishing no later than two hours before dusk, between March and October; and to start no earlier than one hour after dawn and finish one hour before dusk from November to February; and shall not continue for periods of more than 12 hours, to prevent disturbance to nocturnal species. Disturbance impacts can be avoided if construction works in proximity to the turlough (e.g., at Rinn Bridge) are carried out outside of the over-wintering bird season, i.e. outside the September - March season entirely. If for practical reasons, the works at Rinn Bridge have to be undertaken at this time, then it should be determined whether the areas at the western end of the turlough are key areas for birds at this time of the year in order to determine if any disturbance impacts are likely to occur.

The Contractor will employ the best practicable means to minimise noise emissions and will be obliged to comply with the general recommendations of BS 5228, 1997. To this end the Contractor will use “noise reduced” plant and/or will modify their construction methods so that noisy plant is unnecessary.

Archaeological testing will be undertaken in advance of the proposed works at a number of locations throughout the works area as detailed in Section 14.5 of the EIS, including:

1. North of GA103-12001 at Dunkellin and GA103-134 at Killeely Beg within the footprint of the river channel excavation area and embankment location.
2. At the sites of AAP 1, 2, 4, 5, 6, 7 during the excavation of the southern river bank.
3. At the site of AAP 8, during the excavation of the southern river bank.
4. At the site of AAP 9, during the excavation of the southern river bank.
5. A full underwater archaeological survey at Craughwell Bridge, Craughwell Railway Bridge, Rinn Bridge and Killeely Beg Bridge.
6. A full underwater archaeological survey along the 750m southern bank of the Dunkellin River within Killeely More.
7. All excavation works in Craughwell will be the subject of monitoring by a suitably qualified archaeologist.

6 COMMUNICATIONS AND HEALTH & SAFETY PLAN

The Contractor shall appoint a qualified *Project Manager, Construction Manager, Site Manager, Site Agent or Environmental Officer* to act as Liaison Officer between the Contractor and the Employer's Project Engineer, Representatives or Resident Engineering Staff and any other third parties affected by the works and/or statutory authorities.

The Site Agent will responsible for the management of safety, health and the environment on the project and for ensuring that arrangements are in place for such matters as risk assessment, induction, monitoring, consultation and accident investigation / reporting.

All members of the project management team have safety, health and environmental responsibilities and are charged with monitoring site safety, health and environmental performance on a daily basis.

Appointed members of the project management team will complete weekly site inspections using safety, health and environmental checklists.. The Site Agent is responsible for ensuring that these inspections take place and that matters requiring action following each inspection are closed out. All inspection forms will be retained on file for the duration of the project.

The Safety and Health Plan for the construction stage of this project shall contain:

1. Description of Project

- project description and programme details;
- details of client, Project Supervisor Design Process and Project Supervisor Construction Stage, designers,
  main contractor and other consultants;
- extent and location of existing records and plans;
- arrangements for communicating with Contractors, PSDP and others as appropriate.

2. Communication and Management of the Work

- management structure and responsibilities;
- safety and health goals for the project and arrangements for monitoring and review of safety and health performance;
- arrangements for:
  - ➢ regular liaison between parties on site;
  - ➢ consultation with the workforce;
  - ➢ the exchange of design information between the Client, Designers, Project Supervisor for the Design Process, Project Supervisor Construction Stage and Contractors on site;
  - ➢ handling design changes during the project;
  - ➢ the selection and control of contractors;
  - ➢ the exchange of safety and health information between contractors;
  - ➢ security, site induction, and on-site training;
  - ➢ welfare facilities and first aid;
  - ➢ the production and approval of risk assessments and method statements;

➢ the reporting and investigation of accidents and other incidents (including near misses);

d) site rules;

e) fire and emergency procedures

3. Arrangements for Controlling Significant Site Risks

a) safety risks

- services, including temporary electrical installations;
- preventing falls;
- work with or near fragile materials;
- control of lifting operations;
- dealing with services (water, electricity and gas);
- the maintenance of plant and equipment;
- poor ground conditions;
- traffic routes and segregation of vehicles and pedestrians;
- storage of hazardous materials;
- dealing with existing unstable structures;
- accommodating adjacent land use;
- other significant safety risks.

b) health risks:

- removal of asbestos;
- dealing with contaminated land;
- manual handling;
- use of hazardous substances;
- reducing noise and vibration; and
- other significant health risks.

In addition to the above requirements the Health & Safety Plan will contain the following emergency procedures:

- Early weather Warning and flood Alert Procedure
- Flood Alert Procedure
- Galway County Council and OPW Flood Alert Procedure
- Underground and Overground Power Strike Procedure (In Craughwell Village)
- Overhead Cable Strike emergency Procedure
- Rescue from Fall into water procedure
- Gas Main Strike Procedure (In Craughwell Village)
- Communication Cabling Strike Procedure (In Craughwell Village)
- Fire Emergency Procedure
- General Emergency Reporting Procedures
- Road Traffic Accident Procedure

END OF DRAFT DOCUMENT

APPENDIX D

BREEDING BIRD SURVEY

Breeding bird species along the Dunkellin River and Aggard Stream.

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
			April	May	June		
Kilcolgan Bridge **Grid Ref** Start: M 41879 18475 within 6m End: M 42261 18557 within 3m	Dunnock	*Prunella modularis*	6	0	2	Green	Possible (H)
	Mute Swan	*Cygnus olor*	4	0	0	Amber	Non-breeding (F)
	Reed Bunting	*Emberiza schoeniclus*	4	5	0	Green	Probable (P)
	Snipe	*Gallinago gallinago*	3	0	0	Amber	Possible (H)
	Jack Snipe	*Lymnocryptes minimus*	2	0	0	Amber	Non-breeding (U)
	Grey Heron	*Ardea cinerea*	2	3	0	Green	Non-breeding (F)
	Blackbird	*Turdus merula*	3	10	4	Green	Probable (P) & Possible (S), (H)
	Little Egret	*Egretta garzetta*	1	1	0	Green	Non-breeding (F)
	Woodpigeon	*Columba palumbus*	3	5	0	Green	Possible (H)
	Great Tit	*Parus major*	1	0	2	Green	Possible (H)
	Wren	*Troglodytes troglodytes*	2	8	3	Green	Possible (H)
	Chaffinch	*Fringilla coelebs*	1	0	0	Green	Possible (H)
	Rook	*Corvus frugilegus*	2	0	1	Green	Possible (H)
	Feral Pigeon	*Columba livia f. domestica*	1	0	0	Green	Non-breeding (F)
	Hooded Crow	*Corvus cornix*	2	1	1	Green	Possible (H)
	Mallard	*Anas platyrhynchos*	4	2	0	Green	Non-breeding (F)
	Pheasant	*Phasianus colchicus*	2	3	2	Green	Probable (A)
	Magpie	*Pica pica*	0	6	1	Green	Possible (H)
	Sedge Warbler	*Acrocephalus schoenobaenus*	0	1	0	Green	Possible (H)
	Willow	*Phylloscopus*	0	3	0	Green	Confirmed

[1] Grid co-ordinates given to Irish National Grid (ING)
[2] Individuals observed or heard in April (A), May (M) or June (J)
[3] Follows status attributed under the Birds of Conservation Concern (BoCCI) in Ireland 2014-2019 (Colhoun and Cummins, 2013)
[4] Breeding status following BTO Categories of Breeding Evidence.

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
	Warbler	*trochilus*					(FL)
	Robin	*Erithacus rubecula*	0	4	3	Amber	Possible (H)
	Collard Dove	*Streptopelia decaocto*	0	4	0	Green	Possible (H)
	Blue Tit	*Cyanistes caeruleus*	0	1	1	Green	Possible (H)
	Jackdaw	*Corvus monedula*	0	2	3	Green	Possible (H)
Kilcolgan to Killeely Bridge **Grid Ref** Start: M 42261 18557 within 3m End: M 43545 18316 within 24m	Bullfinch	*Pyrrhula pyrrhula*	1	0	1	Green	Possible (H)
	Cormorant	*Phalacrocorax carbo*	2 in flight	0	0	Amber	Non-breeding (F)
	Collard Dove	*Streptopelia decaocto*	1	3	0	Green	Possible (H)
	Willow Warbler	*Phylloscopus trochilus*	3	0	2	Green	Possible (H)
	Wren	*Troglodytes troglodytes*	1	0	3	Green	Possible (H)
	Meadow Pipit	*Anthus pratensis*	1	0	0	**Red**	Possible (H)
	Mallard	*Anas platyrhynchos*	2	2	0	Green	Non-breeding (F)
	Song thrush	*Turdus philomelos*	0	0	1	Green	Possible (H)
	Blackbird	*Turdus merula*	1	6	5	Green	Possible (H)
	Sedge Warbler	*Acrocephalus schoenobaenus*	1	0	0	Green	Possible (H)
	Woodpigeon	*Columba palumbus*	2	2	1	Green	Possible (H)
	Blue Tit	*Cyanistes caeruleus*	2	0	1	Green	Possible (H)
	Snipe	*Gallinago gallinago*	3	0	0	Amber	Possible (H)
	Dunnock	*Prunella modularis*	0	0	1	Green	Possible (H)
	Coal Tit	*Periparus ater*	0	0	1	Green	Possible (H)
	Jack Snipe	*Lymnocryptes minimus*	1	0	0	Amber	Non-breeding (U)
	Reed Bunting	*Emberiza schoeniclus*	3	0	0	Green	Possible (H)
	Great Tit	*Parus major*	1	0	0	Green	Possible (H)
	Hooded Crow	*Corvus cornix*	0	12	0	Green	Non-breeding (F)
	Robin	*Erithacus rubecula*	0	2	5	Amber	Possible (H)
	Jackdaw	*Corvus monedula*	0	2	2	Green	Non-breeding

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
							(F)
	Rook	*Corvus frugilegus*	0	0	2	Green	Non-breeding (F)
	Curlew	*Numenius arquata*	0	0	1	**Red**	Non-breeding (F)
	Swallow	*Hirundo rustica*	0	2	2	Amber	Non-breeding (F)
	Pheasant	*Phasianus colchicus*	0	0	4	Green	Possible (H), (S)
	Starling	*Sturnus vulgaris*	0	4	0	Amber	Possible (H)
	Moorhen	*Gallinula chloropus*	0	2	0	Green	Possible (H)
	Chiffchaff	*Phylloscopus collybita*	0	1	1	Green	Possible (H)
	Grey Heron	*Ardea cinerea*	0	1	0	Green	Non-breeding (F)
Kilcolgan to Killeely (east of) **Grid Ref** Start: M 42793 18633 within 8m End: M 43419 18376	Blackbird	*Turdus merula*	4	-	-	Green	Possible (H)
	Starling	*Sturnus vulgaris*	2	-	-	Amber	Possible (H)
	Chaffinch	*Fringilla coelebs*	1	-	-	Green	Possible (H)
	Dunnock	*Prunella modularis*	1	-	-	Green	Possible (H)
	Woodpigeon	*Columba palumbus*	1	-	-	Green	Possible (H)
	Meadow Pipit	*Anthus pratensis*	1	-	-	**Red**	Possible (H)
	Wren	*Troglodytes troglodytes*	2	-	-	Green	Possible (H)
	Goldcrest	*Regulus regulus*	2	-	-	Amber	Possible (H)
	Robin	*Erithacus rubecula*	1	-	-	Amber	Possible (H)
	Willow Warbler	*Phylloscopus trochilus*	1	-	-	Green	Possible (H)
	Magpie	*Pica pica*	1	-	-	Green	Possible (H)
	Jack Snipe	*Lymnocryptes minimus*	1	-	-	Amber	Possible (H)
	Pied Wagtail	*Motacilla alba yarrellii*	1	-	-	Green	Possible (H)
	Snipe	*Gallinago gallinago*	1	-	-	Amber	Possible (H)
	Mallard	*Anas platyrhynchos*	1	-	-	Green	Non-breeding (F)
	Chiffchaff	*Phylloscopus collybita*	1	-	-	Green	Possible (H)
	Moorhen	*Gallinula chloropus*	1	-	-	Green	Possible (H)
Dunkellin Bridge (west of)	Starling	*Sturnus vulgaris*	4	7	-	Amber	Possible (H)
	Chiffchaff	*Phylloscopus*	1	1	-	Green	Possible (H)

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
Grid Ref Start: M 44179 18391 End: M 43419 18376		*collybita*					
	Hooded Crow	*Corvus cornix*	3	1	-	Green	Possible (H)
	Blue Tit	*Cyanistes caeruleus*	2	0	-	Green	Possible (H)
	Woodpigeon	*Columba palumbus*	3	1	-	Green	Possible (H)
	Willow Warbler	*Phylloscopus trochilus*	4	0	-	Green	Possible (H)
	Wren	*Troglodytes troglodytes*	3	2	-	Green	Possible (H)
	Blackbird	*Turdus merula*	4	3	-	Green	Possible (H)
	Song Thrush	*Turdus philomelos*	3	0	-	Green	Possible (H)
	Grasshopper Warbler	*Locustella naevia*	1	0	-	Green	Possible (H)
	Jackdaw	*Corvus monedula*	1	0	-	Green	Possible (H)
	Pheasant	*Phasianus colchicus*	1	1	-	Green	Possible (H)
	Magpie	*Pica pica*	1	1	-	Green	Possible (H)
	Stonechat	*Saxicola torquata*	3	0	-	Amber	Possible (H)
	Mallard	*Anas platyrhynchos*	2	0	-	Green	Non-breeding (F)
	Moorhen	*Gallinula chloropus*	1	0	-	Green	Possible (H)
	Snipe	*Gallinago gallinago*	2	0	-	Amber	Possible (H)
	Coal Tit	*Periparus ater*	0	2	-	Green	Possible (H)
	Chaffinch	*Fringilla coelebs*	0	1	-	Green	Possible (H)
	Reed Bunting	*Emberiza schoeniclus*	0	1	-	Green	Possible (H)
	Pied Wagtail	*Motacilla alba yarrelli*	0	1	-	Green	Possible (H)
	Swallow	*Hirundo rustica*	0	3	-	Amber	Possible (H)
	Rook	*Corvus frugilegus*	0	1 in flight	-	Green	Non-breeding (F)
	Robin	*Erithacus rubecula*	0	1	-	Amber	Possible (H)
Dunkellin Bridge (east of) **Grid Ref** Start: M 44179 18391 End: M 44304 18493	Starling	*Sturnus vulgaris*	1	0	-	Amber	Possible (H)
	Woodpigeon	*Columba palumbus*	1 in flight	0	-	Green	Non-breeding (F)
	Great Tit	*Parus major*	1	0	-	Green	Possible (H)
	Little Egret	*Egretta garzetta*	2 in flight	0	-	Green	Non-breeding (F)
	Hooded Crow	*Corvus cornix*	2 in flight	0	-	Green	Non-breeding (F)

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
	Blue Tit	*Cyanistes caeruleus*	1	0	-	Green	Possible (H)
	Mallard	*Anas platyrhynchos*	2	0	-	Green	Non-breeding (F)
	Pied Wagtail	*Motacilla alba yarrellii*	1	0	-	Green	Possible (H)
	Sedge Warbler	*Acrocephalus schoenobaenus*	1	0	-	Green	Possible (H)
	Grey Heron	*Ardea cinerea*	1 in flight	0	-	Green	Non-breeding (F)
	Swallow	*Hirundo rustica*	1	0	-	Amber	Possible (H)
Rinn Bridge **Grid Ref** Start: M 45493 18388 within 3m End: M 45572 18426	Pied Wagtail	*Motacilla alba yarrellii*	1	0	-	Green	Possible (H)
	Blackbird	*Turdus merula*	0	2	-	Green	Possible (H)
	Jackdaw	*Corvus monedula*	1	0	-	Green	Possible (H)
	Chiffchaff	*Phylloscopus collybita*	2	0	-	Green	Possible (H)
	Woodpigeon	*Columba palumbus*	1 in flight	1 in flight	-	Green	Non-breeding (F)
	Coal Tit	*Periparus ater*	1 in flight	0	-	Green	Non-breeding (F)
	Sparrowhawk	*Accipiter nisus*	1 in flight	0	-	Amber	Non-breeding (F)
	Bullfinch	*Pyrrhula pyrrhula*	1	0	-	Green	Possible (H)
	Magpie	*Pica pica*	1 in flight	1	-	Green	Non-breeding (F)
	Swallow	*Hirundo rustica*	1	0	-	Amber	Possible (H)
	Willow Warbler	*Phylloscopus trochilus*	0	1	-	Green	Possible (H)
	Song Thrush	*Turdus philomelos*	0	2	-	Green	Possible (H)
	Rook	*Corvus frugilegus*	0	1 in flight	-	Green	Non-breeding (F)
	Chaffinch	*Fringilla coelebs*	0	1	-	Green	Possible (H)
Upstream of Craughwell Bridge Transect 1 **Grid Ref** Start: M51278 19995 End: M 51059 20060	Wren	*Troglodytes troglodytes*	3	5	3	Green	Possible (S)
	Willow Warbler	*Phylloscopus trochilus*	2	1	2	Green	Probable (P)
	Rook	*Corvus frugilegus*	3	6	0	Green	Non-breeding (F)
	Pied Wagtail	*Motacilla alba yarrellii*	1	0	0	Green	Possible (H)

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
	Blackcap	*Sylvia atricapilla*	1	2	2	Green	Possible (S)
	House Martin	*Delichon urbicum*	0	0	2	Amber	Non-breeding (F)
	Robin	*Erithacus rubecula*	2	1	1	Amber	Possible (S) (H)
	Song Thrush	*Turdus philomelos*	2	0	0	Green	Possible (H)
	Blackbird	*Turdus merula*	3	3	1	Green	Probable (P)
	Swallow	*Hirundo rustica*	0	2	0	Amber	Non-breeding (F)
	Dunnock	*Prunella modularis*	1	0	0	Green	Possible (S)
	Collard Dove	*Streptopelia decaocto*	1	0	0	Green	Possible (H)
	Chiffchaff	*Phylloscopus collybita*	1	0	0	Green	Possible (S)
	Pheasant	*Phasianus colchicus*	1	0	0	Green	Possible (S)
	Rook	*Corvus frugilegus*	1	2	1	Green	Probable (P)
	Starling	*Sturnus vulgaris*	1	1	-	Amber	Possible (H)
	Jackdaw	*Corvus monedula*	1	1	-	Green	Possible (H)
	Bullfinch	*Pyrrhula pyrrhula*	0	1	0	Green	Possible (H)
	Woodpigeon	*Columba palumbus*	0	1	0	Green	Non-breeding (F)
	Common Gull	*Larus canus*	0	0	1	Amber	Non-breeding (F)
	Chaffinch	*Fringilla coelebs*	1	2	2	Green	Possible (H), (S)
	Great Tit	*Parus major*	1	0	0	Green	Possible (H)
Downstream of Craughwell Bridge Transect 2 **Grid Ref** Start: M 51091 19934 End: M 50866 19935	Blackbird	*Turdus merula*	4	0	3	Green	Probable (P)
	Dipper	*Cinclus cinclus*	0	1	0	Green	Possible (H)
	Pheasant	*Phasianus colchicus*	4	0	0	Green	Possible (H)
	Starling	*Sturnus vulgaris*	1	0	0	Amber	Non-breeding (F)
	Willow Warbler	*Phylloscopus trochilus*	2	3	2	Green	Probable (P)
	Blackcap	*Sylvia atricapilla*	0	0	1	Green	Possible (S)
	Wren	*Troglodytes troglodytes*	4	5	4	Green	Possible (S), (H)
	Woodpigeon	*Columba palumbus*	1	1	2	Green	Possible (H), (S)

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
	Goldcrest	*Regulus regulus*	0	1	1	Amber	Possible (S)
	Collared Dove	*Streptopelia decaocto*	0	1	1	Green	Non-breeding (F)
	Pied wagtail	*Motacilla alba yarrelli*	0	1	1	Green	Confirmed (FF)
	Robin	*Erithacus rubecula*	1	2	0	Amber	Possible (S)
	Chaffinch	*Fringilla coelebs*	2	1	0	Green	Possible (H)
	Goldfinch	*Carduelis carduelis*	0	2	1	Green	Probable (P)
	Bullfinch	*Pyrrhula pyrrhula*	0	3	0	Green	Probable (P)
	Greenfinch	*Carduelis chloris*	0	1	0	Amber	Possible (H)
	Song thrush	*Turdus philomelos*	1	3	0	Green	Possible (H), (S)
	Long-tailed Tit	*Aegithalos caudatus*	1	0	0	Green	(Possible (H)
	Rook	*Corvus frugilegus*	1	0	5	Green	Probable (P)
	Hooded Crow	*Corvus cornix*	0	1	0	Green	Non-breeding (F)
	House Martin	*Delichon urbicum*	0	7	0	Amber	Non-breeding (F)
	Swallow	*Hirundo rustica*	0	1	2	Amber	Non-breeding (F)
	Starling	*Sturnus vulgaris*	1	1	0	Amber	Possible (S)
	Dunnock	*Prunella modularis*	1	0	0	Green	Possible (S)
	Mallard	*Anas platyrhyncos*	0	2	0	Green	Non-breeding (F)
	Jackdaw	*Corvus monedula*	1	0	2	Green	Non-breeding (F)
	Great Tit	*Parus major*	1	0	0	Green	Possible (S)
Downstream of Craughwell Bridge Transect No 3 **Grid Ref** Start: M50852 19921 End: M50323 19657	Blackcap	*Sylvia atricapilla*	4	4	2	Green	Possible (H)
	Robin	*Erithacus rubecula*	5	2	0	Amber	Possible (H)
	Goldcrest	*Regulus regulus*	3	2	2	Amber	Possible (S)
	Willow Warbler	*Phylloscopus trochilus*	4	2	1	Green	Possible (H)
	Rook	*Corvus frugilegus*	3 in flight	2	0	Green	Non-breeding (F)
	Mallard	*Anas platyrhynchos*	1 in flight	0	0	Green	Non-breeding (F)
	Magpie	*Pica pica*	0	0	2	Green	Possible (H)

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
	Chaffinch	*Fringilla coelebs*	1	2	0	Green	Possible (S)
	Song Thrush	*Turdus philomelos*	2	1	2	Green	Possible (S)
	Great Tit	*Parus major*	0	1	0	Green	Possible (S)
	Blue Tit	*Cyanistes caeruleus*	1	4	0	Green	Probable (P)
	Blackbird	*Turdus merula*	3	3	1	Green	Probable (P)
	Dunnock	*Prunella modularis*	1	1	0	Green	Possible (S)
	Chiffchaff	*Phylloscopus collybita*	4	2	2	Green	Possible (S)
	House Martin	*Delichon urbicum*	0	1	1	Amber	Non-breeding (F)
	Swallow	*Hirundo rustica*	1	2	0	Amber	Non-breeding (F)
	Starling	*Sturnus vulgaris*	0	3	0	Amber	Possible (H)
	Pheasant	*Phasianus colchicus*	0	2	1	Green	Possible (S)
	Woodpigeon	*Columba palumbus*	0	1	1	Green	Possible (H)
	Grey Heron	*Ardea cinerea*	0	1	0	Green	Possible (H)
	Cormorant	*Phalacrocorax carbo*	2	0	0	Amber	Non-breeding (F)
	Wren	*Troglodytes troglodytes*	3	6	9	Green	Possible (H), (S)
	Greenfinch	*Carduelis chloris*	1	0	0	Amber	Possible (H)
Aggard Stream (Ballylin West) **Grid Ref** Start: M 51130 15941 End: M 50437 15948	Willow Warbler	*Phylloscopus trochilus*	7	-	-	Green	Probable (P)
	Wren	*Troglodytes troglodytes*	4	-	-	Green	Possible (S), (H)
	Dunnock	*Prunella modularis*	2	-	-	Green	Possible (S)
	Rook	*Corvus frugilegus*	4	-	-	Green	Non-breeding (F)
	Goldfinch	*Carduelis carduelis*	1	-	-	Green	Possible (H)
	Robin	*Erithacus rubecula*	5	-	-	Amber	Possible (H), (S)
	Blackbird	*Turdus merula*	1	-	-	Green	Possible (H)
	Hooded Crow	*Corvus cornix*	1	-	-	Green	Non-breeding (F)
	Chaffinch	*Fringilla coelebs*	2	-	-	Green	Possible (H)
	Woodpigeon	*Columba palumbus*	1	-	-	Green	Non-breeding (H)

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
	Mallard	*Anas platyrhynchos*	1	-	-	Green	Possible (H)
	Skylark	*Alauda arvensis*	4	-	-	Amber	Probable (P)
	Sand Martin	*Riparia riparia*	4	-	-	Amber	Possible (H)
Upstream of Ballynamannin Bridge (Aggard Stream at Ballynamannin_1) **Grid Ref** Start: M 50538 16763 End: M 50449 16539	Goldfinch	*Carduelis carduelis*	3	0	2	Green	Probable (P)
	Wren	*Troglodytes troglodytes*	1	4	3	Green	Possible (S), (H)
	Goldcrest	*Regulus regulus*	1	0	1	Amber	Possible (S)
	Chaffinch	*Fringilla coelebs*	2	2	0	Green	Possible (S)
	Blue Tit	*Cyanistes caeruleus*	0	1	0	Green	Possible (S)
	Great Tit	*Parus major*	1	0	0	Green	Possible (H)
	Robin	*Erithacus rubecula*	6	2	0	Amber	Confirmed (FL)
	Song Thrush	*Turdus philomelos*	1	1	0	Green	Possible (S)
	Willow Warbler	*Phylloscopus trochilus*	5	3	4	Green	Possible (S)
	Hooded Crow	*Corvus cornix*	0	1	0	Green	Non-breeding (F)
	Rook	*Corvus frugilegus*	0	1	1	Green	Possible (H)
	Woodpigeon	*Columba palumbus*	2	5	0	Green	Probable (P)
	Dunnock	*Prunella modularis*	2	0	0	Green	Possible (S)
	Pheasant	*Phasianus colchicus*	1	1	1	Green	Possible (S)
	Cuckoo	*Cuculus canorus*	0	0	1	Green	Possible (S)
	Blackbird	*Turdus merula*	5	2	1	Green	Probable (P)
	House Martin	*Delichon urbicum*	0	6	1	Amber	Non-breeding (F)
	Mallard	*Anas platyrhyncos*	0	2	0	Green	Probable (P)
	Bullfinch	*Pyrrhula pyrrhula*	0	2	0	Green	Probable (P)
	Swallow	*Hirundo rustica*	0	2	2	Amber	Non-breeding (F)
	Starling	*Sturnus vulgaris*	0	0	4	Amber	Non-breeding (F)
	Grey Wagtail	*Motacilla cinerea*	0	4	0	**Red**	Confirmed (FL)
	Blackcap	*Sylvia atricapilla*	1	1	1	Green	Possible (S)
Upstream of Ballynamannin Bridge	Rook	*Corvus frugilegus*	1	1	1	Green	Non-breeding

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
(Aggard Stream at Ballynamannin_2) **Grid Ref** Start: M50449 16539 End: M50378 15979							(F)
	Wren	*Troglodytes troglodytes*	1	4	4	Green	Possible (H), (S)
	Willow Warbler	*Phylloscopus trochilus*	6	5	0	Green	Possible (H), (S)
	Goldcrest	*Regulus regulus*	0	2	1	Amber	Possible (S)
	Chaffinch	*Fringilla coelebs*	3	4	0	Green	Probable (P)
	Robin	*Erithacus rubecula*	3	0	0	Amber	Possible (S)
	Great Tit	*Parus major*	0	0	1	Green	Confirmed (FL)
	Long-tailed Tit	*Aegithalos caudatus*	0	4[5]	2	Green	Confirmed (FL)
	Pied Wagtail	*Motacilla alba yarrellii*	1	2	1	Green	Possible (S), (H)
	Woodpigeon	*Columba palumbus*	2	1	2	Green	Possible (S)
	Hooded Crow	*Corvus cornix*	1	0	0	Green	Non-breeding (F)
	Blackbird	*Turdus merula*	1	5	5	Green	Possible (P)
	Magpie	*Pica pica*	0	1	2	Green	Possible (P)
	Mallard	*Anas platyrhynchos*	1	1	0	Green	Non-breeding (F)
	Song Thrush	*Turdus philomelos*	1	0	0	Green	Possible (S)
	Mistle Thrush	*Turdus viscivorus*	0	0	2	Amber	Probable (P)
	Goldfinch	*Carduelis carduelis*	0	2	0	Green	Probable (P)
	Robin	*Erithacus rubecula*	0	1	2	Amber	Confirmed (FL)
	Dunnock	*Prunella modularis*	1	1	3	Green	Possible (S)
	Linnet	*Carduelis cannabina*	1	2	0	Amber	Probable (P)
	Meadow Pipit	*Anthus pratensis*	0	2	1	**Red**	Confirmed (FF)
	Common Gull	*Larus canus*	0	0	1	Amber	Non-breeding (F)
	Swallow	*Hirundo rustica*	0	1	0	Amber	Non-breeding (F)
	Stonechat	*Saxicola torquata*	1	2	0	Amber	Probable (P)
	Reed Bunting	*Emberiza schoeniclus*	0	0	1	Green	Possible

[5] Likely adults with young

Transect Section[1]	Common Name	Species Name	No of Individuals Recorded[2]			Conservation BoCCI[3]	Breeding Evidence[4]
	Blue Tit	*Cyanistes caeruleus*	0	0	2	Green	Confirmed (FL)
	Coal Tit	*Periparus ater*	0	1	0	Green	Possible (S)
Upstream of Ballynamannin Bridge (Aggard Stream at Ballynamannin / Emlagh) **Grid Ref** Start: M50372 15972 End: M50631 15316	Goldcrest	*Regulus regulus*	-	1	0	Amber	Possible (S)
	Meadow Pipit	*Anthus pratensis*	-	2	4	**Red**	Probable (T), (D)
	Willow Warbler	*Phylloscopus trochilus*	-	1	1	Green	Possible (S)
	Wren	*Troglodytes troglodytes*	-	0	3	Green	Probable
	Robin	*Erithacus rubecula*	-	2	0	Amber	Possible (S)
	Rook	*Corvus frugilegus*	-	4	0	Green	Non-breeding (F)
	Swallow	*Hirundo rustica*	-	2	1	Amber	Non-breeding (F)
	Wheatear	*Oenanthe oenanthe*	-	3	0	Amber	Possible (H)
	Skylark	*Alauda arvensis*	-	3	3	Amber	Confirmed (FF)
	Lapwing	*Vanellus vanellus*	-	2	3	**Red**	Probable (A)
	Reed Bunting	*Emberiza schoeniclus*	-	1	0	Green	Possible (H)
	Hooded Crow	*Corvus cornix*	-	1	2	Green	Non-breeding (F)
	Common Gull	*Larus canus*	-	1	0	Amber	Non-breeding (F)
	Pheasant	*Phasianus colchicus*	-	2	1	Green	Possible (S)
	Snipe	*Gallinago gallinago*	-	0	1	Amber	Possible (H)
	Blackbird	*Turdus merula*	-	0	2	Green	Probable (P)
	Dunnock	*Prunella modularis*	-	1	0	Green	Possible (S)
	Lesser black-Backed Gull	*Larus fucus*	-	2	0	Amber	Non-breeding (F)
	Stonechat	*Saxicola torquata*	-	0	2	Amber	Probable (P)
	Linnet	*Carduelis cannabina*	-	2	0	Amber	Probable (P)