Appendix 9.3: Fauna

A FIELD SURVEY AND DESK STUDY RESULTS

1. Carrowmore Lake

This is a large shallow lake with surrounding blanket bog. Bird species recorded during the survey are as follows:

Species	*Latin name*	Habitat Type	Comment
Reed Bunting	*Emberiza schoenidus*	Reedbed/grassland	Perching
Meadow Pipit	*Anthus pratensis*	Grassland/bog	Flying
Starling	*Sturmus vulgaris*	Grassland	Flying
Mute Swan	*Cygnus olor*	Open water	-
Cormorant	*Phalacrocorax carbo*	Open water	-

This site is known to support a number of bird species which are considered of international conservation significance and which are listed on Annex I of the European Birds Directive. In winter, Greenland White-Fronted Geese utilise the site. In summer, Merlin and Golden Plover breed within the site. An Irish Tern survey (1984) revealed that Sandwich Term (164 pairs) and Arctic Tern (18 pairs) formerly bred within the site, though terns have not bred in recent years. An island within the lake supports an important colony of Common Gulls (600 individuals, 1993). A variety of wildfowl also occur - Tufted Duck and Pochard. Goosander, a very rare species in Ireland, has been recorded in summer but no young have been seen.

2. Lough Dahybaun

This is a lough near the Bellacorrick SAC but outside it. It was examined for birds but the only species recorded during the survey was Mute Swan. It is likely to be host to overwintering birds.

3. Glencullin Upper

The Glencullin River is the southern boundary of the Slieve Fyagh bog SAC. The area contains mountain and lowland blanket bog. Bird species recorded as follows:

Species	***Latin name***	**Habitat Type**	**Comment**
Blue Tit	*Parus caeruleus*	Hedgerow	Perching
Chaffinch	*Fringilla coelebs*	Hedgerow	Perching
Swallow	*Hirundo rustica*	Hedgerow	Flying
Starling	*Sturmus vulgaris*	Open bog	Flying
Kestrel	*Falco tinnunculus*	Open bog	Flying
Golden Plover	*Pluvialis apricaria*	Open bog	Calling

Mammals recorded were Irish Hare and Fox. The bogland was considered of low importance to other mammals.

4. Bellacorrick Bog Complex SAC

This relatively large site is dominated by blanket bog habitat along with young conifer plantations in places. Bird species recorded as follows:

Species	***Latin name***	**Habitat Type**	**Comment**

Swallow	*Hirundo rustica*	Open bog	Flying
Hooded Crow	*Corvus corone*	Open bog	Flying
Goldfinch	*Carduelis carduelis*	Open bog	Flying
Redpoll	*Acanthis flammea*	Willow cover	Perching
Stonechat	*Saxicola torquata*	Open bog	Flying

The habitat has the potential to host other bird species such as Curlew, Golden Plover, Merlin, Hen Harrier, Grouse, Snipe, Skylark and Meadow Pipit.

The Bellacorrick complex incorporates the Owenboy Nature Reserve which is important for birds.

Mammals recorded were Otter, Mink, Fox and Hare. Otters and Mink were recorded along a tributary of the Deel River bordering the SAC. One Mink road traffic casualty was noted. Vegetation cover along the tributary included Willow and Gorse. The tributary was considered of likely moderate importance to otters.

The large expanse of open bog was however considered of low importance to mammals other than those recorded.

5. Ballinloughaun

The habitat features of this site are essentially cutaway bog and conifer plantation. As these habitat types occur regularly on the northern section of the route, this site was selected for a sample field survey also. Bird species recorded as follows:

Species	*Latin name*	Habitat Type	Comment
Swallow	*Hirundo rustica*	Open bog	Flying
Hooded Crow	*Corvus corone*	Open bog	Flying
Meadow Pipit	*Anthus pratensis*	Open bog	Flying
Blue Tit	*Parus caeruleus*	Conifers	Perching
Goldcrest	*Regulus regulus*	Conifers	Perching

Otters were confirmed on the nearby Owenbeg River. Hares may occur but likely at low density. In general, it is a poor site for most mammals.

6. Lough Conn

Lough Conn is of national importance for its waterfowl population. Lough Conn holds nationally important numbers of breeding Common Scoter (32, average maximum in 1987). This species is at its southern European limit in Ireland and is listed in the Irish Red Data Book as an endangered species. There are nationally important numbers of Pochard (1,410 average maximum, 1984/85-1986/87), Mute Swan (130 average maximum, 1984/85-1986/87) and Greenland White-Fronted Geese (138 average maximum, 1984/85-1986/87). These last ones are an Annex I species in the EU Birds Directive. Areas of wet grassland and dense emergent vegetation on the lake shore are their favoured feeding grounds. Teal, Wigeon, Mallard, Whooper Swan, Coot, Golden Plover, Lapwing, Goldeneye and Tufted Duck also frequent this site.

7. Gort (G1800 0145) To Sranalee (M1708 9590)

Assessment: field visit

General description of route section

This section is located several kilometres to the west and south-west of Lough Cullin and, whilst relatively complex in topography, may be summarised as comprised of mountain, hill, upland peat and low-level peat. The underlying geology of the section is principally granite, with schists and gneiss at the south. Granite is commonly exposed in elevated (northern sections), but through much of this section bedrock is overlain by blanket bog. There are pastures in the central portion of the route (Ross West) on drumlin hillock formations, with mineral soils. The land use capability is mostly very limited or extremely limited, with central pastures of limited capability.

Rainfall in this section will vary with elevation and is estimated at between 1150mm and 1300mm, with mean minimum January temperatures of c. 7.4ºC and mean maximum July temperature of 17.9ºC.

Fauna potential

Upland habitats such as those present in this section tend to be poor in distribution and abundance of mammalian species. Nevertheless, the relative variety of habitats present would allow for several common species to be present, whilst their abundance is likely to be low. Of the larger species, fox *Vulpes vulpes* and Irish hare *Lepus timidicus hibernicus* will be most frequent. The long-tailed field mouse *Apodemus sylvaticus* is ubiquitous, and the pygmy shrew *Sorex minutus*, the hedgehog *Erinaceous europeaus*, and the brown rat *Rattus norvegicus* are likely, especially in farmland. Squirrels are unlikely to occur, with an absence of mature woodland in the area. No signs of badger were noted. No species of deer nor feral goat are anticipated. Otters *Lutra lutra*, an Annexe II species (EU Habitats Directive) are anticipated in the general area and will forage in or traverse through open upland countryside. Tentative signs of the pine marten *Martes martes* were noted.

No locations for bat roosts were observed along the pipeline route, whilst the wetland and farmland habitats do provide feeding areas. Species likely to occur in the vicinity are the common pipistrelle *Pipistrellus pipistrellus*, the soprano pipistrelle *Pipistrellus pygmaeus* and the brown long-eared bat *Plecotus auritus*.

Bird species typical of upland habitat were observed, with common species of pasture farmland and woodland edge present also. Noted were skylark *Alauda arvensis*, meadow pipit *Anthus pratensis* - species very frequent on heaths and moor; also the wren *Troglodytes troglodytes*, dunnock *Prunella modularis*, pied wagtail *Motacilla alba yarrelli*, blackbird *Turdus merula*, robin *Erithacus rubecula*, magpie *Pica pica* and hooded crow *Corvus corone corone*. Likely to occur in the area are stonechat *Saxicola torquata*, snipe *Gallinago gallinago*, songthrush *Turdus philomelos*, cuckoo *Cuculus canorus*, great tit *Parus major*, swallow *Hirundo rustica* and raven *Corvus corax*. Birds of prey such as sparrowhawk *Accipiter nisus*, kestrel *Falco tinnunculus* and merlin *Falco*

columbarius would be anticipated; prey species would be relatively abundant on the heaths and bogs. Similarly, the habitat is suitable for hen harrier *Circus cyaneus* (Annex I, EU Birds Directive) and golden plover *Pluvialis apricaria* (Annex I species).

Frogs *Rana temporaria* are certain to be present, with plentiful breeding pools or ponds. The common lizard *Lacerta vivipara* is also likely to be frequent.

Scientific assessment

This upland habitat is mainly composed of modified blanket bog but includes or fringes a variety of other habitats, including wet grassland, improved pastures, scrub and scrub woodland, coniferous plantation, and raised bog. In general, however, the habitats and the vertebrate species present or likely to occur would be typical of many parts of Co. Mayo and the West. The relatively undisturbed areas of heath and the raised bog areas are of moderate to high conservation value, providing feeding areas and refuges for a variety of vertebrates, particularly birds, and may also harbour invertebrate species of interest. Open heath provides a habitat for scarce birds of prey such as merlin and hen harrier and also golden plover (the latter two species are Annex I species, EU Birds Directive). However, further afforestation of the heath areas is likely to occur in future.

8.North-West Of Rockfield (M1805 9385) To Derrynacross (M1915 9110)

Assessment: field survey

General description of route section

The section is located east of Castlebar, with the Clydagh River at the north and Derrynacross crossroads to the south. The route crosses the Castlebar River.

The Clydagh River marks a pronounced transition from exposed acidic bedrocks (sandstone, schists and gneiss) with blanket bog to the north from the glacial till, largely drumlin, landscape to the south. Most of the section south of the Castlebar River is within the drumlin area, with grey brown podzolics on limestone glacial till overlying Carboniferous limestone; interdrumlin areas are peaty and wet. Limestone bedrock is occasionally exposed to surface. Land use capability is limited.

The landscape is gently undulating, varying in elevation from c. 53m asl at Rockfield to c. 42m asl at Derrynacross (Clydagh River at c. 40m asl; Castelbar River at c. 29m asl). The pipeline route crosses near a small southward flowing stream west of Lickeen and another stream north of Derrynacross.

Rainfall in the area is estimated at 1220mm, with mean minimum January temperature of 7.7°C and mean maximum July temperature

of 18.0°C.

Existing fauna potential

The landscape is one principally of pasture grassland, bounded by limestone rock walls and scrub/hedgerow cover of variable quality. These habitats support a number of common vertebrate species typical of woodland edge in the main.

Of note are the various areas of scrub woodland near the route, mainly on peaty inter-drumlin soils, and the blocks of hazel-ash woodland on exposed limestone bedrock. These woodland areas provide cover and feeding for a variety of faunal species. Mammal species noted were badger *Meles meles*, fox and rabbit *Cuniculus oryctolagus*. Many Irish species would be present also, including hedgehog, pygmy shrew, Irish hare, long-tailed field mouse, brown rat, house mouse *Mus musculus* and Irish stoat *Mustela erminea hibernica*. Red squirrel *Sciurus vulgaris* would be occasional. The areas of scrub also provide habitat for the pine marten, a species that occurs in this part of Co. Mayo. Otters (Annexe II) are certainly present on both the major rivers in this section.

The area includes a number of mature deciduous treelines and buildings; with suitable roosting sites, bat species are likely to be well represented, and would include the common and soprano pipistrelle, brown long-eared bat, Leisler's bat *Nyctalus leisleri*, Daubenton's bat *Myotis daubentoni* (at rivers), and possibly the lesser horseshoe bat *Rhinolophus hipposideros* (an Annexe II species).

The adjacent woodland and scrub habitats also provide for a variety of bird species. Noted were hooded crow, magpie, wren, coal tit *Parus ater*, great tit, blue tit *Parus caeruleus*, chaffinch *Fringilla coelebs*, robin, wood pigeon *Columba palumbus*, song thrush *Turdus philomelos* and pheasant *Phasianus colchicus*. Herons *Ardea cinerea* were observed on both rivers. Woodcock *Scolopax rusticola* are seasonally present (pers. comm.). Other common species expected would include blackbird, willow warbler *Phylloscopus trochilus*, rook *Corvus frugilegus*, jackdaw *Corvus monedula*, starling *Sturnus vulgaris*, and swallow. Sparrowhawk and kestrel would also be expected. The kingfisher *Alcedo atthis* is potential (Annex I species, EU Birds Directive).

Suitable habitat for frogs was identified mainly at interdrumlin areas. The common lizard would also occur at woodland edges.

Scientific assessment

Generally, the principal landscape component - improved grassland - is of low conservation value, whilst hedgerows do provide habitat for a variety of faunal species. The principal habitats of interest that serve as wildlife refuge in the vicinity of the pipeline include the ash-hazel woodland near the pipe route, the willow scrub woodland (some of which will be affected by the route), and in particular the two major rivers.

Otters (Annexe II, EU Habitats Directive) are certainly present along

the river systems, and pine marten are likely in scrub woodland. Badgers are also present. Kingfisher (Annex I, EU Birds Directive) may be present.

9. South Of Ballinavoash (M1955 9015) To Manulla (M2190 8765)

Assessment: Geofilm

General description of route section

This route section is located c. 5km east of Castlebar. The underlying geology is one of Carboniferous Limestone, overlain with limestone glacial tills in gently undulating drumlin landscape. Mineral soils are interspersed with interdrumlin peats and peaty gleys. Landuse capability is limited.

Elevation of the route varies from c. 25m asl to c. 48m asl, skirting drumlin peaks of max. 54m asl. The major watercourse in the area is the Manulla River, with one tributary stream.

Rainfall is estimated at 1200mm/annum, with mean minimum January temperature of 7.7°C and a mean maximum July temperature of 18.0°C.

Existing fauna potential

This landscape is not dissimilar to the section visited north of Derrynacross, but lacks substantial scrub woodland or woodland cover. There is a mix of improved pasture grasslands on dry mineral soils with wet grassland on low-lying peaty soils. A narrow wildlife corridor is provided by the railway line. The Manulla River and its tributary provide a habitat for species such as otter (Annex II species). There are few large mature trees and no buildings affected by the pipeline route.

The principal common mammal species are anticipated in this section; these would include rabbit, Irish hare, fox, badger, hedgehog, pygmy shrew, field mouse, and brown rat. The Irish stoat would be occasional. Otters are likely to be present on the river system. The common bat species would also be anticipated to feed in the area, but it is unlikely that roosting sites would be affected by the development. Both the frog and the common lizard are likely to occur.

Birds typical of grassland pastures and wet meadows would be expected, and riparian species such as heron and kingfisher (latter is Annex I species).

Scientific assessment

Assessment of Geofilm aerial photography does not indicate any habitats of especial value for wildlife, whilst the hedgerow and scrub boundaries provide refuge and wildlife corridors.

The principal habitat of interest is the Manulla River and tributary streams, with otters likely to be present, and potentially kingfisher. The wetland habitats west of Manulla and in the vicinity of Manulla Bridge should be checked by field visit; there may be impacts; an

adjoining lake could also be affected (M213 877).

10. Cloonsheen (M3282 5500) To Caltragh (M3480 4800)

Assessment: Geofilm

General description of route section

This section is located approximately 11km west of Tuam. The underlying geology is Carboniferous Limestone. This is an area of flat to undulating lowland with parent limestone glacial till: principally dry mineral soils (brown earths, grey-brown podzols, interspersed with peaty gleys and gleys). Land use capability is somewhat limited.

Elevation is c. 25m asl to c. 35m asl with little variation. There is only one principal watercourse: the Togher River.

Mean annual precipitation is estimated at 1160mm, with mean minimum January temperature of 7.6°C and mean maximum July temperature of 18.4°C.

Existing fauna potential

The relatively uniform landscape of improved grassland and stone wall and scrub boundaries is of low value for wildlife. There is little additional scrub. The principal area of interest is the extent of bog to the west of the pipeline, west of Beagh More.

Ubiquitous mammalian and avian species are likely to be present. There are few trees and no buildings affected by the development, so impacts on bat roosts are unlikely. However, the pipeline appears to fringe limestone bedrock north-west of Caltragh, where OS map indicates a cave. There is potential for roosts of lesser horseshoe bats in caves in this area, which would require further investigation. The abundance of frogs is likely to be low in much of this area. Otters may utilise the Togher River and wetlands in the vicinity.

Scientific assessment

The conservation value of this area appears low, with a uniform grassland landscape, and some limited wet grassland and scrub in the vicinity of the River Togher.

There is potential for lesser horseshoe bats in this area and potential caves should be checked for bat presence, near Caltragh.

11. Carrowkeel Turlough

Carrowkeel is a moderate sized turlough with a high diversity of vegetation. It has permanent water in part. It is subject to grazing pressure. Bird species recorded during the survey are as follows:

Species	*Latin name*	Habitat Type	Comment
Magpie	*Pica pica*	Hedgerow	Flying
Rook	*Corvus frugilegus*	Hedgerow	Flying
Wren	*Troglodytes troglodytes*	Hedgerow	Perching
Robin	*Erithacus rubecula*	Hedgerow	Perching
Swallow	*Hirundo rustica*	Open turlough	Flying
Lapwing	*Vanellus vanellus*	Rushes	Calling
Woodpigeon	*Columba palumbus*	Open turlough	Flying
Moorhen	*Gallinula chloropus*	Rushes	Calling
Curlew	*Numenius arquata*	Rushes	Calling
Pheasant	*Phasianius colchicus*	Rushes	Calling

Other species of bird to be expected in the Ash/Hawthorn edges bordering the site are Blue Tit, Chaffinch and Song Thrush. In addition to the above, Lapwing were recorded during the vegetation survey perching in rushes and calling at the north-eastern end of the turlough.

The hedgerows bordering the site are considered of likely low to moderate importance to mammals. Elsewhere is considered suitable for Pygmy shrew, but generally unsuitable for other mammal species.

12. Greaghan's Turlough

Greaghan's Turlough is a relatively small site which is moderately grazed. Two streams enter the turlough. Bird species recorded during the survey are as follows:

Species	*Latin name*	Habitat Type	Comment
Swallow	*Hirundo rustica*	Open turlough	Flying
Rook	*Corvus frugilegus*	Green field	Foraging
Chaffinch	*Fringilla coelebs*	Hedgerow	Perching

Greaghan's Turlough is notable for its use in winter by swans - 40 Whooper Swans, a species listed on Annex I of the EU Birds Directive, were recorded in 1986 on the site.

The site has very little vegetation cover, either in clumps or hedgerows, surrounding the site which is dominated by improved pasture. As such the site offers very little potential for mammals.

13. Turlough O'Gall

Turlough O'Gall is a relatively moderate sized turlough situated east of Caherlistrane. The site includes small pasture fields/meadows with relatively good surrounding hedgerows. Bird species recorded during the survey are as follows:

Species	*Latin name*	Habitat Type	Comment
Swallow	*Hirundo rustica*	Hedgerow	Flying
Blackbird	*Turdus merula*	Hedgerow	Flying
Wren	*Troglodytes troglodytes*	Hedgerow	Perching
Chaffinch	*Fringilla coelebs*	Hedgerow	Perching
Blue Tit	*Parus caeruleus*	Hedgerow	Perching
Woodpigeon	*Columba palumbus*	Hedgerow	Flying
Robin	*Erithacus rubecula*	Hedgerow	Perching
Rook	*Corvus frugilegus*	Open turlough	Flying

The small meadows have potential for Corncrake (*Crex crex*), though a May survey is required to confirm this. The site is also likely to attract overwintering birds.

Mammals confirmed on site are Irish Hare and Rabbit. The site is also likely to be used by foxes with woodmice and Pygmy shrews utilising the drier site margins.

14. Kilgill (M 3772 3960) To Cahernashilleeny (M4160 3355)

Assessment: Geofilm

General description of route section

This section is located c. 6km north-east of Claregalway. It is flat to undulating lowland of limestone glacial till overlying Carboniferous Limestone bedrock. Soils are principally shallow brown earths, with grey-brown podzolics, gleys and peat. Land use capability is somewhat limited.

Elevation is generally in the range 20 - 30m asl, with an elevated section at Knockdoe (pipeline skirts west of mound, elevation 70m asl). There are no major watercourses in the area.

Mean annual precipitation is estimated at 1050mm, with mean minimum January temperature of 7.8°C and mean maximum July temperature of 18.7°C.

Existing fauna potential

The relatively uniform landscape of improved grassland and stone wall is of low value for wildlife. There is little additional scrub in these grassland areas. Ubiquitous mammalian and avian species are likely to be present. The abundance of frogs is likely to be low in much of this area. There are few trees and no buildings affected by the development, so impacts on bat roosts are unlikely.

The prime area of interest is the limestone pavement and deciduous scrub woodland on limestone in the central portion of the section at Knockdoe. This area may have high conservation value, and merits further investigation by field survey. There is potential for roosts of lesser horseshoe bats and Natterer's bats in caves or crevices in this area, which would also require further investigation. This area is also likely to be prime habitat for pine marten, a protected species. The habitats also provide refuge for a diversity of bird species and invertebrates of interest.

Scientific assessment

The conservation value of much of this section appears low, with a uniform grassland landscape, bounded in the main by bare stone walls.

The limestone pavement and scrub woodland present at Knockdoe is potentially of relatively high conservation value (Annex I Habitat, EU Habitats Directive), and merits additional field study. Pine marten are likely to be present and there is potential for lesser horseshoe bats in this area and potential cave and crevice roosts sites should be checked for bat presence. Bat survey is recommended.

15. Cregmore (M4195 3315) To Craughwell (Garracloon South) (M5265 2135)

Assessment: Geofilm and field survey

General description of route section

The pipeline section is located to the south-east, south-west, west and north-west of Athenry. It is flat to undulating lowland of limestone glacial till overlying Upper and Lower Carboniferous Limestone bedrock. Soils are principally shallow brown earths, with grey-brown podzolics, gleys and peat. Land use capability is somewhat limited.

Elevation over much of the area is c. 25-30m asl, but rising to c. 70m asl at Knocknacreeva and maintaining an elevation of 50m to the south-east (Rathmorrisey). There are no major watercourses in the northern portion of the route, but to the south-west and south of Athenry, the pipeline crosses the Lavally River, the Eiscir River and Dooyertha River. The Clare River is at the northern extent of this section.

Estimated annual precipitation is 1050mm, with mean minimum January temperature of 7.60C and mean maximum July temperature of 18.50C.

Existing fauna potential

A substantial portion of the landscape of this section is relatively uniform improved grassland with boundaries of bare stone walls and low scrub or low hedgerow. These areas are of relatively low value for wildlife. Common mammalian and avian species are likely to be present.

However, unlike the previous section assessed above, there is greater habitat diversity, with substantial areas of scrub, scrub woodland, and also mature treelines and areas of estate woodland. Grassland on thin soils over limestone is associated with encroaching or adjacent scrub and woodland, forming habitat mosaics of wildlife interest. Pine marten are likely to be present in some of these area and badger presence was observed at Garracloon South also. A variety of mammal species would be present also, including fox, Irish stoat, rabbit, Irish hare, hedgehog, pygmy shrew, field mouse and brown rat. Red squirrel *Sciurus vulgaris* is potential. All rivers were suitable for otter (Annex II species), and American mink *Mustela vison* would also be anticipated.

A variety of bat species would be expected in this area, and, as this

section does include mature tree lines, there are potential bat roosts affected by the development. Species anticipated include common pipistrelle, soprano pipistrelle, brown long-eared bat, Leisler's bat, Daubenton's bat (rivers), lesser horseshoe bat (Annex II species) and Natterer's bat.

The diverse scrub habitats also provide refuge for bird species and invertebrates of interest. Bird species noted included wren, robin, blue tit, blackbird, dunnock, pheasant, magpie, and hooded crow. Elsewhere, wood pigeon and black-headed gull *Larus ridibundus* were also noted. Several large rivers are present, so species such as mallard, moorhen, grey heron and kingfisher are expected to occur (the latter is an Annex I species).

Scientific assessment

Whilst much of this section is composed of grassland pastures with boundaries of stone wall, and is of low scientific interest, the pipeline route does pass through a variety of habitats, more varied than some other sections of the route in Co. Galway. In portions, the grasslands are bounded by mature low hedgerow or mature treeline of ash and also estate planting.

The principal areas of wildlife interest are the 4 rivers, and also the larger areas of scrub and scrub woodland; that at Garraghcloon South is associated with semi-improved calcareous grassland; this diversity provides a refuge for vertebrates and invertebrates. Two principal species protected by Directives are likely to occur: otter and kingfisher.

B LIST OF VERTEBRATES AND ADJUDGED STATUS (EXCLUDING BIRDS)

Areas

1 Gort to south-west of Sranalee
2 North-west of Rockfield to Derrynacross
3 South of Ballinavoash to south of Manulla
4 Cloonsheen to Caltragh
5 Kilgill to Cahernashilleeny
6 Cregmore to Craughwell

Presence/absence/status

P present/certain
T potential
U unlikely
A absent
L likely

Status in Study area

Mammals		**1**	**2**	**3**	**4**	**5**	**6**	**north Mayo**	**east Mayo/ Galway**
Insectivora									
Hedgehog	*Erinaceous europaeus*	P	P	P	P	P	P	P	P
Pygmy shrew	*Sorex minutus*	P	P	P	P	P	P	P	P
Chiroptera									
Common pipistrelle	*Pipistrellus pipistrellus*[1]	L	P	P	P	P	P	P	P
Soprano pipistrelle	*Pipistrellus pygmaeus*	L	P	P	P	P	P	P	P
Nathusius's pipistrelle	*Pipistrellus nathusii*	A	A	A	A	A	A	A	A
Brown long-eared	*Plecotus auritus*	L	P	P	P	P	P	P	P
Leisler's	*Nyctalus leisleri*	T	L	L	L	L	L	L	L
Lesser horseshoe	*Rhinolophus hipposideros*	A	A	A	T	T	T	U	L
Whiskered	*Myotis mystacinus*	U	T	T	T	T	T	T	T
Natterer's	*Myotis nattereri.*	U	T	T	T	T	T	T	T
Daubenton's	*Myotis daubentoni*	U	L	L	U	A	P	L	P
Lagomorpha									
Rabbit	*Oryctolagus cuniculus*	P	P	P	P	P	P	P	P
Irish hare	*Lepus timidus hibernicus*	P	P	P	P	P	P	P	P
Rodentia									
Red squirrel	*Sciurus vulgaris*	A	T	T	T	T	T	T	T
Grey squirrel	*Sciurus carolinensis*	A	A	A	A	A	A	A	A
Bank vole	*Clethrionomys glareolus*	A	A	A	A	A	A	A	A
Long-tailed field mouse	*Apodemus sylvaticus*	P	P	P	P	P	P	P	P
House mouse	*Mus musculus*	L	L	L	L	L	L	L	L
Black rat	*Rattus rattus*	A	A	A	A	A	A	A	A
Brown rat	*Rattus norvegicus*	P	P	P	P	P	P	P	P

[1] Two species of Pipistrelle bat are present in Ireland, recent taxonomic revision. The species are identified by the frequency they use for echolocation (46Hz [Common] and 55Hz [Soprano]), and both are common and occur in similar habitats, whilst distribution is not well known in the West.

List of Irish mammals, vertebrates and amphibians

		1	2	3	4	5	6	north Mayo	east Mayo/ Galway
Carnivora									
Fox	*Vulpes vulpes*	P	P	P	P	P	P	P	P
Badger*	*Meles meles*	L	P	L	L	L	P	L	P
Pine marten	*Martes martes*	L	L	U	U	L	L	L	L
Irish stoat	*Mustela erminea hibernica*	T	T	T	T	T	T	T	T
Otter	*Lutra lutra*	L	P	P	L	A	P	P	P
American mink	*Mustela vison*	T	T	T	T	T	P	P*2	P
Artiodactyla									
Red deer	*Cervus elaphus*	A	A	A	A	A	A	A	A
Sika deer	*Cervus nippon*	A	A	A	A	A	A	A	A
Red/Sika hybrids	*Cervus elaphus/nippon*	A	A	A	A	A	A	A	A
Fallow deer	*Dama dama*	A	A	A	A	A	A	A	A
Feral goat	*Capra*	A	A	A	A	A	A	A	A
Amphibians									
Smooth newt	*Triturus vulgaris*	A	A	A	A	A	A	A	A
Frog	*Rana temporaria*	P	P	P	P	T	P	P	P
Natterjack toad	*Bufo calamita*	A	A	A	A	A	A	A	A
Reptiles									
Common Lizard	*Lacerta vivipara*	P	T	T	T	T	T	P	P

*** Badger densities**

Co. Mayo 0.28 social groups/km²
Co. Galway 0.25 social groups/km²

Note: densities are for entire counties, including western upland areas, and would generally be considerably higher (e.g. c. 0.5 social groups/km²) in the grassland areas of pipeline route sections 2-6.

from Smal, C.M. 1995 *The Badger and Habitat Survey of Ireland.*

*2 additional records from L. O'Sullivan, August 2000.

C BIRD SPECIES

Areas

1 Gort to south-west of Sranalee
2 North-west of Rockfield to Derrynacross
3 South of Ballinavoash to south of Manulla
4 Cloonsheen to Caltragh
5 Kilgill to Cahernashilleeny
6 Cregmore to Craughwell

Presence/absence

P present/certain (this survey)
T potential (this survey)
• species also recorded in 1km square survey squares in generally similar landscape types
see notes below (following table)
*2 additional records from pipeline route, L. O'Sullivan, August 2000, for *both Mayo and Galway*.

Status in Study area

		1	2	3	4	5	6	north Mayo	east Mayo/ Galway
skylark	Alauda arvensis	P						P*	T*
meadow pipit	Anthus pratensis	P				T	T	P**2	T**2
great tit	Parus major	T	P	T		T	T	T	P*
blue tit	Parus caeruleus		P	T		T	P	T**2	P**2
coal tit	Parus ater		P	T		T	T		P*
goldcrest	Regulus regulus		T			T	T	T*2	T**2
treecreeper	Certhia familiaris		T	T			T		T*
wren	Troglodytes troglodytes	P	P	T	T	T	P	P**2	P**2
dunnock	Prunella modularis	P		T		T	P	P*	P*
chaffinch	Fringilla coelebs		P	T		T	T	T**2	P**2
greenfinch	Carduelis chloris		T	T	T	T	T		T*
goldfinch	Carduelis carduelis		T			T	T	*2	T**2
house sparrow	Passer domesticus	T	T			T	T	T*	T
sand martin	Riparia riparia							*	
linnet	Carduelis cannabina	T						T*	
chiffchaff	Phylloscopus collybita		T	T		T	T		T*
blackcap	Sylvia atricapilla								*
wheatear	Oenanthe oenanthe							*	
stonechat	Saxicola torquata	T						T**2	*2
pied wagtail	Motacilla alba yarrelli	P					T	P*	
grey wagtail	Motacilla cinerea							*	
blackbird	Turdus merula	P	P	T	T	T	P	P**2	P**2
fieldfare	Turdus pilaris		T				T		T*
mistlethrush	Turdus viscivorus		T				T		T*
songthrush	Turdus philomelos	T	P	T		T	T	T	P*
starling	Sturnus vulgaris		T	T			T	**2	T**2

Bird species (cont.)

		1	2	3	4	5	6	north Mayo	east Mayo/ Galway
Robin	Erithacus rubecula	P	P	T	T	T	P	P**2	P**2
Redpoll	Acanthis flammea							*2	**2
spotted flycatcher	Muscicapa striata		T				T		T*
Whitethroat	Sylvia communis		T			T	T		T*
reed bunting	Emberiza schoeniclus							*	*
sedge warbler	Acrocephalus schoenobaenus						T	*	T*
Grasshopper warbler	Locustella naevia					T	T	*	T*
willow warbler	Phylloscopus trochilus	T	T			T	T	T*	T*
Cuckoo	Cuculus canorus	T						T*	
Pheasant	Phasianus colchicus		P	T		T	P	*2	P**2
wood pigeon	Columba palumbus		P				P	**2	P**2
Collared dove	Streptopelia decaocto								*
Swallow	Hirundo rustica	T	T	T		T	T	T**2	T**2
snipe	Gallinago gallinago	T		T			T	T*	T*
Woodcock	Scolopax rustica		P			T			P
grey heron	Ardea cinerea		P	T			T		P*
Magpie	Pica pica	P	P	T	T	T	P	P**2	P**2
hooded crow	Corvus corone corone	P	P			T	P	P**2	P**2
Rook	Corvus frugilegus		T	T			T	*2	T**2
Jackdaw	Corvus monedula		T	T			T	*	T*
Raven	Corvus corax	T					T	T	
Sparrowhawk	Accipiter nisus	T	T			T	T	T	T
kestrel	Falco tinnunculus	T	T			T	T	T*2	T**2
Merlin	Falco columbarius	T						T*	
hen harrier	Circus cyaneus	T						T	
great black-backed gull	Larus marinus							*	
black-headed gull	Larus ridibundus						P	*	P*
Common gull	Larus canus							*	
Lapwing	Vanellus vanellus								*
golden plover	Pluvialis apricaria	T						T**2	**2
Sandwhich tern	Sterna sandvicensis							*	
Cormorant	Phalacrocorax carbo							*	
Teal	Anas crecca							*	
Moorhen	Gallinula chloropus							*2	*2
Curlew	Numenius arquata							*2	*2
mute swan	Cygnus olor							*2	*2
Kingfisher	Alcedo atthis		T	T		A	T		T

Bird Census data

lowland

M4030 [Galway, nr. route section 6], April/June 2000
M5020 [Galway, nr. route section 6], April/June 2000
M3080 [Mayo, south-east of route section 3], April/June 2000;

upland

F8030 [Mayo, route nr. Broadhaven/Carrowmore Lake], May/June 200
G0030 [Mayo, east of route, south-east of Glenamoy], May/June 1999
F9030 [Mayo, south of route, south of Glenamoy], May/June 2000

APPENDIX 9.4 HABITAT TYPES WHICH OCCUR ON OR NEAR THE PROPOSED PIPELINE ROUTE

(note: * indicates an Annex I priority habitat type under the EU Habitats Directive 1992)

The composition and ecology of the main habitat/vegetation types encountered along, adjacent to, and within 1 km. of the proposed route is outlined below. The equivalent habitat in the JNCC Phase 1 Survey Guidelines is given where possible, as are the phytoscociological affinities of the vegetation and the Irish habitat type (according to Fossitt, 2000).

(1) Coniferous plantation

Equivalent Phase 1 survey habitat classification: Coniferous plantation (A1.2.2) and recently-felled coniferous woodland (A4.2)
Fossitt: Conifer plantation (WD4)
Substantial sections of the proposed pipeline route in Co. Mayo are dominated by coniferous forestry on blanket peat. These areas of forestry are at various stages of development ranging from saplings of less than 2 metres to mature trees in excess of 10m in height. The main tree species in these plantations are *Pinus contorta* and *Picea sitchensis*. In areas of mature plantation there is little vegetation present due to the shade cast by the trees, however in areas of plantation less than 10 years old the original blanket bog vegetation can still be seen, albeit in a drained and ungrazed state. In such circumstances *Molinia caerulea* and *Calluna vulgaris* are typically the dominant plant species. The habitat is of low ecological interest.

(2) Wet grassland dominated by Juncus effusus

Equivalent Phase 1 survey habitat classification: Neutral grassland (B2) and Marsh/marshy grassland (B5)
Phytosociological synonymy: Holco-Juncetum effusi *Page 1980*
Equivalent N.V.C. community: *Holcus lanatus-Juncus effusus* rush pasture (MG10)
Fossitt: Wet grassland (GS4)
This type of wet grassland is very commonly encountered in the damp acid soils of Co. Mayo and is especially common in revegetating areas of cutaway blanket bog and abandoned wet pastures. The dominant plant species is the tall rush *Juncus effusus* and in many instances the cover of the species can be so complete that few other plant species co-occur. Vegetation where there is a very high cover of *Juncus effusus* coupled with saturated soils corresponds to the marsh/marshy grassland habitat outlined in Phase 1 survey guidelines. In slightly better drained and more open situations *J. effusus* is generally accompanied by species such as *Holcus lanatus, Agrostis stolonifera, Ranunculus acris, Ranunculus repens, Rumex acetosa, Anthoxanthum odoratum, Cardamine pratensis, Trifolium repens* and *Poa trivialis*. This type of more species-rich *Juncus effusus* grassland corresponds to the neutral grassland category (B2) outlined in the Phase 1 Survey guidelines and is transitional to the semi-improved grassland described in the next section. The vegetation of the habitat is generally of low ecological interest due to its rather species-poor nature and the general absence of rare plant species.

(3) Improved/semi-improved grassland dominated by Holcus lanatus and Lolium perenne

Equivalent Phase 1 survey habitat classification: Semi-improved neutral grassland (B2.2) and Improved grassland (B4)
Phytosociological synonymy: Lolio-Cynosuretum cristati *Braun-Blanquet et De Leeuw1950*
Equivalent N.V.C. community: *Lolium perenne – Cynosurus cristatus* grassland (MG6).
Fossitt: Improved agricultural grassland (GA1).

This grassland type encompasses the better-drained, more agriculturally productive grasslands encountered during the pipeline route survey in Counties Mayo and Galway. In north-west Mayo many areas of this grassland occur on recently reclaimed blanket bog and thus have a damp, acid soil. The dominant species in the vegetation is usually either *Holcus lanatus* or *Lolium perenne* however *Cynosurus cristatus* and *Poa pratensis* can also be locally dominant. Other common and ubiquitous species include *Plantago lanceolata, Trifolium repens, Ranunculus acris, Bellis perennis, Taraxacum officinale, Cerastium fontanum* and *Agrostis capillaris*. In the more intensively managed examples of this grassland type ruderal species such as *Rumex obtusifolius, R. crispus, Cirsium arvense* and *C. vulgare*, are frequently conspicuous. Areas of grassland which have been recently reseeded and are subject to heavy manuring tend to be dominated by floristically poor swards of *Lolium perenne* with few other grass species present. The habitat is generally of low ecological interest due to its species-poor composition, however in some areas of Mayo where pastoral agriculture is of a less intensive nature the grassland vegetation can approach that of unimproved hay-meadow.

(4) Heath dominated by Calluna vulgaris

Equivalent Phase 1 survey habitat classification: Acid dry dwarf shrub heath (D1)
Phytosociological synonymy: Carici binervis – Ericetum cinereae *Braun-Blanquet et Tüxen 1950,*
Equivalent N.V.C. community: *Calluna vulgaris – Erica cinerea* heath (H10).
Fossitt: Dry siliceous heath (HH2).

This low-growing heath vegetation is characterised by the dominance of the dwarf shrub *Calluna vulgaris*. The vegetation is confined to areas where the peat depth is generally less than 1 metre in depth. Although *Calluna* is generally dominant, it is frequently accompanied by *Erica cinerea, Carex binervis, Juncus squarrosus, Potentilla erecta, Galium saxatile, Anthoxanthum odoratum, Agrostis canina* and *Potentilla erecta*. Mosses are relatively frequent however species diversity is not high with *Hypnum cupressiforme, Rhytidiadelphus squarrosus, Hylocomium splendens* and *Pleurozium schreberi* locally common. Along the proposed pipeline route between Pullatomish and Oranmore this habitat is confined to high ground to the south-west of Pontoon where the route traverses a gap through the hills. A habitat of some ecological interest, particularly in view of the recent reduction of both the extent and quality of *Calluna* heath in the west of Ireland due to overgrazing by sheep.

(5) Blanket bog

Equivalent Phase 1 survey habitat classification for intact areas: Blanket bog (E1.6.1)
Equivalent Phase 1 survey habitat classification for cutaway or overgrazed areas: Wet modified bog (E1.7)
Equivalent Phase 1 survey habitat classification for industrially cutaway areas: Bare peat (E4)
Phytosociological synonymy: Pleurzio purpureae – Ericetum tetralicis *Braun-Blanquet et Tüxen 1952.*
Equivalent N.V.C. community: *Scirpus cespitosus – Eriophorum vaginatum* blanket mire (M17).
Fossitt: Upland blanket bog (PB2); Lowland blanket bog (PB3); Cutover bog (PB4); Eroding blanket bog (PB5).

Lowland blanket bog vegetation is frequently encountered along the proposed route of the pipeline in Co. Mayo. Generally the vegetation is dominated by either *Molinia caerulea* or *Schoenus nigricans*, with the low-growing shrubs *Erica tetralix* and *Calluna vulgaris* also frequent. Other common vascular plant species in the vegetation include *Potentilla erecta, Carex panicea, Eriophorum angustifolium, Eriophorum vaginatum, Pedicularis sylvatica, Trichophorum cespitosum, Rhynchospora alba, Narthecium ossifragum* and *Polygala serpyllifolia.* In the drier areas of blanket bog, e.g. cutaway banks, species such as *Calluna vulgaris, Carex panicea, Hypnum cupressiforme* and *Leucobryum glaucum* are more prominent in the vegetation. Areas of blanket bog, which have not been grazed for a considerable time, e.g. along fenced-off fire-breaks, tend to be dominated by *Molinia caerulea*, accompanied by conspicuous *Calluna vulgaris*, a grazing sensitive species. Areas of blanket bog subject to overgrazing by sheep and cattle tend to be characterised by a high proportion of bare surface peat and sparse vegetation which is typically dominated *by Nardus stricta, Eriophorum angustifolium, Eleocharis multicaulis* and the moss *Campylopus introflexus.* Bryophyte cover in lowland blanket bogs is generally well-developed, especially in wet areas. Species such as *Sphagnum capillifolium, Sphagnum papillosum, Campylopus atrovirens, Rhacomitrium lanuginosum* and *Hypnum cupressiforme* are common and ground cover generally exceeds 30%. In the more undisturbed, waterlogged, deep peat areas there can be well-developed Sphagnum carpets (mostly *S. papillosum, S. magellanicum* and *S. cuspidatum*) accompanied by *Eriophorum angustifolium* and *Rhynchospora alba.* One of the most conspicuous cryptogamic species of Atlantic blanket bog is the purple liverwort *Pleurozia purpurea*, one of the character species of the association. Another striking feature of lowland blanket bog is the presence of extensive carpets of mucilaginous algae (*Zygogonium* spp.) in wet hollows. In areas of deep blanket bog there may be pool areas, however no well-developed pool areas occur within 50 metres either side of the proposed pipeline route. The characteristic plant species of pools are *Menyanthes trifoliata, Sphagnum cuspidatum, Sphagnum auriculatum, Drosera anglica, Eriophorum angustifolium* and *Eriocaulon aquaticum.* Intact areas of blanket bog are of high ecological interest.

(6) Blanket bog flush
Equivalent Phase 1 survey habitat classification = Basic flush (E2.2)
Phytosociological synonymy: Schoenetum nigricantis Koch 1926
Equivalent N.V.C. community: *Schoenus nigricans-Juncus subnodulosus* mire (M13).

Between the northern edge of Owenboy Nature Reserve and the Crossmolina-Belmullet road, there is an extensive area of species-rich flush dominated by *Schoenus nigricans*. This area is influenced by base-rich groundwater that upwells from the lower peat layers and provides the necessary conditions for the growth of basephile plant species. Other common plant species in the vegetation include *Cladium mariscus, Carex lasiocarpa Carex rostrata, Carex limosa, Carex panicea, Eriophorum angustifolium, Juncus subnodulosus, Molinia caerulea, Menyanthes trifoliata, Eriophorum latifolium, Pinguicula vulgaris* and *Carex lepidocarpa.* Plant species low in stature such as *Anagallis tenella, Pinguicula lusitanica, Selaginella selaginoides* and *Linum catharticum* occur in the more open areas scoured by flowing water. The bryophyte component of base-rich flushes is typically well-developed and includes *Drepanocladus revolvens, Scorpidium scorpioides, Campylium stellatum, Fissidens adianthoides, Bryum pseudotriquetrum, Philonotis fontana* and the rare *Homalothecium nitens.* This habitat is of very high ecological interest due to the high number of plant species the habitat supports and the presence of locally rare species such as *Eriophorum latifolium, Homalothecium nitens* and *Vaccinium oxycoccus.*

(7) Transitional bog

Equivalent Phase 1 survey habitat classification: Mapped as E1.6.1 Blanket bog
Phytosociological synonymy: Erico-Sphagnetum papillosi Moore (1962) 1968
Equivalent N.V.C. community: *Erica tetralix-Sphagnum papillosum* raised and blanket mire (M18)

An area of peatland transitional in terms of structure and vegetation, between raised and blanket bog occurs along the proposed pipeline route approximately 800m north-west of Ross West, Co. Mayo. The peatland area can be viewed as a small area of raised bog which is surrounded by a much larger expanse of intact blanket bog dominated by *Molinia caerulea.* The vegetation of the smaller raised bog area is characterised by a high cover of the dwarf shrubs *Calluna vulgaris* and *Erica tetralix,* accompanied by conspicuous low tussocks of *Trichophorum cespitosum.* Cover of *Sphagnum* is also high and includes the relatively unusual hummock-forming species *Sphagnum imbricatum.* A large number of small, shallow pools are also present. These are typically dominated by *Sphagnum cuspidatum* and also support sparse *Rhynchospora alba, Eriophorum angustifolium* and *Menyanthes trifoliata.* Although there has been some recent fire damage within the area the vegetation appears to be recovering well. The area is of high ecological value because of the unusual structure and floristic composition of the peatland area. In addition, the peatland is one of the most westerly examples of a raised bog 'nucleus' in Co. Mayo.

(8) Raised Bogs

Equivalent Phase I survey habitat classification: Raised Bog E1.6.2.
Phytosociological synonymy: Erico-Sphagnetum magellanici *Moore 1968.*
Fossitt: Raised Bog (PB1)

Characterised by the dominance of *Sphagnum,* with *Calluna vulgaris* (ling) and fewer grasses - in particular *Molinia caerulea* (purple moor grass) - than

blanket bogs, raised bogs are noted for their (usually) hummock and hollow structure. The presence of certain differential species ( ) distinguish raised bogs from Atlantic Blanket Bog (*Andromeda polyfolia* and *Vaccinium oxycoccus*) and Mountain blanket bog (*Sphagnum imbricatum, S. Magellanicum, S.fuscum*).

This plant association has been recorded throughout the Irish midlands (White and Doyle, 1982)

*(9) Turloughs**

Equivalent Phase I survey habitat classification: Turloughs do not readily correspond to any of the categories outlined in this classification scheme. A new habitat category has been assigned to distinguish turloughs from other wet and dry grassland communities.
Phytosociological synonymy: The vegetation of turloughs is generally assigned to the Lolio-Potentillion anserinae *Tüxen 1947*, but also the Caricion davalliniae *Klika 1934*.
Equivalent N.V.C. community: ?
Fossitt: Turloughs (FL6).

Turloughs are ephemeral water bodies that are unique to limestone areas in the west of Ireland, particularly in counties Mayo, Roscommon, Galway and Clare. They appear on the landscape as isolated areas of standing water that do not appear to have any water inlets or outlets. In summer, turloughs exist as dry, rich, calcareous grassy hollows. Typically, the floor of a turlough is comprised of an impermeable layer of lake clay or marl, with one or more 'swallow holes' forming connections to the groundwater system. After periods of heavy rainfall, water wells up from the water-table below, emerging through swallow holes in the floor of the turlough. These swallow holes can vary from 0.5 – 3m in diameter. Periods of immersion can last anything from a few days to a few hours and can take place in any season. In general, these areas remain submerged during the winter months. Where sites contain some permanent standing water, conditions can vary from oligotrophic to eutrophic.

The ecology of these wide, grassy hollows is influenced by fluctuations in the local groundwater-table. As a result, the vegetation of turlough basins is a mixture of aquatic, terrestrial and especially amphibious plants, usually forming a distinct and characteristic concentric zonation pattern. The position of a particular plant species is determined by its tolerance to immersion. Species that are indicative of regular inundation include creeping bent (*Agrostis stolonifera*), marsh foxtail (*Alopecurus geniculatus*), floating sweet-grass (*Glyceria fluitans*), amphibious bistort (*Polygonum amphibium*), common spike-rush (*Eleocharis palustris*), heath bedstraw (*Galium palustre*), shoreweed (*Littorella uniflora*), bogbean (*Menyanthes trifoliata*), along with swamp species such as common reed (*Phragmites australis*), *Typha latifolia* and *Equisetum fluviatile*. Where the vegetation is subject to occasional inundation, species such as common sedge (*Carex nigra*), soft rush (*Juncus effusus*), marsh marigold (*Caltha palustris*), silverweed (*Potentilla anserina*), creeping buttercup (*Ranunculus repens*) and meadowsweet (*Filipendula ulmaria*) are characteristic. These species are found growing in conjunction with a number of swamp species and other

species more typical of dry grassland, such as rough meadow-grass (*Poa trivialis*), perennial rye-grass (*Lolium perenne*), daisy (*Bellis perennis*) and ribwort plantain (*Plantago lanceolata*). The outer limit of water inundation is often marked by a ring of small bushes of hazel, blackthorn, gorse and hawthorn, along with the occurrence of two characteristic bryophyte species. The dark green species found on the sides of boulders is *Fontinalis antipyretica*, while the conspicuous black moss that extends to approximately 1-2m above the high water mark, is *Cinclidotus fontinaloides*. Rare plant species found in turloughs include fen violet (*Viola persicifolia*) and Iceland yellowcress (Rorippa islandica).

The vegetative growth that takes place after the water has receded is extremely lush and considered high quality pasture. As a result, grazing is an important feature of these habitats. These rich wet pastures also play host to a variety of wintering wilfowl, further increasing their ecological value. These include teal (*Anas crecca*), wigeon (*Anas penelope*), whooper swan (*Cygnus cygnus*) and occasionally Greenland white-fronted geese (*Anser albifrons flavirostris*).

Turloughs are of high conservation value for botanical, zoological and ornithological reasons. They are listed as a priority habitat type under Annex I of the EU Habitats Directive (1992).

(10) Hedgerows

Equivalent Phase I survey habitat classification: Hedges (J2)
Phytosociological synonymy: includes elements of the Primulo-Crataegetum *Braun-Blanquet et Tüxen 1952*, Corylo-Fraxinetum *Braun-Blanquet et Tüxen 1952*, Blechno-Quercetum *Braun-Blanquet et Tüxen 1952* and Osmundo-Salicetum atrocinerea *Braun-Blanquet et Tüxen 1952*.
Equivalent N.V.C. community: some affinity with *Crataegus monogyna-Hedera helix* scrub (W21), *Prunus spinosa-Rubus fruticosus* scrub (W22) and *Ulex europaeus-Rubus fruticosus* scrub (W23).
Fossitt: Hedgerows (WL1).

Hedgerows encountered on this survey ranged from a few scattered bushes or trees along the edges of field boundaries, to dense linear strips of shrubs and bushes. These may be associated with other landscape features such as earth walls, ditches, banks, stone walls or a combination of these. In general, the hedges along the pipeline route are dominated by the following species: hawthorn (*Cratageus monogyna*), blackthorn (*Prunus spinosa*), whitebeam (*Sorbus aria*), gorse (*Ulex europaeus*) and elder (*Sambucus nigra*), often found in older, unmanaged hedgerows, in association with ash (*Fraxinus excelsior*), oak (*Quercus robur*), rowan (*Sorbus aucuparia*), willows (*Salix* spp.), horse chestnut (*Aesculus hippocastanum*) and sycamore (*Acer pseudoplatanus*). These hedgerows can be quite species-rich and closely resemble woodland edge communities, although they are less than 5m in width.

The field boundaries encountered along the southern end of the pipeline route, in County Galway, are generally comprised of stone walls, with little

or no hedge communities. The occurrence and diversity of the hedges increases as you progress northwards, through County Mayo.

Although hedgerows may not be of particularly high conservation value in terms of their species richness they act as important wildlife corridors. In view of the rapid rate of destruction of our native broadleaf woodlands, those older hedgerows containing trees of a mature age are of increased ecological value.

(11) Hazel scrub over limestone pavement

Equivalent Phase I survey habitat classification: Scrub (A2)
Phytosociological synonymy: Corylo-Fraxinetum *Braun-Blanquet et Tüxen 1952*
Equivalent N.V.C. community: ?

The proposed pipeline route passes through a number of areas of scrub vegetation, with greater than 50% cover of shrubs and/or small trees. These areas of scrub are generally dominated by hazel (*Corylus avellana*) and overlie areas of limestone pavement, which can often be seen outcropping on the ground. Other species that form the canopy cover include blackthorn (*Prunus spinosa*), whitebeam (*Sorbus aria*), hawthorn (*Crataegus monogyna*) and gorse (*Ulex europaeus*). A number of species of willow (*Salix* spp.) and birch (*Betula* spp.) are occasionally found. The scrub is often dense and impenetrable, with some open patches dominated by nettle (*Urtica dioica*), bracken (*Pteridium aquilinum*), grasses and small herbs such as ground ivy (*Glechoma hederacea*) and wood sage (*Teucrium scordonia*). Typical hazel scrub ground flora includes primrose (*Primula* vulgaris), wood sanicle (*Sanicula* europaea), wood avens (*Geum* urbanum), enchanter's nightshade (*Circaea* luetiana), wood sorrel (*Oxalis* acetosella) and slender St. John's wort (*Hypericum* pulchrum), although the density of the canopy and the presence of large rock outcrops may restrict the occurrence of these species. The greatest diversity of species occurs within the bryophytes and lichens present, many of these being epiphytic on the branches of the trees. Areas of hazel scrub are more prevalent along the southern end of the pipeline route, in County Galway.

Apart from their intrinsic botanical value, particularly owing to the rich variety of bryophytes and lichens present, areas of hazel scrub serve as important wildlife refuges, providing shelter for populations of birds and mammals.

(12) Bare limestone pavement

Equivalent Phase I survey habitat classification: Limestone pavement (I1.3)
Phytosociological synonymy: Corylo-Fraxinetum *Braun-Blanquet et Tüxen 1952*
Equivalent N.V.C. community: ?
Fossitt: Exposed calcareous rock (ER2).

Towards the southern of the pipeline route the pipeline crosses close to a number of patches of level or gently sloping limestone pavement. Pavement may consist of smooth and flat, pale grey rock, although the soft nature of

this rock makes it highly susceptible to water erosion. As a result, it is often fissured and shattered, with lots of loose rock present. The plant species grow precariously in pockets of soil that develop in the rock crevices or 'grykes'. Many of the species typically found in this lime-rich soil are calcicoles, or 'lime-loving' plants. Other species that are typically found in areas of hazel scrub inhabit the deeper crevices of the limestone. The most commonly encountered species include herb Robert (*Geranium robertianum*), wood sage (*Teucrium scordonia*), wild thyme (*Thymus praecox*), purple moor-grass (*Molinia caerulea*), sheep's fescue (*Festuca ovina*), ivy (*Hedera helix*), bloody crane's-bill (*Geranium sanguineum*), maidenhair fern (*Adianthum capillus-veneris*), bramble (*Rubus fruticosus*), false brome grass (*Brachypodium sylvaticum*) and hazel (*Corylus avellana*), as well as a host of orchidaceous species.

Notes on known rare plant species occurring along the proposed pipeline route.

Eriophorum latifolium

Eriophorum latifolium (Broad-leaved Cotton Grass) is a rare species of wet, base-rich fens and flushes. Typically the species grows in peaty soils irrigated by water with a high pH (6-8) and high calcium content (15 to 60 mg/l) (Conaghan, 1995). Although the species is widely distributed throughout Ireland, it is nowhere common and is either absent or very rare in a number of counties, especially in the south of the country (Scannell and Synnott, 1987). The species is occasional in the base-rich bog flush to the east of Eskeragh (G 053 185) and a re-routing of the pipeline away from this area of flush and surrounding blanket bog has been advised.

Vaccinium oxycoccus

Although *Vaccinium oxycoccus* is relatively common in Midland raised bogs, the species is rare in the counties along the western seaboard of Ireland. In the blanket bog systems of Co. Mayo the species has been recorded from approximately 15 sites, which are either base-rich flushes or Sphagnum lawns along the margins of blanket bog pools. The species has previously been recorded from the base-rich bog flush to the east of Eskeragh (G 053 185) (Douglas *et al.*, 1989).

Homalothecium nitens

Homalothecium nitens is a moss of base-rich bog flushes and fens. It is rare in Ireland, being previously recorded from only 5, 10 kilometre squares (Hill *et al.*, 1994). The blanket bog flushes of Co. Mayo are the headquarters of the species in Ireland, where it has been recently recorded from 8 sites (Lockhart, 1987) including the base-rich bog flush to the east of Eskeragh (G 053 185).

Najas flexilis

Najas flexilis is a rare aquatic plant species which is protected by the 1999 Flora Protection Order. In addition, due to the rarity of the species in Western Europe, it is listed under Annex 2 of the Habitats Directive, which confers upon it protection under European law. In Ireland the species is largely confined to oligotrophic lakes along the Atlantic seaboard where it has previously been recorded from at least 30 sites (Curtis and McGough, 1988). In Co. Mayo the only known site for the species is Lough Dahybaun

(G 00 20), located approximately 3 km to the west of Bellacorrick and 200 to 400m north of the proposed route of the gas pipeline. Damage to the oligotrophic water habitat of *Najas flexilis* in this lake, due to future construction of a gas pipeline, is not anticipated.

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DESIGNATED CONSERVATION AREAS

Most of the following sites are: traversed by, adjacent to or are located 1 km. or less from the proposed pipeline route. A few sites are located further than 1km. from the proposed route, but due to their ecological significance are included here in order that they be taken into consideration should the route be altered at a later stage prior to construction.

Carrowmore Lake Complex (SAC no. 476)

This large site, located to the north of Bangor village in Co. Mayo, comprises Carrowmore lake and adjoining areas of blanket bog. The lake itself is a large, shallow, oligotrophic lowland lake which occupies an area of approximately 960 hectares, has a maximum depth of between 2.5 and 3 metres and a circumneutral pH. The vegetation of the lake is typically sparse, reflecting its relatively low productivity. In shallow water along the lake edge plant species such as *Eleocharis palustris, Littorella uniflora, Juncus bulbosus, Hydrocotyle vulgaris, Iris pseudacorus* and *Juncus effusus* are typical. In deeper water there are occasional stands of sparse *Phragmites australis* and *Schoenoplectus lacustris*. The pondweed *Potamogeton perfoliatus* has been recorded from the deeper lake waters. In the heathy transition between lakeshore and surrounding blanket bog, the relatively rare heather *Erica erigena* grows. This species, though locally common in parts of west Mayo, is in Ireland, otherwise only known from a couple of locations in Connemara. The lake and adjoining areas of blanket provides habitat for a number of important bird species including Greenland-White-fronted Goose, Golden Plover and Merlin, all of which are listed on Annex I of the European Birds Directive.

Blanket bog dominates the remainder of the site and the best-developed and most extensive area of the habitat occurs at Largan More, c. 6 km south-east of Carrowmore Lake. Here a wide variety of blanket bog micro-habitats are evident including hummocks, lawns, pools, pool islands and flushes. Typical species of the pools include *Eriocaulon aquaticum, Menyanthes trifoliata, Nymphaea alba* and *Lobelia dortmanna*. The flushed areas contain a wide variety of sedge species such as *Carex limosa, Carex lasiocarpa, Carex rostrata* and *Carex lepidocarpa* and a number also contain *Vaccinium oxycoccus*, a very species in blanket bog regions in the west of Ireland. The very rare and protected plant species *Saxifraga hirculus*, has been recently recorded from blanket bog flushes within the site. The species is listed under Annex II of the European Habitats Directive and within the Republic of Ireland, it is confined to a handful of sites in the blanket bogs of Co. Mayo. The condition of the site is generally good however overgrazing by sheep and turf cutting have locally damaged areas of blanket bog. This damage is particularly evident close to roads and tracks.

The proposed gas pipeline route traverses this site at one point namely Glencullin Upper where the blanket bog is largely intact and is of high quality. Approximately 400 metres of blanket bog in this area will be affected.

Slieve Fyagh Bog (SAC no. 542)

Slieve Fyagh bog is a large area of blanket bog and upland covering an area of approximately 2,300 hectares, located in north-west Co. Mayo. The site is dominated by the mountain of Slieve Fyagh, which reaches a height of just over 300 metres. One of the most noteworthy features of the site is the variation in bog type within the site with examples of mountain, highland and lowland blanket bog present. Mountain blanket bog vegetation on the summit plateau of the mountain is largely intact and is dominated by *Calluna vulgaris, Empetrum nigrum, Vaccinium myrtillus, Eriophorum vaginatum, Rhytidiadelphus loreus* and *Hypnum jutlandicum.* A noteworthy component of the vegetation is the diminutive orchid *Listera cordata,* which is otherwise rare in the county. Along the edges of the summit plateau there is erosion of blanket bog taking place. In addition to the intact mountain blanket bog, the summit contains a number of small oligotrophic lakes and pool systems. Plant colonists of the shallow lake margins include *Carex rostrata* and *Lobelia dortmanna.* The presence of relatively intact mountain blanket bog, along with associated lakes and pools, is a very rare occurrence in County Mayo and thus the site constitutes one of the best- developed areas of this blanket bog type in the county.

The rather steep slopes of Slieve Fyagh are dominated by a mosaic of habitats including acid grassland, wet heath, blanket bog and mountain streams. Due to the combination of steepness of slope and heavy grazing by sheep, this area is somewhat degraded. Below and altitude of 150 metres the terrain is dominated by lowland blanket bog in which *Molinia caerulea, Schoenus nigricans, Erica tetralix, Eriophorum angustifolium, Potentilla erecta, Rhynchospora alba* and *Trichophorum cespitosus* are the characteristic species. These areas of lowland blanket bog also contain numerous pool systems colonised by *Eriocaulon aquaticum, Menyanthes trifoliata* and *Utricularia minor.* The condition of the site at present is variable. Much of the site is has been seriously affected by overgrazing and, in addition, turf-cutting is a problem in some of the low-lying areas of blanket bog. Substantial areas of surrounding peatland have been afforested within the past 30 years.

Although no area of this site will be traversed by the proposed gas pipeline, the pipeline route does come within 150 metres of the margins of the site in the Glencullin valley.

Bellacorrick Bog Complex (SAC no. 1922)

Bellacorrick bog complex is located in the north-west of Co. Mayo and is considered to be the most extensive and best-developed area of blanket bog in the county. Most of the bog is of the lowland type, however some areas have morphological characteristics intermediate between lowland and raised bogs. Most of the landscape features of lowland blanket bog can be seen within the site and within this site they are usually very well-developed. Examples of these features include undifferentiated bog, swallow holes, interconnecting pool systems, pool islands, bog streams and base-rich flushes.

The ombrotrophic blanket bog vegetation is dominated by *Molinia*

caerulea and *Schoenus nigricans*, accompanied by *Erica tetralix, Eriophorum vaginatum, Eriophorum angustifolium, Potentilla erecta, Rhynchospora alba, Trichophorum cespitosus* and *Sphagnum* species such as *S. capillifolium* and *S. papillosum*. Pool areas are particularly well-developed and the site contains many areas of deep quaking peat characterised by large oblong pools. Many of these large pools are almost devoid of vegetation, however some are colonised by *Sphagnum cuspidatum, Eriophorum angustifolium, Eriocaulon aquaticum* and *Menyanthes trifoliata*. Well-developed collapsed swallow-hole systems, fringed by dry heath vegetation, occur frequently, with particularly good examples evident at Srahlahy. One of the most important aspects of blanket bog habitat within the site is the presence of extensive base-rich flushed areas. The vegetation of such areas is typically characterised by a high cover of *Schoenus nigricans* and *Phragmites australis*, with prominent patches of *Cladium mariscus*. Sedges (*Carex* spp.) such as *Carex limosa, Carex hostiana, Carex rostrata* and *Carex lepidocarpa* are a common feature of the vegetation. Flush areas provide the habitat for a large number of rare plant species including *Vaccinium oxycoccus, Eriophorum latifolium, Saxifraga hirculus, Leiocolea rutheana, Paludella squarrosa, Homalothecium nitens, Sphagnum warnstorfii* and *Drepanocladus vernicosus*. Of these species, *S. hirculus, L. rutheana, P. squarrosa* and *D. vernicosus* are protected under the 1999 Wildlife Protection Order, while *S. hirculus* and *D. vernicosus* are, in addition, both listed in Annex 2 of the European Habitats Directive. Although overgrazing is occurring in parts of this site, the blanket bog habitat is generally intact. Turf cutting is also a continuing problem, however this is largely confined to along the sides of roads.

The proposed gas pipeline route traverses this site at a number of points between Eskeragh and the Shanvolahan River. The ecological quality of the site within these areas is variable, ranging from afforested blanket bog to species-rich, blanket bog flush.

Lough Conn and Lough Cullin (Site Code: 519)

Lough Conn (G 18 13) is a large (50km²) calcareous freshwater lake with several reefs and inshore islands and a shallow shoreline. It is part of the Lough Conn and Lough Cullin Natural Heritage Area (NHA) owing to the fish species utilizing the lakes and the vegetation along the shoreline. The site supports an excellent diversity of flora and fauna and is notably the only Irish site for the protected plant, great burnet (*Sanguisorba oficinalis*). Marginal habitats include fen, freshwater marsh, wet grassland, rocky shoreline, cutover bog and deciduous woodland. It also supports nationally important populations of a number of species of waterfowl

Lough Conn is situated where the Carboniferous limestone of the Central Plain meets the harder, more resistant siliceous rocks (granite, gneiss and schist) of the Connaught Uplands. It discharges southwards to the River Moy, passing through the smaller Lough Cullin. While limestone and granite underlie Lough Conn, Lough Cullin is underlain by the Pre-Cambrian metamorphic rocks of the Ox Mountain Complex. Apart from their different underlying geology and size, these two lakes differ in their water chemistry.

Lough Conn is rated as one of the finest, natural, wild brown (*Salmo trutta*) trout fisheries in Europe. Other fish species known to occur include salmon (*Salmo salar*), pike (*Esox lucius*), perch (*Perca fluviatilis*) and rudd (*Scardinius erythrophthalmus*). Recent agricultural intensification in the surrounding countryside has led to some eutrophication, theatening the water quality of the lake. It is now considered to be mesotrophic in character. Arctic charr (*Salvelinus alpinus*) are thought to be virtually extinct, following a dramatic decline in the late 1980's, as a result of increased eutrophication (McGarrigle et al., 1993).

The limited aquatic flora contains several pondweed species (*Potamogeton spp.),* with occasional bladderwort (*Utricularia intermedia*), water lobelia (*Lobelia dortmanna*), common reed (*Phragmites australis*), water lily (*Nuphar lutea*) and least bur-reed (*Sparganium minimum*). The marginal wetlands support the rare and protected heath cudweed (*Omalotheca sylvatica*). Another protected species, Killarney fern (*Trichomanes speciosum*) has also been recorded (RECENT RECORD?).

The two lakes are divided by a peninsula containing a steep-sided granite-based hillside, covered by one of the best examples of Atlantic oak woodland in the region. This semi-natural woodland is known as Pontoon wood. The canopy of oak (*Quecus petraea*) contains some aspen (*Populus tremula*) and birch (*Betula spp.*) with a well-developed understorey, dominated by holly (*Ilex aquifolium*). Species of note include narrow-leaved helleborine (*Cephalanthera longifolia*) and intermediate wintergreen (*Pyrola media*).

Carrowmore Lough Shore (Site Code: 1492)

Carrowmore Lough (M230885) is a proposed Natural Heritage Area (NHA) owing to the diversity of habitat types and substrate present. It is a relatively deep large lake, lying in a depression in calcareous rocks. The diverse shoreline supports a range of habitats including cutover raised bog, limestone outcrop, fen and mineral marsh. Reed beds do occur, although the marly conditions are thought to limit their development and spread. The ridges of limestone are dominated by hazel (*Corylus avellana*) and willow (*Salix* spp.) scrub. Seasonally flooded parts of the shoreline contain yellow wort (*Blackstonia perfoliata*), mountain everlasting (*Antennaria dioica*) and purging flax (*Linum catharticum*), while the fen contains the clubmoss *Selaginella selaginoides*, creeping willow (*Salix repens*) and meadow thistle (*Cirsium arvense*). The drier areas of grassland are characterised by the presence of carline thistle (*Carlina vulgaris*), bird's foot trefoil (*Lotus corniculatus*), mouse-eared hawkweed (*Hieracium pilosella*), autumn gentian (*Gentianella amarella*) and wild carrot (*Daucus carota*). Royal fern (*Osmunda regalis*) and field gentian (*Gentianella campestris*) are found on the areas of cutover peat, while grass of Parnassus (*Parnassia palustris*) and long-stalked yellow-sedge (*Carex lepidocarpa*) grow closer to the lake. The presence of a variety of waterfowl in significant numbers, including common gull (*Larus canus*), black-headed gull (*L. ridibundus*) and great crested grebe (*Podiceps cristatus*) increases the conservation value of the site.

Carrowkeel Turlough (Site Code: 475)

Carrowkeel Turlough (M302693) is designated as a Special Area of Conservation (SAC) owing primarily to its high botanical diversity and natural state. Despite its relatively small size, the turlough contains a high diversity of habitats and displays a clear zonation in its vegetation, reflecting frequency of immersion, as well as depth and quality of the water. The northern section also contains a small spring, which has led to the development of a scraw community. This vegetation is unique to this turlough and contains the rare narrow-leaved water-plantain (*Alisma lanceolata*). The presence of a variety of nesting birds including coot (*Fulica atra*), little grebe (*Tachybaptus ruficollis*) and mallard (*Anas platyrhynchos*), along with other wildfowl such as snipe (*Gallinago gallinago*) and lapwing (*Vanellus vanellus*) further increases the conservation value of the site.

Carrowkeel Turlough is located approximately 2km from the River Robe, between the towns of Ballinrobe and Claremorris, County Mayo. It differs from other turloughs in the immediate area, which are contained in shallow basins with predominantly grass-covered floors. Carrowkeel Turlough, on the other hand, is contained in a northeast-southwest orientated linear basin that is dominated by a shallow lake, known as Poll Oilean-na-gCorr. This lake is spring fed and spreads to cover a much larger area in winter. Flooding still appears to occur naturally. The turlough is relatively oligotrophic (nutrient-poor) in nature, although slight eutrophication may be linked to the adjacent farms. The catchment area for Carrowkeel turlough is estimated to cover 560 ha (Goodwillie, 1992).

The high habitat diversity is linked to the permanent presence of standing water in parts of the turlough. The scraw at the northern end of the basin consists of floating sweet grass (*Glyceria fluitans*), water horsetail (*Equisetum fluviatile*), bladder sedge (*Carex vesicaria*), fine-leaved water-dropwort (*Oenanthe aquatica*), bogbean (*Menyanthes trifoliata*). A distinct zone of vegetation with common spike-rush (*Eleocharis palustris*), unbranched bur-reed (*Sparganium emersum*), creeping bent (*Agrostis stolonifera*) occurs within this scraw, growing with water-plantain (*Alisma plantago-aquatica*) and the rare narrow-leaved water-plantain (*A. lanceolata*). Areas of open water within the lake contain thread-leaved water-crowfoot (*Ranunculus trichophyllus*), lesser marshwort (*Apium inundatum*) and broad-leaved pondweed (*Potamogeton natans*), while common club-rush (*Scirpus lacustris*), fine-leaved water-dropwort (*Oenanthe aquatica*), amphibious bistort (*Polygonum amphibium*), water horsetail (*Equisetum fluviatile*) and the mosses *Drepanocladus revolvens* and *Calliergon giganteum* are found around the lake edge. The scarce marsh stitchwort (*Stellaria palustris*) is also found scattered throughout the turlough. Cattle and sheep graze the entire area.

Turloughs are of high conservation value for botanical, zoological and ornithological reasons. They are listed as a priority habitat type under Annex I of the EU Habitats Directive (1992).

Greaghan's Turlough (Site Code: 503)

Greaghan's Turlough (M290625) is a proposed Special Area of Conservation (SAC) owing to its variety of well-developed vegetation communities, the occurrence of a rare plant species and a large population of wintering Whooper swan (Cygnus cygnus). Turloughs are rare and threatened habitats that are of high conservation value for botanical, zoological and ornithological reasons. They are listed as a priority habitat type under Annex I of the EU Habitats Directive (1992). Despite its somewhat uniform topography Greaghan's is valuable as an undrained turlough with a variety of well-developed vegetation communities. Goodwillie (1992) rates this turlough of Regional Importance.

Greaghan's Turlough is situated approximately 10km from the town of Ballinrobe. It is the most easterly of a group of five turloughs. Its flattish, oval basin is deepest along the northern edge. Two streams feed the area, one from the northeast and another from the south, the latter being ephemeral. The main swallow hole occurs close to Greaghan's farm.

The wettest areas in the turlough are dominated by amphibious bistort (*Polygonum amphibium*), grading through common sedge (*Carex nigra*), jointed rush (*Juncus articulatus*) and lesser spearwort (*Ranunculus flammula*) into dry grassland. This grassland community is species-rich in the eastern end, but species-poor in the western end, owing to slight nutrient enrichment. Cattle graze the entire area. Where cattle grazing and trampling is intensive an unusual area of vegetation dominated by annual plant species such as water-pepper (*Polygonum hydropiper*), redshank (*P. persicaria*), common chickweed (*Stellaria media*), thread-leaved water-crowfoot (*Ranunculus trichophyllus*), marsh foxtail (*Alopecurus geniculatus*) and the rare northern yellow-cress (*Rorippa islandica*). The northern side of the turlough contains a fringe of reed canary grass (*Phalaris arundinacea*), meadowsweet (*Filipendula ulmaria*), creeping cinquefoil (*Potentilla reptans*) and creeping-jenny (*Lysimachia nummularia*). Behind this fringe of vegetation are low spurs covered in ash (*Fraxinus excelsior*), hawthorn (*Crataegus monogyna*) and spindle (*Euonymous europaeus*). The presence of Whooper swan (*Cygnus cygnus*) adds significantly to the value of the site.

Turlough O'Gall (Site Code: 331)

Turlough O'Gall (M346509) is designated as a Special Area of Conservation (SAC) owing to its high habitat diversity and species richness. The presence of the largest stand of sedge heath and second largest stand of limestone grassland in any turlough, are particularly noteworthy. Overall, this site is relatively dry, although the presence of some ponds and rocky outcrops increases the habitat diversity.

The turlough covers an area of 50.9ha and is located approximately 3km west of the town of Belclare, between the towns of Shrule and Tuam. The complex local hydrology is the topic of some debate. There are a number of other important turloughs in the surrounding area, including Turlough Monaghan, Belclare Turlough and Kllower Turlough. While Turlough O'Gall has not been subject to any obvious

on-site drainage modifications, Coxon (1986) considers that arterial drainage of the Clare River has curtailed flooding. Goodwillie (1992), however, suggests that the turlough lies in the Black River catchment, rather than the Clare River, receiving some of its water from the hills to the south. He considers the catchment area to cover approximately 240ha.

The vegetation is dryish in character, reducing the potential of the site for breeding waders and waterfowl. The dominant species in the limestone grassland found in the southern half of the site, include creeping fescue (Festuca rubra), purple moor-grass (Molinia caerulea), lady's bedstraw (Galium verum), daisy (Bellis perennis), yarrow (Achillea millefolium) and glaucous sedge (Carex flacca). Where the soil is slightly leached mat grass (Nardus stricta) invades. The wet areas are dominated by broad-leaved pondweed (Potamogeton natans), curled pondweed (P. crispus), bogbean (Menyanthes trifolitata), common water-plantain (Alisma plantago-aquatica) and horned pondweed (Zannichellia palustris), fringed by vegetation dominated by amphibious bistort (Polygonum amphibium). Areas of hawthorn-dominated scrub, with scattered creeping willow (Salix repens) and buckthorn (Rhamnus catharticus are limited.

The surrounding countryside is very flat but the turlough can be viewed from the Knockmaa ridge to the south. The floor of the basin is uneven because of the bedrock, especially in the eastern half. To the west, there is a large expanse of level ground based on flat limestone which occasionally outcrops. The flat areas around the central lakes seem to have been partly dug out, perhaps as marl pits. Quite deep marl deposits occur in the basin (90-150cm) and they are normally covered by 10cm of peaty soil.

Turloughs are of high conservation value for botanical, zoological and ornithological reasons. They are listed as a priority habitat type under Annex I of the EU Habitats Directive (1992).

Knockmaa Hill (Site Code: 1288)

Knockmaa Hill is a proposed Natural Heritage Area (NHA), owing to its botanical value as a good example of native broadleaf woodland on thin limestone soil. This type of habitat is considerably rare in this part of the country. The area is of archaeological importance. Knockmaa (552ft), which dominates the local countryside, is named after Queen Meadhbh. Close to the summit is a cairn, while the ruins of a Knight's tower and Finbarra's Castle, an 18th/19th century folly, are located nearby. The area of scientific interest lies in the afforested northern and northwestern slopes of Knockmaa Hill, a limestone knoll, located approximately 10km west of the town of Tuam. This woodland is locally known as Horse Shoe Wood. The dominant native species are ash (*Fraxinus excelsior*) and oak (*Quercus* spp.), with alder (*Alnus glutinosa*) occurring in the wetter seepage areas. The ground flora is species-rich and is highly representative of ash/oak woodland. A variety of exotic trees such as beech (*Fagus sylvatica*), sycamore (*Acer pseudoplatanus*), cherry laurel (*Prunus laurocerasus*), larch (*Larix* spp.) and pine (*Pinus* spp.) also occur within the woodland. There is evidence that there is

some natural regeneration of beech and sycamore. The ecological value of the site is further enhanced by the occurrence of species-rich limestone pavement vegetation at the summit. This vegetation is typical of lime-rich soils. Locally, small areas of acidic heath vegetation have established where the weathering of impurities (chert) in the limestone can produce a clay-like soil, on which peaty conditions may develop.

Rahasane Turlough (Site Code: 322)

Rahasane Turlough (W847531) is designated as a Special Area of Conservation (SAC) owing to its botanical and ornithological importance. It is considered to be the most important turlough for birdlife in the country. It contains high habitat diversity and supports two rare plant species listed in the Irish Red Data Book. Atlantic salmon (*Salma salar*), a priority species on Annex II of the EU Habitats Directive (1992), travel through the river when it is flowing overground. The rare fairy shrimp, *Tanymastix stagnalis*, thrives in the isolated southern basin. Overall, it is one of the country's finest examples of a naturally functioning turlough.

Rahasane Turlough is located approximately 2km west of the town of Craughwell, County Galway. It was formerly the natural sink of the River Dunkellin, but an artificially created channel now takes some of the water further downstream. The turlough consists of two basins, the larger northern one taking the Dunkellin River westwards. Active swallow holes are present throughout the area. The substrate is predominantly silty clay with shell fragments, with some evidence of marl in the main basin. There is a complete absence of peat. The large catchment area results in a naturally eutrophic and productive system. For the most-part, the turlough is open, flat and grassy, with occasional depressions and dry channels. The edges of the turlough rise gradually into the gently undulating surrounding land, except in the southern basin, where high rocks mark a more sudden transition.

Distinct wet and dry communities are displayed within the turlough basin, the wet communities being closely associated with the river channel and pools. The wettest areas contain fan-leaved water crowfoot (*Ranunculus circinatus*), fennel pondweed (*Potamogeton pectinatus*), lesser pondweed (*P. pusillus*), fat duckweed (*Lemna gibba*), whorled water-milfoil (*Myriophyllum verticillatum*) and needle spike-rush (*Eleocharis acicularis*). The fringes of these wet areas are colonized by lesser water-parsnip (*Berula erecta*), fool's water-cress (*Apium nodiflorum*), river water-dropwort (*Oenanthe fluviatilis*) and amphibious bistort (*Polygonum amphibium*), along with the rare northern yellow-cress (*Rorippa islandica*). Where there is regular flooding another rare species, the fen violet (*Viola persicifolia*), is found growing with common spike-rush (*Eleocharis palustris*). The areas less frequently immersed supports species such as creeping cinquefoil (*Potentilla reptans*), common sedge (*Carex nigra*), silverweed (*Potentilla anserina*) and creeping bent (*Agrostis stolonifera*). Where the underlying limestone outcrops, particularly in the southern basin, the vegetation is dominated by red fescue (*Festuca rubra*) and crested dog's tail (*Cynosurus cristatus*) among a calcicolous grassland community. The turlough is fringed along the southern and northwestern by scrub

vegetation dominated by buckthorn (*Rhamnus cathartica*), hazel (*Corylus avellana*) and ash (*Fraxinus excelsior*). The branches of these trees support a rich epiphytic community with *Leskea polycarpa, Amblystegium riparium, Isopterygium elegans, Isothecim myosuroides* and *Thuidium tamariscinum*. Cattle, sheep and horse grazing helps to maintain the habitat diversity and species richness.

The ornithological value of the site is based on the presence of internationally important populations of wigeon (*Anas Penelope*) and shoveler (*A. clypeata*). Other regularly occurring birds including golden plover (*Pluvialis apricaria*), Greenland white-fronted goose (*Anser albifrons flavirostris*), Bewick's swan (*Cygnus columbianus bewickii*) and whooper swan (*Cygnus cygnus*), are listed on Annex I of the Birds Directive. It is also the largest inland site for dunlin (*Calidris alpina*) in the British Isles.

Turloughs are of high conservation value for botanical, zoological and ornithological reasons. They are listed as a priority habitat type under Annex I of the EU Habitats Directive (1992). Rahasane Turlough's importance lies in the fact that it is one of only two large naturally functioning turloughs. Goodwillie's assessment of Irish turloughs in 1992 rated Rahasane turlough as the one of international importance, second only to Coole/Newtown turlough.

Route –

County -

Section code –

1:10,000 Map number –

Grid reference (beginning and end of section) –

Length of section –

Elevation of section (range) –

SAC/NHA along/within 1 km of, proposed route –

Dominant habitat –

Characteristic plant species -

Secondary habitat –

Characteristic plant species -

Composition of field boundaries –

Rare plant species present –

Condition of vegetation –

Conservation value of vegetation –

Other comments:

APPENDIX 10.1

DETAILED SITE DESCRIPTIONS OF WATERCOURSE CROSSINGS

Crossing 1 Unnamed Tributary of Carrowmore Lake

Townland: Muingingaun

Ir. Grid Ref: F 8703 3132

Channel dimensions: width: 3.5m; depth 13cm

Banks: RHS 1.0m, ~ vertical; LHS 1.2m ~ vertical

Bankside Composition: Peat soil over till and patches of bedding rock.

Substrate: scattered cobbles, small stones and gravel

Flow: moderate in glide/pools, moderate-swift and turbulent in riffles.

Channel Habitat: typical small-scale pool, pool/glide, riffle sequence.

In-Channel Vegetation: generally plant-free,

Bankside Vegetation:
Soft Rush (*Juncus effusus*), Yellow Flag (*Iris pseudacorus*), *Rhytidiadelphus* occurred on the banks which were backed by a narrow (20m) strip of sheep pasture backed by cutaway bog.

Macroinvertebrates / Water Quality: water appeared clean, clear and silt free.

Macroinvertebrates included *Isoperla, Chloroperla, Rhithrogena, Baetis* and *Elminthidae.* A salmonid fry was also taken in a kicksample. Q5

Fisheries Value: ideal salmonid nursery and spawning habitat. Locals reported salmon spawning along this stretch in December, presumably well strung out as the channel is narrow.

Crossing 2 Unnamed Tributary of Carrowmore Lake

Townland: Glenturk More

Ir. Grid Ref: F 8699 2955

Channel dimensions: width 0.75-1.5 m, depth 5-7cm

Banks: small gorge with LHS bank several metres high, RHS shallow and open by the channel and high set back.

Bankside Composition: dominated by sandy material with some till; eroding.

Substrate: large and small boulders with cobbles and large gravel.

Flow: low at the time, slow to moderate in pools and turbulent over small cascades; probably torrential after heavy rain and in the winter.

Channel Habitat: sinuous channel with mixture of pools and small cascades, steep gradient.

In-Channel Vegetation: trailing filamentous algae and much brown scum on stones.

Bankside Vegetation: both banks with close-cropped sheep grazing with scattered gorse and willow (mainly below the banks) forming small thickets in places. Marginal vegetation with *J. effusus*, *Trifolium repens*, *Holcus lanatus*, *Anthoxanthum odoratum*, *Bellis perennis*, *Lotus corniculatus*, and occasional *Iris pseudacorus* and with scattered *Pedicularis*, *Potentilla erecta*, and *Anagallis tenella* in marginal grazed areas. Dry, hummucky growth of *Sphagnum* mixed in with *Polytrichum* in places at the water's edge.

Macroinvertebrates / Water Quality: water coloured but non-turbid. Much evidence of peat siltation. Presence of trailing algae suggests enrichment. The very coarse nature of the substrate made macroinvertebrate sampling difficult. Dominated by *Baetis*, with a few *Leuctra* and chironomids. Q4 (Q3-4).

Fisheries Value: the low flows and turbulent and narrow channel over very coarse substrate probably limits the value of this habitat for fisheries.

Crossing 3 Unnamed Tributary of Carrowmore Lake

Townland: Glenturk Beg

Ir. Grid Ref: F 8841 2767

Channel dimensions: width 1.0-1.5m, depth 5-12cm.

Banks: LHS 4-5m high in places, otherwise low, RHS 1.2-1.8m.

Bankside Composition: sandy on till (gravel and cobbles).

Substrate: boulders, cobbles and small stones.

Flow: Moderate to slow in glide/pools, moderate and turbulent in small cascades.

Channel Habitat: sinuous channel a mixture small stretches of glide/pool and small cascades. Torrential and spatey in appearance with evidence of undercutting of banks in places.

In-Channel Vegetation: trailing filamentous algae with much peat silt, very scummed-up.

Bankside Vegetation: RHS with *Calluna* dominant backed by conifer plantation. Low section of LHS narrow flood plain dominated by *J. effusus* with *Gallium saxatile* and *Rumex acetosella* frequent. Bracken dominant in places, scattered *Digitalis*.

Macroinvertebrates / Water Quality: evidence of enrichment and peat siltation (macroinvertebrates not sampled).

Fisheries Value: suitable for salmonids. However, siltation and enrichment combined with torrential nature of this stretch may limit its value.

Crossing 4 – Oweniny River (tributary of the Owenmore)

Townland: Upstream of Bellacorick Bridge

Ir. Grid Ref: F 9722 2039

Channel dimensions: width 18-23m, depth 10-30cm

Banks: RHS 1.2 – 1.5m, LHS 1.2-1.7m,

Bankside Composition: peat with sand on top with coarse organic sand below sitting on gravely till

Substrate: upstream glide with cobbles and small boulders, downstream boulder filed with large boulders with cobbles on fine gravel. Hard sandstone or igneous

Flow: moderate to slow in upstream glide moderate or moderate to swift in parts of boulder field.

Channel Habitat: long shallow glide followed by boulder field / riffle alternating with more glide.

In-Channel Vegetation: moss (*Rhynchostegium riparioides* and *Fontinalis antipyretica*) and liverwort common on boulders and large cobbles, *Lemanea* also present. Long trailing filamentous green algae very common in shallow slacker-flow areas of the boulder field.

Bankside Vegetation: RHS at crossing point dominated by improved grassland cut as hay, LHS with marshy grassland both grazed by cattle. RHS just below crossing point with Rush dominated grassland with frequent *Filipendula ulmaria*, *I. pseudacorus*, R. *repens*, and *R. acetosella*.

Macroinvertebrates / Water Quality: water clean and clear but with much evidence of moderate peat siltation in shallows, slack flow areas and glides. Macroinvertebrates present only in very low densities including *Hydropsyche*, *Rhyacophila dorsalis*, *Baetis* (dominant), *Ephemerella*, *Perla* and *Limnius volckmari*. Q 4

Fisheries Value: ideal salmonid nursery habitat, but evidence of enrichment and peat siltation worrying. Glide and boulder area probably unsuitable for spawning,

Site Descriptions Broadhaven - Galway

Crossing 5 River Muing (tributary of the Owenmore)

Townland: 1 km east of Bellacorick

Ir. Grid Ref: F 9805 1995

Channel dimensions: Width 4.5m, depth 30cm

Banks: RHS 0.7m at edge, rising to 2.5-3m behind; LHS 1-1.2m

Bankside Composition: peat sitting on gravel with large stones and cobbles.

Substrate: peat silt over gravel.

Flow: dead slow.

Channel Habitat: straight, canal-like and fairly shallow.

In-Channel Vegetation: scattered marginal clumps of *Sparganium erectum* and *Equisetum fluviatile* marginally, occasional, *Lythrum salicaria* and *Valeriana officinalis*, otherwise plant-free.

Bankside Vegetation: damp grassland dominated by *Potentilla anserina*, *R. repens*, with *J. effusus, Centaurea nigra* and *Plantago lanceolata* backed by coniferous plantation.

Macroinvertebrates / Water Quality: water was cloudy and mud-coloured, no samples taken due to peat silt nature of substratum and lack of structural diversity. System probably low diversity and dystrophic.

Fisheries Value: probably little or none in this stretch.

Crossing 6 Shanvolahan River (tributary of the Deel)

Townland: Just downstream of bridge on N59 (Coolturk)

Ir. Grid Ref: G0617 1801

Channel dimensions: Width 5m, depth <15cm

Banks: 0.5-1.0m (both)

Bankside Composition: obscured by vegetation, probably peat over gravely till.

Substrate: small stones and gravel emerging as banks and islets in places.

Flow: slow in glides and moderate in riffle/glides

Channel Habitat: shallow glides and riffle/glides, localised siltation

In-Channel Vegetation: abundant *Potamogeton* sp. (*P. natans* or *P. polygonifolius*) and *Myriophyllum* cf. *alterniflorum.*

Bankside Vegetation: herbaceous vegetation with *F. ulmaria, P. anserina, L. salicaria, Mentha aquatica, E. fluviatile, H. lanatus, Centaurea nigra, R. acetosella, Caltha palustris* etc.

In-channel gravel islets with *Carex rostrata, Scrophularia aquatica, Gallium palustre, C. palustris, M. aquatica,* and *Juncus cf. articulatus*

Macroinvertebrates / Water Quality: water discoloured and cloudy. Macroinvertebrates with Heptageniidae, *Ephemerella, Gammarus,* Chironomidae, and *Baetis* all in fair numbers and *R. dorsalis* in small numbers. Q 4-5 (Q4)

Fisheries Value: suitable for salmonids but probably too shallow, open and slow in this stretch to be particularly valuable.

Site Descriptions Broadhaven - Galway

Crossing 7 – River Deel – main channel (to Lough Conn)

Townland: Knockbrack/Carrowgarve South

Ir. Grid Ref: G 0756 1490

Channel dimensions: width 18m, depth 50-60cm.

Banks: not measured (estimate 1.2-1.5m).

Bankside Composition: brown peaty sand.

Substrate: scattered boulders and cobbles on fine gravel.

Flow: dead slow to moderate to slow in glide, moderate in boulder field just upstream if crossing point.

Channel Habitat: mainly long moderately deep glide at and below the crossing punt, short boulder riffle immediately upstream before bend.

In-Channel Vegetation: much moss and some liverwort on boulders in glide, same in boulder area upstream but also with abundant *Potamogeton* sp. (*P. natans* / *P. polygonifolius*) and *Myriophyllum* cf. *alterniflorum*. Scattered stands *of S. erectum* marginally (LHS).

Bankside Vegetation: LHS bank J. effusus with occasional small willow, scattered Senecio jacobaea, R. acetosella, Centaurea nigra, Cirsium palustre, P. lanceolata, R. repens, R. acris, V. officinalis and Anthriscus sylvestris etc. backed by improved grassland. RHS bank heavily timbered and overhanging immediately upstream of the crossing point with Sycamore, Hazel, Ash, Hawthorn and possibly Mountain Ash. Crossing point with scattered willow and conifers (low density).

Macroinvertebrates / Water Quality: Mayflies (*Ecdyonurus*, *Ephemerella* (common), *Baetis rhodani* and *Baetis muticus*), *Stoneflies* (*Leuctra*), Caddis Flies (*Lepidostoma hirta* and *Agapetus*), Water Beetles (*Elmis, Limnius* and *Esolus*), True Flies (Chironomidae), Crustaceans (*Gammarus* and *Austropotamobius* pallipes – one only), clear and slightly coloured water. Q4

Fisheries Value: ideal salmonid habitat. Holding and feeding. Spawning unlikely in this stretch due to depth and slow flow.

Crossing 8 – Castlehill River (to Lough Conn)

Townland: ENE of Lahardaun Village

Ir. Grid Ref: G 1142 1095

Channel dimensions: width 4-5m, depth 5-12cm

Banks: RHS 1.5m, LHS 1.5-1.7m

Bankside Composition: RHS with spoil heap of cobbles, boulders and gravel (dredged for local flood relief in the past). Otherwise open.

Substrate: cobbles and small stones on gravel.

Flow: moderate – swift and turbulent.

Channel Habitat: uniform shallow riffle, probably very spatey.

In-Channel Vegetation: plant-free.

Bankside Vegetation: disturbed, LHS with Bramble, *Heracleum sphondylium*, Digitalis *purpurea*, *Valeriana officials*, *Scrophularia aquatica* and *Holcus lanatus*. LHS dominated by Gorse, and Bramble. Both banks backed by improved grassland, damp on the LHS.

Macroinvertebrates / Water Quality: water clear with a slight colour. Macroinvertebrates typical of unpolluted conditions and including Mayflies *Ecdyonurus* and *Heptagenia*, *Leuctra*, *Isoperla*, *Ephemerella*, *Rhyacophila*, *Elmis*, *Gammarus*, Simuliidae, and Chironomidae. Q4-5 (Q5)

Fisheries Value: Ideal salmonid habitat; landowner reported seeing many trout spawning in this stretch in November and salmon spawning in there during December.

Crossing 9 Lecarrow River (to Lough Conn)

Townland: Ballymacredmond (nr. Laharadaun)

Ir. Grid Ref: G 1254 0995

Channel dimensions: width 2m, depth 10-24cm

Banks: RHS 0.5-0.8m, LHS 1m

Bankside Composition: organic sandy soil on coarse till.

Substrate: wide mix with scattered boulders, cobbles, small stones and coarse and fine gravel.

Flow: turbulent, moderate – swift; probably torrential after rain.

Channel Habitat: typical riffle/pool succession with small natural weirs.

In-Channel Vegetation: mainly plant free with scattered moss on boulders.

Bankside Vegetation: RHS Bramble backed by improved grassland with some Juncus. LHS dominated by Alder, and Holly with scattered Gorse and an understorey of Bramble and Ivy. Backed by improved hay meadow.

Macroinvertebrates / Water Quality: Clear slightly coloured water. Macroinvertebrates included *Rhithrogena, Baetis, Ephemerella, Rhyacophila, Gammarus, Limnephilidae* Q4-5 (Q5).

Fisheries Value: Small but ideal salmonid habitat, probably suitable both for spawning and nursery. A salmonid parr was taken in kick-sample.

Site Descriptions Broadhaven - Galway

Crossing 10 Addergoole River (to Lough Conn)

Townland: Cuilkillew/Tonacrock

Ir. Grid Ref: G 1492 0920

Channel dimensions: estimate 6-7m (too deep to cross), depth >1m

Banks: RHS 1.5-2m, RHS 2m

Bankside Composition: adhesive mineral peaty soil

Substrate: peaty mud

Flow: slow

Channel Habitat: deep pool/glide

In-Channel Vegetation: very sparse, occasional marginal submerged clumps of *Callitriche* sp. (LHS), very scattered *P. natans* centrally.

Bankside Vegetation: LHS dominated by medium sized Alder and Willow with intervening Bramble, all overhanging. RHS dominated by *J. effusus*, with scattered *F. ulmaria, S. jacobaea, S. aquaticum, R. acetosa, R. obtusifolius, C. palustre, Agrostis stolonifera, Lotus pedunculatus, L. salicaria* and *V. officinalis* and occasional gorse bushes. Backed by marshy grassland dominated by *Juncus*.

Macroinvertebrates / Water Quality: water appeared clean but was too deep and unsafe to sample.

Fisheries Value: possibly, good holding area for salmonids, particularly during spates. No spawning in the stretch.

Crossing 11 Clydagh River (to Lough Cullin)

Townland: Meelick / Rockfield

Ir. Grid Ref: M 1820 9404

Channel dimensions: width 11m, depth 30-50cm

Banks: LHS bank with high spoil heap now heavily vegetated (possibly 3m+ high), LHS 2-2.5m high, heavily timbered.

Bankside Composition: brown sandy silt

Substrate: coarse gravel and coarse sand forming shallow submerged banks in places.

Flow: moderate-slow, moderate

Channel Habitat: glide and pool

In-Channel Vegetation: abundant long trailing *Myriophyllum* cf. *alterniflorum*. Marginal emergents virtually absent, except for occasional *Oenanthe crocata*, and locally frequent *Mentha aquatica*, *Veronica beccabunga* and *Impatiens glandulifera*.

Bankside Vegetation: LHS dominated by large overhanging trees including Alder and Ash with some Willow and Hawthorn and an understorey of woodland/hedgebank herbs. Same species composition on RHS but not as large and dense.

Macroinvertebrates / Water Quality: water was clear and peaty coloured with a clean-water macroinvertebrate mix which included *Ecdyonurus*, *Ephemerella*, *Leuctra*, *Rhyacophila*, *Sericostoma personatum*, *Arthripsodes* spp., Elmidae, *Gammarus* and oligochaets. Q 4 (Q4-5)

Fisheries Value: suitable salmonid habitat, probably mainly holding and feeding. Fish were seen rising during the survey.

Site Descriptions Broadhaven - Galway

Crossing 12 Castlebar River (tributary of Clydagh River)

Townland: Leckeen

Ir. Grid Ref: M 1903 9278

Channel dimensions: width estimate 8m, depth 55cm

Banks: LHS 1.5-2m, RHS 1-1.5m

Bankside Composition: clay/marl topped with brown organic soil

Substrate: angular cobbles and small stones

Flow: moderate

Channel Habitat: glide

In-Channel Vegetation: Some trailing *Potamogeton natans* but nothing else obvious

Bankside Vegetation: Immediate bankside with *Phalaris arundinacea/Urtica dioica, Filipendula ulmaria*, and *Iris pseudacorus* mix with backed by improved damp grassland. There are some medium-sized Hawthorn scattered along both banks.

Macroinvertebrates / Water Quality: water clear but macroinvertebrates dominated by species indicative of slight to moderate pollution. *Gammarus* and *Asellus* were common (particularly the latter species) with Glossosomatidae, Oligochaeta and Chironomidae. Q 3

Fisheries Value: Probably suitable for large brown trout

Crossing 13 Manulla River

Townland: Kilknock

Ir. Grid Ref: M 2089 8831

Channel dimensions: width estimate 12-15m (too deep to cross), D >1m

Banks: vertical, greater than 1m

Bankside Composition: Clay

Substrate: organic mud/clay ?

Flow: dead slow

Channel Habitat: deep glide / pool

In-Channel Vegetation: Little in-channel vegetation apart from some Berula erecta submerged at the margin.

Bankside Vegetation: Not very extensive; dominated by *Phalaris* with some *Filipendula*. Marginal vegetation backed by improved grassland (right bank) and by plantation coniferous forestry on the left bank (north). Banks open.

Macroinvertebrates / Water Quality: Conditions at the site weere not suitable for obraing macroinvertebrate kick samples

Fisheries Value: The site may hold large trout but it would be more suitable for a mixed coarse fishery and my have some pike in areas of good cover.

Site Descriptions Broadhaven - Galway

Crossing 14 Unnamed Tributary of Needhams Lough

Townland: Smuttanagh

Ir. Grid Ref: M 2342 8413

Channel dimensions: width 3.5m, depth 40cm

Banks: 2.5-3m high, steep.

Bankside Composition: coarse limestone till with silty sand

Substrate: in areas with weak current: cobbles, small stones and coarse sand on sandy silt.

Flow: dead slow in plant-choked areas to moderate to slow in shallow riffle/glide.

Channel Habitat: mixture of canal-like glide and shallow riffle/glide.

In-Channel Vegetation: *S. erectum* co-dominant with *S. emersum*. *M. aquatica* and *Lemna* sp. locally common with occasional *Nuphar lutea*, and *Alisma plantago-aquatica; Lemna triscula, L. minor, Potamogeton crispus* (rare). *O. aquatica/O. fluviatilis*, marginal and occasional.

Bankside Vegetation: slopes dominated by *Phalaris* and Bramble backed on the RHS by marshy grassland with *J. effusus*, *Cirsium palustre*, *C. vulgare*, C. *arvense*, *Senecio aquaticus*, *R. acris*, *T. repens, H. lanatus* and *Cynosurus cristatus*. The LHS side with good growth of Willow, Alder, Elder and Hawthorn backed by a hay meadow (improved).

Macroinvertebrates / Water Quality: macroinvertebrates included *Ecdyonurus*, *Ephemerella*, *Heptagenia sulphurea*, *Baetis muticus, Rhyacophila dorsalis*, *Hydropsyche*, *Polycentropus*, *Lepidostoma hirtum, Sericostoma personatum*, *Agapetus*, *Elmis aenea*, Chironomidae, Simuliidae, *Gammarus*, *Bithynia tentaculata*, *Sphaerium*, *Glossiphonia complanata*, Oligochaeta. Q 4-5.

Fisheries Value: probably contains trout but unlikely by virtue of its size and sluggish nature to be of much fisheries importance.

Crossing 15 River Robe

Townland: Pollrady

Ir. Grid Ref: M 2905 7136

Channel dimensions: width 9m, depth 30-60cm

Banks: 2.5m high, both

Bankside Composition: ?

Substrate: boulders over fine gravel and coarse sand.

Flow: moderate to swift

Channel Habitat: glide with a little riffle/glide with a large pool area immediately downstream of the crossing point just beyond the small drain joining from the LHS bank.

In-Channel Vegetation: dominated by long trailing *Cladophora* with moss (*Fissidens* sp.) common on boulders. Marginal vegetation sparse with *Phalaris* and *Agrostis stolonifera* dominant, with occasional stands *S. erectum.*

Bankside Vegetation: sloping banks grassy with *H. lanatus, Dactylis glomerata, Luzula campestris, R. acris, R. repens, Centaurea nigra, Carex nigra* group, *Trifolium repens, Rumex crispus, Cirsium arvense, C. vulgare, Mentha aquatica* and *Equisetum arvense.*

Macroinvertebrates / Water Quality: the dominant feature of the macroinvertebrate community was large crayfish, which although not specifically identified, are believed to be the White-Clawed variety (*Austropotamobius pallipes*). These were clearly seen holding station on and between boulders and were present with many juveniles in kick-samples; the river would appear to hold a dense population. Other taxa present included *Baetis, Paraleptophlebia cincta, Hydropsyche* (numerous), Chironomidae (abundant), *Leuctra* (scarce), *Asellus* scarce. The presence of large amounts of filamentous algae and the absence of more sensitive species indicates that this stretch, despite the healthy crayfish population, is slightly polluted. Q3-4

Fisheries Value: the large macroinvertebrate biomass would probably favour a good brown trout stock and a large pool downstream of the crossing could be a good holding/angling area at times. The area is not likely to be suitable for spawning.

Site Descriptions Broadhaven - Galway

Crossing 16 Black River – upper reaches, u/s Ardour Bridge

Townland: Ardour

Ir. Grid Ref: M 3216 5893

Channel dimensions:

Banks: low open

Bankside Composition: Limestone till with silty sand

Substrate: mud

Flow: virtually dry

Channel Habitat:

In-Channel Vegetation: choked with *Apium nodiflorum* and *Nasturtium aquaticum*-agg.

Bankside Vegetation: improved pasture

Macroinvertebrates / Water Quality: n/a

Fisheries Value: n/a

Crossing 17 – Kilshanvey River

Townland: Ardour / Kilshanvey

Ir. Grid Ref: M 3217 5800

Channel dimensions: width 4-5m, depth ~ 60cm

Banks: 1.5m high on both sides with a 1m high spoil heap set back a few metres from the RHS bank.

Bankside Composition: ?

Substrate: soft, organic with scattered maerl covered boulders.

Flow: still-dead slow

Channel Habitat: plant-choked and canal-like

In-Channel Vegetation: dominated by *Potamogeton natans* with dense stands of *S. erectum* common; *S. emersum* also locally frequent. Marginally, *Apium nodiflorum* abundant *with Nasturtium aquaticum* agg. also common; *Hippuris vulgaris, Caltha palustris* and *Glyceria fluitans* frequent. *Batrachospermum* and jelly-like algal globules on boulders (*Chaetophora*).

Bankside Vegetation: semi-improved grassland, damp in places, with *Cynosurus cristatus, Brezia media, Gallium verum, Daucus carota, Lotus corniculatus, Trifolium repens, T. arvense, Plantago lanceolata, Cirsium arvense, Iris pseudacorus, Prunella vulgaris.*

Macroinvertebrates / Water Quality: macroinvertebrates were dominated by *Gammarus*, which were very abundant along with Chironomidae and *Lymnea peregra*. Also present were *Ephemerella ignita*, *Lepidostoma hirtum, Limnephilus lunatus*, *Helophorus* beetles and the flat worm *Polycelis* sp. (cf. *P. felina*). Q 3-4

Fisheries Value: this section of the river probably not of any significance from the salmonid fisheries standpoint; three-spined stickleback common

Crossing 18 Togher River

Townland: Cloonbar

Ir. Grid Ref: M 3283 5430

Channel dimensions: width 3.5-4m depth 10-30cm

Banks: both ~ 3m with spoil heay set back a few metres from the LHS bank

Bankside Composition: peaty soil on clay

Substrate: peaty organic bottom with angular cobbles, small stones and gravel in areas of moderate to slow flow, otherwise just organic silt.

Flow: mainly dead slow

Channel Habitat: canal-like and heavily vegetated for the most part

In-Channel Vegetation: dense stands of *S. erectum* marginally *with S. emersum, Lemna triscula, P. natans, M. aquatica, Hippuris vulgaris and Caltha palustris*, locally frequent. Further downstream, *Phragmites, Typha, Alisma plantago aquatica, Apium nodiflorum, Myosotis scorpioides, Senecio aquaticus* and *Ranunculus flammula* also in evidence. The green alga *Batrachospermum* was present on on cobbles.

Bankside Vegetation: RHS bank dominated by mainly by Gorse, with small alder and willow also present. LHS bank with small alder and willow, scattered. RHS backed by hay meadow, LHS with closely grazed improved to semi-improved grass with a mix of species including *H. lanatus. Prunella vulgaris, Hypochaeris radicata, Ranunculus acris, Cirsium arvense. Trifolium repens, Bellis perennis, Rhinanthus minor* (v. occ.)

Macroinvertebrates / Water Quality: macroinvertebrates collected in a small area of coarse substrate with a weak current included *Ephemerella, Baetis, Cloeon simile, Leuctra, Sericostoma personatum, Arthripsodes atterimus, Arthripsodes cinereus*, Elmidae (*Elmis, Oulimnius*), *Helophorus*, Water-boatmen (*Sigara dorsalis & S. fossarum*), *Gammarus, Asellus, Glossiphonia complanata, Bithynia tentaculata, Valvata psicinalis*, Oligocaheta Q 4.

Fisheries Value: too shallow and plant choked to be of any fisheries value in the study reach.

Crossing 19 River Clare

Townland: Cregmore

Ir. Grid Ref: 4166 3373

Channel dimensions: width 15m, 20-40cm in riffles, 40+ cm in glide / pool

Banks: RHS more vertical 2-3m, backed by dredge-spoil berm. LHS gradually sloping to edge backed by a step (1.5-2m) to field level. Large dredge-spoil berms with limestone boulders and cobbles set back 4-6m from the bank in places, although not immediately at the crossing point.

Bankside Composition: loose limestone till mixed with sandy silt.

Substrate: limestone cobbles and boulders; maerl coated; some limestone pavement at channel bed-level in places.

Flow: strong and swift and turbulent in riffles, moderate in glides.

Channel Habitat: mainly glide

In-Channel Vegetation: occasional *Potamogeton perfoliatus, P. x nitens*, and *Nuphar lutea* (submerged); *Batrachospermum* and moss (*Cinclidotus & Rhynchostegium*) common on boulders in riffle. Long trailing filamentous green algae common.

Bankside Vegetation: LHS marginal vegetation very sparse including *Phalaris* (with occasional *Filipendula*) and *Schoenoplectus lacustris. Potentilla anserina, P. reptans, Urtica dioica* and *Equisetum arvense*, with *Trifolium repens* all common backed by grassed areas (grazed by sheep) with *Cynosurus cristatus, Lolium perenne, Plantago lanceolata, Bellis perennis* etc. RHS with scattered Ash, Hawthorn, Gorse, Blackthorn, and Rubus sp. backed by large spoil heaps in places.

Macroinvertebrates / Water Quality: water coloured and slightly turbid; macroinvertebrates in riffle included *Gammarus, Hydropsyche, Rhyacophila, Ephemerella* (all common) with Philopomatidae, *Leuctra* and Leptoceridae. Q3-4 (Q4).

Fisheries Value: important salmon and trout angling area. Probably no spawning in this immediate stretch.

Crossing 20 Lavally River – Upper Tributary of Clarin River

Townland: Millpark

Ir. Grid Ref: M4703 2573

Channel dimensions: width 2.5-3m, 7-13cm in riffles

Banks: RHS more vertical 2-3m, backed by dredge-spoil berm. LHS gradually sloping to edge backed by a step (1.5-2m) to field level. Large dredge-spoil berms with limestone boulders and cobbles set back 4-6m from the bank in places, although not immediately at the crossing point.

Bankside Composition: brown mineral soil on cobble/boulder limestone till.

Substrate: boulders and cobbles on fine gravel and coarse sand

Flow: generally moderate to slow

Channel Habitat: mainly shallow glide and riffle/glide

In-Channel Vegetation: boulders were in luxuriant, long trailing *Cladophora*, which contained much trapped silt. Water crowfoot (submerged leaves only) was locally common in the centre of the channel and large boulders had a covering of *Fontinalis* moss. Marginally (RHS) *Cladophora* was also dominant with interspersed clumps of *Apium nodiflorum*, *Apium inundatum* (Lesser Marshwort) and *Mentha aquatica* with occasional small stands of *Sparganium erectum* also present.

Bankside Vegetation: RHS marginal vegetation was dominated by *Phalaris arundinacea* with *Epilobium hirsutum*, *Senecio aquaticus*, *Agrostis stolonifera*, occasional *Mentha aquatica* and *Plantago major* backed by improved grassland. The LHS bank was more heavily vegetated with a marginal herb layer dominated by Great Yellow-cress (*Nasturtium amphibia*), Bittersweet, and occasional backed by Blackthorn thicket and an Ash-dominated tree layer.

Macroinvertebrates / Water Quality: The snail *Lymnea peregra* was very abundant feeding on the in-channel *Cladophora*, where *Lymnea stagnalis* was also present. The dominant macroinvertebrates were Elmid beetles (*Elmis* and *Limnius*), the crustaceans *Gammarus* and *Asellus* with occasional *Leuctra*, *Rhyacophila dorsalis*, *Hydropsyche*, *Glossiphonia*, *Physa* and *Valvata*. *Q 3 (Q3-4).*

Fisheries Value: possibly a feeding/nursery area; spawning seems unlikely by virtue of the coarse substrate, and slow flows at the site.

Crossing 21 Escir River – Upper Tributary of Clarin River

Townland: Lecarrow

Ir. Grid Ref: M4825 2373

Channel dimensions: width 2.0-2.5m

General Description

This channel was dry and is therefore likely to be seasonal or temporary watercourse. The substrate comprised limestone boulders, cobbles and small stones. Under many stones small to medium-sized water beetles were sheltering in the damp soil, presumably awaiting water to again appear in the river. Some of the stones had a dried papery coating of algal scum and others dried coverings or *Fontinalis* moss in-channel and *Cinclidotus* higher up on marginal boulders. The banks were dominated by very large limestone boulders backed by Hawthorn, Blackthorn Ash and Bramble. Improved grassland was present beyond the banks.

Crossing 22 Dooyertha River – Dunkellin River Catchment

Townland: Garracloon South (NW Craughwell)

Ir. Grid Ref: M 5215 2156

Channel dimensions: width 4-8m

General Description

At the crossing the river comprises a short section of shallow riffle with much terrestrial/semi-aquatic vegetation invading the stream channel (mainly Rumex sp., possibly R. obtusifolius). The substrate here is of cobbles and small stones and the flow is shallow, moderate to swift and turbulent. The banks are steep and earthen in places and dominated by mature Hawthorn and Ash. Downstream of the crossing the water disappears entirely from the channel, which comprises moss-covered limestone boulders in the main. Other species, which occur at the margins of the channel or in the semi-dry areas, include *Potentilla anserina, Ranunculus ficaria, Phalaris, Ranunculus repens* and *Filipendula,* with occasional *Nodding Bur-Marigold (Bidens cernua).*

Immediately upstream of the crossing point the channel is broad and dammed back by a small loose stone weir to form a virtually stagnant glide/pool stretching upstream for more than 100m.

Macroinvertebrates & Water Quality

A kicksample collected in the narrow and shallow riffle at the site contained the following groups Simuliidae, *Baetis*, *Asellus*, *Isoperla*, *Limnephilus*, *Lymnea peregra*. (Q3-4). There was a single salmonid fry also taken at this site.

Fisheries Value

The fact that the river dries-up at least in places, probably during the summer/autumn period, suggests that the channel near the crossing point is of very limited fisheries value. However, a salmonid fry at the crossing point suggests that there must be some limited spawning in pockets possibly including at the site itself.

Appendix 13.1: National Freshwater Quality Database

NATIONAL FRESHWATER QUALITY DATABASE (SOURCE: EPA)

Units in mg/l (ppm)
Temperature in ^{0}C

Quality classification from 1 to 5

1 = Seriously polluted
2 = Moderately/ Seriously polluted
3 = Moderately polluted
4 = Slightly polluted
5 = Unpolluted

1.Muingnabo River

Sampling Point Information

Location	0.3 km u/s Annie Brady Bridge
Hydrometric Area	Blacksod-Broadhaven
River Name	MUINGNABO
Last Q Classification	4 (Unpolluted)

2.Glenamoy River

Sampling Point Information

Location	Glenamoy Bridge
Hydrometric Area	Blacksod-Broadhaven
River Name	GLENAMOY
Last Q Classification	3-4* (Slightly polluted

Biological Sampling Information

Location	Glenamoy Bridge
River Name	GLENAMOY
Hydrometric Area	Blacksod-Broadhaven
Quality 1994	3-4* (Slightly polluted)
Quality 1990	4-5 (Unpolluted)
Quality 1986	4-5 (Unpolluted)
Quality 1981	5 (Unpolluted)

Chemical Sampling Information

Parameter	Symbol	Maximum	Mean	Median	Minimum	No. of Samples
Ammonia	NH3	0.1	0.0326	0.02	0.005	23
BOD	O2	4.3	1.74	1.5	1	23
Chloride	Cl	50	27.82	27	16	22
Colour		250	135.28	138	40	18
Conductivity @ 25 °C		302	166.78	173	80	23
Dissolved Oxygen		106	96.5	97	80	23
Nitrate+Nitrite	N	0.18	0.062	0.054	0.011	22
Ortho-phosphate	PO4	0.057	0.0195	0.018	0.005	22
Ph		8.4	7.3	7.3	5.9	23
Temperature		19.5	11.21	10.9	4.8	23
Un-ionised Ammonia	NH3	0.0013	0.0002	-0.0001	-0.0001	23

3.River Muing
Sampling Point Information

Location	Just u/s Owenmore River
Hydrometric Area	Blacksod-Broadhaven
River Name	MUING
Last Q Classification	3-4 (Slightly polluted)

4. Altnabrocky River
Sampling Point Information

Location	Just u/s Owenmore River confl
Hydrometric Area	Blacksod-Broadhaven
River Name	ALTNABROCKY
Last Q Classification	4-5 (Unpolluted)

5. Shanvolahan River
Sampling Point Information

Location	Bridge S.W. of Coolturk
Hydrometric Area	Moy and Killala Bay
River Name	SHANVOLAHAN
Last Q Classification	3 (Moderately polluted)

6. Shanvolahan River
Sampling Point Information

Location	Just u/s Deel River confl
Hydrometric Area	Moy and Killala Bay
River Name	SHANVOLAHAN
Last Q Classification	4 (Unpolluted)

7. Castlehill River

Sampling Point Information

Location	Bridge S. of Castlehill
Hydrometric Area	Moy and Killala Bay
River Name	CASTLEHILL
Last Q Classification	5 (Unpolluted)

8. Addergoole River

Sampling Point Information

Location	Bridge u/s Lough Conn
Hydrometric Area	Moy and Killala Bay
River Name	ADDERGOOLE
Last Q Classification	4 (Unpolluted)

9. Clydagh (Castlebar)

Sampling Point Information

Location	Clydagh Bridge
Hydrometric Area	Moy and Killala Bay
River Name	CLYDAGH (CASTLEBAR)
Last Q	4 (Unpolluted)

Biological Sampling Information

Location	Clydagh Bridge
River Name	CLYDAGH (CASTLEBAR)
Hydrometric Area	Moy and Killala Bay
Quality 1993	4 (Unpolluted)
Quality 1989	5 (Unpolluted)
Quality 1986	4-5 (Unpolluted)
Quality 1981	5 (Unpolluted)

Chemical Sampling Information

Parameter	Symbol	Maximum	Mean	Median	Minimum	No. of Samples
Ammonia	NH3	0.12	0.0389	0.03	0.01	24
BOD	O2	3.7	1.61	1.4	0.5	25
Chloride	Cl	35	21.42	20	13	24
Colour		300	145.48	150	20	21
Conductivity @ 25 °C		506	160.96	153	82	25
Dissolved Oxygen		103	90.4	91	78	25
Nitrate+Nitrite	N	0.26	0.094	0.072	0.03	23
Ortho-phosphate	PO4	0.03	0.0133	0.011	0.001	24
pH		8.1	7.5	7.5	6.6	25
Temperature		17.5	9.7	11	0.3	25
Un-ionised Ammonia	NH3	0.0011	0.0003	-0.0001	-0.0001	24

10. Clydagh River (Castlebar)

Sampling Point Information

Location	Bridge E. of Ballyguin
Hydrometric Area	Moy and Killala Bay
River Name	CLYDAGH (CASTLEBAR)
Last Q Classification	5 (Unpolluted)

Biological Sampling Information

Location	Bridge E. of Ballyguin
River Name	CLYDAGH
Hydrometric	(CASTLEBAR)
Area	Moy and Killala Bay
Quality 1986	5 (Unpolluted)
Quality 1981	4-5 (Unpolluted)

11. Castlebar River

Sampling Point Information

Location	Br 2.5 km d/s Castlebar
Hydrometric Area	Moy and Killala Bay
River Name	CASTLEBAR
Last Q Classification	3 (Moderately polluted)

Biological Sampling Information

Location	Br 2.5 km d/s Castlebar
River Name	CASTLEBAR
Hydrometric Area	Moy and Killala Bay
Quality 1995	3 (Moderately polluted)
Quality 1993	3 (Moderately polluted)
Quality 1989	3 (Moderately polluted)
Quality 1986	3 (Moderately polluted)
Quality 1984	3 (Moderately polluted)
Quality 1983	3 (Moderately polluted)
Quality 1981	2-3 (Moderately polluted)
Quality 1980	1 (Seriously polluted)
Quality 1979	1 (Seriously polluted)
Quality 1977	1 (Seriously polluted)
Quality 1975	1 (Seriously polluted)
Quality 1973	1-2 (Seriously polluted)
Quality 1971	1 (Seriously polluted)

Chemical Sampling Information

Parameter	Symbol	Maximum	Mean	Median	Minimum	No. of Samples
Ammonia	NH3	0.33	0.0563	0.04	0.005	27
BOD	O2	5.2	2.22	2.1	0.9	27
Chloride	Cl	58	34.89	33	22	27
Colour		125	80.33	85	40	15
Conductivity @ 25 °C		477	396.15	391	333	27
Dissolved Oxygen		126	89.5	88	64	27
Nitrate+Nitrite	N	1.83	0.771	0.73	0.13	27
Ortho-phosphate	PO4	0.66	0.1174	0.04	0.005	27
Ph		8.2	7.7	7.7	7.2	27
Temperature		20	11.79	11.5	2.5	27
Un-ionised Ammonia	NH3	0.0044	0.0008	0.0005	-0.0001	27

12. Castlebar River

Sampling Point Information

Location	Br N. of Turlough Park
Hydrometric Area	Moy and Killala Bay
River Name	CASTLEBAR
Last Q Classification	3 (Moderately polluted)

Biological Sampling Information

Location	Br N. of Turlough Park
River Name	CASTLEBAR
Hydrometric Area	Moy and Killala Bay
Quality 1995	3 (Moderately polluted)
Quality 1993	3 (Moderately polluted)
Quality 1989	3 (Moderately polluted)
Quality 1984	3 (Moderately polluted)
Quality 1983	3 (Moderately polluted)
Quality 1981	3 (Moderately polluted)
Quality 1980	2 (Seriously polluted)
Quality 1979	2-3 (Moderately polluted)
Quality 1977	2-3 (Moderately polluted)
Quality 1975	1-2 (Seriously polluted)
Quality 1973	3 (Moderately polluted)
Quality 1971	3 (Moderately polluted)

Chemical Sampling Information

Parameter	Symbol	Maximum	Mean	Median	Minimum	No. of Samples
Ammonia	NH3	0.14	0.0431	0.04	0.005	27
BOD	O2	2.6	1.7	1.7	0.9	27
Chloride	Cl	57	33.81	31	20	27
Colour		125	78.67	85	40	15
Conductivity @ 25 °C		474	407.59	401	342	27
Dissolved Oxygen		128	93.6	90	80	27
Nitrate+Nitrite	N	2.13	0.809	0.67	0.12	27
Ortho-phosphate	PO4	0.46	0.1111	0.04	0.005	27
Ph		8.5	7.8	7.9	7.2	27
Temperature		19.5	11.63	11.5	3	27
Un-ionised Ammonia	NH3	0.0104	0.0011	0.0005	-0.0001	27

13. Manulla River

Sampling Point Information

Location	Ballinfad Bridge
Hydrometric Area	Moy and Killala Bay
River Name	MANULLA
Last Q Classification	4 (Unpolluted)

Biological Sampling Information

Location	Ballinfad Bridge
River Name	MANULLA
Hydrometric Area	Moy and Killala Bay
Quality 1995	4 (Unpolluted)
Quality 1993	4 (Unpolluted)
Quality 1989	4-5 (Unpolluted)
Quality 1984	4-5 (Unpolluted)
Quality 1980	5 (Unpolluted

Chemical Sampling Information

Parameter	Symbol	Maximum	Mean	Median	Minimum	No. of Samples
Ammonia	NH3	0.19	0.0607	0.05	0.01	27
BOD	O2	2.6	1.59	1.7	0.8	27
Chloride	Cl	48	26.74	25	14	27
Colour		150	77.33	70	30	15
Conductivity @ 25 °C		696	527.04	518	399	27
Dissolved Oxygen		108	81.3	81	65	27
Nitrate+Nitrite	N	2.41	1.179	1.095	0.51	26
Ortho-phosphate	PO4	0.04	0.0148	0.01	0.005	27
Ph		8.2	7.7	7.7	7.2	27
Temperature		19	11.5	11	3.5	27
Un-ionised Ammonia	NH3	0.0051	0.0009	0.0005	-0.0001	27

14. Robe River

Sampling Point Information

Location	Bridge near Tagheen
Hydrometric Area	Corrib
River Name	ROBE
Last Q Classification	3-4 (Slightly polluted)

Biological Sampling Information

Location	Bridge near Tagheen
River Name	ROBE
Hydrometric Area	Corrib
Quality 1989	3-4 (Slightly polluted)
Quality 1987	4 (Unpolluted)
Quality 1985	4 (Unpolluted)
Quality 1982	3-4 (Slightly polluted)
Quality 1980	4 (Unpolluted)

Chemical Sampling Information

Parameter	Symbol	Maximum	Mean	Median	Minimum	No. of Samples
Ammonia	NH3	0.198	0.0577	0.05	0.01	27
BOD	O2	3.5	1.79	1.8	0.7	28
Chloride	Cl	33	25.14	25	19	28
Colour		150	97.17	100	40	23
Conductivity @ 25 °C		648	565.25	578	398	28
Dissolved Oxygen		131	86.7	86	64	27
Hardness	CaCO3	416	0	0	416	1
Nitrate+Nitrite	N	2.15	1.087	0.991	0.365	27
Ortho-phosphate	PO4	0.113	0.0515	0.052	0.005	28
pH		8.5	7.9	7.9	7.3	28
Temperature		16.8	10.21	10.1	3	28
Un-ionised Ammonia	NH3	0.0023	0.0007	0.0007	0.0002	27

15. Black River (Shrule)

Sampling Point Information

Location	Bridge at Kilshanvy
Hydrometric Area	Corrib
River Name	BLACK (SHRULE)
Last Q Classification	3-4 (Slightly polluted)

Biological Sampling Information

Location	Bridge at Kilshanvy
River Name	BLACK (SHRULE)
Hydrometric Area	Corrib
Quality 1994	3-4 (Slightly polluted)
Quality 1989	3-4 (Slightly polluted)
Quality 1984	3-4 (Slightly polluted)
Quality 1980	3-4 (Slightly polluted)

Chemical Sampling Information

Parameter	Symbol	Maximum	Mean	Median	Minimum	No. of Samples
Ammonia	NH3	0.07	0.0291	0.03	0.005	35
BOD	O2	2.9	1.29	1.2	0.5	36
Chloride	Cl	34	25.66	26	16	35
Colour		125	48.08	40	5	26
Conductivity @ 25 °C		738	611	608	228	36
Dissolved Oxygen		106	71.6	69	44	36
Nitrate+Nitrite	N	3.4	1.409	1.39	0.134	35
Ortho-phosphate	PO4	0.055	0.0219	0.02	0.005	36
Ph		8	7.6	7.5	7.2	36
Temperature		15	9.06	8.9	2.5	36
Un-ionised Ammonia	NH3	0.0005	0.0002	-0.0001	-0.0001	35

16. River Clare (Galway)

Sampling Point Information

Location	Br S.W. of Turloughmore
Hydrometric Area	Corrib
River Name	CLARE (GALWAY)
Last Q Classification	4 (Unpolluted)

Biological Sampling Information

Location	Br S.W. of Turloughmore
River Name	CLARE (GALWAY)
Hydrometric Area	Corrib
Quality 1993	4 (Unpolluted)
Quality 1989	4 (Unpolluted)

Chemical Sampling Information

Parameter	Symbol	Maximum	Mean	Median	Minimum	No. of Samples
Ammonia	NH3	0.125	0.0439	0.04	0.005	50
BOD	O2	2.5	1.54	1.6	0.4	50
Chloride	Cl	40	24.02	24	14	49
Colour		150	77.63	78	15	40
Conductivity @ 25 °C		686	542.66	553	402	50
Dissolved Oxygen		137	91.7	90	71	50
Nitrate+Nitrite	N	2.88	1.394	1.312	0.51	49
Ortho-phosphate	PO4	0.114	0.0406	0.0375	0.005	50
pH		8.5	7.9	8	7.4	48
Temperature		17	10.32	10.4	3	50
Un-ionised Ammonia	NH3	0.002	0.0007	0.0007	-0.0001	48

17. River Clare (Galway)

Sampling Point Information

Location	Cregmore Bridge
Hydrometric Area	Corrib
River Name	CLARE (GALWAY)
Last Q Classification	3-4 (Slightly polluted)

Chemical Sampling Information

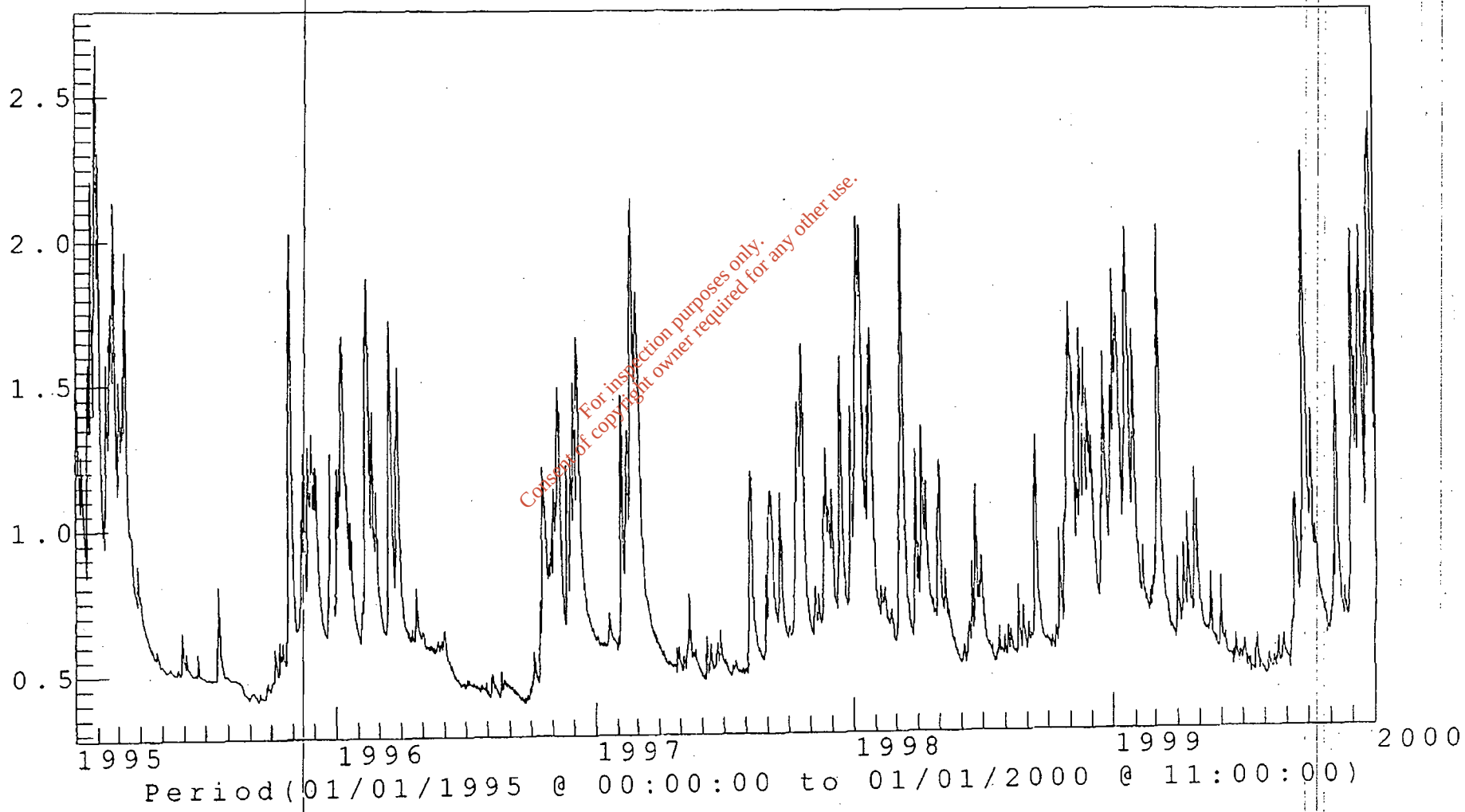
Parameter	Symbol	Maximum	Mean	Median	Minimum	No. of Samples
Ammonia	NH3	0.106	0.0349	0.03	0.009	51
BOD	O2	2.6	1.43	1.4	0.3	51
Chloride	Cl	38	23.98	23.5	16	50
Colour		150	73.9	70	15	41
Conductivity @ 25 °C		682	545.14	552	414	51
Dissolved Oxygen		137	93.3	91	75	51
Nitrate+Nitrite	N	2.65	1.414	1.386	0.39	50
Ortho-phosphate	PO4	0.121	0.0382	0.033	0.005	51
pH		8.6	8	8	7.4	51
Temperature		19.9	10.49	10.3	2.5	51
Un-ionised Ammonia	NH3	0.0033	0.0006	0.0004	-0.0001	51

Appendix 13.2: Hydrometric Data

Office of Public Works
Hydrometric Division

Time Series Plotting

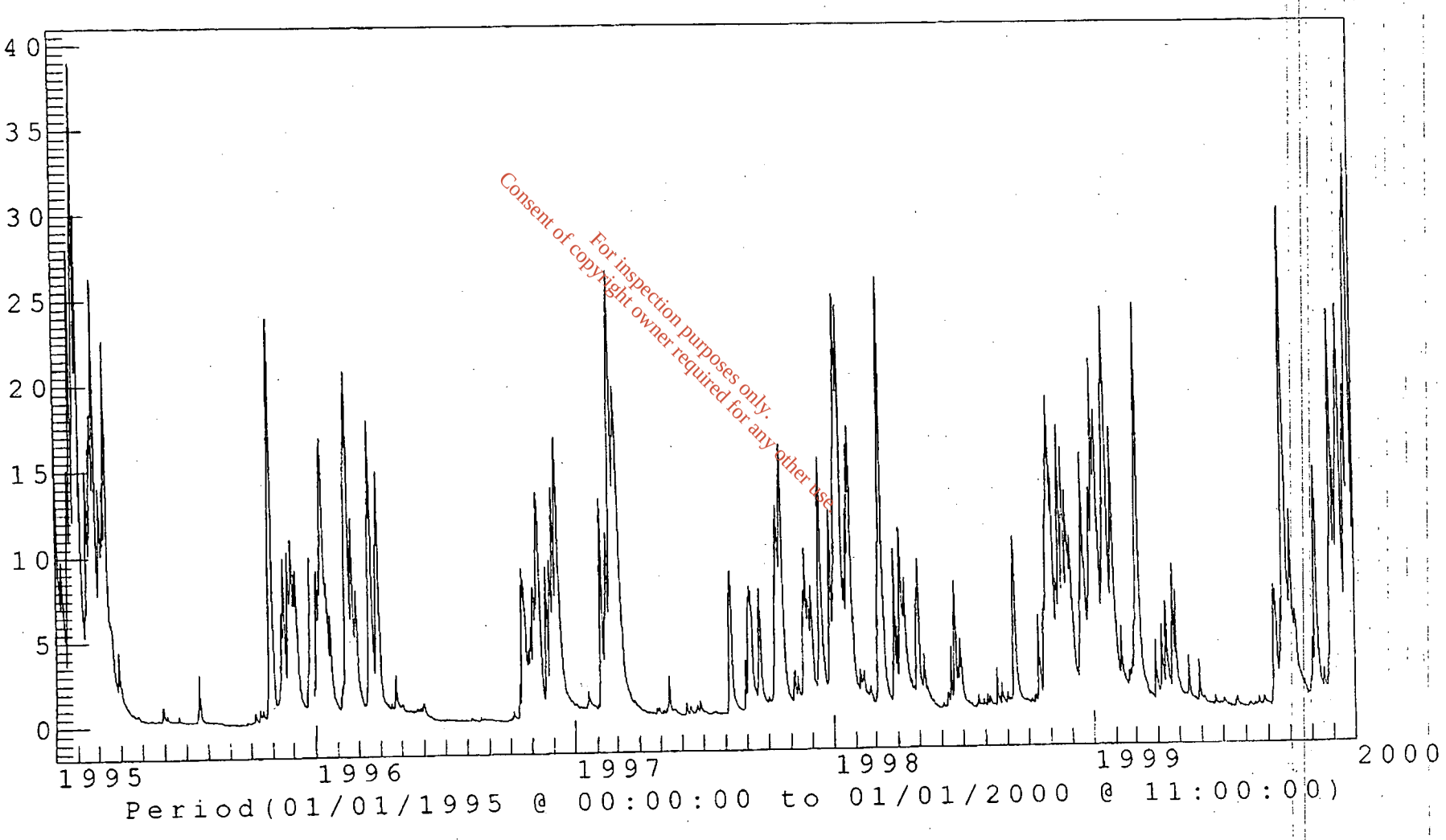
29007.1/100.00/1: Craughwell - Level (m)



Office of Public Works
Hydrometric Division

Time Series Plotting

29007.1/100.00/1: Craughwell (PTo(200.00,0)) - Flow Cmcs



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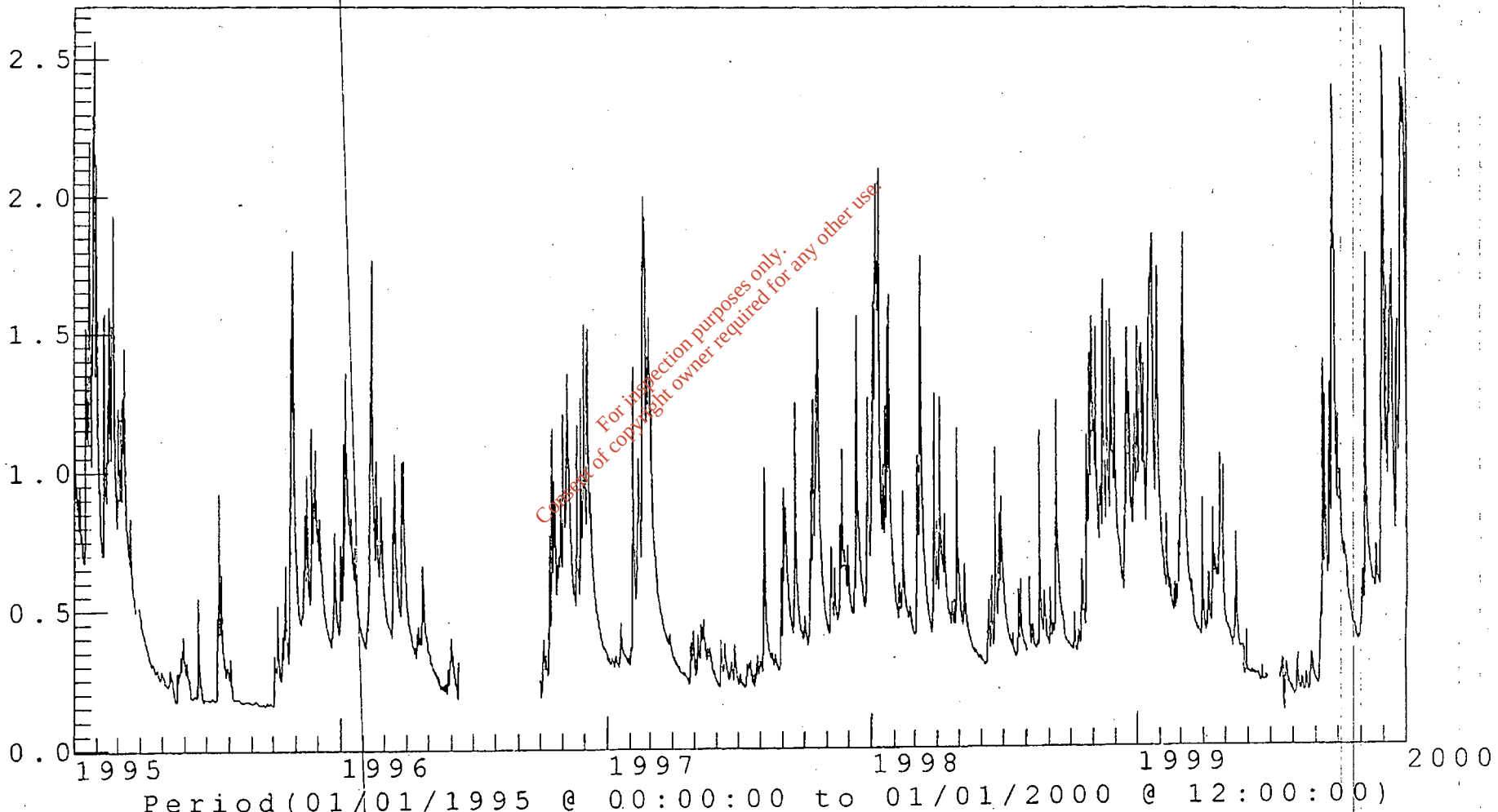
/04/2001 @ 11:41
me Series Plotting 4

Office of Public Works
Hydrometric Division

Time Series Plotting

29014.1/100.00/1: Caherfinesker - Level (m)



Office of Public Works
Hydrometric Division

Time Series Plotting

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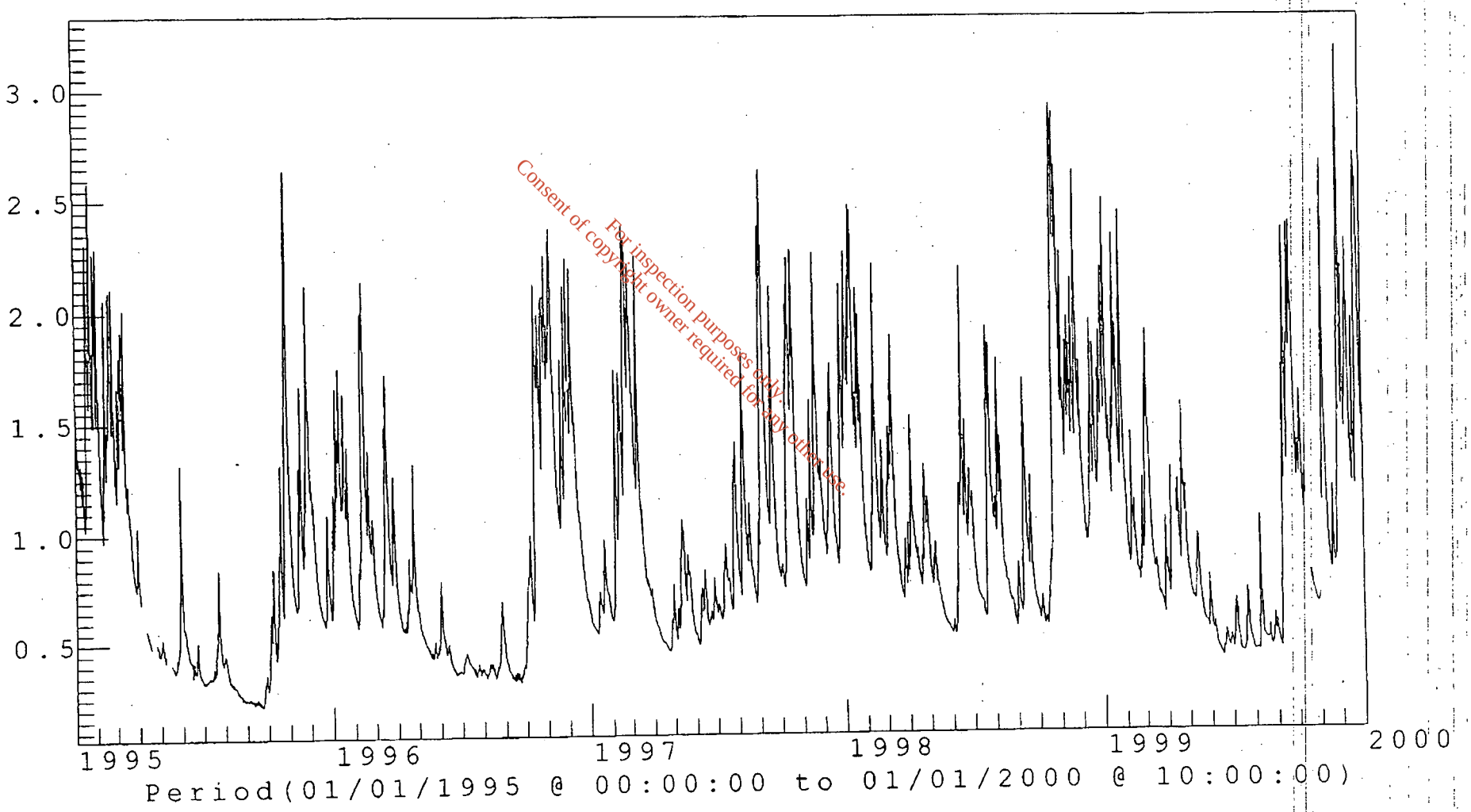
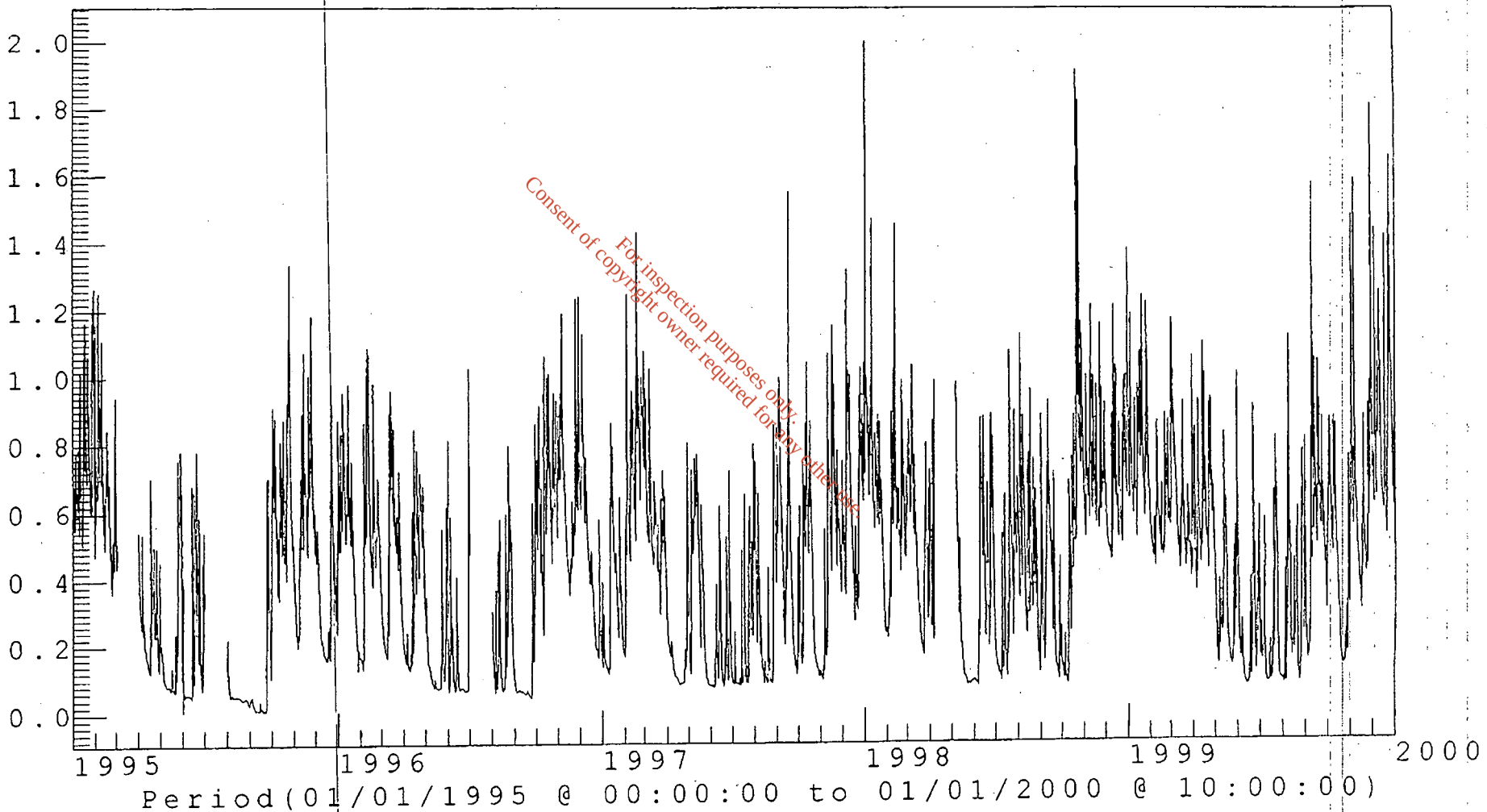


Office of Public Works
Hydrometric Division

Time Series Plotting

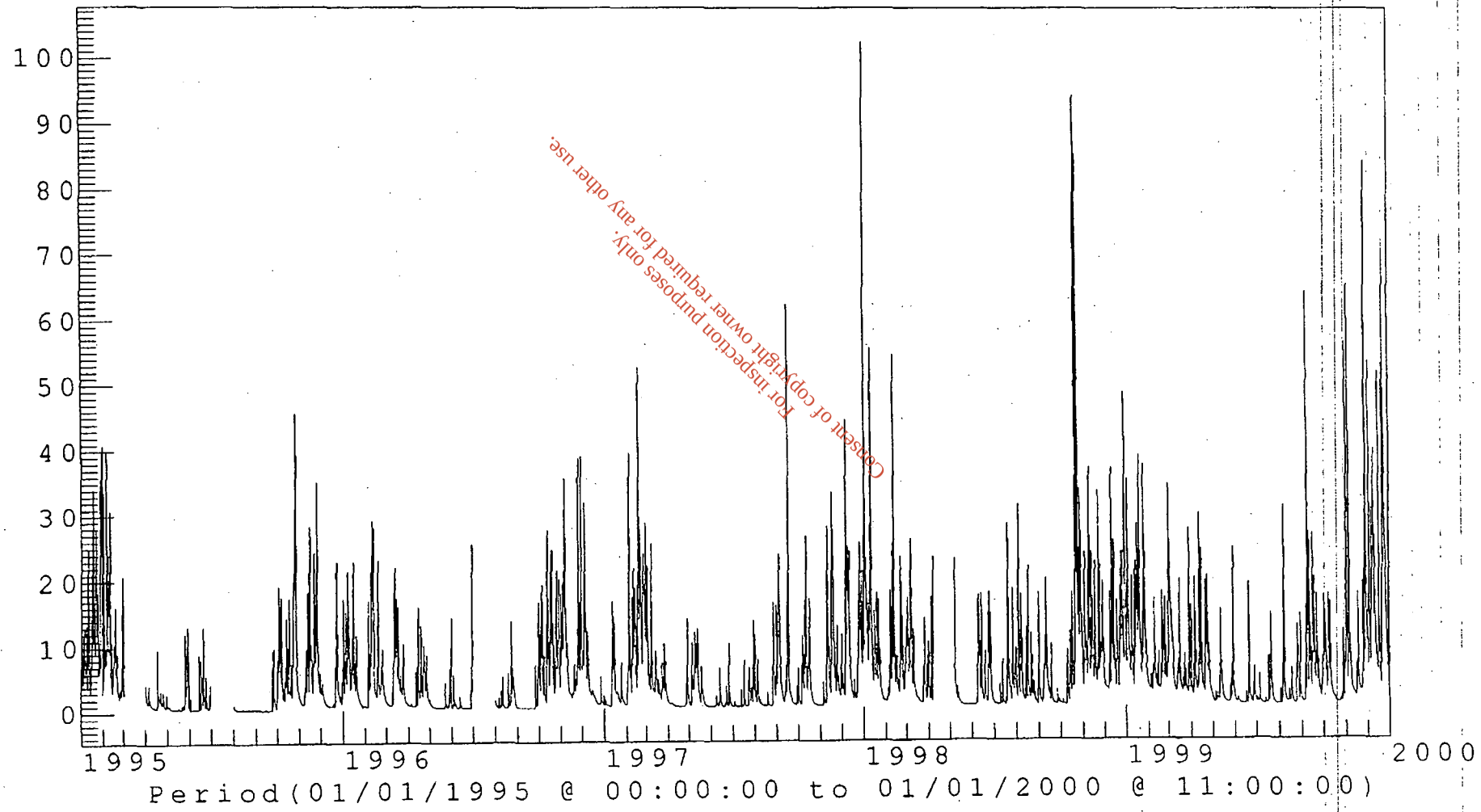
34007.1/100.00/1: Ballycarroon - Level (m)



Office of Public Works
Hydrometric Division

Time Series Plotting

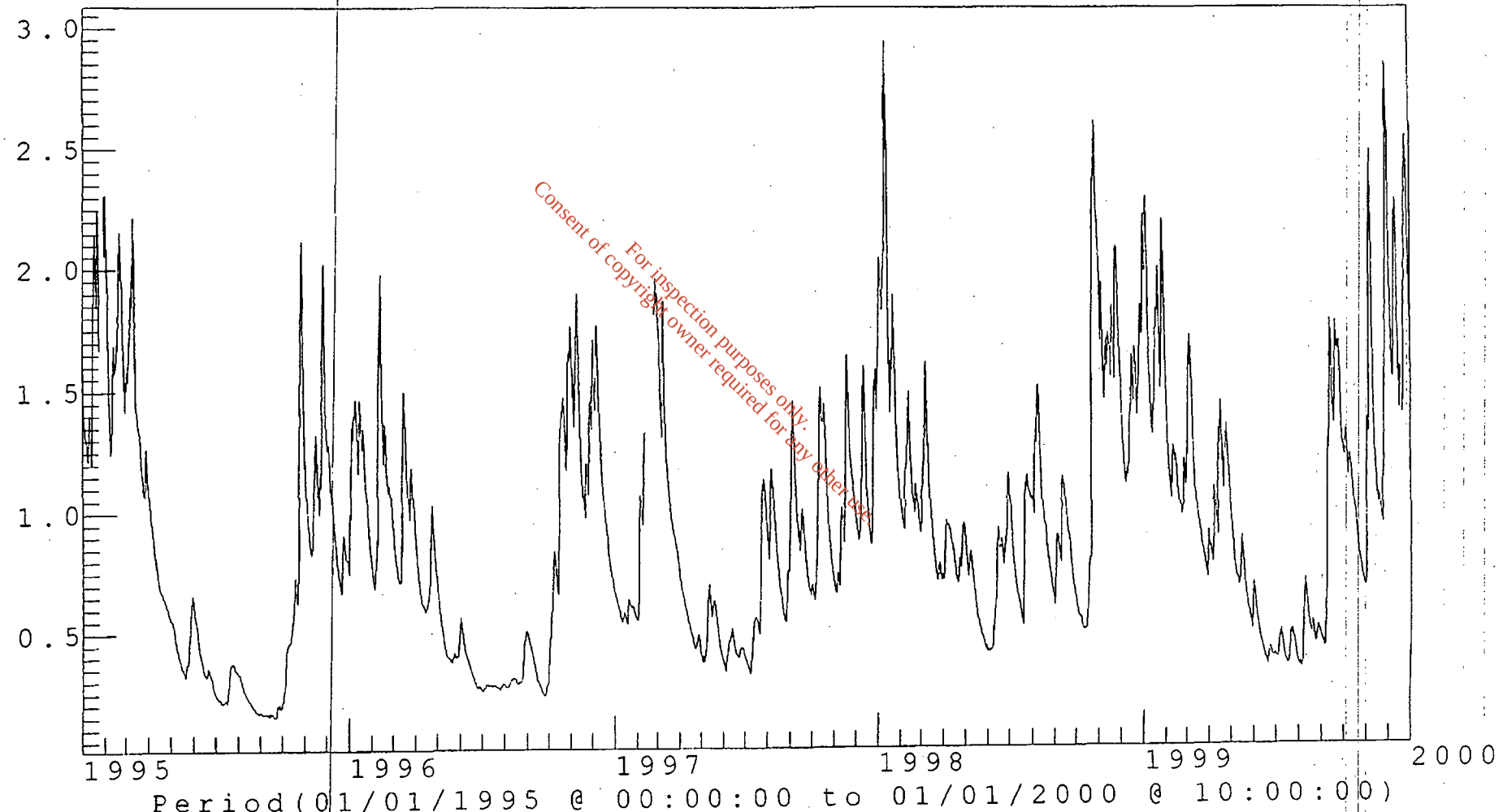
34007.1/100.00/1: Ballycarroon (PTo(200.00,0)) - Flow Cmcs



Office of Public Works
Hydrometric Division

Time Series Plotting

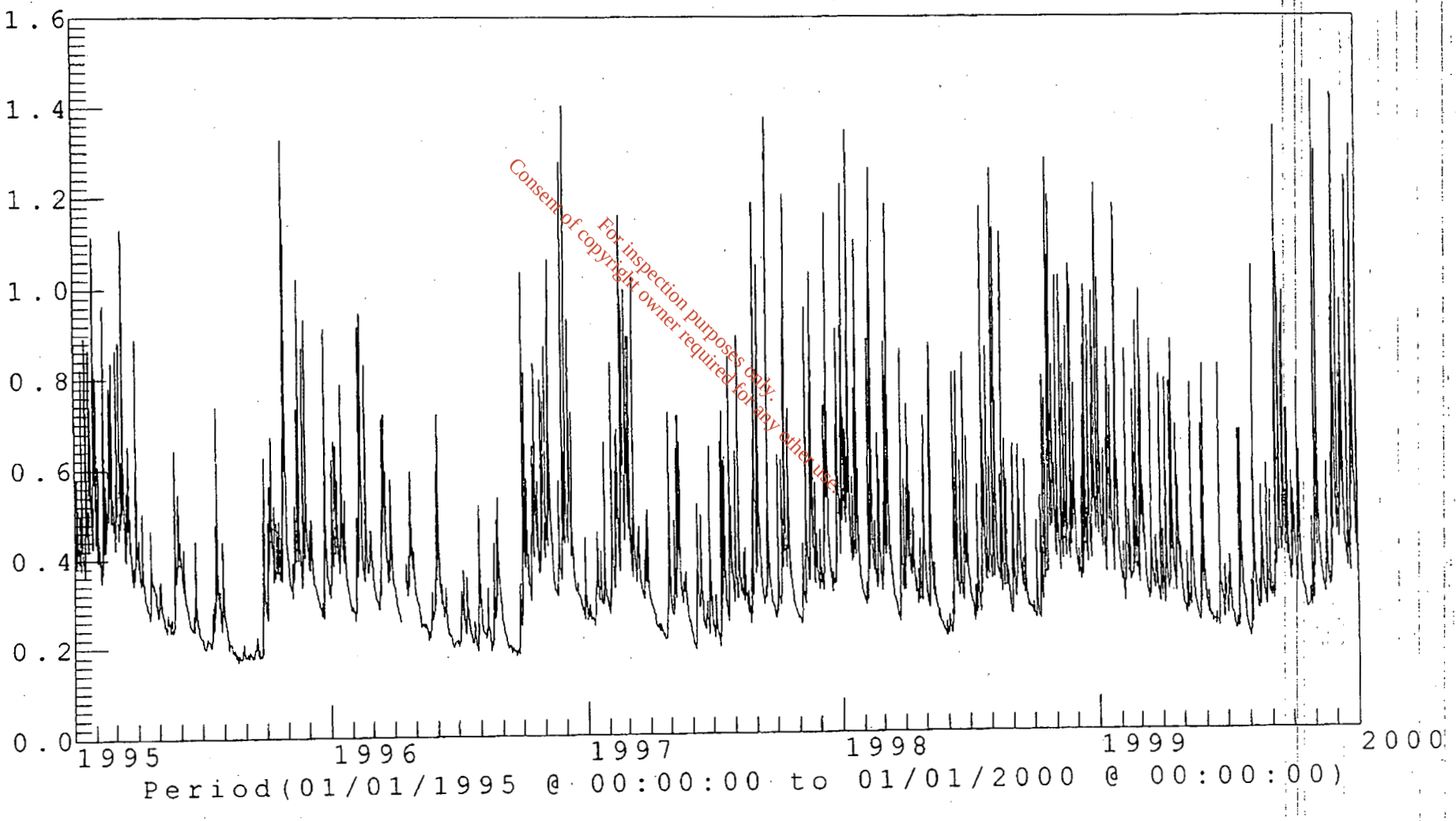
34011.1/100.00/1: Gneeve Bridge - Level (m)



Office of Public Works
Hydrology and Hydrometric Section

Time Series Plotting

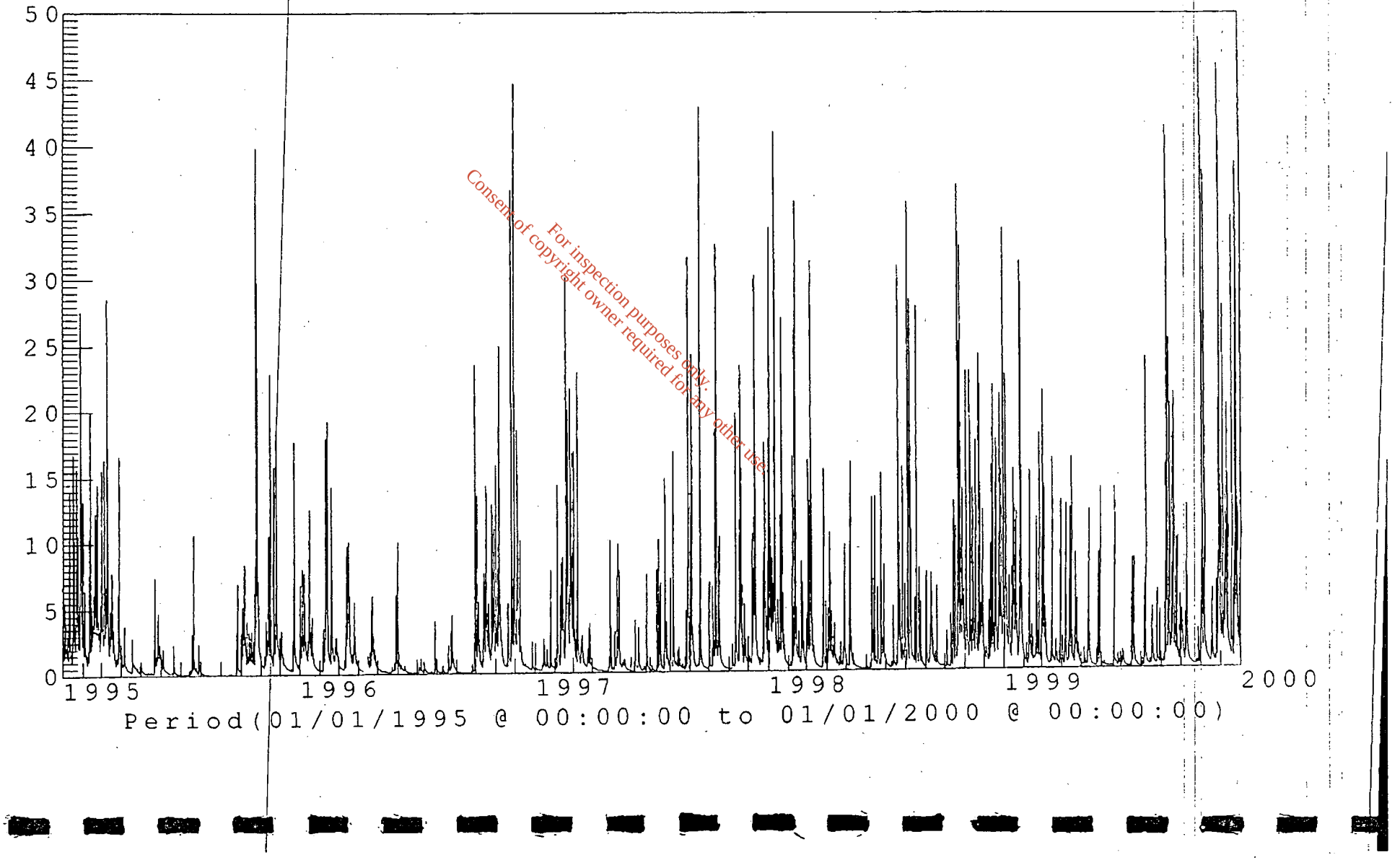
34014.1/100.00/1: Mill Bridge - Level (m)



Office of Public Works
Hydrology and Hydrometric Section

Time Series Plotting

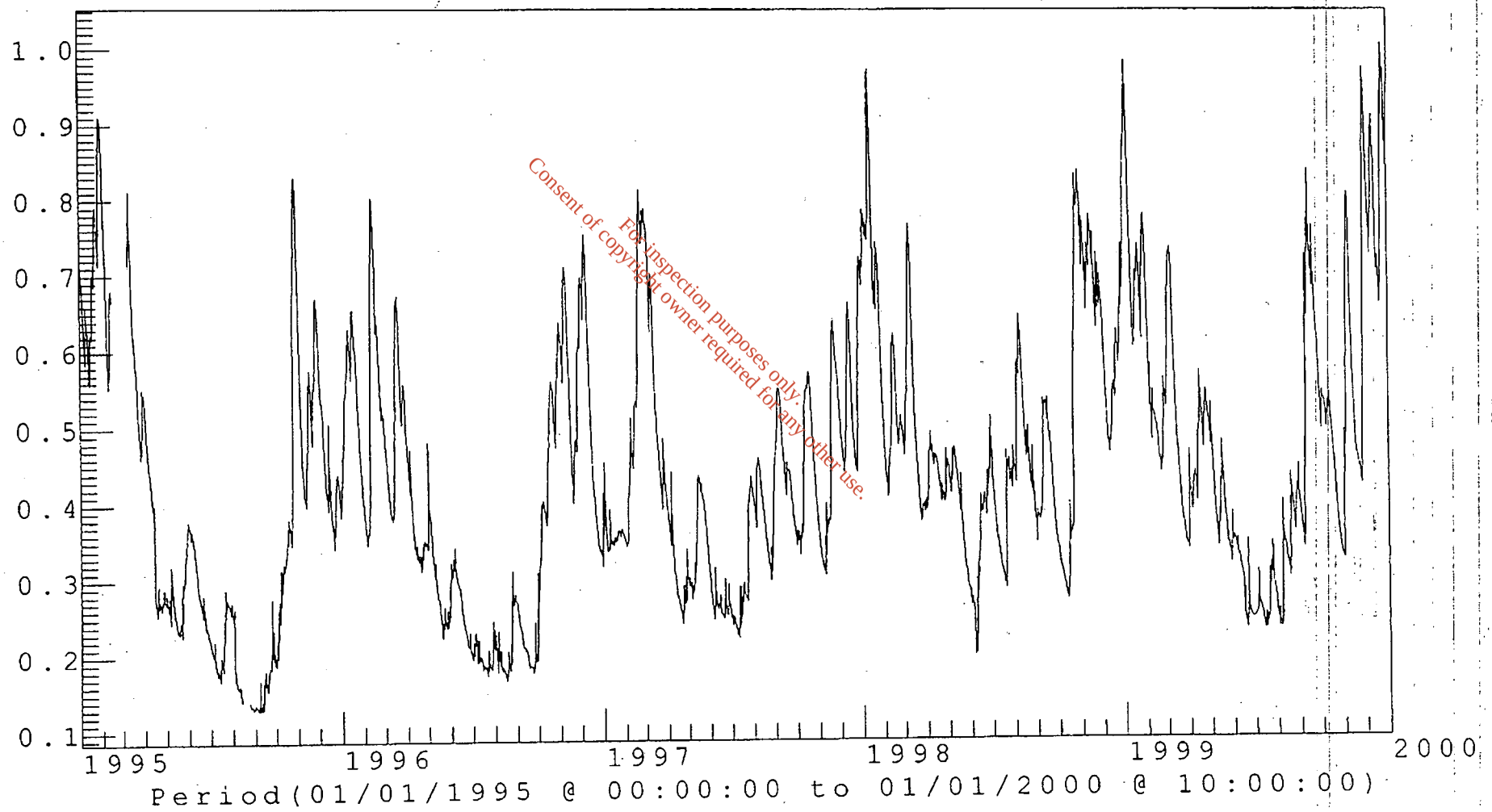
34014.1/100.00/1: Mill Bridge (PTo(200.00,0)) - Flow Cmcs



Office of Public Works
Hydrometric Division

Time Series Plotting

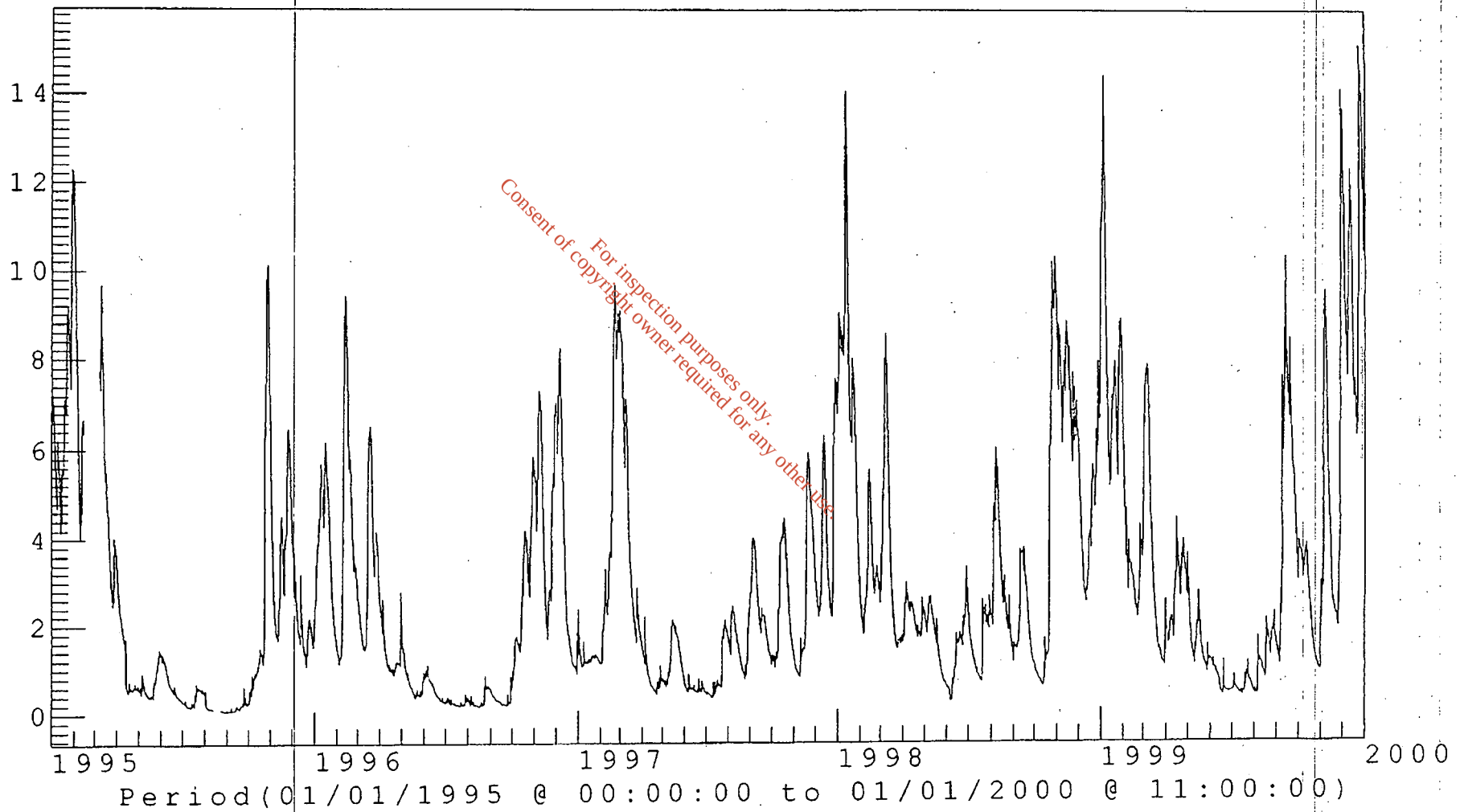
34018.1/100.00/1: Turlough - Level (m)



Office of Public Works
Hydrometric Division

Time Series Plotting

34018.1/100.00/1: Turlough (PTo(200.00,0)) - Flow Cmcs



Appendix 14.1: List of Known Archaeological Sites and Monuments Within 500m of Pipeline

LIST OF KNOWN ARCHAEOLOGICAL SITES AND MONUMENTS WITHIN 250M OF PIPELINE

The information presented below outlines the archaeological and historical potential of the area through which the proposed pipeline will pass. It is based on two main sources. The first source is the SMR manual and corresponding constraint maps at Dúchas. The second is the *Archaeological Inventory for County Galway*, Vol. II.

The sites are numbered according to the OS six-inch sheet on which they are located, so that Site No. 1 on OS six-inch sheet 45 is listed as 045:001. A county code—MA for Mayo and GA for Galway—is utilised.

All the sites listed below are within 250m of the proposed pipeline route and are shown on the accompanying SMR location map.

The national grid reference (NGR) is given for each site, as is the townland in which it is located. The NGR is presented as a ten-figure co-ordinate and indicates the position or siting of each monument.

Archaeological sites are generally classified for the purpose of impact assessment in such a way that their status in the archaeological record is suggested. The classification system is explained in Appendix D.

An area of interest is suggested for each site. This is a zone of archaeological potential around the known extant remains in which related archaeological features are likely to occur.

SMR Ref.	Townland	Monument Type	NGR	Sources	Classification	Area of Interest	Approx. Distance
MA 027:003	Tawnagh More	Cist	94970, 321720	NMI Topographical Files 1991 (co-ordinates may be inaccurate). NMI Finds Register 1991.	F, excavated	10–20m	250m
MA 028:004	Dooleg More	Standing stone	102360, 318750	Per comm. Margaret Keane 1991	D	10–20m	150m
MA 028:005	Dooleg More	Standing stone	102050, 318130	Per comm. Margaret Keane 1991	D	10–20m	150m
MA 028:006	Dooleg More	Stone Row	103260, 318800	Per comm. Margaret Keane 1991	D	10-20m	150m
MA 028:003	Eskeragh	Pre-bog walls, standing stone, court tomb, stone row, enclosure.	104960, 318820	Per comm. P. Walsh 1990 and Margaret Keane 1991	C	Unknown	150m
MA 037:003	Knockbrack	Enclosure	107710, 314860		D	20-30m	70m
MA 038:065	Killacorraun	Ringfort and Souterrain	108430, 313460	Per comm. Margaret Keane 1991	C	Unknown	70–100m
MA 038:151	Killacorraun	Mound	108470, 313100	Per comm. Margaret Keane 1991	D	20–30m	100m
MA 038:152	Killacorraun	Cashel	108780, 312960	Per comm. Margaret Keane 1991	C	20–30m	70m
MA 038:100	Srahyconigaun	Ringfort	108980, 312420	Per comm. Margaret Keane 1991	D	20–30m	170–200m
MA 038:108	Doonbreedia	Enclosure	109990, 311740		C	20–30m	100m
MA 038:109	Doonbreedia	Ringfort	110060, 311510	Per comm. Margaret Keane 1991	C	20–30m	50m

SMR Ref.	Townland	Monument Type	NGR	Sources	Classification	Area of Interest	Approx. Distance
MA 047:002	Ballymoyock	Ringfort and Children's Burial Ground	110790, 311140	Per comm. Margaret Keane 1991	C	20–30m	50m (located in an adjacent field to the monument)
MA 047:003	Ballymoyock	Ringfort	110980, 311300	Per comm. Margaret Keane 1991	D	20–30m	100m
MA 047:006	Ballymoyock	Enclosure	110980, 311230	Per comm. Margaret Keane 1991	Unknown	20–30m	100m
MA 047:005	Carrowkeel (ed Addergoole).	Ringfort	111560, 310720	Site levelled. Per comm. Margaret Keane 1991	G	20–30m	120m
MA 047:007	Carrowkeel (ed Addergoole).	Ringfort	111770,	Per comm. Margaret Keane 1991 E.B. Aldbridge (1986-87), *The Routes Described in the Story Called Táin Bo Flidhais* in the North Mayo Historical Journal, Vol. 1, No. 5 pp 60–66.	G	20–30m	160–200m
MA 047:012	Lahardaun	Enclosure	112720,		G	20–30m	200m
MA 047:024	Lahardaun	Enclosure	113320,		C	20–30m	150m

SMR Ref.	Townland	Monument Type	NGR	Sources	Classification	Area of Interest	Approx. Distance
MA 047:026	Knockfarnaght	Archaeological Complex	113700,	JRSAI Proceedings ('The Excursions') 1898 p.283; Knox 1918, pp 157 - 63De Valera and Ó Nualláin *Survey o the Megalithic Tombs of Ireland* 1964 p. 98 O' Donovan 1838, p. 185 Per comm. Christy Lawless, Turlough 1991, hut site Per comm. Margaret Keane - ring barrow with outer enclosure.	C	200x200m shown on the SMR map.	250–300m
MA 047:060	Lahardaun	Enclosure Possible ("Non Antiquity")	112870,	GSI G 243-2, Roll 221, Print 32	G, not archaeological	None	
MA 047:061	Lahardaun	Enclosure Possible, Field Walls	113190,	GSI G 242-3	F	Unknown	200–230m
MA 047:066	Lahardaun	Ringfort	113430,	Per comm. Margaret Keane 1991.	D	20–30m	30m

MA 059:009	Massbrook South	Enclosure (Non-antiquity)	116610,		G, possibly non-Archaeological	None	200m

SMR Ref.	Townland	Monument Type	NGR	Sources	Classification	Area of Interest	Approx. Distance
MA 060:051	Largan	Hut site	117850,	Site discovered by Mr. Christy Lawless, Turlough, Castlebar See master file.	UC	Unknown	200m
MA 070:172	Rockfield	Ringfort	118060,	Per comm. Mr. Christy Lawless, Turlough, Castlebar.	D	20–30m	200m
MA 070:180	Clogher	Enclosure	11933/29257		D	20–30m	150m
MA 070:181	Clogher	Enclosure	11928/29239		D	20–30m	150m
MA 079:003	Clougher (ED. Turlough)	Ringfort	118800,	OPW Topographical Files, 1959.	D	20–30m	200m
MA 079:011	Ballinvoash	Enclosure	119550,		D	20–30m	70–100m
MA 079:030	Ballinvoash	Enclosure	119320,		D	20–30m	200–240m

MA 079:031	Ballinvoash	Enclosure site	119540,		G	20–30m	50–70m
MA 079:038	Drumdoogh	Enclosure	120290,		D	20–30m	170–180m
MA 079:039	Drumdoogh	Enclosure	120510,		D	20–30m	250m
MA 079:058	Skiddernagh	Enclosure/rath	Not available		D	20–30m	c. 80m
MA 079:082	Creaghanboy	Ecclesiastical Remains - Possible	122440,	O' Donovan Aldridge, JRSAI, Vol. 99, 1969	G, site	Unknown	100–130m
MA 079:083	Lisnolan	Enclosure	122610,		D	20–30m	190–200m

MA 079:031	Ballinvoash	Enclosure site	119540,		G	20–30m	50–70m
MA 079:038	Drumdoogh	Enclosure	120290,		D	20–30m	170–180m
MA 079:039	Drumdoogh	Enclosure	120510,		D	20–30m	250m
MA 079:058	Skiddernagh	Enclosure/rath	Not available		D	20–30m	*c.* 80m
MA 079:082	Creaghanboy	Ecclesiastical Remains - Possible	122440,	O' Donovan Aldridge, JRSAI, Vol. 99, 1969	G, site	Unknown	100–130m
MA 079:083	Lisnolan	Enclosure	122610,		D	20–30m	190–200m

MA 079:084	Lisnolan	Enclosure	122980,		F-G	20–30m	150–200m
MA 090:046	Tullymore	Crannóg	123870,		UC	20–30m	230m
MA 090:048	Brownwall	Enclosure	123680,		UC	20–30m	150m
MA 090:070	Ballymackeogh	Enclosure and Souterrain	124840,		UC	20–30m	100–120m
MA 101:031	Polldrian	Enclosure	129040,		UC	20–30m	200m

SMR Ref.	Townland	Monument Type	NGR	Sources	Classification	Area of Interest	Approx. Distance
MA 101:046	Polldrian	Enclosure	128820,		UC	20–30m	150m
MA 101:048	Carrowmore	Enclosure	128950,		UC	20–30m	70m
MA 111:007/01	Tagheen East	Ecclesiastical remains	128840,		UC	50–100m	100–120m
MA 111:023	Garreens	Enclosure	128890,		UC	20–30m	150m
MA 111:025	Garreens	Enclosure	129300,		UC	20–30m	250m

MA 111:039	Clooneen	Enclosure	128880,		UC	20–30m	200m
MA 111:050	Lissatava	Enclosure	129010,		UC	20–30m	180m
MA 111:051	Lissatava	Enclosure	129480,		UC	20–30m	200m
MA 111:054	Bushfield	Enclosure	12914/22634		UC	20–30m	220m
MA 119:026	Annefield	Enclosure (non-antiquity)	129800,		G	20m	75m
MA 119:025	Annefield / Davros	Earthwork	129860,		G	approx.	Pipeline to avoid area
MA 119:027	Davros	Enclosure	130320,		D	20–30m	100–150m

MA 119:044	Davros	Enclosure / Ringfort	130480,		D	20–30m	80–100m
MA 119 (Discovered 2000)	Davros	Enclosure (possible)	Not available		D	20–30m	80–100m
MA 119:059	Oultauns	Ringfort and Children's Ground	132010,		D	20–30m	150m
GA 015:002	Ardour	Named Well	13213, 25904		D	10–20m	80m
SMR Ref.	**Townland**	**Monument Type**	**NGR**	**Sources**	**Classification**	**Area of Interest**	**Approx. Distance**
GA	Kilshanvy	Conjoined Ringfort	13174, 25830		D, extensive site	20–30m	250m
GA	Kilshanvy	Souterrain	13174, 25829		As above	20–30m	250m

GA 028:001	Ardour /	Bivallate Ringfort	13205, 25807		C	20–30m	40m
GA 028:035	Kilshanvy	Univallate Ringfort	13230, 25751		C	20–30m	150m
GA	Kilshanvy	Univallate Ringfort	13233, 25754		C	20–30m	120m
GA	Kilshanvy	Souterrain Probable	13233, 25754		F, part of a site	20–30m	120m
GA 028:034	Kilshanvy	Bivallate Ringfort	13215, 25737		D	20–30m	250m
GA 028:009	Cloonsheen	Univallate Ringfort	13225, 25615		D	20–30m	130m

SMR Ref.	Townland	Monument Type	NGR	Sources	Classification	Area of Interest	Approx. Distance
GA 042:025	Beagh Beg	Ecclesiastical Remains	13226, 25144		F- G	50–100m	200m
GA 042:029	Biggera Beg	Univallate Ringfort	13559, 24607		D	20–30m	50m
GA 042:074A/B	Carheenard	Enclosure and Field	13306,25084 and 13303,		F	250x250m	100m at its closest point
GA 042:065	Caltragh	Circular Enclosure	13470, 24844		D	20–30m	100m
GA 042:066	Caltragh	Circular Enclosure	13489, 24825		D	20–30m	170m
GA 042:067	Caltragh	Unclassified Earthwork	13488, 24814		G	20–30m	100m
GA 042:068	Caltragh	Unclassified Earthwork	13487, 24812		G	20–30m	50m
GA 042:070	Caltragh	Polygonal Cist	13457, 24868		F- G	10–20m	60–90m
GA 042:071	Carheenard	Enclosure	13347,25036		G	Unknown Area of Interest	200m
GA 42:95	Cave	Unclassified earthwork	13400,24907		D	20–30m	200m
GA 056:088	Laurclavagh	Circular Enclosure	13616, 24408		G	20–30m	60–80m
GA 057:064	Bunoghanaun	Univallate Ringfort	13090, 24957 (incorrect; verified as 137009,		D	20–30m	60–80m

GA 057:142	Slievefin	Enclosure	13883, 23900		G	20–30m	130–150m
GA 070:096	Racoona	Enclosure	13905, 23854		G	20–30m	80–50m
GA 070:105	Knockdoebeg West	Ringfort	13994, 23723		D	20–30m	30–40m
GA 070:104	Knockdoebeg West	Ringfort	13979, 23706		D	20–30m	150–180m
GA 070:080	Knockdoebeg West	Battlefield	14047, 23682		Extensive site no apparent remains	150m by 250m	100m
GA 070:6:6	Knockdoemore	Ringfort	14027, 23630		D	20–30m	130m
GA 070:057	Cregmore	Univallate Ringfort	14194, 23376		D	20–30m	230m
GA 083:044	Knocknacreeva	Enclosure	145010,		D	20–30m	100m
GA 083:045	Knocknacreeva	Earthwork	144890,		G	20–30m	50m
GA 084:122	Rathmorrisey	Ringfort / Rath / Cashel	147370,		UC	20–30m	<50m

GA	Cloran	Cashel	147800,		D	20–30m	150m
GA	Cloran	Souterrain	147800,		F (part of the site)	20–30m	150m
GA 096:061	Cloran	Ringfort	147650,		C-D	20–30m	150m
GA 096:051	Castleturvin	Ecclesiastical remains	148420,		C-D	50–100m	120m
GA 096:029	Cahercrin	Childrens Burial Ground,	14891, 22401		D	30m	c. 250m

		Ringfort					
GA 096:031	Cahercrin	House	14900, 22397		UC	20m	250–300m
GA 096:030	Cahercrin	Ringfort, Souterrain	14910, 22360		C-D	20–30m	150m
GA 096:165	Templemartin	Church and Graveyard	15067, 22213		C-D	50m	approx. 60–
GA 096:012	Ballywinna	Enclosure	151710,		UC	Unknown	200–250m
GA 096:010	Ballywinna	Ringfort; Children's Burial Ground	152130,		UC	Unknown	200m
SMR Ref.	**Townland**	**Monument Type**	**NGR**	**Sources**	**Classification**	**Area of Interest**	**Approx. Distance**
GA 096:099	Garracloon South	Enclosure	152200,		UC	Unknown	50–100m
GA 096:098	Garracloon South	Ringfort, Childrens Burial Ground	15240, 22139		UC	Unknown	30–50m
GA 096:092	Ganty	Souterrain	152830,		F	20–30m	50–100m

Appendix 14.2: List Of Stray Finds

GA 096:094	Ganty	House	152800,		UC	Unknown	100–200m
GA 096:006	Ballyageeragh,	Earthwork	15303, 22099		UC	Unknown	180m

The information presented below is based on the National Museum of Ireland Topographical Files. These files record stray finds reported to or held by the National Museum. The following list provides the registration number of the find, the townland in which it was found and, where available, the context of the find.

County Mayo

Townland	Reg No.	Find	Context
Bellacorick	IA/43/80	Wooden V-shaped object	Found in bog
Bellacorick	1944:218	Wooden vessel	Found in bog
Davros	1971:955	Bronze spearhead	
Dooncarton (Glengad)	1961:138	Human skull fragments and teeth	
Dooleeg More	M1950:8	Cylindrical wooden vessel	
Dooleeg More	1948:8	Wooden deer trap (in four parts)	
Dooleeg More	M1950:16	Wooden vessel fragments	
Inver	1955:37; 38	Polished bone objects	
Lisnolan	1934:5945	Bronze spearhead	Found in bog
Massbrook Lower	1959:26	Stone axehead (riverstone type)	
Rosdoagh	1957:256	Polished stone axehead	
Rosdoagh	P1953:23	Flint arrowhead, barbed and tanged	
Rosdoagh	1968:440a, 440b	Stave-built wooden vessel with bog butter fragments	
Smuttanagh	81.2625	Bronze dish	Loona Bog
Tawnagh	1968-78, 79	Rough-outs for wooden bowls	
Tawnaghmore	1971:1042	Human bones	Cist grave
Tawnaghmore	1960:620	Decorated wooden vessel	
Tawnaghmore	1960:610	Lid for 1960:620	

County Galway

Townland	Reg No.	Find	Context
Beagh More	1950:19	Leather shoe and bog butter container	Bog at Ummoon
Beagh More	E185:21	Flat copper axe	
Beagh More	1949:14	Bronze pin	
Caltragh	1958:2-5, 5a	Cinerary urn, sherd of enlarged food vessel, flint slug knife, bone pin and cremated human bones	
Castlehackett	1932:6524	Food vessel	Cairn at Knockura
Kilshanvy	1932:6413-6418	Bronze pins, bracelets and ear rings	
Kilshanvy/ Nettlehill	1932:6363	Stone axehead (broken)	

Appendix 14.3: National Monuments Legislation

National Monuments Legislation

All archaeological sites have the full protection of the national monuments legislation (Principal Act 1930; Amendments 1954, 1987 and 1994).

In the 1987 Amendment of Section 2 of the Principal Act (1930), the definition of a national monument is specified as:

> any artificial or partly artificial building, structure or erection or group of such buildings, structures or erections,
>
> any artificial cave, stone or natural product, whether forming part of the ground, that has been artificially carved, sculptured or worked upon or which (where it does not form part of the place where it is) appears to have been purposely put or arranged in position,
>
> any, or any part of any, prehistoric or ancient
>
> (i) tomb, grave or burial deposit, or
>
> (ii) ritual, industrial or habitation site,
>
> and
>
> any place comprising the remains or traces of any such building, structure or erection, any cave, stone or natural product or any such tomb, grave, burial deposit or ritual, industrial or habitation site.

Under Section 14 of the Principal Act (1930),

> It shall be unlawful..
>
> to demolish or remove wholly or in part or to disfigure, deface, alter, or in any manner injure or interfere with any such national monument without or otherwise than in accordance with the consent hereinafter mentioned (a licence issued by the Office of Public Works National Monuments Branch),
>
> or
>
> to excavate, dig, plough or otherwise disturb the ground within, around, or in the proximity to any such national monument without or otherwise than in accordance..

Under Amendment to Section 23 of the Principal Act (1930),

> A person who finds an archaeological object shall, within four days after the finding, make a report of it to a member of the Garda Siochana..or the Director of the National Museum..

The latter is of relevance to any finds made during a watching brief.

In the 1994 Amendment of Section 12 of the Principal Act (1930), all the sites and 'places' recorded by the Sites and Monuments Record of the Office of Public Works are provided with a new status in law. This new status provides a level of protection to the listed sites that is equivalent to that accorded to 'registered' sites (Section 8(1), National Monuments Amendment Act 1954) as follows:

> The Commissioners shall establish and maintain a record of monuments and places where they believe there are monuments and the record shall be comprised of a list of monuments and such places and a map or maps

Appendix 14.4: Classification Table for EIS

showing each monument and such place in respect of each county in the State.

The Commissioners shall cause to be exhibited in a prescribed manner in each county the list and map or maps of the county drawn up and publish in a prescribed manner information about when and where the lists and maps may be consulted.

In addition, when the owner or occupier (not being the Commissioners) of a monument or place which has been recorded, or any person proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such monument or place, he shall give notice in writing of his proposal to carry out the work to the Commissioners and shall not, except in the case of urgent necessity and with the consent of the Commissioners, commence the work for a period of two months after having given the notice.

Appendix 14.5: Archaeological Site Investigation Sheet

Classification Table for EIS

EPA Impacts	Impact Level	Criteria for EIS	Category	Status	Implications
Profound or significant, (negative effect only)	Severe	Reserved for adverse effects only. Applies where mitigation would be unlikely to remove such effects. The effects are generally but not exclusively associated with sites and features of international or national importance	A	National Monument	Sites must be avoided
Significant impact, (positive or negative)	Major	Important considerations at a national to regional level. If adverse, they have the capacity to become key components in the structuring of the project. Mitigation measures are unlikely to remove all effects upon the affected communities or interests	B	Nationally important site/ or very rare in the archaeological record	Sites must be avoided
	Moderate	Represents issues where mitigation measures and detailed design work may ameliorate/enhance some of the consequences upon affected interests. If adverse, they are important but not likely to be key decision makers on the EIS. The effects can be mitigated.	C	Extensive, well-preserved sites (ringforts, castles, churches, graveyards, burial mounds) not necessarily rare in the archaeological record	Sites should be avoided, if possible. All archaeological investigation work should take place pre-development well in advance of construction
			D	Sites similar to those in category C, but not as well preserved or extensive	Avoidance is recommended. If not an option, full archaeological excavation ensuring preservation by record would be required. Archaeological work should be conducted at the pre-development stage
			E	Historical Building Sites, post 1700AD and industrial buildings and/or structures.	Archaeological/architectural building survey. Sites are assessed by survey and photographic and historic record. To take place at the pre-construction and/or construction phase
			F	Low visibility sites/features, i.e., fulachta fiadh, souterrains/ lithic scatters	Archaeological investigation/excavation prior to the construction phase. If archaeological material is found, full excavation or avoidance can then be cited
	Minor	Not significant in the decision making process. Can be of relevance to the subsequent design of the project	G	Sites of sites, destroyed or delisted, marked on the OS, or known from documentary sources	Area needs to be archaeologically assessed in the field. Sometimes monitoring is required during the construction phase
	Unknown		UC	Sites of possible archaeological potential but of unquantified extent and significance	Trial excavations for a detailed assessment would be required and a full excavation may be recommended. To take place pre-construction
Neutral or slight Impact	Not significant	The forecasting framework cannot envisage any effect on the environment	N/A	N/A	An area of archaeological potential must be observed around all sites

Archaeological Site Investigation Sheet

ENTERPRISE OIL - CORRIB PIPELINE Site Investigation		
Trial Pit No. *TP -*	*Townland Name*	*OS 6" Sheet No.* *Mayo:*
General Topography		
Dimensions of Trial Pit	*General Information*	
Width:	*Photo:*	
Length:	*Sketch:*	
Depth:	*Initials & Date:*	
Details of Stratigraphy:		
Proximity to Archaeological Monuments:		
Additional Information:		
Access:		
Photo:		
Description:		
Roll No:	*Neg No:*	
Sketch:		

AGRICULTURAL LIAISON OFFICER	A BGÉ employee who provides a communication link between landowner/occupiers and Bord Gáis Éireann
ALLUVIUM	Detrital material, commonly composed of sands and gravels, transported and deposited by a river
ALO	Agricultural Liaison Officer
ANTICLINE	Fold or fold system in the form of an arch
AOD	Ordnance Datum
AQUIFER	A water bearing bed of strata, either by virtue of its porosity or because it is pervious
AUGER	A tool for boring holes
BAR	A unit of pressure
Barg	bars above atmospheric pressure
BAT	Best Available Technology
BATNEEC	Best Available Technology Not Entailing Excessive Costs
BEDDING	Layers within sedimentary rocks characterised by differences in composition, texture or structure
BGÉ	Bord Gáis Éireann
BH	Borehole
BIOCIDES	Chemicals which destroy living organisms within the pipeline during hydrotesting
BOD	Biological Oxygen Demand
BP	Before Present
BPEO	Best Practicable Environmental Option
BRONZE AGE	*c.* 2300 BC–500 BC
BUND	An earth embankment
CAIRN	Burial mound composed of stones, sometimes with internal structures
CHILDREN'S BURIAL GROUND	A burial ground used for unbaptised children, and others who could not be buried on consecrated ground. Graves are sometimes marked with simple stones, and burials are occasionally set within earlier enclosures, or outside church sites.
CIST	Box-like structure of stone, set into the ground or into a burial monument, used to contain the burial.
COD	Chemical Oxygen Demand
COURT TOMB	Megalithic tomb dating to the Early Neolithic, so called because of a its large open court feature with a gallery leading into a long trapezoidal cairn
DAFOR	Ecological abundance classification D: Dominant A: Abundant F: Frequent O: Occasional R: Rare
DEEP-TINE CULTIVATION	Blades pulling behind a tracked vehicle used to loosen compacted soils
DIP	The angle in degrees between a horizontal plane and an inclined feature such as rock strata

DRIFT	A general name for the superficial as distinct from the solid formation of the earth's crust or material deposited by a glacier.
EARTHWORK	Any monument made entirely or largely of earth.
EASEMENT	Permanent wayleave negotiated with the landowner
EC	European Commission
EIA	Environmental Impact Assessment
ENCLOSURE	Any monument consisting of an enclosing feature, such as a bank or a ditch, usually earthen, such as barrows or ringforts.
ENVIRONMENTAL IMPACT ASSESSMENT	A systematic study which identifies and predicts the effects on the bio-geophysical, social and economic environment of a project
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EQS	Environmental Quality Standard
EU	European Union
EVAPO-TRANSPIRATION	Combined water loss through evaporation and transpiration by plants
EXCAVATABILITY	Related to the ease with which the trench can be dug
FIELD SYSTEM	Pattern of fields, now no longer in use, usually visible as low earthworks, often associated with medieval or earlier settlements
FOSSE	Ditch associated with a ringfort.
FULACHT FIADH	Bronze Age cooking sites
FPO	Floral Protection Order
GEOTEXTILE SHEET	A permeable synthetic membrane specifically designed to be used as a construction material
GLEY SOILS	Waterlogged soils that develop where the drainage is poor or the water table high
GPR	Ground Penetrating Radar
HDD	Horizontal Directional Drilling
HOLY WELL	A natural spring or well with an association with a saint, or a tradition of cures. Often found near ecclesiastical or monastic sites.
HORIZONTAL DIRECTIONAL DRILLING	A method of drilling and installing pipelines under large features, such as rivers, with minimal ecological and environmental impact.
HP	High Pressure
HUT SITE	Small ring of stones representing the foundation of a hut. Can be of any date, usually found in upland or marginal land
IFA	Irish Farmers Association
INTELLIGENT PIG/ PIG	A device used for the measurement of several parameters which operates inside a pipe
Iron Age	c. 500 BC – AD 500
Leq	The equivalent continuous sound level (Leq) that is the notional steady noise level which, over a given period, would deliver the same amount of sound energy as the actual fluctuating level

LINEAR EARTHWORK	A long bank or ditch, often a territorial boundary such as the Pale. Can be of any date
MEGALITHIC TOMB	Literally 'large-stone' Neolithic tomb
MESOLITHIC	Middle Stone Age (c. 10,000 BC–4000 BC)
NATURAL GAS	Gaseous forms of petroleum consisting of a mixture of hydrocarbon gases, the most important of which is methane
NEOLITHIC	New Stone Age (c.4000 BC–2300 BC)
NHA	Natural Heritage Area
NMI	National Museum of Ireland
OPEN-CUT CROSSING	A method of pipeline crossing whereby an open trench is dug
OS(I)	Ordnance Survey (Ireland)
PEDOLOGICAL	The scientific study of soils, including their origins, characteristics, and uses
PIG	Pipeline Integrity Gauge: cylinders fitted with rubber or neoprene cups which conform and fit the internal bore of the pipe allowing them to be propelled at a controlled speed through the pipe
PIG TRAP	Equipment for launching and receiving pigs through a pipeline
pNHA	Proposed Natural Heritage Area
PORTAL TOMB	Megalithic tomb dating to the Early Neolithic, so called because of its large door feature, on which a large capstone is balanced. Known also as dolmens or cromlechs. Usually situated near streams and rivers
RUDERAL	Plants which colonise open ground
SAC	Special Area of Conservation
SEMI-NATURAL HABITAT	Habitat modified by human activity from its original state but with a vegetation composed of native species similar in structure to natural types and with native animal communities
SHEET PILING	Vertical supports for trench excavations i.e. wall support.
SI	Statutory Instrument
SMR	Sites and Monuments Record
SPA	Special Protection Area
STONE CIRCLE	Ceremonial ring of stones dated to the Bronze Age, occasionally associated with burials
(PIPE) STRINGS	Assembled lengths of pipe
SUBSOIL	The layer of soil between the topsoil and bedrock
SWARD	Mixture of grasses forming a turf
SYNCLINE	A basin shaped fold or fold system
TILL/BOULDER CLAY	A poorly sorted mixture of sands, clays and boulders produced by the erosion of rocks by moving ice
TOGHER	Literally a causeway, usually used to mean a wooden trackway across a bog
TOPOGRAPHY	The physical features or configuration of a land

	surface
TP	Trial Pit
TRENCH STABILITY	Ease of producing trenches (without collapse)
TURLOUGH	Formed when solution cavities within the limestone collapse to form surface depressions.
VENTING	Release of high pressure gas to atmosphere
WAYLEAVE	Permission or consent to build and maintain the pipeline
WEDGE TOMB	Megalithic tomb dating to the Late Neolithic and Early Bronze Age; so called because of a wide high front, sloping and narrowing towards the back.
(WELL-POINT) DEWATERING	A method used for artificially lowering groundwater levels via pump extraction.
WORKING WIDTH	The area within which the pipeline construction takes place