A REPORT
ON THE
VEGETATION OF THE NANNY SUBCATCHMENT
OF THE
CORRIB/CLARE DRAINAGE CATCHMENT

BY

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SUMMARY

A survey was carried out on the vegetation of the Nanny subcatchments of the Corrib/Clare drainage catchment. The vegetation analysis resulted in the recognition of 33 plant communities in 15 major vegetation types in 5 ecosystems. The communities and ecosystems were described and the vegetation mapped. Two wetland areas of regional scientific importance were identified.

The evolution of the vegetation in the absence of the proposed scheme is outlined. It is concluded that in the absence of the proposed scheme there is unlikely to be any major changes in the area, diversity and quality of vegetation types and communities. The impacts of the proposed scheme are outlined with major losses of rare species predicted as well as a serious decline in diversity, area and quality of the more scientifically interesting vegetation types and communities.

The two wetland sites of scientific interest identified, Knockavanny Turlough (Grid Ref. M 476 542) and Drumbalcaun/ Dunblaney bog (Grid. Ref. M 508 571), do not occur on benefitting land. Their hydrology may however be unintentionally affected by the scheme. It is recommended that all possible precautions be taken to ensure that any such unplanned diverse effects do not occur. General measures for minimising the negative impacts of the proposed scheme are presented and recommended for implementation.

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1.1 OBJECTIVES

The aims of this study of the vegetation of the Nanny subcatchment of the Corrib/Clare catchment were as follows:

a) To assess the present status of vegetation in the area with special reference to the lands directly affected by drainage projects.

b) To estimate the likely evolution of vegetation in the absence of the proposed drainage scheme.

c) To estimate the likely changes in vegetation that might result from the proposed drainage project and its maintenance.

d) To make proposals for minimising the deleterious impacts of drainage on the natural vegetation.

1.2 SITE DESCRIPTION

The Nanny subcatchment (1,987 ha) lies at the western edge of the Central Plain of Ireland in North East Galway. The area is underlain by Carboniferous limestone. The topography has been moulded by retreating ice to form an extensive esker system. These long sinuous ridges, alternately narrowing and widening, characterise the local topography and flank the damaged land. Mineral soils, derived from glacial deposits cover the upland areas occupy about 77% (1,522 ha) of the catchment. These consist mostly of brown earths and grey brown podzolics (Ryan, 1963). The remaining 23% (465 ha) of the land surface is overlain by peats.

The present vegetation of the subcatchment is strongly man modified. The relatively well drained mineral soils support grassland vegetation mostly of the Centaureo - Cynosuretum typicum (O'Sullivan, 1982) which is primarily used as pasture for cattle and sheep. Woodland is rare consisting mostly of small patches of scrub dominated by Hazel (Corylus avellana) and is restricted to small relics on the eskers and on the thinner soils.

Limestone walls are the dominant type of field boundary with infrequent stretches of hedgerows. Occasional trees and shrubs of Hawthorn (Crataegus monogyna), Blackthorn (Prunus spinosa), ash (Fraxinus excelsior), Hazel (Corylus avellana) and Brambles (Rubus fruticosus agg). are associated with the limestone walls and also form the dominants in the hedgerows.

The wetland in the subcatchment is predominantly bog and communities derived from bog. At least 70% of the wetland vegetation is derived from what must have been extensive floodplain and to a lesser extent basin raised bogs. Extensive and repeated peat cutting, drainage, reclamation, burning and grazing for at least the last several 100 years has resulted in a

mosaic of natural and semi-natural plant communities. The greater part of the remaining wetland vegetation is composed of wet pastures, reedbeds and fens.

Only one small lake occurs within the subcatchment. This has a small stand of Bulrush (Scirpus lacustris). At least three turloughs occur within the subcatchment, the largest of which is at Knockavanny (14ha). Turloughs (Gaelic: tur; dry and loch; lake) are temporary lakes (apparently unique to the limestone areas of western Ireland) which fill and empty mainly through underground channels. Their generally short herbaceous vegetation is adapted to prolonged inundation during winter months and to near drought conditions and heavy grazing pressure during summer.

The river channel is no more than a stream, channelised during previous drainage activities but now blocked with vegetation for most of its length. As a result of the channelization of the last century there are no natural river stretches left within the small area of the subcatchment. The vegetation of the main channel is macrophytic, with bryophyte, lichen and encrusting algal communities very poorly developed or absent.

2.1 FIELD METHODS

The primary objective of the vegetation study was to assess the present status of vegetation in the catchment, particularly that of lands directly affected by the proposed drainage scheme. In order to do this efforts were concentrated on areas delineated by the Office of the Public Works (OPW) as "damaged" land i.e. lands currently affected by flooding or impeded drainage. Of the 1,987 hectares comprising the subcatchment approximately 452 hectares are classified by OPW as "damaged" land of which 394 hectares (87% damaged land, 20% of catchment) are expected to benefit from the drainage scheme.

Aerial photographs of the subcatchment (scale 1:25,000) were examined at the Geological survey office in Dublin to assess the gross vegetation types and to ascertain means of access to damaged land.

All areas of damaged lands were visited during September October 1983. Vegetation was sampled using the Braun Blanquet releve method. Notes were also taken on vegetation structure, microtopography, surface soil type, management activity and surrounding vegetation types. In all 83 releves were taken and in addition 28 descriptions.

2.2 ANALYTICAL METHODS

The releves were tabulated and community types were described and tentatively classified aided by keys and descriptions published by White (1982), White and Doyle (1982) and Wheeler (1980 A, B and C). For ease of mapping these communities were grouped into vegetation types. These were included in 5 major ecosystems - lakes, rivers, peatlands, turloughs and uplands (non wetland areas). The vegetation map was drawn using the vegetation classification aided by field data and with reference to the 1973 Geological Survey Aerial photographs. The terms Plant

Community, Vegetation Type and Ecosystem are frequently referred to in the text and are defined as follows:

Plant Community: Part of a vegetation consisting of interacting populations growing in a uniform environment and showing a floristic composition and structure that is relatively distinct from the surrounding vegetation (Westhoff and van der Maarl, 1978).

Vegetation Type: A rather arbitrary term here used to describe units of vegetation which are made up of one or more plant communities.

Ecosystem: An ecosystem is generally defined as including all the parts of a particular environment under consideration. These parts include both living and non living aspects, all contributing in some direct or indirect way to the functioning of the complex interacting subsystems within the space under study.

2.3 EVALUATION METHODS

Assessment of the present vegetation was made by evaluating the status in Ireland of species, communities and sites of scientific interest found in the catchment. This was necessary in order to make an appraisal of the negative impacts of the proposed drainage scheme and to outline any areas for possible exclusion from the scheme due to their scientific interest.

a) Species: The distribution and status of species were examined by reference to Flora Europaea (Tutin et al 1964-82), Atlas of the British Flora (Perring and Walters, 1976), An Irish Flora (Webb, 1977) and the Census Catalogue of the Flora of Ireland (Scannell and Synnott, 1972). Due to the restricted time available, the survey concentrated on higher plants.

Species which were considered to have a relatively restricted distribution have been listed and discussed. Restricted vascular plants were rated in terms of their rarity at local regional and national levels on the basis of 10KM grid squares in which they are recorded in the Atlas of the British Flora (Perring and Walters, 1976) supplemented by the number of vice-counties in which a species has been recorded in the Census Catalogue of the Flora of Ireland (Scannell and Synnott, 1972).

Communities: Some indication of the status and distribution of communities at a national level was made by reference to White and Doyle (1982). However an accurate assessment of their local, regional and national importance could not be made because sufficient information on their distribution in Ireland is not available. However the rating devised by Lockhart (1982) was applied. He outlined the following criteria:

(i) Naturalness (agricultural, semi natural, near natural)
(ii) Status in the catchment (common, occasional, rare)
(iii) Rare Species (absent, present)

The ratings for each criteria was then given a value as follows:

0 = absent
1 = agricultural, common, present
2 = semi natural, occasional
3 = near-natural, rare

The final rating for each community was obtained by summing the values for the four criteria. These ratings were only used as a rough guide in helping to decide whether the replacement of a community by another as a result of drainage should be regarded as a positive or negative impact.

c) Sites of Scientific Interest

These were selected and their importance as sites of scientific interest were assessed by applying the criteria and site rating scale used by an Foras Forbartha (Cabot et al., 1981)

3.1 RARE OR THREATENED SPECIES

Most of the species in the catchment are regarded as common in Ireland. However 5 are considered rather rare and a further 5 of restricted distribution and under threat from this and similar drainage schemes (Table 1). In the discussion which follows anglicised names are taken from Keble Martin (1978), notes on ecology and distribution from Webb (1977), Tutin et alia (1964 - 82) and Perring and Walters (1976).

TABLE 1.: RATING OF SELECTED RARE OR THREATENED SPECIES ON THE BASIS OF RECORDS OF KNOWN DISTRIBUTION

SPECIES	NO OF 10 KM GRID SQUARES* NORTH EAST GALWAY	CONNAUGHT	IRELAND	NO OF VICE* COUNTIES IN CENSUS CATALOGUE	RATING
Thelypteris palustris	0	0	9	17	R
Myriophyllum verticillatum	1	1	19	10	R
Equisetum variegatum	1	3	23	23	R
Carex limosa	0	11	32	26	L
Empetrum nigram	0	18	90	35	L
Carex lasiocarpa	2	13	31	26	-
Epipactis palustris	2	14	37	32	-
Juncus subnodulosus	2	28	60	32	-
Vaccinium oxycoccus	3	6	44	34	-
Cladium mariscus	2	28	79	36	-
Maximum No. Possible		C206	964	40	

* Only records since 1930 included

N = National (⩽ 5 10 Km grid squares in Ireland)

R = Regional (⩽ 3 10 Km grid squares in Connaught)

L = Local (< 1 10 Km grid squares in Vice-County)

- = not rated

Thelypteris palustris (Marsh Fern) Rating: Regional.

This species generally occurs in marshes, fens and occasionally in wet woodland. It was found in small amounts in the quaking swamp at Dunblaney townland. It is thought to be uncommon in Ireland with a scattered distribution and has disappeared since 1930 from several of its former stations in the midlands. Occurs through most of Europe except Spain and the extreme North.

Myriophyllum verticillatum (Whorled Water milfoil)
Rating: Regional.
Occurs in pools, drains, canals and slow flowing streams. Restricted to cutaway pools at Monacow and Cartronroe townlands. Generally local in Ireland, found mostly in the centre. Widespread throughout Europe.

Equisetum variegatum (Variegated Horsetail) Rating: Regional.

Occurs at banks of lakes, canals and rivers and in hollows in sand-dunes. Frequent in scraws at Polldorragha, Drumaskin, Ryehill and lake shore at Tonrevagh Townalnds. Occasional in Central Ireland, rare elsewhere. Occurs in the Arctic and North temperate zones of Europe.

Carex Limosa (Mud Sedge) Rating: Local

Occurs on wet bogs and often characteristic of the fen/bog transition stage (O'Connell, 1981). Found in small amounts on scraw at Polldorragha townland, relic wet hollows in cutaway peat at Drumaskin and extensively on bog surface and scraw margin at Dunblaney and Drumbulcaun townlands. Local in the North and West of Ireland but very rare elsewhere in the country. Occurs in North, Northwest and Central Europe extending locally Southward

to the Pyrenees, Southern Bulgaria and Southeast Russia.

Empetrum nigram (Crowberry) Rating: Local.

Occurs on bogs and heaths, mainly on mountains. Restricted to bog margin at Drumbulcaun townland. Frequent on mountain tops, more rarely on lowland bogs. Europe from Iceland and Scandinavia to the Pyrenees, Montenegro and Bulgaria.

Carex lasiocarpa (Downy - fruited sedge) Rating: None

Occurs in bogs and marshes. Found in small stands at Lomaunaghbaun and Monacow townlands and more extensively in scraw-reedbeds and on bog margin at Dunblaney and Drumbulcaun Townlands. Occasional in the west of Ireland but very rare in the rest of the country. Occurs across Europe extending southwards to the Pyrenees, Central Italy, Southern Yugoslavia and Southern Ukraine.

Epipactis palustris (Marsh Helleborine) Rating: None

Marshes, bogs lake shores and damp sandy pastures. Occasional in Schoenus mixed fen on old cutaway throughout catchment. Frequent in Central Ireland, rather rare elsewhere. Throughout Europe except Arctic.

Juncus subnodulosus (Blunt-flowered Rush) Rating: None

Occurs in fens and marshes. Found in several localities in the catchment. Frequent in the West of Ireland, and centre but decreasing and very rare in the North and South. Occurs in Western, Central and Southern Europe extending northwards to Estonia.

Vaccinium oxycoccus (Cranberry) Rating: None.

Occurs on wet bogs. Found extensively on the bog and its margins at Drumbulcaun and Dunblaney townlands. Frequent on lowland bog in centre though now decreasing, rare elsewhere in Ireland. Europe from Scandinavia to C. France, N. Italy and Rumania.

Cladium mariscus (Saw-Sedge) Rating: None

Marshes and lake margins. Occurs in very small stands in Knockavanny, Cuilbeg and Dunblaney townlands. Mainly in Western Ireland ,local but decreasing. Distributed throughout Europe but decreasing.

3.2 ECOSYSTEMS, VEGETATION TYPES AND COMMUNITIES:

The vegetation types, their constituent communities and the ecosystems in which they occur are listed in Table 2 the Vegetation types and communities are discussed in detail in Appendix 1.0.

3.2.1 Summary Descriptions of Ecosystems, Vegetation Types and Communities

I. **LAKES:**

The lacustrine ecosystem is defined as including the open water areas of the lake, their surrounding reedbeds and marshes and the winter flooded Eulittoral margins. The one small shallow lake (0.9 hectares) within the damaged land (Tonrevagh townland) may have turlough affinities. It is shallow, calcareous, marl depositing and oligo - to mesotrophic in nature and has a narrow reedbed of Scirpus lacustris, and adjacent wet sedge swards. The Carex elata community which has overgrown the lake bed at Grey Lough is also included in this ecosystem.

2. **RIVERS**

The riverine ecosystem includes the channels of the rivers, the drains and the borders immediately affected by channel flooding. The channels are now overgrown, having few areas of open flowing water. Carex elata reedbeds form the dominant vegetation overgrowing the channels in some areas, with Phragmites reedbeds occuring less frequently. Filipendula drain margins occur occasionally forming a narrow margin up to 3m in width. Areas of open water are restricted and most areas which are not covered in scraws are blocked with Apium nodiflorum, Nasturtium offinale and Glyceria fluitans.

TABLE 2: ECOSYSTEMS, VEGETATION TYPES AND COMMUNITIES OF THE NANNY SUBCATCHMENT OF THE CORRIB/CLARE CATCHMENT

ECOSYSTEM	VEGETATION TYPE	COMMUNITY
1. Lakes	1 Lakes	1a Littoral Zone
		1b Plankton
	2 Reedbeds	2b Scirpus lacastris
	5 Carex elata Marsh	5 Carex elata marsh
	11 Grass sedge swards	11b Wet sedge swards
2. Rivers	2 Reedbeds	2a Phragmites
		2c Carex elata
	12 Grasslands	12c Filipendula drain margins
	14 River Channels and Drains	14 River channels and drains
3. Peatlands	3 Bogs	3a Actively growing/ regenerating
		3b Mixed Schoenus Fen
		3c Dry Ridges
		3d Molinia-Myrica
		3e Bog Pools
		3f Narthecium Lawns
		3g Shallow Peat Hummock Hollow
	10 Quaking Swamp	10a Moss rich
		10b Carex diandra
		10c Carex lasiocarpa
		10d Juncus subnodulosus
		10e Empetrum - Calluna
	11 Grass Sedge Swards	11a Low sedge sward
		11b Wet sedge sward
	12 Grasslands	12a Wet pasture
		12b Rich wet pasture
	4 Schoenus marsh	4 Schoenus marsh
	6 Juncus subnodulosus stands	6 Juncus subnodulosus stands
	7 Carex rostrata marsh	7 Carex rostrata marsh
	8 Cladium marsh	8 Cladium marsh
	9 Carex lasiocarpa marsh	9 Carex lasiocarpa marsh
4. Turloughs	12 Grasslands	12d Carexnigra-Potentilla anserina swards
	11 Grass sedge swards	11b Wet sedge sward
5. Uplands	13 Pasture and Arable	
	15 Hazel scrub	

3. PEATLANDS

The peatland ecosystem includes all remaining bogs and most of the vegetation that has developed on reclaimed and cutaway bog surfaces. Little remains of the original bog surfaces of the formerly extensive flood plain and more limited basin raised bog areas. The actively growing/regenerating areas are restricted to small wetter areas in the cutaway and to more extensive areas at Lomaunaghbaun townland, and a relatively intact raised bog at Drumbulcaun townland. The Molina-Myrica community is dominant on many of the drier cutaway surfaces. Mixed Schoenus fen is a species rich community established in areas cut down to fen peat or marl and influenced by calcareous ground waters. This community is obviously related to and probably derived from the Schoenus marsh community which occurs in fragmented form at many of the bog margins. Quaking swamp vegetation occurs within the cutaway and at the margin between the cutaway or intact bog and mineral soil.

Grass sedge swards occur at the cutaway margins on the thinner peat. Wet pasture occurs on reclaimed peat and may occur on adjacent mineral soils and is characterized by an abundance of soft rush (Juncus effusus). Schoenus marsh, Juncus subnodulosus marsh, Carex rostrata marsh and Carex lasiocarpa marsh are included in the bog ecosystem because they are intimately associated with the other bog communities.

4. TURLOUGHS:

Turloughs are thought to be unique to the limestone areas of western Ireland. They are characterised by dramatically fluctuating water levels and drainage through underground channels. They vary in the length of time they remain flooded in winter and dry out in summer. The largest turlough within the catchment is unusual in the presence of Schoenus marsh and a small stand of saw sedge (Cladium mariscus) as well as the more

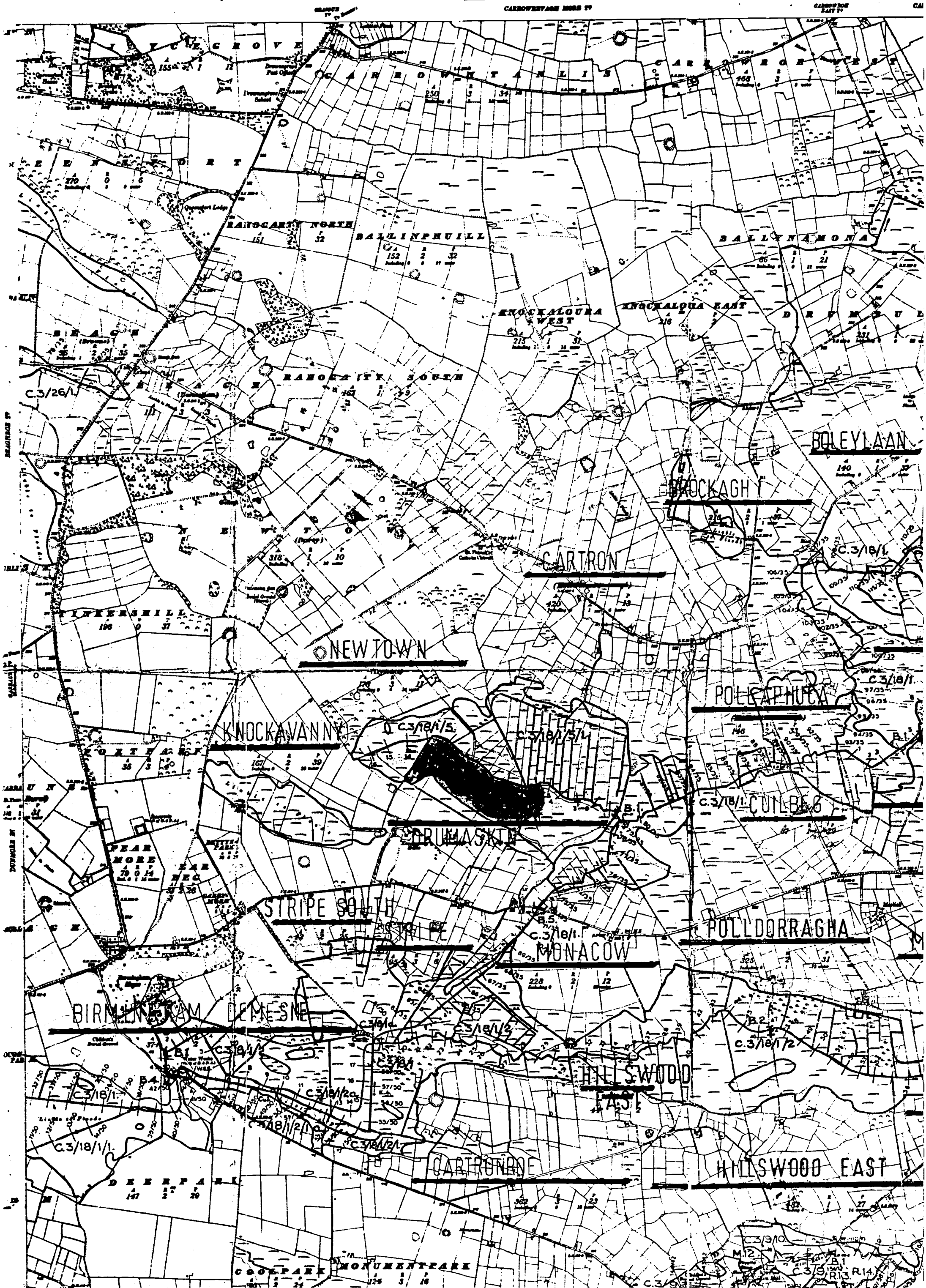
typical flooded pasture dominated by Creeping Bent Grass (Agrostis stolonifera) and Silverweed (Potentilla anserina). A well developed wet sedge sward also occurs with abundant Carex hostiana.

5. UPLANDS

The upland ecosystem in this discussion includes all non wetland vegetation. More than 95% of this area is occupied by agricultural grassland of the Centaureo - Cynosuretum typicum (O'Sullivan, 1982) which is primarily used as pasture for cattle and sheep. These are generally species poor, moderate quality pastures dominated by low yield grasses such as Crested Dog's Tail (Cynosurus cristatus), Yorkshire Fog, (Holcus lanatus) and Common Bent-Grass (Agrostis capillaris). Arable farming, in the form of potatoes and barley, covers a very low percentage area (c 1%). This relatively species poor grassland species gives way on some of the eskers to a more species rich grassland of the Centaureo-Cynosuretum sub association galietosum in which the presence of Common Quaking Grass (Briza media), Ladys Bedstraw (Galium verum) and Bulbous Buttercup (Ranunculus bulbosus) is notable. Pockets of dry chalk grassland also occur on the eskers and on some of the skeletal mineral soils. The presence of such species as Carline Thistle (Carlina vulgaris) Yellow-Wort (Blackstonia perfoliata) and Mouse-ear Hawkweed (Hieracium pilosella) make this grassland easily identifiable.

Scrub woodland, primarily Hazel Scrub, occurs as fragmented stands on the eskers and skeletal mineral soils. Hazel (Corylus avellana) is dominant with Hawthorn (Crataegus monogyna) Ash (Fraxinus excelsior), Blackthorn (Prunus spinosa) and abundant Blackberry bushes (Rubus fruticosus agg). The herb layer is frequently grazed and poached by sheltering animals but Wood Sorrel (Oxalis acetosella) and Wild Strawberry (Fragaria vesca) were typically present.

NANNY SUBCATCHMENT TOWNLANDS



EDITION OF 1981

CORRIB-CLARE CATCHMENT

DUNBLANEY

BALLYNAMONA

EAST BROMBUCAUN

LOMAUNAGHBAUN

BOLEYLAAN

SHANVALLY

KAGH

DAUBAUNS

DEVAGH

POLLATHUCK

COILBOG

RYEHILL

POLLDORRAGHA

NEELICK-EAST

CURRAGHCREEN

BALLAGHALOOE

HILLSWOOD EAST

KILGARRIFF SOUTH

LEWALLY LOUGH

CORRALRA

S.G.30/1

S.G.30/3

C.3/9/18/2

C.3/9/18/2.

C.3/9/18/1

C.3/9/18/1/1

C.3/18/1/6a

C.3/18/1/6

C.3/18/1/6b

C.3/18/1/6c

C.3/18/1

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C.3/9/10

C.3/9

B.1

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R.13

R.14

R.15

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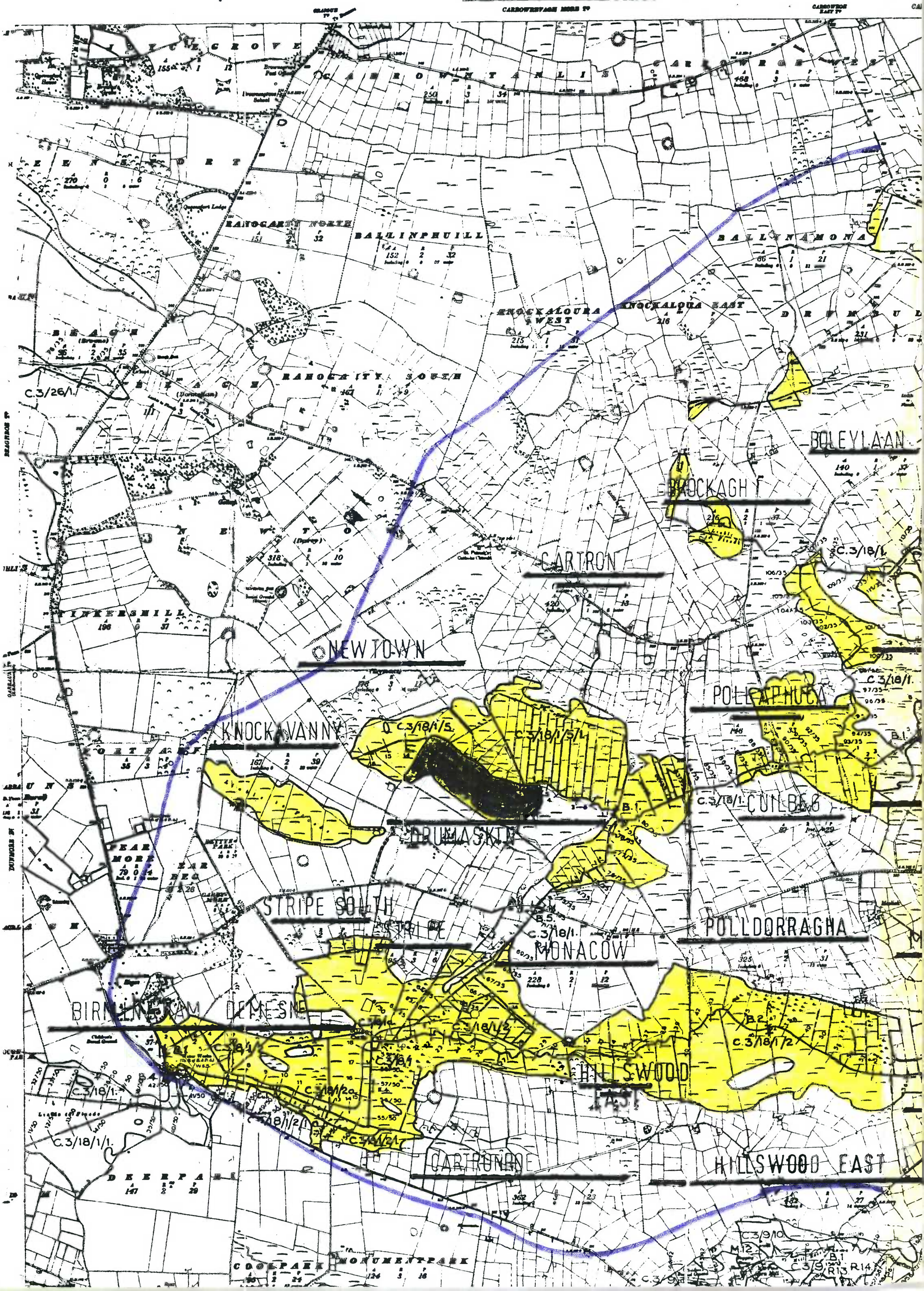
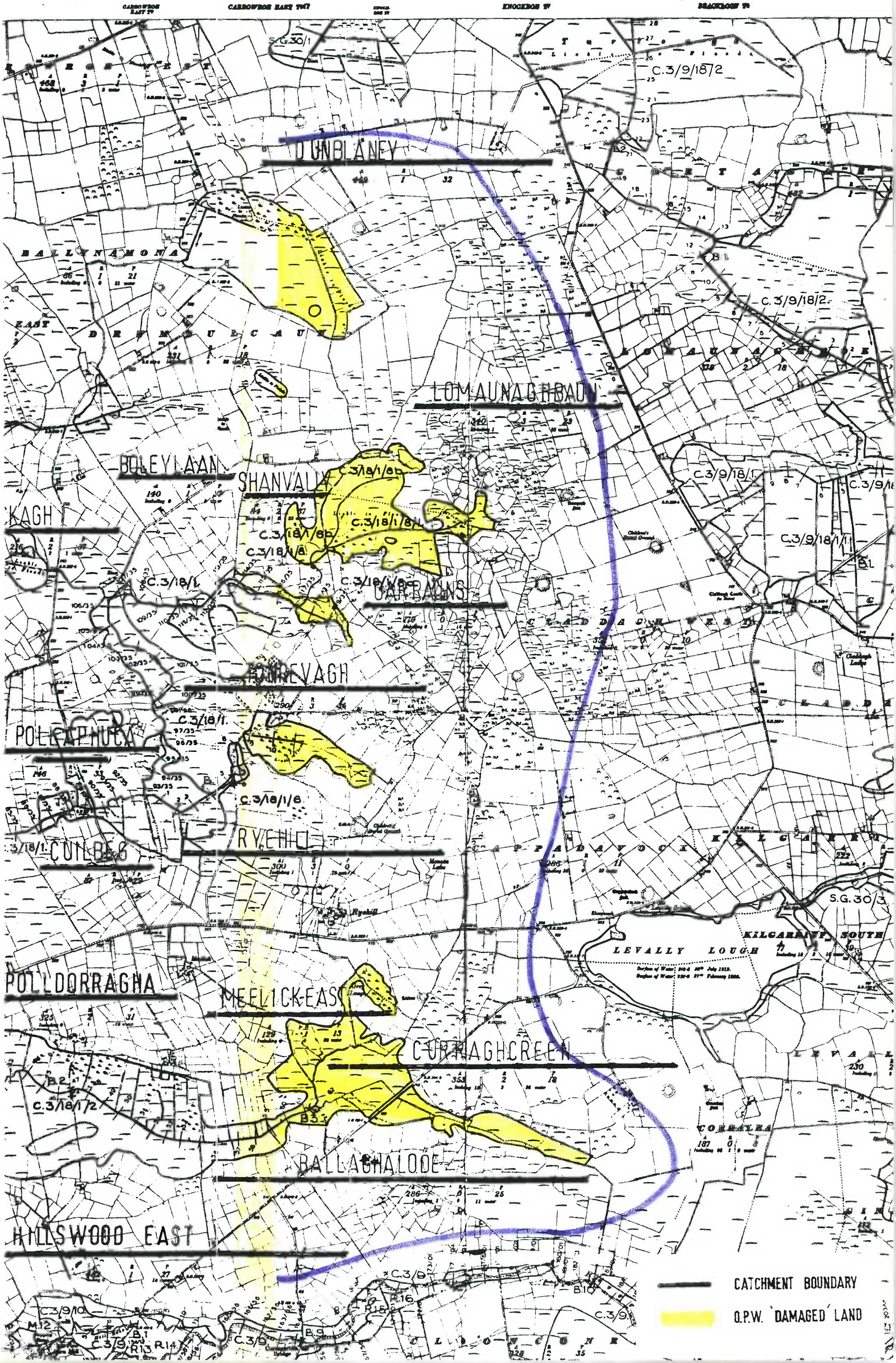
NANNY SUBCATCHMENT TOWNLANDS



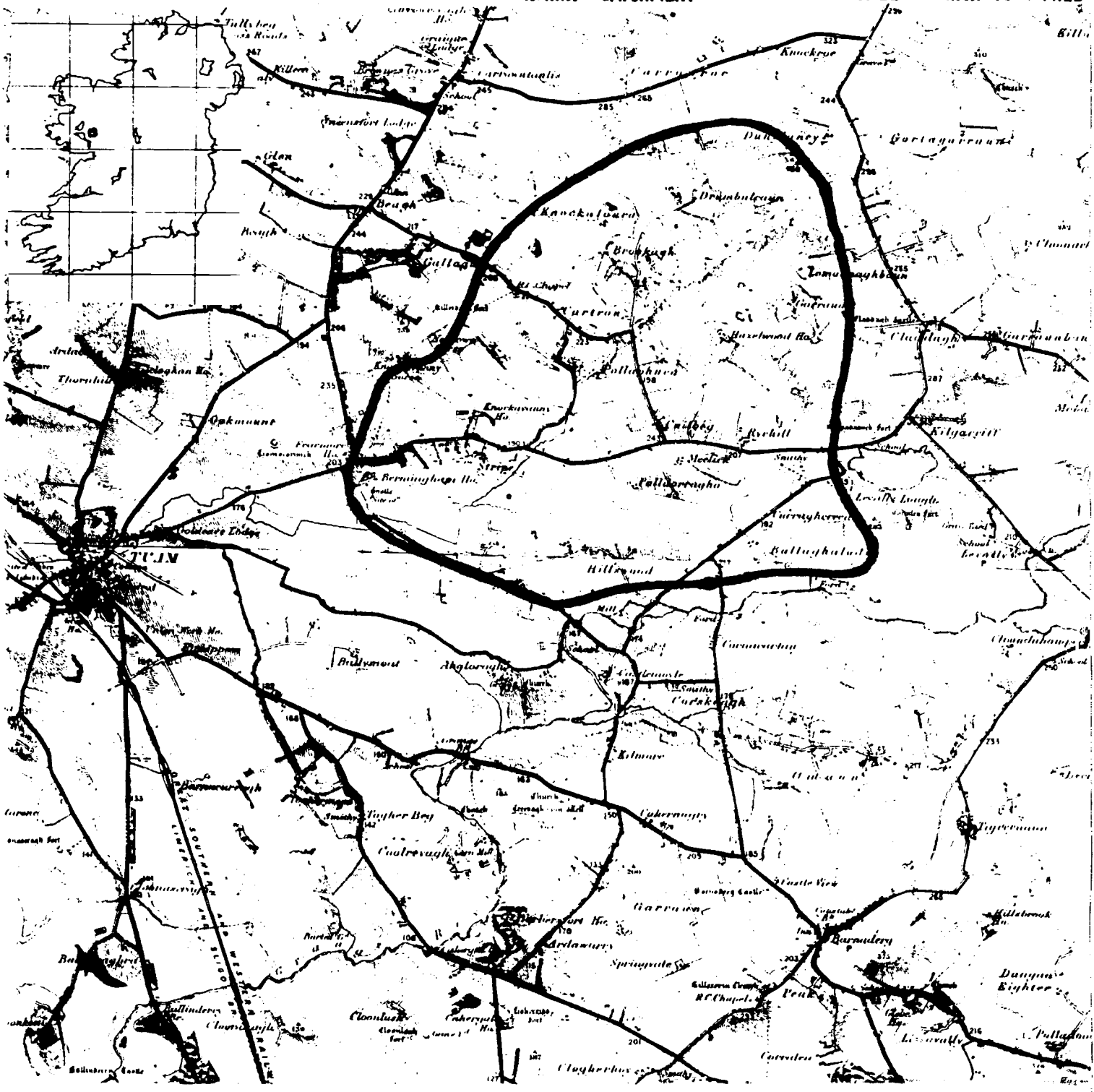
EDITION OF 1991.

CORRIB-CLARE CATCHMENT



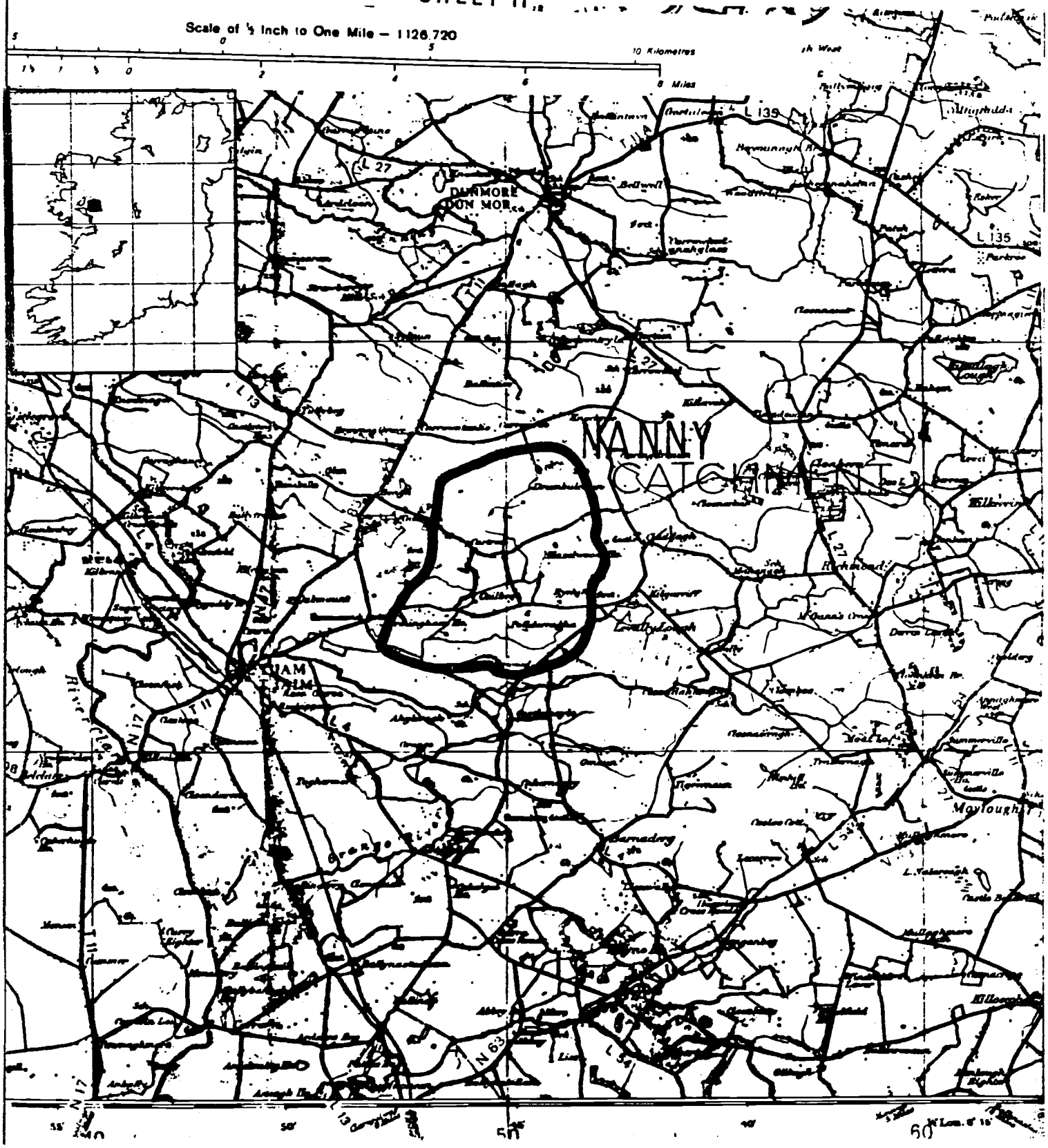
NANNY CATCHMENT

SCALE : 1 INCH TO 1 MILE



SOUTH MAYO

SHEET II



3.3 SITES OF SCIENTIFIC INTEREST

Two sites of Scientific interest were identified in the catchment - The turlough in Knockavanny townland and the bog in Drumbulcaun and Dunblaney townlands. These were rated for their importance at either local, regional or national level by application of the criteria and rating method described by An Foras Forbartha (Cabot et al, 1981). The results of this are given in Table 3.

TABLE 3: RATING OF SITES OF SCIENTIFIC INTEREST BASED ON AN FORAS FORBARTHA CRITERIA

	KNOCKAVANNY TURLOUGH	DRUMBULCAUN DUNBLANEY BOG
Only area of its type	-	R
One of a few such localities	R	-
One of a natural series	R	-
Fine example of its kind	R	R
Specialised educational importance	R	R
General educational importance	R	R
Overall rating of importance	R	R

I = in the world (international)
N = in the country (national)
R = in the province (regional)
L = in the county (local)

3.3.1 **Description of Sites of Scientific Interest.**

a) Knockavanny Townland Turlough.

Rating: Regional Importance

Description

This is the largest of the turloughs in the catchment with a typical turlough sinkhole vegetation including the algae Botrydium granulatum. There are extensive areas of wet sedge sward with abundant Tawny sedge (Carex hostiana) and a large area of flooded pasture with Creeping Bent Grass (Agrostis stolonifera) and Silverweed (Potentilla anserina). The turlough is unusual because of the presence of Schoenus marsh including a small stand of Saw Sedge (Cladium mariscus).

Value:

Turloughs are apparently unique to Ireland and are becoming increasingly rare due to drainage. Ryan (pers. comm.) has estimated that about 70% of the areas known to contain turloughs have already been drained. Hydrological extremes of prolonged inundation in winter and near drought conditions in summer have given rise to some unusual forms of otherwise common plants. As turloughs are natural phenomena and may have existed for thousands of years their present vegetation probably constitutes an important gene pool of unusual adaptations. Although little studied they are undoubtedly of interest to specialists both from Ireland and abroad. As an increasingly rare and threatened geomorphological feature they are also valuable at a general education level.

b) **DRUMBULCAUN/DUNBLANEY TOWNLAND BOG**

Rating: Regional Importance

Description:

This is the only intact raised bog in the catchment. The surface is slightly domed and a pool/hummock system is developed on the surface. A surface tearing pattern exists on its more steeply sloping western margin and there is evidence of old cutaway areas at the margins. There is no evidence of recent exploitation although the area was obviously burnt within the last 1-2 years. Well developed quaking swamp communities occur on northern edge with large hummocks of Calliergon cuspidatum and Sphagnum spp and with open Phragmites australis stands visually dominant.

Value:

This site is unusual in that the bog is obviously mineral enriched, probably due to flooding by mineral rich ground waters (perhaps derived from local springs). As a result there are extensive swards of the mud sedge (Carex limosa) on the bog margins. The Downey fruited sedge (Carex lasiocarpa) also extends onto the bog margins. There are also extensive stands of Cranberry (Vaccinium oxycoccus), a species whose distribution is declining due to the exploitation of the midland raised bogs. Of special interest is the quaking swamp on the Northern margin. Six rare or threatened species are found in the swamp, Marsh fern (Thelypteris palustris), Mud Sedge (Carex limosa), Crowberry (Empetrum nigram) Downy fruited sedge (Carex lasiocarpa), Cranberry (Vaccinium oxycoccus) and saw sedge (Cladium mariscus). Some of the communities are representative of the fen/bog transition stage. One is of special interest (Empetrum-Calluna quaking swamp), as it corresponds to a new association which has only recently been described from Scragh Bog, Co. Westmeath (O'Connell, 1981), which is a site of international scientific

4.1 EVOLUTION OF VEGETATION IN THE ABSENCE OF THE PROPOSED DRAINAGE SCHEME

Even in the absence of the proposed drainage scheme it is probable that as well as natural changes in the vegetation that will take place in areas which are not managed (e.g grazing), there will be more regular maintenance of the existing drainage channels. Local piecemeal reclamation of wetlands will be carried out where possible. With this in mind the possible changes are discussed under the headings of the 5 major Ecosystems (Table 2). No attempt has been made to put a time scale on the events discussed but in general any changes in vegetation would be slow to occur. Where communities are replaced by others, reference should be made to Table 4 to gain some indication of their relative importance in terms of the catchment.

(i) **Lakes:**

It is unlikely that any change would occur at the small lake in Tonrevagh townland and it is probable that a small area of permanent open water will remain there. The Carex elata marsh at Grey Lough has already expanded to fill the lake bed forming an impressive monodominant stand. The possible change that might occur is invasion of the marsh by Willows which would slowly establish to eventually form a fen woodland. No significant change in the scientific interest of the area is likely.

(ii) **Rivers:**

The present channels and ditches are extensively clogged and blocked by vegetation. Local piecemeal reclamation is presently being carried out at Carton townland. This is typical of the activity that might occur in the absence of arterial drainage. The bog vegetation has been removed and the area, ploughed and

TABLE 4: COMPARATIVE RATINGS OF COMMUNITIES AND VEGETATION TYPES

		Naturalness	Status	Rare Species	Rating out of 7
1a	Littoral Zone	NN	R	-	6
2a	Phragmites Reedbeds	SN	O	-	4
2b	Scirpus lacustis Reedbeds	NN	O	-	5
2c	Carex elata reedbeds	SN	O	+	5
3a	Actively growing/regenerating bog surfaces	NN	R	+	7
3b	Mixed Schoenus Fen	SN	C	+	4
3c	Dry Ridges	SN	C	-	3
3d	Molinia-Myrica	SN	C	-	3
3e	Bog Pools	SN	C	+	4
3f	Narthecium Lawns	SN	C	-	3
3g	Shallow peat hummock/hollow	SN-NN	O		4-5
4	Schoenus Marsh	NN	R	+	7
5	Carex elata marsh	NN	R	-	6
6	Juncus subnodulosus stands	NN	O	+	6
7	Carex rostrata marsh	NN	C	-	4
8	Cladium marsh	NN	R	+	6
9	Carex lasiocarpa marsh	NN	R	+	7
10a	Moss rich quaking swamp	NN	R	+	7
10b	Carex diandra quaking swamp	NN	R	+	7
10c	Carex lasiocarpa quaking swamp	NN	R	+	7
10d	Juncus subnodulosus - Carex diandra quaking swamp	NN	R	+	7
10e	Empetrum - Calluna quaking swamp	NN	R	+	7
11a	Low sedge sward	SN	O	-	4
11b	Wet sedge sward	SN	C	+	3
12a	Wet pasture	SN-A	O	-	3-4
12b	Rich wet pasture	SN	R	-	5
12c	Filipendula Drain Margins	SN	O	-	4
12d	Carex nigra-Potentilla anserina swards	SN	R	-	5
12e	Flooded Pasture	SN	O	-	4
13a	Pasture	A-SN	C	-	1-2
13b	Arable	A	R	-	4
14	River Channels and Drains	SN	C	-	4
15	Hazel Scrub	SN	O	-	4

NATURALNESS: NN = Near Natural; SN = Semi-Natural; A = Agricultural
STATUS IN CATCHMENT: C = Common; O = Occasional; R = Rare
RARE SPECIES: + = Present; - = Absent

seeded with commercial grasses. In association with this the ditches are being extensively cleared and deepened. Similar such channel maintenance would result in drying out of the nearby surfaces. It is likely that such piecemeal activities would cause the major changes with little natural charges in the vegetation. Reedbed vegetation may naturally expand, in areas where it is now open and diffuse may become more closed, extending in areas like Poldorragha townland where the Phragmites reedbeds may expand. However any piecemeal reclamatgion would be liable to reversion in the absence of arterial drainage. Overall the re may be a slight decrease in scientific interest.

(III). **Peatlands**

The dominant wetland ecosystem within the catchment. The vegetation of the peatland areas has already been influenced by man for hundreds of years. This is likely to continue. Peat cutting, reclamation, grazing, and fire will continue to influence the vegetation of these areas. However all the changes outlined below will be prone to reversion in the absence of the arterial drainage.

In general bog areas will continue to dry out slowly with continued restricted drainage. The "intact" islands of bog present in the cutaway will dry out to be dominated by dry ridge communities with overall loss of Sphagnum spp and most of the hydrophilous bog plants. Invasion by Birch and Willow as well as Scots Pine is possible, but will depend on the role of fire in controlling the invasion. The species rich Schoenus mixed fen occurs in low lying areas and seems to be frequently flooded by groundwater. In the absence of arterial drainage this community is unlikely to change significantly.

The shallow peat hummock hollow community
would suffer a restriction in hydrophillic mosses and an increase in grasses and drier sedge species with perhaps an expansion in

the Wet sedge sward in some areas. The Quaking swamp communities occur in the wetter areas and would need major channel clearance to have any dramatic effects. However the slow drying out of communities might affect the rare species which occur in them. Such quaking communities may be invaded by Salix species. Slow drying out of grass sedge swards might make them available for reclamation to wet pasture. The Myrica-Molinia stands generally occur on shallow peat and require periodically flooding from stream and channels. If water levels are lowered this vegetation type may become available for drainage as has occurred already in the catchment in Cartron townland.
However small scale local reclamation would have little effect in the absence of major channel clearance. In the absence of major channel clearance the present level and frequency of flooding would continue, resulting in local drain clearances, etc. having a short term effect.

(iv) **TURLOUGHS**

No floristic changes are envisaged in the turloughs if present landuse activities are continued. No change in scientific interest is invisaged.

(v) **UPLANDS**

Pasture and arable vegetation in the drier upland soils is unlikely to change overall if present landuse practices continue. The distribution of the more species rich grasslands would probably become more restricted with the continuing destruction of some of the eskers in their exploitation for gravels etc. Hazel scrub may become more restricted due to land clearance.

(vi) **FUTURE STATUS OF RARE SPECIES**

Of the ten rare or threatened species some face short term

restriction in distribution due to local piecemeal reclamation in the absence of the proposed scheme. None however are likely to become extinct.

CONCLUSIONS

Local piecemeal reclamations may result in a slight lowering of scientific interest overall. However all such reclamation will be subject to reversion in the absence of arterial drainage.

4.2 IMPACTS OF THE PROPOSED DRAINAGE SCHEME

4.2.1 General Impacts (after Lockhart, 1982)

The impacts of the proposed drainage scheme can be considered in two stages, firstly the impacts of arterial drainage alone and secondly the impacts of subsequent land reclamation by clearance, installation of field drains and improvement in land management practices.

4.2.1.1 Arterial Drainage

The affects of arterial drainage on vegetation can be subdivided into direct and indirect impacts. Direct impacts will be caused by the actual carrying out of arterial drainage works through dredging of channels, bank clearance and disposal of spoil and will primarily affect the vegetation of the rivers and their banks. Dredging will physically remove aquatic vegetation from the rivers and cause an increase in silting in downstream areas. Bank clearance will be necessary to allow dredging machinery access to the rivers and will cause damage to bank vegetation by the removal of obstructing trees and shrubs. The disposal of spoil from dredging, either by spreading on surrounding levels or by mounding into ridges on the river banks, will destroy vegetation and cause long term alterations of soil chemistry and

structure. All of these impacts can be regarded as semi-permanent if regular maintenance of arterial drains is carried out.

Indirect impacts will result from deepening and widening river channels, straightening river courses and levelling and smoothing river beds to eliminate obstacles. These activities will cause an overall lowering of water tables in neighbouring wetlands and the elimination of flooding. This in turn will affect wetland vegetation, most especially the aquatic, semi-aquatic and seasonally flooded vegetation types. Regular maintenance will permanently exclude any possibility of a return to high water tables and flooding.

4.2.1.2 **LAND RECLAMATION**

Land reclamation will take place by clearance of trees and shrubs where necessary, installation of field drains and improvement of land management practices. The impacts of these activities, although important in themselves, can be regarded as secondary as they will generally act upon the drier vegetation types resulting from arterial drainage. The impacts of field drainage will be both direct and indirect. The direct impacts will be caused by the physical disturbance of vegetaton during the installation of pipes and tiles. Indirect impacts will result from the decreased waterlogging of the soils and will cause a decline in hydrophilous plants. Once land has been drained improved land management practices, through ploughing and reseeding, will completely change the composition, structure and relative abundances of species in the vegetation.

Any vestiges of wetland vegetation can be expected to have been removed at this stage. Subsequent use of fertilisers will improve productivity, encourage vigorous growing grasses and clovers and permanently exclude the original species. Widespread use of fertiliser may lead to an increase in plant nutrients in

water courses and lakes. This tendency may be exacerbated by the anticipated increase in livestock density and may lead to changes in aquatic vegetation. The use of herbicides for maintenace of drains would have a major impact on aquatic vegetation.

4.2.2 SPECIFIC IMPACTS

Specific impacts of the drainage scheme are considered under the headings of rare species, vegetation types and communities and sites of scientific interest.

4.2.2.1 IMPACTS ON RARE SPECIES

As well as a dramatic overall reduction of wetland plants and an increase of drier grassland species and probably weed species the drainage will have an impact on the rare and threatened wetland species occurring in the catchment (Table 5). The impacts on these species was estimated by reference to their known ecological behaviour using White and Doyle (1982), Webb (1977), Tutin et alia (1964 -82) and Clapham et alia (1962).

TABLE 5: IMPACT OF PROPOSED DRAINAGE SCHEME ON RARE OR THREATENED SPECIES OCCURRING WITHIN CATCHMENT

SPECIES	RATING	IMPACT
Thelypteris palustris	R	Probably unaffected?
Myriophyllum verticillatum	R	Probable extinction
Equisetum variegatum	R	Probable extinction
Carex limosa	L	Restriction in distribution
Empetrum nigram	L	Probably unaffected
Carex lasiocarpa	-	Restriction in Distribution
Epipactis palustris	-	Possible extinction?
Juncus subnodulosus	-	Restriction in Distribution
Vaccinium oxycoccus	-	Restriction in Distribution
Cladium mariscus	-	Restriction in Distribution

As is obvious from Table 5 the scheme will result in the possible or probable extinction of three and a restriction in distribution of five of the rare or threatened species found in the catchment. The remaining two species will probably be unaffected.

4.2.2.2 IMPACTS ON VEGETATION TYPES AND COMMUNITIES

The impacts on vegetation types and communities are estimated by comparing their broad known ecological requirements and their known distribution within the areas expected to benefit from the drainage scheme. These are discussed below under the headings of the 5 major ecosystems (see Table 2). In general the impacts under discussion are those of arterial drainage. It can be assumed that any subsequent land reclamation will completely destroy wetland vegetation in favour of agriculture grassland. Where possible the approximate area of vegetation types and communities affected are given in hectares. A summary table (Table 6) showing the areas of vegetation types a) probably affected, b) possibly affected and c) unaffected is included in this section.

(i) **LAKES:**

Small lake in Tonrevagh townland - loss of Reedbeds (.3 Ha) adjacent Wet Sedge Sward (2.1 Ha) and nearby Flooded Pasture (.6 ha), there will also be a loss of permanent open water (at present 0.9ha). These areas if not further reclaimed may be replaced by wet pasture or a Molinia dominated sward. The Carex elata (1.7 Ha) marsh at Grey Lough will probably be entirely lost, and if undisturbed may be invaded by Willows. Intensive management at least in the initial stages would be necessary to reclaim this area for agriculture. Overall a noted decrease in scientific interest will occur.

(ii) **RIVERS:**

The implementation of the drainage scheme will necessarily involve deepening, clearance and maintenance of the channels. This will involve destruction of the following communities, 2A-

Phragmites Reedbeds 2C-Carex elata Reedbeds, 12G Filipendula drain margins (fragmented) and River Channels and drains. Maintenance of the scheme will ensure that these communities are not re-established. Overall a major loss of habitat and scientific interest is envisaged.

TABLE 6: AREAS OF VEGETATION TYPES AFFECTED OR UNAFFECTED BY THE PROPOSED DRAINAGE SCHEME

VEGETATION TYPE	TOTAL AREA (ha)	AREA AFFECTED (ha)	AREA PROBABLY UNAFFECTED (ha)
1 Lakes (open water)	.9	.9 (100%)	-
2 Reedbeds	8.7	8.6 (98.8%)	.1 (.2%)
3 Bogs	327.7	306.4 *(93.5%)	21.3 (6.5%)
4 Schoenus marsh	2.9	1.3 (44.8%)	1.6 (55.2%)
5 Carex elata marsh	1.7	1.7 (100%)	-
6 Juncus subnodulosus stands	1.6	1.3 (81.3%)	.3 (18.7%)
7 Carex rostrata marsh	1.6	1.6 (100%)	-
8 Cladium marsh	.3	.1 (33.3%)	.2 (66.7%)
9 Carex lasiocarpa marsh	.1	.1 (100%)	- -
10 Quaking swamp	11.7	2.8 (24%)	8.9 (76%)
11 Grass sedge swards	57.8	37.7 (65.2%)	20.1 (34.8%)
12 Grasslands	49.3	35.0 (71%)	14.3 (29%)
13 Pasture and arable	c1522.6	-	C1522.6
14 River channels & drains	-	?	?
15 Hazel scrub	-	-	-
Catchment area	1,987	397.5	1,589.4
Percentage of Catchment (%)	100	20	80
Damaged land area Area	451.4	384.6	66.8
Percentage of Damaged land (%)	100	85.2	14.8

* includes 14.2 ha partially benefitting.

(iii) **PEATLANDS**

Of a total of 407 ha of peatland (90% of wetland in subcatchment) approximately 355 ha (87. %) are expected to fully benefit and 14.0 ha (3.4%) to partially benefit. The clearance and deepening of channels will cause a rapid drying out of all peatland communities in the areas affected. Most of the grass sedge swards, Molinia-Myrica stands and probably the shallow peat Hummock-Hollow types will be reclaimed for pasture. The Actively growing/regenerating surfaces will cease to do so and probably change to a vegetation similar to Dry ridge communities. The vegetation which occurs on irregular topography - Dry ridges, Bog pools, Narthecium lawns and Mixed Schoenus fen, on drying out will probably make areas available for turbary especially as access will be available due to the activity associated with channel clearance. Any Quaking swamp vegetation will be dramatically affected by the lowering of water levels, with grass species or reeds probably expanding. The marsh communities 4-8 will dry out losing the distinctive characteristic of the vegetation. Some which occur on the bog margins may become similar to Wet sedge swards before drying further to become wet pasture. Others due to their position will be destroyed initially due to channel clearance or on drying removed during turbary activities. Areas which are presently wet pasture will dry further and with the probable use of field drains will be improved to a moderate quality grassland, losing their typical aspect of soft rush (Juncus effusus). Again a major loss of habitat and scientific interest will occur.

(iv) **TURLOUGHS**

None of the turloughs within the subcatchment are due to be drained. However turloughs are hydrological complex and the proposed drainage schemes may inadvertently effect the hydrology of these areas.

(v) **UPLANDS**

The vegetation of the uplands areas will not be directly affected by the drainage scheme.

CONCLUSIONS

The arterial drainage scheme will result in the disappearance of four vegetation types (1,5,7,9). Of the remaining eleven types nine will suffer extensive reductions in area (2,3,4,6,8,10,11,12,14). One type will expand (13).

The proposed scheme will therefore result in a major decline in diversity area and quality (Table 4) of the more scientifically interesting vegetation types. These dramatic changes would not occur in the absence of the proposed scheme. The arterial drainage scheme will therefore be directly responsible for the major losses in area, diversity and quality outlined above.

4.2.2.3 Impacts on Sites of Scientific Interest

a) Knockavanny Townland Turlough
   Rating: Regional Importance

No attempt will be made to drain this turlough. However as stressed above, turloughs are hydrologically complex and it is possible that the drainage activities may inadvertently affect the hydrology of the site. Any change in the hydrological regime would effect the scientific value of the site.

b) Drumbulcaun/Dunblaney townlands Bog
   Rating: Regional Importance

Again this site will not be drained during the present drainage scheme. The scientific value of this site is partially due to

the fact that parts of it receive frequent flooding with mineral rich water. The resultant plant communities are of special interest. Therefore like Knockavanny turlough its scientific value is vulnerable to inadvertent subtle changes in the hydrology of the site.

5.1 General Measures for Minimising Negative Impacts (after Lockhart, 1982).

The following discussion is of a general nature and concerns suggestions for carrying out arterial drainage works and the subsequent maintenance and agricultural development so as to minimise negative impacts on vegetation.

5.1.1. Arterial and Field Drainage

All vegetation in the river and drainage channels will be removed during dredging. In order to facilitate more rapid recolonisation of aquatic plants dredging should commence at the top of the catchments and proceed downstream to the outlets. By doing this stretches which have been dredged will receive no further disturbance from silt produced by subsequent downstream dredging, thus allowing for early recolonisation of plants. To ensure re-establishment of aquatic plants channels should not be dredged so deep as to exclude light from the bed. In one case cited by Haslam (1976) a drain dredged to 1.5m deep, with steep sides and water too turbid for light to reach the bed, bore no vegetation for 5 years. In large channels a steep sided trapezoid shaped bed profile should be avoided. Shallow ledges, at least on one side, should be incorporated in channel design to allow for aquatic plant development. Some meanders should be left in the river course to facilitate scour and deposition thus maintaining natural habitats. On long straight stretches meanders should be created. The same applies to riffle and pool sequences; where present they should be left, where absent they should be created. These fast flowing reaches oxygenate water and supply suitable niches for a variety of aquatic plants. Where gravel beds are removed by dredging they should be replaced when works are completed.

Unnecessary removal of trees and shrubs from banks during dredging should be avoided. Tree roots, especially those of

Alder (Alnus glutinosa) serve to stabilise river banks and their foliage can save channel maintenance by shading out excessive aquatic plant growth. Where bank clearance is necessary to allow dredging machinery access to the river, it should take place on one bank only. After clearance banks should be fenced off, at least temporarily to allow vegetation to regenerate sufficiently to stabilise the substrade. Where spoil is not likely to have a serious injuries affect on top soil it should be spread evenly over the adjoining land beyond the channel to a depth not exceeding 0.15m (Conservation and Land Drainage Guidelines (1980). Where spoil is detrimental to agricultural practices it should be buried or heaped. Spoil disposal areas should be fenced of and reseeded and fences should be removed only when the turf can withstand grazing. Spoil mounds, especially where composed of rocks, stones or marl, should be regarded by recovering with top soil. Attempts should be made to landscape spoil mounds in harmony with surrounding topography.

5.1.2 **Maintenance**

Drainage channels will require occasional re-dredging and the above mentioned safeguards will again apply. Weed control is a more frequent problem and is usually achieved by either mechanical or chemical methods.

5.1.2.1 **Mechanical Maintenance**

The frequent use of mechanical methods of weed control over a wide area affects aquatic vegetation in two major ways. The intensive use of a dragline or excavator, if used at intervals of 3 years or less, can cause a decline in the numbers and species of aquatic plants (Newbold, 1977). Extensive use can reduce the number of sites fronm which recolonisation can occur. Weed clearance should therefore be reduced to at least 5-7 year intervals and take place in a chequer-board pattern in space and time. Where plants are used for shelter for birds and mammals

cutting should not be done during critical stages of their life cycle e.g. nesting. Again cutting should be done in short stretches so that animals can find cover nearby. Plants that are non-invasive, such as Reed Canary Grass (Phalaris arundinacea) on channel banks, should not be cut at all. Plant debris should be removed from channels after cutting to avoid excessive oxygen depletion of the water.

5.1.2.2 **Chemical Maintenance**

Weed control can be attained by chemical means through the use of herbidices. Their main disadvantage is that they areless predictable in their actions than weed cutting and can have wide ranging and unforeseen side-effects. Herbicides can kill plants very quickly and serious deoxygenation of water can occur. To avoid this applications should be made in spring before the standing crop becomes too large. This however does have the disadvantage of destroying habitat, food and cover for animals at a critical stage in their life cycles. Most herbicides restrict the regrowth of the original channel flora because of the length of the phytotoxic period. Non-susceptable or resistant species then tend to colonise the vacant habitat, giving the original flora little chance of re-establishment and resulting in an impoverished and simplified flora. Care and judgement are also required to ensure that herbicides do not remove all macrophyte vegetation leaving only phytoplankton and they must not be used where water, whilst toxic, is liklely to be used for domestic or agricultural drinking water.

The flora of drainage channels can be safeguarded by use of less intensive method of mechanical maintenance and restricted use of herbicides. The British Ministry of Agriculture, Fisheries and Food 1975) recommends that herbicides, where necessary, should be applied on 400m lengths of drain alternating with 400m lengths left untreated. In general, however, the use of herbicides should be discouraged.

5.1.2.3 Trees

The use of trees to shade out channel vegetation has many advantages over herbicides both ecologically and financially. Maintenance by trees is possible,

(a) in channels with little sediment or,

(b) channels with more sediment, requiring regular dredging, where trees can be planted on the southern bank only, or

(c) in channels where all potentially choking plants can be shaded, i.e. where tree canopy covers all the channel or physical factors prevent weeds from growing in the centre of the channel.

Alders are well suited for channel maintenance because they are deciduous, allowing spring growth of river plants, and deep rooted, aiding bank stability. Alder saplings, as large as possible should be planted to provide a closed canopy to shade channel vegetation but should incorporate some light gaps to allow growth of bank vegetation. Coppicing is unnecessary unless shading is deleterious to crops.

5.1.3 **Agricultural Development**

After drainage the survival of a relic wetland flora, restricted mostly to drains and river channels, will depend largely upon the activities of landowners. Although there are few controls over the way in which farmers utilise their lands after arterial drainage a number of suggestions could be made through local Agricultural Advisors. Where possible unstable channel banks should be fenced off from grazing animals to avoid erosion and to allow regeneration of shrubs and trees. Erosion can also be a problem unless specific watering access points are constructed for animals. Agricultural buildings, especially where used to

house silage, should be sited well away from water courses to prevent pollution. Slurry should not be spread beside rivers. Care should be taken to exclude animals from banks where vegetation has been sprayed with herbicides or pesticides. Dumping of herbicide or pesticide containers in or near rivers should be strictly avoided.

The major long term threat to aquatic vegetation, which cannot be adequately safeguarded, is from pollution by fertilizers and livestock effluent. Although agricultural pollution is generally less severe than industrial or urban pollution it almost certainly contributes to eutrophication of lakes, river and drainage channels (Newbold, 1977). According to Vollenwieder (1968) phosphorus levels need only increase from 0.005 to 0.1 mg/l and nitrogen levels from 0.2 to 1.5 ml/l to cause a change from ultraoligotrophic to polytriophic (polluted) water conditions. Such an increase is possible from agricultural changes solely attributable to this source. Haslam (1978) regards fertilizers as potentially more hazardous pollutants than effluents because they do not come from point sources and cannot be so readily cleaned up. She states that fertilizers have only recently been added to agricultural land in large quantities in Britain and it may take several decades before their effects on aquatic plants are known. It is therefore recommended that types of land use which require relatively low fertilizer inputs should in far as possible, be encouraged.

5.2 Sites Recommended for Omission from the Proposed Drainage Scheme

None of the wetland sites which occur on benefiting lands are recommended for exclusion from the drainage scheme. However the two sites of scientific interest which occur on damaged land within the subcatchment may be subjected to undesigned effects on their hydrology as a result of the scheme. It is recommended that all precautions should be taken to ensure that any such

unplanned effects do not take place. If necessary a preliminary hydrological investigation should be carried out at both sites. It is also recommended that the two sites in question, Knockavanny turlough (Grid. Ref. M476542) and Drumbulcaun/Dunblaney Bog (Grid Ref. M508571) should be excluded from any future drainage scheme or extensions to the present scheme.

REFERENCES

BIRSE, E.L. (1980). Plant Communities of Scotland. A Preliminary Phytocoenonia. Soil Survey of Scotland Bulletin No. 4. The Macauley Institute for Soil Research, Craigiebuckler, Aberdeen.

CABOT, D. et alia (1981). Areas of Scientific Interest in Ireland. An Foras Forbartha, Dublin.

CLAPHAM,. A.R., TUTIN, T.G. and WARBURG, E.F. (1962). Flora of the British Isles. Seconde edition. Cambridge University Press. Cambridge.

CONSERVATION and Land Drainage Guidelines (1980). Water Space Amenity Commission. London.

HASLAM, S.M. (1978). River Plants. Cambridge University Press. Cambridge. H.M.S.O. London.

KEBLE MARTIN, W. (1976). The Concise British Flora in Colour. Fourth edition. Sphere Books, London.

LOCKHART, N. (1982). Pilot Environmental Impact Assessment L. Carra East - Vegetation Report.

MC VEAN, D.N. and RATCLIFFE, D.A. (1962). Plant Communities of the Scottish Highlands. H.M.S.O.

MINISTRY OF AGRICULTURE, Fisheries and Food (1975). Code of Practise for the use of Herbicides on Weeds in Watercourses and Lakes. H.M.S.O. London.

NEWBOLD, C. (1977). In Conservation and Agriculture. Wiley - Interscience Publications, Chichester.

O'CONNELL, M. (1981). The phytosociology and ecology of Scragh Bog, Co. Westmeath. New Phytol. 87, 139-187.

O'SULLIVAN, A.M. (1982). The lowland grasslands of Ireland. J. Life Sci. R. Dubl. Soc. 3, 131-142.

PERRING, F.H., and WALTERS, S.M. (1976). Atlas of the British Flora. B.S.B.I. London.

RYAN, P. (1983). The Soils of Ireland. Irish Forestry, 20. 2-16.

SCANNELL, M. J.P. and SYNNOTT, D.M. (1972). Census Catalogue of the Flora of Ireland. Stationery Office, Dublin.

TUTIN, T.G. et alia (1964 - 82). Flora Europaea, Vols. 1-6. Cambridge University Press. Cambridge.

VOLLENWIEDER, R.A. (1968). Scientific Fundamentals of the Eutrophication of Lakes and Flowing Waters with particular reference to Nitrogen and Phosphorus as factors in Eutro phication. Organisation for Economic Co-operation and Development, Water Manager Research Group, Report No. 159.

WEBB, D.A. (1977). An Irish Flora. 6th edition. Dundalgen Press, Dundalk.

WESTHOFF, V. and VAN DER MAAREL, E (1978). The Braun - Blanquet Approach. In classification of Plant Communities (2nd edition) ed. Whittaker, R.H., 287-399. W. Junk, The Hague.

WHEELER, B.D. (1980A). Plant Communities of rich fen systems in England and Wales. I. Introduction Tall Sedge and Reed Communities. J. Ecol. 68.365-396.

WHEELER, B.D. (1980B). Plant communities of rich fen systems in England and Wales. II. Communities of calcareous mires. J. Ecol. 68. 405-420.

WHEELER, B.D. (1980C). Plant Communities of rich-fen systems in England and Wales. III. Fen meadow, fen grassland and fen woodland communities. J. Ecol. 68. 761-788.

WHITE, J. (1982). A key for the Identification of Irish Plant Communities: First Approximation. J. Life. Sci. R. Dubl. Soc. 3 (No. 1).

WHITE, J and DOYLE G. (1982). The vegetation of Ireland: a catalogue raisonne. J. Life Sci. R. Dubl. Soc. 3 289-368.

VEGETATION TYPES

Vegetation Type 1: Lakes Total area (open water) - 0.9ha

Community 1a: Littoral zone

Dominant Species: Chara spp.

Associated Secies: Nuphar lutea

Structure: Submerged aquatic community dominanted by Chara spp in 1 - 3 m of water. Floating leaves of Nuphar lutea occur close to the reedbeds and grade into them.

Sociological Affinities: (i) Charetea Fragilis class, the submerged vegetation of oligo to mesotrophic water, composed principally of species of Characeae usually in monodominant stands. Widespread in Ireland. (ii) Nymphaeion alliance in Potametea Class, vegetation of rooted, floating or submerged aquatic plants, forming one or more layers. Widespread in Ireland.

Substrate: Marl

Distrubition: Occurs in Tonrevagh townland only.

Community 1B: Plankton

NOT INVESTIGATED

VEGETATION TYPE 2: Reedbeds - Total area 8.7 ha.

Community 2A: Phragmites Reedbeds

Sample Number: R49, R43.

Dominant Species: Phragmites australis

Associated Species: Mentha aquatica, Galium palustre, Equisetum fluviatile

Structure: This is a species poor community in which Phragmites australis, attaining a height of 2-3m is dominant. Occurs at the edges of pools, slow flowing channels and vegetation blocked channels. In most of these situations summer water table falls below the surface leaving a characteristic layer of high litter. Carex lasiocarpa is a rare associate in more open reedbeds.

Sociological Affinities: Scirpo Phragmitetum association in the Phragmition alliance. This is vegetation made up of tall helophytes (emergent aquatics) mostly poor in species, in stagnant or slightly running water 2 - 3m deep. Frequent in Ireland.

Substrate: Peat, mud, marl.

Distribution: No extensive homogenous Phragmites beds present in catchment, only occasionally pure stands near channel margins associated with surrounding areas of diffuse Phragmites which has invaded other vegetation types.

Vegetation Type: Reedbeds

Community 2B: Scirpus reedbeds

Sample Number: D16

Dominant Species: Scirpus lacustris

Associated Species: Equisetum fluviatile, Mentha aquatica, Polygonum amphibium

Structure: Open to dense homogenous stands of Scirpus lacustris up to 2M tall, occurring in standing water c 50 cm deep. Carex elata occurs occasionally.

Sociological Affinities: Scirpo - Phragmitetum association.

Substrate - Marl

Distribution: Occurs only at lake margin in Tonrevagh townland.

VEGETATION TYPE 2 Reedbeds

Community 2C: Carex elata reedbeds

Sample Number: D10, R19, R9, R7, R21

Dominant Species: Phragmites australis, Carex elata

Associates Species: Menyanthes trifoliata, Carex rostrata, Carex paniculata, Mentha aquatica, Ranunculus flammula, Ranunculus lingua, Typha latifolia, Eleocharis palustris, Equisetum fluviatile, Alisma plantago-aquatica, Galium palustre, Hippuris vulgaris, Agrostis stolonifera, Potentilla palustris, Hydrocotyle vulgaris, Myosotis scorpiodes, Juncus subnodulosus.

Structure: Dominant aspect of open Phragmites with cover up to 50% with frequent tussocks of Carex elata and occasionally Carex paniculata. The vegetation is frequently quaking, a mosaic of Equisetum fluviatile Menyanthes trifoliata, Typha latifolia, Eleocharis palustris, Carex rostrata and Agrostis stolonifera forming small monodominant scraws. Open pools with Myriophyllum spp., Ultricularia spp, Sparganium emersum and Hippuris vulgaris are occasionally interspersed with the scraw mosaic. Herb vegetation in the form of Molinia caerulea, Succisa pratensis and Filipendula ulmaria is frequent on the sedge tussocks which may exceed 1m in height. This vegetation forms a quaking swamp covering old anastomosing channels and flooded cutaways. Grades into small pure Phragmites stands in some areas.

Sociological Affinities: Transition from Scirpo-Phragmition association of the Phragmition allliance to the Magnocaricion alliance showing affinities to the Caricetum elatae and Caricetum paniculatae associations. This Magnocaricion allliance is of vegetation dominated by large sedges in Eu to Mesotrophic water on soft organic or mineral substrates. Vegetation of this alliance occurs quite frequently throughout Ireland.

Substrate: Peat, marl, covered peat.

Distribution: Largest stand in Cartronroe townland. Small fragmented stands throughout catchment.

VEGETATION TYPE 3 Bogs Total Area - 327.7ha

Community 3A: Actively growing/regenerating bog surfaces.

Samples No: R34, R38, R24, R48, R46, R40?, R64, R52, R50.

Dominant Species: Sphagnum spp, Narthecium ossifragum, Molinia caerulea

Associated Species: Calluna vulgaris, Erica tetralix, Eriophorum angustifolium, Scirpus cespitosus, Andromeda polifolia, Vaccinium oxycoccus, Cladonia species.

Structure: Hummocky terrain dominated by Sphagnum and Narthecium ossifragum with frequent Eriophorum angustifolium. Herb layer 30 cms, cover 30 - 80%. Bryophytes well developed, cover 90%. Water table just below the ground surface.

Sociological Affinities: Probably in Erico-Sphagnetum magellanici association - the Sphagnum dominated vegetation of the flats and low hummocks of Irish raised bogs. However there may be some affinities with the Pleurozio purpureae - Ericetum tetralicis association of Atlantic blanket bog making it a transitional vegetational type. Unfortunately the disturbed nature of even the more intact areas make definite classification difficult.

Substrate: Acid Peat

Distribution: Limited to the remaining wet acid areas. Most widespread in Ballynamona and Shanvally townlands. This community may also occur as a relic in the wetter areas of cutaway peat.

VEGETATION TYPE 3: Bogs

Community 3B: Mixed Schoenus Fen

Sample No: R31, D3, R18, D6, R26, R5, Rz D12, R15, R27?, R58?, R83?, R22?

Dominant Species: Schoenus nigricans, Molinia caerulea

Associated Species: Juncus sub nodulosus, Myrica gale, Phragmites australis, Carex rostrata, Potamogeton coloratus, Carex lepidocarpa, Succisa pratensis, Cirsium dissectum, Epipactis palustris, Eleocharis multicaulis, Calluna vulgaris, Erica tetralix, Narthecium ossifragum.

Structure: A mixed community due to its probable mode of origin. Extensive past removal of peat having exposed underlying acid and fen peat which was then subject to frequent inundation by calcareous ground water.

At its best developed an extensive Schoeus fen is formed with tussocks reaching 1m tall. Standing water up to 30cm deep may be present. Myrica gale and herb species are frequent associates on the tussocks. Chara spp, Utricularia spp and Potamogeton coloratus are common submergents. Scorpidium scorpidoides is frequent at tussock bases. Epipactis palustris occurs occasionally. Open Phragmites australis may be the dominant physiogamy in some areas with small dense stands occurring less frequently. Occurring in juxtaposition with the fen species are Calluna vulgaris, Erica tetralix and Narthecium ossifragum. Eleocharis multicaulis is a rare associate occurring between the more open Schoenus tussocks. Relic peat levels, peat hags and cut out pools are distributed throughout this vegetaton emphasising its mode of origin. This vegetation grades into a drier Myrica-Molinia community which advances onto the upper relic bog surfaces. The lower margin of this vegetation

frequently grades into Schoenus - Cirsium dissectum fen at the bog margin. This marginal fen community was most likely the nucleus for initial expansion of fen species onto the freshly exposed peat surfaces.

Sociological Affinities: This vegetation is closely related to the Schoeno - Juncetum subnodulosi subassociation ericetosum described by Wheeler (1980), and is of restricted distribution in Britain. This has not been described for Ireland but has affinities the widespread Cirsio dissecti-Schoenetum nigricantis outlined by White and Doyle (1982).

Substrate: Peat and Marl

Distribution: Widespread in catchment, but best developed at Polldorragha, Stripe South, Pollaphuca and Shanvally townlands.

VEGETATION TYPE 3: Bogs

Community 3C: Dry Ridges - Peat Hags

Sample No: R36, D3, D4, R41, D25, D27.

Dominant Species: Calluna vulgaris, Molinia caerulea, Carex panicea, Hypnum jutlandicum, Cladonia portentosa.

Associated Species: Erica tetralix, Ulex europalus, Potentilla eyecta, Narthecium ossifragum, Myrica gale, Salix aurita, Anthoxanthum odoratum, Hypericum pulchrum, Eriophorum angustifolium, Scirpus cespitosus.

Structure: Dry ridges between cutaway pools, dominated by dwarf shrubs, ranging in height between 5 and 60cm depending on frequency and intensity of grazing and burning. Calluna vulgaris is the most frequent dominant, sometimes forming dense monodominant stands. More frequently it forms a low open vegetation with herb cover dominated by Molinia and Carex paniceae Narthecium ossifragum may occur in the wetter areas. The ferns Pteridium aquilinum, Osmunda regalis and Blechnum spicant are occasional associates. Bryophytes are often abundant with cover up to 90%. Lichens are well developed where burning in less frequent and also may colonize bare peat ridges.

Substrate: Peat

Socioligical Affinities: Calluno - Ulicetea class of shrub heath lands.

Distribution: Frequent and widespread vegetation throughout whole catchment.

VEGETATION TYPE 3: Bogs

Community 3D: Molinia-Myrica

Sample No: R4, R15, R17, R25, R39, R49, R42, R54, D3, D4, 8.

Dominant Species: Molinia caerulea, Myrica gale

Associated Species: Potentilla erecta, Cirsium dissectum Schoenus nigricans, Narthecium ossifragum, Sphagnum spp, Cladonia spp.

Structure: In its best developed form Molinia and Myrica are both dominant and constant, frequently forming tall (1m) dense stands (cover to 80%). Potentilla erecta is the only other constant species. Molinia often shows the dense tussocky habit which mayn be attributed to a copious supply of well aerated drainage water but which may be affected by other factors such as light intensity and grazing (McVean and Ratcliffe, 1962). More open lower vegetation of this type may have elements of mixed Schoenus fen, Dry ridges - peat hags or Narthecium lawn but these disappear with the development of a dense Molinia - Myrica stand. Myrica seems to be the natural counterpart for Salix species which would naturally form a shrub layer but for human influence in the form of repeated and extensive burning.

Substrate: Peat

Sociological Affinities: This is the Molinia - Myrica nodum of McVean and Ratcliffe (1962) recorded as occuring frequently in the Western Highlands of Scotland. It has affinities with the Myricetum gale association of the Franguletea (Shrub Willow) class. This association is the Myrica dominated vegetation of laggs and cutaway around Irish raised bogs and western blanket bogs.

VEGETATION TYPE 3: Bogs

Community 3E: Bog Pools

Samples No: R14, D1, D2, D3, D4, D7, R16.

Dominant Species: Carex rostrata, Menyanthes trifoliata, Utricularia intermedia, Potamogeton coloratis.

Associated Species: Equisetum fluviatile, Chara spp, Myriophyllum alterniflorum, M. verticillatum, Phragmites australis, Eriophorum angustifolium, Sparganium emersum, S. erectum, Potamogeton polygonifolius.

Structure: Usually rectangular pools of varying size holding open water up to 50 cm in depth. Typically the pools contain open Carex rostrata with Menyanthes trifoliata and occasional emergent Phragmites. Submergents are frequent. Indeed Utricularia spp., Myriophyllum spp. or Chara spp may form monodominant submergent stands. In the deeper pools Potamogeton natans may occur. The peat walls of steep sided pools are frequently colonised by Bryophytes and less frequently lichens typically Cladonia verticillata. The borders of these steep sided pools may also support the locally most vigorous Calluna vulgaris, Erica tetralix and Myrica gale. Large cutout pool complexes occur in some areas which include islands of Myrica - Molinia or Dry ridges - Peat Hags. These complexes frequently have a dominanht aspect of diffuse Phragmites.

Substrate: Peat

Sociological Affinities: Contain elements of the Phragmition, Magnocaricion and Caricion curto-nigrae alliances and the Charetea fragilis class. This habitat is widespread on old cutaway peat but is decreasing due to reclamation.

Distribution: Widespread on cutaway throughout catchment.

VEGETATION TYPE 3: Bogs

Community 3F: Narthecium lawns.

Sample No: R87

Dominant Species: Molinia caerulea, Narthecium ossifragum, Carex panicea, Calluna vulgaris, Erica tetralix.

Associated Species: Succisa pratensis, Pedicularis palustris, Sphagnum species, Cladonia species.

Structure: Typically a very short sward (5-10cm) lawn like community. Narthecium leaves and heads are the dominant aspect, with frequent short regenerating Erica/Calluna. Molinia is frequent in some areas. A frequent community associated with cutaway pools and ridges. This vegetation type may grade into Myrica- Molinia stands.

Substrate: Peat

Sociological Affinities: A derived community probably from the Erico-Sphagnetum magnellanici association, due to peat cutting, drainage and burning.

Distribution: Frequent on cutaway throughout catchment.

VEGETATION TYPE 3G - Bogs

Community 3G: Shallow Peat Hummock-Hollow

Sample No: D21

Dominant Species: Molinia caerulea, Sphagnum spp., Calluna vulgaris, Carex echinata, Carex panicea, Narthecium ossifragum.

Associated Species: Schoenus nigricans, Erica tetralix, Pedicularis sylvatica, Potentilla erecta, Cladonia spp., Scirpus cespitosus, Pinguicula lusitanica, Carex binervis.

Structure: Irregular undulating hummock and hollow system lacking the ridge and pool system of deeper peat cutaway. Vegetation is variable with some small Sphagnum lawns in wetter areas and with dry hummocks of Sphagnum carrying dwarf shrubs such as Myrica gale, Caluna vulgaris and Erica tetralix are frequent. Molinia occur throughout and is dominant in some areas. Tussocks of Scirpus cespitosus and Schoenus nigricans are occasionally present. Myrica gale may from dense stands in some areas. This vegetation is cut by small channels and runnels which are frequently bordered by small areas of Schoenus fen, associated sometimes with small stands of Cladium mariscus and Juncus subnodulsus. Carex paniculata may also occur in association with some of these drainage areas. Juncus subnodulosus under the influence of the drainage water may extend onto the peat surface to form open stands.

Substrate: Peat

Sociological Affinities: Affinities with the Sphagnetalia compacti - the wet heath communities on shallow waterlogged peat up to 1m deep. Due to the influence of the calcareous grandwaters elements of the Parvocaricetae class are also present.

VEGETATION TYPE 4 Schoenus Marsh Total area: 2.9 ha.

Community 4 Schoenus Marsh

Sample Number: D28

Dominant Species: Schoenus nigricaus

Associated Species: Carex lepidocarpa, Carex panicea, Molinia caerulea, Succisa pratensis, Cirsium dissectum, Scorpidium scorpiodes, Juncus subnodulosus.

Structure: Vegetation dominated by tussocks of Schoenus nigricans to 60cm tall and cover 60%. Bryophytes well developed with Scorpidium scorpioides frequent. Water table is generally at or just above ground level. This community is closely related to mixed Schoenus fen(3B), but occurs in a pure form, normally at the bog margin and not on old custaway.

Sociological Affinities: Cirsio-dissecti-Schoenetum nigrican tis association. Rich fen vegetation. Widespread in Ireland but decreasing due to land reclamation.

Substrate: Marl or peaty marl.

Distribution: No large areas of pure Schoenus fen in catchment. Small fragmented areas frequent at bog margins.

VEGETATION TYPE 5 Carex elata marsh Total area: 1.7 ha.

Community 5: Carex elata marsh

Sample Number: R57

Dominant Species: Carex elata.

Associated Species: Polygonum amphibium, Mentha aquatica, Filipendula ulmaria, Galium palustre, Caltha palustris, Agrostis stolonifera, Chara spp.

Structure: At its most extreme this community is characterized by low species diversity. Carex elata forming large tussocks over 1m. in height and occurring in dense monodominant stands. Water table at or above surface. Inter tussocky areas dominated by Chara spp. and occasional Polygonum amphibium.

Sociological Affinities: Caricetum elatae association in the Magnocaricion alliance.

Substrate: Peat

Distribution: Large stand in the bed of Grey lough.

VEGETATION TYPE 6 Juncus subnodulosus stands Total area: 1.6 ha

Community 6 Juncus subnodulosus stands

Sample Number: 37

Dominant Species Juncus subnodulosus

Associated Species: Molinia caerulea, Carex rostrata

Structure: Normally open stands of Juncus subnodulosus up to 150cm. in height. Tall pure stands may sometimes be flattened by the wind. Cover normally 40-50%. Occurs with a wide range of associated species.

Sociological Affinities: Juncetum subnodulosus, association in the Caricion Davallianae alliance.

Substrate: Peat, Marl

Distribution: Occurs in a fragmented form throughout catchment, generally in very small stands.

VEGETATION TYPE 7 Carex rostrata Marsh Total area: 1.6 ha.

Community 7 Carex rostrata Marsh

Sample Number: R23, R30

Dominant Species: Carex rostrata, Menyanthes trifoliata, Equisetum fluviatile, Chara spp.

Associated Species: Potamogeton coloratus, Carex nigra, Utricularia spp, Phragmites australis.

Structure: Marsh area in water up to 30cm deep with Carex rostrata as the dominant emergent. Other species such as Menyanthes trifoliata and Equisetum fluviatile can form discrete monodominant stands. Cover up to 75%. Height of vegetation typically 35cm. Frequently occurs outside reedbeds. Chara species may form a dense submergent mat.

Sociological Affinities: Caricetum rostratae association in the class Parvocaricetea. This association is mesotrophic quaking-bog vegetation, usually confined to the waterlogged areas around fens.

Substrate: Peat, Marl

Distribution: Frequent as small fragmented stands in association with Reedbeds, Cutaways and Schoenus marsh. Occurs throughout catchment.

VEGETATION TYPE 8 Cladium Marsh Total area: .3 ha.

Community 8: Cladium marsh

Sample Number: D101.

Dominant Species: Cladium mariscus

Associated Species: Utricularia spp.

Structure: Typically small dense monodominant stands of Cladium mariscus up to 2m in height. Normally cover up to 100%. This vegetation is species poor.

Sociological Affinities: Cladietum marisci association in the Magnocaricion alliance.

Distribution: Small stands occur only in Knockavanny turlough and at pool margins in Polldorragha townland.

Substrate: Peat.

VEGETATION TYPE 9: Carex lasiocarpa. Marsh Total Area .1ha

Community Type 9 Carex lasiocarpa Marsh

Sample Number: R29

Dominant Species: Carex lasiocarpa

Associated Species: Carex rostrata, Chara spp. Scorpidium scoripioides.

Structure: Open homogenous stands of Carex lasiocarpa with cover up to 40% in a 70cm tall sward. Standing water 10-25cm deep. Submergents present in the form of a dense Chara mat. Occasional tussocks of Schoenus nigricans and Carex elata may be present. Scorpidium scorpioides occurs in the Bryophyte layer and may become dominant at the drier margins.

Sociological Affinities: Caricetum lasiocarpae association in the Class Parvocaricetea.

Substrate: Marl

Distribution: Occasional stands in Lomaunaghbaun townland.

VEGETATION TYPE 10 Quaking Swamp Total area: 11.7 ha.

Community 10A: Moss rich quaking swamp

Sample Number: R61, R59, R83

Dominant Species: Calligeron cuspidatum, Sphagnum spp, Carex limosa, Carex lasiocarpa, Vaccinium oxycoccus, Carex diandra.

Associated Species: Carex paniculata, Phragmites australis, Molinia caerulea, Menyanthes trifoliata, Selaginiella selaginioides, Potentilla erecta, Lynchis flos-cuculi, Eriophorum angustifolium, Drosera rotundifolia, Peltigera canina, Calluna vulgaris, Erica tetralix.

Structure: A Quaking wet fen community characterized by rising hummocks of Sphagnoid and non-sphagnoid mosses. Phragmites australis is sometimes the physiognomic dominant but the main contributors to the herb cover are usually Carex limosa, Carex diandra, Carex rostrata, Carex lasiocarpa and Carex paniculata,

any of which can form small local monodominant stands in some areas. Herb cover reaches 40% at a maximum. Moss hummocks serve as oxyphilous nuclei supporting Calluna vulgaris, Erica tetralix, Molinia caerulea and Potentilla erecta. Bryophytes are well represented with species of both rich fen and acid mire being present. Hummocks can reach up to 80cm tall. In some areas Vaccinium oxycoccus forms dense mats carpeting the moss hummocks. Occasional open solid areas support stands of Schoenus nigricans. Small stands of Cladium mariscus may occur at the margins of this vegetation.

Sociological Affinities: Correlates with the Acrocladio (giganteii) - Caricetum diandrae sub-association sphagnetosum with transitions to the sub-association schoenetosum (Wheeler, 1980). This is a rare community recorded from Scotland by Wheeler (1980). Probable affinities with some of the embryonic raised bog communities described from Scragh Bog, Co. Westmeath by O'Connell (1981).

Substrate: Peat

Distribution: Confined to the bog margins in Dunblaney and Drumbulcaun townlands.

VEGETATION TYPE 10 Quaking Swamping

Community 10B Carex diandra quaking swamp.

Sample Number: R53

Dominant Species: Carex diandra

Associated Species: Lynchis flos-cuculi, Equisetum palustre, Equisetum fluviatile, Filipendula ulmaria, Galium palustre, Holcus lanatus, Carex rostrata, Mentha aquatica, Epilobium parviflorum, Angelica sylvestris, Succisa pratensis.

Structure: A quaking mire community with an undulating microtopography dominated by low hummocks of Calliergon cuspidatum. Dominant herb aspect of open Carex diandra swards with abundant Lynchis flos-cuculi. Occasional Angelica sylvestris heads project above the 40cm. tall Carex diandra sward. Grass rich areas occur in some places in which Agrostis stolonifera and Anthoxanthum odoratum are frequent. Occasional shrubs of Salix atrocinerea may occur in this vegetation. Wetter areas may have very mobile quaking rafts of Agrostis stolonifera and Menyanthes trifoliata.

Sociological Affinities: Affinities to Acrocladio - Caricetum diandrae association described by Wheeler (1980). In communities described from Ireland it has affinities with the Caricetum lasiocarpa association - mesotrophic quaking bog vegetation confined to the waterlogged margins around fens.

Substrate: Peat

Distribution: Confined to cutaway bog margins in Polldoragha townland.

VEGETATION TYPE 10 Quaking Swamp

Community 10C: Carex lasiocarpa quaking swamp.

Sample Number: R75, R74

Dominant Species: Carex lasiocarpa, Molinia caerulea, Myrica gale.

Associated Species: Carex limosa, Menyanthes trifoliata, Carex lepidocarpa, Carex paniceae, Juncus bulbosus, Galium palustre, Utricularia minor, Potamogeton polygonifolius, Rhytidelphus squarrosus, Calligeron cuspidatum, Drosera angelica, Festuca rubra, Erica tetralix, Calluna vulgaris, Potentilla erecta, Schoenus nigricans, Vaccinium oxycoccus, Sphagnum spp.

Structure: A variable community characterized by sparse to dense Carex lasiocarpa frequently associated with Molinia caerulea and Myrica gale. This community is normally quite solid and only quaking in places. There is a wide range of associated species and the Ground layer is bryophyte rich but lacks the dense undulating hummocks characteristic of some of the other quaking mire types. Occurs in association with acidophile species on bog surfaces where there is some degree of flushing with mineral enriched water and the nitrogen is enhanced.

Sociological Affinities: Caricetum lasiocarpae association. Little known of its distribution in Ireland. A similar community has been described from Scotland (Birse, 1980), where it is widespread.

Substrate: Peat

Distribution: Occurs only on the bog margins at Dunblaney/Drumbulcaun townlands bog.

VEGETATION TYPE 10 Quaking Swamps

Community 10D Juncus subnodulosus - Carex diandra

Sample Number: R45, R51, D14, R3, R65.

Dominant Species: Carex diandra, Juncus subnodulosus Moss spp, Sphagnum spp.

Associated Species: Equisetum fluviatile, Equisetum varigatum, Agrostis stolonifera, Lychnis flos-cuculi Succisa pratensis, Potentilla palustris, Sagina nodosa, Hydrocotyle vulgaris, Carex nigra, Carex lepidocarpa, Carex limosa, Phragmites australis, Angelica sylvestris, Menyanthes trifoliata.

Structure: A Quaking mire vegetation occuring at bog margins and in the wetter areas of cutaway. Mosaic of monodominant stands of dominant species. Cover variable with herb up to 70% and Bryophytes reaching 100% in places. Frequently a narrow zone around pools in old cutaway. Small pools contain Potamogeton coloratus and Carex rostrata. Bryoplhytes may be dominant at pool margins with Carex limosa forming a loose creeping mat. Juncus subnodulosus scattered throughout this vegetation as well as forming pure stands nearby. Equisetum varigatum is a rarer associate at the pool edges. Carex diandra also occurs in pure stands with Scorpidium scorpioides. This vegetation can occur as a mosaic in association with other quaking communities.

Sociological Affinities: Contains Scorpidio-Caricetum diandrae and Juncetum subnodulosi associations.

Substrate: Peat

Distribution: Occurs as small fragmented communities in Polldorragha, Pollaphuca townlands and in Dunblaney townland fronting more extensive swamp communities.

VEGETATION TYPE 10 Quaking Swamp

Community 10E: Empetrum-Calluna quaking swamps

Sample Number: 63

Dominant Species: Empetrum nigrum, Vaccinium oxycoccus, Calluna vulgaris, Sphagnum spp.

Associated Species: Eriophorum vaginatum, Scirpus cespitosa, Erica tetralix, Eriophorum angustifolium, Molinia caerulea, Succisa pratensis, Narthecium ossifragum, Peltigera canina, Menyanthes trifoliata, Carex limosa, Phragmites australis.

Structure: This vegetation is characterized by vigorous Empetrum nigrum, forming a dense mat over low Sphagnum hummocks. Dwarf shrubs well developed 30cm.+ tall with dense lichen epiphytes. Dwarf shrubs contribute 60% to the cover with herbs covering 15%. Bryophytes Sphagnum spp. cover 100%. This community forms a margin to the adjacent moss rich quaking swamp (community 10A) and grades into it. It forms a border between the moss rich quaking swamp community and the solid bog surface.

Sociological Affinities: This community has affinities with the new association Erico-Sphagnetum plumulosi described by O'Connell (1981) from Scragh Bog, Co. Westmeath.

Substitute: Peat

Distribution: Occurs at the margin of the bog in Dunblaney/Drumbulcaun townlands only.

VEGETATION TYPE 11: Grass Sedge Swards-Total area 57.8ha

Community 11a: Low Sedge Sward

Sample Number: R1, R32, R10, R56, R73, R35

Dominant Species: Calliergon cuspidatum, Agrostis stolonifera, Carex nigra, Carex panicea, Juncus articulatus.

Associated Species: Galium palustre, Filipendula ulmaria, Prunella vulgaris, Potentilla anserina, Leontodon autumnalis.

Structure: Herb layer usually grazed and poached, height 15-20 cm, cover 75-85%. Bryophyte species diversity is low but Calliergon cuspidatum is frequently very abundant in this community with a cover ranging from 20-80%.

Sociological Affinities: Probably Carici nigrae-Juncetum articulati and/or Junco acutiflori Molinietum associations. Both are thought to be widespread in Ireland.

Structure: Peat

Distribution: Cutaway margins in Monacow, Polldorragna and Ballaghalode townlands, small stands in Coilbeg and Lomaunaghbawn townlands.

VEGETATION TYPE II: Grass Sedge Swards

Community 11B: Wet sedge sward

Sample Number: R11, R13, R80, D17, R76, R78, D22, R12, R20, R33.

Dominant Species: Carex flacca, Carex panicea, Molinia caerulea, Carex hostiana, Carex nigra.

Associated Species: Juncus articulatus, Mentha aquatica, Hydrocotyle vulgaris, Holcus lanatus, Agrostis stolonifera, Equisetum fluviatile, Equisetum palustre, Mentha aquatica, succisa pratensis, Ranunculus flammuia.

Structure: Usually ungrazed sedge meadows (height 30-40 cm, cover 100%) dominated by Molinia caerulea, Carex nigra, Carex hostiana, C. echinata and C. pulicaris are sometimes found. Other frequent associates include Myrica gale and Leontodon autumnalis. Bryophyte species diversity is usually poor but the species Calliergon cuspidatum is frequently present and may reach 20% of cover.

Sociological Affinities: Transitional, perhaps between Carici nigrae - Juncetum articulati and Cirsio Molinietum associations.

Substrate: Shallow peat

Distribution: Common at bog margins throughout subcatchment.

VEGETATION TYPE 12: Grasslands - Total Area 49.3 ha.

Community 12A: Wet Pasture

Sample Number: R55, D23, D24, R62.

Dominant Species: Juncus effusus, Trifolium repens, Cynosurus cristatus.

Associated species: Juncus articulatus, Holcus lanatus, Carex nigra, Carex panicea.

Structure: Grazed wet pasture grassland with a dominant aspect of open Juncus effusus tussocks which may reach up to 120cm in height. Total herb cover is normally 100% with high litter cover in some areas. The Bryophyte layer is typically poorly developed. The intertussock area is grazed to a low short grass sward.

Sociological Affinities: This vegetation has affinities with the Junco acutiflori - Molinetum sub association of Trifolium repens and may in places grade into the Centaureo - cynosuretum sub association juncetosum.

Substrate: Peat, Peat mineral mixture

Distribution: Occasional throughout catchment.

VEGETATION TYPE 12: Grasslands

Community 12B: Rich wet pasture

Sample Number: R81

Dominant Species: Cynosurus cristatis, Bellis perennis

Associated species: Plantago lanceolata, Achillea millefolium, Carex panicea, Galium verum, Ranunculus bulbosus, Alchemilla spp., Trifolium pratense, Hypochaeris radicata, Hieracium pillosella, Plantago maritima, Carex flacca, Leontodon autumnalis, Lotus corniculatus, Rhytidiadelphus squarrosus.

Structure: A short sward species rich community characterised by a low undulating topography. Occurs in the upper area between parallel eskers. Floods via small channels and runnels. Unlikely that it floods to any depth and only occasionally.

Sociological Affinities: Centaureo - Cynosuretum subassociation galietosum

Substrate: Thin Peat, Peat mineral mixture.

Distribution: Found only in Tonrevagh townland where areas of this vegetation were flooded at the time of sampling.

VEGETATION TYPE 12: Grasslands

Community 12C: Filipendula drain margin

Sample Number: R47, D5

Dominant Species: Filipendula ulmaria, Juncus effusus, Agrostis stolonifera.

Associated Species: Carex flacca, Juncus subnodulosus, Rumex acetosa, Potentilla palustris, Galium palustre, Valeriana officialis.

Stucture: Dense tall (over 1 m) ungrazed herb vegetation dominated by Filipendula ulmaris. This vegetation forms a relatively narrow border to old vegetation blocked, drains and channels. the Litter layer is typically dense forming a loose carpet several cm's deep. The bryophyte layer is normally poorly developed.

Sociological Affinities: Filipendulion alliance, Valeriano - Filipenduletum association. Seldom grazed or mown, tall grassland vegetation of continuously wet areas along rivers, streams and ditches on humius or mineral rich soils where organic material is deposited.

Substrate: Mineral

Distribution: Fragmented distribution throughout catchment, along drain margins. No large stands present.

VEGETATION TYPE 12: Grasslands

Community 12D: Carex nigra - Potentilla anserina swards.

Sample Number: R67.

Dominant Species: Carex nigra, Potentilla anserina
Associated Species: Mentha aquatica, Agnostis stolonifera, Ranunculus repens, Leontodon autumnalis, Calligeron cuispidatum, Juncus articulatus.

Structure: Carex nigra Sward up to 30 cm, occupies the upper floor of turloughs inundated in winter but expoosed and grazed in Summer. Potentilla anserina is frequent throughout. Herb cover is circa 90%. Heavy grazing encourages species diversity with a strong ruderal element. Surrounding vegetation is normally flood pasture.

Sociologicfal Affinities: Carici nigrae - Juncetum articulata association of the Class Parvo caricetea.

Substrate: Marl

Distribution: Occurs in the turlough in Brockagh townland and at a channel margin in Curraghcreen townland.

VEGETATATION TYPE 12: Grasslands

Community 12E: Flooded Pasture

Sample Number: R69, D20.

Dominant Species: Agrostis stolonifera, Potentilla anserina, Carex hirta, Filipendula ulmaria, Leontodon autmnalis.

Associated Species: Carex panicea, Hydrocotyle vulgaris, Phalaris arundinacea, Molinia caerulea, Ranunculus repens.

Structure: Dominant turlough floor vegetation 5cm to 20cm tall grass/sedge swards with cover up to 100%. Byrophytes poorly developed but frequent Cinclidotus fontinaloides and Fontinalis antipyretica occur on adjacent rocks, walls, trees and fences.

Sociological Affinitiėnities: In the Agropyro-Rumicion crispi alliance. This alliance includes both natural and anthropogenic vegetation of disturbed ground and unstable habitats consisting of rhizomatous and stoloniferous hemicryptophytes; in habitats with extremes of wetness and dryness or alternating brackish and fresh water, nutrient rich or nutrient poor.

Substrate: Marl-Mineral

Distribution: Occurs in all turlough beds in the catchment.

VETGETATION TYPE 13: Pasture and Arable -
Total area: C1522.6 Ha

Community 13A: Pasture i) Non esker grassland

Sample Number:

Dominant Species: Cynosurus cristatus, Holcus lanatus, Lolium perenne, Agrostis capillaris, Trifolium repens, Dactylis glomerata.

Structure: Agricultural grassland, usually grazed pasture. Herbs 5 - 10cm tall cover 50-90% Byrophytes poor or absent.

Sociological Affinities: Centaureo-Cynosuretum subassociation typicum. Moderate quality pastures rich in weeds and poor yield grasses, extremely common and widespread in Ireland.

Substrate: Predominantly mineral soil.

Distribution: The dominant vegetation type of the catchment.

ii) Esker grassland.

Sample Number: R71, R81, R28, D13, D9

Dominant Species: Cynosurus cristatus, Agrostis capillaris, Briza media, Plantago lanceolata, Bellis perinnis.

Associated Species: Galium verum, Festuca rubra, Achillea millefolium, Carex panicea, Hypochoeris radicata, Plantago maritima, Prunella vulgaris, Thymus praecox, Hieracium pilosella, Rhytidiadelphus squarrosus, Ranunculus bulbsus, Carex flacca, Rosa pimpinellifolia, Calluna vulgaris, Carlina vulgaris, Solidago virgaurea, Pteridium aquilinum, Centaurea nigra, Anthoxanthum odoratum, Trifolium pratense, Hypericum pulchrum,

Antennaria diocia, Potentilla erecta, Briza media.

Structure: Species rich grassland of Eskers. Typically a low grazed grassy sward. But in some areas Rosa pimpinellifolia, Calluna vulgaris, Hypericum pulchrum, Potentilla erecta, and Pteridian aquilinum are locallly frequent. In other areas- typically with very thin soils the presence of such species as Antennaria dioica, Polygala vulgaris, and Carlina vulgaris is noticeable.

Sociological Affinities: Centaureo-Cynosuretum sub association galietosum with local transitions to Antennarietum hibernicae association - this is grassland vegetation of calcareous eskers and moraines, local transitions also occur on more leached soils to a heathland vegetation in the Genisto-Callunion alliance.

Substrate: Mineral

Distribution: Confined to the Eskers, which occur frequently in the catchment.

COMMUNITY13B: Arable

Structure: Limited to small area of potatoes etc. associated with dwelling houses.

Distribution: No large area of arable farming within subcatchment.

VEGETATION TYPE 14: River, Channels and Drains

Sample Number: D8, D26, D28

Dominant Species: Apium nodiflorum, Nasturtium officinalis.

Associated species: Sparganium erectum, Mentha aquatica, Callitriche spp, Glyceria fluitans, Hippuris vulgaris, Lemna minor, Potamogeton natans, Equisetum fluviatile, Catabrosa aquatica.

Structure: Vegetation of drains and ditches frequently dominated by Apium nodiflorum and Nasturtium officianalis with Glyceria fluitans. Drains may sometimes be dominated by Chara species on marl substrate. Wide channels invariably choked with vegetation, particularly by submergent Apium nodiflorum and Nasturtium officinalis, emergent Sparganium erectum, Hippuris vulgaris and Alisma plantago - aquatica and floating leaved Nuphar lutea and Potamogeton natans.

Sociological Affinities: - Glyceria-Sparganion alliance, probably Apio Veronicetum beccabunga association, occurring in drains which tend to dry out in summer.

- Apion nodiflora alliance probably apio - Sietum association which generally occurs in clear eutrophic, mostly calcareous or slightly brackish running water.
- Potameto - Nupharetum association which occurs in the wider channels
- Charion asperae alliance on marl substrates.

Substrate: variable

Distribution: Channel drain and ditch vegetation common throughout catchment.

VEGETATION TYPE 15: Hazel Scrub

Community 15: Hazel Scrub

Sample Number: D27

Dominant Species: Corylus avellana, Prunus spinosa Crataegus monogyna, Fragaria vesca, Oxalis acetosella, Rhytidiadelphus triquetrus, Eurhynchium striatum.

Associated Species: Rubus fruticosus, Circaea lutetiana, Potentilla sterilis, Geranium robertianum, Fraxinus excelsior.

Structure: Corylus avellana and Crataegus monogyna woodland with closed canopy at 4m and cover 85%. Understorey dominated by shrubs of Prunus spinosa (2m tall) and occasional clumps of Rubus fruiticosus. Herb layer poorly developed with a cover of less than 20%. Bryophytes well developed with a cover of 30% - 60%

Sociological Affinities: Corylo - Fraxinetum subassociation typicum. A species rich damp Hazel - Ash woodland. Widespread in Britain and Ireland but fragmentary.

Substrate: Mineral

Distribution: occasional but very fragmented distribution, occurring in small stands on Eskers and skeletal soils.