lough boora parklands

Pre-Feasibility Study by Boora Enterprise Group

*A **Plan** for the total integrated use of cutaway peatlands at Bord na Móna, Boora, Tullamore, Co. Offaly*

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LAUNCHED BY MINISTER BRIAN COWEN, T.D., MINISTER FOR TRANSPORT, ENERGY & COMMUNICATIONS ON JUNE 10th 1994

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Pre-Feasibility Study by

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BORD NA MÓNA

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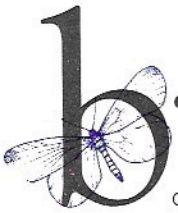
foreword



ord na Móna as a modern, environmentally-conscious company has a responsibility to ensure the full utilization of all cutaway bogs. Every acre of Bord na Móna cutaway bog will be utilized in the national interest, with no derelict, waste or undesignated land remaining.

The 1990 Independent Committee set up by the Minister for Energy to investigate cutaway bog utilization stated "...usage will call for careful planning and full participation and co-operation by all the relevant and public agencies - national and local". The utilised land "will become a valuable resource capable of generating considerable benefits locally and nationally". The Committee recommended that "Bord na Móna, the Office of Public Works, and the relevant local authorities should form an inter-agency group to ensure that amenity and tourism development take place in a proper and co-ordinated way".

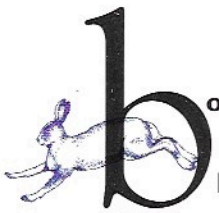
I commend the vision and enterprise of the group of employees who produced this study and the Offaly Leader Programme who co-funded the report.

I hope that the full feasibility report, as proposed in this study, will act as a blueprint for future cutaway development throughout the Midlands.

Eddie O'Connor

Dr. E. O'Connor

introduction



Bord na Móna owns 220,000 acres of bogland in Ireland of which 80,000 acres occur in Co. Offaly. This bogland has been used for the production of fuel peat since the 1940's. Its continued extraction over the next 30 years will result in a steady flow of cutaway bog areas becoming available for development.

"Cutaway" is the word used to describe bog from which most of the peat has been industrially extracted. How that cutaway is utilized in the national interest is a matter of significance for the future. The multi-use option, encompassing a variety of usages from agriculture, to forestry, to amenity and natural sites, was suggested by the Independent Committee of 1990 as the optimum choice for cutaway development. In these proposals we outline a co-ordinated plan, based on the multi-use option, to develop a large area of Co. Offaly cutaway into a Parkland that will enhance the economic and social life of the Midlands.

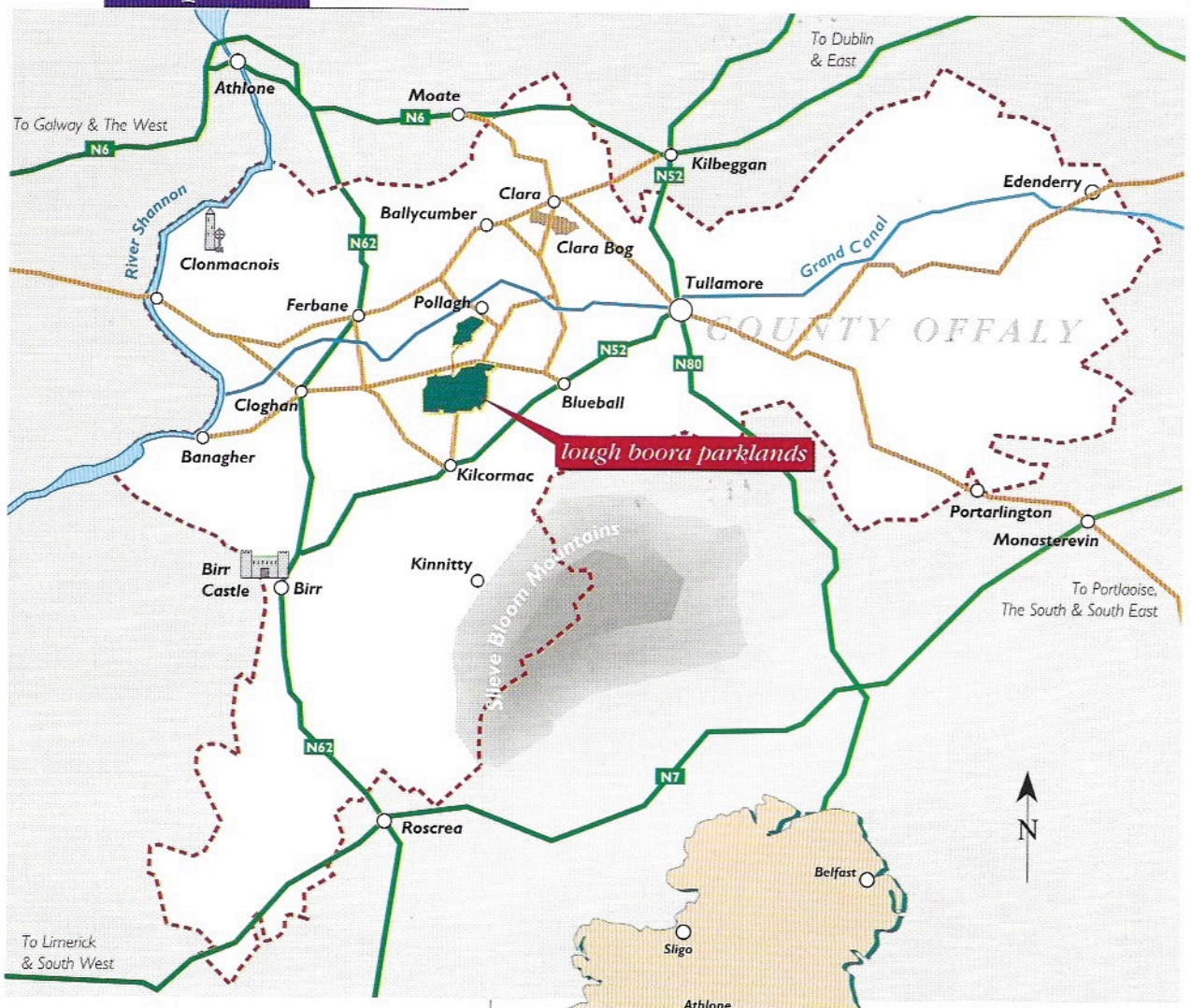
This study is a proposal for the total integrated land use of 5,500 acres of cutaway bog at Boora, near Tullamore, Co. Offaly. This cutaway was initially part of the 20,000 acre Boora Bog production complex. Already over 2,900 acres of this complex have become cutaway bog. The focus of this initiative is to provide an amenity from this enormous resource that will greatly increase the recreational and tourism potential of County Offaly. The direct and indirect employment created in the area will replace jobs in the declining peat industry as the peat resource becomes exhausted.

Bord na Móna have developed and are continuing to develop the commercial aspects of cutaway bogs. This study deals with the areas available for amenity use alongside these commercial developments. This study has been prepared by the Boora Enterprise Group, a team of eight Bord na Móna employees who have an intimate knowledge of the cutaway area in question and a vision of its potential. Expert opinions were sought on the diverse facets of this study and of the cutaway areas it covers. These opinions are included as independent contributions in Section Two of the study. These contributions are colour coded to correspond with the introductory article in Section One.

This plan is prepared for presentation to the relevant state and development agencies and to the public and titled **"Lough Boora Parklands".**

contents

map one location



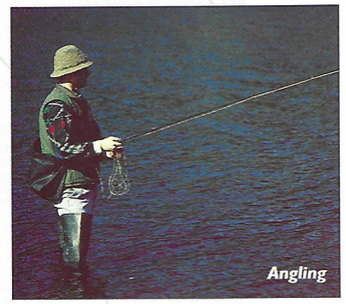
Lough Boora Parklands
Strategic Location

Lough Boora Parklands is centrally located to all of the main attractions at present and proposed for County Offaly.

Slieve Bloom Environmental Park	**8 miles south**
Birr Castle	**13 miles west**
Clonmacnois	**14 miles north west**
Clonmacnois & West Offaly Railway and Mongan Bog	**12 miles north west**
Clara Bog	**10 miles west**
Grand Canal & "The Offaly Way"	**Adjacent to site**

see *map two* over

map two lough boora parklands



Brosna River

Grand Canal

Derries

Wetlands

Recolonised Cutaway

Cocta Hill

Turraun

Lagoon

Pollagh

Oughter

The Offaly Way

R.C. Church

Cloghan

Ferbane Power Station

Boora River

Peat Energy Division Headquarters & Boora Works

West Boora

East Boora

Mesolithic Site (Lough Boora)

Boora Lake

Tumduff

Tumduff Lake

Finnamore's

Blueball

To Kilcormac

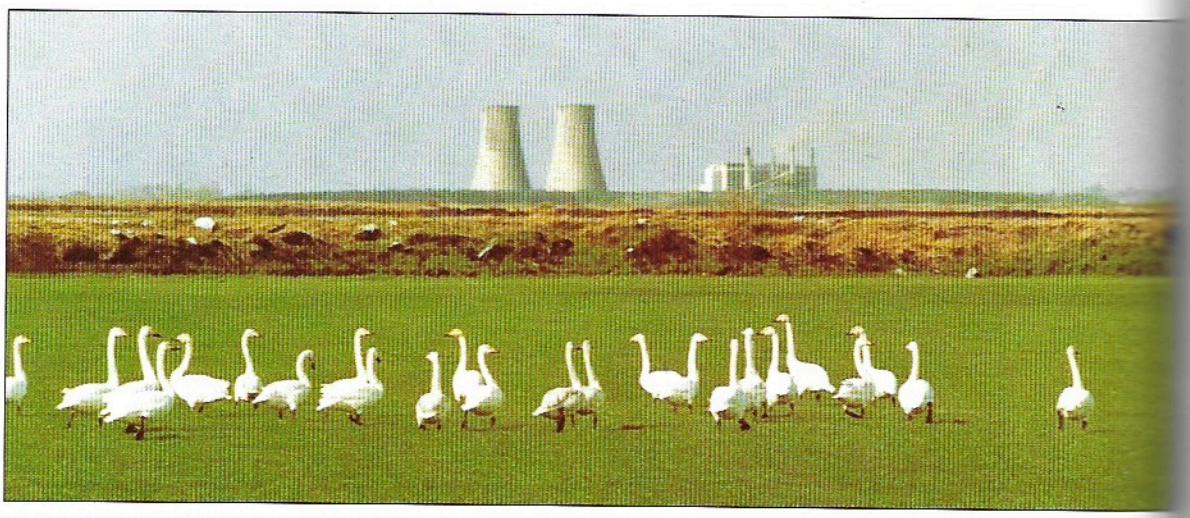
N

Legend

- Development Boundary
- Coniferous Forestry
- Hardwood Forestry
- Grassland
- Lakes
- Wetlands
- Railway Line
- Recolonised Cutaway
- Walkway
- Road

SCALE 0 0.5 1.0 KM

section one



Whooper Swans grazing on Lough Boora Parklands.

the concept

A common perception of cutaway bogs is that they are barren landscapes devoid of life. Nothing could be further from the truth. While we may all lament the loss of much of the natural bog ecosystem through commercial extraction, an imaginary picture of what the future could hold for these areas is much more encouraging.

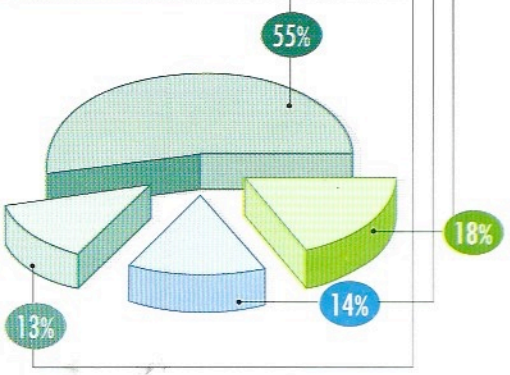
That picture is one of a new landscape retaining much of the rich natural & human heritage of the past. This proposal outlines the possible integrated development of 5,500 acres of cutaway bogland into an expansive open Parkland. **Lough Boora Parklands** would be a great natural wonderland featuring an exciting blend of habitats and attractions. These attractions, and the percentage of the Parklands they will cover, are as follows: Lakes (2%); Historic Sites and Parkland Interpretation (2%); Wetlands (5%); Colonized Areas (5%); Walkways and Nature Trails, etc. (6%); Grassland (20%); and Mixed Woodlands 60%. Furthermore, the potential exists to extend the Parklands to cover 20,000 acres.

This study creates a vision of a vast open unencumbered land mass stretching from Tullamore to Birr and surrounded by the villages of Kilcormac, Banagher, Cloghan, Ferbane and Clara. This expansive bogland amenity will be a unique & invaluable asset to the community on a scale unprecedented in Ireland. It will provide a focal point for environmentally oriented tourism in Offaly, whilst complementing other tourism initiatives in the county.

The wide range of educational, recreational, amenity and tourism activities created by the Parklands will ensure their success in catering for the many needs of the region.

The main features of the Parklands will be:

Grassland	1,000 acres
Amenities	
Wetlands	250 acres
Recolonized areas	350 acres
Lakes	100 acres
Historical Site	50 acres
Visitor Centre & other activities	50 acres
Associated Walks	50 km (30m)
Afforestation	
Amenity Hardwood	700 acres
Afforestation	
Commercial Coniferous	3000 acres



wetlands & wildlife refuges

Turraun Nature Reserve, near Pollagh village, has already been partially developed within the **Lough Boora Parklands** area. It consists of 130 acres of flooded cutaway bog and 250 acres of birchwood, reed-swamp and wild grasslands. This wetland area has proved to be a major sanctuary for wildlife, with over 80 different species of birds recorded there (See Appendix One). Turraun Reserve is especially important for winter migrating birds like Whooper and Bewick Swans. It also carries a large population of duck, including Mallard, Widgeon and Teal, and many species of Waders.

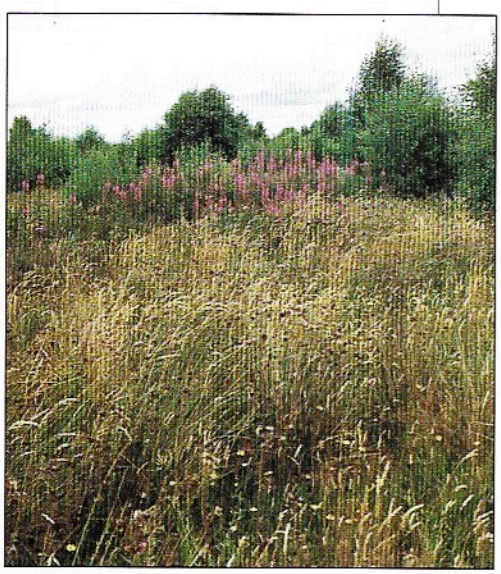
Turraun Nature Reserve is an important habitat for a large population of duck, including Mallard, Widgeon, Teal & many species of Waders.

Much landscape work has yet to be carried out in the Nature Reserve to provide walkways, bird hides, and information points. The Reserve will be a major attraction for birdwatchers and for environmentalists interested in insect and plant life. This will have a very important educational role to play both for the future development of other cutaways and for the student studying environmental projects.

recolonized areas

At Turraun Nature Reserve a large area of cutaway bog has already gone through the process of recolonization. There are other recolonized sites in the townlands of Killooly and Derrydolney (at the south end of Tumduff bog Area) and in Leabeg townland (in the area of former Lough Boora). In all there should be up to 350 acres of naturally recolonized cutaway in the **Lough Boora Parklands**.

The pattern of recolonization forms a mosaic of habitats that merge and blend into each other. These habitats range from birch woodlands, to molinia grasslands, to reedbeds and moss gardens. These areas are very rich in a flora which ranges from acid to alkaline plants growing side by side. During the summer there is an explosion of colour from every type of wildflower. Over 150 plant species have been recorded in one small area alone (see Appendix Two). The recolonized areas are also very rich in fauna and insect life.



Already a large area of cutaway bog has undergone recolonization, transforming the landscape.

We propose that walkways should be carefully developed through these areas and they will provide tranquil and unequalled beauty in both summer and winter.

lakes

Five lakes will be developed throughout **Lough Boora Parklands.** Two of these have already been established, but they will need further development. Experience gained in the establishment of these two lakes has already proved that fresh and coarse fishing can be successfully established on low-lying areas of cutaway bogland with shallow peat residues. With further excavation into the subsoil and with the introduction of aquatic plants, these lakes could easily become established fisheries. The five lakes will be:

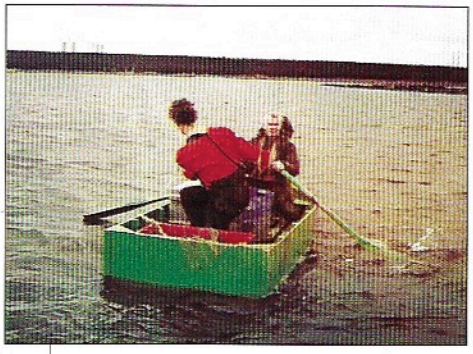
1. ***Boora Lake*** *(15 - 20 acres) a proposed "put & take" fishery for brown and rainbow trout.*

2. ***Tumduff Lake*** *(15 - 20 acres) a proposed "catch and release" fishery for brown & rainbow trout.*

3. ***Finnamore's Lake*** *(30 - 40 acres) a proposed coarse fishery.*

4. ***Turraun Lagoon*** *(17 acres) a proposed coarse fishery.*

5. ***Garden Lake*** *(4 acres) a proposed education and recreation site.*



The lakes will be stocked and developed with facilities for anglers.

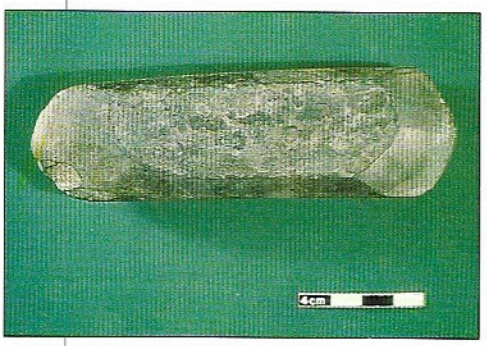
These lakes will be near roads and car parks and have facilities for disabled anglers. There will also be two one-acre nursery ponds established at Turraun for rearing both coarse and game stocks. The lakeside areas will be landscaped with hardwoods, natural grasses, and heathers, and will have walkways and picnic facilities.

lough boora mesolithic site

This is situated on the site of former Lough Boora, a 50 acre lake that was drained during the early 1950's. Evidence of an Early Mesolithic site was discovered there during peat production operations in 1977 by an employee Mr. Joe Craven.

Attention was attracted to the site by a ridge of loose gravel which turned out to have been a storm beach on the eastern shore of a much greater lake that existed there after the last Ice Age. On a promontory of this shore the remains of a number of hearths (cooking areas) were discovered. These were carbon-dated to 8,500 years ago.

Near these hearths a small number of polished stone axes, and over 500 small blades of chert were found. Also found were the bones of wild pigs, hares, birds and small fish, and hazelnut shells. Much of this discarded material was the remains of meals cooked in the hearths in pre-history.



A flint axe head, found on the site at Lough Boora, c. 8,500 years old.

Before this discovery the only evidence of Mesolithic man, Ireland's earliest known inhabitants, had come from the North East of the country. Further details on the Mesolithic Site are supplied in Section Two by Dr. Michael Ryan, who headed the archaeological investigations at Lough Boora in 1977 when he was Keeper of Irish Antiquities at the National Museum.

walks

The Offaly Way" takes the walker through the centre of the proposed **Lough Boora Parklands,** from the Grand Canal at Turraun, onto Kilcormac and along the banks of the Silver River to connect with "The Slieve Bloom Way" at Cadamstown.

A branch of this walkway will eventually extend to the **Lough Boora Mesolithic Site.**
In association with "The Offaly Way" a number of walkways may also be developed along roads and pathways in the Parklands and take walkers to...

1. ***Turraun Nature Reserve.***
2. ***Lakes for angling and recreation.***
3. ***Developed forest walks.***

The walks will average from one to sixteen kilometres in length and facilities can be provided to accommodate disabled people to points of interest by railcar or mini-bus. These vehicles can also be used to collect people at walk terminals.

The walkways will take the visitor right into the heart of Lough Boora Parklands.

visitor centre

There are a number of successful Visitor Centres throughout Ireland associated with Parklands and sites of historical interest. A Centre in **Lough Boora Parklands** is essential to interpret the various elements being developed there. Such a Centre would complement the proposed and existing visitor centres at Clara, Birr and Clonmacnois.

Such a Centre would interpret the following themes...

A brief introduction on the geology of the area and bog formation.

A major focus on the Mesolithic site, about its location, layout, and significance, and a display of artifacts found there and elsewhere in the bog.

A reconstruction of the Poitín Still site that was situated in the Parklands at Spain's Island near Kilcormac.

A brief description outlining milled peat production, the workings of a peat-fuelled electricity generating station, and of a peat briquette factory.

A major focus on cutaway development, divided into...
a) Grassland and Afforestation.
b) Wetlands and Nature Reserves (Flora and Fauna).
c) Amenities on cutaway, i.e., fishing, walking, etc., with displays of locations and routes.

The exhibition would culminate in a model displaying the 100% utilization of **Lough Boora Parklands** and the surrounding district.

other activities

A number of other outdoor activities are already being developed in the Parklands. These include...

1. Model Aeroplane Flying

The Midland Model Aeroplane Club have bought a site within the Parklands and are currently developing this site as one of the main flying grounds in the country.

2. Clay Pigeon Shooting

A fully developed facility for this activity has been developed beside the Parklands and is actively used by the local Gun Clubs.

3. Pony Trekking

An equestrian centre is already established in the Parkland. The owner, a local man, intends to develop pony trekking through the Parklands in the Summer of 1994.

4. Grey Partridge and Merlin

These two endangered species have found a safe habitat within the Parklands where they may be observed and their habits studied.

Other Proposed Activities Include:

- Model Boats Club.
- Archery Range.
- Canoeing and sailing lessons.
- Pet and rare animal farm.

Lough Boora Parklands, a habitat for the endangered Grey Partridge.

afforestation coniferous & hardwood

Within the Parklands 3,700 acres of afforestation will eventually be developed. 3,000 acres will have coniferous forestry and 700 acres hardwoods. These plantations are clearly outlined in the map on *page v*. This development will benefit the community in the short and long term.
Initial planting operations provide good employment and when the coniferous forestry starts to mature additional downstream employment will result.

Since afforestation will have a major visual impact on the area a high priority should be given to the sensitive planning of coniferous tree planting. Conifers along roads and walkways need to be fronted by hardwoods.

The hardwoods will take longer to become established and many will be planted for amenity purposes around lakes and through nature reserves.

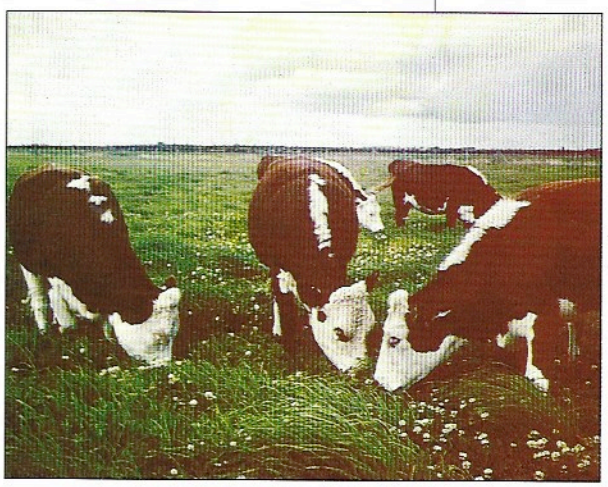
Both hardwood and coniferous plantations in the area will provide excellent habitats for wildlife, including fallow deer. Paths and walkways may be developed through these plantations.

Parklands plantations will contain coniferous and hardwood trees.

grassland development

Iough Boora Parklands will contain 1,000 acres of top quality grassland. Already 750 acres of this development has been completed. These lands are fenced and served by roads and provided with a water supply and are ideally suited for summer grazing by sheep and cattle.

To date 600 acres have been sold in unit sizes to meet market demands. This new grassland will enable farmers to increase their holdings, thus allowing them to become more viable, which in turn will help to retain the rural fabric.



Cattle grazing in the Parklands.

economic impact of parklands development

Profile of the Lough Boora Parklands Area

The physical geography of the area is characterised by large tracts of worked and cutover bog interspersed with regions of medium to good farmland. The area has an average settlement density but with a poor urban structure.

The study area is composed of 5,500 acres of worked and cutover bogs bounded by Cloghan to the West, Blueball to the East, Pollagh to the North & Kilcormac to the South (see Map One).

Population and Employment Details of the Area

Besides a large sector of the community which are involved in farming, the main industrial workforce is employed by Bord na Móna and the E.S.B., with smaller industrial concerns and service companies located in the surrounding towns and villages. The population is declining due to the emigration of young people.

Economy

The area is agriculturally limited in terms of acreage, because of a high percentage of peatland to mineral soil. Consequently the local economy exhibits a high degree of dependence on the peat sector. That industry is vulnerable to further decline and has suffered major job losses.

The area would benefit from an expansion of agricultural acreage if young farmers were to own viable holdings.

The main natural resource of the area is peat which is being harvested by both Bord na Móna and some private individuals.

Since 1956 over 22 million tonnes of peat have been used for electricity generation at Ferbane Power Station, while an additional 10 million tonnes went to produce peat briquettes at Derrinlough Briquette Factory. There are adequate additional Bord na Móna peat reserves in the entire Boora catchment area for the design life of both Derrinlough Briquette Factory and Ferbane Power Station.

Some sections of the study area are already cutaway (meaning that all extractable peat has been removed) and the remaining cutaway areas will be developed in forthcoming years as outlined in Table 1.

Year	Production Acreage	Cutaway Acreage
1994	2,600	2,900
2000	1,400	4,100
2006	500	5,000
2012	0	5,500

Table 1

Impact of Lough Boora Parklands on the Area

Agriculture Sector

The project area is designed to have 1,000 acres of grassland that will be sold at going market rates to the local farming community. This form of enterprise has been successful to date for Bord na Móna and the quality and viability of the grassland created are proven and accepted by farmers.

Employment Potential

1,000 acres of grassland will create 10 to 12 jobs directly and an additional 2 to 4 jobs in food processing and spin-off industries.
Total Potential: 16 Jobs
(Independent Expert's Assessment)

Forestry Sector

It is intended that 3,000 acres of commercial coniferous forestry and 700 acres of hardwoods will be planted in the study area. The hardwoods will be preserved as an amenity area. Commercial Coniferous Forestry operations (tree-felling) will begin in 2030 and this will be followed by replanting in cleared areas.

Employment Potential

Years	Employment per year
0 - 10	6
11 - 20	5
21 - 30	7
31 - 40	13
41 - 50	32

There will also be additional employment downstream in the processing sector.

Tourist Amenities and Ecological Sectors:

It is envisaged that this section of the project area will consist of:

i) 250 acres of wetlands.
ii) 100 acres of lakes for fishing and amenity use.
iii) 350 acres of recolonized cutaway bogs for ecological activities.
iv) A Visitor Centre incorporating the interpretation of cutaway bogs, with adjoining areas for walks and guided tours.

Employment Potential

Direct employment of 12 to 14 jobs based on 512,000 tourists per year to the region, and a projected 50,000 to **Lough Boora Parklands**. There would be additional spin-offs to the locality in tourist spending on food, accommodation, etc.

Long Term Impact of Lough Boora Parklands

By providing a tourist and amenity area in the Mid-Offaly Region and complementing other tourist related activities, e.g., Clonmacnois, Clara Bog, Birr Castle, Slieve Blooms, etc., **Lough Boora Parklands** should increase the tourist stopover time in the region and have a positive economic impact on regional development.

tourism opportunities in the midlands

Over the last number of years certain new trends have emerged in the tourism market in Ireland. There has been a steady growth in the overall industry with numbers increasing from 2,093,000 visitors in 1987 to 3,015,000 in 1991. Interesting details emerge from research into the activities tourists engage in while in Ireland. In 1987, 19% of our overseas visitors came from Europe, 68% from North America, and 13% from other countries worldwide. By 1991 this had grown to 34% from Europe, 51% from North America, and 15% from the Rest of the World. This indicates a tourist market swing toward European customers.

These European visitors are more focused on activity-based holidays than their American counterparts. Statistics show that while 59% of Europeans participate in fishing, golf, equestrian, cycling, and hill-walking holidays, only 31% of American visitors do, and these Americans still manage to participate in such activities as historical and cultural visits to houses and castles, etc.

Where tourists spend their holidays in Ireland can also be determined from research. 1992 statistics show that only 17% of tourists spend time in the Midlands & East Region. This compares with 42% in Dublin, 50% in the Kerry Region, 38% in the Western Region, 28% in the South Eastern Region and 16% in the North Western Region.

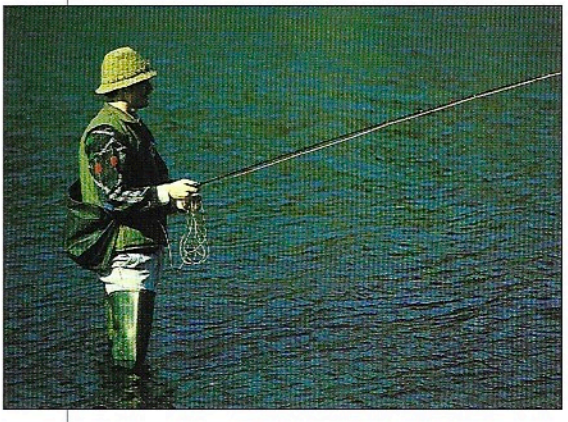
The Midland counties need resources to support their natural environment, the boglands. The overseas visitors interested in activity-based holidays are the same people who appreciate boglands, flora & fauna, nature walks, etc. The strategic plan to develop these resources and attract these people could be accomplished by marketing Offaly as a centre for natural bogland activity-based holidays.

the value of angling

Angling is traditionally a highly popular sport in Ireland. This reflects the abundance and diversity of marine and freshwater fish species that are available and the good quality of the water in which these species live. Freshwater angling species are divided into two groups: game fish (salmonoids) and coarse fish (all other freshwater species). Among the former group, brown trout are probably the most popular quarry for Irish anglers, and a significant number of overseas anglers also specialise in this form of angling. The coarse fish species that receive most angling attention are bream, rudd, roach, their hybrids; and tench; perch and pike.

A survey conducted by Bord Failte for 1992 revealed that 172,000 overseas visitors participated in angling to some extent during their stay in Ireland. Some 76,000 of these were visitors who came specifically to fish. This resulted in a contribution to the Irish Exchequer of IR£56.2 million from tourist anglers.

Tourist income from coarse fishing amounted to IR£27.7 million whilst the income accruing from game and sea anglers was IR£11.8 million and IR£16.7 million respectively.



Fishing in the Parklands.

These figures demonstrate the level of interest in angling in Ireland and its potential to generate significant revenue for the national and local economies. There is an ever increasing need for well-managed unpolluted fisheries in Ireland, and without doubt newly created waters would be exploited to their full angling potential. This is certainly the case in Co. Offaly where stillwater coarse and salmonoid put-and-take fisheries are scarce. The development of quality angling facilities in Offaly would improve the level of diversity available to Irish and overseas fishermen, and should result in a demand for this resource.

conclusions

1. The total utilization of its cut-away bogland presents Bord na Móna and the Midland Region with the opportunity to provide a valuable asset for the benefit of future generations. This development will require financial assistance from other sources, to achieve the cutaway's full potential.

2. The major area of future expansion in the Irish Tourism Industry will be in outdoor activity-related holidays.

3. The proposed **Lough Boora Parklands** development will provide amenities in Co. Offaly for outdoor activity. It will also help to sustain the unique bogland heritage of the county.

4. The proposed development will complement other Co. Offaly tourism activities and increase tourist stopover time.

5. Direct and indirect employment created in the area by the proposed development will help to replace jobs lost in a declining peat industry.

6. An integrated approach will be necessary to fully develop the **Lough Boora Parklands** proposal. Bord na Móna recognises that other agencies can contribute expertise and resources to this project.

recommendations

1. That Bord na Móna should combine with other relevant agencies such as the Office of Public Works, Shannon Development Co., Midland & Eastern Regional Tourism Organisation (MERTO), Offaly Tourist Council, Offaly County Council, and Bord Failte in a full feasibility study of the proposal.

2. That appropriate funding be provided for that study.

3. That other potential ideas and projects suitable for the Parklands proposal be explored.

Whooper Swans in flight over Lough Boora Parklands.

introduction

This section of the report describes the history and development of the Parklands area to date. It also outlines in further detail the proposals put forward by the Boora Enterprise Group in Section One.

Articles expressing the opinions of various experts who have been associated with such developments are included in this section. The experts who have contributed are:

Dr. John Feehan

Dept. of Environment Resource Management, U.C.D.

Dr. Michael Ryan

Director of the Chester Beatty Library.

Valentine Trodd

Journalist and Editor of Scéal na Móna Magazine, Bord na Móna.

Gerry McNally

Land Development Manager, Bord na Móna.

Dr. Brendan Kavanagh

Biology Division, Royal College of Surgeons.

Dr. Joseph Caffrey

Head of Research, Central Fisheries Board.

Terry McCague

Executive Planner, Offaly County Council.

how the story begins

Dr John Feehan

Places, like people, have their history, a story of how they were shaped, how they became the way they are. It is a very much longer story than the human story, and it has a very important influence on it. The story of any place goes back hundreds of millions of years, to the time when the rocks that underline every landscape took shape. These affect the human story, because they influence the shape and form of the surface, they provide resources of minerals and stone, and they ultimately determine the fertility of the soil on which agricultural productivity depends.

The most recent and in many ways the most important chapter in the story of Boora begins 10,000 years ago, at the end of the Ice Age. Before the Ice Age, the area which is now Offaly was very flat, although Croghan Hill away to the North would have been a more prominent landmark in those times than it is today - but there would, of course, have been no people around to see it. To the South, the mountains of Slieve Bloom were more prominent than they are today, because they owe their present rounded forms to the erosive action of glaciers ploughing their way over the summits.

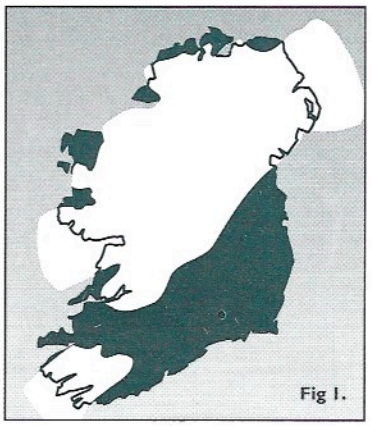


Fig 1.

During the last glaciation an ice sheet covered the northern two thirds of the country whilst the area to the south was cold tundra. The ice front stood along a line that ran north-eastward across the country, up past Roscrea and Birr and on towards Tullamore. But the ice is not static at the front of a glacier. A glacier is a body of ice in motion from an area where snow and ice accumulate (in this case this was in the area of the Twelve Bens in Connemara) towards the ice front, where it is melting.

The position of the front will appear to be static if the rate of melting is approximately the same as the rate at which moving ice is supplied to the front of the glacier. Glacial ice is full of the broken-up rock material it has picked up along its journey, and this rock debris dropped at the front, & piled up as mounds and hummocky ridges of sandy and gravelly material as time goes by. Rock debris dropped from a melting glacier is called moraine; that which accumulates along the front of the glacier is called end moraine. The hummocky country which extends from Roscrea to Birr and on towards Tullamore is classical end moraine country; it is characterised by steep-sided gravel hills, often with deep hollows between.

This end moraine is closely associated with eskers, which are ridges and hills of sand and gravel deposited by rivers of meltwater flowing in tunnels at the base of the glacier at the end of the Ice Age. Superb eskers occur throughout our area, especially around Clonmacnois. Another fine esker is the Birr Esker, which is closely associated with the hummocky end moraine described above. This runs south-eastward from Cloghan Castle towards Birr, and then swings north-eastward to run all the way to Tullamore.
In earlier times eskers provided natural causeways across the boggy terrain of the Midlands, and even today many roads still follow them; a good example is the road along the NW - SE stretch of the Birr Esker; in an earlier time the old road from

Fig. 1: A map showing the extent of glaciation at the time of the last major ice advance across the midlands. Notice in particular where the front of the glacier is.

Birr to Tullamore followed the north-eastward continuation of the same esker. The flora along these ancient tracks can often be exceptionally interesting - none more so perhaps than the roadside flora of the stretch of the Birr Esker that lies south-east of All Saints Bog.

When the ice finally retreated at the end of the Ice Age, the new postglacial topography was dominated by ridges and hills of esker and moraine. Because of this, a pattern of drainage was established over millions of years before the Ice Age was disrupted, and the whole area was covered by a system of lakes connected to the Shannon. The pattern and location of these lakes were determined by the distribution of the eskers and moraines. The Shannon was several meters higher than it is today, and it was swollen beyond its present channel into a great lake which extended, summer and winter, right across the callows, reaching in a south-easterly direction as far as Boora and as far as Derrinlough to the South. These lakes lasted for a long time - for many centuries certainly; they were shallow, and forests of stoneworts covered much of their beds. These special plants have limy skeletons, and when they died, these decayed and accumulated as white marl on the lake floor.

Many centuries after the end of the Ice Age, an event occurred which triggered the development of bogs where up to now there had been shallow open water. A slight digression is needed to explain what happened. Land that is covered by thick glacial ice is depressed, and when that depressing mass is removed, it recovers and rises back up. Evidence now suggests that in this part of the Midlands the land gave a final bounce upwards by several meters some centuries after the ice had gone, at a time when reed-fringed lakes were established throughout the Midlands.

Evidence for this final bounce is provided by a series of wave-worn limestone boulders which formerly stood at the fringes of the ancient postglacial lakes, where they acquired a characteristic wave-sculpted form. When the land rose, the shallow waters were drained from much of the area, which changed to reedmarsh and fen. As time went by, and peat accumulated in these widespread fens, the vegetation changed in favour of species adapted to the increasingly low nutrient status of the peat; the most important of these plants are mosses belonging to the Sphagnum group, which rely solely on rain for their nutrients, and do not need to maintain contact with the nutrients provided by groundwater. Bog now became established everywhere that lakes had previously dominated. To return to the wave-washed stones. The two main groups of these are along the Shannon (on the shores of Lough Ree above Athlone & below Clonmacnois), but many individual examples, often of remarkable form, occur around the edges of the bogs in the Boora-Derrinlough area. Others are likely to be discovered as interest in their significance and importance grows.

The peat in the bogs is made up of the plants which formerly grew at the surface. Bog vegetation varies between different parts of the bog, and also from time to time. The dark peat at the bottom of the bog is reed-swamp and fen peat, made of the highly humified remains of reedmarsh and fen plants; sometimes several feet of peat made up almost entirely of the remains of reeds occur. The fen and reedmarsh peat lie on top of the lake marl, which can itself be several metres thick. The bog peat on top of the fen peat is also highly humified, and made up predominantly of Sphagnum, and the woody remains of plants such as heather. But the top few metres of peat in most bogs contain much more Sphagnum than heather - at times to the exclusion of nearly everything else - because from about 500 B.C. wetter conditions favoured the development of Sphagnum. The line marking the transition to these wetter conditions is often a prominent feature of turf banks where the peat profile can be seen.

It might seem safe to say that wherever there is bog today there was a lake after the Ice Age. This is not quite true, because after the bogs had occupied and filled the former lake basins, they began to creep up the edges of the moraine and the esker hills that surrounded them, eventually covering many of the lower hillocks. Radar profiles show this feature particularly well. As the bogs expanded, they swamped the forests of pine, oak and yew which had surrounded the lakes. The trunks of the trees decayed, but the roots and the bases of the trunks were buried in acid peat, which preserved them. Today, as the overlying peat is removed, the remains of these ancient forests are coming to the surface again.

They are of course the raw material for the works of art produced by Celtic Roots, but there is a special fascination when they can still be seen in the positions in which they once grew, which can be done in many areas where the bog is nearly worked out. The main forest level is at or near the base of the peat, but others occur further up in the profile, where pine was able to establish itself during times when climate was sufficiently dry for this to occur - as happened a number of times in the past. Turraun before its development had no fewer than four levels of trees. The eskers and the moraines with which they are associated were largely responsible for the pattern of distribution of the bogs. The late 18th century historian and agriculturalist Sir Charles Coote interpreted this juxtaposition of bog and esker in a different way.

For him it was, in the most literal sense, providential: providence in its wisdom had placed an endless supply of the fertiliser most important in bog-land reclamation (lime, in the form of limestone gravel) exactly where it was needed.

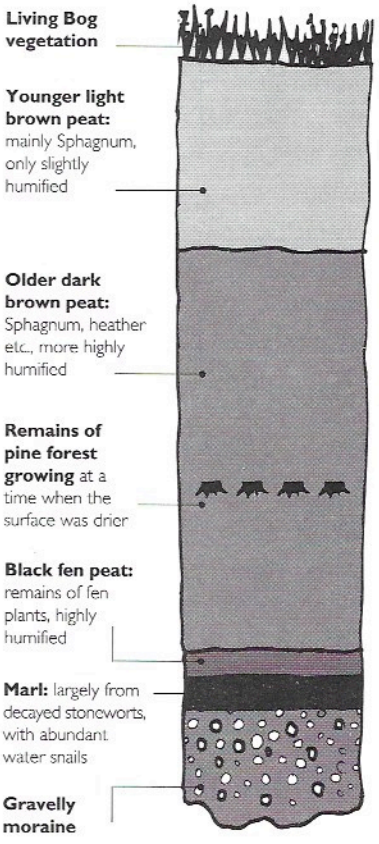


Fig 2.
A typical section of a raised bog in County Offaly.

One of the most remarkable things about our area is that the evolution of the landscape can be so graphically demonstrated from the clues that are still there to be seen and interpreted especially in the cutover landscape. It would be a simple but fascinating exercise to reconstruct what the landscape in any particular locality did look like at the end of the Ice Age, and with the necessary evidence at hand to do so - the presence /absence of marl, radar profiles, wave-marked stones - it would be very interesting to do so.

One of the most fascinating things about the story of the bogs is the way in which the human story moves in parallel with it. The first people in the Midlands camped alongside the pine-fringed postglacial lakes - what an extraordinary landscape that must have been - before the bogs began to develop, and the bogs have been a part of the human story ever since: as refuge and wilderness, as a place of wonder, and as a resource. Now we face a new challenge: to ensure that the new bog landscape which is taking shape retains as much as possible of the rich natural and human heritage of the past, and at the same time continues to play a central role in the economy of the communities which depend on it.

lough boora & other archaeological features in the study area

Dr Michael Ryan

In 1977, the author excavated for the National Museum a settlement site in Broughal Townland, Lough Boora. The site lay on the bed of a former lake some distance west and in from the modern shoreline and on an ancient fossil shore. About 2000 sq. metres of peat were stripped to reveal a series of hearths or fire sites represented by spreads of charcoal. Around these and mixed with the burnt matter were some five hundred artifacts made of chert, a hard siliceous stone, like flint, found in the glacial deposits nearby. Most were simple blades, about two hundred were tiny, carefully worked stone points used to arm the shafts of spears and, maybe, arrows called microliths. A small number of axeheads made of ground stone pebbles were also found The hearths contained a variety of fragments of burnt animal bone, especially wild pig, and fish bones. In a number of places hazelnuts also turned up. There was no evidence of any structures. What appears to have existed at Boora, was an encampment for hunters.

Radiocarbon dating put the occupation of the site into the period about 6800 - 6000 BC. Before this, the only other evidence for human activity in Ireland at this time was to be found in the north-east counties of Antrim, Down and Derry & the lack of any remains elsewhere led people to believe - wrongly - that first human settlement in Ireland happened in the North.

Now we know that this was not so and we must look for sites of similar age along the east coast and in the midlands. The Boora finds told us a number of other things: the bones were the remains of food and are, for their period, especially well identified so we can reconstruct diet and shed light on the available wildlife in the area 9000 years ago; the site lay on the pre-bog surface on the shore of a lake which was much larger than the successor lake, the modern Lough Boora, so we can trace the dramatic changes in the environment and landscape in the midlands since the end of the Ice Age; the silt clay on which the human occupation lay contained bones of giant Irish deer - the only instance where ancient human activity was directly stratified on top of remains of these great extinct animals; the analysis of the pollen from the site gave an insight into the local flora at the point where the great midland raised bogs were just beginning to grow. The Boora site is of great importance in the study of environmental & human history.

Human activity in the region is noteworthy from other later periods. An important "hoard" - a closed group of related objects lost or buried together, was found in 1892 at Frankford (Kilcormac). It consisted of axes and other implements dating to the early part of the Bronze Age in Ireland and is one of the key finds of that period. It is now in the Ulster Museum. In the 1950s an impressive find of gold ornaments from about 1200 - 1000 BC was found at Derrinboy - it constitutes one of the most beautiful treasures of its kind. The manufacture of the ornaments is technically of the highest interest and marks the beginning of the Later Bronze Age in the region.

This period reaches its climax with the enormous hoard fron Dowris near Birr. Strictly speaking this is not a hoard but a votive deposit where year after year objects were cast into a lake. To judge by the number and importance of the objects and that some were of types found in different parts of Ireland, the site, almost at what later was regarded as the exact centre of the island, commanded the reverence of all the inhabitants.

Along with these and other lesser finds of artifacts, the bog system around Boora has produced evidence of toghers or ancient trackways, some of them prehistoric, made of timber. These were designed to connect patches of dry land which were becoming increasingly inaccessible as the bogs grew.

turraun a monument to human endeavour

Valentine Trodd

A tradition exists that many families came to settle at Pollagh village after the canal opened in 1804. It is claimed that these early settlers lived in cabins which were lined with bricks for insulation and that they obtained these bricks from a thriving peat-fuelled brick industry that flourished at Gallen outside Ferbane and in the Turraun-Pollagh area. The people of the district made full use of the Grand Canal to sell both their turf and bricks. It was Kieran Farrelly however, born into a bog-bound farm at Turraun in 1835, who first industrialised the bog there. Farrelly probably began his operations in the late 1850s to meet the good demand for peat stable litter. Moss peat was then traditionally stripped from the bog before turf cutting, and used for livestock bedding. Farrelly's infrastructural developments included laying access roads to his working areas at his own expense. His peat litter was first sun-dried as large sods that were broken down by hand and packed into jute sacks for transportation by horse cart to the nearby railway stations and thus further afield. Farrelly's entrepreneurial skills shine in his ability to make full use of the natural resources available to him. He not only sold the peat litter from the bog surface, and the sod peat beneath it - he also supplied brick clay from beneath the bog to the local brickyards and a material called 'mather' (which was used in the purification of town gas) to the Dublin Gas Company.

He erected a moss-peat factory at Turraun, with a horse-powered grinder and baling press, and large storage sheds for his raw material and finished wire-and-lathe bound moss peat bales. He even reclaimed and levelled his cutaway bogland for oilseed rape production.

Farrelly's enterprise at Turraun was eventually dogged by ill-fortune. Foreseeing an increase in army demands for his stable-litter with the obvious imminence of war in South Africa, he borrowed heavily from a local speculator to further develop his plant & increase his output. He installed the first diesel engine to be used in the district, which proved a local attraction for sightseers, and he considerably enlarged his plant's storage capacity. For a couple of years after this his business flourished, until a terrible rainstorm in the winter of 1903. This caused a breach in the Grand Canal and a flash flood that washed away all of this stocks of raw materials and baled peat, damaging his machinery, and eventually resulting in the death of his 20 year old daughter. His eventual claim for damages against the Grand Canal Company was tried in Dublin and lost on a technicality. Since he was unable to meet his loan repayments, his creditor took legal possession of Turraun moss-peat factory and the Farrelly farm on which it stood. The Farrellys were evicted from their home in October 1905, to eventually emigrate to the United States.

In 1924 Turraun was acquired by Sir John Purser Griffith, a Welshman whom Dr. C.S. "Todd" Andrews considered "as far as turf was concerned ... a prophet unaccepted in his own country". Griffith, who amazingly held the presidency of the Institutes of Civil Engineering of both England and Ireland, whilst practising in Ireland, loved the country of his adoption with an intensity akin to patriotism. At Turraun he drained the bog according to the most modern methods and introduced the early Wieldandt excavators, the most modern German machine of the time. This machine was the precursor of all the large excavating machines that were eventually employed by Bord na Móna. Purser Griffith electrified his bogs and built his own peat-fuelled power station. He use the electricity to power his

machines, but it was his eventual intention to sell electricity to the nearby towns. He intended to install similar small power stations throughout the midland bogs and thereby set up his own rural electrification scheme. That idea was dashed, not by his age although he was almost ninety at the time, but by the arrival of hydroelectric power from the Shannon Scheme. So Purser Griffith directed his attention towards seeking a direct market for his turf. He purchased a barge and set up a distribution centre for his sod peat in Dublin. Like Farrelly, he also built and successfully operated a peat moss litter factory, which he powered on gas from his turf.
So Turraun was the proving-ground for electricity generation. Purser Griffith's Turraun was the inspiration for the mighty industry that would follow, stem the flow of emigration, and bring people from the edge of destitution to prosperity.

Sir John had invested £70,000 of his own money on his Turraun installation, a tidy sum in the 1920s. He now generously handed over his whole Turraun operation, including the moss peat factory, canal barge, and distribution office at Harcourt Terrace in Dublin, for the estimated value of his remaining fuel stock of the time - a mere £6,500. In thus handing over a ready-made project he helped to establish the nucleus of the Irish peat industry.

When the Turf Development Board moved physically into Turraun in 1936, two years before the death of Sir John Purser Griffith in his ninetieth year - 500 of the bog's 1,500 acres had then been developed. The Fuel Emergency, during the period of World War II, which resulted in the non-availability of coal from about 1941 onward, warranted the establishment by the Turf Development Board of residential camps or hostels at 14 locations throughout the midlands including Turraun Camp. These were constructed by the Office of Public Works to house the 4,000 imported workers in the Kildare/Offaly hand-won scheme which would provide turf to replace the coal that was no longer available to city dwellers.

The local Bord na Móna village at Kilcormac, now known as St. Cormac's Park, was officially opened by An Tanaiste and Minister for Industry and Commerce, Mr. William Norton T.D., on Monday, April 9th 1956. The village of 104 houses was constructed at a cost of £1,443 per house, with rents set at 7/6 (37½p) per week for "ordinary workers" and 17/6 (89½p) for those receiving higher pay.

By then the nearby bog at Boora, which had initially been prepared and drained to supply sod peat, had been mostly converted to milled peat production for Ferbane Power Station, then in advanced throes of construction.

Bord na Móna were already supplying the existing power stations at Portarlington and Allenwood with machine turf, but experience gained at Lullymore Briquette Factory had shown that, on the basis of their relative heat values, milled peat could be produced more cheaply than turf because the production process could be completely mechanised. Furthermore, milled peat was already being used to fuel Russian power stations.

February 1957 saw the Ferbane station producing its first electricity from milled peat. It was the first station outside the Soviet Union to do so. It was officially opened by Mr. Sean Lemass, T.D., Minister for Industry and Commerce, on September 15th 1958. That year Turraun bog entered a new phase in its development, being the first bog to produce milled peat from areas of cutaway left behind after machine turf production. Thus it became part of the greater Boora complex of bogs and started feeding its second power station. An extension to Ferbane station in 1964 increased its generating capacity from 240,000,000 units to 360,000,000 units per annum. The newspapers of the time pointed out that it was then bigger than Ardnacrusha hydro-electric power station on the Shannon, which had initially been built to fuel all of Ireland, and the advent of which had altered Sir John Purser Griffith's plans to produce electricity.

the influence of production policy & topography on future land use

Gerry McNally

Having been given the remit to develop the midland peatlands of Ireland "for the generation of electricity, the supply of domestic fuel and the supply of horticultural peat", Bord na Móna were very much aware of the onus on them to ensure that the lands left behind would be productively used for many centuries after the industrial phase.

As soon as the first cutaways were available in the mid-fifties the first experiments on the use of cutaways for agriculture and forestry were established. From the very beginning it was obvious that the cutaways were extremely variable and that no single use would be appropriate for all the emerging landbank It soon became apparent that the traditional hand cutover peatlands were very different from the areas emerging from the industrial process.

Traditional Handcutover Peatlands

For many centuries before the formation of Bord na Mona the midland peatlands had been used as a traditional source of fuel for domestic heating. The task of harvesting this peat was very much a manual task with the fuel peat being removed by means of a "sleán" (a peat digging implement). Experience had shown that the best fuel peat occurred in the lower layers of the bog profile. This meant that the top layer of peat was discarded, being dumped into the site of the previous year's excavation. While the better fuel peat lay in the lower layers of the bog there were nevertheless limitations imposed by the inability to manually dig deep drain outlets.

The medium this left behind after this manual process was very poorly drained and was also acidic. Efforts at reclaiming such areas for agriculture were not very successful with the result that they were traditionally abandoned and allowed to colonize with rushes and other scrub species. Historically therefore "cutaways" are associated with very poor lands and are generally thought of as being unproductive.

Industrial Peatlands

The industrial process however leaves behind a very different medium. Firstly when the bog is being prepared for peat extraction the total bog is subjected to drainage. An intensive matrix of 17 m. drains is laid out across the bog surface which link to outfalls which in turn link to the surrounding arterial drainage. Five to seven years later initial production machinery is able to travel on the bog. Peat is then removed horizontally over the total bog surface with the drains being sequentially deepened as production continues over the following years.

Peatland Drainage

Depending on which area of the country is in question the drainage waters reach the arterial drainage system either by gravity or if necessary by a series of pumping stations. In the areas therefore where gravity drainage is possible the medium left behind is well drained and is devoid of the acid top "strippings". In the case of pumped drainage the medium left behind is also devoid of the acid "strippings" but obviously subject to flooding without continued pumping.

Two distinct land types are thus presented to future planners, i.e., those which are well drained and those with drainage difficulties. It is obvious therefore that the future uses will be very different for these two land types.

Peat Type and Depth

The next important issue to take into account when deciding future use is the type and depth

of the residual peat. As the peat is an acidic medium, and the subsoils underlying the peat are extremely alkaline, the peat depth and to a lesser extent its type are major determinants of future use. Peat depth is of course determined in the main by peat extraction policy but the topography of peatlands which is a result of glaciation also impact significantly on this policy.

Peat Extraction Policy

It is the policy of the Board to remove as much peat as economically possible from all its industrial peatlands. It has to be pointed out however that because of the topographical nature of peatlands maximum economic peat extraction does not equate with total peat extraction. Residual peat depths ranging from 0 up to 1.5 m result from such a policy. The key point is that peat is not specifically left behind for a particular option but that because of the nature of peatlands & the extraction methods employed, that the resultant cutaways contain varying peat depths all of which can be utilised in a diverse matrix of land uses.

Research Findings

Many options of an agricultural nature were researched over the past 30 years. All that were promising at the research stage were pursued to pilot development stage. However the only really successful agricultural crop is grassland. Research has identified the technical parameters that are necessary for its success and these are now well established. Grassland is now commercially developed in unit sizes to meet market demand.

Forestry by its nature is long term and therefore research results are much slower to emerge. Nevertheless it is now well established that coniferous forestry is the optimum option for the vast majority of emerging cutaways.

Land Planning

During the latter years of peat production on a bog unit it is necessary to map in detail the residual peat depths and the underlying soils. Other factors such as access, general infrastructure, market demand, etc., are then taken into account when drawing up a land use map.

Peat production ceases on a phased basis on each bog unit as result of the variable peat depths that occurred on the bog unit before the initiation of peat extraction. It is necessary, therefore, that the future use is planned and that the plan is also implemented on a phased incremental basis.

Pumped Drainage Areas

These areas are generally associated with topographical depressions. The greatest peat depths occur over these depressions and hence they take longest to reach the cutaway stage. The majority of such areas will not reach the cutaway stage until well into the next decade. However within the study area there are already a number of such depression areas at the cutaway stage.

Wetlands

In recent years the emphasis has been on developing the technology to utilise such areas to the maximum benefit. The more obvious future use for such areas is in the creation of wetlands which would in turn provide refuge habitats for wildfowl. The first such area was established in Turraun in Autumn 1991 is already proving an excellent habitat for the winter migrating species such as Whooper and Bewick Swans Widgeon, Teal, Pintail, Golden Plover, etc.

Lakes

The possibility of developing such areas for angling purposes is also being researched. At present investigations into the best methods of establishing a stable aquatic environment are being examined. These lakes will also have amenity and tourism potential.

the potential development of nature conservation and outdoor pursuits

Dr. Brendan Kavanagh

The natural history of the Boora bog complex has a multitude to offer both to the visitor and to the residents of this area of County Offaly even today. The years of natural colonization of the cutaway bogs have provided a wealth of habitats for wild animals and plants again after peat extraction has ceased.

Nature needs time to repair the bare peat fields after the machines have finished. The peat depth, the water table level and the composition of the surrounding vegetation of the bog edge, will all influence this process in a dynamic fashion. In many instances this process is unpredictable with a mosaic of plant associations developing, quite unexpected by the casual observer and researcher alike.

The Boora complex in particular has come a long way on the path of recolonization. Within the complex are areas with a rich diversity of wildlife, harbouring many plants and animals pushed off the agricultural lands throughout the country. The richness of habitats & the mosaic effect of these areas attract a wide diversity of species, all in proximity to each other. While much still needs to be done, the potential for the development of **Lough Boora Parklands**, encompassing a variety of outdoor pursuits, is enormous. This is already apparent in Turraun Nature Reserve to the north of the complex and in the Boora Lakes area to the south of the Bord na Móna Works. Other less well known locations such as the Finnamore's area however are equally important from a natural history perspective.

The outdoor pursuits that can be developed in the Boora area, may be broken up into a number of categories. The first of these is centred on nature and the enjoyment of natural areas. Bird watching and nature walks fall into this category. Literally millions of people go for nature walks and bird watching outings in this country annually. The numbers of visitors to our national parks & forest parks across the country can attest to this.

With any Nature Reserve there is a dichotomy of use which needs careful planning to overcome. On the one hand we have an area dedicated to wildlife and wild animals in particular. The habitats present will attract a variety of wild birds creating a honey pot effect. These animals are wild however and over thousands of years of co-existence with man they have learned to avoid humans whenever possible. On the other hand we often wish to allow access to these Reserves by the visiting public. It is almost inconceivable that visitors would be prevented from entering Reserves.

Human disturbance is thus one of the most serious threats to small Reserves such as Turraun for example. Consequently the sensitive design of nature trails, observation hides and general access is fundamental to the success of such a project.

The other category of outdoor pursuits involves more active participation in recreational activities. Fishing, sailing, swimming, pony trekking, hill walking, and model aeroplane flying are some of the activities in this category. Within the Boora complex there is ample opportunity to develop this category of outdoor pursuit also. Some, such as the trail of "The Offaly Way" and model aeroplane flying, are already in existence within the area but the potential for further development of additional activities within this category is enormous.

The successful accommodation of such a diverse array of outdoor

pursuits will depend on the avoidance of conflict between the different interests involved. For example ponies tend to churn up tracks and paths and make them unsuitable for the walker, swimmers can disturb fish and ruin a planned fishing trip; sailing will disturb ducks and other game birds thus reducing the value of an area for bird watching. This potential for conflict is best avoided by the separation of these pursuits in time & space. For this reason the overall plans for the development of the **Lough Boora Parklands** must carefully zone areas with a view to avoiding such conflicts.

The remainder of this article focuses on this aspect of the development of the **Lough Boora Parklands**. It breaks down the area into three broad zones, the Turraun Nature Reserve, the Boora Lake area and the East Boora area over to the Finnamore's. Each zone has its own strong points and is thus most suited to specific enterprises. This will become more apparent in the treatment given below.

Turraun Nature Reserve

This area of the proposed Lough Boora Parklands has the best potential for wildlife conservation. It is the oldest area of the complex having been exploited for peat even before it was acquired by the Bord. Most of the information available at present on natural recolonization of cutaways, has been gathered from the Turraun project, which has been ongoing since 1991. The northern portion of this bog has been out of production since the 1970's and natural recolonization of the peat fields has occurred for an extended period. The habitats evolved include molinia grassland, phragmites reedbeds, birch woodland and most recently the creation of the first man-made lake on Bord na Móna cutaway bogland.

So successful is this project that today it can boast the presence of over 80 species of birds and over 150 species of plants in the Reserve, with additions to the list being observed regularly. Since the lake was established a flock of 200 Whooper Swans has colonized the site. This alone ranks the lake as an internationally important nature reserve.

At any time during the winter one can expect to see several hundred ducks, similar numbers of waders and large numbers of swans on the lake alone. To date, many rarer species such as Garganey, Goldeneye, Gadwall and many waders have been recorded in the Reserve. Also present and breeding on site is one of our most endangered species today, the Grey Partridge.

The Turraun Reserve is an important integral part of the Boora complex in that it already provides a successful site for wildlife conservation. It thus acts as a focus for the naturalist both locally and from outside the locality. Bird watching, nature trails and a peaceful day out can all be provided on the Reserve once the area has been fully developed.

Being of high conservation value, it is crucially important to plan the future use of and access to Turraun carefully. This has been subject to extensive discussion in previous reports. Suffice to say here that the wildlife interests in Turraun are of paramount importance to all future developments in the Reserve.

Nature trails have been outlined, observation hides around the lake and a lookout tower on Cocta Hill have been suggested and amenity forestry & heather moorland are to be developed.

Turraun is designed for the first category of outdoor pursuits, namely bird watching and structured nature trails. It has an important role in educational walks for school children and adults alike. It is also well on the way to obtaining statutory protection as an internationally important Nature Reserve.

The scope for the more active pursuits in the Reserve is limited. Human disturbance must be kept to a minimum if the wildlife value of the site is to be retained. The local gun club accepts the

wishes of the Bord in declaring the area a no-shooting sanctuary and local people are unofficial custodians of the Reserve.

"The Offaly Way" passes through the western end of Turraun and forms a natural access point to the Reserve. Most visitors coming to the site walk along this route and already an unavoidable degree of disturbance has resulted. The bird-life on the lake has responded by moving towards the eastern side of the lake during the daytime. The severity of the disturbance is being monitored at all times.

Boora Lake Area

The main feature of this area to the south of the Works is the Mesolithic site on the shores of the ancient Boora lake. This attraction is the topic of another article in the report and will not be discussed here. The lake area however is also of interest from a natural history perspective. The lake bed is now dry due to the effective drainage of the site and an interesting molinia/ birch scrubland has developed here. Hen Harriers, Merlins and Grey Partridges are often observed within the basin and the surrounding cutaway has been planted with forestry.

While it is not as diverse as the Turraun Reserve it is nonetheless an important natural habitat with an interesting assemblage of animals and plants. The wild-life encountered here is less sensitive to disturbance as the whole area is well vegetated. It is thus ideally suitable for a nature trail. The route chosen for the trail would need to be carefully planned but one could envisage a circuit through the forest track down to the lake basin turning south to the mineral outcrop at Brock's Wood, then turning east at the southern end of the bog to run along the heather clad edge back to the cycle path road. This walk would be approximately four to five kilometres long and would take two to three hours to complete. A variety of habitats including natural woodland and heather-covered moorland would be seen. It would also be an easy detour for hill walkers using "The Offaly Way", leaving the route at the Works to rejoin it again two kilometres down the road.

East Boora/Finnamore's

This area of the proposed **Lough Boora Parklands** will be one of the most diverse with substantial forestry, grassland and wetland areas. A network of access roads is presently being constructed by the Bord and both grassland and forestry planting is proceeding on an ongoing basis. From a forestry perspective there is a mosaic of mixed age plantings. The overall impression is one of a very accessible, open landscape providing a variety of opportunities for development.

Two lake areas are possible in this location, one to the east of the cycle path in a natural depression beside the road, and the other over at the eastern edge of the area at Finnamore's. Access to both of these lakes will be very easy with new roads alongside each. These two lakes are the most suitably located waterways for a variety of water sports including fishing, boating, sailing, swimming, etc. The active use of these lakes will reduce their potential for wildlife but this is of secondary importance here.

Pony trekking would be a very suitable development here also with a rich mixture of forestry, plus good hard tracks for ponies and walkers alike. At least two excellent routes could be developed for horse riders, one to the northern end through the forestry and along the hard track and another longer route to the south eastern corner back to the cycle path. One could envisage horse riding as being of major significance in this part of the Boora complex.

Preliminary investigation indicated that modification of the existing basin at Finnamore's could render it suitable for a coarse fishery or a "put-and-take" game fishery. With two lakes potentially possible in this general area, both types of fishing could easily be accommodated.

Overview

Zonation of the outdoor pursuits as indicated in this article may give a somewhat erroneous impression that one activity results in the complete exclusion of other alternative activities in the same area. This is not the case though the potential conflicts are real. The intention is to prioritise the activities in each area so that all pursuits can be accommodated in some area. What is important is to determine at the outset of the development what the main priorities are in each section of the Boora complex. Once these are established, further ideas and developments must take cognisance of this.

To give an example, the whole Boora complex supports a rich diversity of birdlife. The Whooper Swans and Waders use Turraun Nature Reserve as a safe refuge for the winter months particularly. However the same birds can be seen regularly on the grassland areas of East Boora and in the potential lake area at Finnamore's. Grey Partridges are also found throughout the Bord na Móna lands while Hen Harriers and Merlin are to be seen hunting in Turraun and in the Boora Lake area throughout the winter.

From a development perspective the Turraun area, being the most productive wildlife area, is zoned for nature. The Boora Lake area, which also has good wildlife habitats, on the other hand is more suitable for walkers, horse riders and historians interested in the Mesolithic site.

lake creation in cutaway bogs

Dr. Joseph Caffrey

To assess the feasibility of creating semi-natural aquatic habitats & viable recreational fisheries in areas of cutaway bog, Bord na Móna commissioned the Central Fisheries Board (C.F.B.) to undertake a pilot study in Boora Bog. An artificial lake was constructed in 1991 and measured approximately 7 acres. In 1992 a pre-determined regime of aquatic plants, macroinvertebrates and fish-farm brown trout were introduced into the lake. An examination in May 1993 revealed that the lake had been transformed from a relatively sterile, artificial waterway to one that is capable of sustaining an abundant and healthy flora and fauna".

Requirements for Recreational Fishery Development.

To create a semi-natural ecosystem that is capable of sustaining aquatic plants, macroinvertebrates and fish life, a primary requirement is the removal of as much residual peat as possible. This will expose the calcium-rich shell marl or gravel subsoils in which aquatic plants can root and proliferate. Plants are the basis of the aquatic food chain and viable communities must be established if the lake is to become self-sustaining and productive.

It is important to achieve an average water depth of 1.5m to 2m, with some areas supporting a depth of 2.5m or greater. Where the water is shallower than 1.5m, it is probable that excessive weed growth will develop during the warmer months. This will prove unsightly, obstructive to anglers and other water-based recreational enthusiasts, & will alter the chemical composition in the water. Deep holes or depressions in the lake provide sanctuary for fish during warm weather.

The specific requirements for salmonoid (brown and rainbow trout) and coarse (all other freshwater species) fish, in terms of water depth, aquatic plant abundance, and diversity and macroinvertebrate community structure, can be quite different and due regard must be paid to this. The infrastructural requirements (e.g., need for ready access, car parking, prepared swims, angling stands and platforms, etc.) for both angling disciplines are also different. It is, therefore, important to clearly designate the type of fishery proposed before any preparatory work is undertaken.

Coarse fishermen carry significantly more rods, nets, ancillary angling equipment and bait than trout fishermen and, hence, are more limited in the distance from their car that they travel to the water edge. Unlike trout anglers, those in pursuit of coarse fish set themselves up in one specific location and fish the stretch of water in front of them for the duration of their visit on that day.

They, therefore, require a firm bank on which to set up their seating arrangements and equipment. This bank, ideally, should be approximately 0.5m above normal water level. A water depth of a least 1m should be attainable within 5m of the bank.

Boora Lake, Tumduff Lake and the Garden Lake

These three lakes will be located beside the "Cycle Path" that links Boora with Kilcormac. They will be situated in low-lying areas that back-flood during heavy rains. A seven acre lake was already developed there as a trial two years ago. This was accomplished by Bord na Móna and the Central Fisheries Board and demonstrates that the conditions suitable for sustaining fish life can be created on cutaway bog.

Recommendations for Boora Lake

1. An area adjacent to the existing lake should be excavated and connected with the lake to enlarge it by some eight additional acres. This new

area should include water depths of between 3 and 1.5 metres. Any spare substrate should be used to create one or more islands. The existing outlet should be moved further west to filter the whole lake properly.

2. The stream feeding the lake has a constant flow of spring water all year round and should be used as a spawning ground for wild brown trout. This stream is approximately 1.2km in length. With proper cleaning and development, and the introduction of correct grades of spawning gravel, this stream should provide a supply of wild brown trout.

3. To develop trout fishing commercially, large rainbow trout would need to be introduced. They would be supplemented by locally reared wild brown trout. Stocking rates would need to maintain a density of approximately one hundred fish per acre.

The methods of fishing regulation envisaged for Boora Lake would be (i) A "put-and-take fishery with day and season tickets and bag limits. (ii) A "catch and release" fishery with day tickets and offering special "Corporate Days" to companies. Fly-fishing only would be allowed. Rainbow trout stocks would be monitored on a weekly basis and maintained from local fish farms. It would be a long term outlook to have a fish farm in the Parklands for rainbow trout.

Recommendations for Tumduff Lake

This is a low-lying triangular area of 40 acres with a rail line on its north side and newly developed farmland to the south.

1. Surveys revealed that over one metre of peat remains in the centre of this area. This peat will need to be excavated to expose shell marl subsoils. This will provide a waterway with an average depth of 1.8m.

2. The introduction of trout into Tumduff Lake would compliment those in nearby Boora Lake and provide enough trout water to accommodate good numbers of anglers. Shoreline conditions around this lake are suitable for fly fishing and roadside access further enhances its appeal. This habitat will benefit from tree-planting along the shoreline.

Landscape Plan around both Lakes

1. Pathways need to be developed for easy access to the lake and to cater for disabled people.

2. A number of fishing platforms need to be constructed on all sides of the lakes.

3. Car parks need to be provided next to the North and South lake shores.

4. A purpose-built lodge to cater for customer needs, with toilets, eating facilities, and a tackle shop, should be provided.

5. Picnic benches are also a necessity.

The 25 acre area around the lake should be landscaped to include hardwood trees (Ash, Oak, Larch, Beech and Birch) and a small stand of conifers. Purple Moor Grass should be planted at the water's edge. Behind the grasses, winter and summer heathers should be sown. The heathers will keep the Autumn leaves from encroaching into the lake. For colour, and to encourage early season fly activity, shrubs could be planted on islands.

The pathways around the lake should be inter-linked with others in the Parklands to provide an attractive integrated system of walkways.

The Garden Recreational Lake

This proposed lake site, being adjacent to the Boora railway network, might accommodate **Lough Boora Parklands** Visitor Centre. It is situated at an ideal location for tour embarkation.

The "garden", as this area is known, takes in about 25 acres. 5 acres of this, with an average depth of 1.25 metres, would be suitable for creating a recreational lake.

This area should be excavated and all excess soil fashioned into one large central island. This island would be developed as a reconstructed pre-historic settlement site on a Mesolithic

theme associated with Lough Boora. Access could be gained to the island by a stone causeway. The causeway could be constructed at water level and the lakeside landscaped to coincide wlth the Mesolithic era.

The lake shore would be encircled by a gravel path suitable for walkers and wheelchair users. A tree park, with native soft and hardwood trees, could be developed on the west of this path, with another area to the south designated for all types of heathers and flora.

These areas could be used as study areas for children doing school projects. The north end of the lake could be developed into an amenity playground and picnic area for visitors.

One corner of the lake should be designated as a study area for aquatic plants and insects.

Finnamore's Lake

Located beside the Blueball-Cloghan road, the proposed site at Finnamore's is bordered on all sides by relatively high ground. It occupies an area of approximately 80 acres, of which 30 - 40 acres would have sufficient depth for lake fishery development. The proximity of the roadway, the highly contoured nature of the site, and the shortage of stillwater coarse fisheries in this part of Co. Offaly, indicate the suitability of the site for development into a fishery.

Major excavation of residual peat will be required at Finnamore's to expose the maximum amount of productive subsoil. This may be achieved by bulldozing the peat into embankments, which would later serve as permanent angling walkways. The creation of a highly contoured lake, composed of an area of open water with a series of finger-like underwater channels averaging 30m width, would increase the angling potential of this proposed waterway. It is essential that provision be made for an average water depth of between 1.5m and 2.0m.

Following embankment construction, with the removal of excess residual peat and re-flooding, a comprehensive programme of aquatic plant and invertebrate introductions should be made. Angling should be postponed for at least a year, until a good population of aquatic macroscopic life has been established. Trees and shrubs should be planted at specific locations on the embankments. These will act as wind breaks for anglers and shelter for the reproduction of aquatic insects in their adult phase.

Stands of hardwoods and conifers should be planted on the south and west shores of the lake. Conifers have already been planted on the north side, between the lake and the road.

A natural constant freshwater supply issues from the east side along bog drainage channels, and this can be tapped and diverted into the lake. The lake's outlet, into the Barony Brook, would be from its north western corner.

For coarse fish spawning purposes reed beds would be established at designated areas. These reeds would need to be managed on a regular basis.

This lake will be suitable for the introduction of the following coarse fish... Bream, Rudd, Tench and Perch. Stock fish would be initially purchased from the Central Fisheries Board, and eventually from our own fish-rearing ponds. With proper stocking and maintenance this lake could eventually become a major coarse angling venue.

Parking facilities for cars and caravans, with toilet and picnic amenities, would need to be developed at Tumduff beside the Barony Bridge on the Tullamore-Cloghan road.

Turraun Lagoon and Fish Farm

Turraun Lagoon is situated 0.4 km from former Turraun Works, which in turn lies 2.5km south west of Pollagh village. This 17 acre lake is located beside the Bord na Móna light railway line that formerly served Turraun, and opposite Turraun's 130 acre nature reserve wetland. The

Lagoon lies roughly 3 km north of Boora Works. Access to the Lagoon, from the Tullamore-Cloghan road, may be gained along the Bord na Mona constructed laneway which runs north from beside Boora Church.

The Lagoon has been excavated to depths of between lm and 2m. There were three steep embankments initially on the east, west, and the northern side, and a fourth bank was built up on the south side during the excavation. The lagoon was excavated down to the shell marl. This was necessary to reach a calcium rich substrate in which to grow aquatic plants. Areas in the lake bed were left undisturbed since they contained concentrations of aquatic plants and animals.

The potential for developing this fishery is enhanced because road access and car parking facilities are available near the lake. To further develop this resource the water level should be raised by about 0.5m. This will give an average depth of 1.5 m and a maximum depth of 2.2m, making conditions for fish and fishermen more favourable.

To facilitate unobstructed coarse angling, for which this waterway would be best suited, it would be desirable to deepen a 40m to 50m strip of lagoon to at least 1.5m around its perimeter. This would create good living conditions for fish within easy reach of the angler. Sufficient depth already exists on two sides of the lagoon, so only the minimum of excavation will be required to deepen the rest.

Banks need to be cleaned and pathways developed for easy access around all the Lagoon. A number of timber fishing platforms need to be installed at suitable intervals along the shore. A roadway should be developed to extend from the end of the Church lane to the Lagoon, and a car park and a purpose-built cabin. The cabin would cater for visitor and angler's needs, and provide cooking facilities, changing rooms, toilets, and an outdoor picnic area.

An inspection of this waterway in November 1993 provided evidence that a good and diverse population of macroscopic life had already colonised it. In addition, about 400 rudd and a small number of trout were introduced there from adjacent ponds. These fish were monitored occasionally during the summer by Bord na Móna staff and showed no signs of distress. This would suggest that conditions in the Lagoon are suitable for fish.

Fish Farm at Turraun

We propose to develop two one-acre ponds beside one another at Turraun.

Pond 1 would accommodate coarse fish and Pond 2 brown or rainbow trout. The two ponds would be fed from a stream that also serves the Lagoon, with an overflow back into Boora River.

Pond 1 will be excavated to a depth where artificially spawned coarse fish can survive. Suitable aquatic plants will be sown there to maintain a proper food chain. This pond will be left free of fish for a year to allow the food chain to develop. After this coarse fish fry and fingerlings will be obtained from the Central Fisheries Board and introduced. These stocks will be used to maintain an adequate supply of coarse fish for the aforementioned lakes moreover for sale under the supervision of the C.F.B.

Pond 2 will be excavated on the same lines as Pond 1. This pond need not be sown with aquatic plants since it will be a holding or hand-feeding area for brown and rainbow trout, fry and fingerlings. This pond could be sub-divided to cater for different fish sizes. A constant flow of oxygenated water would need be maintained in this pond to ensure fish survival. These trout would be used to maintain stocking levels in our "put-and- take" lakes, with surplus stocks sold to interested parties. Revenue from this venture would alleviate some of the day-to-day running expenses of the pond.

lough boora parklands walks

Terry McCague

In association with the Office of Public Works, Bord na Móna, other agencies and landowners, Offaly County Council has formulated a plan for the establishment of a network of Long Distance Walking Routes throughout the County.

The principle objectives for establishing "The Offaly Way" can be stated as follows:

1. To connect "The Slieve Bloom Way" into the National Walking Route Network via "The Grand Canal Way" and along the "Wilderness Corridor" through the Midlands.

2. To develop a long distance walk across the extensive peatlands of County Offaly encompassing virgin, industrial and cutaway bog and to demonstrate the rich diversity of flora and fauna in evidence in these areas. To increase awareness of the wildlife conservation value of Turraun cutaway bog and to illustrate the potential of this experimental project as a model for wildlife conservation on cutaway bogs.

1. To draw attention to important items of cultural heritage such as the Mesolithic site at Lough Boora, the Silver River Mills, the 17th Century Pieta Icon at Kilcormac Church and St. Manchan's Shrine at Boher. In recognition of the importance of the establishment of Bord na Móna in the economic development of the nation and the county, the social significance of the associated population re-settlement, and the predominance of peatland exploitation as a viable land use in the area, it would be intended to focus visitor attention on the Bord na Móna model housing settlement at Kilcormac. It is hoped that in conjunction with the establishment of the Walking Routes, Bord na Móna would mount a permanent exhibition of the story of peat development in the Irish Midlands and its evolution up to the present day.

Brief Description of Walking Route (Phase 1)

"The Offaly Way" commences from "The Slieve Bloom Way" at Leitir Luna Abbey near Cadamstown. The walk proceeds from the village along the bank of the Silver River for about 1.5 km, and rejoins the road to cross Knock Hill and enter Ballyboy. The path returns to the bank of the Silver River and follows the river into Kilcormac. From Kilcormac the walk follows a course which takes it across Boora Bog to emerge at Leabeg. The route then crosses the largely cutaway bog at Turraun and joins "The Grand Canal Way" of Pollagh Village. Stages 3, 4 and 5 which take the walk to Clonmacnois and Clara Bog are to be developed soon. Offaly County Council intend producing a walking map and guide to facilitate walkers on each of the main walking routes throughout the county.

In association with "The Offaly Way" a number of walkways can also be developed in the area of the **Lough Boora Parklands**. These walkways will be across developed & recolonized cutaways culminating in focal points in:

1. Turraun Nature Reserve.
2. Lough Boora Mesolithic Site.
3. Lakes for angling and water recreations.

These walks can range from 1 to 16 kilometres in length and will transverse areas of grassland, forestry hardwoods, etc., and will have pleasant aspects to the Slieve Blooms, Hill of Bellair, etc.

appendix one

list of birds observed at turraun nature reserve 1990 - 1994

The status of each species listed is coded as follows:
B - breeding confirmed. PB - probably breeding. O - observed on site.

Species	Scientific Name	Status
Little Grebe	Tachybaptus ruficollis	B
Great crested grebe	Podiceps cristatus	O
Cormorant	Phalacrocorax carbo	O
Grey Heron	Ardea cinerea	O
Mute Swan	Cygnus olor	O
Bewick Swan	Cygnus columbianus	B
Whooper Swan	Cygnus cygnus	O
Greenland White-fronted Goose	Anser albifrons flavirostris	O
Widgeon	Anas penelope	O
Gadwall	Anas strepera	O
Teal	Anas crecca	O
Mallard	Anas platyrhynchos	B
Pintail	Anas acuta	
Garganey	Anas querquedula	O
Pochard	Aythya ferina	O
Tufted Duck	Aythya fuligula	O
Goldeneye	Bucephala clangula	O
Smew	Mergus albellus	O
Sparrowhawk	Accipiter nisus	O
Kestrel	Falco tinnunculus	O
Merlin	Falco columbarius	B
Peregrine	Falco peregrinus	O
Hen Harrier	Circus cyaneus	O
Grey Partridge	Perdix perdix	B
Pheasant	Phasianus colchicus	B
Water Rail	Rallus aquaticus	PB
Moorhen	Gallinula chloropus	B
Coot	Fulica atra	B
Ringed Plover	Charadrius hiaticula	O
Golden Plover	Pluvialis apricaria	O
Lapwing	Vanellus vanellus	B
Jack Snipe	Lymnocryptes minimus	O
Snipe	Gallinago gallinago	B
Woodcock	Scolopax rusticola	O
Black-tailed Godwit	Limosa limosa	O
Curlew	Numenius arquata	B
Redshank	Tringa totanus	B
Black-headed Gull	Larus ridibundus	B
Herring Gull	Larus argentatus	O
Lesser Black headed Gull	Larus fuscus	O
Stock Dove	Columba oenas	O
Woodpigeon	Columba palumbus	B
Cuckoo	Cuculus canorus	PB
Swift	Apus apus	O
Kingfisher	Alcedo atthis	O
Skylark	Alauda arvensis	B
Swallow	Hirundo rustica	O
Sand Martin	Riparia riparia	O
Meadow Pipit	Anthus pratensis	B
Pied Wagtail	Motacilla alba	O
Wren	Troglodytes troglodytes	PB
Robin	Erithacus rubecula	B
Sedge Warbler	Acrocephalus schoenobaenus	B
Whitethroat	Sylvia communis	PB
Willow Warbler	Phylloscopus trochilus	B
Stonechat	Saxicola torquata	B
Whinchat	Saxicola rubetra	B
Wheatear	Oenanthe oenanthe	O
Blackbird	Turdus merula	B
Fieldfare	Turdus pilaris	O
Song Thrush	Turdus philomelos	B
Redwing	Turdus iliacus	O
Mistle Thrush	Turdus viscivorus	O
Chiffchaff	Phylloscopus collybita	O
Goldcrest	Regulus regulus	O
Long-tailed Tit	Aegithalos caudatus	O
Coal Tit	Parus ater	O
Blue Tit	Parus caeruleus	O
Great Tit	Parus major	O
Treecreeper	Certhia familiaris	O
Magpie	Pica pica	PB
Jackdaw	Corvus monedula	PB
Rook	Corvus frugilegus	O
Hooded Crow	Corvus corone cornix	PB
Raven	Corvus corax	PB
Starling	Sturnus vulgaris	O
Chaffinch	Fringilla coelebs	PB
Goldfinch	Carduelis carduelis	O
Siskin	Carduelis spinus	O
Linnet	Acanthis cannabina	O
Redpoll	Acanthis flammea	B
Reed Bunting	Emberiza schoeniclus	B

Total number of species recorded = 84

appendix two

vascular plants species list

This is a complete list of vascular plants recorded in a special botanical study of a transverse section of Turraun Nature Reserve in June and July 1990.

Common Name	Scientific Name
Wild angelica	Angelica sylvestris
Marsh arrow-grass	Triglochin palustris
Aspen	Populus tremula
Heath bedstraw	Galium saxatile
Marsh bedstraw	Galium palustre
Velvet bent	Agrostis canina
Common bent	Agrostis capillaris
Creeping bent	Agrostis stolonifera
Birch	Betula pubescens
Amphibious bistort	Polygonum amphibium
Greater bladderwort	Utricularia vulgaris
Common cotton grass	Eriophorum angustifolium
Black bog-rush	Schoenus nigricans
Bramble	Rubus fruticosus
Broom	Cytisus scoparius
Bulbous buttercup	Ranunculus bulbosus
Creeping buttercup	Ranunculus repens
Meadow buttercup	Ranunculus acris
St. Patrick's cabbage	Saxifraga spathularis
Wild carrot	Daucus carota
Cat's-ear	Hypochoeris radicata
Common centaury	Centaurium erythraea
Common chickweed	Stellaria media
Mouse-ear chickweed	Cerastium fontanum
Cleavers	Galium aparine
Red clover	Trifolium pratense
White clover	Trifolium repens
Cock's-foot	Dactylis glomerata
Colt's-foot	Tussilago farfara
Cowslip	Primula veris
Great Yellowcress	Rorippa amphibia
Cuckoo-flower	Cardamine pratensis
Daisy	Bellis perennis
Ox-eye daisy	Leucanthemum vulgare
Dandelion	Taraxacum officinale
Devil's-bit scabious	Succisa pratensis
Curled dock	Rumex crispus
Crested dog's-tail	Cynosurus cristatus
Common duckweed	Lemna minor
Fat-hen	Chenopodium album
Hard fern	Blechnum spicant
Broad buckler fern	Dryopteris dilatata
Royal fern	Osmunda regalis
Red fescue	Festuca rubra

Common Name	Scientific Name
Tall fescue	Festuca arundinacea
Purging flax	Linum catharticum
Forget-me-not	Myosotis alpestris
Ramsons	Allium ursinum
Gipsywort	Lycopus europaeus
Goat's-beard	Tragopogon pratensis
Gorse	Ulex europaeus
Wall Whitlow grass	Draba muralis
Groundsel Heath	Senecio sylvaticus
Early hair-grass	Aira praecox
Silver hair-grass	Aira caryophyllea
Autumn hawkbit	Leontodon autumnalis
Beaked hawk's beard	Crepis vesicaria
Smooth hawk's beard	Crepis capillaris
Hawkweed	Hieracium anglicum
Hawthorn	Crataegus monogyna
Heath-grass	Danthonia decumbens
Cross-leaved heath	Erica tetralix
Ling heather	Calluna vulgaris
Herb-Robert	Geranium robertianum
Hogweed	Heracleum sphondylium
Common horsetail	Equisetum arvense
Water horsetail	Equisetum fluviatile
Marsh horsetail	Equisetum palustre
Common knapweed	Centaurea nigra
Knotgrass	Polygonum aviculare
Common male fern	Dryopteris filix-mas
Gold-scaled male fern	Dryopteris pseudomas
Marsh helleborine	Epipactis palustris
Early marsh orchid	Dactylorhiza incarnata
Annual meadow-grass	Poa annua
Rough meadow-grass	Poa trivialis
Smooth meadow-grass	Poa pratensis
Meadowsweet	Filipendula ulmaria
Common milkwort	Polygala vulgaris
Heath milkwort	Polygala serpyllifolia
Purple moor-grass	Molinia caerulea
Nettle	Urtica dioica
False oat-grass	Arrhenatherum elatius
Yellow oat-grass	Trisetum flavescens
Lesser butterfly-orchid	Platanthera bifolia
Knotted pearlwort	Sagina nodosa
Procumbent pearlwort	Sagina procumbens
Marsh pennywort	Hydrocotyle vulgaris

Common Name	Scientific Name
Lodgepole pine	Pinus contorta
Scots pine	Pinus sylvestris
Greater plantain	Plantago major
Bog pondweed	Potamogeton polygonifolius
Broad leaved pondweed	Potamogeton natans
Quaking grass	Briza media
Ragwort	Senecio jacobaea
Wild raspberry	Rubus idaeus
Yellow rattle	Rhinanthus minor
Redshank	Polygonum persicaria
Common reed	Phragmites australis
Great reedmace	Typha latifolia
Ribwort plantain	Plantago lanceolata
Bulbous rush	Juncus bulbosus
Jointed rush	Juncus articulatus
Sharp-flowered rush	Juncus acutiflorus
Soft rush	Juncus effusus
Italian rye-grass	Lolium multiflorum
Imperforate St. John's-wort	Hypericum maculatum
Slender St. John's-wort	Hypericum pulchrum
Square-stalked St. John's-wort	Hypericum tetrapterum
Bottle sedge	Carex rostrata
Carnation sedge	Carex panicea
Glaucous sedge	Carex flacca
Greater tussock sedge	Carex paniculata
Self heal	Prunella vulgaris
Silverweed	Potentilla anserina
Common sorrel	Rumex acetosa
Sheep's sorrel	Rumex acetosella
Perennial sow-thistle	Sonchus arvensis
Prickly sow-thistle	Sonchus asper
Lesser spearwort	Ranunculus flammula
Heath speedwell	Veronica officinalis
Blue water speedwell	Veronica anagallis aquatica

Common Name	Scientific Name
Common spike-rush	Eleocharis palustris
Common spotted-orchid	Dactylorhiza fuchsii
Heath spotted-orchid	Dactylorhiza maculata
Bog stitchwort	Stellaria alsine
Lesser stitchwort	Stellaria graminea
Round-leaved sundew	Drosera rotundifolia
Floating sweet-grass	Glyceria fluitans
Meadow-thistle	Cirsium dissectum
Creeping-thistle	Cirsium arvense
Marsh-thistle	Cirsium palustre
Sow-thistle	Sonchus palustris
Spear-thistle	Cirsium vulgare
Welted-thistle	Carduus acanthoides
Tormentil	Potentilla erecta
Trailing tormentil	Potentilla anglica
Bird's-foot trefoil	Lotus corniculatus
Common twayblade	Listera ovata
Valerian	Valeriana officinalis
Tufted vetch	Vicia cracca
Sweet vernal-grass	Anthoxanthum odoratum
Common dog-violet	Viola riviniana
Water mint	Mentha aquatica
Bay willow	Salix pentandra
Creeping willow	Salix repens
Eared willow	Salix aurita
Goat willow	Salix caprea
Sallow	Salix atrocinerea
Hoary willowherb	Epilobium parviflorum
Marsh willowherb	Epilobium palustre
Rose bay willowherb	Epilobium angustifolium
Short-fruit willowherb	Epilobium obscurum
Heath wood-rush	Luzula multiflora
Marsh woundwort	Stachys palustris

appendix three

vascular plant habitats at turraun nature reserve

By means of a simple code the following list indicates in what type of habitat the various vascular plant species were recorded at Turraun. This list is included in the report to illustrate the wealth of habitat diversity that can occur there in a single study area. The habitat in which each species was found is coded as;
D - ditches & open water; G - grassland; M - moss; P - pioneer vegetation; R - reeds; RU - rushes; W - wooded area.
Species common to more than one habitat type are indicated by the more common type for that species.
Plants hereunder are grouped in their various classes and families.

This list was prepared by Peter Fay, Botany Department, Trinity College, Dublin.

ANGIOSPERMAE
DICOTYLEDONES

RANUNCULACEAE	
Ranunculus acris	G
R. bulbosus	G
R. flammula	D
R. repens	G
CRUCIFERAE	
Cardamine pratensis	G
Erophila verna	P
Rorippa amphibia	G
VIOLACEAE	
Viola rivinianna	R
POLYGALACEAE	
Polygala serpyllifolia	G
P. vulgaris	G
CARYOPHYLLACEAE	
Cerastium fontanum	G
Sagina procumbens	C
S. nodosa	G
Stellaria alsine	G
S. graminea	RU
UTTIFERAE	
Hypericum maculatum	G
H. pulchrum	G
H. tetrapterum	RU
LINACEAE	
Linum catharticum	G
GERANIACEAE	
Geranium robertianum	W
LEGUMINOSAE	
Cytisus scoparius	W
Lathyrus pratensis	G
Lotus corniculatus	G
Trifolium repens	G
T. pratense	G
Ulex Europaeus	G
Vicia cracca	G
ROSACEAE	
Crataegus monogyna	W
Filipendula ulmaria	G
Potentilla anglica	RU
P. anserina	G
P. erecta	RU
Rubus fruticosus agg.	W
R. ideaus	W
DROSERACEAE	
Drosera rotundifolia	M
ONAGRACEAE	
Epilobium angustifolium	RU
E. hirsutum	RU
E. obscurum	RU
E. palustre	RU
E. paviflorum	RU
UMBELLIFERAE	
Angelica sylvestris	RU
Daucus carota	G
Heracleum sphondylium	G
Hydrocotyle vulgaris	R
RUBIACEAE	
Galium aparine	W
G. palustre	D
G. saxatile	RU
VALERIANACEAE	
Valeriana officinalis	G
DIPSACACEAE	
Succisa pratensis	G
COMPOSITAE	
Bellis perennis	G
Carduus acanthoides	G
Centaurea nigra	G
Cirsium arvense	G
C. dissectum	RU
C. palustre	RU
C. vulgare	RU
Crepis capillaris	G
C. vesicaria	G
Hieracium pilosella	P
Hypochaeris radicata	G
Leucanthemum vulgare	G
Leontodon taraxacoides	G
Senecio jacobaea	G
S. sylvaticus	G
Sonchus arvensis	G
S. asper	G
Taraxacum vulgaris	G
Tragopogon pratensis	G
Tussilago farfara	G
ERICACEAE	
Calluna vulgaris	RU
Erica tetralix	RU
PRIMULACEAE	
Primula veris	G
GENTIANACEAE	
Centaurium erythraea	G

BORAGINACEAE
Myosotis laxa G

SCROPHULARIACEAE
Veronica anagallis aquatica D
V. officinalis G
Rhinanthus minor G

LENTIBULARIACEAE
Utricularia vulgaris D

LABIATAE
Lycopus europaeus R
Mentha aquatica R
Prunella vulgaris G
Stachys palustris RU

PLANTAGINACEAE
Plantago lanceolata G

CHENOPODIACEAE
Chenopodium album G

POLYGONACEAE
Polygonium amphibium P
P. aviculare G
P. persicaria G
Rumex acetosa G
R. acetosella G
R. crispus G
R. conglomeratus G

UTRICACEAE
Urtica dioica W

BETULACEAE
Betula pubescens W

SALICACEAE
Populus tremula W
Salix aurita W
S. caprea W
S. cinerea W
S. pentandra W
S. repens W

ANGIOSPERMAE
MONOCOTYLEDONES

ORCHIDACEAE
Dactylorhiza fuchsii G
D. incarnata G
D. maculata G
Epipactis palustris G
Listera ovata G
Plantanthera bifolia G

JUNCACEAE
Juncus acutiflorus RU
J. articulatus RU
J. bulbosus D
J. effusus RU
Luzula multiflora RU

TYPHACEAE
Typha latifolia D

SPARGANIACEAE
Sparganium erectum D

LEMNACEAE
Lemna minor D

ALISMATACEAE
Alisma plantago-aquatica D

JUNCAGINACEAE
Triglochin palustris P

POTAMEGOTONACEAE
Potamogeton berchtoldii D
P. natans D

CYPERACEAE
Carex flacca RU
C. lepidocarpa G
C. panicea G
C. paniculata P
C. rostrata D
Eleocharis palustris D
Eriophorum angustifolium P
Schoenus nigricans RU

GRAMINEAE
Agrostis canina RU
A. capillaris RU
A. stolonifera D
Aira caryophyllea RU
A. praecox RU
Anthoxanthum odoratum G
Arrhenatherum elatius G
Briza media G
Cynosurus cristatus G
Dactylis glomerata G
Danthonia decumbens G
Festuca arundinacea G
F. rubra G
Glyceria fluitans D
Holcus lanatus G
Lolium perenne G
Molinia caerulea G
Phragmites australis R
Poa annua G
P. pratensis G
P. trivialis G

GYMNOSPERMAE

PINACEAE
Pinus contorta W
P. sylvestris W

PTERODOPHYTA

BLECHNACEAE
Blechnum spicant W

DRYOPTERIDACEAE
Dryopteris carthusiana W
D. dilatata W
D. filix-mas W
D. pseudomas W

OSMUNDACEAE
Osmunda regalis W

EQUISETACEAE
Equisetum arvense G
E. flaviatile D
E. palustre G

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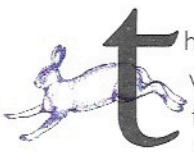

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