POLICY AND PRACTICE FOR THE PROTECTION OF GROUNDWATER

REGIONAL APPENDIX
WELSH REGION

NRA
National Rivers Authority

POLICY AND PRACTICE

FOR THE PROTECTION OF

GROUNDWATER

WELSH REGIONAL APPENDIX

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1.INTRODUCTION

1.1 Purpose of the Regional Appendix

This is one of ten regional appendices to the NRA's "Policy and Practice for the Protection of Groundwater". Its purpose is to provide information specific to Welsh Region which is not included in the main national document. Details are given on the following:

- Description of Welsh Region
- Geology and Hydrogeology
- Particular groundwater problems
- Main office locations and contacts relating to groundwater matters
- How to use the Policy and Practice for the Protection of Groundwater prior to the introduction of the new vulnerability maps.

The Regional Appendix should be read in conjunction with the main document.

1.2 Welsh Region

Geographically, Welsh Region is the third largest of the 10 Regions of the NRA covering a total area of 21,300km^2. The landscape is very diverse across the Region, from the distinctive mountainous areas of North Wales to the low lying coastal areas of the Gwent and Glamorgan levels. The Region is characterised by a large number of river systems which flow in deeply incised valleys, radiating from the central high ground.

Major centres of population are in areas dominated by coal mining activities and associated heavy industry. Approximately 50% of the total 3.1 million population of the Region is located in South East Wales.

Agricultural land use is variable with predominantly dairy farming in the West, arable and market gardening in the Wye catchment in the East and upland grazing in the North and to a lesser extent in the South.

1.3 Importance of Groundwater in Welsh Region

Groundwater is utilised throughout the Region ranging from small private abstractions to major industrial and potable supply sources. There are few areas where groundwater is not used at some scale and currently there are some 3,500 licensed abstractions from groundwater within the Region reflecting its importance as a source.

The karstic limestones of the Carboniferous represent one of the major aquifers in Welsh Region. They are highly permeable as a result of well developed joint and fissure systems. Large yields are obtained from major spring resurgences of groundwater, which occur near the base of the sequence or along faults. Groundwater flow velocities can be rapid with movement taking place in a small number of large fissures. The groundwater catchments in karstic limestone may bear little relation to surface topography.

The Permo Triassic Sandstone in the North East of the Region is a major aquifer but is limited in its distribution within the area. Where it does occur it is exploited by industrial and public supply abstractions.

The Old Red Sandstone, which has minor aquifer status on a national level is regionally important in sustaining a large number of small public and private supplies, both from boreholes and springs.

Supplies from gravel deposits exist throughout the Region and are heavily exploited by both local industry and private abstractors. In most cases these deposits are in hydraulic continuity with surface water systems.

Other aquifer systems throughout the Region may have too limited storage capacity and geographical extent for them to be exploited for large scale public supply. They do, however, offer an important resource for many rural areas and have become increasingly used for spray irrigation purposes.

Public water supplies from groundwater within the Region are provided by four major supply companies. The companies include Dwr Cymru (Welsh Water which supplies much of the Region), Wrexham and East Denbighshire (Wrexham and surrounding areas), North West (The Wirral), and Severn Trent (South Gwynedd Machynlleth area). In the rural areas of the Region where the public supply networks are not comprehensive a significant reliance is placed on groundwater in supplying and meeting local requirements.

Mineral water abstraction within the Region has generated considerable interest in recent years as demand for this product has increased nationally. There are a number of suppliers throughout the Region. Typically, Llanwrtyd Wells, Llandrindod Wells and Builth Wells are well known for their medicinal waters.

Spray irrigation and agricultural abstraction of groundwater is an important and growing demand on the resource. Licensed groundwater abstraction points for these purposes are currently in the order of 3,000 within the Region.

A number of major industries across the Region rely on good quality source water in the process and manufacture of their products, including breweries in South Wales and the Wrexham area.

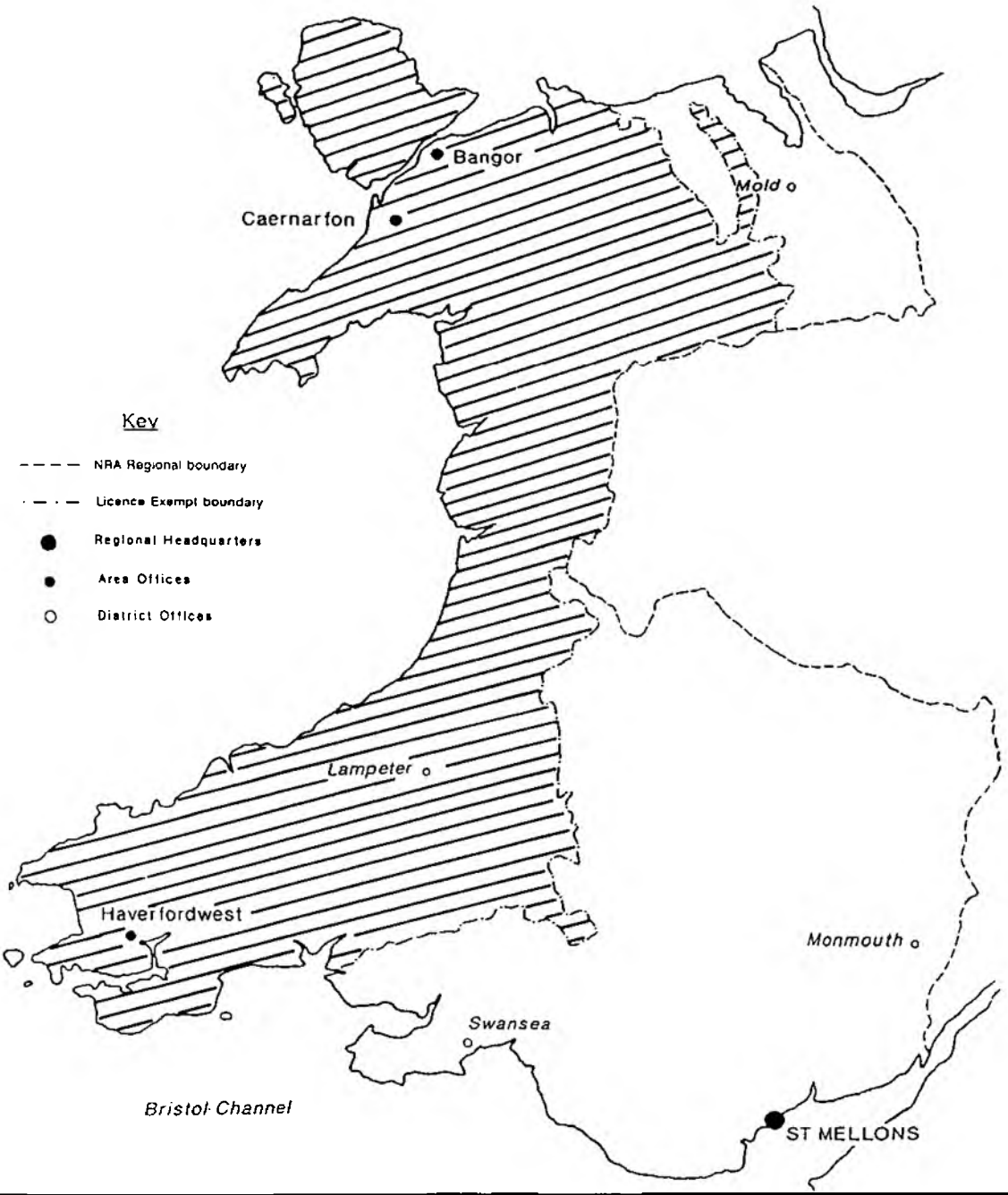
1.4 Hydrogeological differences across the Region

a) Rainfall and Recharge

Welsh Region has a higher average annual rainfall than any of the nine other Regions of the NRA: 1350mm/year compared with 940mm/year for England and Wales as a whole. Locally, average rainfall varies considerably, reflecting the difference in climate and topography across the Region. The largest precipitation is experienced in the uplands of North Wales which can be as high as 4000mm/year in Snowdonia, whilst along the coastal fringes rainfall reduces to about 1000mm/year.

Recharge of the different aquifer systems present in the Region is also variable. For the hard rocks of Mid and North Wales infiltration is limited to the relatively shallow weathered zones, resulting in a large component of run-off. For the Carboniferous Limestone aquifer infiltration rates are significant on areas of outcrop, with little if any run-off of rainfall. Considerable recharge of this aquifer also occurs through point sources such as swallowholes and collapsed dolines. These features act as surface water soakaways and permit the capture of surface water.

LICENSED GROUNDWATER EXEMPT AREA IN WELSH REGION.



SOUTH EASTERN AREA/HEADQUARTERS

National Rivers Authority
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St.Mellons
CARDIFF
CF3 0LT
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SOUTH WESTERN AREA

National Rivers Authority
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NORTHERN AREA (Poll.Control & Plann/Liaison)

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Priestley Road
CAERNARFON
Gwynedd
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NORTHERN AREA (Water Res & Flood Defence)

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Bryn Menai
Holyhead Road
BANGOR
Gwynedd
LL55 2EF
Tel.No. (0248) 370970

Fig.1.

Groundwater in the Carboniferous Limestone responds rapidly to rainfall with water levels rising and spring discharges increasing within hours of a precipitation event.

A large percentage of the Permo Triassic Sandstone is covered by glacial drift. Recharge is therefore relatively low taking place through the limited areas of outcrop strata and permeable drift cover. A small contribution is made via the Carboniferous Limestone in those areas where there is direct hydraulic continuity due to faulting. As a consequence the aquifer responds slowly to rainfall.

b) Unusual Hydrogeology

The natural hydrogeological regime of the South Wales coalfield has been extensively modified by mining activities. Large portions of the upper Coal Measures have been dewatered by pumping, drainage adits and interconnected shaft systems which have all contributed to lowering water levels markedly throughout the aquifer. Some of the drainage systems allow discharges outside the natural groundwater catchments and in some cases the expected natural flow directions are even reversed.

In North Wales, tunnels and adits through the Carboniferous Limestone associated with mineral workings cross major fissure systems and have a significant effect on the hydrogeology of the area. Two of these are Bagillt Tunnel and Halkyn High Level which are used for water supply. In the case of Halkyn it provides public potable supply, whilst for Bagillt the water is used for process purposes.

Drainage from coal or mining and mineral workings are used both for water supply and to augment stream flows.

c) Licensed Abstractions

A large part of the Welsh Region's groundwater resources is exempt from licence control under the Water Resources Act 1991 and includes most of Dyfed, Gwynedd and Anglesey (Fig. 1). These areas were designated by application to the Secretary of State for Wales for an order under the Water Resources Act 1963. Within the groundwater exempt areas, spring water is classed as surface water and its abstraction is controlled by appropriate licensing procedures.

The current lack of controls in groundwater quantity within the licence exempt area pose problems for an integrated approach to water resource management throughout the Region. The controls exercised by the National Rivers Authority concerning water quality within these areas are not compromised by the licence exemption status.

Where an aquifer crosses the Regional boundary, management of the resource together with its protection and conservation are undertaken in consultation with the adjoining Region. This consultation procedure provides the basis for decisions affecting groundwater resources between the Regions.

d) Nitrates in Groundwater

There are very few problems of elevated nitrate concentrations in groundwater resources throughout the Welsh Region. However, monitoring of drinking water in Gwent and Herefordshire has indicated rising concentrations, although below the drinking water level of 50mg/l (as No 3). The areas in which supplies are causing concern are located on intensively farmed agricultural land.

Shallow gravel aquifers in the upper Wye catchment also exhibit elevated nitrate concentrations. In some areas the 50mg/l limit is exceeded in waters abstracted for irrigation purposes. This reflects the local land use, which is primarily intensive market gardening.

1.5 River Protection Zones

The River Dee is an important regulated river providing potable supplies to more than 2 million people in North-East Wales and Merseyside.

Along parts of the river corridor of the Dee and its major tributaries the Alyn and Clywedog, groundwater is in hydraulic continuity with river water. The Dee catchment is the location of a large number of industries and these have been the source of numerous pollution incidents, some affecting the potable water supply. In order to minimise the risk of pollution incidents from industry it was decided to apply for the designation of "Water Protection Zones" under section 93 of the Water Resources Act 1991. This legislation and its precursors in the 1974 Control of Pollution Act and the 1989 Water Act have never been used and therefore the application will be the subject of a Public Inquiry. The Protection Zone will cover the whole of the catchment upstream of the abstractions, and a risk assessment methodology has been devised to indicate the need for prohibition of chemicals or improvements in safety procedures. The application will be made early in 1993 and the Public Inquiry is anticipated around the middle of the year.

2. The Geology and Hydrogeology of Welsh Region

Stratigraphy

2.1 The stratigraphy of Welsh Region extends from Pre-Cambrian strata through to recent deposits. The stratigraphic column is far from complete but a range of both ages and rock types are to be found within the Region. The vulnerability of the groundwater resources associated with each rock type is therefore also diverse. Table 1 illustrates the stratigraphy of the major rock types found in the Region together with a brief description. Included in the table are details of main locations, flow mechanism and geological classification of the formations.

Table 2 is Welsh Region's adaptation of Appendix 3 of the main Policy and Practice document. The classification of geological formations into Major, Minor and Non-Aquifers reflects the regional perspective of importance and vulnerability of the various formations. Regional modifications to the classification of geological strata are not included in the 1:1,000,000 scale National Groundwater Vulnerability map for Wales and England which forms part of the main policy document. These modifications will, however, be fully addressed in the 1:100,000 scale Resource Protection maps which will be published on a county area basis.

The geology of the Region is shown in Fig.2.

2.2 Major Aquifers

The Carboniferous Limestone is characterised within the Region by its karstic development. The flow of groundwater in the saturated zone is entirely through the well developed fissures and fractures, the intergranular permeability of the limestone is virtually zero. Recharge via swallow holes is evident over much of the outcrop, the permeability being sufficiently high for surface water bodies to be rare. Discharge of groundwater is through discrete large springs which are often utilised for supply purposes.

The uncertainties posed by the distribution and interconnection of the fissure system that governs groundwater flow present significant problems in the assessment of pollution risk. The recharge mechanisms that exist and the rapid flow rates that take place make supply sources from this aquifer very vulnerable to contamination from point source pollution events.

The Permo Triassic Sandstones comprise cross bedded, generally well cemented, fine to medium grained sandstones with thin lenses of mudstone. The sediments characteristically exhibit high permeabilities, both intergranular and fissure. Within the Region, a large area is covered by drift deposits which provides protection from contamination by surface activities. Recharge however, is limited by the distribution of these drift deposits. Heavy demands placed upon the resource has resulted in local declines in the potentiometric groundwater surface of the confined system. High rates of abstraction has also given rise to salinity problems at some source locations.

2.3 Minor Aquifers

The Devonian (Old Red) Sandstone consists mainly of consolidated, well cemented, flaggy sandstones with thin sandy marls. Intergranular groundwater flow is limited through the hard sandstones and movement occurs mainly through fissures. Vertical flow is limited by the presence of marl bands giving rise to springs which are extensively utilised. The storativity of the aquifer is small and groundwater yields can decline with time, spring issues dry up during extended periods of low rainfall.

The Upper Coal Measures (Pennant) comprise of hard dense sandstone horizons separated by lower permeability shales, siltstones, seatearths and coal. Large quantities of water are obtained from the sandstone layers but yields are variable both spatially and temporally. The permeability of the sandstones is due to natural joints and fissures and to the presence of tension zones caused by mining activities. The Middle and Lower Coal Measures comprise mainly shales with minor locally impersistent developments of sandstones, along with coal seams.

The Carboniferous Coal Measures are extensively utilised for water resource purposes. Rapid groundwater movement via the fissure systems together with disturbance and interconnection of the permeable sandstone horizons by mining activities, makes the resource very vulnerable.

The Quaternary Sand and Gravels are unconsolidated deposits which include glacial, fluvio-glacial, plateau gravels and river terrace deposits. Such superficial deposits are generally thin and variable in nature but good intergranular permeabilities enable them to be important for supplying local requirements. In most cases these deposits exhibit a degree of hydraulic continuity with surface water systems. There is some scope for pollution attenuation within these variable deposits especially where the silt and clay content is significant. However the near surface position of groundwater within the aquifer makes the resource very vulnerable to pollution.

The Millstone Grit consists of sequences of sandstones, shales, mudstones and seatearths. Groundwater movement occurs through well developed joints and fissures in the well cemented sandstone layers. These secondary discontinuities impart high permeabilities but their limited occurrence makes groundwater abstraction from the deposits speculative. Springs however occur within the Millstone Grit at the junctions of well jointed and inclined sandstones with underlying less permeable shales. In the south of the Region the hydrogeological significance of the Millstone Grit is its importance as a source of recharge to the underlying Carboniferous Limestone, where the Upper Limestone Shales are absent.

The Jurassic Lower Lias comprises an alternating sequence of shales and limestones of varying thickness. The shales are of low permeability, but the secondary permeability of the limestone is utilised as a source of groundwater for small local supplies. At outcrop, small springs which emerge at the limestone/shale boundaries are also locally significant.

The Triassic Penarth Group consists of fine grained calcareous marls and marly limestone, mostly underlain by shales, but sandstones are present in some areas which yield small quantities of potable water.

The Mercia Mudstone Group in the south of the Region comprises uniform mudstones with silty layers and a diachronous basal bed of breccias and conglomerates interbedded with sandy marls. Small quantities of potable water is abstracted from the permeable horizons within the group. In the north of the Region the Mercia Mudstone group confines to the underlying Triassic sandstones.

The Silurian rocks are composed of calcareous sandstones, mudstones and shales. Due to the argillaceous nature of the sediments they exhibit low permeabilities and porosities. However, groundwater supplies are obtained from shallow wells and springs in the fissured limestones which occur in the middle and near the top of the sequence. Supplies are vulnerable to pollution, a consequence of the limited unsaturated zone provided to the resource.

The Ordovician rocks consist of mudstones, shales, sandstones and grits. Groundwater occurs in the more permeable highly weathered and fractured zones and is utilised by private abstractors

for domestic supplies. The water table in these deposits is normally high and groundwater has a corresponding susceptibility to pollution from surface activities.

The Cambrian sediments comprise highly indurated shales, flaggy mudstones, sandstones and basal conglomerates. Similar in nature to the Silurian and Ordovician, groundwater is limited to near surface fractured weathered zones. Supplies from shallow wells and springs are vulnerable because of the normally high water table.

Igneous and metamorphic rocks of Protozoic and Lower Palaeozoic age occur within the Region. Whilst these rocks are well indurated, they do contain appreciable amounts of water locally in sub-surface weathered zones and joint systems. As a result they may provide sources of private domestic supply and sustain surface water features through spring discharges. Fissure flow within these shallow zones limits the potential for pollution alteration.

2.4 Non-Aquifers

The low permeability of the well indurated sediments of the Pre-Cambrian and Lower Palaeozoics, together with the marls, clays and other fine grained sediments which outcrop throughout the Region, act as an effective barrier to groundwater movement. In such areas of outcrop there should be little risk to groundwater supplies. However, because of their low permeabilities, problems of polluted surface run-off can occur with consequent damage to surface water systems and groundwater recharge areas downstream.

TABLE 1
THE GEOLOGY AND HYDROGEOLOGY OF WELSH REGION

AGE/ROCK TYPE	MAIN LOCATIONS	DESCRIPTION	FLOW MECHANISM	GEOLOGICAL CLASSIFICATION
Alluvium	Throughout Region	Limited resources in hydraulic continuity with watercourses	Intergranular	Non-Aquifer
Peat	Throughout Region	Local source of baseflow, supplying water for streamflow for significant periods after rainfall	Intergranular	Non-Aquifer
Lacustrine deposits	Anglesey Teifi Valley	Low permeability silts and clays Some associated sands	Intergranular	Non-Aquifer
Fluvial - Glacial sands and gravels	Throughout Region	Locally important resource	Intergranular	Minor Aquifer
Boulder Clay	Throughout Region	Varied deposits from clays to gravels. Small yields available. Main hydrogeological significance is in limiting recharge to, and confining waters within, underlying formations.	Intergranular	Minor Aquifer
Jurassic Lower Lias (Shales, Limestone)	South Glamorgan	The shales are of low permeability but secondary permeability of the limestone is utilised as a source of groundwater for small supplies. At outcrop, small springs emerge at the limestone/shale boundaries which are also locally significant	Fracture	Minor Aquifer

TABLE 1
THE GEOLOGY AND HYDROGEOLOGY OF WELSH REGION

AGE/ROCK TYPE	MAIN LOCATIONS	DESCRIPTION	FLOW MECHANISM	GEOLOGICAL CLASSIFICATION
Triassic Penarth Group. (marls, marly limestone, sandstone)	South Glamorgan	Limited resources in fractured sandstone (Quarella Sandstone) which yield small quantities of potable water	Fracture/Intergranular	Minor Aquifer
Triassic Mercia Mudstones (mudstones, conglomerates)	South Glamorgan	Small quantities of water are abstracted for public supply from the conglomerates. Small area of outcrop in this Region. Resources are limited	Fracture	Minor Aquifer
Permo Triassic Sandstones	Cheshire and Clwyd	This important resource is exploited for both public supply and industrial use. Controlled discharges of artesian water takes place in the Central Vale of Clwyd to augment the natural summer flows of the River Clwyd	Fracture/Intergranular	Major Aquifer
Coal Measures (cyclic sequence of shales, siltstones, grits, seatearths, coal)	Clwyd, Dyfed, West Glamorgan, Mid Glamorgan, Gwent	Upper Coal Measures contain large quantities of water and naturally form a multi-layered aquifer system with separate water bodies in each sandstone horizon. Supplies from the sandstone formations support both public and private abstractions. Rivers crossing the coalfields receive a significant baseflow contribution by spring discharge from the base of sandstone formations. Drainage from mining adits and shafts augments flows in watercourses.	Fracture/Intergranular	Minor Aquifer

TABLE 1
THE GEOLOGY AND HYDROGEOLOGY OF WELSH REGION

AGE/ROCK TYPE	MAIN LOCATIONS	DESCRIPTION	FLOW MECHANISM	GEOLOGICAL CLASSIFICATION
Millstone Grit (Sandstone, grits)	Clwyd, Dyfed, West Glamorgan, Mid Glamorgan, South Glamorgan and Gwent	Secondary permeabilities are high where joints and fissures are well developed. Public potable supplies are obtained where the frequency of joints and fissures are high. Hydrogeologically this unit is important as a source of recharge to the underlying Carboniferous Limestone aquifer	Intergranular/Fracture	Minor Aquifer
Carboniferous Limestone	Clwyd, Dyfed, West Glamorgan, Mid Glamorgan, South Glamorgan and Gwent	The groundwater resource from this aquifer is heavily utilized for puboic potable supply and for industrial and process use. Spring discharges are significant and provide baseflow to rivers. A large number of deep quarries exist, reflecting its importance as a mineral resource. In the North of the Region lead and zinc mining has taken place in areas of high mineralisation	Fracture	Major Aquifer
Devonian Sandstone (sandstones, conglomerates, marls)	Herefordshire, Gwent, Powys, Mid Glamorgan and Dyfed	Intergranular flow is limited through the hard cemented sandstones, groundwater movement mainly taking place through fissures. This aquifer is of major local importance in South East Wales and the Borders	Fracture/Intergranular	Minor Aquifer
Silurian (shales, mudstones, limestones)	Dyfed and Powys	Small supplies obtained from shallow wells and springs from the fissured Wenlock and Aymestry Limestones	Fracture	Minor Aquifer

TABLE 1
THE GEOLOGY AND HYDROGEOLOGY OF WELSH REGION

AGE/ROCK TYPE	MAIN LOCATIONS	DESCRIPTION	FLOW MECHANISM	GEOLOGICAL CLASSIFICATION
Ordovician (mudstones, shales, sandstone, grits)	Dyfed, Powys and Gwynedd	Calcareous mudstones and impure limestones are present in the upper part of the succession. The grits and shales contain little groundwater except in the more permeable highly weathered and fractured zones. The sandstones are capable of supporting small private abstractions. Interconnected slate working in Mid and North Wales collect and discharge locally significant amounts of groundwater	Fracture	Minor Aquifer Non-Aquifer below weathered zone
Cambrian (shales, mudstones, sandstone, basal conglomerates)	Dyfed, Gwynedd and Anglesey	This sediment contains little groundwater, any present being obtained by shallow wells or spring issues from perched water tables which exist in fractured weathered rock. These small supplies are important in sustaining local rural communities	Fracture	Minor Aquifer Non-Aquifer below weathered zone
Pre-Cambrian (slates, volcanic rocks, grits and quartzites)	Dyfed, Gwynedd and Anglesey	These highly indurated strata contain little groundwater except where sub-surface permeable zones have been developed by weathering. In areas where such perched water tables exist they may provide a source of private supply and sustain surface water features through spring discharges	Fracture	Minor Aquifer Non-Aquifer below weathered zone

TABLE 2

NATIONAL RIVERS AUTHORITY - GROUNDWATER PROTECTION POLICY
CLASSIFICATION OF TYPES OF STRATA IN WELSH REGION

MAJOR AQUIFERS	MINOR AQUIFERS		NON-AQUIFERS
Highly permeable formations usually with the known or probable presence of significant fracturing. High productive strata of regional importance. Often used for large potable abstractions.	Fractured or potentially fractured but without high intergranular permeability. Generally only support locally important abstractions	Variable porous/permeable but without significant fracturing. Generally only support locally important abstractions	Formations with negligible permeability. Only support very minor abstractions, if any
Permo-Triassic Sandstones, Carboniferous Limestones	Jurassic Lower Lias Triassic Conglomerates Coal Measures Millstone Grit Old Red Sandstone Silurian Limestone Some Igneous and Metamorphic formations	River gravels Glacial sands and gravels	All clays, shales, marls and siltstones. Igneous and metamorphic formations without significant fracturing

3. Particular Groundwater Problems in the Region Related to the Policy Statements.

In view of the local importance placed on groundwater resources within Welsh Region, the development of potentially polluting activities will have significant constraints placed upon them at a local level. The following activities highlight issues with regards to particular policy statements.

3.1 Policy A (Resources)

The abstraction of groundwater for drainage purposes in the coal, slate and metal ore mining industries are not controlled by formal licence abstraction procedures under the Water Resources Act 1991. The designation of groundwater exempt areas within the Region further limits the abstraction controls which the Authority would wish to exercise. This lack of control limits the overall effectiveness of groundwater resource management in Welsh Region.

3.2 Policy B (Physical Disturbance)

Mining activities within the Welsh Region have disturbed aquifer systems and altered natural hydrogeological regimes. Closure of a number of mines over recent years have resulted in the recovery of local groundwater levels in a number of areas. However, problems have arisen with the increase in water levels due to the discharge of ferruginous waters into surface water systems via the preferential flow paths that exist in the form of adits, levels, drivages and shafts. This is a result of iron mobilisation due to oxidation of pyrite which is present in the coal seams. Break out of highly mineralised groundwater from deep mine workings into surface waters results in a further oxidation reaction taking place with the formation of ferric hydroxide precipitate. The flooding of old metalliferous mine workings has also resulted in significant heavy metal contamination of some of the surface water systems within the Region.

3.3 Policy C (Waste Disposal to Land)

Landfill activities which were once considered to be acceptable have taken place on fissured aquifer systems, in particular, large quarries in the Carboniferous Limestone. These areas provide a significant potential for water resource development. In such circumstances strict limitations will be imposed on future landfill developments.

3.4 Policy D (Contaminated Land)

The Region has a legacy of heavy and extractive industries. The demise of many of the traditional industries has lead to redevelopment initiatives being implemented which has drawn attention to specific problems of contamination of groundwater and associated surface water systems. A number of these problems are to be found in the South Wales area and within the River Dee catchment.

3.5 Policy F (Discharges to Underground Strata)

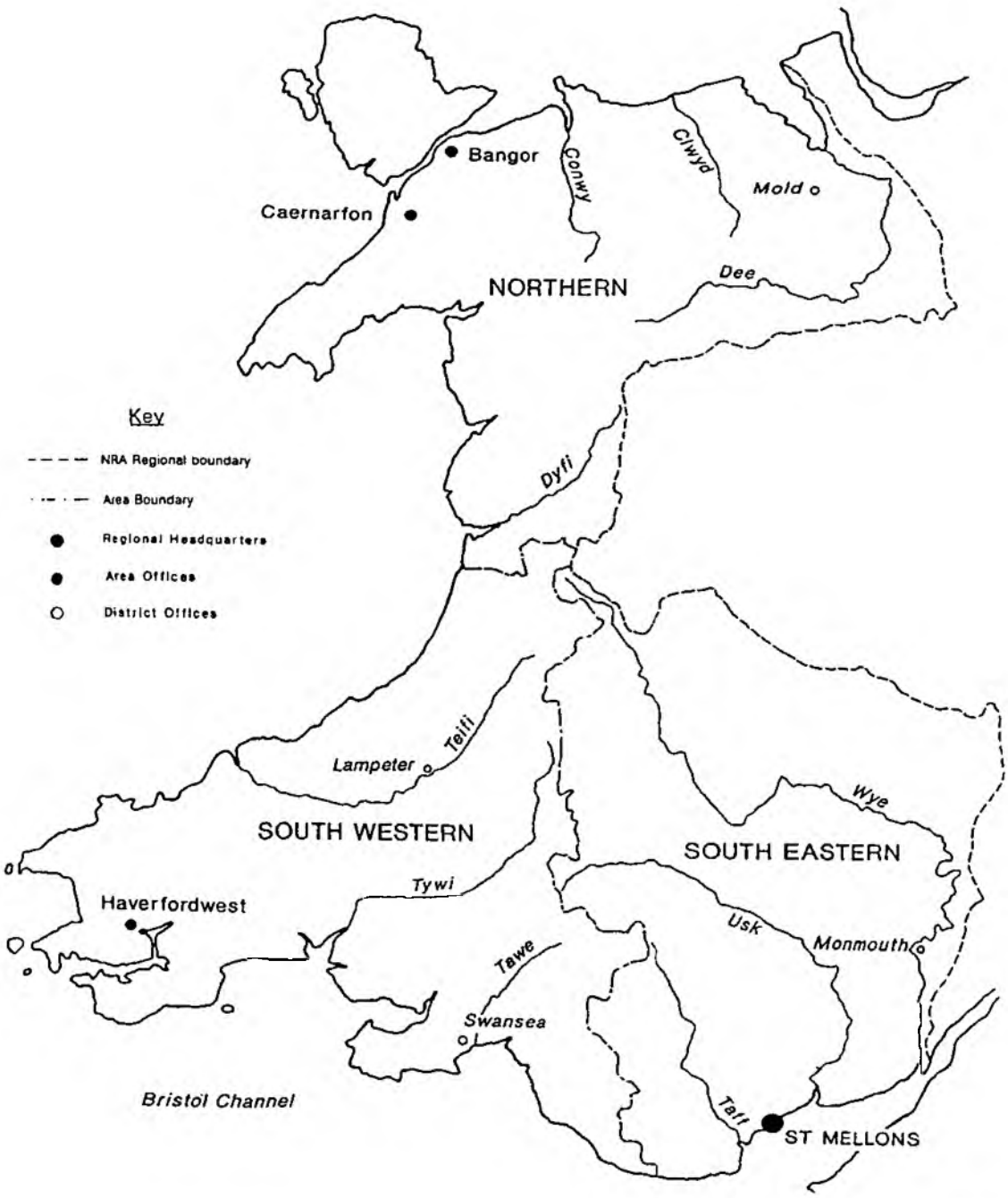
Shallow aquifers are heavily exploited throughout the Region to support local demands for potable supply. Groundwater in those aquifers which exhibit high water tables are vulnerable to pollution from point source discharges. The Welsh Region currently controls discharges of sewage or trade effluent to underground strata in those areas which are considered to be

hydrogeologically sensitive. Control is exercised by the issuing of a Prohibition Notice being served on the discharger which prohibits discharge being made unless a consent is obtained under the Water Resources Act 1991. Consents are only granted if suitable conditions can be imposed to minimise the risk of the discharge contaminating groundwater resources.

4. Main Office Locations in Welsh Region

The main office locations in Welsh Region are provided in table 3 below. Principal staff at the various office locations dealing with aspects of groundwater protection are detailed in the table. In addition brief details of the main duties carried out by these sections where they relate to groundwater are given. Fig. 3. shows the Headquarters and Area office locations within Welsh Region.

NATIONAL RIVERS AUTHORITY
- WELSH REGION -



SOUTH EASTERN AREA/HEADQUARTERS

National Rivers Authority
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NORTHERN AREA (Water Res & Flood Defence)

National Rivers Authority
Bryn Menai
Holyhead Road
BANGOR
Gwynedd
LL55 2EF
Tel.No. (0248) 370970

Fig.3.

TABLE 3

MAIN OFFICE LOCATIONS IN WELSH REGION

AREA	ADDRESS TELEPHONE NO FAX NO	PRINCIPAL STAFF AND RESPONSIBILITIES	POLLUTION CONTROL CATCHMENT	LOCAL PLANNING AUTHORITIES WITHIN AREA
St Mellons Headquarters	Rivers House St Mellons Business Park St Mellons Cardiff CF3 0LT Tel: 0222 770088 Fax: 0222 798555	**Regional Hydrogeologist:** All aspects related to the management and protection of groundwater resources; waste disposal licence consultations, contaminated land redevelopment proposals, discharge and abstractions, advice to internal staff dealing with the public, consultants, contractors and developers on specific proposals which could affect groundwater resources **Regional Technical Planning Officer:** Public Registers of discharge consents. Ground and surface water quality		

TABLE 3

MAIN OFFICE LOCATIONS IN WELSH REGION

AREA	ADDRESS TELEPHONE NO. FAX NO	PRINCIPAL STAFF AND RESPONSIBILITIES	POLLUTION CONTROL CATCHMENT	LOCAL PLANNING AUTHORITIES WITHIN AREA
Northern Area	**Area Office:** (Water Quality, Planning Liaison, Fisheries and Conservation) Highfield Priestly Road Caernarfon Gwynedd LL55 3HR Tel: 0286 672247 Fax: 0286 4451 **District Office:** (Water Resources, Flood Defence) Bryn Menai Holyhead Road Bangor Gwynedd LL57 2EF Tel: 0248 370970 Fax: 0248 370747 **District Office:** P.O.Box 550 Shire Hall Mold Clwyd CH7 6FA Tel: 0352 700176 Fax: 0352 756364	<u>Area Environmental Quality Manager</u> All aspects related to pollution control work including the issuing of prohibition notices for discharges, sampling and monitoring of aquatic environments and implementation of the farm waste regulations. Processing and issuing of discharge consents. <u>Area Water Resources Manager</u> Collection and collation of meteorological data, hydrometric data. Issuing of drilling consents and licences for surface and groundwater abstraction. Licence enforcement. Public registers of abstraction licences for ground and surface waters <u>Area Planning Co-ordinator</u> Liaison with Local Authorities on all planning related matters. Co-ordination of functional responses on all formal consultations. Within each multi-functional area office there are also fisheries, conservation, recreation and flood defence staff.	R.Dee R.Dyfi R.Dysyni R.Mawddach R.Glaslyn R.Dwyfor R.Erch R.Gwyrfai R.Seiont R.Ogwen R.Conwy R.Clwyd R.Braint R.Cefni	**Cheshire County Council** Chester City Council Ellesmere Port & Neston District Council **Clwyd County Council** Alyn & Deeside District Council Colwyn Borough Council Delyn Borough Council Glyndwr District Council Rhuddlan Borough Council Wrexham Maelor Borough Council **Gwynedd County Council** Aberconwy Borough Council Arfon Borough Council Dwyfor Borough Council Meirionydd District Council Ynys Mon Borough Council **Merseyside Metropolitan County Council** Wirral Metropolitan Borough Council **Shropshire County Council** North Shropshire District Council Oswestry District Council **Snowdonia National Park**

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MAIN OFFICE LOCATIONS IN WELSH REGION

AREA	ADDRESS TELEPHONE NO FAX NO	PRINCIPAL STAFF AND RESPONSIBILITIES	POLLUTION CONTROL CATCHMENT	LOCAL PLANNING AUTHORITIES WITHIN AREA
South Eastern Area	**Area Office:** Rivers House St Mellons Business Park St Mellons Cardiff CF3 0LT Tel: 0222 770088 Fax: 0222 798555 **District Office:** Hadnock Road Monmouth Gwent NP5 3NQ Tel; 0600 772245 Fax: 0600 772202	<u>Area Environmental Quality Manager</u> All aspects related to pollution control work including the issuing of prohibition notices for discharges, sampling and monitoring of aquatic environments and implementation of the farm waste regulations. Processing and issuing of discharge consents. <u>Area Water Resources Manager:</u> Collection and collation of meteorological data, hydrometric data. Issuing of drilling consents and licences for surface and ground-water abstraction. Licence enforcement. <u>Area Planning Co-Ordinator:</u> Liaison with Local Authorities on all planning related matters. Co-ordination of functional responses on all formal consultations. Within each multi-functional area office there are also fisheries, conservation, recreation and flood defence staff.	R.Usk R.Rhymney R.Taff R.Ely R.Cadoxton R.Thaw R.Wye	**Mid Glamorgan County Council** Cynon Valley Borough Council Merthyr Tydfil Borough Council Rhondda Borough Council Rhymney Valley District Council Taff Ely Borough Council **South Glamorgan County Council** Cardiff City Council Vale of Glamorgan Borough Council **Gloucestershire County Council** Forest of Dean District Council * **Gwent County Council** Blaenau Gwent Borough Council Islwyn Borough Council Monmouth Borough Council Newport Borough Council Torfaen Borough Council **Hereford & Worcester C.C.** Hereford City Council Leominster District Council Malvern Hills District Council * South Herefordshire D.C. **Powys County Council** Brecknock Borough Council Radnor District Council Montgomeryshire District Council **Brecon Beacons National Park**

*Dealt with by Severn Trent Region

TABLE 3

MAIN OFFICE LOCATIONS IN WELSH REGION

AREA	ADDRESS TELEPHONE NO FAX NO	PRINCIPAL STAFF AND RESPONSIBILITIES	POLLUTION CONTROL CATCHMENT	LOCAL PLANNING AUTHORITIES WITHIN AREA
South Western Area	**Area Office:** Llys Afon Hawthorn Rise Haverfordwest Dyfed SA61 2BQ Tel: 0437 760081 Fax: 0437 760881 **District Office:** Glantawe 154 St Helens Road Swansea West Glamorgan SA1 4DF Tel: 0792 645300 Fax: 0792 648652 **District Office:** Glan Teifi Barley Mow Lampeter Dyfed SA43 7BY Tel: 0570 422455 Fax: 0570 423607	<u>Area Environmental Quality Manager</u> All aspects related to pollution control work including the issuing of prohibition notices for discharges, sampling and monitoring of aquatic environments and implementation of the farm waste regulations. Processing and issuing of discharge consents. <u>Area Water Resources Manager</u> Collection and collation of meteorological data, hydrometric data. Issuing of drilling consents and licences for surface and ground-water abstractions. Licence enforcement. Public Registers of abstraction licences for ground and surface waters. <u>Area Planning Co-ordinator</u> Liaison with Local Authorities on all planning related matters. Co-ordination of functional responses on all formal consultations. Within each multi-functional area office there are also fisheries, conservation, recreation and flood defence staff.	R.Ogmore R. Kenfig R.Afan R.Neath R. Tawe R.Loughor R.Tywi R.Taf R.Pembroke R.Cleddau R.Nyfer R.Teifi R.Aeron R.Ystwyth R.Rheidol	**Mid Glamorgan County Council** Ogwr Borough Council **West Glamorgan County Council** Lliw Valley Borough Council Neath Borough Council Port Talbot Borough Council Swansea City Council **Dyfed County Council** Carmarthen District Council Ceredigion District Council Dinefwr Borough Council Llanelli District Council Preseli Pembrokeshire District Council South Pembrokeshire District Council **Brecon Beacons National Park** **Pembrokeshire Coast National Park**

5.HOW TO USE THE POLICY AND PRACTICE FOR THE PROTECTION OF GROUNDWATER PRIOR TO THE INTRODUCTION OF NEW VULNERABILITY MAPS AND SOURCE PROTECTION ZONES.

5.1 Introduction

Protection of groundwater will embody the concept of vulnerability which considers levels of protection necessary for specified areas of permeable strata and areas around groundwater abstraction. The concept and the factors defining vulnerability are given detailed explanation in the main national document.

Maps showing Resource Protection Areas and the definition of Source Protection Zones are currently being produced. Until the maps are available, Welsh Region will adopt the following procedure in conjunction with the Policy document for the assessment of risks to groundwater resources and individual sources.

5.2 Groundwater Vulnerability Maps Proposed for the new Policy

A series of Resource Protection Maps will be produced on a scale of 1:100,000 on a county area basis. These maps will be produced after considering the vulnerability of groundwater, based on the nature of the strata and type of soil and drift cover. The scheduled completion of this programme of work, to provide complete coverage for all NRA Regions, is 1996. In the interim consideration will be given to those factors affecting groundwater vulnerability, including thickness of unsaturated zone, when assessing development proposals.

5.3 Source Protection Zones

A national NRA Contract is currently in progress for the definition of Source Protection Zones. Production of zones for some of the more vulnerable groundwater abstractions within Welsh Region will be completed by July 1993. The remaining zones will be defined after this time using the same methodology. These will be produced as soon as possible and when necessity arises.

The Source Protection Zones will not be included in the series of Resource Protection maps to be produced but will be detailed on larger scale maps and in reports held in the regional NRA offices. Developers will be able to discuss the definition of the zones with reference to particular proposals. Modification of the areas delineated by the zones will not however be made without detailed hydrogeological information being provided and which may be contrary to that used in the modelling exercise.

Welsh Region does not have previously published maps delineating protection zones around groundwater abstractions. However, for internal purposes to assist in assessment of risks to major groundwater sources from specific development proposals, sensitive areas were drawn around abstractions. The zones were defined on limited information available with due regard given to local knowledge and experience.

For an interim period and until the new zones have been drawn up, the existing zones will be used in the consideration of proposals that could pose a risk to a particular source. Refinement

of a zone may be considered appropriate if detailed local hydrogeological information is made available. Developers in connection with specific proposals may submit appropriate data which will be considered by Welsh Region for the modification of the existing zones. The following parameters will be considered important in the use of established hydrogeological techniques used for any modification of zone boundaries:-

Transmissivity	T
Specific yield	S
Hydraulic gradient	i
Abstraction Rate	Q
Spring Discharge Rate	Q
Effective Aquifer Thickness	b

Consideration will also be given to information provided by tracer studies in defining recharge areas to specific abstractions.

NRA

National Rivers Authority

To obtain copies of any of the following documents, please send cheque (made payable to the National Rivers Authority) or postal order to:

National Rivers Authority
Newcastle-Upon-Tyne X
NE85 4ET

- Policy & Practice for the Protection of Groundwater (including the Groundwater Vulnerability Map) — Price £15
- Individual copies of the Groundwater Vulnerability Map — Price £5
- Summary Leaflets for the Groundwater Protection Policy Document — No Charge

Regional Appendices can be obtained from the appropriate regions free of charge

HEAD OFFICE
Rivers House
Waterside Drive
Aztec West
Almondsbury
Bristol
BS12 4UD
Tel: (0454) 624400
Fax: (0454) 624409

LONDON OFFICE
30-34 Albert Embankment
London SE1 7TL
Tel: (071) 8200101
Fax: (071) 8201603

ANGLIAN REGION
Kingfisher House
Goldhay Way
Orton Goldhay
Peterborough PE2 5ZR
Tel: (0733) 371811
Fax: (0733) 231840

NORTHUMBRIA REGION
Eldon House
Regent Centre
Gosforth
Newcastle Upon Tyne
NE3 3UD
Tel: (091) 2130266
Fax: (091) 2845069

NORTH WEST REGION
Richard Fairclough House
Knutsford Road
Warrington WA4 1HG
Tel: (0925) 53999
Fax: (0925) 415961

SEVERN-TRENT REGION
Sapphire East
550 Streetsbrook Road
Solihull B91 1QT
Tel: (021) 7112324
Fax: (021) 7225824

SOUTHERN REGION
Guildbourne House
Chatsworth Road
Worthing
West Sussex BN11 1LD
Tel: (0903) 820692
Fax: (0903) 821832

SOUTH WEST REGION
Manley House
Kestrel Way
Exeter EX2 7LQ
Tel: (0392) 444000
Fax: (0392) 444238

THAMES REGION
Kings Meadow House
Kings Meadow Road
Reading RG1 8DQ
Tel: (0734) 535000
Fax: (0734) 500388

WELSH REGION
Rivers House/Plas-yr-Afon
St Mellons Business Park
St Mellons
Cardiff CF3 0LT
Tel: (0222) 770088
Fax: (0222) 798555

WESSEX REGION
Rivers House
East Quay
Bridgwater
Somerset TA6 4YS
Tel: (0278) 457333
Fax: (0278) 452985

YORKSHIRE REGION
21 Park Square House
Leeds LS1 2QG
Tel: (0532) 440191
Fax: (0532) 461889