THE GSI GROUNDWATER NEWSLETTER

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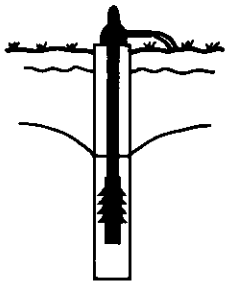

NUACHTÁN SCREAMHUISCE SGÉ

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INTRODUCING THE GSI GROUNDWATER NEWSLETTER

Work on groundwater development and management has expanded significantly in the last 10 years and there are now many scientists and engineers in the public, private and educational sectors involved with groundwater projects or interested in groundwater. Due to this expansion and the interdisciplinary nature of groundwater work, there is an increasing need for an improved means of communication and for a forum where news and views can be exchanged.

This **GSI Groundwater Newsletter** is the first of a series which aims to bring together news, developments, reviews and opinions on all aspects of groundwater - exploration, development, management, water quality, pollution and energy - and to promote a proper appreciation of the value and importance of groundwater.

The **Newsletter** will be circulated free-of-charge to engineers in local authorities; engineering consultants specialising on water supply projects; hydrogeological consultants; certain semi-state bodies and Government Departments; Departments of Geology, Geography and Engineering in third-level colleges; and technical libraries. If you wish to be deleted from the circulation list or if you know of other people who would like to receive the **Newsletter** please contact the Geological Survey.

The **Newsletter** will consist of 3-6 double-sided A4 sheets and will be published 4 times every year. We hope that items included in the **Newsletter** will be contributed mainly by engineers and scientists from outside the Geological Survey. In particular we welcome contributions from engineers - we are pleased that the first item in this issue is from two engineers. All items should be short (maximum 200 words, but preferably 100-150 words) and informative. So please contribute to the dialogue and communication by providing us with details on groundwater in your area of interest.

GROUNDWATER EXPLORATION AND DEVELOPMENT

Tullamore Water Supply

Traditionally Tullamore Urban District Council has procured its potable water supply for Tullamore town (pop. 9,500) from surface water streams near Clonaslee, Co. Laois. When the dry summer of 1975 showed these to be inadequate to satisfy the town's increasing demand for water, investigations were initiated with a view to locating a suitable groundwater source. Since 1976 the Urban Council have located and proven the groundwater potential of the Clonaslee Sandstone Aquifer sited in the foothills of Slieve Bloom. A total of 9 boreholes have been drilled over a 12km^2 area and 5 of these have been yield tested. The anticipated yield of 4 of these boreholes is 2270m^3/d (0.5m.g.d.).

The Clonaslee aquifer has not yet been brought into production as an alternative groundwater source was available at Silver River near the demand area. However, tenders for the development of the scheme are presently under consideration. The design includes for submersible pump installations and delivery via individual rising mains to strategically located collection chambers for gravity delivery to the existing treatment works. The borehole water quality is such that only minimal treatment by chlorination and fluoridation will be required. A microprocessor-based telemetry and remote control system will be provided for pumping and observation borehole data gathering, monitoring and direct control from the existing treatment works.

Sean Lucy, Offaly County Council and Michael Hand, P.H. McCarty Son & Partners

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The Geology and Hydrogeology of the Kiltorcan Aquifer System

In the Slieve Bloom area the Kiltorcan Aquifer System consists of the Clonaslee Flagstone and Lower Limestone Shale formations and the overlying Quaternary deposits. The flagstone formation consists of sandstones and some mudstones and ranges in thickness from 70-150m. The "shale" formation, which is 40-80m thick, is made up of mudstones with thin limestones and sandstones at the base. Much of the aquifer system is covered with unconsolidated deposits of till and sand and gravel which can be up to 40m thick. These strata crop out around the edge of a major anticline and are extensively faulted.

Fissure permeability is dominant in the rock formations with transmissivities of 1-10m^2/d for the "shale" and 50-150m^2/d for the "sandstone" formations. Confined storage is of the order of 10^{-6} and unconfined storage generally less than 2%. The sand and gravel deposits are an important source of additional storage. On the higher ground the aquifer is generally unconfined; elsewhere it is confined by the till or the mudstones of the "shale" formation.

Borehole yields in the Clonaslee wellfield range from 250-1,000m^3/d with specific capacities of 5-35m^3/d/m. Experience both here and elsewhere has shown that optimal yields are obtained where boreholes are collared into the upper part of the "shale" formation and located close to significant structural features.

This aquifer system also crops out in a number of similar settings elsewhere in the Central Plain e.g. Slieve Aughty, Slievenamon and at Moate.

Eugene Daly, Geological Survey

Mitchelstown Water Supply Scheme

Mitchelstown, Co. Cork, is currently supplied with water from impounded springs and a river abstraction. These sources together produce 0.5m.g.d. An additional 0.5m.g.d. was required for current demand and future development and an investigation into potential groundwater sources commenced in 1980.

Two aquifers were indentified that were capable of supplying the required water, one of these was in the local Carboniferous Limestone sequence, the other in the Upper Devonian Sandstone. On economic grounds it was decided to investigate the Upper Devonian Sandstone. A total of five exploration wells were drilled, located to the south of Mitchelstown. The wells were finished in 150mm or 200mm diameter at 60 metres b.g.l and yields varied from 6,000gph to 15,000gph.

Five production wells were drilled and lined with 250mm slotted and blank well liner. The production wells on testing produced a similar range of yield to the test wells. Cork County Council are currently developing the Phase 1 storage and distribution system to bring three of the wells into production. With 16 hours pumping per day the three wells will produce 0.5 million gallons per day. The Phase II development of the two remaining boreholes will produce

an additional 0.32m.g.d. Increased pumping times could, if required, bring total production up to 1.0m.g.d.

Brian Connors, Geoex Limited

Hydrogeology of a Limestone Lowland in Co. Mayo

As part of a Ph.D. thesis entitled "A study of the hydrology and geomorphology of turloughs", a hydrogeological investigation of an area containing turloughs lying to the east of Ballinrobe, Co. Mayo, has been carried out, using techniques from karst hydrology and conventional hydrogeology. Water table mapping from water levels in boreholes indicates that a water table is present to a greater extent than in many karstic areas, but it appears to be somewhat irregular and discontinuous. Troughs on the water table map correspond to zones of higher permeability associated with the turloughs, running westwards across the area. Water tracing from the turloughs, using sodium fluorescein and optical brightener, indicates flow rates of the order of 100m/hr along these lines. Other techniques, such as chemical analysis of water samples, borehole logging and pumping tests, indicate that a uniform groundwater body is absent, and solutional widening of joints and bedding planes is localised. Estimates of aquifer storage coefficients from borehole water level data vary from 1-2% to 5%, and transmissivity estimated from pump test data varies from 1-10m^2/day.

The thesis also contains a general review of current knowledge of the hydrology of the limestone lowlands west of the Shannon. It is available for consultation in Trinity College Main Library and in the Freeman (Geography Department) Library.

Catherine Coxon, Environmental Sciences Unit, T.C.D.

Development of the Devil's Bit Limestone Aquifer

The water shortages affecting the residents of Templemore should shortly be at an end following the successful completion of a trial well drilling and testing programme in the foothills of the Devil's Bit Mountains.

In an effort to secure a reliable source of fresh water for Templemore and its environs to meet existing and future demands the Urban District Council in association with Tipperary County Council (N.R.) commissioned a hydrogeological study of the Lower Carboniferous Limestones that flank the southern edge of the Devil's Bit mountain range.

The study consisted of a preliminary geological assessment of the area and resistivity surveys covering areas to the north and south of Templemore town, and to the south of Borrisoleigh village. The geophysical surveys identified four potential drilling sites in areas characterised by low regional resistivity values.

The trial wells encountered cavernous limestones with large volumes of groundwater at three of the four sites investigated; the well at the remaining site encountered a very soft black shaly limestone. Two of the trial wells recorded yields in excess of 0.25m.g.d. and one well was pumped at a rate of 0.5m.g.d.

Groundwater quality was excellent with the highest yielding well recording a hardness of 372mg/l $CaCO_3$ with iron and manganese levels within potable standards.

Kevin Cullen, Consulting Hydrogeologist

Letterkenny Water Supply Improvement Scheme

The solid geology of Co. Donegal consists mainly of igneous and metamorphic rocks which offer little prospect for groundwater development. At Letterkenny however Minerex were engaged to investigate for groundwater to supplement the existing supply from the River Swilly.

Geologically, the area consists of argillaceous metamorphic rocks which are likely to yield groundwater only in weathered or fractured zones; the only other potential aquifers are superficial deposits in the Swilly valley. Both rock types were investigated using surface geophysical techniques but surveys of the metamorphics searching for a major fault produced negative results.

Investigation of superficial deposits, using resistivity soundings and traverses indicated soft clays and estuarine silts to depths of about 14 metres in most areas, except at the mouth of a side valley just upstream from the town. There, the interpretation indicated a buried channel in the bedrock with coarser sediments deposited by the tributary stream. Exploratory drilling in

this area is proposed and is expected to reveal permeable deposits saturated with fresh water.

Stephen Peel, Minerex Limited

GROUNDWATER QUALITY AND POLLUTION

A Solution to Tuam's Problems

One of Tuam's two sources of water supply is from springs at Tobernanny. Over recent years, and following prolonged heavy summer rain, some of the springs have become severely contaminated with iron (and iron bacteria), ammonia, discoloration and an offensive smell. As it seemed likely that the source of such pollution was a sinking stream which fed the springs, water tracing experiments were carried out at three likely stream sinks until the correct site had been identified - some 1km distant. It was found that following very heavy rain a bog hollow with a very high iron content and rotting vegetation, overflowed into the sinking stream and so tainted the springs. It should be possible to prevent future pollution either by preventing the overflow of polluted water or by isolating the affected springs at Tobernanny.

David Drew, Department of Geography, T.C.D.

Groundwater Quality in South County Sligo

A preliminary investigation of the quality of groundwater in south County Sligo was carried out by the School of Science, Sligo R.T.C. during the summer of 1985 (Thorn. R.H. et al (1986), The Groundwater Resources of South County Sligo - A Preliminary Appraisal. Sligo R.T.C. Technical Report Number 86/1). The purpose of the investigation was to identify the main sources of groundwater pollution and to select specific groundwater sources for long term monitoring.

Fifty wells (both dug and bored) and springs were sampled and while the chemical quality of the water was generally good the microbiological quality

left a lot to be desired. The concentrations of nitrate-nitrogen - an ion of particular concern - were less than the E.E.C. Maximum Admissible Concentration (M.A.C) of 11.3mg/l and only one sample exceeded the E.E.C. Guide Level of 5.6mg/l. In two instances potassium levels exceeded the E.E.C. M.A.C. of 12mg/l. High levels of potassium are generally a good indication of contamination by organic wastes and this was borne out by the microbiological analyses which showed that 29% of the samples were contaminated to a degree that rendered the waters unfit for human consumption. The cause of the contamination was invariably either septic tank effluent or silage effluent.

The investigation is continuing during 1986.

Copies of the report can be obtained from the Librarian, Sligo Regional Technical College, Ballinode, Co. Sligo.

Richard Thorn, Sligo R.T.C.

ENERGY

Geothermal Energy in Ireland

Ireland is not noted for its hot springs but slightly warm springs do exist here. Work in recent years has located two dozen springs with average tempertures ranging between 13° and 22°C. They occur south of a line joining Drogheda and the Shannon Estuary. All rise from the Carboniferous Limestone and are in Counties Cork, Dublin, Kerry, Laois, Limerick, Meath and Offaly. They get their heat from deep circulation in the limestone.

Two-EEC supported investigations are beginning in 1986. In the first boreholes are being sunk at Mallow in the hope of demonstrating the practical use of these warm waters.

In the second project research boreholes are planned to gain information on the warm springs and establish the degree of permeability at depths of 600-800m. Other boreholes will seek heat flow data from the granites.

The results from these borings should provide a clearer picture of the extent of Ireland's geothermal resources.

Bob Aldwell, Geological Survey

I.A.H. NEWS

At a general meeting in May, a new committee was elected for the Irish Group of the I.A.H. (International Association of Hydrogeologists). After six years as treasurer, Kevin Cullen stepped down, to be replaced by Geoff Wright of GSI. Peter Bennet, as President, and Breda Naughton, as Secretary, were re-elected. Stephen Peel was elected to a new post as Assistant Secretary with special responsibility for the annual Portlaoise seminar.

The 6th annual seminar at the Killeshin Hotel in Portlaoise was held in April on the theme of "Hydrogeological Aspects of Waste Disposal". The attendance of about 120 was the largest yet and it was generally agreed to have been our most successful seminar to date.

At the forthcoming I.A.H. Congress at Karlovy Vary Czechoslovakia, in September 1986, Dr. David Burdon is to be made an Honorary Member of I.A.H. for his services to International Hydrogeology.

Geoff Wright, Geological Survey

I.A.H. Programme

A Lecture entitled **"Influence of superficial deposits on major U.K. aquifers"** will be given by Dr. John Lloyd. Dr. Lloyd runs the M.Sc. course in Hydrogeology at Birmingham University.

Date: 16th October 1986

Venue: Geological Survey of Ireland, Lecture Theatre at 6.00pm. Non-members welcome to attend.

Breda Naughton, Secretary, Irish Branch I.A.H.

I.A.H. Awards

Breda Naughton has informed me that the I.A.H. have decided to offer small grants to 3rd level college students doing projects related to groundwater. The purpose of this is to help and encourage students to study aspects of hydrogeology. Details were circulated to all the Departments of Geology, Geography and Environmental Science in Ireland. Only three submissions were received, all from Sligo R.T.C.

So, congratulations to Marie Doyle, Hubert Henry and Brendan Mullen from Sligo R.T.C. who have received the first awards of £50.00 each.

Donal Daly, Geological Survey

NEWS FROM ABROAD

England - Privatisation of the Water Industry

The water authorities in England and Wales are valued at £27 billion with an annual turnover of £2,600 million and a capital investment of £900 million annually. The Conservative government were planning to sell off the water authorities and use the money to finance tax cuts before the next election. This was greeted with horror by many consumers who foresaw increased charges and by environmentalists who feared that water pollution would increase.

The planned Bill would have allowed the privatised water bodies to police their own discharges and to prosecute other private companies for pollution. One environmentalist described the proposal as "like selling the police force to the Mafia" because polluting industries would be able to buy shares in the new privatised water authorities. At present the water authorities are both poachers and gamekeepers but at least they are public bodies whereas privatisation could make the situation much worse.

However the Conservatives have now abandoned their plans at least until after the next election because they did not want to risk the embarrassment of not being able to get the Bill through the House of Lords. The environmentalists may yet gain from this episode because the Government had

promised to implement new anti-pollution measures with the privatisation Bill. These include setting up a small government unit to oversee pollution control by the water authorities.

(Sources: Guardian and Observer newspapers) Donal Daly, Geological Survey

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England - Farmers Blamed for River Pollution

Rivers in Devon and Cornwall have suffered massive increases in pollution according to the South-west Water Authority (New Scientist No. 1515 3rd July 1986). The main culprit is farm effluent - especially slurry from cattle. In the North-west Water Authority area farm pollution has cut the length of rivers recorded in classes 1A and 1B (least polluted) by 200 kilometres since 1980.

Donal Daly, Geological Survey

United States - "Hard" Water may cut risk of Heart Attacks

According to a recent study, calcium and magnesium in hard water reduce the risk of heart attacks and strokes by 10%. The likelihood of dying of heart disease or stroke was 30% greater for those drinking water at 25ppm of calcium than it was for those whose waters had 75ppm.

Irish groundwaters are generally hard. So, perhaps the lessons for Ireland should be : use more groundwater and don't use water softeners. (Source: The U.S. Water News as reported in Groundwater Vol. 24, No. 6)

Donal Daly, Geological Survey

REVIEWS

Paper: Occurrence of volatile organic chemicals in Nebraska Groundwater
Authors: Owen Goodenkauf and Jon C. Atkinson
Journal: Groundwater, Vol. 24, No. 2, pp. 231-233

Volatile synthetic organic chemicals (VOCs) are a general class of chemicals with relatively low molecular weight, low specific gravity, low boiling point and low solubility, and include volatile halogenated aliphatic and aromatic compounds. They are commonly used as industrial solvents and degreasers, in numerous manufacturing processes, as household solvents and cleaning agents, and for many other uses. In 1982 a national survey carried out by the U.S. Environmental Protection Agency (EPA) found that 21% of the groundwater systems in a randomly selected set had one or more VOCs at detectable levels. Nebraska was not expected to have significant VOC contamination because of low population density and limited industrial development. However a survey has shown that 16.5% of public water supplies contained at least one VOC. Eight wells (8%) have since been removed from service. Two monitoring wells at a municipal tip site yielded water containing 8 and 9 VOCs, respectively, and 11 in aggregate.

This paper illustrates the need for a programme to monitor trace organics in Irish groundwaters.

Donal Daly, Geological Survey

NEW PUBLICATIONS

The Geological Survey recently released an Information Circular entitled **"Pumping Tests : a guide to the testing of water wells for public, industrial, and farm supplies"** by G.R. Wright. It can be obtained from the Survey's office at a price of £2.00. This publication provides practical guidelines for the carrying out of pumping tests in water wells of moderate yield, i.e. between about 1,000 and 10,000 gallons per hour.

CONTRIBUTIONS FOR NEXT ISSUE OF THE NEWSLETTER

Your contribution should reach the Geological Survey before 1st October 1986. Please keep your contribution as concise, interesting and newsworthy as possible.