Environmental Management Services

Environmental and Sustainability Assessment of the Proposal by Dublin City Council to Abstract Water from Lough Ree for the Purpose of Meeting a Projected Growth in the Demand for Water in the Greater Dublin Area

A REPORT FOR THE SHANNON ENVIRONMENTAL PROTECTION ALLIANCE (SPA)

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14 August 2007

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1. Introduction

On 31 May 2006, Dublin City Council published a draft feasibility study in which three options were considered for the purpose of providing a new source of raw water to meet the projected water demand growth in the Greater Dublin Area. These options were listed as:

1. Abstraction from the River Shannon at Lough Ree, treatment of the raw water at a plant approximately 4 km from the intake point, and pumping of the treated water to Dublin via twin pipelines 170 km in length;

2. Abstraction of water from either the River Barrow or Slaney, or from both rivers at times when flow volumes would permit the increased abstraction, and then pumping this water directly to the existing water treatment plant at Ballymore Eustace which would require expansion to accommodate the additional volumes; and,

3. Abstraction of seawater from Dublin Bay through an undersea pipeline, desalination to yield potable water, and discharge of the resulting brine (higher salinity effluent) to Dublin Bay via a long outfall.

The second of these options was ruled out because it was considered that neither the River Barrow nor the River Slaney could provide the required volume of water, and the scheme was considered to be too complex. At most, an additional 80 million litres per day could be produced. However, the capital cost of this scheme would be considerably lower (at € 143 million) than either of the other two options.

The third option, desalination, was ruled out because of its high capital cost (€ 575 million) and operating cost (€ 39 million annually). Reverse osmosis (the chosen method of desalination) requires considerable amounts of power, when

compared with conventional water treatment plants; and the amount of energy required to operate the plant was considered to be a disadvantage.

The first of the above options was therefore selected as the recommended strategy, as it was considered to be technically feasible and would provide the most cost-effective solution for delivery of 300 million litres of treated water daily to the Greater Dublin Area (GDA), and a further 50 to 100 million litres daily to local authorities along the pipeline route.. The capital cost of abstracting 300 million litres daily was estimated at € 508 million, with an annual operating cost of some € 11 million.

The draft study then examined the first option in greater detail, and a Strategic Environmental Assessment (SEA) of both the recommended strategy and the rejected desalination option was undertaken. The Feasibility Study and the SEA were prepared by Veolia Water and RPS Consultants.

The strategy recommended by the Feasibility Study was that the first option should be pursued; and it is clear from a reading of the draft Feasibility Study and supporting documentation that Dublin City Council has already decided to press ahead with the proposal to abstract the required quantity of water from the River Shannon at Lough Ree.

2. The Shannon Environmental Protection Alliance, and the Terms of Reference of this Report

Arising from the manner in which the above decision appears to have been made, and from lack of consultation with local and other users of Lough Ree, widespread concern has been expressed about the environmental and other consequences of the proposed scheme. A working group was established in October 2006 (The Lough Ree Task Force) to examine the proposed scheme; and **Environmental Management Services** was commissioned in November 2006 to produce a preliminary environmental and sustainability assessment.

Having studied the draft Feasibility Study and other documentation issued by Dublin City Council, we prepared a preliminary report in November 2006[1], which was revised and expanded in April 2007.

In April 2007, as a result of increasing public concern about the proposed abstraction scheme, members of the Lough Ree Task Force were joined by representatives of a wide variety of organisations with interests in angling, boat hire, tourism, conservation, wildlife and environmental protection; and a new organisation was formed – the **Shannon Environmental Protection Alliance (SPA).**

SPA has now commissioned Environmental Management Services to update and expand the preliminary environmental and sustainability assessment of the

[1] A *Preliminary Environmental and Sustainability Assessment of the Proposal by Dublin City Council to Abstract Water from Lough Ree for the Purpose of Meeting Projected Water Demand Growth in the Greater Dublin Area -- A Report for the Lough Ree Task Force.*

proposed abstraction scheme. We were requested to give particular attention to the feasibility study's lack of an adequate examination or consideration of other alternatives, lack of consultation, and the apparent failure to fully examine the environmental and other impacts of the proposed scheme. Our report also addresses the issue of demand management, as the feasibility study did not critically examine the assumptions on which the projected GDA demand of 300 million litres of water daily is based. Most critically, we also report on whether the abstraction scheme proposed by Dublin City Council can be considered as sustainable development.

Providing answers to all these questions is outside the scope of a brief report such as this; and therefore, where answers cannot be given, we have sought to highlight the principal issues which require further investigation.

3. Projected Demand for Water in the Greater Dublin Area

3.1 Estimation of Future Demand

The draft feasibility study relies significantly on estimates for domestic, commercial and industrial demand for water in the GDA provided in a report[2] commissioned by the Department of the Environment Heritage and Local Government (DEHLG) in conjunction with the seven Local Authorities in the Greater Dublin Area. This report is described as having established the blueprint for the development of water services in the region to the year 2016, and it was revised (in part) in 2000 to ensure compliance with the Strategic Planning Guidelines and to take account of population growth in the intervening period.

The demand estimation methodology described in section 2.5 of the draft feasibility study takes account of increasing per capita consumption (PCC) caused by greater affluence and lifestyle changes, and also considers the impacts of climate change which have recently been predicted to result in an increase in PCC. The need to facilitate possible future industry (including some "wet industry" with high water demand) wishing to locate in the GDA has also been taken into account (Appendix A, Demand / Supply Projections).

3.2 Demand Management, Potential Savings and Avoidance of Waste

On the other hand, potential savings which are likely to result from the introduction of conservation measures such as rainwater harvesting or grey-water use, and from increasing public awareness of the value of clean water, are dismissed as being "*difficult to quantify*" and have not been taken into account[3]. This is an extraordinary statement, given the potential for demand management, conservation and leakage reduction (see section 3.3 below).

[2] *The Greater Dublin Water Supply Strategic Study Report (GDWSSS) 1996 – 2016.*
[3] *Feasibility Study: Demand / Supply Projections 2005 / 2011 / 2031; Appendix A; section 1.5, page 3.*

According to a study by Ben Piper, Claire Hammond and Ruairí O'Carroll[4], the reasons for currently rising domestic water demand in Ireland include:

- increasing population, and consequent increase in the number of households;
- greater affluence leading to more extensive ownership and use of domestic appliances such as automatic washing machines, dishwashers, power-showers, etc;
- changes in demography leading to smaller households;
- lifestyle changes leading to more frequent changes of clothes during the day, and hence increased clothes washing; and,
- climate change leading to greater discretionary use of water.

Concurrently, the forces acting to significantly reduce per capita water demand include:

- more efficient household appliances which use less water;
- lifestyle changes leading to more frequent use of showers instead of baths;
- greater environmental awareness among consumers, leading to conscious attempts to reduce water use;
- increased public awareness of the value of water; and,
- extension of water metering to a wider variety of premises, which is being assisted in Ireland through having all non-domestic customers metered by 2006 as part of the National Water Services Pricing Policy, and will eventually be further extended to include all domestic users.

According to the study by Piper, Hammond and O'Carroll [4], there would appear to be no significant increase in commercial or industrial demand, while the drivers or forces acting to reduce such demand include:

- increased penetration of metering and charges for water, based on actual consumption (for example the implementation of the Polluter Pays Principle through National Water Services Pricing Policy for the non-domestic sector, which required all non-domestic customers to be metered by 2006);
- improved industrial production efficiencies;
- increasing environmental awareness; and,
- greater energy use efficiencies of which heating and cooling process water and housekeeping water can be a major part.

It is apparent that these significant forces or drivers acting to reduce domestic and industrial demand for water have been ignored in the Feasibility Study's

[4] *Water Resource Management – Sustainability Issues" – paper presented to the National Hydrology Seminar, 2002*

projections, despite the following comments from the Office of Licensing and Guidance, EPA, received by Dublin City Council's consultants on 05 April 2006:

- *"It is critical that the issue of radical water conservation measures (including metering / charging for private supply, use of rainwater for sanitary flushing and garden irrigation, grey water re-use on-site, etc.) should be emphasised in this SEA exercise, such that the scale / impact of any proposed infrastructure may be minimised or avoided;*

- *In addition, you are referred to the Waste Prevention Section of the EPA website* ***www.epa.ie*** *which provides a link to water conservation measures as implemented in the south-east of England which you should find of interest."*[5]

3.3 Recommendations by the Environment Agency in England

In England, the Environment Agency has strongly recommended that the privatised water companies must provide for water supply in south-east England to 2025 without the need for large scale transfers of water, as such transfers are considered to be more expensive and environmentally damaging than other options.

A recent report[6] published by the Environment Agency points out that, while it would be possible to build large pipelines to move water to south east England, and the technical feasibility of such a scheme is not in question, it would be worth doing only if:

- the demand for water in south east England exceeds the available supply; and,
- there are no better, cheaper options locally.

The Environment Agency view is that "*there is still considerable scope for further water efficiency in south east England, and that water companies must reduce leakage and work with people and industry to make the best use of the water that is available. Water is precious for people and the environment, and we must all take responsibility for using it responsibly … water companies must take all possible opportunities to manage demand … [and] we expect water companies to demonstrate that they have considered all of the possible options*".

The Agency further recommends that "*as water becomes more scarce, leakage targets will become more demanding and the volume lost through leaks must be reduced*", and this should be done "*through putting more effort into finding and fixing leaks, or investing more in replacement water supply mains*". The report points out that there is "*scope for increased water efficiency at very low cost*" and that "*industrial and commercial premises could save between a quarter and half*

[5] *Greater Dublin Water Supply – Major Source development: Strategic Environmental Assessment Report, page 126 of PDF version (immediately following letter dated 24 March 2006 from Mr Tadhg O'Mahony, EPA, to Mr Gerry Geoghegan, RPS Consulting Engineers.*

[6] *Do we need large-scale water transfers for south east England ? Environment Agency, September 2006.*

of the water they use by taking measures that will pay for themselves in reduced bills in less than two years". Increased metering of household water use is "*essential*", and studies have shown that "*water metering suppresses demand by between five and fifteen per cent, as people become more aware of their water use*".

Adverse impacts of large scale transfers of water mentioned in the report include disturbance to wildlife, habitats and people, the amount of land occupied by pipelines, the energy required for the construction, development and operation of large-scale water transfers, and the resulting emission of greenhouse gases. Finally, the Environment Agency's report[5] recommends that plans produced by the water companies must "*undergo full public consultation and will provide an opportunity for people to debate the future of public water supply*".

While we are not asserting that the situation in the GDA is directly comparable to that in the south east of England, it does seem to us to be anomalous that Dublin City Council has apparently ignored the recommendations of the EPA and the similar recommendations of the Environment Agency quoted above. These recommendations emphasise water saving and conservation, demand management, leakage control and public consultation -- and all of these are areas where we have identified substantial weaknesses in the Feasibility Study (see sections 3.2 above and 3.4 below).

3.4 Current Leakages and Losses from the Water Supply System

The extraordinarily high current levels of leakage from the water supply system, though having been reduced in recent years, are forecast to continue at the present levels of 65 litres per household per day (customer side losses) and an additional 161 million litres per day (distribution leakage)[7].

The Dublin Region Water Conservation Project, which commenced in July 1998 and ended in September 2000, reduced distribution leakage levels from more than 40% to approximately 30% during those few years. Yet we have found no mention in the Feasibility Study of any intention or plan to continue or to revive this useful conservation initiative, or to make any significant attempt to reduce the very high customer side losses. Instead, the study assumes that "*this level of leakage is forecast to continue*" [8]; and Table 6.2 in Appendix A predicts that customer side losses of potable water will rise from 34 million litres per day in 2005 to 53 million litres per day in 2031. The total losses of water in the Dublin system therefore amount to some 200 million litres per day, i.e. around 60 % of the quantity which Dublin City Council plans to abstract from Lough Ree for its own use within the GDA !

The absence of any estimates for water savings which could be made by an effective conservation programme is also very surprising, given the success of the water conservation project operated by the City of Dublin Energy

[7] *Feasibility Study: Demand / Supply Projections 2005 / 2011 / 2031; Appendix A, sections 6 & 7.*
[8] *Feasibility Study: Demand / Supply Projections 2005 / 2011 / 2031; section 6, page 12.*

Management Agency (CODEMA) in Dublin's Civic Offices[9]. This 12-month project reduced water demand by approximately 15% in the Civic Offices during 2003; but its methodology and the lessons learned from it have not been applied in the feasibility study. If this approach and methodology were to be extended throughout the Greater Dublin Area, the reduction of the losses described above, coupled with appropriate and effective conservation measures, could eliminate the need for a large-scale alternative water source, such as that currently proposed by Dublin City Council.

3.5 Additional Amounts of Water to be Abstracted to Supply Midland Towns, part of County Meath and the Royal Canal; and Uncertainty About the Total Abstraction

In addition to the water requirements of the GDA, the Feasibility Study also includes a proposal to supply water to Counties Westmeah and Offaly, and especially to the towns of Athlone, Mullingar and Tullamore; and to a portion of County Meath.

The study refers to an option which exists "*to supply potable water to demand locations in proximity to the treated water pipelines between L. Ree and Dublin, e.g., Athlone/Mullingar/Tullamore. Modelling of abstraction impacts from L. Ree included a 350 Ml/d option which includes provision of 50 Ml/d for local supplies*"[10]. This option is described in more detail in Appendix B, which refers to discussions previously held with Westmeath and Offaly County Councils; and these discussions have shown that both of these Local Authorities are interested in availing of treated water supplies from the proposal pipeline[11].

The design and optimisation of the pipeline, the pumping facilities and the route have therefore been selected to allow for off-takes from the pipeline amounting approximately 50 million litres per day. This additional water is described as providing for "*the foreseeable water needs (to 2045) to sustain socio-economic objectives of this (Midlands) region, including the National Spatial Plan objectives for the gateway towns (Athlone, Tullamore and Mullingar)*". In addition, the scheme has been designed to cater for the possibility that the new pipeline could also provide water supplies to the south-western area of County Meath.

It is unclear whether the proposed off-take of 50 million litres per day will supply the three towns, or whether (as more likely), 50 million litres per day will be supplied to the Athlone area, and a further 50 million litres per day will be supplied to Mullingar and Tullamore. However, it is clear from the Feasibility Study that Westmeath County Council considers "*the potential to take treated water from the proposed pipeline as a more realistic and beneficial option for their future projected needs*".

In recent years, Meath County Council has been abstracting slightly more than 5 million litres (5000 cubic metres) of water per day from Lough Bán, a small lake

[9] *Civic Offices Water Conservation Project. DublinWaterSave Website http://www.dublinwatersave.ie/civic_offices_water_conservation_project*
[10] *Feasibility Study: section 2.15, page 15.*
[11] *Feasibility Study: Appendix B, section 1.8.*

on the boundary between Counties Meath and Westmeath, and this quantity is approximately 11.5 % in excess of the amount legally permitted by the Oldcastle/Kells Water Supply Provisional Order, 1980[12]. The water is required to supply the towns of Oldcastle, Kells, Crossakeel and other smaller settlements in the south-western part of County Meath; and all of these towns are undergoing rapid growth, in accordance with the Strategic Planning Guidelines for the Greater Dublin Area.

Lough Bán is a Special Area of Conservation; and the excessive abstraction has reduced the level of water in the lake, to below the level permitted under the Oldcastle/Kells Water Supply Provisional Order, 1980, with resulting detrimental effects on the lake's trout fishery, surrounding agriculture and nearby household wells. As a consequence, Meath County Council is under pressure to find an additional source of water in order to reduce the amounts being taken from Lough Bán.

It is therefore understandable, but a matter of serious concern to the SPA, that Lough Ree should become a source of water supply for County Meath, especially as the County has adequate groundwater sources which are not exploited (see section 5.1 below).

The Feasibility Study also examined the option of supplying water to the Royal Canal, which currently receives its water supply requirements from Lough Owel near Mullingar, through a channel from the lake, which connects into the summit of the canal near Mullingar. The normal supply requirement of the canal is 20 million litres per day; but Waterways Ireland, which has the responsibility for the canal, predict that this 20 million litres per day requirement will rise to 50 million litres per day as the canal becomes more intensively used for amenity and leisure navigation.

Both Waterways Ireland and Westmeath County Council abstract water from Lough Owel – the latter authority relying on the lake as a source for potable water. However, the lake is relatively small and cannot supply the estimated future demands of both Waterways Ireland and Westmeath County Council without compromising environmental and amenity benefits. Consequently, Waterways Ireland and Westmeath County Council have been discussing with Dublin City Council the option of supplying the canal's water requirement from the Lough Ree to Dublin pipeline; and, even though the details of the off-take point and pipeline have not been agreed, the two authorities "*recognize the merit in the proposal*".[13]

3.6 Implications of the Demand Model's Assumptions, and the Plans for Additional Abstraction Outlined in the Feasibility Study

It is our observation that the combined effects of the model's assumptions listed above, and the failure to take account of or to plan for leakage reduction and water conservation measures, *are to exaggerate the extent of future water*

[12] *Report on the Impact of Reduced Lake Water Levels in Lough Bán, Counties Meath and Westmeath. Environmental Management Services, 2004.*
[13] *Feasibility Study: Appendix B, section 1.9, page 65.*

demand. It is also our belief that the draft feasibility study makes provision for what could be considered an excessive and unnecessary safety margin when assessing the water needs of the GDA, thereby further increasing the volume of the projected water demand.

It also becomes clear from the Feasibility Study that Dublin City Council and their consultants view the proposed abstraction from Lough Ree, and the pipeline from Lough Ree to Dublin, as a means of supplying other local authorities along the pipeline route, with resulting financial benefit to the lead agency (DCC). We can estimate that the total quantity of water to be taken from Lough Ree and the River Shannon could be as high as in the following table:

Customer / user	**Daily amount to be supplied**
Dublin City Council	300 million litres
Athlone (an application for this water supply has already been made to An Bord Pleanála)	50 million litres
Mullingar and Tullamore	50 million litres
Meath County Council	5 to 10 million litres (our estim.)
Royal Canal	50 million litres
Total abstraction from Lough Ree	**455 to 460 million litres / day**

4. Non-Compliance with the Principle of Sustainable Development – Unsustainability of the Proposed Abstraction

Adherence to the principle of "Sustainable Development" requires that demand should be managed sustainably, so that human societies can live within the natural flows of materials and energy, and within the carrying capacity of the environment. Applying the principle to only one side of the equation, i.e., to aim for sustainability of supply, and to fail to manage demand sustainably, is not an adequate or correct approach.

It is our view that the European Union's long-standing commitment to meet the challenges of sustainable development[14], a policy which has been endorsed and supported by our Government, must be considered as an over-arching policy, and that sustainable development cannot be seen as a separate, independent issue. Sustainable Development is generally described as *"development which meets the needs of the present without compromising the ability of future generations to meet their own needs",* but there are other (and perhaps more appropriate) definitions which should find a place in our consideration of water and other natural resources:

[14] *Review of the EU Sustainable Development Strategy (EU SDS). Council of the European Union, Brussels, 9 June 2006; document 10117/06.*

"**Improving the quality of human life while living within the carrying capacity of the Earth's supporting eco-systems**"[15].

and

"Sustainable Development is about raising our quality of life by establishing symbiotic relations within and between our diverse human cultures and between those cultures and the biosphere"[16]

A key objective of the EU Sustainable Development Strategy is "*avoiding waste and enhancing efficient use of natural resources by applying the concept of life-cycle thinking and promoting re-use and recycling*". It is our view that the implementation of the strategy and the above objective requires:

- A long-term and sustainable economic development policy, supported by a healthy and diverse environment;
- Valuing our natural resources and using them efficiently, at a rate not exceeding their natural renewal;
- Preserving the quality of landscape, cultural heritage, material assets and natural resources;
- Involving local communities in decision-making on environmental issues, especially those related to sustainability;
- Protecting flora, fauna, and bio-diversity; and restoring damaged habitats where necessary;
- Sustainable development should form the cornerstone for all planning decisions, especially those involving long-term infrastructural projects.

As we have detailed in section 3 above, the proposal by Dublin City Council to abstract large quantities of water from the Shannon catchment and to convey this water by pipeline to Dublin, cannot be considered as the most efficient use of our water resources. The scheme will also result in a significant number of adverse impacts on the River Shannon and on Lough Ree in particular, and we will describe these in sections 6 and 7 below.

However, we must first enquire whether the proposed source is capable of sustaining the proposed abstraction rate, especially during periods when there may be low flows in the River Shannon.

Appendix C of the Feasibility Study[17] states that an analysis of the records of average annual flows at Athlone weir from 1932 to 2004 was carried out in order to determine the worst case scenario in terms of available water resource; and from this analysis the year 1995 was selected as the driest. The modelling study reported in Appendix C concluded that an abstraction of 350 million litres per day

[15] *From "Caring for the Earth: a Strategy for Sustainable Living", IUCN/UNEP/WWF (1991).*
[16] *Shiela Convery, DIT, 2004.*
[17] *Dublin City Council: Greater Dublin Water Supply – Major Source Development. Appendix C – ESBI / NUI Maynooth Report on Impacts of Climate Change on Proposed Abstractions from Lough Ree.*

from Lough Ree was technically feasible under present conditions and under the expected scenarios for climate change.

On the other hand, Appendix B of the Feasibility Study points out that the proposed abstraction would result in the minimum flow period being extended in drought years by up to 20 days. A modelling study undertaken by ESBI (a subsidiary of the Electricity Supply Board (ESB) which operates the hydro-electric generating station at Ardnacrusha, downstream of the proposed abstraction point) predicted that a total of 73 days at minimum discharge over the weir at Athlone would be required if the proposed abstraction was implemented in order to maintain lake levels above 39.19m OD which is required for navigational purposes, whilst optimizing the storage potential of Lough Ree for flood management[18].

Therefore, if the lake level is not to be affected by the proposed abstraction, the effects that the abstraction will have downstream of the weir at Athlone must be considered. However, as pointed out in Appendix B, "*due to a paucity of low flow data at Athlone and downstream it is difficult to determine the potential impact that the proposed water abstraction may have on ecology and navigation and how far downstream the effects could reach. The scarcity of flow data is due to the difficulties in establishing a stage-discharge relationship in such a heavily controlled system where levels and flows have a poor correlation*".

We would suggest that calculating the low flow discharge over the weir at Athlone is more complex than that outlined in Appendix C, and reflects the difficulty mentioned in Appendix B. The major influence on low flows at Athlone is the necessity to maintain a summer level of 37.49 metres upstream of Athlone lock and 35.36 metres downstream of Athlone for navigational and ESB requirements. Because these levels do not depend solely the amount of water flowing in the river, but are determined by the operation of sluice gates under certain conditions, the upstream level must be considered as an '*artificial*' level.

When the level in Lough Ree is maintained at the summer level, all sluices are closed, the weir is *'dry'*; and during a drought period, there is technically no *flow.* Flow will occur only when the lock gates are opened and water is released. This is a typical scenario during a drought period such as that which occurred in 1995, during which the only flow observed at the Athlone gauging station was that flowing through the lock when the gates were opened to boat traffic. In other words, the river Shannon upstream of the weir at Athlone should be considered hydrographically as a 'storage' or impoundment under such dry weather conditions.

Because of this constraint, a rating curve cannot be derived for low flows, as any flow measurements taken will reflect only what is happening on the actual day of the measurement. Therefore, there is no scientific or engineering information available at present to accurately access the feasibility of the proposed abstraction of 350 million litres per day from Lough Ree.

[18] *Dublin City Council: Greater Dublin Water Supply – Major Source Development. Feasibility Study, Appendix B, section 1.6, pages 55 and 56.*

We may therefore ask how the level in Lough Ree was maintained when water was released through the lock gates at Athlone during this drought period. The most likely possibility is that the river Inny, which is a major feeder to Lough Ree, supplements the level in the lake in order that the summer level could be maintained. It is therefore necessary to ask whether the daily mean flow in the River Inny would be able to maintain the summer level required in Lough Ree, together with the need to supply 350 million litres per day to the Greater Dublin Area, during a future drought similar to that which was recorded in 1995.

In 1995, a daily mean flow in the River Inny of $2m^3$ / sec or less was recorded consecutively for 44 days, and a daily mean flow of only $4m^3$ / sec was recorded consecutively for 123 days, according to the records for the gauging station at Ballymahon[19]. It must therefore be asked if those low flows at Ballymahon would be capable of supplying the proposed abstraction for the GDA along with maintaining the navigational requirements of Waterways Ireland and other stakeholders in the Shannon system ?

It is our assessment that the information available at present on low flows at the Athlone gauging station is not adequate to enable a definitive answer to be given to the above question, and that further investigation is necessary. Our recommendation would be that continuous flow monitoring measuring stations should be installed downstream of Athlone and Banagher for a sufficient time period (at least 5 years), in order to provide meaningful data on low flows in the River Shannon. Until that information becomes available, the proposed abstraction scheme is premature. Furthermore, the records available to date suggest that the abstraction rate proposed is unsustainable, i.e., it cannot be sustained under low flow conditions without causing adverse impacts on other users of the River Shannon.

5. Failure to Consider Alternatives and Issues Related to Lake Water Quality

As mentioned in the introduction above, the Feasibility Study considered only three alternatives, two of which were quickly dismissed as unsuitable, and were ruled out. While we agree that desalination by reverse osmosis is not a suitable option because of its high energy demand, it appears to us that the way in which this option has been presented is very weak and lacking in detail, thereby suggesting that it was included in the study so that it could be ruled out, leaving the abstraction from Lough Ree as the recommended solution.

5.1 Potential of a Major Productive Gravel and Fissured Bedrock Aquifer in the Greater Dublin Area

One alternative which we would strongly suggest should be examined is the possibility of using a large groundwater resource comprising a productive gravel and fissured bedrock aquifer which extends from Fingal County, North County Dublin, and south-westwards into Counties Meath and Kildare. There are very

[19] *OPW hydrometric data for Ballymahon gauging station, no 26021, for year 1995.*

few areas of productive fissured bedrock aquifer in Ireland, the only other principal area being in the south-east across Counties Wexford and Waterford.

A significant part of the aquifer is contained in dolomitised limestone, which is high in calcium and magnesium, and it is our understanding that the water quality is extremely good. Overlying this bedrock is a complex network of saturated gravel bands and buried channels, which constitute a major source of water, though its potential has yet to be fully determined.

A group of residents in Fingal County, who are objecting to a proposed large-scale landfill in the townlands of Nevitt and Tooman, has recorded and mapped the principal boreholes which extract water from this complex aquifer in the Fingal area. Their research, supported by the advice of a consultant hydrogeologist, showed that there are several hundred boreholes in current use, a number of which supply very large quantities of water for the horticulture industry. Large-scale vegetable growers and processors depend on these boreholes, some of which are supplying more than one million litres of water per day.

The residents group has obtained data from one of the principal well drilling contractors, showing that the total amount of groundwater being currently abstracted is approximately 197 million litres per day. This is not the maximum theoretical production from the aquifer beneath Fingal County, and a more detailed borehole and well survey would be needed to determine this maximum.

The number of fault lines crossing the aquifer, the depth of the overlying saturated gravel, and other factors, are strong indications that this aquifer could supply the future needs of the Greater Dublin Area, provided that conservation measures and demand management (as discussed in section 3 above) were put in place. However, the potential of this aquifer would need to be properly evaluated, and its recharge rate accurately determined. This would require a significant but not an insurmountable amount of work, as a sufficient number of exploratory boreholes would have to be drilled and tested. Its existence emphasises the need for a much more thorough evaluation of the alternatives before any recommendation is made to abstract water from Lough Ree.

The recent problems of water quality in Ireland should also serve to remind us that groundwater generally requires less treatment than surface water for potable (drinking water) use, and may be cheaper to produce. As stated by Michael Price in his book "*Introducing Groundwater*" (page 206):

> *"In the areas underlain by an aquifer … wells could be located in or near the areas they serve, avoiding the need for costly pipelines. If demand increases, additional wells can be sunk so that the water supply system can keep pace with the demand. This convenience makes groundwater cheap to develop. The capital costs of boreholes and pumping stations are usually much lower than those of a reservoir or a river intake with the same output. Furthermore, because groundwater needs little treatment other than routine disinfection, the running costs of a groundwater source are usually much less than*

> *those of equivalent of surface-water sources, which usually need complex water treatment processes to filter and clarify the water.'*[20]

We would add that there would be very much less requirement for wayleave or land purchases needed to exploit this local aquifer (in contrast to the extensive wayleave and land required for the pipelines from Lough Ree to Dublin).

5.2 Problems Related to Water Quality in Lough Ree and Other Irish Lakes

A further issue of some importance is that water quality in many Irish lakes (including Lough Ree) has become significantly more enriched by nitrogen and phosphorus run-off, leading to increased incidences of phytoplankton blooms; and these would cause very significant problems for the production of drinking water from such sources. As pointed out in the Strategic Environmental Assessment of the proposed abstraction from Lough Ree, there would be an increased risk of algal blooms in the vicinity of the freshwater abstraction point (see section 7.1.3 below).

When a major proliferation or bloom of blue-green microscopic algae occurs in these enriched or eutrophic surface waters, cyanotoxins can be generated; and there is evidence that many of these toxins are dangerous to human health. Their presence in treated drinking water is influenced not only by the level of cyanobacterial proliferation in raw water but also by the adequacy of the treatment system used. If treatment is inadequate, cyanotoxins can be present at concentrations high enough to influence the aesthetic quality of the water, and may even to cause a risk to health. Some countries (France, Spain) have already included the cyanotoxin, microcystin LR, in their regulations, but there are other as yet unidentified toxins which cannot be regulated at this time.

Microcystins cause cancer of the liver and are not covered by the Irish Drinking Water Regulations. The standard chlorination by most Irish treatment plants does not eradicate the toxin and may even worsen the degree of contamination. Very high doses of this type of toxin may cause death; and a recent study carried out in China has shown that people who have been drinking water contaminated with microcystins have a level of liver cancer seven times higher than the norm.

A recent research report published by authors from Cork Institute of Technology (CIT) has indicated that water tested in Irish lakes was found to have 20 times the World Health Organisation limit for microcystins. The research was funded by the Environmental Protection Agency and was published in June 2007 in the journal *Analytical Chemistry*[21]. The work described an ultra-sensitive method for

[20] *Introducing Groundwater, by Michael Price. Published by Taylor and Francis, ISBN 0-7487-4371-5.*

[21] *Orla Allis, Justine Dauphard, Brett Hamilton, Áine Ní Shúilleabháin, Mary Lehane, Kevin James and Ambrose Furey. Liquid Chromatography --Tandem Mass Spectrometry Application, for the Determination of Extracellular Hepatotoxins in Irish Lake and Drinking Waters. Anal Chem., 03 April 2007. Reported in The Sunday Times, 24 June 2007.*

rapid detection of the toxins, which form in blue-green cyanobacterial algal blooms in Irish lakes in summer.

5.3 Problems Related to the Need for Disinfection in Relation to the Length of the Proposed Water-Main from Lough Ree to Dublin

The Feasibility Study describes very briefly the proposed infrastructure as including a treatment plant involving traditional water treatment processes – coagulation, flocculation, settlement, filtration and disinfection – after which the treated water would be pumped 170 km to a reservoir near Dublin[22]. Public water supplies in Ireland are normally disinfected using chlorine, and occasionally ozone. This is a standard and necessary practice, but it can cause problems, especially when long pipelines are involved.

Trihalomethanes are the major disinfection by-products (DBPs) in drinking water after chemical disinfection. After disinfection using chlorine dioxide, the by-product *chlorite* is invariably present in treated water. As chlorite is harmful to human health, many countries have already included thresholds for chlorite in their drinking water regulations: e.g., Czech Republic, France, Switzerland, Germany, Italy, and Britain.

When chlorine is used in combination with ammonia to disinfect water (a process referred to as chloramination), the chlorine combines with very small quantities of ammonia at the treatment works to form chloramines. It is widely practiced in some countries, for the reason that the disinfection or treatment process lasts longer within the pipe distribution system than when chlorine is used on its own -- so there is no need to add additional chlorine along the network of pipes. Unlike chlorine, chloramines have the benefit of having no significant taste or odour.

However, when chlorine is used with ammonia for disinfection, trihalomethanes (THM) and haloacetic acid (HAA) by-products are produced at relatively low levels. Toxic halonitriles (e.g. cyanogen chloride), halonitromethanes (e.g. chloropicrin), N-nitrosodimethylamine (NDMA), and possibly other nitroso compounds can also be produced in the treated water. As some of these substances are harmful to human health, they should be regularly monitored, if chloramination is used for water treatment.

It is a matter of some concern that this potential problem does not appear to have been addressed in the Feasibility Study, or foreseen as a disadvantage in the recommended option of abstracting water from Lough Ree.

5.4 Cryptosporidium

In late March 2007 it became known that tap water in Galway City and surrounding suburbs had become contaminated with *Cryptosporidium*, and all Galway residents and visitors to Galway City were advised to use bottled or boiled water for drinking, washing uncooked foods (e.g., salads) and brushing teeth. In August 2007, *Cryptosporidium* was detected in the water supply in the

[22] *Dublin City Council: Greater Dublin Water Supply – Major Source Development. Feasibility Study, section 4.2, page 20.*

town of Clonmel. It is expected that it will take several months eliminate this micro-organism from these public water supplies, and from other supplies which may be affected.

Cryptosporidiosis is typically an acute short-term infection but can become severe and non-resolving in children and immuno-compromised individuals such as people with AIDS. There is no drug available at present to cure the infection.

The *Cryptosporidium* micro-organism is an internal parasite found in humans, many animals, birds and fish; it multiplies in the gastrointestinal tract of the host, and tiny oocysts are excreted in very large numbers in the host's faeces. The parasite does not utilize an insect vector (e.g., unlike the malarial parasite which requires a mosquito), and is capable of completing its life cycle within a single host, resulting in cyst stages which are excreted in the faeces and are capable of transmission to a new host.

The parasite is transmitted by environmentally hardy or resistant cysts (oocysts), protected by an outer shell that allows these cysts to survive outside the host's body for long periods of time, and makes them very resistant to chlorine-based disinfectants. When these cysts are ingested, the parasite emerges in the small intestine and causes an infection of the intestinal epithelial tissue. In the case of the Galway outbreak, it does not yet appear to be known whether the micro-organisms present in the water (as cysts) came from human or animal hosts.

The relevance of the Galway outbreak to the proposed abstraction scheme lies in the fact that Galway city draws its water from the Lough Corrib, and it appears the lake had become contaminated with *Cryptosporidium* and the water treatment plant at Terryland was not capable of removing this micro-organism from the water. While accepting that the proposed water treatment plant which would form part of the proposed Lough Ree abstraction scheme would be a much more modern plant, we are concerned that there may be a residual risk of a much more widespread outbreak of cryptosporidiosis in the GDA if the plant were to suffer a malfunction. A safe groundwater source, provided that it could be kept free of contamination, would be much less likely to give rise to such a risk.

5.5 Risks Associated with Dependency on a Large-scale Single Source

It may be considered surprising also that the Feasibility Study did not address the risk of the GDA becoming dependant on a single large-scale source for the capital city's drinking water. As mentioned above, any significant contamination of Lough Ree, such as an outbreak or mass bloom of blue-green algae, or the presence of cryptosporidium in the lake, could require the entire system to be shut down.

On the other hand, if a geographically extensive aquifer were to become the principal source of the capital's water supply, it would be unlikely that all wells in the well field would become contaminated. A scale and design which allowed for a percentage of the wells to be shut down at any time should provide a sufficient safeguard. Considered together with conservation measures, demand

management, leakage reduction, and the continued use of the existing supply sources, a major groundwater source is likely to be the least risky option.

6. The Implications of the EU Water Framework Directive and the Need for Sustainable Water Management and for the Protection of Fragile or Vulnerable Ecosystems

Even though the Water Framework Directive (WFD)[23] receives a relatively brief mention in the draft Feasibility Study, its implications and requirements do not appear to have been taken into account.

6.1 Objectives and Implementation of the Water Framework Directive

The principal intention of the EU Water Framework Directive (WFD) is to ensure that the aquatic environment and water resources are managed in a sustainable way, and this requires detailed attention to issues which have not previously been seriously considered in the planning and management of water supplies in Ireland. Such issues include the identification and regulation of raw water abstractions (both surface and ground water) and assessment of the impact of these abstractions on the *"ecological status*" of the entire aquatic environment with a view to developing comprehensive and sustainable management plans and strategies. A key feature of the WFD is that it encourages optimal management of activities in the catchment to achieve appropriate ecological and water quality standards.

Long term sustainable management of water supplies must include adherence to the "*Precautionary Principle*" (as advised by the European Environment Agency) which states that environmental impacts must be adequately predicted, the causes rather than the effects of potential damage must be addressed, and options must be preserved to allow future decisions to be made under a different set of technologies, objectives and priorities.

Sustainable management of water also requires increased public involvement, and an effective integration of economic, ecological and social goals. On the environmental side, the physical, chemical, and ecological characteristics of the area likely to be affected must be considered simultaneously and comprehensively in the geographical context of catchments, wetlands, habitats and species. To date, there has been no public involvement is what appears to be a final decision to press ahead with the proposed abstraction; and, as we note in the following paragraphs, there has not been a full and complete consideration of the environmental effects of the proposed scheme on the Shannon catchment as a whole.

The Water Framework Directive (2000/60/EEC) is the most significant piece of legislation in the field of water policy to date. The Directive entered into force on 22 December 2000, and was transposed into Irish Law in December 2003 by the

[23] *Water Framework Directive (2000/60/EC), transposed into Irish legislation by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003*

European Communities (Water Policy) Regulations 2003 (S.I. No 722 of 2003), amended in 2005 (S.I. 415 of 2005). The WFD is being implemented by River Basin Management Projects (RBMPs) led by Local Authorities.

6.2 The Shannon River Basin District, and Probable Failure to Meet the Objectives of the WFD because of Over-abstraction

As required by the Water Framework Directive, Ireland is divided into a number of River Basin Districts, of which the **Shannon River Basin District** is the largest at more than 18,000 km^2 in area. It covers the natural drainage basin of the Shannon river itself, stretching from the source of the River Shannon in the Cuilcagh mountains in Counties Cavan and Fermanagh to the tip of the Dingle peninsula in north Kerry. .

The River Shannon flows through 18 local authority areas and is also a national or All-Ireland RBD (as opposed to a regional river basin), since a portion of County Fermanagh in the North of Ireland drains underground to the Shannon Pot. Large areas of counties Limerick, Clare, North Tipperary, Offaly, Westmeath, Longford and Roscommon as well as significant portions of counties Kerry, Galway, Leitrim and Cavan are in the District. Other counties that have smaller portions in the District include Sligo, South Tipperary, Mayo, Cork, Laois and Meath, while all of Limerick City is located within the District.

When the Shannon River Basin District board was asked for comments on the proposed abstraction, the reply noted "*that 40 Ml/d of water is currently proposed for abstraction from Lough Ree, and an additional 350 Ml/d would put Lough Ree into the **probably at risk** category of failing meet the objectives of the WFD due to over-abstraction*"[24]. While the Board did not state that the proposed water abstraction scheme would be contrary to the Water Framework Directive, we believe that the unsustainability of the proposal, together with its negative environmental impacts, makes such conflict very likely.

The River Shannon drains a total area of more than 10,400 km^2 from its source to Ardnacrusha, and the hydraulic characteristics of the catchment are complex, with a series of natural and man-made controls. The Shannon catchment, from which Dublin City Council is proposing to take large quantities of water, also contains a significant number of vulnerable and important Natural Heritage Areas (NHAs), Special Areas of Conservation (SACs), and Special Protection Areas (SPAs) for wildlife.

6.3 Unique Ecology of Lough Ree and the Shannon Callows

Lough Ree itself is designated a Special Area of Conservation (SAC), and is important at both European and National levels. Winter flooding and the specialised habitat for over-wintering wildfowl provided by the River Shannon Callows, located directly downstream of Lough Ree, are particularly important. The Shannon Callows is designated an SAC (site code 000216) and an SPA (Site code 004096), it has by far the largest area of lowland semi-natural

[24] *Dublin City Council: Greater Dublin Water Supply – Major Source Development. Feasibility Study, Appendix B, section 1.5, Table 1.20, page 52.*

grassland and associated aquatic habitats in Ireland, and is additionally important for having the least disturbed natural wetland processes.

The Feasibility Study points out that the Shannon Callows have a unique ecology, providing an important habitat for over-wintering wildfowl, and "*the callow meadows are also important during the low flow periods (summer) as the meadows that are flooded in the winter are traditionally cut later than the surrounding drier land. The regular flooding of the callows means that the land is too soft to support heavy machinery until later in the summer. As a result, the trend towards intensive silage production seen over most of the country has not been pronounced here. If the proposed abstraction was to lower the water levels in the main channel (by abstraction or attenuation) downstream of Athlone earlier than usual, there may be an attempt to cut these meadows earlier, thus affecting the breeding of certain species such as the corncrake*".[25]

The main river channel is also recognised in the Feasibility Study as a significant coarse fishery. Cyprinids spawn in early summer by laying eggs on reeds; and the predicted changes in water levels in summer may expose the fish eggs on these reeds, allowing them to dry out, with the result that they would fail to hatch.

6.4 Failure to Comprehensively Assess the Impacts of the Proposed Abstraction

It is relevant to emphasise that, where a Special Protection Area or Special Area of Conservation, designated under European legislation, may be affected by a proposed abstraction, an appropriate assessment must be undertaken in order to comply with the EU Habitats Directive. In any case, a sustainable management approach would identify whether there is enough water available, identify the rate of flow, water levels and water quality requirements of downstream ecosystems, assess the impacts of the abstraction, and would identify mitigation measures to prevent damage or degradation. A sustainable management approach would need to go beyond the current legal requirements. For example, those who use the affected area should be engaged in this process and properly consulted at a sufficiently early stage so that their concerns can be addressed before or during the environmental impact assessment stage.

The Strategic Environmental Assessment (SEA), which accompanies the draft feasibility study, states that it was undertaken in compliance with the EU Directive on SEA (2001/42/EC), which was transposed into Irish domestic legislation in 2004 by the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations (S.I. No. 435 of 2004 and S.I. No. 436 of 2004). The SEA mentions the environmental issues listed above, but fails to analyse the multiple impacts of the proposed abstraction.

Significant gaps in the data identified in the SEA report include a lack of information on the impacts of the proposed water abstraction on the activity of otters (listed as a 'Threatened Species' in the Red Data Book, and protected under the Wildlife Act 1976 and Wildlife Amendment Act 2000), and on breeding

[25] *Dublin City Council: Greater Dublin Water Supply – Major Source Development. Feasibility Study, Appendix B, section 1.6, page 57.*

waterfowl listed in Annex I of the EU Birds Directive. Other areas where data is lacking include potential impacts on the wetted perimeter downstream of Lough Ree, and impacts on biodiversity of the predicted increase in the duration of the minimum downstream flows of approximately 12m^3 per second.

It is intended that these gaps in the data would be filled by detailed surveys to be undertaken during the EIA process, including measurement of downstream flows and surveys of the wetted perimeter, to establish the extent of potential impacts. Surveys of protected flora, fauna and habitats will also be carried out at the EIA stage to establish the extent of their occurrence in relation to the proposed infrastructure (SEA report, section 9.1). Yet some suggested mitigation measures are proposed in Table 10.1, even though the report states that specific information about impacts and mitigation will become clear only during the EIA stage when a preliminary design has been developed (SEA report, section 11).

It is our observation that the SEA report lacks both focus and defined measures, and it should be much more specific in describing the likely effects of the proposed abstraction on the ecological status and on vulnerable habitats and species; and that, if further data or information were required, this should be obtained during the SEA study itself. To say that "*specific information about impacts … will only become clear during the EIA when a preliminary design is developed*" is not a suitable or justifiable approach, because when the preliminary design is being developed, alternative options will have already been rejected, and a commitment will have been made to implement the recommended project.

The SEA also suffers from inadequate scoping and consultation (only statutory organisations and Government Departments were advised about the proposed abstraction from Lough Ree); and the failure of the draft feasibility study to seriously consider water conservation and demand control measures is also reflected in the SEA.

We would suggest that it is essential that the SEA report should examine the positive impacts of water conservation measures (e.g., those listed in section 3.3 above, such as use of rainwater for sanitary use, toilet flushing, garden irrigation and car washing; use of grey water, and metering and charging) as ways to reduce the scale and the impact of the proposed abstraction. We would further suggest that radical conservation measures and leakage prevention might even avoid the necessity for the recommended option of a large-scale abstraction from Lough Ree.

7. Other Potential Adverse Impacts on Lough Ree and on the Shannon Catchment

In addition to the potential adverse impacts of the proposed abstraction on wildlife, Natural Heritage Areas (NHAs), Special Areas of Conservation (SACs), and Special Protection Areas (SPAs), the scheme would potentially affect other uses of Lough Ree and the River Shannon. Significant impacts are listed in

detail in section 7 of the Strategic Environmental Assessment (SEA) report[26], and we are concerned that many of these potentially serious adverse impacts are listed as having "no impact", or that they would be avoided by appropriate mitigation measures.

7.1 Impacts on Biodiversity, Flora and Fauna

7.1.1 Impacts Resulting from Changes in Lake Levels

The SEA report states that there will be no impact from changes in lake levels, as the ESBI modeling study has predicted that the proposed maximum abstraction of 350 million litres per day can be implemented while maintaining lake levels within the normal operation range and in full compliance with agreed ESB/Waterways Ireland operating guidelines. Because the lake levels will not change, the SEA report also notes that there will be no expected impacts on the hydromorphology of the lake (e.g., substrate, flow, depth, temperature), or no negative impacts on fish spawning areas. However, the report recommends that a bathymetric survey should be undertaken to determine the relationship between the lake's volumetric capacity and its water level.

The SEA report further concludes that, since there will be no changes in lake levels, there will be no negative impacts on the lowland wet grassland around the lakeshore including Callow grasslands (these grasslands of conservation importance provide a feeding ground for winter waterfowl and breeding waders).

Based on the data and analyses in section 4 above, we would disagree with this conclusion in the SEA, and would suggest that changes in the lake water level would be very likely to occur, with consequent damage to shoreline flora and fauna, and to wildlife and fisheries.

7.1.2 Impacts Resulting from Changes in Downstream Flows

The SEA report predicts an increase in the duration of minimum downstream flows during the driest conditions on record; with consequential impacts on biodiversity and the Shannon's riverine habitats. The lowest water levels generally occur in late summer, usually August and September; and any changes in water levels due to a reduction in the downstream flow during summer months may expose the eggs of cyprinid fish (eggs are laid on reeds), with a consequential impact on downstream coarse fisheries. These low flows may also impact migratory fish accessing spawning grounds.

There will be a negative impact on the hydrological characteristics of the river as a result of greater fluctuation in flows than are currently experienced. Low flows and increased fluctuation in flows may result in changes in the aquatic habitats on which fish stocks depend (e.g. water depth, velocity, substrate, and cover), and may also result in an alteration of the riverine and riparian habitats, which may in turn affect the biodiversity of these habitats.

[26] *Dublin City Council: Greater Dublin Water Supply – Major Source Development. Strategic Environmental Assessment Report, 31 May 2006.*

7.1.3 Impacts at the Point where Water is Abstracted from the Lake

The SEA report lists the following negative impacts of the abstraction point on the lakeshore:

- permanent loss of habitat at the abstraction point location;
- negative impact on fish spawning grounds;
- negative impact of the abstraction intake point on lakeshore feeding grounds of the wintering waterfowl and nesting habitat of duck species;
- negative impact of the abstraction intake point on protected flora;
- negative impact of the abstraction intake point on protected fauna;
- negative impact on juvenile fish;
- the proposed abstraction may lead to the spread of Zebra Mussels which are present in considerable numbers in the lake and which have the potential to negatively impact the intake point and spread to water bodies remote from Lough Ree during construction;
- negative impacts resulting from construction of the intake point on the lake margin (e.g., increased amounts of suspended sediment in the lake as a result of runoff of soil from the on-shore construction site, or from disturbance of fine sediments during off-shore construction and excavation in the lake); and,
- increased risk of algal blooms in the vicinity of the freshwater abstraction point.

A number of mitigation measures are proposed; but it appears that the detailed mitigation proposals will be identified only after discussion with the Regional and Central Fisheries Boards. No construction work would be carried out between the end of October and the end of April.

7.1.4 Impacts of the Pipeline and Associated Infrastructure

The SEA report lists the following negative impacts of the proposed pipeline and associated infrastructure:

- negative impacts on locally, regionally and nationally significant flora and fauna and their associated habitats;
- negative impact of construction design on water-crossings and fish passages;
- negative impact of the construction and development of the associated infrastructure (water treatment plant & storage reservoir) on locally, regionally and nationally significant flora and fauna;
- negative impact of discharge of wastewater from the water treatment plant;
- negative impact of disposal/reuse of sludge on the receiving environment (option could include landspreading or landfilling of sludge); and,

- negative impact due to catchment transfer and subsequent transfer of invasive species (e.g. zebra mussels).

A number of mitigation measures are proposed, including the avoidance of sites of ecological importance; but again it seems that detailed mitigation proposals will be identified only after discussion with the Regional and Central Fisheries Boards.

7.2 Impacts on Water Quality

7.2.1 Impacts Resulting from Changes in Lake Levels and from Changes in Downstream Flows

The SEA report lists the following negative impacts resulting from the predicted changes in lake levels:

- cumulative impact associated with existing/proposed abstractions from Lough Ree; and,
- cumulative impacts associated with other existing and proposed abstractions.
- negative impact on hydrological characteristic downstream of Athlone;
- greater fluctuation in flows than currently experienced; and,
- negative impact on the assimilative capacity of river leading to the reduction in rivers ability to receive discharges may occur due to reduction in flow during dry periods.

The “mitigation measures” proposed include a bathymetric survey of Lough Ree, the development of a hydraulic and hydrological model of the Upper Shannon River basin, and the installation of a permanent monitoring stations to measure water flow downstream of Athlone. It should be obvious that these proposals, though very desirable, are not “mitigation measures”, but are intended to supplement the present inadequate information about flows in the River Shannon, especially during dry periods.

7.2.2 Impacts Resulting from the Intake Point, Pipeline and Associated Infrastructure

The SEA report lists the following negative impacts on water quality resulting from the construction of the intake point, pipeline and associated infrastructure:

- negative impact on groundwater and surface water during construction and operation;
- negative impact on water quality status due to the construction of the intake point;
- negative impact on water-crossings (the pipeline will traverse watercourses and drainage channels, which may subsequently impact upon the water quality status of these surface waters);

- negative impact of the disposal/reuse of sludge on receiving environment (e.g. leaching, runoff etc); and,
- discharge of wastewater from the water treatment plant may negatively impact the receiving watercourses.

7.3 Impacts on Air Quality and Climate

The SEA report lists only a small number of negative impacts on air quality and climate resulting from the construction of the intake point, pipeline and associated infrastructure:

- negative impact of intake point construction on air quality (e.g. dust);
- negative impact of pipeline construction on air quality (e.g. dust); and,
- operation of the water treatment plant will require energy, which is likely to be sourced from the national grid, and therefore most of the energy required will be generated from the burning of fossil fuels generating CO_2 and other greenhouse gas emissions. It is predicted that the delivery of water to the GDA from Lough Ree would emit 30,433 tonnes of CO_2 per annum, and these emissions will contribute to Ireland's overall greenhouse gas emissions.

The mitigation measures proposed include the investigation of energy-saving measures at the EIA stage.

7.4 Impacts on Human Population, Human Health, Material Assets, and on Cultural and Archaeological Heritage

The SEA report lists the following negative impacts on human beings and material assets resulting from the changes in lake levels, changes in downstream flows, and from the construction of the intake point, pipeline and associated infrastructure (we have combined the headings of "human beings", "human health" and "material assets", to avoid repetition, as many of the listed impacts are very similar):

- no negative impacts on amenity use of Lough Ree (e.g. boating) are predicted;
- negative impacts on fishing, i.e., on angling;
- negative impacts on downstream and long-term water abstraction needs of the local authorities and communities within the Shannon region;
- negative impacts due to disruption to amenity value of the lake because of the intake point location and structure;
- negative impacts on landowners in the vicinity of the abstraction point;
- negative impacts resulting from the construction of the pipeline (e.g. noise, dust, visual impact);
- negative impacts resulting from the permanent sterilisation (from a planning perspective) of the way-leave lands (i.e., restriction of development, and limitation of future land uses in the vicinity of the pipeline);

- negative impacts resulting from the land-take required by the pipeline and the associated infrastructure;
- impacts of the construction works on architectural and cultural heritage; and,
- negative impacts of the associated infrastructure on the visual landscape.

Given the uncertainty of the data on water flows over the weir at Athlone, and the strong probability that the proposed abstraction will cause changes in the water level of Lough Ree, we disagree with the conclusion in the SEA report that there will no negative impacts on the amenity use of Lough Ree. Information from marina operators, cruiser hire companies and individual boat owners (who have an intimate knowledge and experience of the lake) leads us to the opposite conclusion that even a slight decrease in the water level in Lough Ree, especially during summer when boating activity is at a maximum, would have a significant detrimental effect. This will occur because many areas of the lake are already quite shallow, with submerged rock close to the surface, and boats are more likely to become damaged by running aground; or alternatively, the areas of the lake suitable for navigation would become more restricted.

The SEA report acknowledges that the water supply requirements of the Shannon Region could increase above the 50 million litres per day for "local use" included in the modelling exercises, but there is no mention of the strong possibility that the City of Limerick may also need an additional supply of water for increased domestic and commercial use.

The only downstream user whose water needs have been taken into account is the Electricity Supply Board, which operates the hydro-electric generating station at Ardnacrusha. The anticipated reduction in generating capacity, which uses a constantly renewable energy source (water), will require the equivalent amount of electricity to be generated from the burning of fossil fuels, which will emit CO_2 and other greenhouse gases, at a time when Ireland is required to reduce its greenhouse gas emissions, and when any emissions greater than the country's allowance will require the purchase of "carbon credits" at the expense of the taxpayer. Apart from the cost, we consider that this impact would create a conflict between the proposed scheme and Ireland's international and legally enforceable obligations to increase the proportion of electricity generated from renewable sources, and to reduce emissions of greenhouse gases.

The ESB has already agreed with Dublin City Council that the former would be paid compensation by the latter for the reduction in generating capacity as a result of the proposed abstraction, at a rate of 0.9 cents per m^3 of water[27]. It appears that neither this annual cost (payments to the ESB for loss of generating capacity), nor the cost of purchasing carbon credits, have been taken into account in calculating the annual operating costs of the abstraction from Lough Ree.

[27] *Dublin City Council: Greater Dublin Water Supply – Major Source Development. Feasibility Study, Appendix B, section 1.5, Table 1.20, page 52.*

The agreement between DCC and the ESB is one of the several agreements made between Dublin City Council and a number of State or Semi-state Agencies, in advance of any public consultation, which has led us to conclude that a decision has already been made in principle to go ahead with the recommended option of abstracting water from Lough Ree.

We would consider that this approach is in conflict with the requirements of the Water Framework Directive (see section 6 above).

8. Lack of Consultation

We have referred in a number of places throughout this report to the lack of consultation by DCC with any organisations or individuals other than State or Semi-state organisations and local authorities. The Feasibility Report confirms that "*non-statutory stakeholders were not contacted at this time*", but that "*these stakeholders will be contacted at preliminary report stage*".

We would consider that this failure to engage in consultation at a sufficiently early stage in the process is in breach of the requirements of the Water Framework Directive (see section 6 above) and the Habitats Directive under which Lough Ree is designated as a Special Area of Conservation. Persons and organisations which use the area likely to be affected by the proposed abstraction should be properly consulted at a sufficiently early stage so that their concerns can be addressed before the environmental impact assessment process begins. If this does not happen, the project will become constrained, options will become fixed, and alternatives ruled out, before non-statutory stakeholders can become involved.

9. An Example of Unsustainable Water Abstraction

It is our observation that one remarkable failure of the preliminary study commissioned by Dublin City Council is the lack of any reference to the effects of large-scale water abstraction from lakes or rivers in other parts of the world. One such example, which is the subject of considerable international concern, is the abstraction of water from the River Jordan, which has resulted in near destruction of the Red Sea and serious irreversible damage to the River Jordan.

As reported in the London Times on 09 December 2006, under the headline of "**Why the Dead Sea is Dying**", reporter Stephen Farrell points out that irrigation has lowered the water level, and a proposed rescue plan "*will make things worse*". It seems that the reporter's biblical quotation at the head of his article "*from dust it came, and to dust it is returning*" could be appropriate and prophetic.

The Dead Sea is the most famous body of water on Earth in historical and biblical terms and is in fact the lowest point on Earth. There is no egress route for water from the Dead Sea, except evaporation, and yet the Dead Sea is disappearing rapidly. In the last thirty years, more than half of the surface of the Dead Sea has disappeared, and over a similar time-frame the water level has dropped by 86 metres. Twenty

years ago the famous Bin Gedi health spa in Israel was developed, 25 meters from the shore of the Dead Sea. Today, that shore line is 2.4 km distant from Bin Gedi, and in recent years all commercial, industrial and tourist related development has been completely banned on the shores of the Dead Sea.

The river Jordan itself, where the Bible tells us Jesus was baptized, has been transformed from a 60-metre wide impressive river, into a 6-metre wide trickle of sewage and saltwater because every drop of fresh water has been diverted from its source at the Sea of Galilee. Nearby, numerous sinkholes in the earth have appeared; and these are the result of the erosion of salt layers underground as the Dead Sea recedes.

Experts agree that, barring another miracle, in less that 50 years the Dead Sea will have disappeared forever. And the cause of this destruction of this most famous of water bodies ? The answer is simple and undisputed -- water abstraction from the river Jordan, the source of the Dead Sea's water supply. The governments of Israel, Jordan and Palestine, and environmental experts worldwide agree on this central point -- that water extraction from the Jordan and its tributaries is the sole cause of the demise of the Dead Sea ! This widespread environmental damage is a direct result of government policy in the three countries with borders on the Dead Sea.

Officials from Israel, Jordan, the Palestinian Authority and the World Bank hope that a two-year feasibility study, backed by an environmental and social impact assessment report will identify a solution to reverse the ecological damage. The study will recommend a multibillion-dollar project to link the Dead Sea with the Red Sea, which lies 200 km to the south, using a pipeline or canal to convey 1.9 billion cubic metres of water annually from the Gulf of Aqaba. Running from Eilat and Aqaba to the Plain of Sodom, the "*Red Sea to Dead Sea*" conduit would include a desalination facility to

provide 850 million cubic metres of water a year, and an electricity plant to generate 550 megawatts.

However, environmentalists and Israeli scientists living in the worst-affected areas say that this proposed project would be a costly extravaganza that would fail to address the root cause, and could ruin the very sea that it is intended to save. Pumping lighter seawater into the Dead Sea could kill its delicate micro-organisms and harm its appeal for tourists, who float in its mineral-rich waters. The Council at Ein Gedi, a kibbutz which depends on the tourism income from the 1.25 million visitors drawn annually by the health spas, mud treatments and holiday beaches at the Dead Sea, says that the project organisers have not heeded warnings from its own experts that the project is too little and too expensive.

The authorities in Aqaba, which is the suggested extraction point for this supply to the Dead Sea, including major tourists interests, are also bitterly opposed to this plan and suggest that the resulting ecological damage to the Gulf could destroy marine, coral, fish and aquatic life, their principal source of income through tourism.

While this disastrous situation may not be directly comparable with Dublin City Council's plans for abstraction from Lough Ree, there are lessons to be learned. In the first place, the project to address the damage caused to the Dead Sea and River Jordan by excessive water abstraction appears to be seriously flawed, and likely to cause even greater ecological damage – "*the cure is worse than the disease*" !

Secondly, we should compare the suggested rate of water abstraction, common to both projects.

The rate of abstraction in the Red Sea project would mean that 1% of the Sea's volume would be abstracted every 1200 years. In the case of Lough Ree, the abstraction rate proposed by Dublin City Council would mean that 100% of the volume of the lake would be removed every 5 years! This can only lead to damaging and irreversible consequences at an alarmingly fast rate. If the opposition to the Red Sea Project by Israeli scientists and tourism interests, and by the people of Aqaba is justified, then the opposition to Dublin City Council's project by groups around Lough Ree and within the Shannon catchment area should be justified to a far greater extent.

10. Desalination – Sustainable Solution or Inappropriate Technology ? Examples from Britain, Australia and Israel.

In mid-July 2007, the Department of Environment, Food and Rural Affairs and the Department of Communities and Local Government granted planning permission for a proposed desalination plant in south-east England, intended to provide 140 million litres of water daily to London. The decision was welcomed by Thames Water, the privatised agency which supplies water to the Greater London Area, and which promoted the desalination plant at a public inquiry in May 2006 [28].

[28] *From BBC News, 15 June 2007.*

Even though Thames Water described the desalination plant as "*a vital part of our plans to secure future water supplies to the capital*" and promised that the energy to run it would come from renewable resources, the plant has been severely criticised by other agencies, and by environmental campaigners and scientists.

London's Lord Mayor Ken Livingstone described the move as "*misguided and a retrograde step in UK environmental policy*". The plant was described by Rob Oates, of the World Wildlife Fund (WWF), as "*a sticking plaster solution to the water crisis we have in the south-east … The government should instead conduct a bigger, strategic review of people's water usage and work to reduce demand and leakage, introduce metering in homes and encourage residents to install water-saving technology*." [29]

A report by the World Wide Fund for Nature (WWF), a high profile international environmental association, states that a growth in this energy intensive technology would increase emissions and damage coastal and river habitats, and that more attention should instead be paid to conserving supplies.

The WWF report called for greater emphasis on managing existing supplies before the go-ahead was given to major water projects. It added that new desalination plants, which were primarily located in coastal areas, should also be subject to much tighter environmental impact assessments to minimise damage to the fragile and vulnerable marine environment.

"*Desalinating the sea is an expensive, energy intensive and greenhouse gas emitting way to get water*," said Jamie Pittock, director of WWF's global freshwater programme. "*It may have a place in the world's future freshwater supplies but regions still have cheaper, better and complementary ways to supply water that are less risky to the environment*." [30]

Professor Bowen, from the University of Wales' School of Engineering, Swansea, has described the adverse environmental impacts of desalination: "*The basic problem is that by taking sea water and producing fresh water, you are going to get a stream of fresh water, which is what you want, but you also produce a concentrated salt stream*".

A similar controversy has arisen in Australia, following a decision by the Western Australia Water Corporation to commission a large desalination plant to supply the city of Perth with water [31]. The Kwinana Desalination Plant south of the city opened in early summer 2007, and currently provides nearly 40 million gallons of drinking water each day — roughly 20 percent of Perth's daily consumption. It is

[29] *From BBC News, 18 June 2007.*
[30] *From BBC News, 19 June 2007.*
[31] *Water Corporation (2004) Metropolitan Desalination Proposal: Section 46 Review, Perth. Water Corporation (2006a) Perth Seawater Desalination Project, available at: http://www.watercorporation.com.au/D/desalination.cfm, Water Corporation (2006b) The Perth Desalination Proposal: Wind Power, Perth.*

the first of its kind in Australia, but likely to be followed by other desalination plants, as water-stressed seaside cities in Australia are taking a serious look at desalination. Sydney, on Australia's southeast coast, is expected to commission a plant even larger than Perth's in the next few months.

As a result of concerns expressed by environmental agencies and citizens in Perth, the Western Australia Water Corporation was required to find a non-polluting, renewable energy source to power the desalination plant – and the plant takes its energy supply from an 80 Megawatt wind farm located near the town of Cervantes, a three-hour drive north of Perth.

Australian environmental scientists and engineers have pointed out that large-scale desalination raises a different set of sustainability issues than those associated with established urban water systems. In particular, desalination is very energy intensive and its use will drive significant greenhouse emissions from the fossil-fuelled generation that dominates Australia's electricity supply. They point out that desalination uses significantly more energy than traditional storage and pipe network systems, and desalination uses much more energy than is required to recycle wastewater to a level fit for reuse [32].

Nevertheless, desalination is now being proposed in Australia for a number of urban centres as a supplement to existing infrastructure. Previously in Australia, large desalination plants were used only in the mining and power generating industry, while desalination for urban water usage was restricted to small isolated urban communities with access to no other water supply, such as Kangaroo and Rottnest Islands [33]. The ability to produce potable water independent of rainfall is seen as the major advantage of desalination, e.g., in New South Wales[34] and Victoria [35]. Furthermore, the cost of seawater reverse osmosis plants has fallen by 300% over the last 15 years [36].

It is worthwhile noting that Australia is the world's driest inhabited continent and the country is the highest per capita user of water. The Murray-Darling river system, the nation's largest, has hit rock-bottom with inflows at 40 percent of its annual average, while Melbourne's dam storage levels have dropped to a low of 28.4 percent capacity. Even Perth's new desalination plant will not be able to compensate completely for reservoir inflows that have halved during the last 30 years and dropped by a third in the last 10 years. Nationally, Australia recycles an average of only 9.1 percent of its treated wastewater with Victoria recycling only six percent. Increasing Australian recycling standards by three percent

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[32] *The Sustainability of Desalination Plants in Australia: is Renewable Energy the Answer ? Paper by David Knights, Ecological Engineering, Dr Iain MacGill, Centre for Energy and Environmental Markets, UNSW, and Dr Rob Passey, Centre for Energy and Environmental Markets, UNSW.*

[33] *Agriculture Fisheries and Forestry Australia (AFFA) (2002), Introduction to Desalination Technologies in Australia, ACT.*

[34] *NSW Government (2006) 2006 Metropolitan Water Plan, Sydney.*

[35] *Victorian Government (2006). Central Region Sustainable Water Strategy, Melbourne.*

[36] *Leslie (2004) Desalination: Its place in meeting our fresh water needs, Presentation to Institute of Energy Australia, 15 November, 2004.*

would increase water availability by more than 53 gigalitres, much more than the amount of water desalinated by the Perth seawater reverse osmosis desalination plant each year.

In Israel, water scarcity has always been a harsh reality. Situated in the arid climate of the Middle East, Israel relies primarily on the Jordan River, which dries out along some of its course, as we have pointed out in section 9 of this report. To cope with this degree of water scarcity, more than 72 percent of Israel's sewage is reclaimed for re-use, and the recycled water from cities is used to supply water for agriculture and irrigation. The country has also built desalination plants along the coast to feed a national water grid. The world's largest desalination plant uses technology devised by Israeli Desalination Enterprise (IDE) to pump 320,000 cubic metres per day at a price of US$0.52 per kilolitre.

Nevertheless, Israeli nanotechnology expert Prof. Rafi Semiat of the Technion University believes that Australia's decision to adapt desalination is premature. He has stated that "*in Australia people are still using water hoses to wash their cars*" and he recommended that Australians should "*learn to save water first, and accept the reuse of recycled water before desalinating*." His words may serve as an example to Ireland !

We believe that these international examples are relevant to the situation on the east coast of Ireland, and particularly in the Greater Dublin Area, as they reveal that desalination is not an optimal solution, it is very energy-intensive, has adverse environmental effects, and should be adopted only where no other alternatives exist. Yet, as we have seen, it has been used for many years in Israel, and is becoming adopted in parts of Australia.

11. Summary and Concluding Observations

Even though these observations on the draft feasibility study and the proposed abstraction from Lough Ree can be no more than a preliminary assessment, some issues and concerns are clear:

1. The selection of the two final options (desalination and abstraction from Lough Ree) ignores many other possible options and combinations;

2. Potentially large, reliable and sustainable groundwater resources closer to Dublin do not appear to have been adequately assessed as sources of water;

3. The very high operating cost of desalination leads to the falsely-derived "conclusion" that abstraction from Lough Ree is the only realistic option, and it must therefore be selected as the preferred strategy;

4. At the same time, desalination cannot be ruled out completely as a possible solution for Dublin's water shortage, even though it is an energy intensive and unsustainable technology;

5. The feasibility study does not critically examine the assumptions on which the projected demand of 300 million litres of water daily is based;

6. Driving forces leading to greater per capita water consumption are included into the demand forecasts on which the feasibility study is based, but the potential savings in per capita water consumption resulting from the introduction of conservation measures, and from commercial metering and charging for water use, which will have to be implemented under EU legislation, are dismissed as being "*difficult to quantify*" and have not been taken into account;

7. The feasibility study does not examine the reduction in water consumption which could be achieved if the proposed expenditure on providing the additional supplies were to be directed to conservation and demand reduction measures (it is possible, and even likely, that the reduction achieved would enable the demand to be met sustainably and more cost-effectively from sources closer to or within the GDA);

8. Despite the success of the 1998 to 2000 programme which reduced the level of distribution leakage from more than 40% to approximately 30% of the volume of water supplied, there are no plans to continue or to revive this useful initiative (reducing the leakage from 30 % to 15 % in the GDA would save around one hundred million litres of water daily);

9. If customer side losses of potable water could be reduced by appropriate measures, this could save a significant proportion of the predicted rise from 34 million litres lost per day in 2005 to 53 million litres lost per day in 2031;

10. The large-scale abstraction proposal ignores the success of the water conservation project operated by the City of Dublin Energy Management Agency (CODEMA) in Dublin's Civic Offices -- this 12-month project reduced water demand by approximately 15% in the Civic Offices during 2003; but its methodology and the lessons learned from it have not been applied by the draft feasibility study;

11. Re-use and re-cycling of water within the Greater Dublin Area, the collection and use of rainwater, and other measures to reduce water demand, could eliminate almost completely the need for a large-scale source of supply such as Lough Ree;

12. The draft feasibility study provides no detail of the quantities of water treatment plant sludge which would require disposal, or how that disposal would be carried out;

13. The proposed abstraction, as presently conceived, is directly contrary to the principles of Sustainable Development and Management as contained in the EU Water Framework Directive;

14. Effects of a major abstraction on the capacity of Lough Ree and the River Shannon for recreation, navigation and fisheries, and on the existing

capacity of the river for waste water disposal are not addressed adequately in the proposed plan;

15. The importance of recreational and tourist angling in the Shannon catchment has not been addressed in the feasibility study, and this has lead to the widespread concern among angling and tourism interests;

16. The Shannon catchment, from which Dublin City Council is proposing to take large quantities of water, contains a significant number of vulnerable and important Natural Heritage Areas (NHAs), Special Areas of Conservation (SACs), and Special Protection Areas (SPAs) for wildlife. Lough Ree itself is designated a Special Area of Conservation (SAC), and is important at both European and National levels.

17. The specialised habitat for over-wintering wildfowl provided by the River Shannon Callows, directly downstream of Lough Ree, is particularly important; the Shannon Callows is designated an SAC and an SPA, and it has by far the largest area of lowland semi-natural grassland and associated aquatic habitats in Ireland, and it is additionally important for having the least disturbed natural wetland processes;

18. The preferred option described in the feasibility study has been selected without adequate knowledge of its environmental effects on the NHA, SAC and SPA;

19. The complex impacts of the proposed water abstraction on the *"ecological status*" of the aquatic, wetland and terrestrial environments likely to be affected have not been adequately determined, on account of identified gaps in the information;

20. The scoping and consultation process is fundamentally flawed in that only statutory organisations appear to have been advised, while the many people who use Lough Ree and the wider area likely to be affected by the proposed abstraction were never consulted at an early stage so that their concerns could be addressed at the option selection stage; i.e., there was no real or effective consultation, and therefore no public involvement in the decision-making process;

21. The reliance of the Dublin water supply on a single large-scale source would create a dependence on that source, so that in the inevitable event of widespread adverse effects becoming apparent in the Shannon catchment area, there is no provision for a shutdown of the scheme;

22. The scheme makes no provision for the possibility that an algal bloom (especially blue-green algae which produce the microcystin toxin) could cause a shut-down of the entire abstraction and pumping system, leaving a major part of the Greater Dublin Area without water;

23. No risk assessment has been undertaken of the recommended option which would place the Greater Dublin Area at risk of an event such as that mentioned in the preceding paragraph, and the feasibility study lacks a risk assessment of the viability of the overall scheme; and,

24. The Feasibility Study is unclear about how much water would eventually be abstracted from the Shannon Catchment, placing Lough Ree at risk of failing meet the objectives of the Water Framework Directive because of over-abstraction.

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The valued assistance of **Dr Paul Johnston**, Department of Civil, Structural and Environmental Engineering, Trinity College, Dublin, in compiling this report is gratefully acknowledged.

27 June 2007

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LoughRee-25 Env'tal and Sust'ty Assess't of Proposed Abstraction, 24-Jun-07.doc / revised 14 August 2007 /
Further additional material on desalination added on 03 September 2007