

**Water Supply Project**  
Eastern and Midlands Region

# **Preliminary Options Appraisal Report**

**Volume 1**

**Main Report**

November 2015

**Updated**

August 2016





## **Erratum August 2016**

A mapping error has been identified by Irish Water within three of fifteen aerial photography maps included in the *Preliminary Options Appraisal Report* published on 26 November 2015. Other mapping is not affected. This error has been rectified and the Preliminary Options Appraisal Report has been updated.

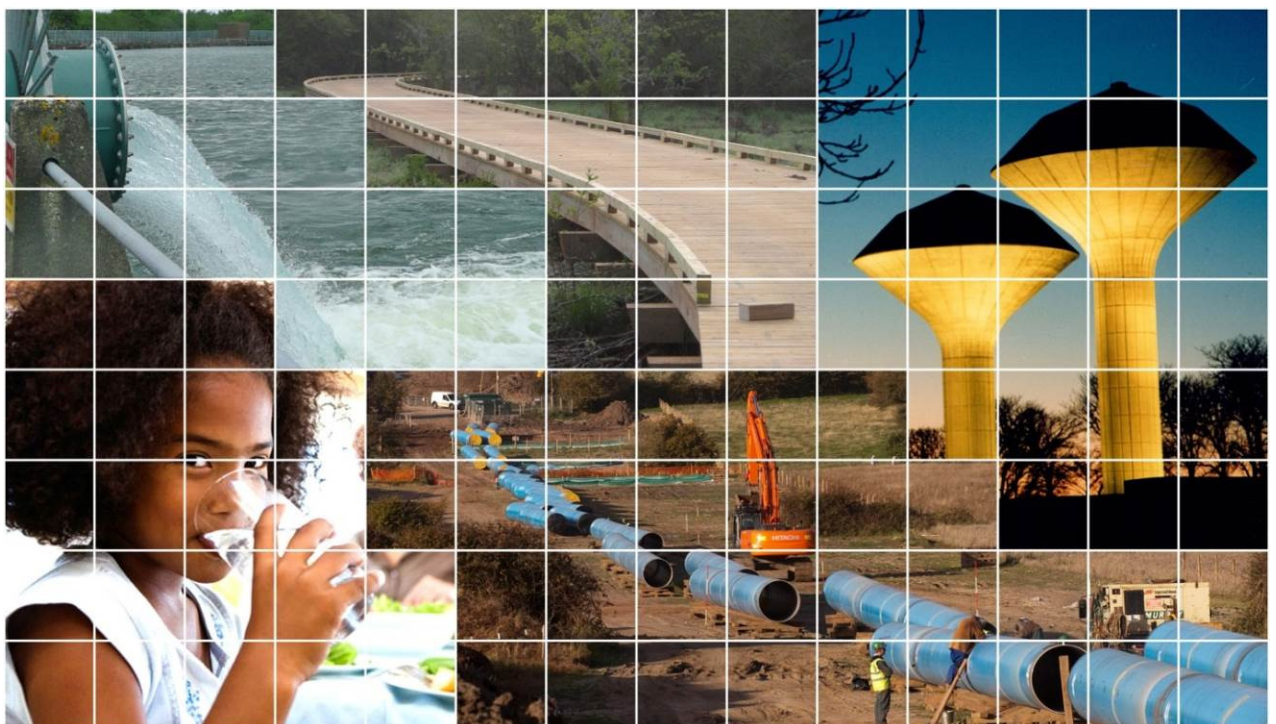
## Water Supply Project – Eastern and Midlands Region

### Preliminary Options Appraisal Report



July 2016

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## List of Acronyms

CAPEX	Capital Expenditure
EIA	Environmental Impact Assessment
GDA	Greater Dublin Area
GDWSSS	Great Dublin Water Supply Strategic Study
IROPI	Imperative Reasons for Overriding Public Interest
IW	Irish Water
MCA	Multi Criteria Analysis
OPEX	Operating and Maintenance Expenditure
SEA	Strategic Environmental Assessment
TOTEX	Total Capital, Operating and Maintenance Expenditure
WSP	Water Supply Project Eastern and Midlands Region
WTP	Water Treatment Plant

### 1.1 Executive Summary - Background

The Water Supply Project, Eastern and Midlands Region, is a key element of Irish Water's overall nationwide remit as it will meet the domestic, commercial and industrial needs of over 40% of Ireland's population into the medium to long-term future (to 2050). The Preliminary Options Appraisal Report (POAR) is the third in a series of reports published in 2015 in a process to identify a new major source of water for the Region.

The first of these reports was the Project Need Report (PNR) (Feb 2015), published in March 2015, which examined the capacity of existing sources, and the need for the new source. It included a fundamental review of the demographic, economic and sectoral water consumption drivers in overall water demand, as well as a critical appraisal of the resilience of the existing water supplies serving the region. It emphasised the importance of both aspects in considering the question of 'need' and concluded that the existing supply sources and infrastructure for the region do not have the capacity or resilience to meet future requirements. It projected that population and industrial growth will generate a demand for an additional 330 million litres of water per day by 2050. The present infrastructure is struggling to meet current need as evidenced by a number of significant and costly outages in Dublin over the past 4 years, one of which coincided with the Web Summit in November 2013. While projected requirements already include ambitious leakage control targets and water conservation initiatives, which will provide valuable water savings, these will not provide a long term solution for our water supply requirements.

The second report was the Options Working Paper (OWP) (June 2015). It examined the work previously carried out in the Strategic Environmental Assessment of ten options considered in 2010, and it validated four options, identified at that time, as technically viable for consideration in the next stage of options appraisal. It also published, for consultation, the assessment criteria in options appraisal, and the proposed approach to positioning infrastructure to achieve least environmental impact, through the use of constraint mapping.

This Preliminary Options Appraisal Report (POAR) considers and evaluates these four options, described below, taking into account preliminary results of investigative surveys and modelling, which are continuing.

It identifies abstraction from the River Shannon, downstream of Lough Derg, at Parteen Basin, as an 'emerging preferred option', with final confirmation of the preferred option expected, with the availability of further survey data, in Spring/Summer 2016.

## 1.2 Four Options

Sections 2 and 3 of the POAR establish the chronology and Roadmap of work to date. The four technically viable options which have been assessed in this Preliminary Options Appraisal Report are:

### 1) LOUGH DERG DIRECT

This is a constant, year-round abstraction design concept, involving abstraction and water treatment on the north eastern shore of Lough Derg, followed by 122km of treated water transfer pipeline, in a configuration which could supply treated water to other communities in a ‘benefiting corridor’ along the route.

### 2) LOUGH DERG AND STORAGE

This would have the same design concept as the Lough Derg (Direct) option, but involves variable abstraction (in this case, on the north eastern shore of Lough Derg) in combination with storage of raw water at Garryhinch in the Midlands. A higher flow would be abstracted for ten months of the year, with a lower flow over two summer months. The storage facility would accommodate up to 2 months average water supply requirements (for Dublin). This option could supply treated water to other communities along the route from Garryhinch to Dublin.

### 3) PARTEEN BASIN DIRECT

This would have the same design concept as the Lough Derg (Direct) option, but involves a longer distance (approximately 165 km), for a treated water transfer pipeline. This option could supply treated water to other communities along the route from the Parteen Basin to Dublin. Abstraction and treatment of water at the Parteen Basin reservoir in Tipperary, together with a treated water pipeline, is emerging from the assessments to date as the option most likely to provide the best and most widely beneficial new source of supply for the Eastern and Midlands Region.

### 4) DESALINATION

This option involves the abstraction of sea water from the Irish Sea in North Fingal and desalination of this water through a Reverse Osmosis (RO) desalination plant, together with the discharge of brine (from the treatment process) back into the Irish Sea. The process includes the pumping of treated water through approximately 35km of pipelines to existing and proposed reservoirs located in northern and western parts of Dublin.

## 1.3 Consultation

Section 4 of the Report defines how public consultations, both on the PNR and the OWP, have been taken into account in the current work. This is accompanied by Appendix H, the Consultation Submissions Report on the previous Options Working Paper, which details the submissions received, by theme, and which responds to those submissions.



## 1.4 Methodology of Option Assessment

The four technically viable options have been assessed in this Preliminary Options Appraisal Report (POAR) under assessment criteria which include:-

Environmental factors:

- Biodiversity, Flora and Fauna
- Fisheries
- Water<sup>1</sup>
- Air/Climatic Factors
- Material Assets (Energy)
- Cultural Heritage (including Architecture and Archaeology)
- Landscape and Visual
- Material Assets (Land Use)
- Tourism
- Population
- Human Health
- Soils, Geology and Hydrogeology

Technical and Risk factors:

- Safety
- Planning Policy
- Engineering and Design
- Capital and Operating Costs
- Sustainability
- Risk (including technical, environmental, planning, financial and socioeconomic)

Section 5 of the Report describes the Options Appraisal Process, and Section 6 outlines how the input of the Investigative Studies has informed the work.

## 1.5 Multi – Criteria Analysis of Options

The four options were assessed by Multi Criteria Analysis (MCA), an approach which allows all the key assessment criteria to be considered collectively. On the Shannon and Desalination options, several potential abstraction locations have been examined and assessed.

Section 7 of the Report documents the assessment of each of the Options, against the criteria, and concludes that:-

- (a) Abstraction from Lough Derg, either directly or with raw water storage in the Midlands, would have significant impact on water residence times in Lough Derg in prolonged dry summer conditions,
- (b) Abstraction from Parteen Basin, being sited downstream of Lough Derg, would avoid such impacts on lake residence time.

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<sup>1</sup> Water, as an environmental factor in multi criteria analysis, considers the requirements of the Water Framework Directive

Section 8 of the Report outlines the appraisal of options related to the location of the Terminal Point Reservoir, and it also documents the development of pipeline corridor options and the identification of the 'least constrained pipeline corridor'. Many environmental constraints, such as European sites, ecology, and cultural heritage, were spatially mapped, to determine the best positioning of infrastructure in a manner which would minimise impact on, and disruption to, the areas in which they would be located. Appendix B sets out the methodology by which this was done, and Appendix F sets out in detail the Multi Criteria Analysis of the pipeline corridor options.

### 1.5.1 Emerging Preferred Option

Section 9 draws the foregoing work into an identification of an Emerging Preferred Option, which is abstraction from the lower Shannon in the Parteen Basin area downstream of Lough Derg. It recognises that further data gathering is required before a Preferred Option can be expected in Mid 2016, and continued appraisal of both abstraction from the Shannon at Parteen Basin and Desalination will continue to that point. Abstraction from the lower Shannon at Parteen is emerging as the most suitable source of new water supply for a number of key reasons:

- It provides treated water, delivered in a way which brings the greatest availability and economic advantages to the widest group of communities in Irish Water's Eastern and Midlands Region. Towns and communities along the proposed pipeline route through the Eastern and Midlands Region will gain a secure water supply to meet future domestic, commercial and industrial water requirements and therefore the opportunity to develop and grow their economies. All consumers will have a reliable and sustainable water supply to international standard of service.
- It enables the delivery of more efficient and up to date supply infrastructure by facilitating the development of fewer and more modern water treatment plants to replace the numerous small, inefficient and outdated plants currently operating across the region.
- It is less expensive by a factor of 1.5, with a lower carbon footprint than the desalination option, the only other remaining technically viable option.

### 1.5.2 Parteen Basin - Emerging as Preferred Option

It is apparent from the investigative studies, and from the detail in Appendices C & D to the Report, that both North Eastern Lough Derg options have a significantly greater potential to negatively impact on the Shannon system than the Parteen option and that extraction from Parteen also provides additional benefits along a more extensive benefitting pipeline corridor. Section 9 of the Report details this Emerging Preferred Option.

Water abstraction from the Parteen Basin area could take place so that water levels can be controlled within the normal operating band by protocols to be agreed with ESB. Adjustment of water used in generation would be covered in this agreement, to avoid impact on water levels or compensation flows. Minimum statutory flow requirements which are maintained below Parteen weir would also remain unaffected.

Treated water would be distributed to locations across the Eastern and Midlands region of the country via an underground pipeline running from Parteen Basin to Dublin. This would provide a reliable and sustainable water supply to current and future domestic, commercial and industrial consumers along the proposed pipeline's route.

The reasons why abstraction from the Shannon in the Parteen Basin area is emerging as preferred can be summarised as:-

- This option has, by far, the least environmental impact of the three Shannon options which have been under consideration. It is the closest location to the river estuary with all of the water having already flowed through the Shannon to Parteen. By contrast, the Lough Derg abstraction options, either directly or in combination with storage at Garryhinch, involve abstraction much further up-river in Lough Derg, they carry greater risk of environmental impact and the option to store untreated water in the midlands also risks transfer of potentially environmentally damaging alien species such as Asian clams and zebra mussels into other river catchments.
- The pipeline from Parteen has the potential to serve treated water to more Midland locations, towns and communities along the route from Shannon to Dublin than any other option.
- Parteen already includes existing storage regulating assets because of the presence of the hydro-power plant. The proposed abstraction of water is, in essence, an abstraction of water from the hydro-power scheme, utilising existing assets. Abstraction of water from hydro-electric power schemes is commonly employed worldwide to enable environmentally sustainable availability of drinking water.

### **1.5.3 Desalination – Possible but not recommended**

Desalination has come through the assessment process, carried out to date, as the only other viable option but is much less suitable than the Parteen Basin option for a number of reasons;

- It is a Dublin-centric solution, so it does not deliver the widespread benefits to towns and communities throughout the Eastern and Midlands Region.
- It is a less environmentally friendly option than the Parteen Basin option because the provision of desalinated water requires a high energy input leading to a greater carbon footprint.
- The cost of water delivered is significantly more expensive than the emerging preferred option.

## 1.6 Community Benefits Opportunities

Section 10 of the Report discusses opportunities for Community Benefits.

Although “Community Benefits” involve many factors, they are discussed within seven broad categories as follows:

- Environmental Enhancement;
- Provision of Community Facilities;
- Educational Improvement, Development and Upskilling;
- Amenity Improvements;
- Strengthening and Enhancement of Physical Infrastructure;
- Engagement and Alignment with Broader Planning / Local Authority Objectives; and
- Economic Development.

At this point, an ‘emerging preferred option’ has not yet been taken to a level of design that would support a reliable estimation of cost. Further work is required to confirm a preferred option, and to develop a full planning stage design. Section 10 develops principles and proposed approaches to community benefits, which will be further developed in parallel with the developing design.

## 1.7 Moving to a Final Decision

While the Parteen Basin option is emerging as the preferred new water supply source for the Eastern and Midland Region of Ireland, more research and assessment needs to be done to ensure that all possible relevant factors (including environmental impacts and the required energy use) are examined in reaching a final decision. That process will involve further assessment under the relevant criteria and constraints, additional ‘on the ground’ investigations and a series of further public consultations where all interested parties will be invited to contribute to the decision making process.

### 1.7.1 Public Consultation

A ten week public consultation process follows the publication of the ‘Preliminary Options Appraisal Report’. It is open to the public and it asks for views on the findings in relation to the two options which are emerging as viable and also the emerging preference for the Parteen Option.

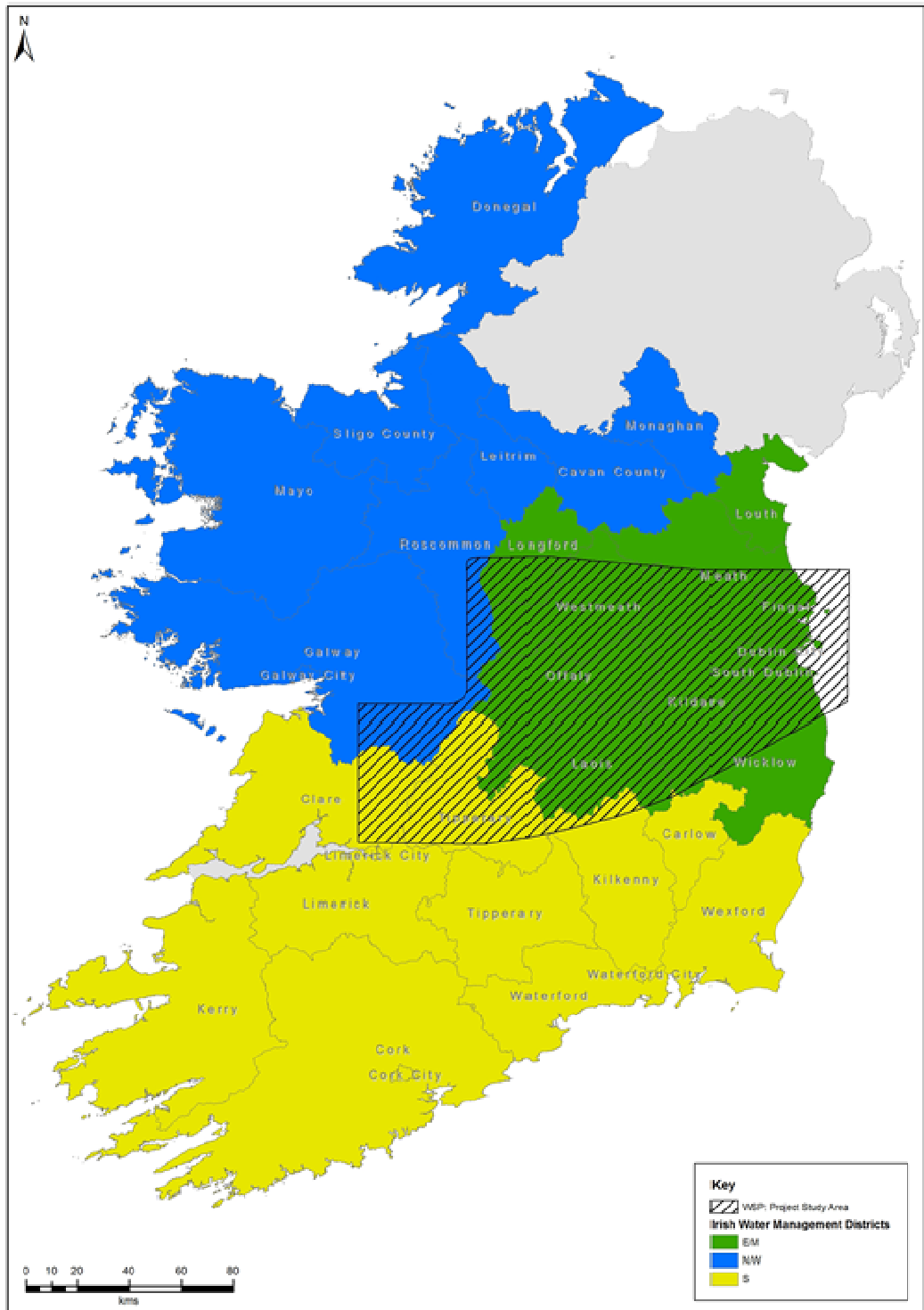
The feedback on this upcoming consultation will be included as part of the final phase of research and assessment on the options which will conclude in Spring/Summer 2016 with the publication of the Final Options Appraisal Report. At that point a ‘final’ preferred option will be put forward for public consultation before proceeding to the remaining phases of the planning process in 2017 which will involve consulting on the ‘Scope of the Environmental Impact Statement (EIS)’ and submission of the planning application to An Bord Pleanála for their independent adjudication. An Bord Pleanála will undertake all necessary statutory consultations including Oral Hearings where everyone will again be entitled to have their say.

### 2.1 Background

On 1st January 2014, Irish Water assumed responsibility for managing Ireland's water and wastewater investment and maintenance programmes. On that date, Irish Water also took over the management of the Water Supply Project Eastern and Midlands Region (WSP) from Dublin City Council / Department of Environment, Community and Local Government. The project is currently in the project planning stage.

Management of the planning stage of the project is currently focused on achieving a planning submission to An Bord Pleanála by mid-2017 with a view to delivering an additional source of water throughout the Eastern and Midlands Region by 2022.

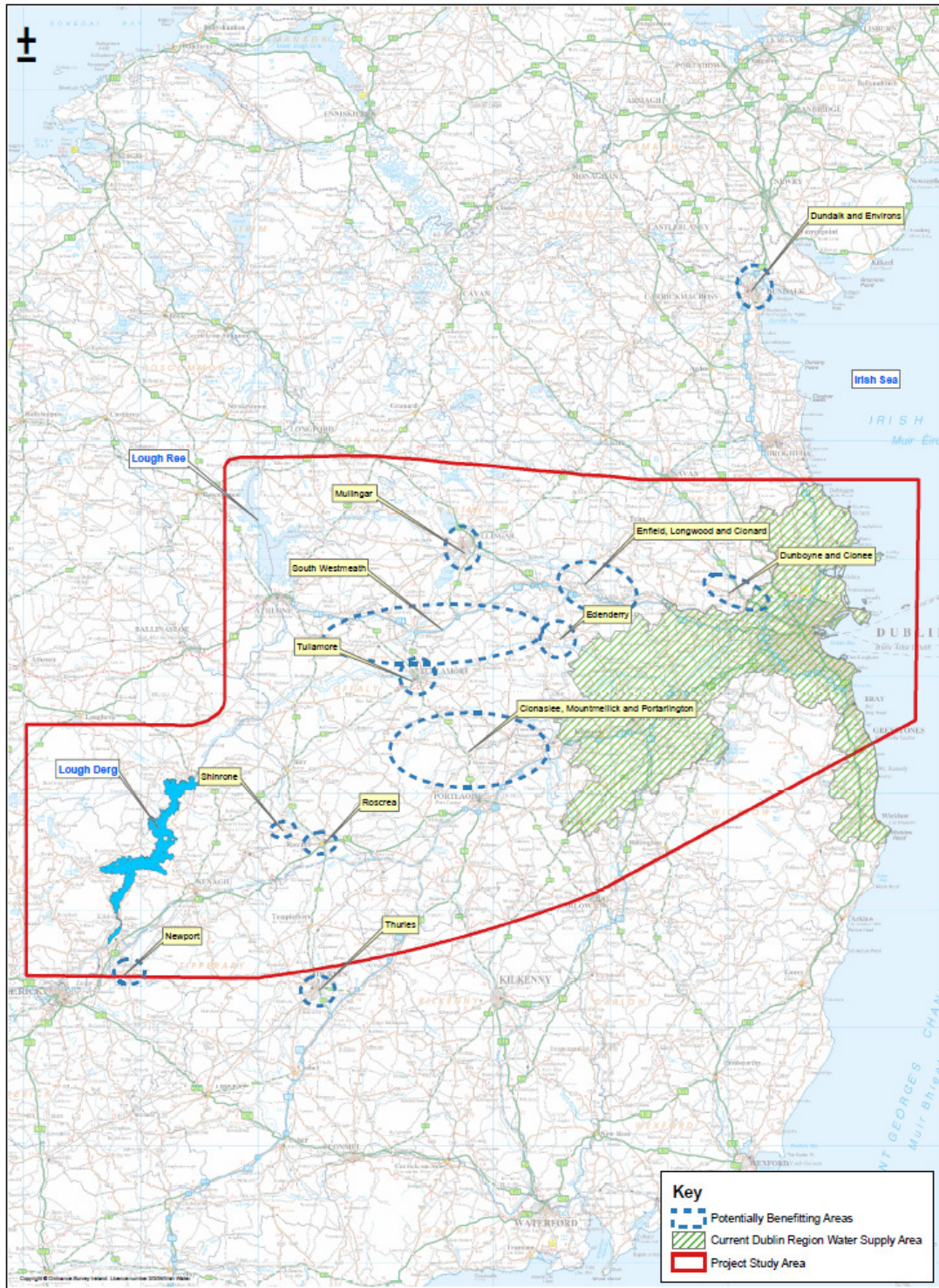
When responsibility for the project was with Dublin City Council, the project was known as the 'Water Supply Project – Dublin Region' as the principal focus was planning for future water supply needs of the East / Dublin Region up to 2050. However, the transfer of water services functions to Irish Water has opened a unique opportunity to take a strategic view of providing water services at a national level and as a result the project has now been referenced to the (three) regions within which Irish Water operates (see Figure 2.1). Since the bulk of water supplies from the project will be delivered to the East & Midlands, the project is now known as the 'Water Supply Project Eastern and Midlands Region (WSP)'.



**Figure 2-1 Irish Water Regions and Study Area**

The transfer of responsibility for managing the project from Dublin City Council to Irish Water has also resulted in an increased focus on potential ‘Benefiting Corridors’ (see Figure 2-2) which will be created by the water transfer pipelines between potential new water source options and the terminal delivery point. This is because Irish Water has responsibility for ensuring secure, resilient and high quality water supplies in all locations of Ireland and not just in the East of Ireland.





**Figure 2-2 Potentially Benefiting Areas**

The ongoing appraisal process<sup>2</sup> identified 4 reasonable and alternative water supply options for further consideration, as they were best capable of meeting the projected demands for the Eastern and Midlands Region, or WSP. Three of these options

<sup>2</sup> Water Supply Project Eastern and Midlands Region Water Supply Options Working Paper (June 2015)

involved a River Shannon-based source, whilst the remaining fourth option (Desalination) relied on source abstraction from the Irish Sea.

This stage of the appraisal is concerned with identifying, from the 4 reasonable and alternative water supply options, an Emerging Preferred Option for the abstraction of water from source, and siting of associated treatment, supply and delivery infrastructure.

## **2.2 Project Consultation Roadmap**

The need<sup>3</sup> for a water supply of 330 MI/d from a new source has been established and planning consents to abstract, treat and transfer this water must be obtained, so that a Phase 1 scheme is in place by 2022.

This requires adherence to the project programme, or Road Map (Figure 2-3), to make a planning Application to An Bord Pleanála by Q2, 2017.

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<sup>3</sup> *Water Supply Project Eastern and Midlands Region Project Need Report (February 2015)*



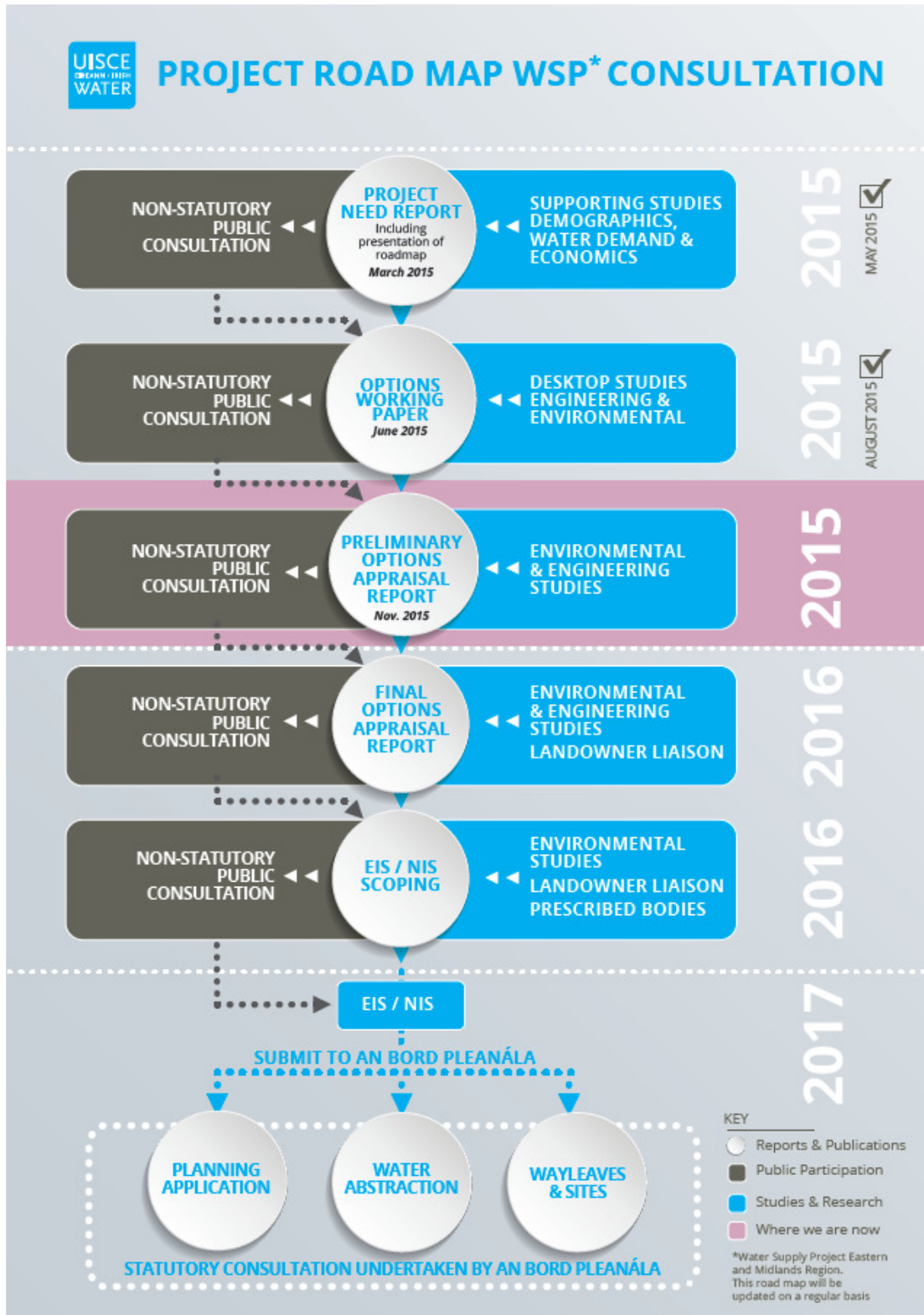


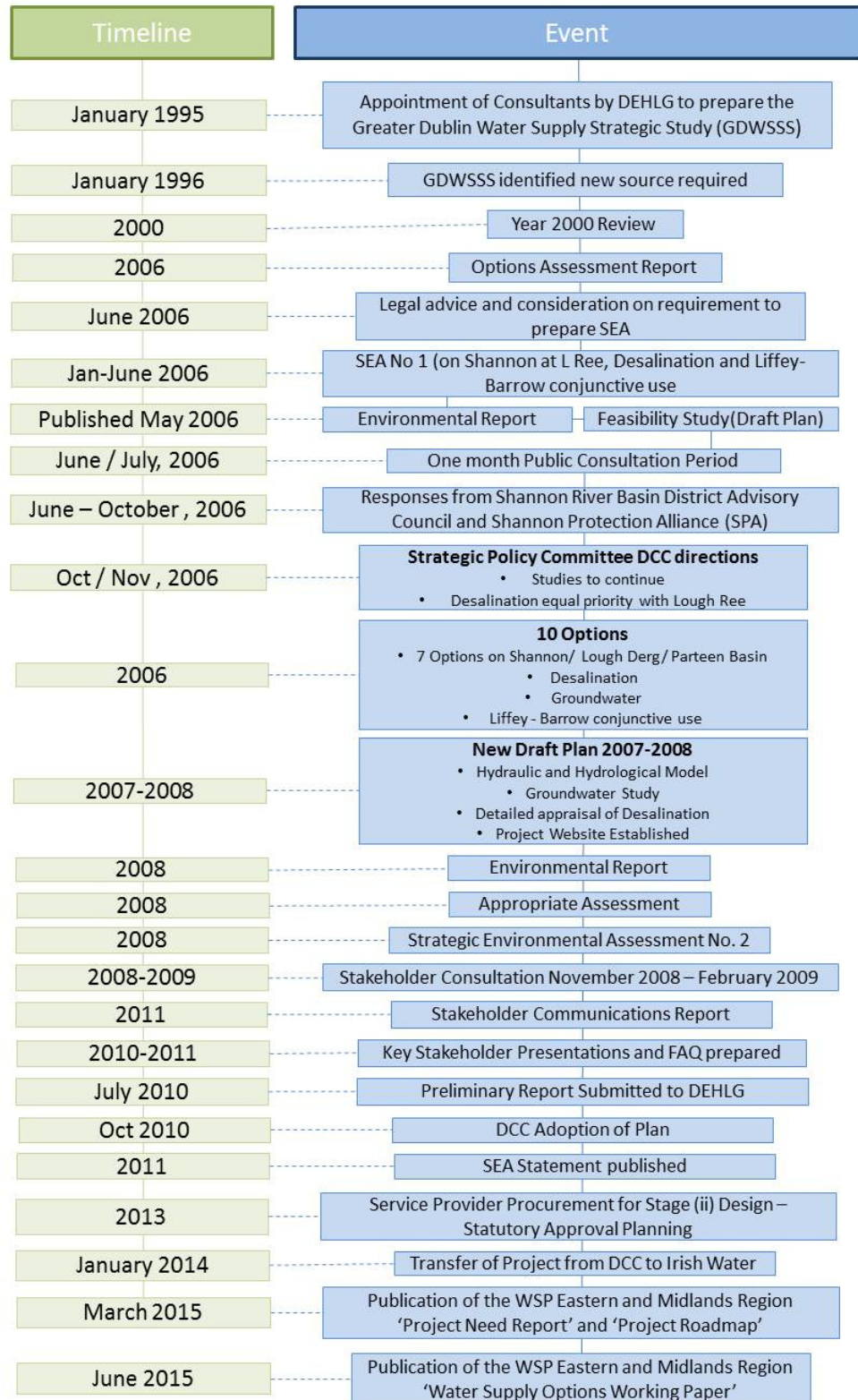
Figure 2-3 Project Road Map

The *Project Need Report* (February 2015) and *Water Supply Options Working Paper* (June 2015) represent Stages 1 and 2 of the Project Road Map respectively.

This document, the Preliminary Options Appraisal Report, is Stage 3 of the *Project Road Map*; a consultative assessment to identify an Emerging Preferred Option from the 4 reasonable water supply options identified in Stage 2.

### 2.3 Previous Work and Reference Studies

The identification of the 4 reasonable alternative options has been outlined and detailed via a robust programme of previous historical assessments and studies. The historical assessments/study reports are referred to in Figure 2-4.



**Figure 2-4 Chronological Development of the Project & Historical Datasets/Reporting**

The reports detailed in Figure 2-4 form the starting baseline datasets for this current Stage 3 process.

Figure 2-4 includes the key deliverables that have taken place since the transfer of responsibility for managing the project from Dublin City Council to Irish Water; namely the *Project Need Report*<sup>4</sup> in March 2015 and the *Water Supply Options Working Paper* in June 2015.

## 2.4 Project Need Report – Project Road Map Stage 1

On assuming responsibility at January 1<sup>st</sup> 2014 for the WSP, which in essence is a nationally strategic Water Supply Project, Irish Water commissioned a review of the fundamental determinants of ‘Need’ for the project. The *Project Need Report* examined:

- a) A range of demographic scenarios, to a planning year of 2050, for Ireland as a whole, for the water supply area served by the existing water sources in the Dublin area, and for those areas likely to benefit from proximity to transfer pipelines from a new source;
- b) The fundamentals of every element of the projection of water demand, drawing on currently available data returns from domestic water metering, projecting industrial water requirements, and assuming ambitious targets on water conservation;
- c) An independent assessment by professional economists, of the strategic economic importance of secure, resilient water supplies in the Midlands and Eastern areas, for the life and health of people living there, and for the sectors of the economy that sustains their livelihoods; and
- d) The importance of resilient connectivity of water resources for the safety, security and reliability of water services.

The Water Services (No. 2) Act 2013 places a statutory obligation on Irish Water under Section 33 of that Act to prepare, and review periodically, a Water Services Strategic Plan (WSSP). Irish Water must state its objectives, and the means to achieve those objectives, for the coming 25 year period, including in relation to (inter alia):

- a) Drinking water quality;
- b) The prevention or abatement of risks to human health or the environment relating to the provision of water services;
- c) The existing and projected demand for water services;
- d) Existing and planned arrangements for the provision of water services by Irish Water;
- e) Existing and reasonably foreseeable deficiencies in the provision of water services by Irish Water; and
- f) Existing and planned water conservation measures.

Section 39 of the Act goes on to require the Commission for Energy Regulation, in the performance of its functions as Economic Regulator, to have regard to the need to ensure, inter alia,

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<sup>4</sup> *The Project Need Report was dated February 2015 but its publication occurred in March 2015.*

- a) The conservation of water resources;
- b) The continuity, safety, security, and sustainability of water services; and
- c) That Irish Water can meet all reasonable demands for water both current and foreseeable.

The draft WSSP was developed following an initial consultation with statutory bodies and the public in mid-2014.

The WSP has been in development for almost two decades, and therefore runs parallel to, and pre-dates Irish Water's WSSP obligations. The discipline of strategic planning, holding a national perspective, embodied in the WSSP, was nonetheless embraced in the review on the *Project Need Report*, and continues to inform the Project.

Irish Water invited submissions on the draft WSSP from the 19th February to the 17th April 2015<sup>5</sup>, and represents the Tier 1 Strategic Plan for Irish Water, whilst the *Project Need Report* was issued for public consultation on 10<sup>th</sup> March 2015.

Conclusions and recommendations drawn from the *Project Need Report* included:

- i. The population of the Water Supply Area, on realistic planning scenarios, will rise from 1.52m at the 2011 Census, to between 2.02m and 2.15m by 2050. Depending on the source option which emerges as preferred, a Benefiting Corridor if it were routed across the Midlands, would rise from 0.53m at 2011, to approximately 0.68m by 2050.
- ii. The existing water supply sources serving the Water Supply Area can currently supply 623 MI/d at full production capacity under stressed conditions, against current average day demand of 540 MI/d. With respect to water supply management, and best international practices, there is inadequate provision for 'buffering' demand peaks and system outages.
- iii. The provision of water to the Water Supply Area and Benefiting Corridor will involve all elements of water conservation, tackling water losses and provision of a new source of supply. The requirement is to both minimise water demand, and to diversify risk from over dependence on existing sources.
- iv. The independent review by Indecon Economists underlined the strategic importance of secure, high quality water supplies for the key exporting sectors of the Irish economy. IDA has also emphasized the importance of resilient water supplies, not only for new industry considering locating in Ireland, but also those already established here, and considering expansion. On demographic, economic and water demand projections, and on considerations of resilience of supply, a need for a new water supply source for the Water Supply Area was established.
- v. A New Source water requirement of 330 MI/d by the year 2050 phased to provide 267 MI/d for an option serving the Midlands and East by the year 2022.

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<sup>5</sup> Following the consultation, the plan is now being finalised and a statement on the Strategic Environmental Assessment is being prepared.



The public consultation on Need, initiated by issuance of the *Project Need Report*, sought feedback on the work presented, and the conclusions / recommendations drawn, for due consideration in the next stage.

## 2.5 Water Supply Options Working Paper – Project Road Map Stage 2

The *Water Supply Options Working Paper* was the second consultative stage of the Project Road Map as outlined in Figure 2-3, and included consideration of the following:

- A review of previous work and recommendations;
- Identification of changes to National / European Legislation and European Site Designations;
- Identification of other relevant changes or new information that had become available since the completion of the body of previous work reported in Figure 2-4;
- Incorporation of any legacy items that were raised as part of the earlier SEA public consultation process.
- Re-visitation, reassessment, and re-evaluation with updated assessment methodologies, of those water supply options identified previously in the body of work from Figure 2-4 to determine:
  - Do those water supply options remain valid?
  - Do those water supply options require further investigation/study?
  - Are there any new water supply options available?
- Identification of the methodology and criteria on which water supply options will be assessed in identification of a Preferred Option.

The earlier SEA assessed 10 Options (and sub-options), and ranked the top 4 technically viable options as follows:

- i. Option F2 (Lough Derg with Storage)
- ii. Option B (Lough Derg Direct)
- iii. Option C (Parteen Basin Reservoir Direct)
- iv. Option H (Desalination)

As a consequence of this second consultative stage, it was affirmed that these top 4 technically viable options still remain appropriate, and be considered further (during the EIA & Planning Process).

The SEA had expressed a preference at the time for Option F2 (Lough Derg with Storage). However, this was provisional and was qualified pending substantiation through additional investigative works. These investigative studies were identified as:

- a) Water quality modelling of Lough Derg and Parteen Basin Reservoir; and
- b) A full geophysical survey of the soil and bedrock conditions at Garryhinch.

These investigative studies have, and are being undertaken as part of the WSP Project, and are reported upon within this document; the *Preliminary Options Appraisal Report - Stage 3* of the Project Road Map.

The *Water Supply Options Working Paper* concludes by identifying constraints, which were a range of limiting factors on site selection for infrastructure, and assessment criteria to be applied in further assessment of the identified top 4 technically viable options.

An initial selection of constraints was mapped, and defined a 'white space' within which project infrastructure would be sited, i.e. a 'space' of least constraints.

A further public consultative process was undertaken on the *Water Supply Options Working Paper*, Project Road Map Stage 2, which sought feedback on:

- The range of identified constraints – in order to establish whether additional relevant constraints should be given due consideration; and
- The proposed assessment criteria to be used in further appraisal of Options at the next stage.

This Report presents, and considers, the findings from the Stage 2 consultative process.

## **2.6 Preliminary Options Appraisal Report - Project Road Map Stage 3**

This is the current stage of the WSP.

The work reported in this Report includes:

- A review, and consideration, of all the submissions received as part of the public consultation process on the Stage 2 document – *Water Supply Options Working Paper*;
- Identification of any other relevant changes or new information that has become available since publication of the Stage 2 document – *Water Supply Options Working Paper*;
- A relative assessment of the top 4 technically viable options identified in the Stage 2 document – *Water Supply Options Working Paper*, on the basis of 'people related' and 'environment related' impacts. These impacts were considered under the following broad categories:
  - Biodiversity, Flora and Fauna
  - Fisheries
  - Air/Climatic Factors
  - Material Assets (Energy)
  - Sustainability
  - Cultural Heritage (including Architecture & Archaeology)
  - Landscape & Visual
  - Material Assets (Land use)
  - Tourism

- Population
- Human Health
- Soils, Geology and Hydrogeology
- A relative assessment of the top 4 technically viable options identified at Stage 2 on the basis of other ‘technical’ impacts such as:
  - Safety
  - Planning Policy
  - Engineering and Design
  - Capital and Operating Costs
  - Sustainability
  - Consideration of Risk.

This Report (Stage 3) was tasked with identifying an Emerging Preferred Option from the top 4 technically viable options identified in the *Water Supply Options Working Paper*.

## 2.7 Preliminary Options Appraisal Report - Project Road Map Stage 3

The Report is structured as follows:

Section 1 – Executive Summary

Section 2 – This section (Introduction and Background)

Section 3 – Introduces and summarises the Reasonable Alternative Options under consideration.

Section 4 – Introduces the submissions that were received as part of the Public Consultation process for the Stage 2 *Water Supply Options Working Paper*, and the responses prepared.

Section 5 – Outlines the proposed options appraisal strategy to be utilised in the identification of a Preferred Option.

Section 6 – A number of investigative studies were carried out to support the options appraisal strategy. They are presented in this section.

Section 7 – This section outlines the Multi-Criteria Analysis, one of the ‘tools’ used as part of the options appraisal strategy, and short-lists the options from four to two for further detailed assessment.

Section 8 – The two remaining options have a number of key elements that need to be considered, and which may have a bearing on the outcome of the final option assessment. This section outlines these key elements, and discusses their influence on the selection process.

Section 9 – This section draws a comparison between the two remaining options, and identifies the Emerging Preferred Option.

Section 10 – This section summaries potential community benefit opportunities.

Section 11 – This section summaries the methodology for options appraisal, and draws conclusions.

Section 12 – Outlines the next preparatory steps in overall scheme development.

The Report is supported by five volumes of appendices, Volume 2 through 6, provided at the back of the report. These contain detail of the reviews / assessments which were undertaken in support of the preparation for this Preliminary Options Appraisal Report.



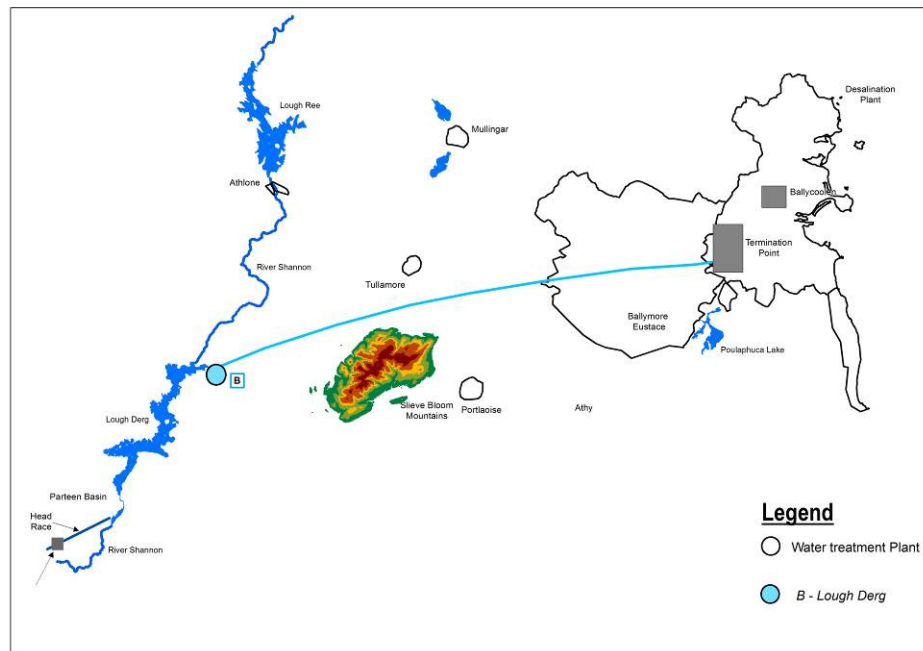
# 3 Reasonable Alternative Options

## 3.1 Introduction

The *Water Supply Options Working Paper – Project Road Map Stage 2* identified 4 reasonable, and technically viable, alternative options from an initial grouping of 10 proposed within the SEA. These are reconfirmed below.

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)
- Option H (Desalination)

## 3.2 Option B - Lough Derg (Direct)



**Figure 3-1 Option B: Lough Derg (Direct)**

This is a constant abstraction design concept. It involves abstraction and treatment on the eastern shore of Lough Derg and a distance of 122km for treated water transfer, capable of supplying communities on route.

### 3.3 Option C – Parteen Basin Reservoir (Direct)

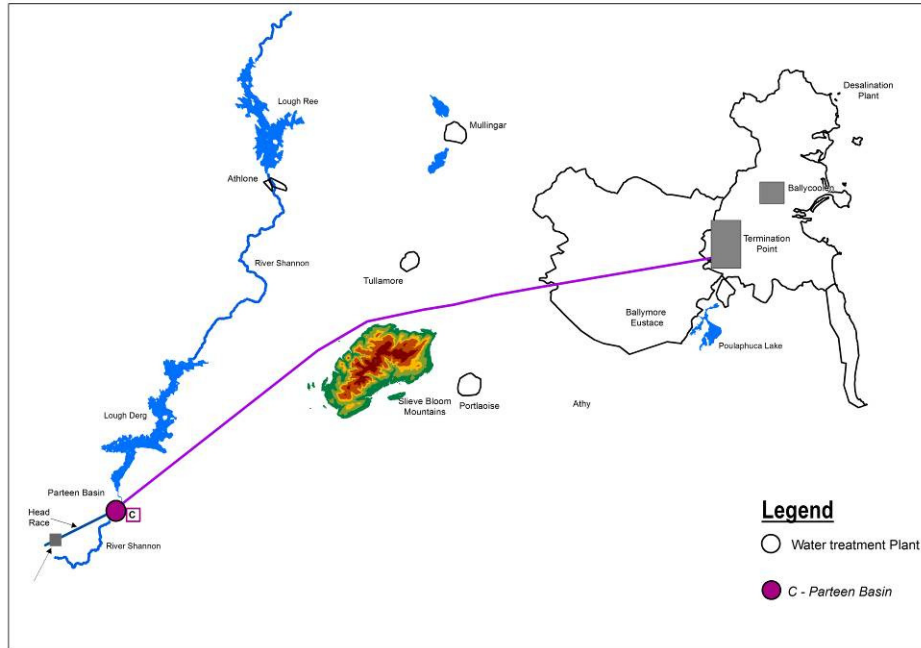


Figure 3-2 Option C: Parteen Basin Reservoir (Direct)

This is a constant abstraction design concept. It involves abstraction and treatment on the shore of Parteen Basin Reservoir, with a longer distance of 165km for treated water transfer, capable of supplying communities on route.

### 3.4 Option F2 – Lough Derg and Storage (Garryhinch)

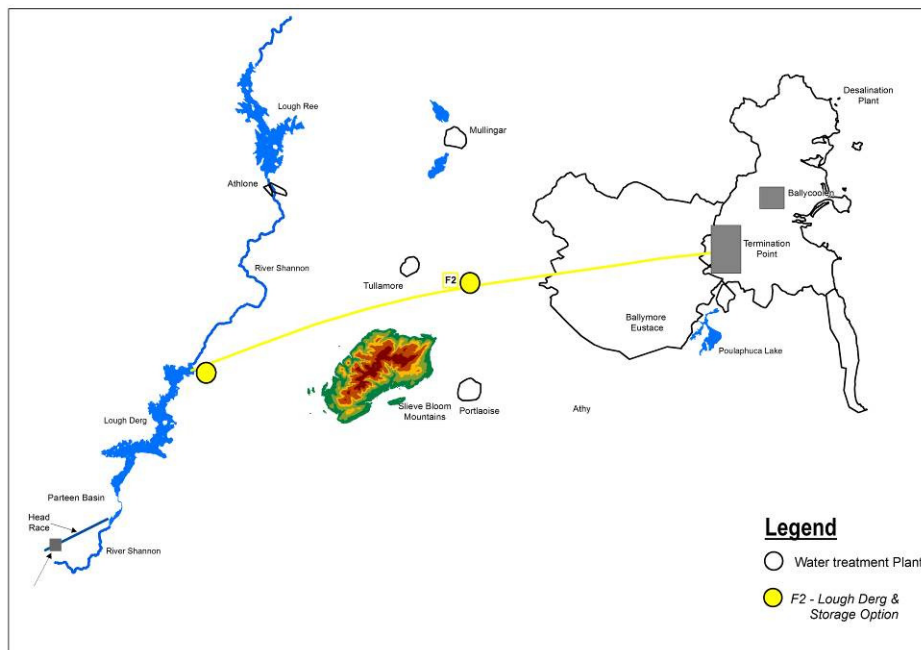
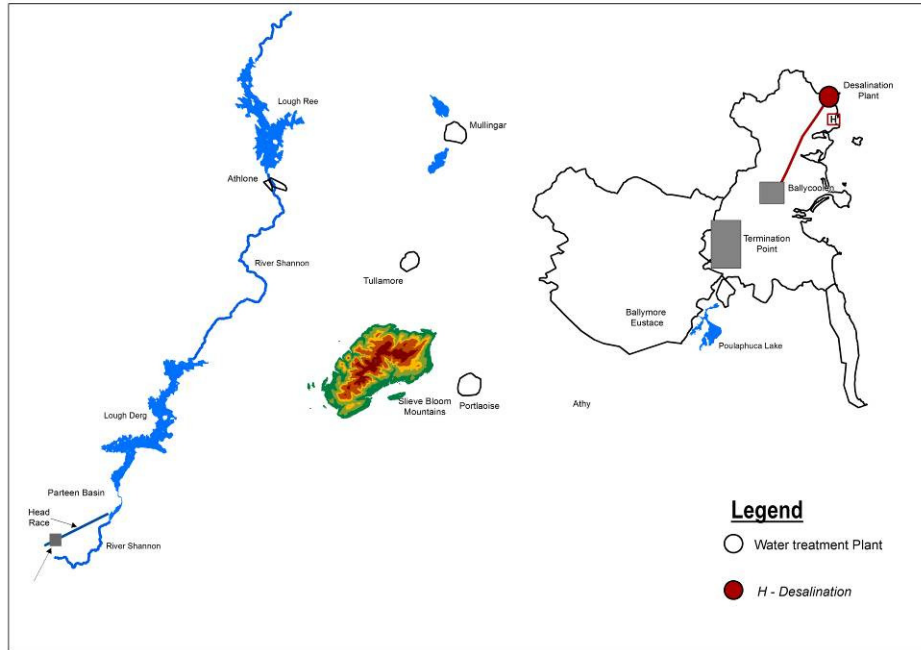


Figure 3-3 Option F2 – Lough Derg and Storage (Garryhinch)

This is a variable abstraction design concept. It involves abstraction on the eastern shore of Lough Derg in combination with bog storage at Garryhinch. Storage

facilities would accommodate up to 2 months average supply requirements. Overall raw water and treated water transfer pipelines are approximately 122km in length, in a configuration which could supply treated water to communities east of Portarlington.

### 3.5 Option H – Desalination



**Figure 3-4 Option H: Desalination**

This option involves abstraction of sea water from the Irish Sea in north Fingal, desalination of sea water through a Reverse Osmosis (RO) desalination plant, pumping of treated water to Ballycoolen reservoirs via 25 km pipelines, capable of supplying treated water to locations on route, and discharge of brine (from the treatment process) back into the Irish Sea.

This section should be read in conjunction with *Appendix H: Options Working Paper - Consultation Submissions Report* which presents the findings from the Options Working Paper consultation.

#### **4.1 Introduction**

Public consultation was undertaken on the *Water Supply Options Working Paper* (OWP) between the period 9th June and 4th August 2015. This was the second of five non-statutory public consultation stages of the WSP (refer to Sections 2.2 and 2.5), and sought feedback on:

1. What other national, regional or locally important Constraints should Irish Water take into account when locating the infrastructure associated with each water supply option?
2. Have you any comments on the proposed Constraints and the approach to their use?
3. Are there any Assessment Criteria other than those proposed which should be used in the next phase of options appraisal?
4. How would you like to be communicated with as the project progresses?

This public consultation informed the multi-criteria analysis, Refer to Sections 7 and 8.

#### **4.2 Consultation Feedback**

There were 46 submissions received during the public consultation process on the OWP. In addition, there were 16 submissions carried forward from the first round of public consultation on the *Project Need Report*. This represented a total of 62 submissions to be considered.

##### **4.2.1 Submissions Received**

Submissions covered a wide spectrum of issues, from conservation measures and leakage control to the importance of a nationally coherent approach to spatial planning and the application of environmental law.

The Submission themes are as follows:

1. Options
  - Desalination,
  - Lough Derg (Direct) / Lough Derg and Storage / Parteen Basin
  - Other options and alternatives
2. Water Conservation
  - Leakage
  - Conservation Initiatives
3. Constraints and Assessment Criteria
4. Economic Development

5. Water Demand
6. Environment
  - Biodiversity
  - Climate change
  - Fisheries
  - Alien Invasive Species
7. Water Framework and Habitats Directives
  - Water Framework Directive
  - Habitats Directive
8. Communities / Benefitting Corridor
  - Benefitting Corridor Demand & Source Consolidation
  - Farming
9. Tourism and Amenity
  - Tourism and Raw Water Storage
10. Planning
  - Planning Policy
  - Planning Horizon
  - Legal Issues
11. Other
  - Plumbosolvency
  - Recommendations
  - Questions raised

The themes are discussed in detail in Section 3 of the Consultation Submissions Report in Appendix H.

#### **4.2.2 Response to submissions**

Every submission received was acknowledged and logged. All submissions were then compiled and reviewed.

Section 4 of the Consultation Submissions Report in Appendix H describes all the issues raised during this public consultation phase under the appropriate theme.

#### **4.3 Next Step**

The issues / themes raised during the *Water Supply Options Working Paper* public consultation will be further reviewed as more data becomes available from follow-on consultations, and will be considered as part of the wider development of the project prior to the preparation of a Planning Application.

As shown in the Project Road Map in Figure 2-3, this consultation is part of a series of Consultations that will take place, and which aim to elicit views from stakeholders and interested parties at each stage in the Water Supply Project.

The publication of the Preliminary Options Appraisal Report, which outlines the Emerging Preferred Option, ancillary site selection and the pipeline route corridor, represents the third of five non-statutory public consultation stages.

**5****Appraisal of Options****5.1 Introduction**

This *Preliminary Options Appraisal Report* documents the work undertaken in Assessment of Reasonable Alternatives (Phase 4) and in the option assessment process (Phase 5), refer to Appendix A.

The Assessment of Reasonable Alternatives (Phase 4) was outlined within the *Water Supply Options Working Paper* (refer to Section 2.5) by the following 4 step process:

- Step 1: Assessment of the findings of particular investigative studies to determine whether anything of such significance has been identified which may make the development of any of the reasonable alternatives unfeasible.
- Step 2 Assessment of the individual components of the options (abstraction, pipeline, storage, terminal point). This will involve identification of site constraints for the individual components and the identification of potential mitigation measures where it is not possible to avoid impacts by good siting and routing of infrastructure from the onset.
- Step 3 Preparation of preliminary cost estimates.
- Step 4 Final combination of individual components into one overall emerging preferred option assessment matrix, with 'more' and 'less' favourable classifications assigned to identified constraints. Selection of emerging preferred option will be based on the relative performance of each of the options against the Environmental, Technical and Cost criteria considered.

In addition to this process, the *Water Supply Options Working Paper* presented a list of appraisal criteria, on which public feedback was sought (Table 5-A):

**Table 5-A Appraisal Criteria**

Environmental Criteria	Technical Criteria	Risk Criteria
Biodiversity, Flora and Fauna	Safety	Technical Risk relating to the Source
Fisheries	Planning Policy	Technical Risk relating to Infrastructure and Operations
Water	Engineering and Design	Environmental and Planning Risk
Air/Climatic Factors	Capital and Operational Costs	Financial Risk
Material Assets (Energy)	Sustainability	Socio-economic risk
Cultural Heritage (including Architecture & Archaeology)		
Landscape & Visual		
Material Assets (Land use)		
Tourism		
Population		
Human Health		
Soils, Geology and Hydrogeology		

## 5.2 Approach to Appraisal of Reasonable Alternative Options (Phase 4)

### 5.2.1 Specialist Appraisal

To undertake the appraisal of the reasonable alternative options, a range of Specialists were engaged to cover the following disciplines:

- i. **Ecology** – the consideration of impact on animals, plants and their environment.
- ii. **Water** – the consideration of impacts on the surface water environment.
- iii. **Air and Noise** - the consideration of air and noise pollution
- iv. **Cultural Heritage** - the consideration of existing archaeological and built heritage
- v. **Soils, Geology and Hydrogeology** – the consideration of impact on soils, geology and hydrogeology.
- vi. **Landscape and visual** – the consideration of landscape and visual impact.
- vii. **Agronomy** – the consideration of impact on land based enterprise.
- viii. **People** – the consideration of impacts on people
- ix. **Planning** – the consideration of planning and land use policy in relation to proposed works
- x. **Engineering** - the consideration of technical challenges associated with proposed works.
- xi. **Traffic** - the consideration of impact on traffic and road network



### 5.2.2 Methodology

The fundamental approach in the assessment of the reasonable alternative options was to utilise the Specialist expertise, in their applicable fields, to conduct a comparative analysis.

The following methodology was employed:

1. Individual Specialists were engaged to independently assess each option relative to the criteria applicable to their field of expertise, and establish an initial position on the least impact under each criteria listed in Table 5-A.
2. The initial position of each Specialist was collated and presented in matrix format, and presented at a workshop where all the other Specialists were represented.
3. In this workshop setting, the matrix of initial individual assessments was presented to the Specialist Collective. The position of each of the Specialists was then discussed to reach a consensus of agreement on an emerging preferred option from the 4 reasonable alternative options.

### 5.2.3 Water Supply Options Working Paper – Consultation Feedback

Submissions from the public consultation on the Water Supply Options Working Paper were received by the project team, refer to Section 4.

Feedback from the consultation process was considered by the Specialists, primarily to establish if there was any impact as part of the individual assessments process, but also within the collective arrangements facilitated by the workshop setting.

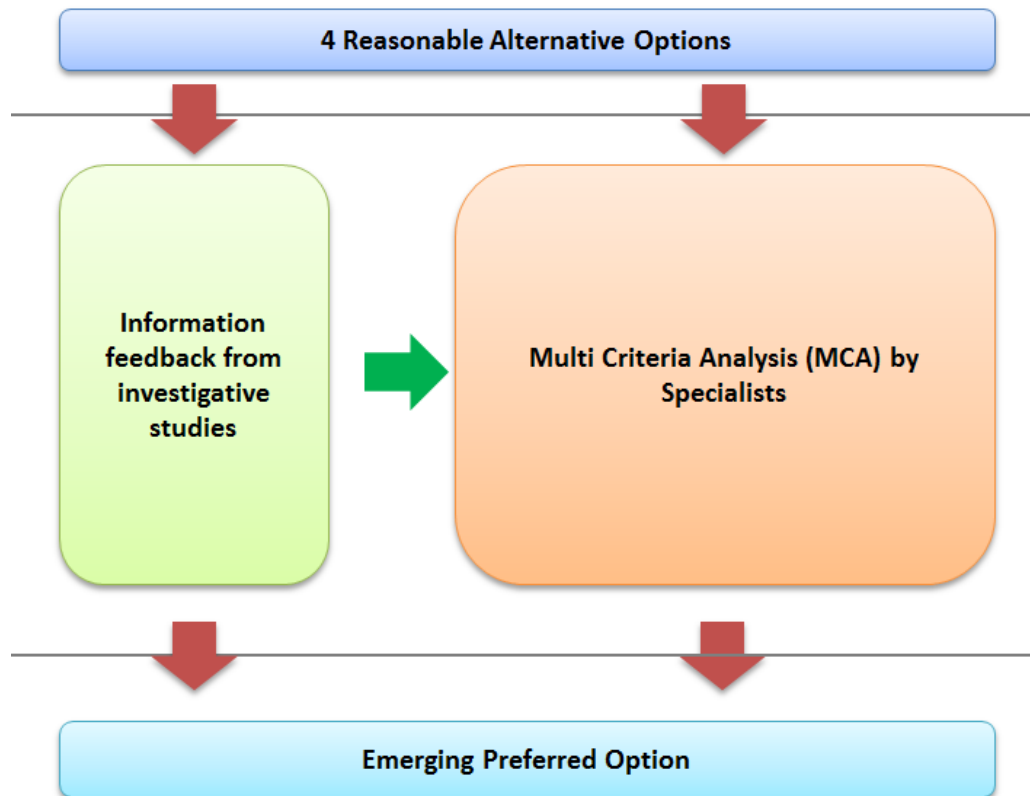
### 5.2.4 Appraisal Process

This appraisal of options by Specialists, considering the criteria applicable to their discipline, was informed by the interpretation of datasets and information sources made available.

Key amongst these information sources were, and are, the investigative studies recommended in the SEA, which are either ongoing or have been completed within this project planning stage, namely:

- Water quality modelling of Lough Derg and Parteen Basin Reservoir; and
- A full geophysical survey of the soil and bedrock conditions at Garryhinch.

With regular information forthcoming from these studies, option appraisal was defined by a two part parallel process; refer to Figure 5-1.



**Figure 5-1 Phase 4 Options Assessment**

Note: Multi Criteria Analysis (MCA) is a mechanism that explicitly considers multiple criteria, as stated in Table 5-A, within a decision-making environment. The MCA approach to the WSP is outlined in Section 5.2.2, and discussed in further detail in Section 7.

### 5.3 Reporting structure

The MCA process is presented as a number of statements compiled by the various specialisms using the criteria defined by table 5-A. The breakdown of criteria to specialism is provided in the below Table 5 – B.

**Table 5-B Applicable Criteria to each specialism**

Specialism	Applicable Criteria
Ecology	Biodiversity, Flora and Fauna, Fisheries
Air and Noise	Air/Climatic Factors
Cultural Heritage	Cultural Heritage (including Architecture & Archaeology)
Soils, Geology and Hydrogeology	Soils, Geology and Hydrogeology
Landscape and visual	Landscape & Visual
Agronomy	Material Assets (Land use)
Water	Water <sup>6</sup>
Engineering	Material Assets (Energy), Safety, Engineering and

<sup>6</sup> Water, as an environmental factor in multi criteria analysis, considers the requirements of the Water Framework Directive

	Design, Capital and Operational Cost, Sustainability, Risk
Planning	Planning Policy
People	Tourism, Population, Human Health

## 5.4 Option Appraisal by Infrastructure element

The selection of 4 reasonable alternative options from the 10 options considered within the SEA process was founded on two key considerations (refer to Section 5 of the *Water Supply Options Working Paper*) namely that of:

- Source yield technical assessment; and
- Habitats Directive Assessment.

While presented as two separate assessments, the considerations of source yield sustainability and compliance with the habitats directive are closely interlinked, as there is a potential for the hydraulic effects of water abstraction to directly impact the ecology of the source waterbody.

### 5.4.1 Principle Driver in Option Appraisal

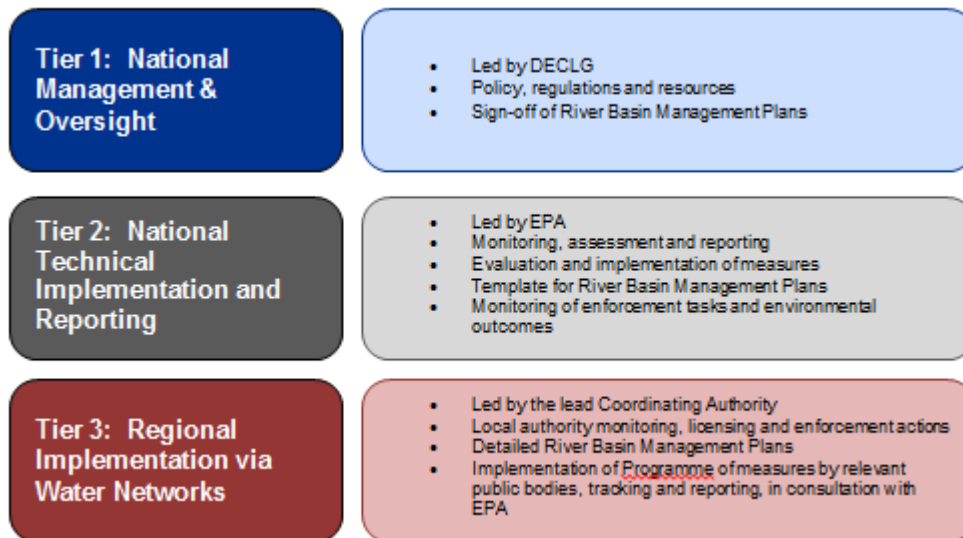
**The consideration of impact associated with abstraction works, its interaction with the source water body, and sustainability of that source to provide a reliable supply is the principle driver in the Options Appraisal Process.**

When the consideration of impact associated with abstraction no longer provides a clear differentiating factor between the reasonable alternative options, the assessment process is defined by the other outstanding criteria, refer to Table 5A.

## 5.5 Water Framework Directive

Consultation submissions have emphasised the importance of the Water Framework Directive (WFD), and the central role of river basin management. The Options Working Paper (OWP) continued the emphasis on the WFD on options appraisal, which the SEA had already adopted. The OWP appendices examining surface water abstraction, groundwater, flood management, impoundments, and low flow regimes considered the requirements of the WFD, and this will continue.

The governance structure for the WFD in Ireland, established by the Minister of the Environment, Community and Local Government under statute in the European Union (Water Policy) Regulations 2014 (SI 350 of 2015), is illustrated in Figure 5-2.



**Figure 5-2 New Governance Structures for Water Framework Directive<sup>7</sup>**

Irish Water has already presented to the Water Policy Advisory Committee (WPAC)<sup>8</sup>, established by the Minister, on its Water Services Strategic Plan. Other stakeholders, who have been consulted on the WSP, have emphasised the central role of the WFD in water resource management and planning.

The Minister of the Environment, Community and Local Government is currently consulting on the development of new River Basin Management Plans; the WSP is cognisant of review work which has been carried out on characterisation of water bodies.

The requirements under the WFD for sustainable abstraction have been centrally recognized in the WSP, through the investment by IW in hydrodynamic modelling and water quality monitoring, and in the conclusions drawn from the work done to date. Engagement with Tier 3 of the governance structure in Figure 5.2 has also commenced to ensure that IW’s implementation of the Water Framework Directive in the WSP is meaningful in the Lough Derg / Parteen Basin area.

The ongoing appraisal of the options for abstraction from the lower Shannon in the Parteen area, and Desalination will document compliance with the WFD of the preferred solution.

<sup>7</sup> Diagram courtesy of DECLG " Significant Water Management Issues in Ireland " June 2015

<sup>8</sup> Dept of the Environment, Community and Local Government, Dept of Agriculture, Food and the Marine, Dept of Communications, Energy and Natural Resources, Dept of Arts, Heritage and the Gaeltacht (NPWS), Dept of Health, Environmental Protection Agency, County and City Management Association, Commissioners for Public Works, Commissioner for Energy Regulation, Health Service Executive

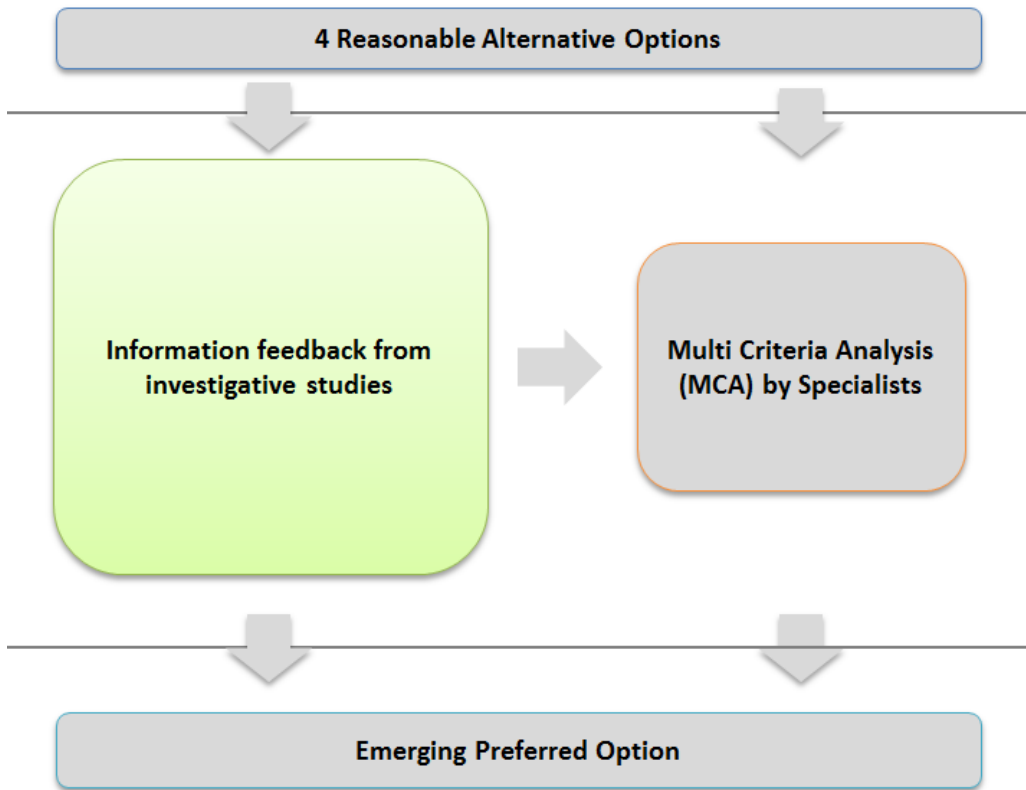
# 6 Investigative Studies

## 6.1 Introduction

A two part parallel assessment process has been applied in the appraisal of reasonable alternative options, refer to Section 5.2.4.

As mentioned in Section 5.2.4 the investigative studies recommended in the SEA, were:

- ❖ Water quality modelling of Lough Derg and Parteen Basin Reservoir (ONGOING); and
- ❖ A full geophysical survey of the soil and bedrock conditions at Garryinch (COMPLETE).



**Figure 6-1 Options Assessment – Investigative Studies**

This section 6 provides comment on the investigative studies that have, and are being undertaken to support and inform the assessment of options.

## 6.2 Background

The requirement for additional investigative studies was originally identified within the SEA process, and in recognition of limitations within the then current datasets to support the identification of a “recommended option”.

These studies are confirmed in Section 6.1.

The SEA provisionally identified, and recommended, an option (primarily for meeting the Eastern Region Needs); which involved abstraction from Lough Derg in combination with a proposed raw water storage and water treatment facility at Garryhinch in the Midlands.

However, the SEA fully recognised that, if this recommendation was to be advanced through the Environmental Impact Assessment (EIA) and Planning Phase, it would need to be supported with data from investigative studies, such as water quality modelling and subsoil surveys. These investigations were required to assess existing conditions in Lough Derg / Parteen Basin and at a potential raw water storage site at Garryhinch Bog.

Whilst the subsoil survey, specifically commissioned for assessing the suitability of Garryhinch Bog as a raw water storage site, has been completed, the construction of a calibrated water quality model for Lough Derg / Parteen Basin is subject to identification and verification of a number of measurable parameters, including:

- Water depths;
- Water flow and current;
- Water quality;
- Water treatability;
- Water temperature;
- Meteorological conditions; and
- Aquatic organisms such as establishing plankton levels.

A bathymetry survey (water depths) for Lough Derg / Parteen Basin was carried out in Q2-Q3 2015; survey data is now becoming available and will be used to refine the hydrodynamic model.

*Note: the hydrodynamic model is a computational numerical model able to describe or represent the motion of water. In this case, for Lough Derg and Parteen Basin, and is the basis for the water quality model.*

The other studies are still ongoing, and will not be concluded until a period of data collection for 26 months from April 2015 has elapsed.

### 6.3 Hydrodynamic Modelling

This section should be read in conjunction with *Appendix C*: which presents the results from the Hydrodynamic Modelling undertaken to date. The hydrodynamic model is the first step in a process towards development of a calibrated water quality model.

The objective of the hydrodynamic modelling is to assess the existing flushing<sup>9</sup> characteristics of Lough Derg and Parteen Basin and to examine how various abstraction options impact on it. The flushing characteristics were assessed for the period from October 1994 to December 1995, this being the reference period for the calibration of models and options appraisal in the original SEA process, and also because it encompassed periods of very high flow on the Shannon (January 1995) as well as periods of extreme low flows (August -September 1995).

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<sup>9</sup> *Flushing, or lake retention, time is a calculated quantity expressing the mean time that water (or some particular dissolved substance) spends in the lake and expresses the amount of time taken for a substance introduced into a lake to flow out of it again.*

In this Preliminary Options Appraisal Report, the model development to date has been based on existing, and limited, bathymetry data from earlier studies. At the time of preparing this Report the more detailed, and accurate, data from the bathymetry survey commissioned under the WSP was only becoming available. The latter will be incorporated into the later water quality model.

Nevertheless, a preliminary assessment of the model outputs has been made; in the clear and important understanding that assumptions to date are subject to change pending receipt of ongoing survey data and verification within an updated model.

This updated model, incorporating the latest bathymetry data, will be available for the Final Options Appraisal Report.

### 6.3.1 Model Scenarios

Each of the options had to satisfy certain requirements, and the scenarios that were developed, and which were modelled, were chosen to elicit the fullest understanding of the behavioural characteristics within the Lough Derg / Parteen Basin water body. The model was used to ascertain how abstraction of water at a pre-determined rate behaved seasonally in an extreme event. The latter was based on historical record and encompassed the drought year of 1995.

The model ran scenarios for the following options:

- i. Option F2 (North East Lough Derg with Storage)
- ii. Option B (North East Lough Derg Direct)
- iii. Option C (Parteen Basin Reservoir Direct)

Each of the options had to satisfy a water abstraction requirement of 350 MI/d, as was referenced in the DCC Adopted Plan and SEA, which were published in 2011. In the case of Options B and C this was a constant year-round abstraction regime. However, Option F2 was predicated on the following:

- A variable abstraction rate incorporating a 2 month storage volume at Garryhinch in the Midlands;
- An increased abstraction rate, from 350 MI/d to 410 MI/d, for a 10 month period in any given year to facilitate filling and storage at Garryhinch.
- For the other 2 months of the year, during the summer when river flows are at their lowest, abstraction would be curtailed to 50 MI/d, the balance being drawn from the storage at Garryhinch and thereby potentially mitigating any adverse impact on lake residence time that an all year-round abstraction might have.

A variation to Option F2 considered whether a larger storage, holding 3 months balancing volume rather than 2 months, would provide improved mitigation. In this situation 450 MI/d were maintained over 9 months, with 50 MI/d being abstracted over the longer 3 month period.

Options F2 and B were predicated on an abstraction from north east Lough Derg, however consideration was also afforded to an abstraction location farther south, in Youghal Bay (see Figure 7-2), to investigate whether this gave substantially different results on residence times.

A total of 10 scenarios were modelled and reported on (see Appendix C). These and their findings are summarised in Table 6-A.



Scenario No.	Description	Notes	Comment
1	Winter - baseline (no abstraction)	Existing hydrodynamic regime in Lough Derg during winter flow conditions.	Residence times are low in Lough Derg in winter but some spatial variation evident in bays.
2	Winter - constant abstraction (350 MI/d) in northeast Lough Derg ( <b>Option B</b> )	Option B - hydrodynamic regime in Lough Derg during winter flow conditions	Low impact on residence times in Lough Derg due to difference in relative magnitude of flows. Slight local reduction in residence time in the immediate vicinity of the abstraction intake.
3	Winter - variable abstraction in northeast Lough Derg (410 MI/d:50 MI/d ) ( <b>Option F2</b> )	Option F2 - hydrodynamic regime in Lough Derg during winter flow conditions with variable abstraction.	Abstraction in winter conditions has low impact on residence times in Lough Derg due to difference in relative magnitude of flows. Little difference between variable abstraction and constant abstraction under winter conditions
4	Winter - constant abstraction (350 MI/d) in Parteen Basin ( <b>Option C</b> )	Option C - hydrodynamic regime in Lough Derg during winter flow conditions with constant abstraction.	No impact on residence time in Lough Derg.
5	Summer - baseline (no abstraction)	Existing hydrodynamic regime in Lough Derg during summer low flow conditions.	Spatial variation evident in residence time under existing natural conditions from north to south and in lateral bays. Southern section above Killaloe has residence time above average for lake as a whole.
6	Summer - constant abstraction (350 MI/d) in northeast Lough Derg ( <b>Option B</b> )	Option B - hydrodynamic regime in Lough Derg during summer low flow conditions with constant abstraction	Worst case residence time impacts of the order of 42 days in the southern region of the lake where baseline residence time is also elevated ( <b>see figure 6-2</b> ).
7	Summer - variable abstraction in northeast Lough Derg (410 MI/d:50 MI/d ) ( <b>Option F2</b> )	Option F2 - hydrodynamic regime in Lough Derg during summer flow conditions with a variable abstraction.	Two months raw water storage does not appreciably mitigate residence time effects in southern Lough Derg over the Scenario 6 outcome. Prolonged duration of the drought in 1995 would bring about residence time impacts that could not be mitigated by raw water storage ( <b>see figure 6-3</b> ).
8	Summer - constant abstraction(350 MI/d) in Parteen Basin ( <b>Option C</b> )	Option C - hydrodynamic regime in Lough Derg during summer flow conditions with constant abstraction.	No prolongation of residence times anywhere in Lough Derg. Intake in Parteen Basin would slightly reduce (improve) existing baseline residence time in the Basin and in the area north of Killaloe ( <b>see figure 6-4</b> ).
9	Summer (450 MI/d:50 MI/d ) variable abstraction in northeast Lough Derg	Hydrodynamic regime in Lough Derg during summer flow conditions with a prolonged variable abstraction. 50% increase in storage at Garryhinch.	Does not produce residence time improvements significantly different from Scenario 7. Duration of the drought in 1995 would still bring about local residence time impacts in the southern section of the lake, even with an increased balancing storage volume.
10	Summer – (410 MI/d:50 MI/d ) variable abstraction in Youghal Bay	Hydrodynamic regime in Lough Derg during summer flow conditions with a variable abstraction.	Changing the point of abstraction from the north east of Lough Derg to Youghal Bay does not bring about a significant difference compared to Scenario 7.

**Table 6-A Abstraction Scenarios Modelled**

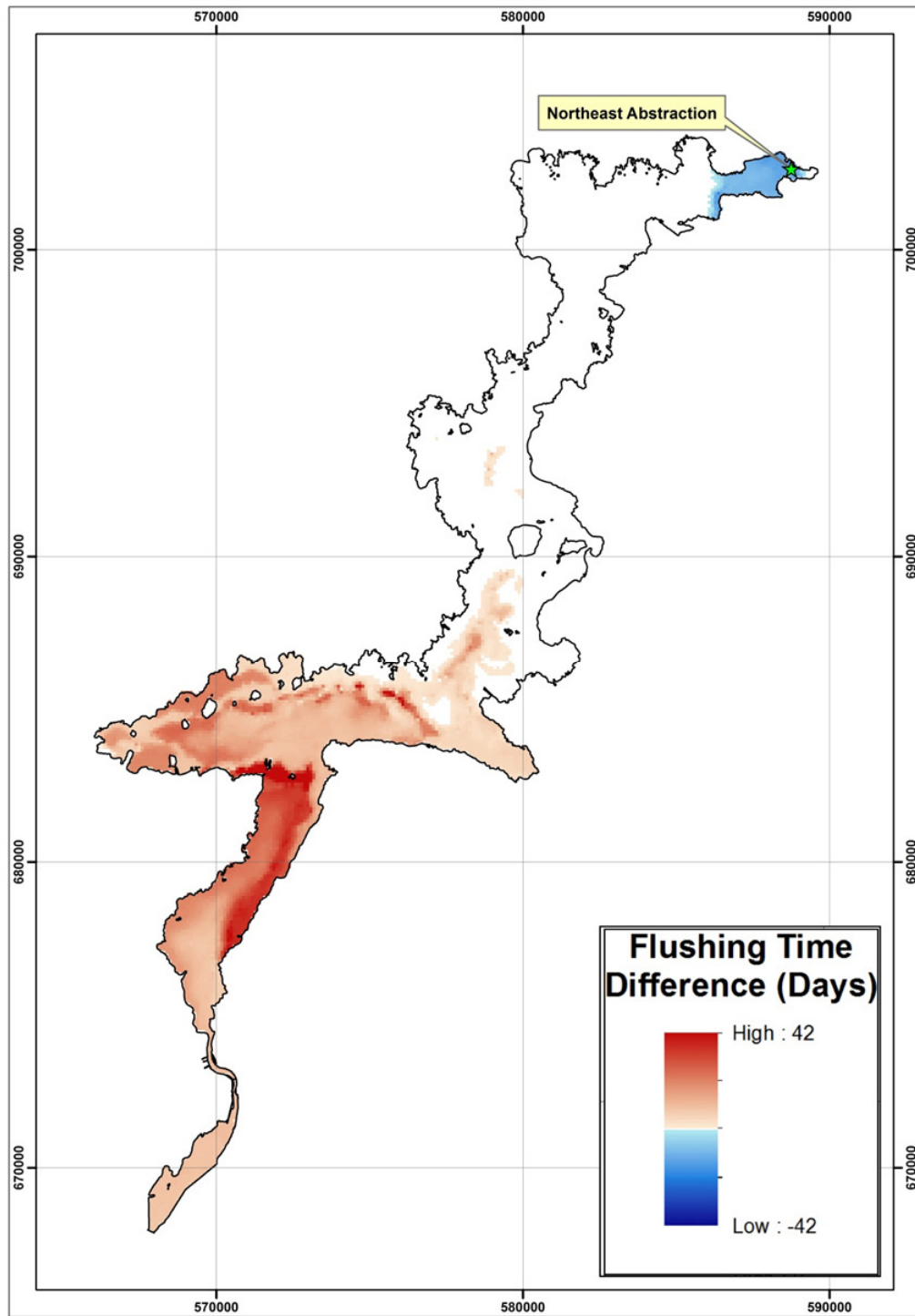


Figure 6-2 Option B – Impact on Flushing Times

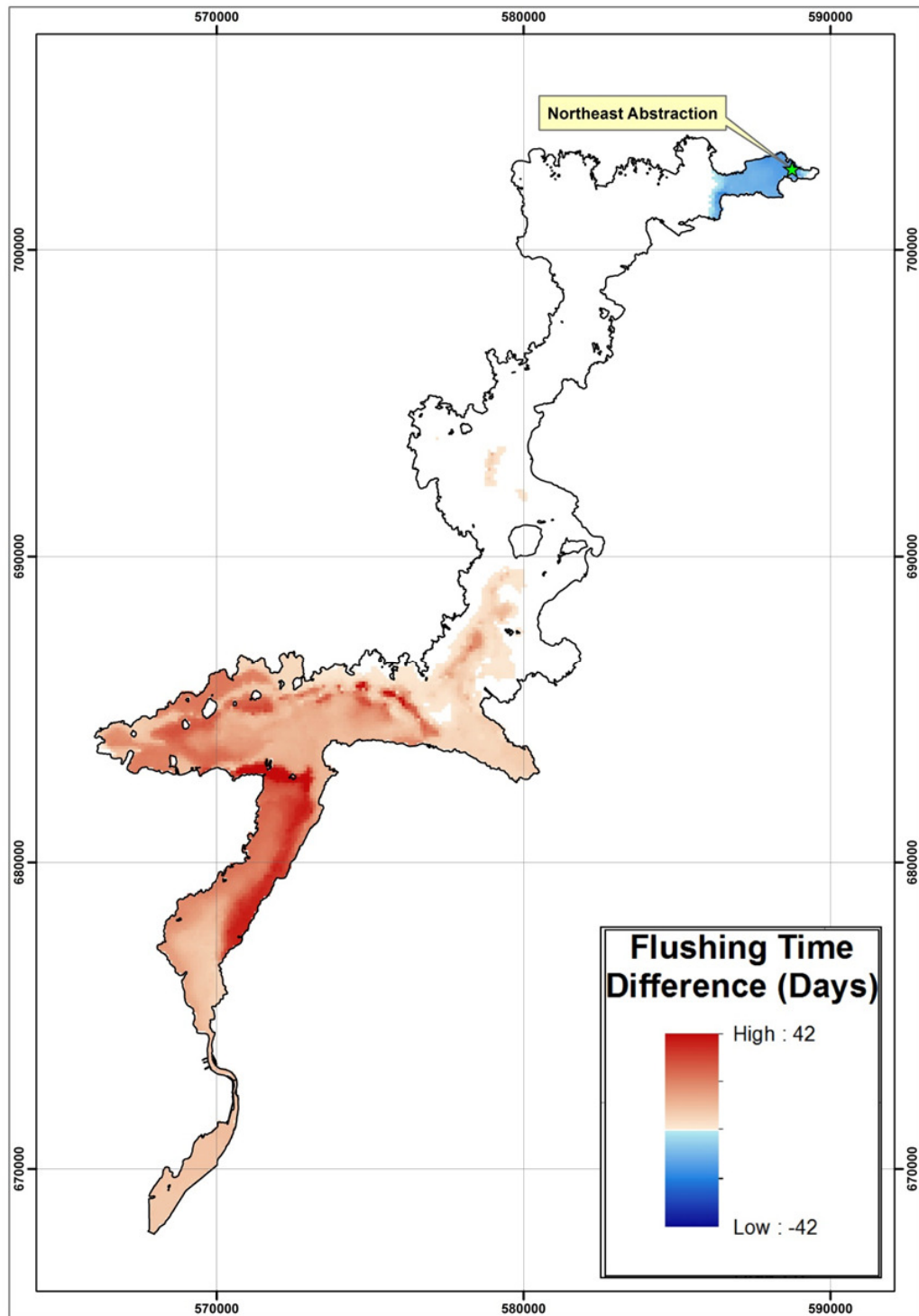
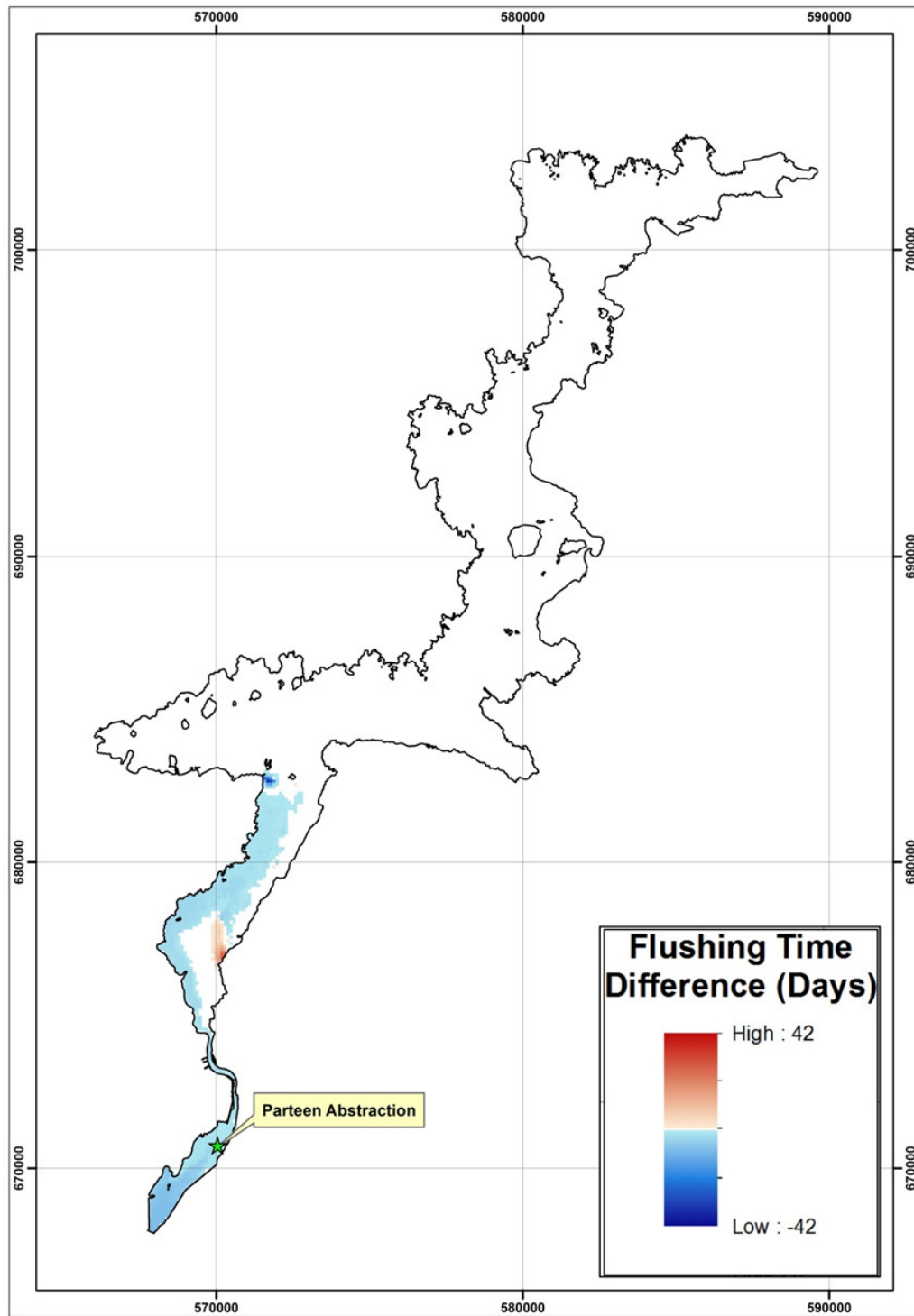


Figure 6-3 Option F2 – Impact on Flushing Times



**Figure 6-4 Option C – Impact on Flushing Times**

The Hydrodynamic Model Report is included in Appendix C. Figures 6-2, 6-3 and 6-4 have been re-produced from this Report; where they are labelled Figure 30, Figure 31 and Figure 32 respectively.

### 6.3.2 Issues with the Preliminary Model Results

The definitive position with modelling can only be arrived at with a full season of calibrating data, which is not available yet.

Low flows from the Shannon into Lough Derg at Portumna are associated with very low current speeds, of the order of 10mm/s; and very small changes in water level (in the range of 5mm) can have significant effects on the calculation of flows. Wind effects on the lake, depending on strength and direction, can bring changes in water level across the lake surface, over short time periods. Results from the ongoing surveys will continue to supplement the existing data sets.

### 6.4 Garryhinch GI Survey and Interpretation

This section should be read in conjunction with *Appendix D*: which presents the results from the ground investigations undertaken at Garryhinch Bog.

The site which has been considered for location of raw water storage is located at Garryhinch. A former major sod peat production facility, owned by Bord na Móna, it is located north of the R423 road between Portarlinton and Mountmellick and east of the N80 road between Tullamore and Mountmellick. The site area is approximately 580 hectares.

The site at Garryhinch is subject to an Integrated Pollution Control Licence No 503-01 issued by the Environmental Protection Agency (EPA), and covers a substantial area of the Allen Group peatlands in Laois, Offaly and Kildare.

The site lies within the River Barrow catchment, the river channel is designated as a Special Area of Conservation (cSAC) as indicated in Appendix D.

Irish Water commissioned a detailed investigation of the ground conditions at Garryhinch to expand on the detail available from previous investigation works at the site in 2009. The fieldwork was guided by a Geophysical Survey and was carried out between November 2014 and March 2015.

The results of the geophysical investigation are set out in Appendix D to this Report, which discusses the interpretation of subsoil investigation data as part of the appraisal of the risks associated with the construction a large scale raw water storage system and treatment facility at Garryhinch Bog.

The significant risks identified include:

- Karst features were identified in areas east and west of the site, increasing the risks of seepage and instability of embankments for both proposed reservoir and sludge lagoons. Furthermore the shear strength of silts on which embankments may be built is such as to represent a risk of unacceptably high settlement of embankments; ground improvement works may be required with resulting increased cost risks.
- The karst features also introduce the risk of a situation, in autumn months, where the floor of a near empty reservoir would be vulnerable in heavy rainfall conditions to rapid groundwater recovery, causing uplift and deformation, or even a breach, of the reservoir floor.
- Depths to rock across the site are greater than envisaged in the Preliminary Report, increasing the risk of higher construction costs and the feasibility of recovering rock for use in constructing the proposed embankments.

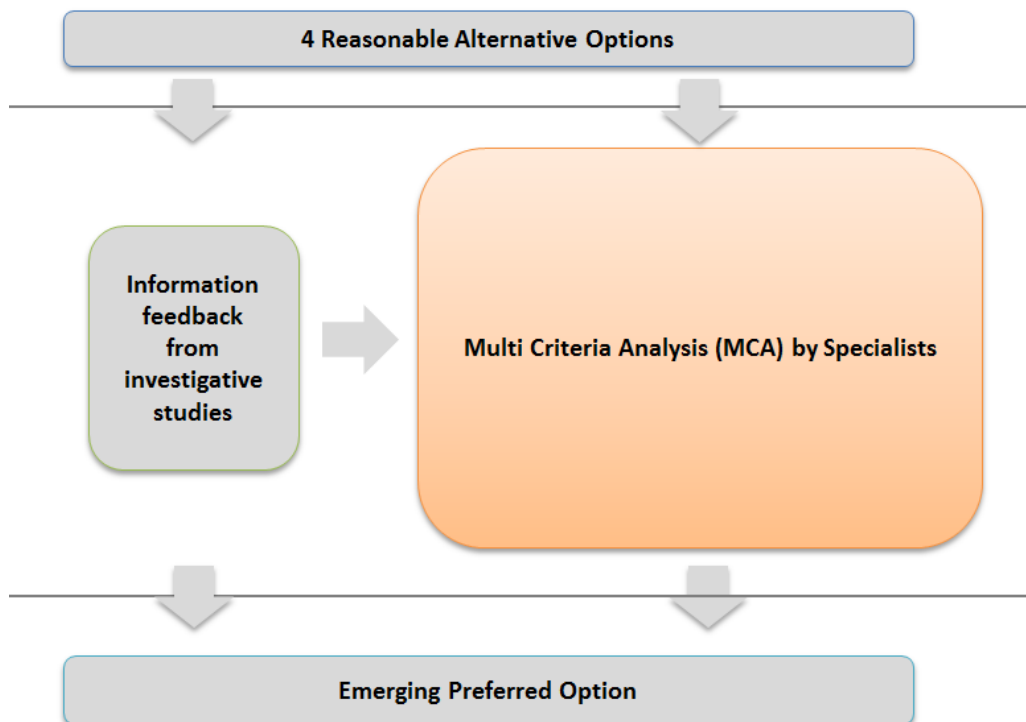
- The site contains soils with high permeability estimated to be 10% of the site area. These soils will require bentonite addition to lower the permeability.
- High groundwater levels exist throughout the year and throughout the site. Water levels were measured close to the surface level in March 2015 and by May 2015 the water levels dropped by variable amounts in the range 0.2m to 1.6m. Pump tests conducted on-site in September 2015 indicate that any dewatering operation will be difficult and will introduce significant cost, programming and environmental risks.
- Dewatering to the scale required at Garryhinch is likely to represent a significant risk to the conservation objectives of the River Barrow SAC.
- Dewatering to the scale required at Garryhinch is likely to represent a significant risk to the protection objectives of the European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010).
- Dewatering pumping equipment of the scale required will require significant quantities of oil and fuel storage on site, with the consequent risk of a pollution incident.
- Quarrying rock from a borrow pit in the south of the site and deposition of excavated peat in this borrow pit will require working at 10-11m depths in a dewatered site. A failure of the dewatering pumps and consequent rapid recovery of the groundwater levels would represent a significant risk to people working in such a borrow pit.
- It is possible that this borrow pit would have to be used as part of the reservoir storage area so as to avoid construction of the reservoir over the identified karst areas. The required materials for the construction of the embankments would therefore have to be imported resulting in programming, traffic management and increased cost risks.
- If this borrow pit is not available to accept excavated peat, disposal of peat will likely have to be off site resulting in programming, traffic management and increased cost risks.

The current cost estimate for the construction of a raw water reservoir system at Garryhinch Bog is €80m – an earlier estimate prepared for the 2010 Preliminary Report (see Figure 2-4) estimated the cost in the range of €40m to €45m.

# 7 Multi-Criteria Analysis

## 7.1 Introduction

A two part parallel assessment process has been applied in the appraisal of reasonable alternative options, refer to Section 5.



**Figure 7-1 Phase 4 Options Assessment - MCA**

This section 7 documents the multi-criteria analysis (MCA) process undertaken by the project specialists. It is informed by, and builds upon, the information and investigative studies made within the previous Section 6 of this report.

## 7.2 Multi-Criteria Analysis of the “Shannon Options”

The “Shannon Options” are presented in Section 3, and include the following:

- Option B (Lough Derg Direct)
- Option C (Parteen Basin Reservoir Direct)
- Option F2 (Lough Derg with Storage)

As discussed in Section 5.3, a principle driver in the Options Appraisal Process is a consideration of the impact associated with the abstraction works. Consequently, potential abstraction locations from the Lough Derg and Parteen Basin Reservoir water bodies were investigated.



### 7.2.1 Shannon - Identification of Abstraction Locations

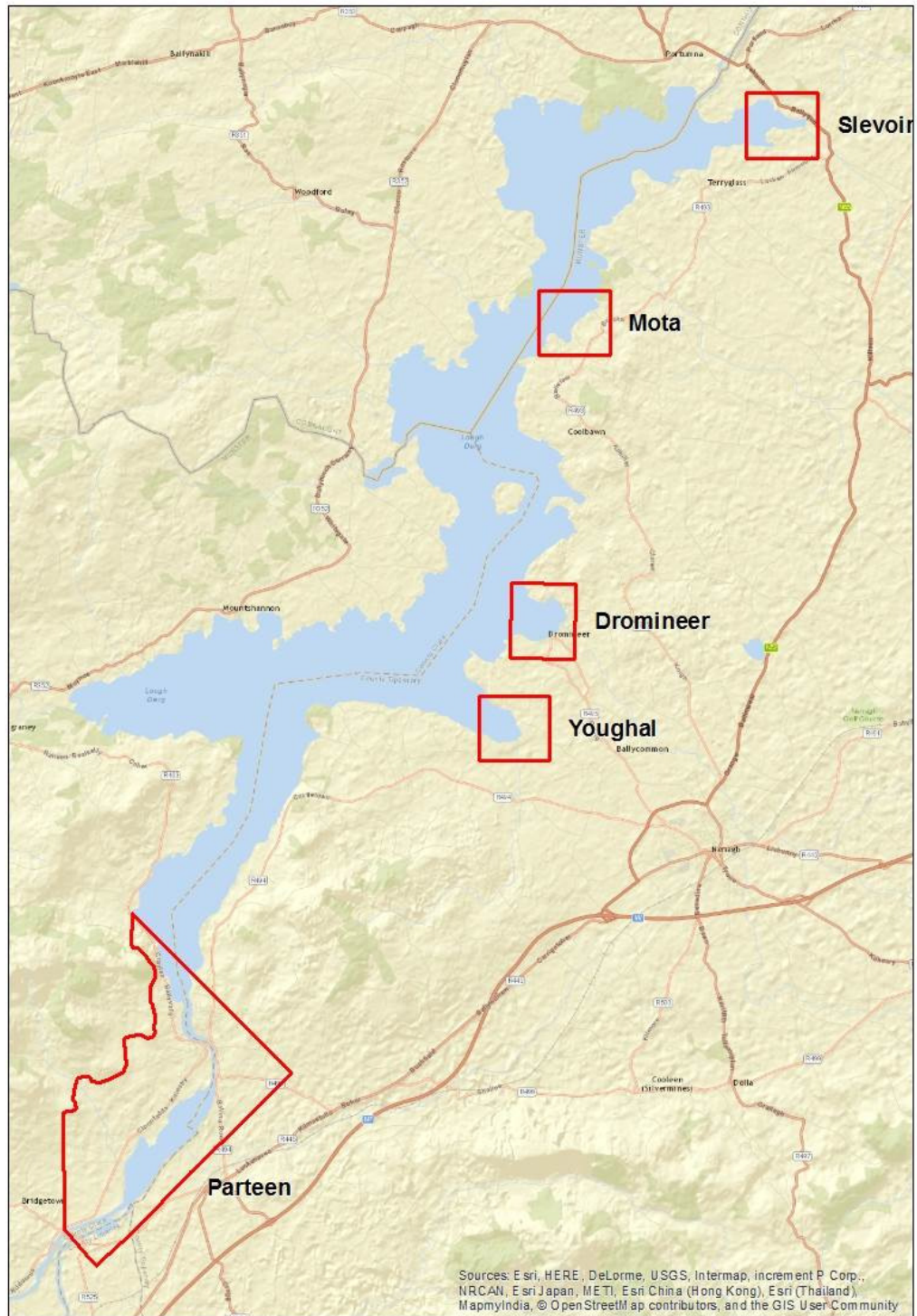
The SEA identified four potential locations along the eastern shoreline of Lough Derg and one potential location along the eastern shoreline of Parteen Basin as suitable for the siting of infrastructure associated with the abstraction of raw water.

Given the period of time that had elapsed since completion of the earlier SEA the method of identification and continued suitability of these locations was initially reviewed to account for any relevant issues that may have transpired over the intervening duration.

No significant issues were identified in this review that would have compromised the selection of these locations as potential points of water abstraction and they were presented to the specialist for further appraisal under the MCA process.

The Parteen Basin Reservoir location was expanded as part of this review process, recognising the physical constraint provided by the existing embankments bounding the reservoir.

The five potential locations for abstraction from Lough Derg / Parteen Basin Reservoir are presented in Figure 7-2.



**Figure 7-2 Potential Abstraction Locations from Lough Derg and Parteen Basin Reservoir**

### 7.2.2 Abstraction locations – Hydrodynamic Modelling

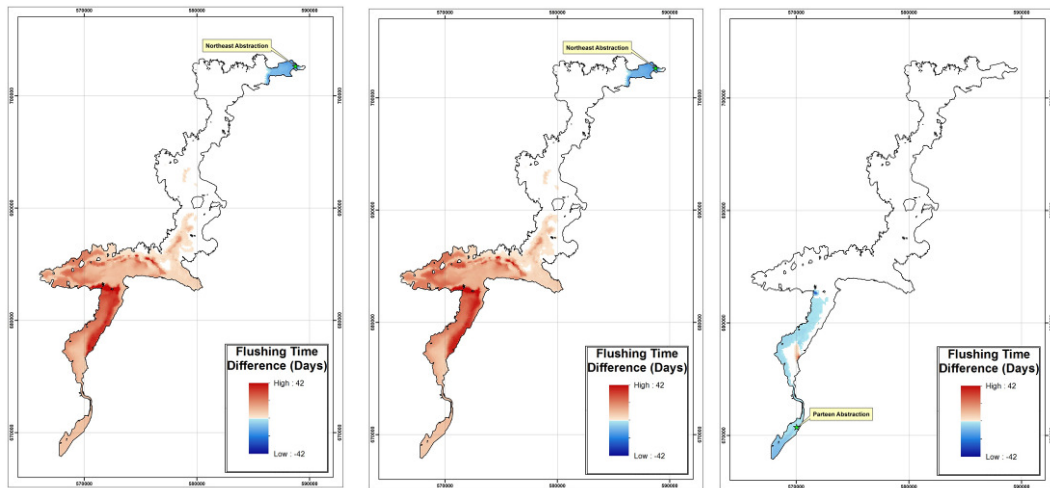
The Hydrodynamic Model (refer to Section 6.3) has assessed the impact of the potential abstraction points, identified for Lough Derg / Parteen Basin Reservoir, on the existing flushing characteristics through the water body.

The model determined that the change from one abstraction location to another in Lough Derg does not significantly impinge on residence times throughout the lake.

Consequently, an abstraction modelled on North East Lough Derg would be representative of the eastern shoreline as a whole.

The lowest flows on the Shannon River system will take place during the summer months. Abstraction during this period will have the greatest impact on the water body.

This impact is presented in Figure 7-3 for Options B, F2 and C respectively.



**Figure 7-3 Option B, F2 and C – Impact on Flushing Times**

A review of the 3 abstraction points indicates that Lough Derg has the potential for greatest impact on the waterbody compared to one located in Parteen Basin.

**7.2.3 Abstraction locations – MCA**

Further to the Water Quality Survey each of the potential abstraction locations were subject to full MCA by each of the Specialists. The MCA, and supporting Statements from each of the Specialists, is presented in Appendix - E.

For simple classification, the MCA applied one of five categories of impact for each of the locations under consideration; colour coded for ready identification.

These were:

Impact Category	Colour Code
Very high	Dark blue
High	Blue
Mid-range	Green
Low	Light Green
Very low	Cream

**Table 7-A MCA – Impact Categories**

The following sections summarise the findings of the MCA.

### 7.2.4 Appraisal of the Slevoir Location

An appraisal of the Slevoir Study Area, regarding a potential abstraction location in Lough Derg is presented in this Section.



**Figure 7-4 Lough Derg - Slevoir**

The Slevoir Study Area is situated approximately 400m north-west of Carrigahorig Village, south-east of Portumna and north-east of Terryglass, and is currently characterised by agricultural and forestry use. There are a number of residential / farming properties situated along the local roads to the west, south and east of the land parcel. The N65 regional road runs to the east. The Study Area is illustrated in Figure 7.6.



(i) *Ecology*

This extensive bay is characterised by relatively undisturbed and extensive fringing wetlands and semi-natural woodlands with the area immediately surrounding the lake largely undeveloped, with limited access to the lake edge. The terrestrial area is dominated by managed agricultural grasslands interspersed with treelines and wetland habitats. Extensive reedbeds are located around the lake edge. Low densities of widely distributed qualifying bird species nest and winter all around the shoreline. Slevoir Bay is included within Lough Derg North-east Shore cSAC, Lough Derg (Shannon) SPA, and Lough Derg pNHA, with these designations overlapping onto terrestrial habitats. Any works in this area will have direct impacts namely, the removal of habitats and associated adverse effects on sensitive qualifying interests of the SACs, at least in the short to mid-term.

Any works in this area will result in direct and indirect impacts, including the removal of habitats, and probable permanent adverse effects on sensitive SAC feature of interest, and other high value habitats.

Mitigation by avoidance or reduction through fully informed ecology surveys can reduce impacts by informing project design and appropriate locations for the development. However, it is still highly likely that residual adverse effects will occur as Annex 1 (SAC – feature of interest) and other high value habitats fringe the entire bay, and likely cannot be avoided.

This is the least favourable abstraction location option in terms of ecology.

(ii) *Aquatic Ecology*

Lough Derg is the only site in Ireland where Irish Fleabane is found (Webb, 1967) and this species is listed on the SAC site synopsis for this part of the lake. The Red Data Book Stonewort *Chara tomentosa*, has its National stronghold in L. Derg and it too is noted in the NPWS site synopsis. The shallow shoreline vegetation in Slevoir Bay includes Reed, Sedges, Meadowsweet and Rush. The sedges and reeds can form dense beds. Although not listed on the NPWS site synopsis, the following species of high conservation interest are considered likely to be present in the Slevoir Bay area: 3 Lamprey species, Salmon, Eel and Otter.

Modelling studies on how the abstraction at this site would affect flushing time of water showed that there would be marked decrease in the rate that water flows through the area and this is likely to cause a change in nutrient concentrations which would affect water quality status. This in turn would impact the distribution of shallow water floral and faunal communities. It is therefore, not possible to say with certainty that there would be no negative impact on the conservation status of the SAC.

Given this uncertainty, it is considered the least favourable abstraction option of all possible sites being considered.

(iii) *Surface Water*

Five Water Framework Directive (WFD) waterbodies enter Lough Derg within the Slevoir Study Area:

- Two Firmount Waterbodies;
- Slevoir Waterbody;
- Carrigahorrig Waterbody; and

- Lorrha Waterbody.

All water bodies have a WFD status of Moderate with the exception of Slevoir, which status is unassigned.

Impacts on the objectives of the WFD from the proposed development are considered to be very high, due to the potential for construction impacts and the potential significant increase in flushing times during the summer (low flow), operation phase conditions.

*(iv) Air Quality*

The Study Area contains a small number of low density residential dwellings. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of a potential abstraction location.

With regards to impacts during the operational phase of the potential development, operational traffic is likely to be the only air quality impact. Considering that the proposed development will lead to a minimal increase in Annual Average Daily Traffic (AADT) on the surrounding road network, there will be a very low air quality impact during the operational phase.

*(v) Noise*

As with air quality, and with consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on residential receptors during the construction phase of a potential abstraction location.

Operational traffic is likely to have small noise impact and there will be some fixed mechanical plant / pumps which will generate noise. With the implementation of standard noise mitigation measures, noise impacts are expected to be very low.

*(vi) Cultural Heritage*

The Slevoir Study Area, in addition to Mota and Youghal, is the least constrained in terms of cultural heritage. However this location has the potential for a mid-range impact on underwater archaeological resources. Following a desk study of cultural heritage resources in the Study Area the following potential negative impacts have been identified;

- 3 Potential direct/indirect low-range impacts on Record of Protected Structures;
- 2 Potential direct/indirect low-range impacts on the historic designed landscapes of Slevoir House and Firmount House; and
- Potential mid-range impacts on underwater archaeology within the lough.

Appropriate site selection can avoid the impacts on the above cultural heritage constraints.

*(vii) Landscape and Visual*

The main landscape and visual constraints to developing an abstraction facility at this location are the scenic route designation on the R493 regional road and the likelihood that this area will be imminently classified as a high sensitivity landscape.

Although an abstraction facility could be assimilated relatively well within this landscape in terms of screen planting mitigation, such a facility is likely to appear ambiguous in this tranquil lakeside landscape, which is currently characterised by low levels of built development. Views from the small lakeside settlement of Terryglass may also be adversely affected by such development.

*(viii) Agronomy*

Regarding farming enterprise there are 4 to 8 landowners specific within the Slevoir Study Area. The land is all good quality, predominately used for beef production with some tillage and forestry also.

*(ix) Tourism*

A number of tourism facilities and attractions are supported in the area local to and within the Slevoir location. Abstraction could have the potential to impact the support system for localised fish stock.

*(x) Soils, Geology and Hydrogeology*

No significant constraints were identified within the Slevoir Study Area. No Irish Geological Heritage sites were recorded, however the boundary of the North Tipperary Crag and Tails CGS is as yet not delineated and may extend towards Lough Derg. A number of crag and tail landforms are located in the Study Area. The underlying aquifer is described as a locally important aquifer.

Although there is potential for areas of High to Moderate vulnerability to be encountered during the construction phase where depth to bedrock is shallow, best practice construction methodologies will mitigate this impact. The potential for encountering shallow bedrock is described as Low.

There is a high possibility that soft ground, including areas of cutover peat and possible intact peat, will be encountered within this Study Area.

*(xi) Planning Policy*

The Study Area is unzoned and there are no local objectives for the area. No other relevant Development Plan objectives have been identified within the vicinity.

*(xii) Traffic, Engineering and Design*

The Study Area is in close proximity to the N65 National Primary Road and no local roads are required for access. Construction of access roads to an abstraction location and to a treatment plant would have a low impact on landowners.

The Portumna WWTP (3,100pe) discharges into an ESB open channel drain, which flows to an ESB pumping facility north east of Portumna, which pumps flow into the River Shannon just north of Slevoir Bay.

Power supply in the form of a 220KV Line is located approximately 3.2km from the potential site.



Though some flooding does occur within the Study Area, impacts are considered to be low to very low as lands are available outside of the flood zones.

*(xiii) Risk*

Abstraction is possible within normal operating band for water levels. There is low risk to navigation/tourism/agriculture/angling/fisheries/ornithology or to the local economy, but the standard of proof would be high and social acceptance of this is less likely where abstraction gives rise to increased residence times of water in Lough Derg during dry periods.

**7.2.5 Appraisal of the Mota Location**

An appraisal of the Mota Study Area, regarding a potential abstraction location in Lough Derg is presented in this Section.



**Figure 7-5 Lough Derg - Mota**

The Mota Study Area is approximately 1.9 km from Ballinderry and 2.6km from Newchapel/Kilbarron village and is currently in agricultural and forestry use.

*(i) Ecology*

This area is dominated by managed agricultural grassland with large areas of woodland. The lake area is included within designated sites (including Lough Derg SPA and Lough Derg North-east Shore cSAC and Lough Derg pNHA). Lake edge habitats are dominated by a mix of extensive reedbeds and woodlands. Such woodland habitats have potential to host pockets of priority Annex I alluvial woodland habitat for which Lough Derg (Shannon) cSAC is designated.

Low densities of widely distributed qualifying bird species nest and winter all around the shoreline. Any works in this area will result in direct and/or indirect permanent impacts to shoreline habitats with potential risk to qualifying interest habitats including fens and alluvial woodlands.

Permanent adverse effects (habitat reduction within SAC), may arise to fringing woodland and lakeshore wetland habitats located within Lough Derg SAC, some of which is likely to be Annex I qualifying interest habitat. Potential localised but long term disturbance effects may also arise to birds within the SPA, associated with the development.

Mitigation by avoidance or reduction, fully informed by site surveys can reduce these development effects. Residual uncertainty regarding water level and water quality changes and associated effects to ecological receptors will arise.

*(ii) Aquatic Ecology*

The common, shallow shoreline vegetation at Mota includes Reed Sedges, Meadowsweet and Rush. The following species of high conservation interest are considered likely to be present in the Mota area: 3 Lamprey species, Salmon, Eel and Otter. The Mota area of Lough Derg is not known to support populations of Freshwater Pearl Mussel.

Modelling studies show that there would be a marked decrease in flow rate through the area if raw water abstraction were to take place at this location. The same concerns as were mentioned above for Slevoyr Bay apply here with regard to nutrient levels in the water, *i.e.* the potential build up of nutrients could cause a shift in the trophic status of the water in this part of Lough Derg and this is most likely to have a negative impact on aquatic ecology, affecting species of high conservation status. Changes in the distribution and species composition of shallow water floral and faunal communities due to changes in the nutrient status of the lake cannot be discounted.

Mota is considered an unsuitable abstraction site due to the predicted negative impact on flushing time and the consequent impact on aquatic ecology and species of conservation interest. Furthermore, as there are small, unsurveyed islands close by, there is a risk, albeit unquantified, that there may be other species or habitats within the location that require protection.

*(iii) Surface Water*

Lough Derg is the only WFD waterbody within the Mota study area. The WFD status of Lough Derg is Moderate.

Impacts on the objectives of the WFD from the proposed development are considered to be very high, due to the potential for construction impacts and the potential significant increase in flushing times during the summer (low flow), operation phase conditions.

*(iv) Air Quality*

This Mota Study Area contains a small number of low density residential dwellings and a hotel. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed abstraction location.

With regards to impacts during the operational phase of the proposed development, operational traffic is likely to be the only air quality impact resulting in a very low air quality impact during the operational phase.

*(v) Noise*

As with air quality with consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on residential receptors during the construction phase of this proposed abstraction location.

Operational traffic is likely to have small noise impact and there will be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Noise impacts are expected to be very low.

*(vi) Cultural Heritage*

The Mota Study Area in addition to Slevoir and Youghal is the least constrained in terms of cultural heritage. However this site has the potential for a mid-range impacts on underwater archaeological resources. The following potential negative impacts were identified;

- 3 Potential direct/indirect low-range impacts on the Record of Protected Structures (RPS);
- 1 Potential direct/indirect very low-range impact on a feature from the National Inventory of Architectural Heritage;
- 3 Potential direct/indirect mid-range impacts on the historic designed landscapes of Mota House, Brookfield House and Kilgarvan House;
- Potential mid-range impacts on underwater archaeology within the lough.

Appropriate site selection within the Mota Study Area can avoid the impacts on the above cultural heritage constraints.

*(vii) Landscape and Visual*

The main landscape and visual constraints to constructing an abstraction facility within this location are the potential disruption of riparian woodlands and visual impacts from the Coolbawn lakeside amenity area. There is also potential to impact on the designated scenic route associated with the R493 to the east of this location. An abstraction facility is also likely to conflict with the tranquil pastoral setting of this location, which is generally characterised by a low level of built development.

Notwithstanding, it is considered that mitigation screen planting could reduce visual impacts from surrounding receptors to a reasonable degree, whilst blending with existing vegetation structures in this Study Area.

As with all of the Lough Derg and Parteen Basin abstraction locations, imminent changes to the County Development Plan are likely to see the Lough Derg landscape character areas attributed a high order sensitivity rating.

*(viii) Agronomy*

Regarding farming enterprise there are 5 to 10 landowners within the Mota Study Area. The land is mostly good quality, with some patches of scrub. Land use is predominately beef production with some tillage.

*(ix) Tourism*

The location includes lakeside amenity areas, marina and tourist accommodation. The Lough Derg walking trail extends through the location. Abstraction could have the potential to impact the support system for localised fish stock.

*(x) Soils, Geology and Hydrogeology*

No significant constraints were identified within the Mota Study Area. The underlying aquifer is described as a locally important aquifer.

Although there is potential for areas of Extreme to High vulnerability to be encountered during the construction phase where depth to bedrock is shallow, best practice construction methodologies will mitigate this impact. The potential for encountering shallow bedrock is described as High.

There is a moderate possibility that soft ground, including areas of lacustrine soils, will be encountered within this Study Area.

*(xi) Planning Policy*

The Study Area is unzoned and it is outside any settlement plan boundary. The potential landscape and visual impact of any proposed development will be a consideration in the assessment of this location for the proposed development. The existence of Coolbawn quay must also be factored into any proposal.

*(xii) Traffic, Engineering and Design*

The Mota location is accessed via a narrow Regional road network (R493) and is located some 12km from the National road at Carrigahorig and 20km from National road at Nenagh.

Access from the R493 to the Mota Study Area would be via a narrow one vehicle wide road and consideration would have to be given for the construction of an independent access route from the R493 in order to provide a safe entrance.

Land take for abstraction and pumping station would not have a significant impact on landowners, however, an access road from the R493 would likely be required and this would potentially result in land splitting.

Power supply in the form of a 220KV Line is located approximately 7.6km from the potential site.

Some flooding does occur within the Study Area. Impacts are considered to be low to very low as lands are available outside of the flood zones.

*(xiii) Risk*

Abstraction is possible within normal operating band for water levels. There is low risk to navigation/tourism/agriculture/angling/fisheries/ornithology or to the local economy, but the standard of proof would be high and social acceptance of this is less likely where abstraction gives rise to increased residence times of water in Lough Derg during dry periods.

**7.2.6 Appraisal of the Dromineer Location**

An appraisal of the Dromineer Study Area, regarding a potential abstraction location in Lough Derg is presented in this Section.



**Figure 7-6 Lough Derg - Dromineer**



The Dromineer Study Area includes the village of Dromineer. The village of Puckane is approximately 1.6km away. There are yacht clubs and sailing clubs in the vicinity. There are cottages and B&B's and a thriving tourism offering in the small village of Dromineer. Outside of the village there are numerous houses along the adjoining roads and agriculture and forestry developments.

*(i) Ecology*

This area is dominated by managed farmland with a narrow fringe of wetland and woodland habitat along the shoreline. Dromineer quay is well developed with artificial and imported surfaces along the lake. Low densities of widely distributed qualifying bird species nest and winter all around the shoreline. This area is included within a European designated site (Lough Derg SPA).

Any works in this area will cause unavoidable direct impacts to lake edge and terrestrial habitats including loss/disturbance to such habitats, with potential for adverse effects on sensitive qualifying interests at least in the short to mid-term.

Permanent adverse effects (habitat reduction within SAC), may arise to fringing woodland and lakeshore wetland habitats located within Lough Derg SAC, some of which is likely to be Annex I qualifying interest habitat. Potential localised but long term disturbance effects may also arise to birds within the SPA, associated with the development.

Mitigation by avoidance or reduction, fully informed by site surveys can reduce these development effects. Residual uncertainty regarding water level and water quality changes and associated effects to ecological receptors will arise.

*(ii) Aquatic Ecology*

The common, shallow shoreline vegetation at Dromineer Bay includes Reed, Sedges, Meadowsweet and Rush. The following species of high conservation interest are considered likely to be present in the Dromineer area: 3 Lamprey species, Salmon, Eel and Otter.

Modelling studies on how abstraction at this site would affect flushing time of water showed that there would be marked decrease in the rate that water flows through the area. The same ecological concerns that were outlined above for Slevoir and Mota apply here.

Although Dromineer Bay is not located within a SAC, the same arguments outlined above in relation to Slevoir and Mota and increased water retention time in the lake and the consequent increased nutrient levels and risk of algal blooms, make it an unsuitable abstraction site. Furthermore, as there are unsurveyed islands close by, it is considered that this features could give added conservation status to the location.

*(iii) Surface Water*

Two WFD waterbodies enter Lough Derg within the Dromineer Study Area:

- Clonmakilladuff Waterbody; and
- The Nenagh Waterbody.

The Clonmakilladuff Waterbody WFD status is unassigned and the Nenagh waterbody and Lough Derg WFD status is Moderate.

Impacts on the objectives of the WFD from the proposed development are considered to be very high, due to the potential for construction impacts and the potential significant increase in flushing times during the summer (low flow), operation phase conditions.

*(iv) Air Quality*

This Study Area contains a small number of low density residential dwellings and a larger residential settlement at Dromineer. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed abstraction location.

With regards to impacts during the operational phase of the proposed development, operational traffic is likely to be the only air quality impact. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low air quality impact during the operational phase.

*(v) Noise*

With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on residential receptors during the construction phase of this proposed abstraction location.

Operational traffic is likely to have small noise impact and there will be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Noise impacts are expected to be low.

*(vi) Cultural Heritage*

In terms of Cultural heritage the Dromineer Study Area is slightly more constrained than Slevoir, Mota and Youghal, but still to a relatively low degree. As with all the Lough Derg sites, this location has the potential for a mid-range impact on underwater archaeological resources. The following potential negative impacts were identified;

- 3 Potential direct/indirect low-range impacts on features from the Record of Monuments and Places;
- 9 Potential direct/indirect low-range impacts on RPS (these are mostly clustered together in a relatively large area);
- 9 Potential direct/indirect low-range impacts on features from the National Inventory of Architectural Heritage (these are mostly clustered together in a relatively large area);
- 2 Potential direct/indirect low-range impacts on the historic designed landscapes of Kilteelagh House and St. David's House;
- Potential mid-range impacts on underwater archaeology within the lough.

Appropriate site selection can avoid the impacts on the above cultural heritage constraints.

*(vii) Landscape and Visual*



There are considerable landscape and visual constraints to the development of a water abstraction facility at this location. These principally relate to the two scenic route designations on the roads approaching the settlement of Dromineer. Also, the potential to impact on views from the settlement enjoyed by residents, water based recreationalists and tourists. There is also a strong potential for such a facility to appear incongruous within this tranquil landscape setting, which is characterised, in part, by designed heritage landscapes.

*(viii) Agronomy*

Regarding farming enterprise there are 4 to 9 landowners within the Dromineer Study Area. The land quality is very good and land use is predominately beef production with some used for sheep pasture and tillage.

*(ix) Tourism*

Contained in the location is the Lough Derg Yacht club, with the Lough Derg walking trail extending through the location. The settlement plan for Dromineer encourages the development of tourism facilities. Abstraction could have the potential to impact the support system for localised fish stock.

*(x) Soils, Geology and Hydrogeology*

No significant constraints were identified within the Dromineer Study Area. The underlying aquifer is described as a combination of locally important aquifers and poor aquifers.

Although there is potential for areas of Moderate to Low vulnerability to be encountered during the construction phase where depth to bedrock is shallow, best practice construction methodologies will mitigate this impact. The potential for encountering shallow bedrock is described as Low.

There is a moderate possibility that soft ground, including areas of lacustrine soils, will be encountered within this Study Area.

*(xi) Planning Policy*

The Settlement Plan for Dromineer village includes all zoning expected in a village, including existing residential, tourism, commercial etc.

It may prove difficult to identify a site that does not impact negatively on the overall tourism and residential aims of the Settlement Plan.

*(xii) Traffic, Engineering and Design*

The Study Area in Dromineer is accessed via the narrow Regional Road R493 and very narrow local roads for a distance of some 2.5km.

An access road for 1.5km would likely be required as the existing local road is only wide enough for a single vehicle. An access road can be routed through agricultural land without the need to cross existing roads.

There is significant works and risks associated with the construction of 1.5km of access road.

Land take for abstraction, pumping station and treatment plant would not have a significant impact on landowners. However, an access road for 1.5km would likely be required and this would potentially result in land splitting and impact on a significant number of landowners.

The treated effluent outfall from the Nenagh Agglomeration (13,000pe) discharges to the Nenagh River, which is nutrient sensitive, and this in turn discharges to Dromineer Bay in the vicinity of the potential abstraction location.

Power supply in the form of a 220KV Line is located approximately 3.2km from the potential site.

Some flooding does occur within the Study Area. Impacts are considered to be low to very low as lands are available outside of the flood zones.

*(xiii) Risk*

Abstraction is possible within normal operating band for water levels. There is low risk to navigation/tourism/agriculture/angling/fisheries/ornithology or to the local economy, but the standard of proof would be high and social acceptance of this is less likely where abstraction gives rise to increased residence times of water in Lough Derg during dry periods.

### **7.2.7 Appraisal of the Youghal Location**

An appraisal of the Youghal Study Area, regarding a potential abstraction location in Lough Derg is presented in this Section.



**Figure 7-7 Lough Derg - Youghal**

This location is currently in agricultural and forestry use. There is some ribbon development in the locality. The village of Ballycommon to the east is approximately 2.3km away; Garrykennedy to the north-west is 2.4km away; Portroe to the south-west is 1.9km away; Newtown/Youghalarra to the south is 1.3km away and Nenagh is 4.5km away. Youghal village comprises a number of road-edge residential developments.

*(i) Ecology*

The surrounding terrestrial habitats at the Youghal abstraction location are dominated by managed agricultural grassland dissected with treelines and patches of woodland. A narrow fringe of wetland and woodland habitat is located along the shoreline. The Newtown River, Youghal Stream and Ardgregane Stream discharge into Youghal Bay. The lake and a proportion of the terrestrial habitat (mainly fringe

and wetland habitats) are included within Lough Derg (Shannon) SPA and Lough Derg pNHA.

Low densities of widely distributed qualifying bird species nest and winter all around the shoreline. Known areas of Annex I semi-natural grassland (*Molinia meadows* 6410) are located around the Bay with high potential for unknown additional areas. Any works in this area may cause unavoidable direct impacts to lake edge and terrestrial habitats including loss/disturbance to such habitats, with potential for adverse effects on sensitive qualifying interests.

Permanent adverse effects (habitat reduction within SAC), may arise to fringing woodland and lakeshore wetland habitats located within Lough Derg SAC, some of which is likely to be Annex I qualifying interest habitat. Potential localised but long term disturbance effects may also arise to birds within the SPA, associated with the development.

Mitigation by avoidance or reduction, fully informed by site surveys can reduce these development effects. Residual uncertainty regarding water level and water quality changes and associated effects to ecological receptors will arise.

#### (ii) *Aquatic Ecology*

Although it is not designated as a SAC, it is considered without doubt that species of conservation interest such as lamprey species, eel, salmon and otter occur in the area.

Modelling studies show that, in common with Slevoir, Mota and Dromineer, an abstraction at Youghal would affect the water residence time in the lake with a marked decrease in the rate that water passes through the bay being predicted. As stated earlier, this raises concerns about the possible impact on nutrient levels and water quality and therefore also on species of high conservation status. Youghal bay is therefore considered an unsuitable abstraction site due to the predicted negative impact on aquatic ecology and species of conservation interest.

#### (iii) *Surface Water*

There are four WFD waterbodies entering Lough Derg within the Youghal Study Area:

- Youghal Waterbody;
- Newtown Waterbody;
- Tomona Waterbody; and
- Ardgregane Waterbody.

The Youghal, Ardgregane and Lough Derg waterbody WFD status is Moderate, the Newtown waterbody WFD status is Good and the WFD status of the Tomona waterbody is Unassigned.

Impacts on the objectives of the WFD from the proposed development are considered to be very high, due to the potential for construction impacts and the potential significant increase in flushing times during the summer (low flow), operation phase conditions.

*(iv) Air Quality*

This Study Area contains a small number of low density residential dwellings. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed abstraction location.

With regards to impacts during the operational phase of the proposed development, operational traffic is likely to be the only air quality impact. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low air quality impact during the operational phase.

*(v) Noise*

With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on residential receptors during the construction phase of this proposed abstraction location.

Operational traffic is likely to have small noise impact and there will be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Noise impacts are expected to be very low.

*(vi) Cultural Heritage*

The Youghal Bay site in addition to Slevoir and Mota is the least constrained Lough Derg site in terms of cultural heritage. However this site has the potential for a mid-range impact on underwater archaeological resources. The following potential negative impacts were identified;

- 4 Potential direct/indirect low-range impacts on features from the Record of Monuments and Places;
- 1 Potential direct/indirect very low-range impact on a Recorded Protected Structure;
- 1 Potential direct/indirect very low-range impact on a feature from the National Inventory of Architectural Heritage;
- 2 Potential direct/indirect low-range impacts on the historic designed landscapes of Shannon Hall and Youghal House;
- Potential mid-range impacts on underwater archaeology within the lough.

Appropriate site selection can avoid the impacts on the above cultural heritage constraints.

*(vii) Landscape and Visual*

The key constraints from a landscape and visual perspective at this location are the potential impacts on lakeside amenity areas and the Lough Derg way. There is also potential to disrupt the riparian vegetation that occurs along the shoreline at this location. It is also likely that an abstraction facility would appear incongruous in this tranquil rural area given the current low levels of built development.

*(viii) Agronomy*

Regarding farming enterprise there are 5 to 10 landowners within the Youghal Bay site. The land quality is very good and land use is predominately beef production with some used for dairy and tillage.

*(ix) Tourism*

There are small marinas and dedicated swimming areas associated with local settlements in the area, with the Lough Derg walking trail present. Abstraction could have the potential to impact the support system for localised fish stock.

*(x) Soils, Geology and Hydrogeology*

No significant constraints were identified within the Youghal Study Area. The underlying aquifer is described as a locally important aquifer.

Although there is potential for areas of Moderate vulnerability to be encountered during the construction phase where depth to bedrock is shallow, best practice construction methodologies will mitigate this impact. The potential for encountering shallow bedrock is described as Low.

There is a moderate possibility that soft ground, including areas of lacustrine soils, will be encountered within this study area.

*(xi) Planning Policy*

This location is currently in agricultural and forestry use. There is some ribbon development in the locality. The location is unzoned as it is outside any defined boundary or area the subject of a Settlement Plan.

*(xii) Traffic, Engineering and Design*

The Youghal location is accessed via the narrow Regional Road R495 and very narrow local roads for a distance of some 2.7km.

Consideration would have to be given for the construction of an independent access route from the R495 in order to provide a safe entrance which would result in one crossing of a local access road. An access road for 4.4km would likely be required from the R495. Alternative would be to widen the local roads.

There is significant works and risks associated with the construction of 4.4km of access road or alternative local road widening.

Land take for abstraction and pumping station would not have a significant impact on landowners. However, an access road for 4.4km would likely be required from the R495 and this would potentially result in land splitting and impact on a significant number of landowners. Alternative would be to widen the local roads but this would also impact on landowners.

Power supply in the form of a 220KV Line is located approximately 2.2km from the potential site.

Some flooding does occur within the Study Area. Impacts are considered to be low to very low as lands are available outside of the flood zones.

*(xiii) Risk*



Abstraction is possible within normal operating band for water levels. There is low risk to navigation/tourism/agriculture/angling/fisheries/ornithology or to the local economy, but the standard of proof would be high and social acceptance of this is less likely where abstraction gives rise to increased residence times of water in Lough Derg during dry periods.

### 7.2.8 Lough Derg Locations - MCA Comparison

A comparison of the four Lough Derg abstraction location options, is presented in Table 7-B.

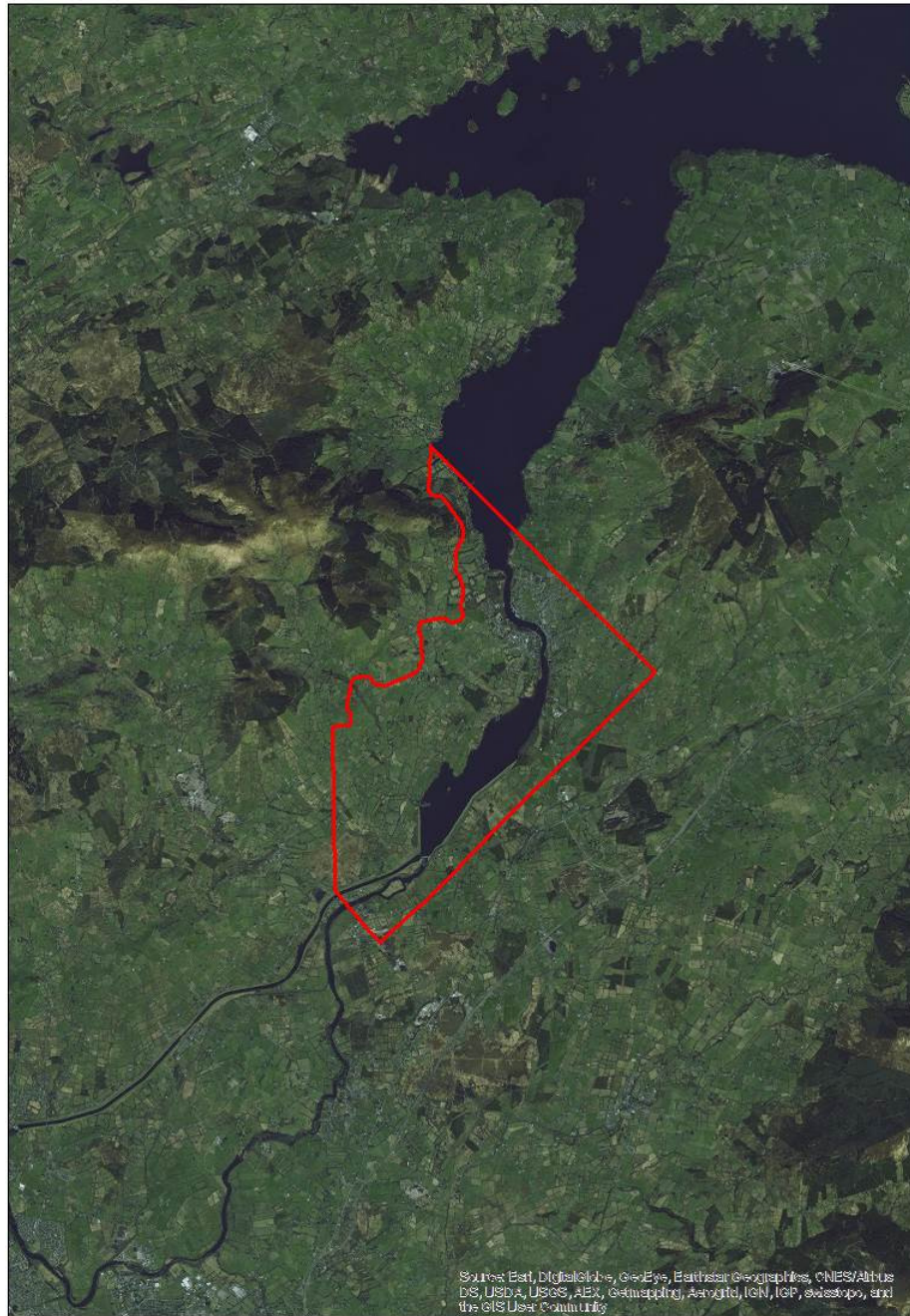
<b>Constraint</b>	<b>Slevoir</b>	<b>Mota</b>	<b>Dromineer</b>	<b>Youghal</b>
<i>Ecology</i>				
<i>Aquatic Ecology</i>				
<i>Surface Water</i>				
<i>Air Quality</i>				
<i>Noise</i>				
<i>Cultural Heritage</i>				
<i>Landscape and Visual</i>				
<i>Agronomy</i>				
<i>People</i>				
<i>Soils, Geology &amp; Hydrogeology</i>				
<i>Planning Policy</i>				
<i>Traffic, Engineering &amp; Design</i>				
<i>Risk</i>				
<b>Overall</b>	<b>1</b>	<b>3</b>	<b>4</b>	<b>2</b>

**Table 7-B MCA – Comparison between Lough Derg Abstraction Locations**

Based upon the appraisal criteria listed in Table 5-A, Slevoir represents the preferred location for the siting of an abstraction point on Lough Derg compared with the alternative sites under consideration since it is not as constrained.

### 7.2.9 Appraisal of the Parteen Basin Reservoir Location

An appraisal of the Parteen Basin Reservoir Study Area, regarding a potential abstraction location is presented in this Section (location shown in Figure 7-6).



**Figure 7-8 Parteen Basin**

The location identified is a large area including the villages of Ballina and Killaloe (Clare County Council). The village of Birdhill is located approximately 790m away. The N7 Road runs to the east of the identified location.

*(i) Ecology*

Parteen Basin is a 'provisional' Heavily Modified Water Bodies (pHMWB)<sup>10</sup> and as noted, the lake itself is recorded as Annex I habitat - Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140]. This habitat does not form one of the Qualifying Interest habitats for the Lower River Shannon cSAC, within which Parteen Basin and a proportion of surrounding terrestrial lands is contained.

As Parteen Basin is heavily modified it is considered a less sensitive habitat than Lough Derg. This is for various reasons including its lack of more sensitive habitat along a large proportion of its shoreline and a high degree of manipulation of water levels.

Many of the Qualifying Interest habitats of the Lower River Shannon cSAC are marine / coastal in origin and do not occur within Parteen Basin. Potential exists for qualifying interest habitat to occur along sections of the lake edge which have not been highly modified, including those closer to Ballina/Killaloe with possible Alluvial Woodland and other high value semi natural woodland.

This is the least constrained of the freshwater options from an ecology standpoint. The lake habitat and fringing wetlands have been modified by past shoreline profiling works and flooding associated with Parteen Dam. The lake bed is also relatively deep on the western side with high water volumes resulting in likely minimal effects on lake heights with drawdown (water abstraction) and water quality. However careful site location/ project design and appropriate mitigation are required.

### *(ii) Aquatic Ecology*

Parteen Basin lies within the Lower Shannon candidate Special Area of Conservation. Freshwater qualifying interest habitats and species include: water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation, Freshwater Pearl Mussel, 3 species of Lamprey, Salmon and Otter.

Modelling studies on how abstraction at Parteen Basin would affect residence time of water showed that there would be no change in Lough Derg flushing time characteristics during winter high flow conditions. During summer low flow conditions, abstraction from Parteen Basin would result in a slight improvement (3 day decrease) in flushing times in the southernmost regions of Lough Derg. This result is due to the fact that the flow of water has already passed through Lough Derg prior to encountering the Parteen Basin abstraction point. Therefore there is unlikely to be a significant, measureable negative impact on aquatic ecology including on qualifying interest species such as lamprey, salmon and otter.

Based on the above, the Parteen Basin Abstraction location is considered the best option out of the freshwater abstraction options as it has least impact on the aquatic environment.

### *(iii) Surface Water*

Parteen is the largest of the Study Areas and this is reflected by the fact that there are numerous WFD waterbodies entering Lough Derg which is located within the Study Area:

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<sup>10</sup> RPS 2005. Shannon River Basin District: Characterisation & Analysis Summary Report

- Lower Shannon Waterbody;
- Rinnaman Point Waterbody;
- Feenlea Waterbody;
- Heritage Centre Killaloe Waterbody;
- Grange Waterbody;
- Roolagh Waterbody;
- Ballyteige Waterbody;
- Kilmastulla Waterbody;
- Ardcloney Waterbody;
- Black Waterbody;
- Fairy hall; and
- O Briens Bridge.

The Lower Shannon, Lough Derg and Kilmastulla Waterbody, WFD status is Moderate. The Ardcloney Waterbody WFD status is High and the Black Waterbody is Good. Other waterbody WFD status is unassigned.

There are construction impacts on the proposed development, with reference to the objectives of the WFD, and a potential for increases in flushing times during summer (low flow) conditions.

Based primarily on the outcome of the hydrodynamic modelling, Parteen Basin Reservoir is considered the least constrained location of all the Lough Derg/Parteen Basin options.

*(iv) Air Quality*

This Study Area contains a number of low density residential dwellings and also a number of larger residential settlements. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of the proposed abstraction location.

With regards to impacts during the operational phase of the proposed development, operational traffic is likely to be the only air quality impact. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low air quality impact during the operational phase.

*(v) Noise*

With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on residential receptors during the construction phase of this proposed abstraction location.

Operational traffic is likely to have small noise impact and there will be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Noise impacts are expected to be low.

*(vi) Cultural Heritage*



The Parteen Basin Reservoir site is the most constrained in terms of recorded archaeological and built heritage, it does however have a lower potential impact on the underwater archaeological resource, as to the south of Parteen, the watercourse has been artificially constructed around the course of the river. The following potential negative impacts were identified;

- 2 Potential low-range impacts on National Monuments;
- Potential direct/indirect mid-range impacts regarding 57 features from the Record of Monuments and Places;
- 29 Potential direct/indirect low-range impact on a Recorded Protected Structure;
- 19 Potential direct/indirect low-range impacts on a feature from the National Inventory of Architectural Heritage;
- 12 Potential direct/indirect mid-range impacts on historic designed landscapes;
- 2 Potential very low-range impacts on an Architectural Conservation Area;
- Potential low-range impacts on underwater archaeology within the lough.

Appropriate site selection can avoid the impacts on the above cultural heritage constraints.

*(vii) Landscape and Visual*

There are a number of landscape and visual constraints contained within the northern portion of the Parteen location. These are mainly associated with the settlements of Killaloe and Ballina, which contain a number of heritage features and are popular tourist destinations. There are comparatively much fewer constraints that might influence the construction of an abstraction facility in the southern reaches of the Parteen Basin, which is much more sparsely populated and has fewer sensitive receptors. Furthermore, it is considered that such a facility could be accommodated in the southern portion of the Parteen location without a sense of being incongruous within a landscape that has already been modified for the purposes of the hydroelectric scheme at Ardnacrusha. It is also considered that mitigation screen planting would be successful in reducing visual impacts associated with the abstraction facility at this location.

*(viii) Agronomy*

Regarding farming enterprise there are 6 to 12 landowners within the Parteen Basin Reservoir site. The land quality is good and land use is predominately beef production with some used for dairy and tillage.

*(ix) Tourism*

Both Killaloe and Ballina are popular tourist and amenity areas. Both the Lough Derg way and East Clare Way pass through, converging on the settlements of Killaloe and Ballina. Parteen Basin Reservoir is a man-made reservoir. Due to its limited natural function abstraction is unlikely to affect fishery levels in this location.

*(x) Soils, Geology and Hydrogeology*

No significant constraints were identified at the Parteen Basin Location. The underlying aquifer is described as a locally important aquifer.

Although there is potential for areas of High to Low vulnerability to be encountered during the construction phase where depth to bedrock is shallow, best practice construction methodologies will mitigate this impact. The potential for encountering shallow bedrock is described as Moderate to High to the north east of Parteen and low to south west.

There is a high possibility that soft ground, will be encountered to the south of the Study Area.

*(xi) Planning Policy*

Due to the large Study Area identified, there are a wide variety of zoning uses identified including, existing residential, new residential, tourism, retail, open space and mixed use. There are also areas outside the villages included which are unzoned.

*(xii) Traffic, Engineering and Design*

The Parteen Basin location covers a large area and on the eastern side it is accessible from the Regional Roads R494 and R466.

Access to an abstraction location on Parteen Basin would likely be direct from the R494 Regional Road with no local road crossings.

The abstraction location is likely to be a short distance from the R494 so minimal number of landowners are likely to be impacted. An access road would potentially be required to the Treatment Plant site from the regional road that is likely to impact on a number of landowners depending on the selected route.

R494 and R445 are roads identified where a high number of accidents have been caused by speeding.

The 4,000pe capacity Wastewater Treatment Plant at Killaloe/Ballina, which is designed for discharge to Cyprinid Waters, discharges to a feeder stream of Parteen Basin.

Power supply in the form of a 400KV Line is located approximately 1.2km from the potential site.

Some flooding does occur within the Study Area. Impacts are considered to be low to very low as lands are available outside of the flood zones.

*(xiii) Risk*

Abstraction is possible within normal operating band for water levels. There is insignificant risk to navigation/tourism/agriculture/angling or to the local economy and there is no infrastructural presence in Lough Derg proper. Abstraction will not increase residence times in Lough Derg during low flow periods - consequently limiting the risk of water quality impacts related to residence time.



### 7.2.10 Shannon Abstraction Locations – MCA Comparison

A comparison between the least constrained option in Lough Derg and Parteen Basin Reservoir is presented in Table 7-C.

Constraint	Slevoir	Parteen Basin Reservoir
<i>Ecology</i>		
<i>Aquatic Ecology</i>		
<i>Surface Water</i>		
<i>Air Quality</i>		
<i>Noise</i>		
<i>Cultural Heritage</i>		
<i>Landscape and Visual</i>		
<i>Agronomy</i>		
<i>People</i>		
<i>Soils, Geology and Hydrogeology</i>		
<i>Planning Policy</i>		
<i>Traffic, Engineering and Design</i>		
<i>Risk</i>		
Overall	<b>2</b>	<b>1</b>

**Table 7-C MCA – Comparison between Shannon Abstraction Locations**

Although Table 7C indicates a number of potentially significant constraints in relation to the Parteen Basin Reservoir option, it is important to note that the study area for this water body is much larger than the relatively confined sites considered in Lough Derg; it is not a like-for-like comparison.

The Parteen Basin Reservoir location is considered to be the least constrained of the Shannon abstraction options overall for the following reasons:

- Modelling studies of the Lough Derg abstraction locations have shown a measurable impact on flushing time in the lake and this would be likely to have a negative impact on the conservation objectives of Lough Derg SAC and of the entire lake aquatic ecosystem. The level of impact predicted at Parteen Basin Reservoir is considered too low to affect its ecological status.
- Parteen Basin Reservoir is a reservoir formed by the creation of Ardnacrusha dam, hence it is not as sensitive a lake habitat as Lough Derg, with low fisheries value, less developed wetlands habitat and with areas of more modified (non-qualifying habitat) occurring on the eastern shore.
- The limited relative impact on flushing times in Parteen Basin Reservoir supports the consideration of a lower potential impact on the objectives of the Water Framework Directive relative to abstraction from Lough Derg
- It is likely that due to the scale of the location of the Parteen Basin Reservoir there is a possibility of finding a suitable site for the location of the necessary infrastructure with will significantly mitigate impact on known Planning, Cultural Heritage and Landscape and Visual constraints.

- From an Agronomy impact perspective the location of an abstraction point will be low at all locations and therefore no location is more or less constrained than another.

### 7.2.11 Shannon Abstraction Locations - Conclusions

The key findings from this two part review and evaluation process for the “Shannon Options” are summarised below:

- Option B: Lough Derg (Direct) – this option will have significant impact on residence times in Lough Derg and is considered to have a high likelihood of significant impact on the aquatic ecology of the lough, compromising the ability of this option to comply with the Habitats Directive.
- Option F2: Lough Derg and Storage (Garryhinch) will have significant impact on residence times in Lough Derg; it is considered that there will be a high likelihood of significant impact on the aquatic ecology of the lough, compromising the ability of this option to comply with the Habitats Directive. In addition, even in drought conditions the perceived benefits of raw water storage provision at Garryhinch to allow variable abstraction from the lough did not mitigate the demands placed on the water supply in drought year conditions, whilst there is significant risk associated with obtaining compliance, within the terms of the Water Framework Directive, for this artificial raw water reservoir.

Appraisal of the Shannon options, using multi criteria analysis and interpretation of the investigative studies, has indicated that an abstraction point using the Parteen Basin Reservoir is the least constrained abstraction location.

**Option C (Parteen Basin Reservoir Direct) is indicating the least impact of the 4 abstraction options considered for the Shannon water body.**

## 7.3 Multi-Criteria Analysis of the “Desalination Option”

As discussed in Section 5.3, a principal driver in the Options Appraisal Process is a consideration of the impact associated with the abstraction works. Consequently, potential abstraction locations along the County Dublin eastern seaboard were identified.

### 7.3.1 Irish Sea - Identification of Abstraction Locations

The SEA identified eight potential locations along the eastern seaboard suitable for the siting of infrastructure associated with the abstraction and treatment of salt water to a drinking standard. These eight sites in close proximity to the Irish Sea were:

- i. South Dublin;
- ii. Ringsend;
- iii. Howth Headland;
- iv. Ardgillan;
- v. Balbriggan;
- vi. Gormanstown;

- vii. Loughshinny South; and
- viii. Loughshinny North.

### 7.3.2 Preliminary Screening of Irish Sea Abstraction Locations

An upper boundary of 15 Hectare (Ha) was considered prudent land provision to accommodate a Desalination Plant for the ultimate water supply demand.

*Note: The water supply demand requirements are discussed in detail in the Project Need Report.*

A desktop constraint mapping exercise was undertaken for each of the eight potential locations taking due cognisance of the requirement to satisfy a ‘footprint’ for a 15 Ha site. This considered the impact of identified environmental constraints on the siting of a Desalination Plant, and was supplemented with the Geo-directory dataset as it is a current indicator of development.

A workshop was held with the Specialists on 16th April 2015 to consider these constraints and the impact of each one on the eight potential Desalination Plant locations.

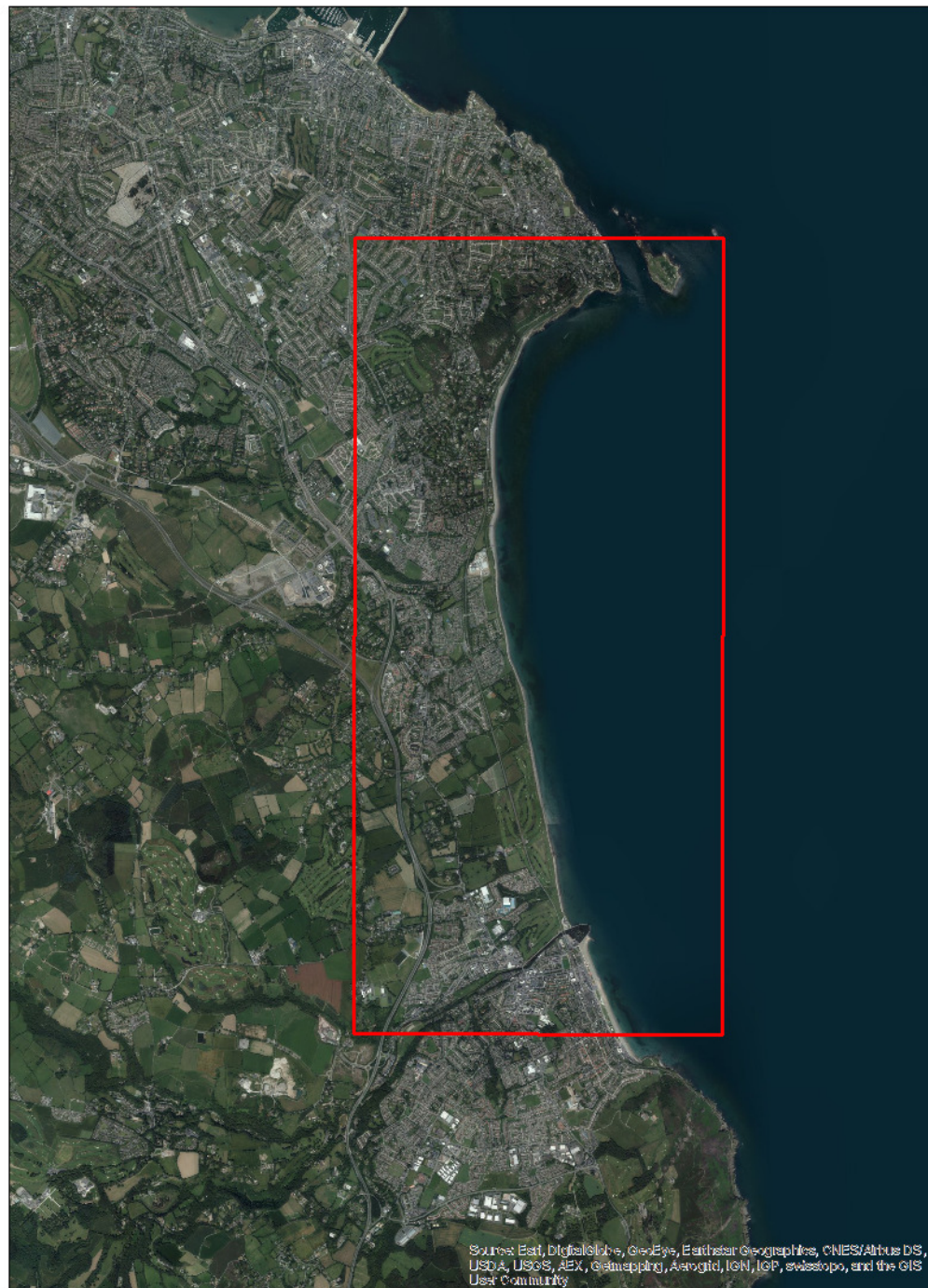
Consequently, 4 locations were deemed unsuitable and excluded from further consideration, namely:

- i. Ringsend
- ii. Howth Headland
- iii. Ardgillan
- iv. Gormanstown

The preliminary screening of these potential sites is discussed in detail in Appendix E2.

The remaining 4 potential locations were presented to the Specialists for further detail appraisal under the MCA process.

### 7.3.3 Appraisal for a South Dublin Location



**Figure 7-9 Desalination Plant - South Dublin Area**

*(i) Ecology*

This very extensive largely urban/ suburban and farmland site contains mature hedgerows, deciduous woodland blocks and mature treelines in farmland locations not currently developed.

Rockabill to Dalkey cSAC is located offshore, at the northern end of the study area only. Dalkey Coastal Zone and Killiney Hill pNHA covers two separate areas of the coast.

The southern section of the South Dublin study area is considered to be the least constrained section of this study area, south of Rockabill to Dalkey cSAC and Dalkey Coastal Zone and Killiney Hill pNHA. However potential exists for the proposed development to be predominantly contained within existing developed areas which would minimise ecological impacts. Subsequently the main impact would be where the abstraction pipeline/structure comes onshore on the sublittoral and littoral habitats. Appropriate design and mitigation, including avoidance or reduction through fully informed site surveys, may reduce any potential impacts.

### *(ii) Aquatic Ecology*

Marine water quality in the South Dublin area is considered acceptable for abstraction, .

In terms of physical oceanography, the area off Killiney Beach has suitable water depths and velocities to the northeast of Bray Head to allow for effective dilution and dispersion of the brine plume. Both the biological and sedimentary data available indicate a high energy environment *i.e.* fast current speeds which would allow for the fast dispersion of the brine.

Rockabill to Dalkey SAC is located within the northern part of the area. This should be avoided by siting the intake and outfall pipes as far south of the SAC as possible and as indicated by mathematical modelling studies of the plume dispersion.

### *(iii) Surface Water*

There are two WFD waterbodies that enter Killiney Bay within the study area these are:

- The Shanganagh waterbody; and
- The Grange waterbody.

(Within the study area the Dargle River enters Killiney Bay via the Dargle Estuary).

The WFD status of Killiney Bay is Good, the Shanganagh waterbody status is Poor and the Grange Stream has no status. The Dargle River and Estuary is Moderate.

Impacts on the objectives of the WFD from the proposed development are considered to be high, due to the potential for construction impacts and due to the release of brine during operation which may have impacts on water quality characteristics such as temperature, chemical constituents and salinity.

### *(iv) Air Quality*

The study area is predominantly suburban with mixed high density residential development. As a result of this, there will likely be a mid-range impact on these receptors as a result of the construction phase of the proposed desalination plant.

With regards to impacts during the operational phase of the proposed development, operational traffic is likely to be the only air quality impact. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low air quality impact during the operational phase.

### *(v) Noise*



With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on residential receptors during the construction phase of this proposed desalination location

Operational traffic is likely to have small noise impact and there may be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a low noise impact due to traffic. Noise impacts are expected to be low.

*(vi) Cultural Heritage*

The South Dublin site was found to be highly constrained, mostly due to the amount of protected structures recorded within the area. Despite the multiple constraints within the study area, it is more likely that further studies could result in the identification of a site in the South Dublin locations that would have less of an impact on the cultural heritage resource than the other three options. The following potential negative impacts were identified;

- 2 potential low-range impacts on National Monuments;
- Potential direct/indirect mid-range impacts regarding 30 features from the Record of Monuments and Places;
- 199 potential direct/indirect high-range impacts on a Recorded Protected Structure;
- 1 potential direct/indirect low-range impact on a feature from the National Inventory of Architectural Heritage;
- 48 potential direct/indirect high-range impacts on historic designed landscapes;
- 3 potential very mid-range impacts on an Architectural Conservation Area;
- Potential high-range impacts on underwater archaeology within the marine environment.

*(vii) Landscape and Visual*

The main landscape and visual issues relating to a desalination facility at this location are associated with elevated designated scenic views from Killiney Hill, the Vico Road and from the dwellings in this area, which are contained within an Architectural Conservation Area. These views are also enjoyed by recreational users of Killiney Hill Park and Killiney Beach. There is also a high potential to impact on views from residential areas throughout this location due to the high population density.

There is a strong potential to impact on high amenity coastal views enjoyed by commuters on the dart rail service along this section of coastline. There is also potential to impact on designed views associated with Rosedale House and demesne, as well as views from Shanganagh Park and Woodbrook Golf Course, which occur at the southern end of this location.

In general it is considered that the northern end of this location would be more sensitive to landscape and visual impacts arising from the proposed desalination facility than the southern end. Given the range and degree of existing development



in this area generally, there is some potential for a desalinisation facility to be incorporated in the southern portion of this location that may not result in significant landscape and visual effects, if an appropriate site could be found.

*(viii) Agronomy*

Regarding farming enterprise there are 4 to 8 landowners within the South Dublin site. The land quality is very good and land use is predominately beef production with some tillage.

*(ix) Tourism*

Killiney beach to the north of the Study Area has been awarded a Blue Flag for the past two years. A number of other beaches are located within the Study Area also, these currently do not hold Blue Flag status.

Bray Sailing Club is based in Bray's harbour about 1.5 miles north of the prominent Bray Head. Approximately 1 km of The Dublin Mountains Way walking trail is within the study area.

*(x) Soils, Geology and Hydrogeology*

No significant constraints were identified at the South Dublin Location.

However, a number of Irish Geological Heritage sites are recorded in this area and further consultation with the GSI would be required if there was a risk of potential impact to these sites.

The underlying aquifer is described as a Local, moderately important aquifer, with areas of poor aquifer at the northern and southern corners of the South Dublin study area.

Although there is potential for areas of Extreme to Moderate vulnerability to be encountered during the construction phase where depth to bedrock is shallow (especially to the north of the study area), best practice construction methodologies will mitigate this impact. Due to the location of this site, there is a notable area of Made Ground, which may include some unknown areas of contaminated land.

*(xi) Planning Policy*

Due to the scale of the location chosen, there is a wide variety of land uses, including residential – both old and new, mixed use, commercial, active recreational areas and open space.

This area is very much part of the urban and metropolitan area of Dublin and the zonings reflect this fact.

As the location chosen is very large and a more defined site is required to establish if there are any local objectives which could conflict with the development of the required infrastructure. The area is urban and if a suitably sized site is found this could comply with typical zonings expected in urban areas. This detail will need to be verified when a site is identified.

*(xii) Traffic, Engineering and Design*

The South Dublin location covers a large area between Dalkey and Bray. The length of access road required to service a potential site in South Dublin can vary depending on the selected location within an area with a high density of road network.

Due to the density of the existing road network and the highly urbanised area there is likely to be some impact on the local road network during the construction and operation phases. The highly urbanised area presents a potential risk during the construction phase due to construction traffic.

Some flooding does occur within the Study Area. However, impacts are considered to be low to very low as lands are available outside of the flood zones.

*(xiii) Risk*

No limitation on abstraction quantity is relevant with sea water. Desalination has high capex and opex costs, high energy requirements, large carbon footprint and high unit cost of water supplied, particularly if operation is intermittent. It includes a large infrastructural land requirement in a sensitive coastal environment, with significant disruption associated with the water pipeline corridor.

### 7.3.4 Appraisal of the Balbriggan Location



**Figure 7-10 Desalination Plant – Balbriggan Area**

*(i) Ecology*

The location is contained in large farmed fields on a relatively open coastal plain where field boundaries are defined by low windswept hedgerows. Coastal habitats at this location include sea cliffs and rocky outcrops, providing important habitat for coastal breeding bird colonies,

Moderate adverse impacts are predicted in a worst case scenario with mitigation if green field (farmland areas) are used for any development. The main impacts will

likely arise through direct hedgerow loss and indirect impacts, including disturbance to protected mammal and bird species.

*(ii) Aquatic Ecology*

Marine water quality in the Balbriggan area is considered acceptable for abstraction.

In terms of physical oceanography, the area off Balbriggan has suitable water depths to the west of Rockabill. However, velocities are lower than off Bray Head. Rockabill lies within a SAC and potential impact from the brine plume would have to be assessed based on output from brine modelling studies.

*(iii) Surface Water*

No WFD waterbodies enter the Northwestern Irish Sea within the Study Area. The WFD status of the Northwestern Irish Sea is High.

Impacts on the objectives of the WFD from the proposed development are considered to be high, due to the potential for construction impacts and due to the release of brine during operation which may have impacts on water quality characteristics such as temperature, chemical constituents and salinity.

*(iv) Air Quality*

The area is considered rural with a small number of low density residential dwellings. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed desalination location.

With regards to impacts during the operational phase of the proposed development, operational traffic is likely to be the only air quality impact. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low air quality impact during the operational phase.

*(v) Noise*

With consideration of standard good practice measures for the control of noise during construction, there will likely be a very low impact on sensitive receptors during the construction phase of this proposed desalination location

Operational traffic is likely to have small noise impact and there may be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low noise impact due to traffic. Noise impacts are expected to be very low.

*(vi) Cultural Heritage*

The Balbriggan area, whilst not containing a large amount of constraints, is highly constrained due to the presence of a prehistoric passage tomb cemetery adjacent to the coast line. The open nature of the landscape would mean that the construction of a plant would likely lead to a significant impact on the setting of the cemetery.

The following potential negative impacts were identified;

- 4 Potential very high-range impacts on National Monuments (protected by a preservation order);
- Potential direct/indirect mid-range impacts regarding 8 features from the Record of Monuments and Places;
- 8 Potential direct/indirect mid-range impacts on a Recorded Protected Structure;
- Potential high-range impacts on underwater archaeology within the marine environment.

*(vii) Landscape and Visual*

The most sensitive aspects of this location in landscape and visual terms, are the ‘highly Sensitive Landscape’ zoning, the short section of designated scenic route applied to the R132 at this location and the distinctive rocky shoreline and low sea cliffs that form the coastline here. There is also potential to impact on views from the main Dublin - Belfast railway line.

Given the open nature of the rural landscape in this area an industrial facility such as a desalination plant may appear incongruous and be difficult to screen. Effective screen vegetation would be difficult to establish and would not easily blend with the low windswept hedgerows in the vicinity. A potential site nearer the southern end of this location and the settlement of Balbriggan would be most appropriate in terms of reducing potential impacts on landscape character, however, this would also increase the potential for visual impacts from dwellings in the northern outskirts of Balbriggan.

*(viii) Agronomy*

Regarding farming enterprise there are 1 to 5 landowners within the Balbriggan site. The land quality is very good and land use is predominately tillage.

*(ix) Tourism*

Balbriggan has considerable tourism potential in terms of its natural and built heritage and amenities, particularly its coastal location with its sandy beach and harbour. The Railway Viaduct, a strong visual landmark in Balbriggan, was built in 1844, as part of the Dublin to Drogheda railway.

*(x) Soils, Geology and Hydrogeology*

No significant constraints were identified at the Balbriggan Location.

Laytown and Gormanstown coastal plain/sea cliffs County Geological Site is located to the north of the study area. The underlying aquifer is described as a Local, moderately important aquifer.

Although there is potential for areas of Extreme vulnerability to be encountered during the construction phase where depth to bedrock is shallow, best practice construction methodologies will mitigate this impact.

*(xi) Planning Policy*

The area is located just north of the town of Balbriggan, and is currently used for a mix of uses including agriculture.

The southern portion of the location is zoned OS – Open Space, and the remainder of the area is zoned HA - High Amenity. The majority of the location is zoned HA – to protect these highly sensitive and scenic locations from inappropriate development.

The location is close to an area of the Fingal/Meath Border. It is in an exposed location and care will have to be taken to determine if there is a site within the identified location that can be screened sufficiently.

*(xii) Traffic, Engineering and Design*

The Balbriggan site area is located to the east of the R132 Regional Road and the site area is partitioned by the Dublin / Belfast railway line. The major part of the site area is located to the east of the railway line. A new access road would be required from the R132 to the site over a distance of the order of 0.7km.

The Balbriggan location will potential require a bridge crossing of the Dublin / Belfast railway line.

The crossing of the railway line during the construction phase could present risks associated with construction traffic.

Some flooding does occur within the Study Area. However, impacts are considered to be low to very low as lands are available outside of the flood zones.

*(xiii) Risk*

No limitation on abstraction quantity is relevant with sea water. Desalination has high capex and opex costs, high energy requirements, large carbon footprint and high unit cost of water supplied, particularly if operation is intermittent. It includes a large infrastructural land requirement in a sensitive coastal environment, with significant disruption associated with the water pipeline corridor.



### 7.3.5 Appraisal of the Loughshinny South Location



**Figure 7-11 Desalination Plant – Loughshinny South Area**

#### (i) Ecology

This extensive farmland area contains coastal habitats, small coastal breeding bird colonies, an extensive hedgerow network and intensively managed farmland

The site is similar in description to that of Loughshinny North with the rural area dominated by intensively managed agricultural lands, however as this site is closer to Rush the number of settlements has increased with the study area hosting more

developed land. The coastal habitat remains similar and is important for small coastal breeding bird colonies.

Moderate adverse impacts are predicted in a worst case scenario, post mitigation, if a desalination plant and associated works are constructed in green field (farmland) areas. In particular impacts will likely arise through direct hedgerow loss, indirect protected mammal species and birds disturbance. A coastal location may additionally disturb coastal birds.

#### *(ii) Aquatic Ecology*

The outfall site for this location lies within the Rockabill to Dalkey Island SAC (site code 3000 and description above) and close to two other SACs and these are Rodgerstown Estuary SAC (site code IE000208 and description above), and Lambay Island SAC (site code IE000204 and description above). Even though modelling studies indicate that the brine plume will disperse quickly, because of the fact that the disposal site lies within a SAC and is close to two other Natura sites, the Loughshinny South option is not considered a preferential option.

#### *(iii) Surface Water*

The Balcunnin waterbody enters the Northwestern Irish Sea within the Loughshinny South study area. The status of the stream has yet to be assigned and the Northwestern Irish Sea WFD status is High.

Impacts on the objectives of the WFD from the proposed development are considered to be high, due to the potential for construction impacts and due to the release of brine during operation which may have impacts on water quality characteristics such as temperature, chemical constituents and salinity.

#### *(iv) Air Quality*

The area is considered rural/suburban with a small number of low density residential dwellings and a larger estate at St Catherine's. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed desalination location

With regards to impacts during the operational phase of the proposed development, operational traffic is likely to be the only air quality impact. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low air quality impact during the operational phase.

#### *(v) Noise*

With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on sensitive receptors during the construction phase of this proposed desalination location

Operational traffic is likely to have small noise impact and there may be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low noise impact due to traffic. Noise impacts are expected to be very low.

(vi) *Cultural Heritage*

The most significant constraints have been identified in the Loughshinny South area, due to the presence of a large landmark promontory fort, which is subject to a preservation order under the National Monuments Act and is also recorded within the RMP and RPS. A landmark Martello Tower is recorded within the fort itself, which is also subject to protection under the National Monuments Act and Planning and Development Act. Development of infrastructure in this area would not be possible without having a significant impact on the setting of the fort and associated features. The following potential negative impacts were identified;

- 1 Potential very high-range impacts on a National Monument (Promontory Fort, protected by a preservation order);
- Potential direct/indirect very high-range impacts regarding 5 features from the Record of Monuments and Places (Promontory Fort and associated features);
- 7 Potential direct/indirect very high-range impacts on a Recorded Protected Structure (Promontory Fort and associated features);
- 5 Potential direct/indirect high-range impacts on a feature from the National Inventory of Architectural Heritage;
- 1 Potential direct/indirect low-range impact on a historic designed landscapes;
- Potential high-range impacts on underwater archaeology within the marine environment.

(vii) *Landscape and Visual*

The main landscape and visual issues associated with a potential desalination facility at this location relate to landscape and visual designations. The entire coastal zone in this area is designated as a 'Highly Sensitive Landscape' in the Fingal County Development Plan. The R128 regional road that follows the coast is also designated as a scenic route along this section and there are coastal walks indicated on the Development Plan 'Green Infrastructure' maps.

The low sea cliffs that form the coastline in this area are a distinctive and sensitive landscape feature that could be impacted upon by any desalination proposal. Furthermore, the landscape character of this area is that of an open coastal landscape with a relatively low degree of built development. There is a strong potential that a desalination facility would appear ambiguous in this landscape and would be difficult to mitigate in the surrounding context of low windswept vegetation.

Coastal views from the Dublin Belfast railway line could also be affected by any proposed desalination facility at this location.

(viii) *Agronomy*

Regarding farming enterprise there are 1 to 5 landowners within the Loughshinny South site. The land quality is very good and land use is predominately tillage.

(ix) *Tourism*

Loughshinny is an attractive seaside village with a beach, a harbour, a circular Millennium Walk and traditional seaside vernacular buildings. Loughshinny Beach

and the fishing spot of Loughshinny are located close to the Study Area, the beach has not been awarded a blue flag since 1996.

*(x) Soils, Geology and Hydrogeology*

No significant constraints were identified at the Loughshinny South Location.

An Irish Geological Heritage site is recorded in this area and further consultation with the GSI would be required if there was a risk of potential impact to this site. The underlying aquifer is described as a Local, moderately important aquifer.

Although there is potential for areas of Extreme to Moderate vulnerability to be encountered during the construction phase where depth to bedrock is shallow (especially in the coastal and central areas of the study area), best practice construction methodologies will mitigate this impact.

*(xi) Planning Policy*

The area is located just north of Rush and south of Loughshinny. It is currently in agricultural use with the south west corner being part of Rush town itself.

This location includes a wide variety of zoning including Rural (RU) and Open Space (OS) to the west, HA (High Amenity) to the east and a mix of town zonings to the south west (mainly existing residential and community use).

Consideration must be given to the location in the rural area to the north of Rush as well as horticultural businesses.

*(xii) Traffic, Engineering and Design*

The Loughshinny South site is located to the east of the R128 Regional Road and a new access road is potentially required and this would be of the order of 1.0km in length.

The R128 Regional Road has a record of accidents through Rush, which is located immediately south of the Loughshinny South.

Some flooding does occur within the Study Area. However, impacts are considered to be low to very low as lands are available outside of the flood zones.

*(xiii) Risk*

No limitation on abstraction quantity is relevant with sea water. Desalination has high capex and opex costs, high energy requirements, large carbon footprint and high unit cost of water supplied, particularly if operation is intermittent. It includes a large infrastructural land requirement in a sensitive coastal environment, with significant disruption associated with the water pipeline corridor.

### 7.3.6 Appraisal of the Loughshinny North Location



**Figure 7-12 Desalination Plant – Loughshinny South Area**

*(i) Ecology*

The agricultural lands are dissected by maintained hedgerow and are relatively uninterrupted until they meet the coastline. The coastline consists of low sea cliffs that provide a distinct and abrupt transition between the coastal plain and the shoreline which consists of rocky outcrops and pebbled coves. The main Dublin - Belfast railway line passes in a north-south direction a short distance inland from the coast.



The northern section of the study area, along the coast is contained within Loughshinny Coast pNHA. The coastal habitat provides important habitat for small coastal breeding bird colonies.

Moderate adverse impacts are predicted in a worst case scenario (post mitigation) if green field (farmland areas) are used as a site for a desalination plant. In particular impacts will likely arise through direct hedgerow/linear woodland loss, protected mammal species and disturbance to birds. A coastal location may additionally disturb coastal birds and protected flora.

#### *(ii) Aquatic Ecology*

The outfall site for the Loughshinny North location lies within the Rockabill to Dalkey Island SAC. Even though modelling studies indicate that the brine plume will disperse quickly in the water column, because of the fact that the disposal site lies within an SAC and is close to two other Natura sites, the Lough Shinnny North option is not considered a preferential option.

#### *(iii) Surface Water*

The Lane watercourse is the only waterbody that enters the Northwestern Irish Sea within the Loughshinny North study area. The status of this stream is not assigned and the status of the Northwestern Irish Sea is High.

Impacts on the objectives of the WFD from the proposed development are considered to be high, due to the potential for construction impacts and due to the release of brine during operation which may have impacts on water quality characteristics such as temperature, chemical constituents and salinity.

#### *(iv) Air Quality*

This area is considered rural with a small number of low density residential dwellings. With consideration of standard good practice measures for the control of dust during construction, there will likely be a low impact on these receptors during the construction phase of this proposed desalination location.

With regards to impacts during the operational phase of the proposed development, operational traffic is likely to be the only air quality impact. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low air quality impact during the operational phase

#### *(v) Noise*

With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on sensitive receptors during the construction phase of this proposed desalination location

Operational traffic is likely to have small noise impact and there may be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low noise impact due to traffic. Noise impacts are expected to be very low.

#### *(vi) Cultural Heritage*



Whilst Loughshinny North was not found to be as constrained as the southern option, the proximity to the Promontory fort to the south, along with a cluster of prehistoric monuments recorded within the area, would mean that the development of plant in this area would still likely have a high impact on the cultural heritage resource. The following potential negative impacts were identified;

- 1 Potential mid-range impact on a National Monument (Promontory Fort);
- Potential direct/indirect high-range impacts regarding 8 features from the Record of Monuments and Places;
- 1 Potential direct/indirect mid-range impacts on a Recorded Protected Structure;
- Potential high-range impacts on underwater archaeology within the marine environment.

*(vii) Landscape and Visual*

The main landscape and visual issues associated with a potential desalination facility at this location relate to landscape and visual designations. The entire coastal zone in this area is designated as a 'Highly Sensitive Landscape' in the Fingal County Development Plan. The R128 regional road that follows the coast is also designated as a scenic route along this section and there are coastal walks indicated on the Development Plan 'Green Infrastructure' maps.

The low sea cliffs that form the coastline in this area are a distinctive and sensitive landscape feature that could be impacted upon by any desalination proposal. Furthermore, the landscape character of this area is that of an open coastal landscape with a relatively low degree of built development. There is a strong potential that a desalination facility would appear ambiguous in this landscape and would be difficult to mitigate in the surrounding context of low windswept vegetation.

Coastal views from the Dublin Belfast railway line could also be affected by any proposed desalination facility at this location.

*(viii) Agronomy*

Regarding farming enterprise there are 3 to 7 landowners within the Loughshinny North site. The land quality is very good and land use is predominately beef production and tillage.

*(ix) Tourism*

Loughshinny is an attractive seaside village with a beach, a harbour, a circular Millennium Walk and traditional seaside vernacular buildings. Loughshinny Beach and the fishing spot of Loughshinny are located close to the Study Area; the beach has not been awarded a blue flag since 1996.

*(x) Soils, Geology and Hydrogeology*

No significant constraints were identified at the Loughshinny North Location.

An Irish Geological Heritage site is recorded in this area and further consultation with the GSI would be required if there was a risk of potential impact to this site. The underlying aquifer is described as a Local, moderately important aquifer.

Although there is potential for areas of Extreme to Moderate vulnerability to be encountered during the construction phase where depth to bedrock is shallow (especially in the coastal and central areas of the study area), best practice construction methodologies will mitigate this impact.

*(xi) Planning Policy*

The area is located just north of Loughshinny village. It is currently in agricultural use with low density residential development along local roads. The village of Loughshinny is to the south – the village is mainly linear in form and the small beach and pier are a popular local attraction.

The location includes a variety of zoning including Rural (RU) and Open Space (OS) to the west, HA (High Amenity) to the east.

Similarly to the location to the south, consideration must be given to the location in the rural area of Fingal as well as horticultural businesses.

*(xii) Traffic, Engineering and Design*

The Loughshinny North site is located to the east of the R128 Regional Road and a new access road is potentially required and this would be of the order of 1.0km in length.

Some flooding does occur within the Study Area. However, impacts are considered to be low to very low as lands are available outside of the flood zones.

*(xiii) Risk*

No limitation on abstraction quantity is relevant with sea water. Desalination has high capex and opex costs, high energy requirements, large carbon footprint and high unit cost of water supplied, particularly if operation is intermittent. It includes a large infrastructural land requirement in a sensitive coastal environment, with significant disruption associated with the water pipeline corridor.

**7.3.7 Irish Sea Abstraction Locations - Conclusions**

A comparison of the four Irish Sea abstraction location options, is presented in Table 7-D.

<b>Constraint</b>	<b>South Dublin</b>	<b>Loughshinny North</b>	<b>Loughshinny South</b>	<b>Balbriggan</b>
<i>Ecology</i>				
<i>Aquatic Ecology</i>				
<i>Surface Water</i>				
<i>Air Quality</i>				
<i>Noise</i>				
<i>Cultural Heritage</i>				
<i>Landscape and Visual</i>				
<i>Agronomy</i>				
<i>People</i>				
<i>Soils, Geology &amp;</i>				

<i>Hydrogeology</i>				
<i>Planning Policy</i>				
<i>Traffic, Engineering &amp; Design</i>				
<i>Risk</i>				
<b>Overall</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>1</b>

**Table 7-D MCA – Comparison between Irish Sea Abstraction Locations**

The Balbriggan location is considered to be the least constrained of the Irish Sea abstraction options overall for the following reasons;

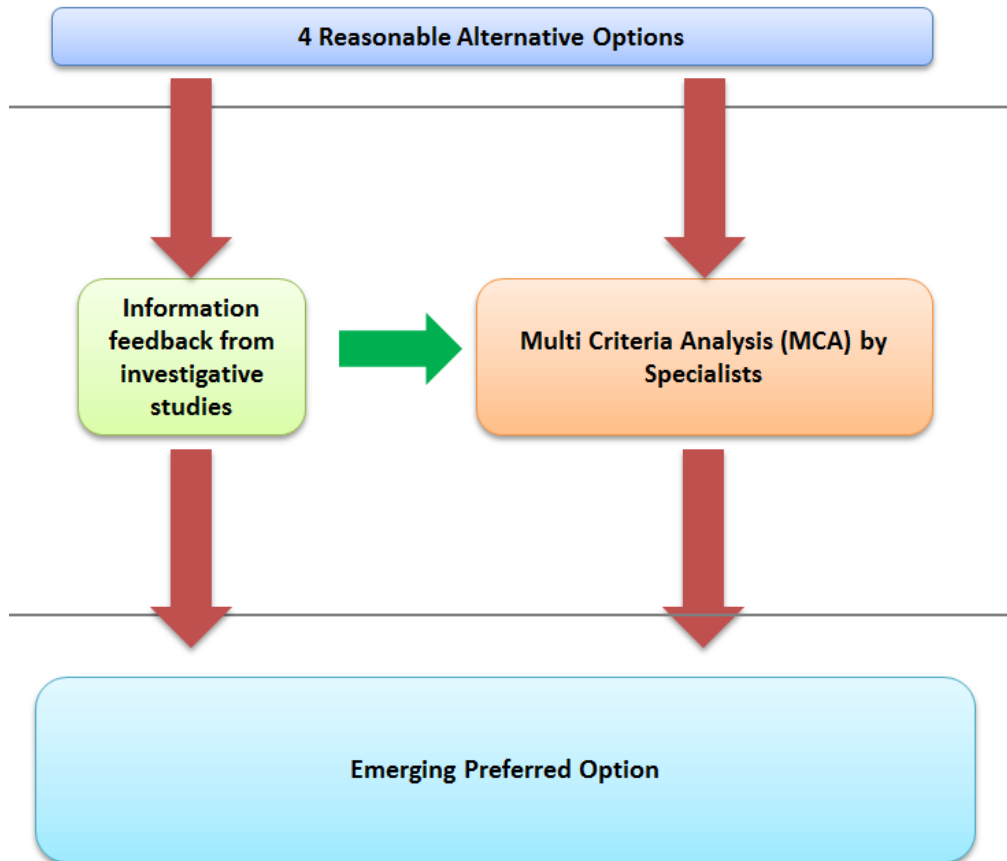
- Regarding surface water, all the areas were found to be highly constrained and therefore of high sensitivity. Despite the multiple constraints within all the study areas it is more likely that further studies could result in the identification of a site that would not impede the objectives of the WFD within the Balbriggan Study Area;
- The Balbriggan area has extensive areas of low ecological value farmland suitable for locating the proposed development.
- The Balbriggan site would be least constrained from an air quality and noise perspective due to the absence of dense residential development;
- The absence of equine enterprises and lesser number of intensive horticultural enterprises support its least constrained status in terms of agronomy and agriculture; whilst
- It is the least constrained location from the point of view of Soils, Geology and Hydrogeology.

**Appraisal of the ‘Desalination’ options, using multi criteria analysis, has indicated that an abstraction point at Balbriggan is the least constrained abstraction location.**

# 8 Options – Component Assessments

## 8.1 Introduction

A two part parallel assessment process has been applied in the appraisal of reasonable alternative options, refer to Section 5.



**Figure 8-1 Phase 4 Options Assessment – Emerging Preferred Option**

The assessments and processes discussed in ‘Section 6 Investigative Studies’ and ‘Section 7 Multi Criteria Analysis’ have identified two remaining options capable of sustainably meeting the potable water requirements of the Eastern and Midlands Region:

- Option C: Parteen Basin (Direct)
- Option H: Desalination

## 8.2 Ancillary Components in Water Supply

The assessments and processes discussed in Sections 6 and 7 were primarily concerned with establishing viable options that would provide not only a sustainable and reliable source, but one that was integrated and in tune with its environment.

The next stage is to determine how the ancillary components of a water supply system impact on their environment; and support comparative assessment of the two remaining options. These components can be broadly defined as:

The Terminal Point Reservoir, and

The Transmission Pipeline.

### **8.3 Terminal Point Reservoir Location**

It has been proposed that Option H: Desalination, refer to Section 3.5, conveys water to Ballycoolin Reservoir only. However, this was never intended to be the ultimate termination point for the WSP. Irish Water would address this linkage through separate proposals, if required, as part of an overall strategy for the East / Dublin Region.

For all intents and purposes the termination point, or Terminal Point Reservoir, location is common to both the two remaining options notwithstanding that Option H: Desalination ‘ends’ in Ballycoolin.

#### **8.3.1 Identification of Termination Point Locations**

A critical piece of infrastructure within the water supply and distribution system is the ‘reservoir’, where clean water is stored after it has been treated in a water plant, and before it is piped to the end users. Their main purpose is to provide a buffer within the water supply system so that water supplies can be maintained across periods of varying demand.

The ‘reservoir’ is the termination point for the WSP. As the main population centre in the Eastern and Midlands Region, the nation’s capital defines a significant proportion of the need within the region, and the focus for identifying a suitable site for the ‘reservoir’.

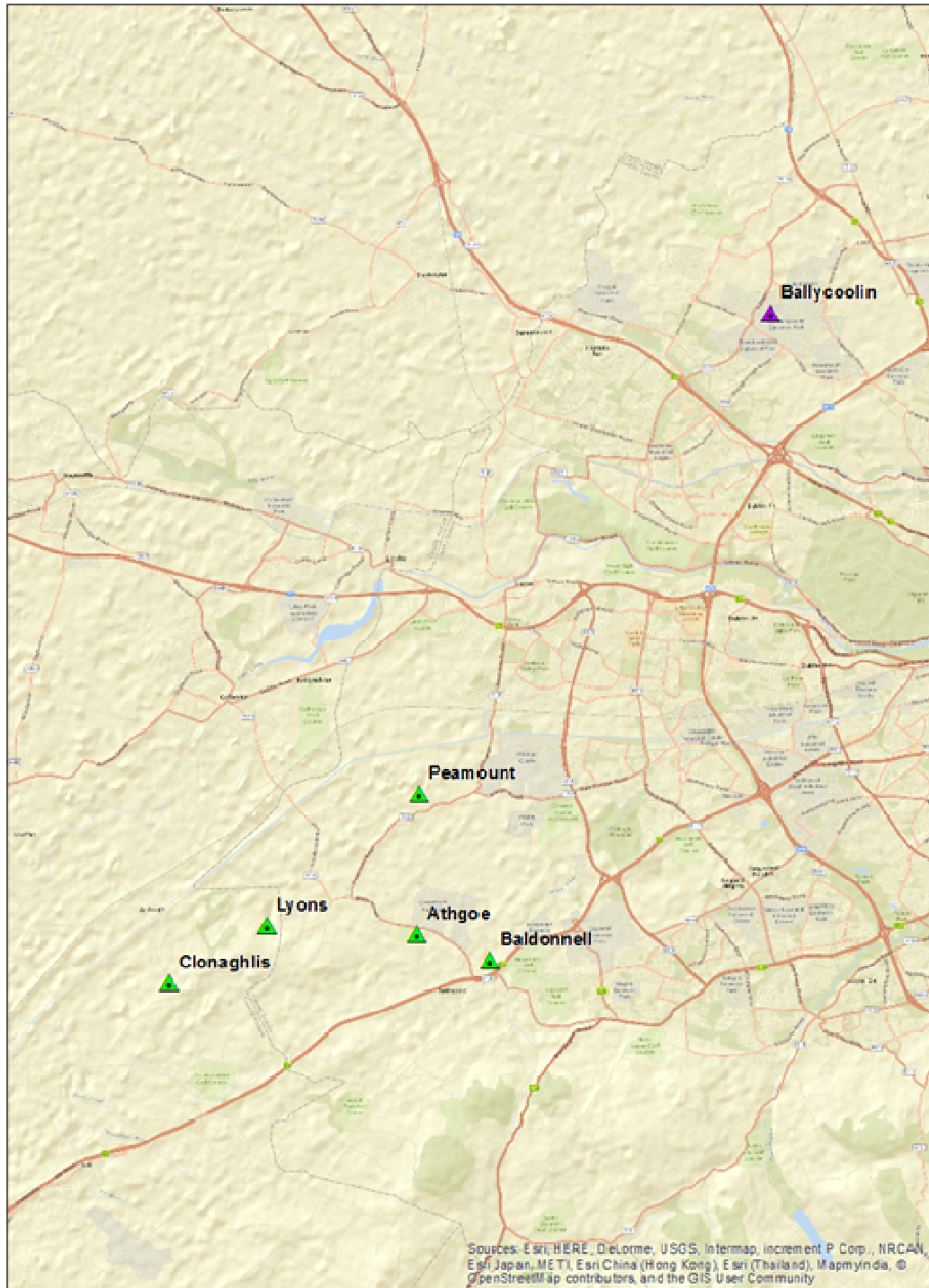
The SEA identified five locations that were deemed suitable for siting the termination point, namely:

- i. Baldonnel;
- ii. Athgoe;
- iii. Lyons;
- iv. Clonaghilis; and
- v. Peamount.

The principal selection criteria were the suitability of elevation at the termination point, and how this could be integrated with existing infrastructure at Saggart and Peamount Reservoirs; key linkages to the greater Dublin water supply distribution network.

The five sites considered for a termination point are shown on Figure 8-2.

The proposed Option H: Desalination conveys water to Ballycoolin Reservoir, in North Dublin, only. Its relative location to the potential termination points is also shown in Figure 8-2.



**Figure 8-2 Potential Terminal Locations ('Reservoir' Sites)**

### 8.3.2 Integration of the new source supply

In recognition of developments since the SEA was completed, a detailed strategic review of storage and distribution in the Eastern Region was undertaken, considering, primarily, current asset interconnectivity and updated demand projections.

The dynamic, and balance, between hydraulic engineering and whole life cycle costs indicates that it would be preferable for the termination point to be in an elevation range of between 70m and 80m OD. Refer to Appendix F13.



Initially the five sites were determined with reference to a key elevation constraint in the range of 100 – 110m ordnance datum (OD); however, the current criteria of an elevation in the range of 70 – 80m OD has excluded four of these sites from further consideration given their much higher elevation.

Of the sites identified in the SEA, and assessed through strategic review of storage and distribution in the Eastern Region, only the location in the Peamount area meets the current criteria of an elevation in the range of 70 – 80m OD.

### 8.3.3 Appraisal of the Peamount Location



**Figure 8-3 Potential Terminal Location**

#### *(i) Ecology*

This site is located in farmland with boundary hedgerows likely to be of local importance for ecology receptors.

No significant ecology constraints were identified at Peamount.

#### *(ii) Aquatic Ecology*

As there are no aquatic habitats at the Peamount site, there are no aquatic ecological constraints.

#### *(iii) Surface Water*

There are two WFD waterbodies within the study area for the Peamount terminal location:

- Lucan waterbody; and
- Griffen waterbody.

The WFD status of the Lucan waterbody is Unassigned and the Griffen waterbody is Bad.

The location of terminal reservoir at this location should not pose any impediment to the objectives of the WFD. The location of the termination point can be further refined at a future stage to avoid surface water features within the study area and the potential impact associated with these.

Flooding within the study area is minimal therefore potential impacts associated with the termination location are considered to be of small magnitude. On that basis the significance of these impacts is considered to be very low, given the lands available outside of the flood zones in which the termination point development could be located.

#### *(iv) Air Quality*

The study area is predominantly rural with sparse one-off residential development, the area also contains a hospital which can be classified as a sensitive receptor. As a result of this, there will likely be a low impact on these receptors as a result of the construction phase of the proposed Terminal Point Reservoir.

With regards to impacts during the operational phase of the proposed development, operational traffic is likely to be the only air quality impact. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low air quality impact during the operational phase. Other constraints in the area include some IPPC licenced facilities in nearby industrial estates, however, due to the low predicted impact of the Terminal Point Reservoir, cumulative impacts are likely to be insignificant.

#### *(v) Noise*

With consideration of standard good practice measures for the control of noise during construction, there will likely be a low impact on sensitive receptors during the construction phase of the proposed Terminal Point Reservoir.

With regards to impacts during the operational phase of the proposed development, operational traffic is likely to have small noise impact and there may be some fixed mechanical plant / pumps which will generate noise. At the detailed design stage however noise from fixed plant will be considered and standard noise mitigation measures will be provided to minimise impacts. Considering that the proposed development will lead to a minimal increase in AADT on the surrounding road network, there will be a very low noise impact due to traffic. Noise impacts are expected to be very low.

#### *(vi) Cultural Heritage*

For the most part the Peamount area is relatively unconstrained with regards to the cultural heritage resource. Only one recorded archaeological site is located within the area. This is listed within the RMP and is not a National Monument nor does it have a Preservation Order. A large majority of the remaining constraints are located within the southern portion of the area. Whilst there are a number of protected structures and the National Inventory of Architectural Heritage (NIAH) structures, many of these are clustered around the already developed Peamount Hospital complex, developed within a former designed landscape associated with Peamount House. Further to the south a slightly smaller house (Kelloges), once possessed a

demesne, although this has been impacted on by development. The main structure is still extant and included in the RPS/ NIAH.

The following potential negative impacts were identified;

- 1 Potential direct/indirect very low-range impact regarding 1 features from the Record of Monuments and Places;
- 8 Potential direct/indirect low-range impacts on a Recorded Protected Structure;
- 16 Potential direct/indirect low-range impact on a feature from the National Inventory of Architectural Heritage;
- 2 Potential direct/indirect mid-range impacts on historic designed landscapes;

*(vii) Landscape and Visual*

Overall the Peamount terminal point location is considered to be relatively robust in terms of landscape and visual constraints. The main consideration is its proximity to the Grand Canal and the associated 'Grand Canal Way' along its tow path, which is a national 'way-marked' walking route. The canal tends to be strongly contained by embankments and vegetation along this section. With considered siting and mitigation screen planting of the terminal point infrastructure it is not envisaged that proximity to the Grand Canal is a critical landscape and visual factor for this location.

Whilst there is potential for some mid-range visual impacts from surrounding residential receptors, the R120 regional road and Peamount Hospital, this is an urban fringe location already characterised by substantial industrial / business park buildings in the near vicinity to the east. Again, potential visual impacts can be substantially mitigated by considered site design and screen planting that will assimilate readily with surrounding vegetation structures. Significant landscape and visual impacts are not envisaged at this terminal point location.

*(viii) Agronomy*

Regarding farming enterprise there are 1 to 5 landowners within the Peamount site. The land quality is very good and land use is predominately tillage.

*(ix) Soils, Geology and Hydrogeology*

No significant constraints were identified at the Peamount Termination Point.

No Geological Heritage sites have been recorded in this area and the underlying aquifer is described as LI (Local important aquifer, only productive in local zones).

Although there is potential for areas of Extreme vulnerability to be encountered during the construction phase where depth to bedrock is shallow, best practice construction methodologies will mitigate this impact.

*(x) Planning Policy*

This location is currently in agricultural use with low density residential development along the adjoining roads.

Part of the area is currently zoned for Distribution, Logistics and Warehousing and to facilitate opportunities for manufacturing, research and development, and light

industry. Casement (Baldonnel) Airport and Newcastle village, as well as Adamstown SDZ, are all within the vicinity of the location.

(xi) *Traffic, Engineering and Design*

No significant constraints were identified at the Peamount Termination Point with respect to traffic.

## 8.4 Transmission Pipeline

### 8.4.1 Identification of Preliminary Pipeline Corridors

As stated in Section 8.1 there are two options remaining under consideration:

Option C: Parteen Basin Reservoir (Direct)

Option H: Desalination

In addition, a termination point has emerged in the vicinity of Peamount.

Option C draws water from the Parteen Basin Reservoir as part of a conventional water treatment process, whilst Option H has preferred the Balbriggan area for a Desalination Plant.

Attention is now to consider identification of Preliminary Route Corridors between the abstraction point for the two remaining options and the termination point (Peamount).

For Option H: Desalination, the Preliminary Route Corridors considered were between the least constrained abstraction location (Balbriggan) and Ballycoolin Reservoir. Refer to Section 8.3 for an explanation on the termination point and relationship with Ballycoolin.

### 8.4.2 Constraints mapping

A methodology was developed, based upon constraint mapping, to assist in route development. This methodology is presented in Appendix B, and applied consideration of pre-determined 'obstacles' that directly influence the routing of a pipeline corridor. The latter was a strip of land within which a potential transmission pipe could be sited and was least constrained following consideration of all the 'obstacles'.

The constraints, or obstacles', are outlined below under the following headings:

Ecology

Archaeology, Cultural Heritage and Architectural Heritage

Soils, Geology and Hydrogeology

Water Quality

Landscape and Visual

Population and Infrastructure

Air / Climate / Noise

Planning

Agronomy

Traffic

Engineering and Design

As per the MCA described in Section 7 for the abstraction locations, a similar exercise was conducted on the Preliminary Route Corridors for the transmission pipeline.

The MCA for the Preliminary Route Corridors is detailed in Appendix F (Shannon) and Appendix G (Deslination).

*Note: The transmission pipeline is below ground infrastructure. For the most part, ancillary structures are at, or below, ground level. Any infrastructure that is above ground is of 'kiosk' type, or similar.*

#### **8.4.3 Preliminary Route Corridor – Parteen Basin Reservoir to Peamount**

A number of preliminary route corridors were identified through the mapping of known environmental constraints (obstructions), with corridors developed to avoid these.

The route between a potential abstraction location, based on a Shannon source water body, and the proposed termination point covers a very large distance, almost the width of the State. Consequently, this generated a large number of options (variations), and sub-options, for routing a transmission pipeline between two fixed points.

Subsequently, a multi-criteria analysis was completed on each route corridor option to identify the least constrained option. Refer to the Statements supporting the MCA in Appendix F.

Through this process a Least Constrained Route Corridor was identified between Parteen Basin Reservoir and Peamount as shown on Figure 8-4.









The proposed route passes north of Nenagh and Roscrea (Tipperary), to the south of Birr and Rhode (Offaly), to the south of Derrinturn and Straffan (Kildare) before crossing the River Liffey and terminating at Peamount.

#### 8.4.4 Preliminary Route Corridor – Balbriggan to Ballycoolin

The route between a potential abstraction location, based on an Irish Sea source water body, and Ballycoolin Reservoir is approximately 35km. Two options for routing a transmission pipeline between these two locations were developed.

A similar approach to that presented in Section 8.4.3 was carried out for the Desalination Plant transmission pipeline.

Refer to the Statements supporting the MCA in Appendix G.

A Least Constrained Route Corridor was identified between Balbriggan and Ballycoolin Reservoir as shown on Figure 8-5.

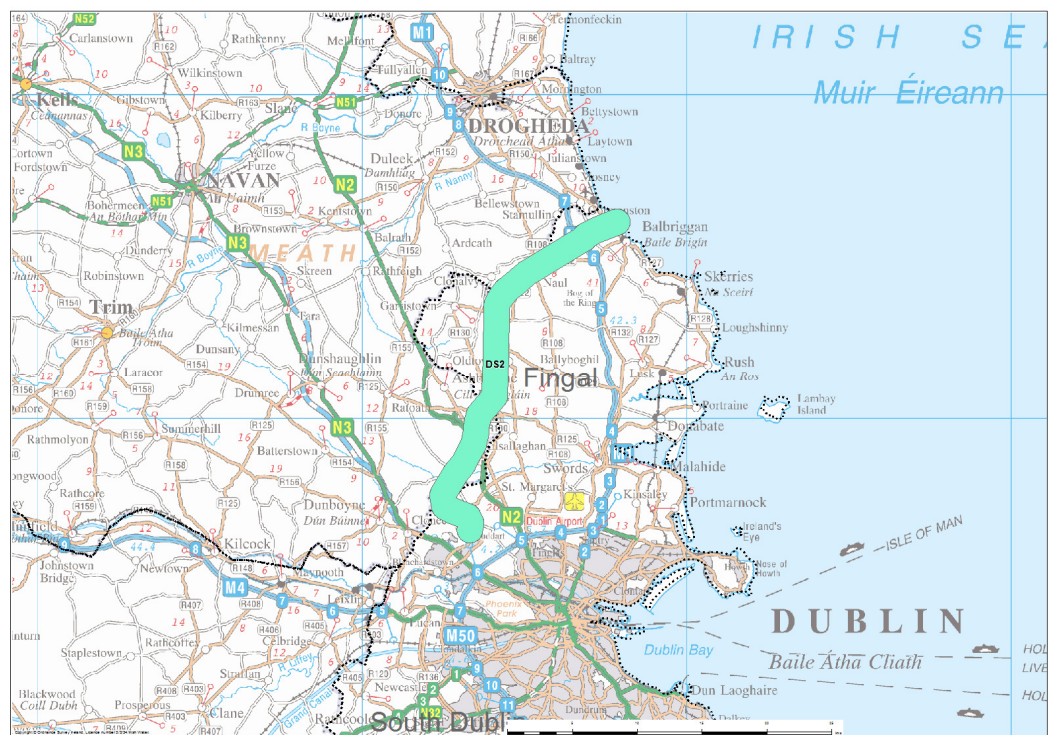


Figure 8-5 Balbriggan to Ballycoolin – Least Constrained Route Corridor

The proposed route traverses immediately north of Balbriggan, making crossings of both the Dublin – Belfast railway line and the M1 carriageway, directly south west to Ballycoolin but keeping west of Swords and Dublin Airport.

### 9.1 Introduction

The Water Supply Options Working Paper – Project Road Map Stage 2 identified 4 reasonable, and technically viable, alternative options for further consideration in this next stage:

- Option B (Lough Derg Direct);
- Option C (Parteen Basin Reservoir Direct);
- Option F2 (Lough Derg with Storage); and
- Option H (Desalination).

A multi-criteria analysis of these four options was carried out in this stage; refer to Sections 7 and 8. This analysis short-listed these four options to two, namely:

- Option C (Parteen Basin Reservoir Direct); and
- Option H (Desalination).

These two options are considered further in this section, and a comparison of the key differentiators carried out.

### 9.2 Option C: Parteen Basin Reservoir (Direct)

#### 9.2.1 Background to Shannon Source Options

The design solution that emerged from the 2010 Preliminary Report (see Figure 2-4), and which had provisional preference subject to investigative water quality and subsoil investigations, was the recommendation that raw water abstracted from Lough Derg be pumped to a raw water storage reservoir at Garryhinch, Co. Offaly with water drawn from this reservoir being treated on site before being transmitted to the greater Dublin region (Option F2 of the SEA). It was recognised however, and it was implicit in Options B (Lough Derg Direct) and C (Parteen Basin), that it would also be possible to treat the raw water at source, i.e. adjacent to Lough Derg or the Parteen Basin Reservoir.

The multi-criteria analysis determined, from the 3 options that were reliant on a Shannon source, that Option C (Parteen Basin Reservoir Direct) was preferred. However, irrespective of which option that was a front runner, all Shannon options would be predicated on a conventional WTP.

#### 9.2.2 Conventional Water Treatment Plant (WTP) Considerations

The *Project Need Report* (February 2015) established a water supply of 330 MI/d was required from a new source by the year 2050 phased to provide 267 MI/d for an option serving the Midlands and East by the year 2022.

A conventional Water Treatment Plant (WTP) from a Shannon source itself would need to be sized for a raw water throughput of 330 MI/day. This could be developed as a Phase 1 flow (270 MI/d) in three parallel discrete modular streams, each treating 90 MI/day. A Phase 2 flow (60 MI/d) could be treated in a smaller modular stream catering for 60MI/day. The sizing and configuration of the modular streams are cognisant of the capacity of best available technology.

The WTP would need to incorporate:

- The provision of an inlet /flow splitting chamber;
- Four main treatment streams, which will be fully enclosed (three built in Phase 1 with the fourth to be built in Phase 2);
- A secondary filters process stream for the treatment of process wastes, prior to return to the head of the Works;
- A sludge dewatering facility;
- Provision of a chemical storage dosing building(s);
- Provision of an administration building(s) which may include a control centre, laboratories, welfare facilities, stores, workshops and a visitors' centre.

To accommodate a WTP to process a raw water throughput of 330 Ml/d, and assuming that the configuration of the tanks are arranged in four parallel streams, (three in Phase 1 with the fourth for Phase 2), a high lift pumping station, control and administration buildings, and access roads, there would be a land requirement (footprint) of approximately 240m by 350m (8.4ha).

If wastewater from the treatment process cannot be discharged from the WTP due to environmental considerations, it may be necessary to provide a higher level of treatment, e.g. a membrane treatment system, specifically for it. A further area of approximately 2.5ha would be required giving a total site area requirement of 10.9ha.

In addition, the abstraction works will need to incorporate protection against infestation of alien species such as zebra mussels or Asian clams or alien vegetation. This can be provided by way of screening and micro-filtration or other methods such as chemical controls, asphyxiation, thermal treatment (heat shocking) ultraviolet irradiation or biological control systems.

Zebra mussels may also cause problems at water treatment plants that are unrelated to fouling. Their filtration activities clarify water by removing much of the particulate matter. In some areas of the Great Lakes (USA), where visibility in the water was limited to a depth of less than 1m in the late summer, the zebra mussel has clarified the water to the extent that one can now see the bottom in water depths exceeding 10 metres. In some areas, this means that so little particulate matter is present that methodologies currently employed at water treatment plants cannot provide effective coagulation. This necessitates changes in treatment technology, often at an increased expense to plant operators. In addition, a change in the relative proportions of blue green algae may be occurring as a result of the zebra mussels' preferential removal of green algae from the water column. The increased amount of blue-green algae is believed to be contributing to an increase in geosmin and 2-MIB compounds that, though harmless, impart a very disagreeable taste and odour to water, further increasing difficulties and costs of treatment.

### **9.2.3 Garryhinch – Particular Considerations**

Options B and C dealt with treatment at source, whereas Option F involves abstraction on the eastern shore of Lough Derg in combination with bog storage at Garryhinch. Notwithstanding the separate issue of effectiveness of variable abstraction at Lough Derg, the concept of treatment at source is supported by the following:

- There is already adequate raw water storage in the 'system' both at Lough Derg /Parteen Weir and at Poulaphuca in the Greater Dublin Area

- Pumping raw water over a distance of up to 62 km would prove troublesome because protection against invasive species carries a different risk at such a scale, compared with a shorter raw water link as is the case with Option C. It would entail the cost of providing complex scouring and crossover arrangements on the raw water mains system. It would also result in a lifetime programme of mains cleansing; and notwithstanding the precautionary measures to be developed at source in respect of the mitigation of zebra mussel infestation, there is nevertheless a risk that the scouring systems associated with the raw water mains, which by necessity will require that water is at times scoured into local watercourses, could potentially lead to inter-catchment contamination with zebra mussels.
- In pumping raw water over 62km to Garryhinch there is an additional operational cost because all of the ‘process wastes’ are being pumped to the storage reservoir whereas removal of these wastes at source would reduce the amount of water to be pumped forward with a significant saving to be made in operational cost.
- A treatment plant at a location along the eastern shore of Lough Derg, or Parteen Basin, would have the potential to make treated water available more easily to a wider and longer Benefiting Corridor along a treated water main route than would be possible from a treatment plant at Garryhinch. This would align more closely with the objectives in Irish Waters’ Water Services Strategic Plan.

The following water treatment issues may also arise at a treatment plant located adjacent to a Raw Water Storage.

- There is a potential issue which could arise at Garryhinch, if the circumstances outlined above in relation to removal of particulate matter by zebra mussels from the raw water were to arise. Published literature would suggest that raw water storage reservoirs that are less than about 10m deep can allow light to reach the bottom; this may encourage the growth of rooted plants (which potentially include transferred species alien to the Barrow catchment) unless the stored waters are sufficiently turbid to reduce light penetration. Shallow reservoirs are therefore generally avoided if there is any likelihood that plant growth could be high.
- The characteristics of raw water stored in Garryhinch for long periods may change over time from those of the raw water abstracted from the Shannon system. Hydrodynamic modelling of the reservoir will be required to predict concentrations of algae, including chlorophyll, which can be used as an indicator of water quality.
- A water treatment plant of the size required at Garryhinch would generate large volumes of process waste water, which will have no obvious discharge location other than the River Barrow SAC.

### **9.3 Option H: Desalination**

#### **9.3.1 Background to Desalination Option**

As outlined in Section 2.1, and prior to transfer of responsibility for managing Ireland’s water and wastewater investment and maintenance programmes, Dublin City Council commissioned a number of studies investigating a suitable source of water supply for the Dublin Region. The Desalination Option described in Section

3.5 was originally conducted as part of a Feasibility Study undertaken by Dublin City Council's Service Providers in 2005. This was developed further by the same Service Providers and concluded with the issuance of the *Desalination Study Report (November 2008)*.

The Desalination Study Report considered eight areas for a locating a Desalination Plant, and how a pipeline could be routed from there to Ballycoolin Reservoir. These areas were:

1. South Dublin;
2. Ringsend;
3. Howth Headland;
4. Ardgillan;
5. Balbriggan;
6. Gormanstown;
7. Loughshinny South; and
8. Loughshinny North.

In addition, the *Desalination Study Report (November 2008)* discussed the technology available in a desalination process, and other key components such as abstraction requirements. The conclusions drawn included, inter alia:

- Reverse Osmosis (RO) as the most appropriate desalination technology principally on account of its technical efficiency, cost effectiveness and environmental impacts;
- The optimum abstraction point (intake) would need to be located 3 to 4 km from shore to avoid tidal effects and enhance water intake quality; and
- The disposal and dispersal of brine from the Desalination Plant would need to occur 2 – 3km from the sea shore.

The findings of the *Desalination Study Report (November 2008)* are summarised in Appendix E14.

### **9.3.2 Technical Review of Desalination Option**

A review of the *Desalination Study Report (November 2008)* was carried out. This review considered technological developments that had taken place over the intervening period and whether the earlier findings remained valid. This review included an assessment, inter alia, of the following:

- Intake system;
- Power availability;
- Specific Treatment Options;
- Storage & network interface work; and
- Capital & operating costs;

**Intake System Design for Sea Abstraction** – this can be either an Open Seawater Intake or Subsurface Intake. Larger installations usually utilise open intake due to ease of construction compared to subsurface intakes. The latter would reduce amount of pre-treatment required but can be more difficult to construct.

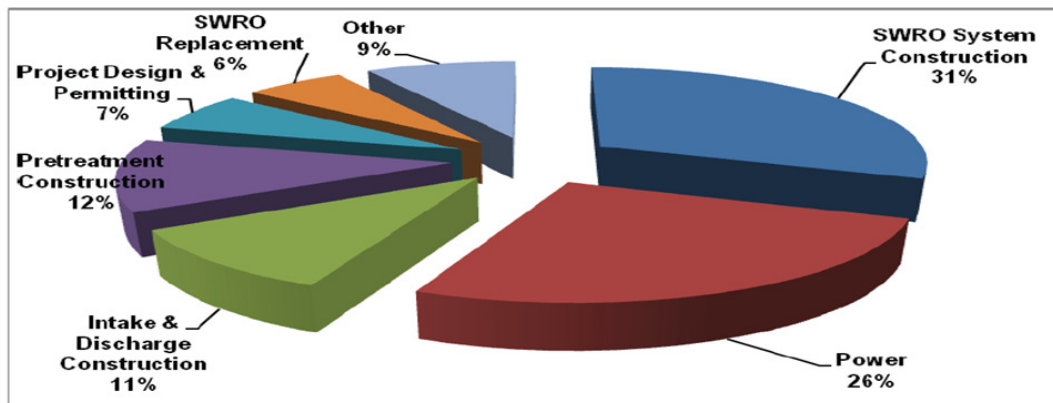


**Power Availability** – the *Desalination Study Report (November 2008)* suggests 3.58 KWh/m<sup>3</sup>, or 44.75 MW, to power the plant. There have been efficiency improvements in power requirements for desalination in the last 5 to 10 years, and power loading to the Desalination Plant, on a like-for-like basis, would be expected to be less than the previous figure envisaged. A new sub-station will be required on the Desalination Plant and would require 2 x 110kV supplies from Stephenstown for a site at Balbriggan.

**Specific Treatment Options** – there is a high level of pre-treatment associated with an open Intake compared to one that is a Subsurface Intake. The *Desalination Study Report (November 2008)* advocated a Reverse Osmosis Plant. There are a number of post treatment options – lime or limestone, chlorine versus onsite hypochlorite generation versus bulk hypochlorite.

**Storage & Network Interface Work** – very large storage tanks will be required on the Desalination Plant site, and modifications to the strategic network to effect its integration.

**Capital & Operating Costs** – the total expenditure is made up of the original costs to construct and commission (CAPEX) and the ongoing annual operating and maintenance (OPEX) costs. For the Desalination Plant components the CAPEX can be proportioned up as shown on Figure 9-1, where SWRO refers to a particular type of treatment, namely Reserve Osmosis.



**Figure 9-1 Desalination Plant – Typical Capital Expenditure Apportionment**

The CAPEX costs in the *Desalination Study Report (November 2008)* appear reasonable. OPEX costs rely predominantly on power consumption, but chemical, labour, and membrane replacement costs are also to be considered. Overall, these OPEX costs would be expected to have reduced over the last 5 – 10 years.

### 9.4 Options – A Relative Comparison

A like-for-like comparison between Option C: Parteen Basin Reservoir (Direct) and Option H: Desalination cannot be made given their fundamental strategic difference. The latter will serve the Eastern region only as the treated water will go into supply / distribution at Ballycoolin, with provision made at some future date by Irish Water to integrate this with their existing infrastructure at Peamount / Saggart. However, a source from the Shannon has the potential to benefit communities in the Midlands en route to the Eastern Region.

Other significant differences are highlighted below:

1. A Shannon source has a limited supply, however the Parteen Basin Reservoir does meet the demand / supply requirements (330Ml/d) for the design year horizon 2050;
2. The Irish Sea can be considered to represent an infinite source for any likely future supply / demand scenario on the Eastern seaboard;
3. A Shannon source provides a ‘benefit’ to the communities in the midlands (99Ml/d has been allocated).
4. A Shannon source relieves the pressures of demand on finite sources in the Midlands, and affords an opportunity to rationalise (decommission) existing water treatment plants which are overly reliant upon poor quality and unreliable water sources.
5. A Shannon source affords an opportunity, as a reliable and adequate resource, for future industry development in the Midlands and would facilitate decentralisation objectives in any planning policy, if required;
6. A Shannon source would be treated by conventional processes. The resultant product is familiar to the consumer;
7. A Desalination Plant produces water which would be unfamiliar to the Irish consumer. The key is to provide treated desalinated water with similar characteristics to their current supply. This is likely to involve remineralisation using carbon dioxide & limewater, or limestone (and possibly magnesium dosing) to provide a water of similar hardness and taste as they are currently used to. Consequently, a review of existing water supplies to consumers will have to be undertaken to establish properties of hardness, alkalinity and dissolved organic carbon to form a product that they are used to.

Desalination Plants are usually provided to communities where there are no other options, as the source water body provides challenges to be overcome that do not present themselves within a conventional treatment plant. Whilst none of these challenges are insurmountable they do add a very significant premium to the operating costs of a Desalination Plant over and above a conventional Water Treatment Plant.

The impact of this premium can be represented in Table 9 – A.

**Table 9-A Costs**

Option	Capital Costs CAPEX (€ Million)	Operating Costs OPEX (€ Million)	Total Costs TOTEX (€ Million)
Option C: Parteen Basin Reservoir (Direct)	€700M - €900M	€200M - €300M	€900M - €1200M
Option H: Desalination	€500M - €700M	€800M - €900M	€1300M - €1600M

Whilst the capital costs to construct a scheme from a Shannon source are initially more expensive over Option H: Desalination, these savings are eroded in the longer term as the operating costs are a factor of 4 greater.

Overall, in terms of TOTEX, Option H: Desalination has a cost factor of 1.4 when compared to Option C: Parteen Basin Reservoir (Direct). However, caution is urged

in interpreting the costs as the options, as mentioned above, are not a like-for-like comparison. For example, Option H is a Dublin centric solution. If the latter was extended to benefit communities in the Midlands then it would be prudent to budget for an additional €100M which would introduce a cost factor of 1.5.

In addition, there is an inherent risk in budgeting for future operational costs given the potential fluctuations in energy markets; particularly when those WTP, which employ a desalination treatment process, are a significant energy user.

*Note: In the Project Need Report (February 2015) Indecon Research Economists quantified the economic consequences of any failure to address deficiencies in available supply; estimating the cost of even a 1 day disruption to the Greater Dublin Area to be likely in excess of €78 million.*

## 9.5 Emerging Preferred Option

With reference to the Section 9.4, Option C: Parteen Basin Reservoir (Direct) emerges as the Preferred Option as it offers, over Option H: Desalination, these key differentiators:

- A transfer pipeline between Parteen Basin Reservoir and a termination point in Peamount provides a 'Benefitting Corridor' to the communities en route;
- A transfer pipeline between Parteen Basin Reservoir and a termination point in Peamount offers greatest strategic flexibility for the supply and distribution of a key National Resource;
- A transfer pipeline between Parteen Basin Reservoir and a termination point in Peamount allows for rationalisation of the existing abstraction / water treatment resources, particularly where they are under 'stress' conditions, in the Midlands;
- A conventional water treatment plant, in terms of capital and operational costs, provides much greater value to the consumer.

### 9.5.1 Siting of Ancillary Infrastructure

Sections 7 and 8 of this Preliminary Options Appraisal Report summarise the MCA process applied to define the least constrained locations for the ancillary infrastructure associated with the Emerging Preferred Option.

The product of this work has been amalgamated and is included as attached drawings at the back of this report.

### 10.1 Introduction

“**Community Effects**” arise primarily when directly affected host communities suffer either a direct loss (quantifiable or perceived) or loss of amenity or inequity from the construction and siting of infrastructure works within their immediate locality.

“**Community Benefits**” refer to the strategies and solutions that are adopted and implemented to alleviate the “Community Effects”.

Because of their nature, the siting and construction of large capital infrastructure projects can on occasion create significant “Community Effects” on host communities.

In the past decade the presence of “Community Effects”, and their significance, have become an ever increasing issue for many large scale capital infrastructure projects both internationally and within Ireland. During the intervening period various approaches in resolution and consensus building within host communities have been developed, tried and implemented across many capital infrastructure projects. The overall objectives of the consensus building in each case have been to avert conflicts between the capital infrastructure promoters and the host communities by ensuring that identified significant “Community Effects” are properly mitigated via the introduction of appropriate “Community Benefits” packages.

Fundamentally, an appropriate “Community Benefit” package will be bench marked against the proportional benefits that it offers to a host community for alleviating the significant “Community Effects” from the construction and siting of the proposed large scale infrastructure within their community.

“Community Benefit” packages are primarily for the alleviation/mitigation of significant “Community Effects” as opposed to “compensation” to local communities. They are recognition that affected communities should be afforded a level of “Community Benefit” which offers them a proportionate benefit to alleviate their direct loss (quantifiable or perceived) or loss of amenity or inequity.

It is the communities in the area directly impacted by the project that share in the primary benefit; and for those in a Shannon – Dublin Benefiting Corridor this is the availability of secure and high quality water supplies to facilitate economic growth and employment creation.

The primary benefits of the Eastern and Midlands Region Water Supply Project (WSP) also extend to availability of secure and high quality water supplies in the Limerick / Ennis corridor, using opportunities to deploy capacity at the Clareville Water Treatment Plant together with the new WSP Treatment Plant.

Irish Water will also bring the benefits of an aligned strategy to manage wastewater, for those communities taking up the opportunity of secure, reliable water supplies. It is the same utility which will manage both, and which will ensure that neither water supply, nor wastewater capacity, will be limiting constraints on development.

It is also noted that water supply from the Shannon to the Midlands and East would involve transfer of water across catchment boundaries, and community benefit

proposals would be expected to acknowledge this. Section 10.2 details some examples of approaches to Community Benefit in other large scale projects, before detailing general principles and specific proposals particular to the Water Supply Project.

In progressing a Planning Application under the Strategic Infrastructure Act, it is noted that An Bord Pleanála, when deciding to grant permission for strategic infrastructure development, may attach conditions in the normal manner e.g. as specified in section 34(4) of the 2000 Act, but Section 37G(7)(d) of the 2000 Act specifies that a condition may provide for ‘community gain’ with respect to Strategic Infrastructure Projects.

Meaningful ‘community gain’ is perhaps best developed in consultation with stakeholders, culminating in proposals developed in partnership with such stakeholders, and proactively submitted to An Bord Pleanála, and this is the approach being followed by Irish Water on the Water Supply Project-Eastern and Midlands Region.

## **10.2 General Categories of Community Benefits**

### **10.2.1 Introduction**

The type of “Community Benefit” package adopted varies according to the type of large scale infrastructure project being implemented – no two projects are the same. We have examined the approaches followed in a number of major UK and Irish projects, including the development and operation of a Minerals Potash mine in the North Yorkshire Moors National Park, the Poolbeg Waste to Energy Plant, and the UK High Speed 2 Rail Project.

The key conclusions from a review of the above three projects are that in terms of “Community Benefit” there is no “one size fits all solution”, rather the type of “Community Benefit” package developed for a project is bespoke to that project and will vary in response to a wide range of project issues encountered.

Typical project issues which will drive the development of any “Community Benefit” package will include, inter alia, the following:

- Project location – Rural/Urban;
- Project extents – Single Constrained Site/Extended Linear Corridor Site;
- Type of proposed capital infrastructure – Above Ground/Below Ground;
- Project funding source – Private/Government;
- Scale/Type/Range of affected communities; and
- Employment opportunity within the affected communities.

Although “Community Benefits” involve many factors they can generally be classified/fall within 7 broad categories as follows:

- Environmental Enhancement;
- Provision of Community Facilities;
- Educational Improvement, Development and Upskilling;
- Amenity Improvements;
- Strengthening and Enhancement of Physical Infrastructure;
- Engagement and Alignment with Broader Planning / Local Authority Objectives; and



- Economic Development.

### **10.2.2 Environmental Enhancement;**

Under this category the key objectives can include:

- Advancing environmental protection and improvement;
- Enhancing the local landscape; and
- Minimising construction phase environmental impacts.

This could involve identifying local environmental initiatives/projects, such as the Lakelands initiative, and measures in the lower Shannon to improve the fisheries connectivity of the river itself. It would involve providing support in terms of direct funding support to the environmental initiative/project sponsors or alternatively incorporating environmental improvement works within the WSP construction contracts. The possible inclusion of fishery enhancement works, with the opportunity of available plant at river and stream crossings, is one area under discussion with Inland Fisheries Ireland (IFI), subject to the agreement of other stakeholders, and alignment with landowner negotiations on wayleaves.

Construction phase environmental impacts could be significantly reduced by limiting construction plant to the wayleaves wherever possible; and maximising re-use of excavated materials, with disposal of all surplus material across the wayleave width. Adoption of these working methods will minimise impact on the people living along the route, and significantly reduce construction traffic on the local road system.

### **10.2.3 Provision of Community Facilities;**

Under this category the key objectives can include:

- Promoting the general health and well-being of the community; and
- Advance citizenship and community development by improving community facilities to bring people in the area together.

This could involve providing material support towards the refurbishment or expansion of local community facilities such as water access jetties / slipways, water sports, schools, playgrounds, sporting complexes, and community halls/centres.

### **10.2.4 Educational Improvement, Development and Upskilling;**

Under this category the key objectives can include:

- Providing assistance to local, disadvantaged and under-represented groups;
- Advance education initiatives supporting projects and training that benefit people from the area by enhancing their skills;
- Support communities – via the provision of bursaries, scholarships, apprenticeships or skills training for local people; and
- Working as a good neighbour to support the local community in their ongoing efforts to understand the sustainability and ecological preservation of their environment, particularly in the proposed final water abstraction waterbody.

Potential “Community Benefit” initiatives could involve:

- Undertaking crèche/schools engagement programmes during the project planning and delivery phases;

- Specifying a requirement for the provision of apprenticeships within the project procurement documents;
- Carrying out a review of the necessary construction skills in engineering, welding, pipelaying, construction plant and machinery operation, with the Local Authority Services National Training Group (with centres at Roscrea, Ballycoolen, Ballincollig, Stranorlar and Castlebar), with Institutes of Technology, and with Universities, well in advance, to maximise local employment opportunities.
- Providing a number of sponsorships/bursaries for the local population to pursue third level education in a technical / engineering / environmental discipline;
- Offering to build and perhaps partially fund the operation of a Water Framework Directive (WFD) research facility – perhaps co-located on the chosen water treatment plant site adjacent to the proposed water source abstraction location. Such a facility could be used as a centre for research/ equipment storage by third level students. It could also be used as a centre of analysis of water quality and ecology and to study the spread of invasive species, for example, in the new source abstraction; and
- Supporting programmes in skills development, certification and safety training for welders, metal workers, plant operators, skilled trades and general operatives.

#### **10.2.5 Amenity Improvements;**

Under this category the key objectives can include:

- Promoting the general health and well-being of the community;
- Improving the overall amenity offering; and
- Promoting and supporting local tourism initiatives.

This could involve material support towards the refurbishment or expansion of fishery / boating access, hiking and trail access, local playgrounds and local sporting facilities.

It could also involve working with Local Authority Managers to provide material support/grants towards the refurbishment or expansion of local (or more regional) facilities such as greenways, walkways, cycle paths etc. under initiatives such as the Lakelands project.

Consideration could also be given for supporting improvements to facilities for local fisheries/angling club groups located along the selected final pipeline route.

As part of the design process, consideration could also be given to providing access to the local community at pre-selected discrete locations along the pipeline route via the inclusion of local amenity sites such as picnic areas or viewing sites, etc.

It is noted that there are a number of tourism related groups and initiatives in the project area. There would be an opportunity to engage with these groups to explore the tourism initiatives currently under consideration with a view to providing seed funding or construction project facilitation activities to support projects that may arise from the tourism initiatives.

### 10.2.6 Strengthening and Enhancement of Physical Infrastructure;

Under this category the key objectives can include:

- Improving the local infrastructure.

This could involve the upgrading/enhancement of:

- Local roads;
- Local drainage;
- Local sewerage; and
- Car parking.

Specifically the overall project design could be scoped in such a way that local underperforming road infrastructure could be selected for designated haul routes in order to provide the opportunity for leaving behind reinstated/upgraded infrastructure at the end of the construction project.

### 10.2.7 Engagement and Alignment with Broader Planning / Local Authority Objectives;

Under this category the key objectives can include:

- Support to Planning and Local Authority objectives

This could involve:

- Identifying local planning and environmental initiatives/projects;
- Providing support for such initiatives/projects in either terms of;
  - Direct funding support to the planning and environmental initiative/project sponsors or;
  - Alternatively incorporating planning and environmental improvement works within the WSP construction contracts.

This could also involve, for example, working with Local Authority Managers to provide material support/grants towards the refurbishment or expansion of local (or more regional) facilities such as greenways, walkways, cycle paths etc.

An important alignment between the Project and the County Development Teams within the economic catchment of the infrastructure, would open the way to maximise the uptake of opportunity arising from spend of the investment inherent in the project. Areas of capacity constraint would be identified in good time, to permit businesses to plan.

### 10.2.8 Economic Development;

Under this category the key objectives can include:

- Encouraging the recruitment of local, disadvantaged or under-represented groups; and
- Working with the County Development Teams, Local Business Enterprise Boards and the local supply chain in advance of the project procurement process to alert them to the opportunities that the project will offer and the scale and extent of such opportunities.

This could involve:

- Analysing the project cost estimate by Labour, Plant, Materials;

- Determining the likely catering and accommodation requirements for the workforce;
- Determining the likely plant maintenance requirements for the project;
- Determining the likely quarry products, concrete requirements, etc.;
- Developing the procurement documents, via appropriate clauses inserted into the project procurement documents, in terms of materials specifications, number of contracts, value of contracts, siting of main construction compounds, etc., to ensure that the local supply chain is not dis-advantaged; and
- Engagement with, and stimulation of, the local supply chain along the benefitting corridor as they position themselves to compete in the Ervia procurement processes.

At this point, an Emerging Preferred Option has not yet been taken to a level of design that would support reliable estimation of cost. Assessing the primary constituents of Labour, Plant and Materials, a domestic spend of 50-60% of the capital cost, might be expected. This includes the wages of a workforce expected to peak near 1,000 employees along the entire pipeline and infrastructure sites, over a three year contract period. Many of these workers will be local, and others will require accommodation, catering, transport and other facilities.

Wayleaves for the buried pipeline, and land acquisition for headworks and infrastructure will bring payments to landowners in accordance with Ervia's established procedures on natural gas transmission pipelines for engagement with landowners.

Likely regional spend is very dependent on capacity of the regional economy to actually service the requirements. It is also somewhat dependent upon the location of the value-intensive elements of the project infrastructure.

Taking the estimated domestic primary spend, and assuming that County Development teams and local industry work effectively to address capacity issues, Limerick/Clare might expect to secure approximately 10% of it, Tipperary 25%, and the Midlands counties, Kildare/Dublin, and the Rest of Ireland approximately equal proportions of the balance.

Spending at this level will be accompanied by a multiplier in the local economy, through the sub-supply chain, and assessment of this effect is part of later work.

Outside the construction stage, it is expected that up to 15 permanent jobs will be created in operating the Water Treatment Plant.

### **10.3 Project Scope and Scale**

The Eastern and Midlands Region Water Supply Project (WSP) is a major infrastructure project which will comprise a number of key components including, inter alia, construction of a:

- New water source abstraction;
- New water abstraction inlet pumping station;
- New water treatment plant/facility;
- New large diameter pipeline of approximately 165 km in length;
- New large concrete storage reservoir;
- Series of new water supply take-off points along the new large diameter pipeline between the new water treatment plant/facility and

the new large concrete storage reservoir site – i.e. provision for multiple take-offs along the corridor to benefit local communities along the route of the new large diameter pipeline.

The capital construction cost for the WSP is likely to be between €700 – €900 million Euro.

In terms of overall project scale the WSP, which is dependent upon the final selected option, is:

- Primarily a linear infrastructure development project;
- Impacting/Crossing up to three Water Framework Directive (WFD) River Basin Districts which could include – Shannon, South Eastern and Eastern;
- A major cross country project which may involve building major infrastructure sited along/within a continuous corridor which may span up to six County Council Areas from a combination of the following - Tipperary, Offaly, Laois, Kildare, South Dublin, Dublin, Meath and Fingal. The economic catchment would be likely to include Clare, Limerick, and Westmeath.

#### 10.4 Next Steps

For the reasons outlined above any “Community Benefit” package considered for the WSP will have to achieve the following:

- Adequately address the drivers (i.e. the significant “Community Effects”);
- Be suitably and adequately scoped;
- Be adequately funded; and
- Provide a suitable framework for the administration of any supplied funding.

Furthermore, a WSP “Community Benefit” package must be a bespoke project specific package tailored to the needs of the project to ensure that the “Community Benefit” potential is maximised.

On the basis of the foregoing it is recommended that the following activities are pursued:

- Continue with the project development works to bring forward the preferred option, following public consultation on the ‘emerging preferred option’ and taking into account any views expressed on how to meaningfully recognise and support community benefit;
- Identify the likely significant “Community Effects” that will result from the implementation of the preferred option;
- Consider and confirm the “Community Benefit” **funding allocation and distribution principles and mechanisms** that would be considered appropriate for a large capital infrastructure project of the nature of the WSP
- Consider and confirm the “Community Benefit” **funding administration principles and mechanisms** that would be considered appropriate for a large capital infrastructure project of the nature of the WSP.



Irish Water commits to proactive submission of a Community Gain proposal as part of any submission by IW to An Bord Pleanála for Planning Approval for the Water Supply Project.

A consultative assessment was undertaken to identify an Emerging Preferred Option from the 4 reasonable water supply options, namely:

- Option B (Lough Derg Direct);
- Option C (Parteen Basin Reservoir Direct);
- Option F2 (Lough Derg with Storage); and
- Option H (Desalination).

This consultative assessment incorporated the following:

- a) A review of the submissions from the public consultation on the Water Supply Options Working Paper, and consideration;
- b) Investigative studies recommended by SEA including a water quality survey and model of Lough Derg, and full geophysical survey of the soil and bedrock conditions at Garryhinch; and
- c) A multi-criteria analysis of each of the options, based on published criteria reviewed following consultation.

Two options were identified as sustainably meeting the Project Need requirements:

- Option C: (Parteen Basin Reservoir Direct); and
- Option H: (Desalination).

Option C (Parteen Basin Reservoir Direct) involves the key components:

1. A raw water abstraction point at the Parteen Basin Reservoir;
2. A 330 Ml/d conventional water treatment plant in close proximity to the raw water abstraction point;
3. A supply main, 165km in length (provisional), between Parteen Basin Reservoir and a termination point at Peamount capable of supplying communities en route.

Option H: Desalination involves the key components:

1. A raw water abstraction point 3 – 4km off shore near Balbriggan;
2. A desalination plant at Balbriggan; and
3. A supply main, approximately 35km, between Balbriggan and Ballycoolin Reservoir.

Option C (Parteen Basin Reservoir Direct) is the Emerging Preferred Option since it offers these key distinct differences:

- A benefitting corridor through the Midlands Region that is able to supply communities en route with a reliable and resilient source of supply;
- A sustainable abstraction regime which can be managed within the existing ESB operating works level range without prolongation of residence time on Lough Derg;
- Least risk in terms of environmental, technical, financial, economic and socio-economic factors;
- The direct cost of construction, commissioning and operation are considerably more economical to the consumer than the alternative; and
- Most likely to deliver the objectives of the Water Services Strategic Plan.

The alternative Option H: Desalination remains a viable option.

Two options have been short-listed as meeting the Project Need, i.e. an ultimate water supply capacity of 330 MI/d. These two options are:

- Option C (Parteen Basin Reservoir Direct); and
- Option H (Desalination).

Option C (Parteen Basin Reservoir Direct) is emerging as the Preferred Option, subject to the model verification process which is dependent upon data being gathered under the Water Quality Survey.

Planning consents and key stakeholder agreements to abstract, treat and transfer this water must be obtained so that a Phase 1 scheme is in place by 2022.

A Preliminary Options Appraisal Report is being published for public consultation in November 2015.

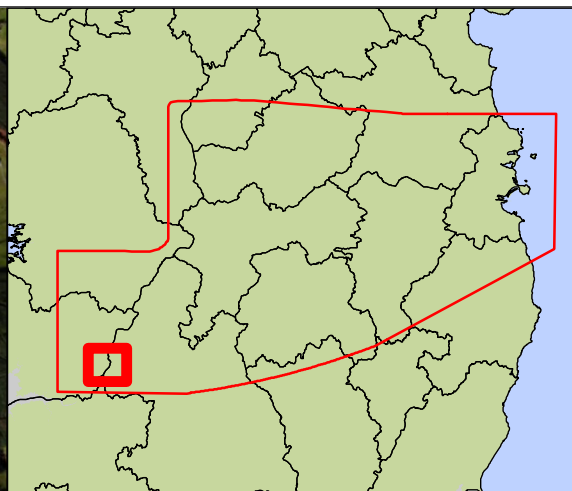
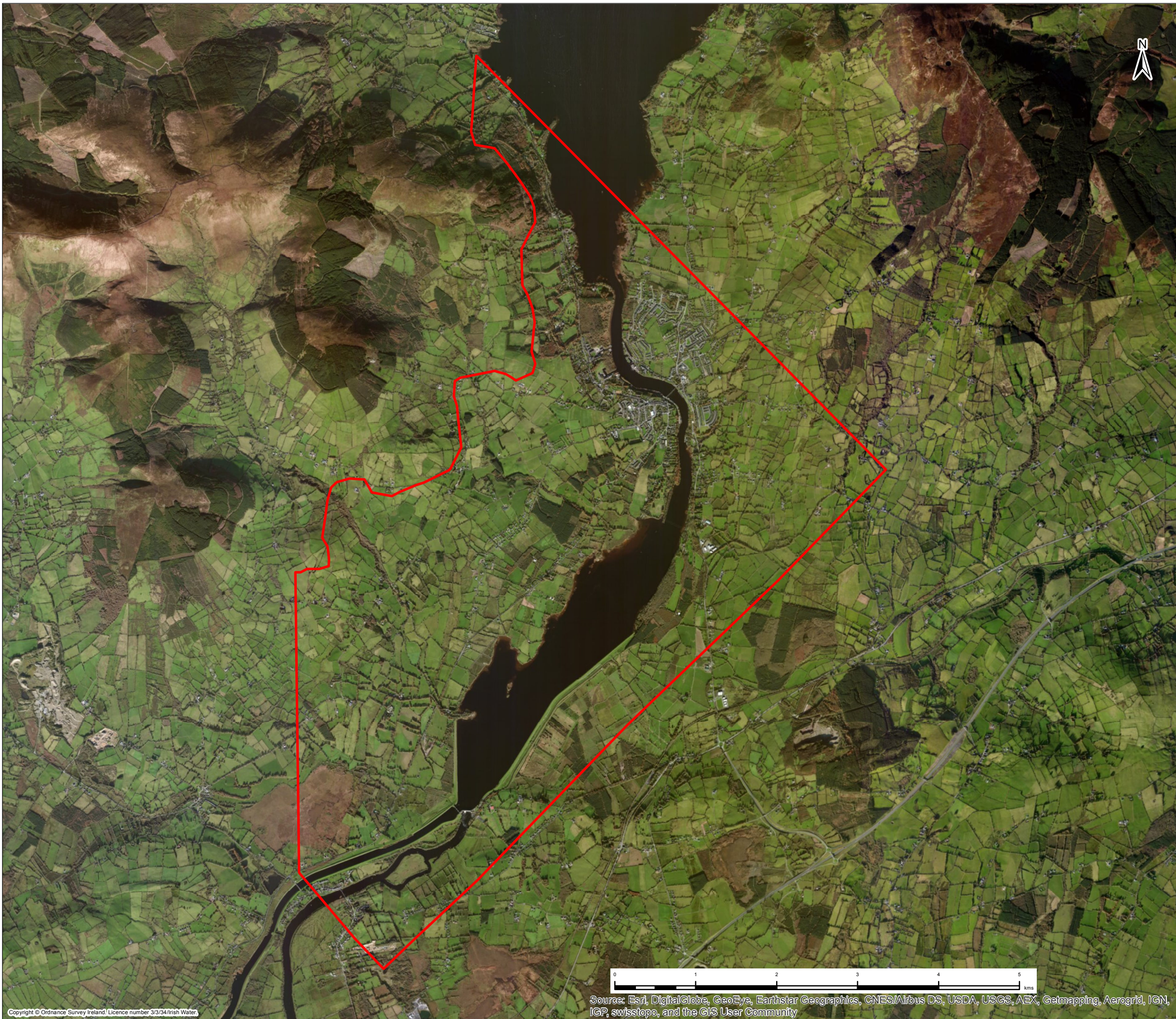
This consultation will elicit responses on the determination of Option C (Parteen Basin Reservoir Direct) as the Emerging Preferred Option and on the siting of ancillary infrastructure associated with this option; with an aim to facilitate confirmation of a preferred option.

# Drawings

Schedule of Drawings

<b>Drawing Number</b>	<b>Drawing Title</b>
32105801-1013	Abstraction Study Area
32105801-1014	Least Constrained Route Corridor, Map 1 of 15
32105801-1015	Least Constrained Route Corridor, Map 2 of 15
32105801-1016	Least Constrained Route Corridor, Map 3 of 15
32105801-1017	Least Constrained Route Corridor, Map 4 of 15
32105801-1018	Least Constrained Route Corridor, Map 5 of 15
32105801-1019	Least Constrained Route Corridor, Map 6 of 15
32105801-1020	Least Constrained Route Corridor, Map 7 of 15
32105801-1021	Least Constrained Route Corridor, Map 8 of 15
32105801-1022	Least Constrained Route Corridor, Map 9 of 15
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32105801-1025	Least Constrained Route Corridor, Map 12 of 15
32105801-1026 <b>rev 2</b>	Least Constrained Route Corridor, Map 13 of 15
32105801-1027 <b>rev 2</b>	Least Constrained Route Corridor, Map 14 of 15
32105801-1028 <b>rev 2</b>	Least Constrained Route Corridor, Map 15 of 15
32105801-1029	Termination Study Area





**Key**  
 Least Constrained Route Abstraction Study Area

Rev.	Date	Purpose of revision	PW Drawn	PMcG Check'd	PMcG Rev'd	MG Apprd
1	21/10/2015	For Issue				



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Project  
 Water Supply Project - Eastern and Midlands Region

Drawing Title  
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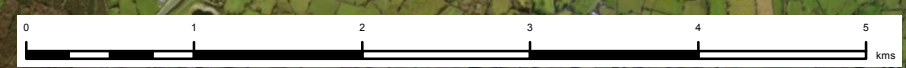
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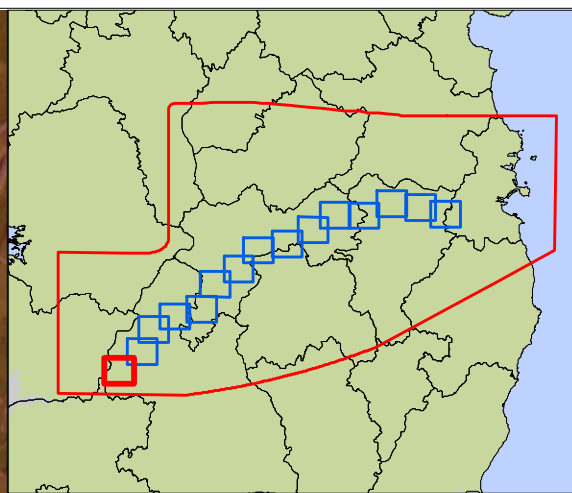
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1	25/11/2015	For Issue				



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Project  
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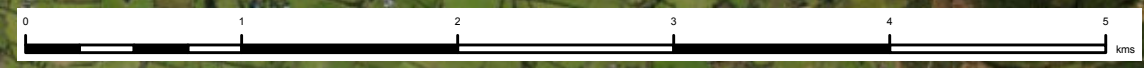
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 Map 1 of 15

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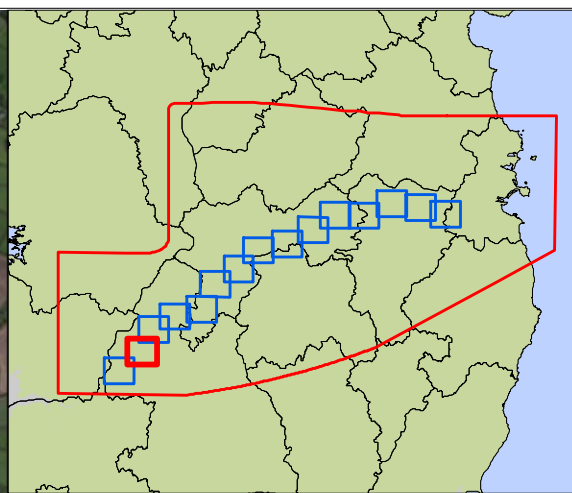
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Drawing Title  
 Least Constrained Route Corridor  
 Map 2 of 15

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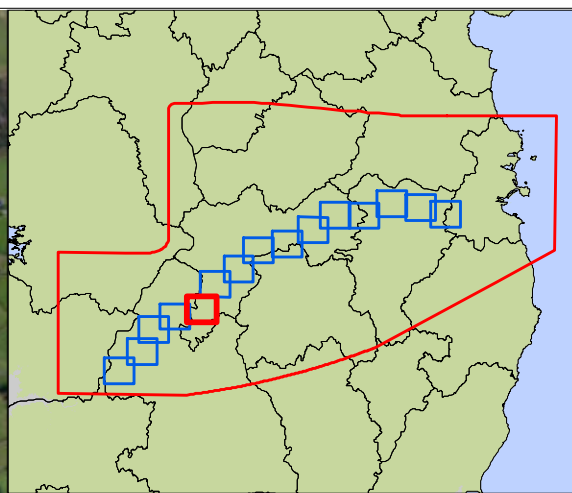













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 Water Supply Project - Eastern and Midlands Region

Drawing Title  
 Least Constrained Route Corridor  
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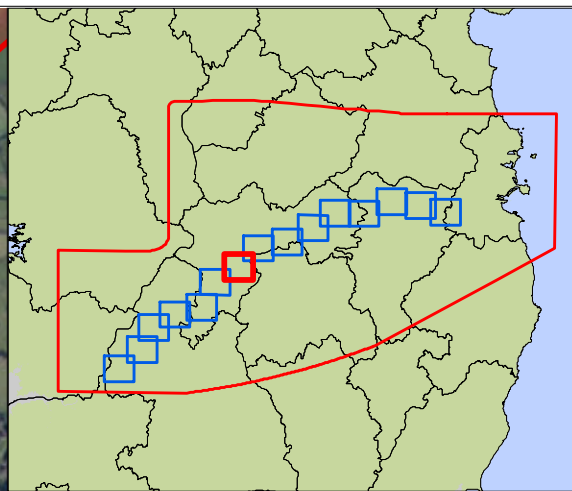
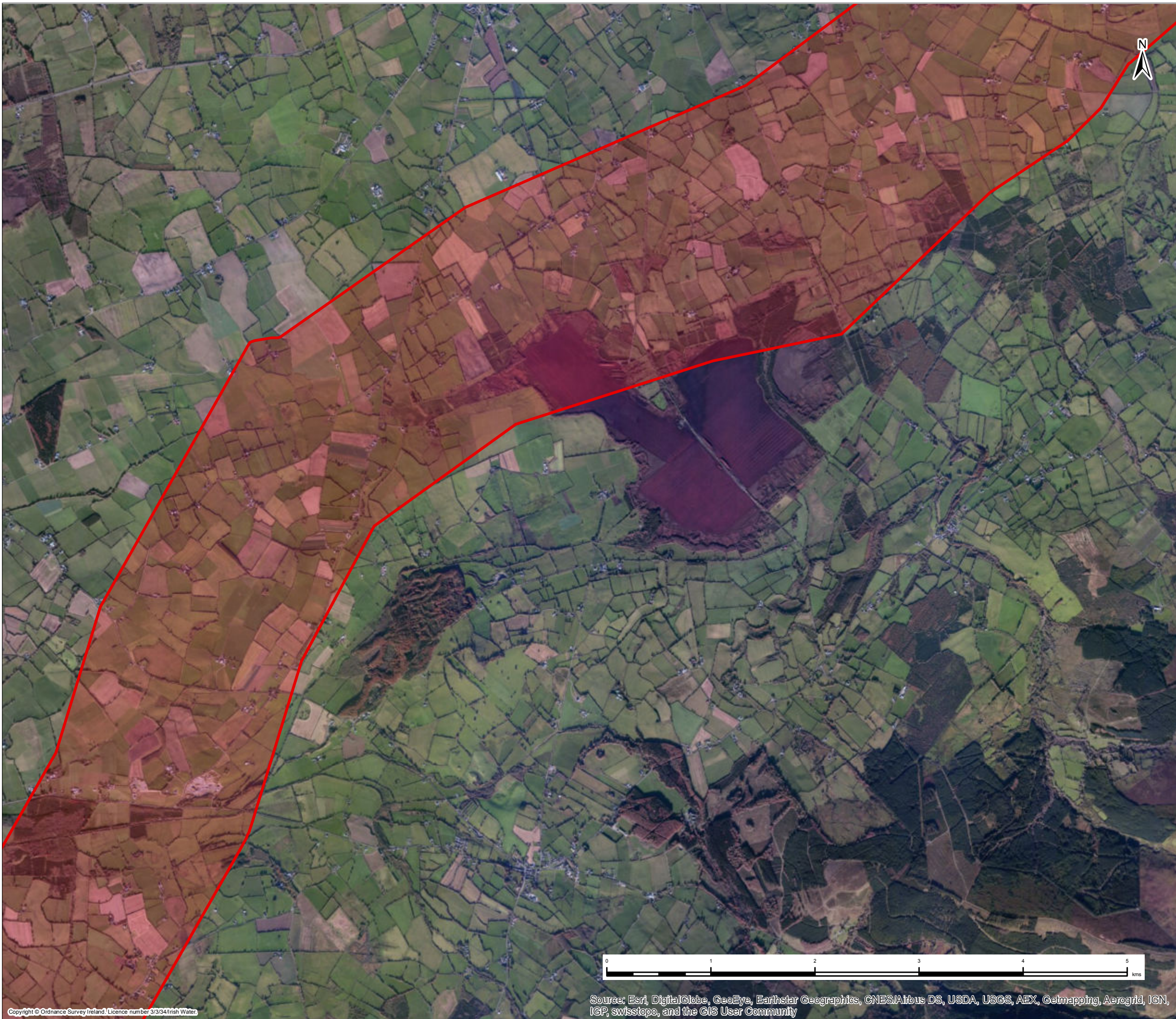



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Drawing Title  
 Least Constrained Route Corridor  
 Map 7 of 15

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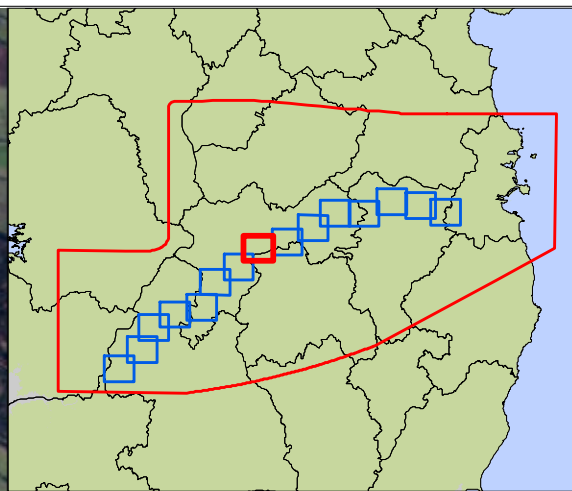
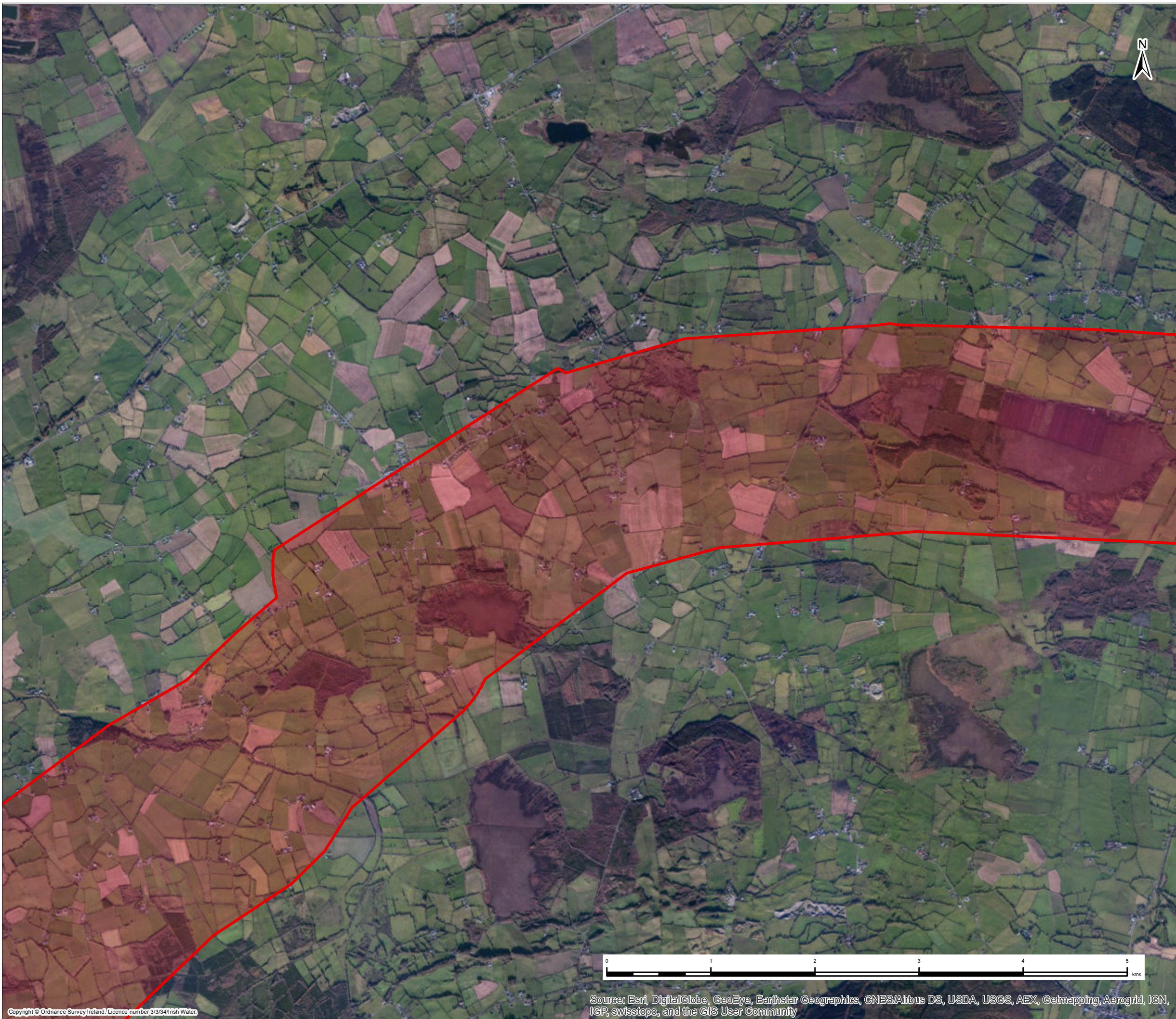
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Drawing Title  
 Least Constrained Route Corridor  
 Map 8 of 15

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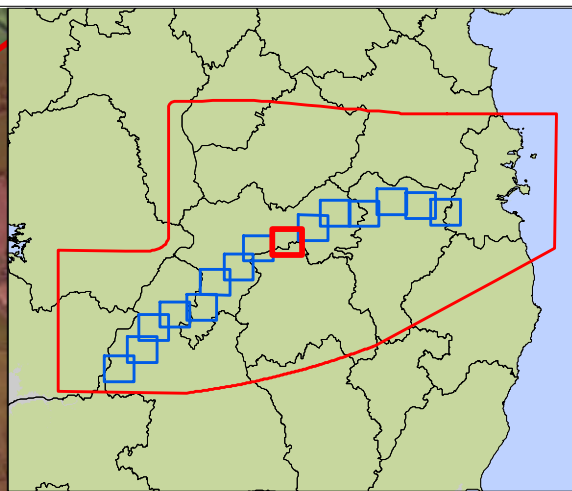
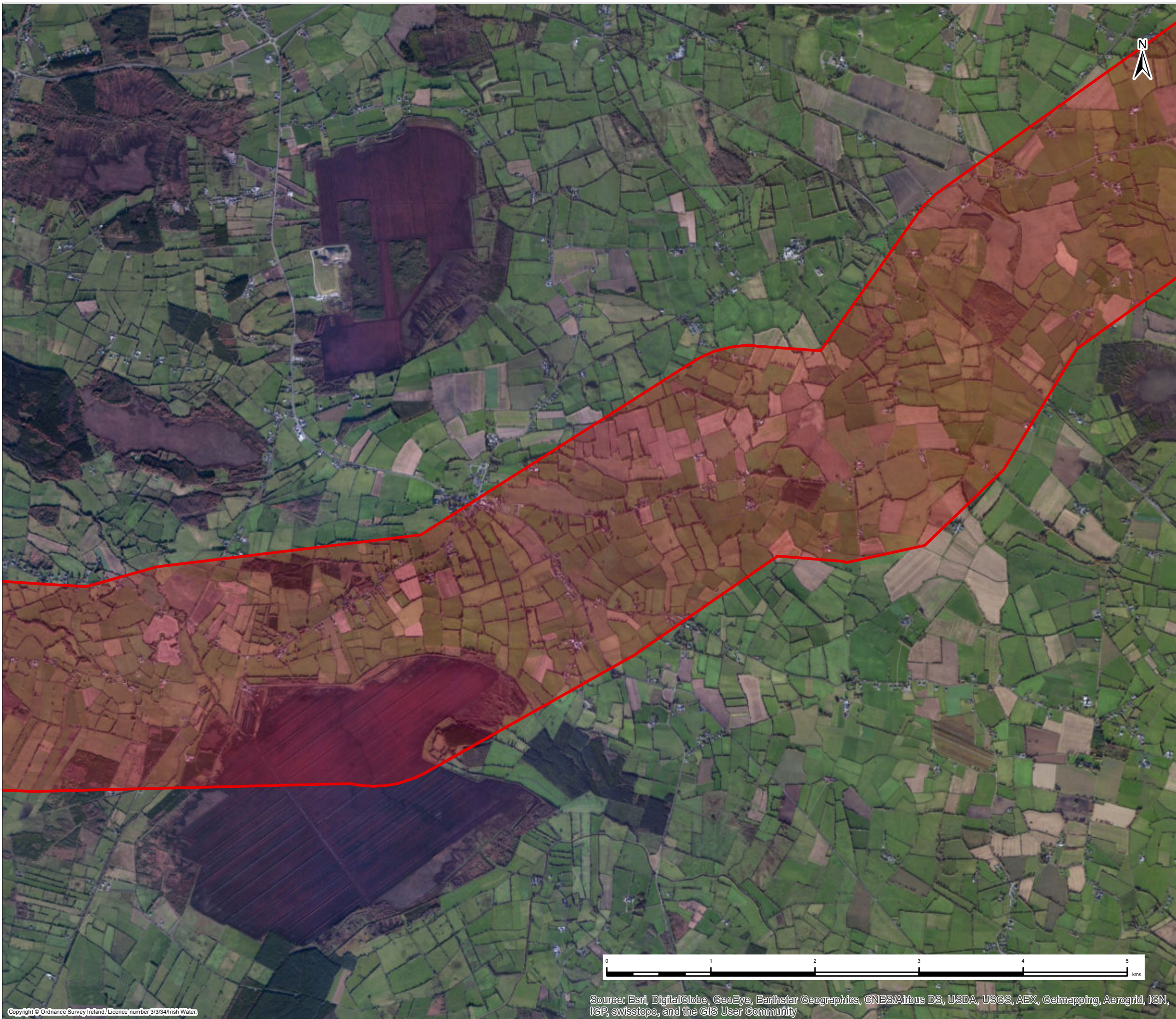
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 Water Supply Project - Eastern and Midlands Region

Drawing Title  
 Least Constrained Route Corridor  
 Map 9 of 15

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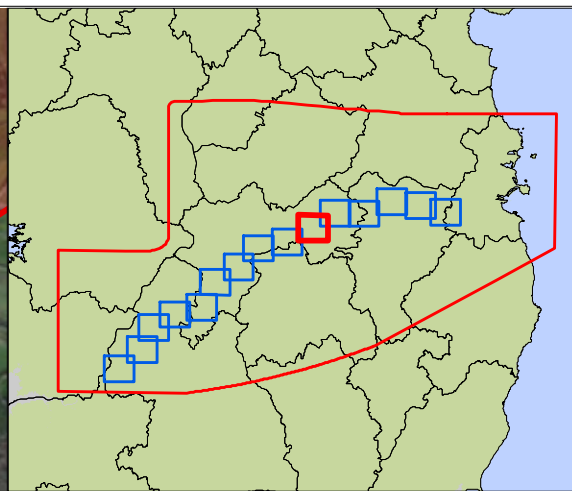
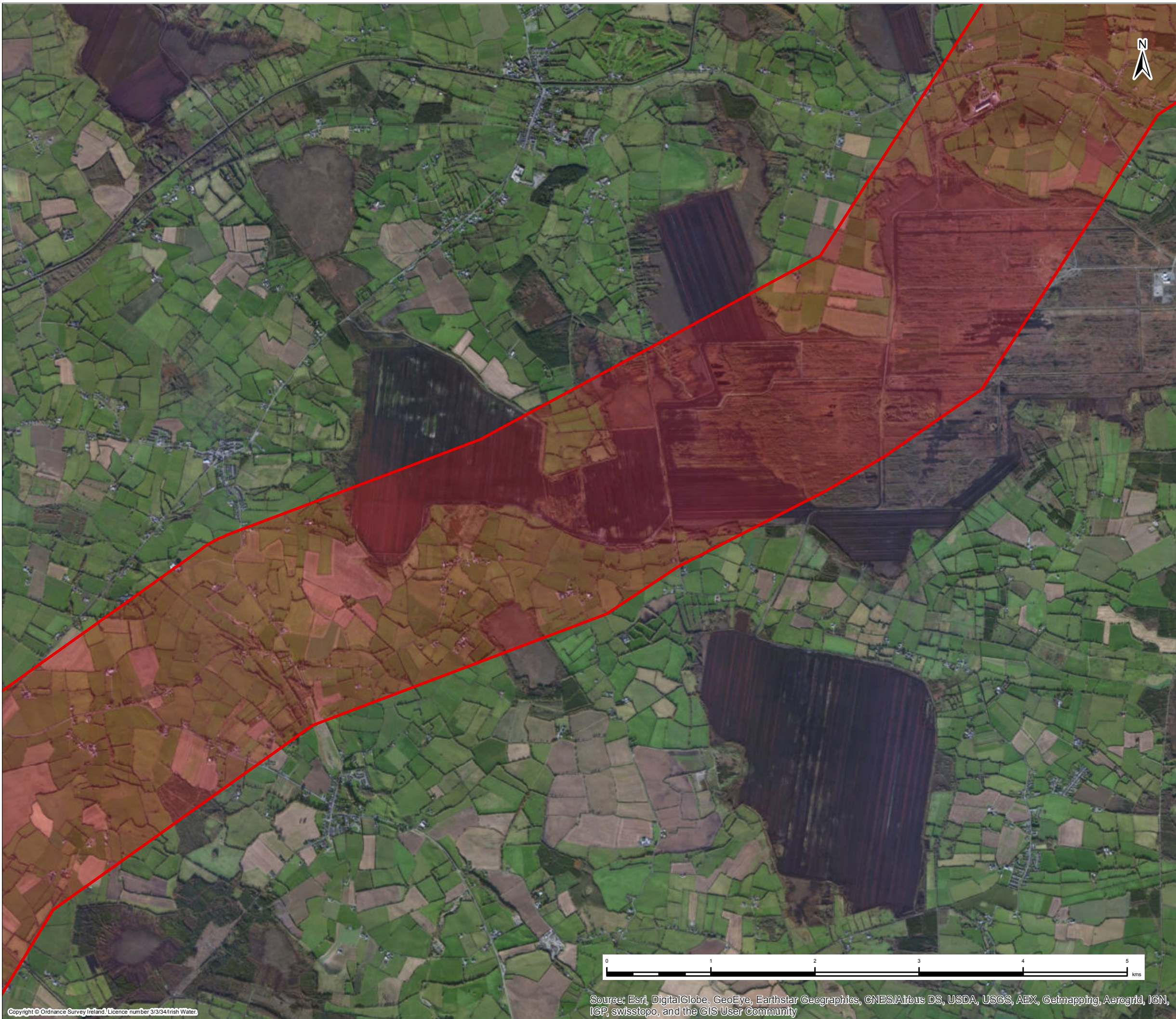
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 Water Supply Project - Eastern and Midlands Region

Drawing Title  
 Least Constrained Route Corridor  
 Map 10 of 15

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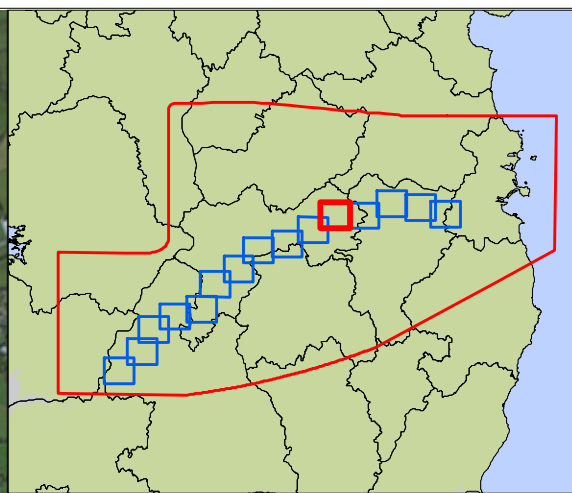
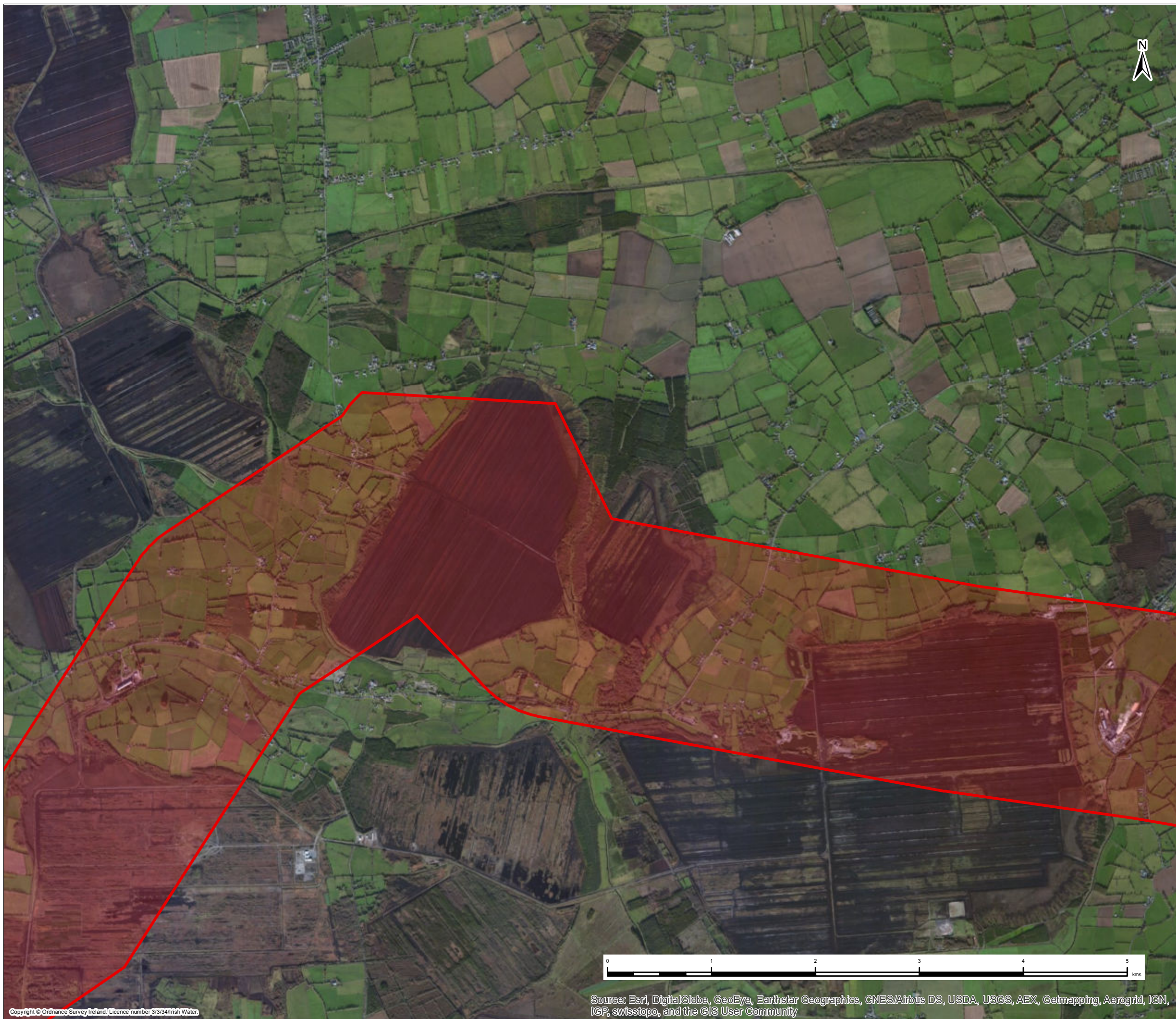
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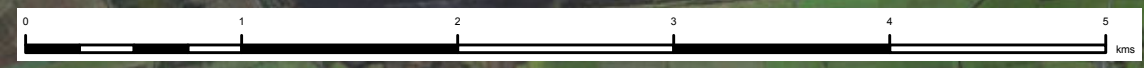
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 Map 11 of 15

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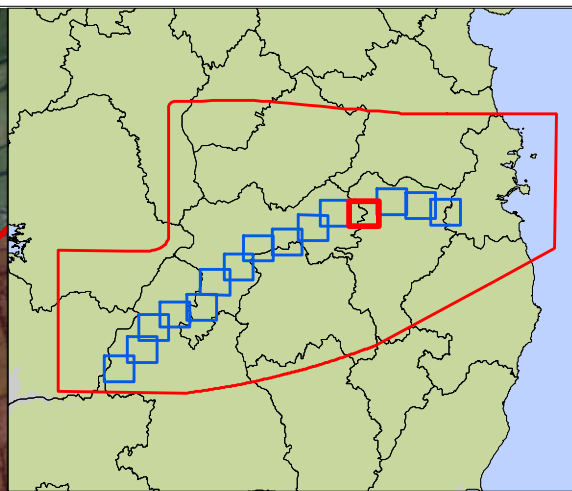
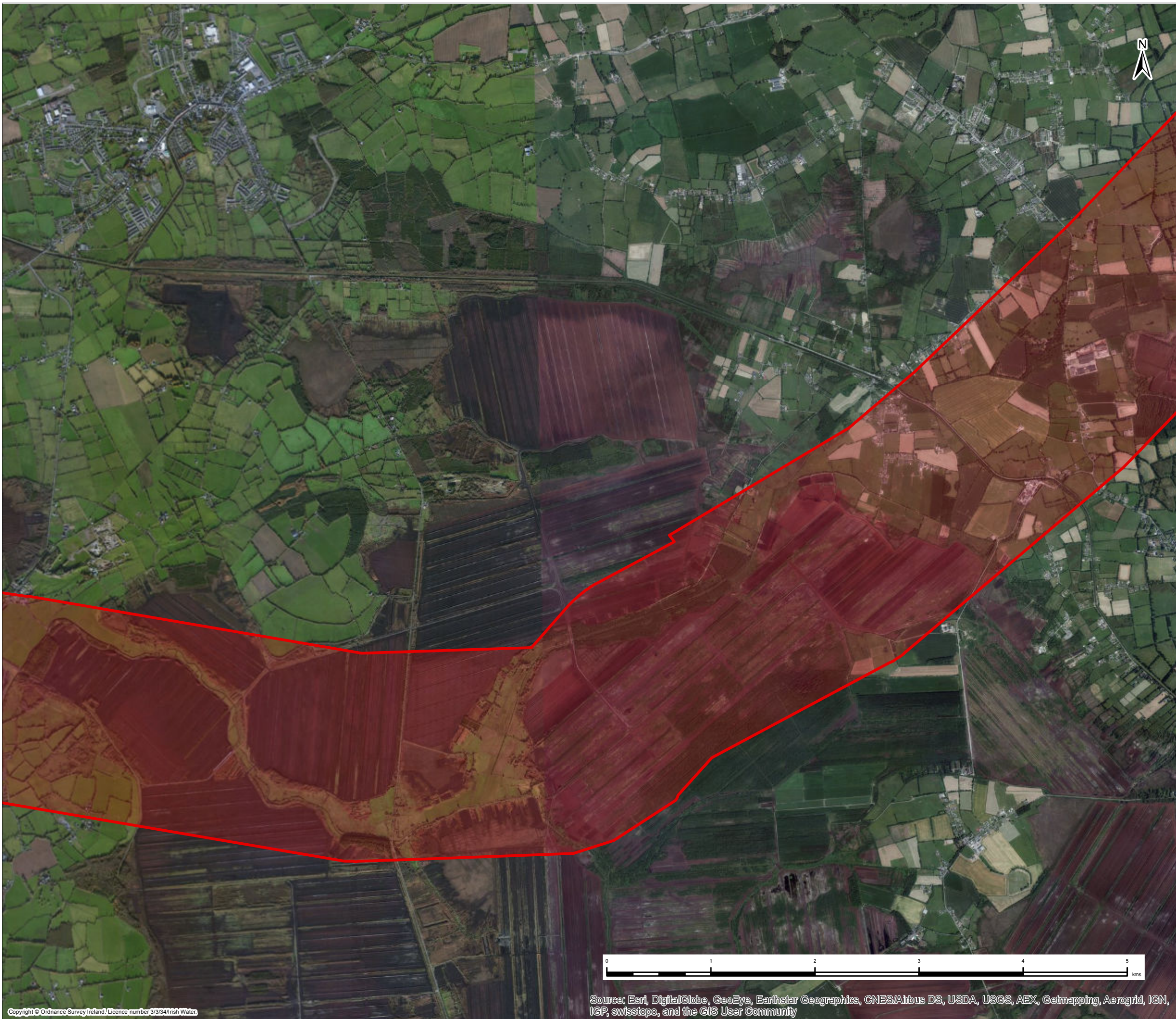
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1	25/11/2015	For Issue				



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Project  
 Water Supply Project - Eastern and Midlands Region

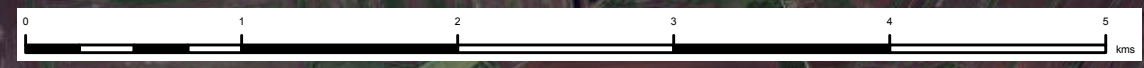
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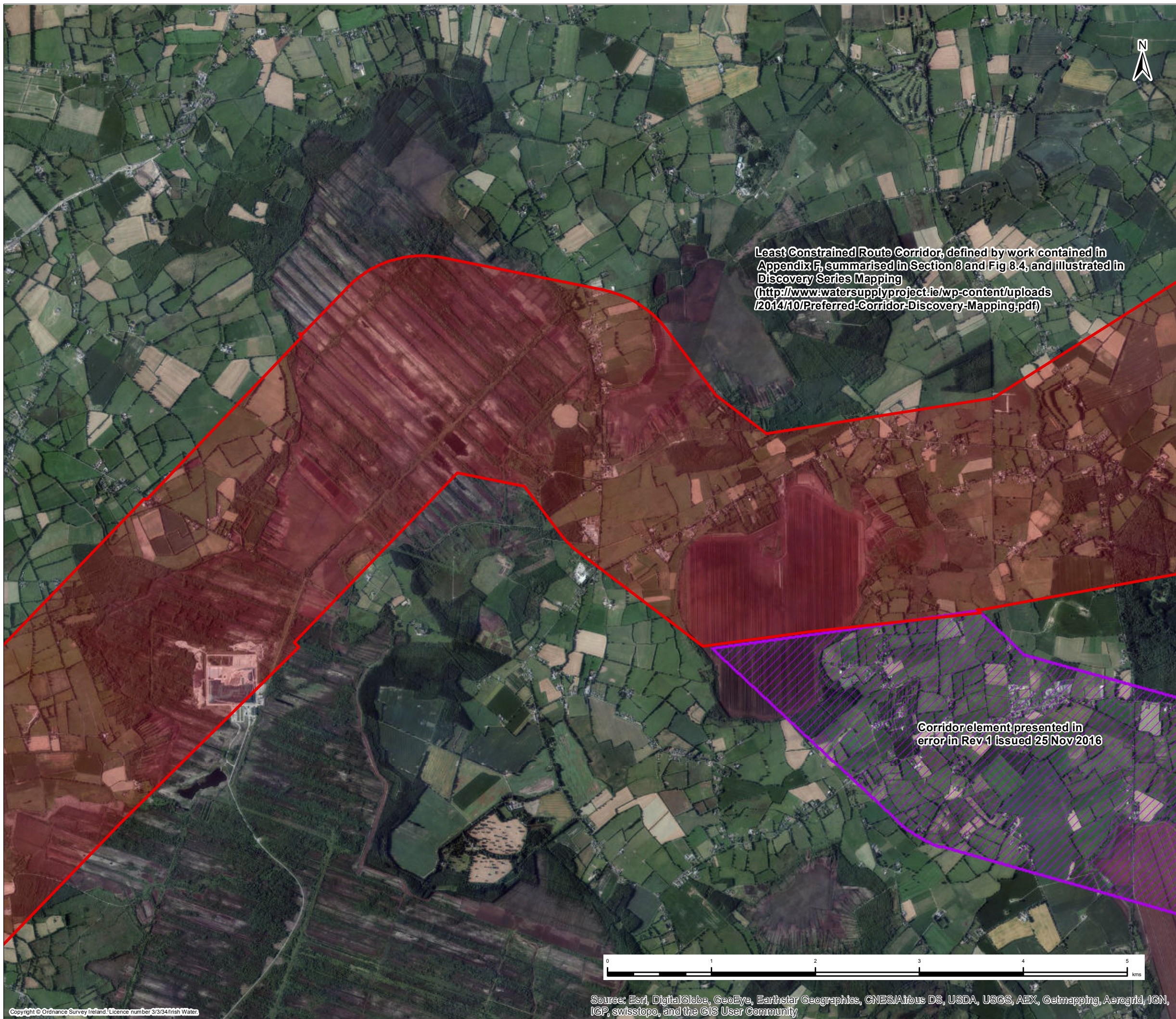
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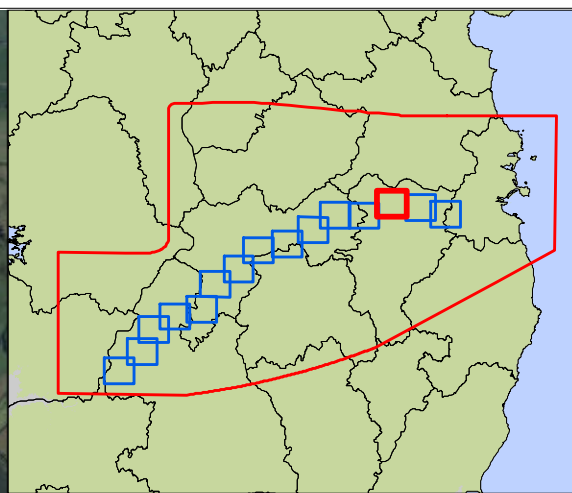
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Least Constrained Route Corridor, defined by work contained in Appendix F, summarised in Section 8 and Fig 8.4, and illustrated in Discovery Series Mapping (<http://www.watersupplyproject.ie/wp-content/uploads/2014/10/Preferred-Corridor-Discovery-Mapping.pdf>)

Corridor element presented in error in Rev 1 issued 25 Nov 2016



- Key**
- Least Constrained Route Corridor
  - Corridor element presented in error in Rev 1 issued 25 Nov 2016

Note : This map should be read in association with the Erratum statement (July 2016) at the front of the Report

2	12/07/2016	Notification of mapping error	PW	PMcG	PMcG	MG
1	25/11/2015	For Issue	PW	PMcG	PMcG	MG
Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprd



Client: UISCE  
IRISH WATER

Project: Water Supply Project - Eastern and Midlands Region

Drawing Title: Least Constrained Route Corridor  
Map 13 of 15

Drawing Status: **For Issue**

Scale @A3	1:35,000	DO NOT SCALE	
Jacobs No.	32105801	Client No.	WSP1
Filepath	<small>\\gis01\proj\32105801_1026\1026_13_1026.dwg</small>		
Drawing No.	32105801-1026		

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.



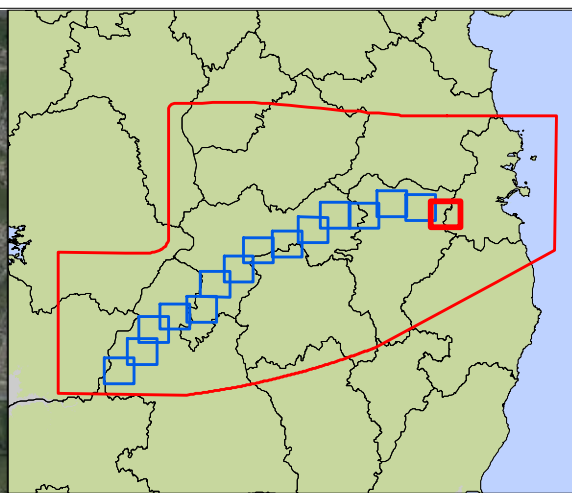






Least Constrained Route Corridor, defined by work contained in Appendix F, summarised in Section 8 and Fig 8.4, and illustrated in Discovery Series Mapping (<http://www.watersupplyproject.ie/wp-content/uploads/2014/10/Preferred-Corridor-Discovery-Mapping.pdf>)

Corridor element presented in error in Rev 1 issued 25 Nov 2016



**Key**

- Least Constrained Route Corridor
- Corridor element presented in error in Rev 1 issued 25 Nov 2016

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2	12/07/2016	Notification of mapping error	PW	PMcG	PMcG	MG
1	25/11/2015	For Issue	PW	PMcG	PMcG	MG
Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Apprd

**JACOBS** **TOBIN**  
Patrick J. Tobin & Co. Ltd.

Client

Project Water Supply Project - Eastern and Midlands Region

Drawing Title **Least Constrained Route Corridor**  
Map 15 of 15

Drawing Status **For Issue**

Scale @A3	1:35,000	DO NOT SCALE	
Jacobs No.	32105801	Client No.	WSP1

Drawing No. 32105801-1028

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