Autumn 2022

Regional Water Resources Plan–Eastern and Midlands

Strategic Environmental Assessment

Appendix H: Study Area 8 – Environmental Review

Tionscadal Éireann
Project Ireland
2040

Data disclaimer: This document uses best available data at time of writing. Some sources may have been updated in the interim period. As data relating to population forecasts and trends are based on information gathered before the Covid 19 Pandemic, monitoring and feedback will be used to capture any updates. The National Water Resources Plan will also align to relevant updates in applicable policy documentation.

Baseline data included in the RWRP-EM has been incorporated from numerous sources including but not limited to; National Planning Framework, Central Statistics Office, Regional Spatial and Economic Strategies, Local Authority data sets, Regional Assembly data sets and Irish Water data sets. Data sources will be detailed in the relevant sections of the RWRP-EM. 2019 was selected as the base year to align with the planning period (2019-2025) of the NWRP.

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1 Introduction and Background

1 Introduction and Background

This Study Area Environmental Review forms part of the SEA Environmental Report for the Regional Water Resources Plan (RWRP) for the Eastern and Midlands Region. The Regional Plan includes nine individual study area reviews (SA1-9) as appendices.

This Study Area 8 Environmental Review includes:

- Context for the Study Area Environmental Review;
- Environmental baseline context;
- Environmental assessment for the options screening process and feasible options;
- Assessment of the alternatives considered and the Preferred Approach;
- Cumulative effects assessment; and
- Recommendations for implementation, including mitigation and monitoring.

This Environmental Review summarises the environmental assessment methodology undertaken for Study Area 8 within the Eastern and Midlands Region for the options and approaches considered and as outlined in the Study Area 8 Technical Report (RWRP-EM Appendix 8). This Environmental Review applies the Strategic Environmental Assessment (SEA) objectives and environmental assessment methodology set out in the NWRP Framework Plan (Framework Plan).

Environmental Reviews have been undertaken for each study area and form Appendices to the SEA Environmental Report for the Regional Plan form Phase 2 of the National Water Resources Plan (NWRP). Phase 1 in the development of the NWRP was the preparation of the Framework Plan, which was adopted in Spring 2021 following SEA, Appropriate Assessment (AA) and extensive public consultation. The Framework Plan and supporting documentation are available at https://www.water.ie/projects/strategic-plans/national-water-resources/.

1.1 Options Assessment Methodology

The Options Assessment Methodology implemented as part of the RWRP-EM provides a framework to identify potential solutions to address identified need. The key stages of the process are illustrated in Figure 1.1 and summarised below:

1) Identifying need – based on SDB and/or Drinking Water Safety Plan Barrier Assessment;
2) Scoping of the study area (WRZs) – understanding the study area and the existing conditions of assets, supply and demand issues; as well as environmental constraints and opportunities;
3) Identifying potential options for consideration relevant to the study area;
4) Coarse screening – assessing the unconstrained options and eliminate any that will not be viable;
5) Further option definition, information collection and preliminary costing;
6) Fine screening – options assessment and scoring against the key criteria with further removal of options identified as unviable and development of feasible options for costing and scoring assessment update;
7) Approach appraisal – comparison and assessment of combinations of options identified to meet the predicted supply demand deficit to determine the Preferred Approach; and

8) Monitoring and Feedback – a process for monitoring the implementation of the plan and responding to changes to policy and guidelines and to information changes which will feed into the 5 year plan cycle and includes an annual review to identify actions required within the plan cycle.

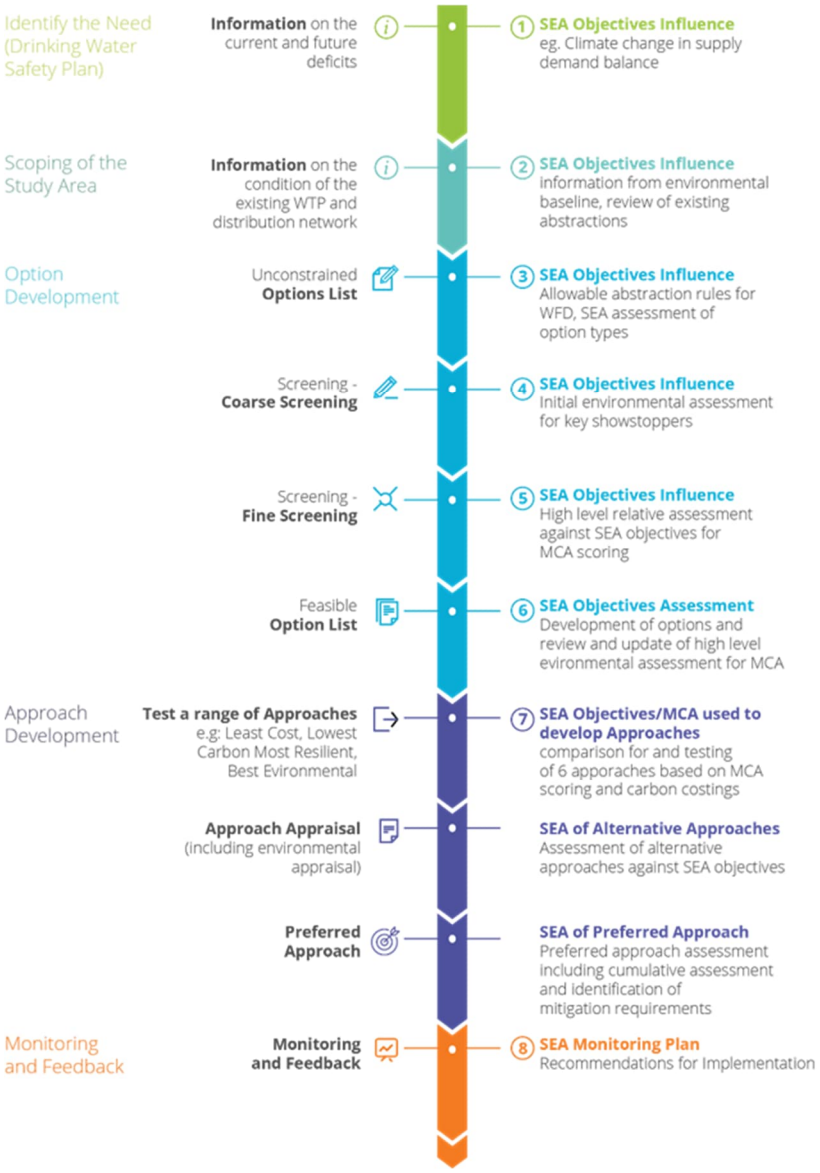

Figure 1.1 Option and Approach Development Process

1.2 Regional Plan Strategic Environmental Assessment

The four RWRPs, implementing Phase 2 of the NWRP, are each subject to a separate SEA process. The study area assessments will follow the outline methodology established by the Framework Plan. The SEA Environmental Report was published for consultation alongside the draft Regional Plans for each of the four regions.

Each of the Study Area Environmental Reviews are presented as appendices to the SEA Environmental Reports and include:

- Introduction for SEA, Water Framework Directive (2000/60/EC) (WFD) and AA applied at the study area level;
- Environmental baseline context;
- Environmental assessment for the options screening process and feasible options;

- Assessment of the alternatives considered and the Preferred Approach;
- Cumulative effects assessment between options within each study area and with other proposed developments in the study area; and
- Recommendations for implementation, including mitigation and monitoring.

1.3 Study Area: Strategic Environmental Assessment

The set of SEA objectives developed at the Phase 1 scoping stage have been refined and finalised following consultation (see Table 1.1). These objectives have been influenced by the plans, policies and programmes review, the baseline trends and pressures identified, and the scope of the assessment as defined in Regional Plan SEA scoping report.

Table 1.1 SEA Objectives

SEA Topic	SEA Objective
Population, economy, tourism and recreation, and human health	Protect and, where possible, contribute to enhancement of human health and wellbeing and to prevent restrictions to recreation and amenity facilities in providing water services.
Water environment	Water quality and resources Prevent deterioration of the WFD status of waterbodies with regard to both water quality and quantity due to Irish Water's activities. Contribute towards the "no deterioration" WFD condition and, where possible, to the improvement of waterbody status for rivers, lakes, transitional and coastal waters, and groundwater to at least 'Good' status.
	Flood risk Protect and, where possible, reduce risk from ground water and surface water flooding as a result of Irish Water's activities.
Biodiversity	Protect and, where possible, enhance terrestrial, aquatic and soil biodiversity; particularly regarding European sites and protected species in providing water services.
Material assets	Minimise resource use and waste generation from, new or upgraded, existing water services infrastructure and management of residuals from drinking water treatment - to protect human health and the ecological status of waterbodies. Minimise impacts on other material assets and existing water abstractions.
Landscape and visual amenity	Protect and, where possible, enhance designated landscapes in providing water services.
Climate change	Climate change mitigation Minimise contributions to climate change emissions to air (including greenhouse gas emissions) as a result of Irish Water's activities.
	Climate change adaptation

SEA Topic	SEA Objective
	Promote the resilience of the environment, water supply and treatment infrastructure to the effects of climate change.
Cultural heritage	Protect and, where possible, enhance cultural heritage resources in providing water services.
Geology and soils	Protect soils and geological heritage sites and, where possible, contribute towards the appropriate management of soil quality and quantity.

The SEA informs the development of the approaches and is undertaken on the various alternative approaches considered and the Preferred Approaches identified, along with cumulative assessment and identification of 'in-combination' effects.

The Regional Plan SEA Environmental Report was completed only after all study area technical reports for the Eastern-Midlands region were available. At that point, Irish Water conducted an exercise as part of the development of the overall relevant Regional Plan to assess the cumulative and in-combination impacts of the Preferred Approaches identified for each study area within the Eastern Midlands region. The conclusions of that cumulative assessment are presented in the SEA Environmental Report for the Eastern Midlands region.

If appropriate, the Preferred Approach identified for SA8 will have been modified prior to finalisation of the Regional Plan Technical Report and Environmental Review to take into account the conclusions of that cumulative assessment and identification of in-combination effects. The SEA for each of the Regional Plans in turn includes a cumulative assessment of the Preferred Approaches identified in the Regional Plan, in combination with the effects of the Preferred Approaches for each other region (to the extent that data was available and recognising that each Regional Plan is at a different stage of development).

1.4 Study Area: Water Framework Directive

Requirements under the WFD to avoid deterioration in waterbody status or objectives has been incorporated into the allowable abstraction constraints for new option abstractions. WFD requirements are also included in the SEA objectives for the assessment (see Table 1.1). Baseline data in relation to the WFD is presented in section 2.2.1 and a summary of the assessment for SA8 is provided in chapter 8 of this review.

1.5 Study Area: Appropriate Assessment

An AA was required for the Framework Plan to comply with the EU Habitats Directive (92/43/EEC) and is relevant to development of the Regional Plans, including the component study areas.

AA issues will be addressed in a separate Natura Impact Statement (NIS) for the Regional Plan, which will support the overall AA process that Irish Water is required to carry out. Habitats Directive requirements have been integrated into the options development process and conclusions from the NIS for SA8 are provided in chapter 9 of this review.

1.6 Study Area 8

The Eastern and Midlands Region is subdivided into nine study areas based on factors such as:

- Groundwater body boundaries;
- Surface water sub-catchments;
- Geographical features;
- WRZ boundaries;
- Local authority functional areas; and
- Appropriate size for an efficient reporting structure.

This Appendix reports on SA8, the location of SA8 in relation to the Eastern and Midlands Region is shown in Figure 1.2.

Study Area 8 lies within the counties of Galway, Clare, Tipperary, Limerick City and County, and Cork and its total area is approximately 4,176 km^2. The principal settlements (with a population of over 10,000) within SA8 are Limerick City and Suburbs, and Ennis (CSO, 2016a), as shown in Figure 1.3.

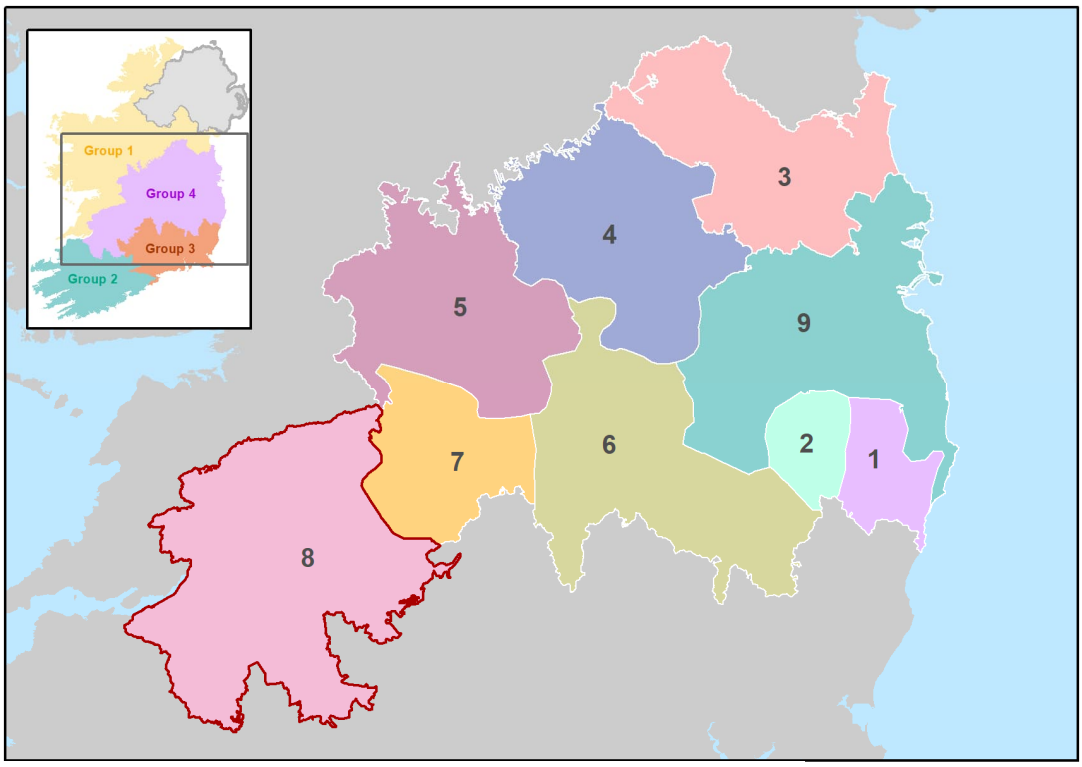

Figure 1.2 Eastern and Midlands Region Study Areas

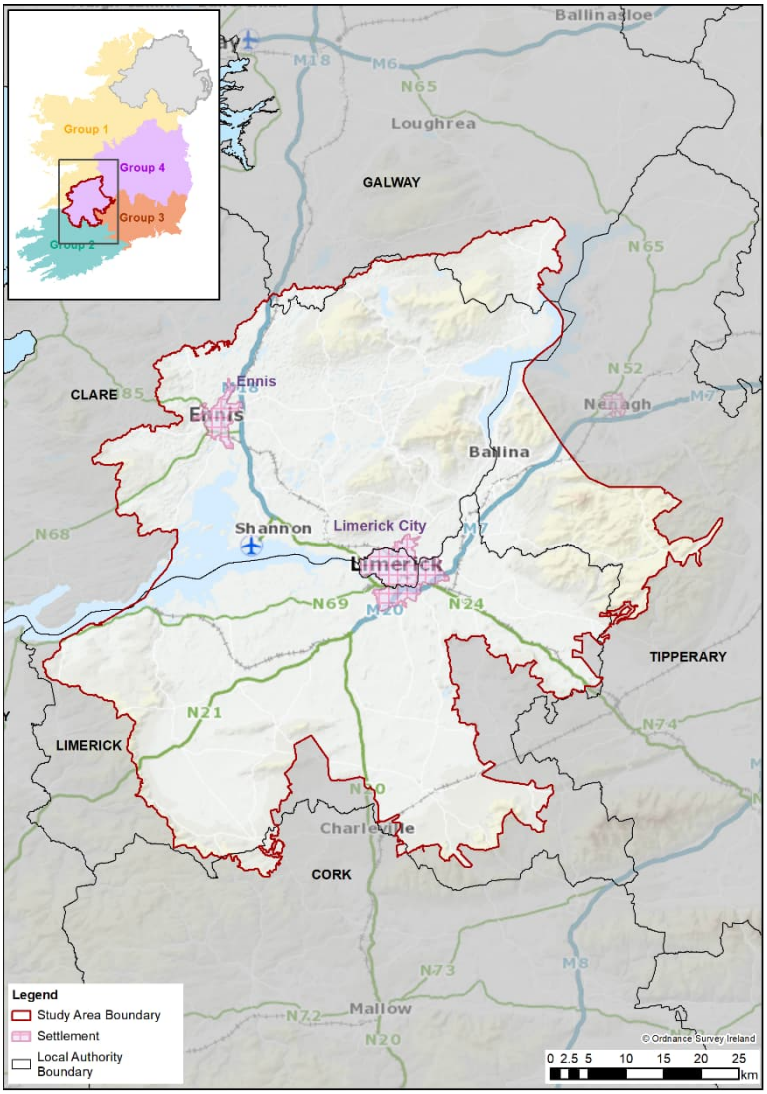

Figure 1.3 Study Area 8

2

Study Area 8 Environmental Baseline Context

2 Study Area 8 Environmental Baseline Context

This chapter provides environmental baseline information for SA8 regarding the following key environmental topics in the SEA:

- Population, Economy, Tourism and Recreation, and Human Health;
- Water Environment;
- Biodiversity, Flora and Fauna;
- Material Assets;
- Landscape and Visual Amenity;
- Air Quality and Noise;
- Climate Change;
- Cultural Heritage;
- Geology and Soils; and
- Summary of Key Issues and Trends over the Plan Period within the study area.

The baseline environment considers key indicators characterising the current situation in the study area and how these aspects are likely to develop over the Framework Plan's planning period. This includes issues relating to pressures on the environment or the sensitivity of the environment to change. This chapter is intended to support and add to the baseline environmental information for the Regional Plans SEA Environmental Report, as context for the option appraisal and programme selection.

The baseline assessment also addresses the environmental aspects of Stages 1 and 2 of the options assessment methodology:

- Stage 1 Identifying need – based on SDB and/or Drinking Water Safety Plan Barrier Assessment; and
- Stage 2 Scoping of the study area (WRZs) – understanding WRZ's within the study area and the existing conditions of assets, supply and demand issues as well as environmental constraints and opportunities.

2.1 Population, Economy, Tourism and Recreation, and Human Health

2.1.1 Population

Table 2.1 provides a general overview of the WRZ's population and the projected percentage change in population between 2019 and 2044. The largest projected increases in population are expected in the WRZs Limerick City Environs P.W.S (1900SC0001), Ennis (0300SC0020) and South West Regional (1900SC0019). The estimated population currently living in each WRZ has been based on the 2016 Census data. The 2016 population was assigned to District Metering Areas (DMAs) by mapping the Central Statistics Office (CSO) data to DMA boundaries. Irish Water have projected the 2016 population forward to 2019 using the growth projections in the National Planning Framework, updated information from the Regional Spatial and Economic Strategies, and Local Authority Planning sections (where available).

Table 2.1 Overview of the Population within the WRZs of SA8

WRZ Reference Number and Name	Total Population Served (2019)*	% Population Change (2019-2044)*
1900SC0029 – Adare	2,272	+15.3%
1900SC0017 - Athlacca Water Supply	97	+15.3%
1900SC0035 – Ballingarry	1,013	+15.3%
1900SC0009 - Bruff Water Supply	1,436	+15.3%
1900SC0016 - Bruree Water Supply	1,039	+15.4%
1900SC0037 - Murroe/Cappamore/Foileen	2,376	+15.3%
1900SC0020 - Carrigkerry Water Supply	258	+15.3%
1900SC0028 - Croom P.W.S	1,730	+15.3%
1900SC0004 - Doon Water Supply	875	+15.3%
0300SC0020 - Ennis	28,963	+29.3%
0300SC0015 - Feakle P.W.S	280	+15.3%
1900SC0007 - Fedamore Water Supply	501	+15.3%
0300SC0014 - Flagmount P.W.S	30	+15.3%
1900SC0024 - Foynes/Shannon Estuary P.W.S	7,155	+15.3%
1900SC0015 - Glenosheen/Jamestown/Kilmallock Water Supply	3,660	+15.4%
1900SC0022 - Glin Water Supply	671	+15.3%
2900SC0005 – Kilcommon	1,242	+15.3%
1900SC0034 - KilfinnaneArdpatrick Water Supply	1,312	+15.3%
0300SC0024 - Killaloe P.W.S	1,814	+15.3%
1900SC0001 - Limerick City Environs P.W.S	121,169	+52.7%
1900SC0014 - Martinstown Water Supply	838	+15.3%
0300SC0017 - Mountshannon P.W.S	817	+15.3%
2900SC0066 - Newport R.W.S.S	7,248	+15.3%
0300SC0019 - O'Briensbridge P.W.S	987	+15.3%
1900SC0005 - Pallasgreen Water Supply	2,401	+15.3%
1900SC0036 - Rathkeale	2,777	+15.3%
0300SC0016 - Scarriff P.W.S	888	+15.3%
0300SC0006 - Shannon/Sixmilebridge	25,284	+15.3%
1900SC0019 - South West Regional	13,960	+22.2%

WRZ Reference Number and Name	Total Population Served (2019)*	% Population Change (2019-2044)*
2900SC0068 - Upperchurch	96	+15.3%
1200SC0036 - Woodford	375	+15.3%

*The estimated population has been based on the 2016 Census data. Irish Water have projected the 2016 population forward to 2019 using the growth projections in the National Planning Framework, Regional Spatial and Economic Strategies, and Local Authority Planning sections

2.1.2 Economy and Employment

SA8 lies within the Mid-West region. SA8 had an above average household disposable income per person in 2016 (CSO, 2016b), and an unemployment rate of 8.7% (CSO, 2017a).

Population increase and expected economic growth has meant that housing and sustainable urban development have been made a priority for the National Development Programme; therefore, to supply the demand there is an aim to increase housing stock. The number of new dwellings completed in Q3 2020 was 347 for the Mid-West region (CSO, 2020a).

2.1.3 Tourism and Recreation

Tourism in SA8 has an important role, particularly in rural areas, with the National Planning Framework (NPF) stating that tourism is a key aspect of rural job creation now and in the future (Government of Ireland, 2018). The county of Limerick includes Limerick City, the first city of culture, and emphasises the importance of sports in its touristic appeal (Limerick City and County Council, 2020). The county of Clare also emphasises the county's natural assets, particularly the rivers and lakes of East Clare (Visit Clare, 2020).

Additionally, the study area includes sections along Ireland's Wild Atlantic Way and within Ireland's Hidden Heartlands, two of Fáilte Ireland's tourism development strategies in the country. Ireland's Hidden Heartlands is located in the Mid-West and focusses on rural communities (Fáilte Ireland, 2020a). Ireland's Wild Atlantic Way, which is Ireland's first long-distance touring route, aims to achieve greater visibility for the west coast of Ireland (Fáilte Ireland, 2020b).

Ireland's natural heritage is also recognised as an important tourism asset by the Department of Transport, Tourism and Sport (2019). For SA8, the nature reserves of note are Caher (Murphy), Derrycrag Wood, Dromore, Pollnaknockaun Wood and Rosturra Wood. Rivers, loughs and coastal areas all make an important contribution to tourism and recreational opportunities and support important fisheries.

2.1.4 Human Health

Table 2.2 provides well-being indicators for the Mid-West region within Ireland. Improvements in air quality, access to good quality drinking water and participation in recreational activities can all have a positive influence on human health and well-being.

Table 2.2 Well-Being Indicators for the Mid-West Region within Ireland

Life Expectancy (CSO, 2017b)	Participation in Sports, Fitness or Recreational Physical Activities (% of Persons Aged 15+) (CSO, 2020b)	Air Quality (EPA, 2020a)
Male: 76.3 Female: 80.4	52%	Good

A key issue for public health is reliable access to good quality drinking water. Regulated water service providers have to ensure appropriate standards of supply and be able to cope with drought conditions, peak events, and maintenance of assets. This requires adequate reserve capacity in Irish Water's supplies to provide a 1 in 50 Level of Service. At present, not all supplies within this study area provide the required levels of reserve capacity. Due to the limited historical monitoring of these supplies, particularly in relation to groundwater, this will need to be studied further. Table 2.3 lists the areas supplied by the Water Treatment Plants (WTPs) in SA8.

Table 2.3 Areas Supplied by the WTPs in SA8

WTP	WRZ	Local Authorities Supplied
Adare WTP	1900SC0029 - Adare	Limerick
Athlacca WTP	1900SC0017 - Athlacca Water Supply	Limerick
Ballingarry Spring WTP	1900SC0035 - Ballingarry	Limerick
Moloney's WTP and Finn's Well WTP	1900SC0009 - Bruff Water Supply	Limerick
Rockhill WTP and Bruree WTP	1900SC0016 - Bruree Water Supply	Limerick
Foileen WTP, Murroe WTP and Murroe (Reservoir) WTP	1900SC0037 - Murroe/Cappamore/ Foileen	Limerick
Carrigkerry WTP	1900SC0020 - Carrigkerry Water Supply	Limerick
Croom Bypass WTP and Skagh Well WTP	1900SC0028 - Croom Water Supply	Limerick
Lacka Doon Borehole WTP and Cooga Spring WTP	1900SC0004 - Doon Water Supply	Limerick
Drumcliffe WTP	0300SC0020 - Ennis	Clare
Bauragegaun WTP	0300SC0015 - Feakle P.W.S	Clare
Fedamore WTP	1900SC0007 - Fedamore Water Supply	Limerick
Flagmount WTP	0300SC0014 - Flagmount P.W.S	Clare

WTP	WRZ	Local Authorities Supplied
Foynes (Aughinish) WTP	1900SC0024 - Foynes/Shannon Estuary P.W.S	Limerick
Jamestown WTP, Kilmallock WTP, Glenosheen WTP and Ballygaddy WTP	1900SC0015 - Glenosheen/ Jamestown/Kilmallock Water Supply	Limerick
Glin WTP	1900SC0022 - Glin Water Supply	Limerick
Kilcommon WTP	2900SC0005 - Kilcommon	Tipperary
Creeveroe WTP	0300SC0024 - Killaloe P.W.S	Clare
Clareville WTP	1900SC0001 - Limerick City Environs P.W.S	Limerick
Martinstown WTP	1900SC0014 - Martinstown Water Supply	Limerick
Cloonmirran WTP	0300SC0017 - Mountshannon P.W.S	Clare
Kilfinnane WTP and Ardpatrick WTP	1900SC0034 - KilfinnaneArdpatrick Water Supply	Limerick
Newport WTP and O'Gorman's Well	2900SC0066 - Newport R.W.S.S	Tipperary
Montpellier (Ardataggle) WTP	0300SC0019 - O'Briensbridge P.W.S	Clare
Pallasgreen WTP, Caherconlish WTP and Oola WTP	1900SC0005 - Pallasgreen Water Supply	Limerick
Clouncagh WTP and Kilcolman WTP	1900SC0036 - Rathkeale	Limerick
Scarriff WTP	0300SC0016 - Scarriff P.W.S	Clare
Castle Lake WTP and Crean WTP	0300SC0006 - Shannon/ Sixmilebridge	Clare
Tobergal WTP and Castlemahon WTP	1900SC0019 - South West Regional	Limerick
Upperchurch WTP	2900SC0068 - Upperchurch	Tipperary
Woodford WTW	1200SC0036 - Woodford	Galway

Currently for day-to-day operations, twenty-two out of thirty-one of the WRZs in the area have a current SDB deficit and twenty-five have a projected SDB deficit (based on a ‘Do Minimum’ approach – see section 4.5 for further clarification). However, under normal weather and demand conditions, the current deficit does not manifest as an interruption to supply for all WRZs.

Poor water quality can be linked to risks to health. The Barrier Assessment identified thirty-nine of the forty-seven WTPs within the study area as being at high risk of failing to achieve Irish Water’s conservative Barrier Assessment standards in relation to bacteria and viruses (Barrier 1) and the

effectiveness of Irish Water's protozoa removal processes (Barrier 3) (see Table 2.1 in the SA8 Technical Report). The "quality need" identified through the Barrier Assessment is not an indicator of compliance with the Drinking Water Regulations. It is an assessment of the need to invest in areas of the Irish Water asset base through resource planning, to ensure that potential risks or emerging risks to supplies are addressed. Currently, there are three WTPs on the EPA Remedial Action List within SA8, namely namely Castlemahon WTP (South West Regional) Fedamore WTP and Foynes WTP. Fedamore WTP and Foynes WTP. These three supplies are also subject to an EPA Direction, with Fedamore currently on a Boil Water Notice.

Irish Water is currently progressing immediate corrective action in relation to a number of supplies within SA8 in advance of the NWRP. Details of these are included in the SA8 Technical Report.

2.2 Water Environment

This topic covers geomorphology, WFD, flood risk, surface water quality and groundwater receptors. Figure 2.1 shows the water environment, including the WRZs, the WFD water catchment boundaries, the WTPs and the waterbodies in SA8.

Table 2.4 provides a summary of the WFD catchments within SA8.

Table 2.4 Catchments within SA8 (EPA, 2020b)

WFD Catchments	Total Catchment Area (km^2)	Catchment Area within SA8 (km^2)
Blackwater (Munster)	3,308	15
Lower Shannon (Lough Derg)	1,820	615
Lower Shannon & Mulkear	1,041	883
Shannon North Estuary	1,651	943
Shannon South Estuary	2,038	1,533
Suir	3,553	15
Tralee Bay-Feale	1,780	<1

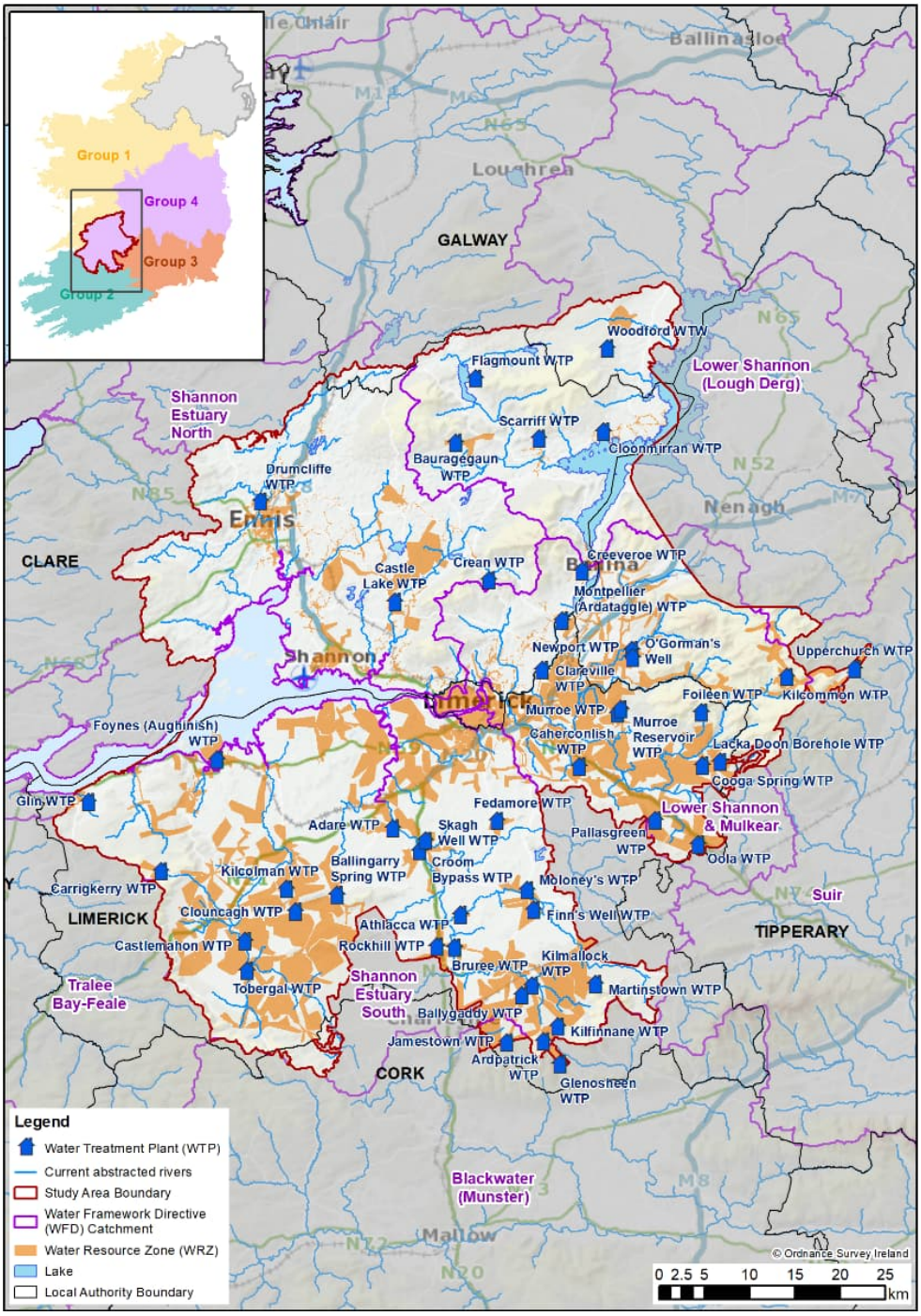

Figure 2.1 Water Environment of SA8

2.2.1 Water Framework Directive

Under the WFD, Ireland must ensure that all waterbodies achieve 'Good' status by 2027. In addition, under the legislation, any modification to a WFD waterbody should not lead to deterioration in either the overall status or any of the WFD water quality parameters.

The General Scheme of the Water Environment (Abstractions) Bill 2018 (The Bill), to introduce abstraction licensing aligned to the WFD, was published in summer 2018. This legislation will set the amount Irish Water can take from the water supplies that it abstracts water from.

As there are very few long duration flow records for Irish Water's abstractions and for waterbodies within Ireland, Irish Water lacks comprehensive data to fully understand the impact of the new legislation on these sources. Information is not currently stored centrally as it was historically collected and collated by

Local Authorities. Irish Water is building a telemetry system which will aid bringing all this data together, but this will take time. Therefore, improved monitoring and gathering better data is a priority.

On an interim basis, Irish Water has developed an initial desktop assessment based on available information (see SA8 Technical Report). Over the coming years, Irish Water will work with the environmental regulator, the EPA and the Geological Survey of Ireland, to develop desktop and site investigation systems to better understand the sustainability of its groundwater sources.

To understand the potential impact of the Abstraction Legislation on the SA8 supplies, Irish Water has assessed its surface water abstractions and summarised the potential impact on the River Shannon (Clareville), River Deel (Foynes and Castlemahon), River Mulkear (Newport WTP), River Maigue (Adare), Loobagh River (Kilmallock), and Castle Lake (Shannon/Sixmilebridge) sources. Based on this initial assessment, the volumes of water abstracted from the River Deel (Foynes), River Mulkear (Newport) and Loobagh River (Kilmallock) may not meet sustainability guidelines during dry weather flows.

Parts of the River Shannon are regulated by the Electricity Supply Board (ESB), who control releases at Parteen Basin and maintain water levels in Lough Derg in accordance with an operational band. This enables the ESB to divert flows to the hydro station at Ardnacrusha for power generation, to maintain the safety and integrity of the dam structures, to fulfil its obligations under the Floods Directive (2007/60/EC), and to maintain statutory compensations flows down the lower reaches of the River Shannon. The largest existing water supply in the region abstracts water from both the headrace canal for Ardnacrusha and the main channel of the River Shannon. The water is treated at Clareville WTP for onward supply into Limerick City and environs.

Irish Water has taken a conservative approach in identifying sustainable abstractions for new options (described in section 3.2) and has applied a sensitivity assessment considers proposals against potential for future sustainability related reductions in volume (section 5.4).

The Department of Housing, Planning and Local Government's (2019a) public consultation document, regarding the significant water management issues, has been considered by Irish Water. Therefore, the pressures, and the relevant priority 'Areas for Action' are provided below and in Table 2.7.

There are seven WFD catchments in SA8 and the total number of surface and groundwater waterbodies within SA8 are provided in Table 2.5 below.

Table 2.5 WFD Waterbodies within SA8 (EPA, 2019b, 2019c, 2019d, 2019e and 2019f)

Waterbody Type	Water Catchments	Number of Waterbodies	Number of Waterbodies Rated Below Moderate
Rivers	Blackwater (Munster)	3	0
	Lower Shannon (Lough Derg, and Lower Shannon & Mulkear)	80	7
	Shannon North Estuary	45	12
	Shannon South Estuary	80	27
	Suir	7	0
	Tralee Bay-Feale	0	0

Waterbody Type	Water Catchments	Number of Waterbodies	Number of Waterbodies Rated Below Moderate
Lakes	Blackwater (Munster)	0	0
	Lower Shannon (Lough Derg, and Lower Shannon & Mulkear)	5	1
	Shannon North Estuary	13	1
	Shannon South Estuary	2	0
	Suir	0	0
	Tralee Bay-Feale	0	0
Transitional and Coastal	N/A	9	2
Groundwater	N/A	82	6

The predominant pressures, and the percentage of 'at risk' waterbodies impacted by them, in the latest catchment summaries (catchments.ie, 2021a, 2021b, 2021c, 2021d, 2021e, 2021f and 2021g) are:

- Blackwater (Munster): Agriculture (53%), Other (including abstraction, historically polluted sites, windfarm construction and unknown anthropogenic) (32%) and Forestry (28%);
- Lower Shannon (Lough Derg): Agriculture (66%), Hydromorphology (34%) and Forestry (28%);
- Lower Shannon & Mulkear: Agriculture (50%);
- Shannon North Estuary: Agriculture (73%);
- Shannon South Estuary: Agriculture (94%);
- Suir: Agriculture (72%); and
- Tralee Bay-Feale: Agriculture (61%), Hydromorphology (35%) and Urban Wastewater (35%).

Table 2.6 includes a summary of the ‘at risk’ waterbodies within SA8.

Table 2.6 Summary of ‘At Risk’ Waterbodies in SA8 (EPA, 2019b, 2019c, 2019d, 2019e and 2019f)

Waterbody Type	Water Catchments	Number of Waterbodies Identified as ‘At Risk’	Surface Waterbodies Status ‘At Risk’ Due to Abstraction Pressure*
Rivers	Blackwater (Munster)	2	4
	Lower Shannon (Lough Derg, and Lower Shannon & Mulkear)	25	
	Shannon North Estuary	15	
	Shannon South Estuary	34	
	Suir	3	
	Tralee Bay-Feale	0	

Waterbody Type	Water Catchments	Number of Waterbodies Identified as 'At Risk'	Surface Waterbodies Status 'At Risk' Due to Abstraction Pressure*
Lakes	Blackwater (Munster)	0	0
	Lower Shannon (Lough Derg, and Lower Shannon & Mulkear)	3	
	Shannon North Estuary	3	
	Shannon South Estuary	1	
	Suir	0	
	Tralee Bay-Feale	0	
Transitional and Coastal	N/A	6	0
Groundwater	N/A	25	0
Total		**98**	**4**

* Based on Irish Water assessment of their current abstractions

To meet WFD objectives, it has been recognised that there is a need to prioritise and focus efforts to address issues through identifying 'Areas for Action'. The reasons for selection of the 'Areas for Action' within the sub-catchments of SA8 are listed in Table 2.7. Note that the 'Areas for Action' included in Table 2.7 are from the WFD cycle 2 River Basin Management Plan (RBMP), as the WFD cycle 3 RBMP was undergoing consultation at the time of writing.

Table 2.7 'Areas for Action' within SA8 (catchments.ie, 2021h)

Areas for Action	Key Reasons for Selection
Awbeg (Buttevant) West	• Test case for drainage issues • Upper reaches of sub-catchment, headwaters to 'At Risk' waterbodies • Failing to meet protected area objectives for Crayfish • Inland Fisheries Ireland (IFI) reported this is a good trout river • Two deteriorated waterbodies
Farahy	• Community groups in the area • Two deteriorated waterbodies • Tributaries to Funshion_050, a deteriorated High Ecological Status objective waterbody
Allow	• Failing to meet protected area objectives for Freshwater Pearl Mussel (19 of 27 catchments of S.I. 296 2009) • Build on proposed improvements at Kanturk WwTP • Life project on this waterbody – potential to build on previous work with Teagasc, NPWS, IFI • Building on previous community and farmer engagement

Areas for Action	Key Reasons for Selection
	• One deteriorated waterbody • One potential 'quick win'
Lough Gur	• Opportunity to work with a strong group water scheme here. Many farmers in the area are members of the scheme • Active community and angling groups • High recreational and amenity value • Important for biodiversity and heritage
Camoge	• Shared ground with the Corcas • Build on improvements as a result of in stream works completed by IFI • Headwaters of the river Camoge • Active angling clubs • One potential 'quick win' • Two deteriorated waterbodies
Owvane	• Potential to build on improvement works completed by IFI • Two potential 'quick wins' • One deteriorated waterbody
Drumcomoge	• Multi-agency effort/cross county opportunity • Headwaters to the Camoge which is already a project • Similar issues to the Arra WRAA • Another test case for poorly drained soils • Good tidy towns group that could be incorporated (Emly)
Upper Deel	• Multi-agency approach between Cork and Limerick • Pilot project for the very poorly draining soils in Limerick • There is the potential for a rivers trust here • Community involvement, including active tidy towns group • The Deel is a good trout fishery • Two deteriorated waterbodies
Lower Graney	• Amenity value in Scariff town • Biodiversity importance (Whooper Swan) • One deteriorated waterbody
Bleach & Lough Graney	• Cross county project • Important for brown trout angling • Opportunity to work with angling group in Woodford • Potential to collaborate with forestry • Would bring entire sub catchment to 'Good' status • Information on investigative assessment and measures can be extrapolated to similar areas

Areas for Action	Key Reasons for Selection
	• One deteriorated High Ecological Status objective waterbody
Woodford - Lower Shannon (Lough Derg)	• Potential test case for community engagement when developing Integrated Constructed Wetlands • Strong community and angling groups • Contributes 3% of trout population to Lough Derg • One deteriorated waterbody
Groody	• Building on improvement to fishery; salmon has returned to the lower section of the river • Zoned for amenity use in Local Area Plan • Active community interest, including Caherconlish tidy towns • Urban stream • Potential to tie in with Limerick regeneration project • One potential 'quick win'
Mulkear (Limerick)	• Building on completed and ongoing work by the MulkearLIFE project • Building on improvements from in-stream works • Important trout spawning streams • Failing to meet protected area objective for salmon • One deteriorated waterbody
Toem and Cappawhite	• Opportunity to look at integration of planning and forestry activities • Potential to link with the Mulkear After LIFE Plan • Important salmon spawning rivers • Headwaters to the river Dead • One deteriorated waterbody
Inch (Bilboa)	• Opportunity to look at integration of planning and forestry activities • Headwaters of one of the most important spawning streams in the system • One deteriorated waterbody • Waterbody is not meeting protected area objectives for Salmon
Dead and Cauteen	• Headwaters to the river Cauteen and the river Dead • Strong local farming involvement • Opportunity to build on awareness initiatives by Limerick County Council
Shallee	• Part of Drumcliff Source protection zone • Building on existing knowledge from works completed by Clare County Council • Building on water quality improvements
Broadford	• Building on existing work completed by Clare County Council • Manageable area: Q scores previously collected by Clare County Council on inputting tributaries will narrow the scope of work • One deteriorated waterbody

Areas for Action	Key Reasons for Selection
Inchiquin & Atedaun Lakes	• Potential pilot project to examine nutrient impact in groundwater fed lakes in karst areas • Building on existing work completed by IFI • Building on existing knowledge from research completed by Trinity College Dublin (David Drew) • Opportunity to work with farmers including in the expanded BurrenLIFE scheme • Inchiquin is an important drinking water abstraction • Important fishery (trout) - top 8 in the country • Amenity value • Inchiquin is one of the 5 arctic char lakes in Clare, it is a deep lake, so it is a good candidate for their reintroduction due to the depth

2.2.2 Flood Risk

Flood risk is considered as part of the options appraisal; however, many options are at a conceptual stage and there is insufficient information to differentiate between options on the basis of flood risk when design details, siting and routing are still to be determined. Both surface water and ground water flood risk will need to be considered further as part of the development of option design and for assessment at project level.

The OPW has been implementing the European Communities (Assessment and Management of Flood Risks) Regulations 2010 mainly through the Catchment Flood Risk Assessment and Management (CFRAM) Programme, through which draft Flood Risk Management Plans have been developed. Approximately 300 Areas for Further Assessment have been established along with a range of measures to reduce or manage the flood risk within each catchment. CRFAMS mapping for all Areas for Further Assessment is available to view on the CFRAMS website (OPW, 2018). Figure 5.4 in the SEA Environmental Report (Appendix A) provides a summary of surface water and groundwater flood risk from the OPW CFRAMS data for the region including SA8.

For existing water infrastructure assets such as WTPs, flood risk vulnerability is considered in decisions on need to rationalise and decommission assets.

Any options which are progressed and require planning permission will require a Flood Risk Assessment to be completed in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities (2009).

2.3 Climate Change

Ireland's climate is heavily influenced by the Atlantic Ocean. Consequently, Ireland has a milder climate that has less extreme temperature variation compared with other countries at a similar latitude. The hills and mountains, many of which are near the coasts, provide shelter from strong winds and from the direct oceanic influence. Winters tend to be cool and windy, while summers are generally mild and less windy (Met Éireann, 2019).

In June 2019, the government agreed to support the adoption of a net zero target by 2050 at EU level, and to pursue a trajectory of emissions reduction nationally which is in line with reaching net zero in Ireland by 2050.

Section 15 of the Climate Action and Low Carbon Development Act 2015 (as amended in 2021) sets a new "national climate objective" for Ireland, which provides that "*The State shall, so as to reduce the extent of further global warming, pursue and achieve, by no later than the end of the year 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy*". The amended Act requires public authorities, including IW, to take account of, so far as practicable, perform their functions in a manner consistent with the furtherance of the national climate objective and the relevant national and sectoral plans and strategies to mitigate greenhouse gas emissions and adapt to the effects of climate change.

The Department of the Environment, Climate and Communications' Climate Action Plan (CAP) published November 2021, replacing CAP 2019, commits to achieving a 51% reduction in overall greenhouse gas emissions by 2030 and reaching net zero carbon emissions by 2050. The aim is for more sustainable growth and to create a resilient, vibrant and sustainable country. The CAP defines a roadmap to this goal and initiates a set of policy actions to achieve this. A detailed sectoral roadmap has also been set out, which is designed to deliver a cumulative reduction in emissions, over the period 2021 to 2030. CAP 2021 updates existing targets with renewable energy to provide 80% of electricity by 2030 and sets targets for sectors including for agriculture and forestry such as woodland planting and improving land management to support carbon sequestration (Department of the Environment, Climate and Communications, 2021).

In addition, Ireland has a sectoral climate adaptation plan for the 'Water Quality and Water Services Infrastructure' sector. A summary of the report's findings is included in Table 2.8.

Table 2.8 Summary of Key Points from the 'Water Quality and Water Services Infrastructure' Sectoral Climate Change Plan (Department of Housing, Planning and Local Government, 2019b)

Summary	
Key Points	• Protecting and improving water quality and improving water services infrastructure are major challenges in Ireland • Climate change-induced threats will increase the scale of these challenges • Risks to water quality and water infrastructure arise from changing rainfall patterns and different annual temperature profiles. The frequency and intensity of storms and sea level rise are also considered
The challenges: Water services infrastructure	• Increased surface and sewer flooding leading to pollution, water and wastewater service interruptions • Reduced availability of water resources • Hot weather increasing the demand for water • Increased drawdown from reservoirs in the autumn/winter for flood capacity, leading to resource issues • Business continuity impacts or interruptions for water services providers
Primary adaptive measures	• Fully adopt the 'integrated catchment management' approach

Summary	
	• Improve treatment capacity and network functions for water services infrastructure • Water resource planning and conservation – on both supply and demand sides • Include climate measures in monitoring programmes and research • Many of these proposed adaptation actions are already underway through existing and scheduled water sector plans and programmes

There are four aims that local authorities are required to include in their climate adaptation strategies (Department of Communications, Climate Action and Environment, 2018):

- Mainstream Adaptation: That climate change adaptation is a core consideration and is mainstreamed in all functions and activities across the local authority. In addition, ensure that local authority is well placed to benefit from economic development opportunities that may emerge due to a commitment to proactive climate change adaptation and community resilience;
- Informed decision making: That effective and informed decision making is based on a reliable and robust evidence base of the key impacts, risks and vulnerabilities of the area. This will support long term financial planning, effective management of risks and help to prioritise actions;
- Building Resilience: That the needs of vulnerable communities are prioritised and addressed, encourage awareness to reduce and adapt to anticipated impacts of climate change, and promote a sustainable and robust action response; and
- Capitalising on Opportunities: Projected changes in climate may result in additional benefits and opportunities for the local area and these should be explored and capitalised upon to maximise the use of resources and influence positive behavioural changes.

In addition to these high-level aims, each local authority is required to identify the key risks to their area; these are provided in Table 2.9.

Table 2.9 Climate Change Risks Identified by Local Authorities in SA8

County	Key Risk Areas
Clare (Clare County Council, 2019)	• Increased temperatures and drought • Increased precipitation • Coastal inundation and increased flood risk • Increased frequency and intensity of storms
Cork (Cork County Council, 2019)	• Groundwater, pluvial, fluvial and coastal flooding • Coastal erosion • Heat waves • Windstorms • Freezing conditions
Galway	• Flood risk

County	Key Risk Areas
(Galway County Council, 2019)	• Increased temperatures - heat waves and drought • Heavy rainfall events • Increased storm intensity • Changes to natural ecosystems • Ocean warming and acidification • Sea level rise and inundation
Limerick City and County (Limerick City and County Council, 2019)	• Flooding • Heat waves • Windstorms • Coastal erosion • Freezing conditions
Tipperary (Tipperary County Council, 2019)	• Low level lands along rivers where fluvial flooding may increase • Bogs and peatlands that may be impacted by drought • Road Infrastructure in the upland areas

Climate change is expected to influence weather conditions, such as frequency of droughts and extreme events such as storms, and is likely to affect habitats and species, water availability for supply and water demand and water quality. For SA8, not all supplies within the study area meet the required levels of reserve capacity. As evidenced in the 2018 drought, there is the potential for this deficit to affect access to water in the future. This situation will further deteriorate over time due to climate change driven reductions in water resources.

A key aspect of Irish Water's strategy is to 'Supply Smarter', by improving the quality, resilience and security of their supply through infrastructural improvements. One of the high-level goals taken from the national level is building resilience, with water services being a key factor.

Supporting environmental resilience to climate change will also be an important consideration for the future with additional benefits for supply resilience.

2.4 Biodiversity, Flora and Fauna

2.4.1 Designated Sites

Within SA8 there are a number of European, national and locally designated sites, including Special Protected Areas (SPAs), Special Areas of Conservation (SACs), nature reserves, Natural Heritage Areas, and proposed Natural Heritage Areas (see Table 2.10 and Figure 2.2). The European sites (SPAs and SACs), and the potential impacts on them, are discussed in more detail in the NIS.

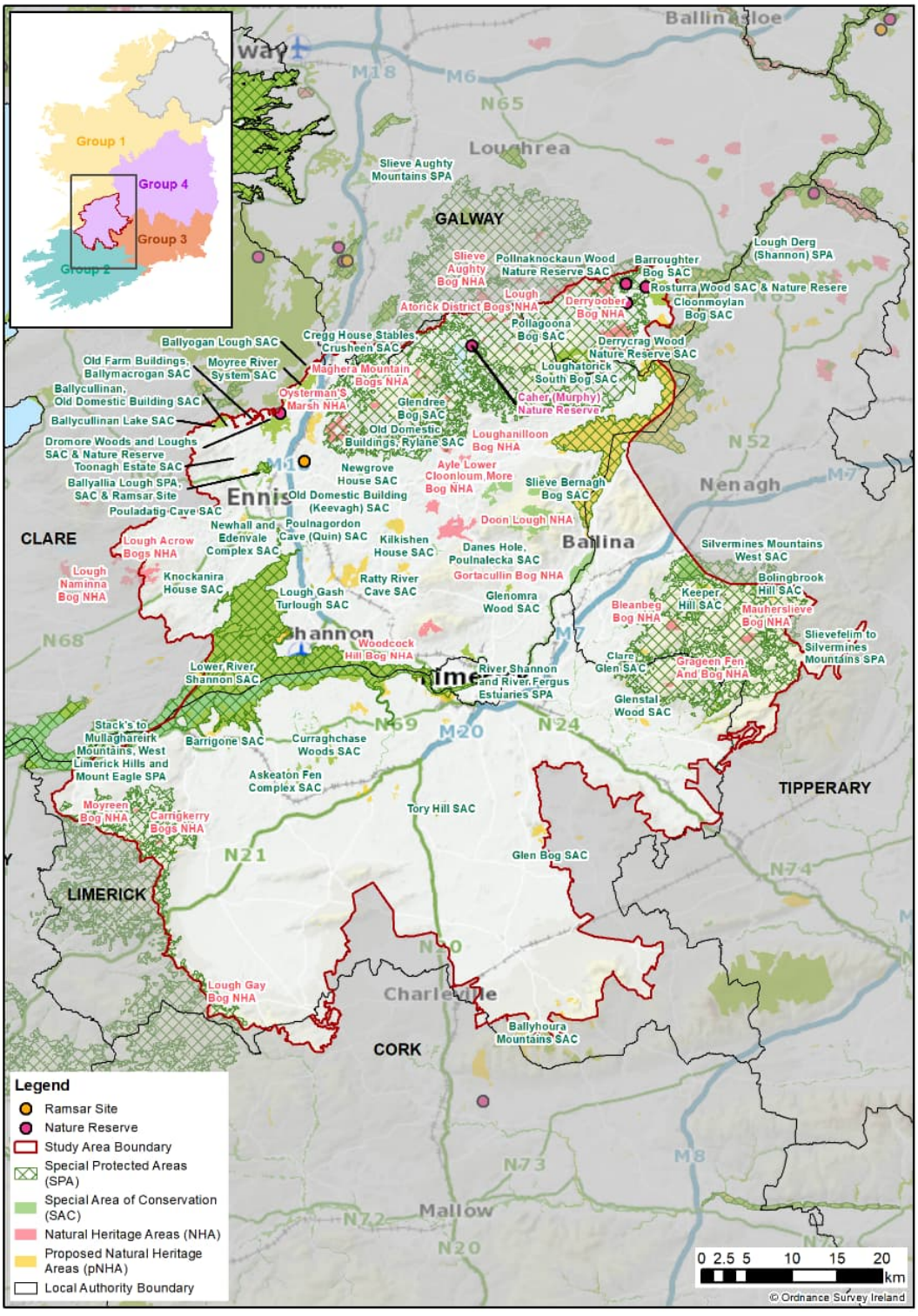

Figure 2.2 Designated Sites in SA8

Table 2.10 Designated Sites within SA8 (NPWS, 2019a)

Receptor	Name	Total Number
Special Protected Area (SPA)	Ballyallia Lough SPA	6
	Lough Derg (Shannon) SPA	
	River Shannon and River Fergus Estuaries SPA	
	Slieve Aughty Mountains SPA	
	Slievefelim to Silvermines Mountains SPA	
	Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA	
Special Area of Conservation (SAC)	Askeaton Fen Complex SAC	42
	Ballyallia Lake SAC	
	Ballycullinan Lake SAC	
	Ballycullinan, Old Domestic Building SAC	
	Ballyhoura Mountains SAC	
	Ballyogan Lough SAC	
	Barrigone SAC	
	Barroughter Bog SAC	
	Bolingbrook Hill SAC	
	Clare Glen SAC	
	Cloonmoylan Bog SAC	
	Cregg House Stables, Crusheen SAC	
	Curraghchase Woods SAC	
	Danes Hole, Poulnalecka SAC	
	Derrycrag Wood Nature Reserve SAC	
	Dromore Woods and Loughs SAC	
	Glen Bog SAC	
	Glendree Bog SAC	
	Glenomra Wood SAC	
	Glenstal Wood SAC	
	Keeper Hill SAC	
	Kilkishen House SAC	
	Knockanira House SAC	
	Lough Gash Turlough SAC	

Receptor	Name	Total Number
	Loughatorick South Bog SAC	
	Lower River Shannon SAC	
	Moyree River System SAC	
	Newgrove House SAC	
	Newhall and Edenvale Complex SAC	
	Old Domestic Building (Keevagh) SAC	
	Old Domestic Buildings, Rylane SAC	
	Old Farm Buildings, Ballymacrogan SAC	
	Pollagoona Bog SAC	
	Pollnaknockaun Wood Nature Reserve SAC	
	Pouladatig Cave SAC	
	Poulnagordon Cave (Quin) SAC	
	Ratty River Cave SAC	
	Rosturra Wood SAC	
	Silvermines Mountains West SAC	
	Slieve Bernagh Bog SAC	
	Toonagh Estate SAC	
	Tory Hill SAC	
Ramsar sites	Ballyallia Lough	1
Nature reserves	Caher (Murphy) nature reserve	5
	Derrycrag Wood nature reserve	
	Dromore nature reserve	
	Pollnaknockaun Wood nature reserve	
	Rosturra Wood nature reserve	
National Parks	N/A	0
Natural Heritage Areas (NHAs)	Ayle Lower Bog NHA	19
	Bleanbeg Bog NHA	
	Carrigkerry Bogs NHA	
	Cloonloum More Bog NHA	
	Derryoober Bog NHA	
	Doon Lough NHA	
	Gortacullin Bog NHA	

Receptor	Name	Total Number
	Grageen Fen and Bog NHA	
	Lough Acrow Bogs NHA	
	Lough Atorick District Bogs NHA	
	Lough Gay Bog NHA	
	Lough Naminna Bog NHA	
	Loughanilloon Bog NHA	
	Maghera Mountain Bogs NHA	
	Mauherslieve Bog NHA	
	Moyreen Bog NHA	
	Oysterman'S Marsh NHA	
	Slieve Aughty Bog NHA	
	Woodcock Hill Bog NHA	
Proposed Natural Heritage Areas (pNHAs)	Shown in Figure 2.2	73

2.4.2 Habitats

Table 2.11 lists the percentage of the study area, and the number of hectares, covered by each habitat within SA8; as reported in the Corine land use dataset[1].

Table 2.11 Habitat Areas for SA8 (EPA, 2018)

Habitat	Ha	% of Study Area
Agricultural Land		
Pastures	272,487	65.26%
Land principally occupied by agriculture, with significant areas of natural vegetation	27,974	6.70%
Non-irrigated arable land	687	0.16%
Complex cultivation patterns	483	0.12%
Urban		
Green urban areas	27	0.01%
Natural Habitats		
Peat bogs	15,853	3.80%
Water bodies	7,234	1.73%
Estuaries	10,736	2.57%

[1] The EPA land use dataset will be used once this is available

Habitat	Ha	% of Study Area
Intertidal flats	4,260	1.02%
Inland marshes	2,383	0.57%
Moors and heathland	1,823	0.44%
Salt marshes	1,242	0.30%
Water courses	569	0.14%
Natural grasslands	546	0.13%
Sparsely vegetated areas	404	0.10%
Bare rocks	13	<0.01%
Forest		
Coniferous forest	29,858	7.15%
Transitional woodland-shrub	19,053	4.56%
Mixed forest	6,693	1.60%
Broad-leaved forest	4,054	0.97%

Particularly relevant habitats that depend on the water quality and/or quantity in SA8 are:

- Turlough ecosystems;
- Oligotrophic, hard oligo-mesotrophic and natural eutrophic lakes;
- Bog habitats – Active raised bogs, degraded raised bogs still capable of natural regeneration, *Rhynchosporion* depressions, transition mires and quaking bogs;
- Alkaline fens; and
- Groundwater dependant terrestrial habitats, such as petrifying springs with tufa formation, calcareous fens and blanket bogs.

2.4.3 Species

The key species and habitats (Nelson et al, 2019) of concern within SA8 include:

- Otter;
- Bat species – Lesser horseshoe bats. Daubenton's bat along the waterways. The most common species in the study area are Common and Soprano pipistrelles and Leisler's bat;
- Fish species (Lamprey, Atlantic salmon and European eel);
- Waterbirds of 'qualifying interest' e.g. Brent goose and winter migratory waders;
- Other 'qualifying interest' bird species e.g. hen harrier and merlin;
- Protected whorl snails (*Vertigo geyeri* (particularly high sensitivity to changes), *Vertigo angustior* and *Vertigo moulinsiana*);
- Fresh-water pearl mussel;
- Freshwater white-clawed crayfish;
- Marsh Fritillary (*Euphydryas aurinia*); and
- Killarney fern.

The key invasive species to consider (European Communities (Birds and Natural Habitats) Regulations, 2011) for developing options within SA8 include:

- Japanese knotweed;
- Himalayan balsam;
- Giant hogweed;
- *Elodea* spp;
- Curly waterweed (*Lagarosiphon major*);
- Himalayan knotweed (*Persicaria wallichii*); and
- Zebra mussel (*Dreissena polymorpha*).

2.5 Material Assets

Material assets are considered to be the natural and built assets (non-cultural assets) required to enable a society to function as a place to live and work, in giving them material value.

Some of the natural assets within SA8 are listed in Table 2.12, such as agricultural land and forest areas.

Built assets include transport and communications infrastructure, and other developed areas, including existing water supply infrastructure (see Figure 2.1 and Figure 2.3). These assets all need to be taken into account in new water resource developments.

In addition, water resources and water quality are influenced by urban, agricultural and forestry activity within river and groundwater catchments. This can affect the availability and quality of water for supply.

Irish Water has forty-eight WTPs in SA8, meeting the demand of 12.7 Ml/d in 2019.

Ireland's canals once played a significant role as a transport network; however, their primary use is now for recreational and heritage purposes. The key canal within SA8 is the Shannon Navigation canal. There are no ports of national or regional significance within SA8.

Other significant transport infrastructure includes the main road (particularly the M7, M18, N69, N20, N21, N24 and the N68) and rail network (Dublin Heuston - Cork, Dublin Heuston - Limerick and Ennis, Dublin Heuston - Tralee, Galway - Limerick, Waterford - Clonmel - Limerick) and Shannon Airport.

Any new infrastructure considered for SA8 will need to take, existing as well as planned land zoning and local development into consideration.

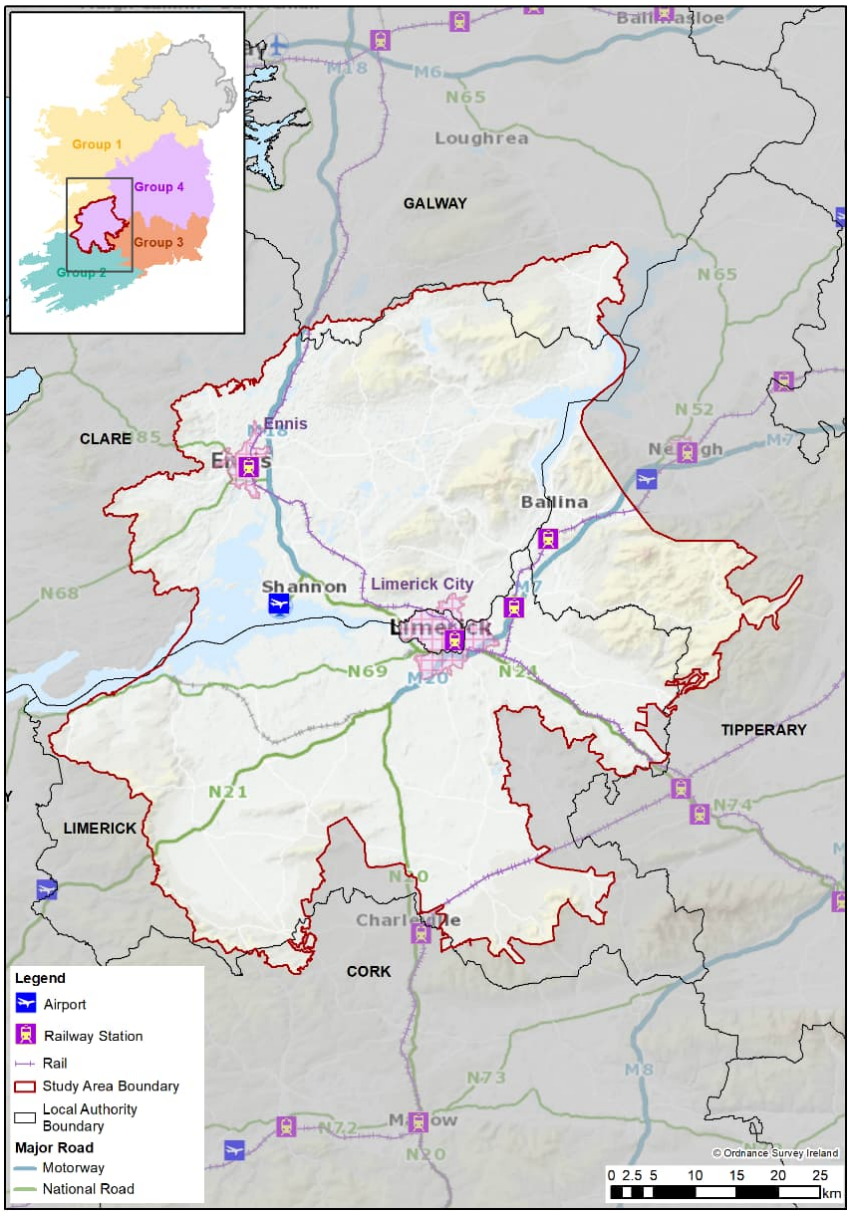

Figure 2.3 Transport Infrastructure in SA8

Table 2.12 Land Use within SA8 (EPA, 2018)[2]

Land use	Ha	% of Study Area	Comparison to Overall Eastern and Midlands Region %
Agriculture	301,632	72.24%	75.52%
Urban	8,689	2.08%	3.69%
Forest	59,658	14.29%	9.42%
Natural habitats	45,062	10.79%	10.61%
Industry	2,432	0.58%	0.70%
Other	62	0.01%	0.06%

[2] The EPA land use dataset will be used once it has been made available

Table 2.13 gives an overview of key nationally important projects highlighted by the NPF (Government of Ireland, 2018) for social and economic development that are located within SA8. Proposals for other strategic developments within SA8 are considered for the assessment. These are primarily identified from the National Planning Framework where any relevant project for the study area are included. Small scale housing and business development are not considered for this plan level assessment.

In addition, proposed developments identified from myProjectIreland (2021) have been considered[3]. Numerous developments are mapped within SA8, so these have been screened to identify potentially relevant developments for cumulative assessment and multiple developments within settlement areas are addressed as a group. For SA8, the individual projects are represented as and assessed as part of the NPF projects' settlements, such as Limerick, and major routes, such as the M20 and N21, in the table below due to the density of project clusters in those areas.

Table 2.13 Proposed New Developments from the NPF

Development		
M20 Cork to Limerick	Celtic Interconnector Project	N21/N69 Limerick to Adare to Foynes Road
Coonagh to Knockalisheen Road	Shannon Crossing/Killaloe	

2.6 Landscape and Visual Amenity

The National Landscape Strategy 2015 - 2025 is in the process of being implemented and will be Ireland's vehicle for complying with the EU Landscape Convention. Landscape assessment guidance is also available from the local authorities. This will be taken into account when identifying landscape character areas and protected areas at the project level in the future.Table 2.14 shows the value and sensitivity of the Landscape Character Areas (LCAs) within each of the counties listed within the study area. No data is available for the values of the LCAs within the counties of Clare or Tipperary. No data is available for the values or the sensitivity of the LCAs within the county of Limerick[4].

The value of the landscape in SA8 is reflected in baseline data sections 2.1.3 (Tourism and Recreation), 2.4 (Biodiversity, Flora and Fauna) and 2.8 (Cultural Heritage).

Water supply infrastructure will need to take account of sensitive landscapes and views. This will need to include culturally important areas, townscapes, natural areas and areas and views of importance for tourism and recreation.

Table 2.14 Value and Sensitivity of Landscape Character Areas in the Counties of SA8 (Ordnance Survey Ireland. n.d.)

Landscape Character Area	Value	Sensitivity
County: Galway (Galway County Council, 2015)		
Northeast Galway (Balinasloe to Ballymoe)	Low	Low with pockets of Moderate

[3] Note that the myProjectIreland dataset was taken at a fixed point in time to allow for assessment of cumulative effects. The date for SA8 being the 15//01/21.
[4] As with all the baseline information, the LCA information will be updated as part of regular reviews

Landscape Character Area	Value	Sensitivity
Shannon and Suck River Valley between Portumna and Ballinasloe	Medium	Special
East central Galway (Athenry, Ballinasloe to Portumna)	Low	Low with pockets of Moderate
Southeast Galway (Clarinbridge to Gort)	Medium	Moderate with pockets of High
Northeast Galway (Tuam environs)	Low	Low with pockets of Moderate
Slieve Aughty Mountains	Medium	High
Northwest Lough Derg	Medium	Special
Lower Burren (Co. Galway portion)	Outstanding	Special with pockets of Moderate
Inveran to Galway City coastline	High	High with a parallel strip of Special
East Connemara Mountains (Moycullen, Oughterard to Loughanillaun)	High	High with pockets of Special
Lough Corrib and environs	Outstanding	Unique with pockets of High and Special
South foothills of east Connemara Mountains (Ouranavilla Tully to Tonabrocky)	Medium (pockets of varying landscape value rating)	Approximately half Special and half High
East Galway Bay (Oranmore to Kinvarra Bay and inland to N18 road)	High	High with a coastal edge of Special
West Connemara	Outstanding	Special
Lettermore and Gorumna Islands	High	High with a coastal edge of Special
West foothills of east Connemara Mountains	High	High
Carraroe (Cashla Bay to Glencoh)	High	High with a coastal edge of Special
Bertraghboy bay and eastern banks	High	Special
West Coast (Gorteen bay to Clifden).	Outstanding	Special
West Coast (Clifden to mouth of Killary Harbour)	Outstanding	High with a coastal edge of Special
Killary Harbour and southern banks	Outstanding	Unique with pockets of Special
Connemara National Park (including Lough Fee, Lough Inagh and Derryclare Lough)	Outstanding	Unique

Landscape Character Area	Value	Sensitivity
Joyces Country (including Lehanagh Loughs and south Lough Mask)	Outstanding	Unique with pockets of Special
Aran Islands	Outstanding	Unique with pockets of Special
Lough Rea	High	Special
County: Clare (Clare County Council, 2004)		
Burren Uplands	-	High
Low Burren	-	High
Cliffs of Moher and Lahinch	-	High
Fergus Loughlands	-	-
Slieve Aughty Uplands	-	Medium
Lough Graney	-	High
Lough Derg Basin	-	High
Slieve Bernagh Uplands	-	Low
River Shannon Farmlands	-	Low
Sixmilebridge Farmlands	-	Low
East Clare Loughlands	-	Medium
Tulla Drumlin Farmland	-	High
Ennis Drumlin Farmland	-	Low
Fergus Estuary	-	High
Kilnamona High Drumlin Farmland	-	Low
Cullenagh River Farmlands	-	-
Slieve Callan Uplands	-	Medium
Shannon Estuary Farmlands	-	-
Kilmihil Farmlands	-	Low
Malbay Coastal Farmland	-	High
Loop Head Peninsula	-	Medium
County: Tipperary (Tipperary County Council, 2016)		
Urban and Fringe Areas	-	Low
Thurles Hinterland	-	Low
Nenagh Corridor	-	Low
River Suir Central Plain / Nenagh Corridor	-	Low

Landscape Character Area	Value	Sensitivity
Templemore Plains	-	Low
West Tipperary Farmland Mosaic	-	Low
Borrisokane Lowlands	-	Dominant Moderate with some Low and High
Littleton Raised Bog	-	Dominant High with some Low and Moderate
Littleton Farmland Mosaic and Marginal Peatland	-	Dominant Low with some Moderate and High
Upper Lough Derg	-	Dominant High with some Low, Moderate, Special and Unique
The Shannon Callows	-	Dominant High with some Low, Moderate, Special and Unique
River Shannon - Newport	-	Dominant Special with some Low, Moderate, High and Unique
Arra Mountains – Lower Lough Derg	-	Dominant Special with some Low, Moderate, High and Unique
Slieveardagh Hills Farmland Mosaic	-	Dominant Moderate with some Low
Linguan Valley Marginal and Farmland Mosaic	-	Dominant Moderate with some Low
Slievenamuck Marginal Mosaic	-	Dominant High with some Moderate and Special
Upperchurch - Kilcommon / Hollyford Hills Mountain Mosaic	-	Dominant High with some Moderate and Special
Silvermines – Rearcross	-	Dominant High with some Low, moderate, Special and Unique
Slievenamon Mountain Mosaic	-	Dominant Unique with some Low, Moderate, High and Special
Glen of Aherlow Uplands	-	Dominant Unique with some Moderate, High and Special
Galtee Mountains Mosaic	-	Dominant Unique with some Moderate, High and Special

Landscape Character Area	Value	Sensitivity
Devilsbit Uplands	-	Dominant Unique with some Moderate, High and Special
Knockmealdown Mountain Mosaic	-	Dominant Unique with some Moderate, High and Special
County: Limerick City and County (Limerick County Council, 2010)		
No values or sensitivity information available		
County: Cork (Cork County Council, 2007)		
City Harbour and Estuary	Very High	Very High
Broad Bay Coast	Very High	Very High
Indented Estuarine Coast	Very High	Very High
Rugged Ridge Peninsulas	Very High	Very High
Fertile Plain with Moorland Ridge	Very High	Very High
Broad Fertile Lowland Valleys (Blarney-Ballincollig-Carrigaline-West to Dunmanway)	High	High
Broad Fertile Lowland Valleys (Cloyne, Castlemartyr, Killeagh and Environs)	Medium	Medium
Broad Fertile Lowland Valleys (Castlelyons-Rathcormack)	Medium	Medium
Rolling Patchwork Farmland (Bandon-Clonakilty-Leap Environs)	Medium	Medium
Rolling Patchwork Farmland (Dunderrow-Belgooly and Environs)	Medium	Medium
Hilly River and Reservoir Valleys	High	High
Broad Marginal Middleground and Lowland Basin	Low	Medium
Fissured Fertile Middleground (South of the Gearagh)	Low	Low
Fissured Fertile Middleground (Rylane east to Waterford)	Medium	High
Broad Marginal Middleground Valley	High	High
Rolling Marginal and Forested Middleground (BallyvourneyGaeltacht)	High	High
Rolling Marginal and Forested Middleground (South)	Medium	Medium

Landscape Character Area	Value	Sensitivity
Valleyed Marginal Middleground (Macroom and Environs)	High	High
Valleyed Marginal Middleground (Glenville and Environs)	Medium	Medium
Fissured Marginal and Forested Rolling Upland (NorthwestRockchapel)	Medium	Medium
Fissured Marginal and Forested Rolling Upland (Lyre and Nad)	Medium	Medium
Ridged and Peaked Upland (Mullaghanish to Millstreet)	High	High
Ridged and Peaked Upland (Millstreet)	Medium	Medium
Glaciated and Forested Cradle Valley (Gougane Barra)	High	High
Glaciated Cradle Valleys (Cullenagh Lake)	Low	Medium
Glaciated Cradle Valleys (Foilanumera)	Medium	Medium

2.7 Air Quality and Noise

2.7.1 Air Quality

Air quality is monitored and managed using Air Quality Zones and air monitoring sites, the air quality index rating of the area within SA8 is rated as ‘good’.

In general, the water industry is not a major contributor to air quality issues, although there is potential for local pollution through Irish Water vehicles, generator plants and drinking water residuals treatment facilities. There is a requirement to comply with air pollution regulations and also identify potential opportunities for reducing emissions. Air quality will be a consideration at the project level, for example, through scheme construction management and scheme design and operation.

2.7.2 Noise

The main areas that experience noise pollution are likely to be areas along the main roads, particularly around the M7, M18, N69, N20, N21, N24 and the N68.

Water infrastructure development is not expected to add significantly to noise pollution. Construction noise will be considered through scheme construction management and design for local receptors and for sensitive receptors in close proximity. Noise pollution will also be managed through the planning process with conditions included in planning permissions.

2.8 Cultural Heritage

Within SA8, there are numerous designated and non-designated cultural heritage assets inventoried in the Record of Monuments and Places, the Sites and Monuments Record, the Record of Protected Structures, and the National Inventory of Architectural Heritage (NIAH) (see Table 2.15).

Figure 2.4 shows the location of the individual cultural heritage records from the National Monuments Service and the NIAH. Given the number of small sites, these can be better viewed on the Department of Culture, Heritage and the Gaeltacht's (2020) 'Historic Environment Viewer' website.

There are also potentially unknown, undesignated archaeological and architectural remains throughout Ireland. Water supply can affect cultural heritage through, direct loss or construction of infrastructure involving disturbance of soils, above ground structures close to existing heritage sites affecting setting or changes due abstraction changing drainage and affecting interests within wetland sites.

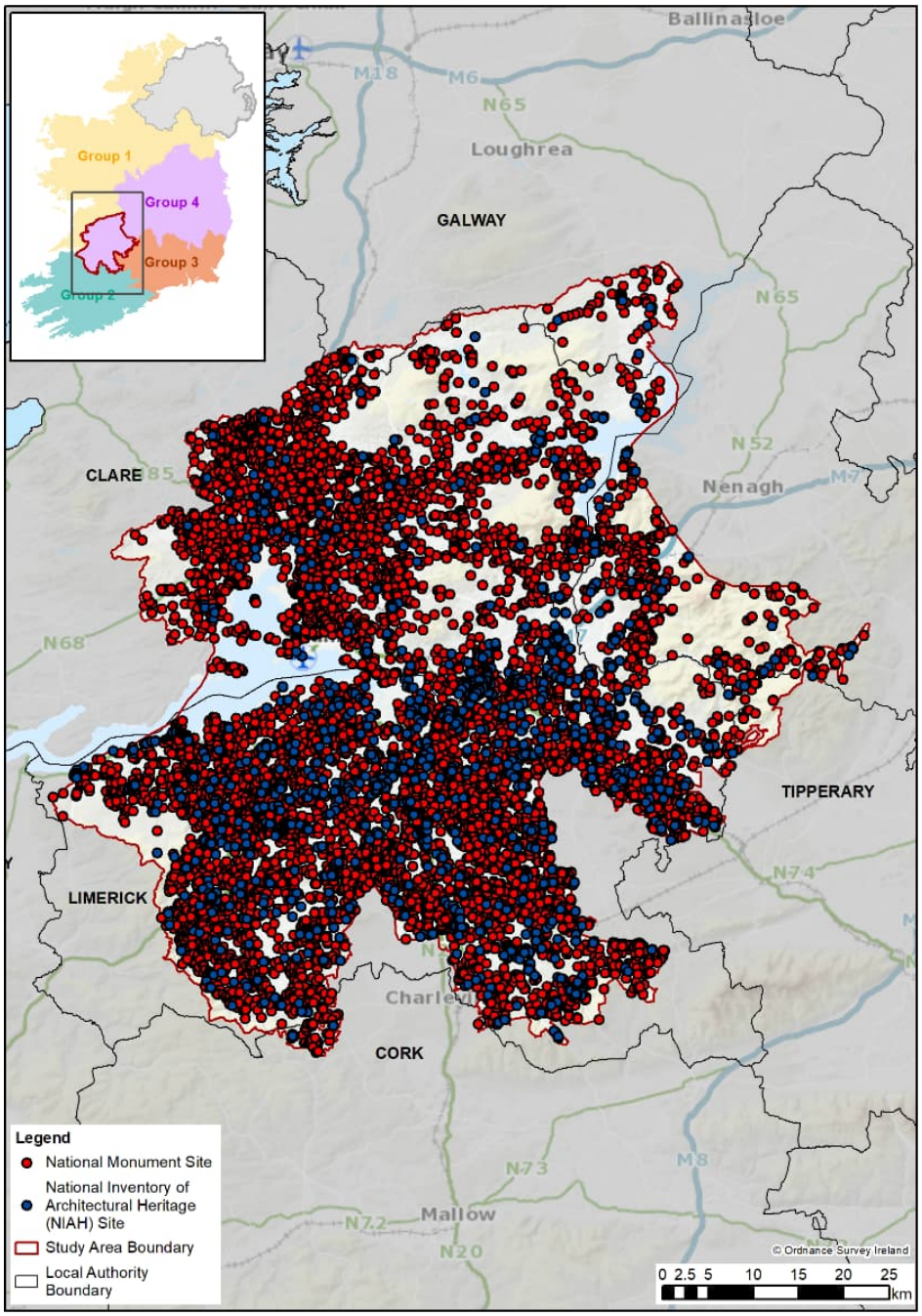

Figure 2.4 SA8 Cultural Heritage Assets

Table 2.15 Cultural Heritage Assets within SA8

Assets	Total Number
National Monuments Service sites	10,340
National Inventory of Architectural Heritage sites	2,837
Sites and Monuments Record Zones	6,588

2.9 Geology and Soils

Table 2.12 lists the land uses within SA8. SA8 has a wide variation of soil types, particularly to the north, and more predominant areas of clayey drift to the south (EPA, 2019a).

The geology and soils in the environment are fundamental for the quality and quantity of water in the area through differences in drainage, chemical composition, filtration and soil type, topography and resultant land use. Land use has significant impact on water quantity and quality. Groundwater supply depends on the type of aquifers in the area, as they determine the system's ability to store and transmit groundwater. The regionally and locally important aquifers with resource potential for SA8 are shown in Figure 2.5.

The natural geology varies across the area with a regionally important karst aquifer as a large basin south of Limerick city and a less productive aquifer lies to the north east towards Nenagh. Twenty-five groundwater abstractions have been developed in the area for public water supply, centred on the clean regional karstic limestone bedrock areas in the Limerick basin, in the Adare/Croom/Rathkeale/Charleville vicinity.

Important geological and geomorphological sites could be identified for protection as NHAs, however, until designation is confirmed, these sites are classified as Irish Geological Heritage Sites (IGHS). There are over 900 IGHS identified around Ireland, 50 of which have the potential to constrain water resource options in SA8.

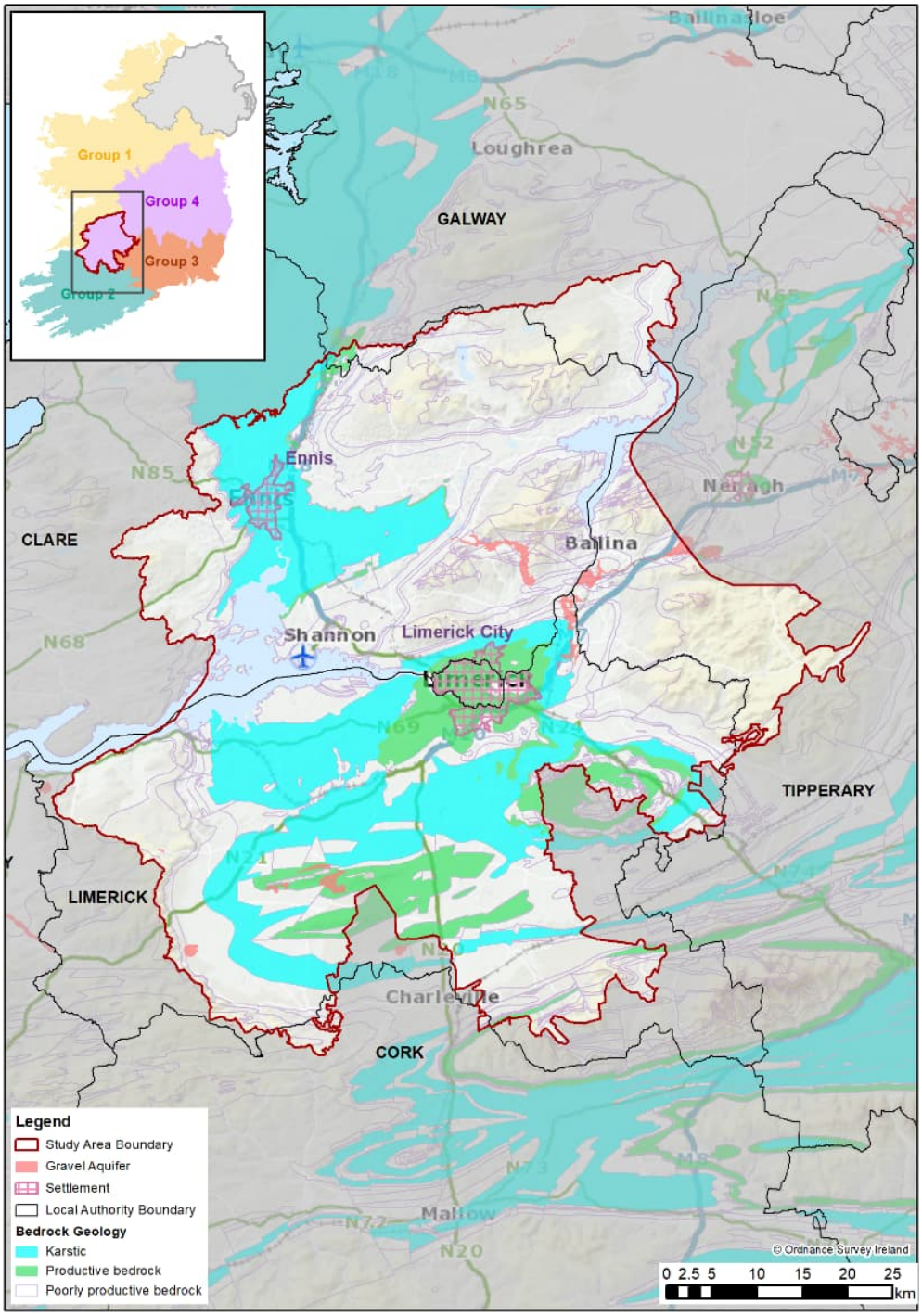

Figure 2.5 SA8 Hydrogeology

2.10 Summary of Key Issues and Trends over the Plan Period

All aspects of the environment will need to be considered as individual schemes are taken forward for further design and implementation. However, the key issues relevant for strategic water planning identified within SA8 are listed in Table 2.16.

Table 2.16 Summary of Key Issues and Trends Over the Plan Period

SEA Topic	Issues and Opportunities	Interrelated Topics
Population, Economy, Tourism and	**Issues:** Increasing population and the increased stress of climate change on water quality and water resources could affect health and well-being.	Climate Change, Water Environment, Biodiversity, Material Assets and

SEA Topic	Issues and Opportunities	Interrelated Topics
Recreation, and Human Health	**Opportunities**: Irish Water will put in place plans to assess water quality and measures to address risks as part of the Framework Plan. Irish Water has ongoing activities to improve the SDB in SA8, including, leakage management and water conservation measures. Raising awareness of the importance of water conservation and efficiency measures, and the value of the environment for health and wellbeing, can play an important part in water planning. Valuing access to environment for recreation.	Landscape and Visual Amenity
Water Environment	**Issues**: The proposed abstraction licensing, aligned to WFD requirements, will require many current abstractions to be licensed and may limit future abstraction or involve significant conditions being imposed at associated sites. For SA8, some of the existing abstractions may not meet sustainability guidelines in the medium term; specifically, during drought periods. On an interim basis, Irish Water has developed an initial conservative assessment based on available information (see SA8 Technical Report). This has been used to inform options identification and appraisal. Irish Water will update its sustainability analysis and impact on their baseline SDB calculations when regulatory assessments for the new legislation is undertaken. **Opportunities:** To take account of identified pressure on the water environment in the selection of solutions for SA8.	Biodiversity and Climate Change
Biodiversity, Flora and Fauna	**Issues:** For SA8, the majority of surface water sources are within designated areas, including the River Shannon Callows SAC, Lough Ree SAC/SPA, River Suck Callows SPA, Middle Shannon Callows SPA, and River Little Brosna Callows SPA. It is considered especially important to avoid the loss of irreplaceable or rare habitats and avoid increasing pressure on vulnerable species; potentially through direct or indirect land take, such as through increased abstraction pressure.	Water resources, water quality and climate change
Material Assets	**Issues:** WTP assets and network infrastructure requiring improvement or replacement. **Opportunities**: Improvements to support reliability of access to good quality water.	Health and Wellbeing

SEA Topic	Issues and Opportunities	Interrelated Topics
Landscape and Visual Amenity	**Issues:** Potential for climate change to affect land use and habitats and influencing landscape quality and amenity.	Biodiversity and geology and soils, climate change, health and well being
Air Quality and Noise	No specific issues identified for the baseline for SA8.	Health and well being
Climate Change	**Issues**: Climate change issues regarding sea level rise, flooding, extreme weather events and changes in seasonal weather patterns. Climate change has been taken into account in supply forecasts and additional risks to infrastructure and operations will need to be taken into account in planning for drought and freeze/thaw events; and in detailed scheme design and network operation. **Opportunities:** Additional management to minimise impact on supply and the environment, vulnerability to climate change, and drought is required.	Biodiversity and water environment
Cultural Heritage	**Issues:** Known cultural heritage and archaeological assets and potential unknown archaeological assets.	Health and wellbeing
Geology and Soils	No specific issues, although general need for good soil conservation and retention of nutrients and carbon in soil resources.	Biodiversity and Landscape and climate change
Additional interrelated aspects	**Issues**: Poor water quality requiring additional water treatment and affecting biodiversity. **Opportunities:** Potential for catchment management initiatives leading to habitat, water retention, water quality enhancement and soil quality have the potential to provide wider benefits for environmental resilience and water supply; although this has not been specifically studied in this study area.	

3 Environmental Assessment – Options Appraisal

3 Environmental Assessment – Options Appraisal

This chapter provides a summary of the environmental assessment of options considered in the study area, including the option identification and screening process, and assessment of options used in approach development.

3.1 Overview

Irish Water applied its Options Assessment Methodology from the Framework Plan to identify potential solutions to meet the needs identified in the SA8 WRZs.

The general methodology, and how environmental assessment is included, is outlined in the SEA Environmental Report prepared in relation to the Framework Plan. That report identifies SEA objectives and assessment criteria and provides a framework for integrating the environmental assessment of options and combinations of options into a phased appraisal process which also takes account of other criteria such as feasibility, deliverability, resilience and cost.

The Framework Plan Options Assessment Methodology covers eight stages. Stages 1 and 2 are covered through the needs and baseline assessments addressed in chapter 2 of this review. The key stages considered in this chapter for SA8 are Stage 3-6:

- Stage 3 Unconstrained options – to identify all the potential options to be considered to resolve water quality or quantity requirements;
- Stage 4 Coarse screening – to assess the unconstrained options and eliminate any that will not be viable and collect information to inform the next stage;
- Stage 5 Fine screening – options assessment and scoring against the key criteria to verify option feasibility and understand key risks and constraints; and
- Stage 6 Feasible option list – further option development encompassing costing and SEA assessment of options.

3.2 Stage 3: Unconstrained Options

Environmental and social assessment criteria are included at the earliest stages of the screening process. At the outset of the process, some fundamental rules are applied as part of option identification. For example, inter-catchment raw water transfers are excluded due to the high risk of transferring invasive non-native species (INNS) between catchments and potential conflict with WFD objectives.

WFD objectives have also been a key consideration at this stage through an internal sustainable abstraction risk review. This was a specialist review of groundwater bodies and surface water catchments that was undertaken as part of the option identification stage. UK Technical Advisory Group on the Water Framework Directive (UKtag) guidance (UKtag, 2013) on baseflows have been used for the purposes of this plan until Ireland specific standards come into place.

The application of these conservative abstraction standards to new options ensures that any new or increased abstractions from rivers are likely to support conservation objectives for the most sensitive environmental sites. For surface waterbodies, the allowable abstraction standard of 10% of Q95 has been applied, with the exception of waterbodies requiring ‘High’ status where a higher threshold of 5% of Q95 has been applied. Allowable abstraction standards for lakes are set at 5 or 10% of Q50 in line with this guidance (the NIS prepared in relation to the Framework Plan, sets out the approach in relation to Appropriate Assessment).

As mentioned previously, these are estimates applied for the purpose of strategic planning and are based on a conservative approach to what new legislative regime might require. The EPA will be the authority adjudicating the sustainability or otherwise of abstractions, once the legislation is enacted and will have the benefit of more detailed site specific information.

For groundwater sources, the assessment includes a high level assessment taking account of a range of information available for existing site and in many cases limited information for new abstraction options This desktop assessment undertaken aimed to identify potential yield and the impact of the yield, including the steps described below.

3.2.1 Existing Groundwater Abstractions

Site specific data is taken into account where possible in identifying the potential sustainable yield at existing sources where abstraction is to be increased. In some cases however location, abstraction rate(s) and site configuration are often the minimum information available. The operational data provides useful information on the yield, and assumptions can be made around the average production from each site. It can be assumed the average abstraction value is an initial estimate of the yield. Most local authorities in the case of development of groundwater sources would likely have drilled and sought the maximum yield possible through 72 hours pumping tests. This provides an initial yield. Additional information on performance in prolonged dry weather periods provides supporting information on yields. Data collected on site is used to improve the yield and impact estimates.

3.2.2 New Groundwater Abstractions

The Zone of Contribution (ZOC), the land area that contributes water to the well or spring, is defined and used to calculate a preliminary water balance for the source using the average abstraction rate and the annual average recharge rate as estimated from the Geological Survey Ireland (GSI) recharge maps. The water balance estimates the area needed to supply the yield and is then compared to the delineated ZOC. A WFD >30% recharge is applied as a guide for assessment in the fine screening assessment but is recognised to apply more to catchment scale abstraction impact assessments so at a very local abstraction scale it can overestimate the impacts for some sources.

Additional assessment is undertaken on potential preferred groundwater options to inform the SEA taking into account site specific information and consideration of likely impacts on WFD and cumulative effects with existing groundwater abstractions.

Further work will need to be undertaken for groundwater options taken forward as part of abstraction licensing and the development of Drinking Water Safety Plans. This will include establishing detailed geoscientifically robust zones of contribution in line with GSI's Groundwater Protection Schemes (Department of Environment, Community and Local Government, GSI and EPA, 1999) and the EPA Advice Note Number 7, Source Protection and Catchment Management (EPA, 2013). This work will provide in-depth hydrogeological information on the source that will establish reliable and sustainable yields.

3.2.3 Sustainable Abstraction in Options Assessment

The Government is currently developing new legislation dealing with water abstractions. As this legislation is still being developed, Irish Water does not have full visibility of the future regulatory regime. As the objective of the plan is to achieve safe, secure, reliable and sustainable supplies, any new abstractions proposed to be developed by Irish Water as part of this plan will be based on conservative assessments of sustainable abstraction. This will ensure that water supplies continually improve in terms of environmental sustainability.

Based on initial desk-based assessments outlined above, Irish Water developed an initial list of unconstrained options for new supplies, increases and upgrades to existing supplies. An Unconstrained Options review workshop was held with Irish Water's Local Authority Water Services Partners to identify any additional unconstrained options that might be available based on local knowledge.

3.3 Stage 4: Coarse Screening

A total of 214 unconstrained options were identified for SA8 and subjected to coarse screening. The coarse screening process assessed the options against the criteria outlined in Table 3.1. This process is summarised in chapter 9 of the SEA Environmental Report for the Framework Plan. The process allows the assessment of the unconstrained options to eliminate any that will not be viable. The focus at this stage is on options that would be difficult to mitigate, those with likely significant effects on European or nationally important sites, or options likely to lead to deterioration of waterbody WFD status.

Table 3.1 Coarse Screening Assessment Criteria

Criteria	Unconstrained Option Assessment Questions	
Resilience	Q1	Does the option address the supply-demand problem?
Deliverability and Flexibility	Q2	Is the option technically feasible?
	Q3	Can the risks and uncertainties associated with the option be mitigated to avoid failure of the option?
Sustainability (Environmental and Social Impacts)	Q4	Can significant impacts on known high level environmental constraints for example European/ international or nationally designated biodiversity, landscape, cultural heritage sites, WFD objectives or community assets, be avoided or minimised? If not, is mitigation likely to be possible?

Of the 214 unconstrained options, 93 were rejected after being analysed against the coarse screening criteria of resilience, deliverability and environment.

Sustainability reasons for rejecting options were identified for eleven options. Table 3.2 provides the options that were rejected on an environmental basis and not considered suitable to address the deficit for the WRZs located in SA8.

Table 3.2 Coarse Screening Rejection Register

Option Reference	Option Description	Rejection Reasoning
SA8-003	New SW abstraction from Lough Inchicronan and new WTP to partly supply deficit in Ennis	This option requires a new SW source and a new WTP. This option will meet only approximately 70% of the deficit while abstracting the full limit of calculated allowable abstraction and as a result is not considered feasible at coarse screening stage and is not taken forward to fine screening stage. Additionally, 6km of new watermain would be required for a relatively small volume. Transferring small quantities of water over long distances can affect the quality of water. Therefore as there were

Option Reference	Option Description	Rejection Reasoning
		other viable options for these WRZs this option was rejected at coarse screening stage.
SA8-004	Supply part of the deficit from neighbouring Kilmaley/Inagh GWS (network upgrades required)	This option takes supply from a very small catchment (<1km^2), which would not have additional yield available to supply both current GWS supply and new Ennis WRZ supply of approximately 4Ml/d deficit. This option would also require significant additional mains of approximately 12km from lake to WTP. The Lake also part of bog NHA. For these reasons it was rejected at coarse screening stage
SA8-010	New GW abstraction from Broadford Gravels groundwater body and new WTP to partly supply deficit in Shannon/ Sixmilebridge	It is unlikely that yield would be available with this option to meet the full demand. Broadford gravels are approximately 8km to the network and would require new watermain for potentially small yield availability. Transferring the small quantity required over long distances can affect the quality of water. There are too many unknowns to progress this option at coarse screening and therefore this option was not taken forward to fine screening.
SA8-012	New SW abstraction from Rosroe Lake and new WTP to partly supply deficit in Shannon/ Sixmilebridge	The desktop assessments undertaken identified a sustainable abstraction at this location of approximately 4.35Ml/d. The deficit in the WRZ is approximately 4.6Ml/d. Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving good WFD status, as the proposed abstraction is calculated at 11% of Q50. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria and was not progressed to the fine screening stage.
SA8-013	New SW abstraction from Lough Cullaunyheeda and new WTP to partly supply deficit in Shannon/Sixmilebridge	This option requires a new SW source and a new WTP. This option can meet less than 50% of the deficit while abstracting the full limit of calculated allowable abstraction and as a result is not considered feasible at coarse screening stage and is not taken

Option Reference	Option Description	Rejection Reasoning
		forward to fine screening stage. Additionally, 10km of new watermain would be required for a relatively small volume. Transferring small quantities of water over long distances can affect the quality of water. Therefore, as there were other viable options for these WRZs this option was not considered feasible at coarse screening stage.
SA8-075	Increase SW abstraction from River Deel and upgrade existing Castlemahon WTP to partly supply deficit	The desktop assessments undertaken identified that the estimated sustainable abstraction at this location is approximately 5.472Ml/d, not accounting for the existing abstraction. We are currently abstracting above the calculated sustainable limits. Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving good WFD status. Therefore this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.
SA8-101	Increase SW abstraction from River Deel and upgrade existing Foynes Shannon Estuary WTP (Aughinish WTP) to partly supply deficit	The desktop assessments undertaken indicate that there is no scope to increase the abstraction from the River Deel, as current abstraction already above allowable abstraction limit. For this reason, this option was rejected at coarse screening stage.
SA8-111	Increase abstraction at Ardpatrick Spring (poorly productive aquifer) and upgrade Ardpatrick WTP to supply deficit	Based on the desktop assessments undertaken the yield availability from this source Is deemed to be high risk and unlikely. Other groundwater options were deemed to be viable for this WRZ and progressed through to fine screening. Therefore, this option was rejected at coarse screening stage.
SA8-115	Increase SW abstraction from River Allow	The desktop assessments undertaken determined that the sustainable abstraction at this location is approximately 1.2Ml/d, not accounting for the existing abstraction. We are currently abstracting at the sustainable limits. Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody

Option Reference	Option Description	Rejection Reasoning
		not achieving good WFD status. Therefore this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.
SA8-116	New GW in karstic developable resource	Based on the desktop assessments undertaken the yield availability from this source Is deemed to be unlikely. Therefore, this option was rejected at coarse screening stage.
SA8-158	Increase SW abstraction from Newport River and upgrade WTP, rationalise O'Gormans Well	The desktop assessments undertaken determined that the sustainable abstraction at this location is approximately 2.2Ml/d, which we are currently abstracting above. Abstracting an increased volume of water at this location would likely to result in the waterbody not achieving good WFD status. Therefore this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.

3.4 Stage 5: Fine Screening

A total of 121 options passed the coarse screening stage; these options were subjected to further consideration as part of a multi-criteria assessment (MCA) at the fine screening stage.

The objective of the MCA and the fine screening process is to determine the potential benefits and impacts of the options across a range of key criteria. The MCA process allows a combination of issues to be considered together. This can help indicate if one option will be overall more cost effective, environmentally sustainable, progressible, resilient or feasible when compared with other options. This process requires a desk-based analysis of the options and their potential benefits and impacts against the key criteria.

The environmental criteria are based on the SEA objectives in the form of screening questions. These questions have been developed to allow the performance of each option to be assessed against the SEA objectives. The list of questions developed to assess the environmental and social effects of the options and guidance on the MCA scoring for the fine screening is provided in the SEA Environmental Report Appendix B.

Summaries of the environmental assessment for options that passed the fine screening stage are grouped by option type and are included in Appendix A. These summaries combine the assessments against individual criteria to give an overall environmental topic score; this overall score is based on the worst score across each of the topic's criteria.

This is a high-level risk based assessment intended to support a comparison of options. Likely beneficial effects are represented by positive scores and likely adverse effects are represented by negative scores based on a seven-point scale.

No further options were rejected at fine screening.

3.5 Stage 6: Feasible Options List

A total of 121 options were included as feasible options and were taken forward for Approach Development. The next step was to use the information collected for the fine screening assessment to inform the development of approaches to resolve the SDB deficit within each WRZ and across the study area.

Details of the feasible options identified for this study area, and the Preferred Approach identified, are provided in the SA8 Technical Report.

4

Environmental Assessment – Approach Development

4 Environmental Assessment – Approach Development

This chapter describes how the SEA was integrated into the development of potential approaches/combinations for meeting the SDB deficit at the WRZ level, then at the study area level, and how alternative approaches were considered and assessed.

4.1 Introduction to Approach Development

After the feasible options for the study area were identified the next step was to assess a range of possible SA combinations to resolve the supply deficit within each WRZ and across the study area as a whole. This chapter addresses Stage 7 in the assessment methodology.

An SA combination is a way of configuring an option, or options, to meet either an SDB deficit or water quality requirements. As set out in the Framework Plan, Irish Water considers six SA approaches, which are the combinations rated as the best within the six categories summarised in Table 4.1. This process contributes to assessment of alternatives to meet plan objectives. Consideration of reasonable alternatives is an important part of meeting SEA regulatory requirements.

Table 4.1 The Six SA Approaches

SA Approaches Tested	Description	Policy Driver
Least Cost (LCo)	Lowest Net Present Value (NPV) cost in terms of Capital, Operational, Environmental and Social, and Carbon Costs	Public Spending Code
Best Appropriate Assessment (Best AA) (BA)	Lowest score against the European Sites (Biodiversity) sub criteria question based on assessing the option as having either no LSEs, LSEs that can be addressed with general/standard mitigation measures or LSEs that may be more difficult to mitigate. For options scoring -3, potential alternative higher scoring options are sought where possible.	Habitats Directive
Quickest Delivery (QD)	Based on an estimate of the time taken to bring an option into operation (including typical feasibility, consent, construction and commissioning durations) as identified at Fine Screening. This is particularly relevant where an option might be required to address an urgent Public Health issue (potential benefit for SEA Objective on population and public health).	Statutory Obligations under the Water Supply Act and Drinking Water Regulations
Best Environmental (BE)	This is the option or combination of options with the highest total score across the SEA objective criteria MCA questions. In addition, high risk -3 issues are considered against individual criteria focusing on long term operational effects.	SEA Directive and WFD
Most Resilient (MR)	This is the option or combination of options with the highest total score against the resilience criteria. (Link	National Adaptation Plan

SA Approaches Tested	Description	Policy Driver
	to SEA Objective for climate change adaptation for environment)	
Lowest Carbon (LC)	This is the option or combination of options with the lowest embodied and operational carbon cost	Climate Change Strategy

These six SA approaches focus on different plan or environmental objectives. Three of the six SA approaches address environmental objectives;

- Best AA;
- Best Environmental; and
- Lowest Carbon approaches.

These are all focused on environmental criteria and are based on the environmental information and scoring undertaken for the MCA.

4.2 Stage 7: Approach Development Process

There are three stages in the Approach Development Process, these are summarised below and provided in more detail in section 7 of the RWRP-EM:

The **First Stage** is the Approach Appraisal at WRZ level. This stage assesses the feasible options for each WRZ and identifies the best performing option within each of the six Approach Types for the relevant WRZ. For example, the option or combination of options that would be classified as the Lowest Carbon Approach, would be that with the lowest carbon cost, based on comparative outline design. The best performing options within each Approach Category are then compared against one another using the 7-step process outlined in Figure 4.1. This process develops an initial Preferred Approach at WRZ level, for all of the individual WRZs in the study area (the "WRZ Level Preferred Approach").

For the Best AA Approach, the scoring on the European Sites (Biodiversity) sub-criteria question refers to the possibility for Likely Significant Effects (LSEs). A Score of 0 equates to no LSEs. If an option is identified that meets the “Objectives of the Plan” and is assessed as having no potential impact on a European Site (zero or neutral score based on desktop assessment), it is automatically adopted as the Preferred Approach at WRZ level. Furthermore, because it is possible that all of the potential impacts identified at Plan level can be entirely ruled out through project level investigation and analysis or avoided through project level mitigation, options with potential for LSEs (score of -1 to -3 for biodiversity) may be progressed as the Preferred Approach. If potential impacts cannot be ruled out or avoided, then mitigation in the form of avoidance is provided for within the NWRP to protect European site(s). Should potential adverse effects on European sites be identified at the project level from a given option/Preferred Approach the NWRP will have identified other options[5] that could be progressed at the project level if required. Therefore, no project arising from the NWRP, with Adverse Effects on Site Integrity (AESI) identified at the project stage would be implemented. Scores of -1 to -3 equates to LSEs being identified. Scores of -1 to -2 are LSEs that will not result in AESI with standard best practice

[5] These options may not have progressed as the Preferred Approach initially as they may have scored significantly worse against other environmental, resilience or feasibility criteria (e.g. the best AA approach may identify an option that results in four times more carbon being produced or is twice as expensive).

project specific mitigation applied as these can be addressed with general/standard mitigation measures. Scores of -3 equates to LSEs that may be difficult to mitigate or where uncertainty remains.

The NIS provides more detail in the LSE and the AESI Tables: Appendices C-D. Any option with a score of -1 to -3 is taken forward to AA (Stage 2 of the AA process) and assessed within the NIS for the Regional Plan.

The **Second Stage** assesses whether there are any larger options (SA options) that might resolve deficits across multiple WRZs within a study area. Combinations are then developed using these SA options and WRZ Preferred options to create "SA Combinations".

The **Third Stage** compiles the SA Combinations that rank highest for each of the Six Approach Types to generate SA Approaches. The WRZ Level Approach and SA Approaches are then compared against each other using the 7-Step process in Figure 4.1 to generate the SA Preferred Approach.

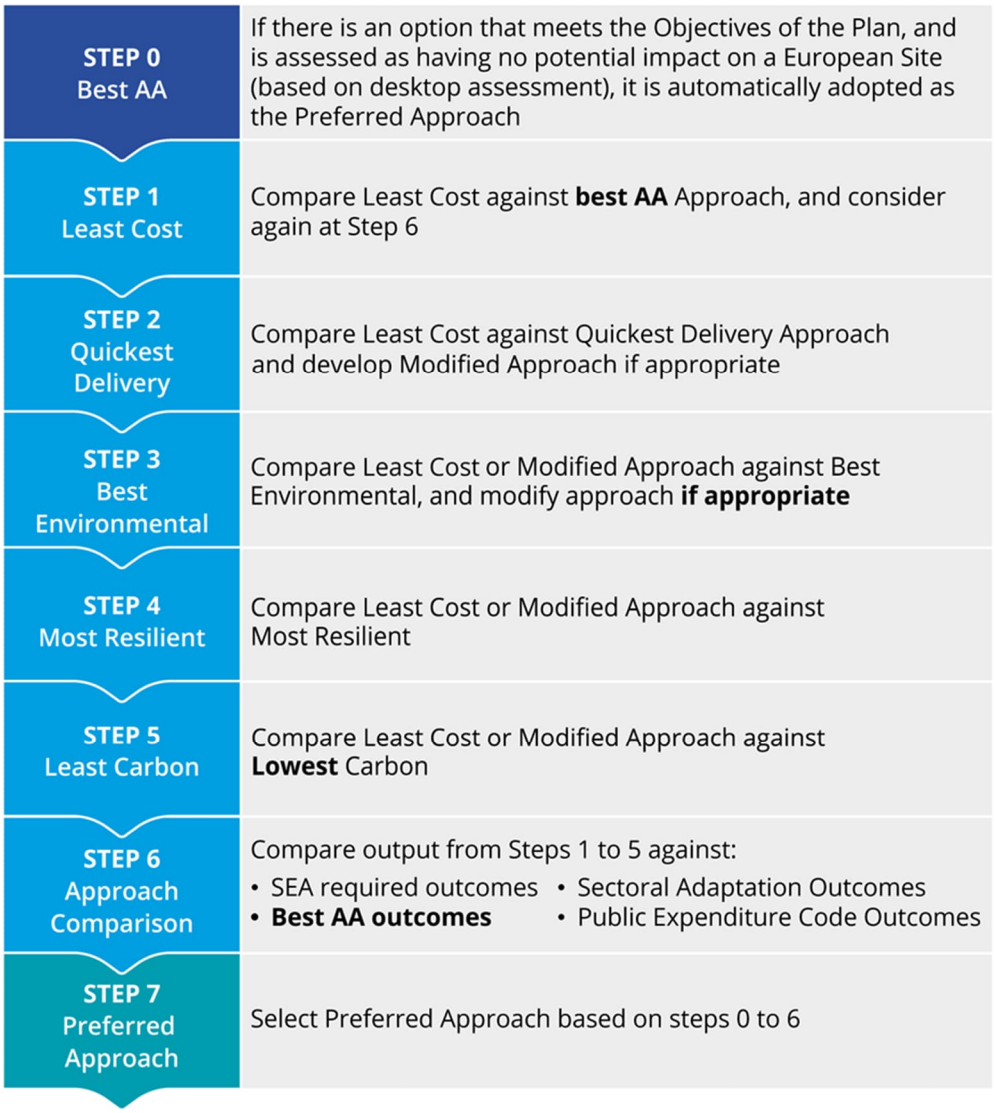

Figure 4.1 The 7 Step Process

4.2.1 Environmental Assessment in the Approach Development process

Combinations of feasible options are identified to balance the water demand and predicted baseline supply and address the remaining deficit over the plan period. The Approach Development process allows Irish Water to compare and optimise the options against different elements to create a range of approaches capable of meeting the deficit.

There are two strands of environmental information and assessment used in the Approach Development process. These are:

Environmental and social costs: these were based on a natural capital/ecosystems services framework and scoped to be relevant and achievable with the information available and to add to, rather than duplicate, the qualitative environmental assessment of the options. This included:

i. Climate regulation – woodland;
ii. Traffic impacts – opportunity cost of time due to road congestion from roadworks;
iii. Food – crops and livestock; and
iv. Carbon equivalent emissions tonnes (note total greenhouse gas emissions are expressed in terms of carbon equivalent emissions) including embodied and operational carbon were also calculated and costed.

The approach for calculating the elements i, ii, iii and iv are explained in the SEA Environmental Report Appendix E.

Carbon emissions (tCO_2e) and carbon costs are calculated alongside construction and operational costs. As part of the environmental assessment carbon efficiency has also been calculated to identify carbon emissions per ML of water supply.

Environmental assessment: this is qualitative assessment against the SEA objective for each option as part of the MCA scoring for the fine screening. These scores are based on assessing options in terms of potential adverse or beneficial effects and a seven-point scale is used from Major, Moderate or Minor Adverse, Neutral, to Minor, Moderate or Major Beneficial. These are reflected in numeric scores -3 to 0 to +3 and are used to assess option performance against the MCA scores. The scoring applied at fine screening is reviewed and updated based on the developed option descriptions and additional environmental analysis.

Carbon emissions (tCO_2e) were initially assessed through qualitative assessment for fine screening as this preceded option costing, however in the approach development process the carbon emissions as total Net Present Value (NPV) costs have been used to inform the Approach Development Process. Total life- time carbon emissions and carbon efficiency per ML have been used to inform the SEA assessment.

The general process is illustrated in Figure 4.2 below.

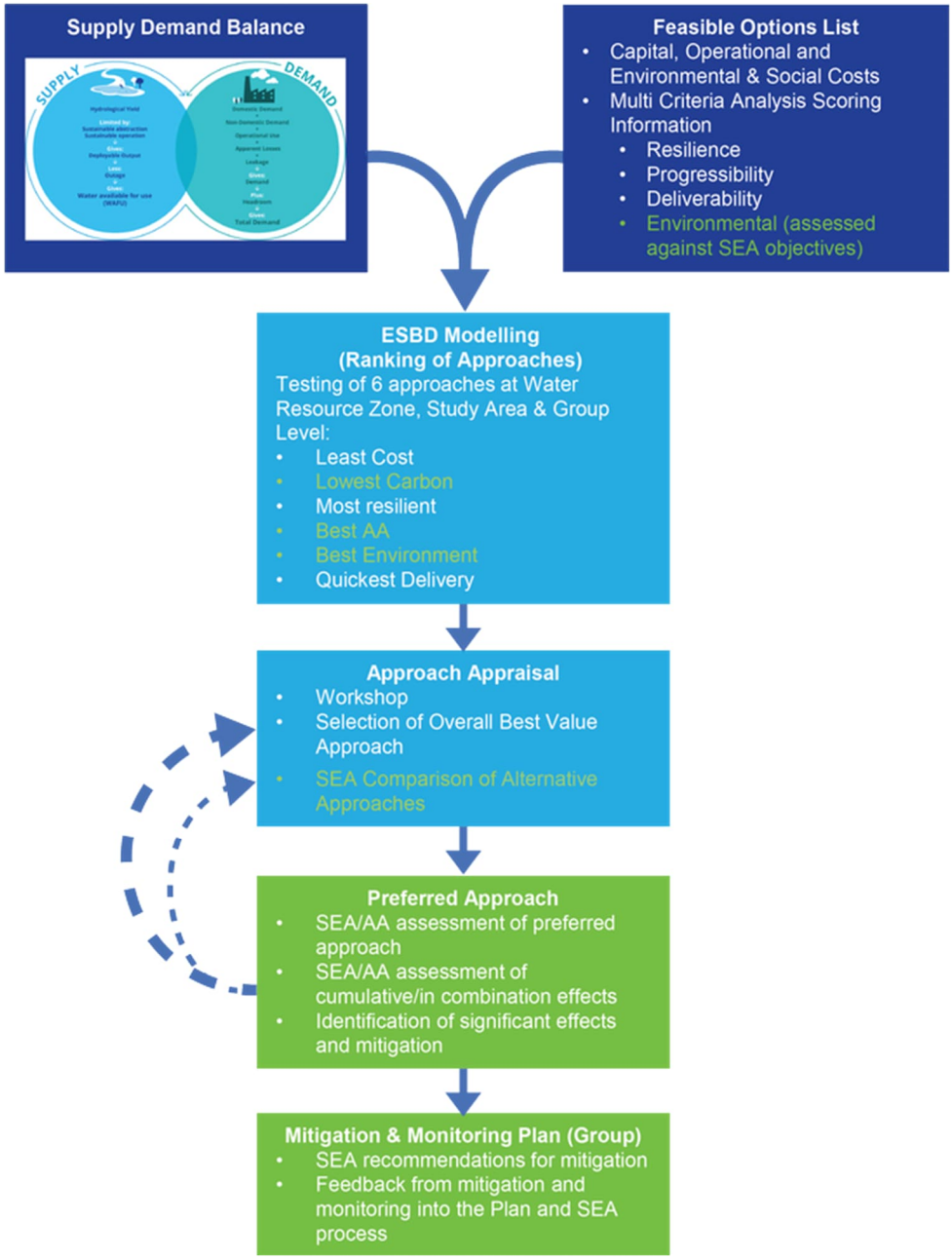

Figure 4.2 Approach Development Process

4.3 SA8 Approach Development Process

The approach appraisal process was undertaken through structured workshops and reviews involving relevant environmental expertise (including ecologists, hydrogeologists, hydrologists and environmental scientists) and included Local Authority involvement and feedback. This process was supported by information on the feasible options, including the environmental assessment against SEA criteria in the MCA and the option costings.

The options were then taken through the sequential testing (the 7 step process detailed in section 4.2, Figure 4.1 above) against the six SA categories (lowest carbon, best environmental, best AA, least cost, quickest delivery and most resilient) to identify the best overall options and combinations at WRZ and study area levels applying the three stages:

Stage 1 - comparing WRZ options and identify the preferred WRZ level approach. For SA8 there are 71 WRZ options and these are listed in Table 5.2 in the SA8 Technical Report, providing option reference

numbers and the relevant WRZ. These options were taken through the 7 step process to identify the preferred WRZ approach.

Stage 2 - creating combinations of WRZ options and SA options (group options) for comparison. These are the possible SA combinations and are presented and ranked against the approach categories (see Table 4.2.

Stage 3 - selecting the Preferred Approach at study area level – this stage compares the WRZ level preferred approach and the SA combinations to determine the Preferred Approach that provides the best outcome for the study area. The best performing SA combinations under each of the six approach categories are identified and then compared using the 7 step process applied in the workshop to establish the Preferred Approach at study area level.

Performance ranking against the assessment criteria was based on the MCA scoring, including the fine screening environmental assessments, and costings. Further environmental assessment has also been undertaken to compare the alternative approaches in line with SEA requirements and this assessment is presented in Table 4.7 and Table 4.9 below.

For SA8, a total of 21 combinations were compared including the WRZ Level Approach; these are presented in Table 4.2.

Table 4.2 SA8 Summary of SA Combination of Performance against Approach Type

Category	WRZ level approach	SA combination 2 (SA option 1a)	SA combination 3 (SA option 1b)	SA combination 4 (SA option 2)	SA combination 5 (SA option 3)	SA combination 6 (SA option 8)	SA combination 7 (SA option 10)	SA combination 8 (SA option 14)	SA combination 9 (SA option 16)	SA combination 10 (SA option 23)	SA combination 11 (SA option 25)	SA combination 12 (SA option 26)	SA combination 13 (SA option 27)	SA combination 14 (SA option 28)	SA combination 15 (SA option 29)	SA combination 16 (SA option 30)	SA combination 17 (SA option 31)	SA combination 18 (SA option 8 & 16)	SA combination 19 (SA option 8, 16 & 31)	SA combination 20 (SA option 8, 10 & 16)	SA combination 21 (SA option 8, 10, 12, 16 & 23)
Least Cost				Worst																	Best
Quickest Delivery			Worst					Best													
Number of -3 Biodiversity Scores	One -3 score	One -3 score	One -3 score	Two -3 scores	One -3 score	One -3 score	One -3 score	One -3 score	One -3 score	One -3 score	One -3 score	One -3 score	Two -3 scores	Two -3 scores	One -3 score	One -3 score	One -3 score	One -3 score	One -3 score	One -3 score	
Lowest Carbon				Worst					Best												
Most Resilient				Worst									Best								
Best Environmental														Worst							Best

Key														
Ranked order (best to worst)	Best													Worst

Through comparing all the potential SA combinations, the best SA approach for each of the six approach categories was identified; these aligned as four approaches (see Table 4.3). For SA8, there were four combinations within 5% of one another for the least cost category. These four combinations were subject to further comparison and combination 21 was identified as the Least Cost approach (see section 5 of the SA8 Technical Report).

During consultation, amendments were made to the Preferred Approach to account for changes in requirements for the Upperchurch and Killaloe WRZs, resulting in a different combination being selected.

Table 4.3 Study Area Approach Categories

Category	SA Approach 1 (SA Combination 21) (LCo, BE)	SA Approach 2 (SA Combination 8) (QD)	SA Approach 3 (SA Combination 13) (MR)	SA Approach 4 (SA Combination 9) (LC, BA)
Least cost (LCo)	✓	-	-	-
Quickest Delivery (QD)	-	✓	-	-
Best Environmental (BE)	✓	-	-	-
Most Resilient (MR)	-	-	✓	-
Lowest Carbon (LC)	-	-	-	✓
Best AA (BA)	-	-	-	✓

The WRZ options and SA options (group options) that make up each SA approach are listed in Table 4.4. More detailed descriptions of the options are provided in Appendix A and a full list of options for each approach is given in Appendix B of this report.

Table 4.4 Study Area Approaches

Options included	Do Minimum	Least Cost Approach (SA Combination 21)	Best Appropriate Assessment Approach (SA Combination 9)	Quickest Delivery Approach (SA Combination 8)	Best Environmental Approach (SA Combination 20)	Most Resilient Approach (SA Combination 13)	Lowest Carbon Approach (SA Combination 9)
SA Options (Group Options)	No options	**SA option 8:** 040, 049, 138, 199 **SA option 10:** 17f, 084, 105, 192	**SA option 16:** 065, 114	**SA option 14:** 019, 089, 097, 107, 109, 160	**SA option 8:** 040, 049, 138, 199 **SA option 10:** 17f, 084, 105, 192	**SA option 27:** 38b, 186	**SA option 16:** 065, 114

Options included	Do Minimum	Least Cost Approach (SA Combination 21)	Best Appropriate Assessment Approach (SA Combination 9)	Quickest Delivery Approach (SA Combination 8)	Best Environmental Approach (SA Combination 20)	Most Resilient Approach (SA Combination 13)	Lowest Carbon Approach (SA Combination 9)
		SA option 12: 027, 118 **SA option 16:** 065, 114 **SA option 23:** 163, 166			**SA option 12:** 027, 118 **SA option 16:** 065, 114 **SA option 23:** 163, 166		
WRZ options	No options	001 009 20a 021 022 024 31a 051 052 059 068 098 100 120 145 149 172 177 179	001 009 20a 021 022 024 31a 036 043 047 051 052 059 068 079 098 100 102 120 145 149 162 165	001 009 20a 021 022 024 31a 036 043 047 051 052 059 068 098 100 112 120 145 149 165 172 175	001 009 20a 021 022 024 31a 051 052 059 068 098 100 120 145 149 172 177 179	001 009 20a 021 022 024 31a 043 047 051 052 059 068 079 098 100 102 112 120 145 149 162 165	001 009 20a 021 022 024 31a 036 043 047 051 052 059 068 079 098 100 102 120 145 149 162 165

Options included	Do Minimum	Least Cost Approach (SA Combination 21)	Best Appropriate Assessment Approach (SA Combination 9)	Quickest Delivery Approach (SA Combination 8)	Best Environmental Approach (SA Combination 20)	Most Resilient Approach (SA Combination 13)	Lowest Carbon Approach (SA Combination 9)
			172	179		172	172
			173	180		173	173
			175	184		175	175
			177	185		177	177
			178			178	178
			179			179	179
			180			180	180
			185			184	185

* For the option references - all options are part of SA8 e.g. SA8-001 is shown as 001 above

For the purposes of the Approach Development Process as set out in the SA Technical Report and for the purpose of the SEA comparison as set out in this Environmental Review, Irish Water has only considered the options that were identified as the "best" performing options for each approach category. The identification of the approaches and 7 step process are outlined in detail in section 5 of the SA8 Technical Report.

Within SA8, this resulted in four approaches being selected from the 21 SA combinations identified in Table 4.2, as they were identified as the best performing against the six approach categories - Least Cost, Best Environmental, Quickest Delivery, Most Resilient, Best AA and Lowest Carbon. This means that when comparing the four identified approaches against each other (representing the Stage 3 analysis for the selection of the Preferred Approach used in the workshop - see Table 4.5), their relative performance against categories they were not identified as “best” in in Table 4.2 may be different. This because Table 4.2 compares all of the combinations to give a wider ranking, whereas Table 4.5 only compares the best performing combinations that have been selected as approaches. For example, an option identified as the "worst" performer against a particular approach category in Table 4.5 may not be the overall worst performing option when considered alongside all of the combinations in Table 4.2.

Table 4.5 includes a summary of the MCA scoring and cost comparison used in the approach development for the each of the SA approaches identified as performing best against at least one of the approach categories.

The three stages identified above were applied through a final workshop with all of the background MCA and option costing information available for each option and the ranking from the Economic Balance of Supply and Demand (EBSD) tool. Table 4.5 for the SA approaches suggests that SA approach 1, SA approach 2 and SA approach 4 are the best AA because they have the same number of -3 biodiversity scores (i.e. one -3 biodiversity score). However, SA approach 4 was selected as the best AA approach in Table 4.3 after comparing the number of -2 and -1 biodiversity scores.

Table 4.5 Summary of the MCA Scoring Costing for the SA Approaches*

Category Criteria	SA Approach 1 (SA Combination 21) (LCo, BE)	SA Approach 2 (SA Combination 8) (QD)	SA Approach 3 (SA Combination 13) (MR)	SA Approach 4 (SA Combination 9) (LC, BA)
Least Cost Score	Best	Worst		
Quickest Delivery Score		Best	Worst	
Best AA Score*	One -3 Biodiversity Score	One -3 Biodiversity Score	Two -3 Biodiversity Scores	One -3 Biodiversity Score
Lowest Carbon Score		Worst	Best	Best
Most Resilient Score		Worst	Best	
Best Environmental Score	Best		Worst	

Key			
Ranked order (best to worst)			
Worst			Best

*SA approach 1 and 4 have four options, SA approach 2 has two options and SA approach 3 has three options where an increase at Clareville is proposed. -3 AA impacts have been applied to each of these options, however, as these -3 AA impacts refer to the same abstraction location (Clareville WTP), this AA impact is reported cumulatively as one -3 AA impact at an approach level.

4.4 Comparison of SA8 Approaches

An overall summary of the infrastructure components and abstractions for each of the SA approaches identified for SA8 is provided below in Table 4.6 and has been used to inform the environmental assessment.

Table 4.6 Study Area Approach Components Summary

Infrastructure Summary	Do Minimum	SA Approach 1 (SA Combination 21) (LCo, BE)	SA Approach 2 (SA Combination 8) (QD)	SA Approach 3 (SA Combination 13) (MR)	SA Approach 4 (SA Combination 9) (LC, BA)
New pipeline network (km)	0	177	157	92	114
New WTPs	0	0	0	5	1
Upgrade WTPs	0	29	37	38	39

Infrastructure Summary	Do Minimum	SA Approach 1 (SA Combination 21) (LCo, BE)	SA Approach 2 (SA Combination 8) (QD)	SA Approach 3 (SA Combination 13) (MR)	SA Approach 4 (SA Combination 9) (LC, BA)
New/upgraded abstractions	0	26	22	25	23
WTPs decommissioned	0	18	8	4	6
Abstractions abandoned	0	4	0	0	0
Raw Water Storage	0	0	0	0	0
Treated Water Storage	0	13	11	11	10

A comparative assessment of the four SA approaches based on the environmental option scores is summarised in Table 4.7 below. This covers:

- Scores across the options summed for all the sub-criteria against each SEA objective topic heading;
- Total numbers of -3 scores representing higher risk of effect, or likely greater requirement for mitigation, against each SEA objective topic heading; and
- Indication of the extent of difference in performance across the options to help identify if the differences between the SA approaches are small or large.

Table 4.7 Study Area Approach Comparison Summary

Topic	Total No. of	SA Approach 1 (SA Combination 21) (LCo, BE)	SA Approach 2 (SA Combination 8) (QD)	SA Approach 3 (SA Combination 13) (MR)	SA Approach 4 (SA Combination 9) (LC, BA)	Range (Difference between Lowest and Highest Score)
Population, health, economy and recreation	-3 scores	No Difference				0
	MCA score	Best	Best	Worst		6
Water Environment: quality and resources	-3 scores	Best		Worst		4
	MCA score	Best		Worst		12
	-3 scores	Worst	Best	Worst	Worst	2

Topic	Total No. of	SA Approach 1 (SA Combination 21) (LCo, BE)	SA Approach 2 (SA Combination 8) (QD)	SA Approach 3 (SA Combination 13) (MR)	SA Approach 4 (SA Combination 9) (LC, BA)	Range (Difference between Lowest and Highest Score)
Biodiversity, Flora and Fauna	MCA score	Best		Worst		29
Material Assets	-3 scores	Best	Worst	Best	Best	1
	MCA score	Best		Worst		11
Landscape and Visual	-3 scores	No Difference				0
	MCA score	Best		Worst		6
Climate Change	-3 scores	Best	Worst	Best	Best	1
	MCA Score	Best		Worst		6
Culture, Heritage and Archaeology	-3 scores	No Difference				0
	MCA Score	Worst	Best			2
Geology and Soils	-3 scores	No Difference				0
	MCA Score	No Difference				0

Key			
MCA/No. of -3 scores against each criterion			
Worst			Best

* approaches are showing similar level of risk on climate change adaptation and therefore represented as no difference. However, carbon mitigation is covered separately based on estimated emissions and carbon cost (NPV). See lowest carbon approach.

** approaches are showing similar level of risk on culture, heritage and archaeology. Routing and siting is only indicative at this stage. Most options involving new constructions include a level of risk to buried unknown archaeology, this would need to be investigated further at the project level.

4.4.1 SA Approach 1 (SA Combination 21) (LCo, BE)

SA approach 1, key comparison points:

- Identified as the best for the following categories: Least Cost and Best Environmental;
- Option types included:
    - SA option (group option): 1 groundwater abstraction option, 1 interconnection option, 2 rationalisation options, 1 New Shannon Source option;
    - WRZ options: 1 advanced leakage reduction option, 14 groundwater abstraction options, 1 rationalisation option, 2 surface water abstraction options, and 1 WTP upgrade option;
- One -3 biodiversity score (higher risk options that could impact on European sites); and
- SA approach 1 has the longest length of pipeline, no new WTPs, the lowest number of WTP upgrades, the highest number of new/upgraded abstractions, and the highest number of decommissioned WTPs, abandoned abstractions and treated water storages.

4.4.2 SA Approach 2 (SA Combination 8) (QD)

SA approach 2, key comparison points:

- Identified as the best in the Quickest Delivery category;
- Option types included:
    - SA option (group option): 1 New Shannon Source option;
    - WRZ options: 1 advanced leakage reduction option, 19 groundwater abstraction options, 2 rationalisation options, 1 surface water abstraction option and 3 WTP upgrade options;
- One -3 biodiversity scores (higher risk options that could impact on European sites); and
- SA approach 2 is similar to SA approaches 3 and 4 in terms of infrastructure. However, compared to these approaches SA approach 2 has the longest length of pipeline,no new WTPs, the highest number of WTPs decommissioned, and the lowest number of WTP upgrades, and new/upgraded abstractions.

4.4.3 SA Approach 3 (SA Combination 13) (MR)

SA approach 3, key comparison points:

- Identified as the best in the Most Resilient category;
- Option types included:
    - SA option (group option): 1 groundwater abstraction option;
    - WRZ options: 1 advanced leakage reduction option, 21 groundwater abstraction options, 1 rationalisation option, 2 surface water abstraction options, 1 New Shannon Source option and 5 WTP upgrade options;
- Two -3 biodiversity scores (higher risk options that could impact on European sites); and
- SA approach 3 is similar to SA approaches 2 and 4 in terms of infrastructure. However, compared to these approaches SA approach 3 has the shortest length of pipeline, the most new WTPs, the highest number of new/upgraded abstractions, and the lowest number of WTPs decommissioned.

4.4.4 SA Approach 4 (SA Combination 9) (LC, BA)

SA approach 4, key comparison points:

- Identified as the best in the Lowest Carbon and Best AA categories;

- Option types included:
    - SA option (group option): 1 rationalisation option;
    - WRZ options: 1 advanced leakage reduction option, 20 groundwater abstraction options, 2 rationalisation options, 2 surface water abstraction options, 1 New Shannon Source option and 4 WTP upgrade options;
- One -3 biodiversity scores (higher risk options that could impact on European sites); and
- SA approach 4 is similar to SA approaches 2 and 3 in terms of infrastructure. SA approach 4 has the highest number of WTP upgrades and the lowest number of treated water storages.

4.5 SA8 Approach Assessment Comparison

The 'Do Minimum' approach is the 'without plan' approach, meaning that this is the approach that would occur without the NWRP. As a result, the 'Do Minimum' approach would only include reactive, unplanned interim measures to address failures in infrastructure.

The SDB shows a current deficit, applying the level of service in the area with the corresponding requirements for reserves, indicating operation of supplies with an SDB ranging from -22,007 m^3/d in 2019, to a projected maximum of -28,137 m^3/d in 2044 during dry conditions under a 'Do Minimum' scenario. As a result, public water supplies in this area are vulnerable, particularly under drought conditions. In addition, there may be ongoing reliability issues with the supplies and the situation is expected to further deteriorate due to climate change driven reductions in water resources and increased demand growth within the area. Table 4.8 shows the SDB for the WRZs in SA8.

Table 4.8 Supply Demand Balance for SA8

WRZ Name	WRZ Code	Population	Maximum Deficit m^3/day*	
			2019	2044
Adare	1900SC0029	2,272	No Deficit	No Deficit
Athlacca Water Supply	1900SC0017	97	No Deficit	No Deficit
Ballingarry	1900SC0035	1,013	-389	-423
Bruff Water Supply	1900SC0009	1,436	-149	-201
Bruree Water Supply	1900SC0016	1,039	-183	-230
Murroe/Cappamore/Foileen	1900SC0037	4,743	No Deficit	No Deficit
Carrigkerry Water Supply	1900SC0020	258	-49	-56
Croom PWS	1900SC0028	1,730	-446	-516
Doon Water Supply	1900SC0004	875	-180	-204
Ennis	0300SC0020	28,963	-1,819	-3,051
Feakle PWS	0300SC0015	280	-76	-92
Fedamore Water Supply	1900SC0007	501	-120	-137
Flagmount PWS	0300SC0014	30	-28	-30
Foynes/Shannon Estuary PWS	1900SC0024	7,155	-8,197	-10,945

WRZ Name	WRZ Code	Population	Maximum Deficit m³/day*	
			2019	2044
Glenosheen/Jamestown/ Kilmallock	1900SC0015	3,660	No Deficit	No Deficit
Glin Water Supply	1900SC0022	671	-142	-167
Kilcommon	2900SC0005	1,242	-407	-452
Kilfinnane Ardpatrick Water Supply	1900SC0034	1,312	-568	-616
Killaloe PWS	0300SC0024	1,814	No Deficit	No Deficit
Limerick City Environs PWS	1900SC0001	121,169	No Deficit	No Deficit
Martinstown Water Supply	1900SC0014	838	No Deficit	-37
Mountshannon PWS	0300SC0017	817	-326	-361
Newport RWSS	2900SC0066	7,248	-182	-412
O'Briensbridge PWS	0300SC0019	987	-965	-1,010
Pallasgreen Water Supply	1900SC0005	2,401	-453	-517
Rathkeale	1900SC0036	2,777	-1,892	-2,047
Scarriff PWS	0300SC0016	888	-263	-308
Shannon/Sixmilebridge	0300SC0006	25,284	-3,618	-4,176
South West Regional	1900SC0019	13,960	-1,555	-2,136
Upperchurch	2900SC0068	96	No Deficit	-2
Woodford	1200SC0036	375	No Deficit	-11

*Based on the Dry Year Critical Period (DYCP) weather event planning scenario

An overall assessment and comparison of the SA approaches considered along with the 'Do Minimum' approach (a continuation of the current situation) is provided in Table 4.9 below.

Table 4.9 Assessment of the SA Approaches and the 'Do Minimum' Approach

SEA Objectives	Phase (Construction (C) / Operation (O))	Do Minimum	SA Approach 1 (SA Combination 21) (LCo, BE)	SA Approach 2 (SA Combination 8) (QD)	SA Approach 3 (SA Combination 13) (MR)	SA Approach 4 (SA Combination 9) (LC, BA)
1. Protect public health and promote wellbeing	C	0	--	--	-	-
	O	---	++	++	++	++

SEA Objectives	Phase (Construction (C) / Operation (O))	Do Minimum	SA Approach 1 (SA Combination 21) (LCo, BE)	SA Approach 2 (SA Combination 8) (QD)	SA Approach 3 (SA Combination 13) (MR)	SA Approach 4 (SA Combination 9) (LC, BA)
2. Protect and enhance biodiversity and contribute to resilient ecosystems	C	0	-	-	-	-
	O	--	--	--	---	--
3. To protect landscapes, townscapes and visual amenity	C	0	-	-	--	--
	O	0	++	+	+	+
4. Protect and where appropriate enhance, built and natural assets and reduce waste	C	0	-	-	--	-
	O	-	0	0	0	-
5. Reduce greenhouse gas emissions	C	0	--	---	-	-
	O	-	--	---	-	-
6. Contribute to environmental climate change resilience	C	0	-	-	-	-
	O	--	+	+	++	++
7. Protect and improve surface water and groundwater status	C	0	0	0	0	0
	O	--	--	---	---	---
	C	0	-	-	-	-

SEA Objectives	Phase (Construction (C) / Operation (O))	Do Minimum	SA Approach 1 (SA Combination 21) (LCo, BE)	SA Approach 2 (SA Combination 8) (QD)	SA Approach 3 (SA Combination 13) (MR)	SA Approach 4 (SA Combination 9) (LC, BA)
8. Avoid flood risk	O	0	-	-	-	-
9. Protect and where appropriate, enhance cultural heritage assets	C	0	--	-	-	-
	O	0	0	0	-	-
10. Protect quality and function of soils	C	0	--	-	-	-
	O	0	0	0	0	0

Key			
Major beneficial	+++	Minor adverse	-
Moderate beneficial	++	Moderate adverse	--
Minor beneficial	+	Major adverse	---
Neutral	0		

The overall assessment of the approaches against the SEA objectives indicates that SA approach 3 is likely to have more adverse biodiversity and materials impacts. SA approach 1 is likely to have more beneficial landscape impacts due to the decommissioning of WTPs and absence of new WTPs in the approach. It is also likely to have a less adverse impact on the water environment than the other approaches as it does not include the SA8-047 increase in groundwater abstraction. SA approach 1 is likely to have moderate adverse impacts to population and health due to the temporary loss of access to amenities during construction and the construction of large scale infrastructure in urban areas. The approach is also likely to have moderate adverse impacts to cultural heritage and geology and soils due to SA8-027 requiring a new asset on an NIAH/SMR site and a geological heritage site. This would not result in the loss of the site but would require substantial archaeological input.

Mitigation for the Preferred Approach is identified in chapter 5 through the individual options assessment and the chapter 6 cumulative assessment. All the approaches address the identified water supply quantity and quality requirements to secure a level of service important for public health and wellbeing compared with the ‘Do Minimum’.

4.5.1 Selection of the SA Preferred Approach

SA approach 1 has been selected through the 7 step process as the best performing approach overall across the different categories.

The SA Preferred Approach includes one -3 biodiversity score options. For such options, mitigation in the form of avoidance is provided for within the Plan, for example, should potential adverse effects on European sites be identified at the project level from such an option, the Plan will have identified other options that could be progressed at the project level if required. The Preferred Approach option where a -3 Biodiversity score was identified is the SA option 10 Clareville abstraction for the Lower River Shannon SAC, and the River Shannon and River Fergus Estuaries SPA. However, with the implementation of general mitigation and option specific mitigation as noted in the NIS section 6.3.3 and 6.3.4 respectively, there are not expected to be any adverse effects on the integrity of this European site, either alone or in-combination with other plans or projects. An alternative option will be progressed should potential for AESI be identified at the project level.

The general approach for mitigation in the form of avoidance is provided in the NIS, for example, should potential adverse effects on European sites be identified at the project level from a given option/SA Preferred Approach, other options[6] are identified that could be progressed at the project level if required. Therefore, no project arising from the Framework Plan with AESI identified at the project stage, would be progressed. This process is covered in detail in the NIS for the Regional Plan.

4.6 Without Regional Transfer Alternative

The approach development process at study area level identifies a number of locations where a supply from outside the study area is likely to represent a better solution than relying on local supply solutions only. The SA8 Preferred Approach includes options that are dependent on the development of the SA9 Preferred Approach. Alternatives for these options need to be considered in the event that the Preferred Approach for SA9 cannot advance, the alternative options are outlined in Table 4.10. Note that the options for the other WRZs that are not specified in Table 4.10 will remain the same as those in the current SA8 Preferred Approach.

Table 4.10 Alternative Options for SA8 WRZs Dependent on the SA9 Preferred Approach

WRZ	SA8 Preferred Approach Option	SA8 Alternative Option
Newport RWSS	SA Option 12 Rationalise Killaloe and Newport to the New Shannon Source scheme	SA8-200 New GW abstraction to supply deficit and rationalise O Gorman's well.
Killaloe		SA8-180 Not in deficit - Upgrade WTP only

An overall infrastructure summary of the Preferred Approach options and the alternative options listed in Table 4.10 are provided in Table 4.11, covering the main components of the options.

[6] These options may not have progressed as the Preferred Approach initially as they may have scored significantly worse against other environmental, resilience or feasibility criteria (e.g. the best AA approach may identify an option that results in four times more carbon being produced or is twice as expensive).

Table 4.11 Alternative and Preferred Approach Options Infrastructure Summary

Infrastructure Summary	Preferred Approach Options	Alternative Approach Options
New pipeline network (km)	11	4.7
New WTPs	0	1
Upgrade WTPs	0	2
New/upgraded abstractions	0	1
WTPs decommissioned	3	1
Abstractions abandoned	3	1
Raw water storage	0	0
Treated water storage	1	0

Table 4.12 provides an overall comparative assessment between the SA8 Preferred Approach options and the alternative options listed in Table 4.10 against the SEA objectives.

Table 4.12 Assessment of the Preferred Approach Options and the Alternatives

SEA Objectives	Phase (Construction (C) / Operation (O))	Preferred Approach Options (PA)	Alternative Approach Options (Alt)	Summary
1. Protect public health and promote wellbeing	C	--	--	Both the Alt and PA options have the potential to cause disruption in rural areas during construction of the pipeline. The PA option also has the potential to impact urban areas and temporarily limit access to amenities, however, the Alt options also requires one new WTP to be constructed.
	O	++	+	The PA option decommissions two more WTPs than the Alt options, removing failing WTPs and reducing traffic in the local area. The Alt option upgrades failing WTPs but also builds a new WTP which could result in higher traffic and noise levels in the local area during operation.
2. Protect and enhance biodiversity and contribute to resilient ecosystems	C	--	-	The pipeline for the PA option crosses over the Shannon and Mulkear with hydrological links to designated sites. Works are also within the Lower River Shannon SAC which have the potential to impact QI and Annex species and habitats. The Alt option is in proximity to the Lower River Shannon SAC and could cause disturbance during construction to local species.

SEA Objectives	Phase (Construction (C) / Operation (O))	Preferred Approach Options (PA)	Alternative Approach Options (Alt)	Summary
	O	0	0	No predicted long term impacts.
3. To protect landscapes, townscapes and visual amenity	C	--	--	Both the Alt and PA options have the potential to cause disruption in rural areas during construction of the pipeline. However, the PA option has the potential to disrupt urban areas and the Alt option requires one new WTP to be constructed.
	O	+	-	The PA options include the decommissioning of two more WTPs than the Alt option and the Alt options requires a new WTP to be built which has the potential to cause long term visual impacts.
4. Protect and where appropriate enhance, built and natural assets and reduce waste	C	-	--	The PA option requires approximately twice the length of new pipeline, however, the Alt approach requires a new WTP to make use of existing assets.
	O	0	-	Land will be reinstated after construction of the pipelines and no long term impacts are predicted. The Alt options will result in the loss of agricultural land to allow for the new WTP.
5. Reduce greenhouse gas emissions	C	--	---	There is a moderate level of carbon emissions associated with the PA and a major level of carbon emission associated with the Alt options in relation to the Deployable Output created.
	O	--	---	
6. Contribute to environmental climate change resilience	C	0	0	No construction impacts are predicted.
	O	+	--	The PA option use a large resilient supply whereas the Alt option utilises a smaller supply that is more vulnerable to climate change impacts. The PA option would also help to reduce pressure on existing environmental sources within these WRZs through rationalising the supply.
7. Protect and improve surface water and groundwater status	C	0	0	No construction impacts are predicted.
	O	0	-	The PA options do not include any new or increased abstractions, whereas the Alt options include a new groundwater abstraction.

SEA Objectives	Phase (Construction (C) / Operation (O))	Preferred Approach Options (PA)	Alternative Approach Options (Alt)	Summary
8. Avoid flood risk	C	0	0	No impediment to surface water flow paths or increase to flood risk anticipated.
	O	0	0	
9. Protect and where appropriate, enhance cultural heritage assets	C	--	-	The Alt options are not located where there are any records of cultural heritage assets or unknown archaeology listed under the Record of Monuments/Record of Protected Structures and/or National Inventory of Architectural Heritage records. However, due to new network required, risk of unknown archaeology is assessed as minor. The PA option is located on an NIAH/SMR site. This would not result in the loss of the site but would require a large amount of archaeological input.
	O	0	0	No operational impacts are predicted.
10. Protect quality and function of soils	C	--	-	The Alt options are located where there are no sites listed under IGHS, NHAs, or pNHAs of geological significance present. However, there is potential risk of minor damage to valuable soils with construction of the network. The PA option is located within a geological heritage site, therefore, more input will be required.
	O	0	0	Soils will be reinstated after construction and no operation impacts are predicted.

Key			
Major beneficial	+++	Minor adverse	-
Moderate beneficial	++	Moderate adverse	--
Minor beneficial	+	Major adverse	---
Neutral	0		

The Preferred Approach options are assessed in Table 4.12 as performing better against six of the ten SEA objectives, a summary of the key reasoning behind this is also provided.

In the event that the SA9 Preferred Approach cannot progress, the alternatives above will be required to replace those options that are reliant on it. These alternatives will be subject to their own planning and regulatory processes and it will take a number of investment cycles to progress these projects; hence, they may change in later iterations of the plan.

5

SA8 Preferred Approach: Strategic Environmental Assessment

5 SA8 Preferred Approach Strategic Environmental Assessment

5.1 SA8 Preferred Approach Options

This chapter provides an environmental assessment of the proposed SA Preferred Approach as required by the SEA Directive and implementing Irish regulations. The environmental effects are considered for each option individually. Additional measures proposed to be taken forward along with these options are also considered. Cumulative effects for both the 'within plan' SA Preferred Approach and the cumulative effects with other proposed developments outside the Framework Plan are addressed in chapter 6.

The SA Preferred Approach consists of WRZ options for nineteen of the WRZs in the study area. This reflects the small scale of the supplies and difficulties in transporting small volumes of water over long distances. For some of the larger demand areas, the SA Preferred Approach used SA options to rationalise and provide spare capacity to neighbouring WRZs, these being:

- SA option 8: Supplies spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore/Murroe/Foileen, Pallasgreen and Doon;
- SA option 10: Increases SW abstraction/WTP capacity and supplies spare capacity from Limerick City to neighbouring WRZs, South West Regional, Foynes Shannon and Adare;
- SA option 12: Rationalises Killaloe and Newport to the New Shannon Source;
- SA option 16: Supplies spare capacity from Glenosheen/Jamestown/Kilmallock to KilfinaneArdpatrick; and
- SA option 23: Increases GW abstraction at Kilcommon and rationalises Upperchurch to Kilcommon.

The SA Preferred Approach for the remaining WRZs involves new and increased groundwater abstractions, along with increased surface water abstractions, WTP upgrades, improved connectivity between WRZs and an advanced leakage reduction programme for the Ennis WRZ.Table 5.1 gives a breakdown of the options in SA8 and the associated abstractions.

Table 5.1 Preferred Approach Breakdown

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
SA8-20a 0300SC0014 Flagmount	Increase GW abstraction from Flagmount borehole) and upgrade existing Flagmount WTP • Increase GW abstraction to meet WRZ deficit (DYCP 2044) • Existing GW source (Lough Graney groundwater body) WFD status 2013-18 – Good	85 m^3/d
SA8-024 0300SC0017 Mountshannon	Increase GW abstraction from existing Mountshannon borehole (poorly productive aquifer) and upgrade Cloonmirran Pumphouse WTP • Increase GW to meet WRZ future deficit (DYCP 2044)	819 m^3/d

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
	• Existing GW source (Tynagh groundwater body) WFD status 2013-18 – Good	
SA8-31a 0300SC0019 O'Briensbridge	Rationalise O'Briensbridge WRZ to Limerick City WRZ • Rationalise WRZ to Limerick City WRZ to meet full future demand. Includes decommissioning of current sources/WTPs - Montpellier WTP. No new surface water abstractions as option would be using spare capacity already available within Limerick WRZ. • WFD status Shannon Lower RWB: 2013-2018 – Unassigned	1,468 m^3/d
SA8-120 1200SC0036 Woodford	Increase existing GW and upgrade Woodford WTP • Increase GW to meet WRZ future deficit (DYCP 2044) • Existing GW source WFD status (Tynagh groundwater body) 2013-2018 – Good	152 m^3/d
SA8-17f (SA option 10) 1900SC0001 Limerick City Environs	Not in deficit - supply spare capacity to neighbouring WRZs and upgrade • WRZ in projected surplus, not in deficit. Part of SA option 10 to use current WRZ spare capacity and increase SW abstraction at Clareville WTP (Shannon) transfer supply to South West Regional WRZ and Foynes/Shannon Estuary WRZ to meet future deficits • WFD status Shannon Lower RWB: 2013-2018 – Unassigned	14,500 m^3/d (combined SA option 10)
SA8-084 (SA option 10) 1900SC0019 South West Regional	Connect South West Regional to Limerick City WRZ • Part of SA option 10 to use current WRZ spare capacity and increase SW abstraction at Clareville WTP (Shannon) transfer supply to South West Regional WRZ and Foynes/Shannon Estuary WRZ to meet future deficits • WFD status Shannon Lower RWB; 2013-2018 – Unassigned	14,500 m^3/d (combined SA option 10)

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
SA8-105 (SA option 10) 1900SC0024 Foynes Shannon Estuary	Connect Foynes/Shannon Estuary to Limerick City WRZ • Part of SA option 10 to use current WRZ spare capacity and increase SW abstraction at Clareville WTP (Shannon) transfer supply to South West Regional WRZ and Foynes/Shannon Estuary WRZ to meet future deficits • WFD status Shannon Lower RWB; Status 2013-2018 – Unassigned	14,500 m^3/d (combined SA option 10)
SA8-192 (SA option 10) 1900SC0029 Adare	Interconnection to Limerick • Part of SA option 10 to use current WRZ spare capacity and increase SW abstraction at Clareville WTP (Shannon) transfer supply to South West Regional WRZ and Foynes/Shannon Estuary WRZ to meet future deficits • WFD status Shannon Lower RWB; Status 2013-2018 – Unassigned	14,500 m^3/d (combined SA option 10)
SA8-051 1900SC0007 Fedamore Water Supply	New GW abstraction from Fedamore and upgrade Fedamore WTP • New GW abstraction to meet WRZ future deficit • New GW source (Fedamore groundwater body) WFD status 2013-18 – Good	288 m^3/d
SA8-059 1900SC0014 Martinstown Water Supply	Increase GW abstraction at Martinstown borehole (poorly productive aquifer) and upgrade Martinstown WTP • Increase GW to meet WRZ future deficit • Existing GW source (Charleville groundwater body) WFD status 2013-18 – Good	770 m^3/d
SA8-068 1900SC0016 Bruree Water Supply	Increase GW abstraction at Bruree borehole (Bruree groundwater body - productive fissured bedrock) and upgrade Bruree WTP • Increase GW to meet WRZ future deficit • Existing GW source (Bruree groundwater body) WFD status 2013-18 – Good	752 m^3/d

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
SA8-098 1900SC0020 Carrigkerry Water Supply	Increase GW abstraction from Carrigkerry Spring (poorly productive aquifer) and upgrade Carrigkerry WTP • Increase GW to meet WRZ future deficit • Existing GW source (Ballylongford groundwater body) WFD status 2013-18 – Good	140 m^3/d
SA8-177 1900SC0028 Croom PWS	Rationalise Croom WRZ to Limerick City WRZ • Rationalise WRZ to Limerick City WRZ to meet full future demand. Includes decommissioning of current sources/WTPs. No new surface water abstractions as option would be using spare capacity already available within the WRZ. • WFD status Shannon Lower RWB: 2013-2018 – Unassigned	1,100 m^3/d
SA8-145 1900SC0036 Rathkeale	Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to partly supply deficit • Increase GW to meet WRZ future deficit • Existing GW source (Newcastle West groundwater body) WFD status 2013-18 – Good	3,789 m^3/d
SA8-163 (SA Option 23) 2900SC0005 Kilcommon	Increase GW abstraction and upgrade Kilcommon WTP • Increase GW to meet WRZ future deficit • Existing GW source (Slieve Phelim groundwater body) WFD status 2013-18 – Good	1,048 m^3/d
SA8-166 (SA Option 23) 2900SC0068 Upperchurch	• Rationalise Upperchurch to Kilcommon. New watermains and network upgrades required Increase GW to meet WRZ future deficit • Existing GW source (Templemore groundwater body) WFD status 2013-18 – Good	57 m^3/d
SA8-009 0300SC0006 Shannon/Sixmilebridge	Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit	17,972 m^3/d

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
	• Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit • Castle CE LWB WFD status 2013-2018 – Poor	
SA8-021 0300SC0015 Feakle PWS	Increase GW abstraction from Feakle public supply new BH (poorly productive aquifer) and upgrade existing Bauragegaun Pump Station WTP • Increase GW abstraction from Feakle public supply new borehole (poorly productive aquifer) and upgrade existing Bauragegaun Pump Station WTP • Existing GW source (Feakle GWB) WFD status 2013-18 – Good	330 m^3/d
SA8-022 0300SC0016 Scarriff PWS	Increase GW abstraction from existing boreholes (poorly productive aquifer) and upgrade Scarriff WTP • Increase GW abstraction from existing boreholes and upgrade Scarriff WTP • Existing GW source (L Graney GWB) WFD status 2013-18 – Good	1,001 m^3/d
SA8-001 & SA8-172 0300SC0020 Ennis	SA8-001: Increase GW abstraction at Drumcliffe Springs (Ennis groundwater body - karstic bedrock) and upgrade Drumcliffe WTP SA8-172: Advanced leakage reduction. This leakage option needs implemented in conjunction with local GW option SA8-001 in order to meet full deficit. • Increase GW abstraction at Drumcliffe Springs and upgrade Drumcliffe WTP. Advanced leakage reduction programme to be implemented in conjunction with local GW option SA8-001 to meet full deficit. • Existing GW source (Ennis GWB) WFD status 2013-18 – Good	16,985 m^3/d
SA8-027 (SA Option 12) 0300SC0024 Killaloe PWS	Rationalise Killaloe PWS to Newport WRZ via Killaloe Bridge • Supply Newport RWSS from New Shannon Source (rationalise). Dependent on New Shannon Source (Lough Derg) to GDA.	3,064 m3/d

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
	Abstraction impact has been assessed as part of GDA. • WFD status Derg Highly Modified Waterbody 2013-2018 – Good	
SA8-040 & SA8-199 (SA option 8) 1900SC0037 Murroe/Cappamore /Foileen	Rationalisation to Limerick • Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon. Murroe (Reservoir), Murroe, Foileen, Oola, Caherconlish, Pallasgreen, Cooga Spring and Lacka Doon Borehole WTPs will be decommissioned as part of this option • WFD status Shannon Lower RWB: 2013-2018 – Unassigned	1,202 m^3/d
SA8-138 (SA option 8) 1900SC0004 Doon Water Supply		570 m^3/d
SA8-049 (SA option 8) 1900SC0005 Pallasgreen Water Supply		1,549 m^3/d
SA8-052 1900SC0009 Bruff Water Supply	Increase GW abstraction at Finn's Well (poorly productive aquifer) and upgrade Finn's Well WTP • Increase GW abstraction at Finn's Well and upgrade Finn's Well WTP • Existing GW source (Hospital GWB) WFD status 2013-18 – Good	899 m^3/d
SA8-065 (SA option 16) 1900SC0015 Glenosheen/Jamestown/Kilmallock	Not in deficit - supply and rationalise Kilfinane Ardpatrick • Rationalise Kilfinnane Ardpatrick to Kilmallock WRZ (rationalise to Jamestown WTP (Mount Russell borehole) • Existing GW source (Charleville GWB) WFD status 2013-18 – Good	1,981 m^3/d
SA8-114 (SA option 16) 1900SC0034 KilfinnaneArdpatrick Water Supply	Rationalise to Jamestown WTP • Rationalise KilfinnaneArdpatrick to Kilmallock WRZ (rationalise to Jamestown WTP (Mount Russell borehole) • Existing GW source (Charleville GWB) WFD status 2013-18 – Good	1,199 m^3/d
SA8-179 1900SC0017 Athlacca Water Supply	Not in deficit - Upgrade WTP only • Not in deficit - upgrade Athlacca WTP for water quality issues • Existing GW source (Hospital GWB) WFD status 2013-18 – Good	N/A

WRZ Name and Option Reference*	Option Description	Abstraction / Demand
SA8-100 1900SC0022 Glin Water Supply	Increase GW abstraction from Glin borehole and upgrade Glin WTP • Increase GW abstraction from Glin BH (poorly productive bedrock) and upgrade existing Glin WTP • Existing GW source (Ballylongford GWB) WFD status 2013-18 – Good	442 m^3/d
SA8-149 1900SC0035 Ballingarry	Increase GW abstraction at Ballingarry Spring and upgrade existing Ballingarry Spring WTP • Increase GW abstraction at Ballingarry Spring (Ballingarry groundwater body - productive fissured bedrock) and upgrade existing Ballingarry Spring WTP to partly supply deficit • Existing GW source (Ballingarry GWB) WFD status 2013-18 – Good	790 m^3/d
SA8-118 (SA Option 12) 2900SC0066 Newport RWSS	Rationalise Newport to New Shannon Source • Supply Newport from New Shannon Source (rationalise). Dependent on New Shannon Source (Lough Derg) to GDA. Abstraction impact has been assessed as part of GDA. • Derg highly modified waterbody WFD status 2013 -2018 – Good	4,262 m^3/d

* Note: SA Options are the same as Group Options

The SA Preferred Approach options are shown in Figure 5.1, in relation to key environmental designations. Note that SA option 8, SA option 10, SA option 12, SA option 16 and SA option 23 are labelled as SA8-508, SA8-510, SA8-512, SA8-516 and SA8-523 respectively.

The Preferred Approach has four options (SA8, 31a, SA8-177, SA option 8 and SA option 10) where an increased abstraction at Clareville is proposed. However, as these options refer to the same abstraction location, only SA option 10 shows the abstraction in Figure 5.1 to avoid duplication.

The SA Preferred Approach options have each been assessed against the SEA objectives, taking account of construction and operational phases, long term and short term, permanent and temporary, and indirect and direct impacts. Mitigation requirements to avoid or reduce effects have also been taken into consideration. Table 5.2 provides a breakdown of the infrastructural components and Table 5.3 provides an assessment summary of the options included in the SA Preferred Approach. Individual options assessments are available on request. The overall Preferred Approach assessment, including all the options combined, is summarised in Table 7.1.

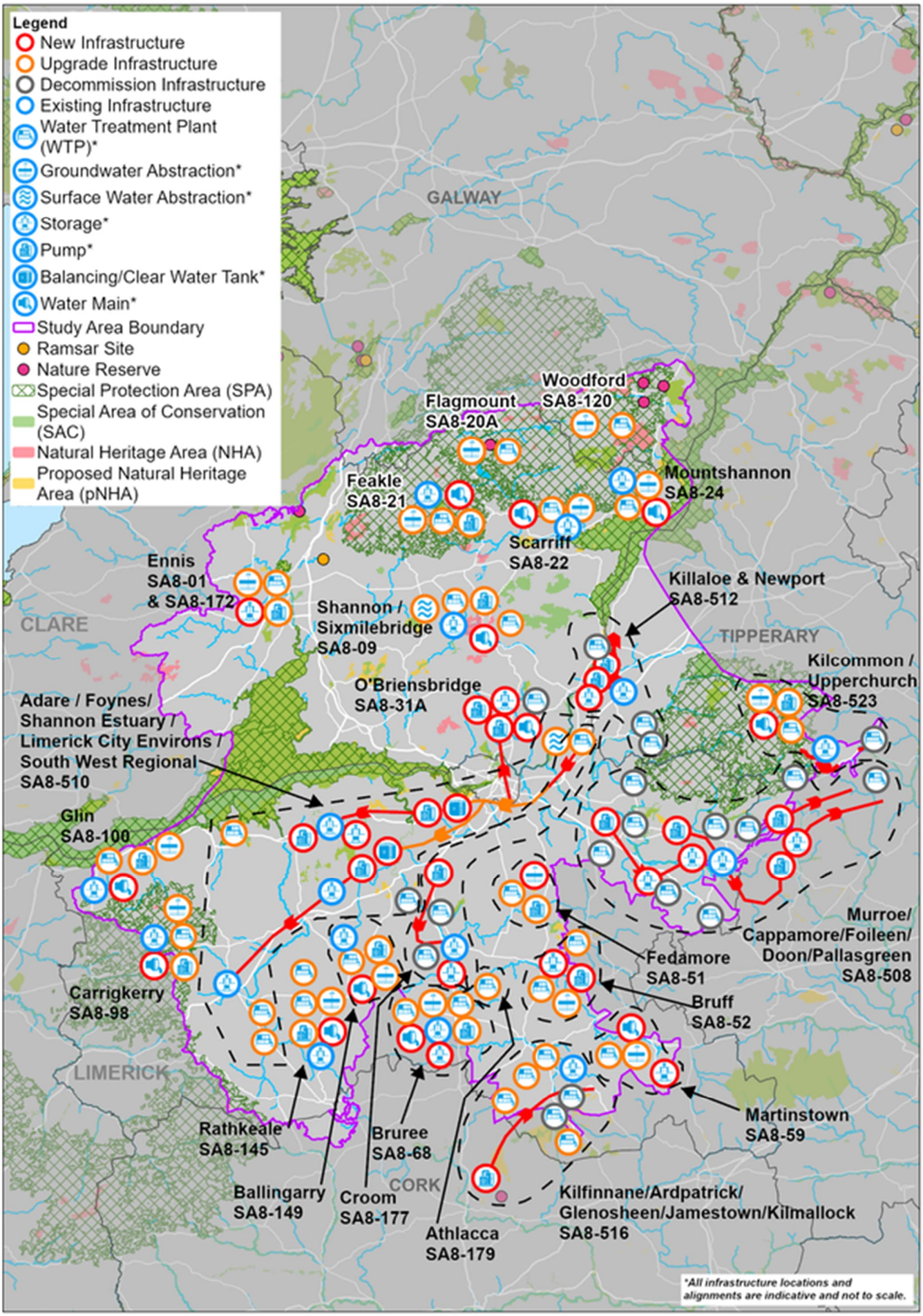

Figure 5.1 SA Preferred Approach and Key Environmental Designations

Table 5.2 Component Table

Option Reference	New / Refurbished Pipeline	New WTP	Upgrade WTPs	New / Upgraded Abstractions	WTPs Decommissioned	Abstractions Abandoned	Service Reservoirs	Storage Reservoirs
SA8-001 & SA8-172	-	-	✓	✓	-	-	-	✓
SA8-009	✓	-	✓	✓	-	-	-	-
SA8-20a	-	-	✓	✓	-	-	-	-
SA8-021	✓	-	✓	✓	-	-	-	-
SA8-022	-	-	✓	✓	-	-	-	-
SA8-024	✓	-	✓	✓	-	-	-	-
SA8-051	-	-	✓	✓	-	-	-	-
SA8-052	-	-	✓	✓	-	-	-	✓
SA8-059	-	-	✓	✓	-	-	-	✓
SA8-068	✓	-	✓	✓	-	-	-	✓
SA8-098	✓	-	✓	✓	-	-	-	-
SA8-100	✓	-	✓	✓	-	-	-	-
SA8-120	-	-	✓	✓	-	-	-	-
SA8-145	✓	-	✓	✓	-	-	-	-
SA8-149	✓	-	✓	✓	-	-	-	-
SA8-177	✓	-	-	-	✓	✓	-	✓
SA8-179	-	-	✓	-	-	-	-	-
SA8-31a	✓	-	-	-	-	✓	-	✓
SA option 8 (SA8-040, SA8-049, SA8-138 and SA8-199)	✓	-	-	-	-	✓	-	✓
SA option 10 (SA8-17f, SA8-084, SA8-105 and SA8-192)	✓	-	✓	✓	✓	✓	-	✓
SA option 12	✓	-	-	-	✓	✓	-	✓

Option Reference	New / Refurbished Pipeline	New WTP	Upgrade WTPs	New / Upgraded Abstractions	WTPs Decommissioned	Abstractions Abandoned	Service Reservoirs	Storage Reservoirs
(SA8-027 and SA8-118)								
SA option 16 (SA8-065 and SA8-114)	✓	-	✓	-	✓	✓	-	-
SA option 23 (SA8-163 and SA8-166)	✓	-	✓	✓	✓	✓	-	-

Table 5.3 Options Assessment Summary

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
SA8-001	Increase GW abstraction at Drumcliffe Springs (Ennis groundwater body - karstic bedrock) and upgrade Drumcliffe WTP to partly supply deficit	Construction	-	--	-	-	---	-	0	-	0	0
		Operation	++	-	0	0	---	-	-	-	0	0
SA8-172	Advanced leakage reduction. This leakage option needs to be implemented in conjunction with a	Construction	-	-	0	0	-	0	0	0	0	0

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	local GW option SA8-001 or SA8-002 in order to meet full deficit.	Operation	+	0	0	0	-	0	0	0	0	0
SA8-009	Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit	Construction	-	-	-	-	--	-	0	0	-	-
		Operation	+	0	0	0	--	-	-	0	0	0
SA8-20a	Increase GW abstraction from Flagmount borehole (poorly productive aquifer) and upgrade existing Flagmount Reservoir Site WTP	Construction	-	--	0	0	0	-	0	0	0	0
		Operation	0	0	0	0	0	-	-	0	0	0

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
SA8-021	Increase GW abstraction from Feakle public supply new borehole (poorly productive aquifer) and upgrade existing Baurageagun Pump Station WTP	Construction	-	-	-	-	+	-	0	0	-	-
		Operation	0	0	0	0	+	-	-	0	0	0
SA8-022	Increase GW abstraction from existing boreholes (poorly productive aquifer) and upgrade Scarriff WTP	Construction	-	-	-	-	0	-	0	0	-	-
		Operation	0	0	0	0	0	-	-	0	0	0

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
SA8-024	Increase GW abstraction from existing Mountshannon borehole (poorly productive aquifer) and upgrade Cloonmirran Pumphouse WTP	Construction	-	-	-	-	0	-	0	0	-	-
		Operation	0	0	0	0	0	-	-	0	0	0
SA8-31a	Rationalise O'Briensbridge WRZ to Limerick City WRZ (approx. distance 2.5km, new watermains and	Construction	-	-	-	-	---	0	0	0	-	-
		Operation	+	--	+	0	---	++	0	0	0	0

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	network upgrades required)											
SA8-120	Increase existing GW	Construction	-	--	0	0	0	-	0	0	0	0
		Operation	0	0	0	0	0	-	-	0	0	0
SA8-051	New GW abstraction from Fedamore groundwater body (karstic) and upgrade Fedamore WTP/new WTP	Construction	-	-	-	0	-	--	0	0	0	0
		Operation	0	0	0	0	-	--	-	0	0	0

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
SA8-052	Increase GW abstraction at Finn's Well (poorly productive aquifer) and upgrade Finn's Well WTP	Construction	-	-	-	-	--	-	0	0	0	0
		Operation	++	0	0	0	--	-	-	0	0	0
SA8-059	Increase GW abstraction at Martinstown borehole (poorly productive aquifer) and upgrade Martinstown WTP	Construction	-	-	-	-	--	--	0	0	-	-
		Operation	++	0	0	0	--	--	---	0	0	0
SA8-068	Increase GW abstraction at Bruee borehole (Bruree	Construction	-	-	-	-	--	--	0	0	-	-

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	groundwater body - productive fissured bedrock) and upgrade Bruree PS WTP	Operation	++	0	0	0	--	--	---	0	0	0
SA8-179	Not in deficit - Upgrade WTP only	Construction	-	-	0	0	0	0	0	0	0	0
		Operation	+	0	0	0	0	0	0	0	0	0
SA8-098	Increase GW abstraction from Carrigkerry Spring (poorly productive aquifer) and upgrade Carrigkerry WTP	Construction	-	--	-	-	-	-	0	0	-	-
		Operation	0	0	0	0	-	-	-	0	0	0
SA8-100	Increase GW abstraction from Glin	Construction	-	-	-	-	-	-	0	0	-	-

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	borehole (poorly productive bedrock) and upgrade existing Glin WTP	Operation	0	0	0	0	-	-	-	0	0	0
SA8-177	Rationalise to Limerick City	Construction	-	--	-	-	--	0	0	0	-	-
		Operation	++	--	+	0	--	++	0	0	0	0
SA8-149	Increase GW abstraction at Ballingarry Spring (Ballingarry groundwater body - productive fissured bedrock) and upgrade existing Ballingarry	Construction	-	-	-	-	0	--	0	0	-	-
		Operation	0	0	0	0	0	--	---	0	0	0

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	Spring WTP to partly supply deficit											
SA8-145	Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well)	Construction	-	-	-	-	-	--	0	0	-	-
		Operation	+	0	0	0	-	--	---	0	0	0
SA Option 12 (SA8-027 & SA8-118)	Rationalise Killaloe WRZ to Newport WRZ via Killaloe bridge	Construction	--	-	-	-	---	0	0	0	-	-
		Operation	++	0	+	0	---	++	0	0	0	0

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	Rationalise Newport to New Shannon Source											
SA Option 23 (SA8-163 SA8-166)	Increase groundwater abstraction at Kilcomman; rationalise Upperchurch to Kilcommon WRZ	Construction	-	--	-	-	+	-	0	0	-	-
		Operation	+	-	+	0	+	-	-	0	0	0
SA Option 8 (SA8-040, SA8-138, SA8-199 and SA8-49)	Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore/Murroe/	Construction	--	--	--	--	---	0	0	0	-	-
		Operation	++	--	++	0	---	++	0	0	0	0

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	Foileen, Pallasgreen and Doon											
SA Option 10 (SA8-192, SA8-105, SA8-17f and SA8-84)	Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	Construction	--	-	--	--	---	-	0	0	-	-
		Operation	++	--	+	0	---	++	--	0	0	0
SA Option 16 (SA8-065 and SA8-114)	Rationalise Kilfinnane Ardpatrick to Kilmallock WRZ (rationalise to Jamestown WTP (Mount Russell	Construction	-	-	-	-	-	0	0	0	-	-
		Operation	++	0	+	0	-	++	0	0	0	0

Option Reference*	Option Description	Phase	Protect Public Health and Promote Wellbeing (P1, P2, P3)	Protect and Enhance Biodiversity and Contribute to Resilient Ecosystems (B1, B2, B3, B4, B5)	To Protect Landscapes, Townscapes and Visual Amenity (L1)	Protect and Where Appropriate Enhance, Built and Natural Assets and Reduce Waste (M1, M2)	Reduce Greenhouse Gas Emissions (C1)	Contribute to Environmental Climate Change Resilience (R1, R2, R5)	Protect and Improve Surface Water and Groundwater Status (W1, W2, W3)	Avoid Flood Risk (W5)	Protect and Where Appropriate, Enhance Cultural Heritage Assets (CH1)	Protect Quality and Function of Soils (G1)
	borehole), approx. distance 4km, network upgrades required)											

* Note SA Option is the same as Group Option

** Total lifetime tCO_2e categories: minor beneficial = -ve negligible/neutral = <1000 minor = 1000 to <10,000, Moderate = 10,000 to <50,000, Major = 50,000+

5.2 Additional Measures

In addition to the SA Preferred Approach supply options, Irish Water is already implementing measures across the three pillars of Lose Less, Use Less and Supply Smarter to improve the level of service to their customers in this study area. These are described in the SA8 Technical Report and include leakage reduction and water conservation.

5.2.1 Leakage Reduction

The leakage reduction measures across the public water supply are based on what Irish Water assess to be both achievable and sustainable and include:

- Ongoing leakage management, including active leakage control, pressure management, and find and fix activities to offset Natural Rate of Leakage Rise;
- Net leakage reductions targets have been applied to the SDB deficit to move towards achieving the national Sustainable Economic Level of Leakage (SELL) target prioritised based on:
  - Supply demand deficit;
  - Existing abstractions with sustainability issues; and
  - Drought impacts.
- Additional leakage targets to achieve SELL and reduce leakage levels to 21% of demand in the WRZs: Ennis/Shannon/Sixmilebridge, Flagmount PWS, Feakle PWS, Scarriff PWS, Mountshannon PWS, Obriens Bridge PWS, Ennis, Doon Water Supply, Oola/Pallasgreen, Fedamore Water Supply, Bruff Water Supply, Rockhill & Bruree, Shannon Estuary Water Supply, Croom Water Supply, Kilfinnane Ardpatrick Water Supply, Ballingarry, Rathkeale, Newport RWSS, Limerick City, South West Regional, and Murroe/Cappamore/Foileen.

5.2.2 Water Conservation

At present, Irish Water is conducting pilot studies in relation to water conservation stewardship in businesses and is actively progressing water conservation messaging campaigns. During drought conditions in 2018, a Water Conservation Order was implemented, in order to protect their water supplies and reduce pressure on the natural environment during this period. Irish Water will continue to promote 'Water Conservation Activities', collecting and monitoring data over a number of years to assess the benefits. As part of the Framework Plan, Irish Water have not applied reductions to the SDB for unquantifiable water conservation gains. However, they do assume that any gain will offset consumer usage growth factors.

5.3 Interim Solutions

The SA8 Technical Report identifies potential interim solutions that allow shorter term interventions to be identified and prioritised, when needed. These are expected to be small scale, within site works and are not likely to give rise to significant environmental effects. However, they would need to be subject to relevant assessments, including AA screening as and when they are required.

5.4 Approach Uncertainty and Adaptability

A summary of the adaptability criteria and sensitivity analysis Irish Water have undertaken for the SA8 Preferred Approach is provided in the SA8 Technical report. A high-level assessment of what this could mean for the SEA is shown in Table 5.4.

Table 5.4 SA8 Sensitivity Analysis and Environmental Impacts

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Environmental Impacts Relative to Assessment of Preferred Approach Key: Green - Positive Amber - Negative
Sustainability	Moderate/High (as Irish Water's current abstractions are large compared to the waterbodies from which they abstract)	+13,700 m^3/d	The impact of sustainability reductions would reduce the volumes that can be abstracted from Irish Water's existing sources; therefore, increasing the SDB deficit. Irish Water's outline sustainability assessments would mean a potential increase in deficit for SA8 based on reductions in the sustainable abstraction amounts from the River Deel (Foynes Shannon), the River Mulkear (Newport) and the Loobagh River (Kilmallock). The proposed option for Foynes Shannon connects to Limerick City WRZ, currently abstracting from the River Shannon, to relieve stress on the River Deel source. The Newport (River Mulkear) preferred option is to rationalise to supply from New Shannon Source. The Loobagh River (Kilmallock) is not projected to be in deficit even with sustainability reductions.
			The SA Preferred Approach addresses reduction, although additional sustainability reductions could add pressure for additional supply from outside the study area.
Climate Change	High (international climate change targets have not been met)	+4,000 m^3/d	Higher climate change scenarios would impact Irish Water's existing supplies and result in decreased water availability at certain times of year. Although the likelihood of this scenario is high based on climate change adaptation to date, potential impacts may be mitigated by optimising Irish Water's operations on a more environmentally sustainable basis across the range of supplies.
			Potential for additional abstraction pressure unless optimisation can address.
Demand Growth	Low/Moderate (growth has been based on policy)	-200 m^3/d	The impact of lower than expected growth would reduce the SDB deficit and the overall need requirement. The SDB deficit is currently spread across twenty-two out of the thirty-one WRZs in SA8 and is projected to spread across twenty-five. This is driven by quality and quantity issues. Many of the WRZs in this area are rural and growth is relatively low. However, Limerick City, Shannon and Ennis are high growth areas.

Uncertainty	Likelihood	Increase/ Decrease in Deficit	Environmental Impacts Relative to Assessment of Preferred Approach Key: Green - Positive Amber - Negative
			This could allow lower than expected energy and carbon and reduce expected abstraction requirements
Leakage Targets	Low (Irish Water is focused on sustainability and aggressive leakage reduction)	+978 m^3/d	The impact of lower than expected leakage savings would increase the SDB deficit and the overall need requirement. Due to the length and condition of Irish Water's networks, Irish Water could potentially fail to achieve target leakage reductions within the timeframes set out. However, as Irish Water is committed to achieving leakage reductions, the likely scenario would be an extension in the period of time taken to achieve leakage targets as opposed to accepting lower targets.
			This could increase carbon and the effects of abstraction pressure on the environment
	Moderate/High (Irish Water is focused on sustainability and aggressive leakage reduction)	-22,264 m^3/d	Increased leakage savings beyond SELL would reduce the SDB deficit and the overall need requirement. The need drivers in SA8 are across all WRZs and are driven by quality as well as availability issues.
			This could allow lower than expected energy and carbon and reduce expected abstraction requirements

6

SEA Cumulative Effects for SA8 Preferred Approach

6 SEA Cumulative Effects for SA8 Preferred Approach

Secondary, cumulative and the synergistic nature of the effects of the SA8 Preferred Approach proposals are required to be considered as part of SEA. These include:

- 'Within plan' or 'in-combination' effects; and
- Interaction with other plans and programmes.

Cumulative effects are also considered for the proposals across the nine study areas within the Eastern and Midlands Region and reported in the SEA Environmental Report of the Regional Plan. Further consideration of any inter regional cumulative effects will be addressed in each Regional Plan SEA sequentially.

6.1 Cumulative Effects 'Within Plan' for SA8

The potential 'within plan' cumulative effects for SA8 are considered at the following different levels:

- Option level: Identification of mutually exclusive or dependent options – this was considered through the options screening and approach development process;
- SA approaches: Cumulative effects are taken into account in the selection of approaches for key aspects such as abstraction from the same waterbody through the sustainability rules applied for Irish Water abstractions (see section 3.2);
- SA Preferred Approach: The combined effect of options within the SA Preferred Approach – these are addressed in this chapter; and
- Eastern and Midlands Region level: Considering combined effects from proposals in the nine study areas (see the SEA Environmental Report of the Regional Plan).

For cumulative effects to occur, there needs to be an overlap of temporal periods in some way for the impact and/or the effect. For example, two schemes being constructed at the same time could result in cumulative traffic movements, while two schemes being operated together could result in additional drawdown of groundwater levels. A precautionary approach has been taken for the cumulative effects assessment, which assumes that all options could be constructed at the same time and then all options would be operated at the same time (Table 6.1). However, this is very unlikely to be the case for construction impacts due to budget resources and regulatory constraints.

The assessment has considered the cumulative effects across all environmental topics to identify those interactions that are likely to generate significant effects. These are likely to be around:

- Biodiversity – for example, a cumulative loss of habitats or changes to a habitat's quality through changes in water quality or groundwater levels;
- Water environment (surface water and groundwater WFD status) – for example, changes to water flow due to combined abstraction pressure;
- People and health – for example, disruption due to multiple construction works taking place at the same time;
- Landscape and visual – for example, if there are a number of options located close together that could alter the landscape character or views;
- Cultural heritage – for example if the same cultural heritage features are affected by above ground infrastructure in close proximity or the combined effect of loss to undesignated archaeological assets or from combined impacts resulting in additional changes to water levels affecting archaeological resources; and

- Climate change – combined carbon emissions for the approach as a whole have been considered through the approach selection process and are also reported here to identify potential requirements for mitigation. Combined effects on climate change adaptation are also considered.

6.1.1 Cumulative Effects during Construction

In general, the SA Preferred Approach options are geographically spaced out and most are small scale in construction works. Therefore, there are unlikely to be many cumulative effect interactions during construction.

Table 6.1 Potential In-Combination Effects between Preferred Options in SA8

Preferred Approach option references	SA8-001 (in conjunction with SA8-172)	SA8-009	SA8-20a	SA8-021	SA8-022	SA8-024	SA8-31a	SA8-120	SA8-051	SA8-052	SA8-059	SA8-068	SA8-179	SA8-098	SA8-100	SA8-177	SA8-149	SA8-145	SA option 12 (Group option 12)	SA option 23 (Group option 23)	SA option 8 (Group option 8)	SA option 10 (Group option 10)
SA option 16 (Group option 16)																						
SA option 10 (Group option 10)	LRS S&F	LRS S&F					LRS S&F			LRS	LRS	LRS	LRS		LRS S&F	LRS	LRS	LRS	LRS		LRS	
SA option 8 (Group option 8)	LRS	LRS					LRS			LRS	LRS	LRS	LRS		LRS	LRS	LRS	LRS	LRS	SSM		
SA option 23 (Group option 23)	LRS	LRS					LRS			LRS	LRS	LRS	LRS		LRS	LRS	LRS	LRS	LRS			
SA option 12 (Group option 12)	LRS	LRS					LRS			LRS	LRS	LRS	LRS		LRS	LRS	LRS	LRS				
SA8-145	LRS	LRS					LRS			LRS	LRS	LRS	LRS		LRS	LRS	LRS					
SA8-149	LRS	LRS					LRS			LRS	LRS	LRS	LRS		LRS	LRS						
SA8-177	LRS	LRS					LRS			LRS	LRS	LRS	LRS		LRS							
SA8-100	LRS S&F	LRS S&F					LRS S&F			LRS	LRS	LRS	LRS									
SA8-098																						
SA8-179	LRS	LRS					LRS			LRS	LRS	LRS										
SA8-068	LRS	LRS					LRS			LRS	LRS											
SA8-059	LRS	LRS					LRS			LRS												
SA8-052	LRS	LRS					LRS															
SA8-051																						
SA8-120			SAM	SAM	SAM	SAM																
SA8-31a	LRS S&F	LRS S&F			LRS	LRS																

Preferred Approach option references	SA8-001 (in conjunction with SA8-172)	SA8-009	SA8-20a	SA8-021	SA8-022	SA8-024	SA8-31a	SA8-120	SA8-051	SA8-052	SA8-059	SA8-068	SA8-179	SA8-098	SA8-100	SA8-177	SA8-149	SA8-145	SA option 12 (Group option 12)	SA option 23 (Group option 23)	SA option 8 (Group option 8)	SA option 10 (Group option 10)
SA8-024			SAM	SAM	SAM																	
SA8-022			SAM	SAM																		
SA8-021			SAM																			
SA8-20a																						
SA8-009	LRS S&F																					

Key	
Construction Phase	
Operation Phase	
Construction and Operation	
Lower River Shannon SAC	LRS
River Shannon and River Fergus Estuaries SPA	S&F
Slieve Aughty Mountains SPA	SAM
Slievefelim to Silvermines Mountains SPA	SSM

There could be cumulative effects from habitat loss, mortality, disturbance, pollution and spread of invasive species on the Lower River Shannon SAC if construction of options SA8-009, 31a, 052, 059, 068, 100, 145, 149, 177, 179, SA option 8, SA option 10, SA option 12 and SA option 23 are concurrent (see 'LRS' in Table 6.1). The Lower River Shannon SAC is designated for a range of coastal habitats including vegetated shingle, saltmarsh and sea cliff, and species such as salmon, otter, common bottlenose dolphin and sea, brook and river lamprey. Cumulative construction works could affect water quality through increasing surface water run off or increasing the risk of pollution during works.

There is potential for cumulative effects from disturbance and pollution impacts on the River Shannon and River Fergus Estuaries SPA if construction of options SA8-001, 31a, 009, 100 and SA option 10 are concurrent (see 'S&F' in Table 6.1). The estuaries of the River Shannon and River Fergus form the largest estuarine complex in Ireland. The site has vast expanses of intertidal flats which contain a diverse macro-invertebrate community providing a rich food resource for the wintering birds.

The construction of the SA Preferred Approach could also cause cumulative effects from disturbance impacts on the Slieve Aughty Mountains SPA (options SA8-20a, 021, 022, 024 and 120) and Slievefelim to Silvermines Mountains SPA (SA option 8 and SA option 23). However, with standard good practice mitigations i.e. such as having buffers along the edge of the river and having an emergency plan in place during construction, cumulative effects are unlikely to be significant. The impacts on the European designations are provided in the NIS and also summarised in chapter 9 of this review.

6.1.2 Cumulative Effects during Operation

The SEA has identified that, at a plan level, there is potential for cumulative effects during the operation phase of the SA Preferred Approach on Lower River Shannon SAC given that option SA8-001, 31a, 177, SA option 8 and SA option 10 all have the potential for hydrological changes and water table impacts to the site. Option SA8-001 involves an increase in groundwater abstraction within a karstic aquifer that is potentially hydrologically linked to the SAC. SA8-31a, SA8-177 and SA option 8 include an increased surface water abstraction adjacent to the SAC. SA option 10 involves direct abstraction from the SAC. See Figure 6.1 for the Preferred Approach abstractions in SA8. All of these abstractions could potentially lead to changes in water table/availability and hydrological changes during operation that could impact QI species and habitats.

The Preferred Approach has four options (SA8-31a, SA8-177, SA option 8 and SA option 10) where an increased abstraction at Clareville is proposed. However, as these options refer to the same abstraction location, only SA option 10 shows the abstraction in Figure 6.1 to avoid duplication.

The potential for cumulative effects on groundwater bodies have been considered in a hydrogeological assessment of the groundwater abstractions commissioned by Irish Water (Irish Water, 2022). This hydrogeological assessment considers the abstraction quantities and proximities and concludes that all twelve (Ballingarry, Knockaderry, Ballylongford, Bruree, Charleville, Ennis, Fedamore, Hospital, Lough Graney, Slieve Phelim, Templemore and Tynagh) of the WFD groundwater bodies affected by abstractions have a good quantitative status, therefore, the likelihood of affecting their WFD objectives is low. However, it should be noted that Ballingarry, Knockaderry, Bruree, Charleville and Ennis groundwater bodies have a good quantitative status but are currently 'at risk' of failing the WFD objectives.

There could also be cumulative effects in terms of carbon across the SA Preferred Approach. The whole life carbon estimate (including construction and operation) for the SA Preferred Approach indicates increased contribution to carbon emissions related to carbon embodied in materials used for construction and through operational energy use and water treatment. Generally, in terms of carbon emissions,

increase in carbon emissions can be considered a significant effect, as these add cumulatively across all developments and contribute to the national target for carbon. However, consideration also needs to be given to the additional water supply provided from the options and therefore the overall carbon efficiency in terms of carbon emissions per ML of supply is an appropriate metric and for SA8 this averages as 4.06 tCO_2e/ML (lifetime sum). Mitigation for carbon emissions could include increased sourcing of energy from renewable sources and improving energy efficiency. This could be undertaken alongside leakage reduction and campaigns to raise awareness of measures to reduce water consumption (which in turn would reduce energy consumption). This could include the promotion of water efficient devices and working with planning authorities and developers to encourage new development to be water efficient.

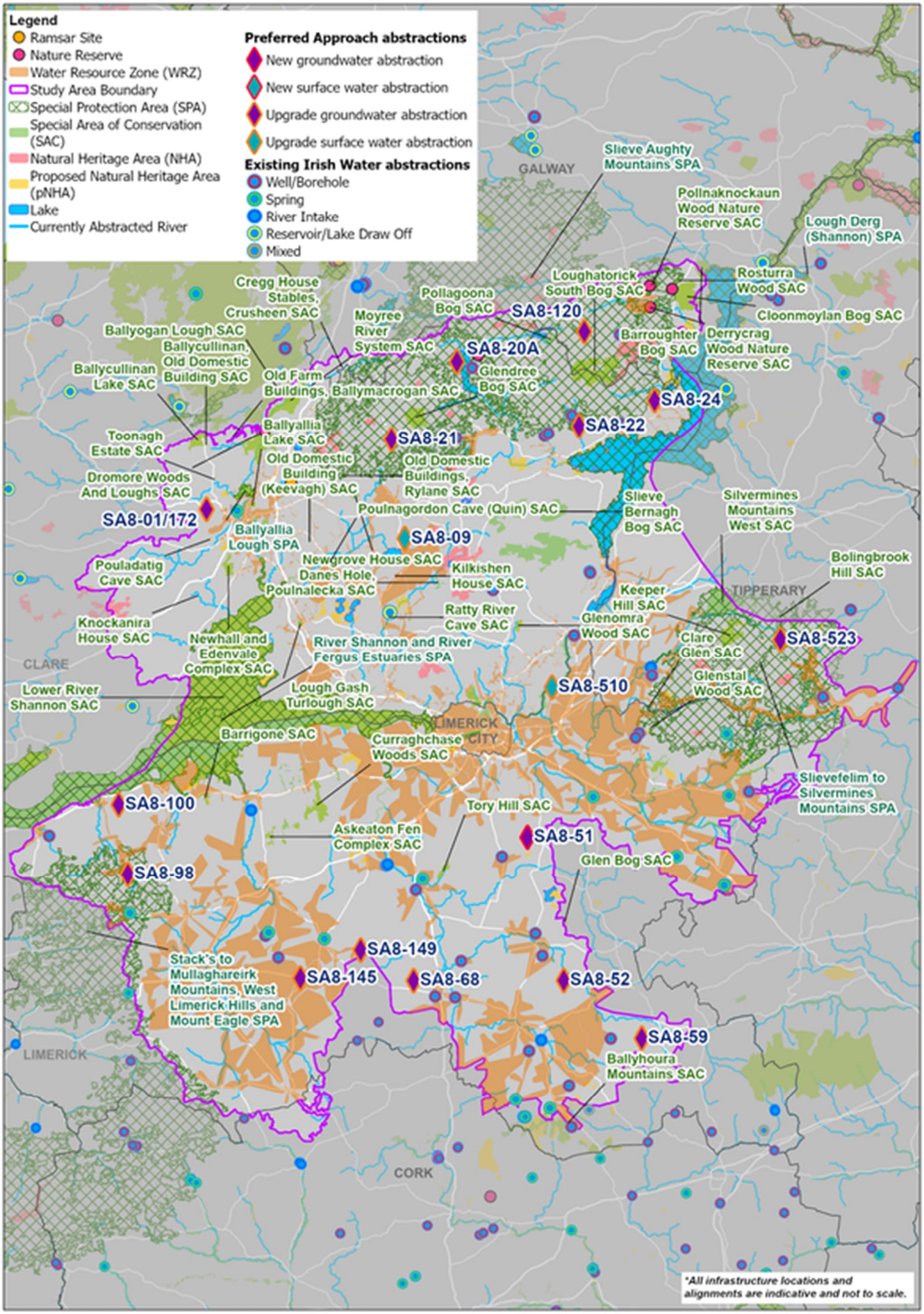

Figure 6.1 SA Preferred Approach Abstractions in SA8

6.2 Cumulative Effects with Other Developments

The SA8 Preferred Approach has been assessed alongside other developments that could occur within the plan area. Potential effects could include increased traffic and noise. These could be mitigated by standard mitigation measures, such as planning of construction traffic routes and informing local residents about the works. With these standard good practice measures in place, there are unlikely to be significant cumulative effects.

Table 6.2 shows that within SA8 there are a number of regeneration and construction projects clustered around Limerick and along N20 and N21 routes. Other developments within SA8 can also be found on myProjectIreland (2020). These individual projects are considered in the cumulative assessment, however, they are represented as and assessed as part of the NPF projects' settlements, such as Limerick, and major routes, such as the N20 and N21, in the table below due to the density of project clusters in those areas.

6.2.1 Cumulative Effects during Construction

The projects near or in Limerick and along N20 and N21 roads could result in cumulative effects with the SA Preferred Approach if they were to be constructed at the same time (represented in Table 6.2 as ‘L’, ‘N20’ and ‘N21’, respectively). Potential effects could include increased traffic and noise to the residential and commercial properties in Limerick or along the two roads. These could be mitigated by standard mitigation measures, such as planning of construction traffic routes and informing local residents about the works. With these standard good practice measures in place, there are unlikely to be significant cumulative effects. There is potential for cumulative effects on cultural heritage assets including archaeological resources related to the total extent of the ground works required, this will need to be considered further as detailed route alignments and site locations are determined along with approaches for more detailed desk studies, investigation and mitigation.

There is potential for cumulative effects from disturbance, habitat degradation, spread of invasive non-native species and pollution impacts on the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA if construction phase of both N21 road projects, Coonagh to Knockalisheen Road and Shannon Crossing/Killaloe projects are concurrent with the SA Preferred Approach (identified as ‘LRS’ and ‘S&F’ in Table 6.2, respectively). The plan level assessment indicates that there is also potential for cumulative effects from disturbance impacts on Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA if construction phase of the SA Preferred Approach (SA8-098) is concurrent with both of the N21 road projects. Both option SA8-098 and N21 Newcastle West Road Scheme/N21 Abbeyfeale Road Scheme are within the boundary of the SPA. SA8-120 has the potential for cumulative effects from pollution impacts during on the Lough Derg (Shannon) SPA. In addition to the four European sites mentioned, if construction phase of the SA Preferred Approach (SA option 16) is concurrent with the N20 Cork to Limerick and Celtic Interconnector projects, there is potential for cumulative effects from habitat degradation on Blackwater River (Cork/Waterford) SAC. With the implementation of mitigations as outlined in section 6.3.3 of the NIS, there will be no adverse cumulative effects on the integrity of any of the SACs or SPAs.

Table 6.2 Potential Cumulative Effects between Preferred Options and Other Developments in SA8

Project Developments	SA8-01 (in conjunction with SA8-172)	SA8-009	SA8-20a	SA8-021	SA8-022	SA8-024	SA8-31a	SA8-120	SA8-051	SA8-052	SA8-059	SA8-068	SA8-179	SA8-098	SA8-100	SA8-177	SA8-149	SA8-145	SA option 12 (Group option 12)	SA option 23 (Group option 23)	SA option 8 (Group option 8)	SA option 10 (Group option 10)	SA option 16 (Group option 16)
N20 Cork to Limerick							L									N20							BR
Celtic Interconnector Project																							BR
N21 Newcastle West Road Scheme/N21 Abbeyfeale Road Scheme	LRS S&F	LRS S&F					LRS S&F L			LRS	LRS	LRS	LRS	SWM	LRS S&F	LRS N21	LRS	LRS	LRS	LRS	LRS	LRS S&F N21	
N21/N69 Limerick to Adare to Foynes Road	LRS S&F	LRS S&F					LRS S&F L			LRS	LRS	LRS	LRS	SWM	LRS S&F	LRS N21	LRS	LRS	LRS	LRS	LRS	LRS S&F N21	
Coonagh to Knockalisheen Road	LRS S&F	LRS S&F					LRS S&F L			LRS	LRS	LRS	LRS		LRS S&F	LRS	LRS	LRS	LRS	LRS	LRS	LRS S&F	
Shannon Crossing/Killaloe	LRS						LRS	LDS		LRS	LRS	LRS	LRS		LRS S&F	LRS	LRS	LRS	LRS	LRS	LRS	LRS	

Key	
Construction Phase	
Operation Phase	
Construction and Operation	
Lower River Shannon SAC	LRS
Lough Derg (Shannon) SPA	LDS
River Shannon and River Fergus Estuaries SPA	S&F
Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA	SWM
Blackwater River (Cork/Waterford) SAC	BR
Limerick	L
M20 Road	M20
N21 Road	N21

6.2.2 Cumulative Effects during Operation

The plan level assessment indicates that there could be cumulative effects on Lower River Shannon SAC from habitat degradation impacts during the operation phase of the SA Preferred Approach (SA8-001, SA8-31a, SA8-177, SA option 8 and SA option 10) and N21/N69 Limerick to Adare to Foynes Road, Coonagh to Knockalisheen Road and Shannon Crossing/Killaloe projects. The Preferred Approach and other developments are all within 1km of the European site, and therefore there may be in-combination effects from disturbance and pollution. With the implementation of standard good practice measures there will be no adverse effects on the integrity of this European site.

There could be cumulative effects in terms of carbon emissions, as all developments will generate carbon emissions from operation whether this is from routine maintenance activities to water treatment and the energy required for moving water. As outlined in section 6.1.2, any increase in carbon can be considered a significant effect, as these add cumulatively across all developments and contribute to the national target for carbon. The same mitigation measures suggested for the SA8 Preferred Approach apply, including increased sourcing of energy from renewable sources and raising awareness of measures to reduce water consumption (which in turn would reduce energy consumption). Working with third parties, including planning authorities and other developers, to identify water efficient measures and joint promotion of water issues would also further mitigate this effect.

7 Strategic Environmental Assessment Summary

7 Strategic Environmental Assessment Summary

SEA objectives have been taken into account at each stage of the approach development process for SA8 and a range of options and SA Approaches have been considered and assessed, including a 'Do Minimum' approach.

Key beneficial impacts assessed include, up to, moderate beneficial impacts for all options associated with increasing resilience and the quality of water supply for local communities; and the subsequent benefits of this for public health.

Key potential adverse impacts identified at plan level include:

- Potential temporary moderate adverse impacts during construction as a result of the SA Preferred Approach being within/adjacent (SA8-001 and 098 SA option 8 and SA option 12) or near (SA8-20a, 120 and 177, and SA option 23) designated sites including Lower River Shannon SAC, Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA, Lough Derg (Shannon) SPA, Slievefelim to Silvermines Mountains SPA and Slieve Aughty Mountains SPA. There is potential for disturbance and loss of/damage to QI/Annex 1 habitats during construction works given that the works are within or near the sites. Potential pollution of watercourses during construction could also affect hydrologically connected habitats. The NIS identifies mitigation measures to avoid AESI for these sites;
- Potential long term or permanent moderate adverse impacts to the Lower River Shannon SAC associated with increase groundwater (SA8-001) and surface water (SA option 10, including SA option 8, 31a and 177) abstractions. There is the potential for changes in water quality (hydrological changes) and changes to the water table availability during operation of the SA Preferred Approach that could impact QI species and habitats of the SAC. The NIS identifies mitigation measures to avoid AESI for these sites;
- Moderate adverse impacts to the resilience of Charleville, Ballingarry, Bruree, Fedamore and Knockaderry groundwater bodies to climate change as new (SA8-051) and increase (SA8-059, 068, 145 and 149) abstractions are required with the SA Preferred Approach. All of the groundwater bodies currently have a good quantitative status. Options SA8-059, 068, 145 and 149 were initially assessed as having potential for major adverse impact against the SEA objective 'protect and improve surface water and groundwater status' based on a conservative high level assessment indicated that groundwater abstraction of these options would be greater than 30% of the recharge Ml/d. However, additional groundwater assessment identifies that an impact on groundwater body quantitative status would be unlikely taking account of additional groundwater information;
- Moderate adverse effects on rural and urban areas near Moroe and Doon (SA option 8) and Limerick and Kildimo (SA option 10) from visual impacts and increase in traffic, noise and dust during construction of the SA8 Preferred Approach. Both of the options include construction of more than 30km of new pipeline; and
- Moderate adverse effects to built and natural assets with SA options 8 and 10 due to the construction of more than 30km of new pipeline.

Cumulative effects assessment identifies potential significant effects in relation to carbon emissions, individual options are assessed as minor beneficial to major adverse in relation to this SEA. This is because potential increases in carbon emissions contribute to national emissions. The average carbon intensity from the individual options provides an indicator for the new options in SA8 but does not provide a complete picture as it does not fully take account of efficiencies from replacement of failing

infrastructure, treatment technology or potential for mitigation, such as use of renewable energy sources in relation to the whole network. Insufficient information is available for the cumulative effects assessment to consider how total study area carbon emissions will change overall and per ML of water.

SEA mitigation identified to address the key adverse impacts identified above include further hydrological or hydrogeological modelling (as appropriate) to further inform understanding of potential impacts on the Lower River Shannon SAC identified as potentially affected by increased abstractions from existing surface and groundwater sources (see the NIS of the Framework Plan for further information). Measures to address the cumulative impact for carbon emissions include sourcing the energy supply from renewable sources. All developments will aim to achieve as far as possible requirements for no net loss in biodiversity or enhancement, as set out in the Biodiversity Action Plan (Irish Water, 2021). There may be potential to also provide opportunities for carbon sequestration with biodiversity enhancement. In addition, there are opportunities to reduce water demand (which in turn would reduce energy and carbon) by raising awareness of water issues, promoting water efficient devices and through leakage reduction.

In general, these are standard mitigation measures with some specific measures and additional requirements for further assessment or monitoring (see the SEA Appendix and the NIS Appendix for AA and SEA standard mitigation measures respectively).

An overall summary assessment, including potential for cumulative and in-combination effects and other measures, identified to be progressed alongside the supply side options is provided in Table 7.1. Key mitigation and proposed monitoring measures are also shown.

Table 7.1 SEA Summary

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
SA Preferred Approach with interim measures as required and a programme of leakage reduction and water conservation measures, taking an adaptive approach to address uncertainty				
1. Protect public health and promote wellbeing	C Minor Adverse to Moderate Adverse O Neutral to Moderate Beneficial The PA is expected to improve overall drinking water quality reliability and sustainability through the decommissioning of failing WTPs and the replacement of abstractions vulnerable to drought conditions. The PA is expected to reduce risks to access of good quality water supply across different conditions and over the plan period.	Standard good construction practice and consultation Further assessment of risks to water quality and consideration of catchment management initiatives to improve water quality and reduce treatment cost. For example, working with landowners and managers on practices to reduce levels of sediment and pollution from entering water courses through run off.	• Level of service, and the frequency and duration of drought orders • Number of days/hours when water supply to people is disrupted due to drought, freeze-thaw or other service/infrastructure issues • Number of public rights of way closures/diversions and length of paths created compared to loss	• Duration of construction works, and number of complaints received regarding construction works • Duration of temporary closures of footpaths and other recreational assets • Number of days where recreational uses of the Murroe Nature Loop, Ballyhourigan Woods Loop, Clare Glens Loop and Glenstal Woods Loop are impeded
2. Protect and enhance biodiversity and contribute to	C Minor Adverse to Moderate Adverse O Neutral to Moderate Adverse Impacts from construction works for pipelines and service reservoirs	Routing/siting to avoid impacts. Standard good construction practice and specific measures as identified in the NIS of the Framework Plan.	• Temporary and permanent habitats lost vs habitats created/enhanced • Site condition and population data for QI of European and	• Monitor construction activities to ensure compliance

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
resilient ecosystems	on biodiversity. These can be minimised through careful routing and siting. Operational impacts on habitats of the River Shannon and River Fergus, River Shannon, River Blackwater and the Kilmastulla River. Potential for construction and operational impacts on European and National designated sites, most notably the Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA, Slievefelim to Silvermines Mountains SPA and Lough Cleggan NHA.	Design to meet no net loss biodiversity or achieve enhancement, where possible, on or off site and in line with the Biodiversity Action Plan objectives. Further hydrological/hydrogeological assessments to determine impacts on designated sites. Operating rules to limit impacts on European and National sites.	National designated sites, including Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA, Slievefelim to Silvermines Mountains SPA and Lough Cleggan NHA.	
3. To protect landscapes, townscapes and visual amenity	C Neutral to Moderate Adverse O Neutral to Moderate Beneficial Construction landscape impacts and long-term impacts from above ground structures, such as new WTPs, rationalisation and the decommissioning of WTPs.	Routing and siting to reduce tree loss and appropriate location and design of above ground structures with landscape planting. Reinstatement of land use and vegetation.	• Total working area of pipelines non-designated landscapes • Land use/landscape features re-established for schemes over appropriate period – areas/km successfully restored to meet requirements	• Duration of construction works • Number of complaints received regarding visual impact of construction works

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
4. Protect and where appropriate enhance, built and natural assets and reduce waste	C Neutral to Moderate Adverse O Neutral New resources required for construction works, including extensive lengths of pipeline, service reservoirs and new/upgraded WTPs. Ongoing maintenance requirements.	Materials management to be integrated into design to optimise use of existing resources and minimise waste from construction and operation.	• Loss of greenfield land, including agricultural, forestry or other land uses • Disruptions to strategic infrastructure/services • Use of waste management plans • Volume of drinking water treatment residuals sent to landfill	• Construction wastes sent to landfill
5. Reduce greenhouse gas emissions	C Neutral to Major Adverse O Neutral to Major Adverse Embodied and operational carbon contribute to national level carbon emission targets. Leakage and water efficiency can contribute to reducing carbon.	Design to minimise embodied carbon emissions and optimise operational efficiency. Seek renewable energy supply sources and optimise use of leakage and water efficiency measures to reduce carbon. Consider offsetting approaches with multiple benefits for water quality, carbon sequestration and linking with other objectives.	• Percentage of energy supply from renewable sources or reduced energy use • Carbon footprint (total tonnes) per year, predicted over plan period, lifetime of schemes and carbon intensity of water resource options (tonnes/Ml/d)	• Carbon footprint (total tonnes) during construction • Operational Carbon Intensity kgsCO2equic/ML

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
6. Contribute to environmental climate change resilience	C Neutral to Moderate Adverse O Moderate Beneficial to Moderate Adverse Abstractions generally reduce environmental resilience but overall improved flexibility for operation using regional schemes has the potential to reduce pressure on at risk local resources. All options, excluding SA8-31a, SA8-179, SA8-177, SA option 8, SA option 10 and SA option 16, require further assessment to understand their sustainability in the longer term.	Consider how operation can further reduce climate change pressure on at risk sources and associated designations, particularly for SA8-051, SA8-059, SA8-068, SA8-149 and SA8-145. Sustainability review of sources taking account of groundwater and surface water interconnections for all options, excluding SA8-31a, SA8-179, SA8-177, SA option 8, SA option 10 and SA option 16.	• WFD waterbody status objectives at risk and designated site condition status • Frequency of drought orders requiring change to normal abstractions/ compensation releases	• None identified
7. Protect and improve surface water and groundwater status	C Neutral O Neutral to Major Adverse Generally, new/increased abstractions are limited to allowable limits and have a low risk of adverse effect on WFD waterbody status objectives, with the potential exception of the River	Further investigation to consider effects on groundwater abstraction on the surface water environment.	• WFD waterbody status objectives at risk	• Pollution incidents during construction • Additional monitoring of River Shannon, and groundwater sources for Martinstown, Bruree, Ballingarry and Rathkeale if needed

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
	Shannon Clareville abstraction and groundwater sources for Martinstown, Bruree, Ballingarry and Rathkeale.			
8. Avoid flood risk	C Neutral to Minor Adverse O Neutral to Minor Adverse Potential loss of flood plain increasing flood risk from construction and location of above ground structures for SA8-001. Also, flood risk impacts on operations with effect on meeting supply.	Siting and design of schemes to take account of flood risk and design for flood risk resilience.	• Number of options at risk of flooding at each AEP level	• Lost time to flooding • Lost time to power supply interruptions
9. Protect and where appropriate, enhance cultural heritage assets	C Neutral to Minor Adverse O Neutral Potential construction impacts on unknown archaeological interest. Impacts on known interests are expected to be avoided.	Standard good practice approaches to minimise potential impacts.	• Number of archaeological assets adversely affected by water resource options • Number of options that are rerouted to avoid cultural heritage impacts • Number of schemes including improvements to access recording of archaeological	• Number of archaeological finds recorded during construction

SEA Objectives	SA Preferred Approach (PA) (SA Approach 1) Residual Effects Including Mitigation C – Construction (Short Term) O – Operational (Long Term)	Mitigation	Monitoring	
			Study Area Level	Scheme Level
			assets or communication/ interpretation of interest features	
10. Protect quality and function of soils	C Neutral to Minor Adverse O Neutral Potential for loss and damage to valuable soils during construction but impacts to geological assets are expected to be avoided.	Standard good practice to conserve and reinstate soils.	• Soil Management Plans implemented • Volume of contaminated land restored, or soils removed	• Total volume of soil removed or reused on site

8

Water Framework Directive Summary

8 Water Framework Directive Summary

Through the options identification and assessment process new options considered have been restricted to those expected to meet estimated sustainability requirements and all options have been assessed based on conservative allowable abstraction constraints. The options identified in SA8 are also expected to be sustainable, based on additional plan-level desk-based assessment, in terms of avoiding deterioration of WFD status or avoiding conflict with meeting WFD objectives.

All groundwater bodies used for the SA8 abstractions have good quantitative status, therefore, the likelihood of affecting their WFD objectives through the increase in abstraction is low. It should be noted that the Ballingarry, Knockaderry, Bruree, Charleville and Ennis GWB's have a good quantitative status but are currently 'at risk' of failing the WFD objectives (Irish Water, 2022). The abstractions are not located in close proximity and the risk of combined effects on groundwater body WFD objectives, or on existing abstractions, are considered low. However, impacts, including cumulative effects with non Irish Water abstractions, will need to be considered in further detail as part of project level consenting to demonstrate both sustainability for any connected surface waterbodies and groundwater dependent habitats and protected areas.

9 Appropriate Assessment Summary

9 Appropriate Assessment Summary

The NIS of the Regional Plan's conclusions for SA8, regarding 'In-combination effects with other plans and projects' and 'In-combination effects between Preferred Options', as set out below and are included in more detail in Appendix E of the NIS for the Regional Plan.

Potential in-combination effects with other projects and plans were identified for the preferred options on the Lower River Shannon SAC, Lough Derg (Shannon) SPA, River Shannon & River Fergus Estuaries SPA, Blackwater River (Cork/Waterford) SAC and Stack's to Mullaghareirk Mountains, West Limerick Hills & Mount Eagle SPA. The potential effects include disturbance, habitat degradation, habitat loss, mortality of QI species and spread of invasive non-native species. However, the assessment concluded that with the mitigation identified there will be no adverse effects on the integrity of the European site in-combination with other plans or projects.

Potential in-combination effects between preferred options were identified for Lower River Shannon SAC, River Shannon & River Fergus Estuaries SPA, Slieve Aughty Mountains SPA and the Slievefelim to Silvermines Mountains SPA if construction of options is concurrent. The potential impacts include habitat loss, habitat degradation, mortality of Qualifying Interest (QI) species, spread of invasive non-native species, hydrological changes and water table impacts, and disturbance. With the implementation of mitigation as detailed in Appendix E of the NIS, there will be no adverse effects on the integrity of European sites.

10 Recommendations for Implementation

10 Recommendations for Implementation

Environmental actions for the implementation plan and the Monitoring Plan are identified in:

- SEA Environmental Report of the Framework Plan – this includes general proposals and standard mitigation requirements (also see SEA Environmental Report Appendix); and
- SEA Environmental Report of the Regional Plan - this includes specific mitigation and monitoring requirements for the Eastern and Midlands Region options and cumulative effects.

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Appendix A Fine Screening Summaries

Key			
0 Neutral	-1 Minor adverse	-2 Moderate Adverse	-3 Major adverse
	1 Minor beneficial	2 Moderate Beneficial	3 Major Beneficial

Table A.1 Fine Screening Summary of Groundwater Options in SA8

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-001	Increase GW abstraction at Drumcliffe Springs (Ennis groundwater body - karstic bedrock) and upgrade Drumcliffe WTP to partly supply deficit									0	0	-11
SA8-002	New GW abstraction/wellfield from Ennis groundwater body (karstic bedrock) and upgrade/new WTP									0	0	-13

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-008	Increase GW abstraction at Crean BH (poorly productive aquifer) and upgrade Broadford WTP to partly supply deficit									1	0	-15
SA8-011	New GW abstraction from Kilkishen groundwater body (karstic bedrock) and new WTP to partly supply deficit									1	0	-19
SA8-20a	Increase GW abstraction from Flagmount BH (poorly productive aquifer) and upgrade existing Flagmount Reservoir Site WTP									0	0	-9
SA8-021	Increase GW abstraction from Feakle public supply new BH (poorly productive aquifer) and upgrade									0	0	-8

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	existing Bauragegaun Pump Station WTP											
SA8-022	Increase GW abstraction from existing BHs (poorly productive aquifer) and upgrade Scarriff WTP									0	0	-7
SA8-024	Increase GW abstraction from existing Mountshannon BH (poorly productive aquifer) and upgrade Cloonmirran Pumphouse WTP									0	0	-8
SA8-028	Increase GW abstraction from existing BH and upgrade Montpelier WTP									0	0	-12
SA8-029	New GW abstraction from O'Briensbridge Gravels groundwater body and upgrade Montpelier WTP									0	0	-12

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-38b	New GW abstraction from Ballyneety groundwater body (karstic bedrock) and new WTP to supply Cappamore and Murroe									2	0	-19
SA8-043	Increase abstraction at Lacka BH (poorly productive aquifer) and upgrade Lacka WTP supply deficit (part/full)									1	0	-12
SA8-044	Increase abstraction at Cooga Spring (poorly productive aquifer) and upgrade Cooga Spring WTP supply deficit (part/full)									1	0	-13
SA8-047	Increase GW abstraction at Pallasgreen Spring (poorly productive aquifer) and upgrade Pallasgreen WTP									0	0	-10

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-48b	New GW abstraction from Pallas Grean groundwater body (productive fissured bedrock) - abstraction point TBC									0	0	-10
SA8-050	Increase GW abstraction at Fedamore BH (Fedamore groundwater body - karstic) and upgrade Fedamore WTP									1	0	-8
SA8-051	New GW abstraction from Fedamore groundwater body (karstic) and upgrade Fedamore WTP/new WTP									1	0	-7
SA8-052	Increase GW abstraction at Finn's Well (poorly productive aquifer) and upgrade Finn's Well WTP									0	0	-7
SA8-053	Increase abstraction at Moloney's BH (poorly									0	0	-7

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	productive aquifer) and upgrade Moloney's Pump Station WTP											
SA8-054	New GW abstraction from Fedamore groundwater body (karstic bedrock) and upgrade GW WTP									0	0	-8
SA8-055	New GW abstraction from Bruree groundwater body (productive fissured bedrock) and upgrade GW WTP									0	0	-8
SA8-059	Increase GW abstraction at Martinstown BH (poorly productive aquifer) and upgrade Martinstown WTP									1	0	-10
SA8-067	Increase GW abstraction at Ballyfookeen BH (Bruree groundwater body - productive fissured									1	0	-11

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	bedrock) and upgrade Rockhill PS WTP											
SA8-068	Increase GW abstraction at Bruee BH (Bruree groundwater body - productive fissured bedrock) and upgrade Bruree PS WTP									1	0	-12
SA8-077	New GW abstraction from Knockaderry groundwater body (productive fissured bedrock) in the vicinity of existing Kilcolman WTP and upgrade WTP to partly supply deficit									1	0	-12
SA8-078	Increase GW abstraction at Clouncagh BH (Knockaderry groundwater body, productive fissured bedrock) and upgrade									1	0	-12

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	existing Clouncagh WTP to partly supply deficit											
SA8-079	Increase GW abstraction from Tobergal Springs (Newcastle West groundwater body - karstic bedrock) and upgrade existing Tobergal WTP to partly supply deficit									0	0	-8
SA8-080	New GW abstraction/wellfield from Newcastle West groundwater body (karstic bedrock)									0	0	-13
SA8-081	New GW abstraction/wellfield from Fedamore groundwater body (karstic bedrock) - abstraction point TBC to									0	0	-14

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	partly supply deficit, new WTP											
SA8-082	New GW abstraction/wellfield from Ballingarry groundwater body (productive fissured bedrock) - abstraction point TBC to partly supply deficit, new WTP									1	0	-15
SA8-083	New GW abstraction/wellfield from Kilmeedy groundwater body (productive fissured bedrock) - abstraction point TBC to partly supply deficit, new WTP									0	0	-13
SA8-090	Increase abstraction at Skagh Well (Tory Hill Fen groundwater body - karstic bedrock) to partly									1	0	-11

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	supply deficit and upgrade existing Skagh Well WTP											
SA8-091	Increase abstraction at Croom Bypass Well (Tory Hill Fen groundwater body - karstic bedrock) to partly supply deficit and upgrade existing Croom Bypass WTP									2	0	-14
SA8-092	New GW abstraction/wellfield from Tory Hill Fen groundwater body (karstic bedrock). New WTP/upgrade existing WTP to supply deficit									1	0	-11
SA8-093	New GW abstraction/well field from Ballingarry groundwater body (productive fissured									1	0	-17

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	bedrock) and new WTP to supply deficit											
SA8-098	Increase GW abstraction from Carrigkerry Spring (poorly productive aquifer) and upgrade Carrigkerry WTP									0	0	-9
SA8-100	Increase GW abstraction from Glin BH (poorly productive bedrock) and upgrade existing Glin WTP									0	0	-9
SA8-102	New GW abstraction/wellfield from Askeaton groundwater body (karstic bedrock) to partly supply deficit. Abstraction point TBC, new WTP									1	0	-20
SA8-103	New GW abstraction/wellfield from									1	0	-18

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	Askeaton North Fens groundwater body (karstic bedrock) to partly supply deficit. Abstraction point TBC, new WTP											
SA8-104	New GW abstraction/wellfield from Kildimo groundwater body (karstic bedrock) to partly supply deficit. Abstraction point TBC, new WTP									1	0	-18
SA8-112	Increase abstraction at Kilfinnane BH (poorly productive aquifer) and upgrade Kilfannane WTP to supply deficit. Better potential for new TW c. 700m north in Rf aquifer									1	0	-11
SA8-120	Increase existing GW									0	0	-7
SA8-125	Bring back old BH at Tulla reservoir site (poorly									0	0	-16

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	productive bedrock) and new WTP to partly supply deficit											
SA8-127	Bring back to use old spring source in Feakle									0	0	-10
SA8-129	Bring back old BH at Scarriff Reservoir site (previously in use - recommission)									0	0	-9
SA8-131	New GW abstraction at reservoir site (poorly productive aquifer)									0	0	-15
SA8-137	Bring back to production old BH at Ardnataggle Reservoir site									0	0	-8
SA8-140	Increase GW abstraction from Ballywilliam BHs (poorly productive groundwater body) and									1	0	-11

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	upgrade Ballygrennan WTP to supply deficit											
SA8-145	Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well)									1	0	-12
SA8-146	New GW abstraction/wellfield to supply deficit									1	0	-13
SA8-149	Increase GW abstraction at Ballingarry Spring (Ballingarry groundwater body - productive fissured bedrock) and upgrade existing Ballingarry Spring WTP to partly supply deficit									1	0	-10
SA8-154	New GW abstraction (poorly productive aquifer), new WTP,									0	0	-13

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	abandon existing sources and WTP											
SA8-159	Increase GW abstraction from O'Gorman's Well or drill new PW close to the existing site. Purchase from existing landowner.									0	0	-7
SA8-163	Increase GW abstraction at Kilcomman (poorly productive aquifer) and upgrade WTP									0	0	-11
SA8-165	Increase GW abstraction at Upperchurch (poorly productive aquifer) and upgrade WTP									0	0	-7
SA8-175	Local GW for Kilcommon									0	0	-10
SA8-186	New GW abstraction from Ballyneety groundwater body (karstic bedrock)									2	0	-19

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	and new WTP to supply Cappamore and Murroe											
SA8-197	Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well) and connect to South West Regional									1	0	-15
SA8-198	Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well) and connect to South West Regional									1	0	-15
SA8-200	New GW abstraction to supply deficit and rationalise O Gorman's well.									0	0	-12

Table A.2 Fine Screening Summary of Group Water Scheme Options in SA8

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-139	Supply deficit from neighboring Carnane GWS (network upgrades required)									0	0	-10
SA8-151	Supply deficit from nearby Kilfinny GWS (approx. distance 2km, new watermains and network upgrades required)									0	0	-9

Table A.3 Fine Screening Summary of Surface Water Options in SA8

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-009	Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit									0	0	-12
SA8-17b	Connect to Ennis and Shannon Sixmilebridge									1	0	-17
SA8-030	New SW abstraction from River Shannon									1	0	-16
SA8-039	New SW abstraction from River Bilboa and new WTP to supply Cappamore and Murroe									1	0	-20
SA8-094	New SW abstraction from River Maigue - abstraction point TBC to supply deficit, upgrade existing WTP/new WTP									0	0	-16
SA8-170b	Upgrade Limerick and supply Adare, Rathkeale,									1	0	-15

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	Ballingarry, South West Regional											
SA8-171	Connect Foynes/Shannon Estuary to Limerick City WRZ									1	0	-18
SA8-177	Rationalise to Limerick City									1	0	-12
SA8-182	Upgrade Limerick and supply Adare, Rathkeale, Ballingarry, South West Regional									1	0	-15
SA8-183	Increase Shannon abstraction and supply Rathkeale and Foynes Shannon									1	0	-18
SA8-187	New SW abstraction from River Bilboa and new WTP to supply Cappamore and Murroe									1	0	-20

Table A.4 Fine Screening Summary of Interconnection Options in SA8

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-15b	Connect Shannon/Sixmilebridge to Limerick City WRZ (increase abstraction at Clareville WTP, network upgrades required for improved connectivity of WRZs)									1	0	-15
SA8-17a	Not in deficit - supply spare capacity to neighboring WRZs									1	0	-15
SA8-17f	Limerick City not in deficit. Upgrade and supply to neighboring WRZs (South West Regional, Foynes Shannon and Adare)									1	0	-18
SA8-084	Limerick City not in deficit. Upgrade and supply to neighboring WRZs (South									1	0	-18

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	West Regional, Foynes Shannon and Adare)											
SA8-105	Limerick City not in deficit. Upgrade and supply to neighboring WRZs (South West Regional, Foynes Shannon and Adare)									1	0	-18

Table A.5 Fine Screening Summary of Rationalisation Options in SA8

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-15a	Rationalise Shannon/Sixmilebridge to Limerick City WRZ									1	0	-16

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	(increase abstraction at Clareville WTP, network upgrades required for improved connectivity of WRZs)											
SA8-17c	Not in deficit - supply spare capacity to neighboring WRZs									1	0	-12
SA8-31a	Rationalise O'Briensbridge WRZ to Limerick City WRZ (approx. distance 2.5km, new watermains and network upgrades required)									1	0	-12
SA8-124	Connect Ennis to Limerick City via Shannon/Sixmilebridge (there is exisitng 400mm connection in place done as part of bypass;									1	0	-17

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	Newmarket to Ennis section currently not in use)											
SA8-148	Rationalise Rathkeale to Foynes/Shannon Estuary WRZ									1	0	-18
SA8-152	Upgrade Limerick and supply Adare, Rathkeale, Ballingarry, South West Regional									1	0	-15
SA8-160	Rationalise Newport to Clareville WTP (distance TBC, new watermains and network upgrades required) (if in deficit)									2	0	-18
SA8-166	Rationalise Upperchurch to Kilcommon WRZ (distance 1km, new watermains and network upgrades required)									0	0	-10

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-185	Rationalise Murroe / Cappamore Foileen to Limerick City WRZ (network upgrades required for improved connectivity of WRZs)									1	0	-12
SA8-188	Limerick City Not in deficit - rationalise neighboring WRZs (Murroe Cappamore Foileen and Doon)									1	0	-13
SA8-189	Limerick City Not in deficit - rationalise neighboring WRZs (Murroe Cappamore Foileen and Doon)									1	0	-13
SA8-190	Limerick City Not in deficit - rationalise neighboring WRZs (Murroe Cappamore Foileen and Doon)									1	0	-13

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-191	Limerick City Not in deficit - rationalise neighboring WRZs (Murroe Cappamore Foileen and Doon)									1	0	-13
SA8-192	Limerick City not in deficit. Upgrade and supply to neighboring WRZs (South West Regional, Foynes Shannon and Adare)									1	0	-18
SA8-193	Upgrade Limerick and supply Adare, Rathkeale, Ballingarry, South West Regional									1	0	-15
SA8-194	Limerick not in deficit - supply spare capacity to Adare									1	0	-11
SA8-195	Upgrade Limerick and supply Adare, Rathkeale, Ballingarry, South West Regional									1	0	-15

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-196	Limerick not in deficit - supply spare capacity to Adare									1	0	-11
SA8-199	Supply spare capacity from Limerick City to neighboring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon									1	0	-13
SA8-17d	Not in deficit - supply spare capacity to neighboring WRZs									1	0	-12
SA8-17e	Supply spare capacity from Limerick City to neighboring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon									1	0	-13
SA8-036	Rationalise Murroe / Cappamore Foileen to Limerick City WRZ									1	0	-12

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	(network upgrades required for improved connectivity of WRZs)											
SA8-040	Supply spare capacity from Limerick City to neighboring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon									1	0	-13
SA8-049	Supply spare capacity from Limerick City to neighboring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon									1	0	-13
SA8-065	Not in deficit - supply spare capacity to neighboring WRZs									0	0	-11
SA8-114	Rationalise Kilfinnane Ardpatrick to Kilmallock WRZ (rationalise to									0	0	-11

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
	Jamestown WTP (Mount Russell BH), approx. distance 4km, network upgrades required)											
SA8-138	Supply spare capacity from Limerick City to neighboring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon									1	0	-13

Table A.6 Fine Screening Summary for New Shannon Source Options in SA8

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-007	Supply Ennis from New Shannon Source via Ennis/Shannon/Sixmilebridge and Limerick City									0	0	-16
SA8-016	Supply Ennis/Shannon/Sixmilebridge from New Shannon Source via Limerick City									0	0	-16
SA8-019	Supply Limerick City from New Shannon Source and offset Clareville WTP to supply neighbouring WRZ									2	0	-18
SA8-027	Rationalise Killaloe WRZ to Newport WRZ via Killaloe bridge									0	1	-18
SA8-089	Supply Newcastle West WRZ from New Shannon Source via Limerick City and Foynes/Shannon Estuary									2	0	-18

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-097	Supply Croom from New Shannon Source via Limerick City and Adare									2	0	-18
SA8-107	Supply Foynes/Shannon Estuary PWS from New Shannon Source via Limerick City WRZ									2	0	-18
SA8-109	Supply Adare from New Shannon Source via Limerick City									2	0	-18
SA8-118	Rationalise Newport to New Shannon Source									0	1	-18
SA8-162	Supply Newport from New Shannon Source									0	0	-9

Table A.7 Fine Screening Summary for WTP Options in SA8

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-173	Not in deficit - Upgrade WTP only									1	0	-9
SA8-178	Not in deficit - Upgrade WTP only									0	0	-7
SA8-179	Not in deficit - Upgrade WTP only									0	0	-7
SA8-180	Not in deficit - Upgrade WTP only									0	0	-7
SA8-184	Not in deficit - Upgrade WTP only									0	0	-9

Table A.8 Fine Screening Summary for Advanced Leakage Reduction Options in SA8

Option Reference	Name	Environmental								Total -3 Scores	Environmental Scoring	
		Population, Health, Economy and Recreation	Water Environment: Quality and Resources	Biodiversity, Flora and Fauna	Material Assets	Landscape and Visual	Climate Change	Culture, Heritage and Archaeology	Geology and Soils		Positive Score - Potential Beneficial Effects	Negative Scores - Potential Adverse Effects
SA8-172	Advanced leakage reduction. This option needs to be implemented in conjunction with a local GW option TG4-SA8-01 or TG4-SA8-02 in order to meet the full deficit.									0	0	-7

Appendix B SA Approaches for SA8

Note: SA Options are also referred to as ‘Group’ options

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 2	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
1900SC0029: Adare	SA8-192 Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-192 Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-109 Supply Adare from New Shannon Source via Limerick City	14
1900SC0017: Athlacca Water Supply	SA8-179 Not in deficit - Upgrade WTP only	-	SA8-179 Not in deficit - Upgrade WTP only	-	SA8-179 Not in deficit - Upgrade WTP only	-
1900SC0035: Ballingarry	SA8-149 Increase GW abstraction at Ballingarry Spring (Ballingarry groundwater body - productive fissured bedrock) and upgrade existing Ballingarry Spring WTP to partly supply deficit	-	SA8-149 Increase GW abstraction at Ballingarry Spring (Ballingarry groundwater body - productive fissured bedrock) and upgrade existing Ballingarry Spring WTP to partly supply deficit	-	SA8-149 Increase GW abstraction at Ballingarry Spring (Ballingarry groundwater body - productive fissured bedrock) and upgrade existing Ballingarry Spring WTP to partly supply deficit	-
1900SC0009: Bruff Water Supply	SA8-052 Increase GW abstraction at Finn's Well (poorly productive aquifer) and upgrade Finn's Well WTP	-	SA8-052 Increase GW abstraction at Finn's Well (poorly productive aquifer) and upgrade Finn's Well WTP	-	SA8-052 Increase GW abstraction at Finn's Well (poorly productive aquifer) and upgrade Finn's Well WTP	-

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 2	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
1900SC0016: Bruree Water Supply	SA8-068 Increase GW abstraction at Bruee BH (Bruree groundwater body - productive fissured bedrock) and upgrade Bruree PS WTP	-	SA8-068 Increase GW abstraction at Bruee BH (Bruree groundwater body - productive fissured bedrock) and upgrade Bruree PS WTP	-	SA8-068 Increase GW abstraction at Bruee BH (Bruree groundwater body - productive fissured bedrock) and upgrade Bruree PS WTP	-
1900SC0037: Murroe/Cappamore/Foileen	SA8-040 & SA8-199 Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon	8	SA8-040 & SA8-199 Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon	8	SA8-036 & SA8-185 Rationalise Murroe / Cappamore Foileen to Limerick City WRZ (network upgrades required for improved connectivity of WRZs)	-
1900SC0020: Carrigkerry Water Supply	SA8-098 Increase GW abstraction from Carrigkerry Spring (poorly productive aquifer) and upgrade Carrigkerry WTP	-	SA8-098 Increase GW abstraction from Carrigkerry Spring (poorly productive aquifer) and upgrade Carrigkerry WTP	-	SA8-098 Increase GW abstraction from Carrigkerry Spring (poorly productive aquifer) and upgrade Carrigkerry WTP	-
1900SC0028: Croom PWS	SA8-177 Rationalise to Limerick City	-	SA8-177 Rationalise to Limerick City	-	SA8-097 Supply Croom from New Shannon Source via Limerick City and Adare	14
1900SC0004: Doon Water Supply	SA8-138 Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon	8	SA8-138 Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon	8	SA8-043 Increase abstraction at Lacka BH (poorly productive aquifer) and upgrade Lacka WTP supply deficit (part/full)	-

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 2	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
0300SC0020: Ennis	SA8-001 & SA8-172 Increase GW abstraction at Drumcliffe Springs (Ennis groundwater body - karstic bedrock) and upgrade Drumcliffe WTP to partly supply deficit. Advanced leakage reduction. SA8-172 leakage option needs to be implemented in conjunction with a local GW option SA8-001 or SA8-002 in order to meet full deficit.	-	SA8-001 & SA8-172 Increase GW abstraction at Drumcliffe Springs (Ennis groundwater body - karstic bedrock) and upgrade Drumcliffe WTP to partly supply deficit. Advanced leakage reduction. SA8-172 leakage option needs to be implemented in conjunction with a local GW option SA8-001 or SA8-002 in order to meet full deficit.	-	SA8-001 & SA8-172 Increase GW abstraction at Drumcliffe Springs (Ennis groundwater body - karstic bedrock) and upgrade Drumcliffe WTP to partly supply deficit. Advanced leakage reduction. SA8-172 leakage option needs to be implemented in conjunction with a local GW option SA8-001 or SA8-002 in order to meet full deficit.	-
0300SC0015: Feakle PWS	SA8-021 Increase GW abstraction from Feakle public supply new BH (poorly productive aquifer) and upgrade existing Bauragegaun Pump Station WTP	-	SA8-021 Increase GW abstraction from Feakle public supply new BH (poorly productive aquifer) and upgrade existing Bauragegaun Pump Station WTP	-	SA8-021 Increase GW abstraction from Feakle public supply new BH (poorly productive aquifer) and upgrade existing Bauragegaun Pump Station WTP	-
1900SC0007: Fedamore Water Supply	SA8-051 New GW abstraction from Fedamore groundwater body (karstic) and upgrade Fedamore WTP/new WTP	-	SA8-051 New GW abstraction from Fedamore groundwater body (karstic) and upgrade Fedamore WTP/new WTP	-	SA8-051 New GW abstraction from Fedamore groundwater body (karstic) and upgrade Fedamore WTP/new WTP	-
0300SC0014: Flagmount PWS	SA8-20a	-	SA8-20a	-	SA8-20a	-

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 2	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
	Increase GW abstraction from Flagmount BH (poorly productive aquifer) and upgrade existing Flagmount Reservoir Site WTP		Increase GW abstraction from Flagmount BH (poorly productive aquifer) and upgrade existing Flagmount Reservoir Site WTP		Increase GW abstraction from Flagmount BH (poorly productive aquifer) and upgrade existing Flagmount Reservoir Site WTP	
1900SC0024: Foynes/Shannon Estuary PWS	SA8-105 Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-105 Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-107 Supply Foynes/Shannon Estuary PWS from New Shannon Source via Limerick City WRZ	14
1900SC0015: Glenosheen/Jamestown/ Kilmallock	SA8-065 Not in deficit - supply spare capacity to neighbouring WRZs	16	SA8-065 Not in deficit - supply spare capacity to neighbouring WRZs	16	SA8-184 Not in deficit - Upgrade WTP only	-
1900SC0022: Glin Water Supply	SA8-100 Increase GW abstraction from Glin BH (poorly productive bedrock) and upgrade existing Glin WTP	-	SA8-100 Increase GW abstraction from Glin BH (poorly productive bedrock) and upgrade existing Glin WTP	-	SA8-100 Increase GW abstraction from Glin BH (poorly productive bedrock) and upgrade existing Glin WTP	-
2900SC0005: Kilcommon	SA8-163 Increase GW abstraction at Kilcomman (poorly productive aquifer) and upgrade WTP	23	SA8-163 Increase GW abstraction at Kilcomman (poorly productive aquifer) and upgrade WTP	23	SA8-175 Local GW for Kilcommon	-
1900SC0034: Kilfinnane	SA8-114	16	SA8-114	16	SA8-112	-

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 2	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
Ardpatrick Water Supply	Rationalise Kilfinnane Ardpatrick to Kilmallock WRZ (rationalise to Jamestown WTP (Mount Russell BH), approx. distance 4km, network upgrades required)		Rationalise Kilfinnane Ardpatrick to Kilmallock WRZ (rationalise to Jamestown WTP (Mount Russell BH), approx. distance 4km, network upgrades required)		Increase abstraction at Kilfinnane BH (poorly productive aquifer) and upgrade Kilfannane WTP to supply deficit. Better potential for new TW c. 700m north in Rf aquifer	
0300SC0024: Killaloe PWS	SA8-027 Rationalise Killaloe WRZ to Newport WRZ via Killaloe bridge	12	SA8-027 Rationalise Killaloe WRZ to Newport WRZ via Killaloe bridge	12	SA8-180 Not in deficit - Upgrade WTP only	-
1900SC0001: Limerick City Environs PWS	SA8-17f Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-17f Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-019 Supply Limerick City from New Shannon Source and offset Clareville WTP to supply neighbouring WRZ	14
1900SC0014: Martinstown Water Supply	SA8-059 Increase GW abstraction at Martinstown BH (poorly productive aquifer) and upgrade Martinstown WTP	-	SA8-059 Increase GW abstraction at Martinstown BH (poorly productive aquifer) and upgrade Martinstown WTP	-	SA8-059 Increase GW abstraction at Martinstown BH (poorly productive aquifer) and upgrade Martinstown WTP	-
0300SC0017: Mountshannon PWS	SA8-024 Increase GW abstraction from existing Mountshannon BH (poorly productive aquifer) and upgrade Cloonmirran Pumphouse WTP	-	SA8-024 Increase GW abstraction from existing Mountshannon BH (poorly productive aquifer) and upgrade Cloonmirran Pumphouse WTP	-	SA8-024 Increase GW abstraction from existing Mountshannon BH (poorly productive aquifer) and upgrade Cloonmirran Pumphouse WTP	-

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 2	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
2900SC0066: Newport RWSS	SA8-118 Rationalise Newport to New Shannon Source	12	SA8-118 Rationalise Newport to New Shannon Source	12	SA8-160 Rationalise Newport to Clareville WTP (distance TBC, new watermains and network upgrades required) (if in deficit)	14
0300SC0019: O'Briensbridge PWS	SA8-31a Rationalise O'Briensbridge WRZ to Limerick City WRZ (approx. distance 2.5km, new watermains and network upgrades required)	-	SA8-31a Rationalise O'Briensbridge WRZ to Limerick City WRZ (approx. distance 2.5km, new watermains and network upgrades required)	-	SA8-31a Rationalise O'Briensbridge WRZ to Limerick City WRZ (approx. distance 2.5km, new watermains and network upgrades required)	-
1900SC0005: Pallasgreen Water Supply	SA8-049 Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon	8	SA8-049 Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon	8	SA8-047 Increase GW abstraction at Pallasgreen Spring (poorly productive aquifer) and upgrade Pallasgreen WTP	-
1900SC0036: Rathkeale	SA8-145 Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well)	-	SA8-145 Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well)	-	SA8-145 Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well)	-
0300SC0016: Scarriff PWS	SA8-022	-	SA8-022	-	SA8-022	-

WRZ	Preferred Approach - SA Approach 1		Least Cost - SA Approach 1		Quickest Delivery - SA Approach 2	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
	Increase GW abstraction from existing BHs (poorly productive aquifer) and upgrade Scarriff WTP		Increase GW abstraction from existing BHs (poorly productive aquifer) and upgrade Scarriff WTP		Increase GW abstraction from existing BHs (poorly productive aquifer) and upgrade Scarriff WTP	
0300SC0006: Shannon/Sixmile bridge	SA8-009 Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit	-	SA8-009 Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit	-	SA8-009 Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit	-
1900SC0019: South West Regional	SA8-084 Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-084 Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-089 Supply Newcastle West WRZ from New Shannon Source via Limerick City and Foynes/Shannon Estuary	14
2900SC0068: Upperchurch	SA8-166 Rationalise Upperchurch to Kilcommon WRZ (distance 1km, new watermains and network upgrades required)	23	SA8-166 Rationalise Upperchurch to Kilcommon WRZ (distance 1km, new watermains and network upgrades required)	23	SA8-165 Increase GW abstraction at Upperchurch (poorly productive aquifer) and upgrade WTP	-
1200SC0036: Woodford	SA8-120 Increase existing GW	-	SA8-120 Increase existing GW	-	SA8-120 Increase existing GW	-

WRZ	Best Environmental - SA Approach 1		Most Resilient - SA Approach 3		Lowest Carbon - SA Approach 4	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
1900SC0029: Adare	SA8-192 Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-178 Not in deficit - Upgrade WTP only	-	SA8-178 Not in deficit - Upgrade WTP only	-
1900SC0017: Athlacca Water Supply	SA8-179 Not in deficit - Upgrade WTP only	-	SA8-179 Not in deficit - Upgrade WTP only	-	SA8-179 Not in deficit - Upgrade WTP only	-
1900SC0035: Ballingarry	SA8-149 Increase GW abstraction at Ballingarry Spring (Ballingarry groundwater body - productive fissured bedrock) and upgrade existing Ballingarry Spring WTP to partly supply deficit	-	SA8-149 Increase GW abstraction at Ballingarry Spring (Ballingarry groundwater body - productive fissured bedrock) and upgrade existing Ballingarry Spring WTP to partly supply deficit	-	SA8-149 Increase GW abstraction at Ballingarry Spring (Ballingarry groundwater body - productive fissured bedrock) and upgrade existing Ballingarry Spring WTP to partly supply deficit	-
1900SC0009: Bruff Water Supply	SA8-052 Increase GW abstraction at Finn's Well (poorly productive aquifer) and upgrade Finn's Well WTP	-	SA8-052 Increase GW abstraction at Finn's Well (poorly productive aquifer) and upgrade Finn's Well WTP	-	SA8-052 Increase GW abstraction at Finn's Well (poorly productive aquifer) and upgrade Finn's Well WTP	-
1900SC0016: Bruree Water Supply	SA8-068 Increase GW abstraction at Bruee BH (Bruree groundwater body -	-	SA8-068 Increase GW abstraction at Bruee BH (Bruree groundwater body -	-	SA8-068 Increase GW abstraction at Bruee BH (Bruree groundwater body -	-

WRZ	Best Environmental - SA Approach 1		Most Resilient - SA Approach 3		Lowest Carbon - SA Approach 4	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
	productive fissured bedrock) and upgrade Bruree PS WTP		productive fissured bedrock) and upgrade Bruree PS WTP		productive fissured bedrock) and upgrade Bruree PS WTP	
1900SC0037: Murroe/Cappamore/Foileen	SA8-040 & SA8-199 Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon	8	SA8-38b & SA8-186 New GW abstraction from Ballyneety groundwater body (karstic bedrock) and new WTP to supply Cappacmore and Murroe	27	SA8-185 & SA8-036 Rationalise Murroe / Cappamore Foileen to Limerick City WRZ (network upgrades required for improved connectivity of WRZs)	-
1900SC0020: Carrigkerry Water Supply	SA8-098 Increase GW abstraction from Carrigkerry Spring (poorly productive aquifer) and upgrade Carrigkerry WTP	-	SA8-098 Increase GW abstraction from Carrigkerry Spring (poorly productive aquifer) and upgrade Carrigkerry WTP	-	SA8-098 Increase GW abstraction from Carrigkerry Spring (poorly productive aquifer) and upgrade Carrigkerry WTP	-
1900SC0028: Croom PWS	SA8-177 Rationalise to Limerick City	-	SA8-177 Rationalise to Limerick City	-	SA8-177 Rationalise to Limerick City	-
1900SC0004: Doon Water Supply	SA8-138 Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon	8	SA8-043 Increase abstraction at Lacka BH (poorly productive aquifer) and upgrade Lacka WTP supply deficit (part/full)	-	SA8-043 Increase abstraction at Lacka BH (poorly productive aquifer) and upgrade Lacka WTP supply deficit (part/full)	-
0300SC0020: Ennis	SA8-001 & SA8-172 Increase GW abstraction at Drumcliffe Springs (Ennis groundwater body - karstic bedrock)	-	SA8-001 & SA8-172 Increase GW abstraction at Drumcliffe Springs (Ennis groundwater body - karstic bedrock)	-	SA8-001 & SA8-172 Increase GW abstraction at Drumcliffe Springs (Ennis groundwater body - karstic bedrock)	-

WRZ	Best Environmental - SA Approach 1		Most Resilient - SA Approach 3		Lowest Carbon - SA Approach 4	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
	and upgrade Drumcliffe WTP to partly supply deficit. Advanced leakage reduction. SA8-172 leakage option needs to be implemented in conjunction with a local GW option SA8-001 or SA8-002 in order to meet full deficit.		and upgrade Drumcliffe WTP to partly supply deficit. Advanced leakage reduction. SA8-172 leakage option needs to be implemented in conjunction with a local GW option SA8-001 or SA8-002 in order to meet full deficit.		and upgrade Drumcliffe WTP to partly supply deficit. Advanced leakage reduction. SA8-172 leakage option needs to be implemented in conjunction with a local GW option SA8-001 or SA8-002 in order to meet full deficit.	
0300SC0015: Feakle PWS	SA8-021 Increase GW abstraction from Feakle public supply new BH (poorly productive aquifer) and upgrade existing Bauragegaun Pump Station WTP	-	SA8-021 Increase GW abstraction from Feakle public supply new BH (poorly productive aquifer) and upgrade existing Bauragegaun Pump Station WTP	-	SA8-021 Increase GW abstraction from Feakle public supply new BH (poorly productive aquifer) and upgrade existing Bauragegaun Pump Station WTP	-
1900SC0007: Fedamore Water Supply	SA8-051 New GW abstraction from Fedamore groundwater body (karstic) and upgrade Fedamore WTP/new WTP	-	SA8-051 New GW abstraction from Fedamore groundwater body (karstic) and upgrade Fedamore WTP/new WTP	-	SA8-051 New GW abstraction from Fedamore groundwater body (karstic) and upgrade Fedamore WTP/new WTP	-
0300SC0014: Flagmount PWS	SA8-20a Increase GW abstraction from Flagmount BH (poorly productive aquifer) and upgrade existing Flagmount Reservoir Site WTP	-	SA8-20a Increase GW abstraction from Flagmount BH (poorly productive aquifer) and upgrade existing Flagmount Reservoir Site WTP	-	SA8-20a Increase GW abstraction from Flagmount BH (poorly productive aquifer) and upgrade existing Flagmount Reservoir Site WTP	-

WRZ	Best Environmental - SA Approach 1		Most Resilient - SA Approach 3		Lowest Carbon - SA Approach 4	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
1900SC0024: Foynes/Shannon Estuary PWS	SA8-105 Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-102 New GW abstraction/wellfield from Askeaton groundwater body (karstic bedrock) to partly supply deficit. Abstraction point TBC, new WTP	-	SA8-102 New GW abstraction/wellfield from Askeaton groundwater body (karstic bedrock) to partly supply deficit. Abstraction point TBC, new WTP	-
1900SC0015: Glenosheen/Jamestown/ Kilmallock	SA8-065 Not in deficit - supply spare capacity to neighbouring WRZs	16	SA8-184 Not in deficit - Upgrade WTP only	-	SA8-065 Not in deficit - supply spare capacity to neighbouring WRZs	16
1900SC0022: Glin Water Supply	SA8-100 Increase GW abstraction from Glin BH (poorly productive bedrock) and upgrade existing Glin WTP	-	SA8-100 Increase GW abstraction from Glin BH (poorly productive bedrock) and upgrade existing Glin WTP	-	SA8-100 Increase GW abstraction from Glin BH (poorly productive bedrock) and upgrade existing Glin WTP	-
2900SC0005: Kilcommon	SA8-163 Increase GW abstraction at Kilcomman (poorly productive aquifer) and upgrade WTP	23	SA8-175 Local GW for Kilcommon	-	SA8-175 Local GW for Kilcommon	-
1900SC0034: Kilfinnane Ardpatrick Water Supply	SA8-114 Rationalise Kilfinnane Ardpatrick to Kilmallock WRZ (rationalise to Jamestown WTP (Mount Russell BH), approx. distance 4km, network upgrades required)	16	SA8-112 Increase abstraction at Kilfinnane BH (poorly productive aquifer) and upgrade Kilfannane WTP to supply deficit. Better potential for new TW c. 700m north in Rf aquifer.	-	SA8-114 Rationalise Kilfinnane Ardpatrick to Kilmallock WRZ (rationalise to Jamestown WTP (Mount Russell BH), approx. distance 4km, network upgrades required)	16

WRZ	Best Environmental - SA Approach 1		Most Resilient - SA Approach 3		Lowest Carbon - SA Approach 4	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
0300SC0024: Killaloe PWS	SA8-027 Rationalise Killaloe WRZ to Newport WRZ via Killaloe bridge	12	SA8-180 Not in deficit - Upgrade WTP only	-	SA8-180 Not in deficit - Upgrade WTP only	-
1900SC0001: Limerick City Environs PWS	SA8-17f Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-173 Not in deficit - Upgrade WTP only	-	SA8-173 Not in deficit - Upgrade WTP only	-
1900SC0014: Martinstown Water Supply	SA8-059 Increase GW abstraction at Martinstown BH (poorly productive aquifer) and upgrade Martinstown WTP	-	SA8-059 Increase GW abstraction at Martinstown BH (poorly productive aquifer) and upgrade Martinstown WTP	-	SA8-059 Increase GW abstraction at Martinstown BH (poorly productive aquifer) and upgrade Martinstown WTP	-
0300SC0017: Mountshannon PWS	SA8-024 Increase GW abstraction from existing Mountshannon BH (poorly productive aquifer) and upgrade Cloonmirran Pumphouse WTP	-	SA8-024 Increase GW abstraction from existing Mountshannon BH (poorly productive aquifer) and upgrade Cloonmirran Pumphouse WTP	-	SA8-024 Increase GW abstraction from existing Mountshannon BH (poorly productive aquifer) and upgrade Cloonmirran Pumphouse WTP	-
2900SC0066: Newport RWSS	SA8-118 Rationalise Newport to New Shannon Source	12	SA8-162 Supply Newport from New Shannon Source	-	SA8-162 Supply Newport from New Shannon Source	-

WRZ	Best Environmental - SA Approach 1		Most Resilient - SA Approach 3		Lowest Carbon - SA Approach 4	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
0300SC0019: O'Briensbridge PWS	SA8-31a Rationalise O'Briensbridge WRZ to Limerick City WRZ (approx. distance 2.5km, new watermains and network upgrades required)	-	SA8-31a Rationalise O'Briensbridge WRZ to Limerick City WRZ (approx. distance 2.5km, new watermains and network upgrades required)	-	SA8-31a Rationalise O'Briensbridge WRZ to Limerick City WRZ (approx. distance 2.5km, new watermains and network upgrades required)	-
1900SC0005: Pallasgreen Water Supply	SA8-049 Supply spare capacity from Limerick City to neighbouring WRZs, rationalising Cappamore Murroe, Pallasgreen and Doon	8	SA8-047 Increase GW abstraction at Pallasgreen Spring (poorly productive aquifer) and upgrade Pallasgreen WTP	-	SA8-047 Increase GW abstraction at Pallasgreen Spring (poorly productive aquifer) and upgrade Pallasgreen WTP	-
1900SC0036: Rathkeale	SA8-145 Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well)	-	SA8-145 Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well)	-	SA8-145 Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well)	-
0300SC0016: Scarriff PWS	SA8-022 Increase GW abstraction from existing BHs (poorly productive aquifer) and upgrade Scarriff WTP	-	SA8-022 Increase GW abstraction from existing BHs (poorly productive aquifer) and upgrade Scarriff WTP	-	SA8-022 Increase GW abstraction from existing BHs (poorly productive aquifer) and upgrade Scarriff WTP	-
0300SC0006: Shannon/Sixmile bridge	SA8-009 Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit	-	SA8-009 Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit	-	SA8-009 Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit	-

WRZ	Best Environmental - SA Approach 1		Most Resilient - SA Approach 3		Lowest Carbon - SA Approach 4	
	Option Description	SA Option	Option Description	SA Option	Option Description	SA Option
1900SC0019: South West Regional	SA8-084 Limerick City not in deficit. Upgrade and supply to neighbouring WRZs (South West Regional, Foynes Shannon and Adare)	10	SA8-079 Increase GW abstraction from Tobergal Springs (Newcastle West groundwater body - karstic bedrock) and upgrade existing Tobergal WTP to partly supply deficit	-	SA8-079 Increase GW abstraction from Tobergal Springs (Newcastle West groundwater body - karstic bedrock) and upgrade existing Tobergal WTP to partly supply deficit	-
2900SC0068: Upperchurch	SA8-166 Rationalise Upperchurch to Kilcommon WRZ (distance 1km, new watermains and network upgrades required)	23	SA8-165 Increase GW abstraction at Upperchurch (poorly productive aquifer) and upgrade WTP	-	SA8-165 Increase GW abstraction at Upperchurch (poorly productive aquifer) and upgrade WTP	-
1200SC0036: Woodford	SA8-120 Increase existing GW	-	SA8-120 Increase existing GW	-	SA8-120 Increase existing GW	-

WRZ	Best Appropriate Assessment - SA Approach 4	
	Option Description	SA Option
1900SC0029: Adare	SA8-178 Not in deficit - Upgrade WTP only	-
1900SC0017: Athlacca Water Supply	SA8-179 Not in deficit - Upgrade WTP only	-

WRZ	Best Appropriate Assessment - SA Approach 4	
	Option Description	SA Option
1900SC0035: Ballingarry	SA8-149 Increase GW abstraction at Ballingarry Spring (Ballingarry groundwater body - productive fissured bedrock) and upgrade existing Ballingarry Spring WTP to partly supply deficit	-
1900SC0009: Bruff Water Supply	SA8-052 Increase GW abstraction at Finn's Well (poorly productive aquifer) and upgrade Finn's Well WTP	-
1900SC0016: Bruree Water Supply	SA8-068 Increase GW abstraction at Bruee BH (Bruree groundwater body - productive fissured bedrock) and upgrade Bruree PS WTP	-
1900SC0037: Murroe/Cappamore/Foileen	SA8-185 & SA8-036 Rationalise Murroe / Cappamore Foileen to Limerick City WRZ (network upgrades required for improved connectivity of WRZs)	-
1900SC0020: Carrigkerry Water Supply	SA8-098 Increase GW abstraction from Carrigkerry Spring (poorly productive aquifer) and upgrade Carrigkerry WTP	-
1900SC0028: Croom PWS	SA8-177 Rationalise to Limerick City	-
1900SC0004: Doon Water Supply	SA8-043	-

WRZ	Best Appropriate Assessment - SA Approach 4	
	Option Description	SA Option
	Increase abstraction at Lacka BH (poorly productive aquifer) and upgrade Lacka WTP supply deficit (part/full)	
0300SC0020: Ennis	SA8-001 & SA8-172 Increase GW abstraction at Drumcliffe Springs (Ennis groundwater body - karstic bedrock) and upgrade Drumcliffe WTP to partly supply deficit. Advanced leakage reduction. SA8-172 leakage option needs to be implemented in conjunction with a local GW option SA8-001 or SA8-002 in order to meet full deficit.	-
0300SC0015: Feakle PWS	SA8-021 Increase GW abstraction from Feakle public supply new BH (poorly productive aquifer) and upgrade existing Bauragegaun Pump Station WTP	-
1900SC0007: Fedamore Water Supply	SA8-051 New GW abstraction from Fedamore groundwater body (karstic) and upgrade Fedamore WTP/new WTP	-
0300SC0014: Flagmount PWS	SA8-20a Increase GW abstraction from Flagmount BH (poorly productive aquifer) and upgrade existing Flagmount Reservoir Site WTP	-
1900SC0024: Foynes/Shannon Estuary PWS	SA8-102	-

WRZ	Best Appropriate Assessment - SA Approach 4	
	Option Description	SA Option
	New GW abstraction/wellfield from Askeaton groundwater body (karstic bedrock) to partly supply deficit. Abstraction point TBC, new WTP	
1900SC0015: Glenosheen/Jamestown/ Kilmallock	SA8-065 Not in deficit - supply spare capacity to neighbouring WRZs	16
1900SC0022: Glin Water Supply	SA8-100 Increase GW abstraction from Glin BH (poorly productive bedrock) and upgrade existing Glin WTP	-
2900SC0005: Kilcommon	SA8-175 Local GW for Kilcommon	-
1900SC0034: Kilfinnane Ardpatrick Water Supply	SA8-114 Rationalise Kilfinnane Ardpatrick to Kilmallock WRZ (rationalise to Jamestown WTP (Mount Russell BH), approx. distance 4km, network upgrades required)	16
0300SC0024: Killaloe PWS	SA8-180 Not in deficit - Upgrade WTP only	-
1900SC0001: Limerick City Environs PWS	SA8-173 Not in deficit - Upgrade WTP only	-
1900SC0014: Martinstown Water Supply	SA8-059 Increase GW abstraction at Martinstown BH (poorly productive aquifer) and upgrade Martinstown WTP	-

WRZ	Best Appropriate Assessment - SA Approach 4	
	Option Description	SA Option
0300SC0017: Mountshannon PWS	SA8-024 Increase GW abstraction from existing Mountshannon BH (poorly productive aquifer) and upgrade Cloonmirran Pumphouse WTP	-
2900SC0066: Newport RWSS	SA8-162 Supply Newport from New Shannon Source	-
0300SC0019: O'Briensbridge PWS	SA8-31a Rationalise O'Briensbridge WRZ to Limerick City WRZ (approx. distance 2.5km, new watermains and network upgrades required)	-
1900SC0005: Pallasgreen Water Supply	SA8-047 Increase GW abstraction at Pallasgreen Spring (poorly productive aquifer) and upgrade Pallasgreen WTP	-
1900SC0036: Rathkeale	SA8-145 Increase GW abstraction at Kilcolman Spring and upgrade existing Kilcolman WTP to supply deficit (new artesian well)	-
0300SC0016: Scarriff PWS	SA8-022 Increase GW abstraction from existing BHs (poorly productive aquifer) and upgrade Scarriff WTP	-
0300SC0006: Shannon/Sixmilebridge	SA8-009 Increase abstraction at Castle Lake and upgrade Castle Lake WTP to supply deficit	-

WRZ	Best Appropriate Assessment - SA Approach 4	
	Option Description	SA Option
1900SC0019: South West Regional	SA8-079 Increase GW abstraction from Tobergal Springs (Newcastle West groundwater body - karstic bedrock) and upgrade existing Tobergal WTP to partly supply deficit	-
2900SC0068: Upperchurch	SA8-165 Increase GW abstraction at Upperchurch (poorly productive aquifer) and upgrade WTP	-
1200SC0036: Woodford	SA8-120 Increase existing GW	-