Winter 2023

Regional Water Resources Plan South East

Appendix 2 Study Area L Technical Report

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.

Baseline data included in the RWRP-SE 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 Uisce Éireann data sets. Data sources will be detailed in the relevant sections of the RWRP-SE. 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 – Study Area L

This is the Technical Report for Study Area L which applies the Options Assessment Methodology, as set out in the National Water Resources Plan - Framework Plan (NWRP-FP), the final version of which was reviewed by the authors of this Technical Report Prior to finalisation of this Technical Report. This document should be reviewed in conjunction with the Framework Plan and the Regional Water Resources Plan – South East (RWRP-SE), which explain key concepts and terminology used throughout the report.

This Study Area includes 10 water resource zones of which 2 are in County Carlow, 7 are in County Kilkenny and 1 is in County Wexford. This Technical Report includes:

- The summary of Identified Need in this Study Area including Quality, Quantity, Reliability and Sustainability;
- Options considered within the Study Area;
- The range of approaches to resolve Identified Need;
- Development of an Outline Preferred Approach for the Study Area; and
- The adaptability of our Preferred Approach.

The Preferred Approach for this Study Area feeds into the regional Preferred Approach detailed in the RWRP-SE.

1.1 Summary of Our Options Assessment Methodology

In Chapter 8 of the Framework Plan, we described the Option Assessment Methodology that will be used to develop a national programme of proposed solutions for all of our water supplies. The objective of these solutions is to resolve the needs identified through the Supply Demand Balance (SDB), Water Quality, Reliability and Sustainability assessments. These needs will be discussed in further detail in this report. In the RWRP-SE, we apply this methodology to the South East Region shown in Figure 1.1.

As outlined in Section 1.9.4 of the Framework Plan, the regional boundaries have been delineated for the purpose of delivering the National Water Resources Plan. As a National Plan, sources outside the delivery region may be considered to meet need within a particular region.

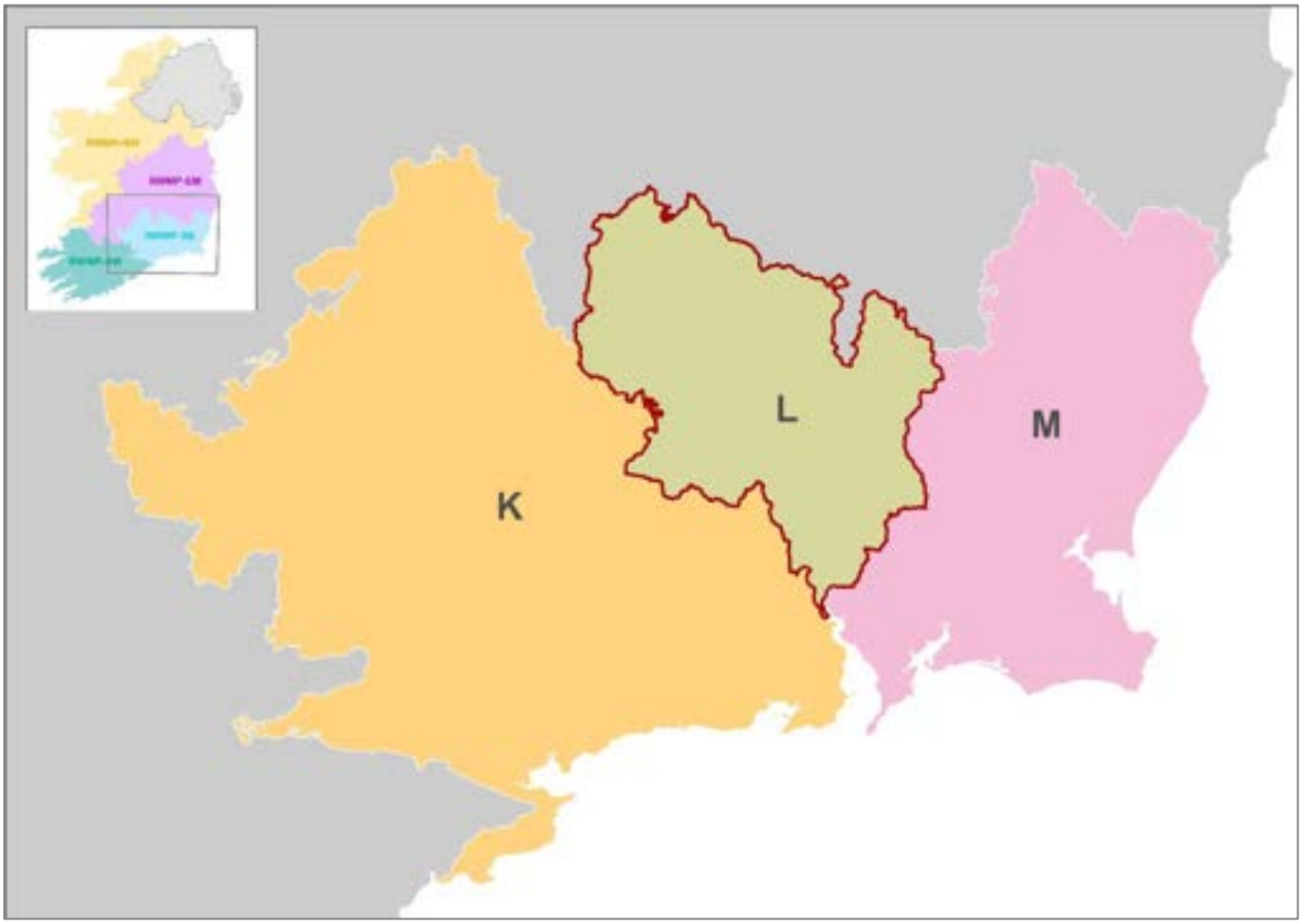

Figure 1.1 Overview of Study Areas within the South East Region.

This Technical Report is for Study Area L (SAL), which consists of 10 individual water resource zones (WRZs). Within this Study Area, the Preferred Approach has been developed following the process shown in Figure 1.2 and as outlined in Section 8.3 of the Framework Plan.

In this document, Option codes are labelled using the following naming convention: SAX-00X

- SAX refers to the Study Area within which the option is located.
- 00X refers to the individual option number.
- Any references to TG3 refers the South East Region (Regional Group 3).

It should be noted that assessments and preferred approaches and solutions at this stage are at a plan level. Environmental impacts and costing of projects are further reviewed at project level. No statutory consent or funding consent is conferred by inclusion in the national plan. Any projects that are progressed following this plan will require individual environmental assessments, including Environmental Impact Assessment and Appropriate Assessment (as required), in support of planning applications (where a project requires planning permission) or in support of licencing applications (for example, for new abstractions). Any such applications will also be subject to public consultation.

Figure 1.2 Option Assessment Methodology Process

1.2 Introduction to the Study Area

SAL consists of 10 WRZs supplying a population of approximately 53,617 people via approximately 714 kilometres of distribution network. The majority of the Study Area is in County Kilkenny, with small eastern parts crossing into County Carlow and Wexford. Kilkenny City is the largest demand centre, with other notable towns including New Ross and Thomastown. The sources of water supply consist of 7 surface water abstractions and 9 groundwater abstraction sites. The Study Area's water treatment plants (WTPs) and their associated source type are summarised in Figure 1.3. and Table 1.1.

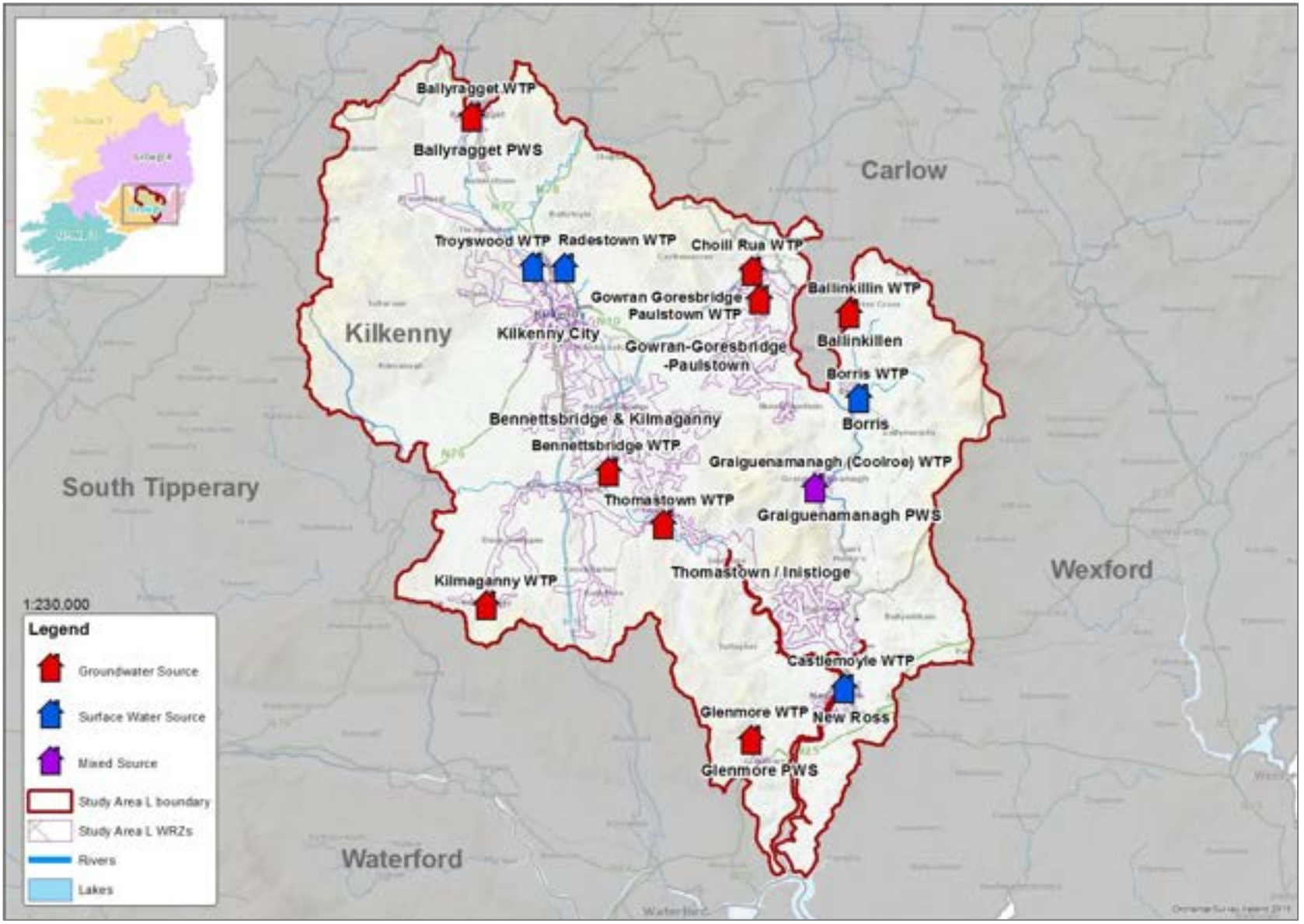

Figure1.3 SAL Water Supply Study Area

Regarding surface water availability in the Study Area, SAL is split between the River Barrow and River Nore catchments. The Barrow and Nore are two of the largest rivers in Ireland, with catchment areas of 3,025 km^2 and 2,595 km^2, respectively. Along with the Suir, these three principal rivers are known as the 'Three Sisters' and drain the South East region of the country. The Barrow rises in the Slieve Bloom Mountains in County Laois, flowing a distance south before crossing into SAL at Muine Bheag, turning tidal at Saint Mullins, being joined by the Nore at Ringwood before flowing through New Ross into the Suir Estuary at Cheekpoint. The Nore rises on the slopes of Borrisnoe Mountain in County Tipperary, flowing south east into SAL around Durrow, traveling through Kilkenny City, turning tidal at Inistioge, before its confluence with the Barrow. Both rivers are designated as part of the large River Barrow and River Nore Special Area of Conservation (SAC). Furthermore, three sub-catchments of the Barrow are designated for *Margaritifera* (Freshwater Pearl Mussel) SAC catchment: Mountain, Ballymurphy and Aughavaud.

Around 80% of the existing water supplies to SAL come from surface water sources, with these comprised from some large river abstractions from the Nore system, and some smaller volumes taken from the Barrow catchment. The Kilkenny City WRZ, by far the largest WRZ in the Study Area, has 3no. river abstractions: an intake from the main Nore channel near Kilkenny City feeds Troyswood WTP to supply up to 23,413 m^3/day; whilst two smaller abstractions from the River Dinin sub-catchment feed Radestown WTP to supply up to 7,000 m^3/day. In the south east of the Study Area, within the Barrow system, abstractions from the River Pollmounty and Dranagh Impoundment sources feed the Castlemoyle WTP to supply up to 3,600 m^3/day to New Ross WRZ. Elsewhere within the Barrow catchment in the north east of the Study Area, the Mountain River source supplies up to 400 m^3/day to Borris WRZ, and the Duiske River is combined with groundwater sources to supply up to 185 m^3/day to Graiguenamanagh PWS WRZ.

Overall, 9 groundwater sources are managed by Uisce Éireann in the region. The predominant aquifer type of the area is made up of poorly productive bedrock (69%), followed by karstic (19%), productive fissured (7%) and sand and gravel (5%). Groundwater provides around 60% of the drinking water supply in Kilkenny, highlighting its importance as a developable resource here. The region's larger groundwater supplies mainly occur in the limestones and gravels.

The poorly productive rocks consist of a combination of Namurian Shales and Sandstones, Granites, Ordovician Metasediments and Dinantian Upper Impure Limestones. This class of rocks will often yield enough water to supply a house or small farm (0.2-0.5 l/s) and occasionally in major fracture zones may yield a good deal more. However, since the yield often depends on the permeability developed in the uppermost few metres of broken and weathered rock, yields will often decrease markedly in dry spells as the water table falls, and these supplies may therefore be unreliable. The Granites, which feature in the south east of the county, are characterised by the absence of an intergranular permeability and the presence of low fissure permeability. Although fractured the Ordovician rocks generally have a low permeability and are mostly regarded as a poor aquifer. The Namurian rocks can often result in groundwaters high in iron, manganese and hydrogen sulphide. This can be from contamination but more often results from a combination of natural iron sulphide within the shalier elements coupled with slow groundwater circulation.

The karst forms a key regionally important aquifer in some areas. The pure bedded limestones make up a relatively minor proportion of the bedrock in this Study Area. The distribution of permeability and yield is more homogenous where the development of karst has resulted in a more diffuse network of flow pathways. This provides a slightly more reliable flow regime than conduit dominated aquifers, however these karstic environments are still prone to pollution from point sources such as septic tanks, disposal sites and land spreading. Previous groundwater exploration in the area showed the productive limestone zones to be relatively localised and associated with areas of dolomitization Some trial well drilling in this setting has indicated the potential for large (> 1 MLD) abstractions, such as at Gowran-Goresbridge-Paulstown and Bausheenmore. Often the wells may be sites proximal to high permeability fractures at depth, resulting in the larger yields. The regionally important aquifers are generally smaller in extent in this part of the country and are banded by locally important, less permeable bedrock.

The productive fissured bedrock and sand and gravel aquifers make up a relatively small proportion of the areas for potential groundwater development. The Rf aquifer comprises a relatively thin band of Devonian Kiltorcan-type Sandstones running through the centre of the Study Area. There are a number of locally important sand and gravel aquifers in the region, namely at Bennetsbridge and Thomastown and a large gravel body stretching northwards from Kilkenny city which remains largely underdeveloped. The gravel wells at Bennetsbridge are capable of supplying approximately 2,850 m^3/day. When overlying lesser productive aquifers such as at Thomastown, the gravels can provide baseflow and storage to the aquifer as well as a degree of protection from surface contaminants.

Table 1.1 provides an overview of the risk of failure against the Quality, Quantity, Reliability and Potential Sustainability criteria. A further breakdown of these scores is provided in Section 2.

Table 1.1 Study Area L

Clare	**Total Population**	53,617	**Total Network Length (km)**	714	**Number of Water Resource Zones**		10
Counties in Study Area	Carlow, Kilkenny, Wexford						
Principal Settlements	Kilkenny, New Ross, Thomastown, Lawcus-Stoneyford, Graiguenamanagh-Tinnahinch, Freshford, Bennetsbridge, Ballyragget, Kells, Gowran, Goresbridge, Paulstown, Inistioge, Ballyhale, Knocktopher, Borris, Kilmoganny						
Number of Water Sources	16	**Surface Water Sources**	7		**Groundwater Sources**	9	
Water Treatment Plant	**Source**	**Population**	**WTP Capacity (m^3/day)**	**Quality**	**Quantity**	**Reliability**	**Potential Sustainability**
Castlemoyle WTP	River Pollmounty, Dranagh impoundment	8,035	3,600	●	●	●	●
Choill Rua WTP	Groundwater	266	39	●	●	●	●
Kilmaganny WTP	Groundwater	329	160	●	●	●	●
Thomastown WTP	Groundwater	2,850	2,500	●	●	●	●
Troyswood WTP	River Nore	14,561	23,413	●	●	●	●
Radestown WTP	River Dinan, River Douglas	15,275	7,000	●	●	●	●
Water Treatment Plant	**Source**	**Population**	**WTP Capacity (m^3/day)**	**Quality**	**Quantity**	**Reliability**	**Potential Sustainability**

Graiguenamanagh (Coolroe) WTP	River Duiske, Groundwater	1,462	185	●	●	●	●
Gowran Goresbridge Paulstown WTP	Groundwater	2,211	1,100	●	●	●	●
Glenmore WTP	Groundwater	140	91	●	●	●	●
Bennetsbridge WTP	Groundwater	4,893	3,280	●	●	●	●
Ballyragget WTP	Groundwater	1,306	1,240	●	●	●	●
Ballinkillen WTP	Groundwater	103	25	●	●	●	●
Borris WTP	Borris WTP (Mountain River intake)	562	400	●	●	●	●

Score	Uisce Éireann Asset Standard Assessment	Priority
●	Low Risk	Low Priority Asset
●	Medium Risk	Priority 2 Asset
●		
●	High Risk	Priority 1 Asset

2 Scoping the Study Area

2 Scoping the Study Area

In this chapter we summarise the current and future issues with water supplies in Study Area L, in terms of water quality, quantity, reliability and sustainability.

To identify the issues and corresponding need with the water supplies in this Study Area, and to inform the nature, scale and scope of the solutions that we need to consider to meet them, we have assessed:

- The **water quality** that we can supply;
- The **water quantity** that we can supply;
- The **reliability** of our existing supplies; and
- Additional information that impacts the long-term **sustainability** of our sources or infrastructure.
-

2.1 Water Quality

We assess the water quality investment needs of our water supplies by assessing the performance of our assets against the barriers set out in Chapter 5 of the Framework Plan. As set out in Chapter 5 of the Framework Plan, Uisce Éireann is developing scientifically robust datasets to assign risk. Uisce Éireann are utilising the well-established 'Failure Mode Effect Analysis' which provides a step-by-step approach for identifying all possible failure modes that can result in a potentially hazardous event. Once identified, we assess risk against the existing controls (Barriers), which we have in place for source protection within our water treatment plants and networks. This Barrier Assessment process highlights where there is a deficit or potential for future deficit in these controls or treatment process elements.

The barriers are an internal gauge and the initial desktop assessments of barrier performance for SAL are summarised in Table 2.1.

Table 2.1 Quality: Barrier Scores

Quality: Barrier Scores				
Water Treatment Plants	**Barrier 1: Bacteria & Virus**	**Barrier 2.1: Maintain chlorine Residual in the Network**	**Barrier 3 Protozoa (Crypto) Asset Potential**	**Barrier 6b THM's Leading Indicator**
Castlemoyle WTP	●	●	●	●
Choill Rua WTP	●	●	●	●
Kilmaganny WTP	●	●	●	●
Thomastown WTP	●	●	●	●
Troyswood WTP	●	●	●	●
Radestown WTP	●	●	●	●
Graiguenamanagh (Coolroe) WTP	●	●	●	●
Gowran Goresbridge Paulstown WTP	●	●	●	●

Quality: Barrier Scores				
Water Treatment Plants	**Barrier 1: Bacteria & Virus**	**Barrier 2.1: Maintain chlorine Residual in the Network**	**Barrier 3 Protozoa (Crypto) Asset Potential**	**Barrier 6b THM's Leading Indicator**
Glenmore WTP	●	●	●	●
Bennetsbridge WTP	●	●	●	●
Ballyragget WTP	●	●	●	●
Ballinkillen WTP	●	●	●	●
Borris WTP	●	●	●	●

Score	Uisce Éireann Asset Standard Assessment	Priority
●	Low Risk	Low Priority Asset
●	Medium Risk	Priority 2 Asset
●		
●	High Risk	Priority 1 Asset

The colour coding within the outline assessment indicates the severity of the potential barrier deficit, and the priority in terms of addressing the identified issues. However, it should be noted that the table is not an indicator of non-compliance with the European Union (Drinking Water) Regulations 2014 as amended (Drinking Water Regulations), but an assessment of the asset capability standard compared with the asset standard set out in Section 5.7 of the Framework Plan.

Based on the barrier assessment, 11 of the 13 Water Treatment Plants in the Study Area appear to have significant deficits, particularly in relation to secondary disinfection (Barrier 2.1). However, in some cases our desktop assessments can over-estimate risk, particularly when there is little available data on the catchment characteristics of our raw water sources. As our "Source to Tap" Drinking Water Safety Plan (DWSP) assessments are developed for each water supply, the barrier scores for all of our supplies will be updated and become more reliable.

It should be noted that 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 our asset base (human and structural) through resource planning, to ensure that we can address potential risks or emerging risks to our supplies.

At present, there is one WRZ within SAL on the Environmental Protection Agency (EPA) Remedial Action List (RAL), Kilkenny City (Radestown).

Uisce Éireann is currently progressing immediate corrective action in advance of the NWRP for a number of supplies within SAL. A national programme to improve disinfection standards (Barrier 1) at water

treatment facilities across Ireland was initiated by Uisce Éireann in 2016. Details of the 'in progress' projects to address critical water quality requirements are included in Table 2.2.

Table 2.2 Critical Water Quality Requirements SAL

Critical Water Quality Requirements	Progress
1. Kilkenny City: Currently Kilkenny City & Environs is serviced by two separate water treatment plants (WTPs) at Radestown and Troyswood. The existing Radestown WTP provides for slow sand filtration followed by disinfection but is unable to remove THM precursors and is currently on the EPA's Remedial Action (RAL) list. The existing Troyswood WTP also requires a significant upgrade to provide robust water treatment facilities. In addition, the raw water intake at Troyswood is inaccessible in periods of flooding. The existing WTPs also have inadequate capacity to cater for future growth in Kilkenny City & Environs. It is proposed to increase capacity at the treatment plant at Troyswood and it will become the primary water treatment plant facility for Kilkenny City. A new 2.9 km watermain from Troyswood to the Radestown site will connect to the existing service reservoirs and enable the Radestown WTP to be decommissioned. These works will ensure a safe, secure and reliable water supply for Kilkenny City and its surrounding areas. The project will ensure that the water supply is removed from the Environmental Protection Agency (EPA) Remedial Action List (RAL). The project will also enable future growth and development in the city and surrounding areas.	**Ongoing**
2. Bennetsbridge Water Treatment Plant Upgrade: The Water Treatment Plant upgrade at Bennetsbridge has provided a more advanced water treatment process, improving the drinking water quality. This upgrade has safeguarded the water supply for the people of Bennetsbridge by providing a barrier protection against cryptosporidium. Delivery of this project has removed the area off the EPA's Remedial Action List (RAL).	**Complete**
3. Site Assessment Groundwater Programme identified for the following Water Resource Zones: • Graiguenamanagh PWS • Bennetsbridge & Kilmaganny • New Ross	**Need Identified**
4. Reservoir Cleaning Programme: A major reservoir cleaning programme has been undertaken at 7 sites, which has reduced network water quality issues.	**Complete**

Critical Water Quality Requirements	Progress
5. Disinfection Programme: In 2016, Uisce Éireann completed a nationwide review of all water treatment plants where disinfection upgrades were required, followed by a programme of works to deliver the required upgrades. To date, the disinfection programme has completed upgrade works at 8 of the 13 WRZs in SAL, based on assessed priority basis. • Ballinkillen WTP • Borris WTP • Ballyragget WTP • Bennetsbridge WTP • Glenmore WTP • Gowran Goresbridge Paulstown WTP • Graiguenamanagh WTP (Coolroe WTP) • Choill Rua Paulstown WTP Any requirements within the remaining 5 supplies will be identified via Drinking Water Safety Plans with solutions developed as part of the NWRP.	**Complete**

In summary, in relation to water quality Uisce Éireann will:

- Continually update Barrier Performance issues in the WRZ which have the potential to impact on drinking water quality in the region;
- Improve these assessments through the development of DWSPs for all of our supplies;
- Address the priority risks identified on the EPA Remedial Action List (noting that steps have already been taken, and are ongoing, to address these risks); and
- All residual need (grey dots) in relation to water quality will be brought through our options assessment process.

2.2 Water Quantity – Supply Demand Balance

Uisce Éireann assess the water quantity investment needs of our supplies by developing SDB calculations for each of our water supplies as summarised in Chapter 3, 4 and 6 of the Framework Plan. The calculations are used to assess the amount of water available in our supplies and compare that to the current and forecast demand for water in accordance with Figure 2.1.

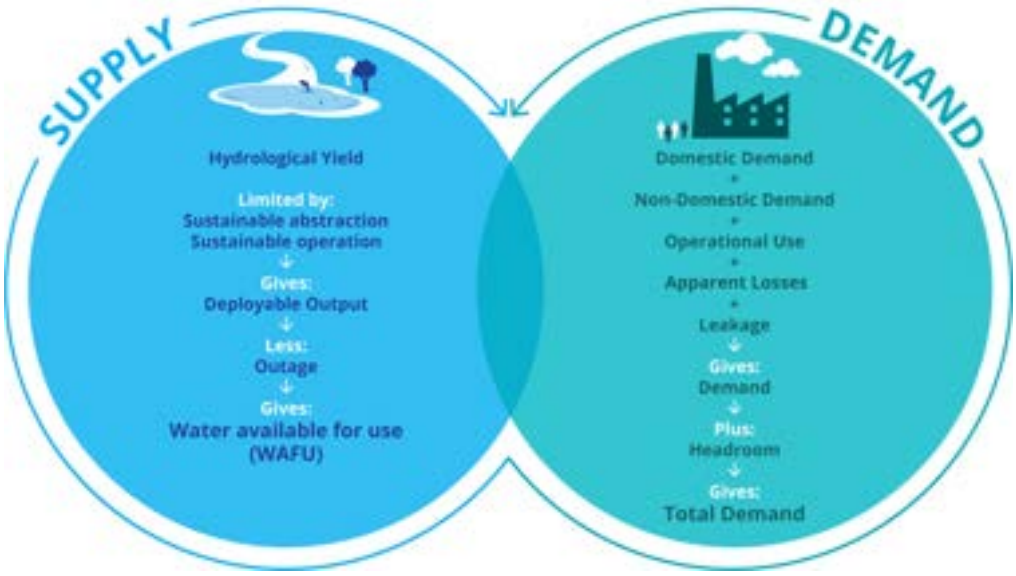

Figure 2.1Supply Demand Balance

For each of the 10 WRZs in this Study Area, we assessed the baseline SDB and developed 25-year forecasts of supply and demand, in accordance with Figure 2.1.

The SDB assessments were carried out for each of the weather event planning scenarios (Normal Year Annual Average, Dry Year Annual Average, Dry Year Critical Period, Winter Critical Period) which described in Chapter 2 of the Framework Plan. The SDB deficits in SAL manifest in the following ways:

1. **Inappropriate standards and levels of risk for a strategic water supply**: As water supply is essential for public health, regulated water service providers must ensure appropriate standards of water supply which are able to endure drought conditions, peak events, and maintenance of our assets. This requires reserve capacity in our supplies. At present, not all supplies within this Study Area meet the required levels of reserve capacity. However, due to the lack of historical monitoring, particularly in relation to groundwater supplies, some of the deficits may be data driven.

2. **Day to day operations:** At present, in the dry year critical period scenario 6 out of 10 of the WRZs in SAL have a current deficit and 7 out of 10 have a projected SDB deficit (based on a “do minimum” approach). During recent dry periods, particularly during the summer of 2018 and 2020 when water conservation orders were implemented, a number of the supplies in SAL were impacted. In 2018 both Radestown and Borris WTPs were impacted by low flows which required low flow interventions. Similar measures were also required for Radestown in 2020. In 2021 the infiltration gallery at Bennetsbridge WTP dried up resulting in the loss of the main water source and the reliance upon the boreholes. This is an inherent on-going risk during prolonged dry weather periods. Similarly, the bedrock aquifer in which the production wells are sited generally have low storage capacity. Alternative additional sources require investigation where sources/schemes are seemingly at or near capacity.

A summary of the SDB deficit across all 10 WRZs is summarised in Table 2.3. The SDB for each WRZ is included in Appendix L of the Framework Plan.

The water resources zones are detailed in Appendix L of the Framework Plan - Supply Demand Balance Summaries.

Table 2.3 WRZ SDB Dry Year Critical Period Deficits

Water Resource Zone Name	Water Resource Zone code	Population	Maximum Deficit m^3/day					
			2019	2025	2030	2035	2040	2044
New Ross	3300SC0025	8,035	-873	-933	-988	-1,043	-1,098	-1,142
Bennetsbridge & Kilmaganny	1500SC0020	5,222	-1,049	-1,219	-1,336	-1,392	-1,436	-1,472
Thomastown / Inistioge	1500SC0017	4,475	-387	-447	-496	-530	-560	-583
Graiguenamanagh PWS	1500SC0013	1,462	-366	-374	-385	-396	-407	-416
Gowran-Goresbridge-Paulstown	1500SC0012	2,477	-119	-134	-148	-163	-177	-189
Ballyragget PWS	1500SC0007	1,306	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Kilkenny City	1500SC0003	29,836	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Glenmore PWS	1500SC0002	140	-29	-30	-31	-32	-32	-33
Ballinkillen	0100SC0010	103	No Deficit	No Deficit	No Deficit	No Deficit	-1	-1
Borris	0100SC0009	562	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit

As outlined in Chapter 4 of the Framework Plan, the estimated population currently living in each WRZ has been based on the 2016 Census data. Forecasts for future populations have been based on draft growth projections from the National Planning Framework (NPF), and updated information from the Regional Spatial and Economic Strategies (RSES) and Local Authority Planning sections (where available).

The target levels of service in the region were applied in each case, along with the corresponding requirements for reserves, indicating that our supplies are operating with a cumulative SDB deficit of approximately 2,822m^3/day for the Study Area. As a result, while we can continue to supply water, the water supplies in this area may come under pressure, particularly in drought conditions. In addition, there may be ongoing reliability issues.

This situation will further deteriorate over time due to climate change driven reductions in water resources, together with increased demand due to population growth. If we do nothing, the SDB deficit is estimated to increase to approximately 3,836 m^3/day by 2044.

Our ongoing activities to improve the Supply Demand Balance in SAL are prioritised as:

- Ongoing leakage management including active leakage control, pressure management and find and fix activities to meet target levels of Leakage.
- Water Conservation measures, including information campaigns and initiatives, and Water Conservation Orders during drought periods.

2.3 Water Supply Reliability

The benefits of having sufficient water supplies in terms of quality and quantity are negated if we cannot distribute the water we produce effectively around our networks. We also need sufficient treated water storage to enable us to respond to planned or unplanned outages on our trunk main and distribution networks.

There are a number of problematic distribution and trunk mains throughout SAL. Uisce Éireann and the Local Authority Water Services sections will continue to monitor the performance of all water mains in the network to ensure that the most problematic mains are replaced as required.

During our needs assessment for SAL, Uisce Éireann has identified a number of critical requirements for upgrades to the existing asset base, including storage and trunk main requirements. Progress to date on these projects is summarised in Table 2.4.

Table 2.4 SAL Critical Infrastructure Projects and Need Identification

Critical Requirement	Progress
1. Gowran Regional Water Supply Scheme: The project includes the construction of a new water treatment plant, reservoir, rising mains, development of two abstraction boreholes. This project will also improve the quality and security for nine housing estates and a nursing home which are currently operating wells which have been subject to Boil Water Notices in the past.	**Planned**
2. Kilkenny City Leakage Reduction Programme: Leakage Reduction Programme works were completed in Kilkenny City in 2020, replacing aging watermains across the city. Smaller scale works have also been completed at Troyswood WTP, which replaced an outdated pressure regulation valve that was causing major pressure issues across the network. These works have now mitigated against unplanned water supply outages, high levels of leakage and repair costs.	**Completed**
3. Distribution Network Repairs and Upgrades: Rolling programme of active leakage control, pressure management, find and fix and network upgrades	**In Progress**

In summary, there are some asset reliability issues across the distribution network within the WRZs. Some critical infrastructural projects, outlined in Table 2.4, to address these issues have been identified and are in progress. In addition to this, a continuous programme of repairs, upgrades and leakage reduction is being progressed as part of Uisce Éireann National Leakage Reduction Programme across all Study Areas.

2.4 Water Supply Sustainability

The water supplies within the region were developed over time to address the needs of the local populations and to support growth and development. As outlined at Section 3.7.2 of the Framework Plan, the Government is currently developing new legislation dealing with water abstractions. While at the end of 2022, the government passed the Water Environment (Abstractions and Impoundments) Act, 2022, it has not yet commenced and the associated regulations and guidelines (which will further detail the types of assessment and national methodology to be used) are not yet in place. As this legislation is still being developed, we do not have full visibility of the future regulatory regime. We have therefore not progressed through a theoretical licencing process on a site-by-site basis and cannot reliably include an estimation of sustainable abstraction within the SDB calculations. Instead, we use the hydrological yield, water treatment capacity and bulk transfer limitations in our calculation of DO. This assessment procedure is set out at Appendix C of the Framework Plan and is in line with a precautionary approach.

To understand the potential impact of the Abstraction Legislation on the SAL supplies, we have assessed the potential impacts on our 7 no. surface water abstractions: Mountain River intake (Borris), Duiske Intake (Graiguenamanagh PWS), River Dinan (Kilkenny City), River Douglas (Kilkenny City), River Nore (Kilkenny City), River Pollmounty (New Ross), and Dranagh (New Ross).

Table 2.5 presents the findings of this assessment in order to indicate the potential reductions to abstraction that may be required at our existing surface water supplies and the potential changes to our

SDB. The table presents our current abstraction levels[1], our source hydrological yield[2], and the estimated sustainable abstraction[3] amount which the source may be limited to in the future.

Based on this initial assessment, the volumes of water abstracted at River Dinan, River Douglas, River Pollmounty and Dranagh may not meet sustainability guidelines during dry weather flows. However, under the proposed regulatory regime, this will be adjudicated by the EPA. We have assumed, given the need to maintain supplies, that a transition to new abstraction quantities would likely take place in the medium term.

Table 2.5 Comparison of Current Abstraction, Hydrological Yield and Theoretical Future Abstraction

Source (WRZ)	Current abstraction (m^3/day)	Hydrological yield (m^3/day)	Theoretical future abstraction limit (m^3/day)
Mountain River intake (Borris)	367	8,674	994
Duiske Intake (Graiguenamanagh PWS)	170	2,541	592
River Dinan (Kilkenny City)	6,417	4,768	2,107
River Douglas (Kilkenny City)		466	131
River Nore (Kilkenny City)	21,462	151,276	36,404
River Pollmounty (New Ross)	3,300	696	482
Dranagh (New Ross)		7,512	1,769

The potential change to the SDB for each WRZ, as a result of these potential reductions in abstraction during Dry Weather Flow are summarised in Table 2.6.

Table 2.6 Potential Change to SDB Based on Potential Abstraction Reductions

Source (WRZ)	Potential change in SDB[4] (m^3/day)
Mountain River intake (Borris)	None
Duiske Intake (Graiguenamanagh PWS)	None
River Dinan (Kilkenny City)	None
River Douglas (Kilkenny City)	

[1] Based on WTP 22hr (DYCP) capacity
[2] Our hydrological yield estimate is the 'safe' yield calculated to be available during a 1 in 50 year drought event. We use this figure in the SDB calculations to determine whether a WRZ is projected to be in deficit or surplus
[3] Our sustainable or 'allowable' abstraction estimate is based on limiting abstraction to 5-15% of the Q95 low flow for river sources or 10% of Q50 inflow for lakes. This is based on our best understanding of how the EPA may enforce future abstraction licencing applying UKTAG guidance.
[4] Based on the potential changes to the projected WRZ supply demand balance (SDB) figure for the dry year critical period (DYCP) 2044 future scenario.

Source (WRZ)	Potential change in SDB[4] (m^3/day)
River Nore (Kilkenny City)	
River Pollmounty (New Ross)	-1,429
Dranagh (New Ross)	

The net impact of these potential minimum environmental flow requirements has been assessed using the outline assessment methodology described in Appendix C of the Framework Plan. Groundwater abstractions will need to conform to the proposed new abstraction licencing regime. These abstractions will be assessed in two ways:

- Impacts on the groundwater bodies from which they abstract; and
- Impact of the groundwater abstraction on the base flow in surface waterbodies.

As noted in Section 3.2.2 of the Framework Plan, producing robust desktop assessments of water availability from our existing groundwater abstractions is very difficult. Ideally, yield estimates would be based on a three-dimensional assessment of the geology within the vicinity of the supply, supplemented with long term records on pumping and drawdown of water levels over many years. Uisce Éireann does not have this type of information available for most of our groundwater supplies and while we will aim to complete site-specific studies of groundwater availability, this may take many years.

On an interim basis Uisce Éireann has developed an initial assessment for existing abstractions based on best available information. For more information, please see Appendix C Supply Assessment and Appendix G Regulatory and Licensing Constraints of the NWRP - Framework Plan. Over the coming years, Uisce Éireann will work with the environmental regulator EPA and the Geological Survey of Ireland, to develop desktop and site investigation systems to better understand the sustainability of our groundwater sources. We are not in a position to estimate changes to the groundwater availability until better data is available.

In summary, when considering the requirements of the Water Framework Directive (WFD), some of our schemes may be subject to reductions in abstraction, especially during drought periods. While we have developed a potential understanding of the impact of the legislation, we cannot reliably include an estimation of sustainable abstraction within the SDB calculations. However, we do use our sustainable abstraction estimations to assess the sensitivity of the Preferred Approach as set out in Chapter 7 of this Technical Report. This assessment determines whether the Preferred Approach is adaptable to change across a range of potential future scenarios and verifies our ability to adapt and increases our resilience to future changes.

When the new Legislation on abstraction of water has been enacted and regulatory assessments completed if an abstraction is confirmed to be affecting a waterbody status the Supply Demand Balance will be updated as outlined in the monitoring and feedback section of the RWRP, Section 9.2.2. All future abstractions considered through the Framework Plan options assessment are validated for sustainability, including options to increase abstraction at existing sites.

2.5 Water Resource Zone Needs Summary

Study Area L has issues in relation to quality, quantity, reliability and sustainability which must be addressed as part of the Preferred Approach to future water resources planning, summarised in Table 2.7.

Table 2.7 Summary of Need Quality, Quantity, Reliability, Sustainability

Quality	Upgrades required to water treatment plants
Quantity	Net leakage reduction 321 m³/day in the region Additional Leakage Targets of 3,831 m³/day to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500 m³/d Interim additional supplies of 2,822 m³/day within 10 years Total of 3,836 m³/day additional supplies beyond the 10-year horizon
Reliability	Continued network upgrades and improvements in the bulk and distribution networks and storage
Sustainability	It is not envisaged that there are sustainability issues with the volumes abstracted at Mountain River intake (Borris), Duiske Intake (Graiguenamanagh PWS), and River Nore (Kilkenny City). Based on this initial assessment, the volumes of water abstracted at River Dinan (Kilkenny City), River Douglas (Kilkenny City), River Pollmounty (New Ross), and Dranagh (New Ross) may not meet sustainability guidelines during dry weather flows. However, under the proposed regulatory regime, this will be adjudicated by the EPA. Over the coming years, Uisce Éireann will work with the environmental regulator EPA and the Geological Survey of Ireland, to develop desktop and site investigation systems to better understand the sustainability of our groundwater sources.

All of these needs will be considered within our options assessment process and in the development of the Preferred Approach.

Further details of planned, live and recently completed projects are available on our website see: https://www.water.ie/projects-plans/our-projects/

3 Solution Types Considered in Study Area L

3 Solution Types Considered in Study Area L

In this chapter, we summarise the type of solutions we have considered to address identified need for treated drinking water supply in Study Area L.

As outlined in Chapter 7 of the Framework Plan, we consider measures across the following three pillars: **Lose Less**, **Use Less** and **Supply Smarter** in forming our list of unconstrained options, which are assessed for short, medium and long-term solutions. For SAL as part of our unconstrained options, the following options have been reviewed.

3.1 Leakage Reduction

The Leakage reduction measures across the public water supply considered for SAL are based on what we 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 (NRR); and
- Net leakage reductions targets listed in Table 3.1 have been applied to 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 WRZs with demand in excess of 1,500 m^3/day, see Table 3.1.

Table 3.1 SELL Targets for WRZ in SAL

WRZ	Net Leakage Reduction applied to SDB(m^3/day)	Additional leakage Targets to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m^3/day (m^3/day)	Total Leakage Targets (m^3/day)
New Ross		531	531
Bennetsbridge & Kilmaganny		1,295	1,295
Thomastown / Inistioge		667	667
Kilkenny City	321	1,313	1,634
Glenmore PWS		25	25

3.2 Water Conservation

At present, Uisce Éireann is conducting pilot studies in relation to water conservation stewardship in businesses and is actively pursuing Conservation Education Awareness Campaigns and partnerships. During drought conditions in 2018 and 2020, a Water Conservation Order was implemented in order to protect our water supplies and reduce pressure on the natural environment during this period. We will continue to promote 'Water Conservation Activities', collecting and monitoring data over a number of years to assess the benefits. As part of the NWRP – Framework Plan, we have not applied reductions to the SDB deficit for unquantifiable water conservation gains, however as stipulated within the Consultation Report prepared in relation to the NWRP- Framework Plan, UÉ will progress pilot studies on water conservation measures. Based on the outcomes of these studies, we may include such factors in future iterations of our NWRP. However, we do assume that any gain will offset consumer usage growth factors.

3.3 Supply Smarter

The supply options considered as part of the options development are unconstrained by distance from SAL and include:

- Stand-alone groundwater options, across the region
- Stand-alone surface water options, across the region
- Transfers
- Rationalisations
- Water Treatment Plant Upgrades for water quality purposes

4 Option Development SAL

4 Option Development for Study Area L

This chapter describes how our options assessment methodology was applied to produce a Feasible Options list to meet the identified needs.

The purpose of our options assessment process, as outlined in Chapter 8 of the Framework Plan, is to consider the widest practicable range of solutions to resolve identified need within a given area. A suitable screening criterion is then applied to filter out any options that are not feasible, based on sustainability (environmental and social impacts), resilience or deliverability. As sustainability is at the heart of our plan, 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 even before screening begins to ensure the protection of the environment. For example, having regard to WFD objectives, Uisce Éireann does not allow for any inter-catchment raw water transfers due to the high risk of transferring invasive non-native species (INNS) between catchments and non-compliance with WFD objectives.

The options assessment screening process involves the following:

- Developing a long list of unconstrained options – the maximum possible list of unscreened options for water supply, not limited by cost or feasibility;
- Coarse Screening – We filter the unconstrained options using a coarse screening assessment where we remove any options that fail to meet desktop assessment criteria under: Resilience, Deliverability and Flexibility or Sustainability (Environmental and Social Impacts); and
- Fine Screening – We filter the remaining options from the coarse screening exercise through a fine screening assessment, which includes 33 detailed questions, related to environmental objectives identified for the SEA (including biodiversity, the water environment, and requirements under climate change adaptation) as well as Resilience, Deliverability and Progressibility.

The coarse screening and fine screening questions, and the associated scoring criteria, are included in Chapter 3 and Appendix A of the Study Area Environmental Report.

4.1 Developing a List of Unconstrained Options

At the start of our screening process, we conduct a specialist desktop review of groundwater bodies and surface water catchments. This allows us to understand potential additional availability at existing water abstractions or to identify any potential new water sources within the Study Area; as summarised in Table 4.1.

Table 4.1 Desktop Assessments for Unconstrained Options

Existing and New Ground Water sources	A Hydrogeologist conducts a desktop groundwater availability assessment of all potential aquifers and aquitards within, and within a reasonable distance of, the study area.
Existing and New Surface Water sources and Conjunctive Use Options	A Hydrologist carries out a desktop surface water availability assessment of all potential catchments and waterbodies within, and within a reasonable distance of, the study area.
Water Treatment upgrades, Desalination, Rationalisation and Effluent Reuse Options	An Engineer reviews any potential increases in capacity at existing water treatment sites and any potential conjunctive use or effluent reuse options.

Based on these desktop assessments, Uisce Éireann developed an initial list of unconstrained options for new supplies and increases and upgrades to existing supplies and assets. An unconstrained options review workshop was then held with our Local Authority Partners to identify any additional unconstrained options that may be available based on local knowledge. A total list of unconstrained options was then compiled.

For SAL, 88 Unconstrained Options were identified to address need. These unconstrained options were not limited by cost, distance from the area or feasibility. These options are summarised in Table 4.2 and shown spatially in Figure 4.1.

Table 4.2 SAL Unconstrained Options

No. of Options	Option Type
30	Groundwater
23	Surface Water
8	Transfers
25	Rationalisation
2	Upgrade WTP (WQ only)

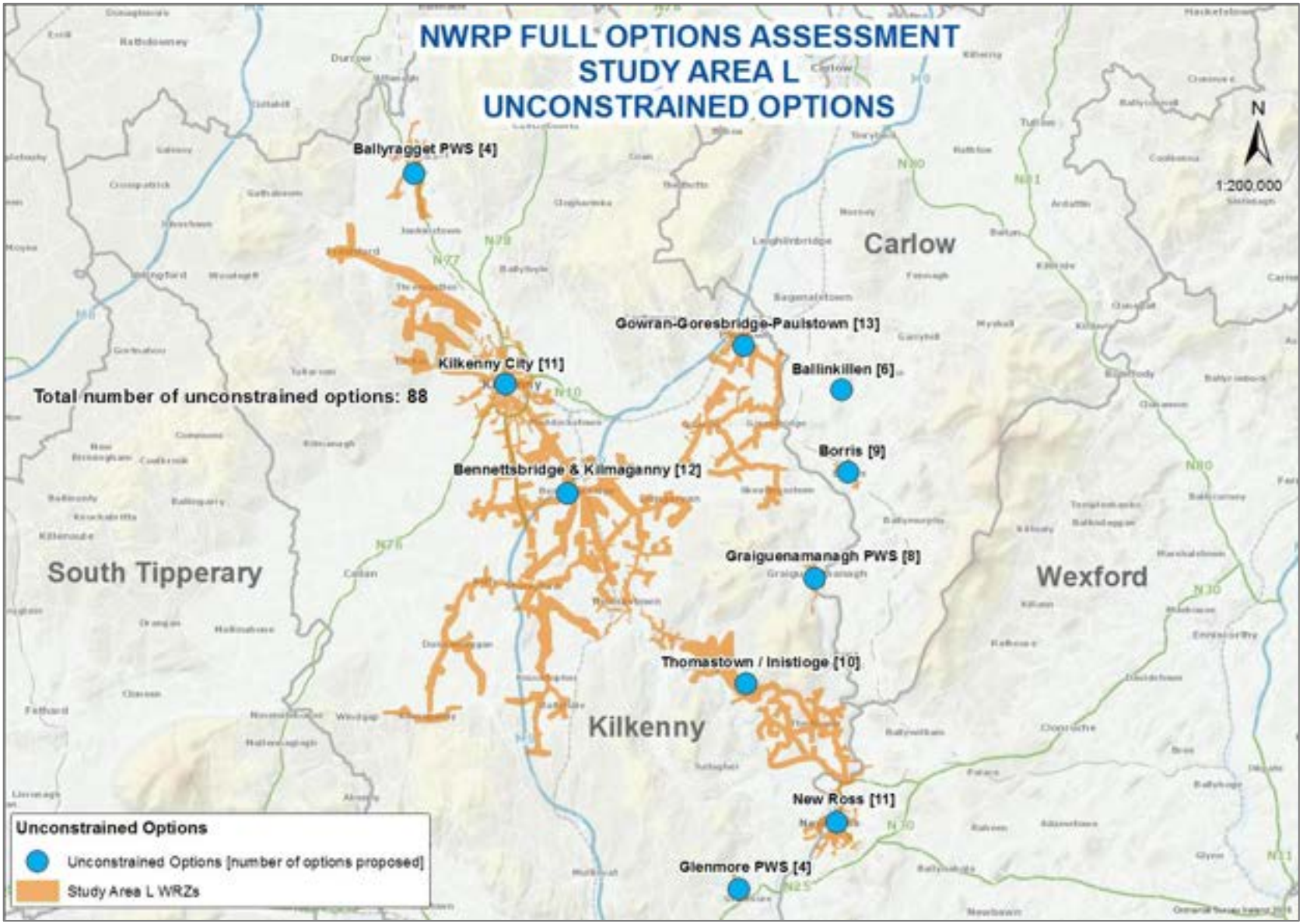

Figure 4.1 SAL Unconstrained Options

The 88 options were filtered through our screening process to eliminate those with potentially unviable environmental impacts or feasibility issues. This process is summarised below.

4.2 Coarse Screening

The 88 identified Unconstrained Options were assessed through Coarse Screening against the criteria of:

- Resilience;
- Deliverability and Flexibility; and
- Sustainability (Environmental and Social Impacts).

The Coarse Screening process is summarised in Chapter 8 of the Framework Plan. The Coarse Screening assessments were conducted by a specialist team, including Engineers, Hydrologists, Hydrogeologists, Ecologists, and Environmental Scientists.

25 Unconstrained Options were rejected at this stage as they were found to be unviable in relation to one or more assessment criteria. Details of these options and the justification for their rejection are outlined in the rejection summary, Annex B of this report. The rejection summary records the criteria against which the rejected options were assessed as having a 'red' score for the purposes of the coarse screening exercise (as explained in more detail in Chapter 8 of the framework plan), and accordingly were not brought forward at the coarse screening phase. The box below provides an example of a rejection justification for an option considered for Kilkenny City WRZ in study area L.

Example Rejected Option

Option SAL-058

Increase abstraction from River Dinan and River Douglas and upgrade Radestown WTP to supply deficit.

Rejection Reason

No scope to increase abstraction at Radestown WTP.

The rejected options are summarised in Annex B of this technical report. Annex B records the criteria against which the rejected options were assessed as having a "red" score for the purposes of the coarse screening exercise (as explained in more detail in Chapter 8 of the Framework Plan), and accordingly were not brought forward at the coarse screening stage. The options remaining after Coarse Screening are summarised by type in Table 4.3.

The remaining 63 options were progressed to further assessment through the Fine Screening process.

Table 4.3 SAL Remaining Options after Course Screening

No. of Options	Option Type
23	Groundwater
11	Surface Water
7	Transfers
20	Rationalisation
2	Upgrade WTP (WQ only)

4.3 Fine Screening

The 63 remaining options were subject to a more detailed multi-criteria assessment (MCA) at the Fine Screening Stage using desktop assessments of performance against 33 specified questions relating to Sustainability (Environmental and Social Impacts), Resilience, Deliverability and Progressibility. These questions are set out in Appendix N of the Framework Plan. The assessment for each option was based on an objective assessment with uniform scoring criteria, based on best publicly available datasets.

At Fine Screening stage, no further options were rejected, with the remaining 63 options considered to be feasible and brought forward to desktop outline design and costing. These are summarised in Table 4.4 and shown spatially in Figure 4.2.

Table 4.4 SAL Remaining Options after Fine Screening (Feasible Options)

No. of Options	Option Type
23	Groundwater
11	Surface Water
7	Transfers
20	Rationalisation
2	Upgrade WTP (WQ only)

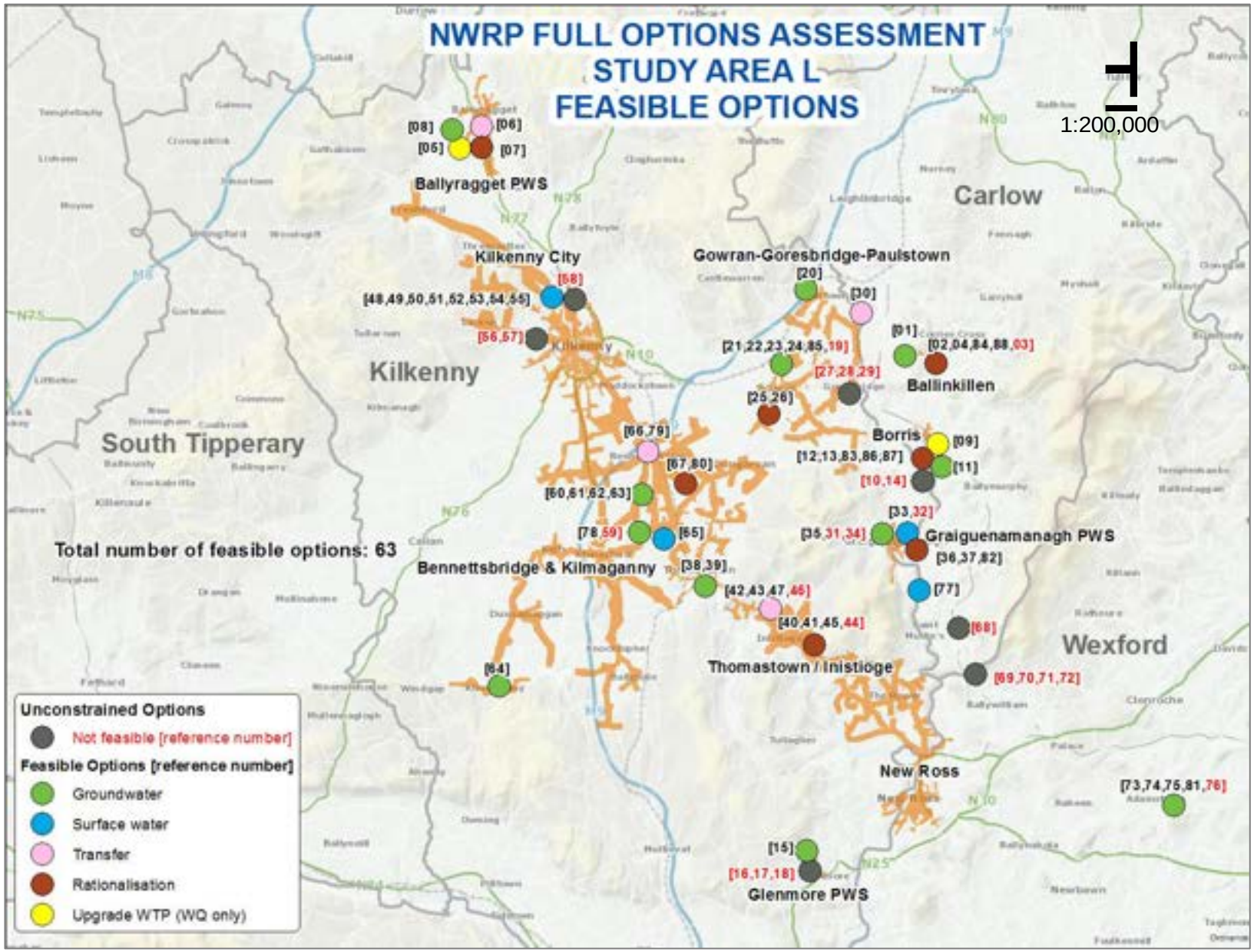

Figure 4.2 SAL Spatial Overview of the Feasible Options

4.4 Options Assessment Summary

The SDB deficit in the region ranges between 2,822 m^3/day in 2019 during normal conditions, to a maximum of 3,836 m^3/day in 2044 during dry conditions. During the options assessment stage, a total of 88 unconstrained options were assessed. Of these, 25 options were screened out for the reasons summarised in Table 4.5 and recorded in Annex B.

Table 4.5 Rejected Options Summary

No. of Options	Reason for Rejection
11	Resilience, Deliverability & Flexibility, Sustainability
9	Deliverability & Flexibility
5	Other

The remaining 63 feasible options are categorised into options that resolve the need for one WRZ only "WRZ options" and options that resolved the need for more than one WRZ "Study Area options". Table 4.6 provides an overview of the number of WRZ options and Study Area options for the WRZs in Study Area L. From this table it can be noted that there are 18 WRZ Options and 45 options which can be merged to form 22 Study Area Options.

A summary of the number of options and whether they are WRZ or SA options is contained in Table 4.6.

Table 4.6 SAL Feasible Options Summary

Water Resource Zone Name	Option Type	
	WRZ Option	SA Grouped Option
New Ross	2	3
Bennetsbridge & Kilmaganny	4	7
Thomastown / Inistioge	1	7
Graiguenamanagh PWS	2	3
Gowran-Goresbridge-Paulstown	2	7
Ballyragget PWS	2	2
Kilkenny City	1	7
Glenmore PWS	1	0
Ballinkillen	1	4
Borris	2	5

5 Approach Development

5 Approach Development

This chapter describes how we tested different combinations of the Feasible Options to develop a Preferred Approach to meet the needs we identified for the WRZ in Study Area L.

5.1 Approach Development

5.1.1 Introduction to Approach Development

The purpose of the NWRP is to examine all potential options that could be used to resolve issues within the water resource zone (unconstrained options) and then to eliminate those that are not feasible or that have identifiable environmental issues at a desktop level (options assessment screening). Of the remaining feasible options Uisce Éireann next step is to assess a number of approaches to resolve need across the Study Area. An approach is a way of configuring an option or options to meet the deficit focused on a particular outcome. For example, a "Least Carbon" approach would be the option or combination of options that would involve the least embodied and operational carbon load over the lifetime of the option. As part of the NWRP, Uisce Éireann considers six approaches, as summarised in Table 5.1.

These six approaches have been outlined at Section 8.3.7 of the Framework Plan and were consulted on as part of the SEA Scoping consultation conducted between 9th November 2017 and 22nd December 2017. These approaches have been specifically chosen to ensure that the NWRP aligns with all the relevant Government Policies outlined in Table 5.1.

Table 5.1 The Six Approaches

Approaches Tested	Description	Policy Driver
Least Cost	Lowest Net Present Value (NPV) cost in terms of Capital, Operational, Environmental and Social and Carbon Costs.	Public Spending Code
Best Appropriate Assessment (AA)	Lowest score against the European Sites (Biodiversity) sub-criteria question: Score = 0 equates to no likely significant effects (LSEs). If, in our opinion, these 0 scoring options meet the deficit/ plan objectives, they are automatically picked as the Preferred Approach. Score = -1 or -2 equates to LSEs that can be addressed with general/standard mitigation measures. Score = -3 equates to LSEs that may be harder to mitigate or require significant project level assessment.	Habitats Directive

Approaches Tested	Description	Policy Driver
Quickest Delivery	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.	Statutory Obligations under the Water Supply Act and Drinking Water Regulations
Best Environmental	This is the option or combination of options with the highest total score across the 19 No. SEA MCA sub-criteria questions	SEA Directive and Water Framework Directive
Most Resilient	This is the option or combination of options with the highest total score against the resilience criteria.	National Adaptation Framework and Climate Action Plan
Lowest Carbon	This is the option or combination of options with the lowest embodied and operational carbon cost.	Climate Action Plan

We then compare the options identified as the best performing within each of the six approach criteria (Least Cost, Best AA, Lowest Carbon etc.) against each other as outlined in Figure 5.1 to come up with a Preferred Approach that meets the objectives of the Framework Plan and aligns with all relevant Government Policy.

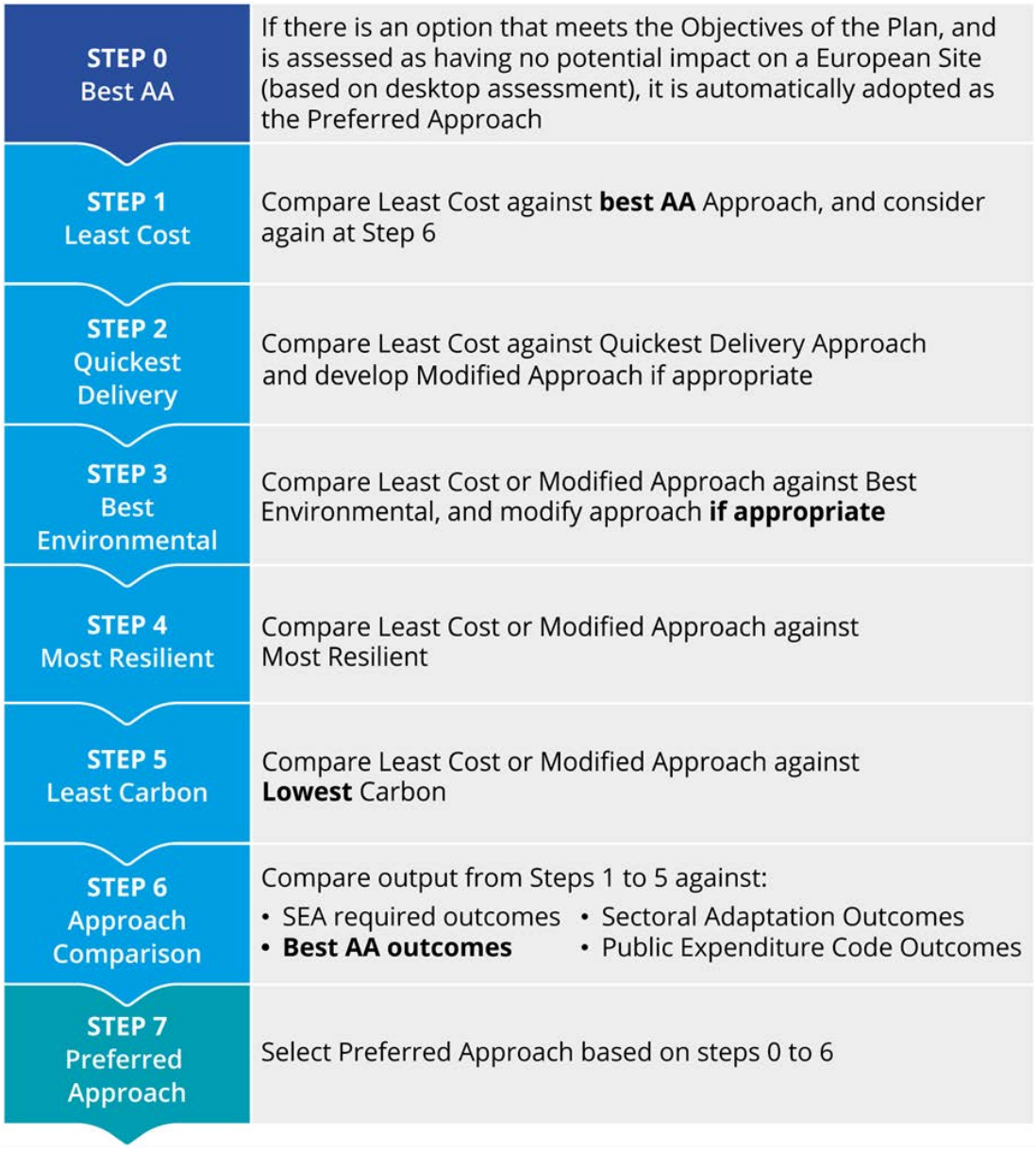

Figure 5.1 Figure of the 7 step assessment process

This methodology which is further detailed in Chapter 7 of the RWRP - SE follows a process to develop the Preferred Approach for a Study Area across three stages;

- **Stage 1** – We assess the water resource zones individually to develop an initial Preferred Approach, the **WRZ Preferred Approach** for all of the supplies in the Study Area
- **Stage 2** – We assess whether there are any larger options that might resolve deficits across multiple WRZs within a Study Area. We then develop combinations of these options (SA Combinations).
- **Stage 3** – We assess the SA Combinations and the WRZ Level approach in order to determine the best performing combination. This is known as the Preferred Approach at SA Level.

At each stage of assessment as detailed above, we carry out an assessment of the cumulative and in-combination effects of the Preferred Approach as detailed in the SEA Environmental Report for the RWRP-SE and the Environmental Review for this Study Area.

Within the Regional Plan, we will examine the Preferred Approach at a third spatial level for the entire South East Strategic Study Areas and will make any required changes in order to develop a Preferred Approach across the entire Region.

Further details on these three stages are provided in Chapter 7 of the RWRP-SE. Section 5.2 provides an overview of the application of this process to SAL.

5.2 Preferred Approach Development Process for Study Area L

5.2.1 Stage 1 – WRZ Level Approach

As outlined in Section 4.4 of this technical report there are 63 feasible options. 18 of these options are WRZ Options while 45 options are merged to form 22 Study Area Options. Table 5.2 outlines the 18 WRZ options for SAL, providing option reference numbers and detailing the WRZs they provide a solution to. These solutions are presented as "Options" for the purposes of this plan; however, will be subject to their own regulatory, timing and budgetary constraints.

Table 5.2 SAL Feasible Options

Water Resource Zone Name	Feasible Options SAL	
	Option Code	Option Description
Ballinkillen	SAL-001	Increase GW abstraction and upgrade Ballinkillen WTP to supply deficit.
Ballyragget PWS	SAL-005	Upgrade WTPs for water quality improvements. Prevent flooding of existing infiltration gallery.
Ballyragget PWS	SAL-008	New GW source and new WTP to address nitrate issues in this WRZ to supply full demand.
Borris	SAL-009	New WTP for Mountain River source to supply full demand and decommission existing Borris WTP.
Borris	SAL-011	New GW abstraction and new WTP to supply full demand.
Glenmore PWS	SAL-015	Increase GW abstraction from Busherstown Springs and upgrade Glenmore WTP to supply deficit.
Gowran-Goresbridge-Paulstown	SAL-020	Increase GW abstraction (no.1 BH) and upgrade Choill Rua WTP to partly supply deficit.
Gowran-Goresbridge-Paulstown	SAL-021	New GW abstraction and new WTP located at Woodquater to supply deficit - currently under development and maintain existing abstraction.
Graiguenamanagh PWS	SAL-033	New SW abstraction from River Barrow and new WTP to supply deficit.
Graiguenamanagh PWS	SAL-035	New GW abstraction and new WTP to supply deficit.
Thomastown / Inistioge	SAL-038	New GW abstraction and upgrade Thomastown WTP to supply deficit.

Water Resource Zone Name	Feasible Options SAL	
	Option Code	Option Description
Kilkenny City	SAL-050	Upgrade WTP. WRZ is not in deficit.
Bennetsbridge & Kilmaganny	SAL-060	New GW source for Bennetsbridge Woolengrange and new WTP located at Rathduff to supply deficit.
Bennetsbridge & Kilmaganny	SAL-064	Increase GW abstraction and upgrade Kilmaganny WTP to partly supply deficit.
Bennetsbridge & Kilmaganny	SAL-065	New SW abstraction from River Nore at Bennetsbridge and new WTP to supply deficit.
New Ross	SAL-073	New GW abstraction/wellfield located south of New Ross WRZ and new WTP to supply deficit.
New Ross	SAL-077	New SW abstraction from River Barrow and upgrade Castlemoyle WTP to supply deficit.
Bennetsbridge & Kilmaganny	SAL-078	New GW abstraction and new WTP for Bennetsbridge.

The WRZ options are then assessed against the six approach types, outlined in Table 5.1 and the result of this process is provided in Table 5.3.

Table 5.3 SAL Alignment of WRZ Options with Approach Categories

Water Resource Zone Name	Feasible Options SAL		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient
Ballinkillen	1	Increase GW abstraction and upgrade Ballinkillen WTP to supply deficit.	✓	✓	✓	✓	✓	✓
Ballyragged PWS	2	Upgrade WTPs for water quality improvements. Prevent flooding of existing infiltration gallery.	-	✓	✓	✓	✓	-
		New GW source and new WTP to address nitrate issues in this WRZ to supply full demand.	✓	-	✓	-	-	✓

Water Resource Zone Name	Feasible Options SAL		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient
Bennetsbridge & Kilmaganny	4	New GW source for Bennetsbridge Woolengrange and new WTP located at Rathduff to supply deficit.	-	-	-	-	✓	-
		Increase GW abstraction and upgrade Kilmaganny WTP to partly supply deficit.	-	✓	-	✓	-	-
		New SW abstraction from River Nore at Bennetsbridge and new WTP to supply deficit.	-	-	-	-	-	✓
		New GW abstraction and new WTP for Bennetsbridge.	✓	-	✓	-	-	-
Borris	2	New WTP for Mountain River source to supply full demand and decommission existing Borris WTP.	✓	✓	✓	✓	✓	✓
		New GW abstraction and new WTP to supply full demand.	-	-	✓	-	-	-
Glenmore PWS	1	Increase GW abstraction from Busherstown Springs and upgrade Glenmore WTP to supply deficit.	✓	✓	✓	✓	✓	✓
Gowran-Goresbridge-Paulstown	2	Increase GW abstraction (no.1 BH) and upgrade Choill Rua WTP to partly supply deficit.	-	✓	✓	✓	✓	-

Water Resource Zone Name	Feasible Options SAL		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient
		New GW abstraction and new WTP located at Woodquater to supply deficit - currently under development and maintain existing abstraction.	✓	-	✓	-	-	✓
Graiguenamanagh PWS	2	New SW abstraction from River Barrow and new WTP to supply deficit.	-	-	-	-	✓	✓
		New GW abstraction and new WTP to supply deficit.	✓	✓	✓	✓	-	-
Kilkenny City	1	Upgrade WTP. WRZ is not in deficit.	✓	✓	✓	✓	✓	✓
New Ross	2	New GW abstraction/wellfield located south of New Ross WRZ and new WTP to supply deficit.	-	✓	✓	✓	-	-
		New SW abstraction from River Barrow and upgrade Castlemoyle WTP to supply deficit.	✓	-	-	-	✓	✓
Thomastown / Inistioge	1	New GW abstraction and upgrade Thomastown WTP to supply deficit.	✓	✓	✓	✓	✓	✓

The 7-Step Process outlined in Figure 5.1 was then applied to each WRZ in SAL, in order to develop a WRZ level approach. A summary of the outcome of this assessment at WRZ level (i.e. WRZ options only) is shown in Table 5.4

The findings of the Preferred Approach Development for SAL at WRZ level, include the following:

- In terms of Best AA, no WRZ option scores a 0 in relation to potential impact on a designated European Site;
- In 8 of the 10 Water Resource Zones, the Preferred Approach consists of the same Plan Level options as the Best AA and Best Environmental Approaches.

- One WRZ approach option has a -3 AA score against the European Site (Biodiversity) question. A -3 Score against biodiversity indicates a potential high risk (without mitigation measures) under the biodiversity criterion for a European Site and for this reason a potential alternative approach must be identified. One of the preferred WRZ level approaches has a -3 AA associated with it.

Preferred Approaches at WRZ level are outlined in Table 5.4.

Table 5.4 SAL WRZ Approach Options

Water Resource Zone Name	Feasible Options SAL		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Ballinkillen	SAL-001	Increase GW abstraction and upgrade Ballinkillen WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Ballyragged PWS	SAL-005	Upgrade WTPs for water quality improvements. Prevent flooding of existing infiltration gallery.	-	-	✓	✓	✓	✓	-	✓
Bennetsbridge & Kilmaganny	SAL-078	New GW abstraction and new WTP for Bennetsbridge.	-	✓	-	✓	-	-	-	✓
Borris	SAL-009	New WTP for Mountain River source to supply full demand and decommission existing Borris WTP.	-	✓	✓	✓	✓	✓	✓	✓
Glenmore PWS	SAL-015	Increase GW abstraction from Busherstown Springs and upgrade Glenmore WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓
Gowran-Goresbridge-Paulstown	SAL-021	New GW abstraction and new WTP located at Woodquater to supply deficit - currently under development and maintain existing abstraction.	-	✓	-	✓	-	-	✓	✓
Graiguenamanagh PWS	SAL-035	New GW abstraction and new WTP to supply deficit.	-	✓	✓	✓	✓	-	-	✓
Kilkenny City	SAL-050	Upgrade WTP. WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓

Water Resource Zone Name	Feasible Options SAL		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
New Ross	SAL-073	New GW abstraction/wellfield located south of New Ross WRZ and new WTP to supply deficit.	-	-	✓	✓	✓	-	-	✓
Thomastown / Inistioge	SAL-038	New GW abstraction and upgrade Thomastown WTP to supply deficit.	-	✓	✓	✓	✓	✓	✓	✓

5.2.2 Stage 2 - Preferred Approach Development at the Study Area Level

The Second Stage of our Approach Development Process involves identifying the Study Area options that can address Need in more than one WRZ within the Study Area, and then develop various combinations which contain elements of the different options. These are called SA Combinations, SA Combinations will consist of a number of different projects or options; however, looking at a wider, more holistic, spatial scale benefits the plan level assessment in considering what options might work across multiple WRZ's.

For each Study Area, one of the SA Combinations will always be the WRZ Level Approach. The WRZ Level Approach is the combination of all of the individual the Preferred Approach at WRZ level for the entire Study Area. Table 5.5 below provides a summary of the 22 Study Area options.

Table 5.5 SAL Grouped Options

Feasible Options SAL			
Water Resource Zone Name	**Option code**	**Option Description**	**SA Grouped Option**
Kilkenny City Bennetsbridge & Kilmaganny	SAL-501	Increase abstraction from River Nore and upgrade WTP Troyswood to supply deficit. Decommission Radestown WTP (RAL). Upgrade interconnection between Kilkenny City and Bennetsbridge WRZs.	Group 1
Ballinkillen Borris	SAL-503	Rationalise Ballinkillen and Borris to Bagenalstown WRZ (SA 6).	Group 3
Gowran-Goresbridge-Paulstown	SAL-505	Interconnect Gowran-Goresbridge-Paulstown with Bagenalstown WRZ (Study Area 6) for increased resilience and supply deficit.	Group 5
Kilkenny City Bennetsbridge & Kilmaganny	SAL-506	Increase abstraction from River Nore and upgrade WTP Troyswood to supply deficit. Decommission Radestown WTP (RAL). Rationalise Bennetsbridge to Kilkenny City WRZ (Troyswood WTP).	Group 6
Gowran-Goresbridge-Paulstown Ballinkillen	SAL-508	New GW abstraction and new WTP located at Woodquater to supply deficit - currently under development. Rationalise Ballinkillen to Gowran-Goresbridge-Paulstown WRZ.	Group 8
Gowran-Goresbridge-Paulstown Borris	SAL-509	New GW abstraction and new WTP located at Woodquater to supply deficit - currently under development. Rationalise Borris to Gowran-Goresbridge-Paulstown WRZ.	Group 9

Feasible Options SAL			
Water Resource Zone Name	**Option code**	**Option Description**	**SA Grouped Option**
Ballyragged WS 1001 Kilkenny City	SAL-510	Increase abstraction from River Nore and upgrade WTP Troyswood to supply deficit. Decommission Radestown WTP (RAL). Interconnect Ballyragged with Kilkenny City WRZ for increased resilience - not in deficit.	Group 10
Ballyragged WS 1001 Kilkenny City	SAL-511	Upgrade Troyswood WTP and abandon Radestown WTP. Rationalise Ballyragged to Kilkenny City WRZ for increased resilience and long term OPEX savings.	Group 11
Gowran-Goresbridge-Paulstown Kilkenny City	SAL-512	Increase abstraction from River Nore and upgrade WTP Troyswood to supply deficit. Decommission Radestown WTP (RAL). Rationalise Gowran-Goresbridge-Paulstown to Kilkenny City WRZ.	Group 12
Gowran-Goresbridge-Paulstown Bennetsbridge & Kilmaganny	SAL-513	New GW source for Bennetsbridge and new WTP to supply deficit. Rationalise Gowran-Goresbridge-Paulstown to Bennetsbridge WRZ.	Group 13
Gowran-Goresbridge-Paulstown Graiguenamanagh WS	SAL-514	New GW abstraction and new WTP located at Woodquater to supply deficit - currently under development. Rationalise Graiguenamanagh to Gowran-Goresbridge-Paulstown WRZ	Group 14
Thomastown / Inistioge Bennetsbridge & Kilmaganny Kilkenny City	SAL-515	Increase abstraction from River Nore and upgrade WTP Troyswood to supply deficit. Decommission Radestown WTP (RAL). Rationalise Bennetsbridge and Thomastown to Kilkenny City WRZ.	Group 15
Thomastown / Inistioge Bennetsbridge & Kilmaganny Kilkenny City	SAL-516	Increase abstraction from River Nore and upgrade WTP Troyswood to supply deficit. Decommission Radestown WTP (RAL). Interconnect Bennetsbridge and Thomastown with Kilkenny City WRZ for increased resilience and supply deficit.	Group 16
Thomastown / Inistioge Bennetsbridge & Kilmaganny	SAL-517	New GW source for Bennetsbridge and new WTP to supply deficit. Rationalise Thomastown to Bennetsbridge WRZ.	Group 17

Feasible Options SAL			
Water Resource Zone Name	**Option code**	**Option Description**	**SA Grouped Option**
Thomastown / Inistioge Bennetsbridge & Kilmaganny	SAL-518	New GW source for Bennetsbridge and new WTP to supply deficit. Interconnect Thomastown with Bennetsbridge WRZ for increased resilience and supply deficit.	Group 18
Thomastown / Inistioge New Ross Town and Environs	SAL-520	New GW abstraction/wellfield located south of New Ross WRZ and new WTP to supply deficit. Interconnect Thomastown with New Ross WRZ for increased resilience and supply deficit from New Ross.	Group 20
Graiguenamanagh WS Thomastown / Inistioge	SAL-521	New GW abstraction and upgrade Thomastown WTP to supply deficit. Rationalise Graiguenamanagh to Thomastown WRZ.	Group 21
Thomastown / Inistioge New Ross Town and Environs	SAL-523	New GW abstraction/wellfield located south of New Ross WRZ and new WTP to supply deficit. Rationalise Thomastown to New Ross WRZ.	Group 23
New Ross Town and Environs Graiguenamanagh WS	SAL-525	New GW abstraction/wellfield located south of New Ross WRZ and new WTP to supply deficit. Rationalise Graiguenamanagh to Thomastown WRZ.	Group 25
Gowran-Goresbridge-Paulstown Borris Ballinkillen	SAL-526	New GW abstraction and new WTP located at Woodquater to supply deficit – currently under development and maintain existing abstraction. Rationalise Ballinkillen and Borris WRZs to Gowran-Goresbridge-Paulstown WRZ.	Group 26
Borris	SAL-527	Rationalise Borris to Carlow Central Regional WRZ.	Group 27
Ballinkillen Borris	SAL-528	Rationalise Borris and Ballinkillen to Leighlinbridge WRZ.	Group 28

The 22 Study Area options result in 26 SA Combinations including WRZ level Approach. The 26 SA Combinations in terms of the types of options within each combination are summarised in Table 5.6 below.

Table 5.6 SAL Combinations

Key	WRZ Approach Option	□	SA Grouped Option	□

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 11,21 and	SA Combination 2 (SA Grouped Option 5 and 20)	SA Combination 3 (SA Grouped Option 14 and 16)	SA Combination 4 (SA Grouped Option 16)	SA Combination 5 (SA Grouped Option 501)	SA Combination 6 (SA Grouped Option 505)	SA Combination 7 (SA Grouped Option 506)	SA Combination 8 (SA Grouped Option 510)	SA Combination 9 (SA Grouped Option 511)	SA Combination 10 (SA Grouped Option 512)	SA Combination 11 (SA Grouped Option 513)	SA Combination 12 (SA Grouped Option 514)
Ballinkillen	○	□	○	○	○	○	○	○	○	○	○	○	○
Ballyragget PWS	○	□	○	○	○	○	○	○	□	□	○	○	○
Bennetsbridge & Kilmaganny	○	○	○	□	□	□	○	□	○	○	○	□	○
Borris	○	□	○	○	○	○	○	○	○	○	○	○	○
Glenmore PWS	○	○	○	○	○	○	○	○	○	○	○	○	○
Gowran-Goresbridge-Paulstown	○	□	□	□	○	○	□	○	○	○	□	□	□
Graiguenamanagh PWS	○	□	○	□	○	○	○	○	○	○	○	○	□
Kilkenny City	○	□	○	□	□	□	○	□	□	□	□	○	○
New Ross	○	○	□	○	○	○	○	○	○	○	○	○	○

WRZ	SA Combination 13 (SA Grouped Option 515)	SA Combination 14 (SA Grouped Option 517)	SA Combination 15 (SA Grouped Option 518)	SA Combination 16 (SA Grouped Option 520)	SA Combination 17 (SA Grouped Option 521)	SA Combination 18 (SA Grouped Option 523)	SA Combination 19 (SA Grouped Option 525)	SA Combination 20 (SA Grouped Option 526)	SA Combination 21 (SA Grouped Option 527)	SA Combination 22 (SA Grouped Option 528)	SA Combination 23 (SA Grouped Option 503)	SA Combination 24 (SA Grouped Option 508)	SA Combination 25 (SA Grouped Option 509)
Thomastown / Inistioge	○	□	□	□	□	○	○	○	○	○	○	○	○
Ballinkillen	○	○	○	○	○	○	○	□	○	□	□	□	○
Ballyragget PWS	○	○	○	○	○	○	○	○	○	○	○	○	○
Bennetsbridge & Kilmaganny	□	□	□	○	○	○	○	○	○	○	○	○	○
Borris	○	○	○	○	○	○	○	□	□	□	□	○	□
Glenmore PWS	○	○	○	○	○	○	○	○	○	○	○	○	○
Gowran-Goresbridge-Paulstown	○	○	○	○	○	○	○	□	○	○	○	□	□
Graiguenamanagh PWS	○	○	○	○	□	○	□	○	○	○	○	○	○
Kilkenny City	□	○	○	○	○	○	○	○	○	○	○	○	○
New Ross	○	○	○	□	○	□	□	○	○	○	○	○	○
Thomastown / Inistioge	□	□	□	□	□	□	○	○	○	○	○	○	○

5.2.3 Stage 3 – Preferred Approach at Study Area Level

As part of stage three, we compare the WRZ Level Approach and the SA Combinations to determine the Preferred Approach that provides the best outcome for the Study Area.

We use the EBSD tool to rank the combinations against the assessment criteria and we then compare the best performing SA Combinations under each of the six approach types, using the 7-step process set out in Figure 5.1, to establish the Preferred Approach at Study Area level. The results of this process are provided in Table 5.7.

Table 5.7 SAL Summary of SA Combination of Performance against Approach Type

Ranked order (best to worst)	Best														Worst

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 11,21 and 26)	SA Combination 2 (SA Grouped Option 5 and 20)	SA Combination 3 (SA Grouped Option 14 and 16)	SA Combination 4 (SA Grouped Option 16)	SA Combination 5 (SA Grouped Option 501)	SA Combination 6 (SA Grouped Option 505)	SA Combination 7 (SA Grouped Option 506)	SA Combination 8 (SA Grouped Option 510)	SA Combination 9 (SA Grouped Option 511)	SA Combination 10 (SA Grouped Option 512)	SA Combination 11 (SA Grouped Option 513)	SA Combination 12 (SA Grouped Option 514)
Least Cost		Best											
Quickest Delivery		Worst	Best										
Best AA biodiversity	1 -3 AA impact	2 -3 AA impact	1 -3 AA impact	0 -3 AA impact	0 -3 AA impact	0 -3 AA impact	1 -3 AA impact	0 -3 AA impact	1 -3 AA impact	1 -3 AA impact	1 -3 AA impact	1 -3 AA impact	1 -3 AA impact
Lowest Carbon		Best											
Most Resilient				Best									
Best Environmental				Best									

WRZ	SA Combination 13 (SA Grouped Option 515)	SA Combination 14 (SA Grouped Option 517)	SA Combination 15 (SA Grouped Option 518)	SA Combination 16 (SA Grouped Option 520)	SA Combination 17 (SA Grouped Option 521)	SA Combination 18 (SA Grouped Option 523)	SA Combination 19 (SA Grouped Option 525)	SA Combination 20 (SA Grouped Option 526)	SA Combination 21 (SA Grouped Option 527)	SA Combination 22 (SA Grouped Option 528)	SA Combination 23 (SA Grouped Option 503)	SA Combination 24 (SA Grouped Option 508)	SA Combination 25 (SA Grouped Option 509)
Least Cost						Worst							
Quickest Delivery													
Best AA biodiversity	0 -3 AA impact	1 -3 AA impact	1 -3 AA impact	1 -3 AA impact	1 -3 AA impact	1 -3 AA impact	1 -3 AA impact	1 -3 AA impact	2 -3 AA impact	1 -3 AA impact	1 -3 AA impact	1 -3 AA impact	1 -3 AA impact
Lowest Carbon						Worst							
Most Resilient													
Best Environmental									Worst				

The SA Combinations in Table 5.7 are assessed to determine the approach categories as summarised in Table 5.8. SA Combination 1 was identified in Table 5.6 as the Best in the Approach Categories of Least Cost and Lowest Carbon. SA Combination 2 was identified as the Best in the Approach Category Quickest Delivery. SA Combination 3 was identified as the Best in the Approach Categories of Best Environmental, Most Resilient and Best AA.

Table 5.8 Best Combinations

Approach Categories	Best Performing Combination
Least Cost (LCo)	SA Combination 1
Best Environmental (BE)	SA Combination 3
Quickest Delivery (QD)	SA Combination 2
Most Resilient (MR)	SA Combination 3
Lowest Carbon (LC)	SA Combination 1
Best AA (BA)	SA Combination 3*

*Note: SA Combination 3 was identified as the Best AA because it has the least -2 AA and -1 AA impacts compared to other combinations with the same number of -3 impacts.

The MCA assessment included the following assessment criteria:

- Resilience;
- Deliverability and Flexibility;
- Progressibility; and
- Sustainability (Environmental and Social Impacts).

The NPV Costs are based on four criteria:

- Capital Costs – the cost to construct the option, including all overheads, consent and land acquisition costs;
- Operational Costs – the whole life cost to operate the option, including operators, chemical requirements and energy requirements including pumping;
- Carbon Costs – the whole life embodied and operational Carbon costs of the option; and
- Environmental and Social – the whole life Environmental and Social cost of the option covering climate regulation, traffic disruption and food production (carbon emissions are covered separately in the bullet point above).

The wider range of costs used in the estimation of the NPV aligns our Plan with any future Project Level Cost Benefit Analysis, in accordance with the Public Spending Code.

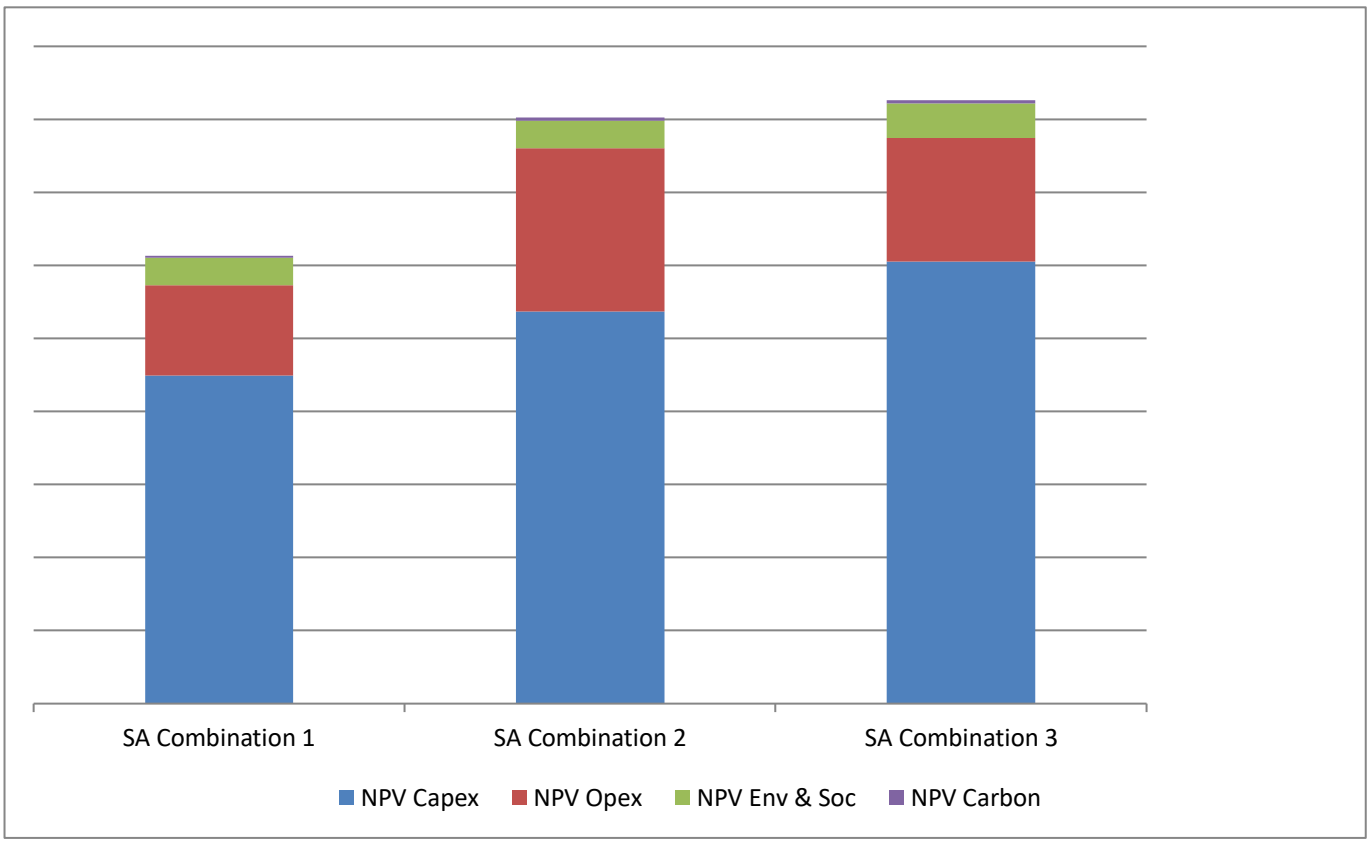

Figure 5.2 NPV Costs for WRZ and SA Approaches

In accordance with the Options Methodology, these approaches are then compared against each other using the 7-Step process in Figure 5.1 to generate the best value combination of options at the Study Area level. The best value combination of options at the Study Area level results in the SA Preferred Approach. The outputs from the assessment were as follows:

- Step 1 – We compared the Least Cost Approach (SA Combination 1) against the Best AA Approach (SA Combination 3). Whilst the Least Cost Approach (SA Combination 1) does not perform as well as the Best AA Approach (SA Combination 3) against the criteria of Most Resilient and Best Environmental the difference in scores between the approaches against these criteria are negligible. Whilst the Best AA Approach (SA Combination 3) has two (2) fewer -3 AA impacts than the Least Cost Approach (SA Combination 1) two (2) of these impacts are associated with groundwater abstractions near to the River Barrow and River Nore SAC. Site-based assessments may be able to reduce these -3 AA impacts due to the completion of detailed safe yield assessments. Therefore, due to the significant difference in costs between the two (2) Approaches it is considered to be more appropriate to take forward the Least Cost Approach as the first case scenario. If through site-based assessments the number of -3 AA impacts cannot be reduced (via maintaining abstractions within the safe yield) then the Preferred Approach could be reconsidered through the NWRP feedback and monitoring loop.
- Step 2 – We compared the Quickest Delivery Approach (SA Combination 2) against the Least Cost Approach (SA Combination 1). The Quickest Delivery Approach (SA Combination 2) performed poorly against the Least Cost, Lowest Carbon, Resilience and Environmental criteria when compared to the Least Cost Approach. The Least Cost Approach was therefore retained at this stage.

- Step 3 - We compared the Least Cost Approach (SA Combination 1) against the Best Environmental Approach (SA Combination 3). The Best Environmental Approach is the same as the Best AA Approach discussed in Step 1 and therefore the Least Cost Approach was retained at this stage.
- Step 4 – We compared the Least Cost Approach (SA Combination 1) against the Most Resilient Approach (SA Combination 3). The Most Resilient Approach is the same as the Best AA and Best Environmental Approach discussed in Step 1 and Step 3 and therefore the Least Cost Approach was retained at this stage.
- Step 5 - We compared the Least Cost Approach (SA Combination 1) against the Least Carbon Approach (SA Combination 1). The Least Carbon Approach is the Least Cost Approach. The Least Cost Approach was therefore retained at this stage.
- Step 6 – A final assessment of the Least Cost Approach was completed against the Least Carbon, Quickest Delivery, Best AA, Best Environmental and Most Resilient Approaches. The Least Cost Approach (SA Combination 1) scores poorly in relation to the Quickest Delivery Approach and has two (2) additional -3 AA impacts associated with it than the Best AA Combination (SA Combination 3). Despite this, SA Combination 1 is significantly cheaper than the Best AA (SA Combination 3) and site-based assessments may be able to reduce the number of -3 AA impacts due to the completion of detailed safe yield assessments. Therefore, due to the significant difference in costs between the two (2) Approaches it is considered to be more appropriate to take forward the Least Cost Approach as the first case scenario. If through site-based assessments the number of -3 AA impacts cannot be reduced (via abstractions within the safe yield) then the Preferred Approach could be reconsidered through the NWRP feedback and monitoring loop.
- Step 7 – The Least Cost Approach was therefore selected as the Preferred Approach.

5.3 Study Area Preferred Approach Summary

On the basis of this initial assessment at Plan level, SA Combination 1 represents the Preferred Approach for Study Area L, which consists of the options listed in Table 5.9.

Table 5.9 Preferred Approach for SAL

WRZ Name	Preferred Approach Option Description SA Combination 1 (SA Grouped Option 11,21 and 26)
Ballinkillen Gowran-Goresbridge-Paulstown Borris	Group 26 New GW abstraction and new WTP located at Woodquater to supply deficit – currently under development and maintain existing abstraction. Rationalise Ballinkillen and Borris WRZs to Gowran-Goresbridge-Paulstown WRZ.
Ballyragged PWS Kilkenny City	Group 11 Upgrade Troyswood WTP and abandon Radestown WTP. Rationalise Ballyragged to Kilkenny City WRZ for increased resilience and long term OPEX savings.
Bennetsbridge & Kilmaganny	SAL-078 New GW abstraction and new WTP for Bennetsbridge.

WRZ Name	Preferred Approach Option Description SA Combination 1 (SA Grouped Option 11,21 and 26)
Glenmore PWS	SAL-015 Increase GW abstraction from Busherstown Springs and upgrade Glenmore WTP to supply deficit.
Graiguenamanagh PWS Thomastown / Inistioge	Group 21 New GW abstraction and upgrade Thomastown WTP to supply deficit. Rationalise Graiguenamanagh to Thomastown WRZ.
New Ross	SAL-073 New GW abstraction/wellfield located south of New Ross WRZ and new WTP to supply deficit.

The Preferred Approach (SA Combination 1) is shown schematically in Figure 5.3.

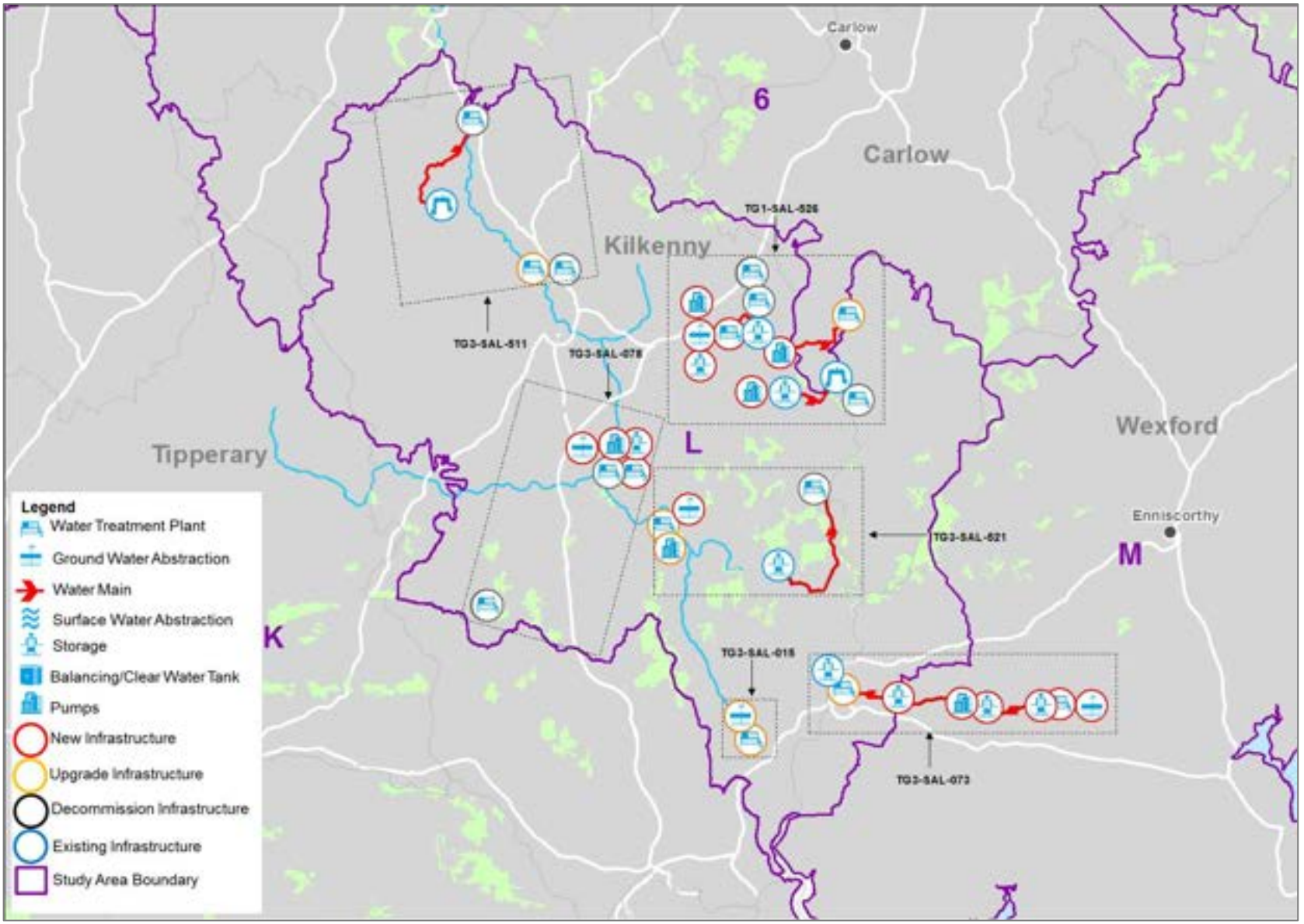

Figure 5.3 SAL Preferred Approach

The Preferred Approach for SAL also includes for demand side (**Lose Less** and **Use Less**) measures, including:

- Ongoing leakage management including active leakage control, pressure management and find and fix activities to offset Natural Rate of Leakage Rise (NRR).
- Continuation of UÉ household and business water conservation campaigns, initiatives and education programmes.
- The option to implement legally enforceable Water Conservation Orders in drought periods in order to protect the environment and our public water supplies.

Before we adopt this approach at Plan level for SAL, we must give consideration to the following:

- **Interim Solutions**: Based on the scale of investment required across the entire country it is likely that it may take 5-10 investment cycles before we address all issues with the existing water supplies. Therefore, small localised options may be required on an interim basis to secure priority need in existing supplies until the SA Preferred Approach can be delivered;
- **Sensitivity Analysis**: When planning for water supplies over a medium to long term horizon, we must give consideration to adaptability of our plan to change across a range of future scenarios (for example, what if changes to technology allow us to reduce leakage beyond SELL, even in small WRZs or what if we are unable to secure a licence in the medium term to abstract the quantity water currently allowed for at a given location).

6 Preferred Plan Constraints – Interim Solutions

6 Preferred Plan Constraints – Interim Solutions

As outlined in more detail in Section 8.3.7.6 of the Framework Plan, the NWRP provides for an "interim solution" approach, which allows shorter term interventions to be identified and prioritised, when needed. The Preferred Approach for each WRZ, Study Area and Region will be delivered on a phased basis subject to budget and regulatory constraints. It will take many investment cycles to deliver the Preferred Approach across all WRZs, therefore, Uisce Éireann must have a means to continue delivering safe, secure and reliable water supplies (on a short to medium term basis) while we deliver our Preferred Approach.

On this basis, interim, short term capital maintenance solutions have been identified for all WTPs and will be utilised when needed. These solutions will allow UÉ time to deliver the Preferred Approach, while at the same time, maintaining a sustainable water supply. These interim solutions are generally smaller in scale and rely on making best use of already existing infrastructure.

Examples of general interim measures for different water sources include the following:

- For groundwater sites, where the Preferred Approach requires that the existing WTP is to be maintained, the interim solution would typically provide for refurbishment of the existing or development of new boreholes and borehole pumps, and an upgrade of the treatment process in line with proposed growth predictions. This may require a staged upgrade of the WTP. For example, the interim solution would typically include an upgrade of the WTP to provide supply to existing customers with consideration given to a further required expansion of the WTP at a later date.
- For surface water sites, where the Preferred Approach requires that the existing WTP is to be maintained, the interim option would typically involve the upgrade of the existing WTP in line with proposed growth predictions. As for groundwater sites this may require a staged upgrade of the WTP where the interim solution would typically include an upgrade of the WTP to provide supply to existing customers with consideration given to a further required expansion of the WTP at a later date.
- For groundwater and surface water sites where the Preferred Approach involves the decommissioning of the WTP by providing supply to the customers from another WTP within the WRZ or from another WRZ/Study Area/Region, the interim solution would involve the advancement of the rationalisation of the WTP, by provision of part supply or full supply if possible. If rationalisation is not feasible at that point in time due to dependencies on Study Area or Regional options, containerised WTP upgrade solutions would be considered for the WTP. This involves the provision of a package WTP within a containerised unit. These package plants can be modified for use on other sites in the future therefore are considered "no regrets" infrastructure investment.

A decision to progress any interim solution will be based on urgent or priority need to address water quality risk or supply reliability e.g., RAL or drought issues or critical need for example. The Regional Plan does not confer funding availability for any project and any interim measures will be subject to budget availability, relevant environmental assessment and other required consents in the normal way.

These solutions, in most cases, will only be used to allow time to deliver the longer-term solution. The interim solutions are determined in line with the Preferred Approach and as such, they are considered "no regrets" infrastructure investment.

Table 6.1 SAL Interim Options

WTP Name	Interim Option
Borris WTP	Upgrade WTP to UÉ Standards – Potential site for a containerised solution
Ballinkillen WTP	Refurb existing Borehole, and upgrade WTP to UÉ Standards – Potential site for a containerised solution
Glenmore WTP	Refurb existing Spring, and upgrade WTP to UÉ Standards
Radestown WTP	Upgrade WTP to UÉ Standards – Potential site for a containerised solution
Troyswood WTP	Upgrade WTP to UÉ Standards
Ballyragget WTP	Refurb existing Borehole, and upgrade WTP to UÉ Standards – Potential site for a containerised solution
Choill Rua WTP	Upgrade WTP to UÉ Standards – Potential site for a containerised solution
Gowran Goresbridge Paulstown WTP	Upgrade WTP to UÉ Standards – Potential site for a containerised solution
Graiguenamanagh (Coolroe) WTP	Upgrade WTP to UÉ Standards – Potential site for a containerised solution
Thomastown WTP	Refurb existing Borehole, and upgrade WTP to UÉ Standards
Bennetsbridge WTP	Refurb existing Boreholes, and upgrade WTP to UÉ Standards – Potential site for a containerised solution
Kilmaganny WTP	Upgrade WTP to UÉ Standards – Potential site for a containerised solution
Castlemoyle WTP	Upgrade WTP to UÉ Standards

Small Towns and Villages Growth Programme Uisce Éireann Investment Plan 2020-2024 includes a number of programmes and projects targeted at providing for growth. One such programme is the Small Towns and Villages Growth Programme (STVGP) which will provide funding for Water and Wastewater Treatment Plant growth capacity in smaller settlements which are not otherwise provided for in the Capital Investment Plan 2020 to 2024. The STVGP is focused on supporting growth in areas already served by UÉ infrastructure but where current or future capacity deficits have been identified.

Uisce Éireann have engaged with Local Authorities across the country to ensure that the investment is made appropriately in accordance with the relevant county development plan. Under this programme interim options works will be considered in the Bennetsbridge & Kilmaganny WRZ.

7

Preferred Approach – Sensitivity Analysis

7 Preferred Approach – Sensitivity Analysis

Our supply demand forecast, and water quality barrier deficit assessments have been developed using the application of best practice methods within the data available. We have identified areas where we will focus improvements in data to improve the certainty of our forecasts. However, all long-term forecasts are subject to uncertainty. We have explored the sensitivity of our supply and demand forecasts to some of the key factors which influence them through a range of scenarios. This enables us to test the sensitivity of the Preferred Approach to changes in need, in order to ensure that our decision making is robust and that the approach is adaptable. We describe the factors which have been considered in Chapter 8 of the Framework Plan. In summary we test our Preferred Approach against the following questions:

1) What if the deployable output across our supplies is reduced based on sustainability limits within the new legislation on abstraction resulting in a larger supply demand balance deficit?
2) What if climate change impacts on our existing supplies are greater than anticipated?
3) What if our forecasts are too great and expected demand growth does not materialise resulting in a smaller supply demand balance deficit?
4) What if we are able to reduce leakage below SELL within the timeframe of the plan resulting in lower Needs?

A summary of the adaptability criteria and analysis we have undertaken for SAL is shown in Table 7.1.

Table 7.1 Sensitivity Analysis for SAL

Uncertainty	Likelihood	Increase / Decrease in Deficit	Impact on Preferred Approach
Sustainability	Moderate/High (as our current abstractions are large compared to the water bodies from which they abstract)	+ 1,429 m^3/day	**The impact of sustainability reductions would reduce the volumes that can be abstracted from our existing sources therefore increasing the supply demand balance deficit**. There are some surface water sources in SAL that may be impacted from sustainability reductions. However, our Preferred Approach is designed to relieve pressure on these sources by supplementing from more resilient sources. Regarding the existing River Nore abstraction at Kilkenny City WRZ, it is deemed that this large resilient source can be further developed, allowing us to abandon the smaller River Dinan and River Douglas sources, as well as the rationalisation of Ballyragget WRZ. Groundwater sustainability is more difficult to assess at desktop level, however, as the abstractions in SAL are small in scale, they do not appear to be problematic.
			Based on this scenario, the Preferred Approach remains the optimal solution.
Climate Change		+300 m3/day	**Higher climate change scenarios would impact our existing supplies and result**

Uncertainty	Likelihood	Increase / Decrease in Deficit	Impact on Preferred Approach
	High (international climate change targets have not been met)		**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 against by optimizing our operations on a more environmentally sustainable basis across the range of supplies.
			Based on this scenario, the Preferred Approach remains the optimal solution.
Demand Growth	Low/Moderate (growth has been based on policy)	-3,836 m^3/day	**The impact of lower-than-expected growth would reduce the supply demand balance deficit and the overall need requirement.** The supply demand balance deficit is spread across 10 individual water resource zones and is driven by quality as well as quantity issues. In this rural area, growth is relatively low.
			Based on this scenario, the Preferred Approach remains the optimal solution.
Leakage Targets	Low (Uisce Éireann is focused on sustainability and aggressive leakage reduction)	321 m^3/day	**The impact of lower-than-expected leakage savings would increase the supply demand balance deficit and the overall need requirement.** As Uisce Éireann 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.
			Based on this scenario, the Preferred Approach remains the optimal solution.
	Moderate/High (Uisce Éireann is focused on sustainability and aggressive leakage reduction)	3,831 m^3/day	**Increased leakage savings beyond SELL would reduce the supply demand balance deficit and the overall need requirement.** The need drivers in SAL Kilkenny are across all 10 water resource zones and are driven by quality as well as availability issues. Therefore, the Preferred Approach is required, even accounting for increased leakage savings.
			Based on this scenario, the Preferred Approach remains as the optimal solution.

In reality, a combination of these scenarios may occur together. For example, growth in demand might be lower if we achieve greater leakage reductions. However, if this coincided with a reduction in permitted abstraction volume under the abstraction licensing regime, the reduction in demand may offset some or all of the loss in supply availability due to abstraction sustainability reductions.

Based on the adaptability assessment, the Interim and Preferred Approaches perform as follows:

- Interim Approach – As the purpose of the Interim Approach is to allow for emergency works for priority Quality and Quantity issues, the solutions will have a limited design life (usually less than 10 years). They allow time to assess the Preferred Approach and improve adaptability within our Plan.
- Preferred Approach – As the Supplies in SAL Kilkenny are relatively small, and as conservative limits have been applied to the supply availability assessments, the Preferred Approach is adaptable to a range of future outlooks in relation to sustainability and climate change. The demand growth in the area is small, and the Supply Demand Deficits are primarily driven by reliability. As Water Treatment Plants are modular, capacity will be delivered on a phased basis, allowing for adaptation across a range of futures. Our Preferred Approach is therefore Adaptable.

In summary, our sensitivity assessment of the Interim and Preferred Approaches demonstrates that they are both highly adaptable to a broad range of futures, and therefore represent ‘no regrets’ infrastructure.

8 Summary of Study Area L

8 Summary of Study Area L

Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience

The Preferred Approach for SAL (summarised in Table 5.8 and Figure 5.3) consists of local WRZ option for 3 of the 10 Water Resource Zones in the Study Area, primarily driven by the small scale of the supplies and difficulties in transporting small volumes of water over long distances.

Proposed solutions for Ballyragget PWS, Borris, Ballinkillen, Gowran-Goresbridge-Paulstown, Graiguenamanagh PWS, Kilkenny City and Thomastown / Inistioge WRZs involve constructing connections across one or more supplies. The Preferred Approach for Glenmore PWS WRZs involves increasing abstraction and upgrade WTP to meet deficit. The Preferred Approach for Bennetsbridge & Kilmaganny and New Ross WRZs involve new GW abstraction and WTP.

Delivery of the Preferred Approach will secure all of the supplies in the area in terms of Quality, Quantity, Sustainability and Resilience.The Preferred Approach for SAL also includes for demand side (**Lose Less** and **Use Less**) measures, including:

- Ongoing leakage management including active leakage control, pressure management and find and fix activities to offset Natural Rate of Leakage Rise (NRR).
- Net leakage reduction in Kilkenny City Water Resource Zone, amounting to 321 m^3 per day (applied to SDB Deficit) to move towards achieving the National SELL Target by 2034.
- Continuation of UÉ household and business water conservation campaigns, initiatives and education programmes.
- The option to implement legally enforceable Water Conservation Orders in drought periods in order to protect the environment and our public water supplies.

As part of our Preferred Approach, we have also identified a range of interim solutions for SAL, as summarised in Table 6.1. The measures will only be progressed in the event of critical need to allow time for delivery of the required Preferred Approach solutions in the Study Area.

Annex A Study Area L Water Treatment Plants

WTP Asset Name	Local Plant Names
Borris WTP	Borris WTP
Ballinkillen WTP	Ballinkillen WTP
Ballyragget WTP	Ballyragget WTP
Bennetsbridge WTP	Bennetsbridge WTP
Glenmore WTP	Glenmore WTP
Gowran Goresbridge Paulstown WTP	Gowran Goresbridge Paulstown WTP
Graiguenamanagh (Coolroe) WTP	Graiguenamanagh (Coolroe) WTP
Radestown WTP	Radestown WTP
Troyswood WTP	Troyswood WTP
Thomastown WTP	Thomastown WTP
Kilmaganny WTP	Kilmaganny WTP
Choill Rua WTP	Choill Rua WTP
Castlemoyle WTP	Castlemoyle WTP

Annex B Study Area L Rejection Register Summary

Annex B Study Area L Rejection Register Summary

Study Area L – Coarse Screening Rejection

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG3-SAL-003	Rationalise Ballinkillin to Bagenalstown WRZ (SA 6) [not in deficit].	The option requires a significant length of pipeline for a relatively small demand. Transferring small quantities of water over long distances can affect the quality of water. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG3-SAL-010	Increase SW abstraction from Mountain River and upgrade Borris WTP to supply deficit.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, there is no longer an identified deficit in this WRZ. Therefore, no new supply option is required.	**WRZ no longer in deficit**		
TG3-SAL-014	New SW abstraction from River Barrow and new WTP to supply full demand.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, there is no longer an identified deficit in this WRZ. Therefore, no new supply option is required.	**WRZ no longer in deficit**		
TG3-SAL-016	Rationalise Glenmore to New Ross WRZ.	The option requires a significant length of pipeline for a relatively small demand. Transferring small quantities of water over long distances can affect the quality of water. Therefore, this option did not meet the requirements of the Deliverability criterion.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG3-SAL-017	Rationalise Glenmore to New Ross WRZ.	The option requires a significant length of pipeline for a relatively small demand. Transferring small quantities of water over long distances can affect the quality of water. Therefore, this option did not meet the requirements of the Deliverability criterion.		●	
TG3-SAL-018	Rationalise Glenmore to South Kilkenny WRZ (SA K).	The option requires a significant length of pipeline for a relatively small demand. Transferring small quantities of water over long distances can affect the quality of water. Therefore, this option did not meet the requirements of the Deliverability criterion.		●	
TG3-SAL-019	Increase existing GW abstraction from Tobergoorlick Pool and upgrade Gowran Goresbridge Paulstown WTP to supply deficit.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG3-SAL-027	New SW abstraction from River Barrow and new WTP to supply deficit.	This option required significant works for a relatively small supply. Therefore, it was not considered feasible at coarse screening stage, due to age of water and sedimentation. As a result, this option did not meet the requirements of the Deliverability criterion.		●	
TG3-SAL-028	New SW abstraction from River Monefelim and new WTP to supply deficit.	This option required significant works for a relatively small supply. Therefore, it was not considered feasible at coarse screening stage, due to age of water and sedimentation. As a result, this option did not meet the requirements of the Deliverability criterion.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG3-SAL-029	New SW abstraction from River Gowran and new WTP to supply deficit.	This option required significant works for a relatively small supply. Therefore, it was not considered feasible at coarse screening stage, due to age of water and sedimentation. As a result, this option did not meet the requirements of the Deliverability criterion.		●	
TG3-SAL-031	Increase GW abstraction and upgrade Graiguenamanagh (Coolroe) WTP to supply deficit.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG3-SAL-032	Increase SW abstraction from Duiske River and upgrade Graiguenamanagh (Coolroe) WTP to supply deficit.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG3-SAL-034	Riverbank filtration from River Barrow and new WTP to supply deficit.	Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving WFD objectives. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG3-SAL-044	Rationalise Thomastown to New Ross WRZ.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG3-SAL-046	Interconnect Thomastown with New Ross WRZ for increased resilience and supply deficit from New Ross.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG3-SAL-056	New GW abstraction (gravels) and new WTP to supply Kilkenny City deficit.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, there is no longer an identified deficit in this WRZ. Therefore, no new supply option is required.	**WRZ no longer in deficit**		
TG3-SAL-057	New GW abstraction (karstic) and new WTP to supply Kilkenny City deficit.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, there is no longer an identified deficit in this WRZ. Therefore, no new supply option is required.	**WRZ no longer in deficit**		
TG3-SAL-058	Increase abstraction from River Dinan and River Douglas and upgrade Radestown WTP to supply deficit.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG3-SAL-059	Increase GW abstraction at Bennettsbridge WTP and new WTP to supply deficit. New WTP is required for Bennettsbridge. Decommission existing Bennettsbridge WTP.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG3-SAL-068	Increase SW abstraction from Dranagh impoundment/raw water storage and upgrade Castlemoyle WTP to supply deficit.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG3-SAL-069	Increase SW abstraction from River Pollmounty and upgrade Castlemoyle WTP (including new fishpass) to supply deficit.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG3-SAL-070	Increase SW abstraction from River Pollmounty and upgrade Castlemoyle WTP (including new fishpass) to supply deficit.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG3-SAL-071	Increase SW abstraction from River Pollmounty and upgrade Castlemoyle WTP (including new fishpass) to supply deficit.	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG3-SAL-072	Increase SW abstraction from River Pollmounty and upgrade Castlemoyle WTP (including new fishpass) to supply deficit.	The option requires a significant length of pipeline for a relatively small demand. Transferring small quantities of water over long distances can affect the quality of water. Therefore, this option did not meet the requirements of the Deliverability criterion.		●	
TG3-SAL-076	New GW abstraction/wellfield located south of New Ross WRZ and new WTP to supply deficit.	The option requires a significant length of pipeline for a relatively small demand. Transferring small quantities of water over long distances can affect the quality of water. Therefore, this option did not meet the requirements of the Deliverability criterion.		●	