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Regional Water Resources Plan North West

Appendix 6 Study Area F Technical Report



Tionscadal Éireann
Project Ireland
2040

6 CLEAN WATER
AND SANITATION



Data Disclaimer:

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

Baseline data included in the RWRP-NW 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-NW. 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 F

This is the Technical Report for Study Area F 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 Framework Plan and the Regional Water Resources Plan – Northern West (RWRP-NW), which explain key concepts and terminology used throughout the report.

This Study Area includes 15 water resource zones located in County Cavan, County Galway, County Leitrim, County Longford and County Roscommon. 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-NW.

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-NW, we apply this methodology to the Northern and Western 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.

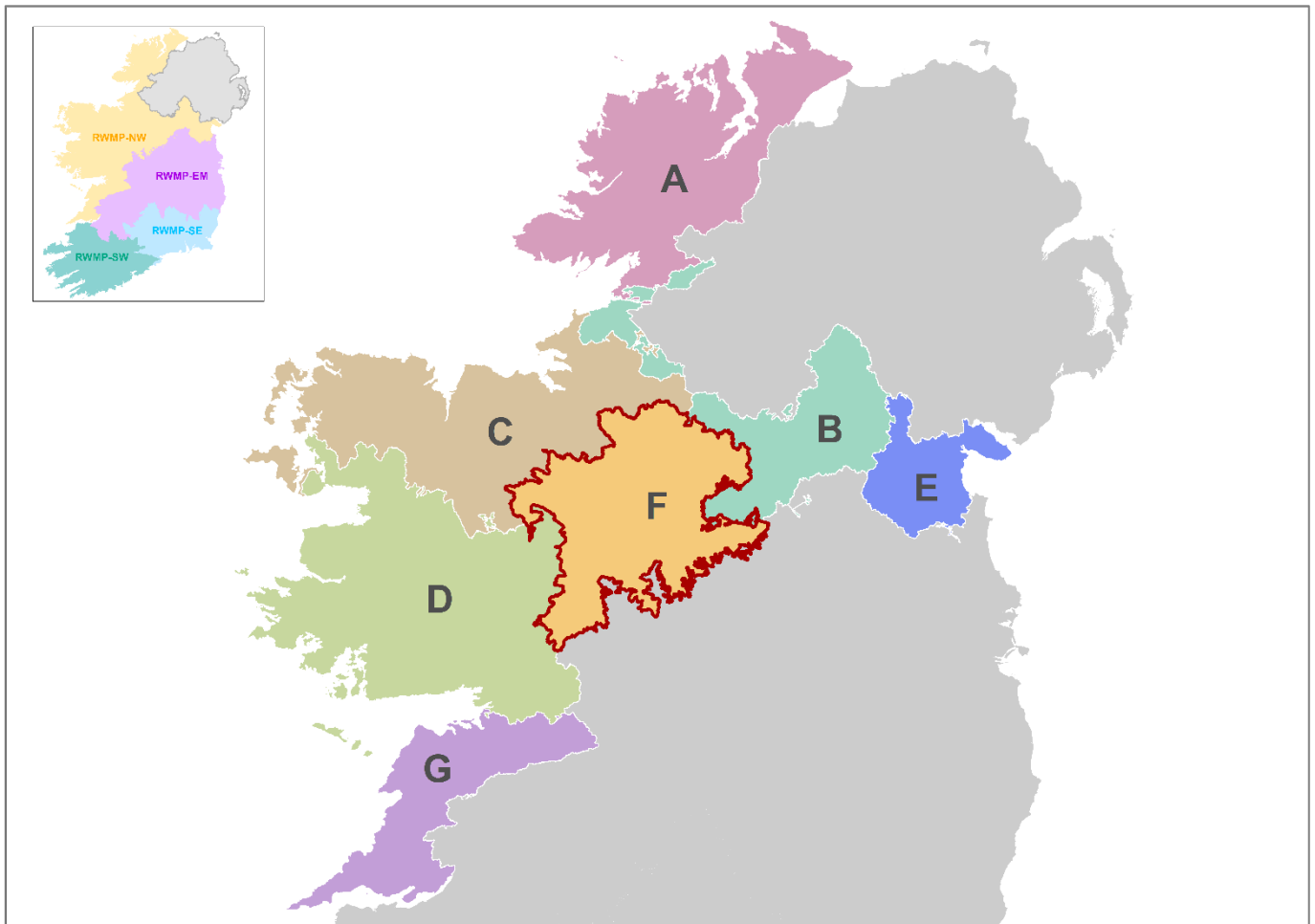


Figure 1.1 Overview of Study Areas within the Northern - Western Region.

This Technical Report is for Study Area F (SAF), which consists of 15 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 TG1 refers the Northern Western Region (Regional Group 1).

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.

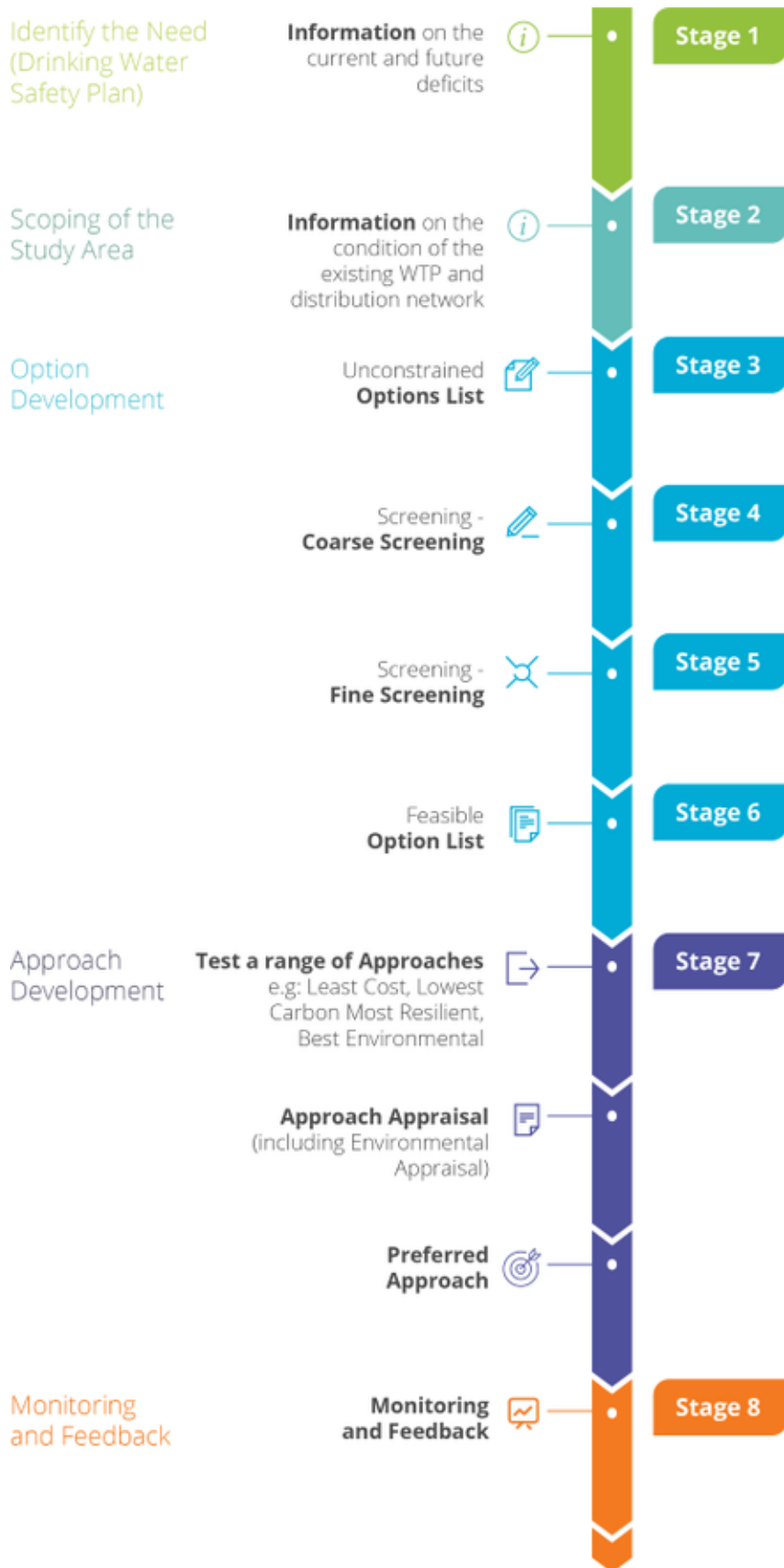


Figure 1.2 Option Assessment Methodology Process

1.2 Introduction to the Study Area

Study Area F consists of 15 WRZs supplying a population of approximately 85,573 people via approximately 3,340 kilometres of distribution network. SAF extends across parts of County Cavan, Galway, Leitrim, Longford, Roscommon and Sligo.

The town of Longford is the largest demand centre, with other notable towns including Roscommon and Carrick-On-Shannon. The sources of water include 13 groundwater sites and 5 surface water sources. The Study Area is summarised in Figure 1.3. and Table 1.1.

Regarding surface water availability in SAF, the Study Area mainly extends across parts of the large Upper Shannon catchment (HA 26), except for a small section in the north east crossing into the Erne catchment (HA 36). The sections of the Upper Shannon catchment within SAF covers the upper reaches around Lough Allen, the adjoining Boyle River sub catchment which includes Lough Gara, and then further downstream sections where the Shannon flows through Lough Forbes before entering the large Lough Ree.

Study Area F has a number of designated area sites including a few small water dependent Special Areas of Conservation (SAC) such as the Lough Forbes Complex SAC and Callow Bog SAC. There are some sections of the Upper Shannon catchment with WFD High Status Objectives (HSOs), but none designated for *Margaritifera* (Freshwater Pearl Mussel).

Around 60% of the water supply to Study Area F comes from surface water sources, with water being abstracted from 4no. lake sources and 1no. direct river abstraction within the Upper Shannon system. The largest abstraction is from the Lough Gara source, which supplies up to 10,000 m³/day to North Roscommon RWSS WRZ. Closely followed by the direct river abstraction from the River Shannon to supply up to 9,500 m³/day to Carrick on Shannon WRZ. Elsewhere, Grange Lough supplies up to 7,200 m³/day to North East Regional PWS WRZ, Lough Forbes supplies up to 6,900 m³/day to Longford Central WRZ, and Lough Kinale supplies up to 2,000 m³/day to Granard WRZ.

Overall, 13 groundwater sources are managed by Uisce Éireann in the region. The predominant aquifer type of the area is made up of karstic (5 – 7%) bedrock followed by poorly productive (40%), with a relatively minor contribution from productive fissured (3%). There are no sand and gravel bodies mapped in the area. 45 of the 51 public supply sources in Co. Roscommon are supplied by karstified limestones, highlighting their potential for to supply large quantities of water.

The karst forms a key regionally important aquifer in some areas, underlying much of Roscommon, which consists of clean limestone that has been extensively karstified. This band also extends north into Leitrim and east into Longford. All of the area's groundwater abstractions occur in this setting, with the majority appearing as spring overflows, which serve as points of groundwater discharge. Limestone dissolution during karstification causes groundwater flow to concentrate along certain pathways/conduits (Rk^c type aquifers), making it difficult to locate successful wells. Locating high yielding wells in Rk^c aquifers can be difficult due to the uneven distribution of permeability; failed and high yielding wells can occur close together. Both point and diffuse recharge occur. Diffuse recharge occurs via rainfall percolating through permeable subsoil and rock outcrops. Despite the presence of peat and till, point recharge to the underlying aquifer occurs by means of swallow holes and collapse features/dolines. The largest abstractions in the region take place from springs, most notably at Roscommon Central WSS (c. 6,000 m³/day), Boyle/Ardcarne WSS (c. 5,500 m³/day) and Castlerea WSS (c. 2,500 m³/day). The Dinantian (Lower Carboniferous) Impure Limestones are interleaved in places with the Pure Bedded Limestones. The limestones are often characterised by the occurrence of chert and shale bands and are generally less productive than the Pure Bedded Limestones. These rocks occur primarily in the east of the Study Area in Longford.

The Namurian Sandstones and Shales make up the 'shale uplands' in Leitrim, an area of flat-topped hills. The fractured upper and more permeable layer is unlikely to provide sustainable supplies for larger

wells and will often contain lesser quality water than the deeper permeable horizons. In general, optimum well yields from the Namurian aquifers will be obtained from boreholes drilled into one of the many fault zones and penetrating at least 50-100 m of the aquifer. Groundwater flow in the lesser productive Dinantian Shales and Limestones circulates primarily through fissures as these rocks do not show significant intergranular permeability, and are predominantly interbedded shales and limestones, with little or no sandstone content. Development will usually be possible in local zones (i.e. along faults, fractures and zones of clean limestone).

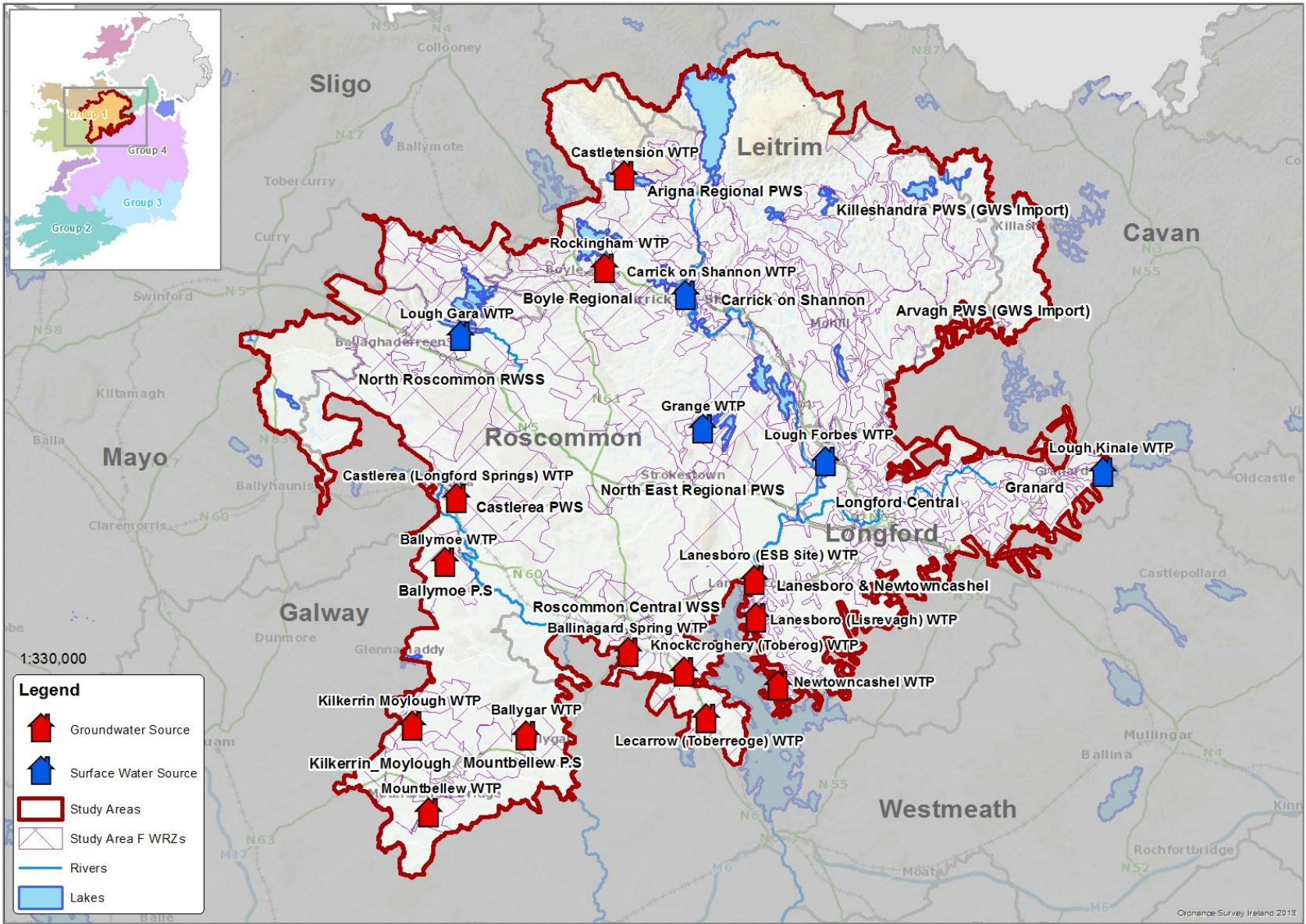


Figure 1.3 SAF Water Supply Study Area

Table 1.1 SAF Study Area Summary

Leitrim, Longford, Roscommon	Total Population	85,573	Total Network Length (km)	3,340	Number of Water Resource Zones	15	
Counties in Study Area	Cavan, Galway, Leitrim, Longford, Roscommon						
Principle Settlements	Longford, Carrick-On-Shannon, Drumlish, Newtownforbes, Boyle, Ballaghaderreen, Lanesborough-Ballyleague, Granard, Drumod, Drumshanbo, Roosky, Strokestown, Mount Bellew, Ballinamore, Mohill, Drumsna, Killashee, Termonbarry, Clontuskert, Ballygar						
Number of Water Sources	18	Surface Water Sources	5		Groundwater Sources	13	
Water Treatment Plant	Source	Population	WTP Capacity (m³/day)	Quality	Quantity	Reliability	Potential Sustainability
Grange WTP	Grange Lough	8,134	7,200	●	●	●	●
Castletenison WTP	Groundwater	816	1,730	●	●	●	●
Castlerea (Longford Springs) WTP	Groundwater	3,969	3,600	●	●	●	●
Rockingham WTP	Groundwater	5,648	5,000	●	●	●	●
Lecarrow (Toberreoge) WTP	Groundwater	1,562	2,200	●	●	●	●
Lough Gara WTP	Lough Gara	8,074	10,000	●	●	●	●
Knockcroghery (Toberog) WTP	Groundwater	848	1,000	●	●	●	●
Ballinagard Spring WTP	Groundwater	7,533	5,000	●	●	●	●
Newtowncashel WTP	Groundwater	400	380	●	●	●	●

Lough Forbes WTP	Lough Forbes	17,147	6,900	●	●	●	●
Lanesboro (Lisrevagh) WTP	Groundwater	4,908	1,600	●	●	●	●
Lanesboro (ESB Site) WTP	Groundwater	4,908	2,000	●	●	●	●
Lough Kinale WTP	Lough Kinale	2,647	2,000	●	●	●	●
Carrick on Shannon WTP	River Shannon	15,791	9,500	●	●	●	●
Mountbellew WTP	Groundwater	2,387	2,340	●	●	●	●
Kilkerrin Moylough WTP	Groundwater	1,575	1,335	●	●	●	●
Ballymoe WTP	Groundwater	707	800	●	●	●	●
Ballygar WTP	Groundwater	1,038	800	●	●	●	●

Score	Uisce Éireann Asset Standard Assessment
●	Low Risk
●	Medium Risk
●	
●	High Risk



2

**Scoping the Study
Area F**

2 Scoping the Study Area

In this chapter we summarise the current and future issues with water supplies in Study Area F, 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 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 SAF 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
Grange WTP	●	●	●	●
Castletenison WTP	●	●	●	●
Castlerea (Longford Springs) WTP	●	●	●	●
Rockingham WTP	●	●	●	●
Lecarrow (Toberreoge) WTP	●	●	●	●
Lough Gara WTP	●	●	●	●
Knockcroghery (Toberog) WTP	●	●	●	●
Ballinagard Spring 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
Newtowncashel WTP	●	●	●	●
Lough Forbes WTP	●	●	●	●
Lanesboro (Lisrevagh) WTP	●	●	●	●
Lanesboro (ESB Site) WTP	●	●	●	●
Lough Kinale WTP	●	●	●	●
Carrick on Shannon WTP	●	●	●	●
Mountbellew WTP	●	●	●	●
Kilkerrin Moylough WTP	●	●	●	●
Ballymoe WTP	●	●	●	●
Ballygar WTP	●	●	●	●

Score	Uisce Éireann Asset Standard Assessment
●	Low Risk
●	Medium Risk
●	
●	High Risk

The colour coding within the outline assessment indicates the severity of the potential risk of barrier failure. 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 internal Uisce Éireann assessment of the asset capability standard compared with the asset standard set out in Section 5.7 of the Framework Plan. The assessment provides an indication 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.

Based on the barrier assessment, 6 of the 18 WTPs in the Study Area are considered to be at high risk of failing to achieve the required standards in relation to barrier and viruses (Barrier 1) chlorine residuals

in our networks (Barrier 2.1) and effectiveness of our Protozoa removal processes (Barrier 3). 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, which are a requirement under the Recast Drinking Water Directive (2020), 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 are three WRZs within SAF on the EPA Remedial Action List, namely Longford Central North East Regional and Granard. Uisce Éireann is currently progressing immediate corrective action in relation to a number of supplies within SAF in advance of the NWRP. Details of these are included in Table 2.2

Table 2.2 Critical Water Quality Requirements SAF – Leitrim, Longford and Roscommon

Critical Water Quality Requirements	Progress
<p>1. Boyle Water Supply Extension: The project involved the extension of Boyle WSS (supplied by Rockingham Water Treatment Plant) to Grangemore, Co Roscommon and the decommissioning of Cavetown Water Treatment Plant which previously served Grangemore. The project has resulted in improved drinking water quality for the area and the removal of Grangemore from the EPA's Remedial Action List.</p>	Complete
<p>2. Carrick-on-Shannon WTP: Upgrade of Carrick-on-Shannon WTP. The works carried out have enhanced water treatment processes and increased capacity and resilience the water treatment plant, ensuring a safe and secure water supply for residents, agriculture, tourism and industry in the area.</p>	In Progress
<p>3. Longford Central: Upgrade of water treatment plant. Catchment focused engagement regarding pesticides control with the stakeholders required.</p>	In Progress
<p>4. Granard: Amona in raw water in Lough Kinale. Existing WTP requires upgrade and intake requires to be moved to more suitable location as it is currently overgrowing with vegetation. Uisce Éireann to develop the plan to address RAL.</p>	Scoping
<p>5. North East Regional Project involves construction of a new water treatment plant and intake works, site and ancillary works and associated pipelines. Testing is currently underway in order to ensure that it can be removed from the EPA RAL for elevated levels in THMs.</p>	In Progress
<p>6. Reservoir Cleaning Programme: A major reservoir cleaning programme has been undertaken at 48 sites, which has reduced network water quality issues.</p>	Complete
<p>6. Disinfection Programme:</p> <p>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 4 of the 15 WRZs in SAF, based on assessed priority basis.:</p> <ul style="list-style-type: none"> • Carrick-on-Shannon WTP • Lough Kinale WTP • Lanesboro (ESB Site) WTP • Lough Forbes WTP <p>Any requirements within the remaining 11 supplies will be identified via Drinking Water Safety Plans with solutions developed as part of the NWRP.</p>	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, see Table 2.1, will be brought through our options assessment process.

2.2 Water Quantity – Supply Demand Balance

Uisce Éireann assesses the water quantity investment needs of our supplies by developing SDB calculations for each of our water supplies as outlined 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.

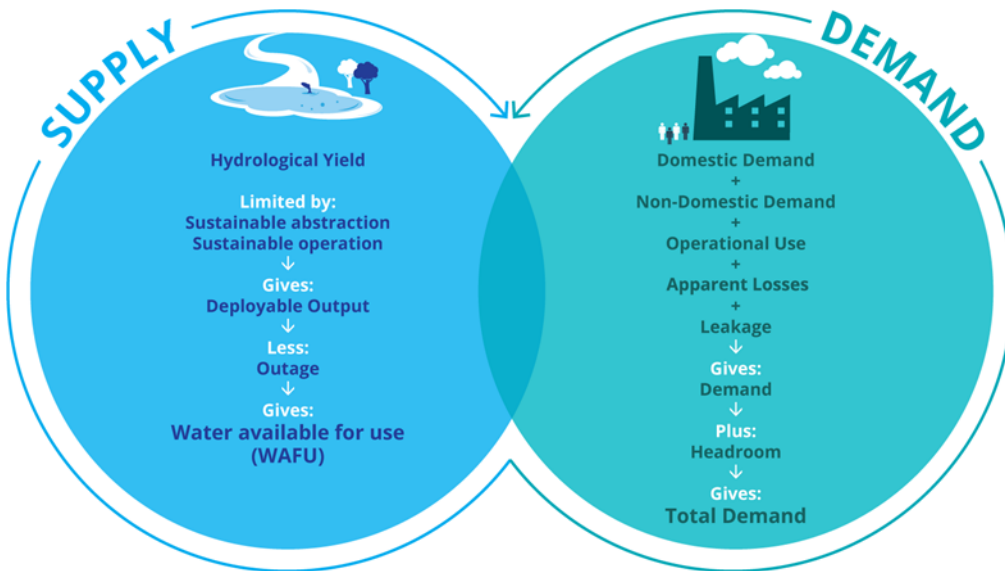


Figure 2.2 Supply Demand Balance

For each of the 15 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 SAF 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, Uisce Éireann must ensure appropriate standards of supply and be able to cope with drought conditions, peak events, and maintenance of assets. This requires adequate reserve capacity in our supplies to provide a 1 in 50 Level of service. 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:** 9 out of 15 water resource zones in the area suggest a supply demand balance deficit (based on a “do nothing” approach) under present & future scenarios. While sufficient on normal weather conditions, several would fail in drought. Longford Springs underwent night-time restrictions in June 2020. Furthermore, the nearby borehole had been used to supplement the spring supply. This ceased on Wednesday 8th July as spring water had replenished sufficiently following the rain over the preceding few weeks.

A summary of the SDB deficit across all 15 Water Resource Zones is summarised in Table 2.3. 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 (DYCP)

Water Resource Zone Name	Water Resource Zone code	Population	Estimated Maximum Deficit m ³ /day					
			2019	2025	2030	2035	2040	2044
North Roscommon Regional Water Supply Scheme	2600SC0009	8,074	-1,406	-1,274	-1,344	-1,414	-1,483	-1,538
Boyle Regional	2600SC0008	7,247	-112	-172	-229	-292	-355	-405
Arigna Regional PWS	2600SC0007	816	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Roscommon Central Water Supply Scheme	2600SC0004	9,942	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Castlerea PWS	2600SC0003	3,969	-2,128	-2,140	-2,153	-2,180	-2,211	-2,235
North East Regional PWS	2600SC0002	8,134	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Longford Central	2000SC0005	17,147	-3,302	-3,486	-3,652	-3,981	-4,350	-4,646
Granard	2000SC0002	2,647	-118	-144	-164	-183	-202	-217
Lanesboro & Newtowncashel	2000SC0001	5,309	-299	-215	-246	-322	-410	-481
Carrick-on-Shannon	1700SC0001	15,791	-4,860	-4,725	-4,874	-5,035	-5,197	-5,327
Ballymoe P.S.	1200SC0001	707	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Mountbellew P.S.	1100SC0001_I	3,425	-221	-250	-273	-296	-318	-336
Kilkerrin_Moylough	1100SC0001_F	1,575	-546	-577	-599	-613	-627	-637
Killeshandra PWS (GWS Import)	0200SC0005	415	0	0	0	0	0	0
Arvagh PWS (GWS Import)	0200SC0001	377	0	0	0	0	0	0

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 1 in 50 level 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 12,993 m³/day. 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 supply demand balance deficit will increase to approximately 15,823 m³/day by 2044.

Our ongoing activities to improve the Supply Demand Balance in SAF 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 network and appropriately manage our water production.

There are a number of problematic distribution and trunk mains throughout SAF. Uisce Éireann & 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.

To date, a significant amount of watermain rehabilitation has been carried out across Study Area F. This provides for a more reliable water supply, reducing instances of bursts and water outages. The works also improve water quality by replacing old cast iron and lead watermains, whilst reducing leakage and improving overall operation and maintenance of our supply system.

During our needs assessment Uisce Éireann identified a number of these critical requirements and progress to date on these projects is summarised in Table 2.4

Table 2.4 SAF Critical Infrastructure Projects and Need Identification

Critical Requirement	Progress
<p>1. National Leakage Reduction Programme – Lanesboro & Newtowncashel WRZ Ballymakeegan Water Mains Replacement:</p> <p>This project involved the decommissioning of 1,400 metres and replacement of approximately 1,500 metres of problematic water mains with high density polyethylene (plastic) pipes.</p>	Complete
<p>2. Longford Central raising main</p> <p>Single intake pipe and no standby raw water pumping. Rising main prone to burst and can flood nearby properties.</p>	Scoping
<p>3. Mountbellew Ballygar Boreholes</p> <p>Mountbellew Ballygar is supplied from Mountbellew as the current borehole in Ballygar struggles and can't supply water supply zone on its own. Further investigations required.</p>	Scoping
<p>4. Distribution Network Repairs and Upgrades:</p> <p>Rolling programme of active leakage control, pressure management, find and fix and network upgrades.</p>	In Progress

In summary, there are some asset reliability issues across the distribution network within the WRZ. 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 Éireanns 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. Most of these supplies predate most modern environmental legislation and none of our current abstractions in this area were developed through any formalised abstraction process.

As outlined at Section 3.7.2 of the Framework Plan, the Government is currently developing new legislation dealing with water abstractions. 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 in line with a precautionary approach.

To understand the potential impact of the pending Abstraction Legislation on the SAF Supplies, we have assessed the potential impacts on our 5 no. surface water abstractions: River Shannon (Carrick-on-Shannon), Lough Kinale (Granard), Lough Forbes (Longford Central), Lough Gara (North Roscommon Regional Water Supply Scheme), and Grange Lough (Lisheen) (North East Regional PWS).

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. The table presents our current abstraction levels¹, our source hydrological yield², and our estimated potential sustainable abstraction³ amount which the source may be limited to in the future.

Based on this initial assessment, it is not envisaged that there are sustainability issues with the volumes abstracted at the volumes of water abstracted at our surface water sources. However, under the proposed regulatory regime, this will be adjudicated on by the EPA.

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 (m ³ /day)
River Shannon (Carrick-on-Shannon)	8,708	87,000	28,963
Lough Kinale (Granard)	1,833	44,261	23,451
Lough Forbes (Longford Central)	6,325	255,558	338,206
Lough Gara (North Roscommon RWSS)	9,167	179,736	73,305
Grange Lough (North East Regional PWS)	6,600	37,241	34,835

The potential change to the SDB⁴ for each WRZ, as a result of these potential reductions in abstraction during dry weather flows are summarised in Table 2.6.

Table 2.6 Potential Change to the SDB Based on Potential Abstraction Reductions

Source (WRZ)	Potential change in WRZ SDB (m ³ /day)
River Shannon (Carrick-on-Shannon)	None
Lough Kinale (Granard)	None
Lough Forbes (Longford Central)	None
Lough Gara (North Roscommon RWSS)	None
Grange Lough (North East Regional PWS)	None

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.

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 based on available information, included in Appendix G of the 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.

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 F 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 and Sustainability

Quality	Upgrades required at all WTPs.
Quantity	Leakage Targets of 513 m ³ /day to achieve SELL in the region
	Additional Leakage Targets of 10,431 m ³ /day to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500 m ³ /day
	Interim additional supplies of 12,993 m ³ /day within 10 years and Total of 15,823 m ³ /day additional supplies beyond the 10-year horizon
Reliability (In addition to projects in	Continued network upgrades and improvements in the bulk and distribution networks and storage
Sustainability	<p>It is not envisaged that there are sustainability issues with the volumes abstracted at River Shannon (Carrick-on-Shannon), Lough Kinale (Granard), Lough Forbes (Longford Central), Lough Gara* (North Roscommon Regional Water Supply Scheme), Grange Lough (Lisheen) (North East Regional PWS). However, under the proposed regulatory regime, this will be adjudicated by the EPA.</p> <p><i>*Although Lough Gara, at desktop level, does not present sustainability issues, there are issues currently experienced at the abstraction location due to vegetation growth.</i></p> <p>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.</p>

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 F**

3 Solution Types Considered in Study Area F

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

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 SAF 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 SAF 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 1,500m³/day, see Table 3.1.

Table 3.1 SELL Targets for WRZ in SAF

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 /d (m ³ /day)	Total Leakage Targets (m ³ /day)
Kilkerrin Moylough		288	288
Mountbellew P.S.		456	456
Carrick-on-Shannon	254	2,681	2,935
Lanesboro & Newtowncashel	79	980	1,059
Longford Central		1,115	1,115
North East Regional PWS		304	304

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 /d (m ³ /day)	Total Leakage Targets (m ³ /day)
Castlerea PWS		499	499
Roscommon Central Water Supply Scheme		247	247
Boyle Regional		764	764
North Roscommon Regional Water Supply Scheme	180	3,097	3,277

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 SAF and include:

- Stand-alone groundwater options, across the region
- Stand-alone surface water options, across the region
- Transfers
- Rationalisations
- Upgrade WTP (WQ only)
- Other



4

**Option
Development SAF**

4 Option Development for Study Area F

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 – Unconstrained Options constitute all of the possible solutions, which either fully or partly resolve a water supply deficit, regardless of any cost, environmental or social constraints. In developing the Unconstrained List, we identify options that are applicable to meet the needs of the study area;
- 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.

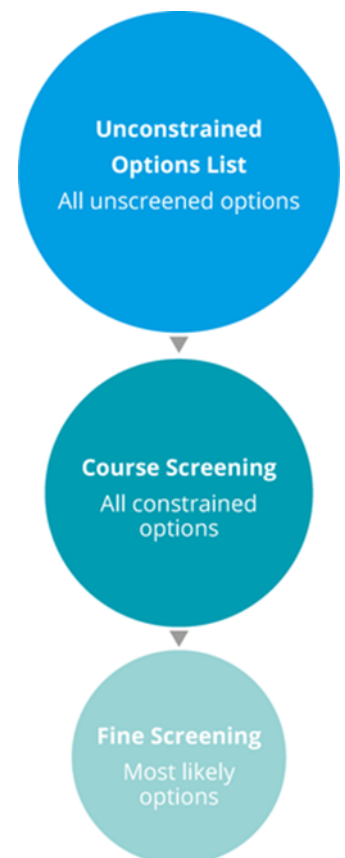


Table 4.1 Desktop Assessments for Unconstrained Options

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 SAF, 175 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 SAF Unconstrained Options

No. of Options	Option Type
53	Groundwater
40	Surface water
26	Rationalisation
49	Transfers
4	Upgrade WTP (WQ only)
3	Other

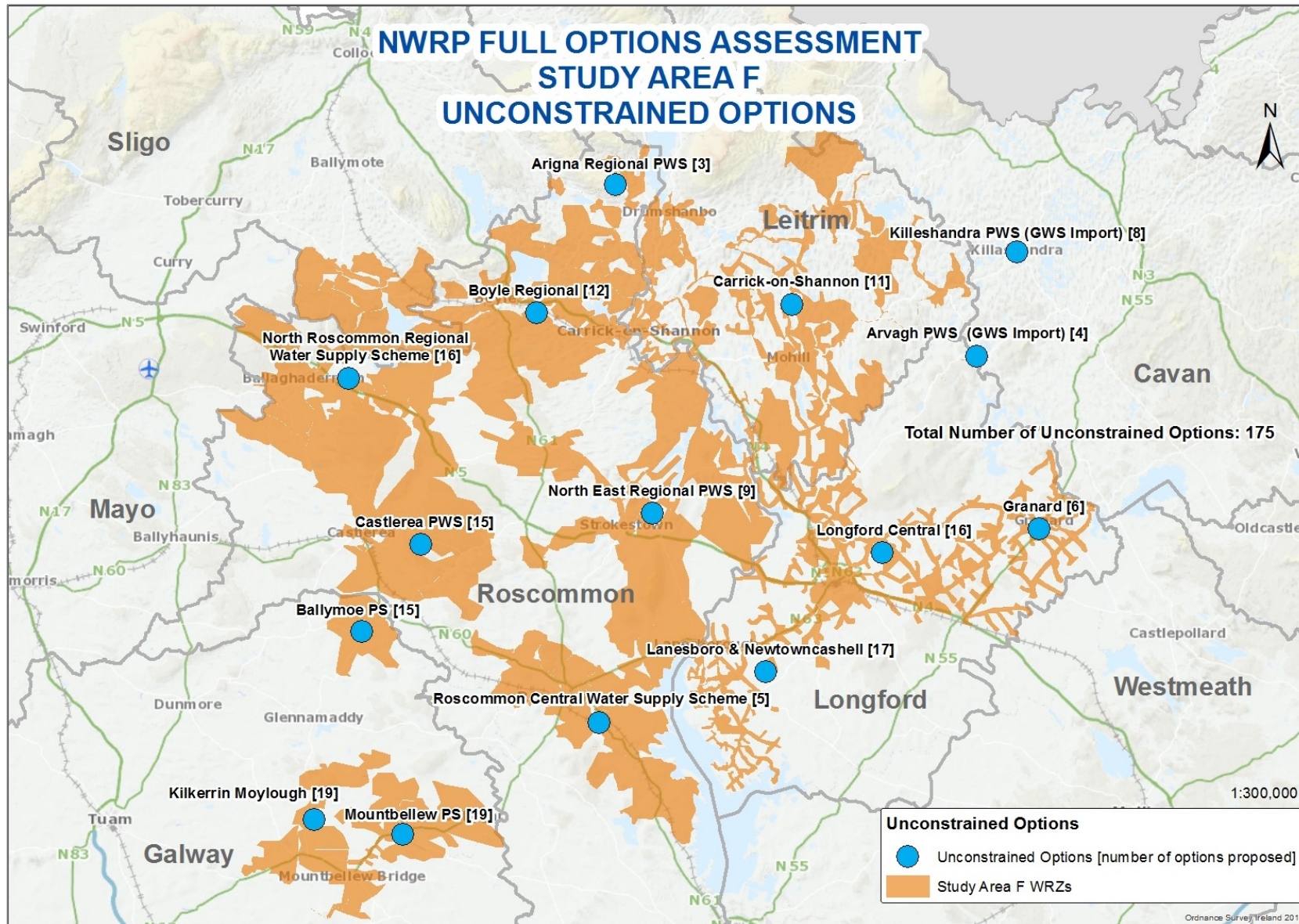


Figure 4.1 SAF Unconstrained Options

The 175 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 175 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, Hydrologist, Hydrogeologist, Ecologists and Environmental Scientists.

Example Rejected Option

Option SAF-011

New riverbank filtration adjacent to Lough Forbes (suitable location point TBC) to supply deficit in Longford Central WRZ

Rejection Reason

The overlying sediments here consist of peat with pockets of Till, as such this is not a feasible option.

52 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 Longford Central WRZ.

The remaining 123 options were progressed to further assessment through the Fine Screening process. The rejected options are summarised in Annex A of this technical report. Annex A 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 remaining options are summarised in Table 4.3.

Table 4.3 SAF Remaining Options after Course Screening

No. of Options	Option Type
37	Groundwater
31	Surface water
22	Rationalisation
29	Transfers
4	Upgrade WTP (WQ only)

4.3 Fine Screening

The 123 remaining options were subject to a more detailed multi-criteria assessment (MCA) at the Fine Screening Stage using desktop assessments of performance against 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, and the 123 options considered to be feasible were 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 SAF Remaining Options after Fine Screening (Feasible Options)

No. of Options	Option Type
37	Groundwater
31	Surface water
22	Rationalisation
29	Transfers
4	Upgrade WTP (WQ only)

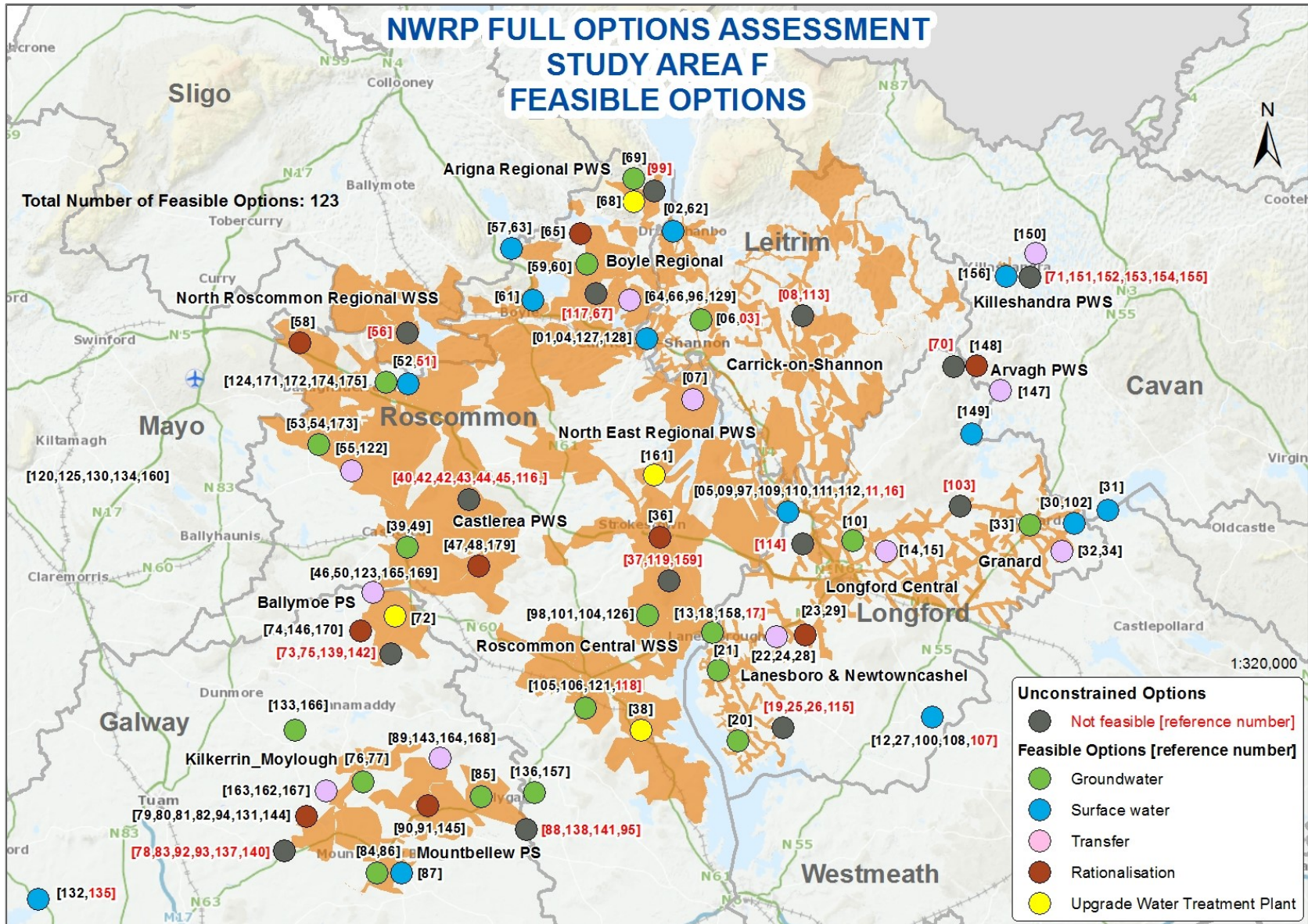


Figure 4.2 SAF Feasible Options

For the purposes of the NWRP, outline designs have been prepared at a desktop level for each feasible option (for use as part of comparative assessments between options). The outline designs include a high level inventory of option requirements, including capacities of plants, pipelines, pumps and treatment requirements. They include comparative budget costs estimates for required site level studies (including site level environmental assessments), Capital (CAPEX), Operational (OPEX), Environmental and Social (E&S) costs and Carbon Costs for use in the next stage of the assessment process.

4.4 Options Assessment Summary

The supply demand balance deficit in the region ranges between approximately 12,993 m³/day in 2019 during dry conditions, to a maximum of approximately 15,823 m³/day in 2044 during dry conditions. During the options assessment stage, a total of 175 unconstrained options were assessed. Of these 52 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
14	Resilience, Deliverability, Flexibility & Sustainability
19	Deliverability & Flexibility
1	Resilience, Deliverability, Flexibility
18	Other

The remaining 123 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 F. From this table it can be noted that there are 36 WRZ Options and 87 options which can be merged to form 38 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 SAF Feasible Options Summary

Water Resource Zone Name	Option Type	
	WRZ Option	SA Grouped Option
Arigna Regional PWS	1	1
Arvagh PWS (GWS Import)	1	1
Ballymoe P.S.	1	10
Boyle Regional	5	5
Carrick-on-Shannon	3	5
Castlerea PWS	2	7
Granard	4	2
Kilkerrin/Moylough	2	13
Killeshandra PWS (GWS Import)	2	0

Water Resource Zone Name	Option Type	
	WRZ Option	SA Grouped Option
Lanesboro & Newtowncashel	3	8
Longford Central	2	10
Mountbellew P.S.	4	6
North East Regional PWS	1	5
North Roscommon RWSS	4	11
Roscommon Central WSS	1	3



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 F.

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's next step is to assess a specified 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 NPV cost in terms of Capital, Operational, Environmental, 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
Quickest Delivery	Based on an estimate of the time taken to bring an option into	Statutory Obligations under the Water Supply

Approaches Tested	Description	Policy Driver
	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.	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 – NW 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-NW and the Environmental Review for this Study Area.

Within the Regional Plan, we will examine the Preferred Approach at a third spatial level across all of the Study Areas in the North West Region and will make any required changes in order to develop a Preferred Approach across the entire Region.

Further details on these three stages is provided in Chapter 7 of the RWRP-NW. Section 5.2 provides an overview of the application of this process to SA F.

5.2 Preferred Approach Development Process for Study Area F

5.2.1 Stage 1 – WRZ Level Approach

As outlined in Section 4.4 of this technical report there are 123 feasible options. 34 of these options are WRZ Options while 87 options are merged to form 38 Study Area Options. Table 5.2 outlines the 34 WRZ options for SAF, 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 SAF Feasible Options

Water Resource Zone Name	Feasible Options SAF	
	Option Code	Option Description
Arigna Regional PWS	SAF-068	Arigna Regional PWS not in deficit – Castletenison WTP Upgrade.
Arvagh PWS (GWS Import)	SAF-147	Maintain supply to Arvagh WRZ from Erne Valley GWS.
Ballymoe P.S.	SAF-072	Ballymoe WTP upgrade - no deficit.
Boyle Regional	SAF-059	Increase GW abstraction at Boyle WRZ to supply deficit.
Boyle Regional	SAF-060	New GW abstraction at Boyle WRZ to supply deficit.
Boyle Regional	SAF-061	New SW abstraction from Lough Key to supply deficit at Boyle Regional, new WTP.
Boyle Regional	SAF-062	New SW abstraction from Lough Allen to supply deficit at Boyle Regional, new WTP.
Boyle Regional	SAF-063	New SW abstraction from Lough Arrow to supply deficit at Boyle Regional, new WTP.
Castlerea PWS	SAF-039	Increase GW abstraction at Longford Springs to supply deficit and upgrade WTP.
Castlerea PWS	SAF-046	Connect neighbouring Group Water Schemes (Carane/Ballintubber, Ballymacurley/Kiltultoge, Shadlough, Grage Lower, Grange/Four-Mile-House, Ogulla/Tulsk, Rathcroghan, Clooneyquinn, Peake Mantua, Creglahan/Cloonchambers , Clooneygrasson, Rathcarren and Donamon) with Castlerea and create a new Mid-Roscommon Water Supply Scheme.
Granard	SAF-030	Increase SW abstraction from Lough Kinale, re-locate existing intake and upgrade WTP.

Water Resource Zone Name	Feasible Options SAF	
	Option Code	Option Description
Granard	SAF-031	New SW abstraction from Lough Sheelin to supply deficit at Granard WRZ, upgrade Lough Kinale WTP.
Granard	SAF-033	New GW to supply deficit in Granard WRZ, upgrade Lough Kinale WTP.
Granard	SAF-034	Supply Granard from neighbouring Group Water Scheme.
Kilkerrin/Moylough	SAF-076	Increase GW abstraction for Kilkerrin Moylough WRZ to supply deficit.
Kilkerrin/Moylough	SAF-077	New GW abstraction for Kilkerrin Moylough WRZ to supply deficit.
Killeshandra PWS (GWS Import)	SAF-150	Keep supplying Killeshandra WRZ from Erne Valley GWS.
Killeshandra PWS (GWS Import)	SAF-156	New SW abstraction from Lake Town and new WTP.
Lanesboro & Newtowncashel	SAF-018	Abandon existing ESB BHs location site with capacity of 1.9MI/d (not UÉ owned). Develop a new wellfield in the vicinity of current BHs.
Lanesboro & Newtowncashel	SAF-020	Increase abstraction at Ballagha Spring (Newtowncashel) and upgrade WTP.
Lanesboro & Newtowncashel	SAF-021	New GW abstraction to supply deficit at Lanesboro & Newtowncashel, upgrade Lisrevagh WTP.
Longford Central	SAF-009	Increase SW abstraction from Lough Forbes and upgrade WTP.
Longford Central	SAF-010	New GW abstraction (Newtown Forbes GWB) to supply full/part of the deficit in WRZ.
Mountbellew P.S.	SAF-085	Increase GW abstraction from Ballygar spring WRZ to supply deficit.
Mountbellew P.S.	SAF-084	Increase GW abstraction for Mountbellew WRZ to supply deficit.
Mountbellew P.S.	SAF-086	New GW abstraction for Mountbellew WRZ to supply deficit.
Mountbellew P.S.	SAF-087	New SW abstraction from Castlegar River, connection to existing Mountbellew WTP and WTP upgrade to supply deficit.
North East Regional PWS	SAF-161	Not in deficit - Grange WTP upgrade.

Water Resource Zone Name	Feasible Options SAF	
	Option Code	Option Description
North Roscommon RWSS	SAF-052	Abandon existing intake. New intake from middle lake to meet full demand. New 1.6km raw water mains to existing WTP. Upgrade of WTP to meet full demand.
North Roscommon RWSS	SAF-053	New GW abstraction - Creevy groundwater source.
North Roscommon RWSS	SAF-054	New GW abstraction (Swinford Gravels GWB, Gweestion-Moy Gravels Group 1 GWB, Carrick-on-Shannon GWB, Ballymote GWB).
North Roscommon RWSS	SAF-057	New SW abstraction from Lough Arrow to supply deficit at North Roscommon RWSS, new WTP.
Roscommon Central WSS	SAF-038	WTP Upgrade - Roscommon Central WSS not in deficit, pump tests to prove high yield spring and BHs.
Carrick-on-Shannon	SAF-001	Increase SW abstraction from River Shannon, upgrade Carrick on Shannon WTP.
Carrick-on-Shannon	SAF-002	New SW abstraction from Lough Allen.
Carrick-on-Shannon	SAF-006	New GW abstraction (Carrick-on-Shannon GWB, Newtown-Ballyconnell GWB, Annaghmore GWB, Scramoge North GWB) to supply full/part of the deficit in WRZ.

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 SAF Alignment of WRZ Options with Approach Categories

Water Resource Zone Name	Feasible Options SAF		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest	Best AA	Best SEA	Lowest Carbon	Most Resilient
Arigna Regional PWS	1	Arigna Regional PWS not in deficit - Castletenison WTP Upgrade.	✓	✓	✓	✓	✓	✓
Arvagh PWS (GWS Import)	1	Maintain supply to Arvagh WRZ from Erne Valley GWS.	✓	✓	✓	✓	✓	✓
Ballymoe P.S.	1	Ballymoe WTP upgrade - no deficit.	✓	✓	✓	✓	✓	✓
Boyle Regional	5	Increase GW abstraction at Boyle WRZ to supply deficit.	✓	-	✓	✓	✓	-

Water Resource Zone Name	Feasible Options SAF		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest	Best AA	Best SEA	Lowest Carbon	Most Resilient
		New GW abstraction at Boyle WRZ to supply deficit.	-	-	✓	-	-	-
		New SW abstraction from Lough Key to supply deficit at Boyle Regional, new WTP.	-	✓	✓	-	-	-
		New SW abstraction from Lough Allen to supply deficit at Boyle Regional, new WTP.	-	-	✓	-	-	✓
		New SW abstraction from Lough Arrow to supply deficit at Boyle Regional, new WTP.	-	-	-	-	-	-
Castlerea PWS	2	Increase GW abstraction at Longford Springs to supply deficit and upgrade WTP.	✓	✓	✓	✓	✓	✓
		Connect neighbouring Group Water Schemes (Carane/Ballintubber, Ballymacurley/Kiltultoge, Shadlough, Grage Lower, Grange/Four-Mile-House, Ogulla/Tulsk, Rathcroghan, Clooneyquinn, Peake Mantua, Creglahan/Cloonchambers, Clooneygrasson, Rathcarren and Donamon) with Castlerea and create a new Mid-Roscommon Water Supply Scheme.	-	-	✓	-	-	-
Granard	4	Increase SW abstraction from Lough Kinale, re-locate existing intake and upgrade WTP.	✓	✓	-	✓	✓	✓
		New SW abstraction from Lough Sheelin to supply deficit at Granard WRZ, upgrade Lough Kinale WTP.	-	-	-	-	-	✓
		New GW to supply deficit in Granard WRZ, upgrade Lough Kinale WTP.	-	-	✓	-	-	-
		Supply Granard from neighbouring Group Water Scheme.	-	-	-	✓	-	-
Kilkerrin/Moylough	2	Increase GW abstraction for Kilkerrin Moylough WRZ to supply deficit.	-	✓	✓	✓	-	✓

Water Resource Zone Name	Feasible Options SAF		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest	Best AA	Best SEA	Lowest Carbon	Most Resilient
		New GW abstraction for Kilkerrin Moylough WRZ to supply deficit.	✓	-	✓	-	✓	-
Killeshandra PWS (GWS Import)	2	New SW abstraction from Lake Town and new WTP.	-	-	-	-	-	-
		Keep supplying Killeshandra WRZ from Erne Valley GWS.	✓	✓	✓	✓	✓	✓
Lanesboro & Newtowncashel	3	Abandon existing ESB BHs location site with capacity of 1.9Ml/d (not UÉ owned). Develop a new wellfield in the vicinity of current BHs.	✓	-	✓	-	-	-
		Increase abstraction at Ballagha Spring (Newtowncashel) and upgrade WTP.	-	✓	✓	-	-	-
		New GW abstraction to supply deficit at Lanesboro & Newtowncashel, upgrade Lisrevagh WTP.	-	-	✓	✓	✓	✓
Longford Central	2	Increase SW abstraction from Lough Forbes and upgrade WTP.	✓	✓	-	-	✓	✓
		New GW abstraction (Newtown Forbes GWB) to supply full/part of the deficit in WRZ.	-	-	✓	✓	-	-
Mountbellew P.S.	4	Increase GW abstraction from Ballygar spring WRZ to supply deficit.	-	-	-	-	-	-
		Increase GW abstraction for Mountbellew WRZ to supply deficit.	✓	✓	-	✓	✓	✓
		New GW abstraction for Mountbellew WRZ to supply deficit.	-	-	-	-	-	✓
		New SW abstraction from Castlegar River, connection to existing Mountbellew WTP and WTP upgrade to supply deficit.	-	-	✓	-	-	✓
North East Regional PWS	1	Not in deficit - Grange WTP upgrade.	✓	✓	✓	✓	✓	✓
North Roscommon RWSS	4	Abandon existing intake. New intake from middle lake to meet full demand. New 1.6km raw water mains to existing	✓	-	-	✓	✓	-

Water Resource Zone Name	Feasible Options SAF		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest	Best AA	Best SEA	Lowest Carbon	Most Resilient
		WTP. Upgrade of WTP to meet full demand.						
		New GW abstraction - Creevy groundwater source.	-	✓	✓	-	-	-
		New GW abstraction (Swinford Gravels GWB, Gweestion-Moy Gravels Group 1 GWB, Carrick-on-Shannon GWB, Ballymote GWB).	-	✓	✓	-	-	-
		New SW abstraction from Lough Arrow to supply deficit at North Roscommon RWSS, new WTP.	-	-	✓	-	-	✓
Roscommon Central WSS	1	WTP Upgrade - Roscommon Central WSS not in deficit, pump tests to prove high yield spring and BHs.	✓	✓	✓	✓	✓	✓
South Leitrim Regional Carrick-on-Shannon	3	Increase SW abstraction from River Shannon, upgrade Carrick on Shannon WTP.	-	-	✓	-	✓	-
		New SW abstraction from Lough Allen.	-	✓	✓	-	-	✓
		New GW abstraction (Carrick-on-Shannon GWB, Newtown-Ballyconnell GWB, Annaghmore GWB, Scramoge North GWB) to supply full/part of the deficit in WRZ.	✓	-	✓	✓	-	-

The 7 Step Process outlined in Figure 5.1 was then applied to each WRZ in SAF, 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 SA at WRZ level, include the following:

- In terms of Best AA, 5 WRZs scores a 0 in relation to potential impact on a designated European Site;
- In 11 of the 15 Water Resource Zones, the Preferred Approach consists of the same Plan Level options as the Best AA. In 13 of the 15 WRZs, the Preferred Approach consists of the same Plan Level options as the Best Environmental Approaches.
- One WRZ 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.

Preferred Approaches at WRZ level are outlined in Table 5.4.

Table 5.4 SAF WRZ Approach Options

Water Resource Zone Name	Feasible Options SAF		Approach							
	Option Code	Option Description	Zero AA	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	Preferred Approach
Arigna Regional PWS	SAF-068	Arigna Regional PWS not in deficit - Castletenison WTP Upgrade.	✓	✓	✓	✓	✓	✓	✓	✓
Arvagh PWS (GWS Import)	SAF-147	Maintain supply to Arvagh WRZ from Erne Valley GWS.	✓	✓	✓	✓	✓	✓	✓	✓
Ballymoe P.S.	SAF-072	Ballymoe WTP upgrade - no deficit.	-	✓	✓	✓	✓	✓	✓	✓
Boyle Regional	SAF-059	Increase GW abstraction at Boyle WRZ to supply deficit.	✓	✓	-	✓	✓	✓	-	✓
Castlerea PWS	SAF-039	Increase GW abstraction at Longford Springs to supply deficit and upgrade WTP.	-	✓	✓	✓	✓	✓	✓	✓
Granard	SAF-030	Increase SW abstraction from Lough Kinale, re-locate existing intake and upgrade WTP.	-	✓	✓	-	✓	✓	✓	✓
Kilkerrin/Moylough	SAF-076	Increase GW abstraction for Kilkerrin Moylough WRZ to supply deficit.	-	-	✓	✓	✓	-	✓	✓
Killeshandra PWS (GWS Import)	SAF-150	Keep supplying Killeshandra WRZ from Erne Valley GWS.	✓	✓	✓	✓	✓	✓	✓	✓
Lanesboro & Newtowncashel	SAF-021	New GW abstraction to supply deficit at Lanesboro & Newtowncashel, upgrade Lisrevagh WTP.	-	-	-	✓	✓	✓	✓	✓
Longford Central	SAF-009	Increase SW abstraction from Lough Forbes and upgrade WTP.	-	✓	✓	-	-	✓	✓	✓
Mountbellew P.S.	SAF-084	Increase GW abstraction for Mountbellew WRZ to supply deficit.	-	✓	✓	-	✓	✓	✓	✓
North East Regional PWS	SAF-161	Not in deficit - Grange WTP upgrade.	✓	✓	✓	✓	✓	✓	✓	✓
North Roscommon RWSS	SAF-052	Abandon existing intake. New intake from middle lake to meet full demand. New 1.6km raw water mains to existing WTP. Upgrade of WTP to meet full demand.	-	✓	-	-	✓	✓	-	✓
Roscommon Central WSS	SAF-038	WTP Upgrade - Roscommon Central WSS not in deficit, pump tests to prove high yield spring and BHs.	-	✓	✓	✓	✓	✓	✓	✓

Water Resource Zone Name	Feasible Options SAF		Approach							
	Option Code	Option Description	Zero AA	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	Preferred Approach
Carrick-on-Shannon	SAF-001	Increase SW abstraction from River Shannon, upgrade Carrick on Shannon WTP.	✓	-	-	✓	-	✓	-	✓

5.2.2 Stage 2 - Creation of the Study Area Combinations

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 Approaches identified at WRZ level for the entire Study Area. Table 5.5 below provides a summary of the 38 Study Area options.

Table 5.5 SAF Study Area Options

Water Resource Zone Name	Feasible Options SAF		
	Option code	Option Description	SA Grouped Option
Carrick-on-Shannon Boyle Regional	SAF-501	Increase SW abstraction from River Shannon and interconnect Boyle and Carrick-on-Shannon WRZs for increased resilience.	Group 1
Carrick-on-Shannon Longford Central	SAF-502	Increase SW abstraction from Lough Forbes and supplement Carrick-on-Shannon WRZ, upgrade Lough Forbes WTP. Supply part of Carrick-on-Shannon from Lough Forbes WTP for increased resilience.	Group 2
Carrick-on-Shannon North East Regional PWS	SAF-503	Develop new wellfield in conjunction with GWS augmentation (Polecat Springs) and supply part of the deficit from North East Regional WRZ (Co. Roscommon).	Group 3
Longford Central Ballymahon	SAF-505	Supplement part of Longford Central deficit from Abbeyshrule WTP – River Inny (Ballymahon WRZ).	Group 5
Longford Central North East Regional PWS	SAF-506	Develop new wellfield in conjunction with GWS augmentation (Polecat Springs) and supply part of the deficit from North East Regional WRZ (Co. Roscommon).	Group 6
Longford Central Granard	SAF-507	Increase SW from Lough Kinale and interconnect Longford Central and Granard to supply deficit and increase resilience.	Group 7
Lanesboro & Newtowncashel North East Regional PWS	SAF-509	Supply part of the deficit at Lanesboro & Newtowncashel from North East Regional WSS.	Group 9
Lanesboro & Newtowncashel Roscommon Central WSS	SAF-510	Increase GW Ballinagard spring abstraction to supply Lanesboro & Newcashel WRZ, upgrade WTP. Rationalise Lanesboro to Roscommon Central (Ballinagard WTP).	Group 10

Feasible Options SAF			
Water Resource Zone Name	Option code	Option Description	SA Grouped Option
Lanesboro & Newtowncashel Roscommon Central WSS	SAF-511	Increase GW abstraction at Ballinagard WTP and supply Lanesboro & Newtowncashel.	Group 11
Lanesboro & Newtowncashel Ballymahon	SAF-513	Increase SW abstraction from River Inny to cover deficit for Ballymahon and supply full demand of Lanesboro & Newtowncashel (upgrade Abbeyshrule WTP).	Group 13
Lanesboro & Newtowncashel Longford Central	SAF-514	Increase SW abstraction from Lough Forbes to cover deficit in Longford Central and Lanesboro & Newtowncashel WRZ (upgrade Lough Forbes WTP).	Group 14
Lanesboro & Newtowncashel Longford Central	SAF-515	Increase SW abstraction from Lough Forbes to cover deficit in Longford Central and supply full demand for Lanesboro & Newtowncashel WRZ, upgrade (Lough Forbes WTP).	Group 15
Granard Longford Central	SAF-516	Increase SW abstraction from Lough Forbes to cover deficit in Longford Central and Granard WRZ (upgrade Lough Forbes WTP).	Group 16
North East Regional PWS Longford Central	SAF-517	Increase SW abstraction from Lough Forbes to cover deficit in Longford Central and supply full demand for North East Regional PWS (upgrade Lough Forbes WTP).	Group 17
Castlerea PWS Lough Mask & Westport Ballymoe P.S.	SAF-521	Increase SW abstraction from Lough Mask and rationalise Castlerea PWS and Ballymoe P.S..	Group 21
Castlerea PWS Roscommon Central WSS	SAF-522	Increase GW abstraction at Ballinagard WTP to fully cover Castlerea PWS demand.	Group 22
Castlerea PWS North Roscommon RWSS	SAF-523	Increase GW abstraction and interconnect Castlerea PWS WRZ with North Roscommon WRZ.	Group 23
Castlerea PWS Ballymoe P.S.	SAF-524	Interconnect Castlerea PWS WRZ with Ballymoe WRZ and supply deficit	Group 24
North Roscommon RWSS Charlestown	SAF-525	Increase GW abstraction from unnamed spring between Killaturly and Charlestown interconnect North Roscommon WRZ and Charlestown WRZ.	Group 25
North Roscommon RWSS Lough Mask & Westport	SAF-526	Increase SW abstraction from Lough Mask to supply deficit at Lough Mask & Westport	Group 26

Feasible Options SAF			
Water Resource Zone Name	Option code	Option Description	SA Grouped Option
		WRZ (upgrade WTP). Rationalise North Roscommon RWSS to Lough Mask RWSS.	
Boyle Regional North East Regional PWS	SAF-527	Supply deficit in Boyle from North East Regional PWS.	Group 27
Boyle Regional Carrick-on-Shannon	SAF-528	Rationalise Boyle Regional to South Leitrim WRZ (increase abstraction from Shannon and upgrade WTP).	Group 28
Boyle Regional Carrick-on-Shannon	SAF-529	Interconnect Boyle Regional with South Leitrim WRZ and supply deficit (increase abstraction from Shannon and upgrade WTP).	Group 29
Arigna Regional PWS Boyle Regional	SAF-530	Interconnect Arigna Regional PWS with Boyle Regional to supplement supply.	Group 30
Ballymoe P.S. Lough Mask & Westport	SAF-531	Increase SW abstraction from Lough Mask to supply deficit at Lough Mask & Westport WRZ (upgrade WTP). Rationalise Ballymoe to Lough Mask.	Group 31
Kilkerrin/Moylough Mid-Galway	SAF-532	Increase GW abstraction at Danganbeg WTP and supply Kilkerrin/Moylough WRZ.	Group 32
Kilkerrin/Moylough Galway City (Terryland & Luimnagh) [Tuam RWSS]	SAF-533	Rationalise Kilkerrin/Moylough to Tuam RWSS (Luimnagh).	Group 33
Kilkerrin/Moylough Dunmore /Glenamaddy P.S.	SAF-534	Increase GW abstraction at Gortgarrow Spring, upgrade WTP. Rationalise Kilkerrin/Moylough to Dunmore Glenamaddy.	Group 34
Kilkerrin/Moylough Lough Mask & Westport	SAF-535	Increase SW abstraction from Lough Mask and supply Kilkerrin/Moylough WRZ, upgrade WTP.	Group 35
Mountbellew P.S. Mount Talbot/Four Roads	SAF-537	Increase GW (spring) abstraction at Cloonlaughnan WTP, rationalise Ballygar WTP and connect Mountbellew to Mount Talbot/Four Roads.	Group 37
Dunmore /Glenamaddy P.S. Kilkerrin/Moylough Mountbellew P.S. Ballymoe P.S.	SAF-541	Interconnect Dunmore/Glenamaddy, Kilkerrin Moylough, Mountbellew, and Ballymoe to create regional scheme for increased resilience and rationalise to Lough Mask.	Group 41

Feasible Options SAF			
Water Resource Zone Name	Option code	Option Description	SA Grouped Option
Lough Mask & Westport			
Arvagh PWS (GWS Import) Gowna	SAF-542	Increase SW abstraction from Lough Gowna and supply Arvagh PWS.	Group 42
Mountbellew P.S. Mount Talbot/Four Roads	SAF-544	Increase GW spring abstraction and supply Mountbellew and Ballygar.	Group 44
Longford Central Lanesboro & Newtowncashel	SAF-545	Increase GW abstraction and supplement Longford Central from Lanesboro BHs.	Group 45
Dunmore /Glenamaddy P.S. Kilkerrin/Moylough Mountbellew Ballymoe P.S.	SAF-546	Interconnect Dunmore Glenamaddy, Kilkerrin/Moylough, Mountbellew, Ballygar and Ballymoe and supply from Tuam.	Group 46
Dunmore /Glenamaddy P.S. Ballymoe P.S Mountbellew Kilkerrin/Moylough	SAF-547	Augment current sources at Dunmore Glenamaddy and/or Kilkerrin/Moylough and supply Dunmore Glenamaddy, Kilkerrin/Moylough, Mountbellew, Ballygar and Ballymoe.	Group 47
North Roscommon RWSS	SAF-548	Further develop existing Trial Wells at L Gara WTP to partly supply full demand (Abandon existing L Gara source). Further develop existing TW's at Creevy to partly supply full demand (Abandon existing L Gara source). New GW development in vicinity of Creevy to partly supply full demand (Abandon existing L Gara source). New GW development in vicinity of Lissian to partly supply full demand (Abandon existing L Gara source). Increase GW abstraction and interconnect Castlerea Regional WRZ with North Roscommon WRZ (Abandon existing L Gara source).	Group 48

Water Resource Zone Name	Feasible Options SAF		
	Option code	Option Description	SA Grouped Option
Castlerea PWS	SAF-549	Rationalise Castlerea Regional WRZ to Lough Mask	Group 49

The 38 Study Area options result in 14 SA Combinations, including the WRZ Level Approach, which can meet the need across all WRZs. The 14 SA Combinations in terms of the types of options within each combination are summarised in Table 5.6 below.

Table 5.6 SA7 Combinations Options Summary

Key	WRZ Approach Option	○	SA Grouped Option	□
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WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 29,34,42)	SA Combination 2 (SA Grouped Option 2)	SA Combination 3 (SA Grouped option 9, 29)	SA Combination 4 (SA Grouped option 11, 29)	SA Combination 5 (SA Grouped option 14, 29)	SA Combination 6 (SA Grouped option 23)	SA Combination 7 (SA Grouped option 24)	SA Combination 8 (SA Grouped option 29)	SA Combination 9 (SA Grouped option 29,30)	SA Combination 10 (SA Grouped option 34)	SA Combination 11 (SA Grouped option 29, 37)	SA Combination 12 (SA Grouped option 41)	SA Combination 13 (SA Grouped option 42)
Arigna Regional PWS	○	○	○	○	○	○	○	○	○	□	○	○	○	○
Arvagh PWS (GWS Import)	○	□	□	□	□	□	□	□	□	□	□	□	□	□
Ballymoe P.S.	○	○	○	○	○	○	○	□	○	○	○	○	□	○
Boyle Regional	○	□	○	□	□	□	○	○	□	□	○	□	○	○
Castlerea PWS	○	○	○	○	○	○	□	□	○	○	○	○	○	○
Granard	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Kilkerrin/Moylough	○	□	○	○	○	○	○	○	○	○	□	○	□	○
Killeshandra PWS (GWS Import)	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Lanesboro & Newtowncashel	○	○	○	□	□	□	○	○	○	○	○	○	○	○
Longford Central	○	○	□	○	○	□	○	○	○	○	○	○	○	○
Mountbellew	○	○	○	○	○	○	○	○	○	○	○	□	□	○
North East Regional PWS	○	○	○	□	○	○	○	○	○	○	○	○	○	○
North Roscommon RWSS	○	○	○	○	○	○	□	○	○	○	○	○	○	○
Roscommon Central WSS	○	○	○	○	□	○	○	○	○	○	○	○	○	○
Carrick-on-Shannon	○	□	□	□	□	□	○	○	□	□	○	□	○	○

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. As the WRZ Level Preferred Approach did not meet the deficit for the Study Area as a whole, it has not been assessed and assigned a score for the purposes of determining the best performing alternative within each approach category.

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 Fig 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 SAF Summary of SA Combination of Performance against Approach Type

Ranked order (best to worst)	Best													Worst
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WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 29,34)	SA Combination 2 (SA Grouped Option 2)	SA Combination 3 (SA Grouped Option 9, 29)	SA Combination 4 (SA Grouped Option 11, 29)	SA Combination 5 (SA Grouped Option 14, 29)	SA Combination 6 (SA Grouped Option 23)	SA Combination 7 (SA Grouped Option 24)	SA Combination 8 (SA Grouped Option 29)	SA Combination 9 (SA Grouped Option 29, 30)	SA Combination 10 (SA Grouped Option 34)	SA Combination 11 (SA Grouped Option 29, 37)	SA Combination 12 (SA Grouped Option 41)	SA Combination 13 (SA Grouped Option 42)
Least Cost	Best												Worst	
Quickest Delivery		Best											Worst	
Best AA biodiversity	1 -3 AA Impacts	2 -3 AA Impacts	1 -3 AA Impacts	1-3 AA Impacts	1 -3 score	One -3 AA Impacts	0 -3 AA Impacts	1 -3 AA Impacts	1 -3 AA Impacts	2 -3 AA Impacts	2 -3 AA Impacts	2 -3 AA Impacts	1 -3 AA Impacts	1-3 AA Impacts
Lowest Carbon	Best		Worst											
Most Resilient				Worst									Best	
Best Environmental							Best*							Worst

The SA combinations outlined in Table 5.6 are assessed to determine the approach categories as summarised in Table 5.8

Table 5.8 Best Combinations

Approach Categories	Best Performing Combination
Least Cost (LCo)	WRZ Approach
Best Environmental (BE)	SA Combination 6*
Quickest Delivery (QD)	SA Combination 1
Most Resilient (MR)	SA Combination 12
Lowest Carbon (LC)	WRZ Approach
Best AA (BA)	SA Combination 6

*Although other combinations have a better environmental score, they also have -3 biodiversity scores. Therefore, combination 6 is selected as the best environmental as it has no -3 biodiversity scores and a similar environmental score overall.

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.

In terms of NPV Cost, the WRZ level approach has the lowest NPV Cost, as shown in Figure 5.2 with the lowest total costs (CAPEX and OPEX) over the solutions lifetime.

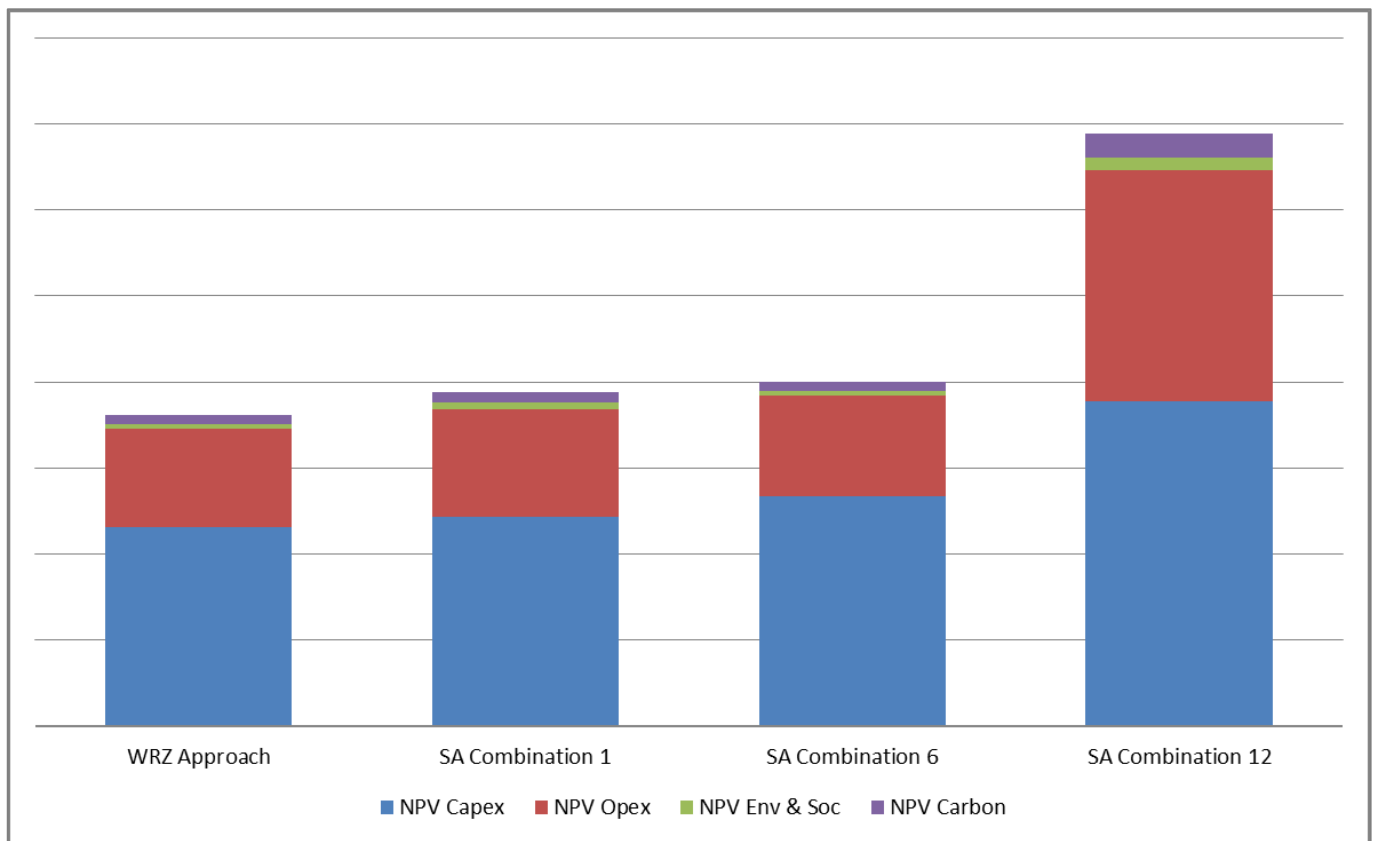


Figure 5.2 SAF NPV Costs for WRZ and SA approaches

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 (the WRZ Approach) against the Best AA Approach (SA Combination 6). The Least Cost Approach, includes one group option which has a -3 score against the AA criteria, which means likely significant effects of the options may be harder to mitigate whereas the Best AA Approach has no -3 scores against the AA criteria. The Best AA Approach was therefore progressed as the Preferred Approach.
- Step 2 – We compared the Quickest Delivery Approach (SA Combination 1) to the Best AA Approach (SA Combination 6). The Quickest Delivery Approach has two -3 scores against the AA criteria in comparison to no -3 scores against the AA criteria for the Best AA Approach. Despite this the Quickest Delivery Approach will be retained and progressed as the Preferred Approach. This is because the -3 scores within the Quickest Delivery Approach are assessed as having potential for mitigation while weaknesses affecting feasibility have been identified with the group option included in the Best AA Approach for Kilkerrin/Moylough. The Best AA Approach consists of the development of a new local groundwater source, however, recent trial wells data has indicated that the source may not be able to provide as much supply as previously expected due to the shallow rock. In addition, high manganese concentrations observed will result in water quality issues. Whilst rationalisation (as applied in the Quickest Delivery Approach) is associated with one -3 score Overall it is considered to be the best option for Kilkerrin/Moylough. The Quickest Delivery Approach also

has a -3 score associated with the option for North Roscommon RWSS which involves an increase in abstraction from Lough Gara and relocation of the abstraction point within the lake. Lough Gara is the largest and most resilient source within the local area. The -3 score has been assigned as Lough Gara is located within the zone of contribution of a number of Groundwater Dependent Terrestrial Environment (GWDTE). Despite this, it is believed that the -3 score (which indicates likely significant effects) will be mitigated by maintaining abstraction below the volume at which the GWDTE could be impacted. Further hydrological/hydrogeological assessments will be conducted at project level to determine impacts on designated sites. In the event that further assessment identifies that the AA impacts are not mitigable, SA option 23/ Group 523 would be considered as an alternative. There are also other benefits associated with the Quickest Delivery Approach such as for Boyle Regional the Quickest Delivery Approach would involve an interconnection to South Leitrim rather than an increase in the existing groundwater abstraction (as identified as part of the Best AA Approach) which is associated with water quality issues. As such it is believed that the Quickest Delivery Approach should be taken forward as the Preferred Approach.

- Step 3 – We compared the Quickest Delivery Approach (SA Combination 1) against the Best Environmental Approach (SA Combination 6). The Best Environmental Approach is also the Best AA Approach and for the above given reasons is not believed to be the best approach. Therefore the Quickest Delivery Approach was therefore retained at this stage.
- Step 4 – We compared the Quickest Delivery Approach (SA Combination 1) against the Most Resilient Approach (SA Combination 12). The Most Resilient Approach performed the worst against the Least Cost and Quickest Delivery criteria. It also scored poorly against the carbon criteria. There are no significant benefits to progressing the Most Resilient Approach over the Quickest Delivery Approach. The Quickest Delivery Approach was therefore retained at this stage.
- Step 5 - We compared the Quickest Delivery Approach (SA Combination 1) against the Lowest Carbon Approach (WRZ Approach). There were no significant benefits progressing the Lowest Carbon Approach over the Quickest Delivery Approach, as it was less resilient, scored lower for environmental impacts and there was no significant difference in NPV costs. Whilst there was 1 additional -3 score associated with the Quickest Delivery, as discussed above these are believed to be able to be mitigated. The Quickest Delivery Approach was therefore retained at this stage.
- Step 6 – A final assessment of the Quickest Delivery Approach was completed against the Least Cost, Best AA, Best Environmental, Most Resilient and Lowest Carbon Approaches. Whilst the Quickest Delivery Approach is associated with two -3 AA scores it is believed that these can be mitigated at site level although further project level assessments will be conducted to confirm this. This may include but is not limited to yield assessments, hydrological/hydrogeological modelling and catchment impact assessments. The other benefits in relation to cost, delivery timescales and resilience are understood to support the progression of this option. There is no significant difference between The Quickest Delivery Approach and alternative approaches against the criteria of carbon and environmental. The Quickest Delivery Approach is therefore retained at this stage as the Preferred Approach.
- Step 7 – The Quickest Delivery 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 F, which consists of the options listed in Table 5.9.

Table 5.9 Preferred Approach for SAF

WRZ Name	Option Description
Longford Central	SAF-009: Increase SW abstraction from Lough Forbes and upgrade WTP.
Lanesboro & Newtowncashel	SAF-021: New GW abstraction at Lisrevagh WTP.
Granard	SAF-030: Increase SW abstraction from Lough Kinale, re-locate existing intake and upgrade WTP
Roscommon Central WSS	SAF-038: WTP Upgrade - Not in deficit, pump tests to prove high yield spring and BHs.
Castlerea PWS	SAF-039: Increase GW abstraction at existing Longford Springs and boreholes to supply deficit and upgrade WTP;
North Roscommon RWSS	SAF-052: Abandon existing intake. New intake from middle lake to meet full demand. New 1.6km raw water mains to existing WTP. Upgrade of WTP to meet full demand.
Arigna Regional PWS	SAF-068: Not in deficit - WTP Upgrade.
Ballymoe P.S	SAF-072: WTP upgrade - no deficit.
Mountbellew	SAF-084: Increase GW abstraction for Mountbellew WRZ to supply deficit.
Killeshandra PWS (GWS Import)	SAF-150: Keep supplying Killeshandra WRZ from Erne Valley GWS.
North East Regional PWS	SAF-161: Not in deficit - WTP Upgrade.
Boyle Regional Carrick-on-Shannon	Group 29: Interconnect Boyle with Carrick-on-Shannon WRZ and supply deficit (increase abstraction from Shannon and upgrade WTP).
Kilkerrin/Moylough Dunmore/Glenamaddy	Group 34: Increase abstraction at Gortgarrow Spring WTP. Rationalise Kilkerrin/ Moylough to Dunmore/ Glenamaddy.
Arvagh PWS (GWS Import)	SAF-147: Maintain supply to Arvagh WRZ from Erne Valley GWS.

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

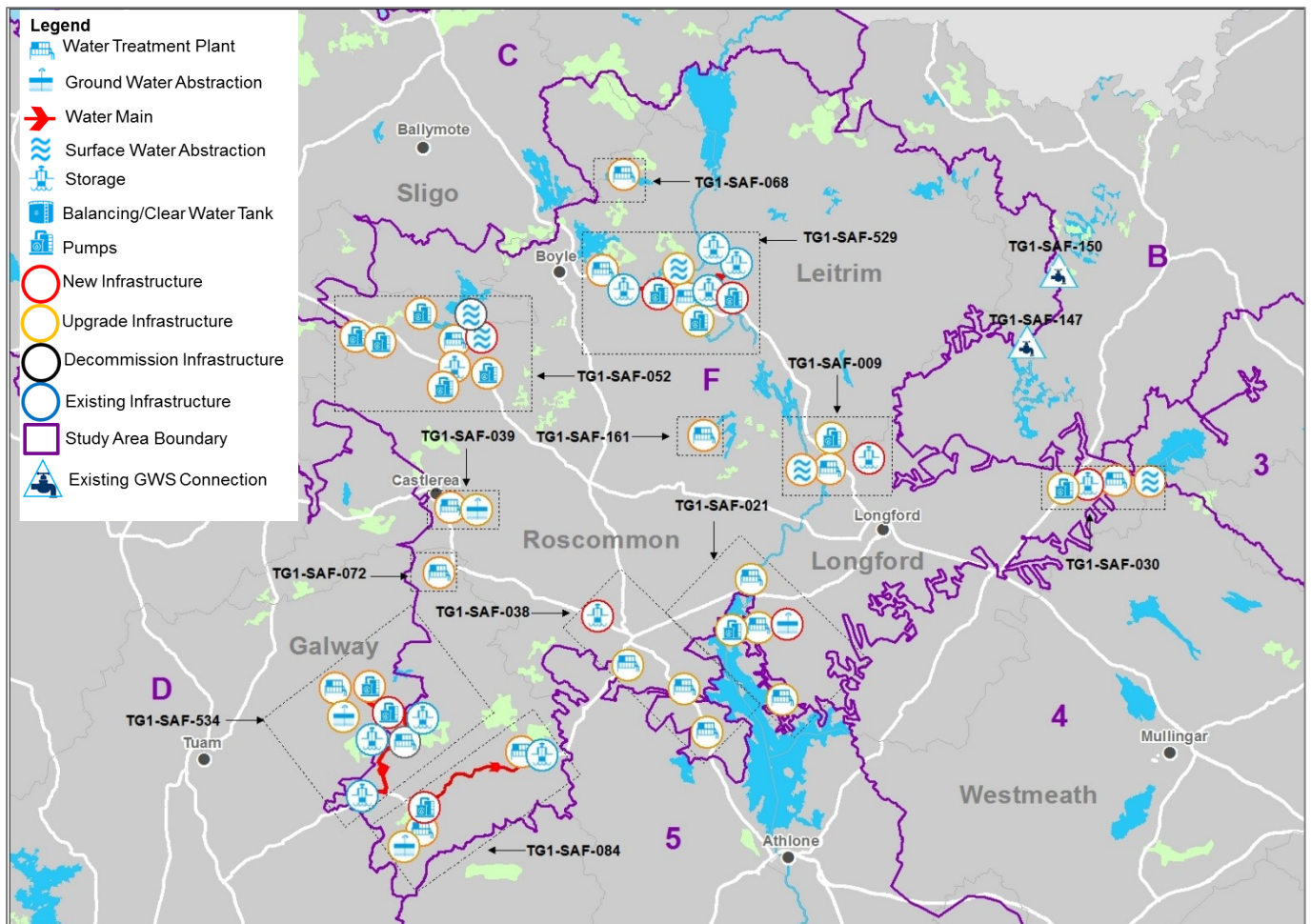


Figure 5.3 SAF Preferred Approach

The Preferred Approach for SAF, 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 SAF, we must give consideration to the following:

- **Interim Solutions:** Based on 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; and
- **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 population growth rates are lower than expected 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 priority need to address water quality risk or supply reliability e.g. RAL, 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 SAF Interim Options

WTP Name	Interim Option
Ballygar WTP	Refurb existing Spring, and upgrade WTP to UÉ Standards – Potential site for a containerised solution
Ballymoe WTP	Refurb existing Spring, and upgrade WTP to UÉ Standards
Kilkerrin Moylough WTP	Refurb existing Borehole, and upgrade WTP to UÉ Standards – Potential site for a containerised solution
Mountbellew WTP	Refurb existing Borehole, and upgrade WTP to UÉ Standards
Carrick on Shannon WTP	Upgrade WTP to UÉ Standards
Lough Kinale WTP	Upgrade WTP to UÉ Standards
Lanesboro (ESB Site) WTP	Refurb existing Borehole, and upgrade WTP to UÉ Standards
Lanesboro (Lisrevagh) WTP	Refurb existing Borehole, and upgrade WTP to UÉ Standards
Lough Forbes WTP	Upgrade WTP to UÉ Standards
Newtowncashel WTP	Refurb existing Spring, and upgrade WTP to UÉ Standards
Ballinagard Spring WTP	Refurb existing Spring, and upgrade WTP to UÉ Standards
Knockcroghery (Toberog) WTP	Refurb existing Spring, and upgrade WTP to UÉ Standards
Lough Gara WTP	Upgrade WTP to UÉ Standards
Lecarrow (Toberreoge) WTP	Refurb existing Spring, and upgrade WTP to UÉ Standards
Rockingham WTP	Refurb existing Borehole and Spring, and upgrade WTP to UÉ Standards
Castlerea (Longford Springs) WTP	Refurb existing Spring, and upgrade WTP to UÉ Standards
Castletenison WTP	Refurb existing Borehole, and upgrade WTP to UÉ Standards
Grange WTP	Upgrade WTP to UÉ Standards



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 SAF is shown in Table 7.1.

Table 7.1 Sensitivity Analysis for SAF

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)	+0 m ³ /day	<p>The impact of sustainability reductions would reduce the volumes that can be abstracted from our existing sources therefore increasing the supply demand balance deficit. Based on our initial assessment, it is not envisaged that there are sustainability issues with the volumes abstracted at our surface water sources as these 5no. abstractions are from large resilient sources in the Upper Shannon system. Groundwater sustainability is more difficult to assess at desktop level, however, as the abstractions in SAF are small in scale they do not appear to be problematic.</p> <p>Based on this scenario, the Preferred Approach remains the optimal solution.</p>

Uncertainty	Likelihood	Increase/Decrease in Deficit	Impact on Preferred Approach
Climate Change	High (international climate change targets have not been met)	+0 m ³ /day	<p>Higher climate change scenarios would impact our existing supplies and result in decreased water availability at certain times of year. Although the likelihood of this scenario is high based on climate change adaptation to date, potential impacts may be mitigated against by optimizing our operations on a more environmentally sustainable basis across the range of supplies. Regarding the existing groundwater abstractions, there is more difficulty and uncertainty in assessing increased climate change impacts, however it is understood that generally groundwater will be more resilient than surface water sources.</p> <p>Based on this scenario, the Preferred Approach remains the optimal solution.</p>
Demand Growth	Low/Moderate (growth has been based on policy)	-15,823 m ³ /day	<p>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 15 individual water resource zones and is driven by quality as well as quantity issues. In this rural area, growth is relatively low.</p> <p>Based on this scenario, the Preferred Approach remains the optimal solution.</p>
Leakage Targets	Low (Uisce Éireann is focused on sustainability and aggressive leakage reduction)	513 m ³ /day	<p>The impact of lower than expected leakage savings would increase the supply demand balance deficit and the overall need requirement.</p> <p>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.</p> <p>Based on this scenario, the Preferred Approach remains the optimal solution.</p>

Uncertainty	Likelihood	Increase/Decrease in Deficit	Impact on Preferred Approach
	Moderate/High (Uisce Éireann is focused on sustainability and aggressive leakage reduction)	10,431 m ³ /d	<p>Increased leakage savings beyond SELL would reduce the supply demand balance deficit and the overall need requirement. The need drivers in SAF are across all 15 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.</p> <p>Based on this scenario, the Preferred Approach remains as the optimal solution.</p>

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 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 – The supplies in SAF vary in size with a large number of small WRZs <1MI/d as well as large growth areas such as Carrick-on-Shannon. The majority of preferred options look to expand existing surface water and groundwater supplies which will require further investigation at project level.

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 F

8 Summary of Study Area F

The Preferred Approach for SAF (summarised in Table 5.9 and Figure 5.3) consists of local WRZ for Arigna Regional PWS, Ballymoe P.S, Castlerea PWS, Granard, Killeshandra PWS (GWS Import), Arvagh PWS (GWS Import), Lanesboro & Newtowncashel, Longford Central, Mountbellew, North East Regional PWS, North Roscommon RWSS, Roscommon Central WSS WRZs in the Study Area. As part of Grouped Preferred Approach, it is proposed to rationalise Kilkerrin/ Moylough to Dunmore/ Glenamaddy and interconnect Boyle with Carrick-on-Shannon WRZ and supply deficit from Carrick-on-Shannon. It is also proposed to increase abstraction from River Shannon and upgrade Carrick-on-Shannon 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 SAF 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 NRR;
- Nett leakage reduction in Carrick-on-Shannon, Lanesboro & Newtowncashel and North Roscommon Regional Water Supply Scheme Water Resource Zones, amounting to 513 m³ per day (applied to SDB Deficit) to move towards achieving the National SELL Target by 2034
- Continuation of UE household and business water conservation campaigns, initiatives and education programmes; and
- 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 SAF, as summarised in Table 6.1 in Section 6. The measures will only be progressed in the event of critical need and/or public health impact and to allow time for delivery of the required Preferred Approach solutions in the Study Area.

Annex A – Study Area F Water Treatment Plants

WTP Asset Name	Local Plant Names
Lough Kinale WTP	Lough Kinale WTP
Lanesboro (Lisrevagh) WTP	Lanesboro (Lisrevagh) WTP
Lanesboro (ESB Site) WTP	Lanesboro (ESB Site) WTP
Lough Forbes WTP	Lough Forbes WTP
Newtowncashel WTP	Newtowncashel WTP
Ballinagard Spring WTP	Ballinagard Spring WTP
Knockcroghery (Toberog) WTP	Knockcroghery (Toberog) WTP
Lough Gara WTP	Lough Gara WTP
Lecarrow (Toberreoge) WTP	Lecarrow (Toberreoge) WTP
Rockingham WTP	Rockingham WTP
Castlerea (Longford Springs) WTP	Castlerea (Longford Springs) WTP
Castletenison WTP	Castletenison WTP
Grange WTP	Grange WTP

Annex B – Study Area F Rejection Register Summary

Annex B Study Area F Rejection Register Summary

Study Area F - CS Rejection

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAF-003	New riverbank filtration adjacent to River Shannon at Carrick-on-Shannon to supply deficit in South Leitrim RWSS 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.	●	●	●
TG1-SAF-008	Partly supply deficit from Arigna (Co. Roscommon) to Drumshambo	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.	●	●	●
TG1-SAF-099	Partly supply deficit from Arigna (Co. Roscommon) to Drumshambo	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 and was rejected at fine screening stage.	●	●	●
TG1-SAF-011	New riverbank filtration adjacent to Lough Forbes (suitable location point TBC) to supply deficit in Longford Central WRZ	The overlying sediments here consist of peat with pockets of Till, as such this is not a feasible option. Therefore, this option did not meet the requirements of the Resilience or Deliverability criteria.	●	●	
TG1-SAF-016	Increase SW abstraction from Lough Forbes, upgrade WTP and interconnect Longford Central and Gowna to supply deficit and increase resilience	Gowna assessed as part of Study Area B. Therefore, this option was not progressed to the fine screening stage.	Gowna assessed as part of Study Area B		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAF-017	Increase GW abstraction from ESB well and extend supply from Lanesboro into Newtowncashel and upgrade 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.	●	●	●
TG1-SAF-019	New riverbank filtration adjacent to River Shannon at Lanesborough to supply deficit in Lanesboro & Newtowncashel WRZ	Difficult to constrain whether there are gravels beneath the alluvium and no information available on the alluvium itself. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAF-025	Raw water impoundment in cutaway bog area to capture flood water in Lanesboro & Newtowncashel WRZ	A bog is located on a regionally important aquifer (Karstified) presenting a water quality issue. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAF-026	Supply deficit from upgraded Abbeyshrule WTP (Ballymahon WRZ)	The option requires a significant length pipeline for a relatively small deficit. Transferring small quantities of water over long distances can affect the quality of water. Therefore, this option did not meet the Deliverability and Flexibility Criteria.		●	
TG1-SAF-037	Develop new wellfield in North East Regional PWS and supply deficit to neighbouring WRZs	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAF-103	Interconnect Longford Central and Gowna to supply deficit and increase resilience	Gowna assessed as part of Study Area B. Therefore, this option was not progressed to the fine screening stage.	Gowna assessed as part of Study Area B		
TG1-SAF-107	Increase SW abstraction from River Inny to cover deficit for Ballymahon and Lanesboro WRZ, upgrade Abbeyshrule WTP	The option requires a significant length pipeline for a relatively small deficit. Transferring small quantities of water over long distances can affect the quality of water. Therefore, this option did not meet the Deliverability and Flexibility Criteria.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAF-113	Develop new wellfield in North East Regional and supply neighbouring WRZs	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAF-114	Develop new wellfield in North East Regional and supply neighbouring WRZs	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAF-115	Develop new wellfield in North East Regional and supply neighbouring WRZs	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAF-116	Develop new wellfield in North East Regional and supply neighbouring WRZs	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAF-117	Develop new wellfield in North East Regional and supply neighbouring WRZs	Abstracting the volume of water required is considered unfeasible. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAF-040	Bring back Silver Island spring source	No information on the source with historic quality issues noted and there are better alternatives available. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAF-041	Longford Springs WTP upgrade only	When unconstrained options list was originally drawn up this WRZ was not in deficit; however, due to an updated SDB, the WRZ is now in deficit and requires additional supply.	WRZ is now in deficit and a new supply option is required.		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAF-042	New GW abstraction (Suck South GWB, Carrick-on-Shannon GWB, Suck North GWB) to supply deficit	New GW is not required, as it is likely that an increase at the existing spring will meet the demand requirement. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		•	
TG1-SAF-043	New SW source to supply Castlera WRZ	Surface water options have been assessed as part of other feasible options, so this option was not progressed.	Assessed as part of a different feasible option		
TG1-SAF-044	Supply part of the deficit from Roscommon Central WRZ	There is not enough surplus available at Roscommon Central to supply deficit in Castlereea. Increase in supply is assessed as part of a different option.	Assessed as part of a different feasible option		
TG1-SAF-118	Surplus to supply Castlereea. Small increase required at Ballingard for full deficit,	There is not enough surplus available at Roscommon Central to supply deficit in Castlereea. Increase in supply is assessed as part of a different option.	Assessed as part of a different feasible option		
TG1-SAF-045	Supply part of the deficit from North East Regional WRZ (Co. Roscommon)	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 is no longer in deficit		
TG1-SAF-119	Develop New GW Wellfield and supply Castlereea	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 is no longer in deficit		
TG1-SAF-051	Increase SW abstraction at Lough Gara and refurbish WTP intake	Problem at intake regarding overgrown vegetation and water quality treatability issues at lower lake. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		•	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAF-056	New SW abstraction from Lough Allen, upgrade Lough Gara WTP	The plan required a significant length of the pipeline for a relatively small supply. 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.		●	
TG1-SAF-067	Supply Boyle/Ardcarne from neighbouring Group Water Scheme (Drumherriff Co. Roscommon; Geevagh/Highwood, Castlebaldwin Co. Sligo) - options available locally	The plan required a significant length of the pipeline for a relatively small supply. 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.		●	
TG1-SAF-070	Maintain GWS import in Arvagh PWS	This is assessed as part of option SAF-147 and as a result, is not taken forward to the fine screening stage as it is assessed as part of a different feasible option	Assessed as part of a different feasible option		
TG1-SAF-071	Maintain GWS import in Killeshandra PWS	This is assessed as part of option SAF-150 and as a result, is not taken forward to the fine screening stage as it is assessed as part of a different feasible option	Assessed as part of a different feasible option		
TG1-SAF-073	New GW abstraction for Ballymoe WRZ 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 is no longer in deficit		
TG1-SAF-075	Critical Infrastructure Upgrades	This option will be considered by IW as a critical infrastructure option, and will be included as part of the design for feasible options	Considered as a critical infrastructure option and will be included in option design		
TG1-SAF-078	New SW abstraction for Kilkerrin Moylough WRZ to supply deficit	This option has a lack of suitable SW river sources in local vicinity that can meet the deficit. This is not a sustainable long-term abstraction to supply deficit. 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
TG1-SAF-083	Critical Infrastructure Upgrades	This option will be considered by IW as a critical infrastructure option, and will be included as part of the design for feasible options	Considered as a critical infrastructure option and will be included in option design		
TG1-SAF-088	Rationalise to Tuam regional	The option requires a significant length of pipeline for a relatively very small supply. 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.		●	
TG1-SAF-092	Increase GW abstraction at Ballymoe and interconnect and supply deficit to Dunmore/Glenamaddy, Kilkerrin Moylough and Mountbellew to create regional scheme for increased resilience	The option requires a significant length of pipeline for a relatively small deficit. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAF-093	Interconnect Dunmore/Glenamaddy, Kilkerrin Moylough, Mountbellew, Ballymoe and Four Roads	The option requires a significant length of pipeline for a relatively small deficit. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAF-095	Critical Infrastructure Upgrades	This option will be considered by IW as a critical infrastructure option, and will be included as part of the design for feasible options	Considered as a critical infrastructure option and will be included in option design		
TG1-SAF-135	Increase SW abstraction from Lough Corrib and supply Mountbellew	The option requires a significant length of pipeline for a relatively very small supply. 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.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAF-137	Increase GW abstraction at Ballymoe and interconnect and supply deficit to Dunmore/Glenamaddy, Kilkerrin Moylough and Mountbellew to create regional scheme for increased resilience	The option requires a significant length of pipeline for a relatively small deficit. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAF-138	Increase GW abstraction at Ballymoe and interconnect and supply deficit to Dunmore/Glenamaddy, Kilkerrin Moylough and Mountbellew to create regional scheme for increased resilience	The option requires a significant length of pipeline for a relatively small deficit. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAF-139	Increase GW abstraction at Ballymoe and interconnect and supply deficit to Dunmore/Glenamaddy, Kilkerrin Moylough and Mountbellew to create regional scheme for increased resilience	The option requires a significant length of pipeline for a relatively small deficit. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAF-140	Interconnect Dunmore/Glenamaddy, Kilkerrin Moylough, Mountbellew, Ballymoe and Four Roads	The option requires a significant length of pipeline for a relatively small deficit. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAF-141	Interconnect Dunmore/Glenamaddy, Kilkerrin Moylough, Mountbellew, Ballymoe and Four Roads	The option requires a significant length of pipeline for a relatively small deficit. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAF-142	Interconnect Dunmore/Glenamaddy, Kilkerrin Moylough, Mountbellew, Ballymoe and Four Roads	The option requires a significant length of pipeline for a relatively small deficit. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAF-143	Interconnect Dunmore/Glenamaddy, Kilkerrin Moylough, Mountbellew, Ballymoe and Four Roads	The option requires a significant length of pipeline for a relatively small deficit. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAF-151	Recommission Portaliffe WTP (Mill Lough) and supply Killeshandra.	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 and was rejected at fine screening stage.	●	●	●
TG1-SAF-152	Increase GW abstraction from existing boreholes at Ballyconnell to supply deficit and supply full demand to killeshandra, and rationalise Bawnboy and Swanlibar	The plan required a significant length of the pipeline for a relatively small supply. 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.		●	
TG1-SAF-153	Increase GW abstraction from existing boreholes at Ballyconnell to supply deficit and supply full demand to killeshandra, and rationalise Bawnboy and Swanlibar	This option covers 3 WRZs in Study Area B and is already assessed as part of this study area. As a result, is not taken forward to the fine screening stage as it is assessed as part of a different feasible option	Assessed in a different option		
TG1-SAF-154	Increase GW abstraction from existing boreholes at Ballyconnell to supply deficit and supply full demand to killeshandra, and rationalise Bawnboy and Swanlibar	This option covers 3 WRZs in Study Area B and is already assessed as part of this study area. As a result, is not taken forward to the fine screening stage as it is assessed as part of a different feasible option	Assessed in a different option		
TG1-SAF-155	Increase GW abstraction from existing boreholes at Ballyconnell to supply deficit and supply full demand to killeshandra, and rationalise Bawnboy and Swanlibar	This option covers 3 WRZs in Study Area B and is already assessed as part of this study area. As a result, is not taken forward to the fine screening stage as it is assessed as part of a different feasible option	Assessed in a different option		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAF-159	Develop new wellfield in North East Regional PWS. Supply deficit to neighbouring WRZs.	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 is no longer in deficit		