Summer 2023

Regional Water Resources Plan North West

Appendix 2 Study Area B 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.

Table of Contents

1 Introduction and Background

1 Introduction – Study Area B

This is the Technical Report for Study Area B 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 –North West (RWRP-NW), which explain key concepts and terminology used throughout the report.

This Study Area includes 23 water resource zones located in County Cavan, Donegal, Leitrim, Longford and Monaghan. 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.

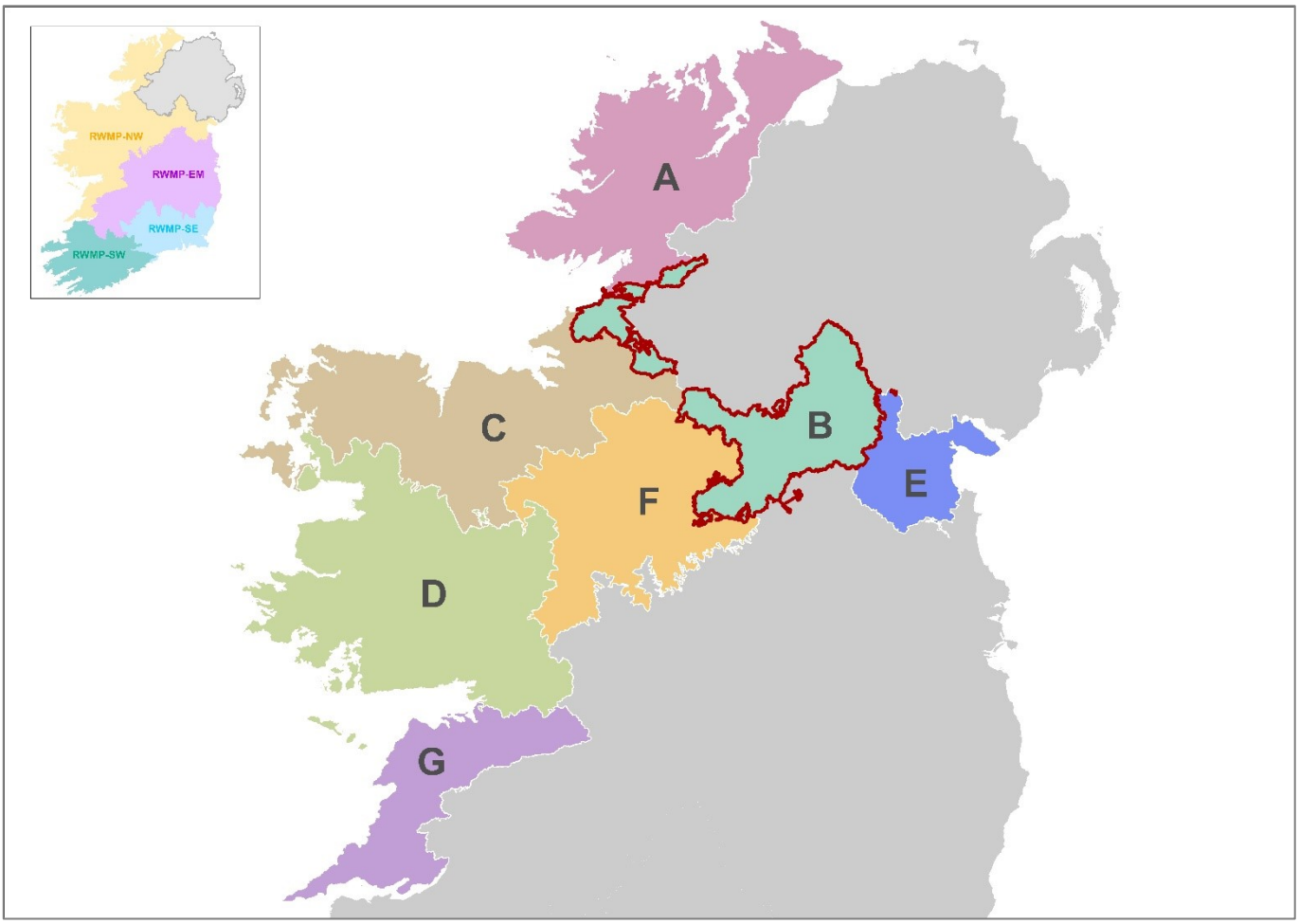

Figure 1.1 Overview of Study Areas within the Northern - Western Region

This Technical Report is for Study Area B (SAB), which consists of 23 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 North West 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.

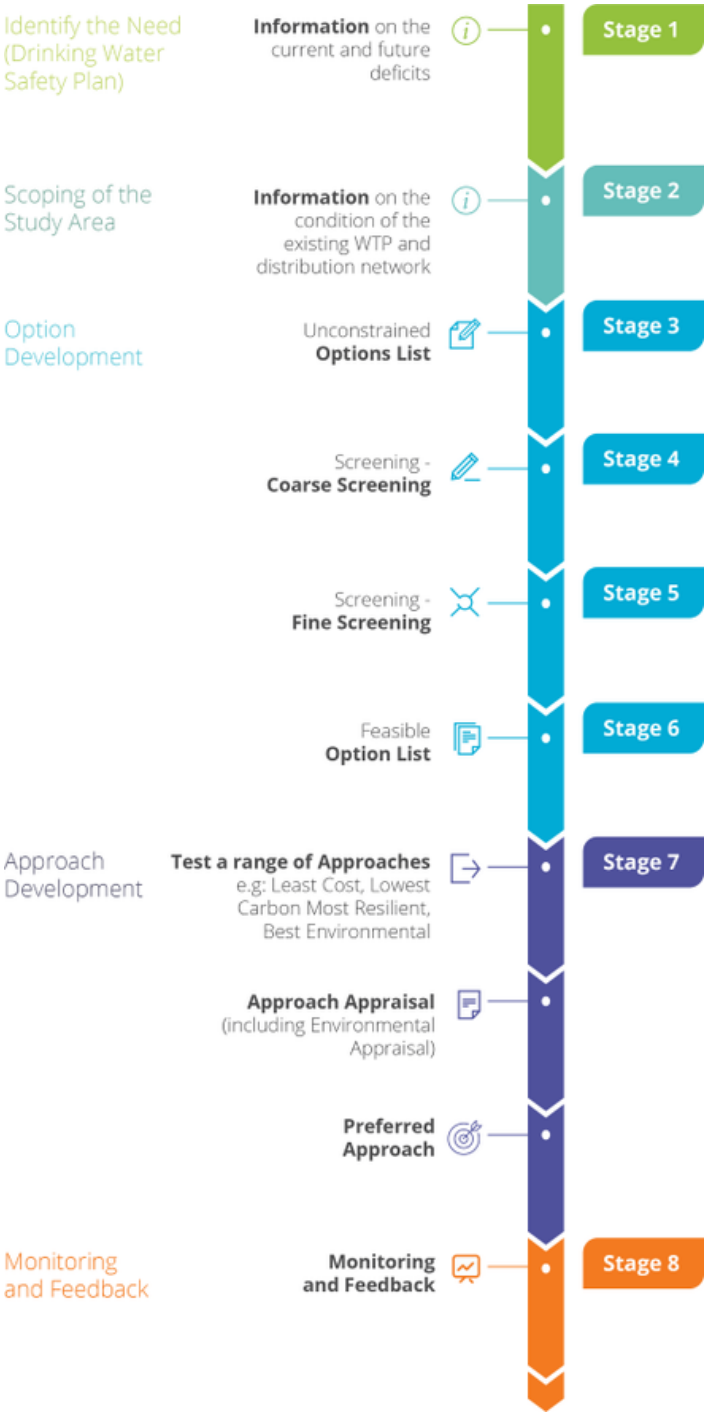

Figure 1.2 Option Assessment Methodology Process

1.2 Introduction to the Study Area

Study Area B consists of 23 WRZs supplying a population of approximately 58,272 people via approximately 1,205 kilometres of distribution network. SAB stretches across parts of County Cavan, Donegal, Leitrim, Longford, Monaghan, and Sligo as it extends along an area of the border region with Northern Ireland. Most of the study area has been delineated to be within the large cross-border River Erne catchment basin.

The town of Cavan is the largest demand centre, with other notable towns including Monaghan, Castleblayney, Ballybay and Ballyjamesduff. The sources of water supply consist of 12 surface water abstractions and 9 groundwater abstractions. The Study Area is summarised in Figure 1.3. and Table 1.1.

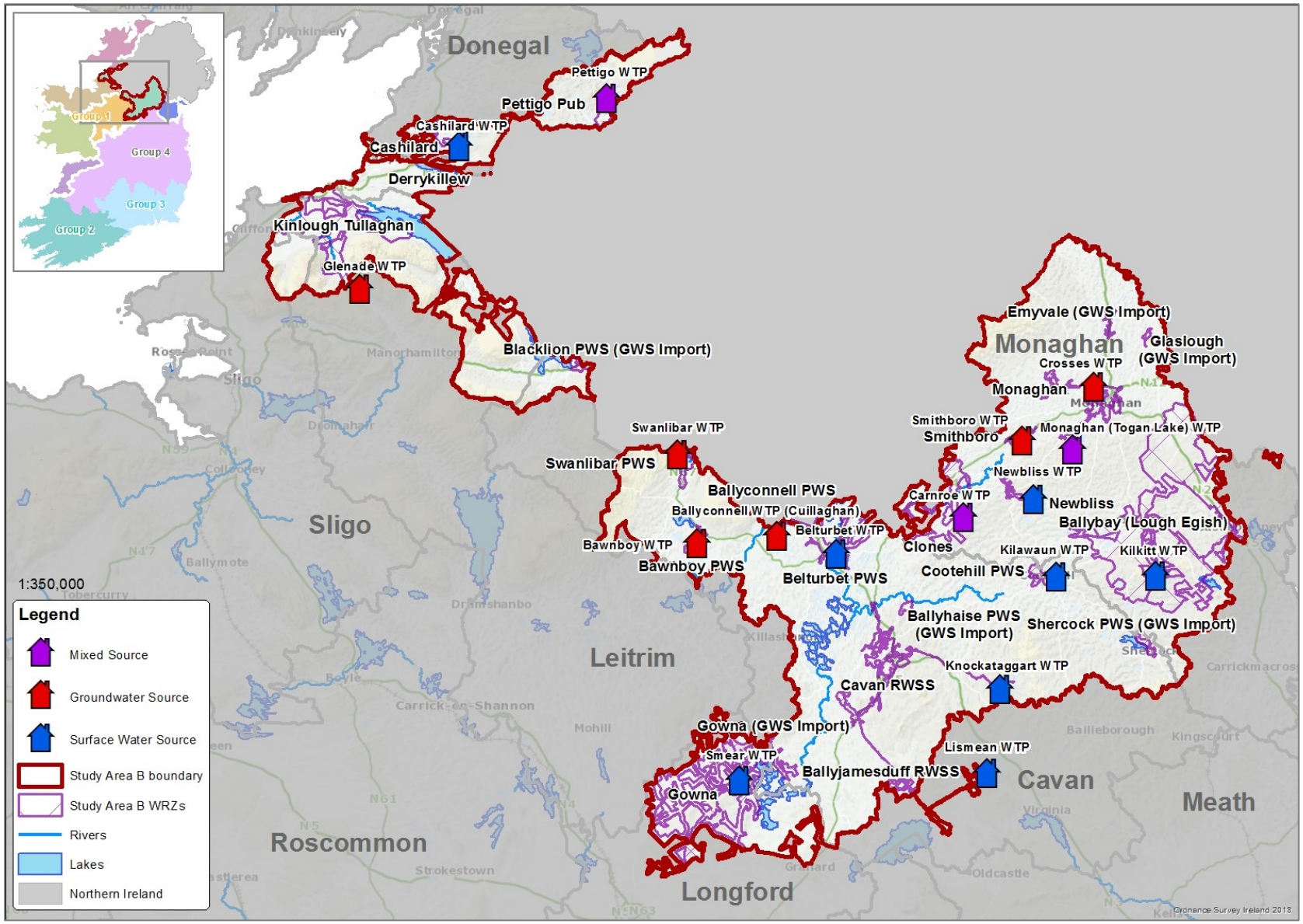

Figure 1.3 SAB Cavan Monaghan Water Supply Study Area

Regarding surface water availability in SAB, most of the study area is within the large cross-border River Erne catchment (HA 36), with a small area in the northeast around Monaghan being within the other large cross-border catchment of Lough Neagh & Lower Bann (HA 03). The Erne catchment covers an area of 4,415 km^2, with 2,515 km^2 of which located in The Republic. The Erne rises in the south of County Cavan, flowing through Lough Gowna and Lough Oughter, entering Upper Lough Erne as it crosses into Northern Ireland, before flowing back into The Republic and out to sea at Ballyshannon, County Donegal. The Erne catchment is dominated by a glacial drumlin landscape characterised by poorly drained low, steep-sided hills and a pattern of sinuous river tributaries and an abundance of shallow lake sources.

SAB has a group of designated area sites including 11no. Special Areas of Conservation (SACs) with notable areas including the Lough Oughter and Associated SAC and the Cuilcagh - Anierin Uplands SAC. There are no waterbodies designated for *Margaritifera* (Freshwater Pearl Mussel) SAC catchments but there are some sections of the Erne catchment with WFD High Status Objectives (HSOs).

Over two thirds of the water supplies for Study Area B come from surface water sources with the majority being from relatively small lake sources within the Erne catchment. The largest abstraction in SAB is the Lough Bawn source in the east of the study area which feeds the Kilkitt WTP to supply up to 8,400 m^3/day the Ballybay (Lough Egish) WRZ. The second largest abstraction is the Lough Acanon Dam source, which feeds Knockataggart WTP to supply up to 5,400 m^3/day to the Cavan Regional Water Supply Scheme (RWSS) WRZ. Lough Acanon is an impounding reservoir source in the Laragh River sub-catchment, constructed from the damming and raising of a natural lough to increase the yield available. Other notable surface water abstractions include the Nadrageel Lough source, which feeds Lismean WTP to supply up to 5,200 m^3/day to the Ballyjamesduff RWSS WRZ, and the Lough Gowna source, which feeds Smear WTP to supply up to 2,000 m^3/day Gowna WRZ, both in the south of the study area. The single direct river abstraction in SAB is from the main channel of the River Erne to feed Belturbet WTP to supply up to 1,000 m^3/day to the Belturbet Public Water Supply (PWS) WRZ in the centre of the study area.

Overall, 15 groundwater sources are managed by Irish Water in the region. The predominant aquifer type of the area is made up of poorly productive bedrock (55%), followed by productive fissured (15%) and karstic (8%) aquifers. There are no sand and gravel aquifers mapped in the area.

The majority of the bedrock in Study Area B is classified as poorly productive and will not offer the same kind of groundwater potential as the productive fissured and karstic rocks seen elsewhere. Groundwater flow in the lesser productive Dinantian Shales and Limestones circulates primarily though fissures as these rocks do not show significant intergranular permeability. These rocks occur primarily in counties Monaghan and Cavan, 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). Ordovician rocks primarily consisting of greywacke sandstones and slaty mudstones, shales and quartzites and Silurian Metasediments and Volcanics dominate the east of the Study Area. Although fractured the Ordovician and Silurian generally have a low permeability and are mostly regarded as a poor aquifer. Such rocks will often yield enough water to a well to supply a house or small farm (0.2-0.5 l/s and occasionally in major fracture zones may yield a good deal more. However, since the yield often depends on the permeability developed in the uppermost few metres of broken and weathered rock, yields will often decrease markedly in dry spells as the water table falls, and these supplies may therefore be unreliable.

Groundwater flow in the productive fissured aquifers largely takes place along fractures and faults. The majority of the region's abstractions take place from this setting. Dinantian (early) Sandstones, Shales and Limestones Group comprises a mixture of siltstones, sandstones, mudstones, shales and limestones. Overall, the interbedding will tend to limit vertical permeabilities and groundwater flow

systems will be rather localised. Permeability is generally low but may be higher in the sandstone and limestone beds, and substantially higher in certain areas. Where extensive faulting occurs, such as at Clones, the aquifer permeability is likely to be increased. Additional fracturing may also be associated with the faulting. Where clean limestones are present, dissolution may occur along faults, fractures and bedding planes, widening them and enhancing the permeability. The Clones Scheme currently supplies c. 600 m3/d. The wellfield at Monaghan records some large inflows from dolomitised limestone interbeds, found in the lower portions of the Bundoran Shale. Similarly, faulting between the Dartry Limestone and shales results in the high yields seen at PW5. Previous reports suggest all 10 boreholes, if brought online, could provide upwards of 5,700 m3/d.

The karst forms a key regionally important aquifer in some areas. The pure bedded limestones make up a relatively minor proportion of the bedrock here and are most prominent in northwest Cavan. A number of relatively high yielding wells (Ballyconnell Lough PWS at c. 890 m3/day and Bawnboy PWS at c. 230 m3/d) occur in this setting while others appear as spring overflows (Kinlough Tullaghan), which serve as points of groundwater discharge. Locating high yielding wells in Rkc 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.

Table 1.1 Study Area B Cavan Monaghan

Cavan, Donegal, Leitrim, Longford, Monaghan	Total Population	58,272	Total Network Length (km)	1,205	Number of Water Resource Zones	23
Counties in Study Area	Cavan, Donegal, Leitrim, Longford, Monaghan					
Principle Settlements	Cavan, Monaghan, Castleblayney, Ballyjamesduff, Bundoran, Cootehill, Clones, Belturbet, Tullaghan, Ballybay, Ballyconnell, Kinlough, Ballinagh					
Number of Water Sources	21	Surface Water Sources	12		Groundwater Sources	9

Water Treatment Plant	Source	Population	WTP Capacity (m^3/day)	Quality	Quantity	Reliability	Potential Sustainability
Monaghan (Togan Lake) WTP	Greagh Lough, Corcaghan Lough, Groundwater	8,286	4,000	●	○	○	●
Crosses WTP	Groundwater	8,286	4,600	●	○	○	○
Smithboro WTP	Groundwater	537	180	●	●	○	●
Newbliss WTP	Feagh Lough	419	333	●	○	○	●
Carnroe WTP	Corconnolly lake, Groundwater	2,674	2,200	●	○	○	●
Kilkitt WTP	Lough Bawn	10,744	8,400	●	○	○	○
Smear WTP	Lough Gowna	4,313	2,000	●	●	●	○
Glenade WTP	Groundwater	2,446	1,300	●	●	○	●

Water Treatment Plant	Source	Population	WTP Capacity (m^3/day)	Quality	Quantity	Reliability	Potential Sustainability
Cashilard WTP	St. Columbkill Lake	375	300	●	○	○	●
Pettigo WTP	Aghalough, Groundwater	318	160	●	●	●	○
Swanlinbar WTP	Groundwater	307	330	●	○	○	○
Kilawaun WTP	Coragh Lough	2,190	810	●	◐	○	●
Belturbet WTP	River Erne	1,962	1,000	●	○	○	○
Bawnboy WTP	Groundwater	253	257	●	○	○	○
Lismean WTP	Nadrageel Lough	4,695	5,160	◐	○	○	●
Ballyconnell WTP (Cuillaghan)	Groundwater	1,399	1,100	●	●	○	●
Knockataggart WTP	Lough Acanon Dam	13,171	5,400	●	○	○	●

Score	Irish Water Asset Standard Assessment
○	Low Risk
◔	Medium Risk
◐	
●	High Risk

2

Scoping the Study Area B

2 Scoping the Study Area

In this chapter we summarise the current and future issues with water supplies in Study Area B, 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, Irish Water is developing scientifically robust datasets to assign risk. Irish Water 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 SAB 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**
Monaghan (Togan Lake) WTP	●	●	●	●
Crosses WTP	●	●	●	●
Smithboro WTP	●	●	●	●
Newbliss WTP	●	●	●	●
Carnroe WTP	●	●	●	●
Kilkitt WTP	●	●	●	●
Smear WTP	●	●	●	●
Glenade 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**
Cashilard WTP	●	●	●	●
Pettigo WTP	●	●	●	●
Swanlinbar WTP	●	●	●	●
Kilawaun WTP	●	●	●	●
Belturbet WTP	●	●	●	●
Bawnboy WTP	●	●	●	●
Lismean WTP	●	●	●	●
Ballyconnell WTP (Cuillaghan)	●	●	●	●
Knockataggart WTP	●	●	●	●

Score	Irish Water 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 Irish Water 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, 12 of the 17 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 is one WRZ, within Study Area B on the EPA Remedial Action List, namely Belturbet PWS. Details of these are included in Table 2.2

Table 2.2 Critical Water Quality Requirements SAB – Cavan, Donegal, Leitrim, Longford and Monaghan

Critical Water Quality Requirements	Progress
1. Pettigo Boreholes: Persistent water quality issues with potential to suffer from lowered water levels during drought periods, however no interventions were required in 2018 and 2020.	**Assessment required**
2. Belturbet WTP: Catchment-focused engagement actions are required with relevant stakeholders to achieve compliance with the limits of pesticides. Upgrade of existing WTP is also required.	**Ongoing**
3. Shercock PWS (GWS Import): Relates to private Group Water Scheme. Upgrades of the WTP and existing cast iron watermains are required.	**Complete**
4. Swanlinbar Recent WTP upgrade works have addressed water quality issues.	**Complete**
5. Clones There are issues with iron and manganese at the source. Borehole maintenance is required.	**Scoping**
6. Reservoir Cleaning Programme: A major reservoir cleaning programme has been undertaken at 39 sites, which has reduced network water quality issues.	**Complete**
7. Disinfection Programme: In 2016, Irish Water 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 10 of the 17 WRZs in SAB, based on assessed priority basis. • Smear WTP • Pettigo WTP • Belturbet WTP • Knockataggart WTP • Kilawaun WTP • Swanlinbar WTP • Glenade WTP • Carnroe WTP • Monaghan (Togan Lake) WTP • Crosses WTP Any requirements within the remaining 7 supplies will be identified via Drinking Water Safety Plans with solutions developed as part of the NWRP.	**Complete**

In summary, in relation to water quality, Irish Water 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

Irish Water 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.

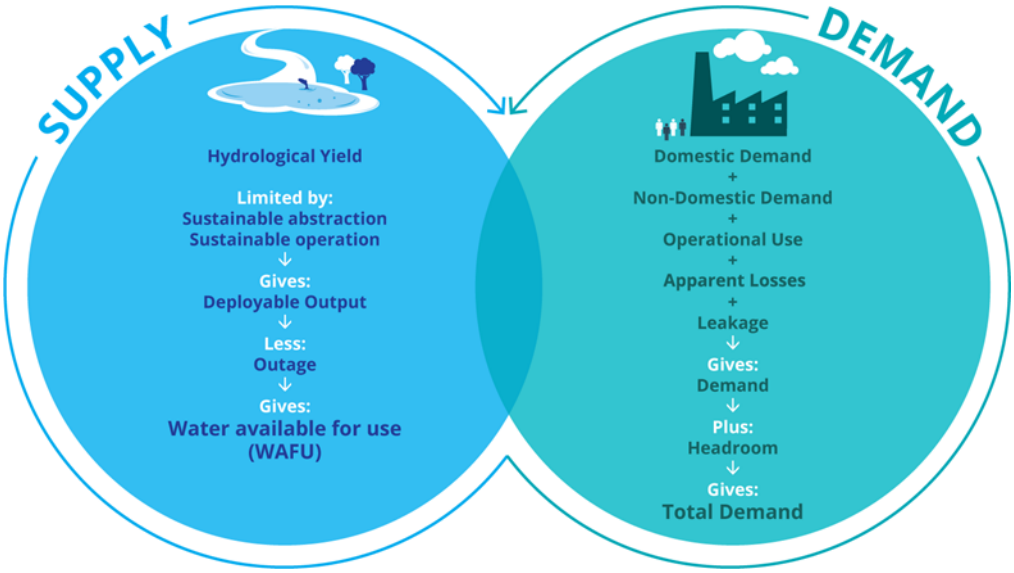

Figure 2.1 Supply Demand Balance

For each of the 23 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 SAB 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, Irish Water 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:** 8 out of 23 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.

A summary of the SDB deficit across all 23 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	Maximum Deficit m^3/day					
			2019	2025	2030	2035	2040	2044
Monaghan	2400SC0011	9,375	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Smithboro	2400SC0010	537	-35	-40	-44	-47	-50	-53
Emyvale (GWS Import)	2400SC0008	787	0	0	0	0	0	0
Glaslough (GWS Import)	2400SC0005	323	0	0	0	0	0	0
Newbliss	2400SC0004	419	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Clones	2400SC0003	2,674	-301	-334	-362	-383	-403	-420
Ballybay (Lough Egish)	2400SC0002	10,744	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Gowna	2000SC0004	4,313	-735	-724	-714	-730	-752	-769
Kinlough Tullaghan	1700SC0004	2,446	-861	-886	-927	-955	-981	-1,001
Cashilard	0600SC0041	375	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Pettigo Pub	0600SC0011	318	-65	-67	-69	-71	-74	-75
Swanlinbar PWS	0200SC0019	307	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Cootehill PWS	0200SC0017	2,190	-155	-175	-197	-213	-228	-241
Belturbet PWS	0200SC0016	1,962	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Cavan RWSS	0200SC0014	13,171	-307	-563	-827	-895	-914	-930
Bawnboy PWS	0200SC0013	253	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Ballyjamesduff RWSS	0200SC0012	4,695	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Ballyconnell PWS	0200SC0011	1,399	-264	-288	-308	-323	-339	-351

Water Resource Zone Name	Water Resource Zone code	Population	Maximum Deficit m^3/day					
			2019	2025	2030	2035	2040	2044
Ballyhaise PWS (GWS Import)	0200SC0008	688	0	0	0	0	0	0
Shercock PWS (GWS Import)	0200SC0006	725	0	0	0	0	0	0
Gowna (GWS Import)	0200SC0004	384	0	0	0	0	0	0
Blacklion PWS (GWS Import)	0200SC0002	187	0	0	0	0	0	0
Derrykillew	No data	No data	No data	No data	No data	No data	No data	No data

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 2,724 m^3/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 3,840m^3/day by 2044.

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

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

2.3 Water Supply Reliability

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

There are a number of problematic distribution and trunk mains throughout SAB. Irish Water & 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 B. 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.

Pettigo PWS has experienced persistent Arsenic and Antimony issues. Desk top assessment suggests both BH1 & 2 (main well) have been refurbished with a new liner in both following a jet wash. No metal trace in groundwater until February 2021 when both boreholes were pumped heavily to deal with network leaks. This suggests high turbidity brings in metal-rich sediment. The local geology consists of Carboniferous limestone overlying Precambrian/Cambrian meta-sandstone and it is from the sandstones that the elevated metal trace in water quality is derived. Change in lithology encountered c. 48 mbgl. Drilling showed the productive zones (12-14 mbgl) to be within the limestone. Further monitoring and testing of BH1 & 2 is suggested to better constrain if contamination only occurs in one or both. Failing this a strict pump regime installed to stop large drawdowns and influx of metals sediments. Groundwater is sourced from the shallower rainfall recharge-fed limestones in wet periods, while the deeper system contributes during drier periods. As such there is a perceived inherent risk to drought.

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

Table 2.4 SAB Critical Infrastructure Projects and Need Identification

Critical Requirement	Progress
1. National Leakage Reduction Programme – Belturbet Backyard Service Replacement: This project involves replacing ageing back yard water mains and providing new service connections for customers in Belturbet to provide a more reliable water supply, improve water quality and reduce high levels of leakage. The communities to benefit from the works are: • St. Mary's Terrace - 195 metres of new mains will be constructed and new service connections to 22 properties will be installed. • Martins Row - 97 metres of mains will be installed along with new service connections for 15 properties. • Marian Park - 270 metres of mains will be constructed, and 24 properties will receive new service connections.	**Ongoing**

Critical Requirement	Progress
2. National Leakage Reduction Programme - Glaslough Water Main Replacement: This project involves the replacement of approximately 1,164 metres of problematic water mains with high density polyethylene (plastic) pipes. The scheme also includes the decommissioning of approximately 313 meters of old cast iron mains and associated back yard service connections.	**Ongoing**
3. Monaghan Town and Clones Water Mains Rehabilitation Project: This project involved the replacement of approx. 9.1km of old water mains that are prone to leakage and regular bursts, which can cause interruptions to supply. The project has delivered significant improvements in network performance and customer service in terms of supply pressure, security of supply and water pressure.	**Complete**
4. Cavan Regional Water Supply Scheme Water Mains Rehabilitation Project: The works involved the replacement of over 1299 metres and decommissioning of 212 meters of problematic water mains with high density polyethylene (plastic) pipes. The project will reduce instances of bursts and water outages and will ensure a reliable supply of water to customers and local businesses in the area.	**Scoping**
5. Cootehill rising main: Pumps at the source are currently at max capacity due to water availability at the lake. Lough Coragh rising main and pumps require upsizing.	**Need Identified and Scoping**
6. Cashilard St. Columbkill Lake There are constraints on the elevation of the lake. Specific operator input required to run the WTP. Old network which can cause a failure to supply the scheme.	**Need Identified and Scoping**
7. Gowna, Lough Gowna Recent flooding at the WTP. Rising main is AC and in low pressure section with is restricting increase of the capacity of the WTP.	**Need Identified and Scoping**
8. Distribution Network Repairs and Upgrades: Rolling programme of active leakage control, pressure management, find and fix and network upgrades.	**In Progress**

In summary, there are some asset reliability issues across the distribution network within the 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 Irish Waters 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 SAB supplies, we have assessed the potential impacts on our 12 no. surface water abstractions: Lough Bawn (Ballybay (Lough Egish)), Nadrageel Lough (Ballyjamesduff RWSS), River Erne (Belturbet PWS), St. Columbkill Lake (Cashilard), Lough Acanon Dam (Cavan RWSS), Corconnolly Lake (Clones), Coragh Lough (Cootehill PWS), Lough Gowna Intake, (Gowna), Corcaghan Lough (Monaghan), Greagh Lough (Monaghan), Feagh Lough (Newbliss), Aghalough (Pettigo Pub).

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

Based on this initial assessment, the volumes of water abstracted at Lough Bawn (Ballybay (Lough Egish)), Nadrageel Lough (Ballyjamesduff RWSS), St. Columbkill Lake (Cashilard), Lough Acanon Dam (Cavan RWSS), Corconnolly Lake (Clones), Coragh Lough (Cootehill PWS), Corcaghan Lough (Monaghan), Greagh Lough (Monaghan), Feagh Lough (Newbliss) may not meet sustainability guidelines during dry weather flows. However, under the proposed regulatory regime, sustainable abstraction quantities will be adjudicated by the EPA. We have assumed, given the need to maintain supplies, that a transition to new abstraction quantities would likely take place in the medium term.

Table 2.5 shows the Cavan RWSS WRZ could have the most significant impacts to SDB based on the theoretical future abstraction at the Lough Acanon Dam reservoir source. However, it is assumed that the current abstraction rates can be maintained until there is more visibility of the future new EPA regulatory regime. This assumption is based on the appropriate enforcement of maintaining compensation flow releases from the dam to the downstream watercourse.

[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.

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)
Lough Bawn (Ballybay (Lough Egish))	7,700	8,405	6,001
Nadrageel Lough (Ballyjamesduff RWSS)	4,730	5,018	1,261
River Erne (Belturbet PWS)	917	43,115	16,103
St. Columbkill Lake (Cashilard)	275	368	66
Lough Acanon Dam (Cavan RWSS)	4,950	10,068	948
Corconnolly Lake (Clones)	2,017	291	112
Coragh Lough (Cootehill PWS)	743	730	173
Lough Gowna Intake, (Gowna)	1,833	42,410	13,079
Corcaghan Lough (Monaghan)	3,667	595	132
Greagh Lough (Monaghan)		431	87
Feagh Lough (Newbliss)	305	273	59
Aghalough (Pettigo Pub)	147	421	219

The potential change to the SDB[4] 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 SDB (m^3/day)
Lough Bawn (Ballybay (Lough Egish))	-498
Nadrageel Lough (Ballyjamesduff RWSS)	-2,308
River Erne (Belturbet PWS)	None
St. Columbkill Lake (Cashilard)	-196

[4] Based on the potential changes to the projected WRZ supply demand balance (SDB) figure for the dry year critical period (DYCP) 2044 future scenario.

Source (WRZ)	Potential change in SDB (m^3/day)
Lough Acanon Dam (Cavan RWSS)	-4,176
Corconnolly Lake (Clones)	-159
Coragh Lough (Cootehill PWS)	-494
Lough Gowna Intake, (Gowna)	None
Corcaghan Lough (Monaghan)	None
Greagh Lough (Monaghan)	
Feagh Lough (Newbliss)	-145
Aghalough (Pettigo Pub)	None

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. Irish Water 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 Irish Water 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, Irish Water 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 B 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 96 m^3/day to achieve SELL in the region. Additional Leakage Targets of 1,142 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 2,724 m^3/day within 10 years. Total of 3,840m^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	It is not envisaged that there are sustainability issues with the volumes abstracted at River Erne (Belturbet PWS), Lough Gowna Intake, (Gowna) and Aghalough (Pettigo Pub). Based on this initial assessment, the volumes of water abstracted at Lough Bawn (Ballybay (Lough Egish)), Nadrageel Lough (Ballyjamesduff RWSS), St. Columbkill Lake (Cashilard), Lough Acanon Dam (Cavan RWSS), Corconnolly Lake (Clones), Coragh Lough (Cootehill PWS), Corcaghan Lough (Monaghan), Greagh Lough (Monaghan), Feagh Lough (Newbliss), may not meet sustainability guidelines during dry weather flows. However, under the proposed regulatory regime, this will be adjudicated by the EPA. Over the coming years, Irish Water will work with the environmental regulator EPA and the Geological Survey of Ireland, to develop desktop and site investigation systems to better understand the sustainability of our groundwater sources.

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

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

3 Solution Types Considered in Study Area B

3 Solution Types Considered in Study Area B

In this chapter, we summarise the type of solutions we have considered to address identified need in Study Area B.

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 SAB 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 SAB 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);
- 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 1,500m^3/d, see Table 3.1.

Table 3.1 SELL Targets for WRZ in SAB

WRZ	Net Leakage Reduction applied to SDB (m^3/day)	Additional leakage Targets to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m^3/day (m^3/day)	Total Leakage Targets (m^3/day)
Cavan RWSS	40	431	471
Kinlough Tullaghan	16		16
Gowna		711	711
Monaghan	40		40

3.2 Water Conservation

At present, Irish Water 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 SAB and include:

- Standalone groundwater options across the Study Area;
- Standalone surface water options across the Study Area;
- Transfers
- Rationalisations
- Water Treatment Plant Upgrades for water quality purposes

4 Option Development SAB

4 Option Development for Study Area B

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, Irish Water 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 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, Irish Water 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 SAB, 194 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 SAB Unconstrained Options

No. of Options	Option Type
24	Groundwater
61	Surface water
43	Rationalisation
50	Transfers
16	Upgrade WTP (QW only)

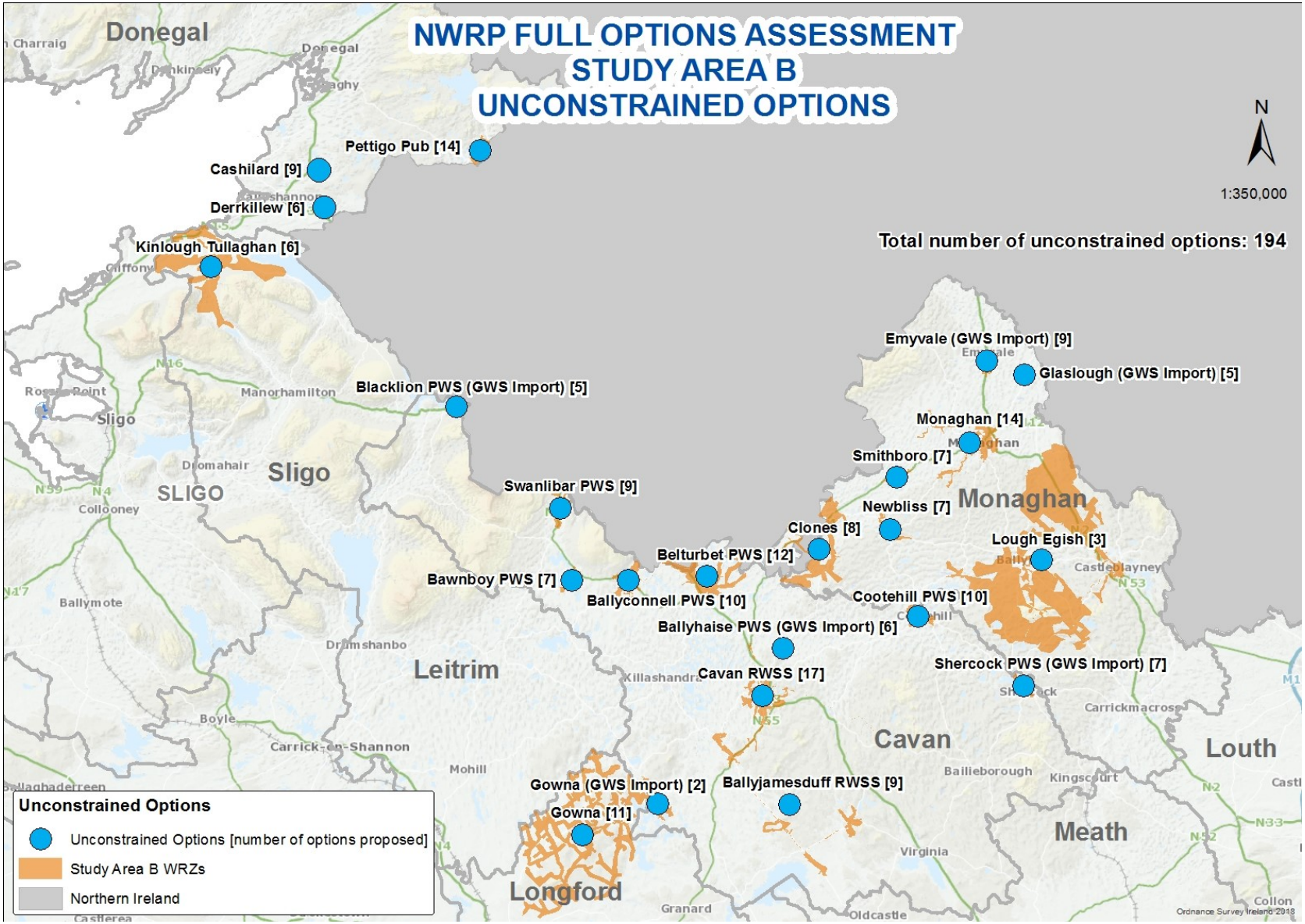

Figure 4.1 SAB Unconstrained Options

The 194 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 194 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.

73 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 Cootehill PWS WRZ.

Example Rejected Option

Option SAB-058:

Increase existing SW abstraction from Lough Coragh and upgrade Kilawaun WTP to supply deficit at Cootehill PWS WRZ.

Rejection Reason:

There is no scope to increase abstraction from the Lough Coragh to meet the deficit at Cootehill PWS.

The remaining 121 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 SAB Remaining Options after Course Screening

No. of Options	Option Type
19	Groundwater
28	Surface water
34	Rationalisation
24	Transfers
16	Upgrade WTP (WQ only)

4.3 Fine Screening

The 121 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 121 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 SAB Remaining Options after Fine Screening (Feasible Options)

No. of Options	Option Type
19	Groundwater
28	Surface water
34	Rationalisation
24	Transfers
16	Upgrade WTP (WQ only)

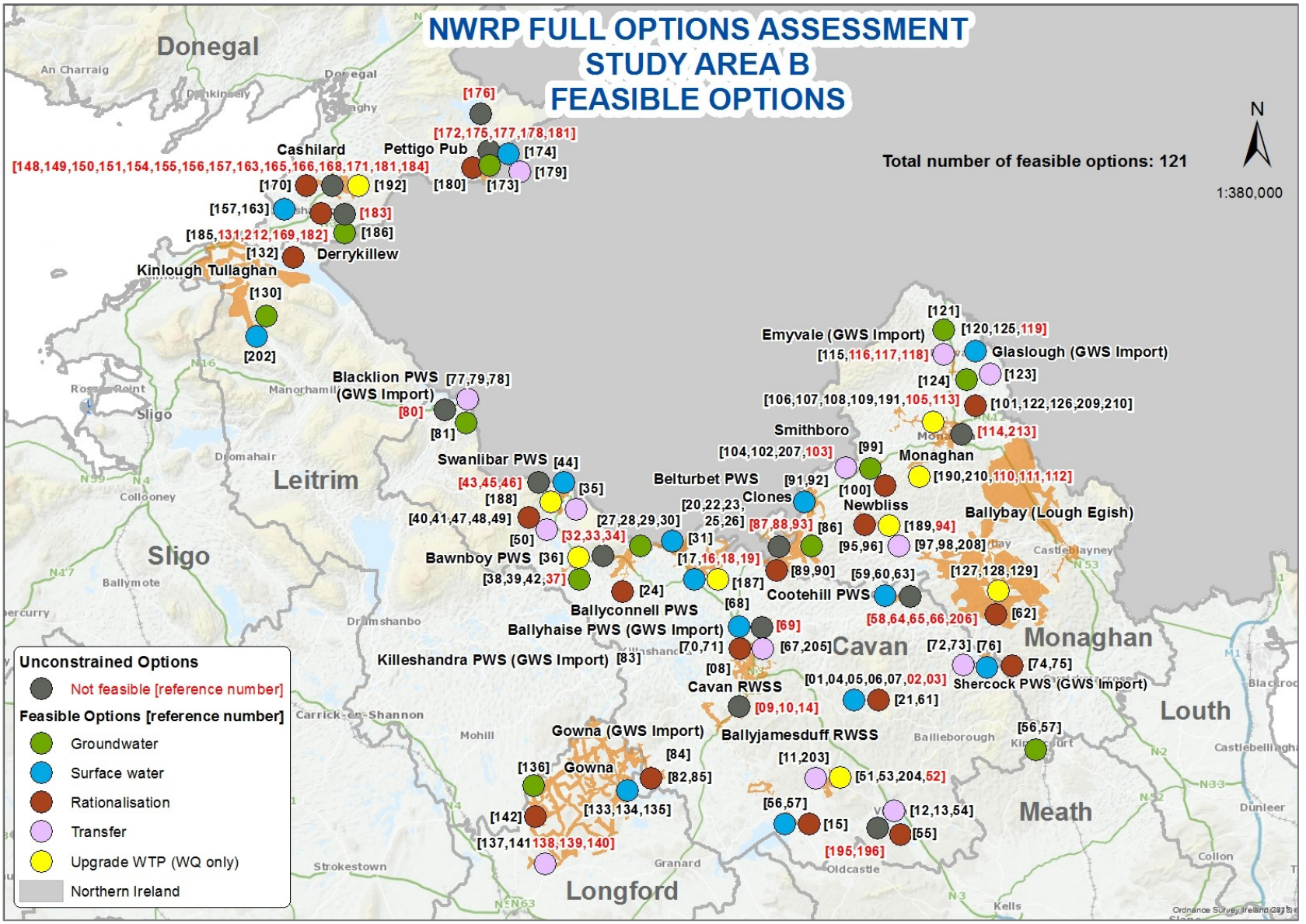

Figure 4.2 Fine Screening (Feasible Options)

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 2,724 m^3/day in 2019 during dry conditions, to a maximum of approximately 3,840 m^3/day in 2044 during dry conditions. During the options assessment stage, a total of 194 unconstrained options were assessed. Of these 73 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
22	Deliverability & Flexibility, Resilience and Sustainability
15	Deliverability & Flexibility
1	Deliverability & Flexibility and Resilience
35	Other

The remaining 121 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 B. From this table it can be noted that there are 45 WRZ Options and 76 options which can be merged to form 37 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 SAB Feasible Options Summary

WRZ Name	Option Type	
	WRZ Option	SA Grouped Option
Ballyconnell PWS	2	4
Ballyhaise PWS (GWS Import)	2	3
Ballyjamesduff RWSS	1	5
Bawnboy PWS	1	5
Belturbet PWS	1	4
Blacklion PWS (GWS Import)	4	0
Cashilard	1	1
Cavan RWSS	2	9

WRZ Name	Option Type	
	WRZ Option	SA Grouped Option
Clones	2	3
Cootehill PWS	3	2
Derrykillew	1	2
Emyvale (GWS Import)	3	2
Glaslough (GWS Import)	3	2
Gowna	2	6
Gowna (GWS Import)	1	1
Kinlough Tullaghan	2	2
Lough Egish	1	2
Monaghan	2	5
Newbliss	1	3
Pettigo Pub	4	1
Shercock PWS (GWS Import)	2	5
Smithboro	2	4
Swanlinbar PWS	2	5

5 Approach Development

5 Approach Development

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

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 Irish Water'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, Irish Water considers six approaches, as summarised in Table 5.1.

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

Table 5.1 The Six Approaches

Approaches Tested	Description	Policy Driver
Least Cost	Lowest Net Present Value (NPV) cost in terms of Capital, Operational, Environmental and Social and Carbon Costs.	Public Spending Code
Best Appropriate Assessment (AA)	Lowest score against the European Sites (Biodiversity) sub-criteria question: Score = 0 equates to no likely significant effects (LSEs). If, in our opinion, these 0 scoring options meet the deficit/ plan objectives, they are automatically picked as the Preferred Approach. Score = -1 or -2 equates to LSEs that can be addressed with general/standard mitigation measures. Score = -3 equates to LSEs that may be harder to mitigate or require significant project level assessment.	Habitats Directive
Quickest Delivery	Based on an estimate of the time taken to bring an option into operation (including typical feasibility, consent, construction and commissioning durations) as identified at Fine	Statutory Obligations under the Water Supply Act and Drinking Water Regulations

Approaches Tested	Description	Policy Driver
	Screening This is particularly relevant where an option might be required to address an urgent Public Health issue.	
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.

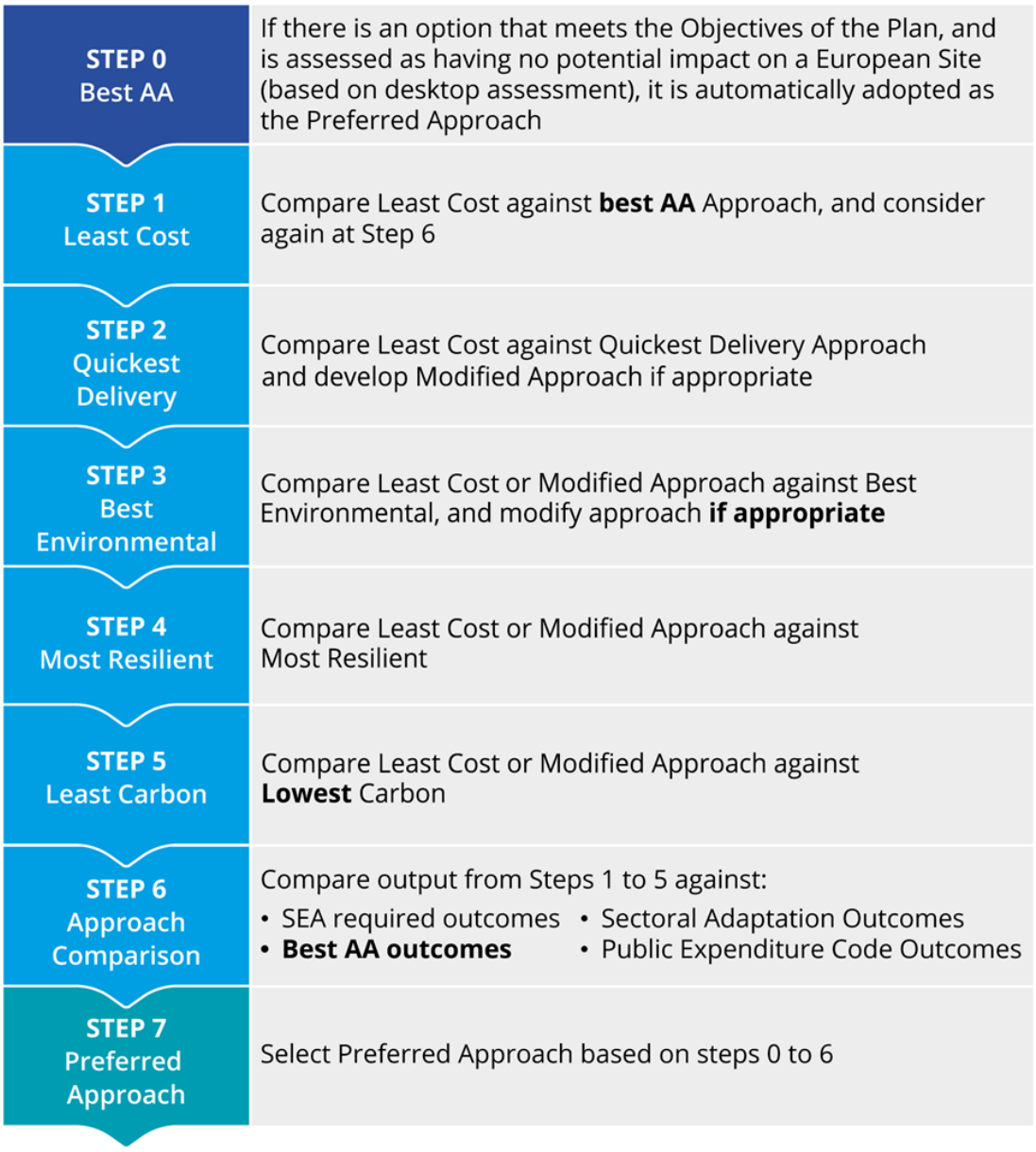

Figure 5.1 Figure of the 7 step assessment process

This methodology which is futured 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 are provided in Chapter 7 of the RWRP -NW. Section 5.2 provides an overview of the application of this process to SAB.

5.2 Preferred Approach Development Process for Study Area B

5.2.1 Stage 1 – WRZ Level Approach

As outlined in Section 4.4 of this technical report there are 121 feasible options. 45 of these options are WRZ Options while 76 options are merged to form 37 Study Area Options. Table 5.2 outlines the 45 WRZ options for SAB, 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 SAB Feasible Options

Water Resource Zone Name	Feasible Options SAB	
	Option Code	Option Description
Ballyconnell PWS	SAB-027	Increase GW abstraction from existing boreholes to supply deficit.
Ballyconnell PWS	SAB-031	New SW abstraction from Lough Cullinaghan to supply deficit. New WTP.
Ballyhaise PWS (GWS Import)	SAB-067	Keep supplying Ballyhaise WRZ from Annagh GWS.
Ballyhaise PWS (GWS Import)	SAB-068	New SW abstraction from Annalee River.
Ballyjamesduff RWSS	SAB-051	Upgrade WTP for water quality improvements. Ballyjamesduff WRZ is not in deficit.
Bawnboy PWS	SAB-036	Upgrade WTP for water quality improvements. Bawnboy WRZ is not in deficit.
Belturbet PWS	SAB-187	Upgrade Belturbet WTP for water quality improvements. Belturbet PWS WRZ is not in deficit.
Blacklion PWS (GWS Import)	SAB-077	Keep supplying Blacklion WRZ from Gowlan GWS (Cuilcagh Mountain Spring).
Blacklion PWS (GWS Import)	SAB-078	Keep supplying Blacklion WRZ from Gowlan GWS (Garvagh Lough).
Blacklion PWS (GWS Import)	SAB-079	Import water from Norther Ireland Water.
Blacklion PWS (GWS Import)	SAB-081	New GW abstraction to supply Blacklion WRZ.
Cashilard	SAB-192	Upgrade Cashilard WTP for water quality improvements. Cashilard WRZ is not in deficit.
Cavan RWSS	SAB-001	Increase existing SW abstraction from Lough Acanon Dam and supply deficit.
Cavan RWSS	SAB-008	New SW abstraction from Lough Oughter to supply deficit.
Clones	SAB-086	Increase GW abstraction from existing boreholes to supply deficit.

Water Resource Zone Name	Feasible Options SAB	
	Option Code	Option Description
Clones	SAB-092	New SW abstraction from River Finn to supply deficit.
Cootehill PWS	SAB-059	New SW abstraction from Lough Drumore to supply deficit. Treat at the existing Kilawaun WTP.
Cootehill PWS	SAB-060	New SW abstraction from River Drumore to supply deficit. Treat at the existing Kilawaun WTP.
Cootehill PWS	SAB-063	New SW abstraction from Annalee River.
Derrykillew	SAB-186	New GW abstraction to supply Derrykillew WRZ.
Emyvale (GWS Import)	SAB-115	Keep supplying Emyvale WRZ from Glaslough and Tyholland GWS.
Emyvale (GWS Import)	SAB-120	New SW abstraction from Mountain River.
Emyvale (GWS Import)	SAB-121	New GW abstraction and new WTP.
Glaslough (GWS Import)	SAB-123	Keep supplying Glaslough WRZ from Glaslough and Tyholland GWS.
Glaslough (GWS Import)	SAB-124	New GW abstraction and new WTP.
Glaslough (GWS Import)	SAB-125	New SW abstraction from Glaslough lake.
Gowna	SAB-133	Replace rising main connecting raw water pump station and WTP at Lough Gowna (Cornadrung Pump Station), namely flooding of pump station, lack of control (raw water pumps control flow through plant) and increase SW abstraction to supply deficit.
Gowna	SAB-136	New GW abstraction at Gowna WRZ.
Gowna (GWS Import)	SAB-084	Keep supplying Gowna WRZ from Erne Valley GWS.
Kinlough Tullaghan	SAB-130	Increase existing GW abstraction from spring and supply deficit.
Kinlough Tullaghan	SAB-202	New SW abstraction from Glenade Lough and upgrade of existing Glenade WTP.
Lough Egish	SAB-127	Upgrade WTP for water quality improvements. Lough Egish WRZ is not in deficit.
Monaghan	SAB-190	Upgrade Togan (Lake) WTP for water quality improvements. Monaghan WRZ is not in deficit.
Monaghan	SAB-191	Upgrade Crosses WTP for water quality improvements. Monaghan WRZ is not in deficit.
Newbliss	SAB-189	Upgrade Newbliss WTP for water quality improvements. Newbliss WRZ is not in deficit.
Pettigo Pub	SAB-173	Increase GW abstraction from existing BHs.

Water Resource Zone Name	Feasible Options SAB	
	Option Code	Option Description
Pettigo Pub	SAB-174	New SW abstraction from Sessiaghkeelta River to supply deficit. Treat at existing WTP (upgrade).
Pettigo Pub	SAB-179	Continue to import water from NI Water.
Pettigo Pub	SAB-212	Rationalise Pettigo Pub to Ballyshannon WRZ (River Erne) via Cashilard.
Shercock PWS (GWS Import)	SAB-072	Keep supplying Shercock WRZ from Dhuish GWS.
Shercock PWS (GWS Import)	SAB-076	New SW abstraction from Lough Sillan and new WTP.
Smithboro	SAB-099	Increase GW abstraction from existing boreholes to supply deficit.
Smithboro	SAB-104	Interconnect Smithboro WRZ and Stranoodan GWS and supply deficit from GWS.
Swanlinbar PWS	SAB-044	New SW abstraction from River Swanlinbar. New WTP and abandon existing spring source.
Swanlinbar PWS	SAB-188	Upgrade Swanlinbar WTP for water quality improvements. Swanlinbar PWS WRZ is not in deficit.

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 SAB Alignment of WRZ Option/s with Approach Categories

Water Resource Zone Name	Feasible Options SAB		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest	Best AA	Best SEA	Lowest Carbon	Most Resilient
Ballyconnell PWS	2	Increase GW abstraction from existing boreholes to supply deficit.	✓	-	✓	✓	✓	-
		New SW abstraction from Lough Cullinaghan to supply deficit. New WTP.	-	✓	✓	-	-	✓
Ballyhaise PWS (GWS Import)	2	New SW abstraction from Annalee River.	-	-	-	-	-	-
		Keep supplying Ballyhaise WRZ from Annagh GWS.	✓	✓	✓	✓	✓	✓

Water Resource Zone Name	Feasible Options SAB		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest	Best AA	Best SEA	Lowest Carbon	Most Resilient
Ballyjamesduff RWSS	1	Upgrade WTP for water quality improvements. Ballyjamesduff WRZ is not in deficit.	✓	✓	✓	✓	✓	✓
Bawnboy PWS	1	Upgrade WTP for water quality improvements. Bawnboy WRZ is not in deficit.	✓	✓	✓	✓	✓	✓
Belturbet PWS	1	Upgrade Belturbet WTP for water quality improvements. Belturbet PWS WRZ is not in deficit.	✓	✓	✓	✓	✓	✓
Blacklion PWS (GWS Import)	4	Keep supplying Blacklion WRZ from Gowlan GWS (Cuilcagh Mountain Spring).	✓	✓	✓	✓	✓	✓
		Keep supplying Blacklion WRZ from Gowlan GWS (Garvagh Lough).	✓	✓	✓	✓	✓	✓
		New GW abstraction to supply Blacklion WRZ.	-	-	-	-	-	-
		Import water from Norther Ireland Water.	-	-	-	-	-	-
Cashilard	1	Upgrade Cashilard WTP for water quality improvements. Cashilard WRZ is not in deficit.	✓	✓	✓	✓	✓	✓
Cavan RWSS	2	Increase existing SW abstraction from Lough Acanon Dam and supply deficit.	✓	-	✓	✓	✓	-
		New SW abstraction from Lough Oughter to supply deficit.	-	✓	-	-	-	✓
Clones	2	Increase GW abstraction from existing boreholes to supply deficit.	✓	-	✓	✓	✓	-

Water Resource Zone Name	Feasible Options SAB		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest	Best AA	Best SEA	Lowest Carbon	Most Resilient
		New SW abstraction from River Finn to supply deficit.	-	✓	✓	-	-	✓
Cootehill PWS	3	New SW abstraction from Lough Drumore to supply deficit. Treat at the existing Kilawaun WTP.	-	✓	✓	-	-	✓
		New SW abstraction from River Drumore to supply deficit. Treat at the existing Kilawaun WTP.	✓	✓	✓	-	✓	-
		New SW abstraction from Annalee River.	-	-	✓	✓	-	✓
Derrykillew	1	New GW abstraction to supply Derrykillew WRZ.	✓	✓	✓	✓	✓	✓
Emyvale (GWS Import)	3	Keep supplying Emyvale WRZ from Glaslough and Tyholland GWS.	✓	✓	✓	✓	✓	✓
		New SW abstraction from Mountain River.	-	-	-	-	-	-
		New GW abstraction and new WTP.	-	-	-	-	-	-
Glaslough (GWS Import)	3	Keep supplying Glaslough WRZ from Glaslough and Tyholland GWS.	✓	✓	✓	✓	✓	✓
		New GW abstraction and new WTP.	-	-	-	-	-	-
		New SW abstraction from Glaslough lake	-	-	-	-	-	-
Gowna	2	Replace rising main connecting raw water pump station and WTP at Lough Gowna (Cornadrung Pump Station), namely flooding of pump station, lack of control (raw water pumps control flow	✓	✓	✓	✓	✓	✓

Water Resource Zone Name	Feasible Options SAB		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest	Best AA	Best SEA	Lowest Carbon	Most Resilient
		through plant) and increase SW abstraction to supply deficit.						
		New GW abstraction at Gowna WRZ.	-	-	-	-	-	-
Gowna (GWS Import)	1	Keep supplying Gowna WRZ from Erne Valley GWS.	✓	✓	✓	✓	✓	✓
Kinlough Tullaghan	2	Increase existing GW abstraction from spring and supply deficit.	✓	-	-	-	✓	-
		New SW abstraction from Glenade Lough and upgrade of existing Glenade WTP	-	✓	✓	✓	-	✓
Lough Egish	1	Upgrade WTP for water quality improvements. Lough Egish WRZ is not in deficit.	✓	✓	✓	✓	✓	✓
Monaghan	2	Upgrade Togan (Lake) WTP for water quality improvements. Monaghan WRZ is not in deficit.	✓	✓	✓	✓	✓	✓
		Upgrade Crosses WTP for water quality improvements. Monaghan WRZ is not in deficit.	✓	✓	✓	-	✓	✓
Newbliss	1	Upgrade Newbliss WTP for water quality improvements. Newbliss WRZ is not in deficit.	✓	✓	✓	✓	✓	✓
Pettigo Pub	4	Increase GW abstraction from existing BHs.	✓	-	✓	✓	✓	-
		New SW abstraction from Sessiaghkeelta River to supply deficit. Treat at existing WTP (upgrade).	-	-	✓	-	-	-
		Rationalise Pettigo Pub to Ballyshannon WRZ (River Erne) via Cashilard	-	✓	-	-	-	✓

Water Resource Zone Name	Feasible Options SAB		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest	Best AA	Best SEA	Lowest Carbon	Most Resilient
		Continue to import water from NI Water.	-	-	-	✓	✓	-
Shercock PWS (GWS Import)	2	Keep supplying Shercock WRZ from Dhuish GWS.	✓	✓	✓	✓	✓	✓
		New SW abstraction from Lough Sillan and new WTP	-	-	-	-	-	-
Smithboro	2	Increase GW abstraction from existing boreholes to supply deficit.	-	-	✓	✓	-	✓
		Interconnect Smithboro WRZ and Stranoodan GWS and supply deficit from GWS.	✓	✓	✓	-	✓	-
Swanlinbar PWS	2	New SW abstraction from River Swanlinbar. New WTP and abandon existing spring source.	-	-	-	-	-	✓
		Upgrade Swanlinbar WTP for water quality improvements. Swanlinbar PWS WRZ is not in deficit.	✓	✓	✓	✓	✓	-

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

- In terms of Best AA, 8 WRZ options score a 0 in relation to potential impact on a designated European Site;
- The Best AA and the Best Environmental (overall SEA score) approach is identified as the Preferred Approach for 23 and 22 respectively of the 23 WRZs
- No WRZ option has a -3 AA score against the European Site (Biodiversity) question. A "-3" score indicates that while likely significant effects may be harder to mitigate, it is understood at plan level that mitigation would be achievable, however further project level assessments are required to confirm this.

Preferred Approaches at WRZ level in SAB are outlined in Table 5.4.

Table 5.4 SAB WRZ Approach Options

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Ballyconnell PWS	TG1-SAB-027	Increase GW abstraction from existing boreholes to supply deficit.	-	✓	-	✓	✓	✓	-	✓
Ballyhaise PWS (GWS Import)	TG1-SAB-067	Keep supplying Ballyhaise WRZ from Annagh GWS.	✓	✓	✓	✓	✓	✓	✓	✓
Ballyjamesduff RWSS	TG1-SAB-051	Upgrade WTP for water quality improvements. Ballyjamesduff WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Bawnboy PWS	TG1-SAB-036	Upgrade WTP for water quality improvements. Bawnboy WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Belturbet PWS	TG1-SAB-187	Upgrade Belturbet WTP for water quality improvements. Belturbet PWS WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Blacklion PWS (GWS Import)	TG1-SAB-077 TG1-SAB-078	Keep supplying Blacklion WRZ from Gowlan GWS (Cuilcagh Mountain Spring and Garvagh Lough).	✓	✓	✓	✓	✓	✓	✓	✓
Cashilard	TG1-SAB-192	Upgrade Cashilard WTP for water quality improvements. Cashilard WRZ is not in deficit.	-	✓	✓	✓	✓	✓	✓	✓
Cavan RWSS	TG1-SAB-001	Increase existing SW abstraction from Lough Acanon Dam and supply deficit.	✓	✓	-	✓	✓	✓	-	✓

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Clones	TG1-SAB-086	Increase GW abstraction from existing boreholes to supply deficit.	-	✓	-	✓	✓	✓	-	✓
Cootehill PWS	TG1-SAB-060	New SW abstraction from River Drumore to supply deficit. Treat at the existing Kilawaun WTP.	-	✓	✓	✓	-	✓	-	✓
Derrykillew	TG1-SAB-186	New GW abstraction to supply Derrykillew WRZ.	-	✓	✓	✓	✓	✓	✓	✓
Emyvale (GWS Import)	TG1-SAB-115	Keep supplying Emyvale WRZ from Glaslough and Tyholland GWS.	✓	✓	✓	✓	✓	✓	✓	✓
Glaslough (GWS Import)	TG1-SAB-123	Keep supplying Glaslough WRZ from Glaslough and Tyholland GWS.	✓	✓	✓	✓	✓	✓	✓	✓
Gowna	TG1-SAB-133	Replace rising main connecting raw water pump station and WTP at Lough Gowna (Cornadrung Pump Station), namely flooding of pump station, lack of control (raw water pumps control flow through plant) and increase SW abstraction to supply deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Gowna (GWS Import)	TG1-SAB-084	Keep supplying Gowna WRZ from Erne Valley GWS.	✓	✓	✓	✓	✓	✓	✓	✓
Kinlough Tullaghan	TG1-SAB-202	New SW abstraction from Glenade Lough and upgrade of existing Glenade WTP	-	-	✓	✓	✓	-	✓	✓

Water Resource Zone Name	Feasible Options SAB		Zero AA	Approach						Preferred Approach
	Option Code	Option Description		Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	
Lough Egish	TG1-SAB-127	Upgrade WTP for water quality improvements. Lough Egish WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Monaghan	TG1-SAB-190 & SAB-191	Upgrade Togan (Lake) WTP for water quality improvements. Monaghan WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Newbliss	TG1-SAB-189	Upgrade Newbliss WTP for water quality improvements. Newbliss WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	✓	✓
Pettigo Pub	TG1-SAB-173	Increase GW abstraction from existing BHs.	✓	✓	-	✓	✓	✓	-	✓
Shercock PWS (GWS Import)	TG1-SAB-072	Keep supplying Shercock WRZ from Dhuish GWS.	✓	✓	✓	✓	✓	✓	✓	✓
Smithboro	TG1-SAB-104	Increase GW abstraction from existing boreholes to supply deficit.	✓	✓	✓	✓	-	✓	-	✓
Swanlinbar PWS	TG1-SAB-188	Upgrade Swanlinbar WTP for water quality improvements. Swanlinbar PWS WRZ is not in deficit.	✓	✓	✓	✓	✓	✓	-	✓

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 37 Study Area options.

Table 5.5 SAB Study Area Options

Water Resource Zone Name	Feasible Options SAB		
	Option Code	Option Description	SA Grouped Option
Cavan RWSS Ballyjamesduff RWSS	SAB-501	Interconnect Cavan and Ballyjamesduff WRZs. Supply spare capacity from Ballyjamesduff RWSS to Cavan RWSS. Upgrade Lismean WTP for water quality improvements.	Group 1
Cavan RWSS Belturbet PWS	SAB-503	Increase existing SW abstraction from Lough Acanon Dam. Raise the dam and supply deficit to Cavan. Rationalise Belturbet PWS to Cavan RWSS WRZ for increased resilience.	Group 3
Belturbet PWS Ballyconnell PWS	SAB-504	Increase GW abstraction (Newtown-Ballyconnell GWB (karstic)) from Ballyconnell existing boreholes to supply deficit. Interconnect Belturbet WRZ and Ballyconnell WRZ.	Group 4
Ballyconnell PWS Bawnboy PWS	SAB-506	Increase GW abstraction and supply spare capacity to neighbouring schemes. Interconnect Ballyconnell WRZ and Bawnboy WRZ and supply deficit from Bawnboy.	Group 6
Bawnboy PWS Swanlinbar PWS	SAB-507	Increase GW abstraction and supply spare capacity to neighbouring schemes. Rationalise Swanlinbar WRZ to Bawnboy WRZ.	Group 7
Bawnboy PWS Swanlinbar PWS	SAB-508	Increase GW abstraction and supply spare capacity to neighbouring schemes.	Group 8

Water Resource Zone Name	Feasible Options SAB		
	Option Code	Option Description	SA Grouped Option
		Interconnect Swanlinbar WRZ and Bawnboy WRZ and supply deficit from Bawnboy.	
Cavan RWSS Cootehill PWS	SAB-509	Increase existing SW abstraction from Lough Acanon Dam. Raise the dam and supply deficit to Cavan. Rationalise Cootehill PWS to Cavan RWSS WRZ.	Group 9
Cavan RWSS Ballyhaise PWS (GWS Import)	SAB-510	Increase existing SW abstraction from Lough Acanon Dam. Raise the dam and supply deficit to Cavan. Rationalise Ballyhaise to Cavan WRZ.	Group 10
Shercock PWS (GWS Import) Kingscourt PWS	SAB-511	Increase existing GW abstraction to supply deficit at Kingscourt PWS WRZ, and upgrade Lisanisky WTP. Interconnect Shercock and Kingscourt WRZs and supply deficit from Kingscourt.	Group 11
Shercock PWS (GWS Import) Kingscourt PWS	SAB-512	Increase existing GW abstraction to supply deficit at Kingscourt PWS WRZ, and upgrade Lisanisky WTP. Rationalise Shercock to Kingscourt WRZ.	Group 12
Cootehill PWS Lough Egish	SAB-513	Upgrade Kilkitt WTP for water quality improvements. Lough Egish WRZ is not in deficit and supply spare capacity to Cootehill PWS. Rationalise Cootehill to Lough Egish WRZ.	Group 13
Shercock PWS (GWS Import) Lough Egish	SAB-514	Upgrade Kilkitt WTP for water quality improvements. Lough Egish WRZ is not in deficit and supply spare capacity to Shercock PWS. Rationalise Shercock to Lough Egish WRZ.	Group 14
Belturbet PWS Clones	SAB-515	Increase existing SW abstraction from River Erne and upgrade Belturbet WTP to supply deficit. Rationalise Clones to Belturbet WRZ.	Group 15
Cavan RWSS Clones	SAB-516	Increase existing SW abstraction from Lough Acanon Dam. Raise the dam and	Group 16

Water Resource Zone Name	Feasible Options SAB		
	Option Code	Option Description	SA Grouped Option
		supply deficit to Cavan. Rationalise Clones to Cavan WRZ.	
Newbliss Smithboro	SAB-517	Increase GW abstraction (productive fissured bedrock) from existing boreholes to supply deficit at Smithboro WRZ. Rationalise Newbliss WRZ to Smithboro WRZ.	Group 17
Clones Newbliss	SAB-518	New SW abstraction from River Finn, upgrade Carnroe WTP and supply deficit at Clones WRZ. Rationalise Newbliss WRZ to Clones WRZ for increased resilience (River Finn source).	Group 18
Smithboro Monaghan	SAB-519	Upgrade existing WTP for water quality improvements. Monaghan WRZ is not in deficit and supply spare capacity to Smithboro WRZ. Rationalise Smithboro to Monaghan WRZ (increase GW abstraction) via Three Mile House connection.	Group 19
Smithboro Monaghan	SAB-520	Upgrade WTP existing for water quality improvements. Monaghan WRZ is not in deficit and supply spare capacity to Smithboro WRZ. Interconnect Smithboro and Monaghan for increased resilience and supply deficit from Monaghan WRZ (increase GW abstraction) via Three Mile House connection.	Group 20
Monaghan Emyvale (GWS Import)	SAB-521	Upgrade existing WTP for water quality improvements. Monaghan WRZ is not in deficit and supply spare capacity to Emyvale WRZ. Rationalise Emyvale to Monaghan WRZ.	Group 21
Monaghan Glaslough (GWS Import)	SAB-522	Upgrade existing WTP for water quality improvements. Monaghan WRZ is not in deficit and supply spare capacity to Glaslough WRZ. Rationalise Glaslough to Monaghan WRZ.	Group 22
Arvagh PWS (GWS Import) Gowna	SAB-523	Replace rising main connecting raw water pump station and WTP at Lough	Group 23

Water Resource Zone Name	Feasible Options SAB		
	Option Code	Option Description	SA Grouped Option
		Gowna (Cornadrung Pump Station), namely flooding of pump station, lack of control (raw water pumps control flow through plant) and increase SW abstraction to supply deficit. Rationalise Arvagh to Gowna WRZ.	
Gowna (GWS Import) Gowna	SAB-524	Replace rising main connecting raw water pump station and WTP at Lough Gowna (Cornadrung Pump Station), namely flooding of pump station, lack of control (raw water pumps control flow through plant) and increase SW abstraction to supply deficit. Rationalise Gowna (GWS Import) to Gowna WRZ.	Group 24
Kinlough Tullaghan Ballyshannon & Bundoran	SAB-530	Rationalise Kinlough Tullaghan to Ballyshannon/Bundoran WRZ (Bundoran Urban WSZ - Lough Melvin source).	Group 30
Derrykillew Ballyshannon & Bundoran	SAB-535	Rationalise Derrykillew to Ballyshannon WRZ (Assaroe lake source).	Group 35
Belturbet PWS Swanlinbar PWS Bawnboy PWS Ballyconnell PWS	SAB-538	Increase GW abstraction (Newtown-Ballyconnell GWB (karstic)) from existing boreholes to supply deficit at Ballyconnell PWS. Rationalise Belturbet WRZ, Swanlinbar and Bawnboy to Ballyconnell WRZ and create a new regional scheme.	Group 38
Ballyconnell PWS Killeshandra PWS (GWS Import) Bawnboy PWS Swanlinbar PWS	SAB-539	Increase GW abstraction from existing boreholes to supply deficit at Ballyconnell PWS. Rationalise Killeshandra WRZ, Swanlinbar and Bawnboy to Ballyconnell WRZ and create a new regional scheme.	Group 39
Cavan RWSS Ballyjamesduff RWSS	SAB-540	New regional scheme including Cavan RWSS, Ballyjamesduff and Bailieboro WRZ (Lough Ramor source).	Group 40
Cavan RWSS Ballyjamesduff RWSS	SAB-541	New regional scheme including Cavan RWSS, Ballyjamesduff and Bailieboro WRZ (Lough Ramor source).	Group 41

Water Resource Zone Name	Feasible Options SAB		
	Option Code	Option Description	SA Grouped Option
Cavan RWSS Ballyhaise PWS (GWS Import) Ballyjamesduff RWSS	SAB-543	New SW abstraction from Lough Sheelin. Abandon existing Lough Nadrageel source. Rationalise Cavan to Ballyjamesduff WRZ (new SW abstraction from Lough Sheelin). Rationalise Ballyhaise to Cavan regional WRZ. Interconnect Cavan and Ballyjamesduff WRZs and supply deficit from Ballyjamesduff (new SW abstraction from Lough Sheelin).	Group 43
Gowna Longford Central Regional	SAB-544	Interconnect Gowna WRZ and Longford Central WRZs and supply deficit from Longford Central.	Group 44
Gowna South Leitrim	SAB-545	Interconnect Gowna with South Leitrim WRZs and supply deficit from South Leitrim WRZ.	Group 45
Gowna Granard	SAB-546	Rationalise Gowna to Granard WRZ.	Group 46
Cashilard Ballyshannon & Bundoran	SAB-549	Rationalise Cashilard to Ballymagoarty (part of Ballyshannon/Bundoran WRZ)	Group 49
Pettigo Pub Donegal (River Eske)	SAB-550	Rationalise Pettigo Pub to Donegal Eske WRZ.	Group 50
Cavan RWSS Ballyhaise PWS (GWS Import) Ballyjamesduff RWSS	SAB-553	Upgrade Lismean WTP for water quality improvements. Ballyjamesduff RWSS is not in deficit and supply spare capacity to Cavan RWSS. Interconnect Cavan and Ballyjamesduff WRZs. Interconnect Ballyhaise and Ballyjamesduff WRZs.	Group 53
Smithboro Newbliss	SAB-554	Rationalise Smithboro WRZ and Newbliss WRZ to Stranoodan GWS and supply deficit from GWS. Increase in WTP capacity required.	Group 54
Emyvale (GWS Import) Glaslough (GWS Import) Monaghan	SAB-555	Upgrade existing WTPs for water quality improvements. Monaghan WRZ is not in deficit. Rationalise Emyvale and Glaslough to Monaghan WRZ.	Group 55

The 37 Study Area options result in 6 SA Combinations including the WRZ level Approach. The 6 SA Combinations in terms of the types of options within each combination are summarised in Table 5.6 below.

Table 5.6 SAB Combinations Options Summary

Key	WRZ Approach Option	○	SA Grouped Option	□

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 1, 22, 24, 35,38 and 49)	SA Combination 2 (SA Grouped Option 1, 24, 35,38 and 49)	SA Combination 3 (SA Grouped Option 24, 35, 38 and 49)	SA Combination 4 (SA Grouped Option 24, 35, 38, 49, 53 and 55)	SA Combination 5 (SA Grouped Option 1, 35,38 and 49)
Ballyconnell PWS	○	□	□	□	□	□
Ballyhaise PWS (GWS Import)	○	○	○	○	□	○
Ballyjamesduff RWSS	○	□	□	○	□	□
Bawnboy PWS	○	□	□	□	□	□
Belturbet PWS	○	□	□	□	□	□
Blacklion PWS (GWS Import)	○	○	○	○	○	○
Cashilard	○	□	□	□	□	□
Cavan RWSS	○	□	□	□	□	□
Clones	○	○	○	○	○	○
Cootehill PWS	○	○	○	○	○	○
Derrykillew	○	□	□	□	□	□
Emyvale (GWS Import)	○	○	○	○	□	○
Glaslough (GWS Import)	○	□	○	○	□	○
Gowna	○	□	□	□	□	○
Gowna (GWS Import)	○	□	□	□	□	○
Kinlough Tullaghan	○	○	○	○	○	○
Lough Egish	○	○	○	○	○	○

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 1, 22, 24, 35,38 and 49)	SA Combination 2 (SA Grouped Option 1, 24, 35,38 and 49)	SA Combination 3 (SA Grouped Option 24, 35, 38 and 49)	SA Combination 4 (SA Grouped Option 24, 35, 38, 49, 53 and 55)	SA Combination 5 (SA Grouped Option 1, 35,38 and 49)
Monaghan	○	□	○	○	□	○
Newbliss	○	○	○	○	○	○
Pettigo Pub	○	○	○	○	○	○
Shercock PWS (GWS Import)	○	○	○	○	○	○
Smithboro	○	○	○	○	○	○
Swanlinbar PWS	○	□	□	□	□	□

5.2.3 Stage 3 – Preferred Approach at Study Area Level

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

We use the EBSD tool to rank the combinations against the assessment criteria and we then compare the best performing SA Combinations under each of the six approach types, using the 7-step process set out in 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 SAB Summary of SA Combination of Performance against Approach Type

Ranked order (best to worst)	Best					Worst

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 1, 22, 24, 35,38 and 49)	SA Combination 2 (SA Grouped Option 1, 24, 35,38 and 49)	SA Combination 3 (SA Grouped Option 24, 35, 38 and 49)	SA Combination 4 (SA Grouped Option 24, 35,38, 49, 53 and 55)	SA Combination 5 (SA Grouped Option 1,35, 38 and 49)
Least Cost				Worst		Best
Quickest Delivery	Best	Worst	Worst		Worst	
Best AA biodiversity	No -3 impact	No -3 impact	No -3 impact	No -3 impact	No -3 impact	No -3 impact
Lowest Carbon	Worst					Best
Most Resilient	Worst					Best
Best Environmental	Worst					Best

The SA combinations including the WRZ approach 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)	SA Combination 5
Best Environmental (BE)	SA Combination 5*
Quickest Delivery (QD)	WRZ Approach
Most Resilient (MR)	SA Combination 5*
Lowest Carbon (LC)	SA Combination 5
Best AA (BA)	SA Combination 5*

*Combination 5 and Combination 2 have the same AA, resilience and environmental score. However, combination 5 scores better against the Least Cost, Quickest Delivery and Lowest Carbon criteria. Combination 5 also has fewer negative AA impacts. Therefore, Combination 5 was selected as the Best AA, Most Resilient and Best Environmental Approach.

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, SA Combination 5 has the lowest NPV Cost, as shown in Figure 5.2 with the lowest total costs (CAPEX and OPEX) over the solutions lifetime.

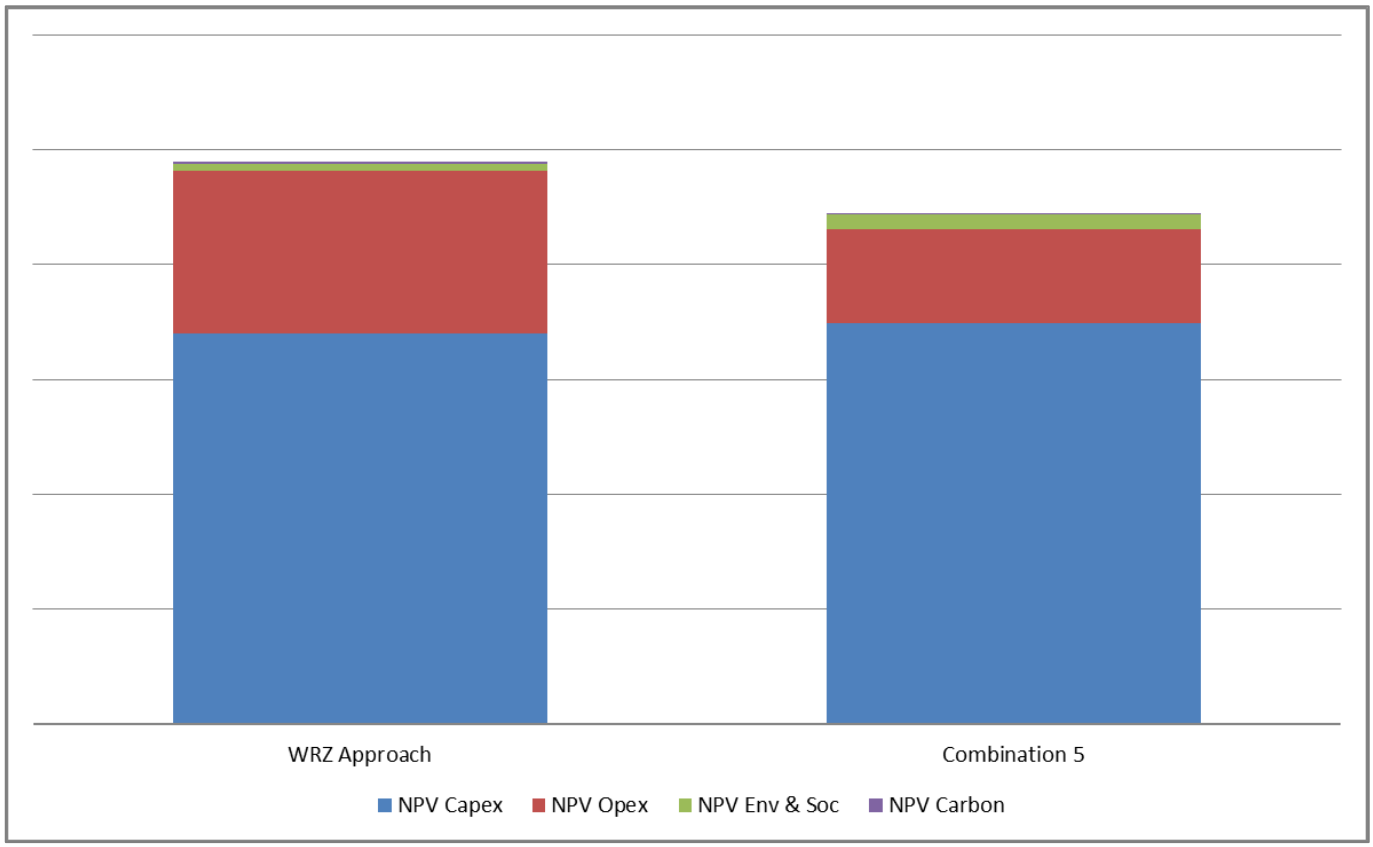

Figure 5.2 NPV Costs for WRZ and SA approaches

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 against the Best AA approach. The Least Cost Approach does not have any -3 AA impacts. The Least Cost Approach is the Best AA Approach.
- Step 2 – We compared the Quickest Delivery Approach against the Least Cost Approach. Whilst the Quickest Delivery Approach scored the same in terms of the no. of AA -3 scores it was associated with a higher no. of -1 AA scores compared to the Least Cost Approach. The Quickest Delivery Approach also performed poorly against the environmental, resilience and lowest carbon criteria when compared to the Least Cost Approach. The Quickest Delivery Approach cost is also significantly higher than Least Cost. The Least Cost approach was therefore retained at this stage.
- Step 3 - We compared the Least Cost Approach against the Best Environmental Approach. The Best Environmental Approach is also the Least Cost Approach. The Least Cost Approach was therefore retained at this stage.
- Step 4 – We compared the Least Cost Approach against the Most Resilient Approach. The Most Resilient Approach is also the Least Cost Approach. The Least Cost Approach was therefore retained at this stage.
- Step 5 - We compared the Lowest Carbon against the Least Cost Approach. The Lowest Carbon Approach is also the Least Cost Approach. The Least Cost Approach was therefore retained at this stage.
- Step 6 A final assessment of the Least Cost Approach was completed against the Least Carbon, Quickest Delivery, Best AA, Best Environmental and Most Resilient Approaches. While the Least

Cost Approach does not have the lowest score for all six criteria, it does not significantly increase the scores of the other criteria and is the preferred approach in terms of cost. The Least Cost Approach was therefore retained at this stage.

- Step 7 – The Least Cost Approach was therefore selected as the Preferred Approach for the Water Resource and Study Area Levels.

5.3 Study Area Preferred Approach Summary

On the basis of this initial assessment at Plan level, SA Combination 5 represents the Preferred Approach for Study Area B, which consists of the options listed in Table 5.9.

Table 5.9 Preferred Approach for SAB

WRZ Name	Preferred Approach Option Description SA Combination 5
Ballyconnell PWS Bawnboy PWS Belturbet PWS Swanlinbar PWS	Group 538 Increase GW abstraction (Newtown-Ballyconnell GWB (karstic) from existing boreholes to supply deficit at Ballyconnell PWS. Rationalise Belturbet WRZ, Swanlinbar and Bawnboy to Ballyconnell WRZ and create a new regional scheme.
Cavan RWSS Ballyjamesduff RWSS	Group 501 Upgrade Lismean WTP for water quality improvements. Ballyjamesduff RWSS is not in deficit and supply spare capacity to Cavan RWSS. Interconnect Cavan and Ballyjamesduff WRZs.
Ballyhaise PWS (GWS Import)	SAB-067 Keep supplying Ballyhaise WRZ from Annagh GWS.
Blacklion PWS (GWS Import)	SAB-077 & SAB-78 Keep supplying Blacklion WRZ from Gowlan GWS (Cuilcagh Mountain Spring and Garvagh Lough).
Cashilard	Group 549 Rationalise Cashilard to Ballymagoarty (part of Ballyshannon/Bundoran WRZ).
Clones	SAB-086 Increase GW abstraction from existing boreholes to supply deficit.
Cootehill PWS	SAB-060 New SW abstraction from River Drumore to supply deficit. Treat at the existing Kilawaun WTP.

WRZ Name	Preferred Approach Option Description SA Combination 5
Derrykillew	Group 535 Rationalise Derrykillew to Ballyshannon WRZ (Assaroe lake source).
Glaslough (GWS Import)	SAB-123 Keep supplying Glaslough WRZ from Glaslough and Tyholland GWS.
Emyvale (GWS Import)	SAB-115 Keep supplying Emyvale WRZ from Glaslough and Tyholland GWS.
Monaghan	SAB-190 & SAB-191 Upgrade Togan (Lake) WTP for water quality improvements. Monaghan WRZ is not in deficit.
Gowna	SAB-133 Replace rising main connecting raw water pump station and WTP at Lough Gowna (Cornadrung Pump Station), namely flooding of pump station, lack of control (raw water pumps control flow through plant) and increase SW abstraction to supply deficit.
Gowna (GWS Import)	SAB-084 Keep supplying Gowna WRZ from Erne Valley GWS.
Kinlough Tullaghan	SAB-202 New SW abstraction from Glenade Lough and upgrade of existing Glenade WTP.
Lough Egish	SAB-127 Upgrade WTP for water quality improvements. Lough Egish WRZ is not in deficit.
Newbliss	SAB-189 Upgrade Newbliss WTP for water quality improvements. Newbliss WRZ is not in deficit.
Pettigo Pub	SAB-173 Increase GW abstraction from existing BHs.
Shercock PWS (GWS Import)	SAB-072 Keep supplying Shercock WRZ from Dhuish GWS.

WRZ Name	Preferred Approach Option Description SA Combination 5
Smithboro	SAB-104 Interconnect Smithboro WRZ and Stranoodan GWS and supply deficit from GWS.

The Preferred Approach (SA Combination 5) is shown schematically in Figure 5.3.

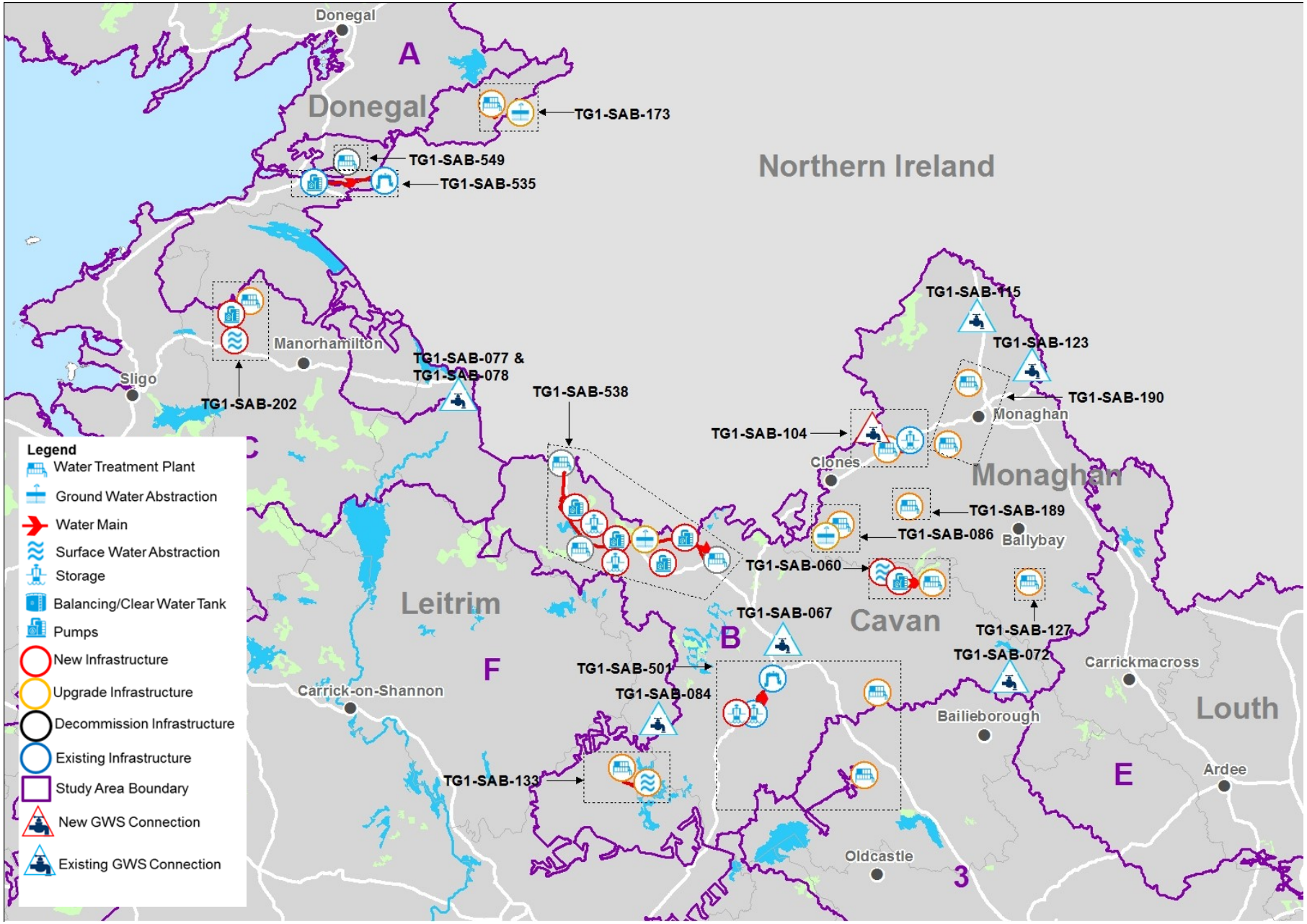

Figure 5.3 SAB Preferred Approach

The Preferred Approach for SAB, 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 SAB, 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, Irish Water 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 SAB Interim Options

WTP Name	Interim Option
Knockataggart WTP	Upgrade WTP to UÉ Standards
Ballyconnell WTP (Cuillaghan)	Refurb existing Borehole, and upgrade WTP to UÉ Standards
Lismean WTP	Upgrade WTP to UÉ Standards
Bawnboy WTP	Refurb existing Borehole, and upgrade WTP to UÉ Standards – Potential site for a containerised solution
Belturbet WTP	Upgrade WTP to UÉ Standards – Potential site for a containerised solution
Kilawaun WTP	Upgrade WTP to UÉ Standards
Swanlinbar WTP	Refurb existing Spring, and upgrade WTP to UÉ Standards – Potential site for a containerised solution
Pettigo WTP	Refurb existing Boreholes, and upgrade WTP to UÉ Standards
Cashilard WTP	Upgrade WTP to UÉ Standards – Potential site for a containerised solution
Glenade WTP	Refurb existing Spring, and upgrade WTP to UÉ Standards
Smear WTP	Upgrade WTP to UÉ Standards
Kilkitt WTP	Upgrade WTP to UÉ Standards
Carnroe WTP	Refurb existing Boreholes, and upgrade WTP to UÉ Standards
Newbliss WTP	Upgrade WTP to UÉ Standards
Smithboro WTP	Refurb existing Boreholes, and upgrade WTP to UÉ Standards
Crosses WTP	Refurb existing Boreholes, and upgrade WTP to UÉ Standards
Monaghan (Togan Lake) WTP	Refurb existing Boreholes, and 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 SAB is shown in Table 7.1.

Table 7.1 Sensitivity Analysis for SAB

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)	+8,000 m^3/day	**The impact of sustainability reductions would reduce the volumes that can be abstracted from our existing sources therefore increasing the supply demand balance deficit**. There are some surface water sources in SAB that would be impacted from sustainability reductions. However, our preferred approach is designed to relieve pressure on these sources by supplementing supply from more resilient sources. Groundwater Sustainability is more difficult to assess at desktop level, however, as the abstractions in SAB are small in scale, they do not appear to be problematic. Based on this scenario, the Preferred Approach remains the optimal solution.

Uncertainty	Likelihood	Increase/Decrease in Deficit	Impact on Preferred Approach
Climate Change	High (international climate change targets have not been met)	+200 m^3/day	**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. Also, as part of the Preferred Approach, several of the supplies from smaller lake sources most vulnerable to climate change impacts are to be interconnected to larger surface water or groundwater sources more resilient to climate change. 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 Based on this scenario, the Preferred Approach remains the optimal solution.
Demand Growth	Low/Moderate (growth has been based on policy)	-2,274 m^3/day	**The impact of lower than expected growth would reduce the supply demand balance deficit and the overall need requirement.** The supply demand balance deficit is spread across 23 individual water resource zones and is driven by quality as well as quantity issues. In this rural area, growth is relatively low. Based on this scenario, the Preferred Approach remains the optimal solution.
Leakage Targets	Low (Irish Water is focused on sustainability and aggressive leakage reduction)	96 m^3/day	**The impact of lower than expected leakage savings would increase the supply demand balance deficit and the overall need requirement.** As Irish Water is committed to achieving leakage reductions, the likely scenario would be an extension in the period of time taken to achieve leakage targets as opposed to accepting lower targets. Based on this scenario, the Preferred Approach remains the optimal solution.

Uncertainty	Likelihood	Increase/Decrease in Deficit	Impact on Preferred Approach
	Moderate/High (Irish Water is focused on sustainability and aggressive leakage reduction)	1,142 m^3/day	**Increased leakage savings beyond SELL would reduce the supply demand balance deficit and the overall need requirement.** The need drivers in SAB are across all 23 water resource zones and are driven by quality as well as availability issues. Therefore, the Preferred Approach is required, even accounting for increased leakage savings. Based on this scenario, the Preferred Approach remains as the optimal solution.

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

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

- Interim Approach – As the purpose of the Interim Approach is to allow for 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 SAB vary in size with a large number of small WRZs <1Ml/d as well as large growth areas such as Cavan Town. 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 B

8 Summary of Study Area B

The Preferred Approach for SAB (summarised in Table 5.8 and Figure 5.3) consists of local WRZs solutions for Cootehill PWS, Ballyhaise PWS (GWS Import), Shercock PWS (GWS Import), Blacklion PWS (GWS Import), Gowna (GWS Import), Clones, Newbliss, Smithboro, Monaghan, Emyvale (GWS Import), Glaslough (GWS Import), Lough Egish, Kinlough Tullaghan, Gowna and Pettigo Pub WRZs. The Preferred Approach for the remaining Water Resource Zones involve transfers from a number of existing surface water abstractions in the study area. It is proposed to rationalise Derrykillew to Ballyshannon WRZ and rationalise Cashilard to Ballymagoarty (part of Ballyshannon/Bundoran WRZ). It is proposed to create a new regional scheme for Belturbet, Swanlinbar, Bawnboy and Ballyconnell WRZs and to interconnect Cavan and Ballyjamesduff WRZs.

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 SAB 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 Cavan RWSS, Kinlough Tullaghan and Monaghan Water Resource Zones, amounting to 96 m³ per day (applied to SDB Deficit) to move towards achieving the National SELL Target by 2034
- Continuation of UÉ household and business water conservation campaigns, initiatives and education programmes; 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 SAB, as summarised in Table 6.1. The measures will only be progressed in the event of critical need to allow time for delivery of the required Preferred Approach solutions in the Study Area.

Annex A – Study Area B Water Treatment Plants

WTP Asset Name	Local Plant Names
Crosses WTP	Crosses WTP
Monaghan (Togan Lake) WTP	Monaghan (Togan Lake) WTP
Smithboro WTP	Smithboro WTP
Newbliss WTP	Newbliss WTP
Carnroe WTP	Carnroe WTP
Kilkitt WTP	Kilkitt WTP
Smear WTP	Smear WTP
Glenade WTP	Glenade WTP
Cashilard WTP	Cashilard WTP
Pettigo WTP	Pettigo WTP
Swanlinbar WTP	Swanlinbar WTP
Kilawaun WTP	Kilawaun WTP
Belturbet WTP	Belturbet WTP
Bawnboy WTP	Bawnboy WTP
Lismean WTP	Lismean WTP
Ballyconnell WTP (Cuillaghan)	Ballyconnell WTP (Cuillaghan)
Knockataggart WTP	Knockataggart WTP

Annex B – Study Area B Rejection Register Summary

Annex B Study Area B Rejection Register Summary

Study Area B - CS Rejection

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAB-002	Increase existing SW abstraction from Lough Acanon Dam. Raise the dam and supply deficit to Cavan, upgrade Knockataggart WTP	TG1-SAB-001, to increase abstraction is a better option. The reservoir has suitable yield, therefore there is no need to raise dam to increase storage/ yield available. Proposed abstraction is above allowable abstraction estimate, based on inflows. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAB-003	Increase existing SW abstraction from Lough Acanon Dam. Raise the dam and supply deficit to Cavan. Interconnect with Belturbit.	Proposed abstraction is above allowable abstraction estimate, based on inflows. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAB-009	Interconnect Cavan WRZ and Annagh GWS and supply deficit from GWS, upgrade Knockataggart WTP	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-SAB-010	Interconnect Cavan and Belturbet WRZs. Increase SW abstraction from River Erne and supply deficit to Cavan.	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. This option did not meet the requirements of the Deliverability criteria.		●	
TG1-SAB-014	Interconnect Cavan and Ballyjamesduff WRZs and supply deficit from Ballyjamesduff (new SW abstraction from Lough Sheelin).	Ballyjamesduff is in surplus so new source is not required. Interconnection between Cavan and Ballyjamesduff is assessed as part of a different feasible option.	**This is assessed as part of a different feasible option**		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAB-016	Increase existing SW abstraction from River Erne and upgrade Belturbet WTP to supply deficit	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Belturbet WRZ is no longer in deficit**		
TG1-SAB-018	Increase existing SW abstraction from River Erne and upgrade Belturbet WTP to supply deficit	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. This option did not meet the requirements of the Deliverability criteria.		•	
TG1-SAB-019	Increase existing SW abstraction from River Erne and upgrade Belturbet WTP to supply deficit	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. This option did not meet the requirements of the Deliverability criteria.		•	
TG1-SAB-020	Interconnect Belturbet and Cavan WRZs for increased resilience and supply deficit from Cavan WRZ.	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.	**Belturbet WRZ is no longer in deficit**		
TG1-SAB-022	Interconnect Belturbet WRZ and Annagh GWS and supply deficit from GWS.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Belturbet WRZ is no longer in deficit**		
TG1-SAB-023	Interconnect Belturbet WRZ and Milltown GWS and supply deficit from GWS.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Belturbet WRZ is no longer in deficit**		
TG1-SAB-026	Interconnect Belturbet WRZ and Ballyconnell WRZ and supply deficit from Ballyconnell WRZ (Lough Cullinaghan).	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.	**Belturbet WRZ is no longer in deficit**		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAB-032	New SW abstraction from Lough Cullinaghan to supply deficit. New WTP.	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.	**Ballyconnell WRZ is no longer in deficit**		
TG1-SAB-033	Interconnect Ballyconnell WRZ and Kildallan GWS and supply deficit from GWS.	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-SAB-034	Import water from Northern Ireland Water to supply deficit at Ballyconnell PWS	This option has a high cost associated, based on other IW schemes with connections to supplies in Northern Ireland. There are more suitable alternatives. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		•	
TG1-SAB-037	Increase GW abstraction for Bawnboy PWS and supply spare capacity to neighbouring schemes.	This WRZ is in surplus and connections with other schemes will be assessed as part of different feasible options. Therefore, this option at WRZ level is not taken forward to the fine screening stage as it is assessed as part of a different feasible option.	**This is assessed as part of a different feasible option**		
TG1-SAB-043	Increase GW abstraction (poorly productive bedrock) from existing spring source to supply deficit at Swanlinbar PWS	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Swanlinbar PWS is no longer in deficit**		
TG1-SAB-045	Interconnect Swanlinbar WRZ and Corlough GWS and supply deficit from GWS.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Swanlinbar PWS is no longer in deficit**		
TG1-SAB-046	New GW abstraction (poorly productive bedrock) to supply deficit at Swanlinbar PWS	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Swanlinbar PWS is no longer in deficit**		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAB-052	Increase existing SW abstraction from Lough Nadrageel and supply spare capacity to neighbouring WRZs.	This WRZ is in surplus and connections with other schemes will be assessed as part of different feasible options. Therefore, this option at WRZ level is not taken forward to the fine screening stage as it is assessed as part of a different feasible option.	**This is assessed as part of a different feasible option**		
TG1-SAB-056	New SW abstraction from Lough Sheelin. Abandon existing Lough Nadreegeel source.	This WRZ is in surplus and connections with other schemes will be assessed as part of different feasible options. Therefore, this option at WRZ level is not taken forward to the fine screening stage as it is assessed as part of a different feasible option.	**This is assessed as part of a different feasible option**		
TG1-SAB-058	Increase existing SW abstraction from Lough Coragh and upgrade Kilawaun WTP to supply deficit at Cootehill PWS WRZ	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-SAB-064	Interconnect Cootehill WRZ and Drumgole GWS and supply deficit from GWS.	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-SAB-065	Interconnect Cootehill WRZ and Barraghy GWS and supply deficit from GWS.	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-SAB-066	Interconnect Cootehill WRZ and Kill GWS and supply deficit from GWS.	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.	●	●	●

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAB-069	Rationalise Ballyhaise to Belturbet WRZ.	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. This option did not meet the requirements of the Deliverability criteria. There were also other viable options for this WRZ.		●	
TG1-SAB-080	Interconnect Blacklion WRZ and Glenfarne GWS and supply deficit from GWS.	This option was screened out due to lack of information. More up to date information may allow for future feasibility, however, the relatively large increase would suggest this is an unlikely option. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAB-087	Increase existing SW abstraction from Corconnelly lake, upgrade Carnroe WTP and supply deficit at Clones WRZ	The desktop assessment undertaken indicates that there is no scope to increase the abstraction from the small lake to meet demand. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAB-088	Recommission Carnroe Lake (manmade reservoir at the WTP) Skerrick Lake abstractions.	The desktop assessment undertaken indicates that there is no scope to increase the abstraction from the small lake to meet demand. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	●	●	●
TG1-SAB-093	Import water from Northern Ireland Water to supply deficit at Clones WRZ, upgrade Carnroe WTP	This option has a high cost associated, based on other IW schemes with connections to supplies in Northern Ireland. There are more suitable alternatives. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAB-094	Increase existing SW abstraction from Lough Feagh, upgrade Newbliss WTP and supply deficit at Newbliss WRZ.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Newbliss WRZ is no longer in deficit**		
TG1-SAB-097	Interconnect Newbliss WRZ and Drumgole GWS and supply deficit from GWS.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Newbliss WRZ is no longer in deficit**		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAB-098	Interconnect Newbliss WRZ and Stranoodan GWS and supply deficit from GWS.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Newbliss WRZ is no longer in deficit**		
TG1-SAB-103	Interconnect Smithboro WRZ and Aughnashalvey GWS and supply deficit from GWS.	The desktop assessment undertaken indicates that there is no scope to increase the abstraction from the small lake source to meet demand. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.	•	•	•
TG1-SAB-105	Increase GW abstraction (Monaghan Town GWB (productive fissured bedrock)) from existing boreholes and supply spare capacity to neighbouring scheme.	This WRZ is in surplus and requires WTP upgrades for its own demand needs. This was considered as part of larger regional groups. Therefore, the option was not taken forward to the fine screening stage as it is assessed as part of a different feasible option.	**This is assessed as part of a different feasible option**		
TG1-SAB-110	Increase existing SW abstraction from Lough Greagh and supply spare capacity to neigbouring schemes.	This WRZ is in surplus and connections with other schemes will be assessed as part of different feasible options. Therefore, this option at WRZ level is not taken forward to the fine screening stage as it is assessed as part of a different feasible option.	**This option is assessed as part of a different feasible option**		
TG1-SAB-111	Increase existing SW abstraction from Lough Corcaghan and supply spare capacity to neigbouring schemes.	This WRZ is in surplus and connections with other schemes will be assessed as part of different feasible options. Therefore, this option at WRZ level is not taken forward to the fine screening stage as it is assessed as part of a different feasible option.	**This option is assessed as part of a different feasible option**		
TG1-SAB-112	Bring back Togan lake source and treat at Togan WTP.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Monaghan WRZ is no longer in deficit**		
TG1-SAB-113	Bring back Lambs lake source and treat at Crosses WTP.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Monaghan WRZ is no longer in deficit**		

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAB-114	New SW abstraction from Ballagh Lough.	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is in surplus. Therefore, no new supply option is required.	**Monaghan WRZ is no longer in deficit**		
TG1-SAB-116	Interconnect Emyvale WRZ and Truagh GWS and supply deficit from GWS.	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-SAB-117	Interconnect Emyvale WRZ and Tydavnet GWS and supply deficit from GWS.	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-SAB-118	Interconnect Emyvale WRZ and Glaslough and Tyholland GWS and supply deficit from GWS.	This option is a repeat of TG1-SAB-115 and as a result, is not taken forward to the fine screening stage as it is assessed as part of a different feasible option.	**This option is a repeat and is assessed as part of a different feasible option**		
TG1-SAB-119	New SW abstraction from Emy lake and new WTP	High cost associated with new WTP. Better alternative to maintain supply from GWS. Therefore, this option did not meet the requirements of the Deliverability criterion.		●	
TG1-SAB-131	Rationalise Kinlough Tullaghan to Ballyshannon WRZ - Assaroe Lake.	Ballyshannon WRZ is assessed as part of SAA. Interconnection with existing source is assessed as part of a different option.	**This option is assessed as part of Study Area A.**		
TG1-SAB-138	Interconnect Gowna WRZ and Smear/Crott GWS and supply deficit from GWS.	This option was screened out due to lack of information for GWS. More up to date information may allow for future feasibility, however relatively large increase would suggest this is an unlikely option. 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-SAB-139	Interconnect Gowna WRZ and Garty Lough GWS and supply deficit from GWS.	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-SAB-140	Interconnect Gowna WRZ and Carrigallen GWS and supply deficit from GWS.	This option was screened out due to lack of information for private GWS. More up to date information may allow for future feasibility, however relatively large increase would suggest this is an unlikely option. Therefore, this option did not meet the requirements of the Deliverability and Flexibility criteria.		●	
TG1-SAB-148	Increase existing SW abstraction from Lough Unshin (Ballyshannon (Parkhill) WTP).	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-SAB-149	Increase existing SW abstraction from Lough Unshin (Ballyshannon (Parkhill) WTP).	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-SAB-150	Increase existing SW abstraction from Lough Unshin (Ballyshannon (Parkhill) WTP).	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-SAB-151	Increase existing SW abstraction from Lough Unshin (Ballyshannon (Parkhill) WTP).	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.	●	●	●

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAB-154	New SW abstraction from Assaroe Lake and new WTP	Ballyshannon WRZ is assessed as part of SA-A. Interconnection with existing source is assessed as part of a different option.	**This option is assessed as part of Study Area A.**		
TG1-SAB-155	New SW abstraction from Assaroe Lake and new WTP	Ballyshannon WRZ is assessed as part of SA-A. Interconnection with existing source is assessed as part of a different option.	**This option is assessed as part of Study Area A.**		
TG1-SAB-156	New SW abstraction from Assaroe Lake and new WTP	Ballyshannon WRZ is assessed as part of SA-A. Interconnection with existing source is assessed as part of a different option.	**This option is assessed as part of Study Area A.**		
TG1-SAB-165	Rationalise Bundoran Urban to Ballyshannon supply.	Ballyshannon WRZ is assessed as part of SA-A. Interconnection with existing source is assessed as part of a different option.	**This option is assessed as part of Study Area A.**		
TG1-SAB-166	Increase existing SW abstraction from St. Columbkill Lake (Cashilard WTP).	When unconstrained options list was originally drawn up this WRZ was identified as having a deficit; however, due to an updated SDB, the WRZ is not in deficit. Therefore, no new supply option is required.	**Cashilard WRZ not in deficit**		
TG1-SAB-168	Rationalise Cashilard to Ballyshannon WSZ.	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-SAB-169	Rationalise Cashilard to Ballyshannon/Bundaron WRZ (new Assaroe Lake source).	Ballyshannon WRZ is assessed as part of SA-A. Interconnection with existing source is assessed as part of a different option.	**This option is assessed as part of Study Area A.**		
TG1-SAB-171	Split Cashilard and rationalise part to Ballyshannon supply and part to Ballymagroarty WRZs.	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-SAB-172	Bring back SW abstraction from Lough Aghalough	There are water quality issues here and it is not desirable to return to source when there are better alternatives. Therefore, this option did not meet the requirements of the Deliverability criterion.		●	

Option Reference	Option Description	Rejection Reasoning	Resilience	Deliverability & Flexibility	Sustainability
TG1-SAB-175	New SW abstraction from Termon River to supply deficit at Pettigo Pub WRZ, upgrade Pettigo WTP	High cost to develop new SW abstraction and WTP for small demand. There are better alternative options that are feasible. Therefore, this option did not meet the requirements of the Deliverability criterion.		●	
TG1-SAB-176	New SW abstraction from Lough Derg to supply deficit at Pettigo Pub WRZ, upgrade Pettigo WTP	High cost to develop new SW abstraction and WTP for small demand requirement. There are better alternative options that are feasible. Therefore, this option did not meet the requirements of the Deliverability criterion.		●	
TG1-SAB-177	New SW abstraction from nearby lakes to supply deficit at Pettigo Pub WRZ.	High cost to develop new SW abstraction and WTP for small demand requirement. There are better alternative options that are feasible. Therefore, this option did not meet the requirements of the Deliverability criterion.		●	
TG1-SAB-178	New GW abstraction (karstic) to supply deficit at Pettigo Pub WRZ.	Refurbishment and treatment works are currently ongoing at Pettigo Site. Groundwater in the vicinity assessed as part of option SAB-173.	**This option is a repeat and is assessed as part of a different feasible option**		
TG1-SAB-181	Rastionalise Pettigo Pub to Ballyshannon WRZ (Lough Unshin source).	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-SAB-182	Rationalise Pettigo Pub to Ballyshannon WRZ (Assaroe lake source).	Ballyshannon WRZ is assessed as part of SA-A. Interconnection with existing source is assessed as part of a different option.	**This option is assessed as part of Study Area A.**		
TG1-SAB-183	Continue to import water from NI Water.	This option has a high cost associated, based on other IW schemes with connections to supplies in Northern Ireland. There are more suitable alternatives. 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-SAB-184	Rationalise Derrykillew to Ballyshannon WRZ (Lough Unshin source).	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-SAB-195	New SW abstraction from Lough Ramor.	This WRZ is assessed in Study Area 3 and as a result, this option is not taken forward to the fine screening stage as it is assessed as part of a different feasible option in the EM-RWRP.	**This is assessed as part of Study Area 3**		
TG1-SAB-196	New SW abstraction from Lough Ramor.	This WRZ is assessed in Study Area 3 and as a result, this option is not taken forward to the fine screening stage as it is assessed as part of a different feasible option in the EM-RWRP.	**This is assessed as part of Study Area 3**		
TG1-SAB-206	Rationalise Cootehill to Baileboro WRZ (GW at Baileboro)	The local geology makes it unfeasible to meet full deficit. Therefore, this option is not taken forward to the fine screening stage as did not meet the requirements of Resilience or Deliverability criteria.	●	●	
TG1-SAB-213	Use White Lough Source (currently source for Stranooden GWS) as an additional source for Monaghan WRZ. Pump raw water from White Lough to Togan WTP.	Monaghan WRZ not in deficit. Therefore, no new supply option is required.	**Monaghan WRZ not in deficit**		