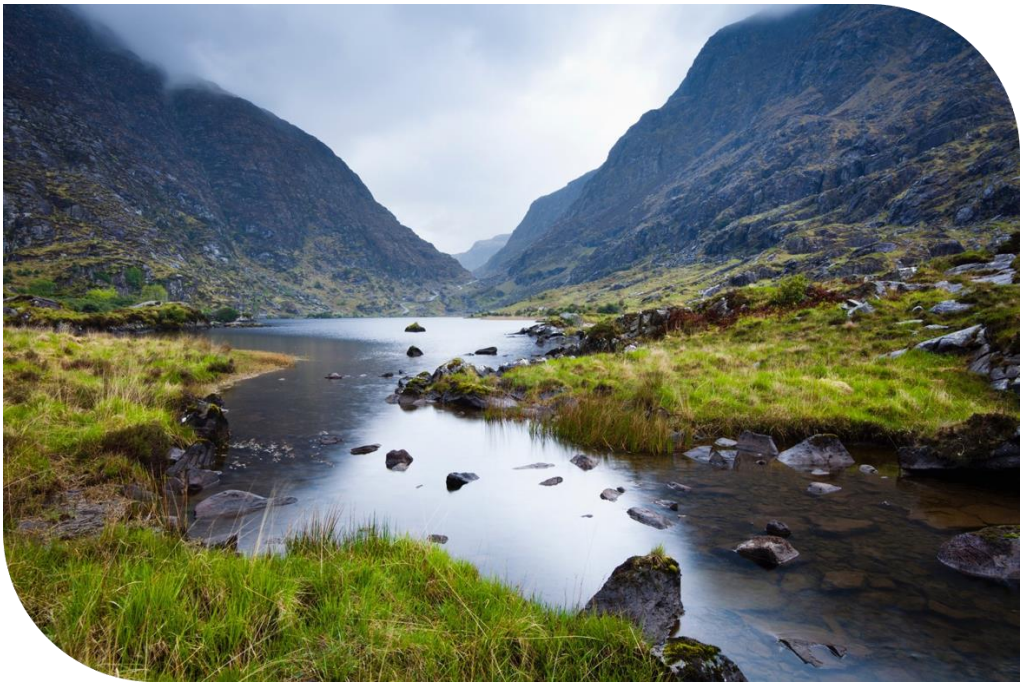
Spring 2023

Regional Water Resources Plan –South West
Appendix 1
Study Area H Technical Report



Tionscadal Éireann
Project Ireland
2040

Data disclaimer: This document uses best available data at time of writing. 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 (NWRP) will also align to relevant updates in applicable policy. In December 2022, the Water Services (Amendment) (No. 2) Act, 2022 was signed into law. This act legislates that from the 31 December 2022, Irish Water will only be known as Uisce Éireann. It also provides that, from that date, all references in any enactment, legal proceedings or other document to Irish Water shall be construed as references to Uisce Éireann only. Therefore, in this Regional Plan, which was developed prior to the name change, all references to Irish Water shall be construed as Uisce Éireann.

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

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1 Introduction and Background

1 Introduction – Study Area H – Kerry

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

This Study Area includes 23 water resource zones of which 22 are located in County Kerry and 1 in County Limerick. 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 Regional Water Resources Plan – South West (RWRP-SW).

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 Regional Water Resources Plan – South West (RWRP-SW), we apply this methodology to the South West Region shown in Figure 1.1.

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

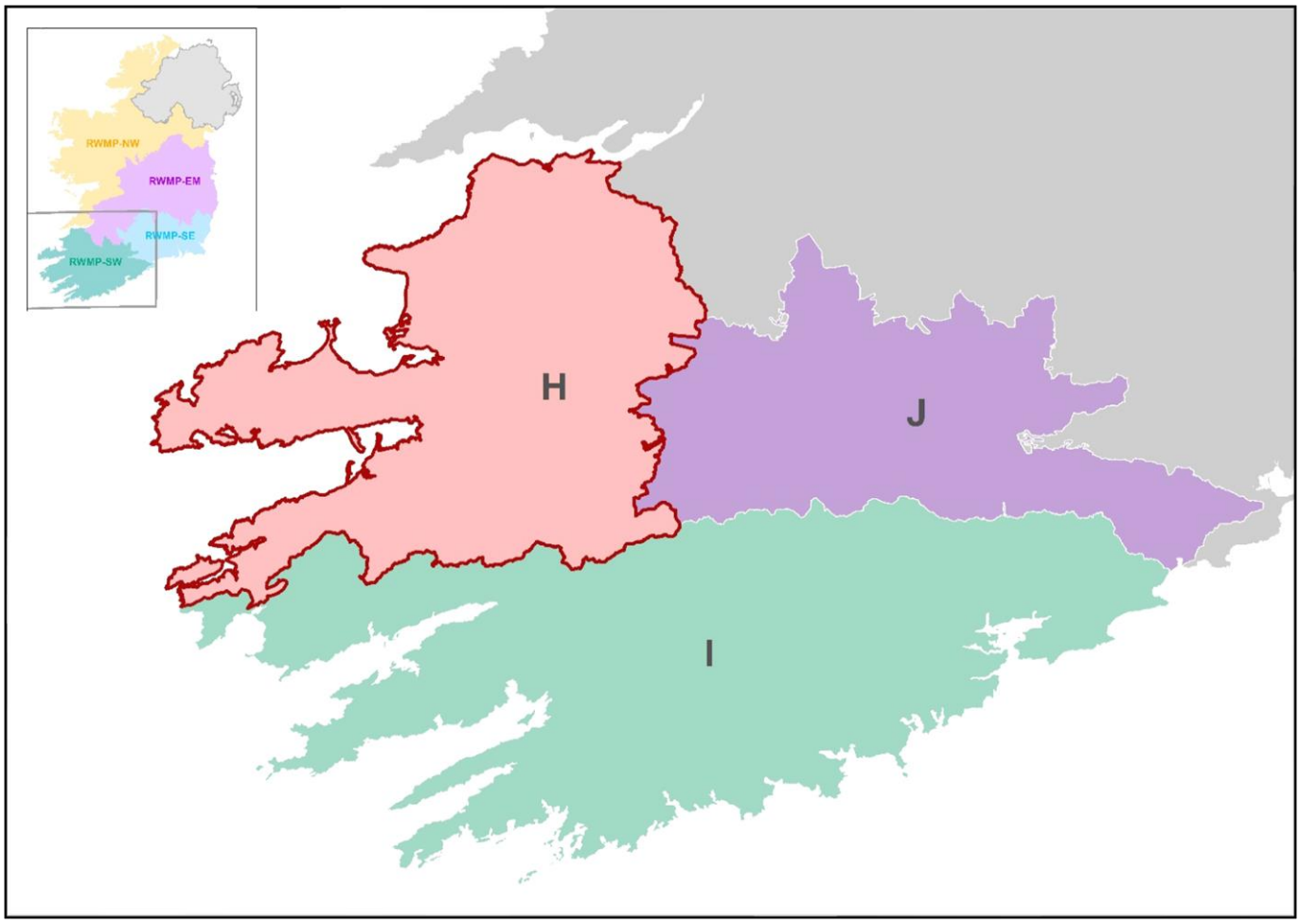

Figure 1.1 Overview of Study Areas within the South West Region.

This Technical Report is for SAH, 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 TG2 refers the South West Region (Regional Group 2).

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 NWRP (National Water Resource Planning) Framework. 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.

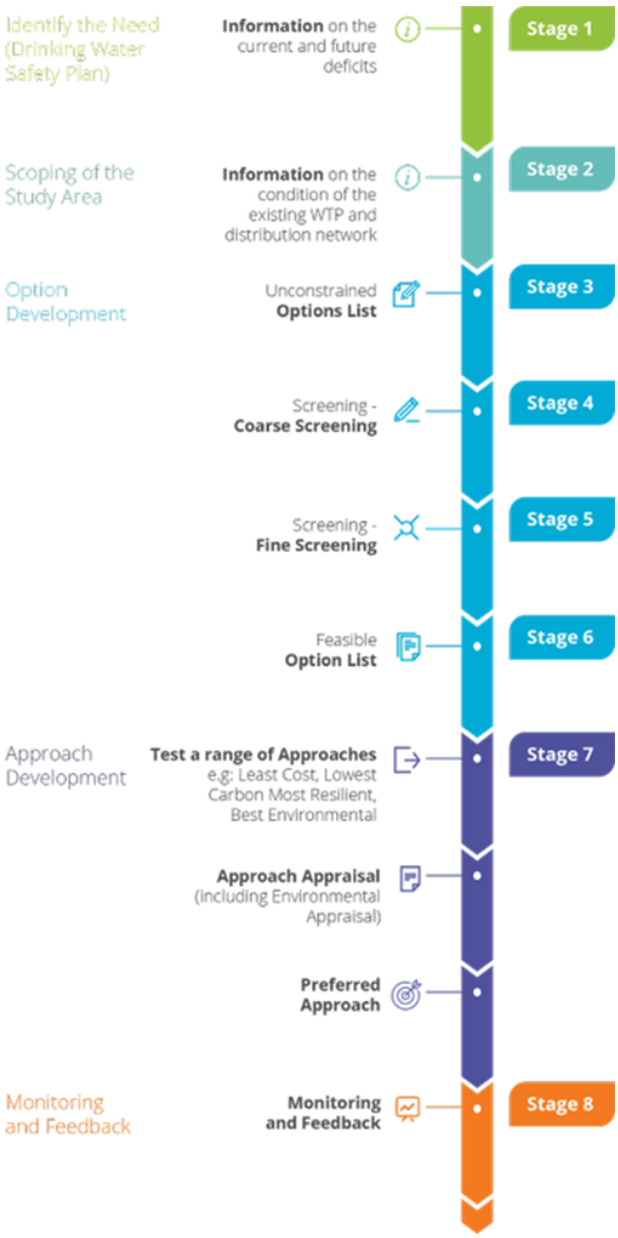

Figure 1.2 Option Assessment Methodology Process

1.2 Introduction to the Study Area

Study Area H consists of 23 WRZs supplying a population of approximately 125,225 people via approximately 2,479 kilometres of distribution network. The majority of the Study Area is in County Kerry, with the northeast boundary in County Limerick. The largest town is Tralee, whilst Killarney and Listowel are other areas of high demand within the Study Area. The Study Area's water treatment plants (WTPs) and their associated source type are summarised in Figure 1.3 and Table 1.1.

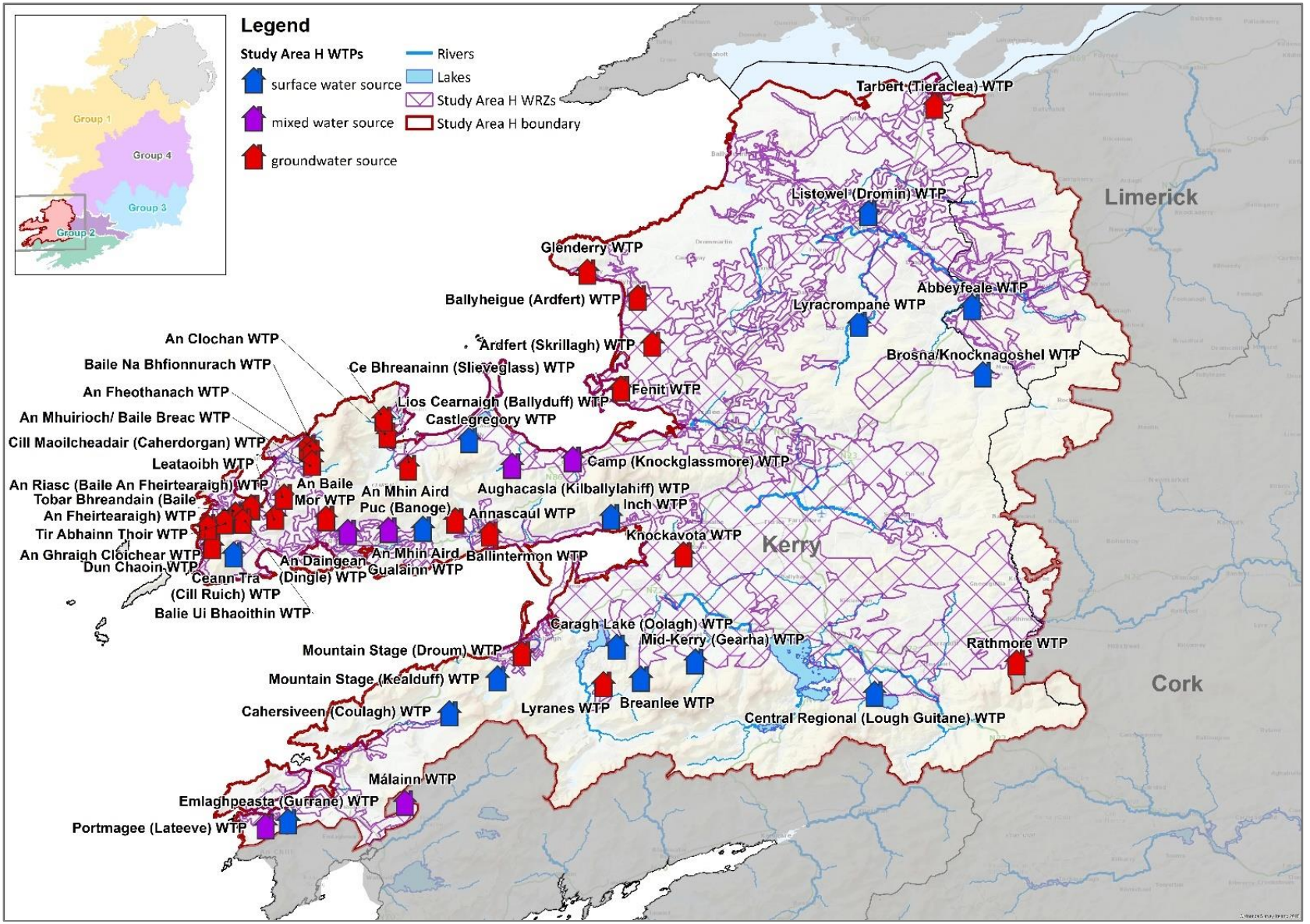

Figure 1.3 SAH Water Supply Study Area

The sources of water supply consist of 26 surface water abstraction and 31 groundwater sources (approximately 50 individual boreholes) in SAH.

Regarding surface water availability in the Study Area, SAH is split between the Laune-Maine-Dingle Bay catchment (HA 22) in the south, and the Tralee Bay-Feale catchment (HA 23) in the north. The Laune River catchment drains the southeast of the Study Area, flowing through the large Lough Leane waterbody at Killarney, before out to sea at Dingle Bay. The River Feale catchment drains the northern part of the Study Area, as it flows through Abbeyfeale in Co. Limerick, before Listowel in Co. Kerry, and emptying into the Shannon Estuary at Cashen Bay. The Study Area includes the Dingle Peninsula and the northern side of the Iveragh Peninsula, which are drained by a series of small rivers.

Many of these surface waters are within designated areas, including the large Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC and Castlemaine Harbour SAC in the south, and the Lower River Shannon SAC in the north of the Study Area. There are three designated Freshwater Pearl Mussel sub-catchments (under Freshwater pearl mussel regulations (S.I. 296 2009)) located within SACs: Caragh and Gearhameen within Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC; and Owenmore within the Mount Brandon SAC. Several river and lake water bodies within the Study Area have a WFD high ecological status objective: twenty-nine river water bodies and two lakes (Caragh and Muckross) within the Laune-Maine-Dingle Bay catchment; and four river water bodies within the Tralee Bay-Feale catchment.

Most of the water supplies for the Study Area come from a few large abstractions from surface water sources. The Central Regional WRZ is the largest water resource zone in SAH, covering the Tralee and Killarney high demand areas. To meet these demands, Central Regional has the most significant abstraction from the Lough Guitane source within the upper Laune catchment. The lake has an existing abstraction licence in place allowing an abstraction amount up to 12 million gallons per day (i.e. 54,540 m^3/d). Elsewhere in the Laune catchment, there are abstractions from the smaller Lough Callee and Gaddagh River sources for Mid Kerry WRZ. The River Feale catchment and its tributaries are an important supply source for the north of the Study Area. There are two abstractions in the upper catchment at Brosna and Abbeyfeale, another one from one of its main tributaries River Smearlagh, before the most significant abstraction downstream at Listowel before the Feale enters transitional waters. Elsewhere across the Study Area, including across the Dingle and Iveragh Peninsulas, the WRZ supplies are made up of combinations of smaller surfac e water and groundwater sources.

All other WRZs are groundwater supplies. The topography of County Kerry, and associated geological deposits, can be broadly split into the topographic highs of the Macgillycuddy’s Reeks just west of the Killarney National Park and the Slieve Mish Mountains north of Dingle Bay. The higher topographic features have the sedimentary rocks of the Old Red Sandstones at or close to the surface in some parts. These sandstones also cover most of the southern half of the county. They are predominantly overlain by quaternary sediments of Till and raised Peat in the more upland areas. The most obvious lowland feature in the Study Area is the S-shaped “green belt” stretching from Ardfert to Killarney. Just south of the Study Area lies the broadly east-west trending syncline of Kenmare. The predominant bedrock in these areas are the Lower Carboniferous limestones (Dinantian Pure Unbedded Limestones) and generally have thick (5-10m) cover of Quaternary deposits. Finally, the centrally located uplands between Killarney and Farranfore, are underlain by Upper Carboniferous rocks dominated by shales and sandstones and these pose the least amount of potential from a groundwater resource perspective.

The karst forms a key regionally important aquifer in some areas, namely around Ardfert and Castlemaine. There are a number of sand and gravel aquifers throughout the Study Area; the Ardfert gravels from which the Ardfert South scheme currently abstracts, and the Killorglin gravels which currently has no abstractions taking place. The Old Red Sandstones are predominantly of a poorly productive bedrock flow regime and

assumed to be generally devoid of intergranular permeability, with groundwater flow occurring predominantly through fractures and faults. Most groundwater flow occurs in the top 15-20 metres of the aquifer, with levels generally mirroring topography, although deeper flows along fault zones or connected fractures are encountered which can provide much higher yields. Significant flows can be found at springs issuing from bedding planes marking a change in lithology.

Overall, 31 groundwater sources (approximately 50 individual boreholes/ sources) are managed by Irish Water in the region, abstracting between 125m^3/d to 1,600m^3/d. The majority of abstractions taking place from the sandstones produce yields averaging 120 – 350m^3/d. The higher abstraction volume is from the Ardfert South borehole which is sited in a sand and gravel aquifer overlying Carboniferous limestone.

An overview of the Study Area is outlined in Table 1.1.

Table 1.1 SAH Study Area Summary

Kerry	Total Population	125,225	Total Network Length (km)	2,479	Number of Water Resource Zones	23
Counties in Study Area	Kerry, Limerick					
Principle Settlements	Tralee, Killarney, Listowel, Killorglin, Abbeyfeale, Castleisland, Dingle-Daingean Uí Chuis, Abbeydorney, Kilflynn, Newtownsandes, Ardfert, Lixnaw, Ballybunion, Milltown, Cahirciveen, Cromane, Gneevgullia, Beaufort, Spa, Castlegregory, Rathmore, Ballyduff, Fieries					
Number of Water Sources	57	Surface Water Sources	26	Groundwater Sources	31	

Water Treatment Plant	Source	Population	WTP Capacity (m^3/day)	Quality	Quantity	Reliability	Potential Sustainability
Abbeyfeale WTP	River Feale	6,791	2,800	●	●	●	○
Cahersiveen (Coulagh) WTP	Coulagh River Intake	1,396	1,680	●	●	○	●
Rathmore WTP	Multiple Groundwater	1,123	840	●	○	●	○
Aughacasla (Kilballylahiff) WTP	Lough Acummeen & Multiple Groundwater	348	576	●	○	●	●
Ce Bhreanainn (Slieveglass) WTP	Groundwater	147	288	●	○	○	●
Lios Cearnaigh (Ballyduff) WTP	Groundwater	30	144	●	○	○	○
Mountain Stage (Droum) WTP	Groundwater	856	190	●	●	○	○
Mountain Stage (Kealduff) WTP	Maithegarbh River & Coomaglaslaw Lake	856	744	●	●	○	●
Lyranes WTP	Groundwater	91	48	◐	●	○	○

Ceann Tra (Cill Ruich) WTP	Mount Eagle Lake S50	438	840	●	●	●	●
Málainn WTP	Maulin River & Groundwater	824	720	●	●	●	●
Portmagee (Lateeve) WTP	Lateeve Stream & Multiple Groundwater	807	600	●	●	●	●
Emlaghpeasta (Gurrane) WTP	Gurrane Stream	129	240	●	●	●	●
Knockavota WTP	Groundwater	1,554	600	●	●	●	●
Breanlee WTP	Cottoners River (Breanlee Stream from Lough Eighter)	1,266	1,320	●	●	●	●
Mid-Kerry (Gearha) WTP	Gaddagh River & Lough Callee	5,850	14,664	●	●	●	●
Caragh Lake (Oolagh) WTP	Lough Cummernamuck	1,935	960	●	●	●	●
Inch WTP	Ballyarkane River	1,375	792	●	●	●	●
Camp (Knockglassmore) WTP	Curracullenagh River & Multiple Groundwater	894	840	●	●	●	●
Central Regional (Lough Guitane) WTP	Lough Guitane & Owgrarriff River	66,025	48,000	●	●	●	●
Fenit WTP	Groundwater	849	336	●	●	●	●
Ardfert (Skrillagh) WTP	Groundwater	2,439	1,320	●	●	●	●
Brosna/Knocknagoshel WTP	Clydagh River (Knoppoge)	947	1,680	●	●	●	●
Listowel (Dromin) WTP	Feale	14,602	14,400	●	●	●	●
Tarbert (Tieraclea) WTP	Groundwater	354	600	●	●	●	●

Lyracrompane WTP	Smearlagh River	2,544	4,080	●	○	○	●
Glenderry WTP	Groundwater	162	312	●	●	○	○
Ballyheigue (Ardfert) WTP	Groundwater	2,512	3,360	●	●	○	●
Castlegregory WTP	Stradbally Intake	1,158	1,200	●	●	○	●
An Clochan WTP	Multiple Groundwater	173	480	●	●	●	●
An Mhuirioch/ Baile Breac WTP	Multiple Groundwater	537	576	●	○	○	●
An Fheothanach WTP	Groundwater	214	480	○	○	●	○
Dun Chaoin WTP	Groundwater	153	240	○	●	●	●
Tir Abhainn Thoir WTP	Groundwater	115	91	●	●	○	●
Cill Maoilcheadair (Caherdorgan) WTP	Multiple Groundwater	116	240	○	●	○	○
Leataoibh WTP	Groundwater	116	240	●	●	●	●
An Ghraigh Cloichear WTP	Groundwater	88	144	●	●	○	○
Balie Ui Bhaoithin WTP	Groundwater	474	12	○	●	○	○
Tobar Bhreandain (Baile An Fheirtearaigh) WTP	Multiple Groundwater	474	240	●	●	○	●
An Riasc (Baile An Fheirtearaigh) WTP	Multiple Groundwater	474	480	○	●	○	○
An Daingean (Dingle) WTP	Garfinny River & Spring	1,755	2,400	●	○	○	○

An Baile Mor WTP	Multiple Groundwater	840	864	●	●	●	●
An Mhin Aird Gualainn WTP	Gowlane Stream & Spring	587	960	●	●	●	●
An Mhin Aird Puc (Banoge) WTP	Puckisland	403	720	●	●	●	●
Ballintermon WTP	Groundwater	245	273	●	●	●	●
Annascaul WTP	Multiple Groundwater	461	576	●	●	●	●

Score	Irish Water Asset Standard Assessment
●	Low Risk
●	Medium Risk
●	
●	High Risk

2 Scoping the Study Area

2 Scoping the Study Area

In this chapter we summarise the current and future issues with water supplies in SAH, 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 SAH 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**
Abbeyfeale WTP	●	●	●	●
Cahersiveen (Coulagh) WTP	●	●	●	●
Rathmore WTP	●	●	●	●
Aughacasla (Kilballylahiff) WTP	●	●	●	●
Ce Bhreanainn (Slieveglass) WTP	●	●	●	●
Lios Cearnaigh (Ballyduff) 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**
Mountain Stage (Droum) WTP				
Mountain Stage (Kealduff) WTP				
Lyranes WTP				
Ceann Tra (Cill Ruich) WTP				
Málainn WTP				
Portmagee (Lateeve) WTP				
Emlaghpeasta (Gurrane) WTP				
Knockavota WTP				
Breanlee WTP				
Mid-Kerry (Gearha) WTP				
Caragh Lake (Oolagh) WTP				
Inch WTP				
Camp (Knockglassmore) WTP				
Central Regional (Lough Guitane) WTP				
Fenit WTP				
Ardfert (Skrillagh) WTP				
Brosna/Knocknagoshel WTP				
Listowel (Dromin) WTP				
Tarbert (Tieraclea) WTP				
Lyracrompane 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**
Glenderry WTP	●	●	○	○
Ballyheigue (Ardfert) WTP	○	●	●	○
Castlegregory WTP	●	○	○	○
An Clochan WTP	●	○	○	○
An Mhuirioch/ Baile Breac WTP	●	○	○	○
An Fheothanach WTP	○	○	○	○
Dun Chaoin WTP	○	○	○	○
Tir Abhainn Thoir WTP	●	○	●	○
Cill Maoilcheadair (Caherdorgan) WTP	○	○	○	○
Leataoibh WTP	●	○	○	○
An Ghraigh Cloichear WTP	●	○	○	○
Balie Ui Bhaoithin WTP	○	○	○	○
Tobar Bhreandain (Baile An Fheirtearaigh) WTP	●	○	○	○
An Riasc (Baile An Fheirtearaigh) WTP	○	○	○	○
An Daingean (Dingle) WTP	●	○	○	○
An Baile Mor WTP	○	●	○	○
An Mhin Aird Gualainn WTP	○	●	○	○
An Mhin Aird Puc (Banoge) WTP	○	○	○	○
Ballintermon WTP	○	○	●	○
Annascaul 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 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, 34 of the 46 Water Treatment Plants in the Study Area appear to have significant deficits, particularly in relation to primary disinfection (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 are developed for each water supply, the barrier scores for all of our supplies will be updated and become more reliable.

It should be noted that the “quality need” identified through the Barrier Assessment is not an indicator of compliance with the Drinking Water Regulations. It is an assessment of the need to invest in areas of our asset base (human and structural) through resource planning, to ensure that we can address potential risks or emerging risks to our supplies.

At present, there are 5 WRZs within SAH on the Environmental Protection Agency (EPA) Remedial Action List (RAL), Cahersiveen, Aughacasla, Mountain Stage, Mid Kerry, and Listowel.

Irish Water is currently progressing immediate corrective action in advance of the NWRP for a number of supplies within SAH. A national programme to improve disinfection standards (Barrier 1) at water treatment facilities across Ireland was initiated by Irish Water in 2016. Details of the ‘in progress’ projects to address critical water quality requirements are included in Table 2.2.

Note that Fenit WTP which provides supply to Fenit area (Central Regional WRZ) was decommissioned. An Ghraigh Cloichear WTP which provides supply to An Ghraig Cloichear and Tir Abhainn Thoir WTP which provides supply to Teeravane East are no longer is use and the scheme is supplied from Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear WRZ. Mountain Stage (Kealduff) WTP which provides a supply to Mountain Stage is no longer in use and the scheme is supplied from Commonage WTP. These were completed after the optioneering works for this Study Area commenced therefore they are reported on separately in this Technical Report.

Table 2.2 Critical Water Quality Requirements SAH – Kerry

Critical Water Quality Requirements	Progress
1. Kerry Central Regional Water Supply Scheme The new water treatment plant is among the largest in the country and has capacity to provide over 50 million litres of drinking water every day. The scheme abstracts raw water from Lough Guitane and, until the completion of this project, did not have an effective treatment system that incorporated a cryptosporidium barrier to treat the raw water. This meant that the areas supplied by the Kerry Central Regional Water Supply Scheme were at risk due to the lack of sufficient water treatment and were on the Environmental Protection Agency's Remedial Action List (RAL).	Complete
2. Mountain Stage WTP Upgrades works required to remove the WTPs from the RAL are complete. These works included upgrades to the existing treatment process and the provision of UV disinfection. The site is currently supplied from a generator and the site will not be removed from the RAL until a permanent power supply is provided at the site.	Ongoing
3. Ardfert North (Ballyheigue WTP) This WTP was on the RAL due to issues with the existing Protozoa barrier. Upgrades works included the provision of UV treatment.	Completed
4. Mid Kerry (Caragh Lake WTP) This WTP is on the RAL due to issues with THMs and Aluminium exceedances. Irish Water are currently in the process of scoping the full upgrade required which is likely to include an activated carbon system to improve the organic removal process.	Scoping
5. Cahersiveen WTP Previous upgrades at this WTP included the provision of UV disinfection to ensure the Protozoa barrier at the WTP was in line with the risks in the catchment. The WTP is currently on the RAL due to issues with THMs. Irish Water is in the process of providing activated carbon treatment at the WTP to improve the WTPs ability to remove organics.	Ongoing
6. Aughacasla (Kilballylahiff) WTP This WTP is currently on the RAL due to issues with THMs. Irish Water is in the process of providing activated carbon treatment at the WTP to improve the WTPs ability to remove organics.	Ongoing
7. Listowel RAL Listowel is on RAL due to THM issues. The proposed solutions are WTP upgrades and development of additional groundwater sources.	Ongoing
8. Reservoir Cleaning Programme: A major reservoir cleaning programme has been undertaken at 78 sites, which has reduced network water quality issues.	Complete
9. Disinfection Programme Disinfection systems at 16 plants have been upgraded and standardised. These sites include: Ballyheigue, Ardfert South, Lyreacrompane, Brosna/Knocknagoshel, Camp, Annascaul, An Baile Mor, An Daingean, Dun Chaoin, An Fheothanach, Inch, Ceann Tra (Ventry), Coulagh, Breanlee, An Mhín Aird Gualainn and Dromin. The programme also allowed Ceann Trá (Ventry) supply to be removed from the RAL in November 2017. Any requirements within the remaining supplies will be identified via Drinking Water Safety Plans with solutions developed as part of the NWRP.	Ongoing

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 will be brought through our options assessment process.

2.2 Water Quantity – Supply Demand Balance

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

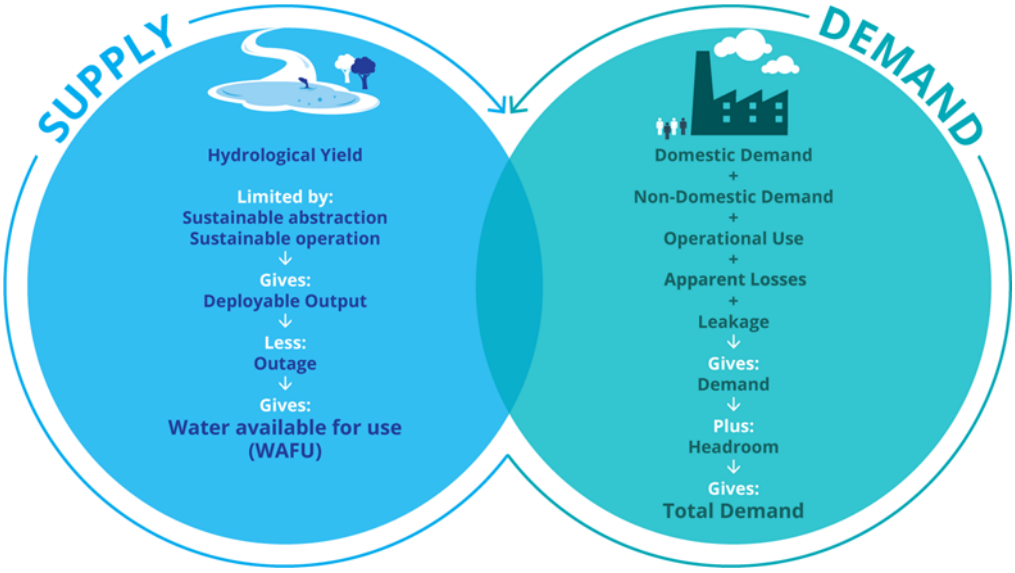

Figure 2.2 Supply Demand Balance

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 SAH 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:** At present, 19 out of 23 of the WRZs in SAH have a current deficit and 21 out of 23 have a projected SDB deficit (based on a “do minimum” approach). However, under normal weather and demand conditions, this does not manifest as an interruption to supply for all WRZs. During recent dry periods, particularly the summer of 2018 and 2020 when water conservation orders were implemented, a number of the supplies in SAH were impacted. Several groundwater supplies were impacted along with surface water supplies including Abbeyfeale, where instream pumping has been required and Central Regional where pumping to the intake was required at the Lough Guitane source. Night-time restrictions have also been implemented in recent years for the Mid Kerry supply.

A summary of the SDB deficit across all 23 WRZs 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

Water Resource Zone Name	Water Resource Zone code	Population	Estimated Maximum Deficit m^3/day					
			2019	2025	2030	2035	2040	2044
Abbeyfeale Water Supply	1900SC0021	6,791	-715	-750	-796	-845	-894	-926
Cahersiveen	1300SC0032	1,396	-1,573	-1,597	-1,618	-1,635	-1,653	-1,664
Rathmore	1300SC0031	1,123	-48	-67	-84	-96	-109	-117
Aughacasla	1300SC0030	348	No Deficit	No Deficit	No Deficit	No Deficit	-1	-4
Ce Bhreannain	1300SC0028	147	-26	-31	-35	-37	-40	-42
Lios Cearnaigh PWS 052D	1300SC0026	30	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit
Mountain Stage PWS 062A	1300SC0025	856	-458	-472	-484	-496	-509	-516
Lyranes 303A	1300SC0024	91	-15	-16	-16	-17	-18	-18
Ceann Tra PWS 074D	1300SC0022	438	-469	-482	-492	-500	-508	-514
Emlaghpeasta / Portmagee / Maulin	1300SC0016	1,760	-987	-1,015	-1,044	-1,069	-1,094	-1,112
Mid Kerry	1300SC0015	10,604	-9,757	-9,769	-9,918	-10,032	-10,143	-10,218
Central Regional - Lough Guitane	1300SC0013	73,201	-12,219	-12,265	-13,139	-13,952	-14,743	-15,251

Water Resource Zone Name	Water Resource Zone code	Population	Estimated Maximum Deficit m^3/day					
			2019	2025	2030	2035	2040	2044
Brosna/Knocknagoshel PWS 016F	1300SC0012	947	-207	-226	-233	-241	-248	-253
Listowel Regional Public Water Supply	1300SC0011	17,499	-1,684	-1,834	-2,003	-2,143	-2,280	-2,389
Ardfert North/ Glenderry	1300SC0010	2,674	-2,144	-2,211	-2,253	-2,283	-2,312	-2,333
Castlegregory	1300SC0009	1,158	-980	-998	-1,016	-1,033	-1,049	-1,059
An Clochan	1300SC0008	173	-237	-242	-246	-249	-251	-253
An Fheothanach / An Mhuirioch/ Baile Breach	1300SC0007	751	No Deficit	-5	-13	-20	-27	-32
Dun Chaoin PWS 034D	1300SC0006	153	-156	-158	-160	-162	-163	-164
Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig /Cloichear	1300SC0005	793	-410	-430	-440	-450	-459	-467
An Baile Mor / An Daingean	1300SC0004	2,596	-309	-350	-382	-410	-438	-456
An Mhin Aird	1300SC0003	990	-342	-363	-377	-388	-398	-405
Annascaul / Ballintermon	1300SC0002	706	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit	No Deficit

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

The target 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 supply demand balance deficit for the Region of approximately 32,737m^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 is projected to increase to 38,102 m^3/day by 2044.

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

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

2.3 Water Supply Reliability

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

There are a number of problematic distribution and trunk mains throughout SAH. Irish Water and the Local Authority Water Services will continue to monitor the performance of all watermains 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 SAH. This provides for a more reliable water supply, reducing instances of bursts and water outages. The works also improve water quality by replacing old cast iron and lead watermains, whilst reducing leakage and improving overall operation and maintenance of our supply system.

During our needs assessment, 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 2.2.4.

Table 2.2.4 SAH Critical Infrastructure Projects and Need Identification

Critical Water Supply Reliability Requirement	Progress
1. Listowel watermain replacement The works involved the replacement of over 850 metres of problematic watermains with plastic pipes. The works also involved laying new water service connections from the public watermain in the road to customers' property boundaries and connecting it to the customers' water supply.	**Complete**
2. Mid Kerry raw watermain from Lough Callee New raw watermain required from Lough Callee to the WTP as frequent bursts occur and unable to transfer the full supply required at present due to the condition of the pipeline.	**Need Identified**
3. An Baile Mor/ An Daingean Poor yield during DYCP demands. Emergency borehole required in 2018.	**Assessment Complete**
4. Cahersiveen Poor yield during DYCP demands. Trial Wells developed in the region	**Assessment Complete**
5. Critical network upgrades and controls: Identification of priority network upgrades, new control valves and pressure controls required across the region.	**Detailed Design**
6. 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. As outlined at Section 3.7.2 of the Framework Plan, the Government is currently developing new legislation dealing with water abstractions. While at the end of 2022, the government passed the Water Environment (Abstractions and Associated Impoundments) Act, 2022, this act has not yet commenced and its associated regulations and guidelines which will further detail the types of assessment and national methodology to be used are not yet in place. As this legislation is still being developed, we do not yet 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 abstraction legislation on the SAH supplies, Irish Water has used the procedure set out at Appendix C of the Framework Plan have assessed our surface water abstractions from River Feale (Abbeyfeale Water Supply), Garfinny River (An Baile Mor / An Daingean), Garfinny River (An Baile Mor / An Daingean), Puckisland (An Mhin Aird), Gowlane Stream

(An Mhin Aird), Lough Acummeen (Aughacasla), Clydagh River (Knoppoge) (Brosna/Knocknagoshel PWS 016F), Coulagh River Intake (Cahersiveen), Stradbally Intake (Castlegregory), Mount Eagle Lake S50 (Ceann Tra PWS 074D), L. Guitane (Central Regional - Lough Guitane), Curracullenagh Stream (Central Regional - Lough Guitane), Curracullenagh River (Central Regional - Lough Guitane), Ballyarkane River (Central Regional - Lough Guitane), Gurrane Stream (Emlaghpeasta / Portmagee / Maulin), Smearlagh River (Listowel Regional Public Water Supply), Feale (Listowel Regional Public Water Supply), Lough Cummernamuck (Mid Kerry), Gaddagh River (Mid Kerry), Lough Callee S76 (Mid Kerry), Cottoners River (Breanlee Stream from Lough Eighter) (Mid Kerry), Coomaglaslaw Lake S67 (Mountain Stage PWS 062A), and Maithegarbh River (Mountain Stage PWS 062A) sources.

Table 2.5 presents the findings of this assessment in order to indicate the potential reductions to abstraction that may be required at our existing surface water supplies. The table presents our current abstraction levels1, our source hydrological yield[2], and our estimated sustainable abstraction[3] amount which the source may be limited to in the future.

Based on this initial assessment, the volumes of water abstracted at Puckisland (An Mhin Aird), Gowlane Stream (An Mhin Aird), Lough Acummeen (Aughacasla), Coulagh River Intake (Cahersiveen), Stradbally Intake (Castlegregory), Mount Eagle Lake S50 (Ceann Tra PWS 074D), L Guitane (Central Regional - Lough Guitane), Curracullenagh Stream (Central Regional - Lough Guitane), Curracullenagh River (Central Regional - Lough Guitane), Ballyarkane River (Central Regional - Lough Guitane), Gurrane Stream (Emlaghpeasta / Portmagee / Maulin), Smearlagh River (Listowel Regional Public Water Supply), Feale (Listowel Regional Public Water Supply), Lough Cummernamuck (Mid Kerry), Gaddagh River (Mid Kerry), Lough Callee S76 (Mid Kerry), Cottoners River (Breanlee Stream from Lough Eighter) (Mid Kerry), Coomaglaslaw Lake S67 (Mountain Stage PWS 062A), and Maithegarbh River (Mountain Stage PWS 062A) may not meet sustainability guidelines during dry weather flows. However, under the proposed regulatory regime, sustainable abstraction quantities will be adjudicated by the EPA who will have the benefit of detailed Project Level information. We have assumed, given the need to maintain supplies, that a transition to new abstraction quantities would likely take place in the medium term.

The Central Regional WRZ could have the most significant impact to SDB based on the potential sustainability reductions for the Lough Guitane abstraction source. It has been assumed that the current abstraction rates from the lake may be maintained for the future due to the regional importance of this supply source and the presence of an existing abstraction licence in place allowing an abstraction of up to 12 million gallons per day (i.e. 54,540 m^3/d). However, it has also been recognised that an additional supply source must be developed for Central Regional WRZ to supplement supplies from Lough Guitane in order to both help meet future projected demands and allow us to alleviate pressure on the lake during drought periods. Details of the new supply options that have been assessed and the preferred approach to be developed are discussed in the next sections of this report.

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

Source (WRZ)	Current abstraction (m^3/day)	Hydrological yield (m^3/day)	Theoretical Future abstraction (m^3/day)
River Feale (Abbeyfeale Water Supply)	2,567	15,319	5,462

[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.

Source (WRZ)	Current abstraction (m^3/day)	Hydrological yield (m^3/day)	Theoretical Future abstraction (m^3/day)
Garfinny River (An Baile Mor / An Daingean)	2,200	89	50
Garfinny River (An Baile Mor / An Daingean)	2,200	243	138
Puckisland (An Mhin Aird)	660	781	114
Gowlane Stream (An Mhin Aird)	880	59	37
Lough Acummeen (Aughacasla)	528	610	89
Clydagh River (Knoppoge) (Brosna/Knocknagoshel PWS 016F)	1,540	9,712	2,682
Coulagh River Intake (Cahersiveen)	1,540	176	106
Stradbally Intake (Castlegregory)	1,100	132	75
Mount Eagle Lake S50 (Ceann Tra PWS 074D)	770	304	37
L. Guitane (Central Regional - Lough Guitane)	44,000	53,000	4,167
Curracullenagh Stream (Central Regional - Lough Guitane)	770	16	9
Curracullenagh River (Central Regional - Lough Guitane)	770	54	31
Ballyarkane River (Central Regional - Lough Guitane)	726	124	50
Gurrane Stream (Emlaghpeasta / Portmagee / Maulin)	220	19	9
Smearlagh River (Listowel Regional Public Water Supply)	3,740	1,243	405
Feale (Listowel Regional Public Water Supply)	13,200	33,464	10,955
Lough Cummernamuck (Mid Kerry)	880	543	50
Gaddagh River (Mid Kerry)	13,442	709	339
Lough Callee S76 (Mid Kerry)	13,442	2,319	302
Cottoners River (Breanlee Stream from Lough Eighter) (Mid Kerry)	1,210	152	122
Coomaglaslaw Lake S67 (Mountain Stage PWS 062A)	682	3,052	250
Maithegarbh River (Mountain Stage PWS 062A)	682	14	30

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

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

Source (WRZ)	Potential change in SDB[4] (m^3/day)
River Feale (Abbeyfeale Water Supply)	None
Garfinny River (An Baile Mor / An Daingean)	None
Garfinny River (An Baile Mor / An Daingean)	None
Puckisland (An Mhin Aird)	-573
Gowlane Stream (An Mhin Aird)	-573
Lough Acummeen (Aughacasla)	-289
Clydagh River (Knoppoge) (Brosna/Knocknagoshel PWS 016F)	None
Coulagh River Intake (Cahersiveen)	-60
Stradbally Intake (Castlegregory)	-47
Mount Eagle Lake S50 (Ceann Tra PWS 074D)	-249
L Guitane (Central Regional - Lough Guitane)	-38,380
Curracullenagh Stream (Central Regional - Lough Guitane)	-38,380
Curracullenagh River (Central Regional - Lough Guitane)	-38,380
Ballyarkane River (Central Regional - Lough Guitane)	-38,380
Gurrane Stream (Emlaghpeasta / Portmagee / Maulin)	-8
Smearlagh River (Listowel Regional Public Water Supply)	-4,729

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

Source (WRZ)	Potential change in SDB[4] (m^3/day)
Feale (Listowel Regional Public Water Supply)	-4,729
Lough Cummernamuck (Mid Kerry)	-2,445
Gaddagh River (Mid Kerry)	-2,445
Lough Callee S76 (Mid Kerry)	-2,445
Cottoners River (Breanlee Stream from Lough Eighter) (Mid Kerry)	-2,445
Coomaglaslaw Lake S67 (Mountain Stage PWS 062A)	-419
Maithegarbh River (Mountain Stage PWS 062A)	-419

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

SAH has issues in relation to quality, quantity, reliability and sustainability which must be addressed as part of the preferred approach to future water resources planning, summarised in Table 2.7.

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

Quality	Upgrades required at all WTPs, aligned with the barrier approach
Quantity	Net leakage reduction 1,070 m^3 in the region Additional Leakage Targets of 32.3 Ml/d to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m3/d Interim additional supplies of 32.7Ml/d within 10 years and Total of 38.2Ml/d 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	The volumes of water abstracted at Puckisland (An Mhin Aird), Gowlane Stream (An Mhin Aird), Lough Acummeen (Aughacasla), Coulagh River Intake (Cahersiveen), Stradbally Intake (Castlegregory), Mount Eagle Lake (Ceann Tra PWS), L Guitane (Central Regional), Curracullenagh Stream (Central Regional), Curracullenagh River (Central Regional), Ballyarkane River (Central Regional), Gurrane Stream (Emlaghpeasta / Portmagee / Maulin), Smearlagh River (Listowel Regional Public Water Supply), Feale (Listowel Regional Public Water Supply), Lough Cummernamuck (Mid Kerry), Gaddagh River (Mid Kerry), Lough Callee (Mid Kerry), Cottoners River (Breanlee Stream from Lough Eighter) (Mid Kerry), Coomaglaslaw Lake (Mountain Stage P and Maithegarbh River (Mountain Stage PWS) 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 H

3 Solution Types Considered in Study Area H

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

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 the SAH 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 SAH are based on what we assess to be both achievable and sustainable and include:

- Ongoing leakage management, including active leakage control, pressure management and Find and Fix activities, to offset Natural Rate of Leakage Rise (NRR); and
- Net leakage reductions targets listed in Table 3.1 have been applied to SDB deficit to move towards achieving the national Sustainable Economic Level of Leakage (SELL) target prioritised based on
    - Supply demand deficit;
    - Existing abstractions with sustainability issues; and
    - Drought impacts.
- Additional leakage Targets to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m^3/d, see Table 3.1.

Table 3.1 SELL Targets for WRZ in SAH

WRZ	Net Leakage Reduction applied to SDB(m^3)	Additional leakage Targets to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m3/d (m3)	Total Leakage Targets (m3)
Listowel Regional Public Water Supply	153	6,376	6,529
Central Regional - Lough Guitane	764	14,116	14,880
Mid Kerry	153	5,811	5,946
An Mhin Aird		408	408
An Baile Mor / An Daingean		1,093	1,093
Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear		606	606
Dun Chaoin PWS 034D		36	36

WRZ	Net Leakage Reduction applied to SDB(m^3)	Additional leakage Targets to achieve SELL and reduce leakage levels to 21% of demand in WRZs with demand in excess of 1,500m3/d (m3)	Total Leakage Targets (m3)
An Fheothanach / An Mhuirioch/ Baile Breach		47	47
An Clochan		107	107
Ardfert North/ Glenderry		1,829	1,829
Brosna/Knocknagoshel PWS 016F		804	804
Ceann Tra PWS 074D		125	125
Mountain Stage PWS 062A		279	279
Lios Cearnaigh PWS 052D		32	32
Ce Bhreannain		18	18
Aughacasla		126	126
Cahersiveen		316	316
Abbeyfeale Water Supply		258	258

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 Framework Plan, we have not applied reductions to the SDB deficit for unquantifiable water conservation gains. 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 SAH and include:

- Standalone groundwater options across the Study Area;
- Standalone surface water options across the Study Area;
- Water Quality upgrades to existing WTPs;
- Transfers and Rationalisation of WRZs within the Study Area; and
- Cross Study Area Supply

4 Option Development SAH

4 Option Development for Study Area H

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 and 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 SAH, 227 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 4.2 SAH Unconstrained Options.

Table 4.2 SAH Unconstrained Options

No. of Options	Option Type
69	Groundwater
84	Surface Water
4	Conjunctive Use
36	Transfers
3	Cross Study Area Supply
1	Advanced Leakage Reduction
23	Rationalisation
3	Upgrade WTP (WQ only)
1	Network improvements
3	Reservoirs

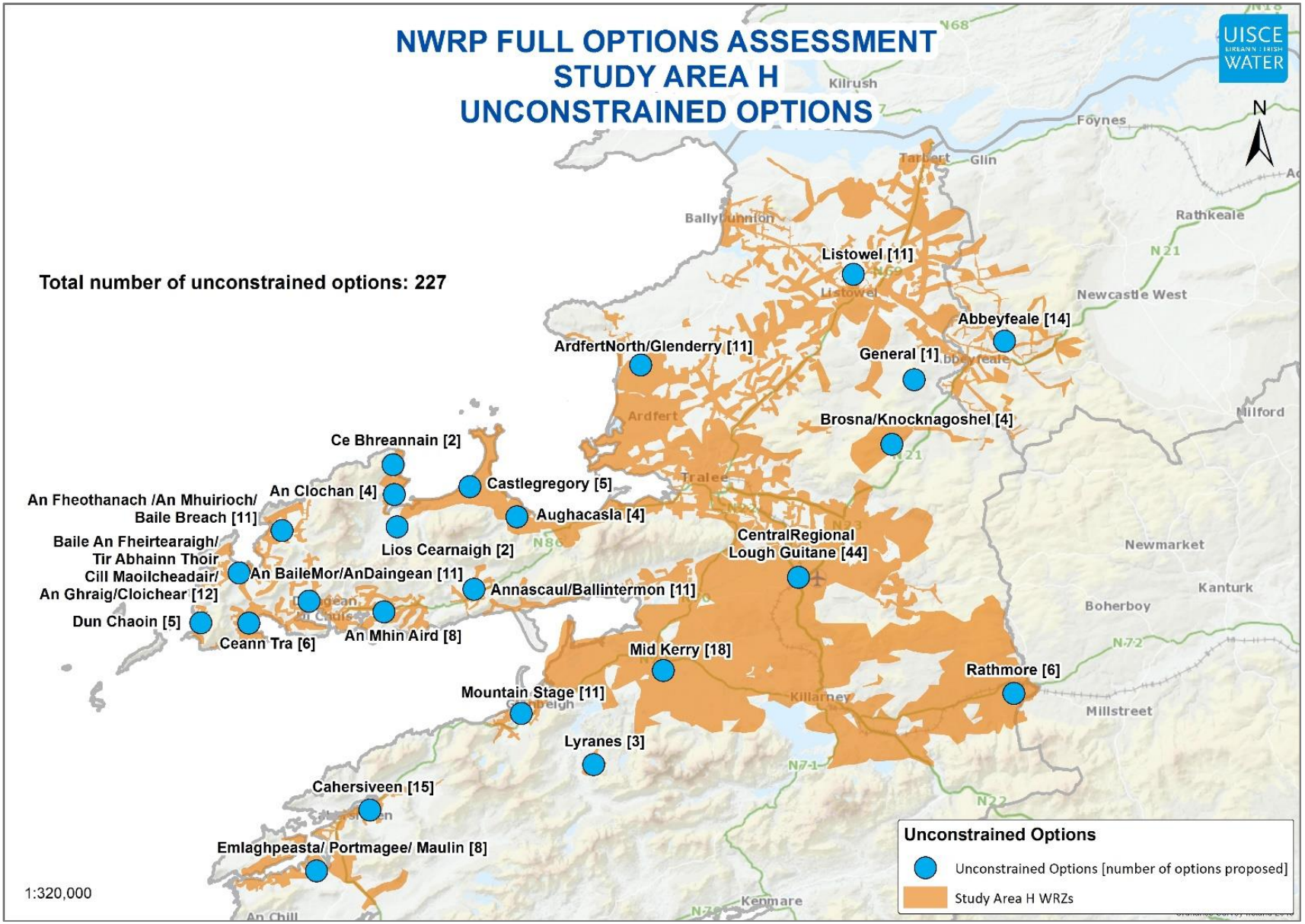

Figure 4.2 SAH Unconstrained Options

The 227 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 227 identified Unconstrained Options were assessed through Coarse Screening against the criteria of:

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

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

98 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 a Central Regional WRZ in SAH.

Example Rejected Option

Option SAH-010

Increase existing abstraction from the Owgarriff River to supply deficit for Central Regional WRZ

Rejection Reason

The existing abstraction from Owgarriff River is already at its Allowable Abstraction limit. Abstracting the volume of water required to make this a feasible option is considered likely to result in the waterbody not achieving good WFD status. Therefore, this option did not meet the requirements of the Environmental, Resilience or Deliverability criteria.

The remaining 129 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 options remaining after Coarse Screening are summarised by type in Table 4.3.

Table 4.3 SAH Remaining Options after Course Screening

No. of Options	Option Type
41	Groundwater
44	Surface Water
1	Conjunctive Use
24	Transfers
15	Rationalisation
2	Upgrade WTP (WQ only)
2	Reservoirs

4.3 Fine Screening

The 129 remaining options were subject to a more detailed multi-criteria assessment (MCA) at the Fine Screening Stage using desktop assessments of performance against 33 specified questions relating to Sustainability (Environmental and Social Impacts), Resilience, Deliverability and Progressibility. These questions are set out in Appendix N of the Framework Plan. The assessment for each option was based on an objective assessment with uniform scoring criteria, based on best publicly available datasets.

At Fine Screening stage, no further options were rejected, with the remaining 129 options considered to be feasible and brought forward to desktop outline design and costing. These are summarised in, and shown spatially in Figure 4.4 SAH Spatial Overview of the Feasible Options.

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

No. of Options	Option Type
41	Groundwater
44	Surface Water
1	Conjunctive Use
24	Transfers
15	Rationalisation
2	Upgrade WTP (WQ only)
2	Reservoirs

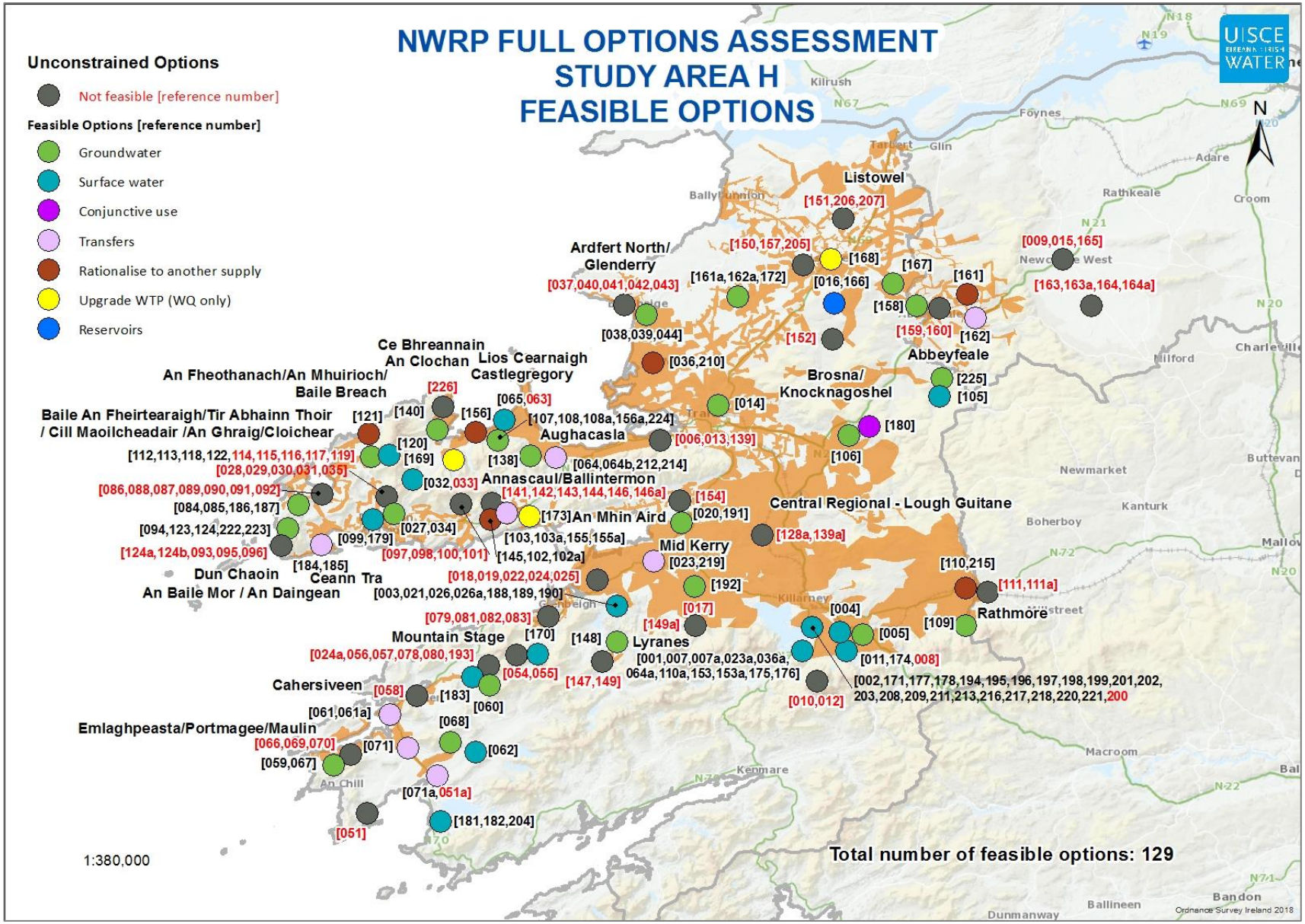

Figure 4.3 SAH Spatial Overview of the Feasible Options

4.4 Options Assessment Summary

The estimated SDB deficit in the region ranges between 16,954 m^3/d in 2019 during normal conditions, to a maximum of 38,193 m^3/d in 2044 during dry conditions. During the options assessment stage, a total of 227 unconstrained options were assessed. Of these, 98 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
74	Resilience, Deliverability & Flexibility, Sustainability
1	Resilience, Deliverability & Flexibility
12	Deliverability & Flexibility
11	Other

The remaining 129 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 SAH. From this table it can be noted that there are 56 WRZ Options and 73 options which can be merged to form 32 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 SAH Feasible Options Summary

WRZ Name	Option Type	
	WRZ Option	Study Area Option
Abbeyfeale Water Supply	2	4
An Baile Mor / An Daingean	4	1
An Clochan	1	2
An Fheothanach / An Mhuirioch/ Baile Breach	6	0
An Mhin Aird	1	3
Annascaul / Ballintermon	2	4
Ardfert North/ Glenderry Ballyheigue WRZ	4	2
Aughacasla	1	2
Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear	2	2
Brosna/Knocknagoshel PWSS 016F	4	0
Cahersiveen	4	4*
Castlegregory PWSS 024D	2	2
Ce Bhreannain	1	1
Ceann Tra PWS 074D	1	1
Central Regional - Lough Guitane	10	23

WRZ Name	Option Type	
	WRZ Option	Study Area Option
Dun Chaoin PWS 034D	1	3
Emlaghpeasta / Portmagee / Maulin	2	3*
Lios Cearnaigh PWS 052D	1	1
Listowel Regional Public Water Supply	0	4
Lyranes 303A	1	0
Mid Kerry	4	7
Mountain Stage PWS 062A	1	2
Rathmore	1	2

***** *Waterville in SAI, is part of 3 groups in SAH as it is the parent supply where an increase in supply is proposed. These 3 Waterville options are included in Study Area Options with Cahersiveen (2) and Emlaghpeasta (1) in Table 2.4 above.*

5 Approach Development

5 Approach Development

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

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 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,	Statutory Obligations under the Water Supply Act and Drinking Water Regulations

Approaches Tested	Description	Policy Driver
	consent, construction and commissioning durations) as identified at Fine Screening This is particularly relevant where an option might be required to address an urgent Public Health issue.	
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.

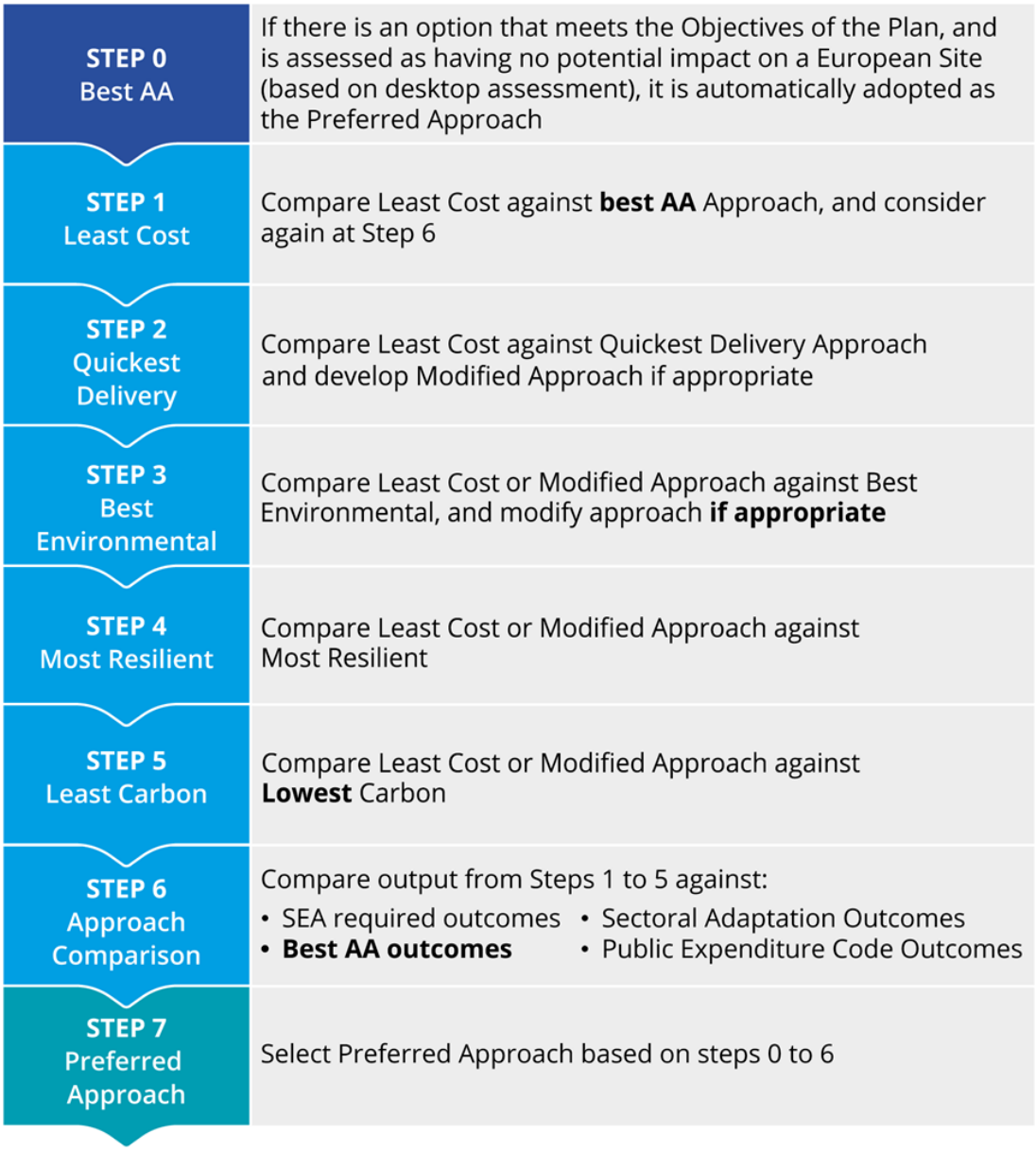

Figure 5.1 Figure of the 7 step assessment process

This methodology which is futured detailed in Chapter 7 of the RWRP-EM 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-SW and the Environmental Review for this Study Area.

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

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

5.2 Preferred Approach Development Process for Study Area H

5.2.1 Stage 1 – WRZ Level Approach

As outlined in Section 4.4 of this Technical Report there are 129 feasible options. 56 of these options are WRZ Options while 73 options are merged to form 32 Study Area Options. Table 5.2 outlines the 56 WRZ options for SAH, 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.

There is no feasible local solutions for the Listowel WRZ. Four unconstrained options were considered, however, these were considered unfeasible at the screening stage.

For example, an option of increasing the existing abstraction was considered, however, the existing abstraction is already significantly greater than theoretical future permissible abstraction. Therefore, this option was not considered feasible at coarse screening stage. Also, consideration was given to the provision of additional raw water storage of 120 ML which could be used to provide supply during dry periods, however, this volume of water would only meet the needs of the area over a one week period. Future dry spells are expected to be longer than 1 week therefore this option was not considered feasible as it would not provide the required level of service in the future and it is not resilient to climate change.

Table 5.2 SAH Feasible Options

Water Resource Zone Name	Feasible Options SAH Kerry	
	Option Code	Option Description
Abbeyfeale Water Supply	SAH-158	New GW abstraction.
Abbeyfeale Water Supply	SAH-167	New GW from Gravel belt between Abbeyfeale and Listowel
An Baile Mor / An Daingean	SAH-027	Increase SW abstraction from Mannings Spring and upgrade An Baile Mor WTP
An Baile Mor / An Daingean	SAH-032	New SW abstraction from An Geal Lough and upgrade An Daingean WTP
An Baile Mor / An Daingean	SAH-034	Recommission Culligh spring in Dingle-currently abandoned but could be brought back into production

Water Resource Zone Name	Feasible Options SAH Kerry	
	Option Code	Option Description
An Baile Mor / An Daingean	SAH-179	New SW abstraction from Milltown River and WTP
An Clochan	SAH-107	Increase GW abstraction at BH. (Currently 5 springs and 2 BHs)
An Fheothanach / An Mhuirioch/ Baile Breach	SAH-112	Increase abstraction from Cloghaun Spring and upgrade An Fheothanach WTP
An Fheothanach / An Mhuirioch/ Baile Breach	SAH-113	Increase GW abstraction from BH at WTP (local important aquifer) and upgrade An Mhuirioch/ Baile Breach WTP
An Fheothanach / An Mhuirioch/ Baile Breach	SAH-118	Increase GW abstraction from An Fheothanach WTP BH (local important aquifer) and upgrade An Fheothanach WTP
An Fheothanach / An Mhuirioch/ Baile Breach	SAH-120	New SW abstraction from Fheothanach Stream (Disused source) and upgrade WTP
An Fheothanach / An Mhuirioch/ Baile Breach	SAH-121	Abandon Baile na bhFionnúrach WTP and connect to An Fheothanach.
An Fheothanach / An Mhuirioch/ Baile Breach	SAH-122	Amalgamate all sources in WRZ to one WTP and rationalise smaller WTP - Upgrade an Fheothanach WTP.
An Mhin Aird	SAH-099	New GW abstraction in Dingle area to serve the customers currently served by An Mhín Aird Gualainn WTP.
Annascaul / Ballintermon	SAH-145	Increase GW abstraction from Annascaul WTP BH1 (local important aquifer) and upgrade Annascaul WTP. Rationalisation of Ballintermon WTP and feed customers from Annascaul WSS.
Annascaul / Ballintermon	SAH-173	WTP Upgrade only
Ardfert North/ Glenderry Ballyheigue WRZ	SAH-038	Increase Ballyheigue abstraction. Abandon existing BH at Glenderry Well and rationalise WTP
Ardfert North/ Glenderry Ballyheigue WRZ	SAH-039	Increase GW abstraction from Slugaire Well (local important aquifer) and upgrade Ballyheigue WTP
Ardfert North/ Glenderry Ballyheigue WRZ	SAH-044	Potential for new GW abstraction at Larig Reservoir, Ballyheigue Reservoir site
Ardfert North/ Glenderry Ballyheigue WRZ	SAH-172	New GW abstraction from Ballybunnion GWB

Water Resource Zone Name	Feasible Options SAH Kerry	
	Option Code	Option Description
Aughacasla	SAH-138	New GW abstraction from Aughacasla BHs and upgrade existing Aughacasla WTP to supply deficit.
Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear	SAH-084	Increase GW abstraction from Tobar Bhreandáin WTP BH (local important aquifer) and upgrade Tobar Bhreandáin WTP
Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear	SAH-085	Abandon An Ghraig Cloichear WTP,Tir Abhainn Thoir WTP and Leataoibh WTP and feed from Tobar Bhrendain WTP, An Riasc WTP and Cill Maoilcheadair WTP
Brosna/Knocknagoshel PWSS 016F	SAH-105	Increase SW abstraction from Clydagh River and upgrade Brosna/Knocknagoshel WTP and undertake source protection works
Brosna/Knocknagoshel PWSS 016F	SAH-106	New GW abstraction - Karstic Geology - New WTP required
Brosna/Knocknagoshel PWSS 016F	SAH-180	Increase SW abstraction from Clydagh River during times of high flow and upgrade Brosna/Knocknagoshel WTPand undertake source protection works. Develop new GW in Karstic region with treatment on site for times of low flow.
Brosna/Knocknagoshel PWSS 016F	SAH-225	Develop trial well at Brosna raw water pump house, upgrade Brosna/Knocknagoshel WTP and undertake source protection works.
Cahersiveen	SAH-059	Increase GW abstraction at BH - Conversion of existing trial to production wells
Cahersiveen	SAH-060	New GW abstraction at WTP - Conversion of existing trial to production wells
Cahersiveen	SAH-062	Supplement Cahersiveen from River Inny
Cahersiveen	SAH-183	New SW abstraction from Ferta River
Castlegregory PWSS 024D	SAH-065	New SW abstraction from Lough Gill and upgrade Castlegregory WTP
Castlegregory PWSS 024D	SAH-224	New GW as interim (likely to only provide partial deficit)
Ce Bhreannain	SAH-140	Increase GW abstraction at BH. (1 Spring)
Ceann Tra PWS 074D	SAH-094	Increase GW abstraction from Ceann Trá WTP BHs (Local important aquifer) and upgrade Ceann Tra WTP
Central Regional - Lough Guitane	SAH-001	New SW abstraction from Muckross Lake treat at Lough Guitane WTP

Water Resource Zone Name	Feasible Options SAH Kerry	
	Option Code	Option Description
Central Regional - Lough Guitane	SAH-002	New SW abstraction from lower Leane catchment treat at Lough Guitane WTP
Central Regional - Lough Guitane	SAH-003	New SW abstraction from Lough Caragh and new WTP onsite
Central Regional - Lough Guitane	SAH-004	New SW abstraction from River Flesk treat at Lough Guitane WTP
Central Regional - Lough Guitane	SAH-005	New GW abstraction in Karstic region and new WTP
Central Regional - Lough Guitane	SAH-011	Raise Lough level to increase storage volume.
Central Regional - Lough Guitane	SAH-014	New GW abstraction close to Tralee
Central Regional - Lough Guitane	SAH-171	New SW abstraction from lower Leane catchment for full demand and treat at Lough Guitane WTP
Central Regional - Lough Guitane	SAH-174	Lower intake for increased abstraction
Central Regional - Lough Guitane	SAH-221	New SW abstraction from lower Leane catchment for full demand and new WTP
Dun Chaoin PWS 034D	SAH-123	Increase GW abstraction with 1 new BH. (Currently 1 Spring source)
Emlaghpeasta / Portmagee / Maulin	SAH-067	Increase GW abstraction from Portmagee BH (poorly productive aquifer) and upgrade Portmagee WTP
Emlaghpeasta / Portmagee / Maulin	SAH-068	Increase GW abstraction from Maulin Well (local important aquifer) and upgrade Málainn WTP
Lios Cearnaigh PWS 052D	SAH-169	WTP Upgrade only
Lyranes 303A	SAH-148	Increase GW abstraction from source Lyranes BH (local important aquifer) and upgrade Lyranes WTP
Mid Kerry	SAH-020	Increase GW abstraction at Poulgorm Spring and Upgrade Knocknavota WTP - will require new boreholes in the region of the spring
Mid Kerry	SAH-021	New SW abstraction from Lough Caragh and new WTP
Mid Kerry	SAH-191	New GW abstraction in the limestones
Mid Kerry	SAH-192	New GW abstraction in the sand and gravel aquifer
Mountain Stage PWS 062A	SAH-170	New abstraction from Coomasaharn Lake, upgrade Mountain Stage WTP to treat
Rathmore	SAH-109	Increase GW abstraction from Awnaskirtaun Spring and upgrade existing Rathmore WTP

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 SAH Alignment of WRZ Option/s with Approach Categories

Water Resource Zone Name	Feasible Options SAH Kerry		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient
Abbeyfeale Water Supply	2	New GW abstraction - abstraction point TBC. Poorly productive aquifer	□	□	□	□	□	□
		New GW from Gravel belt between Abbeyfeale and Listowel	-	□	□	□	-	□
An Baile Mor / An Daingean	4	Increase SW abstraction from Mannings Spring and upgrade An Baile Mor WTP	-	-	-	-	-	-
		New SW abstraction from An Geal Lough and upgrade An Daingean WTP	-	-	-	-	-	-
		Recommission Culligh spring in Dingle- currently abandoned but could be brought back into production	-	□	-	□	-	-
		New SW abstraction from Milltown River and WTP	□	-	□	-	□	□
An Clochan	1	Increase GW abstraction at BH. (Currently 5 springs and 2 BHs) Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	□	□	□	□	□	□
An Fheothanach / An Mhuirioch/ Baile Breach	6	Increase abstraction from Cloghaun Spring and upgrade An Fheothanach WTP	-	-	□	-	-	□
		Increase GW abstraction from BH at WTP (local important aquifer) and upgrade An Mhuirioch/ Baile Breach WTP	-	-	□	-	-	□
		Increase GW abstraction from An Fheothanach WTP BH (local important aquifer) and upgrade An Fheothanach WTP	-	-	□	-	-	□
		New SW abstraction from Fheothanach Stream (Disused source) and upgrade WTP	-	-	-	-	-	-
		Abandon Baile na bhFionnúrach WTP and connect to An Fheothanach.	-	-	□	-	-	□

Water Resource Zone Name	Feasible Options SAH Kerry		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient
		Amalgamate all sources in WRZ to one WTP and rationalise smaller WTP - Upgrade an Fheothanach WTP.	□	□	□	□	□	□
An Mhin Aird	1	New GW abstraction in Dingle area to serve the customers currently served by An Mhín Aird Gualainn WTP.	□	□	□	□	□	□
Annascaul / Ballintermon	2	Increase GW abstraction from Annascaul WTP BH1 (local important aquifer) and upgrade Annascaul WTP. Rationalisation of Ballintermon WTP and feed customers from Annascaul WSS.	□	□	□	□	□	□
		WTP Upgrade - No deficit	-	□	□	□	-	-
Ardfert North/ Glenderry Ballyheigue WRZ	4	Increase Ballyheigue abstraction. Abandon existing BH at Glenderry Well and rationalise WTP	□	□	□	-	-	□
		Increase GW abstraction from Slugaire Well (local important aquifer) and upgrade Ballyheigue WTP	-	□	□	-	-	□
		Potential for new GW abstraction at Larig Reservoir, Ballyheigue Reservoir site	-	-	□	□	-	-
		New GW abstraction from Ballybunnion GWB	-	-	□	-	□	-
Aughacasla	1	New GW abstraction from Aughacasla BHs and upgrade existing Aughacasla WTP to supply deficit. Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	□	□	□	□	□	□
Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear	2	Increase GW abstraction from Tobar Bhreandáin WTP BH (local important aquifer) and upgrade Tobar Bhreandáin WTP	-	□	-	□	-	□

Water Resource Zone Name	Feasible Options SAH Kerry		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient
		Abandon An Ghraig Cloichear WTP,Tir Abhainn Thoir WTP and Leataoibh WTP and feed from Tobar Bhrendain WTP, An Riasc WTP and Cill Maoilcheadair WTP	□	□	□	□	□	□
Brosna/Knocknagoshel PWSS 016F	4	Increase SW abstraction from Clydagh River and upgrade Brosna/Knocknagoshel WTP, and undertake source protection works	-	□	-	□	-	-
		New GW abstraction - Karstic Geology - New WTP required	-	-	□	-	-	-
		Increase SW abstraction from Clydagh River during times of high flow and upgrade Brosna/Knocknagoshel WTP and undertake source protection works. Develop new GW in Karstic region with treatment on site for times of low flow.	-	-	-	-	-	□
		Develop trial well at Brosna raw water pump house, upgrade WTP and undertake source protection works.	□	-	-	-	□	-
Cahersiveen	4	Increase GW abstraction at BH - Conversion of existing trial to production wells	-	-	□	-	-	-
		New GW abstraction at WTP - Conversion of existing trial to production wells	-	-	□	-	-	-
		Supplement Cahersiveen from River Inny	□	□	□	□	□	□
		New SW abstraction from Ferta River	-	-	□	-	-	-
Castlegregory PWSS 024D	2	New SW abstraction from Lough Gill and upgrade Castlegregory WTP	□	□	□	-	-	□
		New GW as interim (likely to only provide partial deficit)	-	-	□	□	□	-

Water Resource Zone Name	Feasible Options SAH Kerry		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient
Ce Bhreannain	1	Increase GW abstraction at BH. (1 Spring) Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	□	□	□	□	□	□
Ceann Tra PWS 074D	1	Increase GW abstraction from Ceann Trá WTP BHs (Local important aquifer) and upgrade Ceann Tra WTP	□	□	□	□	□	□
Central Regional - Lough Guitane	10	New SW abstraction from Muckross Lake treat at Lough Guitane WTP	-	-	-	-	-	□
		New SW abstraction from lower Leane catchment treat at Lough Guitane WTP	-	-	-	-	-	□
		New SW abstraction from Lough Caragh and new WTP onsite	-	-	-	-	-	-
		New SW abstraction from River Flesk treat at Lough Guitane WTP	-	-	-	-	-	-
		New GW abstraction in Karstic region and new WTP	-	-	-	-	-	-
		Raise Lough level to increase storage volume.	-	-	-	-	-	-
		New GW abstraction close to Tralee	-	-	□	-	-	-
		New SW abstraction from lower Leane catchment for full demand and treat at Lough Guitane WTP	-	-	-	-	-	-
		Lower intake for increased abstraction	□	□	-	□	□	-
		New SW abstraction from lower Leane catchment for full demand and new WTP	-	-	-	-	-	-
Dun Chaoin PWS 034D	1	Increase GW abstraction with 1 new BH. (Currently 1 Spring source)	□	□	□	□	□	□
Emlaghpeasta / Portmagee / Maulin	2	Increase GW abstraction from Portmagee BH (poorly productive aquifer) and upgrade Portmagee WTP	-	-	□	-	-	-

Water Resource Zone Name	Feasible Options SAH Kerry		Approach					
	No. of WRZ Options	Option Description	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient
		Increase GW abstraction from Maulin Well (local important aquifer) and upgrade Málainn WTP	□	□	□	□	□	□
Lios Cearnaigh PWS 052D	1	No Deficit - WTP Upgrade	□	□	□	□	□	□
Lyranes 303A	1	Increase GW abstraction from source Lyranes BH (local important aquifer) and upgrade Lyranes WTP	□	□	□	□	□	□
Mid Kerry	4	Increase GW abstraction at Poulgorm Spring and Upgrade Knocknavota WTP - will require new boreholes in the region of the spring	-	-	□	-	□	-
		New SW abstraction from Lough Caragh and new WTP	□	□	-	□	-	□
		New GW abstraction in the limestones	-	-	□	-	□	-
		New GW abstraction in the sand and gravel aquifer	-	-	□	-	□	-
Mountain Stage PWS 062A	1	New abstraction from Coomasaharn Lake, upgrade Mountain Stage WTP to treat	□	□	□	□	□	□
Rathmore	1	Increase GW abstraction from Awnaskirtaun Spring and upgrade existing Rathmore WTP	□	□	□	□	□	□

The 7 Step Process outlined in Figure 5.3 Preferred Approach Development Process was then applied to each WRZ in SAH, in order to develop a WRZ level approach. A summary of the outcome of this assessment at WRZ level (i.e., WRZ options only) is shown in Table 5.4.

The findings of the Preferred Approach development for SA at WRZ level include the following:

- In terms of Best AA, 5 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 for 16 of the 23 WRZs;
- Of the 23 WRZ level preferred approaches, 4 have a -3 score against biodiversity; and,
- No local option has been identified for the Listowel WRZ.

Table 5.4 SAH WRZ Approach Options

Water Resource Zone Name	Feasible Options SAH Kerry		Approach							
	Option Code	Option Description	Zero AA	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	Preferred Approach
Abbeyfeale Water Supply	SAH-158	New GW abstraction -abstraction point TBC. Poorly productive aquifer	-	□	□	□	□	□	□	□
An Baile Mor / An Daingean	SAH-179	New SW abstraction from Milltown River and WTP	□	□	-	□	-	□	□	□
An Clochan	SAH-107	Increase GW abstraction at BH. (Currently 5 springs and 2 BHs) Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	-	□	□	□	□	□	□	□
An Fheothanach / An Mhuirioch/ Baile Breach	SAH-122	Amalgamate all sources in WRZ to one WTP and rationalise smaller WTP - Upgrade an Fheothanach WTP.	-	□	□	□	□	□	□	□
An Mhin Aird	SAH-099	New GW abstraction in Dingle area to serve the customers currently served by An Mhín Aird Gualainn WTP.	□	□	□	□	□	□	□	□
Annascaul / Ballintermon	SAH-173	WTP Upgrade - No deficit	-	-	□	□	□	-	-	□
Ardfert North/ Glenderry Ballyheigue WRZ	SAH-038	Increase Ballyheigue abstraction. Abandon existing BH at Glenderry Well and rationalise WTP	-	□	□	□	-	-	□	□

Water Resource Zone Name	Feasible Options SAH Kerry		Approach							
	Option Code	Option Description	Zero AA	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	Preferred Approach
Aughacasla	SAH-138	New GW abstraction from Aughacasla BHs and upgrade existing Aughacasla WTP to supply deficit. Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	-	□	□	□	□	□	□	□
Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear	SAH-085	Abandon An Ghraig Cloichear WTP,Tir Abhainn Thoir WTP and Leataoibh WTP and feed from Tobar Bhrendain WTP, An Riasc WTP and Cill Maoilcheadair WTP	□	□	□	□	□	□	□	□
Brosna/Knocknagoshel PWSS 016F	SAH-225	Develop trial well at Brosna raw water pump house, upgrade WTP and undertake source protection works.	-	□	-	-	-	□	-	□
Cahersiveen	SAH-062	Supplement Cahersiveen from River Inny	-	□	□	□	□	□	□	□
Castlegregory PWSS 024D	SAH-065	New SW abstraction from Lough Gill and upgrade Castlegregory WTP	-	□	□	□	-	-	□	□
Ce Bhreannain	SAH-140	Increase GW abstraction at BH. (1 Spring) Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	-	□	□	□	□	□	□	□
Ceann Tra PWS 074D	SAH-094	Increase GW abstraction from Ceann Trá WTP BHs (Local important aquifer) and upgrade Ceann Tra WTP	□	□	□	□	□	□	□	□

Water Resource Zone Name	Feasible Options SAH Kerry		Approach							
	Option Code	Option Description	Zero AA	Least Cost	Quickest Delivery	Best AA	Best SEA	Lowest Carbon	Most Resilient	Preferred Approach
Central Regional - Lough Guitane	SAH-002	New surface water abstraction from lower Leane catchment treat at Lough Guitane WTP.	-	-	-	-	-	-	□	□
Dun Chaoin PWS 034D	SAH-123	Increase GW abstraction with 1 new BH. (Currently 1 Spring source)	-	□	□	□	□	□	□	□
Emlaghpeasta / Portmagee / Maulin	SAH-068	Increase GW abstraction from Maulin Well (local important aquifer) and upgrade Málainn WTP	-	□	□	□	□	□	□	□
Lios Cearnaigh PWS 052D	SAH-169	No Deficit - WTP Upgrade	□	□	□	□	□	□	□	□
Listowel Regional Public Water Supply	**No local solution.**									
Lyranes 303A	SAH-148	Increase GW abstraction from source Lyranes BH (local important aquifer) and upgrade Lyranes WTP	-	□	□	□	□	□	□	□
Mid Kerry	SAH-021	New SW abstraction from Lough Caragh and new WTP	-	□	□	-	□	-	□	□
Mountain Stage PWS 062A	SAH-170	New abstraction from Coomasaharn Lake, upgrade Mountain Stage WTP to treat	-	□	□	□	□	□	□	□
Rathmore	SAH-109	Increase GW abstraction from Awnaskirtaun Spring and upgrade existing Rathmore WTP	-	□	□	□	□	□	□	□

5.2.2 Stage 2 - Creation of the Study Area Combinations

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

For each Study Area, one of the SA Combinations will always be the WRZ Level Approach. The WRZ Level Approach is the combination of all of the individual the Preferred Approach at WRZ level for the entire Study Area. Table 5.5 below provides a summary of the 32 Study Area options.

Table 5.5 SAH Grouped options

Feasible Options SAH Kerry			
Water Resource Zone Name	**Option Code**	**Option Description**	**SA Grouped Option**
Central Regional - Lough Guitane	SAH-501	Abandon Camp and Camp Lower WTP and supply from Central Regional.	Group 1
Central Regional - Lough Guitane Mid Kerry	SAH-503	Conjunctive Use - New source (from one of the bigger lakes) to supplement both Mid Kerry and Lough Guitane.	Group 3
Ardfert North/ Glenderry Ballyheigue WRZ Central Regional - Lough Guitane	SAH-504	Rationalise both Glenderry WTP and Ballyheigue WTP and feed from Central Regional. New SW source required for Central Regional.	Group 4
Cahersiveen Waterville PWS 075H	SAH-506	Connect Cahersiveen and Waterville for resilience purposes.	Group 6
Castlegregory PWSS 024D Central Regional - Lough Guitane Aughacasla	SAH-507	Supply deficit from Central Regional WRZ via Aughacasla. New SW source required for Central Regional, includes rationalisation of Camp WTP.	Group 7
Emlaghpeasta / Portmagee / Maulin Waterville PWS 075H	SAH-508	Augment Maulin from Waterville. Supply Maulin. New source required. Inny option has the largest allowable abstraction.	Group 8
An Mhin Aird Annascaul / Ballintermon	SAH-510	Rationalise An Mhin Aird Puc WTP and feed from Annascaul WSS. Increase GW abstraction and supply An Mhin Aird.	Group 10
An Mhin Aird Annascaul / Ballintermon	SAH-511	Reduce usage at An Mhin Arid Puc and supplement from Annascaul WSS.	Group 11
An Clochan Ce Bhreannain	SAH-512	Increase GW abstraction at An Clochan. Ce Brennan and Clochan are connected - Could feed from either depending on where yield is.	Group 12
Rathmore Central Regional - Lough Guitane	SAH-513	Rationalise Rathmore WTP and connect to Central Regional WRZ. New SW source required for Central Regional.	Group 13
Central Regional - Lough Guitane (Inch PWS 044D)	SAH-520	Rationalise Inch WTP and feed from Central Regional. New SW source required for Central Regional.	Group 20
Central Regional - Lough Guitane (Inch PWS 044D) Annascaul / Ballintermon	SAH-521	Reduce usage at Inch WTP and supply from Annascaul WSS. Increase GW source at Spring and Supply Inch.	Group 21

Feasible Options SAH Kerry			
Water Resource Zone Name	**Option Code**	**Option Description**	**SA Grouped Option**
Lios Cearnaigh PWS 052D An Clochan	SAH-522	No deficit in WRZ - Small WRZ only 10properties - Abandon and connect to An Clochan - 1km mains required. Increase GW abstraction at BH. (Currently 5 springs and 2 BHs) and Rationalise Lios Cearnaigh PWS.	Group 22
Abbeyfeale Water Supply Listowel Regional Public Water Supply	SAH-523	Rationalise Abbeyfeale WRZ to Listowel Regional WRZ (approx. distance 1km, new watermains and network upgrades required).	Group 23
Abbeyfeale Water Supply Listowel Regional Public Water Supply	SAH-524	Interconnect Abbeyfeale and Listowel Regional WRZs (approx. distance 1km, new watermains and network upgrades required) for increased resilience and supply deficit.	Group 24
Abbeyfeale Water Supply Listowel Regional Public Water Supply	SAH-527	Construction of impounded storage at River Smearlagh to supply Abbeyfeale and Listowel.	Group 27
Central Regional - Lough Guitane Mid Kerry	SAH-528	Augment part of Mid-Kerry to Central Regional scheme (schemes close to Killarney). New SW source required for Central Regional.	Group 28
Central Regional - Lough Guitane Mid Kerry	SAH-529	New abstraction from Muckross Lake and WTP at abstraction to feed deficit in Central Regional and Mid Kerry.	Group 29
Central Regional - Lough Guitane Mid Kerry	SAH-530	New abstraction from lower Leane catchment and WTP at abstraction to feed deficit in Central Regional and Mid Kerry.	Group 30
Waterville PWS 075H Cahersiveen Emlaghpeasta / Portmagee / Maulin	SAH-531	Increase abstraction from Lough Currane and supply Cahersiveen and Emlaghpeasta.	Group 31
Dun Chaoin PWS 034D Ceann Tra PWS 074D	SAH-532	Interconnect Ceann Tra and Dun Caoin - local increase at both WRZs required.	Group 32
Dun Chaoin PWS 034D Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear	SAH-533	Increase GW abstraction from Tobar Bhreandáin WTP BH (local important aquifer), upgrade Tobar Bhreandáin WTP and supply Dun Chaoin.	Group 33
Mid Kerry Central Regional - Lough Guitane Mountain Stage PWS 062A	SAH-534	New abstraction and WTP at Lough Caragh to meet deficit in Mid Kerry, Mountain Stage and Central Regional.	Group 34
Abbeyfeale Water Supply Central Regional - Lough Guitane Listowel Regional Public Water Supply	SAH-535	New lower Leane catchment abstraction for Central Regional and transfers to Listowel and Abbeyfeale.	Group 35
Central Regional - Lough Guitane Mid Kerry Mountain Stage PWS 062A Annascaul / Ballintermon An Mhin Aird An Baile Mor / An Daingean	SAH-536	New Lower Leane catchment Regional Scheme with new WTPl	Group 36

Feasible Options SAH Kerry			
Water Resource Zone Name	**Option Code**	**Option Description**	**SA Grouped Option**
Central Regional - Lough Guitane	SAH-537	Abandon Camp and Camp Lower WTP and supply from Central Regional. New SW source required for Central Regional.	Group 37
Ardfert North/ Glenderry Ballyheigue WRZ Central Regional - Lough Guitane	SAH-538	Rationalise both Glenderry WTP and Ballyheigue WTP and feed from Central Regional. New SW source required for Central Regional.	Group 38
Castlegregory PWSS 024D Central Regional - Lough Guitane Aughacasla	SAH-539	Supply deficit from Central Regional WRZ via Aughacasla. New SW source required for Central Regional, includes rationalisation of Camp WTP.	Group 39
Rathmore Central Regional - Lough Guitane	SAH-540	Rationalise Rathmore WTP and connect to Central Regional WRZ. New SW source required for Central Regional.	Group 40
Central Regional - Lough Guitane (Inch PWS 044D)	SAH-541	Rationalise Inch WTP and feed from Central Regional. New SW source required for Central Regional.	Group 41
Central Regional - Lough Guitane Mid Kerry	SAH-542	Augment part of Mid-Kerry to Central Regional scheme (schemes close to Killarney). New SW source required for Central Regional.	Group 42
Dun Chaoin PWS 034D Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear	SAH-543	New boreholes at Dun Chaoin and connect to Tobar Bhreandain.	Group 43

The 32 Study Area options results in 11 SA combinations that could meet the need across all WRZs. The WRZ Level Approach is excluded at this stage of comparison as 1 WRZ, Listowel, does not have a WRZ Level Approach. The 11 SA Combinations in terms of the types of options within each combination are summarised in Table 5.6 below.

Table 5.6 SAH Combinations

Key	WRZ Approach Option	□	SA Grouped Option	□

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 24, 30, 31 and 32)	SA Combination 2 (SA Grouped Option 24, 30, 31 and 33)	SA Combination 3 (SA Grouped Option 24, 30 and 31)	SA Combination 4 (SA Grouped Option 24, 30 and 32)	SA Combination 5 (SA Grouped Option 24, 30, 31 and 39)	SA Combination 6 (SA Grouped Option 24, 30, 31, 32 and 39)	SA Combination 7 (SA Grouped Option 24, 30, 31, 33 and 40)	SA Combination 8 (SA Grouped Option 31, 33 and 40)	SA Combination 9 (SA Grouped Option 12, 24, 30, 31, 33 and 40)	SA Combination 10 (SA Grouped Option 36)	SA Combination 11 (SA Grouped Option 24)
Abbeyfeele Water Supply	○	□	□	□	□	□	□	□	○	□	□	□
An Baile Mor / An Daingean	○	○	○	○	○	○	○	○	○	○	□	○
An Clochan	○	○	○	○	○	○	○	○	○	□	○	○
An Fheothanach / An Mhuirioch/ Baile Breach	○	○	○	○	○	○	○	○	○	○	○	○
An Mhin Aird	○	○	○	○	○	○	○	○	○	○	□	○
Annascaul / Ballintermon	○	○	○	○	○	○	○	○	○	○	□	○
Ardfert North/ Glenderry Ballyheigue WRZ	○	○	○	○	○	○	○	○	○	○	○	○
Aughacasla	○	○	○	○	○	□	□	○	○	○	○	○

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 24, 30, 31 and 32)	SA Combination 2 (SA Grouped Option 24, 30, 31 and 33)	SA Combination 3 (SA Grouped Option 24, 30 and 31)	SA Combination 4 (SA Grouped Option 24, 30 and 32)	SA Combination 5 (SA Grouped Option 24, 30, 31 and 39)	SA Combination 6 (SA Grouped Option 24, 30, 31, 32 and 39)	SA Combination 7 (SA Grouped Option 24, 30, 31, 33 and 40)	SA Combination 8 (SA Grouped Option 31, 33 and 40)	SA Combination 9 (SA Grouped Option 12, 24, 30, 31, 33 and 40)	SA Combination 10 (SA Grouped Option 36)	SA Combination 11 (SA Grouped Option 24)
Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear	○	○	□	○	○	○	○	□	□	□	○	○
Brosna/Knocknagoshel PWSS 016F	○	○	○	○	○	○	○	○	○	○	○	○
Cahersiveen	○	□	□	□	○	□	□	□	□	□	○	○
Castlegregory PWSS 024D	○	○	○	○	○	□	□	○	○	○	○	○
Ce Bhreannain	○	○	○	○	○	○	○	○	○	□	○	○
Ceann Tra PWS 074D	○	□	○	○	□	○	□	○	○	○	○	○
Central Regional - Lough Guitane	○	□	□	□	□	□	□	□	○	□	□	○
Dun Chaoin PWS 034D	○	□	□	○	□	○	□	□	□	□	○	○
Emlaghpeasta / Portmagee / Maulin	○	□	□	□	○	□	□	□	□	□	○	○
Lios Cearnaigh PWS 052D	○	○	○	○	○	○	○	○	○	○	○	○
Listowel Regional Public Water Supply	No local solution	□	□	□	□	□	□	□	□	□	□	□
Lyranes 303A	○	○	○	○	○	○	○	○	○	○	○	○
Mid Kerry	○	□	□	□	□	□	□	□	○	□	□	○

WRZ	WRZ Approach Options	SA Combination 1 (SA Grouped Option 24, 30, 31 and 32)	SA Combination 2 (SA Grouped Option 24, 30, 31 and 33)	SA Combination 3 (SA Grouped Option 24, 30 and 31)	SA Combination 4 (SA Grouped Option 24, 30 and 32)	SA Combination 5 (SA Grouped Option 24, 30, 31 and 39)	SA Combination 6 (SA Grouped Option 24, 30, 31, 32 and 39)	SA Combination 7 (SA Grouped Option 24, 30, 31, 33 and 40)	SA Combination 8 (SA Grouped Option 31, 33 and 40)	SA Combination 9 (SA Grouped Option 12, 24, 30, 31, 33 and 40)	SA Combination 10 (SA Grouped Option 36)	SA Combination 11 (SA Grouped Option 24)
Mountain Stage PWS 062A	○	○	○	○	○	○	○	○	○	○	□	○
Rathmore	○	○	○	○	○	○	○	□	□	□	○	○

5.2.3 Stage 3 – Preferred Approach at Study Area Level

As part of stage three, we compare the WRZ Level Approach and the SA Combinations to determine the Preferred Approach that provides the best outcome for the Study Area. As the WRZ Level Preferred Approach did not meet the deficit for the Study Area as a whole, it has not been assessed and assigned a score for the purposes of determining the best performing alternative within each approach category.

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

In accordance with Section 7.2.2 of the RWRP-SW, where options or combinations of options achieve similar, although not exactly identical scores under the six approach types, Irish Water takes a wider look at the comparable combinations /options to consider which to categorise as the "Best" approach within each category. In particular, Irish Water takes into account whether the option or combination of options meets the SEA and Habitats objectives outlined in the Framework Plan. This is an example of the professional judgement from the multi-disciplinary teams, identified in section 8.3.7.4 of the Framework Plan.

For SAH, four SA combinations had a very similar ranking under the Least Cost category, within 3% of each other.

- Grouped Option 24, 30, 31 and 32 (Combination 1)
- Grouped Option 24, 30 and 31 (Combination 3)
- Grouped Option 24, 30, 31, 33 and 40 (Combination 7)
- Grouped Option 12, 24, 30, 31, 33 and 40 (Combination 9)

The Least Cost Approach is determined using an Irish Water Net Present Value assessment tool. The NPV tool uses a strict set of requirements and is limited in what flexibility it offers. Therefore, as set out in further detail in Section 7.2.1 of the RWRP-SW, where an Option or Combination of Options provide similar NPV costs, and in some circumstances so as to ensure that no option is discounted at this early stage by reference only to "Least Cost" only, Irish Water has considered that all options within a 5% NPV cost margin are in principle eligible to be identified as the "Least Cost" option. This approach recognises the desktop nature of the NPV assessment and the fact that the figures will almost certainly change at project stage.

When we compare these four combinations against each other to identify which should go forward as the Least Cost approach, all 4 combinations scored similarly under Quickest Delivery and Best AA apart from Grouped Option 12, 24, 30, 31, 33 and 40 (Combination 9) which performs better against the Best AA criteria, with two options with a -3 biodiversity score. While, Grouped Option 24, 30, 31, 33 and 40 (Combination 7) scored the highest under the Lowest Carbon Category, Grouped Option 12, 24, 30, 31, 33 and 40 (Combination 9) scored significantly better against the environmental criteria than the other Combinations and was also very close to Grouped Option 24, 30, 31, 33 and 40 (Combination 7) in terms of Lowest Carbon. It also scored the highest under the Most Resilient Category. Overall Combination 9 performs well against the SEA and Habitats Objectives of the plan and accordingly has been identified as the Least Cost option and brought forward to the Approach Development Stage.

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

Ranked order (best to worst)	Best														Worst

WRZ	WRZ Level Approach (Did not meet need)	SA Combination 1 (SA Grouped Option 24, 30, 31 and 32)	SA Combination 2 (SA Grouped Option 24, 30, 31 and 33)	SA Combination 3 (SA Grouped Option 24, 30 and 31)	SA Combination 4 (SA Grouped Option 24, 30 and 32)	SA Combination 5 (SA Grouped Option 24, 30, 31 and 39)	SA Combination 6 (SA Grouped Option 24, 30, 31, 32 and 39)	SA Combination 7 (SA Grouped Option 24, 30, 31, 33 and 40)	SA Combination 8 (SA Grouped Option 31, 33 and 40)	SA Combination 9 (SA Grouped Option 12, 24, 30, 31, 33 and 40)	SA Combination 10 (SA Grouped Option 36)	SA Combination 11 (SA Grouped Option 24)
Least Cost										Best	Worst	
Quickest Delivery							Best		Worst			
Best AA *no. of -3 scores against biodiversity	4 No. -3 scores	3 No. -3 scores	3 No. -3 scores	3 No. -3 scores	3 No. -3 scores	4 No. -3 scores	4 No. -3 scores	3 No. -3 scores	4 No. -3 scores	2 No. -3 scores	2 No. -3 scores	4 No. -3 scores
Lowest Carbon			Best								Worst	
Most Resilient									Best		Worst	
Best Environmental											Best	

The SA Combinations including the WZR 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)	Combination 9 (Group 12, 24, 30, 31, 33 and 40*)
Best Environmental (BE)	Combination 10 Group 36
Quickest Delivery (QD)	Combination 6 (Group 24, 30, 31, 32 and 39)
Most Resilient (MR)	Combination 8 (Group 24, 31, 33 and 40*)
Lowest Carbon (LC)	Combination 2 (Group 24, 30, 31 and 33)
Best AA (BA)	Combination 9 or Combination 10 Group 36

*Note -3 AA impact associated with group 40 for Rathmore is dependant on proposed solution for Central Regional and therefore, -3 AA impact is only counted once.

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, Group 12, 24, 30, 31, 33 & 40 has the lowest NPV Cost, as shown in Figure 5.2 with the lowest total costs (CAPEX and OPEX) over the solutions lifetime.

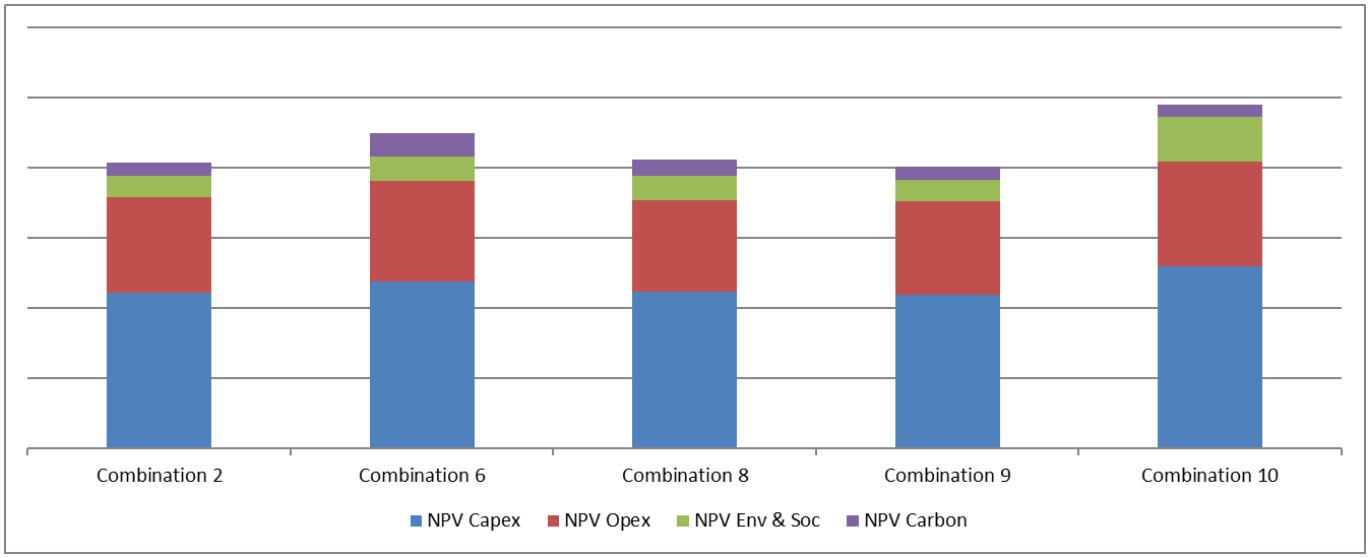

Figure 5.2 SAH NPV Costs for SA approaches

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 – The Least Cost Approach is also the Best AA Approach, along with Combination 10. The Least Cost approach was therefore retained at this stage.
- Step 2 – We compared the Quickest Delivery Approach against the Least Cost Approach. The Quickest Delivery approach does not deliver significantly better scores against the quickest delivery criteria compared to the Least Cost Approach and the Quickest Delivery Approach contains 4 options with a -3 biodiversity score and performs poorly against the Carbon criteria. The Least Cost approach was therefore retained at this stage.
- Step 3 - We compared the Least Cost against the Best Environmental Approach. The Best Environmental Approach does not have a significant higher Environmental Score than the Least Cost Approach and performs poorly against the Carbon and Resilience criteria. The Least Cost approach was therefore retained at this stage.
- Step 4 – We compared the Least Cost against the Most Resilient Approach. The Most Resilient Approach does not have a significant higher Resilience Score than the Least Cost Approach and performs poorly against the Environment and Carbon criteria when compared to the Least Cost Approach. The Most Resilience Approach contains 4 options with a -3 biodiversity score compared to the Least Cost Approach which contains only one option with a -3 biodiversity score. The Least Cost approach was therefore retained at this stage.
- Step 5 - We compared the Least Cost against the Lowest Carbon Approach. The Least Carbon Approach has lower carbon costs compared to the Least Cost Approach, however, carbon costs for both approaches are comparable and low when compared the total NPV costs. The Least Carbon Approach performs poorly against the Environmental and Resilience criteria when compared to the Least Cost Approach and contains 3 options with a -3 biodiversity score. The Least Cost approach was therefore retained at this stage.
- Step 6 – A final assessment of the Least Cost was completed against the Least Carbon, Best AA, Best Environmental, Quickest Delivery and Most Resilient Approaches. The Least Costs Approach performs well against all criteria compared to other approaches, and there is no

significant difference between the scores for the Best AA, Best Environmental, Lowest Carbon, Quickest Delivery and Most Resilience against the relevant criteria compared to the Least Cost Approach. Therefore, the Least Cost Approach is consider the Approach the preforms best in the round. 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

Study Area level, SA combination 9 - Group 12, 24, 20, 31, 33 & 40 has the best score in terms of cost and MCA scores. On the basis of this initial assessment at Plan Level, SA combination 9 represents the Preferred Approach for Study Area H.

The Preferred Approach comprised the options listed in listed in Table 5.9.

Table 5.9 Preferred Approach for SAH

WRZ Name	Preferred Approach Option Description SA Combination – Combination 9 (Group 12, 24, 30, 31, 33 and 40)
Abbeyfeale Water Supply	Group 24 Interconnect Abbeyfeale and Listowel Regional WRZs (approx. distance 1km, new watermains and network upgrades required) for increased resilience and supply deficit
Listowel Regional Public Water Supply	
An Baile Mor / An Daingean	SAH-179 New SW abstraction from Milltown River and WTP
An Clochan	Group 12 Increase GW abstraction at An Clochan. Ce Brennan and Clochan are connected - Could feed from either depending on where yield is
Ce Bhreannain	
An Fheothanach / An Mhuirioch/ Baile Breach	SAH-122 Amalgamate all sources in WRZ to one WTP and rationalise smaller WTP - Upgrade an Fheothanach WTP.
An Mhin Aird	SAH-099 New GW abstraction in Dingle area to serve the customers currently served by An Mhín Aird Gualainn WTP.
Annascaul / Ballintermon	SAH-173 WTP Upgrade - No deficit
Ardfert North/ Glenderry Ballyheigue WRZ	SAH-038 Increase Ballyheigue abstraction. Abandon existing BH at Glenderry Well and rationalise WTP.
Aughacasla	SAH-138 New GW abstraction from Aughacasla BHs and upgrade existing Aughacasla WTP to supply deficit. Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones.
Baile An Fheirtearaigh / Tir Abhainn Thoir / Cill Maoilcheadair / An Ghraig/Cloichear	Group 33 Increase GW abstraction from Tobar Bhreandáin WTP BH (local important aquifer), upgrade Tobar Bhreandáin WTP and supply Dun Chaoin.
Dun Chaoin PWS 034D	

WRZ Name	Preferred Approach Option Description SA Combination – Combination 9 (Group 12, 24, 30, 31, 33 and 40)
Brosna/Knocknagoshel PWSS 016F	SAH-225 Develop trial well at Brosna raw water pump house, upgrade WTP and undertake source protection works.
Cahersiveen	Group 31 Increase abstraction from Lough Currane and rationalise Cahersiveen and Emlaghpeasta to Waterville (SA I).
Emlaghpeasta / Portmagee / Maulin	
Waterville	
Castlegregory PWSS 024D	SAH-065 New SW abstraction from Lough Gill and upgrade Castlegregory WTP.
Ceann Tra PWS 074D	SAH-094 Increase GW abstraction from Ceann Tra WTP BHs (Local important aquifer) and upgrade Ceann Tra WTP
Central Regional - Lough Guitane Mid Kerry	Group 30 New abstraction from lower Leane catchment and WTP at abstraction to feed deficit in Central Regional and Mid Kerry.
Rathmore	Group 40 Rationalise Rathmore WTP and connect to Central Regional WRZ.
Lios Cearnaigh PWS 052D	SAH-169 WTP Upgrade - No deficit
Lyranes 303A	SAH-148 Increase GW abstraction from source Lyranes BH (local important aquifer) and upgrade Lyranes WTP
Mountain Stage PWS 062A	SAH-170 New abstraction from Coomasaharn Lake, upgrade Mountain Stage WTP to treat

The Preferred Approach (SA approach Combination 12, 24, 30, 31, 33 & 40) is shown schematically in Figure 5.3.

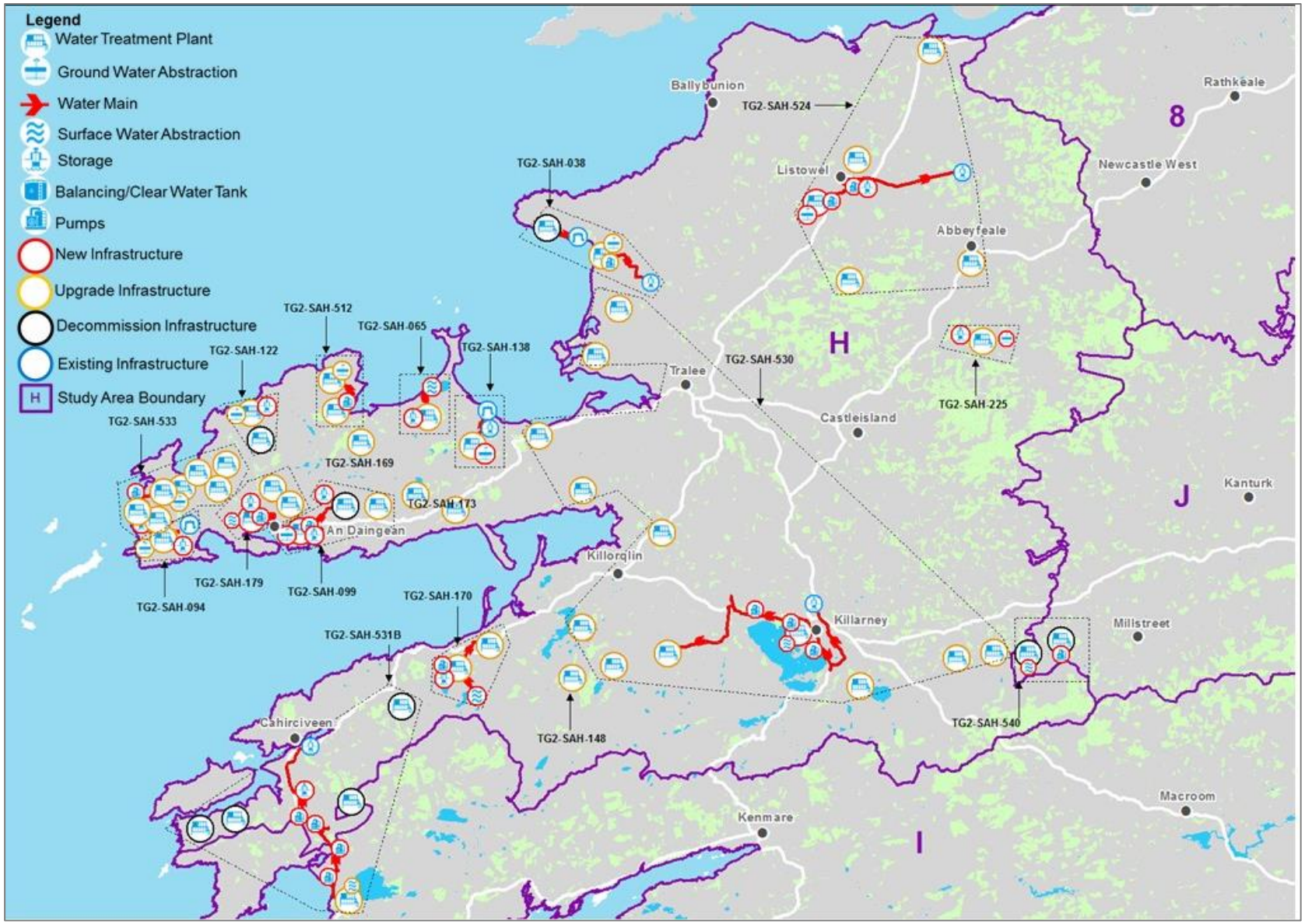

Figure 5.3 Study Area H Preferred Approach

The Preferred Approach for SAH 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);
- Nett leakage reduction, amounting to 1,070 m³ per day (applied to SDB Deficit) to move towards achieving the National SELL Target by 2034;
- Continuation of Irish Water 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.

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

- **Interim Solutions**: Based on the scale of need identified 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 changes to technology allow us to reduce leakage beyond SELL, even in small WRZs or what if we are unable to secure a licence in the medium term to abstract the quantity water currently allowed for at a given location).

6

Preferred Plan Constraints – Interim Solutions

6 Preferred Plan Constraints – Interim Solutions

As outlined in more detail in Section 8.3.7.6 of the Framework Plan, the NWRP provides for an "interim solution" approach, which allows shorter term interventions to be identified and prioritised, when needed. The Preferred Approach for each WRZ, Study Area and Region will be delivered on a phased basis subject to budget and regulatory constraints. It will take many investment cycles to deliver the Preferred Approach across all WRZs, therefore, 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 Irish Water time to deliver the Preferred Approach, while at the same time, maintaining a sustainable water supply. These interim solutions are generally smaller in scale and rely on making best use of already existing infrastructure.

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

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

A decision to progress any interim solution will be based on urgent or priority need to address water quality risk or supply reliability e.g., RAL, 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 SAH Interim Options

WTP Name	Interim Option
Ballyheigue (Ardfert) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Ardfert (Skrillagh) WTP	Refurb existing Borehole, and upgrade WTP To Irish Water Standards
Fenit WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Lyracrompane WTP	Upgrade WTP to Irish Water Standards
Tarbert (Tieraclea) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Brosna / Knocknagoshel WTP	Upgrade WTP to Irish Water Standards
Central Regional (Lough Guitane) WTP	Upgrade WTP To Irish Water Standards
Rathmore WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards – Potential site for a containerised solution
Aughacasla (Kilballylahiff) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Ce Bhreanainn (Slieveglass) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Camp (Knockglassmore) WTP	Upgrade WTP to Irish Water Standards
Castlegregory WTP	Upgrade WTP to Irish Water Standards
An Clochan WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Lios Cearnaigh (Ballyduff) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Annascaul WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
An Riasc (Baile An Fheirtearaigh) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Tobar Bhreandain (Baile An Fheirtearaigh) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Balie Ui Bhaoithin WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
An Baile Mor WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
An Daingean (Dingle) WTP	Upgrade WTP to Irish Water Standards
Dun Chaoin WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
An Fheothanach WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Inch WTP	Upgrade WTP to Irish Water Standards
An Mhin Aird Puc (Banoge) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards

WTP Name	Interim Option
An Mhuirioch/ Baile Breac WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards – Potential site for a containerised solution
Ceann Tra (Cill Ruich) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Caragh Lake (Oolagh) WTP	Upgrade WTP to Irish Water Standards
Cahersiveen (Coulagh) WTP	Upgrade WTP to Irish Water Standards – Potential site for a containerised solution
Emlaghpeasta (Gurrane) WTP	Upgrade WTP to Irish Water Standards – Potential site for a containerised solution
Portmagee (Lateeve) WTP	Upgrade WTP to Irish Water Standards – Potential site for a containerised solution
Mid-Kerry (Gearha) WTP	Upgrade WTP to Irish Water Standards
Breanlee WTP	Upgrade WTP to Irish Water Standards
Glenderry WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards – Potential site for a containerised solution
An Ghraigh Cloichear WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Leataoibh WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Cill Maoilcheadair (Caherdorgan) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Malainn WTP	Upgrade WTP to Irish Water Standards – Potential site for a containerised solution
An Mhin Aird Gualainn WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards – Potential site for a containerised solution
Knockavota WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Mountain Stage (Kealduff) WTP	Upgrade WTP to Irish Water Standards
Mountain Stage (Droum) WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Tir Abhainn Thoir WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Listowel (Dromin) WTP	Upgrade WTP to Irish Water Standards
Ballintermon WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Lyranes WTP	Refurb existing Borehole, and upgrade WTP to Irish Water Standards
Abbeyfeale WTP	Upgrade WTP to Irish Water Standards

Small Towns and Villages Growth Programme Irish Water's Investment Plan 2020-2024 includes a number of programmes and projects targeted at providing for growth. One such programme is the Small Towns and Villages Growth Programme (STVGP) which will provide funding for Water and Wastewater Treatment Plant growth capacity in smaller settlements which are not otherwise provided for in the

Capital Investment Plan 2020 to 2024. The STVGP is focused on supporting growth in areas already served by Irish Water infrastructure but where current or future capacity deficits have been identified.

Irish Water have engaged with Local Authorities across the country to ensure that the investment is made appropriately in accordance with the relevant county development plan.

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 we 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 achieve SELL and 21% leakage targets in our larger WRZs within the timeframe of the plan resulting in lower Needs?
5) What if we fail to achieve our leakage targets?

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

Table 7.1 Sensitivity Analysis for SAH

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)	+47,200 m^3/d	**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 several surface water sources in SAH that would be impacted from sustainability reductions. However, our preferred approach is designed to relieve pressure on these sources by supplementing from new more resilience surface water and groundwater sources. Regarding the abstraction from Lough Guitane supplying Central Regional WRZ, it is assumed that the existing abstraction licence conditions can be maintained, but we have identified an alternative supply source to supplement supply in order to provide long term resilience. Groundwater sustainability is more difficult to assess at desktop level, however, as the abstractions in SAH 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)	+1,000 m3/d	**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.
			Based on this scenario, the Preferred Approach remains the optimal solution.
Demand Growth	Low/Moderate (growth has been based on policy)	-33,867 m^3/d	**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 12 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	Moderate (the distribution network in the region is extensive at nearly 234 kilometres)	+1,070 m^3/d	**The impact of lower than expected leakage savings would increase the supply demand balance deficit and the overall need requirement.** Due to the length and condition of our networks, we could potentially fail to achieve target leakage reductions within the timeframes set out. However, as Irish Water is committed to achieving leakage reductions, the likely scenario would be an extension in the period of time taken to achieve leakage targets as opposed to accepting lower targets.
			Based on this scenario, the Preferred Approach remains the optimal solution.
	Moderate/High (Irish Water is focused on sustainability and aggressive leakage reduction)	-32,362 m^3/d	**The impact of achieving SELL and 21% leakage targets in our larger WRZs would reduce the supply demand balance deficit and the overall need requirement.** The need drivers in SAH 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 – As the Supplies in SAH are relatively small, and as conservative limits have been applied to the supply availability assessments, the Preferred Approach is adaptable to a range of future outlooks in relation to sustainability and climate change. The demand growth in the area is small, and the Supply Demand Deficits are primarily driven by reliability. As Water Treatment Plants are modular, capacity will be delivered on a phased basis, allowing for adaptation across a range of futures. Our Preferred Approach is therefore Adaptable.

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

8 Summary of Study Area H

8 Summary of Study Area H

The Preferred Approach for SAH (summarised in Table 5.8 and Figure 5.5 of Section 5.4) consists of local WRZ supplies for 14 of the 23 WRZs in the Study Area, primarily driven by the small scale of the supplies and difficulties in transporting small volumes of water over long distances.

The 9 other WRZs in SAH involves constructing connections across one or more supplies. The preferred approach for Ce Bhreannain involves increasing groundwater abstraction at An Clochan and increasing connection between the 2 schemes. The preferred approach for Listowel and Abbeyfeale involves developing groundwater in the gravels between the 2 WRZs and interconnecting them. The preferred approach for Central Regional and Mid Kerry involves developing a new source from the l;ower Leane catchment and interconnecting the 2 schemes. The Preferred Approach for Cahersiveen, Emlaghpeasta, Portmagee and Maulin involves rationalising these schemes to Waterville and increasing abstraction from the existing Lough Currane source. The Preferred Approach for Dun Chaoin and Baile an Fheirtearaigh WRZs looks at increasing groundwater abstraction from Tobar Bhreandáin WTP boreholes and supplying Dun Chaoin. Finally, the preferred approach for Rathmore involves rationalising the scheme to Central Regional.

The Preferred Approach will result in a reduction of WRZs from 23 to 16. 2 of the existing 57 abstractions in SAH are proposed to be decommissioned, providing environmental benefit.

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 SAH 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)
- Nett leakage reduction, amounting to 1,070 m^3 per day (applied to SDB Deficit) to move towards achieving the National SELL Target by 2034
- Continuation of Irish Water household and business water conservation campaigns, initiatives and education programmes
- The option to implement legally enforceable Water Conservation Orders in drought periods in order to protect the environment and our public water supplies

As part of our Preferred Approach we have also identified a range of interim solutions for SAH, as summarised in Table 6.1 in Section 6. The measures will only be progressed in the event of critical need and/or public health impact to allow time for delivery of the required Preferred Approach solutions in the Study Area.

Annex A

Study Area H Water Treatment Plants

WTP Asset Name	Local Plant Names
Abbeyfeale WTP	Abbeyfeale WTP
An Clochán WTP	An Clochán WTP
An Daingean WTP	An Daingean WTP
An Fheothanach WTP	An Fheothanach WTP
An Gráig Cloichear WTP	An Gráig Cloichear WTP
An Mhín Aird Gualainn WTP	An Mhín Aird Gualainn WTP
An Mhín Aird Puc WTP	An Mhín Aird Puc WTP
An Riasc WTP	An Riasc WTP
Annascaul WTP	Annascaul WTP
Ardfert WTP	Ardfert WTP
Aughacasla WTP	Aughacasla WTP
Baile Breach WTP	Baile Breach WTP
Baile Mor WTP	Baile Mor WTP
Baile Uí Bhaoithín WTP	Baile Uí Bhaoithín WTP
Ballintermon WTP	Ballintermon WTP
Ballyheigue WTP	Ballyheigue WTP
Breanlee WTP	Breanlee WTP
Brosna/Knocknagoshel WTP	Brosna/Knocknagoshel WTP
Cahersiveen WTP	Cahersiveen WTP
Camp WTP	Camp WTP
Caragh Lake WTP	Caragh Lake WTP
Castlegregory WTP	Castlegregory WTP
Cé Bhréanainn WTP	Cé Bhréanainn WTP
Ceann Trá WTP	Ceann Trá WTP
Cill Maoilchéadair WTP	Cill Maoilchéadair WTP
Dún Chaoin WTP	Dún Chaoin WTP
Emlaghpeasta WTP	Emlaghpeasta WTP
Fenit WTP	Fenit WTP

WTP Asset Name	Local Plant Names
Glenderry WTP	Glenderry WTP
Inch WTP	Inch WTP
Leataoibh WTP	Leataoibh WTP
Lios Cearnaigh WTP	Listowel (Dromin) WTP
Lough Guitane WTP	Lough Guitane WTP
Lyracrompane WTP	Lyracrompane WTP
Lyranes WTP	Lyranes WTP
Málainn WTP	Málainn WTP
Mid-Kerry WTP	Mid-Kerry WTP
Miltown WTP	Miltown WTP
Mountain Stage (Droum) WTP	Mountain Stage (Droum) WTP
Mountain Stage WTP	Mountain Stage WTP
Portmagee WTP	Portmagee WTP
Rathmore WTP	Rathmore WTP
Tarbert WTP	Tarbert WTP
Tír Abháin Thoir WTP	Tír Abháin Thoir WTP
Tobar Bhreandáin WTP	Tobar Bhreandáin WTP

Annex B

Study Area H Rejection Register Summary