Winter 2020

National Water Resources Plan -
Draft Framework Plan
Technical Appendices

Appendix B
Planning Scenarios

Table of Contents

Data Disclaimer:

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

1.1 Introduction

As outlined in Chapter 3 of the draft Framework Plan, there are some years when there is more stress on the water supply system than in others.

For example, during Storm Emma (March 2018), the network was under pressure from the short-term increase in pipe bursts, as a result of prolonged period of freezing temperatures followed by relatively rapid warming. Conversely, during the summer of 2018, a prolonged period of warm dry weather lead to an increase in demand, which coincided with reduced in supply due to low flows in our rivers and lakes.

During the years, where the climatic conditions experienced may be classified as either relatively wet (compared to the long-term average) or normal, we would expect to have water resource capacity to meet customer water demands. During these years, customer demand will tend to be relatively lower than average, as there are unlikely to be prolonged periods of hot and dry weather which increase demand.

In contrast, during dry years, the water supply system is likely to be under greater stress as river flows tend to be lower, with corresponding reduced raw water reservoir capacity. Water demand is also likely to be higher due to increased periods of prolonged hot and dry weather.

Where there is a sustained period of dry weather, the resulting water resource situation could develop into a drought event. A drought event can be defined as occurring when a period of low rainfall creates water restrictions for people, the environment, agriculture and/or industry.

Another critical period being considered explicitly in this plan is the “freeze-thaw” event, which occurs during winter. Major events of this type are typically caused by short-term increases in leakage as a result of prolonged periods of temperatures well below freezing, followed by relatively rapid warming. The short-term increase in pipe bursts, which occur in customer pipes as well as in our infrastructure, places a high demand for water on the supply system. Storm Emma, which occurred in March 2018 is a recent example of a freeze-thaw event. Demand during the event was such that, in many locations, it exceeded our capacity to treat and supply water.

We consider these critical periods as planning scenarios, which all need to be addressed in the NWRP. For the purposes of this plan, the scenarios, outlined in Table 1-1 below, are deemed to be reasonable to cover any foreseeable critical period event within the defined Level of Service (LoS).

Table 1-1 WRP planning scenarios

Scenario	Scenario Description and Weather Type	Feels like
NYAA	Normal Year Annual Average: The normal year scenario describes the demand and supply available to Irish Water in typically average weather year	
DYAA	Dry Year Annual Average: The dry year scenario in when there is low rainfall but no constraints on demand. Demands are based on the average daily demands experienced over the year under “dry” year weather conditions. Demands would be higher than in normal years	
DYCP	Dry Year Critical Period: This occurs within the dry year, generally a few weeks during the summer where demands can be significantly above the annual average	

Scenario	Scenario Description and Weather Type	Feels like
WCP	Winter Critical Period: The WCP generally occurs as a result of freeze – Thaw incidents such as Storm Emma in 2018. High demands during these periods are driven by an increase in leaks from burst of pipes as a result of the very low temperatures	

1.2 Normal Year Annual Average (NYAA)

The normal year scenario describes the demand and supplies available to us in an “average” weather year. Demands are expressed in terms of the average daily demand that would typically be experienced in an average weather year without any forms of demand restrictions in place and are measured in million litres per day (Ml/d) of water. This scenario is often referred to as the Normal Year Annual Average (NYAA) scenario.

For the purposes of water resources planning, the NYAA scenario is not a critical scenario, as the other scenarios below are more severe. However, the NYAA scenario is used to demonstrate how we might operate our sources in most years and is therefore important for costing our future operations.

For carrying out the economic analyses in the plan, it is necessary to assess the expected duration of normal years and dry years throughout the planning period. It is customary practice in the UK for water utilities to define a dry year (not a drought year) as occurring once in every ten years (in other words 10% of the time). Therefore, the definition of the NYAA represents the demand and supply levels that occur nine years in every ten i.e. 90% of the time. We have adopted the same durations for the whole life costing in this Plan.

1.3 Dry Year Annual Average (DYAA)

The dry year scenario, also known as the Dry Year Annual Average (DYAA) scenario, is when there is low rainfall but no constraints on demand (that is, no demand restrictions through Water Conservation Orders such as bans on using hosepipes or sprinklers limitations on garden watering). Demands are based on the average daily demands experienced over the year under dry year weather conditions. Demand would be higher than in normal years, but no restrictions on water demand would be required. Generally, under this scenario, demand is on average 2% higher than under a normal year scenario.

Supplies available during the DYAA scenario are based on the Deployable Output (DO) of sources under dry and drought conditions for the defined LoS. The DO from each source may be affected by hydrological conditions, as well as infrastructure, treatment capacity and abstraction licenses. Under this scenario, although the demand only increases by a small amount, due to the long duration of the dry period, the water available in supply comes under significant pressure.

1.4 Dry Year Critical Period (DYCP)

The Dry Year Critical Period (DYCP) generally occurs during the summer when demands can be significantly higher than the annual average. The critical demands for this plan are deemed to occur over a period of several weeks. This is often referred to as “peak week demand”, although the elevated demands generally persist for a longer period. In Ireland we witnessed a DYCP during June and July 2018. See the Information text Box 1 below.

Box 1

June/July 2018 Warm Dry Weather

Ireland experienced exceptionally high temperatures, low rainfall and corresponding drought conditions across the country in June and July 2018. Met Éireann reported that every rainfall station across the country reported June/July combined rainfall totals as below the long-term average with many in the South and East recording less than 50%.

Irish Water experienced a number of difficulties in relation to public water supply as the volume of water available within water bodies reduced significantly due to falling natural flowrates, while the demand for water simultaneously increased over this period.

To manage this issue and to ensure continuity of water supply, in early July 2018, Irish Water implemented Water Conservation Orders, to restrict unnecessary water use, and therefore reduce demand. The measures addressed both domestic and non-domestic users equally in relation to banning the use of hosepipes (or similar apparatus) for non-essential activities. The restrictions were instrumental in reducing water demand nationally, and prevented large scale water outages that could have impacted on up to 50% of the domestic and non-domestic water users who are reliant on the public water supply.

During the dry weather, we collected flow and level data at approximately 140 of our surface water sources and we have analysed this data to develop a better understanding of the water available at these sources during a DYCP event. We also carried out a post-event analysis to determine the actual extent of the nationwide increase in demand witnessed during the 2018 DYCP event.

1.5 Winter Critical Period (WCP)

The Winter Critical Period (WCP) generally occurs due to freeze-thaw incidents, which have occurred most recently in Ireland during the winters of 2009-2010, 2010-2011 and 2017-2018.

An increase in leaks from pipe bursts drives the high demands during these periods. The constraining supply factor is the capacity of the Water Treatment Plant (WTP), that is, the maximum volume of water that can be supplied to the distribution network. The duration of the WCP can be difficult to estimate but would typically be one to four weeks.

In Ireland we witnessed a WCP in 2018 during Storm Emma, the impacts of which is outlined in Information Text Box 2 below.

Box 2

Storm Emma

On March 1st 2018, Storm Emma arrived on the south coast of Ireland and swept northward across the country. Met Éireann placed the whole country under a 'Red' warning until March 4th, 2018, resulting in the nationwide closure of all schools, businesses, public transport etc. It was reduced to an ‘Orange’ Weather Warning on the 5and 6 March, then a ‘Yellow’ Weather Alert for 7 to 9 March.

Storm Emma had a severe impact on the delivery of water services to over 600,000 people, and presented challenges such as:

- Power outages on water and wastewater treatment plants.
- Lack of access to Irish Water sites (plants and offices) as well as access to isolated communities.
- Water supply issues due to increased open tap usage,
- Water wastage and leakage.
- Compromised water supply quality which led to an increase in boil water notices and the imposition of restrictions on use.

The severity and impacts to drinking water supplies varied across the country. Irish Water classified the impacts using five different criteria ('No Water', 'Water Supply At Risk', 'Restricted Supply', 'Water Quality At Risk', and 'Boil Water Notices'). The largest number of customers affected was on March 5 when 33,678 people across the country had no water.

During Storm Emma, we witnessed a significant increase in water demand and production for the Greater Dublin Area (GDA). While there was a reduction in demand a few days before the event, from March 1 onwards, demand increased dramatically, while storage volumes dropped significantly. During Storm Emma demand exceeded the treatment plant capacity for GDA forcing us to increase production from Ballymore Eustace WTP above normal operating levels as well as implement other water supply and demand management measures.

Figure 1-1 below illustrates the typical demand profiles for the various scenarios for an example Water Resource Zone (WRZ).

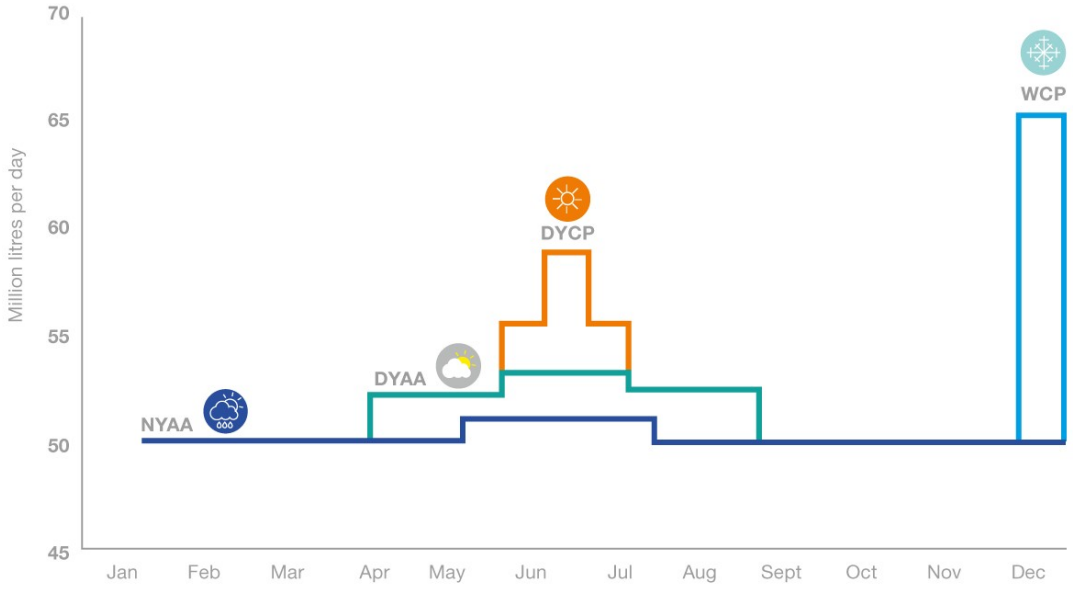

Figure 1-1 Demand profiles for various planning scenarios

1.6 Peaking factor for the planning scenarios

When we develop the NYAA demand profile for a Water Resource Zone (WRZ), we apply peaking factors to the NYAA demand profile to determine the demand profiles for the DYAA, DYCP and WCP.

Ideally, to determine these peaking factors, we would look to historical data in water use during these scenarios. However, country-wide, reliable, historical data is not available, therefore we derived factors that describe the scale of the increase in demand for each planning scenario from data for Northern Ireland and parts of the UK with similar demand and supply characteristics to Ireland.

These factors are called peaking factors and vary significantly according to the size of WRZ. Demands in small zones tend to experience much larger levels of fluctuation than larger zones.

The peaking factors determined are outlined in Table 1-2.

Table 1-2 Peaking factors for WRZs during summer and winter planning scenarios

Size of WRZ	DYAA	Summer planning scenario (DYCP)	Winter planning scenario (WCP)
Small WRZ (up to 1 Ml/d)	2%	20%	50%
Medium WRZ (up to 10 Ml/d)	2%	20%	40%
Large WRZ (up to 100 Ml/d)	2%	20%	30%
GDA (> 100 Ml/d)	2%	13%	20%

Since the development of these peaking factors in early 2018, we witnessed both Storm Emma (March 2018) and an intense drought throughout the country (June/July 2018). These events produced notable peaks in demand across our WRZs and led to water supply issues in a significant number of several WRZs. We are currently compiling and assessing data in relation to these events to determine if these peaking factors need to be updated.