Test Surface Water Stage 0.1 Drought Order 2025
Appendix B
Hydrology and Physical Environment Assessment

July 2025
Version 9.0

Version No.	Date of Issue	Changes
Final Draft for EA/NE Review	Jan-18 & Mar-18	Issued for Public Inquiry (Jan 18) and for consultation (Mar-18)
V2.0	Jun-18	To NE/EA for comment
V3.2	Oct-18	To NE/EA for comment
V4.0	Apr-19	To NE/EA for comment
V5.0	2019	Update to support drought permit application
V6.0	2020	Update to support drought permit application
V7.0	Mar-21	Updates for draft Drought Plan 2022
V8.0	Jan-22	Updated to address NE/EA comments
V9.0	Jul-25	Updated for application for Stage 0.1 Drought Order

Contents

B.1 Introduction

As part of its Drought Plan 2022, Southern Water is required to undertake environmental assessments of each of the drought permits and drought orders set out in the plan. This appendix forms the hydrological impact and physical environment assessment for the proposed **Testwood Surface Water Stage 0.1 Drought Order 2025**, and informs the Environmental Assessment Report (EAR) for the application for the **Testwood Surface Water Stage 0.1 Drought Order 2025**. Throughout this document the Testwood Surface Water Stage 0.1 Drought Order is referred to as 'the Stage 0.1 Drought Order' unless the full name is necessary for understanding.

This report incorporates relevant evidence prepared for the Hampshire Abstraction Licences public inquiry held in March-April 2018 and the agreements reached as part of the inquiry process, as formalised in the Section 20 Agreement made under the Water Resources Act 1991. It also reflects the revised abstraction licence issued for the Testwood abstraction following the signing of the Section 20 Agreement.

Note that this document is based on, and is largely the same as, the report prepared to support the Southern Water 2022 draft Drought Permit application. Since this was produced Southern Water, the Environment Agency and Hampshire and Isle of Wight Wildlife Trust have all undertaken extensive monitoring programmes on the Rivers Test and Itchen as agreed under the Section 20 Agreement. However at this time the vast majority of these data are still being analysed, and the findings are yet to be reported to the Environment Agency and Natural England independently of this document. Therefore it has not been possible to update the EAR with the results of these data in respect of the assessment presented. However the report has been updated to reflect the specific application in 2025 and changes in respect of the understanding of potential impacts on Internationally designated sites as reflected in the Habitats Regulations Assessment (WSP, 2025[1]) accompanying the application in 2025.

B.1.1 Drought options on the Test and Itchen

Southern Water's resources in its Western Area are dominated by the abstractions on the Rivers Test and Itchen at Testwood and Otterbourne, the locations of which are shown in Figure 1. The Section 20 Agreement sequence of drought actions is summarised in Table 1. As noted in the Agreement, Southern Water "will take account of ecological considerations in deciding the order of applications for drought orders from the Test (at flows below 265 Ml/d), the Candover boreholes and the River Itchen".

[1] WSP (2025). Test Surface Water Licence 11/42/18.16/54 Stage 0.1 Drought Order 2025. *Information to support an assessment under Regulations 63 and 64 of the Conservation of Habitats and Species Regulations 2017.*

Figure 1 Schematic of River Test and River Itchen

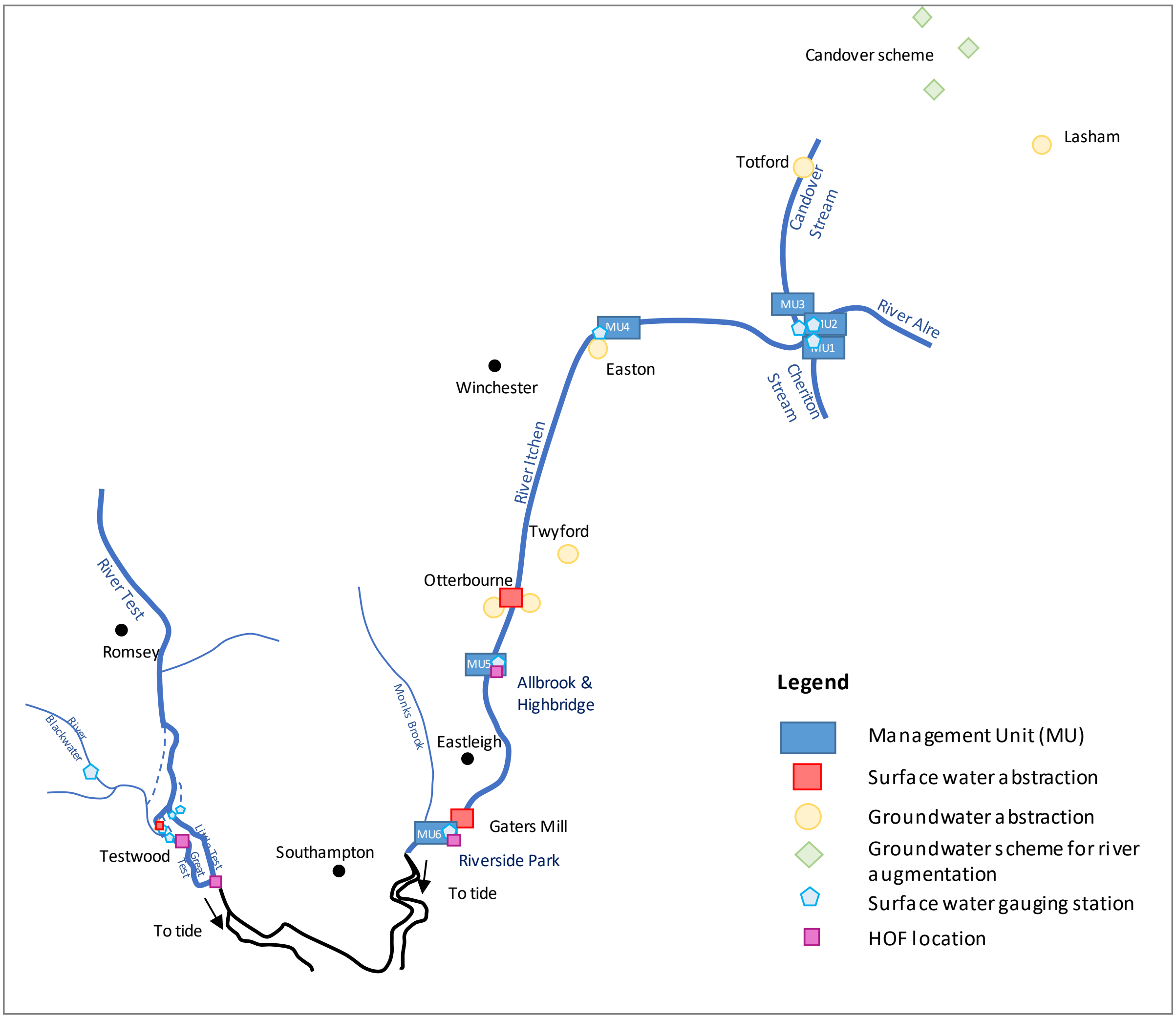

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Table 1 Summary of the Section 20 agreement sequence of drought actions

<table>
<tr><th>s20 Ref</th><th>Activity</th><th colspan="3">Comment</th></tr>
<tr><td>1</td><td>Utilisation of SWS water sources and bulk supplies</td><td colspan="3">Prior to any application for a drought permit or order, SWS will utilise its own existing water sources available to supply the Hampshire and Isle of Wight Water Resource Zones within the terms of their respective licences. This will include water available under the Portsmouth Water bulk supply scheme.</td></tr>
<tr><td>2</td><td>Level 1 water use restrictions</td><td colspan="3">Escalate demand-side water efficiency measures including media campaigns</td></tr>
<tr><td>3</td><td>Level 2 water use restrictions</td><td colspan="3">Implement partial temporary use bans (TUBs) pursuant to section 76 IA 1991 unless it is agreed with the Environment Agency that it is unnecessary because savings will be minimal</td></tr>
<tr><td>4</td><td>Test Surface Water Drought Permit (Stage 0.1 Drought Order)</td><td colspan="3">Abstract from Testwood below the Environment Agency’s proposed Total Test Flow (TTF) Hands off flow (HoF) of 355 Ml/d down to 265 Ml/d pursuant to a drought permit</td></tr>
<tr><td>5</td><td>Level 3 water use restrictions</td><td colspan="3">Apply for a drought order to authorise partial Non-Essential Use (NEU) restrictions (Level 3 phase 1 drought restrictions).</td></tr>
<tr><td rowspan="2">6</td><td>Candover augmentation scheme</td><td>Test Surface Water Drought Order</td><td>Level 3 phase 2 drought restrictions</td><td>Lower Itchen drought order</td></tr>
<tr><td>When flows fall below 205 Ml/d at Allbrook and Highbridge abstract up to 27 Ml/d (limited to 20 Ml/d in certain months). Discharge to the River Itchen downstream of the Candover stream but retaining an environmental flow to the Candover Stream</td><td>When TTF falls below 265 Ml/d abstract down to a baseline of 200 Ml/d pursuant to a drought order</td><td>When flows fall below 200 Ml/d at Allbrook and Highbridge implement full TUBS and NEUs (Level 3 phase 2 drought restrictions).</td><td>When flows fall below 198 Ml/d at Allbrook and Highbridge, as a measure of last resort, abstract below the 198 Ml/d HoF to a floor of 160 Ml/d. Coincident with this, Portsmouth Water will also need to abstract below the Riverside Park HoF of 194 Ml/d.</td></tr>
</table>

This table summarises the proposed sequence of actions. The guiding principle in Annex 1 of the section 20 agreement is that Southern Water will take account of ecological considerations in deciding the order of applications for drought orders on the Test and Itchen Rivers and Candover Stream. For full details of the conditions, refer to the signed section 20 agreement.

B.1.2 Test Surface Water Stage 0.1 Drought Order

B.1.2.1. Southern Water's existing operations

Southern Water abstracts from the River Test at Testwood, approximately 1.7 km upstream of the normal tidal limit (NTL) near Testwood Mill / Testwood Pool.

The current abstraction licence allows abstraction of up to 80 Ml/d and 29,200 Ml/year. This is subject to a Hands-off Flow (HOF) of 355 Ml/d calculated as a sum of flow at Testwood Bridge, Test Back Carrier and Conagar Bridge. This licence was revised following the agreement reached from the 2018 Public Inquiry and the new licence conditions are detailed in Table 1.

As part of the revision, the location of the HoF has been moved to capture the total flows to the Test estuary. However, there is no gauging station at this location, and due to the braided nature of the river, the flow at the HoF location is estimated combining measurements from multiple flow gauges. The Environment Agency have committed to install a continuous water level recorded at Testwood Bridge.[2]

Table 1 Test Surface Water abstraction licence details

Licence number	Daily (Ml/d)	Annual (Ml/d)	HoF (Ml/d)	HoF location / calculation
11/42/18.16/546	80	29200	355	Total Test Flow - "sum of flow at Testwood Bridge, Test Back Carrier and Conagar Bridge"

B.1.2.2. Southern Water's Test Surface Water Stage 0.1 Drought Order

Water resources modelling using Southern Water's Western Area 'Aquator' water resources model indicates that, under the current River Test abstraction licence conditions (see above) there would be a significant supply deficit in the Western Area under a range of low flow conditions. Therefore, there is a need for Southern Water to apply to relax the HoF from 355Ml/d to 265Ml/d, to help maintain public water supplies to the Western Area during these low flow conditions.

Under conditions where the available mitigation measures are deemed to fully off-set the potential effects of the relaxation of the HoF, Southern Water would be applying to the EA for a Drought Permit as detailed under the Section 20 Agreement. However, the HRA Stage 2 assessment for the application concludes that it is not possible to conclude there will be no adverse effect on site integrity for the River Itchen SAC and River Meon Compensatory SAC Habitat even with mitigation in place (WSP, 2025[3]). Therefore, compensation is required and this level of abstraction can only be approved as a Drought Order and through an application to the Secretary of State for Environment, Food and Rural Affairs.

The Drought Order seeks to reduce the licence HoF (355 Ml/d) to 265 Ml/d (Table 2). The Test Surface Water Stage 0.1 Drought Order would always be applied for before the Test Surface Water Stage 1 Drought Order, as referred to in the Section 20 Agreement.

Table 2 Test Surface Water Stage 0.1 Drought Order summary

	Stage 0.1 Drought Order details
Receiving watercourse	River Test
Abstraction sources	Testwood
Normal HoF / licence details	355 Ml/d (licence condition)

[2] Southern Water Test Surface Water Drought Permit and Drought Order Monitoring Plan, 11 June 2018

[3] WSP (2025). Test Surface Water Licence 11/42/18.16/54 Stage 0.1 Drought Order 2025. *Report to inform an assessment under Regulations 63 and 64 of the Conservation of Habitats and Species Regulations 2017.*

HoF control	Flow at the Total Test Flow (TTF)
Proposed drought action	Relax HoF to 265 Ml/d Assumes Coleridge Award split is enforced – this may require specific provisions to be included in the Stage 0.1 Drought Order, along with potential additional legal provisions about the operation of other control structures. TTF is not affected by the Coleridge split, but the operation of this and other control structures do control flows between the Great and Little Test.
Permit Or Order	Order
Yield (Ml/d)	Up to 80 Ml/d for extreme drought conditions

B.1.3 Structure of appendix

This appendix is set out as follows:

- Section B.2 Hydrological impact assessment;
- Section B.3 Physical environment assessment; and
- Section B.4 Cumulative impacts.

B.2 Catchment setting

This section details the understanding of the River Test catchment, enabling assessment of the Stage 0.1 Drought Order impact on hydrology and the physical environment to be undertaken in later sections.

B.2.1 Catchment overview

The River Test is a Chalk stream that rises in Overton in Hampshire. Downstream of Timsbury, the Test flows across the clays and sands discharging into Southampton Water. Approximately 50 km in length, with a catchment area of 443 ha, the River Test is longer and larger than its eastern neighbour, the River Itchen. The catchment setting is shown in Figure 2.

Like all Chalk rivers, the River Test is characterised by a baseflow dominant flow regime. The reaches downstream of Romsey are characterised by several significant flow splits, which divert water away from the main channel, for example, the Great Test-Little Test divide. This is due to the historical modifications (realignment and deepening) for land drainage, flooding of water meadows, navigation and water mills. The river is still heavily managed, with many control structures, some of which support current commercial activities, including fishing, that occur along the river.

The river is designated as a Site of Special Scientific interest (SSSI) downstream to the NTL. The transitional and estuarine water bodies downstream of the NTL have European level protection through the designations of the Solent Maritime Special Area of Conservation (SAC), Solent and Southampton Water Special Protection Area (SPA), the Solent and Dorset Coast SPA and the Solent and Southampton Water Ramsar site. The Lower Test Valley is also designated as a SSSI.

Southern Water's Testwood abstraction intake is located at Testwood on the Great Test, approximately 1.4 km above the NTL at Testwood Mill. The proposed Stage 0.1 Drought Order would temporarily modify the abstraction licence conditions for this water source and therefore this report is focused on the lower reaches of the Test, south of Romsey.

B.2.2 Geology and soils

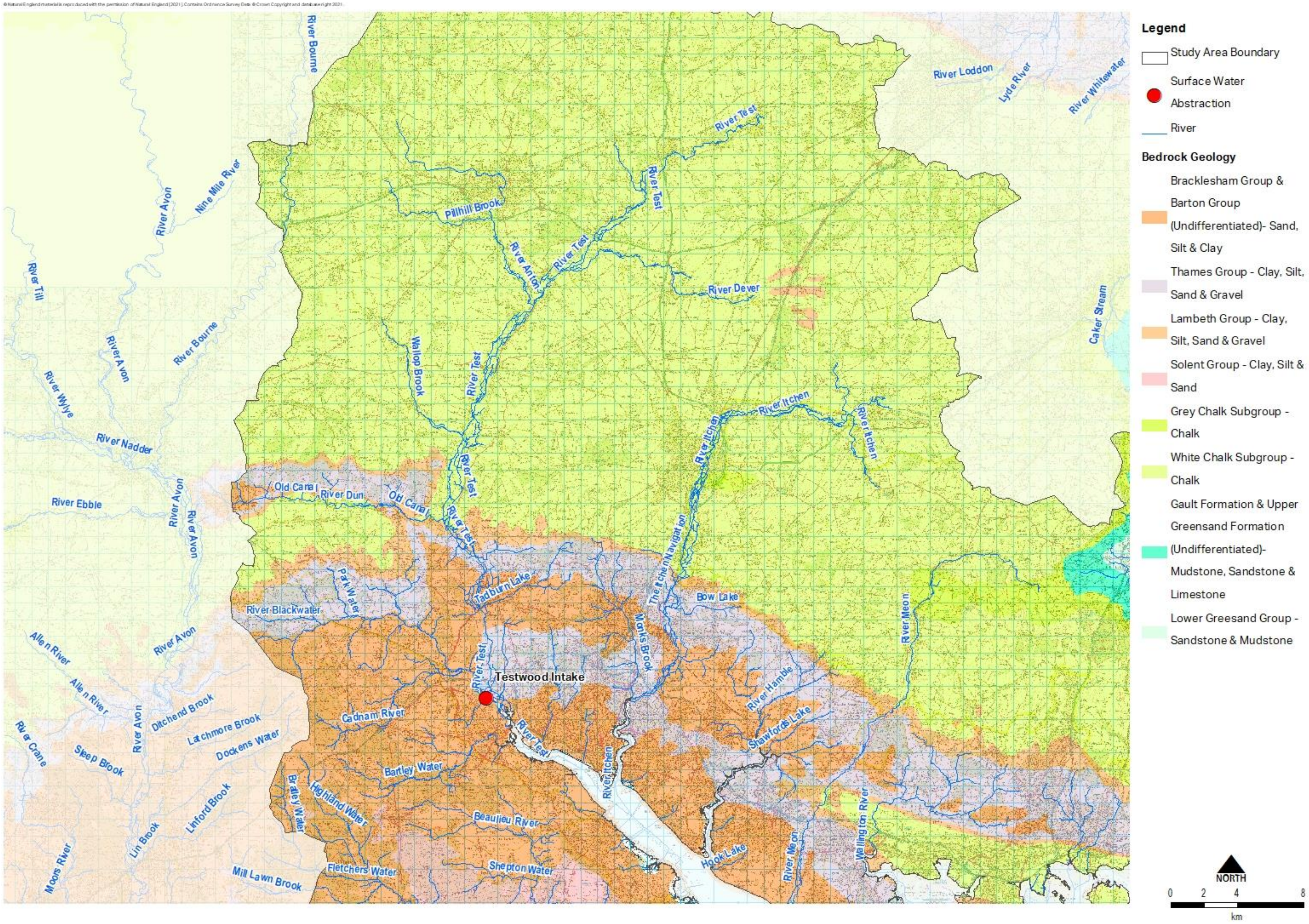
As stated, the River Test rises on the Chalk at Ashe, near Overton. As it flows towards Timsbury, the Test continues to gain water directly from the underlying Chalk and also from its tributaries, such as the River Anton, Phillhill Brook and Wallop Brook. However, downstream of Timsbury, the Test flows across lower permeability formations[4]. At Testwood, the Chalk aquifer is over 100 m deep (the Chalk is recorded as being 180 m deep at Bunkers Hill borehole, approximately 5 km west of Testwood[5]) and the London Clay formation is at surface.

Alluvium and river terrace deposits are located along the main river channel, with tidal flat deposits becoming prevalent at the NTL.

Soil deposits reflect the bedrock and superficial deposits. Along the river channel, Willingham soils are prevalent, until NTL and transition from swamp and saltmarsh communities to neutral grassland, where Wallasea soils dominate[6].

[4] BGS, 1987, Southampton Solid and Drift Geology, Sheet 315
[5] BGS borehole log ID 406528 http://scans.bgs.ac.uk/sobi_scans/boreholes/406528/images/10737902.html, accessed September 2017
[6] Atkins, 2013. Lower River Test NEP Investigation

Figure 2 Catchment overview



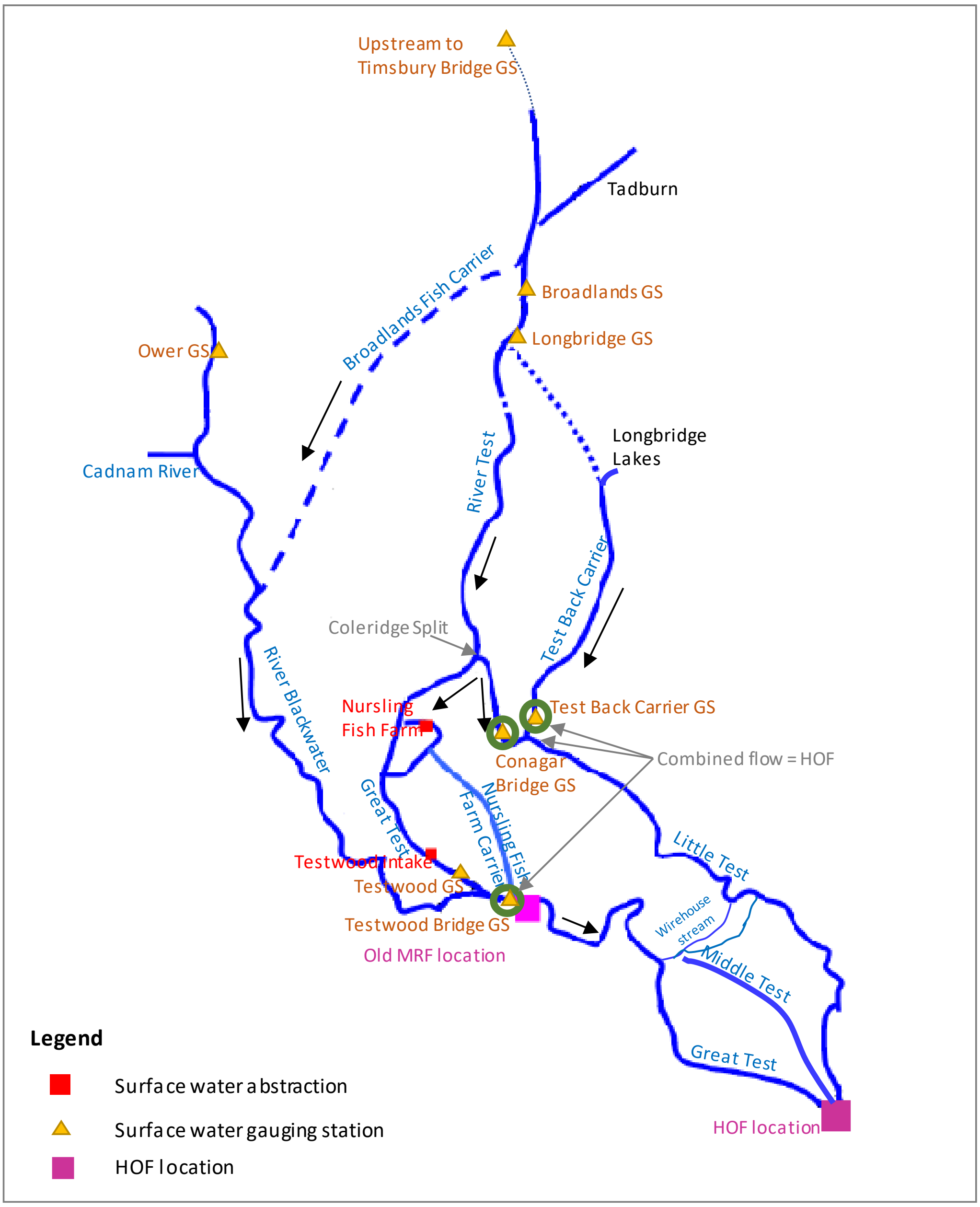
B.2.3 Hydrology - flow

This section sets out the baseline hydrology of the Test, downstream of Romsey, in the vicinity of the Testwood abstraction. It first details the key channels and diversions, then summarises the available flow data, before finally presenting key flow statistics.

B.2.3.1. Flow splits

The hydrology of the River Test is complicated by the number of channels and diversions. Whilst this is well documented in Atkins (2013)[6] and Environment Agency (2011)[7], to understand the operation and potential impact of the Testwood abstraction, it is important to appreciate the flow routing. Therefore, a brief summary is presented below and shown in Figure 3.

Figure 3 Hydrology schematic of the Test downstream of Romsey



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[7] Environment Agency, 2011. Lower Test Project

Broadlands fish farm carrier (BFFC)

This is the first significant flow split downstream of Romsey, and upstream of Broadlands gauging station. The carrier was originally developed to feed the Broadlands water meadow system[7] but more recently is used as part of the Broadlands Fishery for angling. The carrier discharges into the River Blackwater, upstream of its confluence with the River Test. Atkins (2013)[6] reported average flows of 72 Ml/d and a Q95 of 46 Ml/d. Since May 2016, flows in the carrier have significantly reduced due to a change in management of the channel by the fishery[8].

Test back carrier (TBC)

The carrier is connected to the main Test, but this channel is believed to be poorly managed such that there is little flow now from the Test. The TBC drains Longbridge Lake, and has been known to dry up[7]. Atkins (2013)[6] reported average flows of 13 Ml/d. The TBC joins the Little Test downstream of the Conagar Bridge gauging station.

Great and Little Test split

This is the main split between the River Test into the Great Test and Little Test. The flow division is regulated by the agreement introduced in 1831, known as the Coleridge Award, to fairly manage the flow between the different river users and riparian owners. The agreement states that one third of the flow should pass down the Little Test and two thirds down the Great Test. However, flow data indicate that, historically, there has been significantly more than two thirds of the flow passing down the Great Test in normal to high flow periods. Under low flow conditions, less than two thirds of flow typically pass down the Great Test. The Little Test re-joins the Great Test just above the Test estuary.

Manor House Farm (Nursling fish farm carrier (NFFC))

The fish farm at Manor House Farm (Nursling) was licensed to abstract 45.5 Ml/d from the Great Test. This water can be returned to the Great Test either directly, or via the NFFC, which re-joins the Great Test downstream of the Blackwater confluence. The Environment Agency now holds the abstraction licence for Manor House Farm and propose to abstract a small amount to support a wetlands habitat at this site.

River Blackwater

The River Blackwater rises from both Chalk springs at Sherfield English and Tertiary springs in the area west of Romsey[7]. It receives flow from the BFFC and discharges into the Great Test, downstream of Testwood abstraction.

Wirehouse Streams

The Wirehouse Streams are fed from an offtake from the Great Test downstream of the Testwood Bridge gauging station. Flow to this distributary system is controlled by a sluice, which is understood to be kept locked open to provide a constant flow to the two Wirehouse streams (there is a bifurcation a short distance from the Great Test offtake), one flowing in directly in a north-easterly direction to the Little Test (the “northern” Wirehouse Stream) and the other flowing south-east initially before flowing north-easterly to the Little Test (“southern” Wirehouse Stream).

B.2.3.2. Flow gauges

There are numerous locations where flow in the Test (or its tributaries) downstream of Romsey is measured by the Environment Agency. Different techniques are used at different gauges and data are available for different time periods. The gauges are listed in Table 2 and shown on Figure 3. The

[8] Appendix H of Environment Agency, 2017. Restoring Sustainable Abstraction, Licence Change Proposal Report

key gauges are highlighted in bold text in Table 2. Further information on these gauges is detailed in Environment Agency (2011)[7].

Due to the complicated nature of the river braiding and the varying quality of the gauged records, an approved flow time series was developed for the NEP investigation[6] to enable the hydrology assessment to be undertaken. The methodology used built on that undertaken by the Environment Agency. This approved record starts in 1996 and is limited by the length of reliable record that can be obtained for the BFFC. The flow statistics for these reaches are summarised in Table 3 and the associated flow duration curves are presented in Figure 4. These data help to provide an understanding of flow through the River Test.

Table 2 Surface water flow monitoring along the Test downstream of Romsey

Gauge	River	Location	Gauge type	Data range	Commentary
Broadlands	**River Test**	**Downstream of BFFC**	**Chart recorder**	**01/10/1957 to date**	**Records stage. Flow is estimated using the relationship with spot flow data measured at Longbridge/Broadlands using the EA's 'RIVTEST' programme. In 2007, the logger was upgraded from weekly to 15minutes. The conversion programme works on a daily basis and is updated at the start of each month**
Longbridge	River Test	Upstream of TBC confluence	ElectroMag	01/10/1981-31/12/2008	No longer operational
M27 Main Test	River Test	Upstream of Coleridge Award	Ultrasonic	02/02/2004 to date	Installed with the intention of replacing Longbridge. There are reliability and instrument issues and Broadlands is used in preference.
Testwood	**Great Test**	**Upstream of the Blackwater confluence**	**ElectroMag Ultrasonic**	**11/05/1987 to date**	**Some missing data in early 1990s drought. New Nivus ultrasonic gauge installed and running parallel with old Sarasota gauge**
Testwood bridge	**Great Test**	**Downstream of the Blackwater**	**ADCP Level site**	**2004 2007 – 2012 2018 to date**	**Spot flow location site from 2004. Some flow data from 2007 – 2012 using a side looker. Level sensor installed in June 2018 and site is gauged weekly when flows are close to the HOF. The data is believed to be reliable, and specified as the HoF gauged location from 2027 in the varied Testwood abstraction licence.**
Conagar bridge	**Little Test**	**Upstream of confluence with TBC**	**ElectroMag ultrasonic**	**01/01/1982 to date**	**Data reliable. Matches well to spot flows. New Nivus ultrasonic gauge installed in September 2018 – parallel running with existing Sarasota gauge.**
Test Back Carrier	**TBC**	**Upstream of confluence with Little Test**	**Stage logger**	**10/01/1986 to date**	**Flow mainly derived from offtake close to Longbridge. Flows have reduced in recent years and in summer are often dry. Data reliable**
Nursling GS	NFFC	Inlet to Manor House Farm (Nursling)		1983 - 1991	Unreliable. Site not currently operational
Ower	**Blackwater**	**Blackwater**	**Weir**	**01/10/1976 to date**	**Reasonable quality**
M27 Blackwater	Blackwater	Upstream of BFFC.	Ultrasonic	03/02/2004 to date	Ower GS is used in preference
M27 TV1	BFFC	BFFC, upstream of confluence with Blackwater	Ultrasonic	03/02/2004 to date	Historic data reliability issues – sensors fail when water level drops too low. Recent summer flows have not been recorded. Manual gaugings carried out weekly when flows are low.

Key gauges highlighted in bold. For locations refer to Figure 3.

Table 3 Summary of flow statistics from approved flow record in the River Test catchment (Jan 1996 – July 2015)

Reach	Reach name	Flow calculation	Average flow (Ml/d)	Q95 (Ml/d)	Q99 (Ml/d)	Min (Ml/d)
A	Main Test d/s of Longbridge GS and upstream of the Little and Great Test flow split	Flow at Broadlands GS - Flow at Test Back Carrier	957	462	406	350
B	Great Test d/s of the Little and Great Test flow split and upstream of the Manor House (Nursling) Fish Farm offtake	Flow at Reach A - Flow at Conagar Bridge	731	285	241	177
C	Great Test downstream of the Manor House (Nursling) Fish Farm Offtake and upstream of the Testwood Abstraction	Flow at Reach B - volume diverted at Manor House (Nursling) Fish Farm	712	265	216	163
D	Great Test d/s of the Testwood Abstraction and upstream of the Blackwater confluence	Flow at Testwood Gauging Station	746	202	151	83
E	Great Test just d/s of the Blackwater confluence	Flow at Reach D + catchment factorised Ower GS flow + synthesised Flow of Broadlands FFC	954	279	226	169
F	Great Test at old HoF location	Flow at Reach E + Manor House (Nursling) Fish Farm abstraction	973	308	246	199
G	Great Test downstream of the MRF and just upstream of Testwood Pool	Flow at Reach F - offtake to the Wirehouse Streams	Flow time series not provided. Determined by hydraulic modelling.			
H	The Little Test d/s of the Little and Great Test flow split	Flow at Conagar Bridge GS + Test Back Carrier GS	234	151	128	90
F + H	TTF – new HoF location	Flow at Reach F (Great Test) + Reach H (Little Test)	1208	482	410	357

Data range for flow statistics: 1996 - 2015

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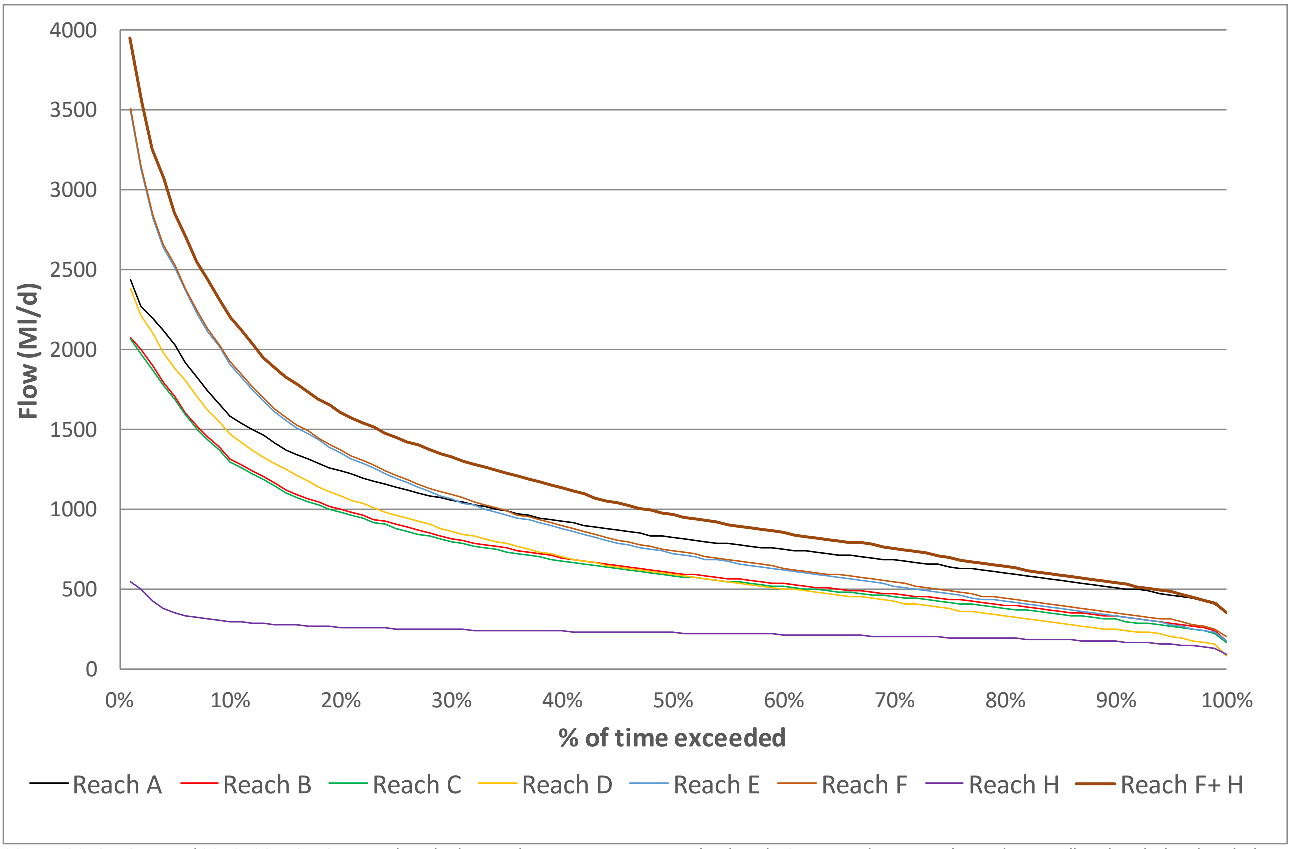
Figure 4 Flow duration curves for River Test downstream of Romsey



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B.2.1 Hydrology – levels and velocities

The lower River Test is a highly-managed and tidally influenced river system. Understanding the controls on water level and velocity, and therefore how flows are expressed in terms of the river habitat, is thus a very important issue when it comes to understanding river hydrology and habitat in low flow and drought conditions.

B.2.1.1. Structures and character of the River Test downstream from Testwood

There are a large number of structures in the River Test, and these have a significant influence on the hydrology of the River Test. Key structures upstream of Testwood abstraction include the BFFC offtake and the Great Test/Little Test split at the Coleridge structure. Downstream of Testwood Mill the nature of the watercourse changes considerably as the transition from a free-flowing chalk stream to estuarine conditions is apparent. Superimposed on this natural transition are a number of influencing factors which further modify the conditions in the river. The key factors influencing the natural transition and modifying it include:

Testwood Gauging station - Operated by the EA, the gauging station lies approximately 120m downstream of the abstraction before the confluence with the River Blackwater. The structure includes a concrete weir (and base). The weir creates impounded conditions upstream and while it is submerged at higher flows it exerts an increasingly strong control on the velocities experienced upstream during periods of low flow.

The River Blackwater - this joins the River Test about 300 m downstream of the abstraction and is an entirely natural contributor to the rapidly changing habitat downstream of the abstraction. The

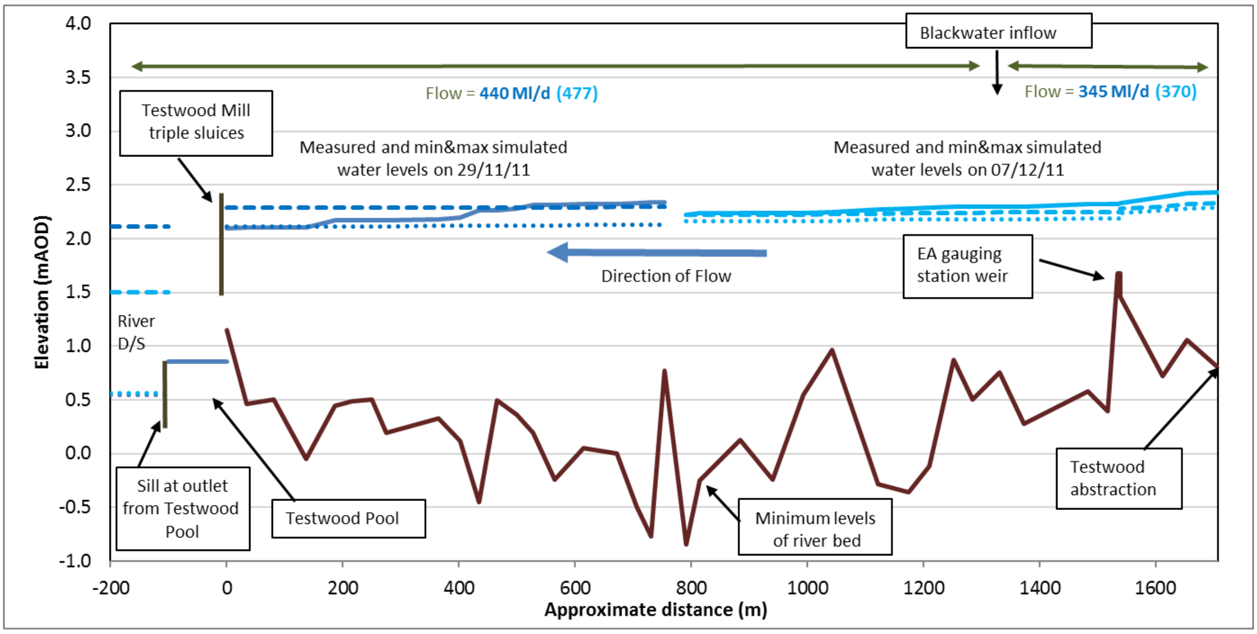
Blackwater runs off a mixed clay catchment, with a much lower base flow. The flow regime is much 'flashier' - it responds much more rapidly to rainfall events and drought events. The chemistry of the water is very different and being more dependent on rainfall run-off for its flow carries much more sediment than the inflow from the Test – this is reflected in its name - the Blackwater.

Testwood Mill – the river structures at Testwood Mill are an important historic example of how the river has been controlled and utilised. They are also the dominant control on the nature of the river habitat downstream of the Testwood abstraction. As with all such structures, the river is impounded, raising its level and reducing velocities in order to increase the potential energy released as it passes through the mill structure itself. The effect of this impoundment on the river habitat extends for some considerable distance upstream. Due to their location, the structures also act as a barrier to the incoming tide, creating an artificial tidal limit.

Located about 300m upstream of the Testwood Mill is the weir that controls the offtake to the Wirehouse Streams system that diverts flow from the Great Test to the Little Test.

A longitudinal section of the Lower Test between the Testwood abstraction and the Testwood Mill structure is shown in Figure 5. **However, this is only indicative of relative elevation of the river as there is uncertainty as to the precise elevations shown in this diagram due to concerns about the quality of the cross-section data used to provide the elevations**.

Figure 5 Longitudinal section from the Testwood abstraction intake to the structures at Testwood Mill. The section is derived from survey data obtained on 29/11/11 and 07/12/11



There is a backwater and impounding effect of the Testwood Mill structures that extends as far upstream as Testwood gauging station and usually further upstream. In addition, the EA's gauging station weir also has its own backwater effect and its effect on reducing velocities upstream will increase as flows reduce. In the reach immediately downstream of the Blackwater confluence there is a sequence of pools and potential riffles, although the latter are drowned out by the backwater effect. Overall, the whole reach is deep and generally has lower energy and potentially higher rates of sediment deposition than further upstream; however, there are some significant areas of higher energy and erosive flows, as highlighted by silt-free areas of clean gravel.

A full review of the structures in the lower River Test is beyond the scope of this assessment, but can be found in the Test and Itchen River Restoration Strategy[9] and related documents. The influence of structures is considered further in this assessment in Section B.3.5 with reference to an updated hydraulic model of the Lower Test.

B.2.1.2. Tidal influence

The NTL is marked on Ordnance Survey maps near Testwood Mill / Testwood Pool. During very high tides, the NTL is known to be exceeded and there can be extensive inundation of the Lower Test Valley SSSI and the lower reaches of the River Test more generally[6].

The precise location of the "natural" hydraulic limit of the tide on the Great Test is uncertain due to the presence of river control structures, most notably those at Testwood Mill, but also the EA's flow gauging station immediately downstream of the abstraction. However, the fact that tidal signals are occasionally seen in the records from the gauging station suggests that in a more natural un-impounded context the hydraulic limit would extend further upstream of the Testwood abstraction[6].

B.2.1.3. Influence of structures and tidal regime on water levels and velocities

The hydraulic character of the Lower Test River was investigated extensively in the NEP Investigation and the Testwood Licence Review[6]. During this study new topographic survey data were collected and a hydraulic model was developed and used to assess:

- Flow profiles and duration curves across wide range of natural flows, abstraction scenarios, tidal cycles and sluice gate settings at 4 locations (more are available) between the abstraction intake and Testwood Pool
- Velocity profiles and duration curves for the same range of variables and locations
- Depth profiles and duration curves for the same range of variables and locations

During 2017 and 2018 further work was carried out to extend and update the hydraulic model of the Lower Test. Results from this updated model were referred to during the 2018 Public Inquiry and are summarised below. Full details of the modelling reported as part of the Testwood AMP6 Investigations[10]. **However, the concerns about the quality of the cross-section survey data used in the model need to be considered and the modelling results therefore need to be treated with some caution.**

[9] Test and Itchen River Restoration Strategy, Atkins 2013.
[10] Testwood AMP6 Investigations, Hydraulic Modelling of the Lower River Test, Atkins 2018 (in prep.)

B.3 Hydrological impact assessment

The Stage 0.1 Drought Order would temporarily allow abstraction below the HoF of 355 Ml/d (TTF) down to 265 Ml/d.

This assessment of hydrological impacts has primarily focused on the freshwater reach of the Great Test, between the Testwood abstraction intake and the NTL near Testwood Mill / Testwood Pool. Downstream of Testwood Mill, the river is tidal and therefore impacts on flow are anticipated to be lower in comparison, with the effects greatest in the Test Estuary with negligible effects within the main transitional water body of Southampton Water.

The Stage 0.1 Drought Order assumes the Coleridge Award flow split at the Little Test – Great Test divide is in place as per the agreement of 1831 and therefore the Stage 0.1 Drought Order will not directly alter flows on the Little Test. The Middle Test is entirely tidal and any impacts on this water body will be negligible.

B.3.1 Approach

For the Stage 0.1 Drought Order environmental assessment, hydrological impacts have been assessed using a combination of Southern Water's Western Area Aquator water resources model and the Test and Itchen groundwater model.

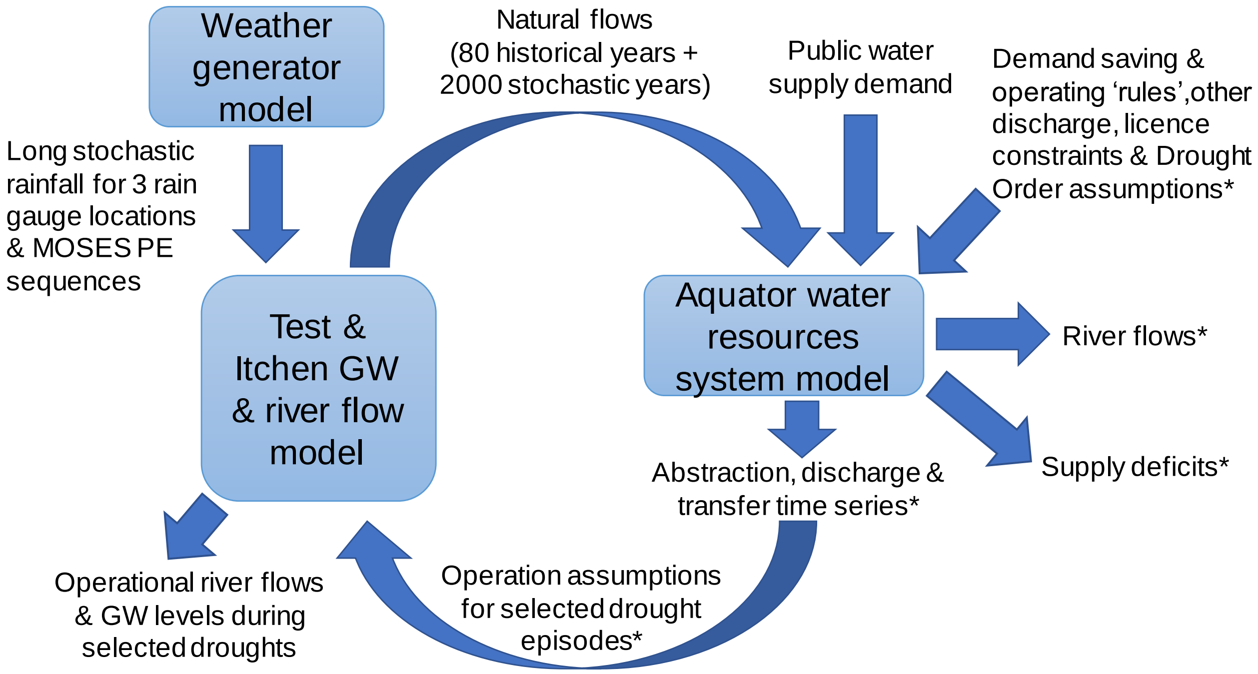
Southern Water's Aquator model was developed for the Water Resources Management Plan (WRMP) 2014 and has been refined during 2017 for use in Southern Water's draft WRMP19 and draft Drought Plan 18. It has further been updated following the Hampshire Abstraction Licences public inquiry held in March-April 2018. Aquator is an industry standard tool for modelling water demand, abstractions, river flow and water supply deficits.

The Test and Itchen groundwater model (pre-MODFLOW 6 version[11]) has been applied to a range of water resources investigations by both the Environment Agency and Southern Water over recent years. Although there are some differences between the modelled behaviour and observations, the model is accepted as the best available tool for assessing the complex relationships between climate, abstractions, groundwater levels and flows.

A schematic summarising the key inputs, outputs and relationships between the two models is shown in Figure 6.

[11] The Environment Agency delivered a new MODFLOW 6 version of the model in March 2020 and there is an on-going Water Industry National Environment Programme (WINEP) investigation. This Testwood EAR will be updated post-Summer 2022 to consider the investigation outputs.

Figure 6 Inputs and outputs from the Test and Itchen groundwater model and the Aquator model



*Model runs use predictive scenario abstractions, discharges, licence conditions, demand constraints and drought order availability rules, assuming current public supply demands (e.g. with 'drought orders' or 'without drought orders'). Predicted environmental impacts come from the differences between runs (e.g. 'with drought orders' minus 'without drought orders')

In-line with the approach taken for the draft WRMP19, a stochastically-generated climate sequence has been used to help assess potential water demand and supply balances and environmental impacts under more severe and extreme droughts. To generate naturalised flows for the Aquator model (as shown in Figure 6), two climate sequences (generated using MOSES PE data) were simulated in the Test and Itchen groundwater model (run 178):

- An 80-year historical period from 1918 to 1997
- A 2000-year stochastic sequence

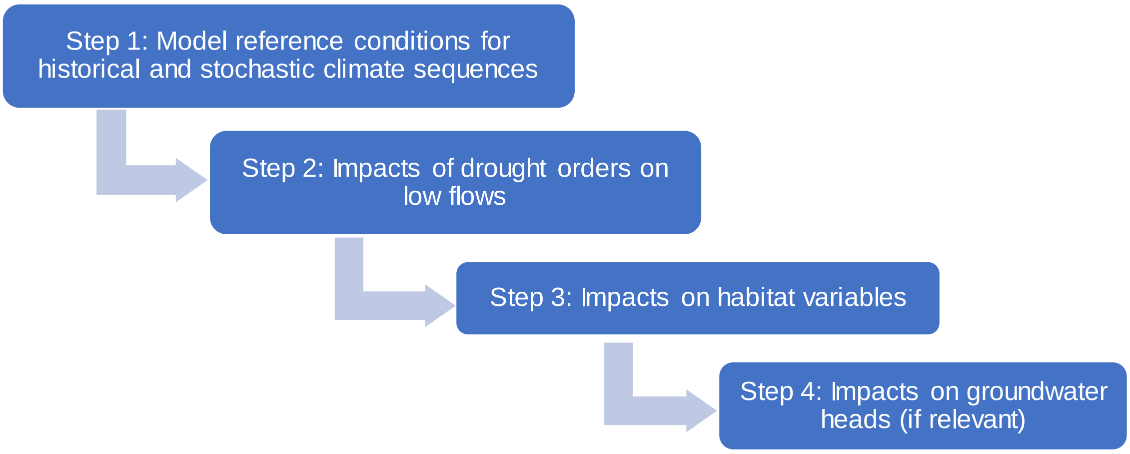
The Aquator model has then been used to assess the impacts of the Stage 0.1 Drought Order. For this drought option, which has no significant groundwater connectivity, there is no requirement to complete the cycle described in Figure 6 back to the Test and Itchen groundwater model.

The hydrological assessment has been conducted by comparing two scenarios; a scenario with all drought permits and orders available (referred to here as the 'drought permit/order scenario') with that of a 'reference condition' - the situation that would occur during a drought but without the drought permit/orders in place. The drought order/permit scenario assumes all the Lower Test and Itchen drought options can be utilised, namely: Testwood Surface Water Drought Permit and order, Candover drought order, Gaters Mill drought order and SWS Lower Itchen drought order.

There is no Aquator model run with only the Testwood Stage 0.1 Drought Order in place. However, because it is the first drought permit/order action to be sought for the Test and Itchen, the frequency, duration and timing of flows falling below the TTF HoF of 355 Ml/d can be easily extracted from the model run which assumes all drought management options can be utilised.

The main steps in the hydrological impact assessment are summarised in Figure 7. Additional details of the modelling tools and approach are set out in a separate method statement.

Figure 7 Main steps in hydrological impact assessment



B.3.1.1. Model uncertainty

As noted in the Statement of Common Ground on Modelling for the 2018 Inquiry[12] "the modelled river flows are subject to considerable uncertainty". These uncertainties include but are not limited to:

1. **Gauged records** that have been used to calibrate the Test and Itchen groundwater model. This is pertinent to the River Test which is affected by flow splits some of which are ungauged.

2. Following calibration of the model, which leaves remaining uncertainties relative to the gauged records, a process of **naturalisation** is required with respect to the abstraction and discharges occurring at the time – a process which is associated with uncertainties.

3. Assumptions in **the weather generator** that is used to generate stochastic rainfall inputs for longer term (2000-year) sampled inputs to the Test and Itchen groundwater.

4. **Potential evapotranspiration** inputs to the Test and Itchen groundwater model that are used to generate naturalised flow time series for input to the Aquator model. The differences between flows predicted by the PENSE and MOSES potential evapotranspiration assumptions (as discussed in the Statement of Common Ground) are an illustration of this.

5. **Aquator is not an operational model** – it responds to pre-defined rules that govern the conditions under which abstraction and other actions are permitted. The rules are necessarily simplifications of the operating procedures that may be followed in practice.

6. **Aquator model flows have not been calibrated** against gauged records because the operation of sources in the historical record will differ from the Aquator scenario assumptions. These differences include licence constraints, demand profiles (based on 2015/16 demands in the current model) drought savings, abstractions, and day-to-day operational decisions.

7. Water Resources Management Plan considers a range of different stochastic years as examples of 1 in 200 and 1 in 500 year drought events. These **example events are selected primarily based on rainfall characteristics not annual minimum low flows**. So if a 2000 year sequence is ranked, i.e. ordered, based on minimum flows, the minimum flow rank

[12] Hampshire Abstraction Licences public inquiry. Statement of Common Ground – Modelling. Southern Water and the Environment Agency, 2018.

(which can be translated into a frequency), would not be expected to match the ordering/frequency based on rainfall analysis.

8. Related to this, **the predictions for any selected event is just one scenario of how flows might respond** in an extreme event, and assumes that all planned operational measures are deployed in a certain way. It is equally possible that flows may follow a different pattern or that operational measures are deployed differently or are more or less effective than anticipated[13].

9. Finally, small changes in flow predictions of a few Ml/d can result in a specific year just triggering – or not triggering a drought permit/order. At the infrequent end of low flows, these **small changes in flow predictions can result in significant changes in apparent frequencies**.

B.3.2 Reference conditions

During any drought, a number of factors determine the 'reference conditions' for river flows. The principal factors are:

- Climate
- Water demand
- Pre-agreed demand restrictions
- The deployable output of sources (taking account of licence constraints); and
- Southern Water's water imports and internal water transfers.

The reference conditions for the Test and Itchen drought permits/orders are based on the new licence constraints in the new abstraction licences issued following the Hampshire Abstraction Licences public inquiry. No drought permit or orders are in operation in the reference condition.

With regards to the Candover Augmentation Scheme drought order, the reference condition assumes that **no** abstraction takes place from the Candover boreholes.

B.3.3 Drought conditions

During drought a number of actions may be taken. The ordering of these have been agreed following the Hampshire Abstraction Licences public inquiry. These are set out in Annex 1 of the section 20 agreement, which has been summarised in this report in Table 1. The sequencing of these actions along with the thresholds these are modelled at in Aquator are detailed in Table 4 (flow thresholds set out in Annex 1 to the Section 20 Agreement are highlighted in this table). The modelled drought scenario assumes all these actions are available once the implementation flow threshold has been reached.

It is important to note that the numerical values for some thresholds are set in order to force a sequencing in Aquator that aligns with the section 20 agreement. For example:

The threshold of 206 Ml/d for TUBS phase 1 ensures that TUBS are implemented prior to Candover drought order (triggered at 205 Ml/d A&H) in the Aquator model. In an operational sense, the use of transfers from Southampton West to Southampton East Water Resource Zones will mean that abstraction can be reduced at Otterbourne to maintain flows above 205 Ml/d and only when the transfer capacity is maximised, and flows continue to fall, will the Candover Drought order be used.

[13] Hampshire abstraction licences public inquiry. Rebuttal proof of evidence of Alison Matthews.

Table 4 Sequencing of drought actions in the drought scenario

Drought stages	s20 Ref	Activity	Implementation flow threshold		Comment / reference to Section 20 agreement
			Test at TTF	Itchen at A&H	
Impending Drought	1	Portsmouth Water Bulk Supply	n/a	Profiled - nominal 1 in~5 annual frequency	Triggered from A&H DTL1. PWBS is also used in preference to transfers when flows are above DTL1 (typically in September).
	2	DSL1 – Advertising	Profiled - nominal 1 in~5 annual frequency		Profiles are developed to with reference to a target level of service. A minimum value ('floor') is applied to the profiles to ensure subsequent sequencing is honoured.
Drought	3	DLS2-1 - TUBs phase 1	356	206	Thresholds are set to ensure TUBS 1 are in before the Test Surface Water Drought Permit (Stage 0.1 Drought Order) and Candover drought order.
	4	Test Surface Water Drought Permit (Stage 0.1 Drought Order)	355	n/a	Trigger specified by section 20 agreement. (As a shorthand, 265 Ml/d is referred to as the drought permit HoF)
	n/a	Internal transfers from Southampton West to Southampton East WRZs	n/a	212	Transfers are enabled at 212 Ml/d to ensure they are available in advance of NEU phase 1 and Candover drought order. A buffer of 7 Ml/d has been applied for modelling purposes.
Severe Drought	5	Apply for DLS3-1 NEU Phase 1	310*	205	Section 20 action 5 is to apply for NEU Phase 1 restrictions. For modelling purposes (only), implementation at 310 Ml/d has been assumed, being half way between the permit and order HoF triggers (355 and 265 Ml/d). The threshold for the Itchen is governed by the Candover drought order trigger.
	6	DLS2-2 TUBs Phase 2	265 (if not already triggered by Itchen at A&H flows)	200	Trigger specified by section 20 agreement
		DLS3-2 NEU Phase 2	265 (if not already triggered by Itchen at A&H flows	200	Trigger specified by section 20 agreement.
		Candover drought order	n/a	205	Trigger specified by section 20 agreement
		Test Surface Water Drought Order	265	n/a	Trigger specified by section 20 agreement. (As a shorthand, 200 Ml/d is referred to as the drought order HoF)
		Gaters Mill drought order	n/a	198	Trigger specified by section 20 agreement.
		Lower Itchen drought order	n/a	198	Trigger specified by section 20 agreement.

DSL - Demand Saving Level. DTL – Drought Trigger Level. TUBS - Temporary Use Bans. NEU – None Essential Use restrictions.
PWBS - Portsmouth Water Bulk Supply.
A&H – Allbrook and Highbridge. TTF – Total Test Flow
20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\Drought Trigger Levels\ProposedDroughtTriggers_v3.0_FINAL.xlsx

B.3.4 Impact on river flow

B.3.4.1. Zone of influence

The Stage 0.1 Drought Order has the potential to impact upon flows in the freshwater reach of the Great Test, between the Testwood abstraction intake and the normal tidal limit (NTL) at Testwood Mill. The reach to the NTL will also be the extent of potential influence of the abstraction on the freshwater water quality, hydraulics, geomorphology and most ecology. There is also the potential for the abstraction to impact on the upstream and downstream migration of salmonids, eel and sea lamprey, including passage through the tidal reach downstream of Testwood Mill (e.g. through the tidal reedbeds). Changes to the freshwater flow inputs to the estuary are also important and may have effects on estuarine features and species in the Test estuary. Appendix D provides the assessment of the ecological effects of the Stage 0.1 Drought Order.

The Stage 0.1 Drought Order assumes the Coleridge Award split at the Little Test–Great Test divide as per the agreement of 1831, and therefore the Stage 0.1 Drought Order will not directly alter flows on the Little Test. The operation of the Coleridge Award split does not influence TTF. The Middle Test is entirely tidal and any impacts on this water body will be negligible. The Wirehouse streams system, fed from an offtake from the Great Test that takes flow across to the Little Test is ungauged and is controlled by a sluice (kept locked open), and these streams provide an important aquatic habitat.

The potential impact that the Stage 0.1 Drought Order would have on flow in the River Test has been assessed by comparing the reference condition flows to those predicted with the Stage 0.1 Drought Order in place. To do this, the assessment has considered both the historical and stochastic flow timeseries generated from the Southern Water Aquator model runs DP1009_h (without drought permits/orders) and DP1008_h (with drought permits/orders) and focused on two historical and four stochastic drought periods representing varying degrees of drought severity. As set out above, the drought order scenario also includes the option to utilise the Test Surface Water Drought Order, when flows drop below 265 Ml/d. However, this assessment is focused on the Stage 0.1 Drought Order impacts only – i.e. when flows are between the licence HoF (355 Ml/d) and the drought permit HoF (265 Ml/d).

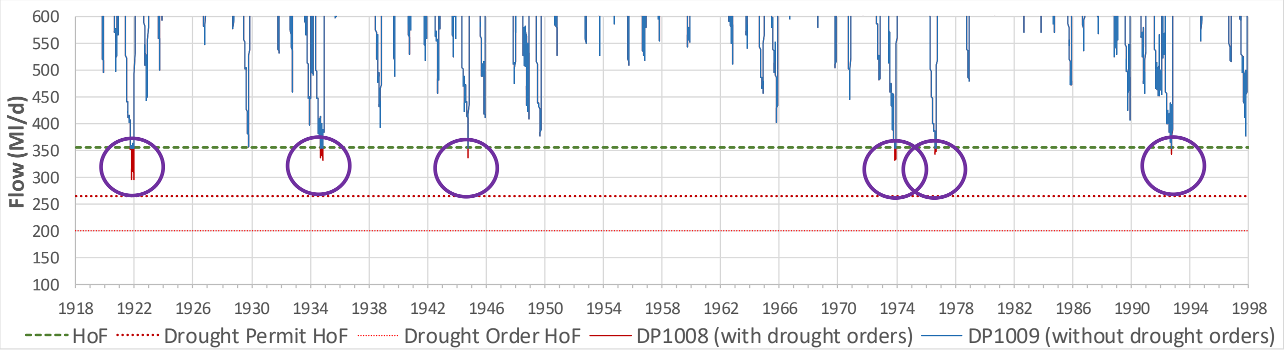
The primary flow location used in this assessment is the licence HoF location at the TTF. Note, although the HoF location is within the tidal extent, Aquator is a water balance model and therefore does not represent the tidal regime; the calculation of flows at this location are effectively equivalent to those prescribed by the licence (Table 4).

B.3.4.2. Historical context

Figure 8 provides an initial indication as to the likely scale and frequency of flow impacts associated with the Stage 0.1 Drought Oder under historical climate conditions (1918 – 1997). The figure plots the modelled daily mean historical flows at the HoF location with and without the Stage 0.1 Drought Order and order in place.

From Figure 8 it can be seen that, over the modelled 80 year historical flow period, there are six occasions where flow falls beneath the Testwood HoF (355 Ml/d) and the Stage 0.1 Drought Order would be required to enable Southern Water to continue abstracting to maintain public water supplies. This highlights that this Stage 0.1 Drought Order is required with reasonable frequency. The minimum flow occurs in 1921 when flow drops to 295 Ml/d, 64 Ml/d beneath the licence HoF.

Figure 8 Impacts on daily mean flows at TTF HoF location - historical time series (1918 - 1997)



Model run output – DP1008_h and DP1009_h

Purple circles highlight the lowest flows over the historical flow record period

20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\Model output\DP1008vsDP1009 analysis.xlsx

B.3.4.3. Analysis of example drought events

For the Stage 0.1 Drought Order, six selected drought events have been evaluated. The stochastic data series includes events of greater severity and duration than observed in the historical record and from this record four drought periods that have been used in Southern Water's draft Water Resource Management Plan 2019 (WRMP 2019) to represent 1:200 and 1:500 year drought events have been analysed:

- Historical droughts: 1921 and 1976
- Stochastic droughts: 1 in 200: 3594 and 4315; 1 in 500: 2995 and 3260

Summary statistics on the extent and duration of flow impact are presented in Table 5 alongside the public water supply deficits that are predicted to arise without any of the section 20 drought permits or orders in place.

As noted previously, there is no Aquator model run with only the Stage 0.1 Drought Order in place. However, because it is the first drought permit/order action on the Test and Itchen, the frequency, duration and timing of flows falling below the TTF HoF of 355 Ml/d can be easily extracted from the model run which assumes all drought permits and orders are in place.

The two key points to note in Table 5 are:

- The flow data shown in brackets are the flow that would occur without the Stage 0.1 Drought Order in place on the equivalent day to the minimum flow with the Stage 0.1 Drought Order, thereby indicating the impact of the drought permit on minimum river flows.
- For one of the 1:200 year events and both the 1:500, the Test Surface Water Drought Order is also required to maintain supplies, and therefore the modelled minimum flow during the drought event is lower than drought permit HoF (265 Ml/d). These numbers, along with the equivalent minimum flow without the drought orders in place, are shown in grey italics in Table 5. The impact of these lower flows is covered by the Test Surface Water Drought Order environmental assessment

The Stage 0.1 Drought Order is required with an approximate frequency of 1 in 20 years. The magnitude and duration of flow impact is related to the drought severity and will vary over the course of the drought. The maximum modelled impact of the Stage 0.1 Drought Order is ~ 80 Ml/d, this is slightly higher than the maximum modelled Testwood abstraction during droughts of 76 Ml/d, the difference being due to changes in upstream abstraction. However, even during these more severe droughts this maximum degree of impact is not sustained throughout the whole drought period, as shown in Figure 9 to Figure 14. In terms of duration, the droughts analysed indicated a potential duration of between two and nine months when flow would be lower than 265 Ml/d. The longer duration droughts, and those with longer periods of maximum impact, are those that also require a Test Surface Water Drought Order to be in place.

During the more extreme droughts (1:200 and 1:500 year events) the modelling results indicate that, even without the Stage 0.1 Drought Order and order in place, river flows would drop beneath the licence HoF (355 Ml/d).

Table 5 Balance of low flows at HoF location and public water supply deficits

	River Test low flows with (without) Stage 0.1 Drought Order			Public Water Supply deficits without any s.20 permit or order in place	
	Minimum flow (Ml/d)	Duration below 355 HoF (days)	Months below 355 HoF	Maximum deficit (Ml/d)	Duration of deficit (days)
Historical flow sequence					
1921/22	295 (355)	81 (9)	Oct – Jan	56	72
1976	343 (355)	24 (1)	Aug - Sept	12	23
Stochastic flow sequence					
~1:200 (yr 3594)	301 (355)	62 (1)	Sept - Oct	46	54
~1:200 (yr 4315)	265 (345) *256 (335)*	103 (32)	June - Oct	89	99
~1:500 (yr 2995)	265 (346) *213 (294)*	252 (168)	Apr – Dec	119	250
~1:500 (yr 3290)	265 (265) *225 (305)*	254 (87)	April – December	128	245

*Deficits without the Stage 0.1 Drought Order and all the preceding/ subsequent drought actions as set out in Table 4

Grey text indicates example droughts where the Test Surface Water Drought Order is required

Statistics from model runs DP1008_h and DP1009_h (without drought orders and with Test and Itchen drought orders, respectively)

20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\Model output\DP1008vsDP1009 analysis.xlsx

Figure 9 to Figure 14 provide time series information for the three selected droughts which result in use of the Stage 0.1 Drought Order. Three year periods are shown so that the lead-in and recovery from the drought can be seen.

The figures show a lot of information so that the relationships between features such as flow in the River Test and Itchen, abstractions, bulk supplies, transfers and savings can be seen. The graphs on the left show the scenario with drought actions in place (following the sequence and rules shown in Table 4) and the right-hand graph shows the scenario without permits and orders.

From the detail that is provided, the main information to take from the two paired graphs is:

- From the left-hand graphs – the timeline summary at the bottom.
- From the right-hand graph – the large deficits that arise as abstraction is cut back due to licence constraints.

As noted previously, droughts can evolve in very different ways and this has a profound effect on the timing and sequence of actions and the droughts shown here are just examples. Although the timing of application for drought permits and orders is not relevant to the environmental assessment, an indicative timing for application of the Stage 0.1 Drought Order is included for reference. This is based on an application flow in the order of 450 Ml/d for TTF (derived from analysis of model data and inspection of the ‘DG100’ estimated record for TTF).

The key sequence of actions for each drought are show in the timeline summary. As an example, the timeline for the 1 in 200 year stochastic drought 4315 Figure 12 is summarised below.

1. This drought develops quite rapidly during the latter part of 4314. There is a is a significant recovery following rainfall in November 4314 following which the drought develops through to October 4315.

2. In September 4314 it would have been necessary to apply for the Stage 0.1 Drought Order to have the permit in place for implementation in October 4314. In this example, the permit would only have been required for a brief period.

3. In April 4315 the Stage 0.1 Drought Order would have lapsed having been in-place for 6 months. Flows had risen well above 500 Ml/d at TTF, but as flows fall to ~450 Ml/d again a new application would be needed in May 4315.

4. In June 4315 the Testwood permit is implemented again at a TTF flow of 355 Ml/d.

5. In June 4315 Allbrook and Highbridge flows fall close to 205 Ml/d. The Portsmouth Water bulk supply is already at maximum capacity so transfers from Southampton West to East water resource zones are utilised as required to allow Southern Water’s Lower Itchen sources to be reduced and hence maintain flows above the Candover drought order trigger of 205 Ml/d.

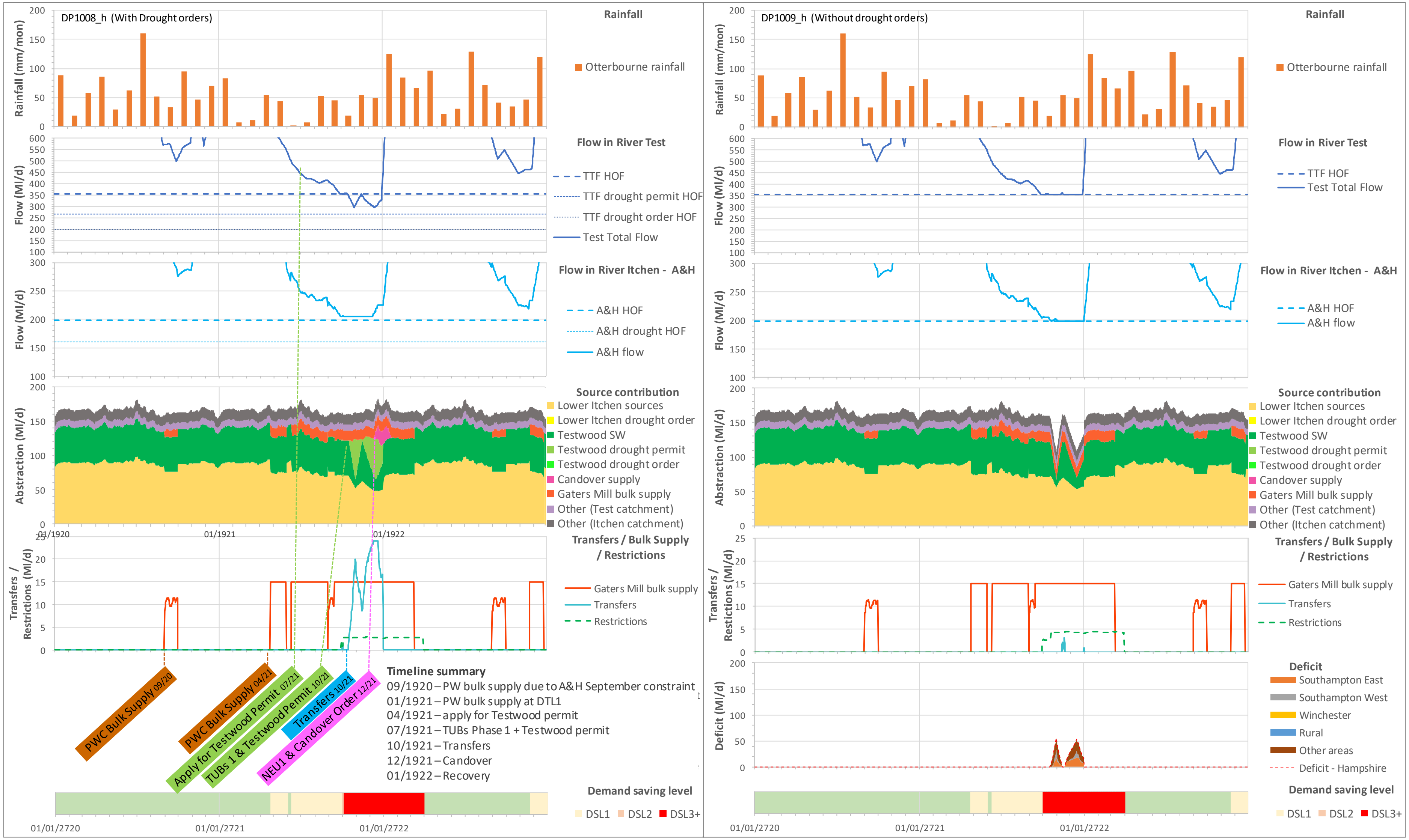
6. In September 4315 the drought progresses. With the bulk supply and transfers at maximum capacity the Candover drought order is implemented. Application would have been required several months before.

7. Also in September 4315, TTF had fallen to 265 Ml/d so the Test Surface Water Drought Order would have been implemented. As for Candover, application would have been required several months before.

8. In October 4315 flows recover rapidly in response to rainfall.

Figure 9 Flows and drought actions during 1921/22

Model results from DP1008_h and DP1009_h



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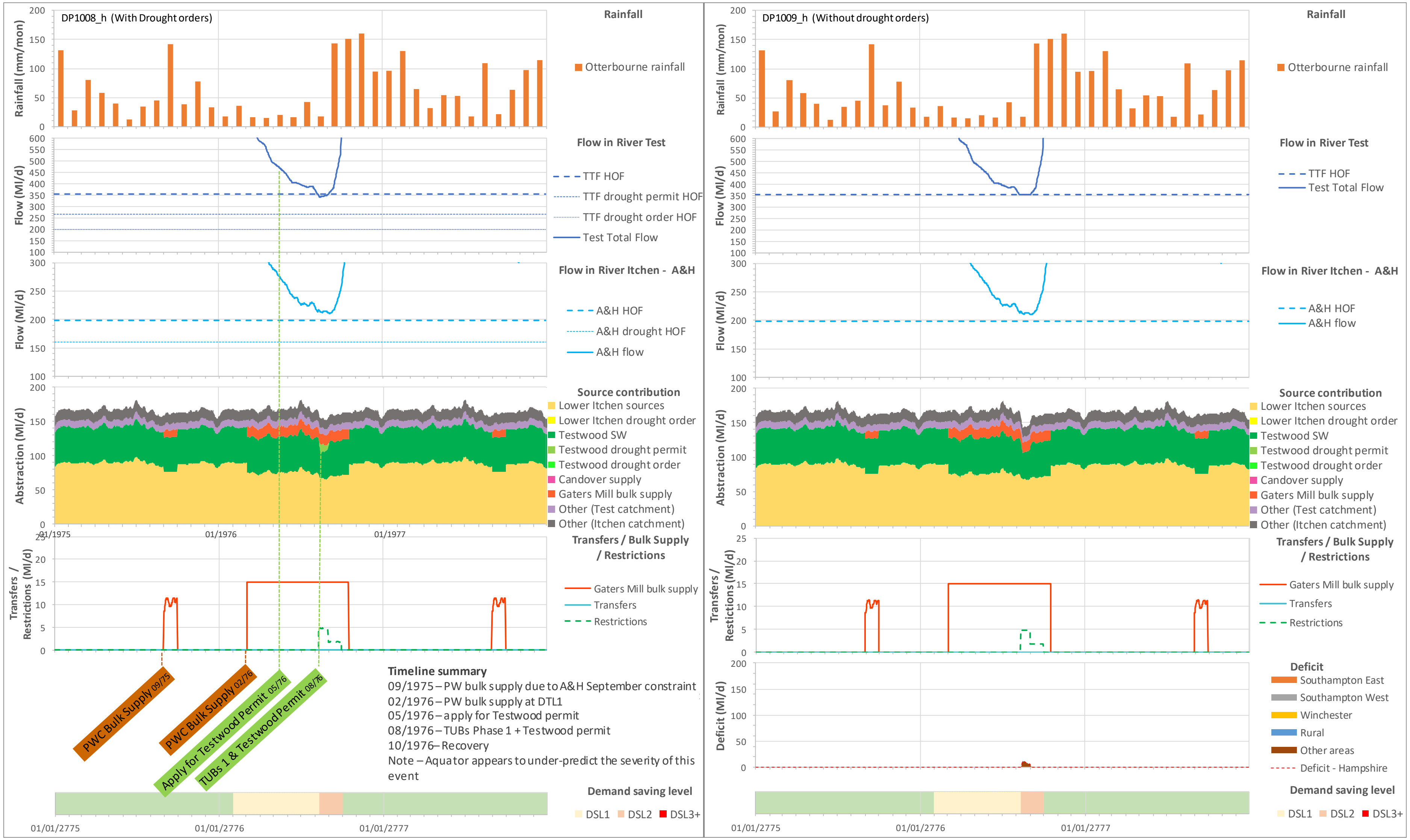
\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\EARs

Figure 10 Flows and drought actions during 1976

Model results from DP1008_h and DP1009_h

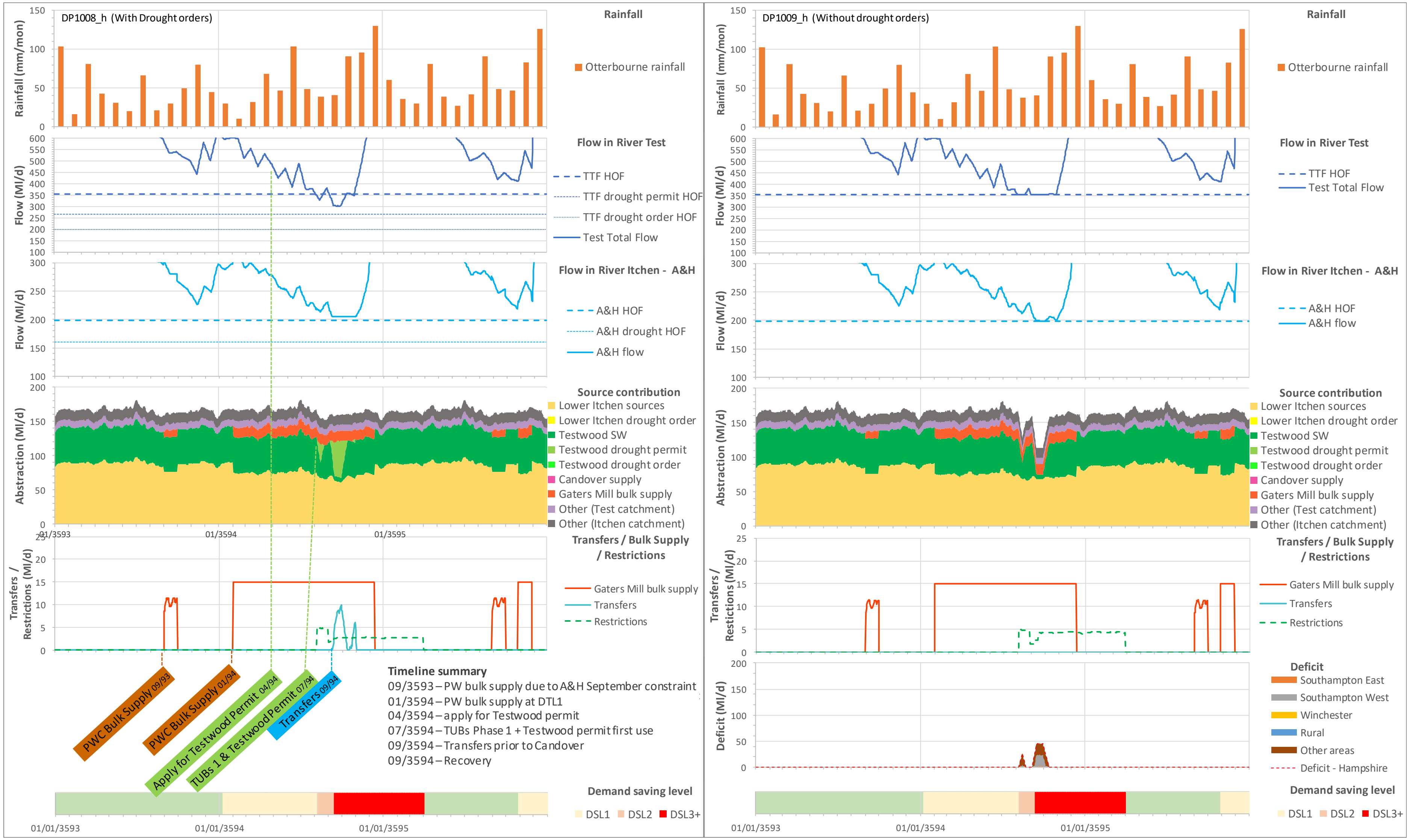


\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\EARs\Timeseries plots_v2.2.pptx

\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\EARs

Figure 11 Flows and drought actions during stochastic year 3594 (~1:200 year event)

Model results from DP1008_h and DP1009_h

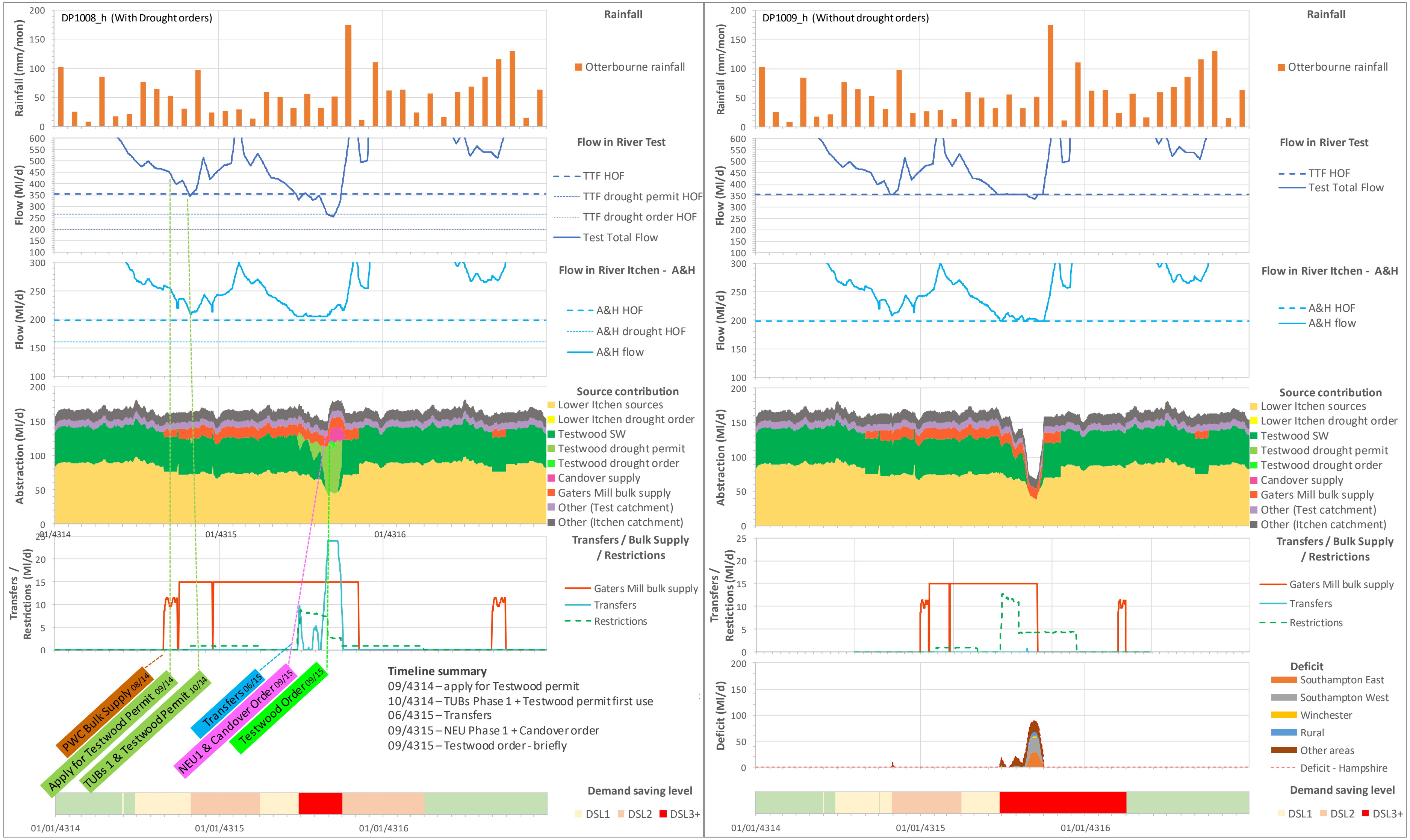


\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\EARs\Timeseries plots_v2.2.pptx

\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\EARs

Figure 12 Flows and drought actions during stochastic year 4315 (~1:200 year event)

Model results from DP1008_h and DP1009_h

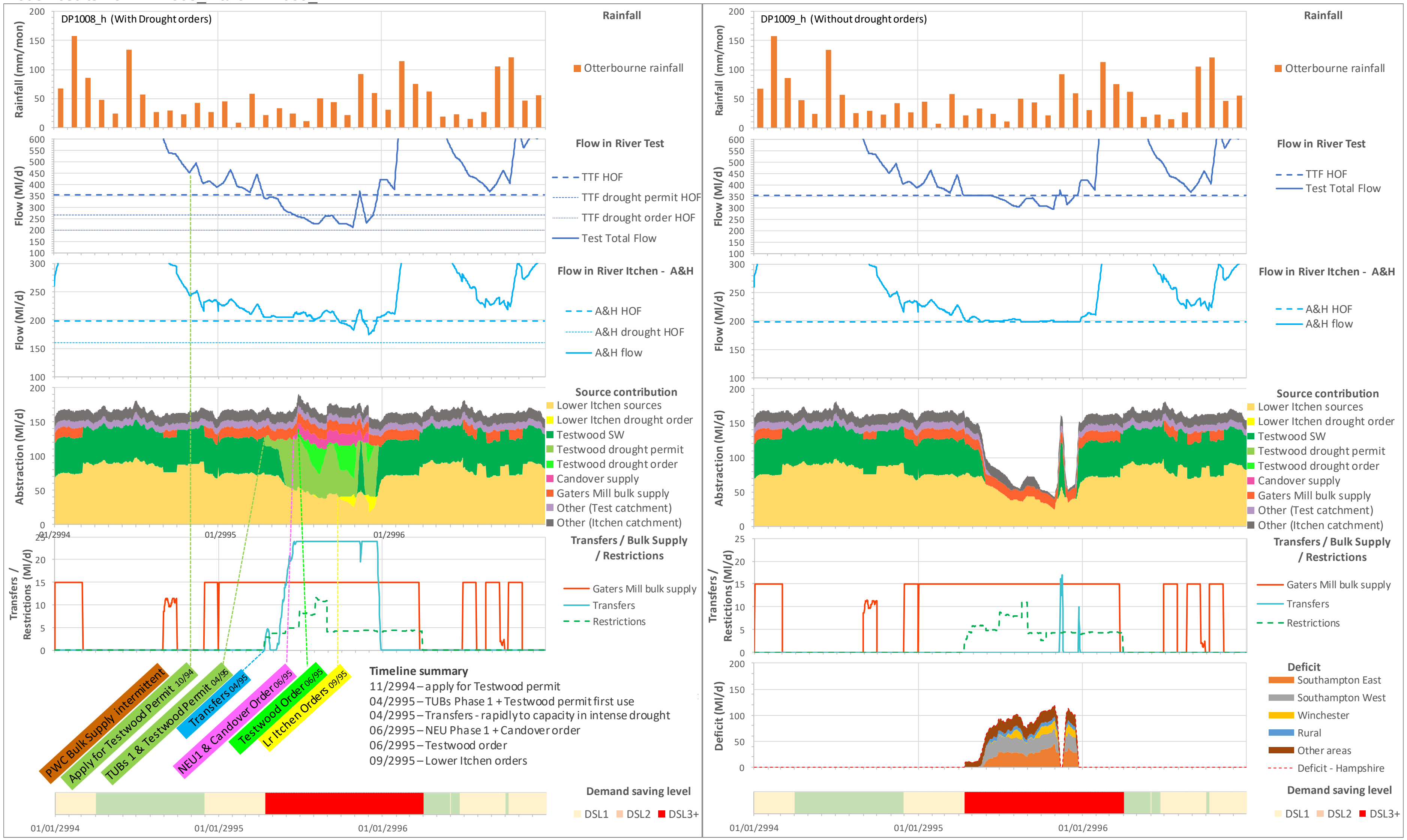


\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\EARs\Timeseries plots_v2.2.pptx

\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\EARs

Figure 13 Flows and drought actions during stochastic year 2995 (~1:500 year event)

Model results from DP1008_h and DP1009_h



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\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\EARs

Figure 14 Flows and drought actions during stochastic year 3290 (~1:500 year event)

Model results from DP1008_h and DP1009_h

\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\EARs\Timeseries plots_v2.2.pptx

\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\EARs

B.3.4.4. Relationship of flow impact and drought severity

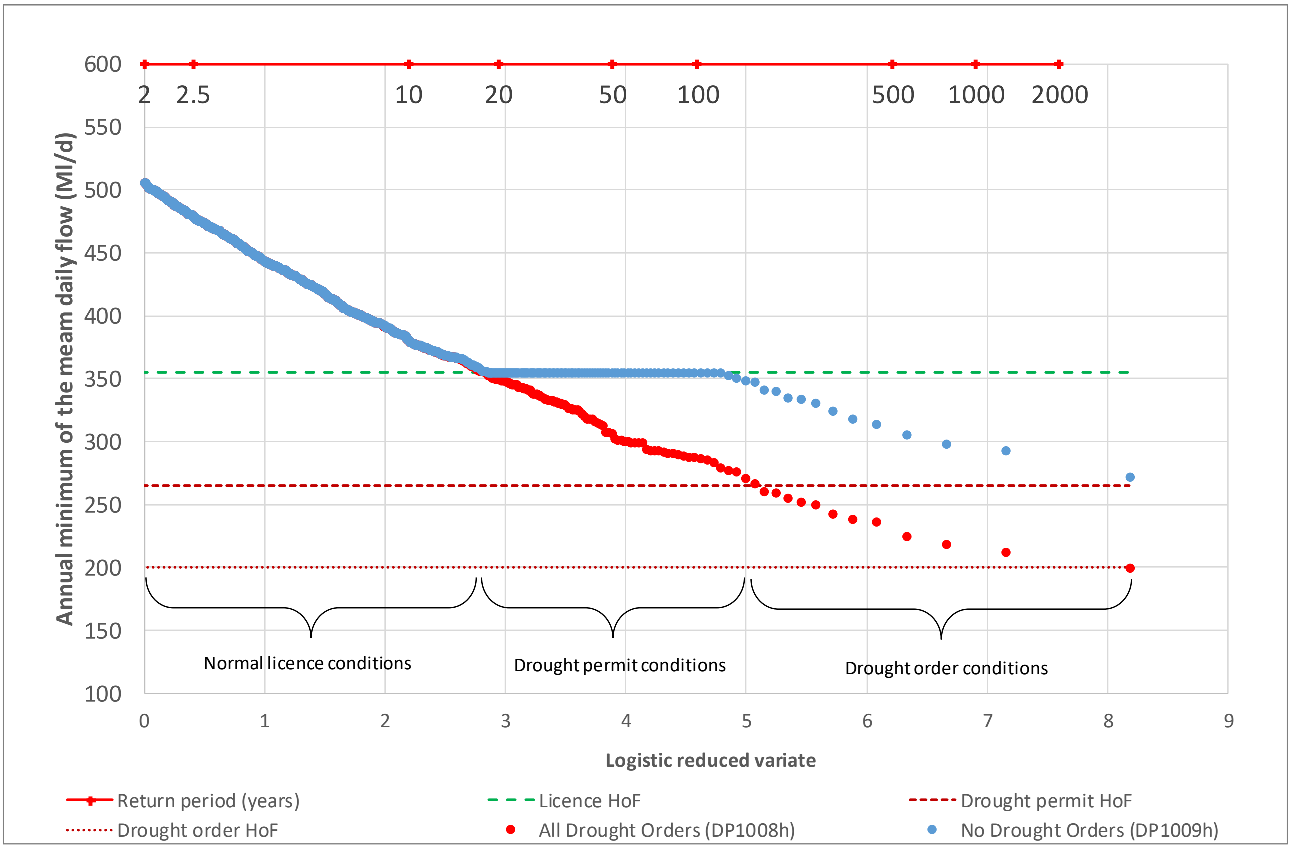
Whilst the above assessment considers discrete example drought return periods, Figure 15 examines the relationship between maximum river flow impact and frequency.

Figure 15 plots the annual minimum flows at the TTF HoF location, as calculated from the daily mean Aquator model flow output, for the two model scenarios (with and without drought permits/orders), from the stochastic time sequence. The Y axis has been translated to flow frequencies, plotted in red along the top. The licence HoF (355 Ml/d), Testwood Surface Water Stage 0.1 Drought Order HoF (265 Ml/d) and Testwood Surface Water Drought Order HoF (200 Ml/d) are shown.

Figure 15 shows that there is no difference in minimum flows at frequencies of less than ~1:20 years. Beyond this, with the Test Surface Water Stage 0.1 Drought Order, and then the Test Surface Water Drought Order, in place, abstraction is allowed to continue so the annual minimum flow continues to decrease. The annual minimum flow tends to drop beneath 355 Ml/d at an approximate frequency of 1:20.

Under reference conditions (i.e. with no drought permit/order in place), the licence HoF constrains abstraction from Testwood, maintaining flow at 355 Ml/d until approximately a 1:125 year return period. Beyond this, Testwood abstraction has been constrained to zero. Even so, flows then fall below the licence HoF of 355 Ml/d.

Figure 15 Annual minimum flows (daily mean) at HoF location under the stochastic climate



Model results from DP1008_h and DP1009_h

\20151566 SWS MWH\20170884 S Hants Inquiry\7 WIP\7_04 Aquator\FFC_FDC\Run comparisons\DP100X_v0.1.xlsx

B.3.4.5. Frequency and seasonality of drought permit/order implementation

Frequency of implementation

The frequency of implementation of the Stage 0.1 Drought Order is set out in Table 6, along with the other drought order options. For additional explanation of the flow thresholds – see Table 4. The Stage 0.1 Drought Order is anticipated to be required during drought events, with a frequency of approximately 1 in 20 years.

Table 6 Frequency of drought actions implementation in the drought scenario

<table>
<tr><th rowspan="2">Drought stages</th><th rowspan="2">s20 Ref</th><th rowspan="2">Activity</th><th colspan="2">Implementation flow threshold</th><th rowspan="2">Annual frequency of implementation (on average)</th></tr>
<tr><th>Test at TTF</th><th>Itchen at A&H</th></tr>
<tr><td rowspan="2">Impending Drought</td><td>1</td><td>Portsmouth Water Bulk Supply</td><td>n/a</td><td rowspan="2">Profiled - nominal 1 in~5 annual frequency</td><td>n/a</td></tr>
<tr><td>2</td><td>DSL1 - Advertising</td><td>Profiled - nominal 1 in~5 annual frequency</td><td>1 in ~5</td></tr>
<tr><td rowspan="3">Drought</td><td>3</td><td>DLS2-1 - TUBs phase 1</td><td>356</td><td>206</td><td>1 in ~10 - 20</td></tr>
<tr><td>4</td><td>Test Surface Water Drought Permit (Stage 0.1 Drought Order)</td><td>355</td><td>n/a</td><td>1 in ~20</td></tr>
<tr><td>n/a</td><td>Internal transfers from Southampton West to Southampton East WRZs</td><td>n/a</td><td>212</td><td>1 in ~20</td></tr>
<tr><td rowspan="3">Severe Drought</td><td>5</td><td>Apply for DLS3-1 NEU Phase 1</td><td>310*</td><td>205</td><td>1 in ~20</td></tr>
<tr><td rowspan="2">6</td><td colspan="4">Apply for / implement the following measures in line with the provisions of the Section 20 Agreement Annex 1</td></tr>
<tr><td>Candover Drought Order

Itchen at A&H flow threshold: 205 Ml/d

Annual frequency of implementation (on average)

1 in ~60-80 years</td><td>Test Surface Water Drought Order

Test at TTF flow threshold: 265 Ml/d

Annual frequency of implementation (on average)

1 in ~150 – 180 years</td><td>Implement DLS2-2 TUBs Phase 2 and DLS3-2 NEU Phase 2

Itchen at A&H flow threshold: 200 Ml/d and/or Test at TTF flow threshold: 265 Ml/d

Annual frequency of implementation (on average)

1 in ~100 years</td><td>Lower Itchen and Gaters Mill drought order

Itchen at A&H flow threshold: 198 Ml/d

Annual frequency of implementation (on average)

1 in ~200-300 years</td></tr>
</table>

Model results from DP1008_h
\20151566 SWS MWH\20161205 SWS Drought Plan\7 WIP\8_Revisions\Drought Trigger Levels\DP1008 Return Frequencies V2.xlsx

Seasonality of implementation

Table 7 details the percentage of months from the 2000 year stochastic record where flow is less than key trigger flows; the normal licence HoF (355 Ml/d), the Testwood Surface Water Stage 0.1 Drought Order relaxed HoF (265 Ml/d) and the Testwood Surface Water drought order relaxed HoF (200 Ml/d). This indicates that the drought order is more likely to be required during August to October, but this period may be extended into the summer and winter.

Table 7 Seasonality of low flows

Percentage of months less than:	January	February	March	April	May	June	July	August	September	October	November	December
355 Ml/d	0.6	0.3	0.3	0.3	0.4	0.5	0.8	1.3	2.6	3.7	3.3	1.7
265 Ml/d	0.1	0.0	0.1	0.0	0.1	0.2	0.2	0.3	0.5	0.3	0.2	0.2
200 Ml/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Percentage of months in the 2000 year stochastic record

20151566 SWS MWH\20170884 S Hants Inquiry\7 WIP\7_04 Aquator\Results\DP2018\DP1008\Processed output\DP1008_h Test flow summary.xlsx

20151566 SWS MWH\20170884 S Hants Inquiry\7 WIP\7_04 Aquator\Results\DP2018\DP1009\Processed output\DP1009_h Test flow summary.xlsx

B.3.4.6. Common Standards Monitoring Guidance assessment

The Joint Nature Conservation Committee (JNCC) Common Standards Monitoring Guidance (CSMG) methodology defines the minimum set of common standards required to consistently monitor the condition of features of interest in designated conservation sites (SACs and SSSIs) to help in their conservation and preservation. Flow targets are one component of a CSMG assessment[14]. Given that the River Test is designated as a SSSI, Natural England expects that a CSMG assessment should ordinarily be considered for river flows as well as water quality (as discussed later in this report under the Water Quality section).

A draft consultation document of Definitions of Favourable Condition for the River Test was issued in February 2018[15]. This document sets out the features found in each unit of the SSSI and the favourable condition targets for each of the features. With regard to flows, the site-specific targets are the same as the CSMG targets and relate to maximum deviations from daily naturalised flows. The targets for Unit 91 are summarised in Table 10 and shown in full in Annex 1 of Appendix D.

Table 8 Natural England favourable condition targets for flows in River Test SSSI units 85-91

Flow condition	<Qn95 low	Qn95 to Qn50 low – moderate	Qn50 to Qn10 moderate to high	>Qn10 high
Maximum deviation from daily naturalised flow	10%	15%	20%	10%

The River Test is braided at the location of Testwood abstraction and subject to upstream flow diversions. In addition, gauged records are incomplete. As a result, it is not straight forward to calculate naturalised flows and apply the Favourable Condition Table (FCT)/CSMG targets in a normal manner. In 2017 the Environment Agency stated[16]:

[14] JNCC (2016) Common Standards Monitoring Guidance for Rivers. September 2016.
[15] Natural England (2018) Definitions of Favourable Condition: River Test - Consultation Draft February 2018
[16] Appendix D of Environment Agency, 2017. Restoring Sustainable Abstraction, Licence Change Proposal Report

"the CSM targets assume the calculation of naturalised flow takes account of flow splits so all channels should be assessed using extant monitoring data and derivations of flow split information. The data available on flows on the Test are not in the format which the Environment Agency or Natural England can calculate compliance with CSM flow targets. For Unit 91 below the natural hydraulic tidal limit due to outstanding information and queries relating to emerging licence conditions for the large water company abstraction and lack of a clear river restoration for this part of the unit, lack of clarity around the applicability of freshwater targets to tidal sections, it was agreed that setting flow targets below the natural hydraulic tidal limit Unit 91 will await resolution of water resource and river restoration planning."

Notwithstanding these complexities, Natural England have requested that consideration is given to the FCT/CSMG targets as part of this assessment. The FCT/CSMG targets apply to the whole river, not an individual river or stream. If the FCT/CSMG targets were to be applied to the Test Total Flow (TTT - as defined in the Testwood abstraction licence), it is likely, under a range of assumptions, that abstraction from Testwood would comprise more than 10% of daily 'natural' flow in some low flow years. Based on initial analysis it is also considered highly likely that flows will already be below the FCT/CSMG targets when the Stage 0.1 Drought Order comes into operation at the TTF HoF of 335 Ml/d. Further modelling work is required to assess the drought permit flow conditions against the FCT/CSMG targets, as explained below.

The Environment Agency has commented that *"the data available on flows on the Test are not in the format which the Environment Agency or Natural England can calculate compliance with CSM flow targets".* As just one example of the uncertainties and other factors at play, flow through the Broadlands Fish Carrier, which diverts flow around the reach impacted by the Testwood abstraction, is of a similar magnitude to the abstraction (90 Ml/d on average and a Q95 flows of 55 Ml/d - based on gauged records from 30/6/2007 to 14/6/2018). In recognition of these uncertainties, Southern Water has committed to an AMP7 WINEP investigation into flows on the River Test relative to the FCT/CSMG targets. On completion of the AMP7 WINEP investigations, the assessment against FCT/CSMG targets will be updated in this EAR.

B.3.5 Impact on river hydraulics

The assessment in the preceding sections of this report has evaluated daily flows using modelled time sequences from the Aquator model at the TTF HoF location. This section now considers sub-daily flow conditions at multiple locations along the Great Test using output from hydraulic modelling undertaken during 2017 and 2018.

B.3.5.1. Development and use of a hydraulic model

The most effective means of evaluating the relationship between river flow and how it translates into water depth and velocity is to develop a hydraulic model. Such modelling techniques are well established and have been the subject of considerable investment due primarily to their widespread use in the evaluation of flood risk where a high level of accuracy and precision is sought over extended lengths of river and floodplain.

The use of hydraulic modelling software to evaluate lower flows remaining within a river channel is a much more straightforward application of the technology, albeit still with some quite intensive data requirements.

A hydraulic model was developed as part of the NEP Investigation in 2010-12. This covered the reach of the Great Test between the Testwood abstraction and Testwood Mill[6]**.** The model used in the NEP investigation was extended and upgraded in 2017 by Southern Water to extend it to Redbridge and to include the lower reaches of the Little Test, the Middle Test and the lower floodplain. The development of this extended model, and the additional data used to enable its development, is described in a separate report[10]. **However, whilst the modelling approach is**

considered robust, the Environment Agency has reported concerns about the cross-section survey data used in the model, and in particular that the surveys were hindered by weed growth along the river channel which meant that the automatic survey instrument failed to fully capture the channel dimensions accurately. The surveys were also not designed specifically to be applied to a hydraulic model. As a result, the modelling outputs should be treated with caution.

It should be noted that the fishery operating the Testwood Mill structures do not generally alter the penstock and gate settings. These settings were noted and agreed as part of the NEP Investigation and described as “partially open”. While the NEP investigation explored the impact of the gates being “fully open” or “fully closed”, all more recent work has assumed “partially open” as the default setting.

B.3.5.2. Interpreting outputs from the hydraulic model

The use of a hydraulic model in the context of low flow investigations is very different from its use for flood modelling purposes. With the latter, a high level of accuracy and precision is required regarding the duration and height of the flood peak, with model runs focusing in on a matter of hours or a maximum of a few days.

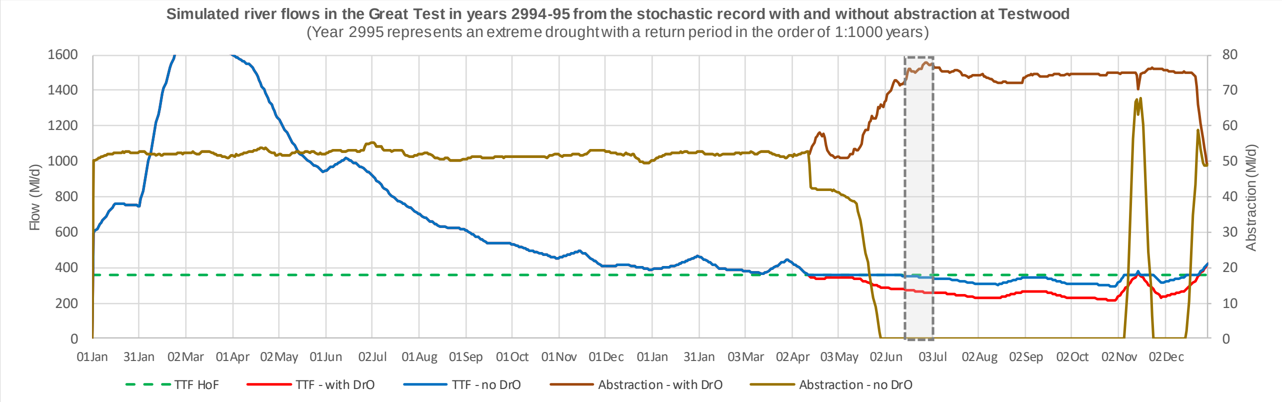
By contrast, while there is no loss of accuracy or precision with a low flow model, the use of the model for habitat assessment is more subtle in its approach and objectives. Ranges of depths and/or velocities over days or weeks (and sometimes seasons), and the relative changes in response to particular scenarios (e.g. low flows with and without abstraction; spring and neap tides) are of greater importance than the absolute values of the outputs. The model outputs can be used to help inform the assessment of the effects of the Testwood abstraction and the Stage 0.1 Drought Order, along with other evidence on hydrology and river habitats.

However, as highlighted above, whilst the modelling approach is considered robust, the Environment Agency has reported concerns about the cross-section survey data used in the model, and in particular that the surveys were hindered by weed growth along the river channel which meant that the automatic survey instrument failed to fully capture the channel dimensions accurately. The surveys were also not designed specifically to be applied to a hydraulic model. As a result, the modelling outputs should be treated with caution. Further consideration will be given, in dialogue with the Environment Agency, as to whether new cross-section surveys should be carried out and the model re-run with the new data. The following sub-sections and the assessment of effects on aquatic ecology in Appendix D should therefore be considered in light of the concerns raised in respect of the cross-section survey data.

B.3.5.3. Assessing the potential impact on water depth and velocity

Figure 16 shows Aquator modelled river flows over a 2 year period for the TTF with and without drought permits/orders (Aquator runs DP1008_h and DP1009_h respectively). The figure also shows the volume being abstracted from Testwood with and without drought permits/orders. These flows, which are extracted from the 2000 year stochastic flow series generated by Southern Water, were used as to derive inflows to the hydraulic model. The model was then run for the 2 year period using a repeating spring/neap tidal cycle as the lower boundary condition at Redbridge. This was derived from the Environment Agency’s gauge data at Eling Mill.

Figure 16 Simulated river flows in the Great and Little Test for the 1:500 year drought



Notes: Based on Aquator model runs DP1008_h and DP1009_h

File: 20162290 AMP6 Testwood Enabling\7 WIP\Lower Test Modelling\Flow data for Hydraulic Model Ver 0.3_Jun18.xlsx

The 2 year period (2994-95) selected from the stochastic record shows the development of an extreme drought. In April of 2994, flows are >1600 Ml/d. This marks the start of an 18 month recession, at the end of which, in October 2995, flows have fallen to around 215 Ml/d (with drought permits/orders) and 295 Ml/d (without drought permits/orders).

Outputs from the model run were extracted for the end of the period covered by the Stage 0.1 Drought Order, just before flow falls beneath 265 Ml/d and the Test Surface Water Drought Order is required to maintain abstraction, as indicated by the grey box in Figure 16. Flows in 2995 are among the most extreme in the stochastic record.

Simulated velocities and depths (with and without abstraction) from this period is shown for four locations in Figure 17. The graphs are plotted on the same scale to ease comparison and the three locations are:

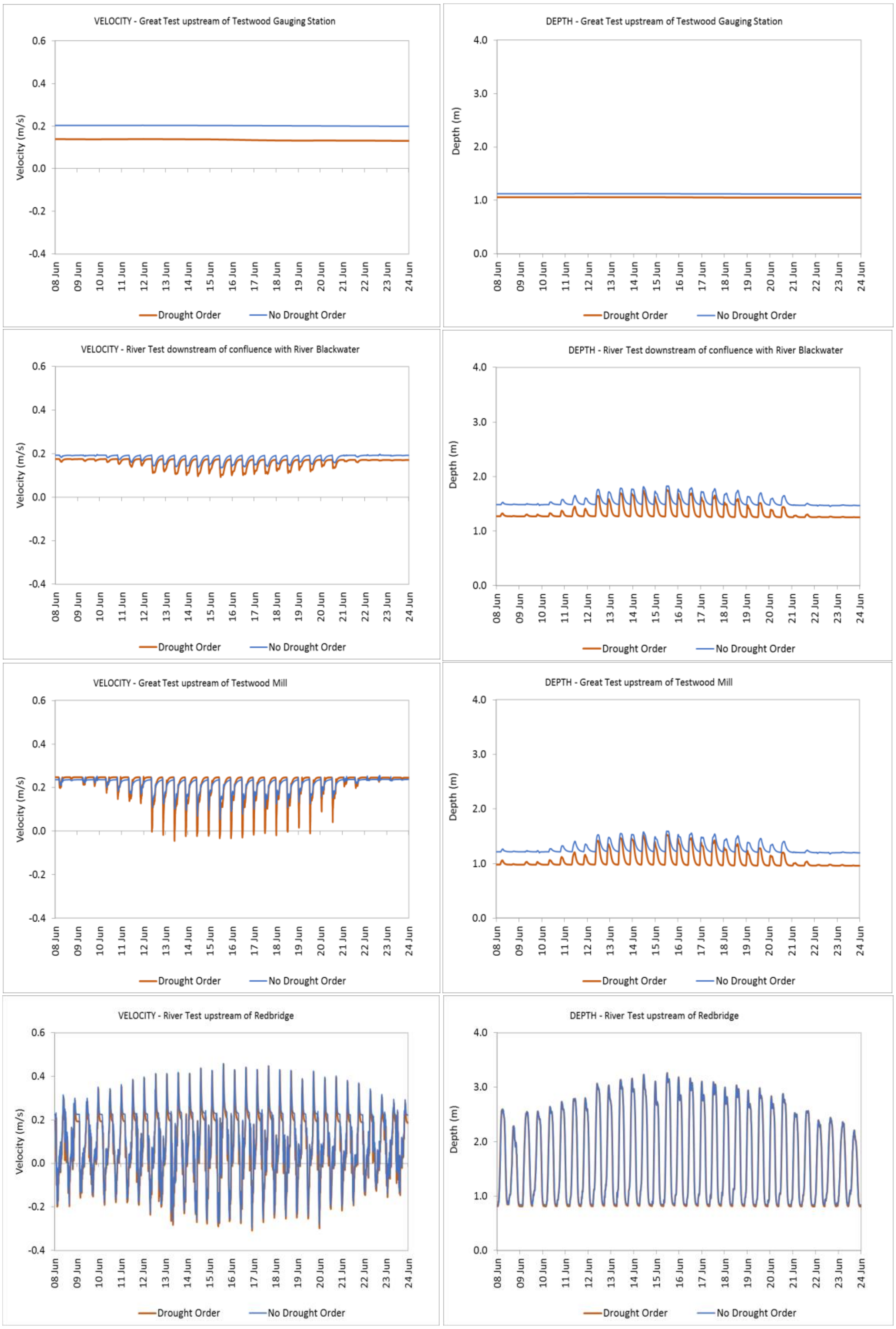
- The Great Test upstream of Testwood gauging station but downstream of the abstraction (cross section reference 38)
- The Great Test downstream of the confluence with the River Blackwater (cross section reference 32)
- The Great Test between the confluence with the River Blackwater and Testwood Mill (cross section reference 12)
- The River Test just downstream of the confluence of the Great and Little Test (i.e. just upstream of Redbridge, cross section Redbridge_P6)

Key features of the velocity and depth regimes shown in these Figures are:

- The progressive increase in the tidal influence moving downstream (i.e. down the page);
- Water depths are maintained around or in excess of 1 m throughout the system but there is uncertainty as to the changes in depths at the margins of the channel due to the data quality issues.
- The effects of the Stage 0.1 Drought Order on the velocity and depth regime at the most extreme low flows compared with the normal abstraction licence conditions when no water would be abstracted. These changes are considered in Appendix D in relation to the effects on different aquatic species and life-cycle stages.
- The data presented in the Figures need to be treated with caution due to the cross-section data concerns outlined above.

Figure 17 Modelled velocities and depths at 4 locations in the lower River Test for the shaded flow period shown in Figure 15.

Velocity *Depth*



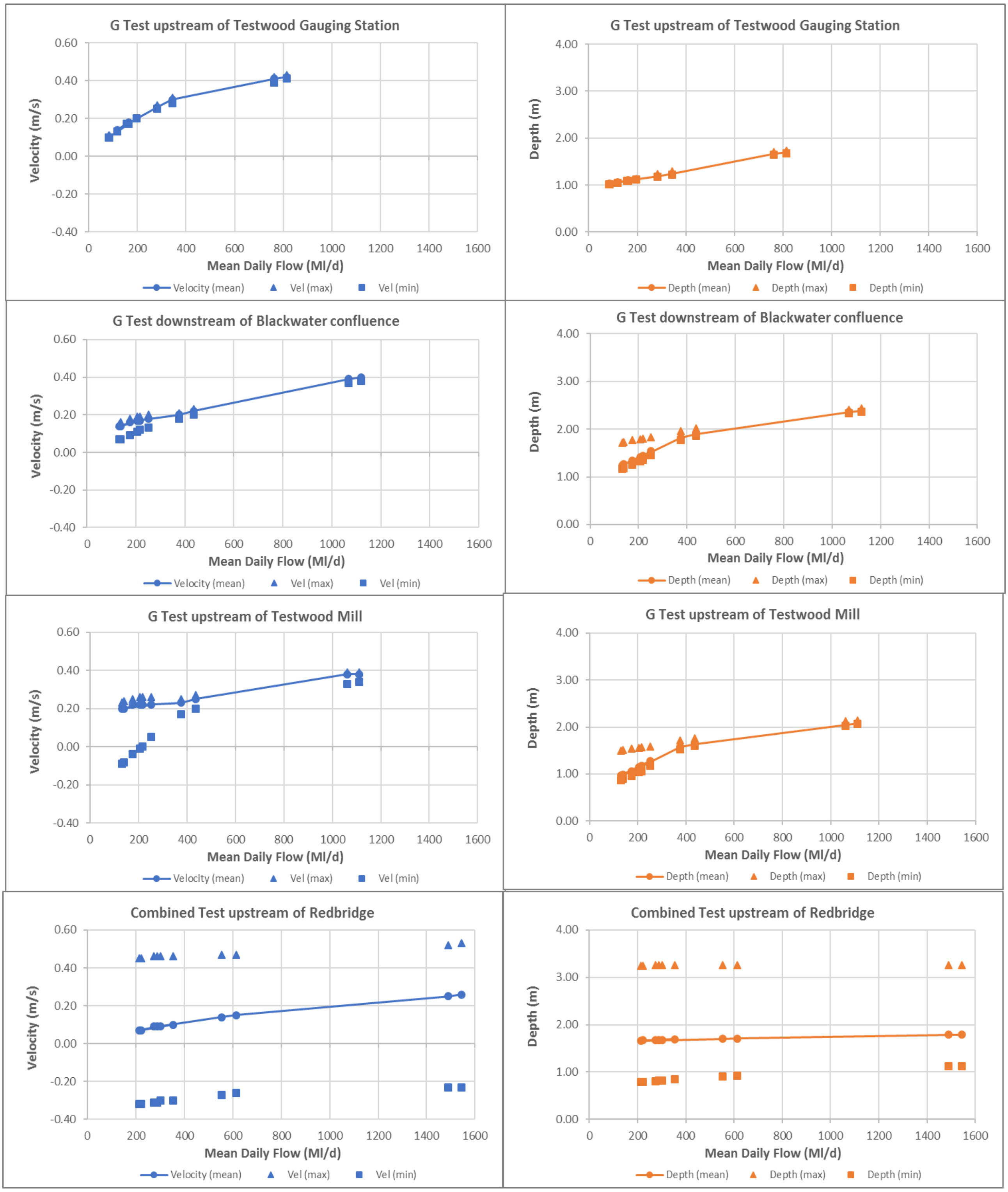
20151566 SWS MWH\20162290 AMP6 Testwood Enabling\7 WIP\Lower Test Modelling\Outputs\Processed Outputs\1 in 500 (2994 & 2995)\Summary plots for Report (Jun 2018).xlsx

Figure 18 shows the relationship of flow to both velocity and depth across the same range of locations presented in Figure 17. Each graph shows the average, minimum and maximum velocity (or depth) over the spring/neap cycle plotted against the flow. A selection of flow inputs, that represent the span of the 2995 year recession, have been run through the hydraulic model to generate these relationships. For example, the flow for October 2995, at the worst point in the drought, is the lowest flow point on the graphs, whereas flow equivalent to April 2994, at the start of the recession, is the highest.

From Figure 18, the impact a reduction of flow (abstraction induced or natural) has on velocity and depth can therefore be observed, although noting the uncertainty identified above in respect of the model outputs. The main observations from Figure 18 are:

- At all locations, the river is deep (>1 m) and slow (<0.4 m/s) in normal summer flow conditions.
- The tidal influence, increasing with distance downstream, is evident through the increasing variation in minima and maxima.
- The rate of change of velocity is slow compared with changes in flow. For example, downstream of the Blackwater confluence, a 50% reduction in flow from 400 Ml/d to 200 Ml/d equates to a change in average velocity from ~0.2 m/s to 0.18 m/s.
- The rate of change of depth is also slow compared with changes in flow. Again, for the example, downstream of the Blackwater confluence, a 50% reduction in flow from 400 Ml/d to 200 Ml/d equates to a change in average depth from 1.8 m to 1.3 m.

Figure 18 Relationship between mean daily flow and mean velocity and depth over a full spring/neap tidal cycle at 4 locations on the Great Test between the Testwood abstraction and Testwood Mill



20151566 SWS MWH\20162290 AMP6 Testwood Enabling\7 WIP\Lower Test Modelling\Outputs\Processed Outputs\1 in 500 (2994 & 2995)\Summary plots for Report (Jun 2018).xlsx

B.3.5.4. Conclusions of the hydraulic modelling assessment

Due to the concerns about the cross-section data quality the hydraulic model outputs have limited applicability but provide a high level understanding of the controls of various structures in the Lower Test on river velocity and depth. In particular, they do indicate the Stage 0.1 Drought Order would lead to a reduction in flow, depth and velocity than would otherwise occur. Further surveys designed specifically for low flow hydraulic modelling and the vegetated channels would be required to improve the quality of the hydraulic modelling and calibration/validation.

B.3.6 Hydrological impact summary

The Stage 0.1 Drought Order seeks to relax the licence HoF (355 Ml/d) to 265 Ml/d. The Stage 0.1 Drought Order will be the first of the five drought permits/ orders for on the Lower Test and Itchen.

The results presented here are primarily based upon modelled data, which are the best available tools to predict drought flows. However, it is noted that, as set out in B.3.1.1, the models do have inherent uncertainty and this should not be forgotten when considering these conclusions.

Frequency and timing

- The Stage 0.1 Drought Order will be required during droughts with a frequency of implementation approximately 1:20.
- The Stage 0.1 Drought Order is more likely to be required during late summer / autumn but could be needed throughout the year.

Impacted reaches

The Stage 0.1 Drought Order has the potential to impact upon flows in the freshwater reach of the Great Test, between the Testwood abstraction intake and the NTL at Testwood Mill. Downstream of the NTL, the hydrological impacts are anticipated to be smaller due to the influence of tidal processes during high tide conditions. The assessment assumes that:

- The Coleridge Award split at the Little Test – Great Test divide is adhered to, and therefore the Stage 0.1 Drought Order will not directly alter flows on the Little Test.
- The operation of the sluice governing flow into Wirehouse Streams is unchanged (i.e. kept locked open, although there is uncertainty as to how this sluice would be operated during implementation of the Stage 0.1 Drought Order in a severe drought) and so there may still be some flow entering the Wirehouse Streams system at the time of implementing the permit (to be confirmed, depending on the invert level of the sluice).
- The Middle Test is entirely tidal and any impacts on this water body will be negligible.

Impact on the Great Test between Testwood abstraction intake and the NTL

- The impact on river flow is dependent on the duration and severity of the drought conditions. The maximum daily flow reduction has been estimated to be ~80 Ml/d.
- Under extreme droughts flows are predicted to fall below the Stage 0.1 Drought Order HoF (265 Ml/d), and the Test Surface Water Drought Order would be required.
- The impacts above are the maximum impact on any day for either of the two 1 in 500 year droughts. For the majority of time over which the Stage 0.1 Drought Order is in operation, impacts are less.
- The lower reaches of the River Test are influenced by the tidal cycle: at high tide, the tidal signal influences both velocity and depth.
- Flow, velocity and depth are affected by the Stage 0.1 Drought Order and the implications on aquatic ecology of these changes are assessed in Appendix D. The precise extent of these changes is uncertain due to the data quality issues identified above.

B.4 Physical environment assessment

B.4.1 Geomorphology

B.4.1.1. Baseline

The baseline geomorphology for the drought order assessment study area has largely been informed from a geomorphological survey undertaken as part of the NEP investigations in 2011[17]; the survey was undertaken by the geomorphologist who also carried out the Test and Itchen River Restoration Strategy in the wider catchment[9] and from River Habitat Surveys (RHS) carried out in 2019 by Southern Water The NEP geomorphological survey undertaken in 2011[9] focused specifically on the river reaches downstream of the Testwood abstraction intake down to Testwood Pool but not the tidal section from Testwood Mill to Redbridge. In 2019 four RHS surveys were completed downstream of Testwood Bridge and a further two were undertaken on the Wirehouse Stream, covering both the northern and southern channels.

Testwood abstraction to Blackwater Confluence

This reach has been straightened at some point which may be related to the Environment Agency Testwood gauging station, which consists of a concrete channel and raised weir, and/or the SWS off-take for the water supply to the pumping station. The channel either side of the gauging station is uniform and homogenous, lacking instream diversity. There is evidence of bank slumping along the right bank at the upstream section of the reach potentially caused by the river adjusting to previous straightening and there are pockets of trees, while the left bank is well vegetated.

Extensive bank protection exists along the left bank which is associated with the pumping station and the Testwood gauging station

Water is generally slower flowing slower than in the reach above the abstraction as a result of the impounded section upstream of Testwood gauging station.

Blackwater Confluence to Bend Upstream of Chadney Meadows

The confluence of the River Blackwater and the River Test marks a change within the River Test as the Blackwater drains a different geology and is known to provide a higher proportion of fine sediment into the system. The River Blackwater was turbid on the date of the survey. Immediately downstream of the confluence, near Testwood Bridge, marks the start of the artificially raised water levels created by the structures at Testwood Mill.

In the upper section of the reach localised narrowing of the channel has occurred. Overhanging trees were interacting with the river during the survey leading to changes in localised hydraulics.

Moving downstream, embankments are increasingly evident, particularly along the right bank, much of which is extensively vegetated with biodiversity value. Invasive species (Himalayan balsam) becomes commonplace, particularly along the right bank, in some locations the balsam has been mown.

The reduction in energy within this reach, as a result of the Mill structures, causes sediment deposition across the whole bed of the channel which increases with distance downstream. Evidence of old riffles are still observed within this reach but remain drowned out by the backwater from the structures at Testwood Mill. The channel width increases in this reach and macrophyte growth across the width of the channel becomes more evident.

[17] Atkins, 2011. Lower River Test NEP Investigation. River Test Geomorphology Assessment Technical note

Bend Upstream of Chadney Meadows to NTL, near Testwood Mill

The reduction in energy within this reach is evident and causes deposition across the whole bed of the channel which increases with distance downstream.

Water depths increase and there are increasing volumes of instream macrophyte growth across the width of the channel.

Bank protection is visible at the toe of the right bank at the start of the sharp bend.

Much of the channel is straight and it is believed, at some stage, to have been an artificial cut as the original channel appears to have flowed through Chadney Meadow at the current diffluence of a small side channel. The embankment is increasingly evident, and becomes higher, along the right bank. It is also starts to become prominent along the left bank although it is significantly lower on this side of the channel.

Much of the right bank continues to be mown leading to the development of a limited riparian corridor and fishing platforms frequently extend into the river along the right bank throughout the reach.

Downstream of Testwood Mill

Downstream of Testwood Mill, the channel becomes tidal. When the tide is out, the upper section of this reach shows increased geomorphological diversity than the reach upstream as it is free flowing with a well-established pool-riffle system. This is accompanied by steeper banks on the outside of the bend and more shallow sections on the inside of the bends as would be expected of a more natural river system. The in-channel diversity is also more heterogeneous. There are a series of mid-channel bar features which again mark increased geomorphological diversity with both depositional and erosional features evident. Further downstream, the channel increasingly becomes more estuarine in nature with a wide meandering channel evident with multiple channels at various locations.

Wirehouse Streams

The Wirehouse Stream is split into two distinct channels that provide a connection between the Great Test and the Little Test, the flow and level are controlled by a sluice (locked open) on the entrance to the streams from the Great Test. The 2019 RHS surveys indicated that the upper sections of both streams were impacted by cattle poaching, but otherwise had no physical bank modifications present, downstream of the sluice from the Great Test. The northern channel bed was dominated by gravel with silt present directly downstream from areas impacted by cattle poaching. The southern channel bed was predominately silt dominated with some gravel areas at the upper limit. The flow in both channels was smooth with some flow variation influenced by in-channel emergent and submerged vegetation.

B.4.1.2. Assessment

Much of the River Test has been modified to some degree. This has either been through channel widening, vegetation cutting, dredging, embankments, sluices or weirs. As a result, the current river system overall is likely to be less resilient during a drought than would have been the case with a more natural form. In a naturalised form, the river cross-section would be more varied compared to the uniform trapezoidal channel that occurs in some sections of the lower River Test. The modifications to the river channel are further exacerbated by the fact that numerous cut channels exist that are connected to the main channel thread.

The reaches between the abstraction and the NTL at Testwood Mill will be less impacted by drought conditions and the Stage 0.1 Drought Order than many other parts of the River Test. The reach between the Testwood abstraction intake and Testwood Mill is heavily modified and water levels are maintained higher than naturally as a result of Testwood Mill. Thus, the overall change in wetted perimeter due to a drought and the Stage 0.1 Drought Order will be smaller than in more freely flowing sections. A small section is free-flowing upstream of the confluence of the River Blackwater and this is likely to be slightly more impacted by drought and the Stage 0.1 Drought Order.

The risk of impact is linked to abstraction as well as the physical modifications. Hydraulic modelling data suggest that, in the event of a 1:500 year drought event at a cross-section (CS38) between the abstraction intake location and the confluence of the River Blackwater, the abstraction of water with the Stage 0.1 Drought Order in place will lead to a drop in minimum water depths from 1.09 m to 1.02 m (a 6% reduction). The minimum velocities will drop from 0.17 m/s to 0.10 m/s (around 41% reduction). As a result, the impact of the Stage 0.1 Drought Order abstraction at Testwood is small in relation to the wetted perimeter but larger in relation to the potential for increased sediment deposition due to lower velocities. The geomorphological impact in the free-flowing section will be short lived until higher flows re-establish and mobilise finer sediment. The impacts of lower flows will be longer lasting in the impounded section as an increased risk of fine sediment deposition will add to the high amount of sediment already deposited behind the structure in the impounded section. Any sediment is less likely to be mobilised in higher flows in this section due to the impoundment.

Downstream of Testwood Mill, the river is a more natural feature as it is free-flowing and not impounded. Any reduction in water levels due to the Stage 0.1 Drought Order abstraction is small relative to the impact of the tidal cycle. At a cross-section downstream of Testwood Mill (GTT6), the abstraction of water under the Stage 0.1 Drought Order will lead to a drop in water level at minimum depths from 1.02 m to 0.94 m in the 1:500 year extreme drought event. For comparison purposes, this depth of 0.94 m rises to 2.78 m in an average tidal peak. As a result, the drop in 0.08 m water level in the main river is small (reduction of around 8%). However, the increase in water level from an average high tide more than compensates for any marginal loss, with the high tide raising water levels significantly. This reach already has more heterogeneity than the reach between the Testwood abstraction intake and Testwood Mill, with deposition on the inside of the bends and erosion on the outside. The increased complexities in the flow due to the tidal prism means that the relative effect of reduced water volumes in this reach due to the Stage 0.1 Drought Order will have a negligible impact on both geomorphological form and function.

B.4.2 Water quality

This section sets out the baseline water quality and examines changes over time and with respect to river flows. Environmental pressures on river water quality (such as discharges from wastewater treatment works), which may cause increased deterioration in water quality with the Stage 0.1 Drought Order in place, are discussed separately in Section B.4.3.

To support the assessment of potentially sensitive environmental features, an understanding has been developed of the water quality of the river reaches within the hydrological zone of influence of the Stage 0.1 Drought Order. For Water Framework Directive (WFD) classification, the Environment Agency has set out (according to UKTAG evidence) what pressures, including water quality pressures, each biological quality element is capable of responding to. For the purposes of this Stage 0.1 Drought Order assessment, the relevant supporting water quality parameters are as follows:

- for fish and macroinvertebrates (where identified as sensitive features), the key parameters are dissolved oxygen saturation and total ammonia concentration; and
- for macrophytes and algae (phytobenthos / diatoms) (where identified as sensitive features), the key parameters are soluble reactive phosphorus.

Potential impacts on water temperature have also been considered.

Environment Agency routine water quality monitoring data were reviewed to provide an overview of water quality in the hydrological zone of influence: there are two freshwater and three estuarine water quality sampling sites, as detailed in Table 9 and shown in Figure 19.

Table 9 Environment Agency freshwater and estuarine water quality monitoring sites

EA site ID	Site name	NGR	Reach	Fish designation
G0003890	River Test at Longbridge	SU3549917847	Longbridge to NTL	Salmonid
G0003885	River Test at Testwood	SU3529415330	Longbridge to NTL	Salmonid
G0017136	Downstream Bitcmac T/E Edge of Mixing Zone	SU3681013320	Test Estuary (Southampton Water)	N/A
G0003877	Eling Junction, Test Estuary	SU3745012350	Test Estuary (Southampton Water)	N/A
G0003873	Test Estuary 2	SU3948011910	Test Estuary (Southampton Water)	N/A

Figure 19 Location of Environment Agency water quality monitoring sites

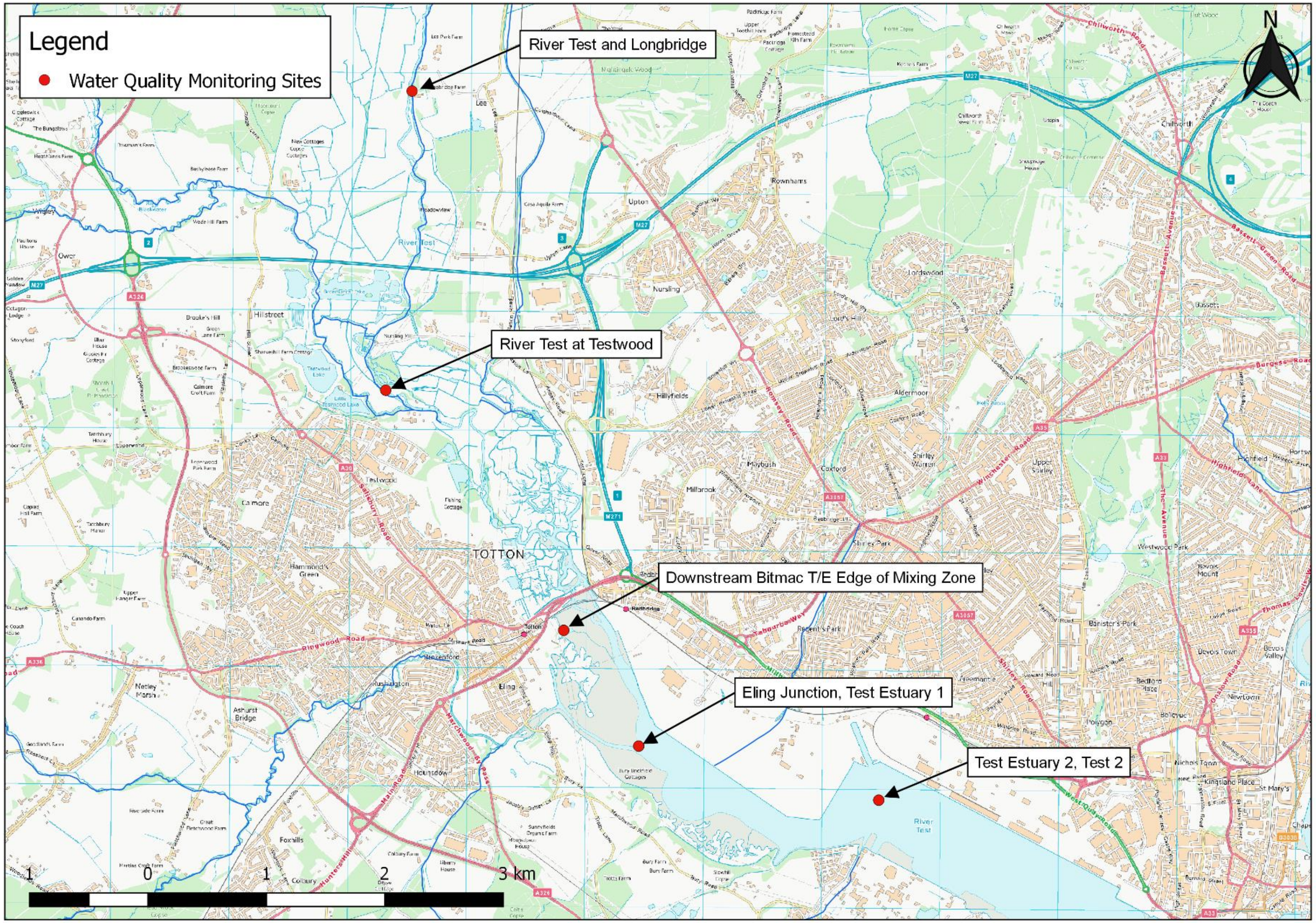


Table 11 provides a comparison of key water quality data against WFD Environmental Quality Standards (EQS) as set out in Table 10. It should be noted that this information is provided for interpretive purposes only and is based on the available dataset from 2005-2020; it does not provide a formal WFD water quality assessment, which is based on annual datasets.

Table 10 Relevant WFD EQS for freshwater sites

Determinand	EQS High	EQS Good	EQS Mod	EQS Poor	Notes
Total ammonia (mg/l) (EQS is a 90th percentile)	0.3	0.6	1.1	2.5	
Soluble Reactive Phosphorus (mg/l) (EQS is an annual average)	0.053	0.096	0.223	1.115	River Test at Longbridge
	0.054	0.097	0.225	1.119	River Test at Testwood
Dissolved Oxygen (% saturation) (EQS is a 10th percentile)	80	75	64	50	Salmonid waters
pH (EQS is 5th and 95th percentiles for High and Good; 10th percentile for Moderate and Poor)	6 to 9	6 to 9	4.7	4.2	
Temperature (°C) (EQS is a maximum temperature)	20	23	28	30	Salmonid waters

Table 11 Summary statistics against EQS

2005-2020 dataset	Site:	River Test at Longbridge	River Test at Testwood
Total Ammonia	Min	0.03	0.03
	Mean	0.06	0.05
	Max	0.19	0.17
	90%ile	0.09	0.08
Soluble Reactive Phosphorus	Min	0.01	0.01
	Mean	0.05	0.05
	Max	0.13	0.11
Dissolved Oxygen Saturation	Min	67.10	71.20
	Mean	93.43	96.46
	Max	151.70	136.10
	10%ile	82.67	86.00
pH	Min	6.91	7.23
	Mean	7.97	8.11
	Max	8.70	8.56
	95%ile	8.36	8.46
	5%ile	7.28	7.79
Temperature	Min	4.27	4.40
	Mean	11.64	11.62
	Max	21.74	20.75

Southern Water has been collecting data since 2019 as part of the Test drought monitoring package, however there is insufficient data to provide a robust analysis. The data collected by the EA is therefore used to inform the primary analysis with comments on the nature of the Southern Water data where appropriate.

B.4.2.1. River Test from the Testwood Abstraction Intake to NTL

Water quality analysis for this reach has been undertaken based on the data available at the two sites detailed in Table 9. Data from the National River Flow Archive for the Test at Broadlands gauging station was used to provide daily flow data.

pH and Temperature

The average pH values recorded were 7.97 (River Test at Longbridge, upstream of Testwood Intake) and 8.11 (River Test at Testwood), respectively, with the 5 and 95 percentile values in line with WFD High status (see Figure 20 and
Figure 21). This is broadly in line with the data collected by Southern Water as part of the Test drought monitoring package, however the 5th percentile exceeded the upper pH limit of 9 at the Redbridge and BFFC1 sites. The maximum temperature recorded was 21.74°C and 20.75°C, respectively, this being in line with WFD High status for Salmonid waters (see Figure 22 and

Figure 23).

Figure 20 pH record from River Test at Longbridge

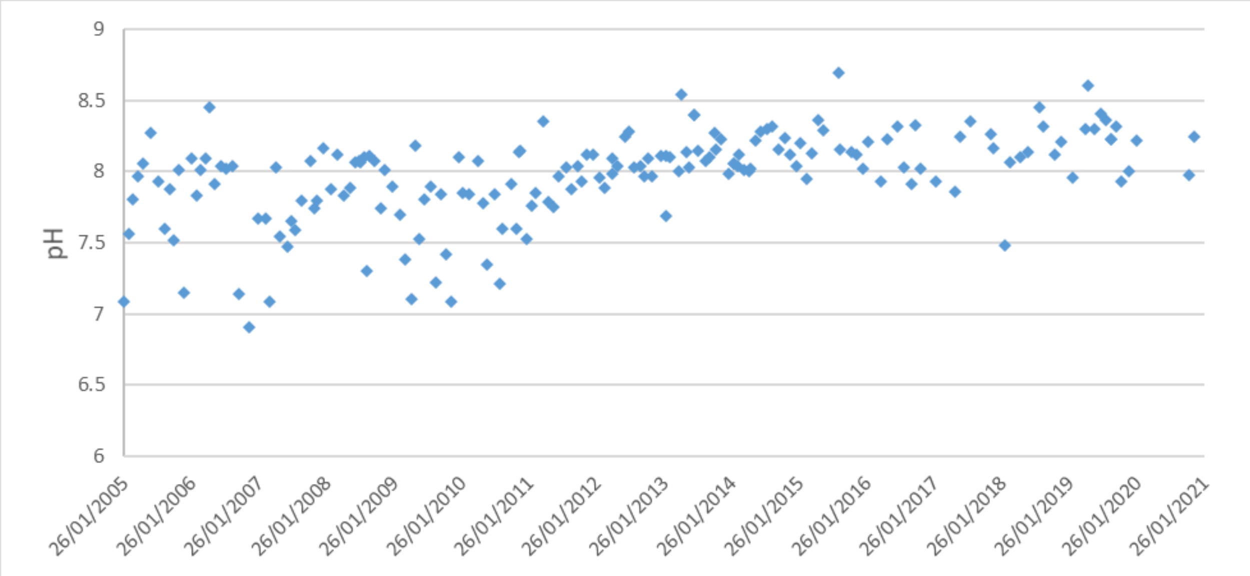


Figure 21 pH record from River Test at Testwood

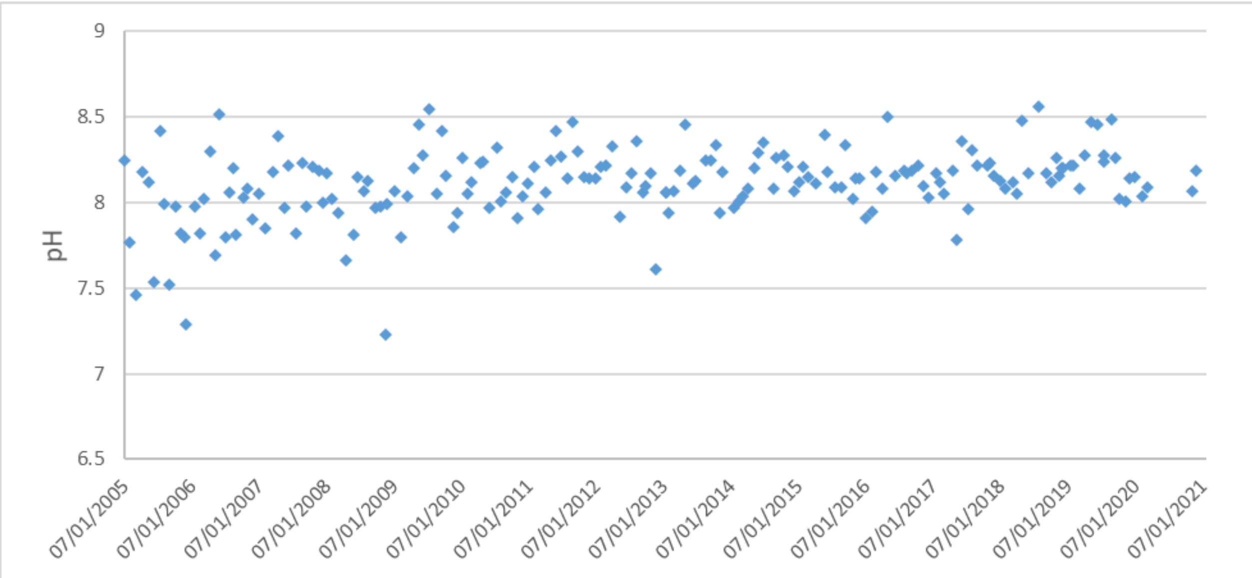


Figure 22 Temperature record from River Test at Longbridge

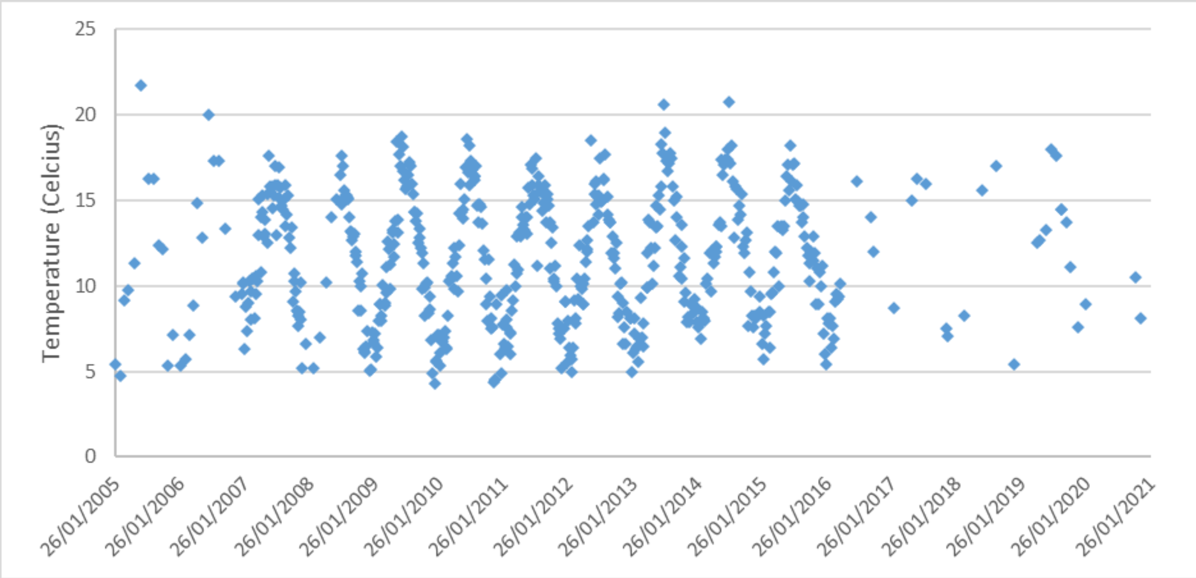
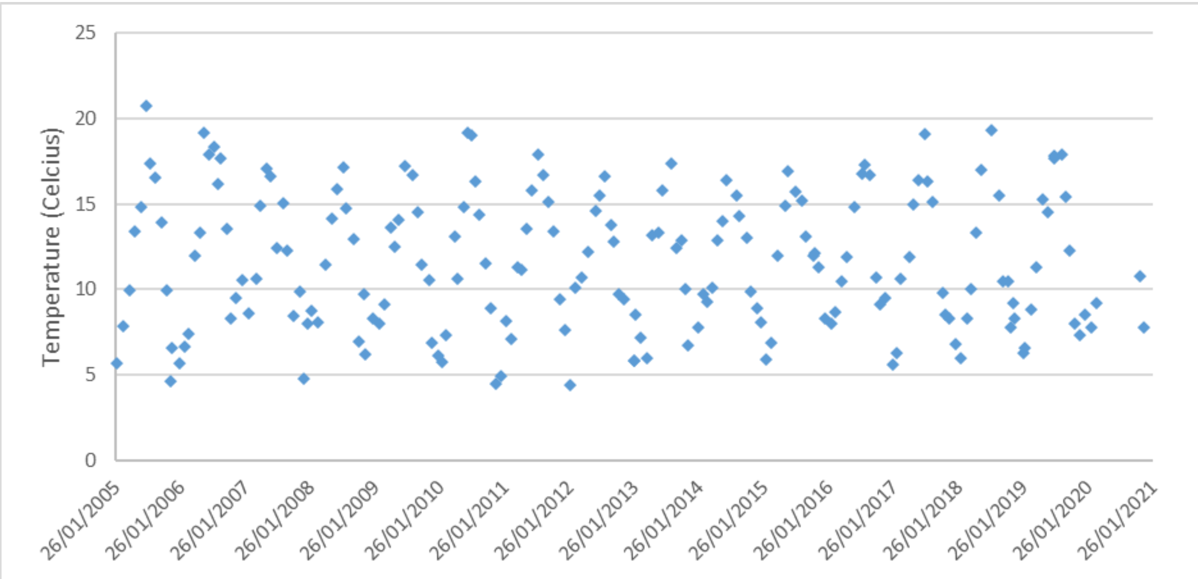


Figure 23 Temperature record from River Test at Testwood



In addition to this standard temperature data there has been extensive work undertaken on the thermal regime of the lower Test since 2010. In particular, a thermal model for the Lower Test was developed and applied in the NEP Investigation[6] and then updated further in 2014-15[18] following the implementation by the EA of an intensive monitoring programme in the summer of 2013[19]. However, there are uncertainties attached to the raw temperature data (relating to siting difficulties for some of the probes) and therefore the thermal model outputs. The data presented below therefore need to be treated with caution.

The dominance of weather conditions over any potential flow-related impacts is described in the assessment of the 2013 monitoring data, key points from which are summarised below:

[18] River Test thermal model, Atkins Technical Note, June 2015

[19] SWS Lower Test: Licence Review, 2013 Temperature, Atkins Technical Note December 2013

- At the beginning of July 2013 total flows in the River Test were over 800 Ml/d and maximum daily temperatures were approaching 20°C. By mid-September total flows had reduced by well over 200 Ml/d and maximum daily temperatures had also reduced to about 14°C.
- Diurnal variations in temperature are routinely >2°C and maximum daily temperatures can easily vary by 2-3°C within a week with no substantive change in river flows.
- On the 12th July 2013, the Conagar Bridge structure was altered, resulting in a relative increase in flows in the Great Test compared with the Little Test of more than 60 Ml/d. This is the equivalent of the entire abstraction at Testwood at the time and the loggers showed that no detectable difference in temperature arose as a consequence.
- On average, the temperature difference between the main River Test close to Broadlands Gauging Station and the Great Test at Testwood Mill (a distance of about 6km) is only about 0.3°C. Thus, on the 22nd July, the day with the highest maximum temperature at Testwood Mill (21.20°C), the temperature of the water flowing into the lower reaches of the Test was already reaching 20.87°C.

The EA's monitoring data also indicates that, due to an unusual set of circumstances, the abstraction is likely to enhance the cooling of the river in the reach between the confluence with the Blackwater and Testwood Mill. The pathway for this unlikely scenario is apparent from the data - the Blackwater is consistently 1-2°C cooler than the Great Test and the abstraction increases the ratio of this cooler water in the river downstream. Although the data suggest that it will still have a minor cooling effect when flows in the Blackwater are very low, it is acknowledged that in extended drought periods there will be times when the flow contribution from the Blackwater is close to zero. Additionally, at drought low flows, there is a risk that the Blackwater could be warmer than the main River Test, but this needs further temperature monitoring to be carried during a period of extended low flow conditions in both river reaches.

A short summary of the evidence for abstraction impacts on temperature in the lower Test is provided in Section B.4.2.4.

Total ammonia concentration

Total ammonia concentration data for the River Test at Longbridge and River Test at Testwood were reviewed and are presented in

Figure 24 and

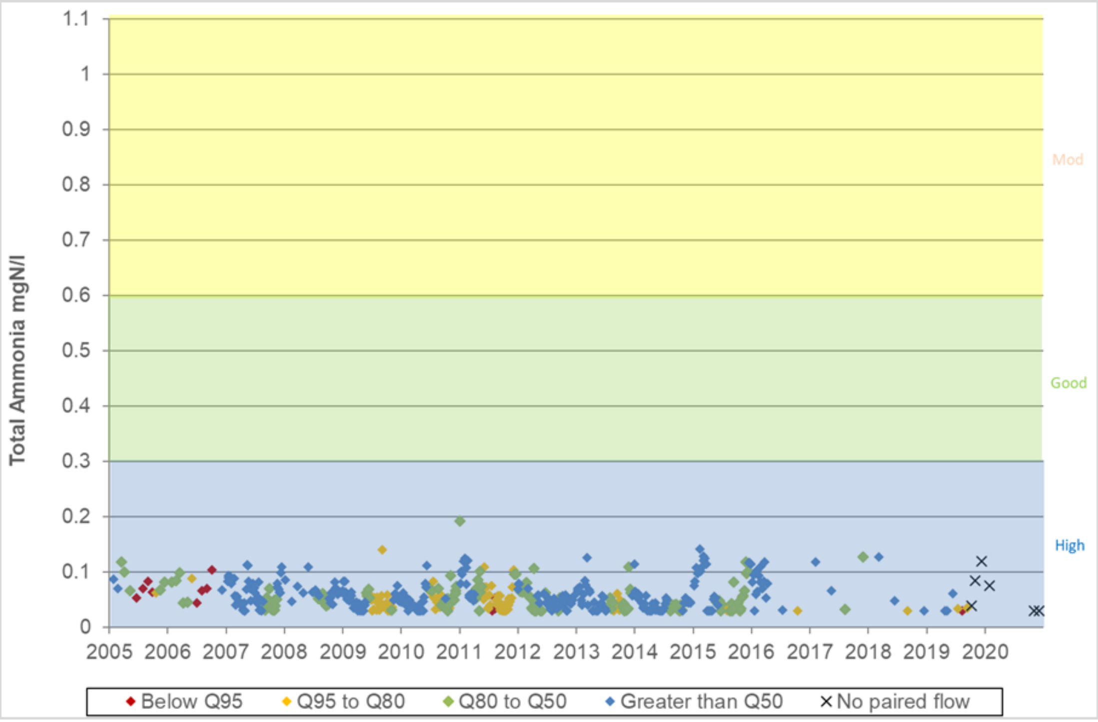


Figure 25 against the relevant WFD standards for a lowland high alkalinity river. Total ammonia concentration measurements were consistently compliant with the WFD standard to support high status (0.3 mg/l) for fish and invertebrates for a lowland high alkalinity river; peaks in concentrations were not linked to low flow conditions. This is in line with the data collected by Southern Water as part of the Test drought monitoring package.

Figure 24 Total ammonia concentration at River Test at Longbridge against WFD status bands

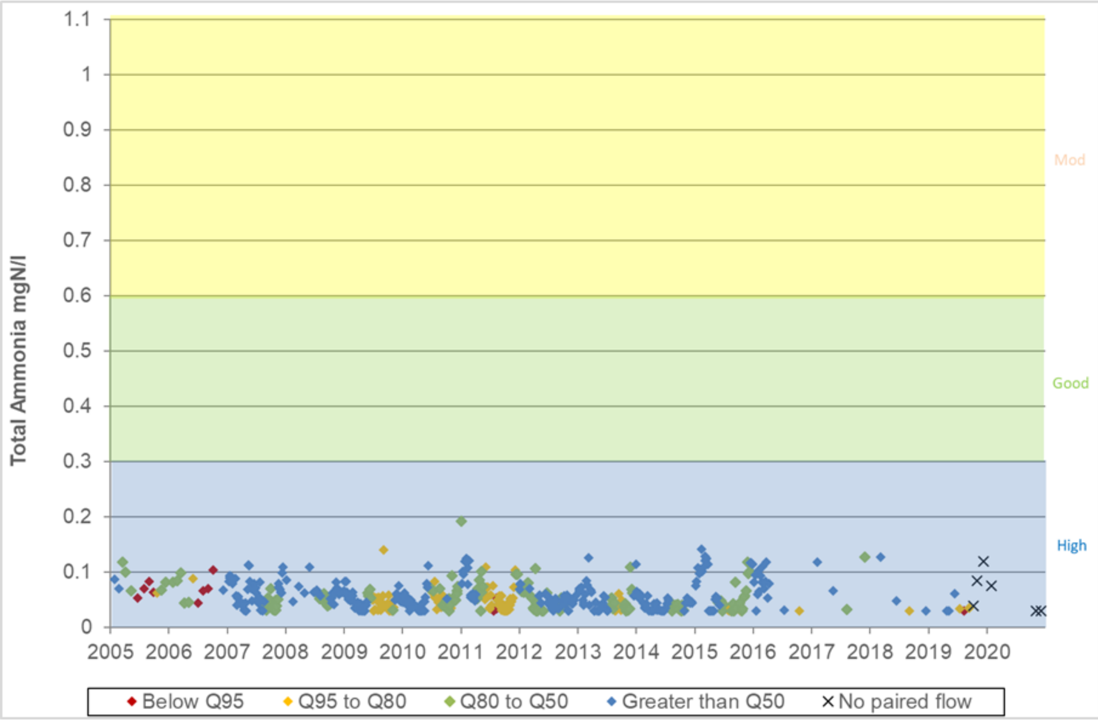
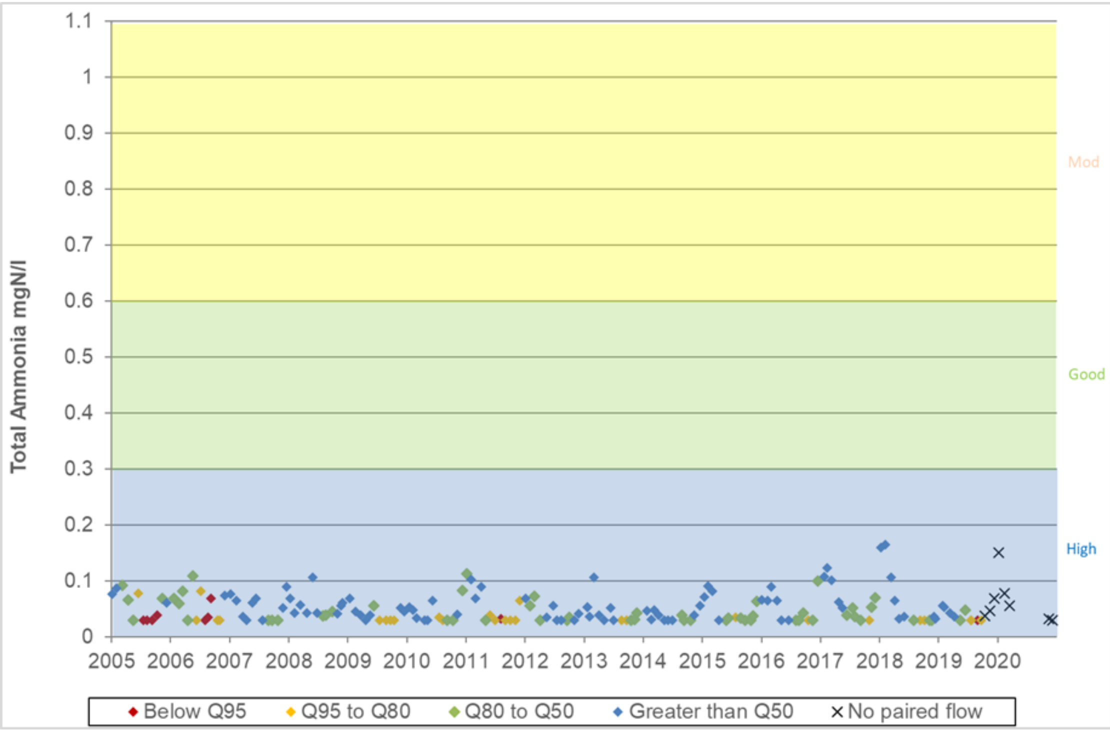
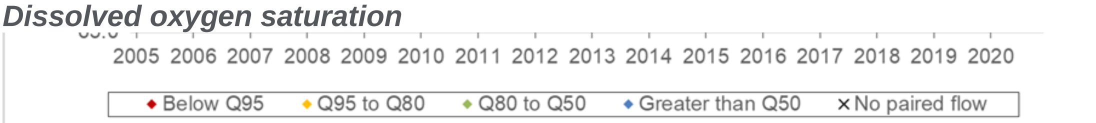


Figure 25 Total ammonia concentration at River Test at Testwood against WFD status bands



Dissolved oxygen saturation



estwood were
and

Figure 27 against the relevant WFD standards for a lowland high alkalinity river with salmonid designation. Dissolved oxygen saturation measurements were consistently compliant with the WFD standard to support good status (75% saturation; salmonid designation) for fish and invertebrates for a lowland high alkalinity river with salmonid designation at both sites, with only four instances when this standard was not met (two at the Longbridge site and two at the Testwood site). This is in line with the data collected by Southern Water as part of the Test drought monitoring package, where DO measurements are mostly over 75%, with occasional instances where this standard is not met. Dissolved oxygen saturation values display some moderate seasonality during the spring/summer but this is not linked directly to low flow conditions.

Figure 26 Dissolved oxygen saturation at River Test at Longbridge against WFD status bands

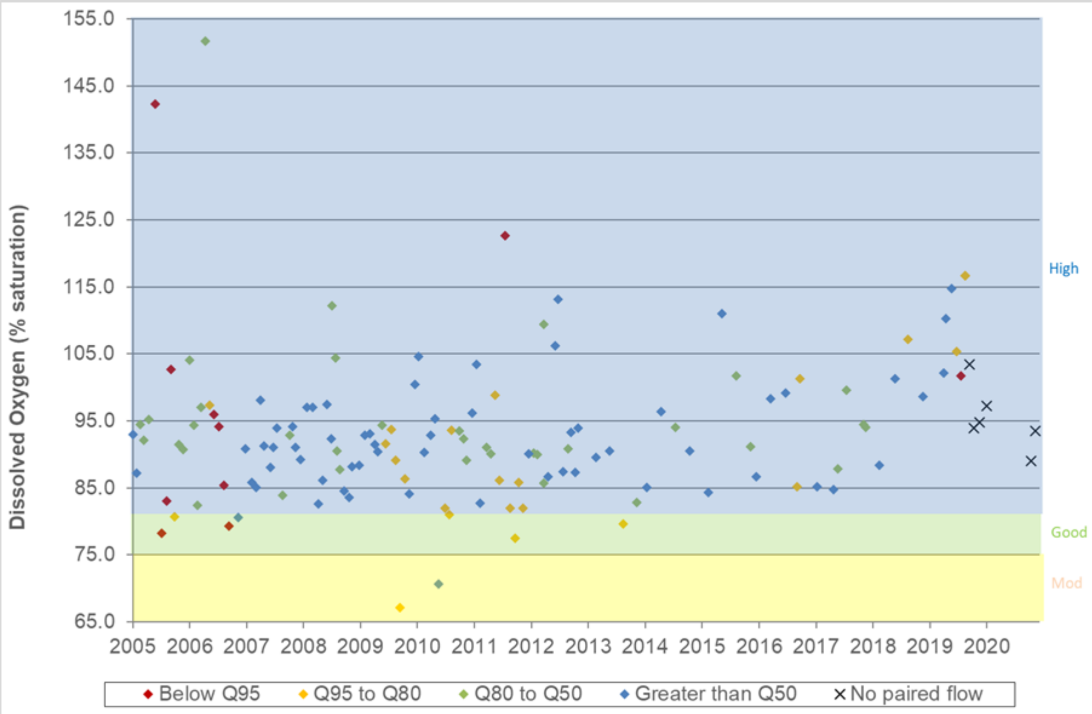
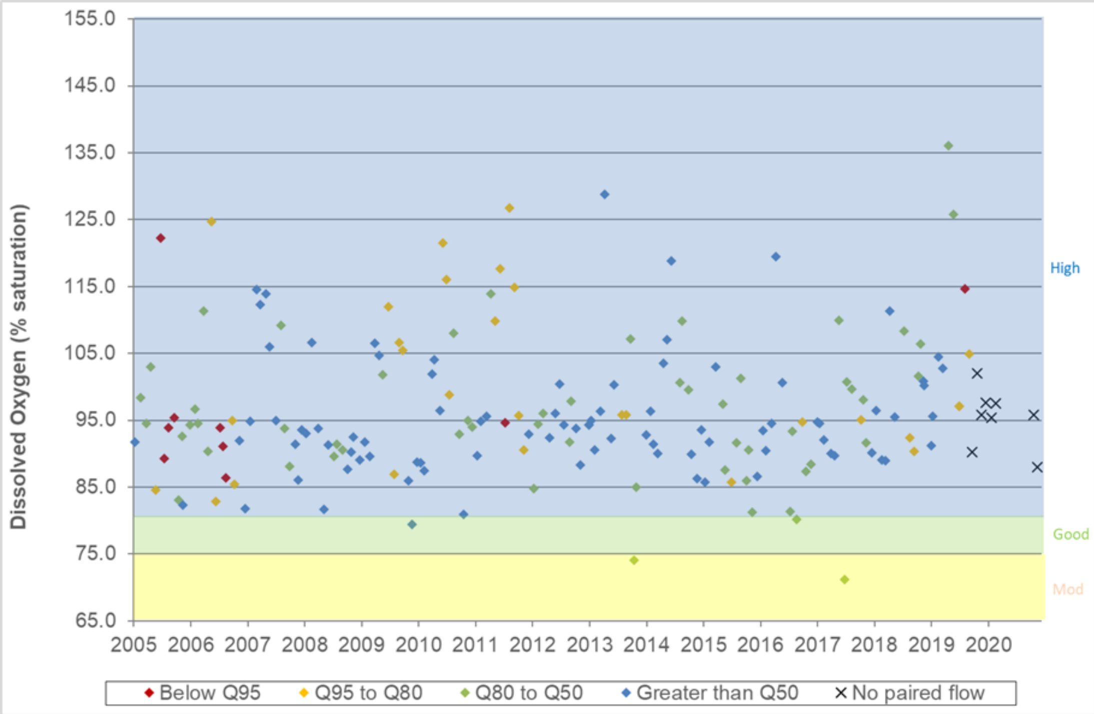


Figure 27 Dissolved oxygen saturation at River Test at Testwood against WFD status bands



Soluble reactive phosphorus concentration

Soluble reactive phosphorus (SRP) concentration values at River Test at Longbridge and River Test at Testwood were reviewed and data are presented in
Figure 28 and

Figure 29 against the relevant WFD site specific standards provided by the Environment Agency. SRP concentrations were largely consistent with the WFD standard to support good status (0.096 and 0.097mg/l respectively) for fish and invertebrates for a lowland high alkalinity river. SRP concentration peaks are indicative of a 'moderate' status. This is in line with the data collected by Southern Water as part of the Test drought monitoring package, with an average concentration of 0.005 mg/l SRP at most sites.

Figure 28 Soluble reactive phosphorus concentration at Test at Longbridge against WFD status bands

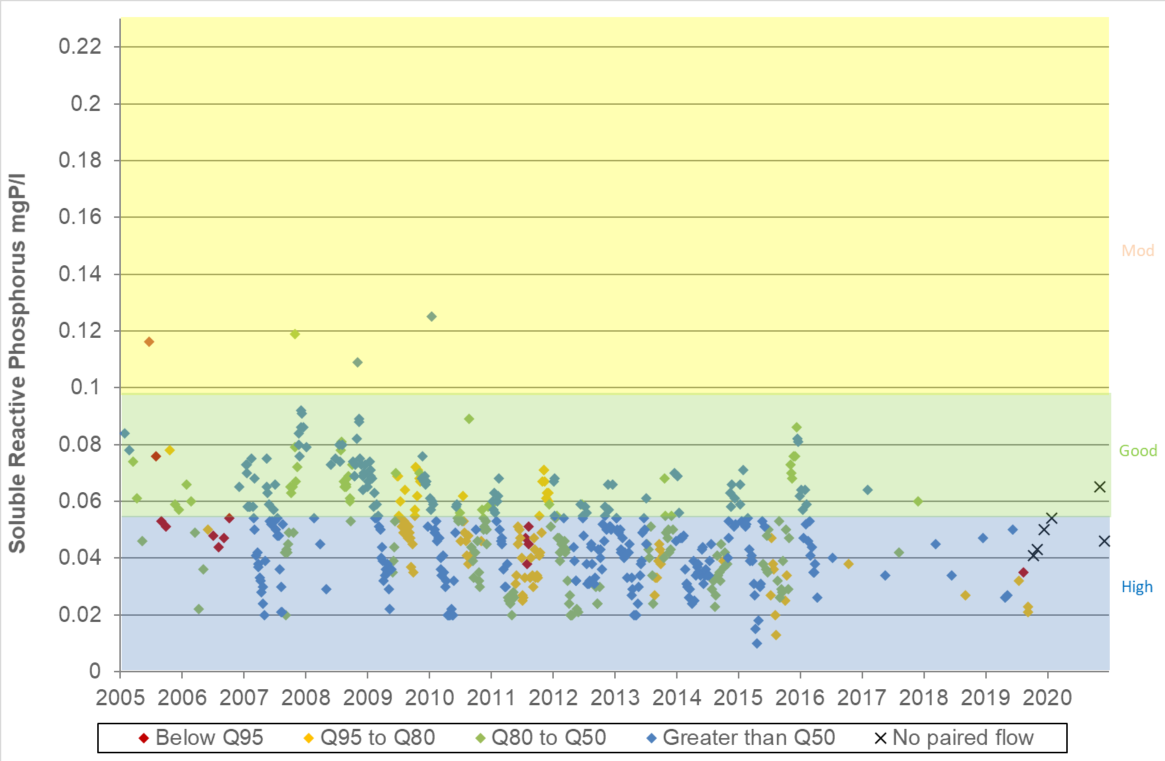
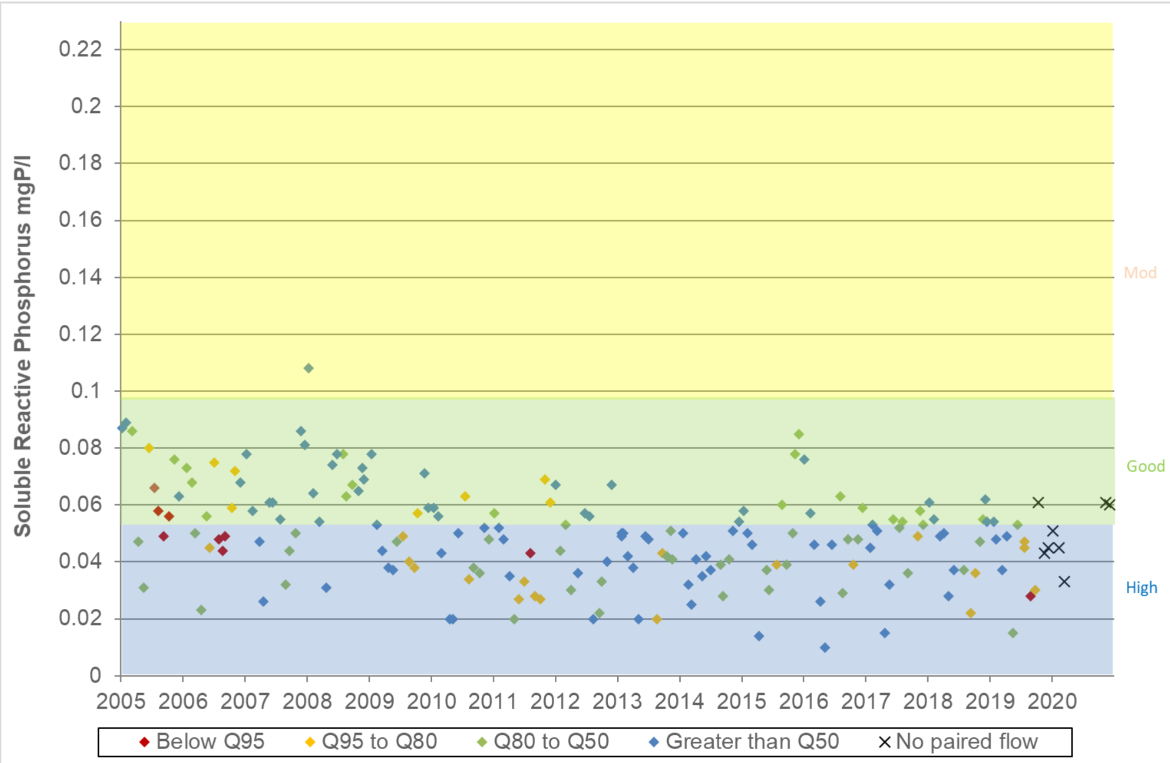


Figure 29 Soluble reactive phosphorus concentration at Test at Testwood against WFD status bands



B.4.2.2. CSMG Assessment

For the River Test SSSI to achieve favourable condition it has to meet the Common Standards Monitoring Guidance targets for water quality, as well as the other parameters outlined in the FCT. Whilst water quality is generally of a good standard as illustrated above, the Stage 0.1 Drought Order may lead to a temporary deterioration in water quality, including when considered against the CSMG target as well as the WFD targets that have been assessed in the preceding section.

The CSMG assessment for the River Test (unit 91) (Table 14) has been carried out with data collected by the Environment Agency from the River Test at the Testwood water quality monitoring site for the period 2018 to 2020, and the specific CSMG targets agreed for the River Test between Natural England and the Environment Agency as part of RBMP2. This is in line with CSMG River guidance which states that data from the past 3 years should be used. This assessment will be updated in future with further water quality data collected as part of the River Test drought permit and drought order monitoring package. The assessment concluded that, over the record period 2018-2020, compliance with the CSMG standards is achieved with respect to total ammonia, un-ionised ammonia, dissolved oxygen and BOD. It should be noted that monitoring for BOD began in August 2020 and the dataset is therefore limited.

Non-compliance is noted with regards to SRP concentrations (both annual mean and March – September mean).

Table 14 Current compliance against agreed River Test water quality CSMG standards

CSMG Parameter	CSMG Standards for Test WFD water body (GB107042016840)	Testwood Water Quality (2018-2020)	Compliant?
Total ammonia (90th percentile)	0.25 mg/L	0.106 mg/L	Compliant
un-ionised ammonia (95th percentile)	0.021 mg/L	0.002 mg/L	Compliant
BOD (mean)	1.5 mg/L	<1 mg/L*	Compliant
SRP (annual mean)	0.03 mg/L target	0.045mg/L	Non-compliant
SRP (March - September mean)	0.03 mg/L target	0.037 mg/L	Non-compliant
Dissolved Oxygen (10th percentile)	85%	90%	Compliant

*Based on six available Southern Water samples between August 2020 and November 2020 – three samples upstream of the Testwood abstraction and three samples downstream. All six samples were below the limit of detection.

As indicated in the WFD water quality assessment above, the Stage 0.1 Drought Order has the potential to lead to a low risk of an increase to SRP from the baseline conditions although there is no discernible link between SRP concentration and low flow conditions.

There is a low risk (given the small margin between the dissolved oxygen levels and the CSMG standard), that the lower flows will lead to local reduced dissolved oxygen levels in the reach downstream of the abstraction (and a possible increase to BOD) that will lead to a local failure of the CMSG standard (as opposed to a failure at the WFD water body scale due to the length of river in the WFD water body). This risk is due to lower flows and flow velocity, along with the prevailing drought conditions where there is a greater risk of die-off of macrophytes and often hotter, sunnier conditions.

B.4.2.3. Test Estuary (part of Southampton Water WFD water body)

Water quality analysis for this reach has been undertaken based on the data available at the three sites detailed in Table 91 and shown in Figure 19.

Salinity and turbidity

The salinity and turbidity data for the three sites in the Test Estuary are presented in Table 125 below.

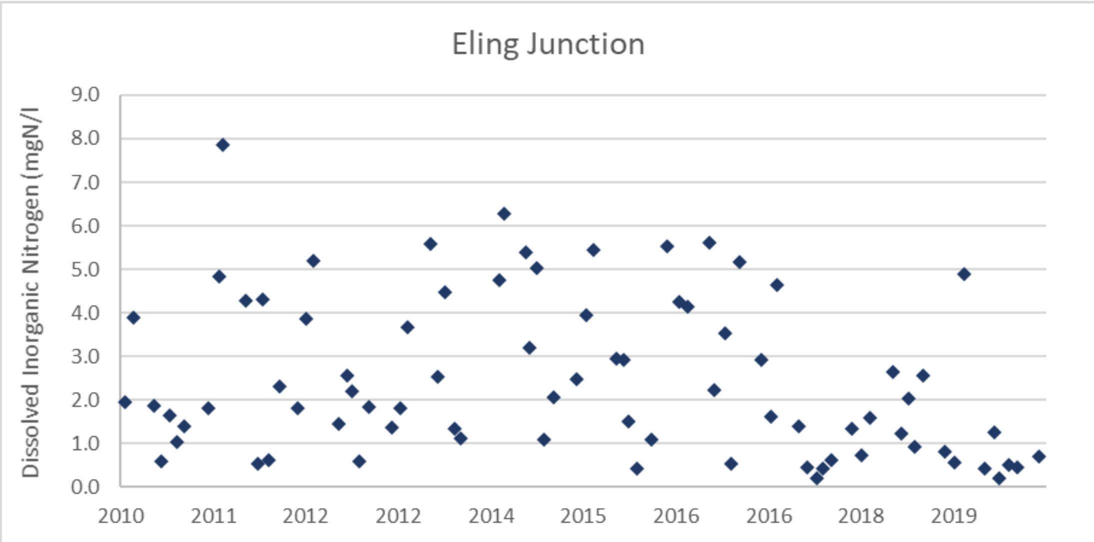
Table 12 Summary statistics for the Test Estuary monitoring sites against EQS

2005-2020 dataset	Site:	Downstream Bitmac	Eling Junction, Test Estuary	Test Estuary 2
Salinity (ppt)	Min	0.47	2.82	10.41
	Mean	24.65	27.53	28.92
	Max	33.27	33.11	33.29
Turbidity (as FTU)	Min	3.00	0.30	0.30
	Mean	9.13	13.68	11.47
	Max	51.90	193.60	196.20

Dissolved Inorganic Nitrogen

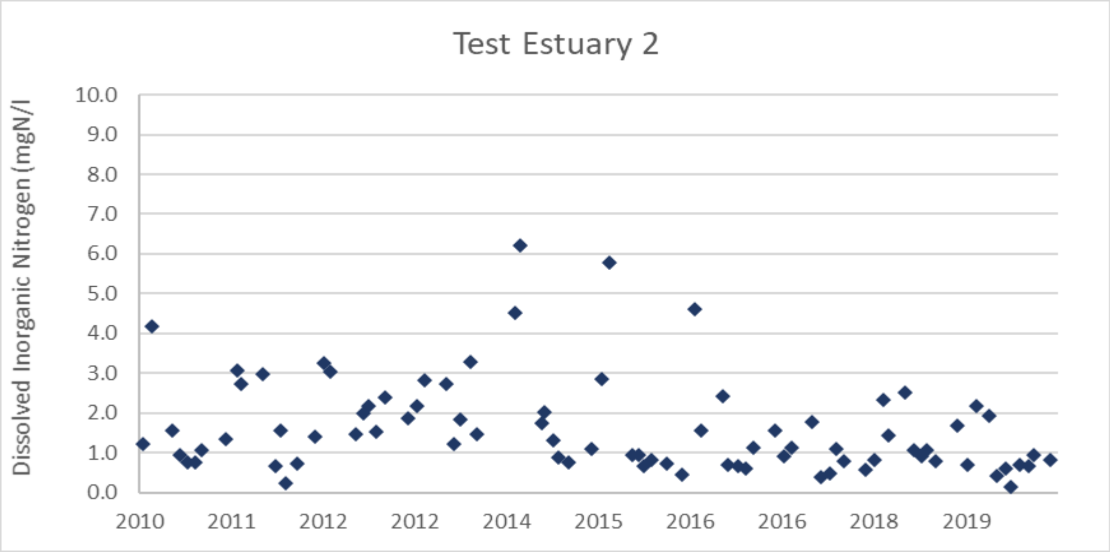
Dissolved Inorganic Nitrogen (DIN) is a measure of the dissolved fractions of ammonia, nitrate and nitrite present in the water column. DIN standards are specific to each site, being expressed in micromoles/litre and calculated based on the average annual turbidity and salinity data[20]. Owing to the lack of comprehensive data on the three chemical fractions which characterise DIN, it has not been possible to calculate the EQS specific to the sites in the Test Estuary. However, the current WFD DIN status for Southampton Water (which includes the Test Estuary) is moderate[21] and the available DIN data (expressed in mg/L) are presented in Figure 30. There were no DIN data available at the D/S Bitmac monitoring site.

Figure 30 Dissolved inorganic nitrogen (DIN) concentration data for two sites in the Test Estuary



[20] The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015. Available at http://www.legislation.gov.uk/uksi/2015/1623/pdfs/uksiod_20151623_en_auto.pdf. Accessed 21/11/2017.

[21] Environment Agency. Catchment Data Explorer – Southampton Water. Available at http://environment.data.gov.uk/catchment-planning/WaterBody/GB520704202800 . Accessed 20/01/2021

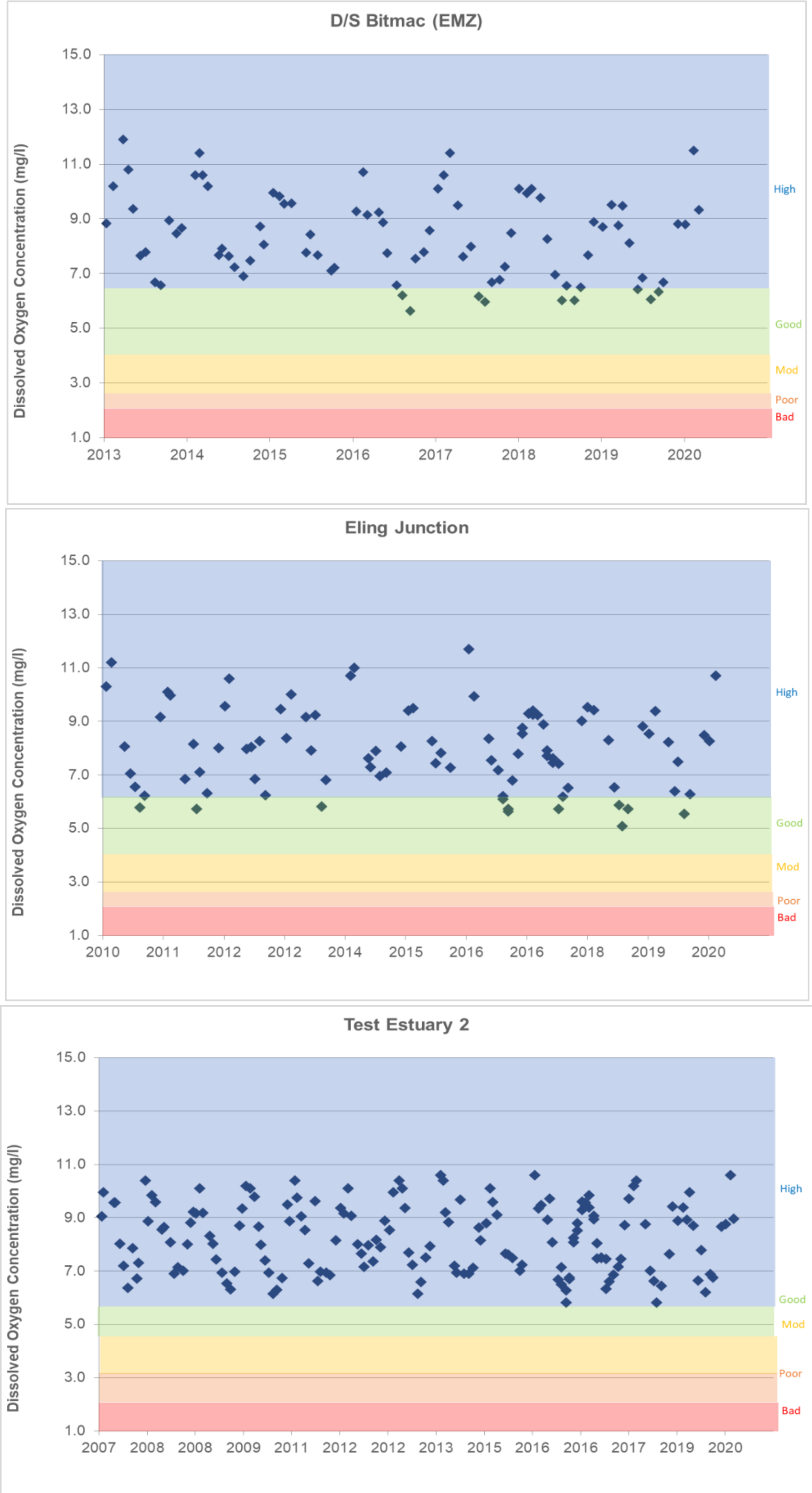


Dissolved Oxygen Concentration

The dissolved oxygen concentration EQS for estuarine waters are also site-specific and have been calculated for the three sites in the Test Estuary based on the specific average salinity data and in accordance to the methodology presented in Section 3 of the Water Framework Directive Directions 2015[22]. The results are presented in Figure 31 and show that all sites in the Test Estuary achieve an overall 'high' WFD status for dissolved oxygen concentration, as confirmed by the current WFD status classification for Southampton Water[21].

[22] The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015. Section 3. Available at http://www.legislation.gov.uk/uksi/2015/1623/pdfs/uksiod_20151623_en_auto.pdf. Accessed 21/11/2017.

Figure 31 Dissolved oxygen concentration data for the three sites in the Test Estuary against WFD status bands



B.4.2.4. Implications of investigations of lower Test temperature regime

As summarised in Section 4.2.1, extensive work has been carried out on the thermal regime of the lower Test. Through this work process an understanding of the controlling factors driving the thermal regime of the lower Test has been developed, which has been founded primarily on survey data, although there are some concerns as to the quality of the survey data which needs to be taken into consideration. This work has demonstrated that the main driver of water temperature in the river is the prevailing weather (solar radiation in particular).

The most recent modelling work from 2015[36] indicates that in the most extreme drought conditions, abstraction at Testwood may give rise to an increase in maximum daily temperature by the time the river reaches Testwood Mill. However, this would be short-lived (a matter of hours), unlikely to exceed 0.1°C and would be in the context of a natural diurnal variation in the order of 2°C.

The EA's monitoring data show that in hot, sunny weather conditions water temperatures will rise throughout the Lower Test by several degrees, with very little difference between the abstracted and non-abstracted reaches.

However, given the concerns raised by the Environment Agency in respect of the raw water temperature data series, there remains uncertainty as to the impact of the drought order abstraction on river temperatures in the Lower Test.

It is noted that since August 2020 temperature has been monitored at four sites on the Blackwater waterbody (Broadlands 1, Broadlands 2, Testwood Lakes and Blackwater APEM) and seven sites on the Test (Little Test, Redbridge Park, Romsey, Little Test – APEM, Wirehouse Stream APEM, Testwood u/s Intake and Testwood d/s Intake). Monitoring is ongoing, however there is currently a very limited dataset. The benefits of on-going temperature monitoring to inform a thermal model will continue to be discussed with the Environment Agency.

B.4.2.5. Water quality summary

Assessment of the risk of water quality deterioration as a result of the Stage 0.1 Drought Order has been undertaken considering the available water quality data and the hydrological impact assessment presented earlier within the affected reaches. The findings are summarised in Table .

Table 16 Summary of water quality WFD deterioration risks and CSMG standards risks due to the Test Surface Water Drought Order

Reach	Target	pH and temperature	Ammonia	Dissolved oxygen	Soluble reactive phosphorus
Testwood Intake to NTL	WFD	Negligible	Negligible	Negligible	Negligible
	CSMG	Not applicable	Negligible	Low (and BOD)	Low
Test Estuary (Southampton Water)	WFD	Negligible	Negligible	Negligible	Negligible

Total ammonia and dissolved oxygen baseline data were consistently in line with the WFD standard to support good status for fish and invertebrates in the River Test. SRP concentrations are generally indicative of 'good' status but with occasional spikes being indicative of WFD 'moderate' status. However, such spikes are not linked to low flows and are probably attributed to diffuse pollution events or (when they arise at higher flows) to flushing of nutrients from the catchment.

The Stage 0.1 Drought Order will have negligible risk impacts on WFD water quality deterioration given the baseline water quality conditions and the localised nature of the potential impact of the Stage 0.1 Drought Order on water quality. However, there is a risk of a local reduction in dissolved oxygen in the reach below the abstraction intake, with implications for ecology, in particular fish species, if there is a reduction in flow and flow velocity together with the risk of die-off of macrophytes due to drought conditions and/or due to hot, sunny weather conditions.

In respect of CSMG water quality targets, there is a risk of failing the CSMG water quality standards in the wider unit 91 of the River Test SSSI (as CSMG is assessed at unit scale), for SRP, dissolved oxygen and BOD at the local level in the reach downstream of the abstraction intake, rather than at the WFD water body scale. SRP standards have not been met in the Lower Test and there is a low risk that the Stage 0.1 Drought Order will temporarily exacerbate the degree of failure downstream of the abstraction intake; however, as indicated above for the WFD assessment, there is not a strong relationship between low flows and SRP concentrations, with temporary increases in SRP more likely linked to diffuse pollution events and periods of high rainfall leading to flushing events from the catchment.

Given the low margin between the measured water quality and the CSMG standard for dissolved oxygen (and potentially a similar position for BOD despite initial monitoring results in 2020), the reduction in flow and the prevailing drought conditions gives rise to a low risk of a local failure of the CSMG standards in the reach downstream of the abstraction intake for the reasons already explained above in respect of WFD.

B.4.3 Environmental pressures

B.4.3.1. Abstraction pressures

There are no other material surface or groundwater abstractions in the reaches affected by the Stage 0.1 Drought Order.

B.4.3.2. Water quality pressures

Discharges put pressure on water quality during a drought as lower than normal river flows are experienced. There are a multitude of discharges in the hydrological zone of influence of the Stage 0.1 Drought Order; however, most of these discharge into the Southampton Water WFD water body. Most of these discharges are regulated by the EA in terms of their effluent quality. The risk of water quality deterioration in relation to these discharges during the operation of the Stage 0.1 Drought Order, is assessed as negligible.

B.5 Cumulative impacts

The Test Surface Water Drought Order also applies to the Testwood abstraction. This drought order would be applied after the Stage 0.1 Drought Order has ceased, i.e. once flows had dropped below 265 Ml/d. As such the Stage 0.1 Drought Order and order would not be active simultaneously. The drought order seeks to allow a further reduction in the HoF from 265 Ml/d to 200 Ml/d. The impact of this further reduction has been assessed within the Test Surface Water Drought Order EAR.

A report to inform an assessment under Regulations 63 and 64 of the Conservation of Habitats and Species Regulations 2017 of the effects of the Drought Order application for the Test Surface Water abstraction licence at Testwood on Habitats Sites[23] (report to inform an HRA) has been produced

[23] Habitat Sites (also known as European sites) include, Special Areas of Conservation (SACs) candidate Special Areas of Conservation (cSACs) and Special Protection Areas (SPAs). As a matter of policy, the UK Government also considers possible SACs (pSACs), potential SPAs (pSPAs), Ramsar sites and, in England, proposed Ramsar sites as European sites

(reported in WSP, 2025[24]). It concluded that no adverse effect on integrity cannot be concluded for the River Itchen SAC or the River Meon Compensatory SAC Habitat, even with mitigation in place, in respect of operation of the Drought Order, alone. However no plan or project included in the assessment is considered to result in effects that could act in combination with the potential effects arising from the proposed Drought Order in respect of the River Itchen SAC or River Meon Compensatory SAC Habitat. Therefore the report to inform the HRA was required to consider the three legal tests required to be satisfied in order for the proposed Drought Order to qualify for a derogation in respect of the potential for effects on the River Itchen SAC and the River Meon Compensatory SAC Habitat (alone). It demonstrates there are no feasible alternative to the drought order, the application for a drought order it is of overriding public interest and therefore it outlined proposed compensatory measures that would take place at the Woodmill Activity Centre, specifically on the Woodmill Salmon Pool.

[24] WSP (2025). Test Surface Water Licence 11/42/18.16/54 Stage 0.1 Drought Order 2025. *Information to support an assessment under Regulations 63 and 64 of the Conservation of Habitats and Species Regulations 2017.*