Candover Drought Order

Monitoring Plan

Draft 20 March 2018

This document has been prepared following consultation with the Environment Agency, Natural England and the Hampshire & Isle of Wight Wildlife Trust. The Agency, Natural England the Trust have worked very hard to develop these packages of monitoring, mitigation and compensation in a very compressed time frame.

The contents are broadly agreed but, due to time constraints, are subject to further work. Specifically:

- **The costs and budget arrangements which underpin this package are to be agreed.**
- **The scope of the monitoring packages remains incomplete with regards to the need for monitoring of the mitigation and compensation works.**

The Agency and Southern Water are committed to working together and with Natural England and others to refine these documents and complete the missing information in the near future.

In the meantime, this draft document is shared on a without prejudice basis. The observations and advice of interested parties will be a valuable contribution to that process.

Southern Water

Introduction

This document sets out the package of measures to monitor for the possible environmental impacts on the Candover Stream and the River Itchen as a result of Southern Water Service's ("**SWS**") abstraction from the Candover Boreholes up to 27 Ml/d and discharge up to 5 Ml/d into the Candover Stream via the existing outfall and discharge of up to 25 Ml/d via a new pipeline to a new discharge point located on the River Itchen, pursuant to a Drought Order ("**the Candover Drought Order**").

This document has been prepared by SWS in respect of the matter before the Planning Inspectorate (ref. RSA/WR/00016/17/18) as part of a settlement agreement with the Environment Agency ("**the Agency**") ("**the Settlement Agreement**"). This monitoring plan has been agreed between SWS and the Agency.

This monitoring package will be incorporated into SWS's Drought Plan Environmental Monitoring Plan.

Content of this paper

The purpose of this document is to set out an environmental monitoring plan to monitor the impact of abstraction pursuant to a Candover Drought Order. This monitoring plan has been developed by SWS with advice from Natural England and the Agency.

In accordance with proposals from the Agency and Natural England, in consultation with the Hampshire & Isle of Wight Wildlife Trust, most of the monitoring will be funded by SWS (save some hydrometric monitoring) but delivered by the following organisations:

- The Agency
- The Hampshire & Isle of Wight Wildlife Trust (subject to formal agreement)

Involving the Agency and the Hampshire & Isle of Wight Wildlife Trust in the delivery of this monitoring plan increases the chances of achieving the stated objectives, as those bodies can deliver work in ways and locations that SWS cannot, plus optimises budget and resource efficiencies and economies of scale.

The Agency agrees that:

- The agreed programme of monitoring measures set out below provide an assessment of the environmental baseline for the Candover Drought Order that will ensure that the Company is 'application ready', within the meaning of the Drought Plan Guidance for the purposes of any application for a Candover Drought Order.
- These measures represent the maximum extent of monitoring to be required from SWS where a Candover Drought Order is implemented.

Summary of proposed measures

The aim of the proposed monitoring plan is to:

- Improve understanding of normal (non-drought) conditions at the Candover Stream / the Upper River Itchen and the River Itchen SSSI wetland units
- Improve understanding of the environmental sensitivity of the Candover Stream / the Upper River Itchen and the River Itchen SSSI wetland units
- Improve understanding of the risk of drought actions on the Candover Stream / the Upper River Itchen and the River Itchen SSSI wetland units

The package consists of:

- Hydrometry and water quality monitoring measures
- Monitoring to gather geological and hydrological and ecological baseline data about the River Itchen SSSI wetland units
- Invertebrate and macrophyte monitoring in the Candover stream and River Itchen upstream of the Otterbourne abstraction
- Monitoring to gather ecological baseline data about NERC habitats and species
- A Crayfish monitoring programme
- Walkover surveys during implementation of a Candover Drought Order

Hydrometry and water quality monitoring

Monitoring Measure 1: Installation and maintenance of three telemetered water quality monitoring stations and up to two non-telemetered water quality logger stations

Description:

1. SWS will, dependent on agreement for access and installation, maintain up to three telemetered water quality monitoring stations and up to two non-telemetered water quality logger stations.

2. The proposed parameters to be measured at each telemetered water quality station are listed below:-

    - Water temperature
    - Electrical Conductivity
    - pH
    - Turbidity
    - Dissolved Oxygen
    - Water Level

Non-telemetered stations may only provide sub-set of these.

***Funding and delivery*:** SWS will fund and maintain such proposed telemetered and non-telemetered water quality stations as it is able to install.

Monitoring Measure 2: Monitoring of Candover wetland and Candover valley by shallow dip-wells and piezometers

Description: SWS will fund the Agency and Hampshire & Isle of Wight Wildlife Trust to undertake monitoring of the Candover wetland SSSI Units and NERC habitats in the Candover valley by installing a small network of six pairs of shallow dip-wells and piezometers approximately 1 m to 5 m deep on wetland interest features or wetland boundary.

The Agency and SWS agree this data is a subset of data to be gathered and used in assessment of the impacts of abstractions at Totford and Lasham –and AMP6/7 restoring sustainable abstraction (WINEP) investigation.

SWS will fund a survey to establish the location and elevation of the proposed monitoring stations and key agreed features. The Agency and SWS recognise that much of this monitoring also serves data provision for the investigation of the impacts of the abstractions at Totford and Lasham.

***Funding and delivery*:** SWS will fund monitoring of Candover wetland and Candover valley by shallow dip-wells and piezometer. The level of funding appropriate has been agreed with the Agency. The Agency and the Hampshire & Isle of Wight Wildlife Trust are

responsible for delivery the programme of monitoring once funding has been provided by SWS.

Monitoring for River Itchen SSSI wetland units (Candover and downstream of the Candover DO augmentation discharge to the Itchen)

Monitoring Measure 3: Monitoring to gather geological, hydrological and ecological baseline data about the River Itchen SSSI wetland units (Candover) and NERC habitats and species

Objective: There are some limited ecological baseline data for the Itchen SSSI wetland units alongside the Candover (Units 114, 3, 4 and 5) but no geological or hydrological data, and the NERC habitats/species have previously not been specifically included in baseline assessments (although some features are covered by existing monitoring in respect of SAC and WFD features).

Data are required to inform the EAR for the Candover Drought Order, and also the WINEP investigation that will be undertaken into the Totford and Lasham abstractions. Note there is also a second WINEP investigation into impacts on all wetlands across the whole of the Itchen Valley including Totford, though it will be open to SWS to combine these investigations at the measures specification/ scoping stages. So work undertaken now will serve all these purposes.

Features to be monitored:

- River Itchen SSSI wetland units (Candover and downstream of the Candover DO augmentation discharge to the Itchen)
- NERC Habitats: CFPGM, Lowland Fen, Deciduous woodland
- NERC Species: water vole

Description:

The main focus of the wetland monitoring effort will be Units 3 and 114 as, if any units could be affected by groundwater abstraction for the Candover DO, or other abstractions in the vicinity, it will be these. However a limited monitoring suite is also proposed at Units 4 and 5 that are located downstream, to consider the relationship between stream and wetland water levels. A limited monitoring suite is also proposed at Unit 41 or 42downstream of the discharge at Itchen Abbas.

Action
• Walkover to confirm appropriateness of proposals and confirm design • Assent for invasive works in SSSI (i.e. augering, dipwell, piezometer and gaugeboard installation)
• Botanical survey (NVC) of Units 114, 3, 4 and 5 to define the SSSI interest

features present. Already completed by EA contract in 2017.

- Shallow augering to determine geology of the bed of the wet area in Unit 3. Care to be taken.
- Shallow dipwell (pair, max 1-1.25m deep) in ecological interest feature near to river (logger monitored for up to 10 years. Note this is also covered under Monitoring Measure 2 above.
- Shallow dipwell (pair, max 1-1.25m deep) in ecological interest feature distant from river (logger monitored for up to 10 years). Note this is also covered under Monitoring Measure 2 above.
- Topographic survey to relate level of ecological features to river level and piezometer and dipwell levels (Unit 3, once).
- Topographic survey transect across unit and cross section of channel, with flow gauging, ideally in low flow conditions. Analysis using the Rapid Hydro-ecological Flow Threshold (RHEFT) method to enable assessment of changes in extent of in channel river habitat with changes in flow and also how this relates to the ground level of the Unit. Alongside Units 3-5 and downstream of the discharge to the Itchen (e.g. Unit 41 or 42) (once)
- River level gaugeboard and logger alongside Units 3, 4 and 5, and also downstream of the discharge at Itchen Abbas (logger monitoring of at least 3 of these for up to 10 years). Note this is also covered under Monitoring Measure 1 above.
- Piezometer (tube well – 4-5m deep) into chalk (presume single only needed as would be shallow, on edge of SSSI wetland, or off site in valley bottom) (logger monitored for up to 10 years). Note this is also covered under Monitoring Measures 2 above.
- Piezometers (tube well – 4-5m deep) in the chalk up the valley between the wetland and the abstractions. Akin to the design used in the 1970s study – 1 downstream of the discharge, 1 upstream and 1 in the vicinity of the Coastal and Floodplain Grazing Marsh up the valley then this would give an indication of the levels in this habitat also (logger monitored for up to 10 years) Note this is also covered under Monitoring Measure 2 above.
- Up to 10 years monitoring and annual update reporting.

***Funding and delivery*:** SWS will fund the package of SSSI wetland monitoring set out above. The level of funding appropriate has been agreed with the Agency. The Agency and Hampshire & Isle of Wight Wildlife Trust (subject to formal agreement) will be responsible for delivering the programme of monitoring once funding has been provided by SWS save that installations will be completed by SWS or others as agreed.

Monitoring Measure 4: River Itchen SSSI wetland units (Candover and downstream of the Candover DO augmentation discharge to the Itchen) water vole monitoring

Objective: Assess the impact of the Candover Drought Order on the water vole population in the River Itchen SSSI wetland units (Candover and *downstream* of the Candover DO augmentation discharge to the Itchen).

Description: The exact status of water voles in the Itchen Valley is largely unknown as monitoring efforts have been intermittent in scale and frequency. Their presence in the Valley is known and they are potentially vulnerable to changes in water levels, such as may occur in drought conditions and exacerbated by abstraction.

The monitoring will comprise annual / biannual monitoring of two 500m stretches of known water vole habitat (one on the Candover and d/s of the Candover DO augmentation discharge to the Itchen). This is one of two methods recommended by the Hampshire & Isle of Wight Wildlife Trust. The monitoring proposals are subject to landowner access/agreement and walkover to confirm whether the proposals are appropriate or require refinement.

Funding and delivery: SWS will fund the package of water vole monitoring in the Lower Itchen Valley. The level of funding appropriate has been agreed with the Agency. The Hampshire & Isle of Wight Wildlife Trust (subject to formal agreement) will be responsible for delivering the programme of monitoring once funding has been provided by SWS.

Ecological monitoring for the River Itchen, Candover Stream and upper tributaries of the River Itchen

Monitoring Measure 5: Candover Stream and upper River Itchen invertebrate and macrophyte monitoring programme.

Objective: A pre, during and post drought monitoring plan to provide an understanding of how macro-invertebrates and macrophytes on the Candover Stream and upstream of the Otterbourne abstraction respond to low flow events.

Description:

All monitoring will be performed to standard methodology as set out in the Agency's Operational Instructions:

- 018_08 Freshwater macro-invertebrate sampling in rivers;
- 024_08 Freshwater macro-invertebrate analysis in riverine samples; and
- 131_07 Surveying freshwater macrophytes in rivers.

Any deviation from standard methodologies will be stated in the following tables and on any site sheets that are completed during surveying. The package of monitoring measures is set out in the table below. It will be carried out three times a year, in Spring, Summer and Autumn. For the stages of in-drought and post-drought, this monitoring should continue at these sites to enable assessment of impact and recovery.

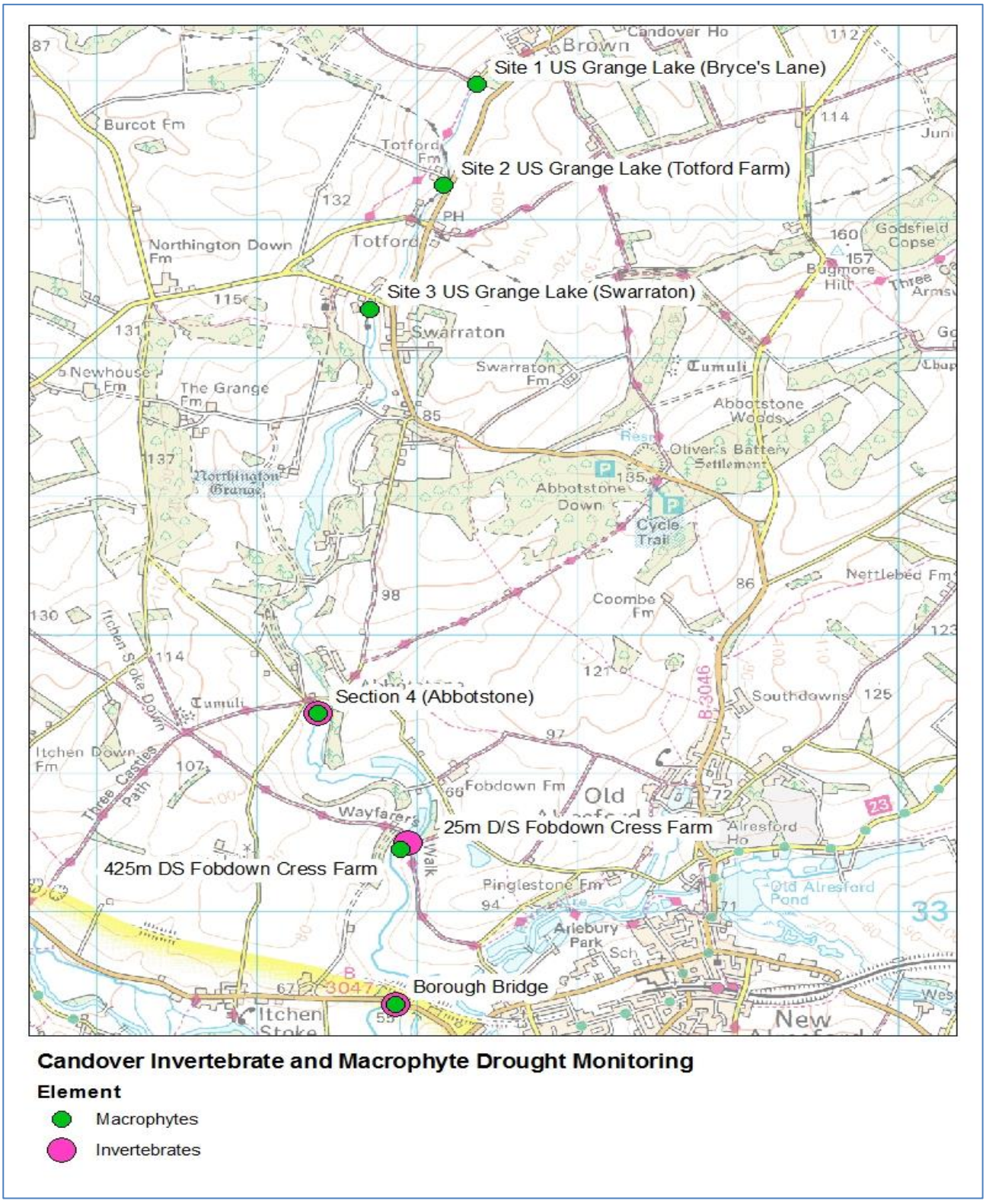
Monitoring on the Candover Stream

Biosys River Name	BiosysID	Site	NGR	Element	Method	Spring			Summer			Autumn			Annual Frequency	Funding
						March	April	May	June	July	August	September	October	November		
Candover Brook	42056	25m D/S Fobdown Cress Farm	SU56946 33496	Invertebrates	3-min kick	x			x			x			3	EA
Candover Brook	43407	Borough Bridge	SU56870 32330	Invertebrates	3-min kick	x			x			x			3	EA
Candover Brook	110121	Section 4 (Abbotstone)	SU56390 34430	Invertebrates	3-min kick	x			x			x			3	EA
Candover Brook	42057	425m DS Fobdown Cress Farm	SU56900 33450	Macrophytes	MTR				x			x			2	EA
Candover Brook	43407	Borough Bridge	SU56870 32330	Macrophytes	MTR				x			x			2	EA
Candover Brook	110121	Section 4 (Abbotstone)	SU56390 34430	Macrophytes	MTR				x			x			2	EA
Candover Brook	New	Site 1 US Grange Lake (Bryce's Lane)	SU57380 38969	Macrophytes	Ephemeral MTR				x			x			2	SWS
Candover Brook	New	Site 2 US Grange Lake (Totford Farm)	SU57172 38241	Macrophytes	Ephemeral MTR				x			x			2	SWS
Candover Brook	New	Site 3 US Grange Lake (Swarraton)	SU56712 37346	Macrophytes	Ephemeral MTR				x			x			2	SWS

Information in red font represents sites that are not fixed to the stated map grid references until a site visit is completed.

The macrophytes upstream of Grange Lake are in the stretch of river that is ephemeral. The MTR survey is not restricted to the wetted width as it is in the standard MTR method but a fixed width. This will allow the assessment of terrestrial encroachment in lower flow years and any recovery in subsequent years. This is the accepted technique for surveying macrophytes in temporary streams.

Proposed Monitoring Sites for Candover Stream



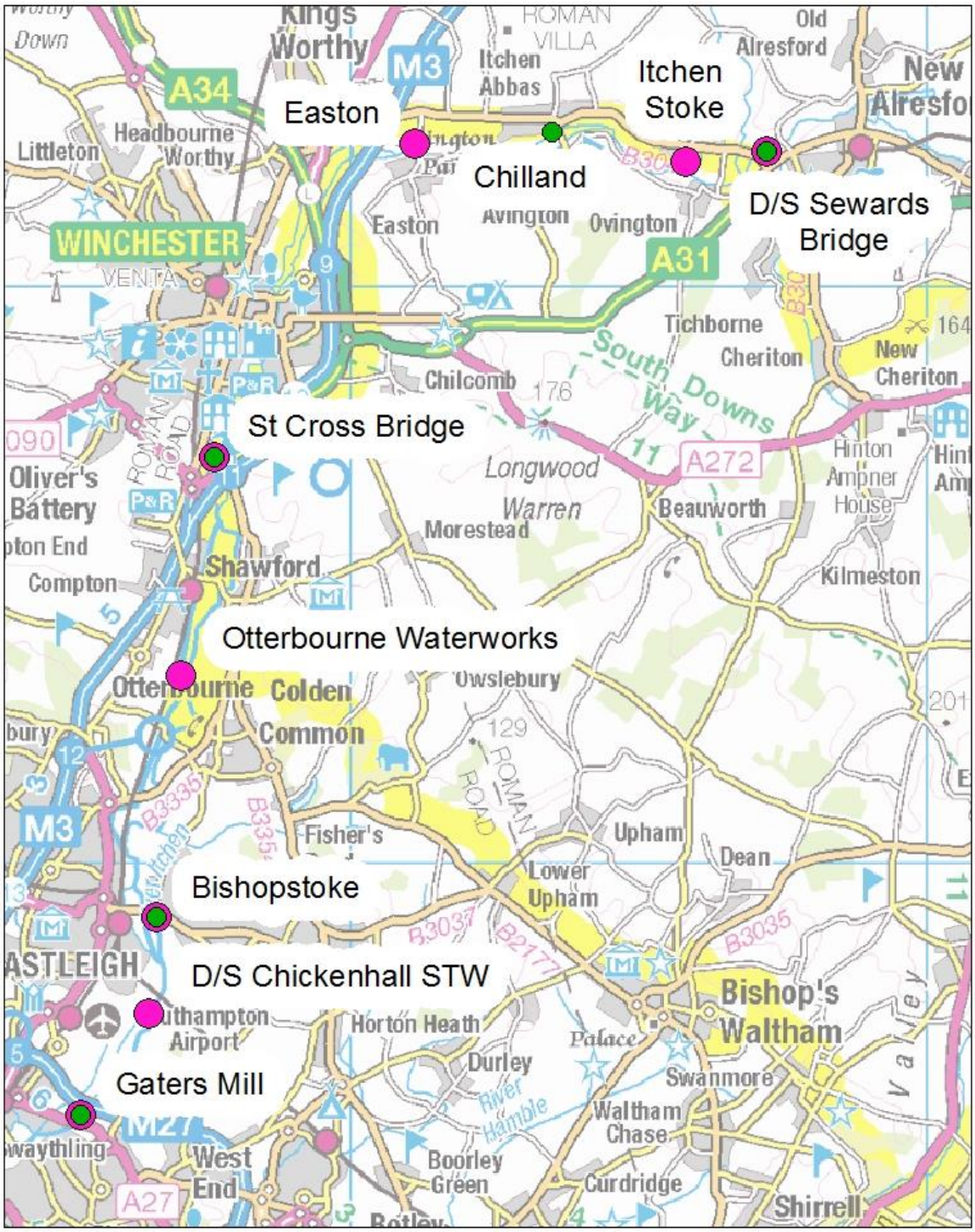
The site locations and monitoring frequency were chosen by following guidance in the Agency's Operational Instruction 776_15 Hydroecological monitoring for flow pressure assessment.

Monitoring on the River Itchen upstream and including the Otterbourne intake

Note – this monitoring overlaps with monitoring being carried out under the Lower Itchen Drought Order Monitoring plan.

						Spring			Summer			Autumn				
Biosys River Name	Biosys ID	Site	NGR	Element	Method	March	April	May	June	July	August	September	October	November	Annual Frequency	Funding
River Itchen	41998	Itchen Stoke	SU5582032150	Invertebrates	3-min kick	x			x			x			3	SWS
River Itchen	42048	Otterbourne Waterworks	SU4706023240	Invertebrates	3-min kick	x			x			x			3	Both
River Itchen	43091	St Cross Bridge	SU4764027030	Invertebrates	3-min kick	x			x			x			3	SWS
River Itchen	43091	St Cross Bridge	SU4764027030	Macrophytes	MTR				x						1	SWS
River Itchen	43307	Easton	SU5113032470	Invertebrates	3-min kick	x			x			x			3	SWS
River Itchen	43391	Chilland (Itchen Abbas)	SU5350332657	Macrophytes	MTR				x						1	Both
River Itchen	43102	D/S Sewards Bridge	SU5724032330	Invertebrates	3-min kick	x			x			x			3	Both
River Itchen	43102	D/S Sewards Bridge	SU5724032330	Macrophytes	MTR				x						1	Both

Proposed Monitoring Sites for River Itchen



Funding and delivery: SWS and the Agency will jointly fund the Candover Stream invertebrate and macrophyte monitoring programme. The level of funding appropriate has been agreed with the Agency. The Agency is responsible for delivery of the programme of monitoring once funding has been provided by SWS.

Monitoring Measure 6: Monitoring plan for Crayfish

Objective: A pre, during and post drought monitoring plan for the Crayfish populations (White-clawed and Signal) in the upper tributaries of the River Itchen.

Description:

1. Deploy and manage the data set collected by a minimum of 5 multi-parameter sondes at five agreed locations between the existing discharge point and Borough Bridge. Note this is also covered under Monitoring Measure 2 above.

2. Fund existing projects to deliver a rolling programme of monitoring to maintain an up to date knowledge of crayfish (both White-clawed and Signal) distribution in the upper tributaries of the River Itchen.

Funding and delivery: SWS will fund the Crayfish monitoring programme. The level of funding appropriate has been agreed with the Agency. The Hampshire & Isle of Wight Wildlife Trust (subject to formal agreement) will be responsible for delivery the programme of monitoring once funding has been provided by SWS.

Fish monitoring for the River Itchen

Monitoring Measure 7: River Itchen fish monitoring programme.

Note – this monitoring overlaps with monitoring being carried out under the Lower Itchen Drought Order Monitoring plan.

Objective: SWS will fund a drought monitoring plan for River Itchen fish which has been devised and will be implemented by Dominic Longley, the Agency's Solent & South Downs Senior Environmental Monitoring Officer, with input from Dr Adrian Fewings and Dr Nigel Milner.

Description: The Agency's proposed River Itchen Fish Drought Monitoring Plan expands on existing Agency fish monitoring programmes in order to optimise spatial coverage and temporal frequency.

A draft of the River Itchen Fish Drought Monitoring Plan is attached to this monitoring plan. In summary, fish monitoring will comprise:

- CPUE fish surveys;
- Single catch electric fishing;
- Juvenile lamprey sampling by quadrat; and
- Standardised winter salmon / sea trout spawning redd surveys.

Funding and delivery: SWS will fund the River Itchen Fish Drought Monitoring Plan monitoring programme. The level of funding appropriate has been agreed with the Agency. The Agency is responsible for delivering the programme of monitoring once funding has been provided by SWS.

Monitoring during implementation of Candover Drought Order

Monitoring Measure 8: Walkover surveys during implementation of a Candover Drought Order.

Description: SWS will fund the Agency to carry out walkover surveys to assess and monitor the impact of the abstraction throughout the duration of a Candover Drought Order and post Drought Order on a range of habitats and species in particular those designated under the SAC, SSSI and NERC priority habitats and species.

Walkover surveys will be carried out focus on the following features:

- Flowing waters -
    - Identify any key sources of nutrient loading exacerbating low flow effects
    - Carry out additional water quality sampling particularly Soluble Reactive Phosphorus (SRP)
    - Consider addressing nutrient loading sources
    - Consider in-stream measures or adjustments to improve habitat conditions during drought conditions.
- Fish community
    - Targeted walkover surveys in areas known to contain high densities of fish.
    - Additional water quality sampling to check temperature, conductivity and dissolved oxygen levels in key spawning and holding areas.
    - Consider any measures to improve temperature and dissolved oxygen levels e.g. aerators and temporary shading.
- Crayfish
    - Targeted walkover of key areas supporting crayfish
    - Consider in-stream measures or adjustments to improve habitat conditions during drought conditions, to ensure maintenance of crayfish habitat.

Funding and delivery: SWS will fund this package of walk over monitoring on the Candover stream on a weekly basis for the duration of a Drought Order. The level of funding appropriate has been agreed with the Agency. The Agency is responsible for carrying out walk over monitoring once funding has been provided by SWS.