



Clockhouse Lane Pit Lakes - Water Quality and Ecology Overview 2016

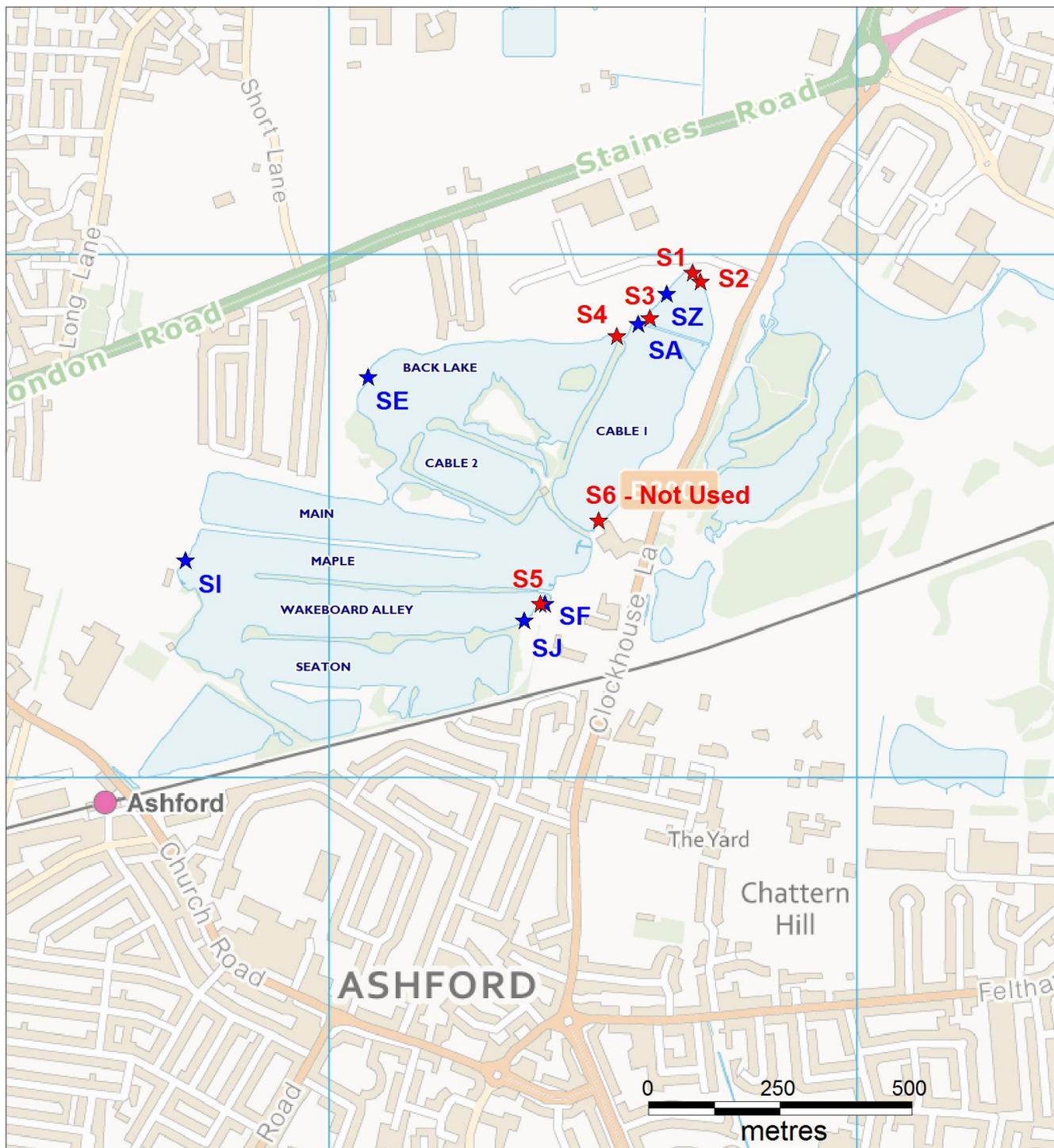


Heathrow Airport uses specialist consultants to monitor the Clockhouse Lane Pit system of interconnected lakes for water quality and biological indicators, including macroinvertebrates; which are important tools in monitoring its health and condition. This helps to inform decision making and management of rainfall runoff from the airport to ensure the protection of the Clockhouse Lane Pit system, and the waters it discharges into.

This fact sheet provides some of the highlights of the monitoring data collected in 2016 on the Clockhouse Lane Pit system.

Water Quality

Good water quality is essential for sustaining a diversity of aquatic life. Water quality is often referenced against a set of legislative standards which helps those managing the airport to assess the nature and status of those waterbodies it influences. For surface waters, the current and most important piece of legislation is the EU Water Framework Directive (2000/60/EC) or WFD, which aims for European waterbodies to achieve a 'good ecological status' by meeting a number of chemical, physical and biological standards by 2020. There are six main water quality standards in the WFD, against which the performance of the Clockhouse Lane Pit has been compared, and these are illustrated below.



BAA Heathrow: Surface Water Sampling and Biological Monitoring Locations at Clockhouse Lane Pit (CLP)

- | | |
|--|------------------------------------|
| S1 Southern Catchment Inlet | SA Cable 1, Downstream Weir |
| S2 Western Catchment (SWOT) Inlet | SE Back Lake |
| S3 Inside Weir Notch | SF Boatyard |
| S4 Northern Peninsular | SI Lake House |
| S5 Outlet | SJ Slipway |
| S6 Club House* | SZ At Outfall |

*Sample point used only in emergency sampling



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Table 1: Performance of the Clockhouse Lane Pit lake system monitored by OHES Environmental on behalf of Heathrow Airport during 2016 against the main Water Framework Directive water chemistry standards

	WFD standard for 'good' status	Performance of Clockhouse Lane Pit against WFD		
		Southern Catchment Inlet	Western Catchment Inlet	Lake Outlet
Dissolved Oxygen	60% saturation (90% of the time)	'Good status' EQS met	'Good status' EQS met	'Good status' EQS met
Biochemical Oxygen Demand (BOD)	5 mg/l (90% of the time)	'Good status' EQS met	'Good status' EQS met	'Good status' EQS met
Acidity: pH	6 – 9 (95% of the time)	'Good status' EQS met	'Good status' EQS met	'Good status' EQS met
Water temperature	< 28°C	'Good status' EQS met	'Good status' EQS met	'Good status' EQS met
Ammoniacal nitrogen	< 0.6 mg/l	'Good status' EQS met	'Good status' EQS met	'Good status' EQS met
Reactive Phosphorus	Annual average value based on alkalinity and altitude at each site	Standard not met, annual average met 'poor status'	Standard not met, annual average met 'moderate status'	'Good status' EQS met

Dissolved Oxygen: required to sustain aquatic life and is therefore an essential component of achieving 'good' water quality status under WFD. These standards were met on all sampling occasions in the Clockhouse Lane Pit lake system.

Biochemical Oxygen Demand (BOD): BOD is related to the dissolved oxygen and is a measure of how fast oxygen is used up by organisms in the water. This is usually bacteria breaking down organic matter. Each of the CLP sites achieved a 'good' standard overall obtaining BOD measurements ≤ 5 mg/l.

Temperature and pH: All standards were met for 2016 across the Clockhouse Pit Lane lake system other than pH at the CLP Outlet in July. pH was 9.34 on that occasion.

Ammoniacal Nitrogen: Known also as available ammonium and exchangeable ammonium, this is the dissolved form of nitrogen as ammonia, which indicates the presence of organic pollution. The 'good' standard was met on each sampling occasion across the lake system in 2016.

Reactive Phosphorus: An annual average EQS for 'good' status is calculated using site specific alkalinity and altitude. The Southern Catchment Inlet obtained a 'poor' and the Western Catchment Inlet met the 'moderate' status.

Of the two key nutrients measured (reactive phosphorus and ammonia as nitrogen), mean reactive phosphorus levels did not meet the EQS at either of the inlets which is consistent with the 2013 – 2015 results. At the Lake Outlet the site achieved a 'good' status in relation to these nutrients. This suggests that the source of the water entering the system is nutrient rich. The results indicate the nutrients break down as they pass through the system towards the Lake Outlet.

Aquatic Ecology

Pollution can change macroinvertebrate and fish species assemblages and abundances, as well as the number of individuals present for a particular species. Change may be due to the in-situ demise of individuals or the migration of individuals away from pollution. In order to investigate, the data must be translated into an applicable value. Biological analysis has several advantages over chemical analysis, the primary being the lasting response organism's exhibit following pollution events and the ability to discern chronic effects to a range of pollutants, rather than a snap-shot in time.

Macroinvertebrate Surveys

Aquatic invertebrates spend part of their life-cycle in or around sediment on the bottom of the water column, among submerged and emergent plants or in the margins and drawdown zone. The Biological Monitoring Working Party (BMWP) has been applied to assess the CLP macroinvertebrate communities, with ongoing bi-annual data. The BMWP scores 'Families' from 1 to 10, based on sensitivity to pollution and oxygen requirements with highest scoring Families most sensitive. The BMWP score is the sum of Family scores. With any science-based tool, there is potential for review as research continues.

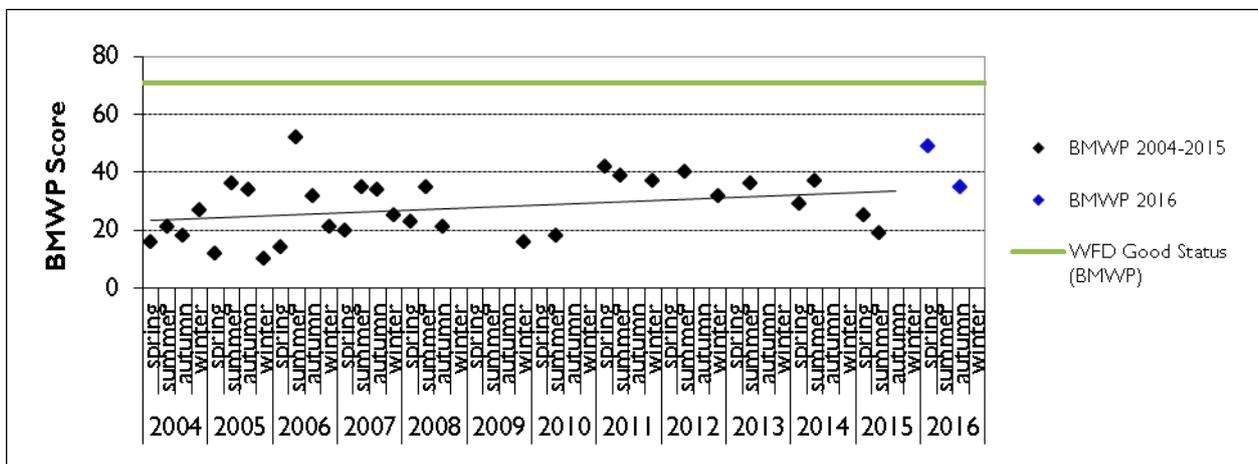
OHES has summarised and contextualised the macroinvertebrate survey results using the principles of RIVPACS (River Invertebrate Prediction and Classification System).

RIVPACS is a statistical model which allows the classification of a macroinvertebrate population. The system is used to predict the expected fauna of a site, which is then compared to the observed fauna. OHES has adopted the Ecological Status Class of RIVPACS to award each BMWP score a corresponding reference condition under the WFD.

There are five classification categories based on the BMWP score, which are outlined in the table below:

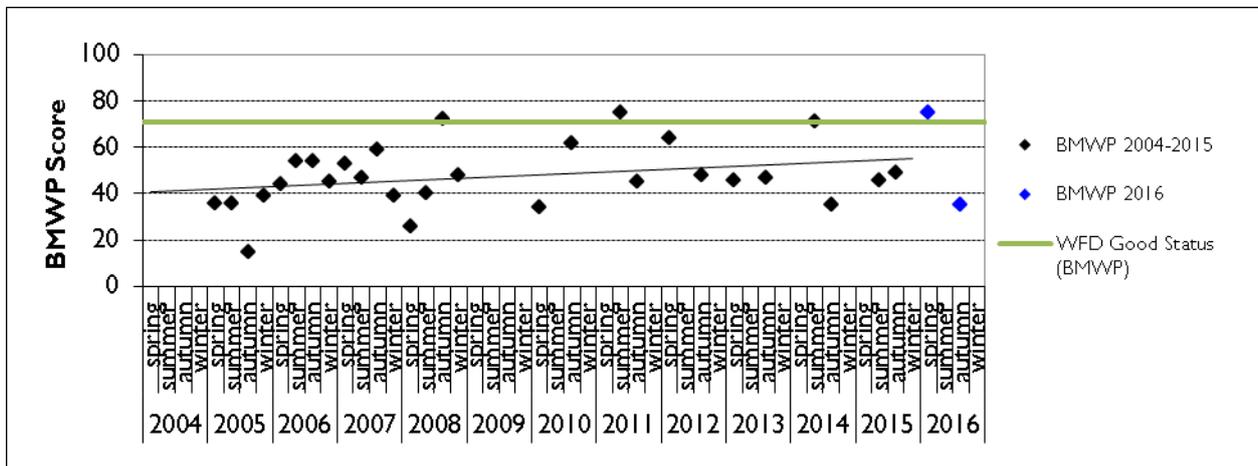
BMWP Score	Category	Interpretation
0-10	Very Poor	Heavily Polluted
11-40	Poor	Polluted or Impacted
41-70	Moderate	Moderately Impacted
71-100	Good	Clean but Slightly Impacted
>100	Very Good	Unpolluted / Unimpacted

Macroinvertebrate data has been collected for over ten years across the lakes and the resulting BMWP scores for the Inlet, downstream of the Western and Southern inlets, and the Lake outlet are shown in the following graphs:



BMWP Score for the Clockhouse Lane Pit Inlet (Site Z) downstream of Western and Southern Inlets

The BMWP scores for the Clockhouse Lane Pit Inlet do not meet the 'Good' status required by WFD and are classed as 'Moderate' for spring and 'Poor' for autumn. No high scoring (pollution intolerant) taxa were identified at this site, and the macroinvertebrate community was comprised of low abundances of pollution tolerant taxa such as hoglice (*Asellidae*), freshwater shrimp (*Gammaridae* (incl. *Crangonyctidae*)) and worms (*Oligochaeta*). Biotic indices scores were similar and in line with previous years' data (2011 – 2014); however, it is worth highlighting that the spring score was the second highest recorded since monitoring began in 2004.



BMWP Score for the Lake Outlet (Site J)

The spring BMWP score for the Lake Outlet does meet the 'Good' status required by WFD (score of 75), however the autumn is classed as 'Poor'. The 'Good' score of the spring data is likely to be attributed to the high abundance of the more sensitive species small squaregill mayflies (*Caenidae*) and moderate numbers of the top-scoring long-horned caddisfly (*Leptoceridae*) which requires a good water quality for its survival. The spring 2016 BMWP score is jointly the highest recorded at this site since monitoring began in 2004. Although conversely, the autumn is one of the lowest recorded showing the influence of seasonal fluctuation within the site and system. Overall, there appears to be an upward trend and increase in biological water quality at this site. BMWP scores were higher at this location than the Southern and Western Inlets, suggesting an increase in water quality as it moves through the system.