



Clockhouse Lane Pit Lakes - Water Quality and Ecology Overview 2015

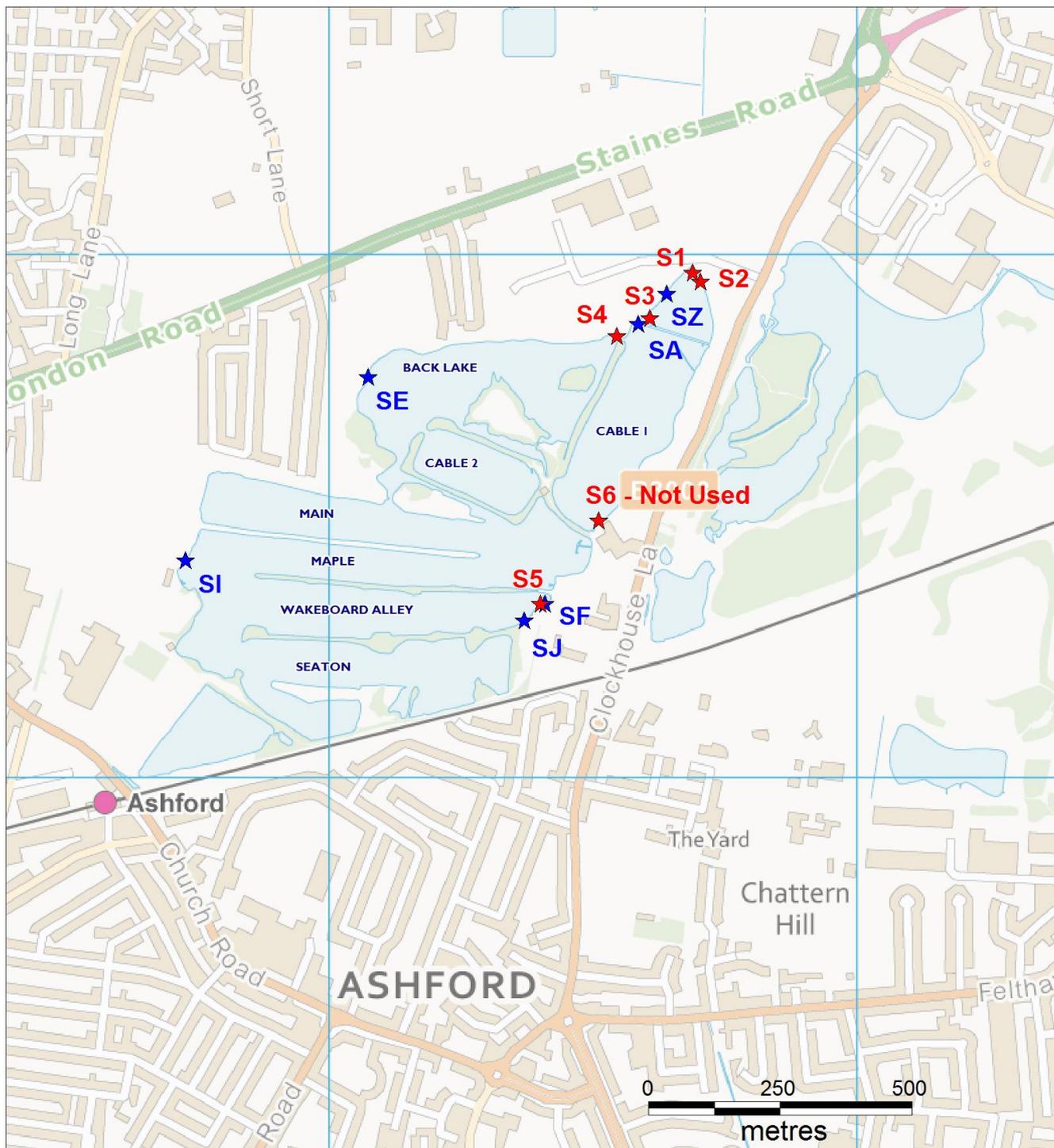


Heathrow Airport uses specialist consultants to monitor the Clockhouse Lane Pit system of interconnected lakes for water quality and biological indicators, including macroinvertebrates; which are important tools in monitoring its health and condition. This helps to inform decision making and management 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 2015 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 2015 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)	Standard met for all 12 samples	Standard met for all 12 samples	Standards met for all 12 samples
Biochemical Oxygen Demand (BOD)	5 mg/l (90 % of the time)	Standards met for 10 out of 12 samples – 'moderate'	Standards met for 9 out of 12 samples – 'moderate'	Standard met for 11 out of 12 samples
Acidity: pH	6 – 9 (units)	Standard met	Standards met	Standards met
Water temperature	< 28 °C	Standard met for all 12 samples	Standard met for all 12 samples	Standards met
Ammonia as nitrogen	< 0.6 mg/l	Standards met	Standards met	Standards met
Reactive Phosphorus	< 0.12 mg/l annual average	Standard not met, annual average 1.21 mg/l – 'bad'	Standard not met, annual average 0.53 mg/l – 'poor'	Standard met, annual average 0.03 mg/l

Dissolved Oxygen: is 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 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. The Southern and Western Catchment Inlets met 'moderate' status for BOD overall. At the Southern Catchment inlet BOD was measured at 'good' levels on 10 out of 12 sampling occasions, and at the Western Catchment Inlet on 9 out of 12 occasions. The Lake Outlet achieved a 'good' standard overall with 11 out of 12 samples obtaining BOD measurements ≤ 5 mg/l.

Temperature and pH: All standards were met for 2015 across the Clockhouse Pit Lane lake system.

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 2015.

Reactive Phosphorus: The Southern Catchment Inlet obtained a 'poor' status with an annual average of 1.21 mg/l compared to a 'good' standard of an annual average of ≤ 0.12 mg/l.

Of the two key nutrients measured (reactive phosphorus and ammonia as nitrogen), elevated levels of reactive phosphorus were recorded at both of the inlets on three of the four sampling occasions which is consistent with 2013 and 2014 results. At the Lake Outlet, all 4 of the samples 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 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, 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.

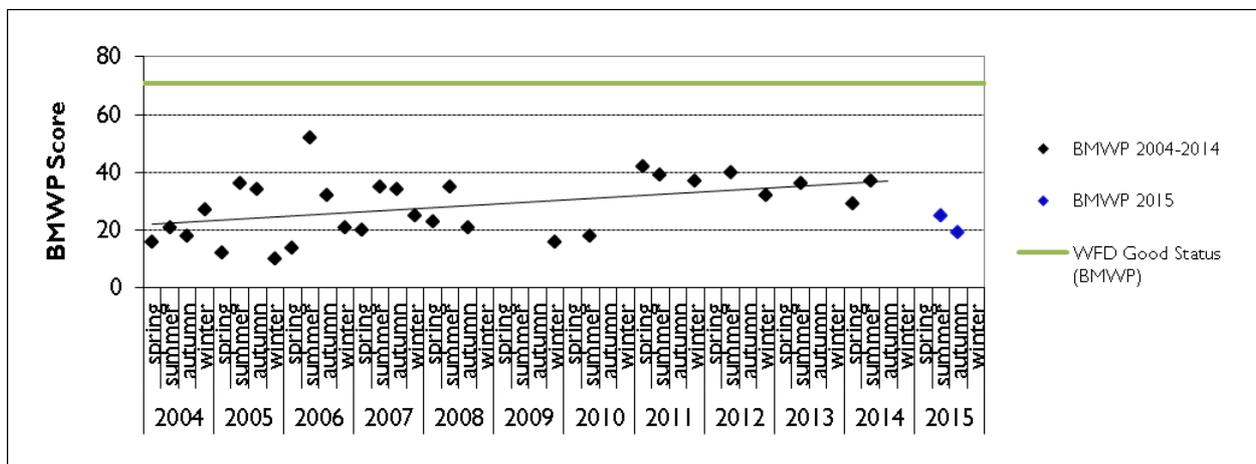
OHES has summarised and contextualised the macroinvertebrate survey results using the RIVPACS (River Invertebrate Prediction and Classification System).

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. An Ecological Status Class can then be awarded to each BMWP score, which generally corresponds to reference conditions under the WFD.

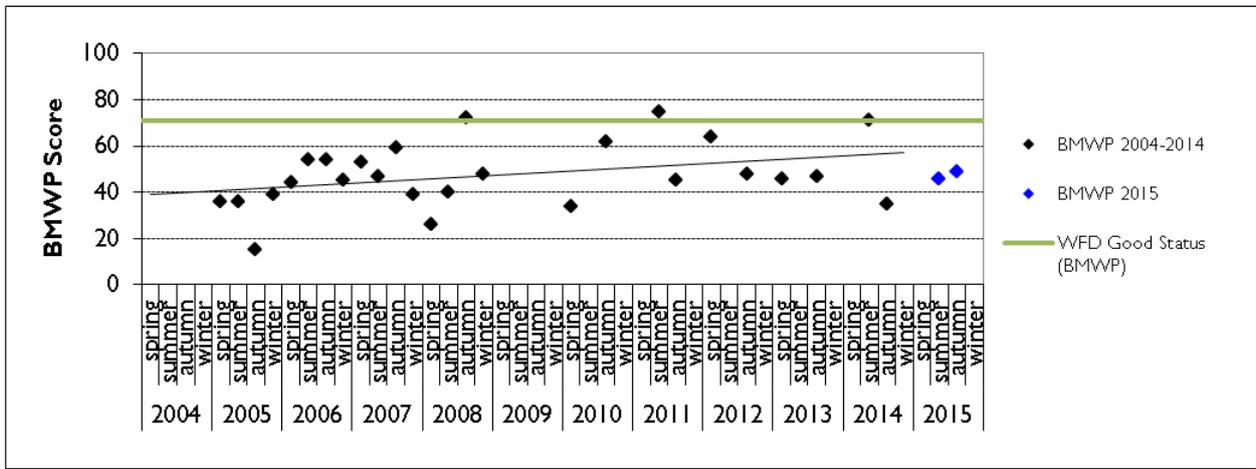
There are five classification categories based on the BMWP score, which are outlined in the table below:

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 are shown in the following graphs:



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



BMWP Score for the Lake Outlet (Site J)

Clockhouse Lane Pit Inlet (Site Z): With a summer score of 25 and an autumn score of 19, the BMWP scores at this site are lower than in previous years (2011 – 2014). The results were comparable with the scores observed 2004 – 2010 and are classified as ‘poor’. These results give further weight to the suggestion that these sites are impacted by nutrient rich waters. No high scoring taxa were identified at this site, which was comprised of low abundances of pollutant tolerant species.

Lake Outlet (Site J): The summer BMWP score has declined since 2014, with a score of 46 compared to 71. The autumn score of 49 classes this site as ‘moderate’ for both seasons. Although biotic indices scores were lower than 2014, they were more consistent with previous years’ results. 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.