



Monitoring the River Crane Water Quality and Ecology 2016



Heathrow Airport uses specialist accredited consultants to monitor water quality and biological indicators in the River Crane, a tributary of the River Thames, which flows next to the airport. Investigating the chemistry and biology is a valuable tool for understanding a river's health and this brief report presents the salient points of the 2016 data, focussing on the River Crane east of Heathrow Airport and upstream of the Duke of Northumberland's River and Crane Valley Nature Park.

Water Quality

Good water quality is a fundamental requirement to sustain a diversity of aquatic life. Aquatic systems also underpin our daily lives, providing domestic water and supporting business and industry. There is legislation in place to safeguard water quality, including 'standards' with which businesses and industry must comply. At present, the primary over-arching legislation is the EU Water Framework Directive (2000/60/EC) (WFD). This aims for European waterbodies to achieve a 'good ecological status'. This status is defined by physical, chemical and biological parameters. For chemical standards, there are six key measures, against which the River Crane has been independently assessed, upstream and downstream of an airport outlet. The airport naturally cleans surface waters through lake systems before it returns to the river and undertakes continued monitoring of the quality to any receiving waterbody. The River Crane has been subject to recent pollution events elsewhere in the catchment, as determined by the Environment Agency, which has had an impact upon its aquatic life.

River Crane water quality 2016 against WFD chemistry standards (DEFRA, 2015¹) (OHES, 2016)

| | WFD standard for 'good' status | Performance of River Crane | |
|--|--|--|---|
| | | Upstream of outlet | Downstream of outlet |
| Dissolved Oxygen | 60% saturation (90% of the time) | 'Good status' EQS met 7 out of 12 samples – overall 'poor' status | 'Good' status EQS met 7 out of 12 samples taken – 'moderate' status overall |
| Biochemical Oxygen Demand (BOD) | 5 mg/l (90% of the time) | 'Good status' EQS met for 10 out of 12 samples – 'moderate status' | 'Good' status EQS met 11 out of 12 samples taken – 'good' status overall |
| Acidity: pH | 6 – 9 (95% of the time) | 'Good status' EQS met | 'Good status' EQS met |
| Water temperature | < 28°C | 'Good status' EQS met | 'Good status' EQS met |
| Ammoniacal nitrogen | < 0.6 mg/l | 'Good status' EQS met | 'Good status' EQS met |
| Reactive Phosphorus | Annual average value based on alkalinity and altitude at each site | EQS not met, annual average met 'poor status' overall | Standard not met, annual average met 'moderate status' overall |

Dissolved oxygen: Aquatic organisms require dissolved oxygen to survive. Overall concentrations during 2016 were 'poor' upstream of the EBR outfall and 'moderate' downstream of the outfall. On the five occasions the 'good' standard was not met, the dissolved oxygen was lower upstream than it was downstream. This is why downstream achieved 'moderate' status whereas upstream was 'poor'.

Biochemical Oxygen Demand (BOD): BOD is related to oxygen, measuring how fast oxygen is being used up by organisms, usually bacteria breaking down organic matter. Results met the 'moderate' standard upstream and 'good' downstream.

Temperature and pH: All standards were met for 2016.

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. Consistent with previous years, all results met WFD standards.

Reactive Phosphorus: An annual average EQS for 'good' status is calculated using site specific alkalinity and altitude. As determined in previous years, results upstream and downstream of the airport did not meet the 'good' WFD status.

Aquatic Ecology

Any changes in the biota can be linked to a number of external influences in a river system, including natural population fluctuations, seasonality, changes in habitat or migration. Organic pollutants can also impact macroinvertebrate and fish species assemblage and communities, as well as the number of individuals present. Fish and macroinvertebrate population assessments are often used to provide metrics for biological water quality. Advantages over chemical analysis are in the lasting response by organisms following pollution, where chemical analysis is a snap shot in time and may not screen all possible types of pollution which biological indicators respond to.

Macroinvertebrates surveys

Aquatic invertebrates live or 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 River Crane's 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.

¹ DEFRA (2010) River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Direction 2010, ISBN 978-0-85521-1192-9

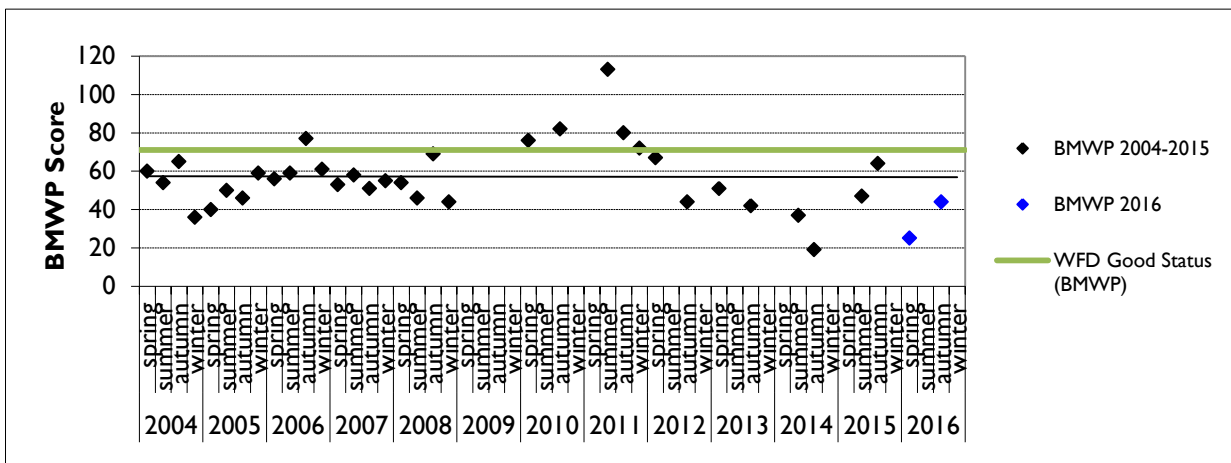
OHES has summarised and contextualised the macroinvertebrate survey results using the principles of RIVPACS (River Invertebrate Prediction and Classification System).

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.

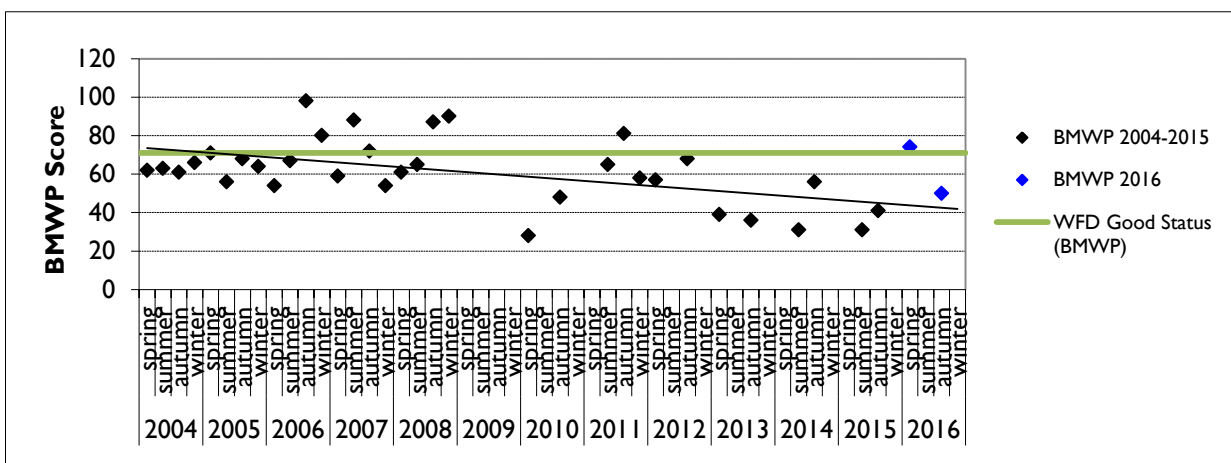
There are five classification categories based on the BMWP score, which are outlined in the table below:

| 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 |

The graphs below show the BMWP scores for the River Crane over time (2004-2016) at the sampling points above and below the Eastern Balancing Reservoir (EBR) outfall. The 2016 results for summer and autumn are highlighted in blue. The BWMP score for 'Good' Status as required by WFD (71) has been included as a green line on each graph.



Biological Monitoring Working Party (BMWP) scores over time for the River Crane Upstream of the EBR outfall



Biological Monitoring Working Party (BMWP) scores over time for the River Crane Downstream of the EBR Outlet

Both the summer and autumn BMWP scores for the site upstream of the outfall do not meet the 'Good' status required by WFD. The autumn score only met the 'Moderate' status, recorded as **44** and the spring 'Poor' recorded as **25**. The spring BMWP is the second lowest recorded for this site since 2004. The autumn score is in-line with previous survey data recorded for the site. The general trends, shown by a fine black line, of the biological indices are suggesting that there has been little change over the years at this site.

The site downstream of the EBR outfall recorded a spring BMWP score that met the 'Good' status required by WFD. Unfortunately, the positive trend did not continue into the autumn, with the BMWP score classed as 'Moderate'. The biotic indices scores are generally in line with early monitoring results (2004 – 2008); however, the 2009 onwards saw greater variability and a general decline in the recorded taxa. Higher scoring taxa, such as the Trumpet-net Caddisflies (Psychomyiidae) are present in low abundances and a single top-scoring (pollution intolerant) taxa, Long-horned Caddisflies (Leptoceridae), was recorded as present in both seasons. Since 2010, there has been a marked variability in the BMWP scores, suggesting an overall general trend of deterioration in biological water quality.

Fish Surveys

OHES undertook electro-fishing surveys at six locations on the River Crane, repeating the survey work completed in 2014 & 2015, including both upstream and downstream of the airport EBR Outlet.

The uppermost site at Cranford Park produced very low numbers of fish, however both roach and dace were present. In 2015 only minor species were found. Further downstream, at Waye Avenue, a more diverse fish population was present, with five different species recorded. The presence of a new species to this site, barbel, recorded at reasonable numbers, suggests that the improvement in fish stocks is either linked to fish stocking directly at the site, or at a site lower in the system and fish may have migrated upstream in search of more favourable habitats.



Photograph: Barbel caught at Waye Avenue in 2016

Directly upstream of the EBR outfall the fish survey results saw a major fish species richness of six. The presence of both barbel and common bream is encouraging as these are new species to the survey reach. Downstream of the EBR outfall, major fish species richness was highest of all the 2016 survey sites with nine major species recorded.



Photograph: Bream Upstream of the EBR Outfall in 2016

Like the majority of the other sites within this survey programme, the upstream site at Crane Park has followed the trend of continuous improvement. The species richness was composed of five major species, dominated by dace. At the lower site the species richness has been recorded as six major species. The results are positive and the presence of notable species such as barbel, chub and dace in good numbers is worthy of a mention.



Photograph: Chub caught Downstream of the EBR Outlet in 2016

The River Crane is very much impacted by the surrounding conurbations of Feltham, West Drayton, Cranford, Heathrow Airport and Hanworth. It has to cope with the environmental impacts of this, not only in water quality terms, but also with regard to the high levels of surface water drainage and general urban waste and litter.

In conclusion the River Crane is performing extremely well for an urban river, with very good, albeit slightly patchy, fish populations boosted by fisheries management. Any further introduction of fish should concentrate on the areas identified with slightly poorer fish populations in the upper sections of the river.

Please note: electro-fishing surveys are subject to Environment Agency consent and adhere to strict health and safety procedures, such work must only be carried out by suitably qualified professionals.