

Monitoring the River Crane Water Quality and Ecology January - June 2017



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 2017 data collected so far, 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

The airport naturally cleans surface waters through the Eastern Balancing Reservoir (EBR) lake system before it is released to the River Crane. The airport undertakes continued monitoring of the quality of water in the EBR and the receiving waterbody. In January 2017 the River Crane showed evidence of 'sewage fungus' growth. Sewage fungus is predominantly composed of *Sphaerotilus spp.* which is a bacterium that can colonise a watercourse rapidly when there is a continuous supply of organic compounds. Sewage fungus growth was evident in the River Crane from the Causeway down to Crane Valley Nature Park.

The airport instructed an independent environmental consultancy to attend the River Crane and investigate water chemistry and aquatic biology over a period of 6 months. The aim of the investigation was to identify

possible sources of organic compounds contributing to sewage fungus growth and assess recovery of the watercourse.

River Crane water quality January – June 2017 against WFD chemistry standards (DEFRA, 2015¹) (OHES, 2017)

	WFD standard for 'good' status	Performance of River Crane				
		Surface water outfall	Upstream of airport outlet	Airport Outlet	Downstream of airport outlet	Crane Valley Nature Park
Dissolved Oxygen	60% saturation (90% of the time)	Good	Good	Good	Good	Good
Biochemical Oxygen Demand (BOD)	5.0 mg/l (90% of the time)	Good	Moderate	Poor	Poor	Good
Acidity: pH	6.0 – 9.0 (95% of the time)	Moderate	Good	Good	Good	Good
Water temperature	≤ 28.0°C	Good	Good	Good	Good	Good
Ammoniacal nitrogen	≤ 0.6 mg/l (90% of the time)	Poor	Moderate	Good	Moderate	Good
Glycols	N/A	Present 1/10 sampling occasions	Present 1/10 sampling occasions	Present 4/10 sampling occasions	Present 0/10 sampling occasions	Present 0/10 sampling occasions

Dissolved oxygen: Aquatic organisms require dissolved oxygen to survive. Overall concentrations from January – June 2017 were 'good' at all monitoring locations.

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 immediately upstream and 'poor' at the outlet and immediately downstream. At Crane Valley Nature Park BOD was 'good' on all sampling occasions. One on occasion BOD was measured at 34.0 mg/l at the surface water outfall which is not reflected in the percentile results.

Temperature and pH: pH was 'moderate' at the surface water outfall and achieved the 'good' standard at all the other sites. The standards were met for temperature at all monitoring locations.

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. Results at the surface outfall were 'poor' with 'moderate' results downstream. At the Airport Outfall and Crane Valley Nature Park the 'good' standard was achieved.

Glycols: Glycols are organic compounds which can be found in de-icing products. They can increase biochemical oxygen demand (BOD) in water as they are broken down by aerobic organisms. There are no WFD environmental quality standards for glycols and they are not considered toxic. Glycols were recorded at the airports outlet on four out of ten sampling occasions and one of ten at the sites upstream of the outlet.

¹ DEFRA (2010) River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Direction 2010, ISBN 978-0-85521-192-9

Sewage Fungus Survey

OHES conducted a survey of sewage fungus coverage along the River Crane between January and June 2017. Sewage fungus coverage was assessed at each monitoring location by taking a transect of the river and applying the below standards of sewage fungus cover in the water course:



SEWAGE FUNGUS ABUNDANCE

D	A	F	O	R	N
Dominant	Abundant	Frequent	Occasional	Rare	None
>75%	51% - 75%	26% - 50%	11% - 25%	1% - 10%	<1%

The image to the right shows sewage fungus in the River Crane on the 27th March 2017. The table below highlights the sewage fungus investigation results between January and June 2017.

Date	US surface water outfall	Surface Water Outfall	Upstream of Airport Outfall	Airport Outfall	Downstream of Airport Outfall	Donkey Wood	Crane Valley Park
24/01/17			Present		Present	Present	
01/02/17			*	*	*	*	
16/02/17			A	N	F	D	
23/02/17	N	R	A	F	O	D	N
02/03/17	N	O	F	F	F	A	N
07/03/17	N	F	A	O	F	A	N
16/03/17	N	F	F	R	A	F	N
22/03/17	N	*	F	R	R	F	N
27/03/17	N	F	A	F	R	R	N
10/04/17	N	F	O	N	N	N	N
26/04/17	N	D	N		N	N	N
09/05/17	N	N	N				N
21/06/17	N	R	N	N	N	N	N

*The water was too turbid to assess sewage fungus coverage; grey box indicates site not visited; 24/01/17 & 01/02/17 only presence or absence was recorded

As the table highlights, sewage fungus was present at the start of the survey period from upstream of the airports outfall to just before Crane Valley Nature Park. An improvement in water quality over time resulted in a decline in sewage fungus cover. By the 10th April there was no sewage fungus present downstream of the airports outfall. Sewage fungus was still present upstream of the outfall, indicating a continued input of organic compounds to the river.

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.

OHES collected macroinvertebrate samples in March, April and June to assess if there had been an impact to the River Crane macroinvertebrate community and gauge recovery. 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 Table below summarises the aquatic invertebrate survey results in March, April and June on the River Crane.

BMWP Scores						
	Site 1 Upstream of airport outlet	Site 2 Downstream of airport outlet	Site 3 Upstream of Duke of Northumberla nd River	Site 4 Brazil Mill Wood	Site 5 Crane Park Entrance	Site 6 Crane Park
16/03/17	42	21	21	40	30	76
26/04/17	38	34	51	46	76	93
12/06/17- 28/06/17	61	32	69	98	88	65

Overall, during the investigation, the macroinvertebrate results indicate an improvement in biological water quality at the majority of sites (Site 1, 3, 4 and 5). Significant increases in the biotic indices scores were witnessed at Site 4 (Brazil Mill Wood), where the BMWP score rose from 40 (Poor) to 98 (Good) and at Site 5 (Crane Park Bridge), where the BMWP score increased from 30 (Poor) to 88 (Good). Such a rapid and definitive increase indicates the effects of elevated BOD levels and presence of sewage fungus has had only an acute short-term impact on the freshwater biota within this reach.

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 from these areas, not only in water quality terms, but also with regard to the high levels anthropogenic activities creating impacts on flow and aesthetics (such as waste and litter).