Gwash Flows - Routine Sites Analysis 2017

There are two routinely sampled ecology sites on the River Gwash where invertebrate samples are collected during spring, summer and autumn annually (Tickencote, SK 98900 09400 and Belmesthorpe, TF 04200 10400) with data running back to the 1980s. The locations of the two routine sampling sites are displayed in Figure 1. These sites are being used to assess the overall condition of the Gwash prior to and during the trial period, with WHPT-HEV[1] (hydroecological validation) plots being used to assess the impact of flow variability on the river ecology and to identify any other historical and/or current pressures acting on the fauna and flora. The WHPT-HEV plots for each site can be found in Appendix 1. Photographs of the sampling sites are displayed in Appendix 2.

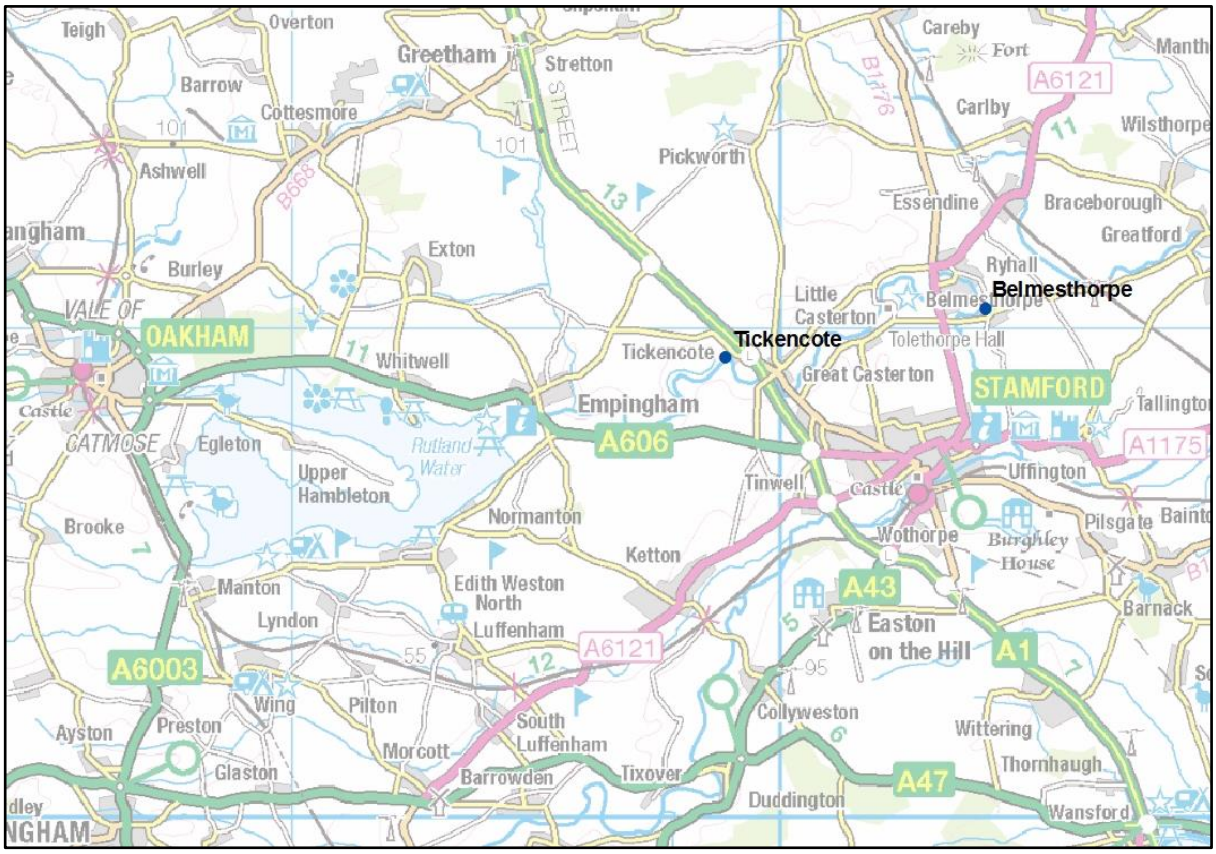

Figure 1. Map showing the ecology survey sites on the Gwash.

[1] WHPT-HEV performs the same job as HEV but does so using the revised indices WHPT-ASPT and WHPT-NTAXA in place of their BMWP-derived analogues.

Walley, Hawkes, Paisley & Trigg (WHPT) index – an index originally derived to assess the response of certain freshwater invertebrate taxa to organic enrichment, used as an assessment of biological water quality and replaced Biological Monitoring Working Party (BMWP). Scores range from -1.6 to 13 with species tolerant of organic enrichment having low scores. Scores for individual taxa are added together to give an overall sample score and then divided by the number of scoring taxa to give an average score per taxon.

The two WHPT indices are primarily designed to detect organic pollution. Habitat improvements and restoration works that increase macro-invertebrate diversity, however, will be reflected in increasing WHPT-NTAXA and WHPT-ASPT scores.

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WHPT-ASPT and WHPT-NTAXA index scores were calculated from the macroinvertebrate data available from the 1980s to 2017. LIFE (Lotic-invertebrate Index for Flow Evaluation) and PSI (Proportion of Sediment-sensitive Invertebrates) scores were also calculated to provide measures of the flow conditions and the quantity of fine sediment present on the river bed respectively.

In order to allow comparisons between sites and across different seasons, the predictive software RICT (River Invertebrate Classification Tool) was used to generate observed:expected (O:E) ratio values for the two WHPT indices, LIFE and PSI. The O:E values provide a standardised measure of the pressure to which the respective metric is related (i.e. sedimentation for PSI, flow for LIFE and water quality for WHPT-ASPT and WHPT-NTAXA) resulting from anthropogenic influences. An O:E value of less than 1.0 may indicate ecological stress and the lower the calculated value, the greater the degree of stress.

O:E values for PSI, LIFE, WHPT-ASPT and WHPT-NTAXA are presented in WHPT-HEV plots, alongside hydrological data. Threshold values specific to each metric are also included on the plots. If the O:E value for a metric falls below the threshold value, then the pressure to which the respective metric is related can be inferred as having a detrimental effect on the ecology. For the two WHPT indices the threshold values are the Water Framework Directive (WFD) Good:Moderate boundaries used in Cycle 2. WFD boundary values for LIFE and PSI are expected in Cycle 3, but the current threshold value for LIFE was established in the Environment Agency's Catchment Abstraction Management Strategy (CAMS). The threshold value for PSI is based on expert judgement.

In the 2015 Gwash Flows Routine Site Analysis, data was also analysed for the site at Empingham on the Gwash. This site is approximately 500m downstream of Rutland Water and has numerous pressures impacting on the ecology at the site, including poor water quality, high levels of sedimentation and habitat modifications. These pressures will confound any alterations in LIFE score that is due to the trialling of the lower flows when the Gwash-Glen transfer is operational. Tickencote and Belmesthorpe are not affected by the same habitat, water quality and sedimentation issues as Empingham. It is for this reason that Tickencote and Belmesthorpe are being used to assess the effect the flow trial is having on the ecology of the Gwash from 2016 onwards.

WHPT-HEV Analysis

The ecology at Tickencote and Belmesthorpe was not being substantially impacted by water quality, flow or sedimentation pressures in 2015 and 2016. This is also true for 2017, as the O/E ratios for all of indices are above the threshold values in the WHPT-HEV plots (Appendix 1: Figure 2 and Figure 3).

For Tickencote, there was a decrease in the PSI O/E ratio for October 2017 (Appendix 1: Figure 2). This indicated that fine sediment was building up at Tickencote during the autumn of 2017, however the PSI O/E ratio for October 2017 was still above the guidance threshold. This indicates that despite there being a build-up of fine sediment in autumn 2017, it is not having a substantial impact on the ecology of Tickencote. The data from 2018 will determine whether the degree of fine sedimentation increases further at Tickencote.

The new minimum flow at Belmesthorpe was first trialled when the Gwash-Glen transfer was operational between 7th September and 21st November 2016, and had no apparent impact on the invertebrate community at Tickencote and Belmesthorpe. During 2017 the Gwash-Glen transfer was operational between 14th August and 27th December. During this time the new minimum flow at Belmesthorpe was also implemented. The summer samples for Belmesthorpe and Tickencote were taken on 23rd August and the autumn samples were taken on 26th and 27th October respectively, during the time that the Gwash-Glen transfer was operational. Figures 2 and 3 show that there were no apparent ecological impacts which could be attributed to the changed flow regime in the summer and autumn of 2017.

SUMMARY & CONCLUSION

- The two routine ecological sampling sites (Tickencote and Belmesthorpe) are not currently being substantially impacted by water quality, flow or sedimentation pressures. Fine sediment increased at Tickencote in the autumn of 2017 (as indicated by PSI O:E), however the PSI O/E ratio did not fall below the guidance threshold.
- The Gwash-Glen transfer was operational between 14th August and 27th December 2017. During this time the new minimum flow at Belmesthorpe was implemented. The summer and autumn samples for Tickencote and Belmesthorpe were collected when the transfer was operational, and show that the new flow regime did not have a substantial negative impact on the ecology at these sites (Figures 2 and 3).

The results of the ecological surveys at the two sites indicate that the River Gwash is currently classified as above the respective thresholds for WHPT-ASPT, WHPT-NTAXA, LIFE and PSI, at Tickencote and Belmesthorpe, with relatively stable trends at these sites. Thus far there is no discernable ecological change that can be linked to modifications in the river's flow regime.

Appendix 1: WHPT-HEV plots

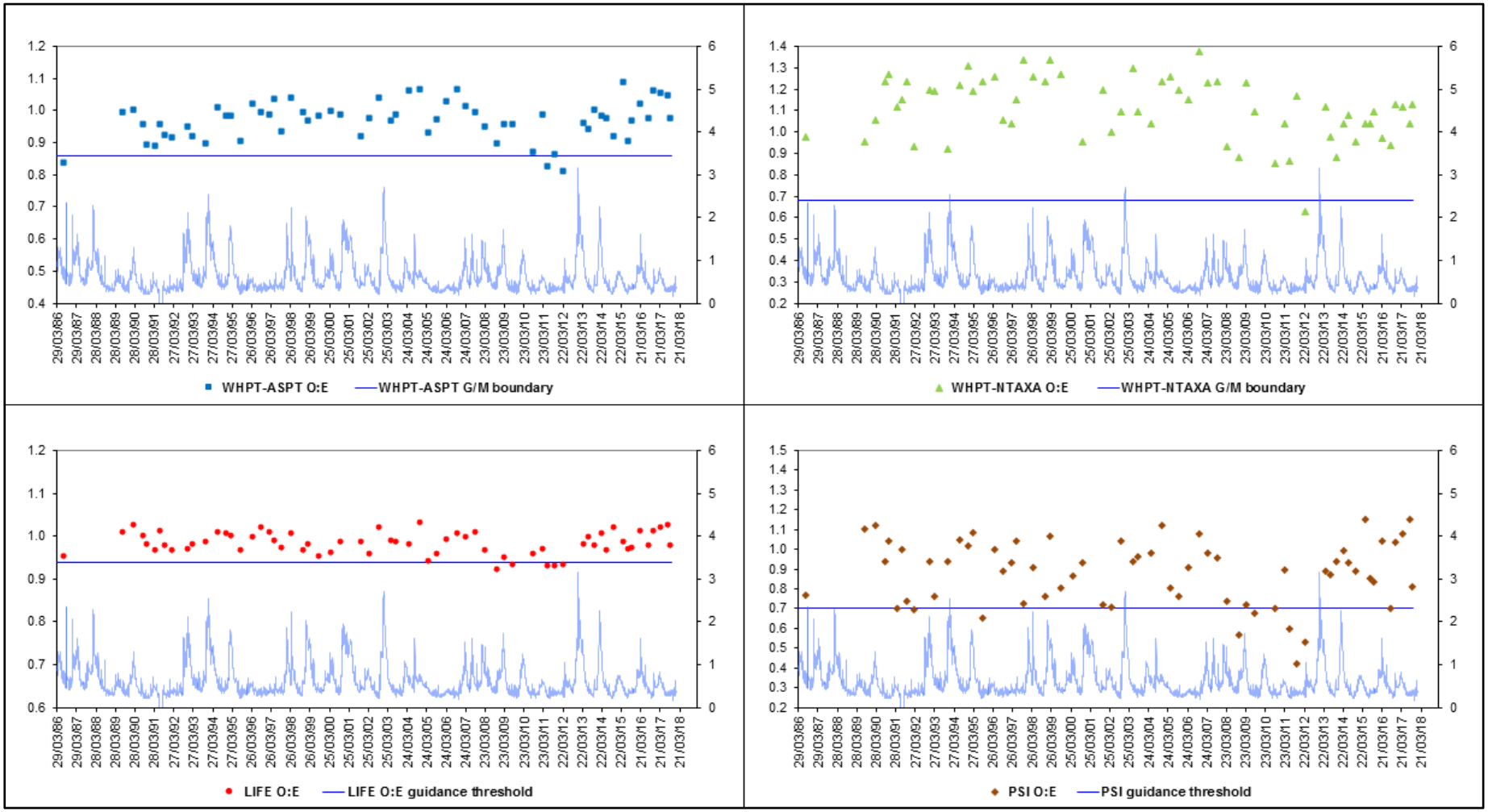

Figure 2: Tickencote WHPT-HEV Plot

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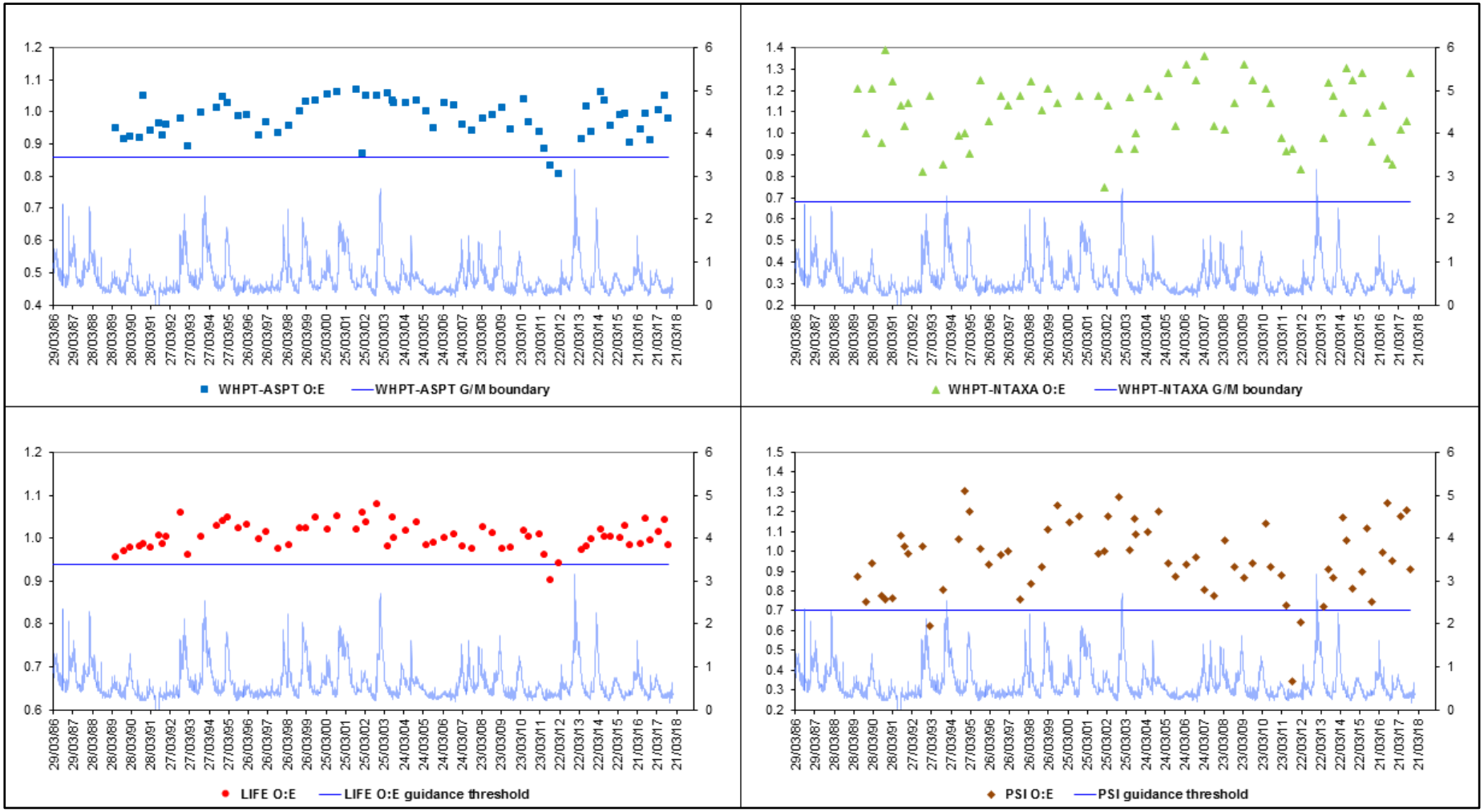

Figure 3: Belmesthorpe WHPT-HEV Plot

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Appendix 2. Site Photographs.

Plate 1. Tickencote Site Photograph (spring 2017)

Plate 2. Belmesthorpe Site Photograph (spring 2017)