TECHNICAL NOTE

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Contract	Eastleigh Hydrological Study
Client	Eastleigh Borough Council
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Subject	Tasks 1 & 2 Technical Note – summary of potential impacts and constraints of proposed road alignments

1 INTRODUCTION

1.1 Terms of Reference

JBA Consulting was commissioned by Eastleigh Borough Council to investigate hydrological and ecological constraints within one of their boroughs, as part of plans to develop housing projects. As part of this commission, JBA Consulting was asked to advise on the alignment of the proposed North of Bishopstoke link road (NBLR) to ensure that it has the least possible impact and that hydrological flows and stream systems can maintain their current functions. This Technical Note summarises the key ecological, geomorphological, hydrological and flood risk constraints of the proposed road alignments and outlines key recommendations.

2 CONTEXT

The following studies have been carried out in order to understand the hydrological, flood risk, geomorphological and ecological constraints of the proposed road alignments:

- Hydrology (for further information see accompanying report - *2017s6220 Itchen Hydrology FINAL v1.0 (Task 1).pdf*
- Flood risk (for further information see accompanying report - *2017s6220 Hydraulic Modelling Technical Note Final v1.0 (Task 2 Appendix 1).pdf*
- Geomorphology and Ecology assessment (for further information see accompanying report - *2017s6220 Geomorphology and Ecology Assessment Final v1.2 (Task 2 Appendix 4).pdf*

3 POTENTIAL IMPACTS AND CONSTRAINTS

The following potential impacts and constraints have been identified in terms of the proposed road alignment:

3.1 Hydrological

- Care should be taken to ensure that other currently unconnected drains are not connected to the headwaters due to the proposed road routes. Vice versa, care needs to be taken that existing drainage pathways are not blocked, to maintain existing conditions supporting the Itchen SAC
- Given the relatively low contribution of groundwater baseflow to the headwater stream, and perched nature of any local shallow groundwater, only in the north of the project area where London Clay thins out over the Chalk is care needed to ensure that Chalk water levels are not disrupted by any deep excavation which fully penetrates the low permeability strata.
- Removal of wooded headwater areas may lead to increased runoff rates and stream flows with potentially lower rates of slower baseflow response. In turn, these may cause further downstream erosion with water quality implications for the SAC.

3.2 Geomorphological / flood risk

- Road routes should be chosen that minimises the number of crossings.

- Use existing structures (if suitable), or upgrade and replace structures if environmental improvements can be made (i.e. fish and mammal passage).
- An options appraisal should be undertaken to identify a design that minimises disruption to geomorphological processes. The most suitable option is one which minimises environmental harm at a cost that is not disproportionately expensive.
- Road routes and crossings should be designed to ensure that they do not alter fluvial forms (i.e. channel width, bank slopes, floodplain connectivity etc.) or impede natural hydromorphic functioning (i.e. sediment transport, biotopes etc.).
- Bridge crossings should be designed so that the soffit elevation is above the level of the 1-in-100 year plus climate change flood level. The maximum water levels for the 1-in-100 year plus climate change flood event for the proposed NBLR route crossing locations are given in Section 3.1.5 of the Geomorphology and Ecology Report (*2017s6220 Geomorphology and Ecology Assessment Final v1.0 (Task 2 Appendix 4).pdf*).
- Clear span structures are preferable (structures that span the width of the channel with no in-stream support). Clear span structures do not affect the bed of the river, i.e. they have no artificial invert and a natural bed is maintained. Bank habitat can also be maintained under the crossing if the abutments are set back. Making the distance between the bridge abutments as wide as possible maximises the riparian corridor and allows the river some space to move.
- The foundations of abutments (and in-stream piers, if unavoidable) should be buried deep enough to minimise or prevent the need for bed or bank reinforcement or bridge weirs or aprons. This maintains the natural bed material and bed levels, protecting habitat and allowing fish passage. The foundations should be buried deep enough to allow for scour during high flows.
- Subject to the design of the bridge structure, it will be necessary to understand the impact of any works within the floodplain. Viaducts (a road deck spanning between piers) should be used to cross floodplains rather than embankments. This option greatly reduces the impact on the floodplain, but can have cost implications. Where embankments are unavoidable, 'normally dry culverts' in embankments can be used to connect the floodplain. There may be hydraulic design issues to overcome, which can result in reinforcement around the culverts to prevent scour and embankment failure during high flow events. If any embankments are proposed, level for level floodplain compensation will be required subject to the Environment Agency's approval.

3.3 Ecological

- The road crossings and enabling works are likely to take place within the River Itchen SAC and SSSI, or in the immediate surrounds of the designated sites. These features are designated due to their botanical and fish interest, and include species such as Salmon and Bullhead. It is also an important catchment for Otter, Southern Damselfly and White-clawed Crayfish. Further assessment will be needed to ensure these sites will not be adversely affected by the proposed works. For a SSSI, this will involve liaising with the relevant Natural England officer. For the SAC, a Habitat Regulations Assessment is required and will need to demonstrate that the features that qualify it for designation will not be adversely impacted upon as a result of the works. Reasonable time should be allowed for this exercise as approval and changes to proposed works may be required.

4 RECOMMENDATIONS

4.1 Water Framework Directive Assessment

A Water Framework Directive (WFD) assessment should be conducted in advance of works to ensure that the proposals are in line with European legislation, to mitigate against any adverse in-channel effects and to support the Environment Agency permit. WFD is a desk-based assessment which relies on information given of the status of the River Itchen as detailed within the relevant River Basin Management Plan (RBMP).

4.2 Geomorphological Assessments

Hydraulic modelling should be undertaken as part of the bridge design process to inform the options appraisal and ensure that the bridge design does not have the potential impact upon the geomorphology of the watercourses. Outputs from hydraulic modelling can be used to quantify flow velocity and shear stress at the bridge structures and assess the impacts of the proposed structure on flow and sediment dynamics. This will allow potential risks, such as localised scour/erosion and/or changes in sediment deposition patterns to be identified for each proposed bridge option. Iterative hydraulic modelling can be used to refine the bridge design, allowing these risks to be mitigated during the design process. Similarly, the proposed road route across the floodplain can be investigated using hydraulic modelling by identifying potential impacts on flood flow routes when the floodplain is inundated. For example, outputs from the hydraulic modelling can be examined to ensure that the proposed road alignment does not back up flow and cause an increase in flood risk upstream.

4.3 Ecological Assessments

It is recommended that further detailed surveys of habitats to be impacted by the works are conducted to allow a full assessment of impacts to be made. AS a minimum, this should include:

- Macrophyte surveys of all proposed river crossings using LEAFPAC methodology which is the WFD standard, to assess the species richness and abundance in proposed critical construction areas.
- Mapping and assessment of habitat suitable to support Southern Damselfly.
- Detailed habitat assessments of all proposed works areas should be undertaken, not just in the vicinity of river crossings, as the River Itchen valley contains areas of fen, swamp, ditches and wet meadows which are not replicable habitats once altered and are influenced by changes in both water level and quality. Survey assessments should comprise of at least detailed Phase 1 habitat mapping, or preferably National Vegetation Classification (NVC) of areas to be impacted to fully assess the plant communities.

The following protected species will require further consideration for all proposed routes:

- Bat activity and roosting surveys: dependent on level of tree removal and disturbance to foraging and commuting routes.
- Water Vole: Activity surveys at all waterbody crossing points (both up and downstream of locations).
- Otter: Activity surveys at all waterbody crossing points (both up and downstream of locations).
- Fish: Spawning season to be avoided for salmonids (November - February). All in-channel crossing will require fish passage to remain open and rescue surveys to be conducted for SAC Annex II fish species and Brook Lamprey.

- White-clawed Crayfish presence / absence Surveys at river crossings and where any works to riverbanks are taking place on River Itchen SAC, SSSI.
- Amphibians: Habitat suitability assessments of identified waterbodies.
- Badger: Activity surveys along proposed road route(s) and enabling works areas.
- Reptiles: Activity surveys along proposed road route(s) and enabling works areas.
- Southern Damselfly surveys at river crossings and temporary works locations.

To maximise ecological gain from these works the following opportunities for enhancement are suggested:

- Riparian planting e.g. bankside trees to provide shade and additional habitat. This can help attract species, such as otter, and can be used by bats for navigation. Riparian planting should only be taken in areas identified as suitable to support riparian mammals and not within habitat areas which support Southern Damselfly.
- Marginal planting to increase vegetation and species diversity in Colden Common Stream and Bow Lake. This habitat is utilised by invertebrates, fish, and small mammals such as water vole, and can help improve water quality. Expansion of this type of habitat should be prioritised in areas where Southern Damselfly is present to help create larger, and where possible, more connected habitats between populations.
- Increase the number and quality of slow flowing floodplain channels to increase the habitat available for Southern Damselfly on the River Itchen tributaries.
- Changes in land management – a reduction in grazing pressure where issues have been identified with excessive sediment input and bank erosion. Limitations on bankside poaching will have a positive effect on biodiversity by reducing nutrient and sediment inputs into connecting tributaries of the River Itchen.
- Increase in habitat connectivity across a catchment scale, by increasing existing habitat cover, including swamp, meadow and woodland areas.
- Explore opportunities for Natural Flood Management within the catchment which can also have beneficial impacts on niche aquatic communities.

It is assumed that additional work will be carried out for ecology in terms of a detailed mitigation and enhancement plan to ensure all habitats and species are taken into account, once details of the works are finalised.