A358 Taunton to Southfields Dualling
White-clawed Crayfish Technical Report

PCF Stage 2

HE551505-MMSJV-EBD-000-RP-LB-0044

Date: March 2021

Version: P02

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Document control

Client	Highways England
Project	A358 Taunton to Southfields Dualling
Document title	White-clawed Crayfish Surveys Technical Report
Job no.	HE551508
Document reference	HE551508-MMSJV-EBD-000-RP-LB-0044

Revision history

Job number: HE551508			Document ref: HE551508-MMSJV-EBD-000-RP-LB-0044			
Revision	Purpose description	Originator	Checked	Approved	Authorised	Date
P01	First revision	J. Willmott	Z. Trent	K Atkinson	E. Rapa	03/12/2020
P02	Updated following comments	J. Willmott	S. White	K. Atkinson	E. Rapa	18/03/2021

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Executive summary

The proposed A358 scheme (hereafter referred to as 'the scheme') would provide a dual carriageway along the length of the A358 between Taunton and Ilminster in Somerset, connecting the A303 at Ilminster to the M5 motorway to the north. The scheme would include grade separated junctions and, with the purpose of providing a high-quality free flow journey for those using the route, the removal of at-grade junctions and direct accesses.

A desk study was undertaken in April 2016 to obtain existing records of white-clawed crayfish *Austropotamobius pallipes.* No records within 2 kilometres of the scheme were returned by Somerset Environmental Records Centre (SERC). There were also no records of the non-native North American signal crayfish *Pacifastacus lenuisculus,* which have detrimental impacts on the native species. An additional supplementary desk study in November 2020 identified 30 Environment Agency (EA) macroinvertebrate sites within 2 kilometres of the scheme. Neither white-clawed nor signal crayfish were identified at any of these sites.

Habitat assessments and manual search surveys to identify the presence of white-clawed crayfish were undertaken by Five Rivers Environmental Contracting in October 2017, for watercourses within 250m of the scheme. A total of seven watercourses were identified as potentially suitable for white-clawed crayfish and were surveyed using a manual search method. One watercourse was inaccessible (watercourse 7) and two were deemed unsuitable. Evidence of white-clawed and/or signal crayfish was not found in any of the watercourses.

It is possible that remnant populations of white-clawed crayfish are present in some of these watercourses but were missed by the manual search surveys. This survey method has limitations in deeper water, where targeted trapping surveys are more effective. Five of the seven watercourses were identified as suitable for trapping surveys by Five Rivers Environmental Contracting. Following additional discussion with specialist Zoe Trent (Mott MacDonald Sweco Joint Venture), the methodology employed was deemed robust enough to assume likely absence of white-clawed crayfish without the need for further trapping surveys. Likely absence can be assumed within all surveyed watercourses.

At the time of writing, the project is still within the early design phase. Therefore, the full extent of potential impacts of the scheme on the white-clawed crayfish population is yet to be confirmed. An impact assessment, and mitigation and compensation measures to alleviate any potential impacts will be detailed within the Ecology and Nature Conservation chapter of the project Environmental Statement, when published.

1. Introduction

1.1. Background

1.1.1. The A303 / A358 corridor is a vital connection between the south-west of England, London and the south-east of England. Due to the population density, employment opportunities, urban concentrations and tourist attraction of the south-west, the A303 / A30 / A358 corridor experiences a wide range of traffic flows which lead directly to severe and regular instances of congestion and delay.

1.1.2. The A303 / A30 is part of the strategic road network (SRN) and together with the A358 forms a key strategic link between the South West Peninsular (SWP) and the rest of the south, south-east and London. Although it is dualled over much of its length there are several unimproved single carriageway sections between the M3 motorway at Basingstoke and the M5 at Taunton and Exeter which cause congestion, especially during summer weekends.

1.1.3. The A358 between Taunton and Southfields Roundabout is predominantly single carriageway with a short (1.1 miles) dual carriageway section in the vicinity of Thornfalcon and a 3 lane (2+1) section (0.3 miles) immediately to the south of the traffic lights at the A378 junction. There are many side roads and private accesses which directly adjoin the A358. The national speed limit applies between Southfields and Henlade where it reduces to 30mph; the speed limit increases to 40mph north of Henlade on the approach to the M5 junction 25. A plan showing the existing route between Taunton and Southfields is provided in Figure 1:1.

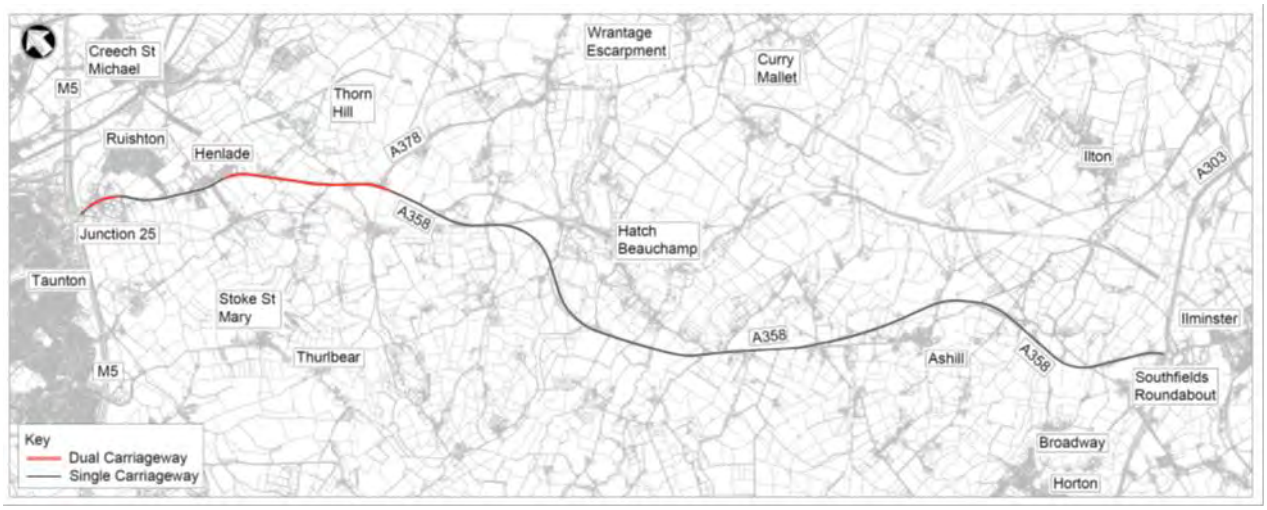

Figure 1:1 : A358 Taunton to Southfields existing road layout.

1.1.4. Following the most recent public consultation in 2018, the following three route options were presented; Pink, Blue and Orange route options are described below and depicted in Figure 1:2.

- The **Pink option** commences at a new junction on the M5 approximately 1.2 miles (2 kilometres) south of junction 25. South-facing slip roads from the M5 would combine to become the new dual carriageway, which runs eastwards and north of Stoke Hill. Here a limited-movement junction is proposed with east-facing slip road connections to the new road which would allow traffic to travel between the new A358 and junction 25 via a new 0.9 mile (1.5 kilometre) dual carriageway link past the planned Nexus 25 site. The proposed route would then follow the existing A358 to Southfields Roundabout enabling the existing road to be upgraded from a single to a dual carriageway. The total length of the Pink option is 9 miles (14.6 kilometres), plus the 0.9 miles (1.5 kilometres) spur leading to M5 junction 25.

- The **Blue option** commences at the M5 approximately 1.2 miles (2 kilometres) south of junction 25 and runs eastwards on a more southerly alignment. At Stoke Hill a junction is proposed similar to that with the Pink option which would allow traffic to travel between the road and junction 25 via a new 1.2 miles (2 kilometres) dual carriageway link past the planned Nexus 25 site. The road would then continue in a south-easterly direction to West Hatch Lane, where an all-movement, grade separated junction is proposed to allow access to Hatch Beauchamp, Henlade and surrounding communities, and the A378. This option is identical to the Pink option from this point onwards to Southfields Roundabout. The total length of the Blue option is 8.7 miles (14.1 kilometres), plus the 1.2 miles (2 kilometres) spur leading to M5 junction 25.

- The **Orange option** commences at the M5 approximately 2.1 miles (3.5 kilometres) south of junction 25 at a proposed new two-bridge roundabout which would form a new all-movements junction between the new A358 and the motorway. The proposed road initially takes a north-easterly course towards Henlade before arcing around the north of Stoke Hill. In contrast to the Blue option, there is no link to junction 25 from this location, and therefore no junction at Stoke Hill. This option is identical to the Blue option from this point onwards. The total length of the Orange option is 9.5 miles (15.3 kilometres).

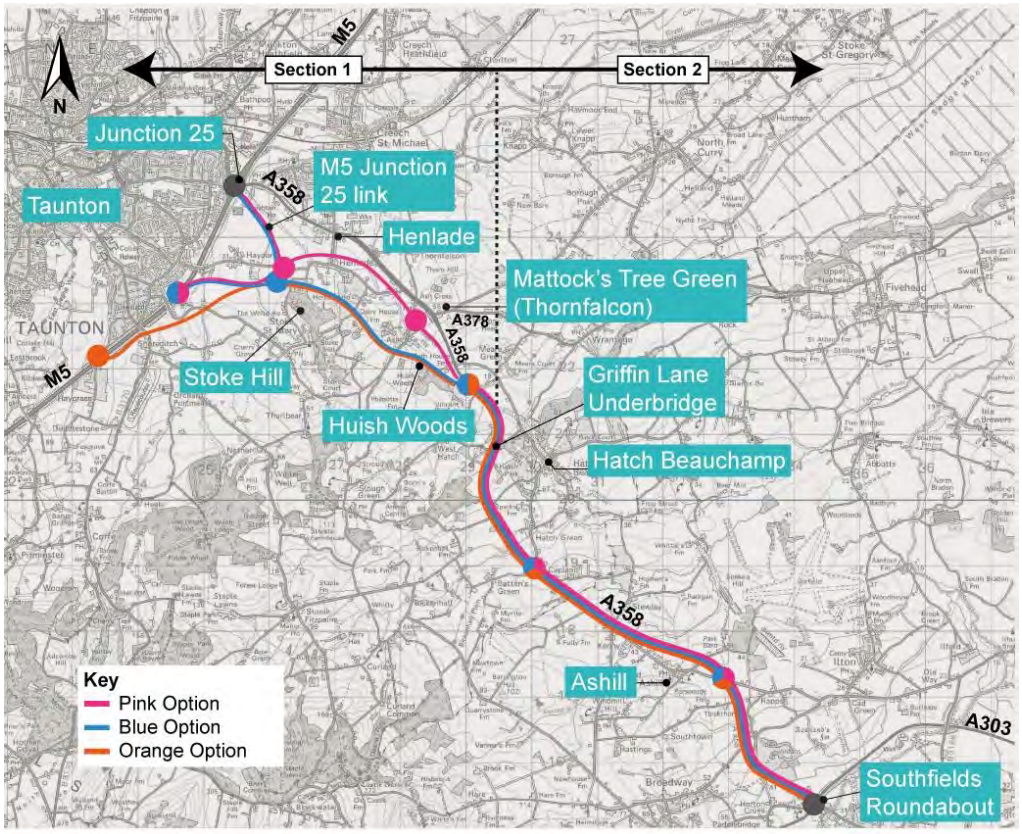

Figure 1:2: Route options presented at the 2018 public consultation

1.2. Scheme proposal

1.2.1. The scheme would provide a dual carriageway along the length of the A358 between Taunton and Ilminster in Somerset, connecting the A303 at Ilminster to the M5 motorway to the north. The scheme would include grade separated junctions with the purpose of providing a high-quality free flow journey for those using the route, with the removal of at-grade junctions and direct accesses.

1.2.2. The Preferred Route Announcement (PRA) on the 13 June 2019 identified the Pink Modified option as the preferred route option, (refer to the Scheme Appraisal Report (SAR) for details of the development of the Pink option to the Pink Modified option). This is hereby referred to as 'the scheme'.

1.2.3. The scheme would comprise online widening between West Hatch Lane and Southfields Roundabout. This option would involve the re-use of a large amount of the existing A358 corridor, and between West Hatch Lane and Henlade the route would pass close to the A378 junction at Mattocks Tree Green. This would enable direct interchange between the proposed road and the A378. The scheme retains the bypass at Henlade,

connects with the A378, and connects directly to junction 25 on the M5. A plan showing the scheme is shown in Figure 1:3 below.

1.2.4. The scheme would provide a dual carriageway along the length of the A358 between Taunton and Ilminster in Somerset, connecting the A303 at Ilminster to the M5 motorway to the north. The scheme would include grade separated junctions and, with the purpose of providing a high-quality free flow journey for those using the route, the removal of at-grade junctions and direct accesses.

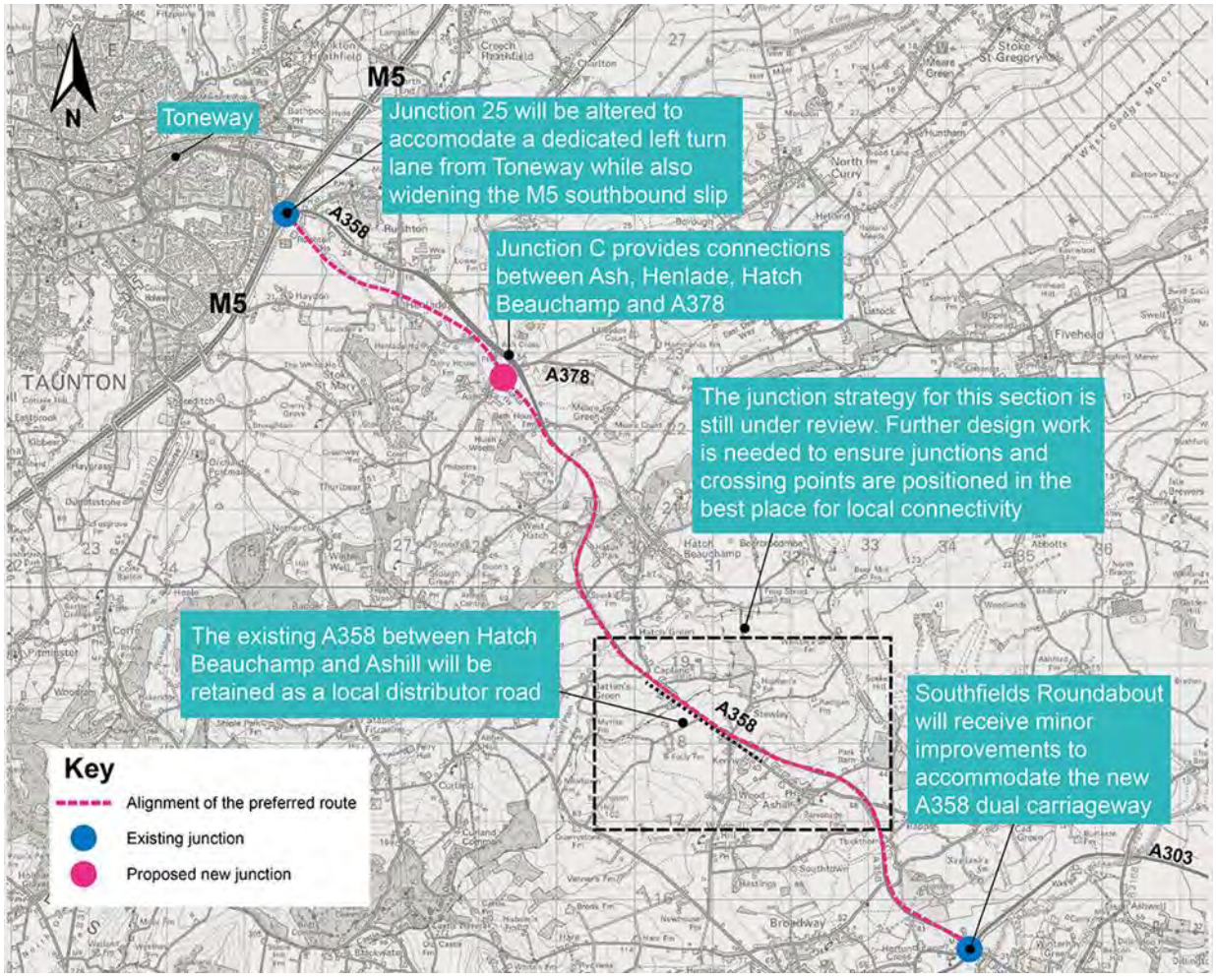

Figure 1:3: The preferred scheme option.

1.3. Scope of report

1.3.1. This white-clawed crayfish (WCC) Technical Report has been prepared during Stage 2 of the Highway England's Project Control Framework (PCF).

1.3.2. The objectives of this report are:

- to collate and review existing records for WCC and non-native crayfish species
- to present the methods, constraints and results of WCC habitat assessments and manual search surveys undertaken in 2017
- to inform the Biodiversity chapter of the Environmental Statement

1.3.3. Only results relevant to the scheme are detailed. Survey results for locations which will not be impacted by the preferred route have been omitted from this report.

1.4. Study area

1.4.1. Guidance on ecological assessments recommends that all ecological features that occur within a zone of influence (ZoI) for a proposed scheme are investigated[1]. The potential ZoI includes:

- areas to be directly impacted by land take for the proposed scheme and access that could cause loss or degradation of suitable aquatic habitat
- aquatic habitat which could be indirectly affected by the scheme such as through changes in water levels, including any habitat hydrologically connected to the construction area.

1.4.2. The ZoI for WCC encompasses all aquatic and riparian habitat within 250m of the scheme in accordance with the Mott MacDonald Sweco Joint Venture survey protocol produced for this scheme. This buffer was implemented to employ a catchment-based approach to surveys, ensuring that watercourses which may be subject to indirect impacts by the scheme are also considered for WCC surveys, rather than simply watercourses crossed by the scheme. The *Design Manual for Roads and Bridges* (DMRB) does not provide guidance on a recommended ZoI for WCC.

1.5. Legislation

1.5.1. White-clawed crayfish *Austropotamobius pallipes* are protected under European and National legislation. They are listed under Annexes II and V of the *European Council Directive 92/43/EEC* the *Habitats Directive 1992*, transposed into UK Legislation through the *Conservation of Habitats and Species Regulations 2017*. This legislation requires that:

- Special Areas of Conservation (SAC) are established specifically to conserve this species where important sites are identified
- taking from the wild and exploitation (such as captive breeding programmes) must be subject to management measures

[1] Chartered Institute of Ecology and Environmental Management (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal.

1.5.2. This species is also partially protected under Schedule 5 of the *Wildlife and Countryside Act 1981* (as amended), which makes it an offence to:

- intentionally, or recklessly, kill or injure a WCC
- sell, or attempt to sell, any part of the species, alive or dead. Advertises that he / she buys or sells, or intends to buy or sell

1.5.3. WCC are listed as species of principal importance under Section 41 of the *Natural Environment and Rural Communities (NERC) Act 2006*. Section 40(1) of the Act states that 'every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity'. Section 40(3) explains that conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat.

1.6. Status of White-clawed crayfish

National Status

1.6.1. The WCC is the only species of crayfish native to the UK and was once common across the country but suffered significant decline during the mid to late 20th Century. Populations are now found in fragmented patches across England and Wales, meaning the species is nationally very rare. Despite the decline, populations of WCC are still known to be present in the following areas; South Wales, Suffolk, East Midlands, Dorset, Somerset, Gloucestershire, Exmoor and the North York Moors[2].

1.6.2. A major threat to the native WCC is the introduction of non-native crayfish species, farmed for food in Britain since the late 1970s. Soon after the introduction of non-native crayfish farming, a virulent disease caused by the fungus *Aphanomyces astaci* (known as the "crayfish plague") broke out and spread rapidly, having catastrophic impacts on the native crayfish populations in rivers.

1.6.3. The reservoir for the original infections has never been established, but non-native crayfish species such as the North American signal crayfish *Pacifastacus leniusculus* are known to spread the disease; this species was the most frequently farmed. This species is a carrier of the disease but largely unaffected itself. The crayfish plague can be introduced into waterbodies not only by the presence of non-native species but also by water, mud, fish or equipment that has been in contact with the fungus. This greatly increases the risk to remaining WCC populations, which are often decimated by the disease within just days of exposure[3].

[2] Buglife (2015). Crayfish Identification, Distribution and Legislation [online] available at: https://cdn.buglife.org.uk/2019/07/Final-Crayfish-ID-distribution-and-Legislation-23-06-15_JG.pdf. Last accessed November 2020.
[3] Peay, S. (2002). Guidance on Habitat for White-clawed Crayfish and its Restoration. English Nature and the Environment Agency.

1.6.4. Whilst the introduction of non-native crayfish species is the major threat to WCC, loss of habitat and reduction of water quality also threaten populations throughout the UK. There are catchments which are free of non-native crayfish species, yet still exhibit rapidly diminishing WCC populations. Susceptibility to pollution occurring from domestic sewage and agricultural run-off also have a negative effect on WCC populations.

Somerset County status

1.6.5. Somerset does not have a local biodiversity action plan (LBAP), but the districts within the county have their own local plans. The WCC is not mentioned as an LBAP species within any of the Somerset districts' plans.

1.6.6. Within Somerset, watercourses supporting WCC are rare, but the species has been recorded at the following eight locations; River Mells, River Sheppey (culverts through Shepton Mallet), River Alham, Batcombe House Tufa Spring and Cistern, River Brue (Bruton), Lopen Brook, Dairy Field (Chard) and River Tone (Tonedale Bridge, Wellington)[4].

1.6.7. Estimated population sizes for the county were not available at the time of writing.

1.7. White-clawed crayfish ecology

1.7.1. WCC distribution in the UK is largely determined by geology and water quality; areas with relatively hard, mineral-rich waters on calcareous substrates are typical and PH level between 6.8-8.6 preferable for this species. They can inhabit a range of freshwater systems, including small streams, river, lakes, reservoirs and old quarries. Watercourses between 0.75m and 1.25m deep are more likely to support WCC, although presence in very shallow streams and deeper, slow-flowing rivers has also been confirmed[5].

1.7.2. The availability of suitable refuges is also vital to WCC populations, which is why it may be more abundant in watercourses which flow north to south where shading is often increased. Refuges may be provided by natural or artificial habitat; crevices in rocks, within tree roots or submerged plants all provide shelter from predators and protection from periods of higher water flow. They typically favour habitats with an underlying substrate of fine gravel / sand with some pebbles, overlaid with aggregations of boulders and large cobbles; this offers refuge opportunities for all life stages against their numerous predators such as eels, other fish species, birds and mammals such as mink and otter. Even dragonflies and insect larvae predate on juvenile crayfish. They are particularly

[4] Somerset Highways. (2015). Biodiversity Manual 2015-2020: Part of the Somerset County Council Highways Network Management Plan, version 2.2.
[5] Holdich, D. (2003). Ecology of the White-clawed Crayfish. Conserving Natura 2000 Rivers Ecology Series No. 1. English Nature, Peterborough.

susceptible after a fresh moult, when their exoskeleton is softer and offers less protection. Due to the large number of potential predators, WCC are primarily nocturnal[6].

1.7.3. WCC feed on all manner of live and dead organic matter, such as fallen leaves, vegetation, worms, insect larvae, small fish and other crayfish. Where available, calcified plants are of particular value as they provide a ready source of calcium to benefit their exoskeleton.

1.7.4. Activity varies by season in response to temperature, river flow and annual cycle of growth, breeding and periods of inactivity. Breeding typically takes place between September and November when water temperatures drop below 10°C for an extended period. During the breeding season different areas within the watercourse may be used for shelter and feeding. During the winter period, between December to March, they spend most of their time in torpor in refuges until the water temperature increases. Females carry their eggs over the winter period and the juveniles remain on her after hatching at the beginning of the summer. They are usually released from the tail and disperse in June, but this may vary due to location and temperature.

1.7.5. WCC are able to spread along a watercourse for a distance of at least 3 kilometres, maintaining genetic homogeneity within the population. However, even small barriers such as weirs, may limit their movements and isolate populations, limiting connectivity and preventing expansion.

Signal crayfish

1.7.6. As mentioned in 1.6.3, the signal crayfish carries the fatal crayfish plague fungus, but also outcompetes the WCC for both food resources and habitat. It is a larger, more aggressive species, typically growing up to 18cm compared to 12cm for the WCC. The signal crayfish is also more virile, and females can carry up to 250 eggs at a time; WCC usually carry less than 100[7].

1.7.7. Signal crayfish can occupy all of the same habitats as WCC but have higher tolerance to poor water quality and acidity. They are also able to move across land, can survive for weeks out of water[8], making colonisation of waterbodies a major concern.

1.7.8. The spread of the signal crayfish is not only an issue for the WCC, but for the health of waterbodies in general. Extensive burrowing into banks increases siltation,

[6] Natural England. (2013). Standing Advice Species Sheet: White clawed crayfish [online] available at: http://witham-1st-idb.gov.uk/wp-content/uploads/2013/03/Crayfish-factsheet.pdf Last accessed November 2020
[7] Inside Ecology. (2017). Invasive non-native species (UK) – signal crayfish [online] available at: https://insideecology.com/2017/09/27/invasive-non-native-species-uk-signal-crayfish/#:~:text=Legislation%20Legislation%20which%20attempts%20to%20control%20the%20distribution,of%20signal%20crayfish%20includes%20predation%2C%20trapping%20and%20biosecurity. Last accessed November 2020.
[8] Holdich et al. (1995). Interactions between three species of freshwater crayfish (*Austropotamobius pallipes, Astacus leptodactylus* and *Pacifastacus lenuisculus*). Freshwater Crayfish 10:46-56.

erosion and flood risk, as their tunnels can extend up to 2m inwards. Predation on fish eggs and occupying habitat also has ecological and economic impacts of fisheries.

1.7.9. Schedule 9 of the *Wildlife and Countryside Act 1981* (as amended) provides legislation which attempts to control the spread on invasive non-native species. This makes it illegal to distribute or release the signal crayfish into the wild. Control of signal crayfish includes predation, trapping and biosecurity.

1.8. Planning policy

1.8.1. In 2012, the *UK Post-2010 Biodiversity Framework* superseded the *UK Biodiversity Action Plan (BAP) 2007*[9]. Consequently, the WCC, which was historically listed as a UKBAP priority species, is now listed as a species of 'principal importance for the conservation of biodiversity in England under Section 41 (S41) of the *Natural Environment and Rural Communities (NERC) Act 2006*.

Highways England Biodiversity Action Plan

1.8.2. Highways England's BAP identifies their approach to meeting the key performance indicator identified within the *Roads Investment Strategy* of "no net loss of biodiversity by 2020". Biodiversity is required to be fully considered during the building of any new roads and opportunities sought to work with stakeholders and enhance the network for wildlife[10].

South Somerset District Council Local Plan 2006 - 2028

1.8.3. Policy EQ4 (Biodiversity) within *South Somerset District Council Local Plan 2006 – 2028,* contains the following which are relevant to the conservation of WCC[11]:

1.8.4. *"All proposals for development, including those which would affect sites of regional and local biodiversity, nationally and internationally protected sites and sites of geological interest, will:*

- *protect the biodiversity value of land and buildings and minimise fragmentation of habitats and promote coherent ecological networks*
- *maximise opportunities for restoration, enhancement, and connection of natural habitats*
- *incorporate beneficial biodiversity conservation features where appropriate*

[9] UK Government (2007). UK Biodiversity Action Plan [online] available at: http://jncc.defra.gov.uk/PDF/UKBAP_ConBio-UKApproach-2007.pdf (last accessed November 2020).
[10] Highways England (2015). 'Our plan to protect and increase biodiversity' [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/441300/N150146_-_Highways_England_Biodiversity_Plan3lo.pdf (last accessed November 2020).
[11] South Somerset District Council (2015). South Somerset Local Plan [online] available at: https://www.southsomerset.gov.uk/media/1250/j-plan_pol-web-site-2018-1-local-plan-local-plan-2006-2028-south_somerset_local_plan_2006-2028_adoption_version_march_2015.pdf (last accessed November 2020).

- *protect and assist recovery of identified priority species*
- *ensure that Habitat Features, Priority Habitats, and Geological Features that are used by bats and other wildlife are protected and that the design including proposals for lighting does not cause severance or is a barrier to movement.*

1.8.5. *Where there is a reasonable likelihood of the presence of protected and priority species development design should be informed by, and applications should be accompanied by, a survey and impact assessment assessing their presence. If present, a sequential approach to the design of the proposal should be taken that aims first to avoid harm, then to lessen the impact, and lastly makes compensatory provision for their needs.*

1.8.6. *Development will not be allowed to proceed unless it can be demonstrated that it will not result in any adverse impact on the integrity of national and international wildlife and landscape designations, including features outside the site boundaries that ecologically support the conservation of the designated site."*

Taunton Deane Borough Council Core Strategy 2011 – 2028

1.8.7. The former Taunton Deane Borough Council has now merged with West Somerset to form the new Somerset West and Taunton Council. The previous Core Strategy has been adopted by the new joint council until a new Local Plan is published. As a result, the following information is still applicable to the conservation of WCC.

1.8.8. Policy CP8 (Environment) within *Taunton Deane Borough Council Core Strategy 2011 – 2028,* contains the following which is relevant to the conservation of WCC:

1.8.9. *"The Borough Council will conserve and enhance the natural and historic environment and will not permit development proposals that would harm these interests or the settings of the towns and rural centres unless other material factors are sufficient to override their importance.*

1.8.10. *Development will be supported at sustainable locations to improve green infrastructure, public access, visual amenity and the overall quality of the natural environment. Development will need to mitigate and where necessary, compensate for adverse impacts on landscape, protected or important species, important habitats and natural networks, river and ground water quality and quantity so that there are no residual effects."*

2. Methodology

2.1. Desk study

2.1.1. A biological records data search was requested from Somerset Environmental Records Centre (SERC) on 7 April 2016, obtaining all records of WCC within 2 kilometres of the scheme. Invasive non-native species were also requested from the data search.

2.1.2. A supplementary desk study was undertaken on 13 November 2020 to identify any additional data available since 2016. The Environment Agency (EA) Ecology & Fish Data Explorer[12] was used to identify locations where aquatic invertebrate surveys were undertaken between 1995 and 2020. Data from this resource is often not included within county species records.

2.2. Habitat assessment

2.2.1. An initial habitat suitability assessment was undertaken along all rivers and joining tributaries, including streams and ditches, which are to be crossed by the scheme, as well as those within 250m of the proposed scheme footprint; this included all original route options. These were identified using 1:10,000 Ordnance Survey mapping data. A total of ten watercourses were identified within 250m of the scheme. Nine of these were assessed for their potential to support WCC and one was refused access.

2.2.2. The habitat suitability survey assessed the quality of the watercourse and riparian habitat for supporting WCC, based on the guidance by Peay (2002)[13] and the following factors:

- physical properties of the watercourse including the type of watercourse, depth, flow and channel width
- refuges in the channel and bank
- substrate composition
- pollution, erosion and siltation
- presence of invasive crayfish
- presence of bullhead *Cottus gobio*

2.2.3. The presence of bullhead is a good indicator species for watercourse and habitat conditions which are suitable for WCC. Both of these species occupy similar refuge types within the channel and/or margins and thrive in areas of good water quality.

[12] Environment Agency. (2020). Ecology & Fish Data Explorer. [online] available at: https://environment.data.gov.uk/ecology-fish/. Last accessed November 2020.
[13] Peay, S. (2002). Guidance on Habitat for White-clawed Crayfish and its Restoration. English Nature, Peterborough [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290346/sw1-067-tr-e-e.pdf. Last accessed November 2020.

2.2.4. Habitat assessments were conducted across a 100m length of each watercourse, centred on the point at which the scheme is anticipated to cross if applicable. If no suitable WCC habitat was found within 100m, the survey area was extended up to 500m from the scheme, or until a length of at least 100m was identified.

2.3. Manual search surveys

2.3.1. To determine the presence or likely absence of WCC in the assessed watercourse, manual search surveys were undertaken by Five Rivers Environmental Contracting. All surveyors were accredited agents under the Natural England Class Survey Licence (CL11) belonging to Tom Grayling at Five Rivers (2016-21410-CLS-CLS).

2.3.2. Manual search surveys were undertaken at the same time and in the same locations as the habitat assessments, where watercourses were considered suitable for WCC. Survey methodology followed the protocol outlined in the Joint Nature Conservation Committee (JNCC) Common Standards Monitoring Guidance for Freshwater Fauna (Protocol 2)[14], based on Peay (2003)[15].

2.3.3. Each watercourse was divided into five patches of habitat that appeared to be favourable for WCC, where a search of ten potential refuges was undertaken in each patch. The aim was to find individual refuges that have the highest probability of being used by WCC. A refuge may be a single large rock (or other item of physical refuge), but if smaller stones are overlapping then multiple stones may need to be lifted until the gravel substrate (or finer substrate) is reached; this would still count as one refuge.

2.3.4. A hand net was used during manual search surveys to catch any smaller WCC in the shallow water. Holding the net immediately downstream of the refuge would increase the chance of catching anything disturbed during the survey.

2.3.5. For manual searches, the following conditions were met at the time of survey:

- water depth <0.5m
- water flow <20cm^{s-1}
- smooth water surface
- clarity which enabled a clear view of the substrate
- low water turbidity to ensure WCC could be seen, caught and/or identified
- surveys undertaken during daylight hours

[14] Joint Nature Conservation Committee (2015). Common Standard Monitoring Guidance for Freshwater Fauna. [online] available at: https://data.jncc.gov.uk/data/9b80b827-b44b-4965-be8e-ff3b6cb39c8e/CSM-FreshwaterFauna-2015.pdf. Last accessed November 2020.
[15] Peay, S. (2003). Monitoring the White-clawed Crayfish Austropotamobius pallipes. Conserving Natura 2000 Rivers Monitoring Seres No. 1. English Nature, Peterborough.

2.4. Constraints

2.4.1. The optimal survey window for undertaking white-clawed crayfish surveys is after the breeding season between mid-July and mid-September. Surveys should avoid late-May and June when females may be carrying newly hatched young. Surveys were undertaken in October which is outside of this optimal survey window. However, the surveys were undertaken at a time of year when crayfish are still active and water temperatures recorded during the surveys were suitable for surveys (12 – 13.4°C). It is therefore considered that the surveys were undertaken at an appropriate time of year to detect the presence or likely absence of white-clawed crayfish on the surveyed watercourses.

2.4.2. The surveys provide a snapshot of activity at the site and therefore there is always the risk of protected species being overlooked, either owing to the timing of the survey or the scarcity of the species at the site.

2.4.3. Conditions on site meant that some areas were difficult to access, owing to the density of vegetation. However, an assessment of these areas was made as far as was practicable, and surveys were undertaken upstream and downstream of these areas where habitat was suitable and therefore this is not considered a significant constraint. However, there is a risk that any crayfish present and confined to these inaccessible areas would have been overlooked.

2.4.4. Access to watercourse 7 was refused and therefore did not receive habitat assessments or manual searches.

2.4.5. Crayfish are generally more active at night, so torchlight surveys on watercourses may be a more effective survey method than daytime manual searches.

3. Results

3.1. Desk study

3.1.1. No records for WCC were returned from the SERC biological record search in April 2016. However, no records of signal crayfish were returned from the search either, making it difficult to rule out WCC presence with any confidence. The presence of WCC and signal crayfish within 2 kilometres of the scheme is unknown in 2020.

3.1.2. A total of 30 EA invertebrate survey sites were identified within 2 kilometres of the scheme. Neither WCC nor signal crayfish were identified within any of the sites between 1995 and 2020.

3.2. Habitat assessment

3.2.1. Habitat assessments were undertaken between the 10 and 12 October 2017 by Five Rivers Environmental Contracting. An assessment was possible on nine watercourses.

3.2.2. Table 3:1 summarises the results of the habitat assessments and are supplemented by descriptions of each watercourse below.

Table 3:1 : WCC watercourse habitat assessments

Watercourse	Date	Upstream Start (XY)	Downstream End (XY)	Water temperature (°C)	Flow	Water Clarity	Suitable Refugia
4	10/10/17	325985, 124211	325922, 124405	12.2	Low	Moderate	Yes
5	11/10/17	327878, 122225	327915, 122304	12.9	Low	Good	Yes
6	11/10/17	329250, 121586	329255, 121661	12.9	Low	Moderate	Yes
7	Access refused						
8	11/10/17	329763, 119327	329965, 119410	13.4	Low	Good	Yes
9	11/10/17	330633, 118518	330724, 118553	13.2	Low	Good	Yes
10	12/10/17	331549, 117875	331614, 118009	12.2	Poor	Good	No
11	12/10/17	333193, 116461	333350, 116591	12	Poor	N/A as water flowing under gravel	No
12	12/10/17	333584, 115684	333784, 115711	12.4	Low	Good	Yes
13	12/10/17	334487, 115116	334630, 115280	12.4	Normal	Good	Yes

Watercourse 4

3.2.3. The top of the watercourse section is just a muddy ditch but becomes a naturalised stream channel further down near to where the scheme will cross. However, the stream is small and was ponded at the time of survey. Survey patches were carried out after the confluence where the stream turns towards the M5 junction 25 park and ride.

The channel is straight and homogenous, with heavy silting and very little in-channel cover for crayfish. There is some suitable habitat within the channel margins for manual searching. Bullhead, minnow *Phoxinus phoxinus* and 3-spine stickleback *Gasterosteus aculeatus* were identified.

Watercourse 5

3.2.4. The braided channel had a very low trickle but was largely ponded. The substrate and channel consist of clay running through the wet woodland, overlaid by some silt. The pools are separated by clay cascades. There is very little refugia within the channel, but some habitat in the margins suitable for manual search. No bullhead were identified.

Watercourse 6

3.2.5. The meandering channel has good riffle and pool sequences, but flow was very low. There was lots of cover in the upstream section, consisting of woody debris, tree roots and cobbles. The presence of frequent refugia in the channel and some cover within the channel margins made this watercourse suitable for manual search. Bullhead and 3-spine stickleback were identified.

Watercourse 8

3.2.6. This was a diverse channel with varied surrounding habitat. Abundant refugia both in the mid-channel and the margins provided by large cobbles made this suitable for manual search. A possible patch in the bank could be used for burrows in the winter months. The undercut banks indicated that flow is high at times and erosion was noted as a potential issue. Bullhead, stone loach *Barbatula barbatula*, minnow and 3-spine stickleback were all identified.

Watercourse 9

3.2.7. The channel was heavily wooded and quite large yet provided very little cover for its size. There was very little life except for 3-spine stickleback, with no bullhead recorded. However, there was enough refugia in the channel and margins to make the watercourse suitable for manual search; large tree roots, undercut banks, cobbles and shading all offered opportunities for crayfish to hide.

Watercourse 10

3.2.8. The watercourse consisted of a heavily silted channel and clay banks. There was a lack of frequent cover and a homogenous channel, offering little in the way of habitat variation. There was not enough suitable refugia to undertake a manual search and so this watercourse has been scoped out as unsuitable for WCC.

Watercourse 11

3.2.9. This small land drain only had a tiny trickle of water which flowed under gravel at the existing A358. The habitat was very poor with only one pool; 2m by 1m and 30cm deep. There was no suitable habitat within 200m of the scheme crossing and therefore no reason for a subsequent manual search.

Watercourse 12

3.2.10. The channel was diverse with varied habitat, heavily shaded and with a stony bank. There were signs of high flow and flooding at times. An abundance of refugia opportunities within the channel and margins were provided by the presence of cobbles, tree roots, undercut banks and general shading. Therefore, manual search was appropriate. Bullhead were not recorded, but other species such as minnow, stone loach, 3-spined stickleback and pike *Esox lucius* were spotted.

3.2.11. This watercourse is to be diverted as part of the scheme and will therefore be directly impacted by construction works.

Watercourse 13

3.2.12. The channel had a good riffle and pool sequence, with in-channel vegetated berms, clean gravels and *Ranunculus* beds, exhibiting good habitat variation. Large boulders and cobbles, marginal vegetation, tree roots and undercut banks offered frequent refugia, making this watercourse suitable for manual search. There was potential effluent entering from the pipe at the road bridge, noted from the presence of sewage fungus. Bullhead were recorded, along with minnow, 3-spined stickleback, dace *Leuciscus leuciscus* and eel *Anguilla anguilla*.

3.2.13. Further details from the habitat assessments for each watercourse are available in Appendix A. The locations of each watercourse in the context of the scheme is provided within Appendix B.

3.3. Manual search surveys

3.3.1. Manual search surveys were carried out on all watercourses which were deemed to have enough suitable habitat to potentially support WCC. As recommended from the habitat assessments, watercourses 4, 5, 6, 8, 9, 12 and 13 were surveyed for the presence of WCC.

3.3.2. None of the watercourses identified evidence of WCC or any non-native crayfish species. However, some watercourses contained good habitat which was deep enough to be surveyed using a trapping method. Five Rivers Environmental Contracting identified watercourses 5, 6, 8, 12 and 13 as suitable for trapping surveys if deemed necessary.

3.3.3. Following discussions with Mott MacDonald Sweco JV specialist Zoe Trent, it was decided that the methodology employed was robust enough to determine likely absence without the need for further trapping surveys in 2018; despite areas of deeper water, all possible refuges were checked thoroughly, meaning trapping would not provide significant additional information. As a result, likely absence of WCC can be concluded in all watercourses surveyed in 2017.

3.3.4. Details of the survey effort in each watercourse is available within Appendix A, with results shown in Appendix B.

4. Conclusion

4.1.1. Watercourses which support WCC in Somerset are rare, and no records of this species or non-native crayfish were returned from the SERC biological records search within 2 kilometres of the scheme. An initial desktop study was undertaken in 2017, identifying ten watercourses within 250m of the scheme which required further habitat assessment.

4.1.2. Suitable habitat with the potential to support WCC was identified in seven of the watercourses, where manual search surveys were undertaken on the same day by Five Rivers Environmental Contracting. Two of the watercourses, 10 and 11, were not suitable and watercourse 7 was refused access; the suitability of this watercourse to support WCC remains unknown.

4.1.3. There was no evidence of WCC in any of the watercourses surveyed. No evidence of non-native crayfish was found either.

4.1.4. Likely absence of WCC is assumed in all watercourses throughout the scheme.

Appendices

Appendix A: Habitat assessment and manual search survey cards

Crayfish Habitat Survey Card

Catchment:		**River**	
Date	**10/10/17**	**Site Name**	**Watercourse 4**
U/S NGR	**ST 25985 24211**	**D/S NGR**	**ST 25922 24405**
Site Length	**200m**	**Surveyors**	**DB + RG**
Width channel (m)	**1.1 – 1.8m**	**Start/finish time**	**12:15/13:05pm**
Photo ref. & location		**Water Temp (ºC)**	**12.2**
Weather (good 1, mod. 2, poor 3)	**1**	**Flow:** (norm 1, low 2, mod. 2, poor 3)	**2**
Clarity: (good 1, mod. 2, poor 3)	**2**		

Description (channel features, land use) Top of section just a muddy ditch. Becomes naturalised stream channel further down by crossing point but very small and currently ponded. Survey patches done after conf where stream turns towards park and ride. Straightened channel, heavily silted with little in stream cover.

Sample	**Patch 1**	**Patch 2**	**Patch 3**	**Patch 4**	**Patch 5**
Survey method, std 1, quad 2, net/kick 3, trap 4, view 5	1/3	1/3	1/3	1/3	1/3
Details (if not standard)					
Extent (l x w patch)	16x1	12x1.5	4x1.5	18x1.5	8x1.5
Channel (1 margins, 2 mid, 3 both, other specify)	3	3	3	3	3
Depth (metres)	0.04	0.54	0.32	0.24	0.18
Feature (1 marg. d'water, 2 pool, 3 glide, 4 run, 5 riffle)	5/3 ponded	2/5 ponded	3 ponded	3 ponded	3/2 ponded
Refuges in channel (tick all present in patch, ring main type(s) searched)					
Cobble (6.5–15cm)					
Cobble (15–25.6 cm)					
Boulder (25.6-40 cm)					
Boulder (>40cm)					
Rubble (give size)					
Woody debris	✓	✓	✓	✓	✓
Other urban debris					
Tree roots, fine	✓	✓	✓	✓	✓
Moss					
Filamentous algae					
Other submerged vegetation					
Emergents					
Substrate (%)					
Bedrock					
Cobble (6.5-15 cm)					
Pebble (<6.5 cm)					
Gravel (<1.6cm)	20				
Sand (<2mm)					
Clay					
Silt	80	100	100	100	100

Crayfish Habitat Survey Card

Siltation					
None					
Low					
Moderate					
High	✓	✓	✓	✓	✓
Refuges in bank					
None					
Cobble/boulder					
Tree roots, large	✓	✓	✓		
Vertical or undercut bank		✓	✓	✓	✓
Dry stone wall					
Other reinforced					
Crayfish burrows					
Shading above	✓	✓	✓	✓	
Total Search Time					
Bullhead present?	**Yes. + 3 spine stickleback, minnow**				

	Score	**Notes** (survey conditions, patches, etc.)
Evaluation crayfish habitat for whole site (0 none, 1 pres., 2 freq., 3 abund.) In margins	**1**	
In mid-channel	0	
In banks	1	
Surveyability		Very silted but ok.
Problems pollution 1, erosion 2, (E if >33% affected), aliens 3.		
Total crayfish (by 1 method, note total(s) by other methods in notes if applicable)	0	

Crayfish Habitat Survey Card

Catchment:		**River**	
Date	**11/10/17**	**Site Name**	**Watercourse 5**
U/S NGR	**ST 27878 22225**	**D/S NGR**	**ST 27915 22304**
Site Length	**96m**	**Surveyors**	**DB + JM**
Width channel (m)	**0.4 – 2.4**	**Start/finish time**	**11:34 – 12:10**
Photo ref. & location		**Water Temp (ºC)**	**12.9**
Weather (good 1, mod. 2, poor 3)	**1**	**Flow:** (norm 1, low 2, mod. 2, poor 3)	**2**
Clarity: (good 1, mod. 2, poor 3)	**1**		

Description (channel features, land use). Braided channel. Very low flow, a trickle but largely ponded. Bed consists of 'fused' clay. Through wet woodland. Clay channel. Pools separated by clay cascades. Only Gammarus present.

Sample	**Patch 1**	**Patch 2**	**Patch 3**	**Patch 4**	**Patch 5**
Survey method, std 1, quad 2, net/kick 3, trap 4, view 5	1/3	1/3	1/3	1/3	1/3
Details (if not standard)					
Extent (l x w patch)	28 x 0.4 – 2.4	14 x 1.5	12 x 1	8 x 1	5 x 1
Channel (1 margins, 2 mid, 3 both, other specify)	3	3	3	3	3
Depth (metres)	0.2	0.1 – 0.4	0.2 – 0.35	0.2 – 0.4	0.05 – 0.1
Feature (1 marg. d'water, 2 pool, 3 glide, 4 run, 5 riffle)	2 ponded	2 ponded	2 ponded	2 ponded	3 ponded
Refuges in channel (tick all present in patch, ring main type(s) searched)					
Cobble (6.5–15cm)					
Cobble (15–25.6 cm)					
Boulder (25.6-40 cm)					
Boulder (>40cm)					
Rubble (give size)					
Woody debris	✓	✓	✓	✓	✓
Other urban debris					
Tree roots, fine	✓	✓	✓	✓	✓
Moss					
Filamentous algae					
Other submerged vegetation	✓	✓	✓	✓	✓
Emergents					
Substrate (%)					
Bedrock					
Cobble (6.5-15 cm)					
Pebble (<6.5 cm)					
Gravel (<1.6cm)					
Sand (<2mm)					
Clay	90	100	100	100	
Silt	10				100

Crayfish Habitat Survey Card

Siltation					
None					
Low					
Moderate	✓	✓	✓	✓	✓
High					
Refuges in bank					
None					✓
Cobble/boulder					
Tree roots, large	✓	✓	✓	✓	
Vertical or undercut bank	✓	✓	✓	✓	
Dry stone wall					
Other reinforced					
Crayfish burrows					
Shading above		✓	✓	✓	
Total Search Time					
Bullhead present?	**No**				

	Score	**Notes** (survey conditions, patches, etc.)
Evaluation crayfish habitat for whole site (0 none, 1 pres., 2 freq., 3 abund.) In margins	**1**	**Silt overlaying clay – very little cover mid-stream.**
In mid-channel	0	
In banks	1	
Surveyability		Ok. Just very little habitat.
Problems pollution 1, erosion 2, (E if >33% affected), aliens 3.		
Total crayfish (by 1 method, note total(s) by other methods in notes if applicable)	0	

Crayfish Habitat Survey Card

Catchment:		**River**	
Date	**11/10/17**	**Site Name**	**Watercourse 6**
U/S NGR	**ST 29250 21587**	**D/S NGR**	**ST 29255 21661**
Site Length	**110m**	**Surveyors**	**DB + JM**
Width channel (m)	**0.4 – 2.2m**	**Start/finish time**	**9:40/10:45am**
Photo ref. & location		**Water Temp (ºC)**	**12.9**
Weather (good 1, mod. 2, poor 3)	**1**	**Flow:** (norm 1, low 2, mod. 2, poor 3)	**2**
Clarity: (good 1, mod. 2, poor 3)	**2**		

Description (channel features, land use) Meandering channel. Good riffle/pool sequences but very low flow. Just a trickle. Lots of cover in upstream of section (woody debris, Roots + Cobbles).

Sample	**Patch 1**	**Patch 2**	**Patch 3**	**Patch 4**	**Patch 5**
Survey method, std 1, quad 2, net/kick 3, trap 4, view 5	1/3	1/3	1/3	1/3	1/3
Details (if not standard)					
Extent (l x w patch)	26 x 1.2	5 x 0.5	3 x 1	4 x 1	8 x 1.5
Channel (1 margins, 2 mid, 3 both, other specify)	3	3	3	1	3
Depth (metres)	0.18	0.04	0.12	0.02 – 0.25	0.08 – 0.32
Feature (1 marg. d'water, 2 pool, 3 glide, 4 run, 5 riffle)	3 Ponded	2/5	2/5	2/5	2/5
Refuges in channel (tick all present in patch, ring main type(s) searched)					
Cobble (6.5–15cm)	✓	✓	✓	✓	✓
Cobble (15–25.6 cm)	✓	✓	✓	✓	✓
Boulder (25.6-40 cm)					
Boulder (>40cm)					
Rubble (give size)					
Woody debris	✓	✓	✓	✓	✓
Other urban debris					
Tree roots, fine	✓	✓	✓		✓
Moss					
Filamentous algae					
Other submerged vegetation		✓			✓
Emergents					✓
Substrate (%)					
Bedrock					
Cobble (6.5-15 cm)		5	20	20	20
Pebble (<6.5 cm)		30	10	10	20
Gravel (<1.6cm)	5	60	60	60	40
Sand (<2mm)	20				
Clay	75	5	10	10	20
Silt					

Crayfish Habitat Survey Card

Siltation					
None					
Low	✓	✓	✓	✓	✓
Moderate					
High					
Refuges in bank					
None					
Cobble/boulder					
Tree roots, large	✓	✓	✓	✓	✓
Vertical or undercut bank		✓		✓	✓
Dry stone wall					
Other reinforced					
Crayfish burrows					
Shading above					

Total Search Time		
Bullhead present?	**Yes + 3 Spine Stickleback**	
	Score	**Notes** (survey conditions, patches, etc.)
Evaluation crayfish habitat for whole site (0 none, 1 pres., 2 freq., 3 abund.) In margins	**2**	**Habitat present but very low flows currently.**
In mid-channel	2	
In banks	1	
Surveyability		Good
Problems pollution 1, erosion 2, (E if >33% affected), aliens 3.		
Total crayfish (by 1 method, note total(s) by other methods in notes if applicable)	0	

Crayfish Habitat Survey Card

Catchment:		**River**	**Fivehead River**
Date	**11/10/17**	**Site Name**	**Watercourse 8**
U/S NGR	**ST 29763 19327**	**D/S NGR**	**ST 29965 19410**
Site Length	**215m**	**Surveyors**	**DB + JM**
Width channel (m)	**0.4 – 4.5. (Av 1.5)**	**Start/finish time**	**13:05/13:55pm**
Photo ref. & location		**Water Temp (ºC)**	**13.4**
Weather (good 1, mod. 2, poor 3)	**1**	**Flow:** (norm 1, low 2, mod. 2, poor 3)	**2**
Clarity: (good 1, mod. 2, poor 3)	**1**		

Description (channel features, land use) Diverse Channel with varied habitat – improved pasture with urban areas. Large cobbles with little silt. Undercut banks. Signs of high velocity at times.

Sample	**Patch 1**	**Patch 2**	**Patch 3**	**Patch 4**	**Patch 5**
Survey method, std 1, quad 2, net/kick 3, trap 4, view 5	1/3	1/3	1/3	1/3	1/3
Details (if not standard)					
Extent (l x w patch)	2 x 1.5	6 x 1.5	10 x 2	15 x 2	
Channel (1 margins, 2 mid, 3 both, other specify)	3	3	3	3	3
Depth (metres)	0.1	0.2 – 0.3	0.1 – 0.6	0.1 – 0.3	0.1 – 0.5
Feature (1 marg. d'water, 2 pool, 3 glide, 4 run, 5 riffle)	5	2/3	5/2/3	2/5	2/5
Refuges in channel (tick all present in patch, ring main type(s) searched)					
Cobble (6.5–15cm)	✓	✓	✓	✓	✓
Cobble (15–25.6 cm)				✓	✓
Boulder (25.6-40 cm)		✓	✓		✓
Boulder (>40cm)			✓		
Rubble (give size)					
Woody debris		✓	✓	✓	✓
Other urban debris			✓		✓
Tree roots, fine		✓	✓	✓	✓
Moss				✓	
Filamentous algae				✓	
Other submerged vegetation					
Emergents				✓	
Substrate (%)					
Bedrock					
Cobble (6.5-15 cm)	50	100	80	80	75
Pebble (<6.5 cm)	25		10	10	10
Gravel (<1.6cm)	25		5	5	10
Sand (<2mm)			5	5	5
Clay					
Silt					

Crayfish Habitat Survey Card

Siltation					
None					
Low	✓	✓	✓	✓	✓
Moderate					
High					
Refuges in bank					
None					
Cobble/boulder	✓	✓	✓	✓	✓
Tree roots, large	✓	✓			✓
Vertical or undercut bank	✓	✓		✓	✓
Dry stone wall					
Other reinforced					
Crayfish burrows	✓				
Shading above	✓	✓	✓	✓	✓
Total Search Time	10mins	10mins	15mins	20mins	20mins
Bullhead present?	**Yes + Stone loach, Minnow, 3 Spine Stickleback**				

	Score	**Notes** (survey conditions, patches, etc.)
Evaluation crayfish habitat for whole site (0 none, 1 pres., 2 freq., 3 abund.) In margins	**3**	**Frequent large cobbles/boulders present. Possible burrow patch.**
In mid-channel	3	
In banks	1	
Surveyability		
Problems pollution 1, erosion 2, (E if >33% affected), aliens 3.	2	
Total crayfish (by 1 method, note total(s) by other methods in notes if applicable)	0	

Crayfish Habitat Survey Card

Catchment:		**River**	
Date	**11/10/17**	**Site Name**	**Watercourse 9**
U/S NGR	**ST 30633 18518**	**D/S NGR**	**ST 30724 18553**
Site Length	**100m**	**Surveyors**	**DB + JM**
Width channel (m)	**1.8m**	**Start/finish time**	**2:20/2:53pm**
Photo ref. & location		**Water Temp (ºC)**	**13.2**
Weather (good 1, mod. 2, poor 3)	**2**	**Flow:** (norm 1, low 2, mod. 2, poor 3)	**2**
Clarity: (good 1, mod. 2, poor 3)	**1**		

Description (channel features, land use)
Heavily wooded channel. Low flow, Very little life except for 3 spine stickleback.

Sample	Patch 1	Patch 2	Patch 3	Patch 4	Patch 5
Survey method, std 1, quad 2, net/kick 3, trap 4, view 5	1/3	1/3	1/3	1/3	1/3
Details (if not standard)					
Extent (l x w patch)	12 x 1.5	8 x 1.5	7 x 0.75	10 x 1	12 x 1
Channel (1 margins, 2 mid, 3 both, other specify)	3	3	3	3	3
Depth (metres)	0.23	0.02-0.18	0.33	0.02-0.38	0.2
Feature (1 marg. d'water, 2 pool, 3 glide, 4 run, 5 riffle)	3 pooled	2/5	3/5 ponded	2/5	
Refuges in channel (tick all present in patch, ring main type(s) searched)					
Cobble (6.5–15cm)		✓		✓	✓
Cobble (15–25.6 cm)		✓			
Boulder (25.6-40 cm)					
Boulder (>40cm)					
Rubble (give size)					
Woody debris	✓	✓	✓	✓	✓
Other urban debris					
Tree roots, fine	✓	✓	✓	✓	✓
Moss					
Filamentous algae					
Other submerged vegetation					
Emergents					
Substrate (%)					
Bedrock					
Cobble (6.5-15 cm)	5		5	20	20
Pebble (<6.5 cm)	20	20	5	30	30
Gravel (<1.6cm)	75	70	70	40	40
Sand (<2mm)					
Clay					
Silt		10	20	10	10

Crayfish Habitat Survey Card

Siltation					
None					
Low	✓		✓	✓	✓
Moderate		✓			
High					
Refuges in bank					
None					
Cobble/boulder					
Tree roots, large	✓	✓	✓	✓	✓
Vertical or undercut bank		✓	✓		
Dry stone wall					
Other reinforced					
Crayfish burrows					
Shading above		✓	✓		
Total Search Time	8mins	6mins	7mins	8mins	5mins
Bullhead present?	**No. 3 Spine Stickleback**				

	Score	**Notes** (survey conditions, patches, etc.)
Evaluation crayfish habitat for whole site (0 none, 1 pres., 2 freq., 3 abund.) In margins	**1**	**Low flows, little cover available in what is quite a large channel.**
In mid-channel	1	
In banks	1	
Surveyability		Ok
Problems pollution 1, erosion 2, (E if >33% affected), aliens 3.		
Total crayfish (by 1 method, note total(s) by other methods in notes if applicable)	0	

Crayfish Habitat Survey Card

Catchment:		**River**	
Date	**12/10/17**	**Site Name**	**Watercourse 10**
U/S NGR	**ST 31549 17875**	**D/S NGR**	**ST 31614 18009**
Site Length	**148m**	**Surveyors**	**DB + JM**
Width channel (m)	**2**	**Start/finish time**	**11:10/11:45am**
Photo ref. & location		**Water Temp (ºC)**	**12.2**
Weather (good 1, mod. 2, poor 3)	**1**	**Flow:** (norm 1, low 2, mod. 2, poor 3)	**3**
Clarity: (good 1, mod. 2, poor 3)	**1**		

Description (channel features, land use)
Heavily silted channel, clay banks.

Sample	**Patch 1**	**Patch 2**	**Patch 3**	**Patch 4**	**Patch 5**
Survey method, std 1, quad 2, net/kick 3, trap 4, view 5	1/3	1/3	1/3	1/3	1/3
Details (if not standard)					
Extent (l x w patch)	10 x 2	15 x 2	20 x 2	25 x 2	20 x 2
Channel (1 margins, 2 mid, 3 both, other specify)	3	3	3	3	3
Depth (metres)	0.1-0.3	0.1-0.5	0.1-0.5	0.1-0.5	0.1-0.6
Feature (1 marg. d'water, 2 pool, 3 glide, 4 run, 5 riffle)	3/2	3/2/5	3/5	3/5	3/5
Refuges in channel (tick all present in patch, ring main type(s) searched)					
Cobble (6.5–15cm)			✓	✓	✓
Cobble (15–25.6 cm)					
Boulder (25.6-40 cm)					
Boulder (>40cm)					
Rubble (give size)					
Woody debris	✓	✓	✓	✓	✓
Other urban debris					
Tree roots, fine	✓	✓	✓	✓	✓
Moss	✓	✓	✓		
Filamentous algae	✓	✓			
Other submerged vegetation					
Emergents					
Substrate (%)					
Bedrock					
Cobble (6.5-15 cm)		1	10	10	10
Pebble (<6.5 cm)		9	10	10	10
Gravel (<1.6cm)		20	30	10	10
Sand (<2mm)					
Clay					10
Silt	100	70	60	70	60

Crayfish Habitat Survey Card

Siltation					
None					
Low					
Moderate					
High	✓	✓	✓	✓	✓
Refuges in bank					
None					
Cobble/boulder		✓	✓	✓	✓
Tree roots, large	✓	✓	✓	✓	✓
Vertical or undercut bank	✓	✓	✓	✓	✓
Dry stone wall					
Other reinforced					
Crayfish burrows					
Shading above	✓	✓	✓	✓	✓
Total Search Time	10mins	10mins	15mins	15mins	10mins
Bullhead present?	**No. 3 Spine Stickleback**				

	Score	**Notes** (survey conditions, patches, etc.)
Evaluation crayfish habitat for whole site (0 none, 1 pres., 2 freq., 3 abund.) In margins	**0**	**Lack of frequent cover. Clay banks, no visible burrows. Homogenous channel.**
In mid-channel	0	
In banks	1	
Surveyability		
Problems pollution 1, erosion 2, (E if >33% affected), aliens 3.	2	
Total crayfish (by 1 method, note total(s) by other methods in notes if applicable)	0	

Crayfish Habitat Survey Card

Catchment:		**River**	
Date	**12/10/17**	**Site Name**	**Watercourse 11**
U/S NGR	**ST 33193 16461**	**D/S NGR**	**ST 33350 16591**
Site Length	**224m**	**Surveyors**	**DB + JM**
Width channel (m)	**0.2m**	**Start/finish time**	**10:15**
Photo ref. & location		**Water Temp (ºC)**	**12**
Weather (good 1, mod. 2, poor 3)	**1**	**Flow:** (norm 1, low 2, mod. 2, poor 3)	**3**
Clarity: (good 1, mod. 2, poor 3)			

Description (channel features, land use)

Small land drain. Very poor Habitat (see photos). Tiny Trickle flowing under gravel at A358 bridge, one pool 2m x 1m x 0.3m deep, no crayfish present. No survey undertaken. No habitat in 200m reach. 3 spine stickleback in pool.

Sample	Patch 1	Patch 2	Patch 3	Patch 4	Patch 5
Survey method, std 1, quad 2, net/kick 3, trap 4, view 5					
Details (if not standard)					
Extent (l x w patch)					
Channel (1 margins, 2 mid, 3 both, other specify)					
Depth (metres)					
Feature (1 marg. d'water, 2 pool, 3 glide, 4 run, 5 riffle)					
Refuges in channel (tick all present in patch, ring main type(s) searched)					
Cobble (6.5–15cm)					
Cobble (15–25.6 cm)					
Boulder (25.6-40 cm)					
Boulder (>40cm)					
Rubble (give size)					
Woody debris					
Other urban debris					
Tree roots, fine					
Moss					
Filamentous algae					
Other submerged vegetation					
Emergents					
Substrate (%)					
Bedrock					
Cobble (6.5-15 cm)					
Pebble (<6.5 cm)					
Gravel (<1.6cm)					
Sand (<2mm)					
Clay					
Silt					

Crayfish Habitat Survey Card

Siltation					
None					
Low					
Moderate					
High					
Refuges in bank					
None					
Cobble/boulder					
Tree roots, large					
Vertical or undercut bank					
Dry stone wall					
Other reinforced					
Crayfish burrows					
Shading above					
Total Search Time					
Bullhead present?					

	Score	**Notes** (survey conditions, patches, etc.)
Evaluation crayfish habitat for whole site (0 none, 1 pres., 2 freq., 3 abund.) In margins	**0**	
In mid-channel	0	
In banks	0	
Surveyability		Nothing to survey
Problems pollution 1, erosion 2, (E if >33% affected), aliens 3.		
Total crayfish (by 1 method, note total(s) by other methods in notes if applicable)	0	

Crayfish Habitat Survey Card

Catchment:		**River**	
Date	**12/10/17**	**Site Name**	**Watercourse 12**
U/S NGR	**ST 33584 15684**	**D/S NGR**	**ST 33784 15711**
Site Length	**268m**	**Surveyors**	**DB + JM**
Width channel (m)	**1-3m**	**Start/finish time**	**08:35am**
Photo ref. & location		**Water Temp (ºC)**	**12.4**
Weather (good 1, mod. 2, poor 3)	**1**	**Flow:** (norm 1, low 2, mod. 2, poor 3)	**2**
Clarity: (good 1, mod. 2, poor 3)	**1/2**		

Description (channel features, land use)
Diverse channel with varied habitat, heavily shaded. No clay visible in banks – stoney bank. Signs of high flow/flood. Pike and other species of fish spotted.

Sample	**Patch 1**	**Patch 2**	**Patch 3**	**Patch 4**	**Patch 5**
Survey method, std 1, quad 2, net/kick 3, trap 4, view 5	1/3	1/3	1/3	1/3	1/3
Details (if not standard)					
Extent (l x w patch)	8 x 1	25 x 2	30 x 2.5	40 x 2	20 x 2.5
Channel (1 margins, 2 mid, 3 both, other specify)	3	3	3	3	3
Depth (metres)	0.2	0.1-0.5	0.3-0.75	0.4-0.75	0.4-0.6
Feature (1 marg. d'water, 2 pool, 3 glide, 4 run, 5 riffle)	4/5	3/5	2/3/5	2/3/5	2/3
Refuges in channel (tick all present in patch, ring main type(s) searched)					
Cobble (6.5–15cm)	✓	✓	✓	✓	✓
Cobble (15–25.6 cm)	✓	✓	✓	✓	
Boulder (25.6-40 cm)					
Boulder (>40cm)					
Rubble (give size)					
Woody debris		✓	✓	✓	✓
Other urban debris		✓			
Tree roots, fine		✓	✓	✓	✓
Moss		✓	✓	✓	
Filamentous algae		✓	✓	✓	
Other submerged vegetation		✓ duckweed	✓ duckweed	✓ Starwort, Duckweed.	✓ duckweed
Emergents			✓	✓	✓
Substrate (%)					
Bedrock					
Cobble (6.5-15 cm)	75	50	50	30	15
Pebble (<6.5 cm)	10	20	20	30	10
Gravel (<1.6cm)	10	5	5	30	50
Sand (<2mm)	5	5	5	5	10
Clay					
Silt		20	20	5	10

Crayfish Habitat Survey Card

Siltation					
None					
Low	✓				
Moderate		✓	✓	✓	✓
High					
Refuges in bank					
None	✓				
Cobble/boulder		✓	✓	✓	
Tree roots, large		✓	✓	✓	✓
Vertical or undercut bank		✓	✓	✓	✓
Dry stone wall					
Other reinforced					
Crayfish burrows		✓ potential	✓ potential high up bank		✓
Shading above	✓	✓	✓	✓	✓
Total Search Time	15mins	15mins	15mins	30mins	10mins
Bullhead present?	**No. Minnow, Stoneloach, 3 Spine Stickleback.**				

	Score	**Notes** (survey conditions, patches, etc.)
Evaluation crayfish habitat for whole site (0 none, 1 pres., 2 freq., 3 abund.) In margins	**3**	**Cobbles and roots/woody material present.**
In mid-channel	3	
In banks	3	
Surveyability		
Problems pollution 1, erosion 2, (E if >33% affected), aliens 3.	E	Eroded banks, signs of high flows.
Total crayfish (by 1 method, note total(s) by other methods in notes if applicable)	0	

Crayfish Habitat Survey Card

Catchment:		**River**	**River Isle**
Date	**12/10/17**	**Site Name**	**Watercourse13**
U/S NGR	**ST 34487 15116**	**D/S NGR**	**ST 34630 15280**
Site Length	**215m**	**Surveyors**	**DB + JM**
Width channel (m)	**1.5 – 9m**	**Start/finish time**	**12:38/13:48pm**
Photo ref. & location		**Water Temp (ºC)**	**12.4**
Weather (good 1, mod. 2, poor 3)	**1**	**Flow:** (norm 1, low 2, mod. 2, poor 3)	**1**
Clarity: (good 1, mod. 2, poor 3)	**1**		

Description (channel features, land use)
5om either side of road bridge. Nice channel with in-channel vegetated berms, clean gravels and ranunculus beds. Good riffle/pool sequence.

Sample	**Patch 1**	**Patch 2**	**Patch 3**	**Patch 4**	**Patch 5**
Survey method, std 1, quad 2, net/kick 3, trap 4, view 5	1/3	1/3	1/3	1/3	1/3
Details (if not standard)					
Extent (l x w patch)	14 x 1.5	9 x 3	4 x 6.5	20 x 9	16 x 5
Channel (1 margins, 2 mid, 3 both, other specify)	3	3	3	3	3
Depth (metres)	0.3	0.5	0.3	0.35	0.4
Feature (1 marg. d'water, 2 pool, 3 glide, 4 run, 5 riffle)	4/5	2/3	5/5	3/4	3/5
Refuges in channel (tick all present in patch, ring main type(s) searched)					
Cobble (6.5–15cm)	✓	✓	✓	✓	✓
Cobble (15–25.6 cm)	✓	✓	✓	✓	✓
Boulder (25.6-40 cm)	✓		✓		✓
Boulder (>40cm)					
Rubble (give size)					
Woody debris	✓	✓		✓	
Other urban debris					
Tree roots, fine	✓			✓	✓
Moss					
Filamentous algae	✓	✓	✓	✓	✓
Other submerged vegetation	✓			✓	
Emergents	✓		✓	✓	
Substrate (%)					
Bedrock					
Cobble (6.5-15 cm)	10	20	20	15	30
Pebble (<6.5 cm)	30	20	30	60	30
Gravel (<1.6cm)	60	40	40	20	20
Sand (<2mm)					
Clay					
Silt		20	10	5	20

Crayfish Habitat Survey Card

Siltation					
None					
Low	✓				
Moderate		✓	✓	✓	✓
High					
Refuges in bank					
None					
Cobble/boulder		✓	✓		
Tree roots, large	✓	✓	✓	✓	✓
Vertical or undercut bank		✓	✓	✓	✓
Dry stone wall					
Other reinforced					
Crayfish burrows					
Shading above		✓	✓	✓	✓
Total Search Time	13mins	8mins	17mins	20mins	8mins
Bullhead present?	**Yes. 3 Spine Stickle Back. Minnow, Dace, Eel.**				

	Score	**Notes** (survey conditions, patches, etc.)
Evaluation crayfish habitat for whole site (0 none, 1 pres., 2 freq., 3 abund.) In margins	**2**	
In mid-channel	2	
In banks	2	
Surveyability		Good
Problems pollution 1, erosion 2, (E if >33% affected), aliens 3.	1	Effluent entering from pipe at road bridge. Sewage fungus.
Total crayfish (by 1 method, note total(s) by other methods in notes if applicable)	0	

Appendix B: Watercourse locations and survey status

4

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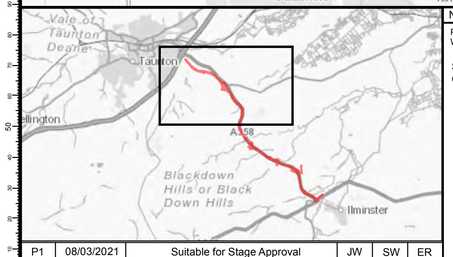
NTS 0 750 1,500m



REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
P1	08/03/2021	Suitable for Stage Approval	JW	SW	ER

Notes

Pink Modified Scheme, Mott MacDonald (2019)
White-clawed crayfish manual search locations, Mott MacDonald (2017)

Service Layer Credits: Contains OS data © Crown Copyright and database right 2020

Key to symbols

- Pink modified scheme option
- 250m buffer
- 500m buffer

White-clawed crayfish status

- Absent
- No Access

References drawings

Drawing Status	Suitability
Suitable for Stage Approval	S4

Mott MacDonald Sweco
Stoneham Place
Stoneham Lane
Southampton
SO50 9NW
Tel : +44 (0)23 8062 8800
Fax : +44 (0)23 8062 8801
www.mottmac.com

Client: highways england

Project Title: A358 Taunton to Southfields

Drawing Title: Appendix B: white-clawed crayfish survey results

Page 1 of 3

Scale	Designed	Drawn	Checked	Approved
NTS	JW	JW	SW	ER

Original Size	Date	Date	Date	Date
A1	08/03/2021	08/03/2021	08/03/2021	08/03/2021

Drawing Number: HE551508 - MMSJV - EBD - 000 - DR - LB - 0100
(HE PIN | Originator | Volume | Location | Type | Role | Number)

Project Ref. No.: 370774

Revision: P1

6

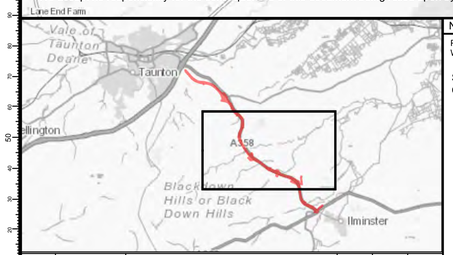
7

8

9

10

0 750 1,500m
NTS



REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
P1	08/03/2021	Suitable for Stage Approval	JW	SW	ER

Notes

Pink Modified Scheme, Mott MacDonald (2019)
White-clawed crayfish manual search locations, Mott MacDonald (2017)

Service Layer Credits: Contains OS data © Crown Copyright and database right 2020

Key to symbols

Pink modified scheme option
250m buffer
500m buffer

White-clawed crayfish status

Absent
No Access

References drawings

Drawing Status: Suitable for Stage Approval
Suitability: S4

Mott MacDonald Sweco
Stoneham Place
Stoneham Lane
Southampton
SO50 9NW
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Client: highways england

Project Title: A358 Taunton to Southfields

Drawing Title: Appendix B: white-clawed crayfish survey results

Page 2 of 3

Scale	Designed	Drawn	Checked	Approved
NTS	JW	JW	SW	ER

Original Size	Date	Date	Date	Date
A1	08/03/2021	08/03/2021	08/03/2021	08/03/2021

Drawing Number: HE551508 - MMSJV - EBD - 000 - DR - LB - 0101
(HE PIN | Originator | Volume | Location | Type | Role | Number)

Project Ref. No.: 370774

Revision: P1

9

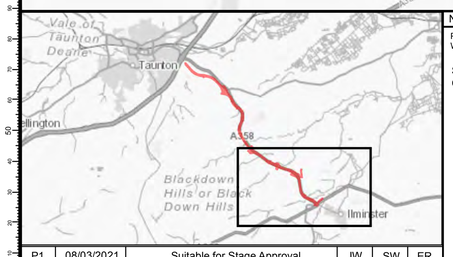
10

11

12

13

NTS 0 750 1,500m



REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
P1	08/03/2021	Suitable for Stage Approval	JW	SW	ER

Notes

Pink Modified Scheme, Mott MacDonald (2019)
White-clawed crayfish manual search locations, Mott MacDonald (2017)

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Key to symbols

Pink modified scheme option
250m buffer
500m buffer

White-clawed crayfish status

Absent
No Access

References drawings

Drawing Status: Suitable for Stage Approval

Suitability: S4

Mott MacDonald Sweco
Stoneham Place
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Client: highways england

Project Title: A358 Taunton to Southfields

Drawing Title: Appendix B: white-clawed crayfish survey results

Page 3 of 3

Scale	Designed	Drawn	Checked	Approved
NTS	JW	JW	SW	ER
Original Size	**Date**	**Date**	**Date**	**Date**
A1	08/03/2021	08/03/2021	08/03/2021	08/03/2021

Drawing Number: HE551508 - MMSJV - EBD - 000 - DR - LB - 0102
(HE PIN | Originator | Volume | Location | Type | Role | Number)

Project Ref. No.: 370774

Revision: P1