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TWYFORD PARISH COUNCIL
TWYFORD FLOOD ALLEVIATION SCHEME
TWYFORD

FLOOD ALLEVIATION PROPOSALS

JUNE 2019

the journey is the reward

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FLOOD ALLEVIATION PROPOSALS

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1 Introduction

Introduction

1.1 Mayer Brown Ltd has been commissioned by Twyford Parish Council to undertake an outline design and cost estimate for a flood mitigation scheme in the centre of Twyford. Figure 1 shows the location.

1.2 The scope of the study comprises an analysis of the winterborne (its existing route and flood impact); assessment of the existing drainage network (condition and capacity); identification of potential improvements to the drainage network to alleviate flooding; measures to manage flood flows should they still occur; potential cost of feasible improvements.

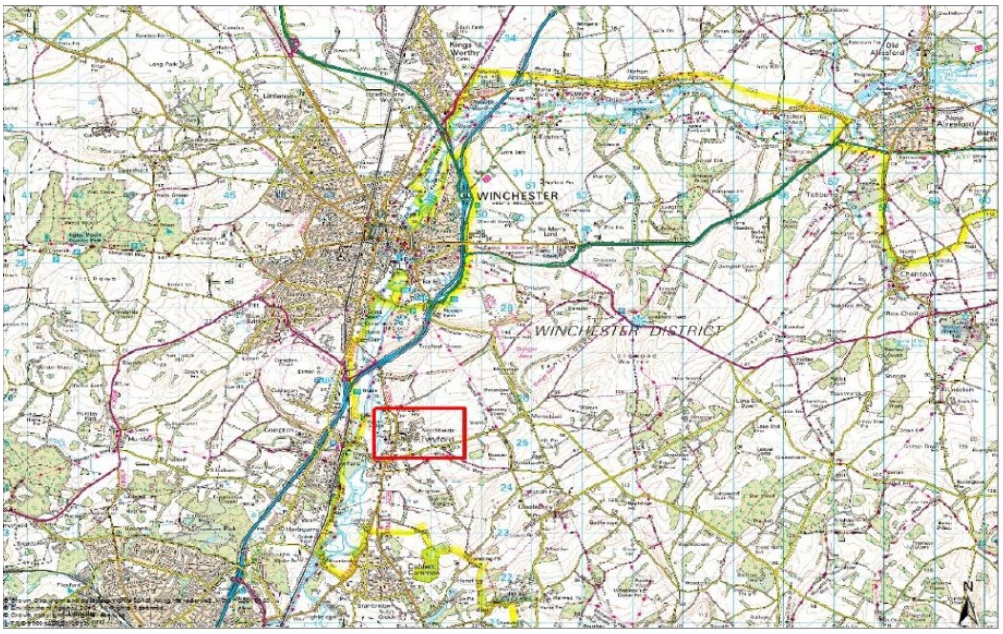


Figure 1 - Location Plan

Site Location and Description

1.3 Twyford village is located in Hampshire approximately 3 miles south of Winchester.

1.4 The centre of Twyford Village, located at the western end of Hazeley Road, lies at the lower end of a tributary catchment area for the River Itchen of about 12km^2. Flooding occurs when groundwater levels are high enough to charge winterbournes further up the valley. Discharge from the winterbournes inundate the existing drainage network

through the village, resulting in flooding. Significant flooding took place in the winters of 2000/01 and 2013/4 when surface water issued from springs above and below the Morestead Road and flowed as surface water along Hazeley Road flooding the village centre. The flow is augmented by smaller springs lower down the valley, on either side of Hazeley Road.

Background

1.5 Historically, a large ditch ran all the way along the lower end of Hazeley Road, before discharging into a large culvert passing under the B3335 (High Street) and then into an open culvert along Finches Lane and eventually into fields beyond. This ditch was replaced by a mix of small ditches and piped stormwater system when development took place in the latter half of the 20th century.

1.6 In 2001, Hampshire County Council rebuilt the section of storm sewer along Finches Lane (from below the B3335 to the discharge point into the existing open ditch across the field to the Itchen River) with a 750mm diameter pipe. The culvert from the High Street/Finches Lane junction to its outfall appeared to contain all the flows from above the B3335 in the 2014 floods and there was no observed flooding below the B3335 caused by the surcharging of drains.

1.7 The ditch/piped system to the east of the B3335 has not been upgraded. It functions adequately most of the time to drain highway runoff but is unable to cater for flows in the flood conditions described above when winterborne flows are large enough to inundate and bypass the drainage system and collect on the low ground at the village centre. In July 2017, Hampshire County Council, as the Land Drainage Authority, undertook a study to identify possible mitigation schemes to reduce the risk of flooding in the centre of the village as part of a wider review of settlements affected by the 2014 flood. The study indicated that mitigation is possible and proposed that two engineering schemes should be looked at further; these are:

a) *Improving the existing infrastructure in key locations, namely a new interception ditch within the car park to the rear of the Parish Hall, increased capacity along Hazeley Road to the east of the car park.*

and reinstating the ditches along Hazeley Road to the east of the car park.

b) *Providing a new flow route within the car park in the form of a slot drain (or similar), reinstating the historic ditch line at the rear of Sparkford and increasing capacity within the culvert to connect at the Hazeley Road/High Street junction.*

1.8 The above two schemes and their potential costs did not include any detailed study of topography, drainage system or of utilities to verify viability.

1.9 The Study and other flood data, such as details of properties affected by the floods, can be viewed on the environmental tab of the Twyford Neighbourhood Plan website.

1.10 The study concluded that Twyford does not qualify for government flood grants. Hampshire County Council has no further plans to progress the study to the next stage and this has now been passed to Twyford Parish Council (TPC) to develop further.

2 Scope of Study

2.1 Mayer Brown Ltd has been commissioned to undertake further engineering analysis to investigate the viability, effectiveness, cost and risk of the measures identified by HCC.

2.2 The area of the scope is between the headwall located at Churchfields Road which is the outfall to the river and Bourne Lane where the water builds up in the nearby field. This can be seen in Figure 2.1.

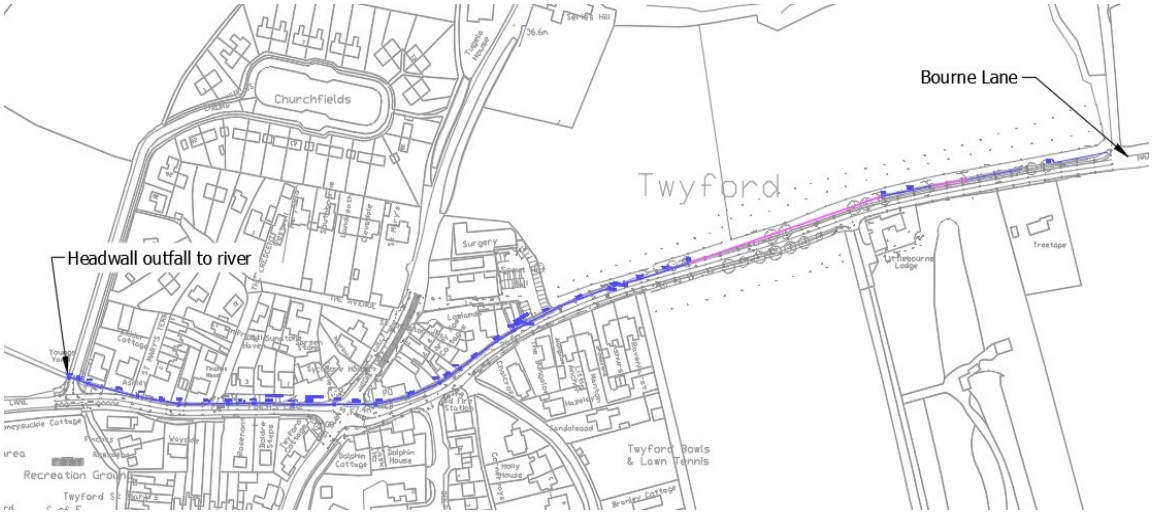


Figure 2.1 – Extents of study

Work completed

2.3 A topographical survey was done in July 2018 of the extent of the study in order to provide accurate positions and levels of all existing features.

2.4 EEG was commissioned by Mayer Brown Ltd in July 2018 to complete a CCTV condition survey of the existing drainage conditions. Jet washing of the drainage network was required in order to complete the survey. EEG experienced several blockages during the survey where they could no longer continue the survey in those locations. Subsequently, the entire drainage network could not be assessed. It would be advisable to get these parts of the network surveyed once access to them is available during the necessary repair works referenced in Section 6.

2.5 Despite the above referred missing survey data, the collected information is sufficient to enable modelling and detailed analysis of the networks condition, performance and capacity.

2.6 The Environment Agency has been consulted with regards to the winterborne's behaviour and impact. A response was received on 19 March 2019.

2.7 The EA's main concern is an increase in surface flows from groundwater extraction either by pumping or by interception of ground water springs by pipe networks or ditches. These drainage features would provide a defined route for groundwater to flow, thereby generating more surface water and putting more demand on the surface water network, which already experiences flooding.

2.8 A copy of this report has subsequently been issued to the Environment Agency for further comment.

3 Existing Conditions

3.1 This section outlines the existing conditions within the scope of the survey. Drawing ZTPCTWYFORD-DR-01-A & 02-A (Appendix A) provides an overview of the network including locations where the condition is critical.

3.2 A schedule of the current condition and critical items is contained in Table 3.1 in Appendix A.

3.3 Within the sewer network, there are several areas where there are blockages and obstructions to the flow of water through the sewer.

3.4 The most critical area is located immediately to the west of the parish hall car park entrance where a culvert has partially collapsed resulting in a severely restricted flow through the sewer. Figure 3.1 shows the corrugated iron sheet collapsed in the sewer which has also resulted in concrete elements getting in. This has severely reduced the flow of water through the sewer and is especially critical as this area directly drains the surface water from the parish hall car park.

3.5 Further constriction has been caused by a ducted water supply which passes through the middle of the culvert.

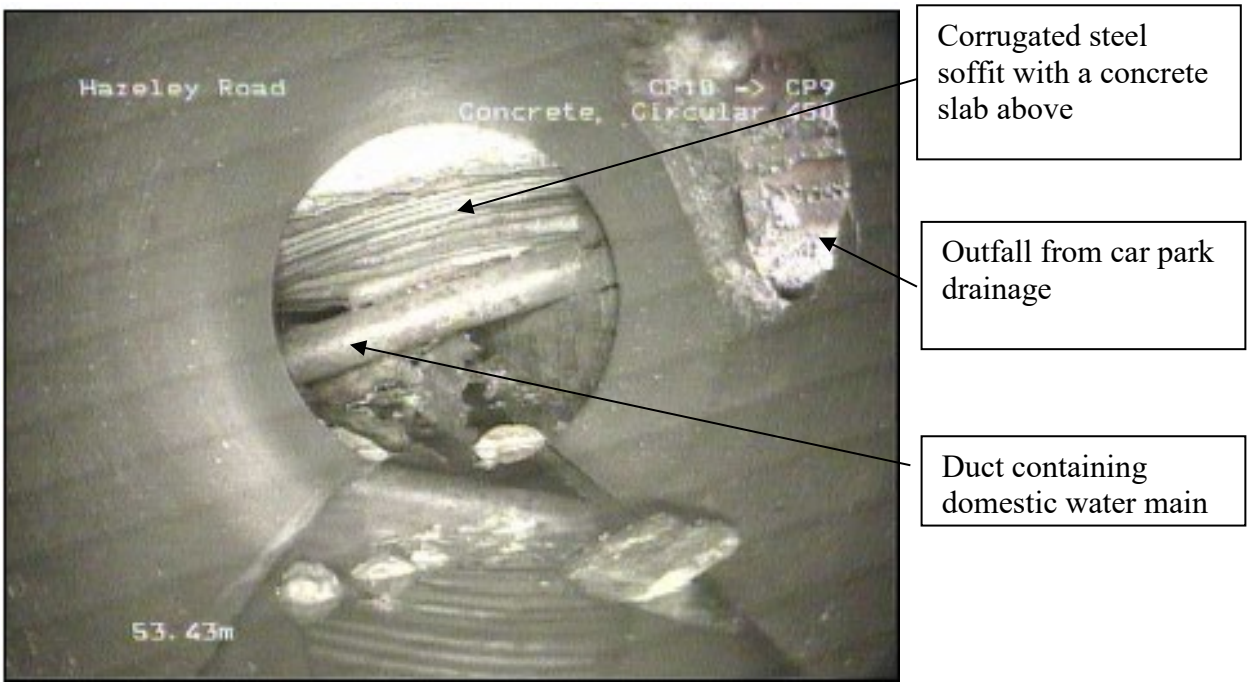


Figure 3.1 – Collapsed Sewer

3.6 The general condition of the sewer in Figure 3.1 may compromise the bearing capacity of the footway above.

3.7 There are several locations throughout the network where pipes protrude into the main storm sewer and reduce the capacity of the pipe. In some cases, they protrude 50% of the way into the main sewer as can be seen in Figure 3.2. This has no beneficial engineering purpose and reduces the flow of water through the network and increases the risk of blockages during significant flow events.

Figure 3.2 – Protruding connections into the sewer

3.8 Figure 3.3 shows a utility pipe crossing the sewer. There are 3 instances of utilities crossing through the sewer network. These will marginally reduce the capacity of the sewer and cause turbulence in the water flow. They may also obstruct detritus within the flow causing further restriction.

3.9 There are several instances of longitudinal cracking in the sewer network as can be seen in Figure 3.4. They have the potential to collapse and could lead to subsidence/collapse in the surface above. The instance in Figure 3.7, is below an area where cars normally park so poses a high risk.

Figure 3.3 – Utility connection

Figure 3.4 – Longitudinal cracking

3.10 The section of drainage between Bourne Lane and the Littlebourne Lodge was a continuous ditch in the past which used to take the flows from the winterbourne. Pipe sections have replaced parts of the original ditch to accommodate footway, parking laybys and services. It

is likely the pipe sections have been designed purely as a highway drain and consequently will not have the capacity to accommodate the winterborne flows. Surplus flow from the winterborne returns to the highway during seasonally wet events and flows towards a low point outside the old fire station. If the flow is great enough, then discharge will breach into the parish hall car park and some neighbouring properties.

3.11 The ditch from Littlebourne Lodge discharges to a 450mm pipe. Collection of highway run-off is provided by side inlet gullies. It is likely the full capacity of the ditch is reached when it receives winterbourne flows from the adjacent field.

3.12 From the topographical survey, it was identified that the Hazeley Road is on a balanced crown. The water, therefore, drains to both edges of the highway and runs west towards Hazeley road/Highstreet junction. The first gully that picks up the southern side of the highway is not until Littlebourne Lodge. By this point, there will be a large collection of water on the road which should be discharging into the drainage system. On inspection, the manholes on the south side of Hazeley Road were almost completely blocked as can be seen by Figure 3.5. Subsequently, most of the water arising on the southern side of the road is not discharging into the drainage system. This becomes a bigger problem when as per previous storm events, additional flooding comes onto the highway network from the Littlebourne Fields.

Figure 3.5 – Partially Blocked Highway Drainage

3.13 Along Hazeley road, there are two inlet headwalls constructed of concrete sandbags which are in poor condition. Dislodged sandbags have partially blocked the inlet and in some cases been washed downstream. Further deterioration will risk further blockages. The partially collapsed headwalls will have a detrimental effect on the stability of the adjacent highway and pose a highway safety risk. This is shown in Figure 3.6.

Figure 3.6 – Concrete Sandbag Headwall

3.14 The majority of the manholes are in good condition. Some of the manholes use concrete sandbags as a structural element as can be seen in Figure 3.7. These are in poor condition and if they become dislodged, they would impact the structural integrity of the manhole and adjacent kerbing and raise the risk of blockages/reduced capacity in the drainage system downstream.

Figure 3.7 – Concrete Sandbag Manhole

3.15 There a numerous instance of debris in the pipes as can be seen in Figure 3.8 and 3.9. The current debris reduces the capacity of the sewer by approximately 20% in the affected areas.

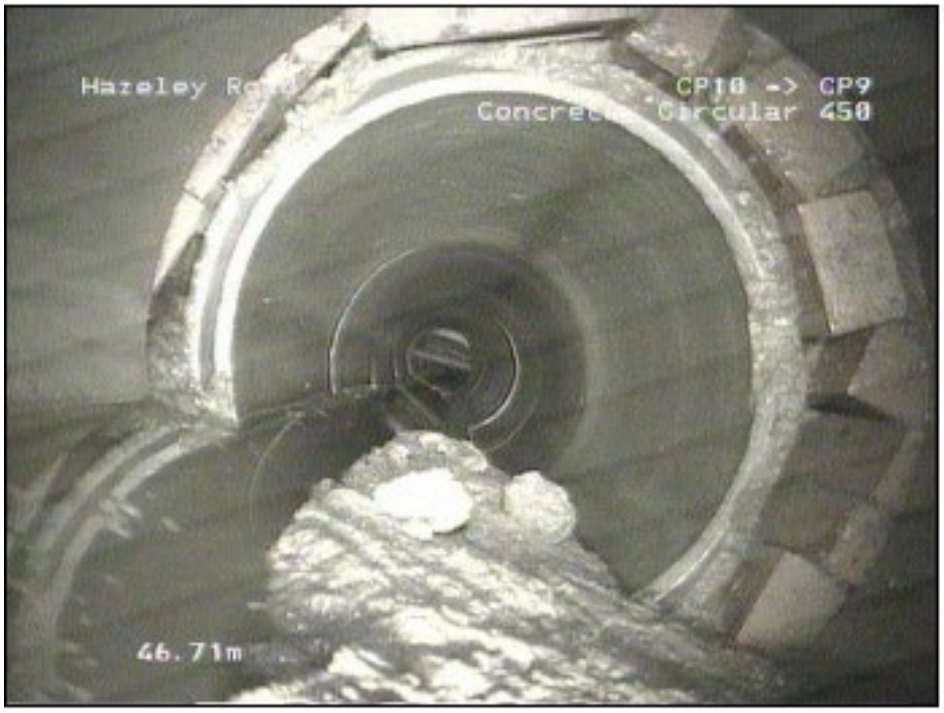


Figure 3.8 – Sewer Settlement

Figure 3.9 – Sewer Settlement

3.16 The outfall for the system has a grating covering it. This blocks the passage of a significant amount of the debris as can be seen in Figure 3.10. This will reduce the capacity of the outfall and also block any large debris from exiting the system

Figure 3.10 – Outfall Grating

4 Method of Analysis

4.1 A drainage model was built in Windes Network software using the topographic information and data collected from the CCTV survey to represent existing conditions. An additional model was created to represent the existing network with critical repairs undertaken to address some of the obstructions described in Section 3.

4.2 Extensive long-term on-site studies, including hydrological and geological flood modelling of the winterbourne catchment, would be required to determine more precise flow rates and volumes. This is currently beyond the scope of the study. However, Environment Agency observations of the 2014 event indicated that winterbourne discharge reached between 0.75m^3/s – 1m^3/s. It is believed that these flows are maintained for several weeks and are independent of the shorter-term weather conditions experienced during this period.

4.3 Windes Network assumes flood water from an inundated pipe will follow an overland route and will not re-enter the pipe network downstream. Therefore, applying the winterbourne flow at the upstream end of the network would result in artificially lower flows in the downstream sections of the network.

4.4 To overcome the above the network was modelled over three sections to ensure overland flood water re-entering the network was represented in the downstream sections.

4.5 Therefore, a range of flows have been used in the model to determine their existing capacity and to determine flood impact assuming a range of flows between 90l/s and 2000l/s to represent the winterbourne discharge.

4.6 The models were also tested in three areas to determine the constraints in each area of the network. The sections were:

4.6.1. Section 1 – From the west of High Street to the outfall at Churchfields Road.

4.6.2. Section 2 – From the west of the Twyford Parish Hall Car Park to High Street

4.6.3. Section 3 – From Bourne Lane Twyford Parish Hall Car Park to High Street

4.7 Culvert obstructions identified in the CCTV survey were then added to the model and tested against the existing sewer system were it fully functioning.

4.8 The outfall has been surcharged to represent the water level within the River Itchen flood plain. The flood level will vary but a single conservative representation has been used to surcharge the outfall to allow a consistent comparison for the different discharge scenarios.

4.9 The discharge scenarios assume a consistent flow so that the capacity of the network can be determined. In reality, the inflow to the pipe will be a combination of rainfall from the catchment and groundwater discharge via the winterbourne. Therefore, it is likely inflow to the network will vary seasonally and during rainfall events. The range of discharge scenarios have been selected to cover this variation

4.10 Drainage Models representing the existing conditions were created for each of the areas referred to in Section 4.6. An additional model was created for area 2 to represent repairs being made to the network which are considered essential as discussed Section 3.

4.11 Finally, a drainage model reflecting both repairs (Section 6) and proposed improvements have been created.

5 Existing Network Performance

Overland Flow paths

5.1 Overland flow paths can be identified during simulation to show how the system reacts when the sewer system is at capacity. This terrain model was built from the topographical survey and is therefore limited to its extents. Figure 5.1 demonstrates the behaviour of the overland flow paths and where the water collects under large flows.

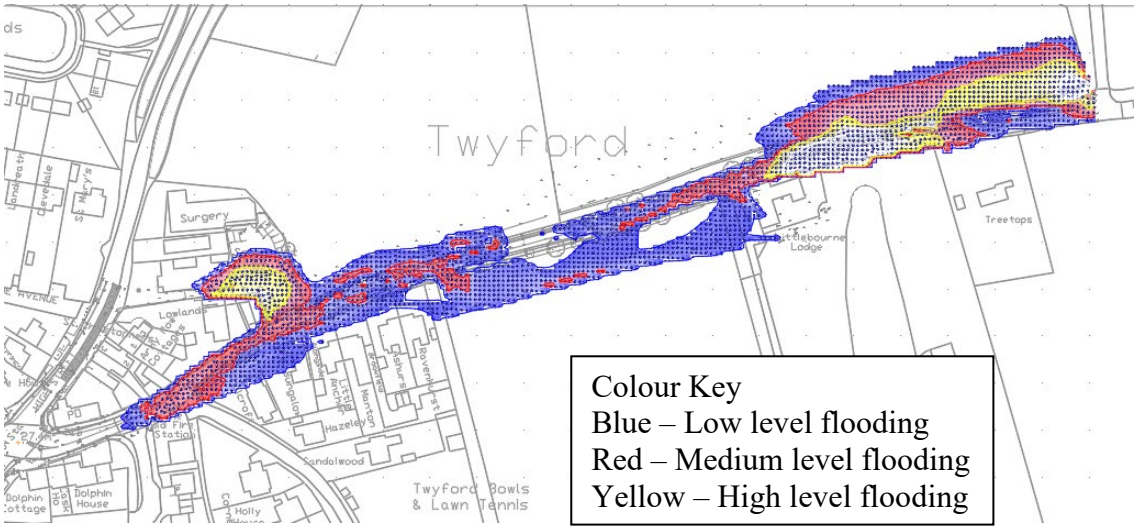


Figure 5.1 – Overland flow paths

5.2 Discharge from the winterbourne initially ponds in Twyford School Sports Field. It then enters the road at a low point opposite Winterbourne Lodge before it then travels down the road and into the fields by Littlebourne lodge. It returns to the road and either flows into the Parish car park or heads further west and floods the highway outside the Old Fire station. The model in Figure 5.1 is just based on input flows from the winterbourne. Other areas may become flooded due to discharge from springs in the locality.

5.3 At this point, the water has nowhere to go due to the raised level of High Street which acts like a weir. High Street has both inclining gradients to the North and South and so water runs towards the crossing point with Finch Lane and Hazeley Road.

Drainage Modelling Sections

5.4 Section 1 covers the drainage network from the west of the High Street to the outfall at Churchfields Road. This section has the largest pipe/culverts in the system and so should have the largest capacity for flow

5.5 Section 2 covers the drainage network from the Parish Car Park entrance to High Street.

5.6 Section 3 covers the drainage network from Bourne Lane to Parish Car Park.

Section 1 Models

5.7 The pipe network in Section 1 has a very flat gradient, particularly between the last three manholes before the outlet. Therefore, discharge capacity relies on the hydraulic head in order to transport the discharge to the outfall.

5.8 Section 1 of the network has a capacity of approximately 700l/s before flooding starts to occur. Once flooding does occur it is likely surface run-off will flow via the main carriageway to the flood plain. However, during flood events it is likely the extent of surface flow will cause temporary flooding to properties on the north side of Finch's Lane between The Crescent and St Mary's Terrace.

Section 2 Models

5.9 For Section 2, two different models have been made. The first model simulates the condition with the collapsed culvert to demonstrate the effect of the blockage which approximately reduces the cross-sectional area by 50%. The second model simulates the capacity of the system with the culvert being repaired.

5.10 The first model, which has significant constrictions, has a capacity limited to approximately 90l/s. This is due to the partial blockages due to damage and debris.

5.11 The second model for section 2 shows that the capacity of section 2 would increase to approximately 230l/s if repairs were made to the critical areas highlighted in Part 3 of this report.

5.12 When capacity within Section 2 is reached flooding occurs mainly within the Parish Car Park. This is exacerbated by the channel outlet from the car park which connects directly to the network upstream of the brick culvert. The model shows flood water will backflow along the channel into the car park.

Section 3 Models

5.13 Section 3 has a capacity of 63l/s. This is due to the pipe capacity and the existing ditch would provide a greater discharge capacity if uninterrupted by the pipe sections. Once flooding occurs flood water will initially collect in the Twyford School sports field before flowing down both sides of the carriageway.

5.14 Section 3 has a smaller capacity due to the sections of the ditch which have been replaced with low capacity pipes for highways drainage. The model demonstrates that available capacity in the highway network would have a significant impact on managing the winterbourne flows

Existing Model Conclusions

5.15 All the drainage models show that the network upstream of Finches Lane does not have the capacity to deal with the large flows which are produced from the winterbourne. However, there are significant improvements that can be done to the existing network to mitigate flood impacts.

6 Repairs to Existing Highway Drainage

List of potential improvements

6.1 This section of the report will list the required highways drainage repairs and maintenance that needs to be done in order to maximise the capacity of the drainage system. This has also been summarised in Appendix B in priority order.

6.2 The first priority would be to the repair the collapsed culvert as seen in Figure 3.1 which is located to the west of the Parish Hall car park entrance. This is currently the bottleneck of the system and has reduced the capacity of the system by over 50%. This also poses a further blockage problem as it will trap any debris which may get into the system and allow detritus to settle. Unless this has been resolved, no benefits will come of any potential improvements upstream of the culvert.

6.3 The second priority would be to repair the collapsed concrete sandbag headwall. The headwall is currently blocking the flow of water into the network. Furthermore, if the sandbags become dislodged, they could block the sewer further downstream. There is also the potential for it to impact the structural stability of the adjacent highway.

6.4 The third item, which is currently not affecting the system, would be the longitudinal cracking in the top of pipes in the vicinity of the Parish Hall car park as seen in Figure 3.4. This, however, is a potential safety and flow issue if it was to collapse. If it was to collapse it would completely block the sewer stopping all flow. In addition to this, it will pose a safety issue as cars park directly above the cracked pipe.

6.5 The final item would be the general maintenance of the pipes in the system. The pipes that form part of the CCTV investigation have been jet washed. However, due to blockages and access issues, not all pipes could be jet washed. Therefore, jet washing of the entire existing drainage is required including the highway drainage on the South side of Hazeley Road which is currently 90% filled with settlement. Once pipes have been jet washed, the previously unchecked sections should be inspected by CCTV.

7 Proposed Improvements to the System

7.1 This section of the report will look at proposed improvements that could be made to the drainage system over and above the repairs referred to in Section 6, to mitigate the impacts of flooding from the Winterbourne. The design aims to increase the upstream capacity whilst not having a detrimental effect on the capacity of the pipe downstream (i.e. west of Highstreet). Drawing ZTPCTWYFORD-DR-03 in Appendix B shows the potential improvement locations.

Overland Flow and Flooding

7.2 The priority is to reduce the amount of water that will get onto the carriageway and hence into the adjacent property should the highway boundary be breached. Once the flood water is in overland flow it is currently difficult to get it back into the system. The available gullies only have the capacity of 10-15 litres per second each which is minimal compared to the flows from the winterbourne.

7.3 From historic flooding, it has been observed that flood water will travel from the field to the east of the Little Bourne Lane, over the road and into the fields owned by Twyford School. From here it will travel West until it gets to a low point in which it then enters Hazeley Road.

7.4 In order to mitigate the above, it is proposed to create a ditch which will run from Little Bourne Road down through Twyford School fields to the East of the Parish Hall car park. The new ditch would effectively route winterbourne flows through the field avoiding ingress into the highway. Where necessary bunding on the highway side is proposed to contain flows within the fields. Part of the route will need to be culverted where ground levels would be too high to accommodate the ditch and where the potential proposed development will require access from Hazeley Road. The downstream end of the ditch/culvert will be connected in the existing drain on the North side of the Hazeley Road and the more recent improved drain on the South side of the Hazeley Road.

7.5 It is also worth noting that historically the ditch which currently serves as the highway's drainage used to service the flows of the

winterbourne. It can no longer do this as it has been progressively restricted with the introduction of piped sections.

7.6 At the downstream end of the ditch, a bund with an overflow weir will be constructed to the East of the Parish Hall car park to ensure any excess flows are diverted into Hazeley Road before they impact the car park.

7.7 From past events, it has been observed that the majority of the flood water collects on the carriageway between Roman Rd and Dolphin Hill. During one of these events, one of the covers was lifted and the flooding in this area significantly reduced. Lifting covers in these situations is strongly discouraged due it being a major safety problem. However, it did demonstrate that if water was allowed to get into the system, the flooding would be reduced due to the available capacity downstream.

7.8 Therefore, there is potential for a heavy-duty concrete channel with grating to be installed across the entrance of Roman Road and the frontage of the old fire station to Dolphin Hill. This will offer the opportunity for any flood water to get back into the system and maximise the capacity of the drainage network. An example of this is a BGZ-500 Concrete Drainage Channel supplied by Althon which has a flow rate capacity of 191l/s. It will be important to regularly clean the channel to ensure it has full capacity during the winterborne season. The exact location of the channel and surface treatment of the adjacent pedestrian route across Roman Lane should be considered further at the detailed design stage to mitigate against the premature silting up of the channel.

7.9 A similar channel solution has been used in other areas around the country which require extensive surface water drainage. An example of this is in St Ives, Cornwall where they installed these channels to deal with large flows of surface water. Links to case study here: https://www.barbourproductsearch.info/control-of-local-flooding-in-st-ives-cornwall-news039780.html

Non-Return Valves

7.10 A non-return valve is proposed at the outfall from the car park drain into the Hazeley Road system (Figure 3.1).

7.11 When the pipe gets surcharged there is potential for the water to discharge back into the Parish Hall car park. The non-return valve will prevent this, whilst maximising flow depths and subsequently capacity within the existing pipe network.

7.12 It is noted that flooding arising from local springs already occurs in the car park. The non-return valve will not prevent spring water from the car park discharging to the carrier drain when capacity allows.

Pipe Upgrades

7.13 The downstream 750mm diameter has a much larger capacity, compared to the 450mm diameter section further upstream. As can be seen by table 7.1 below any reduction in pipes sizes has a much higher proportional reduction in the cross-sectional area of the pipe and therefore in the pipe capacity.

Pipe Size	Cross-Sectional Area
225mm	0.040m^2
300mm	0.071m^2
450mm	0.159m^2
600mm	0.283m^2
750mm	0.442m^2

Table 7.1

7.14 The existing system to the North of Hazeley road does not have enough cover depth for the system to be upgraded. For example, the 450mm pipe outside the Parish Hall car park has an invert level of 26.232 with a cover level of 26.937 and so a total cover level of 705mm. A 750mm diameter pipe has an external diameter of approximately 850mm. The invert level would have to remain the same and so the level of the top of the pipe would be 27.082mm which is 145mm over existing ground levels. You will also need to add on top of that at least 200mm of footway construction making it 345mm higher than the existing ground. The footway would then be 445mm higher than the road in this location which is completely unfeasible.

7.15 Therefore, upgrading of the highway drainage on the south side of Hazeley road has been considered.

7.16 The existing pipe system on the South side of Hazeley Road is a 150mm pipe which connects into a triple pipe section comprising of two 225mm pipes and one 250mm pipe. It is proposed that the single 150mm pipe is upgraded to two 300mm pipes and with a connection to the proposed winterbourne ditch. The existing 225/250 pipes would also be upgraded to two 300mm pipes. 450mm pipes would increase the capacity, however, there would be insufficient cover depth the accommodate them.

7.17 The above improvement would allow the ditch to discharge the winterbourne flows to two different pipes which connect to the 750mm pipe further downstream. This would therefore improve the capacity of the system.

7.18 The capacity of the two 300mm pipes would be approximately 175l/s. Once the culvert has been repaired, the capacity of the 450mm pipe would be 230l/s. This will make a combined capacity of 405l/s.

Section	Existing Capacity	Existing Capacity with repairs	Proposed Capacity
Section 1 – Finch's Lane to Outfall	700 l/s	700 l/s	700 l/s
Section 2 – Car park to High Street to Junction	Range from 90 to 110 l/s	255 l/s	405 l/s
Section 3 – Bourne lane to car park	65 l/s	65 l/s	No Longer used as new ditched constructed

7.19 It has been noted that there is a foul sewer in the carriageway, which the two 300mm pipes would have to cross. Due to the manholes covers being in the carriageway, it was not possible to determine the depth of the foul sewer. However, further downstream the highway drainage system already crosses the foul sewer. With the gradients not changing it is very likely that it will be able to cross over the top of

the foul again in the proposed location. An allowance for any potential diversion has been accounted for in the cost estimate.

7.20 Alternatively, subject to further consultation with HCC, it may be feasible to dispense with the proposed 300mm pipes by allowing the discharge to flow via the carriageway surface from its emergence at the car park to its collection at the proposed channel downstream. Further assessment of the carriageway profile would need to be carried out to ensure surface flow was contained within the carriageway and did not present an unacceptable hazard.

7.21 Additional pipes to supplement the existing have been considered. However, both BT Openreach and Portsmouth Water occupy space on the North side of Hazeley Road. Furthermore. The lack of workable cover depth beneath the carriageway has limited improvements to the South side of the footway. Both Openreach and Portsmouth Water assets may require local diversion in the location of the new stormwater network.

Low Leak Manhole Covers

7.22 It is recommended that the covers in Finch's Lane are replaced with low leak covers. The covers would increase the hydraulic head and subsequent flow through the pipe.

7.23 They would limit the amount of water from being pushed out of the top of the manhole and into the carriageway.

7.24 It will significantly reduce the risk of a cover being dislodged during a flooding event, which has the potential to suck any bystanders down into the system.

Grating Improvement

7.25 As can be seen in Figure 3.10 the grating on the outfall catches debris during low flood events. Raising the grating by 200 - 300mm would allow any debris to pass under the grating whilst discouraging unauthorised access.

Future Developments

7.26 It has been mentioned by the Parish Council that there is an intention to allocate the land between the playing field and the car park for

development. If this was to happen then that section of the ditch would need to be culverted and the bund would need to be recreated further upstream. The developer would need to base their design around the culvert for this to work effectively.

7.27 It would be assumed that the developer would design its SuDS so that the discharge rate for the development would match or lessen the greenfield runoff for the site development. This is so that it would not worsen the drainage.

7.28 The Parish Council also mentioned the possibility of expanding the Parish Hall car park to the East with an additional or relocated access. The design of the new access could be done in such a way to discourage water flows into the car park. The old entrance could be decommissioned and built up to stop overland flows from the winterbourne from entering the car park.

Limitations to Improvements

7.29 The enlargement of existing pipes is constrained by the downstream invert level at the connection with the 750mm diameter culvert and by the available cover depth. The design described in this section maximises the capacity of the pipes taking account of the existing ground levels and the available invert level at the connection with the 750mm diameter pipe.

7.30 The pipes to the West of High Street not only have shallow covers levels but also have very flat gradients in order to get the water to the outfall. Therefore, upgrades of these pipes to larger than 750mm is highly unfeasible.

7.31 It is noted under high groundwater conditions, there is a risk of flooding within the parish hall. This occurs when groundwater emanating from local springs rises through the suspended timber floor. The parish hall already has flood prevention equipment to prevent the ingress of surface water at the entrances. The installation of a replacement solid concrete floor and tanking would prevent flood water entering via the floor. We advise a feasibility study is undertaken to consider whether a concrete floor and tanking would address parish hall flooding.

7.32 This event is not directly related to the winterbourne flows and could occur as a result of flooding from the local springs. Therefore, measures proposed in this report will not necessarily prevent flooding within the parish hall due to groundwater.

7.33 The Environment Agency have strongly advised against the conveyance of groundwater by pumping or by other means, to the drainage network to reduce spring activity. The concern is that pumping would have a detrimental effect on ground conditions and likely adverse overall flood impact in the area.

Comparison with HCC Proposals.

HCC Option 1

7.34 The proposals outlined in this report largely follow the same principle of HCC's option 1, with the main difference being to the improvements east of the Parish Hall car park along Hazeley Road.

7.35 Option 1 proposes the replacement of the existing 225mm pipe system with a pipe to match the capacity of the ditch. However, a bigger pipe would have insufficient cover and would therefore be unfeasible.

7.36 The proposed replacement pipe would also require the removal of the hedge and trees in the vicinity of the existing pipe. It is likely that trenching for the pipe within the vicinity of existing trees would require extensive root removal leaving no option than to fell affected trees. A tree survey would be required to establish the ecological importance of the trees and whether they have statutory protection. The Ecological report in Appendix F indicates that the hedge row is an important habitat site. It is likely a significant part of the hedge and its root system would need to be removed to enable construction of the pipe. The hedge has a nominal width of between 2.5 and 4m so it is likely a sufficient portion could be preserved to retain a viable though thinner hedge. However, the construction works would be subject to ecological constraints. particularly during nesting season.

7.37 In order to mitigate the flow of water from the school fields into the carriageway a bund would need to be created on the carriageway side of the existing ditch behind the footway. This would require moving the ditch into the existing hedge/tree line.

7.38 The MB proposal in this report would create a new ditch and culvert on the other side of the hedge. The alignment of the ditch will be subject to the school premises owners. However, it is likely the new ditch would have less of a detrimental effect on the adjacent hedge. Neither the ditch nor the culvert impact on the trees within the vicinity.

7.39 The 600mm culvert would be a vast improvement on the 225mm pipe in Hazeley road. Furthermore, the new ditch would be in addition to the highway drainage network and would provide significant additional capacity.

HCC Option 2

7.40 HCC option 2 is largely the same as option 1, however it has the inclusion of a slot drain in the Parish Hall car park, which discharges to a new ditch where it passes south of the Parish Hall to connect to an upgraded High Street drain.

7.41 Whilst this is hydrologically possible, it has many constraints which make it very difficult to achieve a system that would work in this area.

7.42 The existing ground levels along the path of the proposed drain rise from 26.5maOD at low point in the car park to 27.6mAOD where it meets High Street. Therefore, the ditch between the Parish Hall and Lowlands would need to be approximately 1.35m minimum depth. There is insufficient width within the available corridor to provide a ditch in this location.

7.43 This was therefore discounted, and the points made in 7.1 of this report should be investigated in order to mitigate flooding within the Parish Hall.

8 Ecological Constraints and Mitigatory Measures

8.1 An ecological survey of the site was carried out in August 2018. A copy of the survey report is contained in Appendix F. The report concentrates mainly on the Hazeley Road field margins where a new ditch is proposed.

8.2 In response to the ecological report recommendations in section 5:

- a pollution control valve will be provided at the western end of the proposed Hazeley Road ditch, immediately upstream of the outfall into the existing network. The pollution control valve will enable prevention of pollutants entering the river following a highway incident.
- The new ditch and culverts will require Ordinary Water Consent (OWC) from the local authority. As part of the application, it will be necessary for the contractor to propose a method for undertaking the works. His methodology will need to include preventative measures for flooding and pollution.
- The ditch/culvert will be designed and constructed to ensure tree root zones are avoided. Side slopes will be relaxed enough to allow small mammals to vacate the area during flood events and promote indigenous planting to establish.

9 Cost Estimates

9.1 Appendix E contains a cost estimate for the proposed works. There is also a £60k contingency for diversions of services. As can be seen in Appendix D, there is BT Infrastructure in the area which is the most high-risk service. From site inspections, it is also noted that there is a water supply in the carriageway as well as there likely being electric and gas.

9.2 It has been assumed that the cost estimates in this report are purely for the potential improvements to the network for the mitigation of flooding from the Winterbourne. No cost estimate has been provided for the repairs needed to the highway drainage as per Section 6 of this report.

9.3 If the alternative measures, described in 7.20 were undertaken then the risk of necessary diversion works to the foul sewer and other services would be avoided. Together with the reduction in proposed pipework this would result in a maximum cost saving of approximately £27,000. However, the overall saving would be reduced by any carriageway reprofiling that might be required in order to ensure the resulting surface flows follow a definitive path to the surface channel.

9.4 In order to allow for potential diversions and other unknown constraints, a factor of 44% has been applied to the core cost. Once more detailed analysis and design has been done, a more accurate figure can be established.

9.5 The total cost estimate for the works would therefore be in the region of £397,000.

9.6 The cost estimate excludes:

- Flood prevention improvements to the parish hall structure
- improvements relating to the expansion of the parish hall car park
- wholesale resurfacing of the highway
- repairs to the existing drainage network as identified in Section 3 above.

10 Conclusions

10.1 The study has identified several areas (some critical) where repairs are required to the existing network. These should be considered and undertaken either before or during the proposed improvements. The repairs above would increase the existing capacity by between 232% and 280%.

10.2 The proposed improvement to the system would provide an additional 159% capacity thereby reducing the impact and frequency of flooding during winterbourne flood events.

10.3 Additional flow from groundwater springs will have an impact on flood events. However, further study is required to assess the extent and frequency of spring activity during winterbourne flood events. The Environment Agency have strongly advised against the conveyance of groundwater by pumping or by other means to the drainage network to reduce spring activity. The concern is that pumping would have a detrimental effect on ground conditions and likely adverse overall flood impact in the area.

10.4 The cost of the improvements (excluding repairs) will be approximately £397,000.

10.5 The proposed improvements are intended to mitigate flood events as far practically possible with the constraints presented by the highway, utilities, existing topography and available budget. Therefore, although reduced, there would still be a risk of surface flooding within the car park and old fire station areas.

APPENDIX A: Existing Condition Drawings and Schedule

Reference	Sewer Element	Condition/Issue	Risk	Impacts
H1	500W by 400H Culvert	Collapsed Culvert with domestic water connection running through centre of sewer. Risk of completely collapsing	High	Potential to colapse footway above it which pedestrians use
				Potential to undermine the nearby buildings foundations especially if water is allowed to flow to them
				Potential to completely block the sewer
				Potential to break water connection to building
H2	Concrete Sandbag Headwall	Headwall collapsing	High	Potential for concrete headwall to completely collapse blocking the flow of water into the sewer system
				Potential for sandbags to become dislodged and block the sewer downstream
				Potential to effect the stability of the adjacent highway and are a potential highway safety risk
M1	Sewer Pipe	Longitudinal cracking in the top of the pipe	Medium	Large amounts of cracking in the top of the pipe which could cause it to collapse. One critical areas is situated below the parking bay and so could create a hole in the surface
M2	Capacity of Highway Drainage	The drainage on the south side of Hazeley road is severely reduced due to large amounts of settlement	Medium	The highways drainage is reduced by around 80-90%. This means that the water from the highway and potentially from the fields to the south of Hazeley road cannot get in to the sewer. This increases the amount of overland flow.
L1	Settlements in pipe	Concrete and other items settled in pipes	Low	Lots of settlement in the pipes reduce the flow of water through the sewer.
L2	Pipes in sewer	There are multiple points within the sewer network where connections have been made and the connecting pipes are not flush with the sewer walls.	Low	Reduces flow and increased turbulence in the system
L3	Concrete Sandbag in Manhole	Poor condition of concrete sandbag headwall	Low	Potential for sandbags to become dislodged blocking the sewer downstream and potentially compramising the structural integrity of the manhole
L4	Ditches	Ditches are over grown and contain large amount of debris including concrete	Low	This reduces the flow through the ditches

Table 3.1 - Issues Identified from Condition Survey

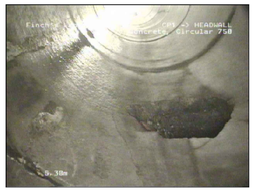
A1 ORIGINAL

KEY

EXISTING SURFACE WATER DRAINAGE

DITCH

225 connection protruding into 750 sewer. Headwall grating partially blocked by leaves and debris



Hole in sewer at 4 o'clock

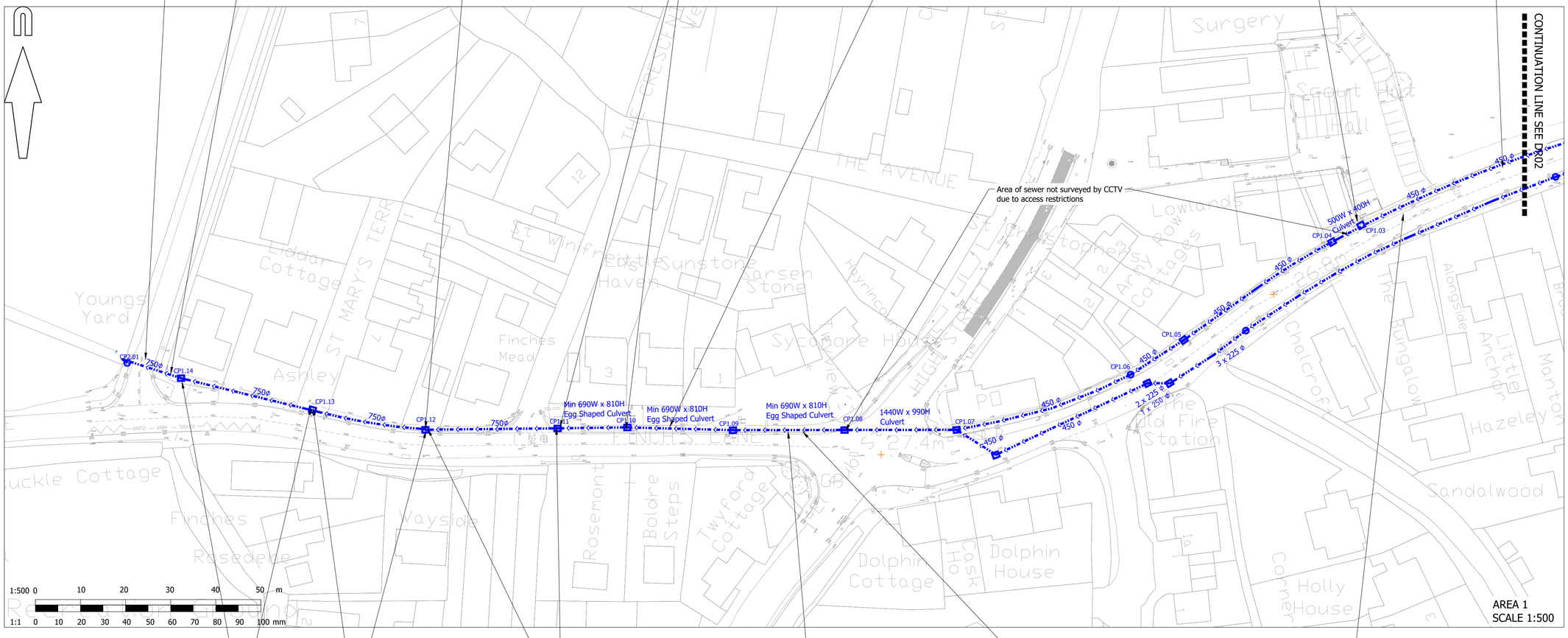
Debris and settled deposits in manhole

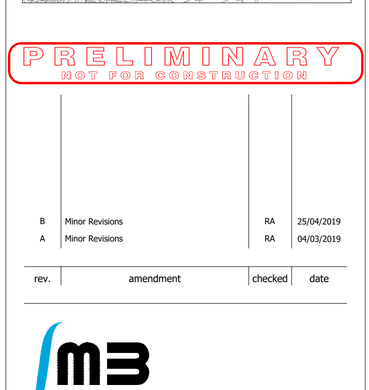
Services running along the top of the sewer

Large amount of settlement and debris in sewer

Collapsed culvert with utility connection crossing the culvert.

Longitudinal cracking in the top of the sewer

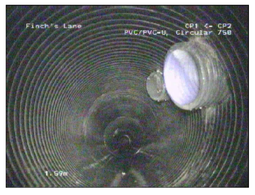




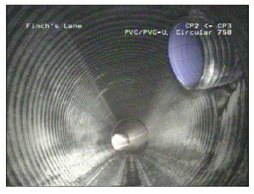
PRELIMINARY
NOT FOR CONSTRUCTION

rev.	amendment	checked	date
B	Minor Revisions	RA	25/04/2019
A	Minor Revisions	RA	04/03/2019

Total of 3 connections which protrude into 750mm and reduce the capacity of the flow



Pipe protruding into sewer reducing flow



Settled deposits in sewer

Pipe intruding 50% into the sewer reducing capacity of pipe

Utility connection going across top of sewer

Large amount of settlement in sewer

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scale	1:500	drawn by	KDB	checked by	DRAFT
date	NOVEMBER 2018	cad file	DR-01-02.DWG		

title
Main Drainage Culvert - Area 1
Existing Condition

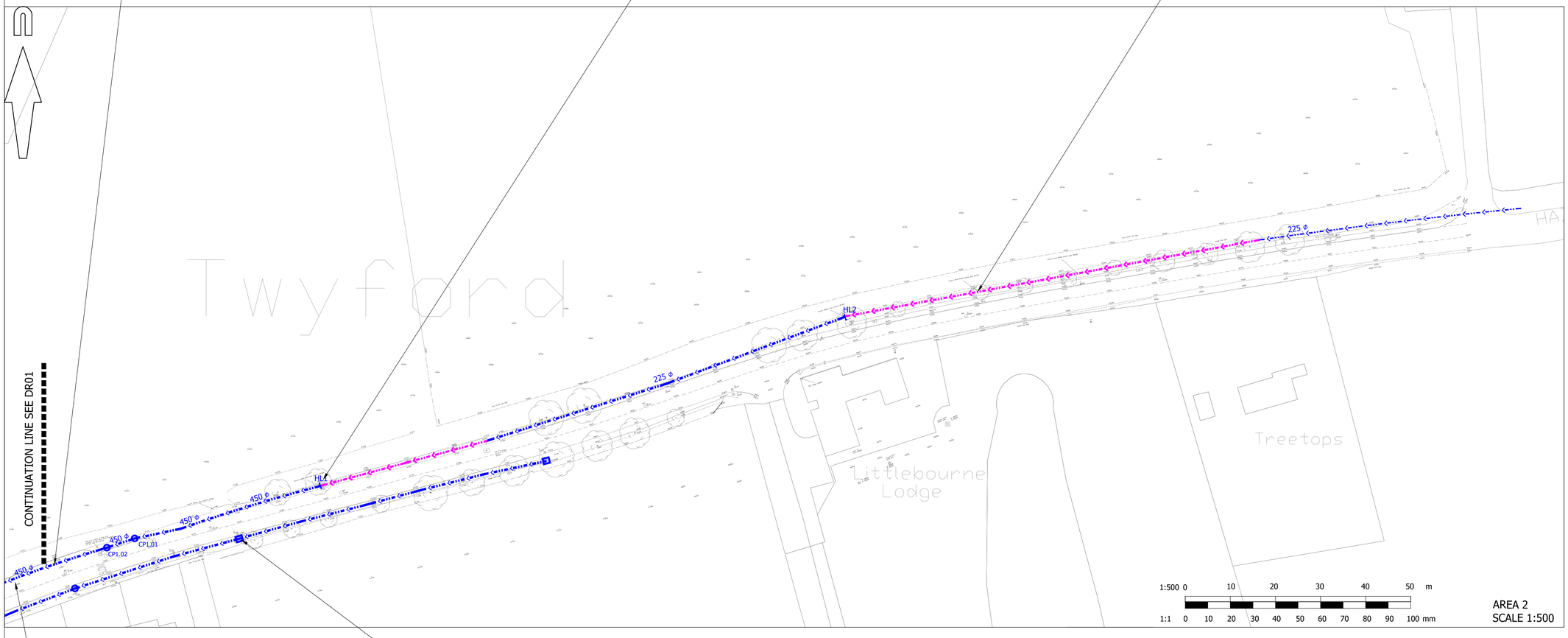
drawing number
ZTPCTWYFORD-DR-01

rev. B

Longitudinal cracking in top of sewer

Concrete sandbag headwall collapsing and reducing flow into sewer

Pipes from road drainage in poor condition and large amount of concrete debris in ditch



AREA 2
SCALE 1:500

Large amount of settlement in sewer

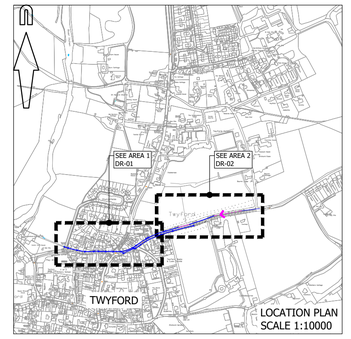
Highway drainage severely undermaintained reducing flow

A1 ORIGINAL

KEY

EXISTING SURFACE WATER DRAINAGE

DITCH



PRELIMINARY
NOT FOR CONSTRUCTION

rev.	amendment	checked	date
C	Minor Revisions (AM)	RA	12/06/2019
B	Minor Revisions (AM)	RA	25/04/2019
A	Minor Revisions	RA	04/03/2019

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scale	1:500	drawn by	KDB	checked by	RHA
date	NOVEMBER 2018	cad file	DR-01-02.DWG		

title
Main Drainage Culvert
Existing Condition - Area 2

drawing number
ZTPCTWYFORD-DR-02 rev. C

APPENDIX B: Proposed Improvements – Drawings and Repairs Schedule

Potential Improvements and Repairs to Aid Flowrate		
Priority to flowrate	**Item**	**Comments**
Priority 1	Repair Collapsed Culvert	In its existing state this is a bottle neck for the system. Unless repaired it will negate any potential improvements which could be made upstream.
Priority 2	Repair Collapsed Headwall	The headwall is currently blocking the flow of water into the network. Furthermore if the sandbags become dislodged they could block the sewer further downstream. There is also the potential for it to impact the structural stability of the adjacent highway.
Priority 3	Interception Ditch	An interception ditch located in the vicinity of Bourne Lane would reduce the amount of uncontrolled flow down the highway. In existing conditions, once the water is on top of the highway, there is limited opportunities for it to get back into the system. The aim of this ditch is to reduce the uncontrolled flow and get it into the drainage network as soon as possible.
Priority 4	Improvements to grill	Improvements to the grill could be made in order to improve the outfall capacity. In its existing state, any objects that get into the network become trapped and restrict capacity. Potential improvements are to lift the grill from the invert level within safe limits.
Priority 5	Non-return Flap	A non return valve on the entrance into the network from the Parish Hall car park could stop the network discharging flow back into the car park when surcharged. The effectiveness of this will depend on the comparative flood levels caused by ground water surcharge in the car park and the level within the culvert.
Priority 6	Longitudinal Cracking	This is a potential safety and a future flow issue. There are pipes in the system which have significant longitudinal cracking in the top of pipe. Subsequent collapse would block the sewer and compromise the structural stability of the ground above.

A1 ORIGINAL

KEY

- EXISTING SURFACE WATER DRAINAGE
- EXISTING DITCH
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED DITCH

Proposed bund to stop flow of water into Parish Car Park

Proposed 600mm Pipe

Proposed Manholes

Install Non Return Valve

Proposed 2 x 300mm pipe

Proposed Concrete Channel with Grating

Proposed 2 x 300mm Pipe

Install Double Sealed Lockable Cover

Install Double Sealed Lockable Cover

Install Double Sealed Lockable Cover

Install Double Sealed Lockable Cover

Install Double Sealed Lockable Cover

Min 690W x 810H Egg Shaped Culvert

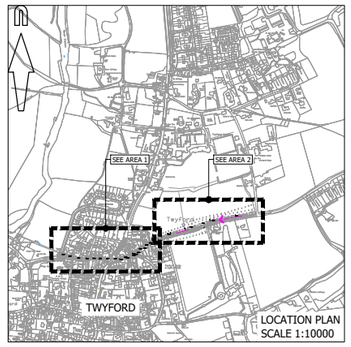
Min 690W x 810H Egg Shaped Culvert

Min 690W x 810H Egg Shaped Culvert

1440W x 990H Culvert

590W x 400H Culvert

AREA 1
SCALE 1:500



LOCATION PLAN
SCALE 1:10000

1:500 0 10 20 30 40 50 m

1:1 0 10 20 30 40 50 60 70 80 90 100 mm

Proposed 140m long ditch
0.6m base width with 1 in 3 slopes

Proposed Headwall

Proposed 600mm Culvert 85m long

Proposed Headwall

2 Proposed 50m long ditch's
0.6m base width 1 in 3 slopes

1m wide Bund to stop flow of water onto carriageway

1m wide Bund to stop flow of water onto carriageway

1m wide Bund to stop flow of water onto carriageway

AREA 2
SCALE 1:500

PRELIMINARY
NOT FOR CONSTRUCTION

rev.	amendment	checked	date
B	Design Updates (AM)	RHA	24/04/2019
A	Microdrainage labels added	RHA	01/04/2019

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scale	drawn by	checked by
1:500	AM	DRAFT

date	cad file
MARCH 2019	DR-03.DWG

title
Proposed Improvements

drawing number
ZTPCTWYFORD-DR-03

rev.
B

APPENDIX C: Modelling Results (Proposed improvements)

Existing Network Details for Existing

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type
E1.000	117.715	0.291	404.5	0.000	5.00	230.0		0.045	3 \=/	1000	1:3 Swale
E1.001	34.046	0.068	500.7	0.000	0.00	0.0	0.600		o	600	Pipe/Conduit
E1.002	32.893	0.066	498.4	0.000	0.00	0.0	0.600		o	600	Pipe/Conduit
E1.003	47.626	1.192	40.0	0.000	0.00	0.0	0.600		o	600	Pipe/Conduit
E1.004	101.141	0.416	243.1	0.000	0.00	0.0		0.045	3 \=/	1000	1:3 Swale
E1.005	7.794	0.213	36.6	0.000	0.00	0.0	0.600		o	450	Pipe/Conduit
E1.006	20.698	0.095	219.0	0.000	5.00	0.0	0.600		o	450	Pipe/Conduit
E1.007	7.450	0.063	118.3	0.000	4.00	0.0	0.600		[]	-2	Pipe/Conduit
E1.008	39.427	0.270	146.0	0.000	0.00	0.0	0.600		o	450	Pipe/Conduit
E1.009	14.164	0.161	88.0	0.000	4.00	0.0	0.600		o	450	Pipe/Conduit
E1.010	40.741	0.141	288.9	0.000	15.00	0.0	0.600		o	450	Pipe/Conduit
E2.000	12.994	0.087	149.4	0.000	5.00	170.0	0.600		oo	300	Double Pipe
E2.001	41.004	0.273	150.2	0.000	5.00	0.0	0.600		oo	300	Double Pipe
E2.002	9.057	0.060	151.0	0.000	5.00	0.0	0.600		oo	300	Double Pipe
E2.003	11.538	0.077	149.8	0.000	5.00	0.0	0.600		oo	300	Double Pipe
E2.004	4.915	0.033	148.9	0.000	5.00	0.0	0.600		oo	300	Double Pipe
E2.005	37.192	0.109	341.2	0.000	5.00	0.0	0.600		o	450	Pipe/Conduit
E2.006	10.240	0.031	330.3	0.000	5.00	0.0	0.600		o	450	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E1.000	28.573	0.000	230.0	0.70	2328.3
E1.001	28.282	0.000	230.0	1.08	305.8
E1.002	28.214	0.000	230.0	1.08	306.5
E1.003	28.148	0.000	230.0	3.86	1091.5
E1.004	26.956	0.000	230.0	0.95	3782.1
E1.005	26.540	0.000	230.0	3.37	535.9
E1.006	26.327	0.000	230.0	1.37	217.8
E1.007	26.232	0.000	230.0	1.85	370.8
E1.008	26.169	0.000	230.0	1.68	267.2
E1.009	25.899	0.000	230.0	2.17	344.9
E1.010	25.738	0.000	230.0	1.19	189.4
E2.000	26.267	0.000	170.0	1.28	181.6
E2.001	26.180	0.000	170.0	1.28	181.0
E2.002	25.907	0.000	170.0	1.28	180.6
E2.003	25.847	0.000	170.0	1.28	181.3
E2.004	25.770	0.000	170.0	1.29	181.8
E2.005	25.737	0.000	170.0	1.09	174.1
E2.006	25.628	0.000	170.0	1.11	177.0

Existing Network Details for Existing

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type
E1.011	25.002	0.347	72.1	0.000	4.00	0.0	0.600		o	1000	Pipe/Conduit
E1.012	24.705	0.338	73.1	0.000	4.00	0.0	0.600		[]	-1	Pipe/Conduit
E1.013	23.449	0.117	200.4	0.000	4.00	0.0	0.600		[]	-1	Pipe/Conduit
E1.014	15.408	0.359	42.9	0.000	4.00	0.0	0.600		o	750	Pipe/Conduit
E1.015	29.263	0.066	443.4	0.000	4.00	0.0	0.600		o	750	Pipe/Conduit
E1.016	25.448	0.001	25448.4	0.000	4.00	0.0	0.600		o	750	Pipe/Conduit
E1.017	30.059	0.030	1002.0	0.000	4.00	0.0	0.600		o	750	Pipe/Conduit
E1.018	13.713	0.014	979.5	0.000	4.00	0.0	0.600		o	750	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
E1.011	25.597	0.000	400.0	3.94	3096.2
E1.012	25.250	0.000	400.0	3.56	2668.8
E1.013	24.912	0.000	400.0	2.14	1607.9
E1.014	24.795	0.000	400.0	4.28	1890.3
E1.015	24.346	0.000	400.0	1.32	584.3
E1.016	24.280	0.000	400.0	0.17	73.3
E1.017	24.279	0.000	400.0	0.88	386.9
E1.018	24.249	0.000	400.0	0.89	391.3

Surcharged Outfall Details for Existing

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
E1.018	E	25.200	24.235	24.235	0	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1	24.985	5	24.985	9	24.985	13	24.985	17	24.985	21	24.985
2	24.985	6	24.985	10	24.985	14	24.985	18	24.985	22	24.985
3	24.985	7	24.985	11	24.985	15	24.985	19	24.985	23	24.985
4	24.985	8	24.985	12	24.985	16	24.985	20	24.985	24	24.985

Surcharged Outfall Details for Existing

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
25	24.985	69	24.985	113	24.985	157	24.985	201	24.985	245	24.985
26	24.985	70	24.985	114	24.985	158	24.985	202	24.985	246	24.985
27	24.985	71	24.985	115	24.985	159	24.985	203	24.985	247	24.985
28	24.985	72	24.985	116	24.985	160	24.985	204	24.985	248	24.985
29	24.985	73	24.985	117	24.985	161	24.985	205	24.985	249	24.985
30	24.985	74	24.985	118	24.985	162	24.985	206	24.985	250	24.985
31	24.985	75	24.985	119	24.985	163	24.985	207	24.985	251	24.985
32	24.985	76	24.985	120	24.985	164	24.985	208	24.985	252	24.985
33	24.985	77	24.985	121	24.985	165	24.985	209	24.985	253	24.985
34	24.985	78	24.985	122	24.985	166	24.985	210	24.985	254	24.985
35	24.985	79	24.985	123	24.985	167	24.985	211	24.985	255	24.985
36	24.985	80	24.985	124	24.985	168	24.985	212	24.985	256	24.985
37	24.985	81	24.985	125	24.985	169	24.985	213	24.985	257	24.985
38	24.985	82	24.985	126	24.985	170	24.985	214	24.985	258	24.985
39	24.985	83	24.985	127	24.985	171	24.985	215	24.985	259	24.985
40	24.985	84	24.985	128	24.985	172	24.985	216	24.985	260	24.985
41	24.985	85	24.985	129	24.985	173	24.985	217	24.985	261	24.985
42	24.985	86	24.985	130	24.985	174	24.985	218	24.985	262	24.985
43	24.985	87	24.985	131	24.985	175	24.985	219	24.985	263	24.985
44	24.985	88	24.985	132	24.985	176	24.985	220	24.985	264	24.985
45	24.985	89	24.985	133	24.985	177	24.985	221	24.985	265	24.985
46	24.985	90	24.985	134	24.985	178	24.985	222	24.985	266	24.985
47	24.985	91	24.985	135	24.985	179	24.985	223	24.985	267	24.985
48	24.985	92	24.985	136	24.985	180	24.985	224	24.985	268	24.985
49	24.985	93	24.985	137	24.985	181	24.985	225	24.985	269	24.985
50	24.985	94	24.985	138	24.985	182	24.985	226	24.985	270	24.985
51	24.985	95	24.985	139	24.985	183	24.985	227	24.985	271	24.985
52	24.985	96	24.985	140	24.985	184	24.985	228	24.985	272	24.985
53	24.985	97	24.985	141	24.985	185	24.985	229	24.985	273	24.985
54	24.985	98	24.985	142	24.985	186	24.985	230	24.985	274	24.985
55	24.985	99	24.985	143	24.985	187	24.985	231	24.985	275	24.985
56	24.985	100	24.985	144	24.985	188	24.985	232	24.985	276	24.985
57	24.985	101	24.985	145	24.985	189	24.985	233	24.985	277	24.985
58	24.985	102	24.985	146	24.985	190	24.985	234	24.985	278	24.985
59	24.985	103	24.985	147	24.985	191	24.985	235	24.985	279	24.985
60	24.985	104	24.985	148	24.985	192	24.985	236	24.985	280	24.985
61	24.985	105	24.985	149	24.985	193	24.985	237	24.985	281	24.985
62	24.985	106	24.985	150	24.985	194	24.985	238	24.985	282	24.985
63	24.985	107	24.985	151	24.985	195	24.985	239	24.985	283	24.985
64	24.985	108	24.985	152	24.985	196	24.985	240	24.985	284	24.985
65	24.985	109	24.985	153	24.985	197	24.985	241	24.985	285	24.985
66	24.985	110	24.985	154	24.985	198	24.985	242	24.985	286	24.985
67	24.985	111	24.985	155	24.985	199	24.985	243	24.985	287	24.985
68	24.985	112	24.985	156	24.985	200	24.985	244	24.985	288	24.985

Surcharged Outfall Details for Existing

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
289	24.985	333	24.985	377	24.985	421	24.985	465	24.985	509	24.985
290	24.985	334	24.985	378	24.985	422	24.985	466	24.985	510	24.985
291	24.985	335	24.985	379	24.985	423	24.985	467	24.985	511	24.985
292	24.985	336	24.985	380	24.985	424	24.985	468	24.985	512	24.985
293	24.985	337	24.985	381	24.985	425	24.985	469	24.985	513	24.985
294	24.985	338	24.985	382	24.985	426	24.985	470	24.985	514	24.985
295	24.985	339	24.985	383	24.985	427	24.985	471	24.985	515	24.985
296	24.985	340	24.985	384	24.985	428	24.985	472	24.985	516	24.985
297	24.985	341	24.985	385	24.985	429	24.985	473	24.985	517	24.985
298	24.985	342	24.985	386	24.985	430	24.985	474	24.985	518	24.985
299	24.985	343	24.985	387	24.985	431	24.985	475	24.985	519	24.985
300	24.985	344	24.985	388	24.985	432	24.985	476	24.985	520	24.985
301	24.985	345	24.985	389	24.985	433	24.985	477	24.985	521	24.985
302	24.985	346	24.985	390	24.985	434	24.985	478	24.985	522	24.985
303	24.985	347	24.985	391	24.985	435	24.985	479	24.985	523	24.985
304	24.985	348	24.985	392	24.985	436	24.985	480	24.985	524	24.985
305	24.985	349	24.985	393	24.985	437	24.985	481	24.985	525	24.985
306	24.985	350	24.985	394	24.985	438	24.985	482	24.985	526	24.985
307	24.985	351	24.985	395	24.985	439	24.985	483	24.985	527	24.985
308	24.985	352	24.985	396	24.985	440	24.985	484	24.985	528	24.985
309	24.985	353	24.985	397	24.985	441	24.985	485	24.985	529	24.985
310	24.985	354	24.985	398	24.985	442	24.985	486	24.985	530	24.985
311	24.985	355	24.985	399	24.985	443	24.985	487	24.985	531	24.985
312	24.985	356	24.985	400	24.985	444	24.985	488	24.985	532	24.985
313	24.985	357	24.985	401	24.985	445	24.985	489	24.985	533	24.985
314	24.985	358	24.985	402	24.985	446	24.985	490	24.985	534	24.985
315	24.985	359	24.985	403	24.985	447	24.985	491	24.985	535	24.985
316	24.985	360	24.985	404	24.985	448	24.985	492	24.985	536	24.985
317	24.985	361	24.985	405	24.985	449	24.985	493	24.985	537	24.985
318	24.985	362	24.985	406	24.985	450	24.985	494	24.985	538	24.985
319	24.985	363	24.985	407	24.985	451	24.985	495	24.985	539	24.985
320	24.985	364	24.985	408	24.985	452	24.985	496	24.985	540	24.985
321	24.985	365	24.985	409	24.985	453	24.985	497	24.985	541	24.985
322	24.985	366	24.985	410	24.985	454	24.985	498	24.985	542	24.985
323	24.985	367	24.985	411	24.985	455	24.985	499	24.985	543	24.985
324	24.985	368	24.985	412	24.985	456	24.985	500	24.985	544	24.985
325	24.985	369	24.985	413	24.985	457	24.985	501	24.985	545	24.985
326	24.985	370	24.985	414	24.985	458	24.985	502	24.985	546	24.985
327	24.985	371	24.985	415	24.985	459	24.985	503	24.985	547	24.985
328	24.985	372	24.985	416	24.985	460	24.985	504	24.985	548	24.985
329	24.985	373	24.985	417	24.985	461	24.985	505	24.985	549	24.985
330	24.985	374	24.985	418	24.985	462	24.985	506	24.985	550	24.985
331	24.985	375	24.985	419	24.985	463	24.985	507	24.985	551	24.985
332	24.985	376	24.985	420	24.985	464	24.985	508	24.985	552	24.985

Surcharged Outfall Details for Existing

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
553	24.985	597	24.985	641	24.985	685	24.985	729	24.985	773	24.985
554	24.985	598	24.985	642	24.985	686	24.985	730	24.985	774	24.985
555	24.985	599	24.985	643	24.985	687	24.985	731	24.985	775	24.985
556	24.985	600	24.985	644	24.985	688	24.985	732	24.985	776	24.985
557	24.985	601	24.985	645	24.985	689	24.985	733	24.985	777	24.985
558	24.985	602	24.985	646	24.985	690	24.985	734	24.985	778	24.985
559	24.985	603	24.985	647	24.985	691	24.985	735	24.985	779	24.985
560	24.985	604	24.985	648	24.985	692	24.985	736	24.985	780	24.985
561	24.985	605	24.985	649	24.985	693	24.985	737	24.985	781	24.985
562	24.985	606	24.985	650	24.985	694	24.985	738	24.985	782	24.985
563	24.985	607	24.985	651	24.985	695	24.985	739	24.985	783	24.985
564	24.985	608	24.985	652	24.985	696	24.985	740	24.985	784	24.985
565	24.985	609	24.985	653	24.985	697	24.985	741	24.985	785	24.985
566	24.985	610	24.985	654	24.985	698	24.985	742	24.985	786	24.985
567	24.985	611	24.985	655	24.985	699	24.985	743	24.985	787	24.985
568	24.985	612	24.985	656	24.985	700	24.985	744	24.985	788	24.985
569	24.985	613	24.985	657	24.985	701	24.985	745	24.985	789	24.985
570	24.985	614	24.985	658	24.985	702	24.985	746	24.985	790	24.985
571	24.985	615	24.985	659	24.985	703	24.985	747	24.985	791	24.985
572	24.985	616	24.985	660	24.985	704	24.985	748	24.985	792	24.985
573	24.985	617	24.985	661	24.985	705	24.985	749	24.985	793	24.985
574	24.985	618	24.985	662	24.985	706	24.985	750	24.985	794	24.985
575	24.985	619	24.985	663	24.985	707	24.985	751	24.985	795	24.985
576	24.985	620	24.985	664	24.985	708	24.985	752	24.985	796	24.985
577	24.985	621	24.985	665	24.985	709	24.985	753	24.985	797	24.985
578	24.985	622	24.985	666	24.985	710	24.985	754	24.985	798	24.985
579	24.985	623	24.985	667	24.985	711	24.985	755	24.985	799	24.985
580	24.985	624	24.985	668	24.985	712	24.985	756	24.985	800	24.985
581	24.985	625	24.985	669	24.985	713	24.985	757	24.985	801	24.985
582	24.985	626	24.985	670	24.985	714	24.985	758	24.985	802	24.985
583	24.985	627	24.985	671	24.985	715	24.985	759	24.985	803	24.985
584	24.985	628	24.985	672	24.985	716	24.985	760	24.985	804	24.985
585	24.985	629	24.985	673	24.985	717	24.985	761	24.985	805	24.985
586	24.985	630	24.985	674	24.985	718	24.985	762	24.985	806	24.985
587	24.985	631	24.985	675	24.985	719	24.985	763	24.985	807	24.985
588	24.985	632	24.985	676	24.985	720	24.985	764	24.985	808	24.985
589	24.985	633	24.985	677	24.985	721	24.985	765	24.985	809	24.985
590	24.985	634	24.985	678	24.985	722	24.985	766	24.985	810	24.985
591	24.985	635	24.985	679	24.985	723	24.985	767	24.985	811	24.985
592	24.985	636	24.985	680	24.985	724	24.985	768	24.985	812	24.985
593	24.985	637	24.985	681	24.985	725	24.985	769	24.985	813	24.985
594	24.985	638	24.985	682	24.985	726	24.985	770	24.985	814	24.985
595	24.985	639	24.985	683	24.985	727	24.985	771	24.985	815	24.985
596	24.985	640	24.985	684	24.985	728	24.985	772	24.985	816	24.985

Surcharged Outfall Details for Existing

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
817	24.985	861	24.985	905	24.985	949	24.985	993	24.985	1037	24.985
818	24.985	862	24.985	906	24.985	950	24.985	994	24.985	1038	24.985
819	24.985	863	24.985	907	24.985	951	24.985	995	24.985	1039	24.985
820	24.985	864	24.985	908	24.985	952	24.985	996	24.985	1040	24.985
821	24.985	865	24.985	909	24.985	953	24.985	997	24.985	1041	24.985
822	24.985	866	24.985	910	24.985	954	24.985	998	24.985	1042	24.985
823	24.985	867	24.985	911	24.985	955	24.985	999	24.985	1043	24.985
824	24.985	868	24.985	912	24.985	956	24.985	1000	24.985	1044	24.985
825	24.985	869	24.985	913	24.985	957	24.985	1001	24.985	1045	24.985
826	24.985	870	24.985	914	24.985	958	24.985	1002	24.985	1046	24.985
827	24.985	871	24.985	915	24.985	959	24.985	1003	24.985	1047	24.985
828	24.985	872	24.985	916	24.985	960	24.985	1004	24.985	1048	24.985
829	24.985	873	24.985	917	24.985	961	24.985	1005	24.985	1049	24.985
830	24.985	874	24.985	918	24.985	962	24.985	1006	24.985	1050	24.985
831	24.985	875	24.985	919	24.985	963	24.985	1007	24.985	1051	24.985
832	24.985	876	24.985	920	24.985	964	24.985	1008	24.985	1052	24.985
833	24.985	877	24.985	921	24.985	965	24.985	1009	24.985	1053	24.985
834	24.985	878	24.985	922	24.985	966	24.985	1010	24.985	1054	24.985
835	24.985	879	24.985	923	24.985	967	24.985	1011	24.985	1055	24.985
836	24.985	880	24.985	924	24.985	968	24.985	1012	24.985	1056	24.985
837	24.985	881	24.985	925	24.985	969	24.985	1013	24.985	1057	24.985
838	24.985	882	24.985	926	24.985	970	24.985	1014	24.985	1058	24.985
839	24.985	883	24.985	927	24.985	971	24.985	1015	24.985	1059	24.985
840	24.985	884	24.985	928	24.985	972	24.985	1016	24.985	1060	24.985
841	24.985	885	24.985	929	24.985	973	24.985	1017	24.985	1061	24.985
842	24.985	886	24.985	930	24.985	974	24.985	1018	24.985	1062	24.985
843	24.985	887	24.985	931	24.985	975	24.985	1019	24.985	1063	24.985
844	24.985	888	24.985	932	24.985	976	24.985	1020	24.985	1064	24.985
845	24.985	889	24.985	933	24.985	977	24.985	1021	24.985	1065	24.985
846	24.985	890	24.985	934	24.985	978	24.985	1022	24.985	1066	24.985
847	24.985	891	24.985	935	24.985	979	24.985	1023	24.985	1067	24.985
848	24.985	892	24.985	936	24.985	980	24.985	1024	24.985	1068	24.985
849	24.985	893	24.985	937	24.985	981	24.985	1025	24.985	1069	24.985
850	24.985	894	24.985	938	24.985	982	24.985	1026	24.985	1070	24.985
851	24.985	895	24.985	939	24.985	983	24.985	1027	24.985	1071	24.985
852	24.985	896	24.985	940	24.985	984	24.985	1028	24.985	1072	24.985
853	24.985	897	24.985	941	24.985	985	24.985	1029	24.985	1073	24.985
854	24.985	898	24.985	942	24.985	986	24.985	1030	24.985	1074	24.985
855	24.985	899	24.985	943	24.985	987	24.985	1031	24.985	1075	24.985
856	24.985	900	24.985	944	24.985	988	24.985	1032	24.985	1076	24.985
857	24.985	901	24.985	945	24.985	989	24.985	1033	24.985	1077	24.985
858	24.985	902	24.985	946	24.985	990	24.985	1034	24.985	1078	24.985
859	24.985	903	24.985	947	24.985	991	24.985	1035	24.985	1079	24.985
860	24.985	904	24.985	948	24.985	992	24.985	1036	24.985	1080	24.985

Surcharged Outfall Details for Existing

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1081	24.985	1125	24.985	1169	24.985	1213	24.985	1257	24.985	1301	24.985
1082	24.985	1126	24.985	1170	24.985	1214	24.985	1258	24.985	1302	24.985
1083	24.985	1127	24.985	1171	24.985	1215	24.985	1259	24.985	1303	24.985
1084	24.985	1128	24.985	1172	24.985	1216	24.985	1260	24.985	1304	24.985
1085	24.985	1129	24.985	1173	24.985	1217	24.985	1261	24.985	1305	24.985
1086	24.985	1130	24.985	1174	24.985	1218	24.985	1262	24.985	1306	24.985
1087	24.985	1131	24.985	1175	24.985	1219	24.985	1263	24.985	1307	24.985
1088	24.985	1132	24.985	1176	24.985	1220	24.985	1264	24.985	1308	24.985
1089	24.985	1133	24.985	1177	24.985	1221	24.985	1265	24.985	1309	24.985
1090	24.985	1134	24.985	1178	24.985	1222	24.985	1266	24.985	1310	24.985
1091	24.985	1135	24.985	1179	24.985	1223	24.985	1267	24.985	1311	24.985
1092	24.985	1136	24.985	1180	24.985	1224	24.985	1268	24.985	1312	24.985
1093	24.985	1137	24.985	1181	24.985	1225	24.985	1269	24.985	1313	24.985
1094	24.985	1138	24.985	1182	24.985	1226	24.985	1270	24.985	1314	24.985
1095	24.985	1139	24.985	1183	24.985	1227	24.985	1271	24.985	1315	24.985
1096	24.985	1140	24.985	1184	24.985	1228	24.985	1272	24.985	1316	24.985
1097	24.985	1141	24.985	1185	24.985	1229	24.985	1273	24.985	1317	24.985
1098	24.985	1142	24.985	1186	24.985	1230	24.985	1274	24.985	1318	24.985
1099	24.985	1143	24.985	1187	24.985	1231	24.985	1275	24.985	1319	24.985
1100	24.985	1144	24.985	1188	24.985	1232	24.985	1276	24.985	1320	24.985
1101	24.985	1145	24.985	1189	24.985	1233	24.985	1277	24.985	1321	24.985
1102	24.985	1146	24.985	1190	24.985	1234	24.985	1278	24.985	1322	24.985
1103	24.985	1147	24.985	1191	24.985	1235	24.985	1279	24.985	1323	24.985
1104	24.985	1148	24.985	1192	24.985	1236	24.985	1280	24.985	1324	24.985
1105	24.985	1149	24.985	1193	24.985	1237	24.985	1281	24.985	1325	24.985
1106	24.985	1150	24.985	1194	24.985	1238	24.985	1282	24.985	1326	24.985
1107	24.985	1151	24.985	1195	24.985	1239	24.985	1283	24.985	1327	24.985
1108	24.985	1152	24.985	1196	24.985	1240	24.985	1284	24.985	1328	24.985
1109	24.985	1153	24.985	1197	24.985	1241	24.985	1285	24.985	1329	24.985
1110	24.985	1154	24.985	1198	24.985	1242	24.985	1286	24.985	1330	24.985
1111	24.985	1155	24.985	1199	24.985	1243	24.985	1287	24.985	1331	24.985
1112	24.985	1156	24.985	1200	24.985	1244	24.985	1288	24.985	1332	24.985
1113	24.985	1157	24.985	1201	24.985	1245	24.985	1289	24.985	1333	24.985
1114	24.985	1158	24.985	1202	24.985	1246	24.985	1290	24.985	1334	24.985
1115	24.985	1159	24.985	1203	24.985	1247	24.985	1291	24.985	1335	24.985
1116	24.985	1160	24.985	1204	24.985	1248	24.985	1292	24.985	1336	24.985
1117	24.985	1161	24.985	1205	24.985	1249	24.985	1293	24.985	1337	24.985
1118	24.985	1162	24.985	1206	24.985	1250	24.985	1294	24.985	1338	24.985
1119	24.985	1163	24.985	1207	24.985	1251	24.985	1295	24.985	1339	24.985
1120	24.985	1164	24.985	1208	24.985	1252	24.985	1296	24.985	1340	24.985
1121	24.985	1165	24.985	1209	24.985	1253	24.985	1297	24.985	1341	24.985
1122	24.985	1166	24.985	1210	24.985	1254	24.985	1298	24.985	1342	24.985
1123	24.985	1167	24.985	1211	24.985	1255	24.985	1299	24.985	1343	24.985
1124	24.985	1168	24.985	1212	24.985	1256	24.985	1300	24.985	1344	24.985

Surcharged Outfall Details for Existing

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1345	24.985	1361	24.985	1377	24.985	1393	24.985	1409	24.985	1425	24.985
1346	24.985	1362	24.985	1378	24.985	1394	24.985	1410	24.985	1426	24.985
1347	24.985	1363	24.985	1379	24.985	1395	24.985	1411	24.985	1427	24.985
1348	24.985	1364	24.985	1380	24.985	1396	24.985	1412	24.985	1428	24.985
1349	24.985	1365	24.985	1381	24.985	1397	24.985	1413	24.985	1429	24.985
1350	24.985	1366	24.985	1382	24.985	1398	24.985	1414	24.985	1430	24.985
1351	24.985	1367	24.985	1383	24.985	1399	24.985	1415	24.985	1431	24.985
1352	24.985	1368	24.985	1384	24.985	1400	24.985	1416	24.985	1432	24.985
1353	24.985	1369	24.985	1385	24.985	1401	24.985	1417	24.985	1433	24.985
1354	24.985	1370	24.985	1386	24.985	1402	24.985	1418	24.985	1434	24.985
1355	24.985	1371	24.985	1387	24.985	1403	24.985	1419	24.985	1435	24.985
1356	24.985	1372	24.985	1388	24.985	1404	24.985	1420	24.985	1436	24.985
1357	24.985	1373	24.985	1389	24.985	1405	24.985	1421	24.985	1437	24.985
1358	24.985	1374	24.985	1390	24.985	1406	24.985	1422	24.985	1438	24.985
1359	24.985	1375	24.985	1391	24.985	1407	24.985	1423	24.985	1439	24.985
1360	24.985	1376	24.985	1392	24.985	1408	24.985	1424	24.985	1440	24.985

Simulation Criteria for Existing

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	2880
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	24

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.100	Storm Duration (mins)	1440
Ratio R	0.350		

Summary of Critical Results by Maximum Level (Rank 1) for Existing

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Winter
Duration(s) (mins)	10080
Return Period(s) (years)	1
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
E1.000	E1	10080 Winter	1	+0%					28.906
E1.001	E2	10080 Winter	1	+0%					28.756
E1.002	E3	10080 Winter	1	+0%					28.660
E1.003	E4	10080 Winter	1	+0%					28.347
E1.004	E3	10080 Winter	1	+0%					27.267
E1.005	E4	10080 Winter	1	+0%	1/10080 Winter				27.145
E1.006	E8	10080 Winter	1	+0%	1/10080 Winter				26.978
E1.007	E9	10080 Winter	1	+0%	1/10080 Winter				26.682
E1.008	E8	10080 Winter	1	+0%	1/10080 Winter				26.707
E1.009	E9	10080 Winter	1	+0%	1/10080 Winter				26.453
E1.010	E10	10080 Winter	1	+0%	1/10080 Winter				26.286
E2.000	E13	10080 Winter	1	+0%	1/10080 Winter				26.987
E2.001	E13	10080 Winter	1	+0%	1/10080 Winter				26.872
E2.002	E13	10080 Winter	1	+0%	1/10080 Winter				26.594
E2.003	E13	10080 Winter	1	+0%	1/10080 Winter				26.479

Summary of Critical Results by Maximum Level (Rank 1) for Existing

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E1.000	E1	-0.570	0.000	0.10		230.0	OK	
E1.001	E2	-0.126	0.000	0.90		230.0	OK	
E1.002	E3	-0.154	0.000	0.91		230.0	OK	
E1.003	E4	-0.401	0.000	0.24		230.0	OK	
E1.004	E3	-0.686	0.000	0.06		230.0	OK	
E1.005	E4	0.155	0.000	0.88		230.0	FLOOD RISK	
E1.006	E8	0.202	0.000	1.33		230.0	FLOOD RISK	
E1.007	E9	0.050	0.000	1.09		230.0	FLOOD RISK*	
E1.008	E8	0.088	0.000	0.97		230.0	FLOOD RISK	
E1.009	E9	0.104	0.000	1.02		230.0	SURCHARGED	
E1.010	E10	0.098	0.000	1.36		230.0	SURCHARGED	
E2.000	E13	0.420	0.000	1.15		170.0	FLOOD RISK	
E2.001	E13	0.392	0.000	1.01		170.0	FLOOD RISK	
E2.002	E13	0.387	0.000	1.39		170.0	FLOOD RISK	
E2.003	E13	0.332	0.000	1.22		170.0	FLOOD RISK	

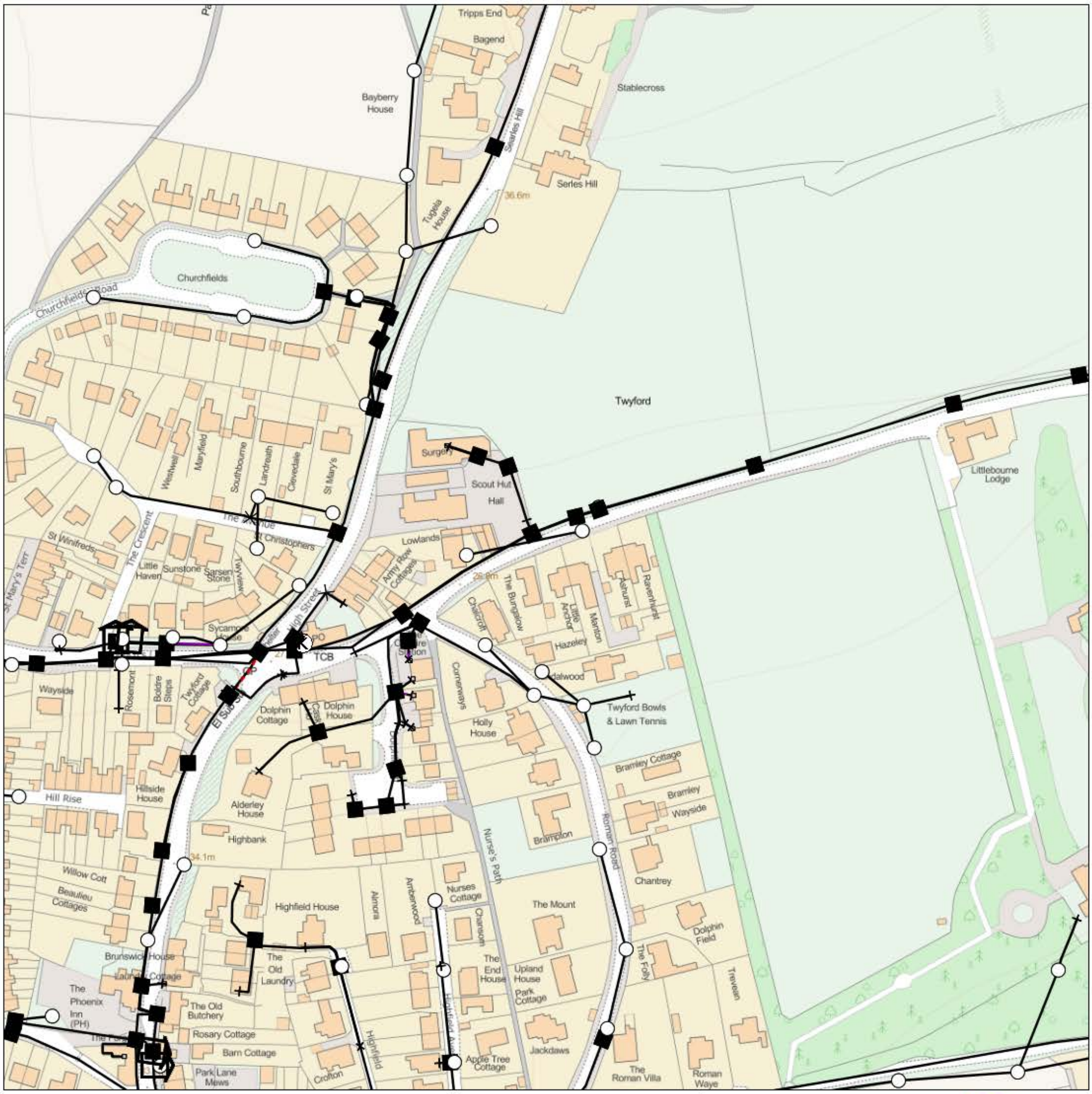
Summary of Critical Results by Maximum Level (Rank 1) for Existing

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
E2.004	E13	10080 Winter	1	+0%	1/10080 Winter				26.364
E2.005	E13	10080 Winter	1	+0%	1/10080 Winter				26.249
E2.006	E13	10080 Winter	1	+0%	1/10080 Winter				26.115
E1.011	E11	10080 Winter	1	+0%					25.930
E1.012	E12	10080 Winter	1	+0%					25.490
E1.013	E14	10080 Winter	1	+0%					25.295
E1.014	E14	10080 Winter	1	+0%					25.223
E1.015	E15	10080 Winter	1	+0%	1/10080 Winter				25.180
E1.016	E16	10080 Winter	1	+0%	1/10080 Winter				25.128
E1.017	E17	10080 Winter	1	+0%	1/10080 Winter				25.079
E1.018	E18	10080 Winter	1	+0%	1/10080 Winter				25.026

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
E2.004	E13	0.294	0.000	1.42		170.0	FLOOD RISK	
E2.005	E13	0.062	0.000	1.11		170.0	SURCHARGED	
E2.006	E13	0.037	0.000	1.44		170.0	SURCHARGED	
E1.011	E11	-0.667	0.000	0.24		400.0	OK	
E1.012	E12	-0.760	0.000	0.26		400.0	OK	
E1.013	E14	-0.617	0.000	0.37		404.3	OK	
E1.014	E14	-0.322	0.000	0.44		410.0	OK	
E1.015	E15	0.084	0.000	0.91		409.4	SURCHARGED	
E1.016	E16	0.098	0.000	1.97		407.3	SURCHARGED	
E1.017	E17	0.050	0.000	1.75		407.2	SURCHARGED	
E1.018	E18	0.027	0.000	2.06		406.7	SURCHARGED	

APPENDIX D: BT Infrastructure Location Plan

Maps by email Plant Information Reply



IMPORTANT WARNING

Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only.
No guarantee is given of its accuracy.
It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.

openreach

CLICK BEFORE YOU DIG

FOR PROFESSIONAL FREE ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS INCLUDING LOCATE AND MARKING SERVICE

email cbyd@openreach.co.uk

ADVANCE NOTICE REQUIRED
(Office hours: Monday - Friday 08.00 to 17.00)
www.openreach.co.uk/cbyd

KEY TO BT SYMBOLS

	Planned	*Live*
PCP		
Pole		
Box		
Manhole		
Cabinet		

Change Of State	+	Hatchings	
Split Coupling	×	Built	
Duct Tee	▲	Planned	
Building		Inferred	
Kiosk	K	Duct	

Other proposed plant is shown using dashed lines.
BT Symbols not listed above may be disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

	Pending Add	*In Place*	*Pending Remove*	*Not In Use*
Power Cable				
Power Duct				N/A

BT Ref : VAV03005D
Map Reference : (centre) SU4825224627
Easting/Northing : (centre) 448252,124627
Issued : 22/02/2019 15:00:23

WARNING: IF PLANNED WORKS FALL INSIDE HATCHED AREA IT IS ESSENTIAL BEFORE PROCEEDING THAT YOU CONTACT THE NATIONAL NOTICE HANDLING CENTRE. PLEASE SEND E-MAIL TO: nnhc@openreach.co.uk

APPENDIX E: Cost Estimate

Cost Estimate Twyford				
Item	**Quantity**	**Units**	**Rate**	**Cost**
Preliminaries including welfare and fencing	1	Per Item	£5,000.00	£5,000.00
Traffic management	8	Per Week	£2,000.00	£16,000.00
New Manholes	4	Per Item	£1,500.00	£6,000.00
Excavate footway, kerbs and all drainage within construction	65	Per Meter	£75.00	£4,875.00
Excavate trench in road	7	Per Meter	£300.00	£2,100.00
Excavated trench in road including drainage	12	Per Meter	£400.00	£4,800.00
2 x 300mm UPVC Pipe with bedding material	80	Per Meter	£200.00	£16,000.00
600mm UPVC Pipe with bedding material	12	Per Meter	£300.00	£3,600.00
Footway Construction per metre including kerbs and edgers	65	Per Meter	£105.00	£6,825.00
Reinforced Pavement Construction for carriageway	7	Per Meter	£300.00	£2,100.00
Excavate and Construct ditch	250	Per Meter	£200.00	£50,000.00
Install Non-Return Valve	1	Per Item	£1,500.00	£1,500.00
Construct Headwall	3	Per Unit	£1,000.00	£3,000.00
Install conrete drainage channel with gratting	12	Per Meter	£1,000.00	£12,000.00
Construct 600mm Concrete Culvert	85	Per Meter	£500.00	£42,500.00
Install low leak covers	6	Per Item	£500.00	£3,000.00
Resurface Patch of Highways	800	Meters Squared	£10.00	£8,000.00
Total Cost of BoQ		£187,300.00		
Detail Design Fee		£18,730.00		
Service Redirection	BT	£40,000.00		
	Water	£10,000.00		
	Other	£10,000.00		
Ground Radar Survey		£10,000.00		
CCTV Survey		£4,000.00		
Factor for Unknowns and early design stage		£117,053.20		
Total		**£397,083.20**		

APPENDIX F: Ecological Report

LINDSAY CARRINGTON ECOLOGICAL SERVICES

ECOLOGICAL APPRAISAL
HIGH STREET
FINCH'S LANE AND HAZELEY ROAD
TWYFORD

AUGUST 2018

ON BEHALF OF MAYER BROWN LTD

LINDSAY CARRINGTON
ECOLOGICAL SERVICES

The Old Squash Court,
Rempstone Hall,
Rempstone,
Corfe Castle,
Wareham,
Dorset,
BH20 5JQ
www.ecological-services.co.uk

Telephone: 01929 477115
E-mail: William@ecological-services.co.uk

Authorisation

	Name	Date	Signature
Report prepared by:	William Davis	16.08.18	
Report checked and authorised by:	Louisa Jones	16.08.18	

The contents of this report were correct at the time of the last survey visit. The report is provided for the sole use of the named client and is confidential.

CONTENTS

SUMMARY

1. Lindsay Carrington Ecological Services Limited were commissioned by Mayer Brown Ltd to conduct an ecological appraisal along land at High street, Finch's lane and Hazeley road, Twyford, SO21 1NH (Grid ref: SU 48143 24588). The location of the site is provided in appendix I. The survey was conducted to support plans to modify the drainage ditches and culverts to manage water retention in the area.

2. An ecological appraisal is essentially a multi-disciplinary walk-over survey and was conducted with the objective of identifying any ecological constraints associated with the proposals such as the site's potential to support any legally protected species or habitats of high nature conservation value.

3. The site comprises hardstanding, tarmac, scrub, native and non-native hedgerows and verges.

4. The site is located 300 metres east of the River Itchen SAC/SSSI. Further recommendations have been made in section 5.1 to prevent adverse impacts to these protected sites and habitats.

5. The site holds a hedgerow which is classified as a priority habitat and signs of a hedgehog population, a priority species, were also noted. Recommendations in relation to priority habitats and species have been made in section 5.1.

6. The verges hold potential to support low numbers or reptiles. Further recommendations have been made in section 5.2.

7. The hedgerows on site provide nesting bird habitat. Further recommendations have been made in section 5.3

8. General recommendations for enhancing the ecological value of the site for wildlife have been made in section 5.5.

1.0 INTRODUCTION

Lindsay Carrington Ecological Services Limited were commissioned by Mayer Brown Ltd to conduct an ecological appraisal along land at High street, Finch's lane and Hazeley road, Twyford, SO21 1NH (Grid ref: SU 48143 24588). The location of the site is provided in appendix I. The survey was conducted to support plans to modify the drainage ditches and culverts to manage water retention in the area.

An ecological appraisal is essentially a multi-disciplinary walk-over survey and was conducted with the objective of identifying any ecological constraints associated with the proposals such as the site's potential to support any legally protected species or habitats of high nature conservation value.

Section 2 of the report provides some background information on legislative requirements and relevant policy. Section 3 details the methodologies adopted for the ecological surveys that were conducted and section 4 provides an account of the survey results. Section 5 provides information on the relevance of the results to any future development and makes recommendations for measures to mitigate and compensate for the effects on a particular habitat or species.

2.0 LEGISLATION AND POLICY

2.1 Legislation

The following legislation may be of relevance to the proposed works. Full details of statutory obligations with respect to biodiversity and the planning system can be recorded in DCLG Circular 06/2005.

- **The Conservation of Habitats and Species Regulations 2017:**
  This transposes the EU Habitats Directive (Council Directive 92/43/EEC) into domestic law. The Regulations provide protection for a number of species including:

  - All species of bat;
  - Dormouse;
  - Otter; and
  - Great crested newt.

  This legislation makes it an offence to deliberately capture, kill or injure individuals of these species listed on Schedule 2 and damage or destroy their breeding site or place of shelter. It is also illegal to deliberately disturb these species in such a way as to be likely to significantly affect: (i) the ability of any significant group of the species to survive, breed or rear or nurture their young; or (ii) the local distribution or abundance of the species[1];

  This legal protection means that where development has the potential to impact on bats, or other European protected species, the results of a protected species survey must be submitted with a planning application.

  Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) are also protected under this legislation. These are a network of sites designated for supporting habitats or species of high nature conservation importance in the European context. Any activity that has a detrimental effect on these European sites is made an offence under the Regulations. Where a development is likely to have a significant impact on a European site, the Regulations require a rigorous assessment of the impacts, known as an Appropriate Assessment.

[1] Note that the amendment to the Habitats Regulations in August 2007 and January 2009 has resulted in an increase in the threshold of illegal levels of disturbance to European Protected Species (EPS). An offence is only committed if the deliberate disturbance would result in significant impacts to the EPS population. However, it should be noted that activities that cause low levels of disturbance to these species continue to constitute an offence under Section 9 of the Wildlife and Countryside Act (see below).

- **The Wildlife and Countryside Act 1981 (and amendments):** Protected fauna and flora are listed under Schedules 1, 5 & 8 of the Act. Species likely to be of relevance include:
    - All species of **bat.** It is an offence to intentionally or recklessly disturb any bat whilst it is occupying a roost or to intentionally or recklessly obstruct access to a bat roost;
    - All species of British **reptile** (in particular grass snake, common lizard, adder and slow-worm). It is illegal to kill or injure these species; and
    - **Great crested newt.** It is illegal to obstruct access to any structure or place which great crested newts use for shelter or protection or to disturb any great crested newt while it is using such a place.
    - **Water vole.** It is an offence to intentionally kill, injure or take water vole, intentionally or recklessly damage, destroy, obstruct access to water vole holes or disturb them whilst in a hole.

  This Act also makes it an offence to intentionally kill, injure or take any wild bird or to take, damage or destroy their eggs and nests (whilst in use or being built). In addition, it is an offence to disturb any nesting bird listed on Schedule 1 or their young.

  Schedule 9 of the Act lists those species for which it is an offence to cause their spread. Schedule 9 species that are most likely to be encountered are Japanese knotweed (*Fallopia japonica*) and New Zealand pigmyweed (*Crassula helmsii).*

  Sites of Special Scientific Interest (SSSIs) are also protected under the Wildlife and Countryside Act 1981. These are a network of sites identified as being of national nature conservation importance and hence afforded legal protection.

- **The Countryside and Rights of Way Act 2000:** This Act strengthens nature conservation and wildlife protection. It places a duty on Government Ministers and Departments to conserve biological diversity, provides police with stronger powers relating to wildlife crimes, and improves protection and management of SSSIs.

- **The Protection of Badgers Act 1992:** This Act makes it an offence to wilfully take, injure or kill a badger (*Meles meles*); cruelly mistreat a badger; interfere with badger setts. A licence is required for work which may damage or disturb a sett.

- **Wild Mammals (Protection) Act 1996:** This Act provides protection for all wild animals from intentional acts of cruelty.

- **Hedgerow Regulations 1997:** These Regulations establish a set of criteria for assessing the importance of hedgerows. Where a hedgerow is deemed to be 'important' its removal is prohibited without consent from the local Planning Authority.

2.2 Policy

The following policy is of relevance to the proposed works:

- **National Planning Policy Framework (NPPF):** This sets out the Government's vision for biodiversity in England with the broad aim that planning, construction, development and regeneration should maintain and enhance, restore or add to biodiversity and geological conservation interests. NPPF includes sections on legally protected species and sites (see Section 2.1).

- **Local Sites (including Sites of Nature Conservation Interest (SNCIs), Local Nature Reserves (LNR), and Biological Notification Sites (BNSs)/County Wildlife Sites (CWSs)):** These are a network of sites designated for their nature conservation importance in a local context. Although they are not afforded legal protection they contribute towards local and national biodiversity. Where such development is permitted, the local planning authority will use conditions and/or planning obligations to minimise the damage and to provide compensatory and site management measures where appropriate.

- **Biodiversity Action Plans (BAPs):** BAPs set out policy for protecting and restoring priority species and habitats as part of the UK's response as signatories to the Convention on Biological Diversity. BAPs operate at both a national and local level with priority species and habitats identified at a national level and a series of Local BAPs that identify ecological features of particular importance to a particular area of the country. The requirement to consider and contribute towards BAP targets was strengthened through the Countryside and Rights of Way Act 2000. Habitat and Species Action Plans that are likely to be of relevance include:

    - Hedgehog (Hampshire BAP, UK BAP)
    - Reptiles (UK BAP)
    - Brown long-eared bat (UK BAP)
    - Soprano pipistrelle (UK BAP)

3.0 METHODOLOGY

3.1 Desk study

Hampshire Biodiversity Information Centre (HBIC) and the Multi-Agency Geographical Information for the Countryside (MAGIC) website were used to provide any information they may hold on protected species within two kilometres and designated sites within five kilometres of the proposed development.

3.2 Field study

3.2.1 Vegetation

The standard phase 1 habitat survey methodology (JNCC, 2010) was adopted whereby habitats are mapped using colour codes (appendix II). A detailed walkover survey was undertaken on the 2nd July 2018 by William Davis and Elen Lesourd, directly searching for legally protected and invasive species of plant and categorising any habitats of ecological value that were encountered. A general description of the vegetation was also noted, listing species encountered and scoring their abundance using the DAFOR scale:

D Dominant;
A Abundant;
F Frequent;
O Occasional;
R Rare;
L Local (used as a prefix to any of the above).

3.2.2 Protected species assessment

Habitats and features were assessed for their potential to support protected species (see section 2). In many cases determining the presence, distribution and population size of protected species will require additional, specialist surveys.

Badgers

A direct search was undertaken for signs of badger (*Meles meles*). Signs of badger may include setts, dung pits, latrines, paths or hairs on fences and vegetation. Any setts encountered were classified according to the number of entrances and the extent of their use.

Bats

Activity

Potential for the site to support roosting, foraging and commuting bats was assessed in accordance with the Bat Conservation Trust (BCT) *Bat Surveys for Professional Ecologists Good Practice Guidelines* (Collins *et al*, 2016).

The site was assessed for its suitability to support foraging bats. Bats will forage on sites that support linear landscape features (e.g. hedgerows, tree lines and rivers) with good habitat connectivity and within proximity to suitable roosting sites. Sites that support a varied vegetation structure are considered to provide more suitable foraging habitat for bats as they support an abundance and diversity of insect prey.

Trees

All bats use trees as they provide a foraging area, and connectivity between different habitats, however the most significant use is as a roost. Bats often roost in trees. Features such as old woodpecker holes, splits, cavities and rot holes, loose or flaking bark and ivy creepers will be exploited by bats to roost. Any trees present on site were therefore assessed for their potential to support roosting bats by searching for such features. The presence of roosting bats can be spotted through signs such as accumulations of moth or butterfly wings, staining, bat droppings, or bats themselves. The absence of these cannot, however, be treated as conclusive evidence that bats are not present, and therefore an assessment was made of the potential of the trees to support bats based on the scale presented below in table 1, adapted from the *Good Practice Guidelines* (Collins, 2016):

Table 1: Criteria for assessing bat roosting potential of trees

High Roosting Potential	Trees with multiple, highly suitable features capable of supporting larger roosts or with evidence of bat occupation found
Moderate Roosting Potential	Trees with definite bat potential, supporting fewer suitable features than high roosting potential trees or with potential for use by single bats
Low or Negligible Roosting Potential	Trees with no obvious potential, although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features which may have limited potential to support bats or trees with no potential to support bats

Dormice

The habitat on the site was assessed for the potential to support dormice (*Muscardinus avellanarius*), which are recorded in habitats such as woodlands, scrub and hedgerows with good connectivity and suitable food plants. Satellite images were used to assess the connectivity of any suitable habitat present on the site to other areas of woodland and hedgerow networks.

Great crested newts

Suitable breeding ponds are essential to support populations of great crested newt (*Triturus cristatus*) although they actually only spend a relatively short period of the year in the ponds during the spring for breeding. The remainder of the year is spent in suitable 'foraging' habitat such as tall grassland and woodland. During the winter the great crested newt hibernates, often amongst the roots of trees and scrub or in places such as piles of rubble or under fallen trees and logs.

Great crested newts are known to forage up to at least five hundred metres from their breeding sites and suitable habitats that fall within five hundred metres must be considered even in situations where the breeding site itself will not be affected. No ponds were identified within five hundred metres of the development area so no further assessment was required.

Reptiles

Reptiles are widespread in habitats that provide both cover, in the form of scrub or tall vegetation, and basking areas such as areas of hard standing or short grassland communities. Piles of debris or rubble also provide excellent cover and hibernation sites for reptiles. Effective survey for reptiles is time-consuming and labour intensive involving the use of artificial refuges (usually roofing felt or carpet tiles) which attract individuals. Habitats within the site were therefore assessed for their suitability to support reptiles and further specialist surveys recommended where appropriate.

4.0 RESULTS

4.1 Desk study

Statutory and non-statutory sites

Table 2 below lists statutory sites within a five-kilometre radius of the site and non-statutory sites within a two-kilometre radius of the site.

Table 2: Statutory sites within a five-kilometre radius and non-statutory sites within a two-kilometre radius of the proposed development

Site name	Conservation status	Distance from site (km)	Size (Ha)	Habitat description
River Itchen	SAC[2]	0.3 west	303.99	The SAC was selected for the annex 1 habitat "Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation" as well as the populations of Southern Damselfly (*Coenagrion mercuriale*) and bullhead (*Cottus gobio*). White clawed crayfish (*Austropotamobius pallipes*), brook lamprey (*Lampetra planeri*), atlantic salmon (*Salmo salar*) and Otter (*Lutra lutra*) are also present, although these are not primary reasons for the selection of the site.
	SSSI[3]	0.3 west	748.50	The River Itchen is a chalk river that runs approximately 42 km in length. The riparian habitat includes fen meadow, flood pasture and swamp. The site is noted for its significant populations of the nationally rare southern damselfly (*Coenagrion mecuriale*) and bullhead (*Cottius gobo*), and qualifying species white-clawed crayfish (*Austropotamobius pallipes*), brook lamprey (*Lampetra planeri*), Atlantic salmon (*Salmo salar*) and otter (*Lutra lutra*).
St. Catherine's Hill	SSSI	2.5 north	43	The Site of Special Scientific Interest comprises chalk grassland

[2] SAC: Special Area of Conservation
[3] SSSI: Site of Special Scientific Interest

Site name	Conservation status	Distance from site (km)	Size (Ha)	Habitat description
				scrub occupying the spur of St. Catherines Hill and an adjoining dry valley. The site supports a diverse range of plant communities.
Shawford Down	LNR[4]	0.9 west	19.65	Chalk grassland grazed by highland cattle. Notable species include chalk down land plants and butterflies.
Twyford Waterworks Meadows	SINC[5]	0.7 east	1.47	Agriculturally unimproved grassland.
Twyford Mead Meadow	SINC	0.8 north	2.88	Water meadow with quality characteristics of species present in unimproved habitats. Notable species include river water-dropwort (*Oenanthe fluviatilis*), sea knotgrass (*Polygonum maritimum*) and stream water-crowfoot (*Ranunculus penicillatus agg.*).
Cockscomb Hill	SINC	0.9 south east	4.27	Agriculturally unimproved grassland with notable species including chalk milkwort (*Polygala calcarea*)
Shawford Down	SINC	0.9 west	19.19	Grassland which has been recently impoverished but could show signs of recovery to unimproved state. Notable species include basil thyme (*Clinopodium acinos*), corn cleavers (*Galium tricornutum*), chalkhill blue (*Polyommatus coridon*), sweet briar (*Rosa rubiginosa*) and striped lychnis (*Shargacucullia lychnitis*).
B3354/B335 Main Road	SINC/ RVEI[6]	1.0 south	59 metres in length	Triangle by junction of B3354 and B335 near Twyford. Notable species of the lowland meadow/marsh flora includes dittander CI (*Lepidium latifolium*).
Twyford Reservoir	SINC	1.0 south east	1.47	Agriculturally unimproved grassland with notable species including sainfoin (*Onobrychis viciifolia*).

[4] LNR: Local Nature Reserve
[5] SINC:Site of Importance for Nature Conservation
[6] RVEI: Road Verge of Ecological Importance

Site name	Conservation status	Distance from site (km)	Size (Ha)	Habitat description
Cockscomb Down	SINC	1.0 south east	16.84	Agriculturally unimproved grassland hound's tongue (*Cynoglossum officinale*).
The Malms Down	SINC	1.0 west	0.62	Grassland which has been recently impoverished but could show signs of recovery to unimproved state.
Hazeley Copse	SINC	1.2 east	4.16	Ancient semi-natural woodlands.
Gabriel's Copse	SINC	1.2 South east	10.76	Ancient semi-natural woodlands.
Cockscomb Hill Copse	SINC	1.4 south east	4.18	Ancient semi-natural woodlands.
Sparrowgrove Copse	SINC	1.4 south west	4.88	Ancient semi-natural woodlands.
Roundbushes Copse	SINC	1.5 south east	2.02	Ancient semi-natural woodlands.
Hockley Golf Course	SINC	1.7 north	79.11	Range of grassland characteristics, with potential for quality unimproved habitat throughout.
Oakwood Copse	SINC	1.7 south west	3.74	Ancient semi-natural woodlands.
Taylor's Copse	SINC	1.8 south	4.73	Ancient semi-natural woodlands.
Warners Farm Down	SINC	1.8 west	0.44	Agriculturally unimproved grassland.
Hazeley Down	SINC	1.9 east	0.25	Agriculturally unimproved grassland.
A3090 Hockley Link Road	RVEI	2.0 north	320 metres in length	Both sides of the A3090 east of the Hockley link roundabout. Notable species of the chalk flora include common spotted-orchid (*Dactylorhiza fuchsii*), Pyrimidal orchid (*Anacamptis pyrimidalis*) and bee orchid (*Ophrys apifera*).

The proposed development is located within 300 metres of the River Itchen SSSI/SAC. Mitigation to prevent impacts to this site is presented in section 5.1.

Protected species records

Table 3 below presents the results of the search for protected and notable species within a two-kilometre radius of the site as highlighted by HBIC.

Table 3: Protected and notable species within a two-kilometre radius of land at High street, Finch's lane and Hazeley road, Twyford

Common Name	Scientific Name	Status	Location
Amphibians & Reptiles			

Slow-worm	*Anguis fragilis*	Schedule 5 WCA[7],, UK BAP[8]	5 records, 2008-2013
Grass snake	*Natrix helvetica*	Schedule 5 WCA	2 records, 2002-2009
Great crested newt	*Triturus cristatus*	Schedule 5 WCA, Schedule 2 Habs Regs, UK BAP	2 records, 2008-2012
Common lizard	*Zootoca vivipara*	Schedule 5 WCA, UK BAP	1 record, 2010
Birds			
Skylark	*Alauda arvensis*	Red List BoCC[9], UK BAP	1 record, 2007
Kingfisher	*Alcedo atthis*	Schedule 1, Annex 1, Amber List BoCC	20 records, 1998-2016
Tree pipit	*Anthus trivialis*	Red List BoCC, UK BAP	1 record, 2008
Pochard	*Aythya ferina*	Red List BoCC	1 record, 2003
Barnacle goose	*Branta leucopsis*	Annex 1, Amber List BoCC	1 record, 2006
Stone-curlew	*Burhinu soedicnemus*	Schedule 1, Annex 1, Amber List BoCC, UK BAP	1 record, 2010
Linnet	*Carduelis cannabina*	Red List BoCC, UK BAP	4 records, 2002-2011
Cetti's warbler	*Cettia cetti*	Schedule 1	16 records, 2005-2012
Cuckoo	*Cuculus canorus*	Red List BoCC, UK BAP	3 records, 2002-2010
Little egret	*Egretta garzetta*	Annex 1	6 records, 1997-2009
Yellowhammer	*Emberiza citrinella*	Red List BoCC, UK BAP	6 records, 2006-2011
Peregrine	*Falco peregrinus*	Schedule 1, Annex 1	1 record, 2002
Hobby	*Falco subutteo*	Schedule 1	3 records, 2002-2012
Brambling	*Fringilla montifringilla*	Schedule 1	1 record, 2011
Little bittern	*Ixobrychus minutus*	Schedule 1, Annex 1	1 record, 2010
Mediterranean gull	*Larus melanocephalus*	Schedule 1, Annex 1, Amber List BoCC	1 record, 2010
Grasshopper warbler	*Locustella naevia*	Red List BoCC, UK BAP	7 records, 2002-2011
Woodlark	*Lullula arborea*	Schedule 1, Annex 1, UK BAP	6 records, 2003-2010
Red kite	*Milvus milvus*	Schedule 1, Annex 1, Amber List BoCC	9 records, 2006-2012
Grey wagtail	*Motacilla cinerea*	Red List BoCC	33 records, 1995-2011

[7] WCA: Wildlife and Countryside Act (1981) (as amended)
[8] UK BAP: UK Biodiversity Action Plan
[9] BoCC: Birds of Conservation Concern v.4

Yellow wagtail	*Motacilla flava*	Red List BoCC, UK BAP	1 record, 2011.
Spotted flycatcher	*Muscicapa striata*	Red List BoCC, UK BAP	9 records, 2005-2011
Curlew	*Numenius arquata*	Red List BoCC, UK BAP	1 record, 2012.
Osprey	*Pandion haliaetus*	Schedule 1, Annex 1, Amber List BoCC	2 records, 2009-2010
House sparrow	*Passer domesticus*	Red List BoCC, UK BAP	2 records, 2011
Black redstart	*Pheonicurus ochruros*	Schedule 1, Red List BoCC	2 records, 1995-2011
Marsh tit	*Poecile palustris*	Red List BoCC, UK BAP	2 records, 2003-2008
Whinchat	*Saxicola rubetra*	Red List BoCC	2 records, 2004-2005
Turtle dove	*Streptopelia turtur*	Red List BoCC, UK BAP	2 records, 2002-2006
Starling	*Sturnus vulgaris*	Red List BoCC, UK BAP	2 records, 2010-2011
Redwing	*Turdus iliacus*	Schedule 1, Red List BoCC	6 records, 2005-2011
Song thrush	*Turdus philomelos*	Red List BoCC, UK BAP	6 records, 2006-2011
Fieldfare	*Turdus pilaris*	Schedule 1, Red List BoCC	3 records, 2004-2009
Mistle thrush	*Turdus viscivorus*	Red List BoCC	5 records, 2006-2011
Barn owl	*Tyto alba*	Schedule 1	4 records, 2006-2010
Lapwing	*Vanellus vanellus*	Red List BoCC, UK BAP	3 records, 2006-2012
Mammals – Terrestrial (Bats)			
Western barbastelle	*Barbastella barbastellus*	Schedule 2, Annex 2, Habs Regs, Schedule 5 WCA	2 records, 2011
Serotine	Eptesicus serotinus	Schedule 2 Habs Regs, Schedule 5 WCA	7 records, 1984-2009
Daubenton's bat	*Myotis daubentonii*	Schedule 2 Habs Regs, Schedule 5 WCA	6 records, 1997-2012
Whiskered bat	*Myotis mystacinus*	Schedule 2 Habs Regs, Schedule 5 WCA	1 record, 2011
Natterer's bat	*Mytois Nattereri*	Schedule 2 Habs Regs, Schedule 5 WCA	1 record, 2005
Noctule	*Nyctalus noctula*	Schedule 2 Habs Regs, Schedule 5 WCA	9 records, 1987-2011

Pipistrelle	*Pipistrellus pipistrellus*	Schedule 2 Habs Regs, Schedule 5 WCA	12 records, 2008-2016
Soprano pipistrelle	*Pipistrellus pygmaeus*	Schedule 2 Habs Regs, Schedule 5 WCA, UK BAP	10 records, 2005-2016
Long-eared bat species	*Plecotus*	Schedule 2 Habs Regs, Schedule 5 WCA, UK BAP	3 records, 2011-2012
Brown Long-eared Bats	*Plecotus auritus*	Schedule 2 Habs Regs, Schedule 5 WCA, UK BAP	5 records, 2003-2011
Mammals – Terrestrial (Non-Bats)			
European water vole	*Arvicola amphibius*	Schedule 2 Habs Regs, Schedule 5 WCA, UK BAP	126 records, 2004-2013
West European hedgehog	*Erinaceus europaeus*	Schedule 6 WCA, HBAP	1 record, 2007
Brown hare	*Lepus europaeus*	Schedule 6 WCA, UK BAP	2 records, 2002-2012
European otter	*Lutra lutra*	Schedule 2 Habs Regs, Schedule 5 WCA, UK BAP	28 records, 2006-2013
Eurasian badger	*Meles meles*	Protection of Badger Act 1992	2 records, 2002-2009
Harvest mouse	*Micromys minutus*	UK BAP	1 record, 2009
Invertebrates			
Stag beetle	*Lucanus cervus*	Schedule 5 WCA, UK BAP	6 records, 2002-2006

These records of protected and notable species in the vicinity of the site increase the likelihood of them being present where suitable habitat is identified in the field survey.

4.2 Field study

The field survey was conducted by William Davis and Elen Lesourd on the 2nd July 2018.

4.2.1 Vegetation

The accompanying phase 1 habitat map provided as appendix II depicts the habitats encountered and highlights areas of particular interest with target notes.

Descriptions of these habitats are provided below:

Hardstanding (Target note 1)

An area of gravel hardstanding is present to the western boundary of the site. Species present are all rarely distributed and include common sorrel (*Rumex acetosa*), scarlet pimpernel (*Anagallis arvensis*), dandelion (*Taraxacum agg.*), cock's foot (*Dactylis glomerata*), smooth sow thistle (*Sonchus oleraceus*), annual meadow-grass (*Poa annua*), perennial rye-grass (*Lolium perenne*), shepherd's purse (*Capsella bursa-pastoris*), false wood broom (*Brachypodium sylvaticum*).

This area has no ecological interest and no further action is required.

Tarmac (Target note 2)

An area of tarmac was recorded north of Hazeley Road. This is currently used as a car park and measures approximately 800m^2. This area is very actively used and has not been colonised.

This area has no ecological interest and no further action is required.

Scrub (Target note 3)

An area of scrub is present in the south east corner of the car park as it joins Hazeley Road, species present include dominant bramble (*Rubus fruticosus agg.*), frequent nettle (*Urtica dioica*) and hedge bindweed, abundant snowberry (*Symphoricarpos sp.*) and rare hogweed (*Heracleum sphondylium*).

Species present within this habitat are common and widespread. The scrub holds potential to support nesting birds. Further recommendations have been made in section 5.3.

Non-native hedgerow (Target note 4)

A non-native hedgerow was recorded along the western section of Hazeley Road where it joins the car park. This hedgerow was planted within recent years and has been dominated by a species of snowberry. The snowberry has displaced a number of other species which appear to have been planted at a similar time. This includes young blackthorn (*Prunus spinosa*) and hawthorn (*Crataegus monogyna*) that were largely dead within the hedgerow. Where the planted section joins older more original sections of hedgerow species such as field maple (*Acer campestre*), hazel (*Corylus avellana*) were recorded along with immature oak (*Quercus robur*) trees. Species present within the hedgerow are shown in table 4 below.

Table 4: Species recorded within the hedgerow

Common name	Scientific name	Abundance	Status
Herbaceous plants			

Common name	Scientific name	Abundance	Status
Lords-and-Ladies	*Arum maculatum*	R	Common, mostly on calcareous or richer soils
Spear thistle	*Cirsium vulgare*	R	Common & widespread
Cleavers	*Galium aparine*	O	Common & widespread
Ivy	*Hedera helix*	F	Common & widespread
Hogweed	*Heracleum sphondylium*	O	Common & widespread
Stinking iris	*Iris foetidissima*	R	Occasional introduced in woods, hedgebanks, scrub on sea cliffs and inland, mainly on calcareous soils
Bramble	*Rubus fruticosus agg.*	F	Common & widespread
Dandelion	*Taraxacum agg.*	F	Common & widespread
Nettle	*Urtica dioica*	O	Common & widespread
Trees and shrubs			
Field maple	*Acer campestre*	O	Frequent in woodlands on basic soils, scrub & hedgebanks
Sycamore	*Acer pseudoplatanus*	O	Introduced, common on richer soils
Dogwood	*Cornus sanguinea*	R	Common in woodlands & scrub on calcareous soils
Hazel	*Corylus avellana*	F	Common & widespread, on less acid soils
Hawthorn	*Crataegus monogyna*	F	Common & widespread
Ash	*Fraxinus excelsior*	O	Common on moister, base-rich soils
Wild privet	*Ligustrum vulgare*	R	Common, especially on calcareous soils
Blackthorn	*Prunus spinosa*	R	Common & widespread
Oak	*Quercus robur*	R	Common & widespread, except on very poor soils
Elder	*Sambucus nigra*	R	Common on nutrient-enriched soils
Snowberry	*Symphoricarpos sp.*	D	Non-native ornamental.
Elm	*Ulmus procera*	R	Full-sized trees are rare, found in hedgerows, parks & riverside woods

Species recorded within this habitat are common and widespread. The hedgerow holds potential to support nesting birds. Further recommendations have been made in section 5.3.

Improved grassland /Verge (Target note 5)

A verge was recorded in small sections along the east of Hazely Road. The verge is not continuous but instead limited to areas where the existing drainage ditch is located. These areas are largely dominated by a mixed height sward of grassland and a number of low

herbs. Dominant species in the area include perennial rye-grass with frequent false oat-grass (*Arrhenatherum elatius*). There are a number of herb species including; agrimony (*Agrimonia eupatoria*), creeping cinquefoil (*Potentilla reptans*) and great willowherb (*Epilobium hirsutum*). A full species list has been provided in table 5 below.

Table 5: Species recorded within the verge

Common name	Scientific name	Abundance	Status
Grasses			
False oat grass	*Arrhenatherum elatius*	F	Common in meadows & on road verges
Perennial rye-grass	*Lolium perenne*	A/LD	Common & widespread
Herbaceous plants			
Agrimony	*Agrimonia eupatoria*	O	Common, especially on chalky soils
Lords-and-Ladies	*Arum maculatum*	R	Common, mostly on calcareous or richer soils
Shepherd's-purse	*Capsella bursa-pastoris*	R	Common on wasteland, roadsides & arable land
Great willowherb	*Epilobium hirsutum*	F	Common in fens, marshes, river banks and occasionally drier areas
Cleavers	*Galium aparine*	O	Common & widespread
Common bird's-foot-trefoil	*Lotus corniculatus*	F	Common on grasslands & roadsides, except on very acid soils
Creeping cinquefoil	*Potentilla reptans*	F	Common in lowland hedgebanks, grassland & wasteland
Common fleabane	*Pulicaria dysenterica*	F	Common on clay & wet soils
Bramble	*Rubus fruticosus agg.*	R	Common & widespread
Broad-leaved dock	*Rumex obtusifolius*	O	Common & widespread
Hoary ragwort	*Senecio erucifolius*	R	Common on grasslands on clay or calcareous soils
Common ragwort	*Senecio jacobaea*	O	Common & widespread
Dandelion	*Taraxacum agg.*	O	Common & widespread
Nettle	*Urtica dioica*	O	Common & widespread
Trees and shrubs			
Sycamore	*Acer pseudoplatanus*	R	Introduced, common on richer soils

Species recorded within the verge are common and widespread. The verge holds potential to support reptiles. Further recommendations have been made in section 5.2.

Semi-improved grassland/ Verge (Target note 6)

This verge was located in the far north east of the site along Hazeley Road. This grassland is a mixed high tussock sward that contains a number of tall herbs. The dominant species is cock's-foot (*Dactylis glomerata*) with a frequent distribution of false-oat grass and creeping cinquefoil (*Potentilla reptans*). A full species list has been provided in table 7 below.

Common name	Scientific name	Abundance	Status
Grasses			
False-oat grass	*Arrhenatherum elatius*	F	Common in meadows & on road verges
Cock's-foot	*Dactylis glomerata*	D	Common & widespread
Herbaceous plants			
Yarrow	*Achillea millefolium*	O	Common & widespread
Field bindweed	*Convolvulus arvensis*	O	Common & widespread
Ribwort plantain	*Plantago lanceolata*	F	Common & widespread
Creeping cinquefoil	*Potentilla reptans*	F	Common in lowland hedgebanks, grassland & wasteland
Bramble	*Rubus fruticosus agg.*	R	Common & widespread
Curled dock	*Rumex crispus*	O	Common & widespread
Broad-leaved dock	*Rumex obtusifolius*	R	Common & widespread
Hoary ragwort	*Senecio erucifolius*	O	Common on grasslands on clay or calcareous soils
Common ragwort	*Senecio jacobaea*	O	Common & widespread
Black Bryony	*Tamus communis*	R	Very common in open woods, scrub, hedgebanks on richer or calcareous soils
Dandelion	*Taraxacum agg.*	O	Common & widespread
Goat's-beard	*Tragopogon pratensis agg.*	R	Common on grassland, roadsides & wasteland
Nettle	*Urtica dioica*	R	Common & widespread

Species recorded within the verge are common and widespread. The verge holds potential to support reptiles. Further recommendations have been made in section 5.2.

Native hedgerow (Target note 7)

The central section of hedgerow that runs along Hazeley Road is a native hedgerow. This hedgerow is largely formed from blackthorn and field maple and includes a number of semi-mature whitebeam trees (*Sorbus aria*). The hedgerow is dominated by wild privet (*Ligustrum vulgare*). A full species list is provided in table 6 below.

Table 6: Species recorded within the native hedgerow

Common name	Scientific name	Abundance	Status
Herbaceous plants			
Ramsons	*Allium ursinum*	O	Common in moist woodlands, hedgebanks,

Common name	Scientific name	Abundance	Status
			especially richer or calcareous soils
Cleavers	*Galium aparine*	O	Common & widespread
Stinking iris	*Iris foetidissima*	R	Occasional introduced in woods, hedgebanks, scrub on sea cliffs and inland, mainly on calcareous soils
Trees and shrubs			
Field maple	*Acer campestre*	O	Frequent in woodlands on basic soils, scrub & hedgebanks
Sycamore	*Acer pseudoplatanus*	O	Introduced, common on richer soils
Hornbeam	*Carpinus betulus*	R	Common in woodlands & hedgebanks, especially on loamy & sandy soils
Field maple	*Acer campestre*	A	Frequent in woodlands on basic soils, scrub & hedgebanks
Ash	*Fraxinus excelsior*	O	Common on moister, base-rich soils
Wild privet	*Ligustrum vulgare*	R	Common, especially on calcareous soils
Blackthorn	*Prunus spinosa*	D	Common & widespread
Elder	*Sambucus nigra*	O	Common on nutrient-enriched soils
Whitebeam	*Sorbus aria*	O	Commonly planted within hedges and parkland.

Species recorded within this habitat are common and widespread. The hedgerow is classified as a priority habitat due to its native species composition. The hedgerow holds potential to support nesting birds. Further recommendations have been made in section 5. 1 and 5.3.

4.2.2 Protected species assessment

Badgers

No evidence of badgers, such as mammal holes, foraging signs, latrines, tracks or fur was identified. The hedgerows within the development area are very dense and could not be fully inspected for mammal holes. As no mammal paths were identified in the dense foliage it is considered unlikely that any burrows were missed despite the limited visibility.

Due to the lack of any evidence of badger use within the survey area, it is considered that badgers are absent from site and will not be impacted directly or indirectly by the proposed development.

No further recommendations have been made.

Bats

The majority of the development area did not contain any suitable bat habitats. The section of the works that run adjacent to Hazeley road contains a large hedgerow and some immature trees which could be used by commuting bats.

None of the trees within the survey area contained features suitable to support roosting bats.

There are a total of five known bat roosts within 500 metres of the development area, as shown on MAGIC and as such a known population is nearby and likely to be using the hedgerow as a commuting route. The proposed work will not result in a loss of this commuting route as there is a hedgerow parallel to it and identical in length. This is discussed further in section 5.4.

No further recommendations have been made.

Dormice

There was no evidence of dormice such as nests or feeding remains observed during the walkover survey, but due to the cryptic nature of this species, this is not considered sufficient evidence to determine the absence of dormice on site.

The survey area does contain suitable habitat for dormice in the form of the hedgerow that runs adjacent to Hazeley road and the small area of scrub located adjacent to the hedgerow and the carpark in the centre of the development area.

Though there is suitable habitat for dormouse within the survey area it is considered unlikely that a dormouse population is using the hedgerow as a part of its natural range. The hedgerow is largely isolated from any woodland fragment that could support a

dispersing population. Though a woodland fragment is present to the south of the site it is located over one kilometre from the survey area and any dispersing dormouse would have to have reached the site through a specific route of hedgerow connections. This makes colonisation of the hedgerow unlikely. In addition to this the majority of the hedgerow does not contain a significant proportion of food species as it is largely non-native. As such a self-sustaining population within the development area would not be possible based upon the quality of its habitats.

No further recommendations have been made.

Great crested newts

Though suitable grassland on site is present for great crested newts, a population would require interconnectivity to a nearby waterbody to support the aquatic life stages. The dispersion range for a great crested newt population is approximately 500 metres. The nearest suitable waterbody is located over one kilometre to the north of the survey area. In the event that this pond does contain a viable breeding population of great crested newts, it is unlikely that the population would be dispersing to the habitats on site due to the intervening distance.

It is considered that this species is absent from the survey area. No further recommendations have been made in relation to this species.

Reptiles

The grassland verges along Hazeley Road supports habitat suitable for reptiles. These areas are of a moderate suitability for reptiles as the areas contain a varied mixed height sward that would offer areas of foraging, refuge and basking. The areas of suitable habitat were relatively small and are connected to offsite low suitability arable land on the other side of the hedgerow.

These areas of suitable habitat are quite small and are unlikely to support more than individuals of widespread reptiles. The areas of suitable habitat are also located within the sections of the development where the existing ditch will be cleared out. As such following the ditch clearance it is likely the vegetation will be restored to is present condition. Due to this any impacts to any reptiles are likely to be transitional in nature and will not result in permanent habitat loss.

During works along Hazeley road there will be the temporary loss of small areas of suitable reptile habitat that will have the potential to cause adverse impacts to low numbers of reptiles.

Further recommendations have been made in section 5.2.

Nesting birds

Although no evidence of previous nests was observed with the survey area, hedgerows, mature trees and scrub within the development area hold potential to support nesting birds.

As the development proposals will likely result in the removal of sections of these habitats mitigation to prevent the damage or destruction of active bird's nests will be required.

Further recommendations have been made in section 5.3.

Hedgehog

A dead hedgehog (*Erinaceus europaeus*) was found on the gravel hardstanding that is located next to High Street. This species is listed under section 41 of the NERC act 2006 and as such is a priority species. The presence of a dead individual indicates the local area holds a population that is using the habitats where the proposed drainage works will occur.

The development works are unlikely to directly encounter a hedgehog or result in impacts to an individual as they are highly mobile and are unlikely to remain in the area once works begin. However, as the works will involve low excavation, measures to prevent the trapping of this species in the new ditches will be required.

Further recommendations have been made in section 5.4.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The site comprises hardstanding, tarmac, scrub, native and non-native hedgerows along with grass verges. The species recorded within these habitats are common and widespread and the site is generally considered to hold low ecological value. The predicted impacts in absence of mitigation to protected species are as follows:

- Impacts upon the River Itchen SAC.
- Potential loss of a priority habitat (hedgerow).
- Potential impacts to priority species (hedgehog).
- Loss of suitable habitat for reptiles.
- Loss of suitable habitat for nesting birds.

Recommendations to mitigate for these impacts and general recommendations for enhancing the ecological value of the site have been provided below.

5.1 Designated sites

5.1.1 River Itchen

The site is located 300 metres east of the River Itchen SAC/SSSI. The proposed works at this site will ensure that there is an increased capacity to retain water on site which will in turn reduce the level of discharge into the River Itchen. Therefore, the proposed works will benefit the site rather than negatively impact it.

As the drainage ditches are located next to a road and residential area they will also capture any pollutants that run off from the local area. It is advised that some form of suitable pollution capture system is installed to ensure that in the event of a major pollution incident, such as a car accident or foul water leak no pollutants enter the River itchen.

During the works a Construction Method Statement (CMS) will be implemented during the works. The following matters will be addressed in the CMS:

- Details of how materials / chemicals will be stored and controlled on-site to avoid pollution and siltation (for example, all plant will be fitted with drip trays in order to avoid potential pollution incidents and no re-fuelling will take place on the site).
- Details on the proposed construction methodology including factors such as construction access, methods of construction, timing of work and working hours.
- Industry standard dust suppression methodology.

5.1.2 Priority Habitat

The native hedgerow that runs along the eastern section of Hazely Road is a priority habitat. The proposed works will involve the clearance of the existing ditch and the creation of a new ditch within close proximity of the hedgerow. This may result in terminal damage to the root systems of the mature trees in the area. If this occurs it is advised that replanting is undertaken to restore the hedgerow. Measures outlined in section 5.4 will be suitable to compensate for the minor impacts that may occur.

5.2 Reptiles

5.2.1 Summary of findings

Within the verges of Hazeley road there are some small areas of suitable reptile habitat that are likely to hold low number of widespread reptiles. There is the potential for adverse impacts during the works to restore ditches in these areas which are likely to result in the temporary loss of these habitat sections and involve the movement of machinery over the area that could cause the killing or injury of individual reptiles.

5.2.2 Implications of survey findings and recommendations for further actions

The areas of reptile habitat within the development area are very small and are unlikely to hold more than a low population of reptiles. The most practical means of mitigation would be to render the habitat unsuitable for reptiles during the duration of the works through habitat manipulation and disperse the population to the surrounding suitable habitat. The surrounding habitats are grassland and are likely to be functionally linked to the areas of habitat on site.

- The habitat manipulation should be undertaken during May-October when reptiles are active.
- If works occur during the inactive period then no habitat manipulation will be required to the grassland. However, as the hedgerow holds potential to support hibernating reptiles it will need to be removed, including the stumps, prior to the start of the hibernation period.
- The habitat manipulation of the areas will involve two successive cuts using a handheld strimmer in temperatures above 10°C. The first cut will be made to a height of ten centimetres and an hour later the second will be made down to ground level. The cuts will be made directionally from the road towards the offsite vegetation.

5.3 Nesting Birds

5.3.1 Summary of findings

The scrub and hedgerows recorded on site hold potential to support nesting birds. The following precautions should negate risk of harming, injuring or contributing to the demise of these species:

5.3.2 Mitigation

- Removal of any trees and vegetation should, where possible, be undertaken outside of the bird nesting season, this is considered to extend from the 1st March to the 31st August, or if this is not possible, must be done under the supervision of an ecologist to ensure that nesting birds are not harmed.
- Where nesting birds are encountered, clearance must be postponed until the nestlings have fledged.

5.4 Hedgehog

5.4.1 Summary of findings

During the survey a dead hedgehog was recorded by the road and this indicates a population is in the area. This species is listed as a priority species. It is unlikely that this species will be directly impacted by the proposed works, however this species is mobile and may become trapped in the new ditch network and cause injury.

5.4.2 Mitigation

To prevent hedgehogs becoming trapped it is advised that the new ditch and restored ditch sections are graded, at least in part, at low angle to allow this species to move in and out of the ditch network. The ecological enhancements detailed in section 5.5 will provide additional foraging habitat for this species.

5.5 Ecological enhancement

Enhancement measures to increase the ecological value of the site are provided below:

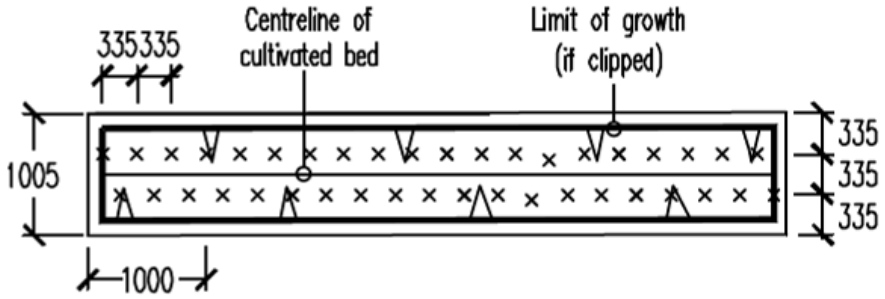
- The grassland verges will be sown with Emorsgate EG8 meadow grass mixture for wet soils. This will encourage plant and invertebrate diversity and is a seed mix tolerant of seasonal flooding.
- Any hedgerows that are removed will be replaced by hedgerow planting that is equivalent to the length of habitat lost. This will be done using native species mix

using species listed below in table 7 following the planting pattern outlined in diagram 1.

Table 7: Species to be included in hedgerow/shrub planting

Species	Proportion within hedgerow
Spindle	15%
Hawthorn	10%
Blackthorn	5%
Field maple	25%
Elm	5%
Hazel	15%
Elder	5%
Crab apple	5%
Guelder-rose	15%

Diagram 1: Planting Pattern



6.0 REFERENCES

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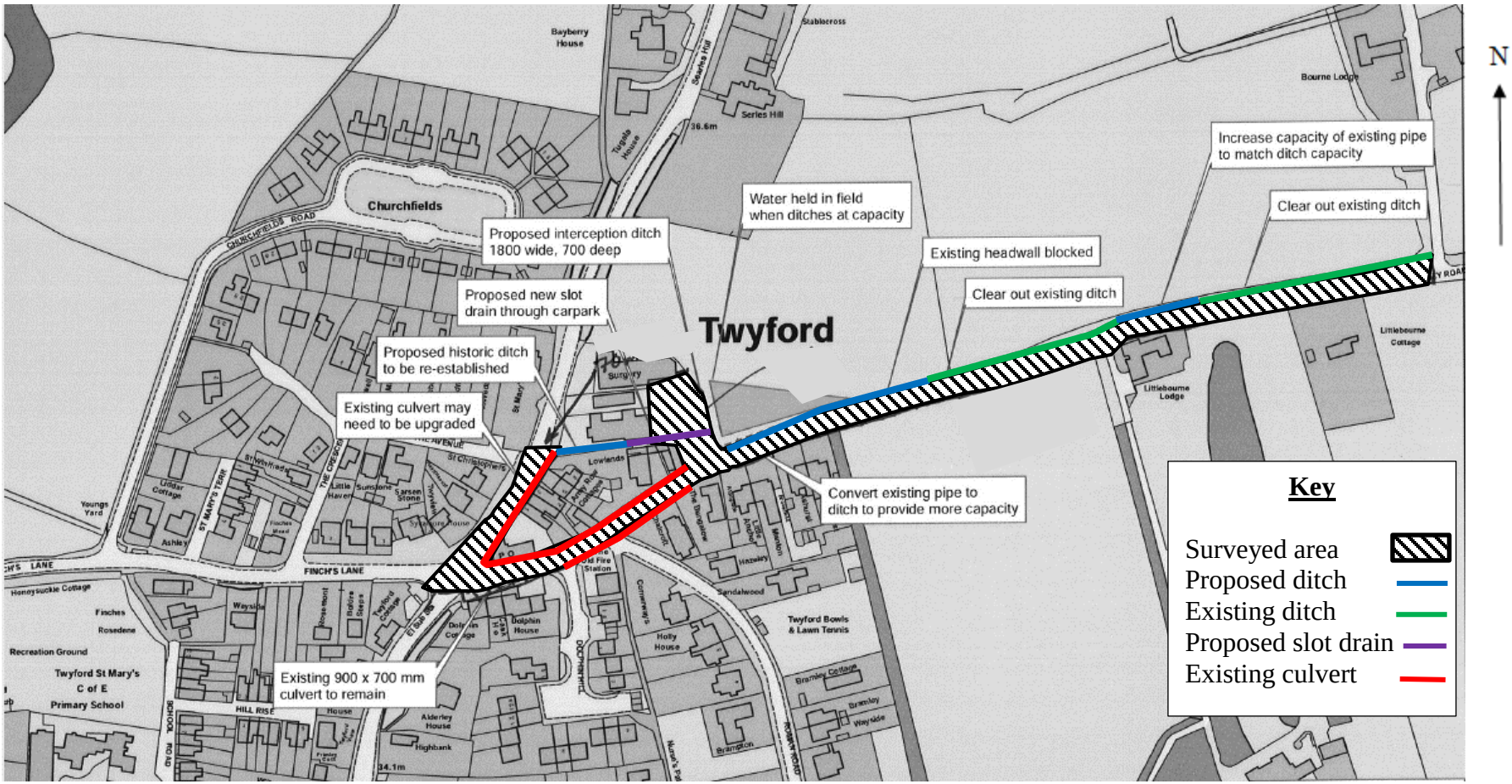
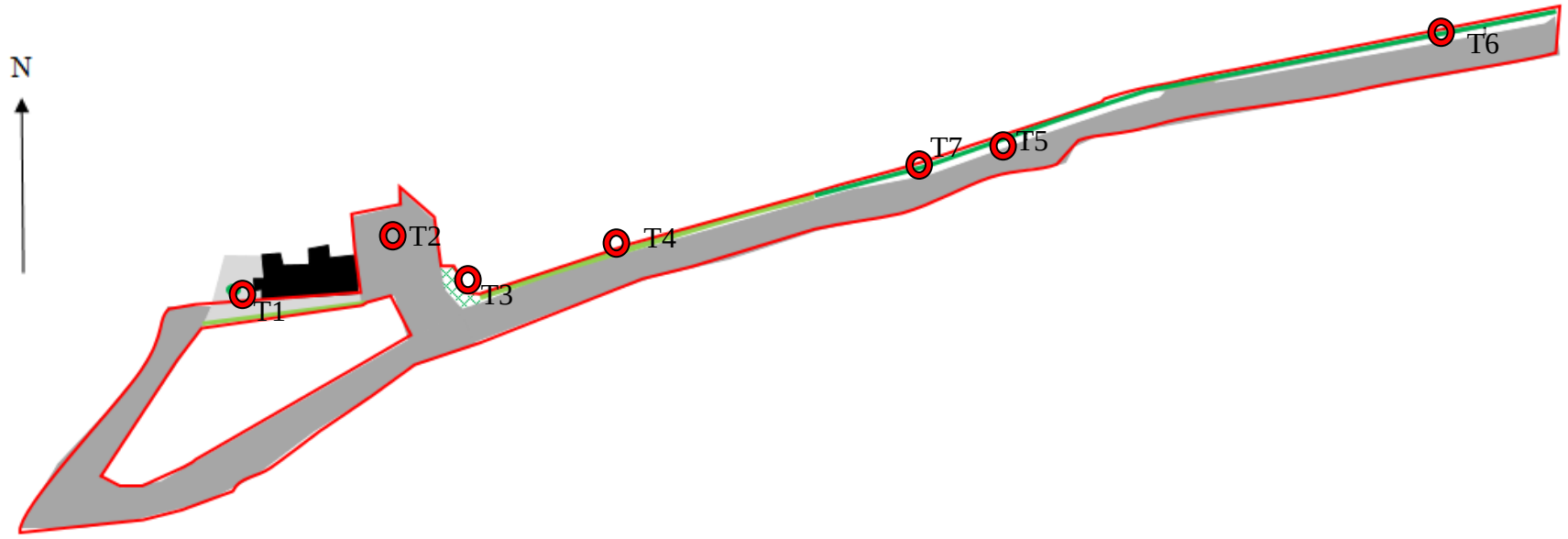
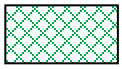
APPENDIX I: SITE LOCATION PLAN AND DESIGN PROPOSALS



APPENDIX II: PHASE 1 HABITAT MAP



Key to Phase 1 Habitat Map

Habitat Code	Description
I	Improved grassland
	Building
	Hardstanding
	Dense scrub
	Mature tree
	Non-native hedgerow
	Native hedgerow
	Survey area
 T1	Target note

Target notes to accompany Phase 1 habitat map

Target Note	Description
T1	An area of gravel hardstanding is present to the west side of the site. Species present are all rarely distributed and include common sorrel (*Rumex acetosa*), scarlet pimpernel (*Anagallis arvensis*), dandelion (*Taraxacum agg.*), Cock's foot (*Dactylis glomerata*), smooth sow-thistle (*Sonchus oleraceus*), annual meadow-grass (*Poa annua*), perennial rye-grass (*Lolium perenne*), shepherds purse (*Capsella bursa-pastoris*), false wood broom (*Brachypodium sylvaticum*)
T2	An area of tarmac hardstanding. This area is very actively used and has not been colonised.
T3	An area of scrub is present in the south east corner of the car park as it joins Hazeley Road, species present include dominant bramble (*Rubus fruticosus agg.*), abundant snowberry (*Symphoricarpos sp*.) frequent nettle (*Urtica dioica*), hedge bindweed (*Convolvulus arvensis*), and rare hogweed (*Heracleum sphondylium*).
T4	A non-native section of hedgerow that is dominantly formed from snowberry. This area also contains occasional distribution of field maple (*Acer campestre*), sycamore (*Acer pseudoplatanus*) and ash (*Fraxinus excelsior*). There was also an occasional distribution of nettle, hogweed (*Heracleum sphondylium*) and cleavers (*Galium aparine*) within the understorey. Frequent species in this area include; ivy (*Hedera helix*), bramble, dandelion, hazel (*Corylus avellana*) and hawthorn (*Crataegus monogyna*). There was a rare distribution of; Lords-and-Ladies (*Arum maculatum*), spear thistle (*Cirsium vulgare*), stinking iris (*Iris foetidissima*), dogwood (*Cornus sanguinea*), wild privet (*Ligustrum vulgare*), blackthorn (*Prunus spinosa*), oak (*Quercus robur*), elder (*Sambucus nigra*) and elm (*Ulmus procera*)
T5	An improved grassland road verge with abundant to locally dominant perennial rye-grass (*Lolium perenne*) with frequent false oat grass (*Arrhenatherum elatius*). There is a frequent distribution of common bird's-foot-trefoil (*Lotus corniculatus*), great willowherb (*Epilobium hirsutum*), creeping cinquefoil (*Potentilla reptans*) and common fleabane (*Pulicaria dysenterica.*). There is an occasional distribution of nettle, cleavers, dandelion, common ragwort (*Senecio jacobaea*), agrimony (*Agrimonia eupatoria*) and broadleaf dock (*Rumex obtusifolius*). This area contains a rare distribution of; Lords-and-Ladies, bramble, hoary ragwort (*Senecio erucifolius*), shepherds' purse (*Capsella bursa-pastoris*) and sycamore saplings.
T6	A semi-improved grassland verge that is dominantly Cock's foot with frequent false-oat grass. There is also a frequent distribution of ribwort plantain and creeping cinquefoil This area contains an occasional distribution of yarrow (*Achillea millefolium*), field bindweed (*Convolvulus arvensis*), curled dock (*Rumex crispus*), common ragwort, hoary ragwort and dandelion. There is a rare distribution of bramble, broadleaf dock, black bryony (*Tamus communis*), nettle and goat's beard (*Tragopogon pratensis agg.*).
T7	A section of native hedgerow. This hedgerow is dominantly formed of blackthorn (*Prunus spinosa*) with abundant field maple (*Acer campestre*). There is occasional distribution of; sycamore, ash, elder, whitebeam (*Sorbus aria*), cleavers and ramsons (*Allium ursinum*). There was a rare distribution of stinking iris, wild privet (*Ligustrum vulgare*) and hornbeam (*Carpinus betulus*)