Detecting the Presence of the European Otter (*Lutra lutra*) in Areas Facing Urban Development. An Analysis of Potential Threats and Possible Safety Mitigations.

A Dissertation submitted by

Lisa Anna Stephens

BSc (Hons) Applied Animal Management (Top-Up)

I hereby declare that the dissertation submitted is wholly the work of Lisa Anna Stephens.

Any other contributors or sources have either been referenced in the prescribed manner or are listed in the acknowledgements together with the nature and scope of their contribution

School of Tourism
Bournemouth University
and
Bridgwater College
Animal Care, Equine and Agriculture
(2001)

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Abstract

A survey was carried out to determine the presence of the European otter Lutra lutra in specific areas of Somerset. South West England. Data was collated via physical signs (padding and spraint) over a six week period. Positive otter evidence was found in all four areas. The lowest overall mean percentage of positive evidence found was 33% and the highest was 89%. There was no significant difference between the overall findings within each area. The findings were used to devise predicted foraging routes for the local population of otters. The four surveyed areas are facing urbanisation due to developments for a new nuclear power station by EDF Energy. The proposed plans were analysed alongside the predicted foraging routes and potential threats were predetermined. Safety mitigations were suggested to EDF Energy. Mitigations were undertaken in some instances but others remain under review. Public opinion was investigated through a questionnaire. Results illustrated a strong support for modifications in the proposed plans to best protect the European otter.

Word Count: 9975

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A survey was carried out to determine the presence of the European otter Lutra lutra in specific areas of Somerset, South West England. Data was collated via physical signs (padding and spraint) over a six week period. Positive otter evidence was found in all four areas. The lowest overall mean percentage of positive evidence found was 33% and the highest was 89%. There was no significant difference between the overall findings within each area. The findings were used to devise predicted foraging routes for the local population of otters. The four surveyed areas are facing urbanisation due to developments for a new nuclear power station by EDF Energy. The proposed plans were analysed alongside the predicted foraging routes and potential threats were predetermined. Safety mitigations were suggested to EDF Energy. Mitigations were undertaken in some instances but others remain under review. Public opinion was investigated through a questionnaire. Results illustrated a strong support for modifications in the proposed plans to best protect the European otter.

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Contents

1. INTRODUCTION

The European otter *Lutra lutra* is one of the UK's most elusive mammals. In the late 1900's this species faced extinction in many parts of the UK. It is through legislation and proactive conservation measures that the population has now increased. Continuous urbanisation tenders a threat to this protected species. Proposed plans for a nuclear power station development by Électricité de France Energy ('EDF' hereafter) may threaten any otters inhabiting in areas facing urbanisation. In order for safety mitigations to be considered, there must be proven evidence of otter presence. This study aims to detect any European otters within proposed development areas and assess any impending perils.

2. LITERATURE REVIEW

2.1. The European Otter *Lutra lutra*

2.1.1 Taxonomy

Table 1: Taxonomic Classification of the European Otter *Lutra lutra*

Kingdom	Phylum	Class	Order	Family
Animalia	*Chordata*	*Mammalia*	*Carnivora*	*Mustelidae*

(Information taken from IUCN 2009)

The European otter, also known as the Eurasian otter, Common otter and Old World otter has seven subspecies outside of the UK according to Pocock (1941). Scientists such as Kranz (1995) and Kruux (2006) would argue that there are no proven subspecies to European otter.

2.1.2 Population and Range

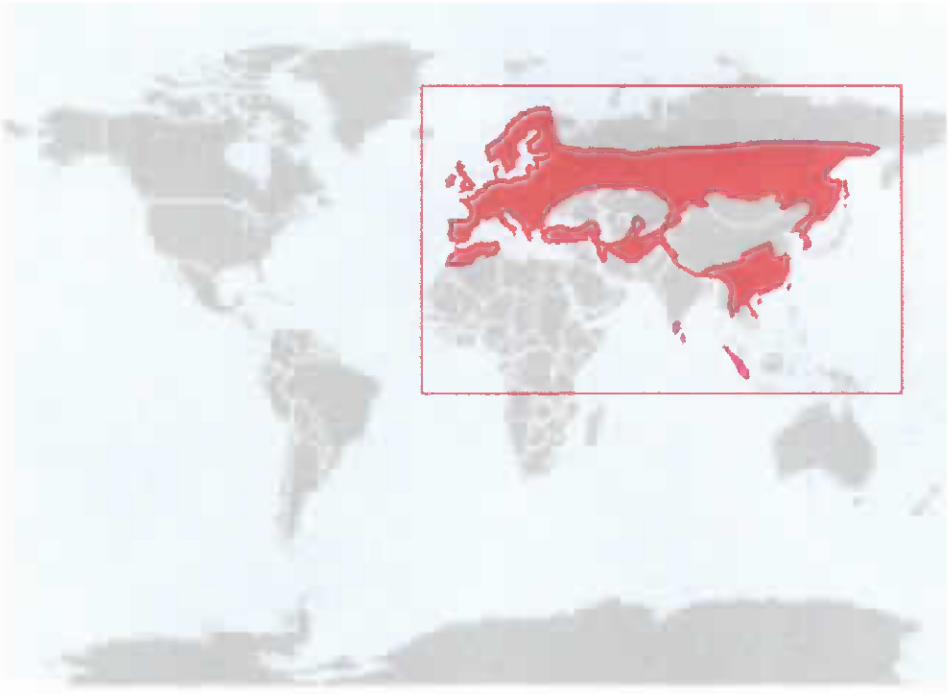


Figure 1: European Otter Distribution

(Taken from IUCN 2010)

The European otter has the widest distributions of all Palaearctic mammals (Figure 1). It is the only species of otter found in the UK (Wildlife Britain 2007). Figure 2 shows the distribution of otters within the UK.

Figure 2: UK Otter Distribution Pre 1995 (black) and areas of increased population Post 1995 (red).
(Taken from JNCC 2010)

Figure 2 illustrates the increase in otter population since 1995[1]. The dramatic decline in otter population is thought to be a result of a wipe out of much of its range between 1950 -1990[2] (Wildlife Britain 2007). The otter population has since increased due to being a focal point for British conservation (Wildlife Trust 2009). The European otter is listed as *near threatened* on the IUCN Redlist for Endangered Species (IUCN 2009) and. although numbers within the UK have increased in the last two decades, the distribution is still considered unstable and in

[1] Otter populations are estimated through the National Otter Survey which is evidence based and carried out over alternative 50km squared sampling areas therefore the accuracy is inconclusive
[2] The introduction of the non-native America mink (*Mustela* vison) in the 1920's after the release from fur farms had a direct effect on the otter population due to resource competition (Lack 1954). Exploitation may have had a role in the plummeting otter population in the twentieth century; up until the 1960's otter hunting in England was a popular sport, trapping for fur occurred and they were even considered an honorary fish dish by the Roman Catholic Church (Kruuk 2007).

need of constant monitoring and protection by conservation organisations and researchers (Jefferies *et al* 2000; Williams 2010; Wildlife Trust 2009; Wildlife Britain 2007). Similarly, the IUCN claim that the *near threatened* listing is a precautionary approach, as it indicates that the recovery in Western Europe is genuine and that the conservation actions for this species need to be sustained. It is difficult to estimate the population of otters throughout the UK due to their elusiveness. The Environment Agency (2010) carried out its 5th national otter survey in England in 2009 – 2010[3] from which 56% of sites had positive findings. James Williams, Chairman of the Somerset Wildlife Trust Otter Group (SWTOG hereafter), claims that a recent survey showed there are an estimated 67 otters in Somerset (Personal communication 4 October 2010). Figure 3 shows the highest positive findings of otter evidence occurred in Somerset and West Devon (grid number 90).

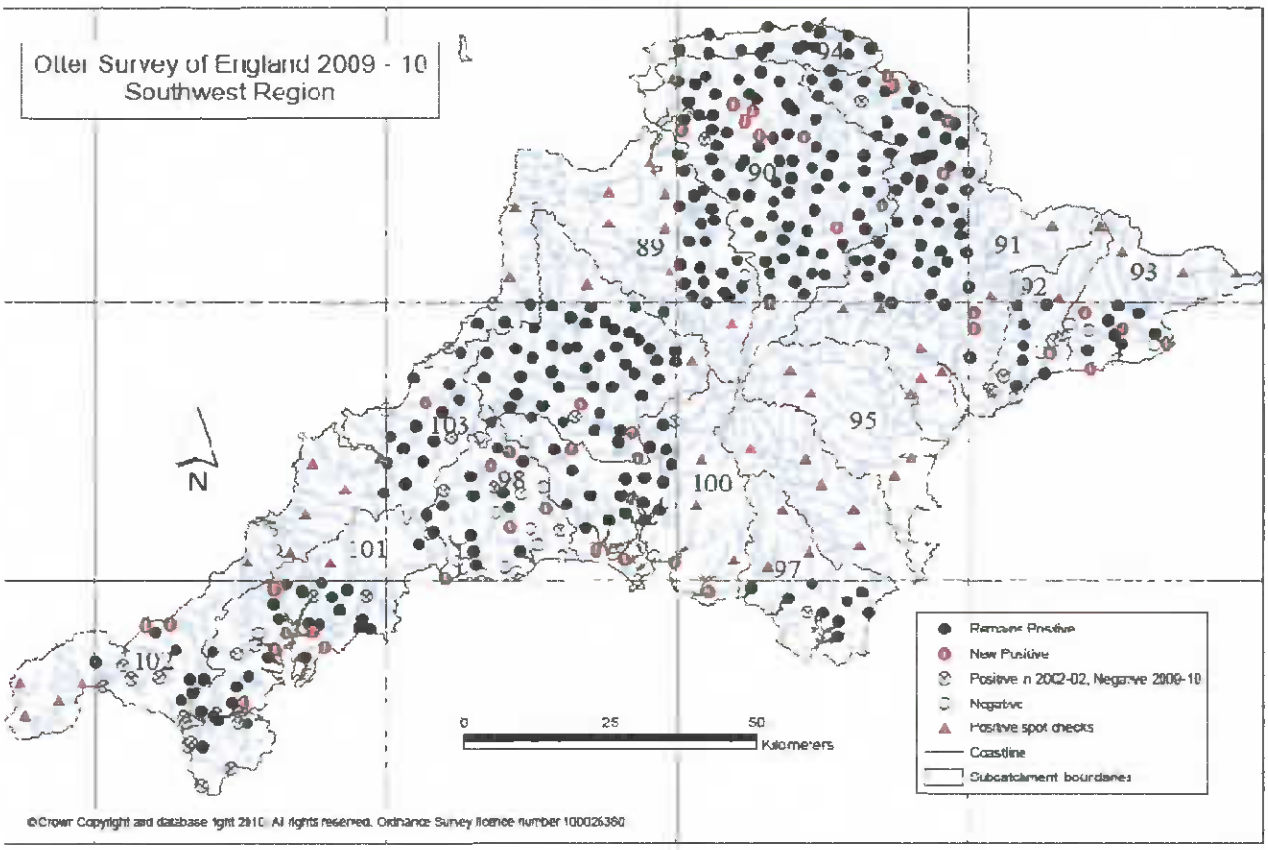


Figure 3: The National Otter Survey Results From 2009 - 2010 Illustrating New and Remaining Evidence in the South West Region.
(Taken from the Environment Agency 2010)

[3] The national otter survey was carried out in 3327 sites across England using thirty eight 50 x 50km squares as a sampling grid. Footprints and faeces (spraints) were recorded (Environment Agency 2010)

2.1.3 Habitat

European otters may inhabit lowlands or highlands and may utilise many types of water sources. They are often connected to linear living spaces such as stretches of rivers and streams (Channin 2003). Holts are compulsory for otters in order to carry out breeding. These may be cavities in river banks or trees or piles of rock or debris (Jefferies *et al* 2000). A study on holt distribution in Scotland revealed an average spacing between holts was 11km (Kruuk and Hewson 1978)

Figure 3a: Holt Entrance on a Stream
(Taken from Nature Diary 2005)

Figure 3b: Holt in a River Bank
(Taken from Wildlife Direct 2010)

2.1.4 Physiology

The European otter exhibits physical features that are typical of the *mustelidae* family (table 2). Otters have thick and dense fur thought to be an adaptation to reduce energy costs in extreme weather. Unlike many aquatic mammals, they do not possess a layer of blubber for thermo-insulation, but are sufficiently lean for their foraging demands (Pfeiffer and Culik 1998).

Table 2: Physical Characteristics of the European Otter

Colour	Dark brown with a lighter underside and creamy patches on the chin and throat (figure 4a).
Average length (nose – tail tip)	Adult bitch (female): 1m Adult dog (male): 1.2m
Average weight	Adult bitch: 5 - 7kg Adult dog: 8 - 12kg
Body shape	Long and slender with an arched cervical spine and humped lumbar spine. Short limbs and comparably large feet. The hind feet are slightly larger than the front (figure 4b).

(Information taken from Mason and MacDonald 1986; Williams 2000; Williams 2010)

Figure 4a: The European Otter *Lutra lutra* Approaching the River Bank
(Taken from Wildlife Extra 2008)

Figure 4b: The European Otter *Lutra lutra;* an Illustration of its Physique
(Taken from Nelson 1998)

2.1.5 Ecology and Behaviour

The European otter is semi aquatic and mostly nocturnal, although Kruux (2006) claims otters living near the sea are diurnal[4]. This may be in correlation with solar rhythm which affects the day length and subsequently day/night time activity of their prey. They are typically a solitary species except during mating season and post gestation when the cubs remain with their mother for up to a year (Channin 2003). Some females live in group territories where their spaces may overlap but they remain out of one another's way. Males are highly territorial and so each possess territories of around 8km of river or stream (Erlinge 1968: Channin 2003).

2.1.5.1 Foraging Behaviour

The otter will both swim and travel overland for many kilometres, foraging along the way, in order to consume sufficient quantities of protein (Kranz 1995: Williams 2000). Research suggests that an otter will utilise particular adjoining routes within an area to forage before returning back to its holt (Pfeiffer 1998; Williams 2010). The 5th national otter survey advocated that streams in the South West region are not sufficient for foraging due to size and water degradation therefore otters forage in sea water. Otters are not physiologically adapted to marine use therefore, once foraging has occurred, they utilise fresh water sources to wash salt from their fur and as rest areas (Environment Agency 2010). This behaviour would explain the increased use of estuarine coastal sites from 7 in the 1st national survey (1977) to many more in 2010 (figure 3). Otters minimise energy expenditure by pursuing the most direct routes to a water source. When travelling overland, the otter usually bounds or canters resulting in four pad markings close together, a space, then the pattern repeats (figure 5) (Sussex Otter Group 2009; Wildlife Britain 2007). They are versatile foragers known to catch rabbits, frogs and small birds but mostly consume bottom dwelling fish which they dive to the bottom of rivers to catch (Channin 1985).

[4] Studies carried out at in Shetland determined the European otters in that area were entirely diurnal (Kruuk 2006; Williams 2000)

Figure 5: Otter Padding in the Snow at Combwich Estuary (Stephens 2010)

2.1.5.2 Communicative Behaviour

The overlapping of territories is thought to result in subsequent communication. Scent marking occurs in strategic spots on riverbank ledges or large rocks with their faeces (spraint) (Hutchings and White 2001; Kruux 2006). Researchers dispute the predominant reason spraint signalling arises. Kranz (1995) and Erlinge (1968) claim it is little to do with territorial behaviour but rather the otters mark their ranges with spraint in strategic places as an indicative signal to other otters, and possibly other species, of their presence. Channin (2003). Hutchings and White (2001) and Mason and MacDonald (1986) state that scent marking is predominantly a territorial behaviour. A study by Rostain *et al* (2004) suggests that otters also use spraint marking as an advertisement of their reproductive state or to communicate their social status and identify group members. Kruux's case study in 1992 determined there was no increase in spraint concentration on territory boundaries. Kruux proposes sprainting is an advantageous system utilised by otters to signal areas of post exploitation and subsequent low resources. Williams (2000; 2010) believes spraint signalling is a communication of all of the above. Despite different theories, all researchers claim that scent marking is carried out by all European otters. Anal jelly is sometimes present along with the spraint. Researchers suggest the slimy, orange/green, marmalade-like substance is the secretion of the gut lining which acts as a protective lubricant against the sharp, undigested bones (Rostein *et al* 2004; Kruux 1992). The presence of spraint and anal jelly are used to monitor otter populations and movement by researchers.

2.2 Current Threats within the UK

The most common current threats to the European otter are habitat loss, destruction or degradation and incidents occurring on black spots on roads[5] (Wildlife Trust 2009). Williams (2010) claims that between 80 – 90% of otter carcasses handed in to the SWTOG are a result of road traffic accidents. A sample of 113 otter carcasses in Shetland were analysed for cause of death by Kruuk and Conroy (1991) indicating 49% were killed by vehicles. Other causes of death were starvation (9%) bite wounds (8%), haemorrhaging of the stomach (2%), liver damage (1%), Pneumonia (1%) and unconfirmed (30%). A further study was carried out a year later which exemplified an increase in road traffic mortalities to 86% in Shetland (Kruuk 2006). The IUCN (2010) describe the otters' aquatic habitats as extremely vulnerable to man-made changes. Developments such as canalisation of rivers, dam construction, wetland drainings and aquaculture, agriculture and urban developments have an unfavourable impact on their habitats (Reuther and Hilton-Taylor 2004). Due to extensive land and water use by otters, developments (mentioned above) are likely to result in direct habitat or foraging route loss, fragmentation and destruction or loss of holts utilised for breeding and shelter. Since research suggests otters navigate via the most direct route, this often results in them exiting the water sources thus exposing themselves to potential dangers such as areas of high traffic volumes (Williams. Personal Communication November 2010). According to the Scottish Natural Heritage (2010), otters are often vulnerable to such impacts although there are no publicised studies confirming the effects a development has had on a surrounding population.

A decline in water quality due to chemical and physical pollution is also a major threat to otters in the UK. According to the IUCN (2010), organochlorines dieldrin, polychlorinated biphenyls (PCB's) and the heavy metal mercury are the main pollutants affecting the European otter. Post mortems carried out on otters in Shetland revealed traces of PCB's, organochlorines DDE, lindane and mercury in over 50% of the sample (Kruuk and Conroy 1991). The source of the pollutants is not stated. Otters analysed in Shetland surround an industrial park and oil terminal which may be the source although this remains unconfirmed. The Environment Agency's technical report states until recently, pollution was a major cause of otter mortality although the ban of pesticide use has assisted in the recovery of populations

[5] 673 mortalities of the Eurasian otter due to road traffic accidents were recorded between 1971 – 1996 (Philcox *et al* 2001)

throughout the UK. They claim the biggest current threat is urban encroachment along river corridors (Environment Agency 2010)

2.3. Current Conservation within the UK

2.3.1 Legal Protection

Legislation for the protection of otters was first put in place in 1978 in England and Wales under the Conservation of all Creatures and Wild Plants Act 1975. This resulted in an immediate reduction in direct persecutions (IUCN 2010). The Wildlife and Countryside Act 1981 (WCA) extended this protection to their resting places (holts) and habitats (Environment Agency 2010). The otter is also protected under European law[6] (CITES 2010). Collectively the legislation states that under no circumstances should this species of otter be deliberately or recklessly disturbed. harmed, captured or killed and habitats, breeding sites and rest areas (including access areas) must not be obstructed or damaged (Environment Agency 2010).

2.3.2 UK Otter Conservation Organisations and Strategies

The Otter Species Action Plan was developed under the UK Biodiversity Action Plan (BAP) by the Environment Agency and the Wildlife Trusts (Environment Agency 2010). Actions included consistent monitoring and recording of otter distribution. water quality analysis and improvement measures, habitat restoration and protection and species management and protection (BAP 1995). There is a steady correlation between the start of the action plan and an increase in otter population in the 1990's suggesting actions were successful. The Wildlife Trusts carry out localised otter surveys over the UK and raise awareness and education regarding the European otter and its threats.

Reintroductions prove to be controversial due to live trapping and transportation which may cause possible stress and injury for the mammals. The Eurasian otter has been successfully reintroduced into parts of Europe including Eastern England in 1996 (Reading and Clark

[6] The otter is protected under the EC Directive 92/43 Conservation of Natural Habitats and Wild Fauna and Flora (the Habitats Directive). This is now the national legislation by the Conservation (Natural Habitats, &c.) Regulations 1994, which was replaced by the Conservation of Habitats and Species Regulations 2010. The otter is also listed in Appendix II of the Berne Convention and in Appendix II of The Convention on International trade in Endangered Species 1973 (CITES 2010).

1996). Guidelines regarding the reintroduction of otters have been put forward by the IUCN who claim that the European Breeding Programme has successfully reintroduced otters back to areas of former habitat. Reintroduction into suitable habitats in the UK could increase the lack of genetic diversity which is thought to be a result of the near extinction in the 1990's. Economic and welfare costs surrounding this make it impractical (Dallas *et al* 2002)

2.3.3 Justification for Conserving the European Otter

The European otter is described as an emblem for nature conservation in the UK by the Environment Agency (2010). Monitoring the status of the otter provides a measure of the state of water and wetland biodiversity. Mason and Macdonald (1986) claim the existence of otters as an indicator of a healthy wetland environment and that any aquatic area supporting viable populations of otters are likely to have a healthy ecological condition. Kruux (2006) claims that otters are ambassadors for a clean environment and the destruction of their habitat indicates a destruction of a whole ecosystem. It is conceivable to describe the European otter as a flagship species for British wildlife. The return of otter populations has assisted in driving out the non-native American mink and subsequently preserving native ground nesting birds and water vole *Arvicola terrestris* (Garcia *et al* 2009). According to the Wildlife Trust (2009) there is an aesthetic argument for conserving this species since many keen wildlife watchers appreciate the presence of this elusive native mammal[7]. The near extinction period in the 1960's proves a lack of conservation measures has significant affects. With an ever increasing population and need for urban developments, it is even more vital that precautions are implemented and monitored in order to conserve this species.

[7] A Recent survey carried out by the Wildlife Trust suggested that 56% of participants preferred the Eurasian otter over other native mammals

2.3.4 Protection against Developments and Planning

Provision of licensing[8] is required for a proposed development to occur in areas which impose a potential threat to protected wildlife listed under the WCA. Species specific safety mitigations are put forward by Natural England and Wales County Council/Welsh Assembly Government (2007) (table 3). The specific recommendations are not legally binding. Despite this, it may be regarded as an offence under section 9 of the WCA and Countryside and Rights of Way Act 2000 if they are not implemented since deliberate disturbance could be avoided by correct planning and sufficient mitigations. Licences for development operations which will result in direct disturbance to otters may still be given if there are imperative reasons for over-riding public interest (Natural England 2007). There is no elaboration on *imperative reasons for over-riding public interest* available.

[8] Licences are provided by Natural England or the Wales County Council/Welsh Assembly Government

Table 3: Recommended Safety Mitigations to be Implemented for Proposed Development Plans in accordance with the Countryside and Wildlife Act 1981

Recommended Protection of the Otter	Recommended Protection of the Habitat
An area of 30m surrounding otter routes and resting places should be out of bounds during construction and development.	
If breeding is suspected to commence during construction, work should be suspended until a) breeding is no longer occurring at the resting site b) cubs are old enough to utilise alternative sites.	Vegetation surrounding habitats and routes should remain untouched.
In the case of breeding and if work cannot be suspended, the out of bounds zone should be expanded to 100 - 200m surrounding otter breeding sites.	New public paths should not be placed closer than 30m to suspected otter holts.
Precautions must be placed in road developments which cross otter routes or water sources: Culverts and tunnels to go under roads or fencing to prevent otters from crossing roads.	River banks and lake shores must remain unaffected by recreational developments.

(Information taken from Natural England and Wales County Council/Welsh Assembly Government 2007; Environment Agency 2010)

2.4 Proposed Planning of the Hinkley Point Station Development

EDF Energy propose to develop a new nuclear power station 'Hinkley C' next to the pre-existing A and B stations on the Somerset Coast (figure 6)

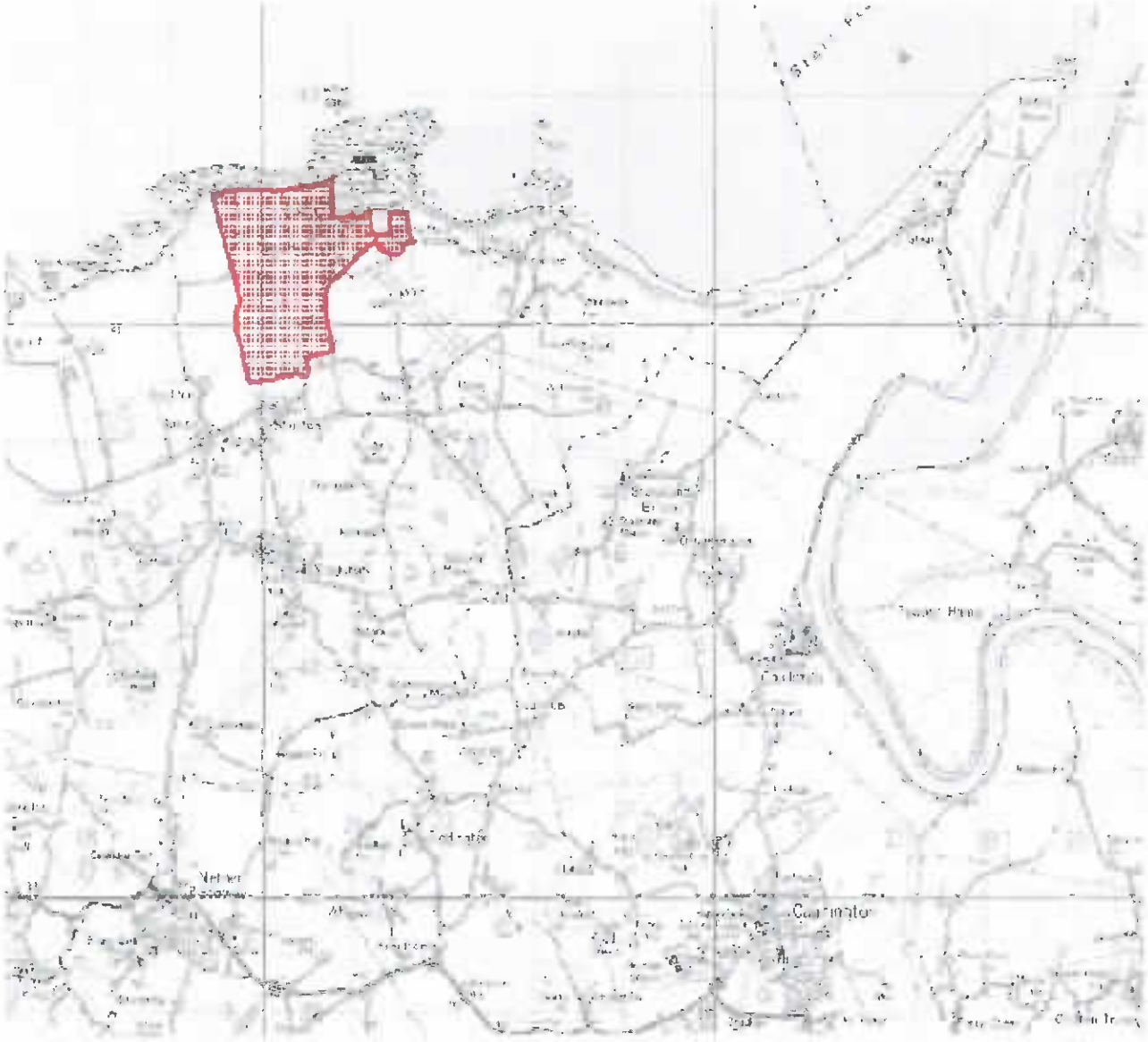


Figure 6: Proposed Location for New Nuclear Power Station – Hinkley C
(Taken from Hinkley Point Planning Agreement 2009)

Hinkley C will consist of numerous developments within the Somerset area. Including the main site. this study focuses on four of the major proposals as shown in figure 7.

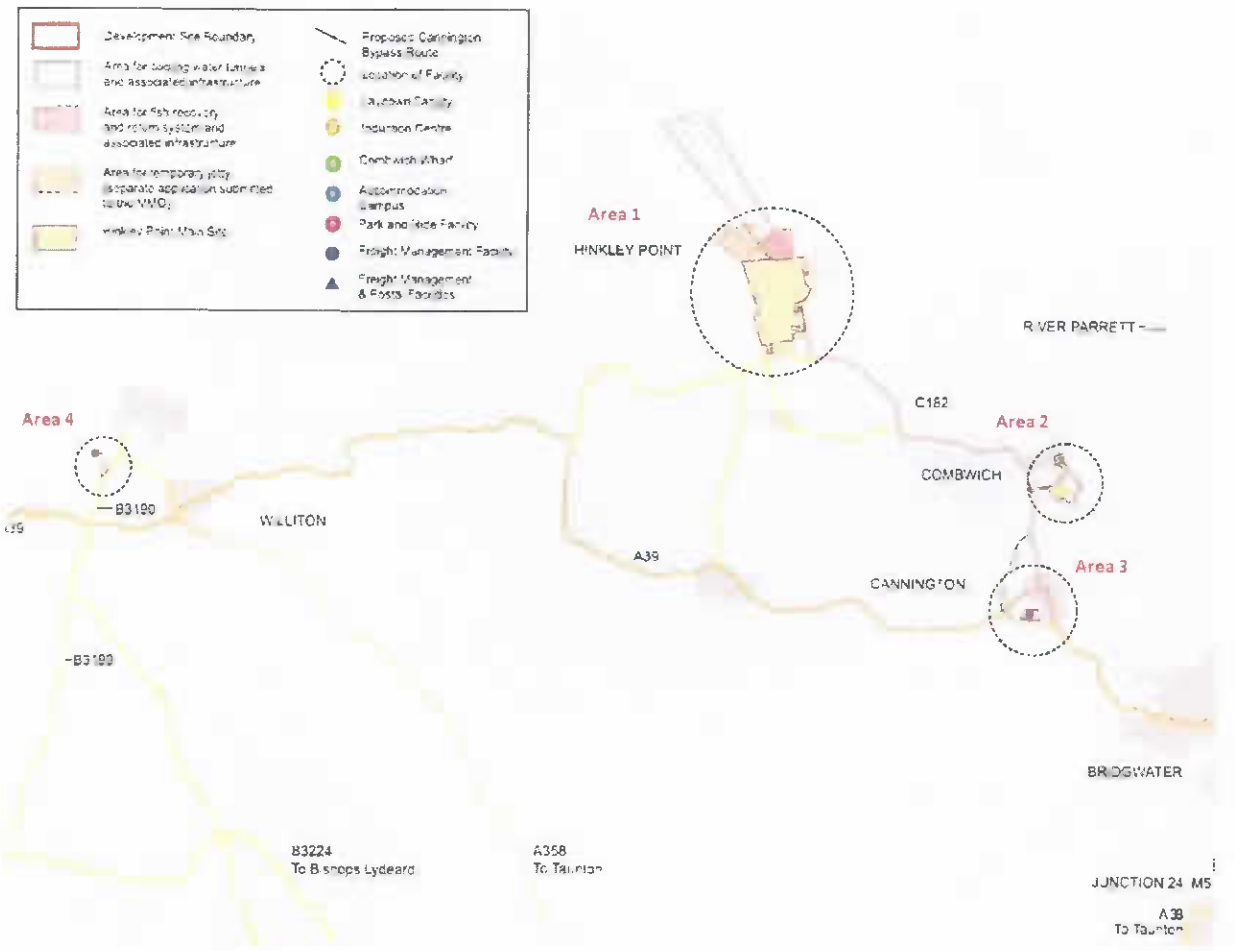


Figure 7: Proposed Development Areas for Hinkley Point C Power Station. (Area 1 = proposed main site station. Area 2 = proposed freight. Area 3 = proposed bypass. Area 4 = proposed park and ride)
(Edited from Hinkley Point Planning Agreement 2009)

2.4.1 Area 1 Proposal Plan

The main development site and proposed area coverage is illustrated in in figure 7. The new station will cover the area from the coast and beyond down the village of Shruton.

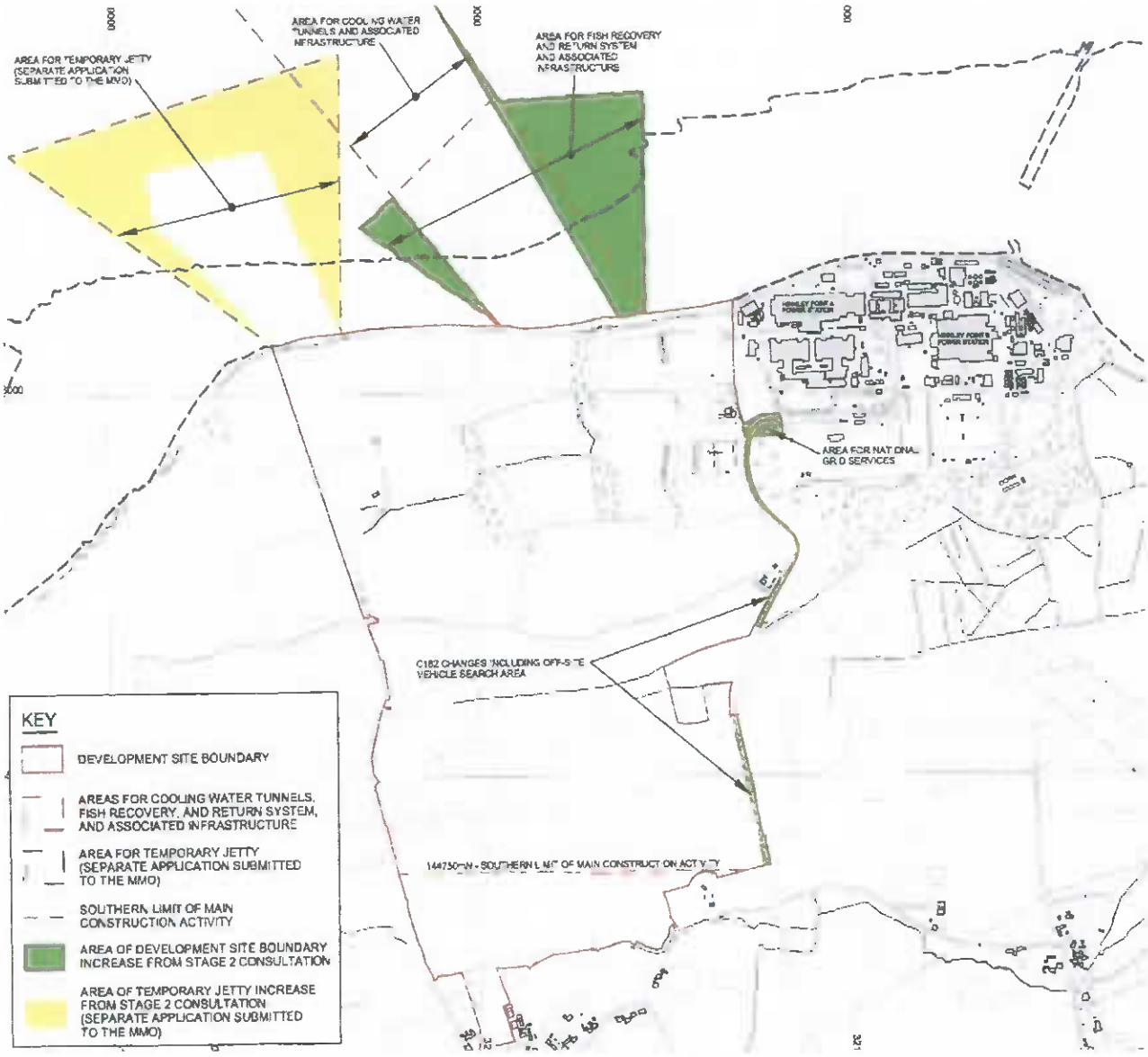


Figure 8: Proposed Development Site for Hinkey Point C Power Station- Main Site (Taken from Hinkley Point Planning Agreement 2009)

2.4.2 Area 2 Proposal Plan

Part of Combwich Wharf will be reconstructed for freight shipment and storage and a docking station for boats. A heavy goods vehicle road is also proposed as outlined (red) in figure 9

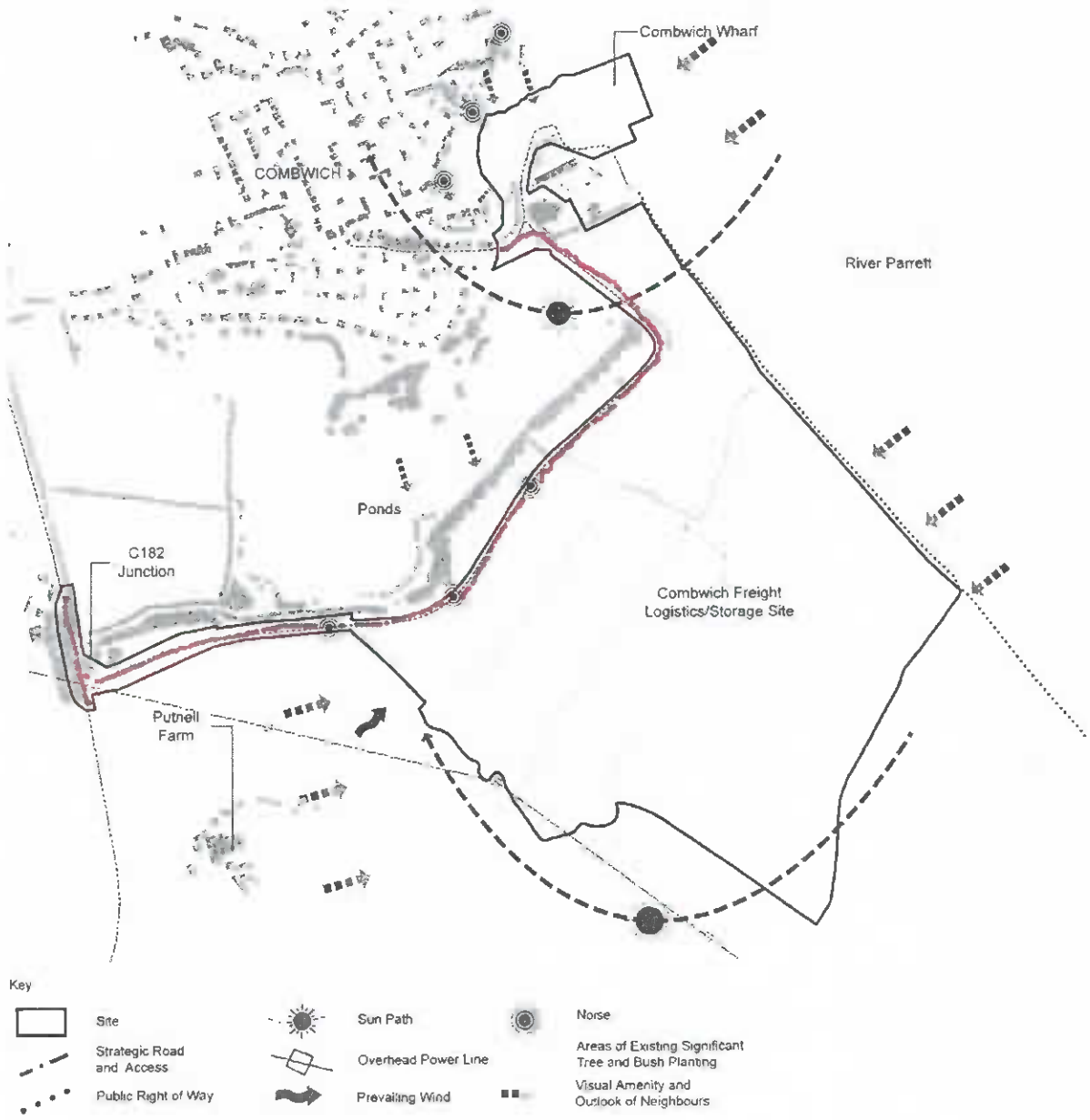


Figure 9: Proposed Development Site for Combwich Wharf Freight Logistics. (Edited from Hinkley Point Planning Agreement 2009)

2.4.3 Area 3 Proposal Plan

The proposed Cannington bypass links the existing roundabout on the A39 southern Cannington bypass to Rodway road which leads to Hinkley Point main site (figure 10). Balancing ponds are also proposed however it is not stated where overflow water will go (figure 11)

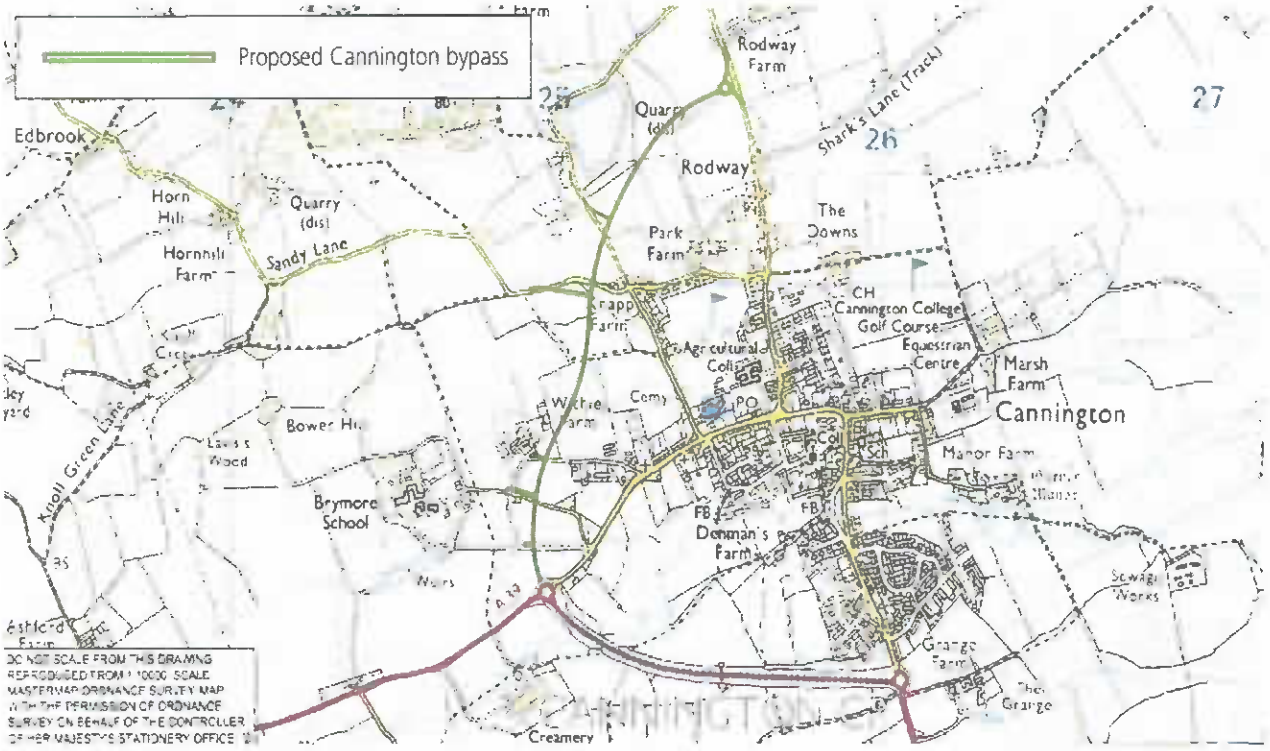


Figure 10: Proposed Cannington Bypass

(Taken from Hinkley Point Planning Agreement 2009)

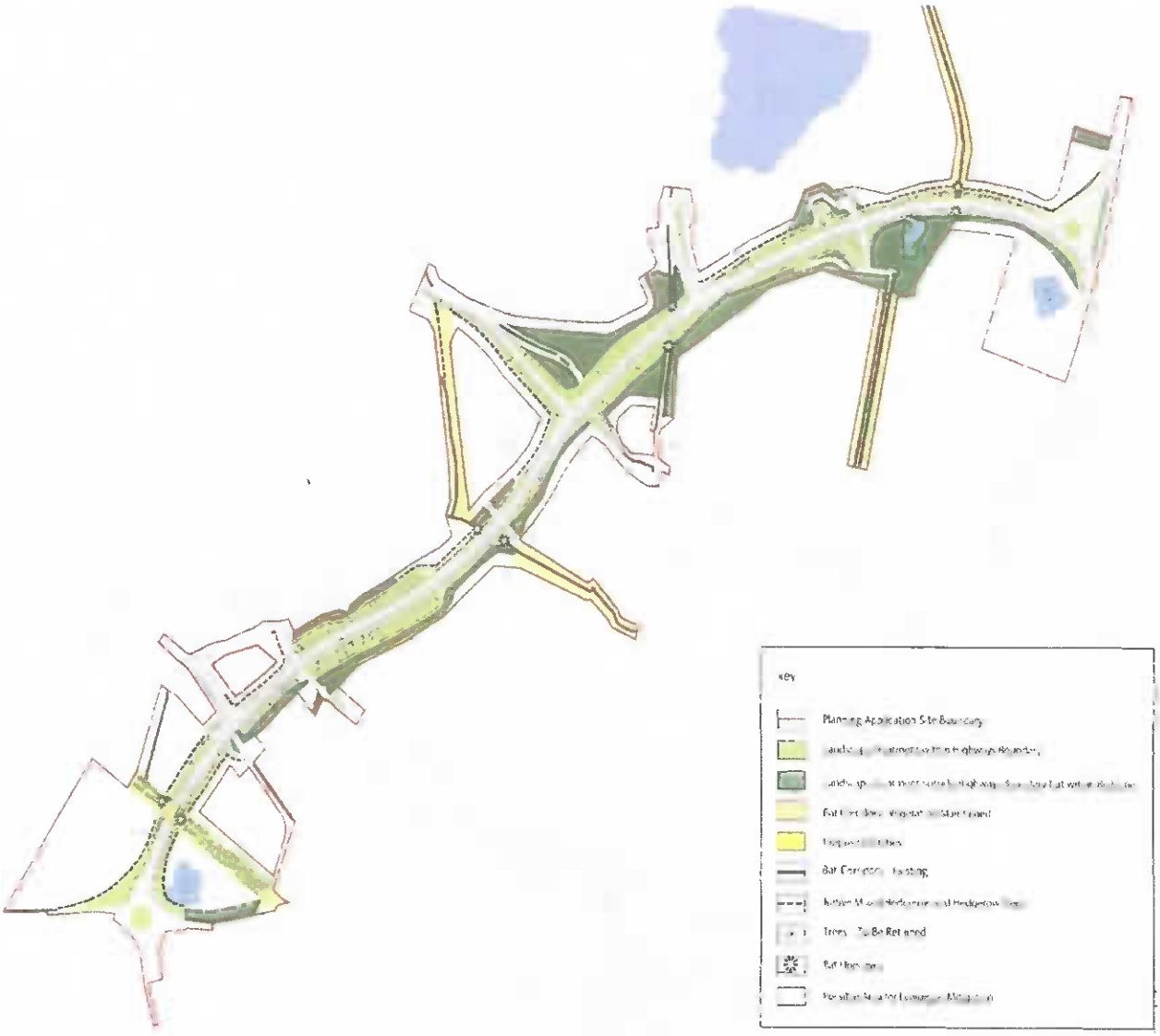


Figure 11: Proposed Bypass Structure and Balancing Ponds in Cannington
(Taken from Hinkley Point Planning Agreement 2009)

2.4.4 Area 4 Proposal Plan

A park and ride service for Hinkley's main site is to be developed in Williton next to Mamsey Bridge (figure 12). The development will consist of an entrance and exit off the A39, bus service station and car park. The area is currently fields, marsh land and vegetation.

Figure 12: Proposed Park and Ride Site at Mamsey Bridge, Williton
(Taken from Hinkley Point Planning Agreement 2009)

2.5 Assessment of European Otter Populations in Proposes Development Areas 1 – 4 by ENTEC UK Ltd

Entect UK Ltd was appointed by EDF Energy to undertake assessments of the impact the new developments will have on biodiversity. Otter surveys were carried out in proposed development areas including areas 1 - 4 of this study. Three survey visits were carried out in 2009 by an Entec principal consultant ecologist. The findings from these surveys are summarised in in table 4.

Table 4: A Summary of Results from Three Otter Surveys Carried Out by ENTEC UK Ltd

Area Surveyed	Overall Percentage of Positive Otter Evidence
Area 1 – Stolford (Main site)	0%
Ares 2 - Combwhich	8%
Area 3 - Cannington	0%
Area 4 - Williton	10%

(Information taken from ENTEC 2009; ENTEC Principle Consultant Ecologist, Personal Communication December 6th 2010)

It is plausible to suggest that the data gathered by Entec is insufficient to base a conclusion on otter presence and distributions as there were only three surveys carried out. Factors such as weather, tidal patterns and human error may have affected the findings.

Previous studies suggest there are otters regularly utilising water sources throughout the West Somerset coast (figures 2 and 3). It can be predicted from this that that the four areas focused upon in this study (Stolford, Combwich, Cannington and Williton) will have equally established otter distribution and land/water use. The recent study carried out by Entec does not support this (Table 4). Legislation for the protection of the otter cannot be enforced if there is no proof of them inhabiting the areas, therefore mitigations will not be considered. Due to pressures from the SWTOG, Entec propose to carry out desk studies regarding otter distributions in the development areas by utilising data put forward by the SWTOG, for which this study will provide the data (appendix 9.1) (SWTOG, J. Williams Personal Communication October 24th 2010).

3. AIMS, OBJECTIVES AND SIGNIFICANCE OF STUDY

3.1. Primary Aim:

To identify the presence of the Eurasian otter(s) (*Lutra lutra*) in areas where proposed development plans for a nuclear power station may affect their welfare and assess the adequacy of mitigations put into place to minimise the disruption to them

3.1.1. Primary Objectives:

- Collect Primary data of the otter population, distribution and use of land within the anticipated areas to be affected by the new development
- Analyse the proposed development plans[9] in conjunction with the primary data collected in order to identify possible impacts and solutions regarding protection of the otters and their habitats
- Determine considerations within the plans currently in place for the otter(s) protection and, where they are lacking, suggest alterations to the Environmental Engineering and Consultancy (ENTEC).

3.2. Secondary Aim:

To ascertain differences in public perception regarding the welfare of the population of otter(s) present at proposed development sites.

3.2.1. Secondary Objectives:

- Collate the opinions and possible concerns, regarding the otters welfare, from members of the public living locally (within a 5 mile radius) of development areas
- Compare public opinions and views regarding the proposed mitigations to considerations made for the otter in the EDF plans.

[9] Hinkley Point C proposed development plans are available for viewing at public Libraries

3.3. Hypothesis:

Hypothesis 1:

H_0: There is no significant difference between the expected and observed findings of positive otter evidence in areas of proposed development in West Somerset

H_1: There is a significant difference between the expected and observed findings of positive otter evidence in areas of proposed development in West Somerset

Hypothesis 2:

H_0: There is no significant difference between the overall percentage of positive otter evidence observed by EDF Energy and this study

H_1: There is a significant difference between the overall percentage of positive otter evidence observed by EDF Energy and this study

3.4. Significance of Study:

This study will assist in determining the presence of the European otter in areas currently disputed by previous research (JNCC 2010; Environment Agency 2010; SWTOG 2010) and a recent study[10]. Assuming otters are present, legislation can then be enforced, and consequently mitigations placed in proposed development plans. This would benefit both otters and other wildlife. The public awareness of the presence of otters and potential impacts that urban developments may have on them could proliferate.

[10] Survey carried out by Entec UK Ltd on behalf of EDF Energy

4. METHODOLOGY

4.1 Otter Survey

4.1.1 Data Collection

The combination of low density Eurasian otter population together with their predominantly nocturnal and elusive behaviour makes direct observation highly impractical. For this reason, field signs, including faecal droppings, anal secretions and padding evidence were utilised for data collection during this study. This method of monitoring has been successful in providing otter population, distribution and locomotive data by many researchers (Channin 2003; Green and Green 1997; Hutchings and White 2001; Mason and MacDonald 1987; Williams 2000; Somerset Wildlife Trust Otter Group 2010)

The survey was carried out in the early morning[11] since this is when otters are most likely to have just ceased foraging activity. Researchers claim that the Eurasian otter will stick to one particular route with little, or no deviation within their range (Kruux 1992; Philcox *et al* 2001). Consequently each location was surveyed three times a week for six weeks, a total of eighteen surveys. Table 5 was used to record field evidence during the survey.

Table 5: Survey Table for Otter Evidence Recordings

Date	Location (grid reference)	Presence of:					
		F.S	R.S	A.J	P (cm)	0	notes

(F.S = Fresh Spraint, R.S = Recent Spraint, A.J = Anal Jelly, P = Padding/prints (cm = width of print), 0 = No evidence)

[11] Survey start times varied depending on tidal activity. Surveys were carried out pre-high tide to avoid the washing away of spraint and padding.

4.1.2 Survey Area

The otter survey was carried out in four areas which are all targets for urban developments as a result of the proposed nuclear power station (figure 7). During a preliminary study specific locations were determined within each of the four target areas (appendices 1 – 3). These locations were selected where water sources exist and link together. access by foot was possible[12] and where otter sightings/mortalities have been recorded [13]. Table 7 describes the precise landmarks within each location which were searched during each survey. Landmarks were elected based on the theory that the otter travels between water sources and overland via the most direct route therefore expending the least energy (Channin 2003; Kruux 2006; Pfeiffer and Culik 1998). The start and end of distinctive paths acting as corridors between water sources were examined during a preliminary study and selected as 'survey landmarks', where the grass was lusher and longer suggesting regular fertilization[14].

[12] Permission was granted by local commoners and farmers for crossing their land and by Hinkley Point in order to access their grounds prior to the study
[13] Sightings recorded by the Somerset Wildlife Trust Otter Group
[14] Grass and vegetation will grow faster if fertilised regularly with otter faeces (Mason and McDonald 1986; Sussex Otter Group 2009)

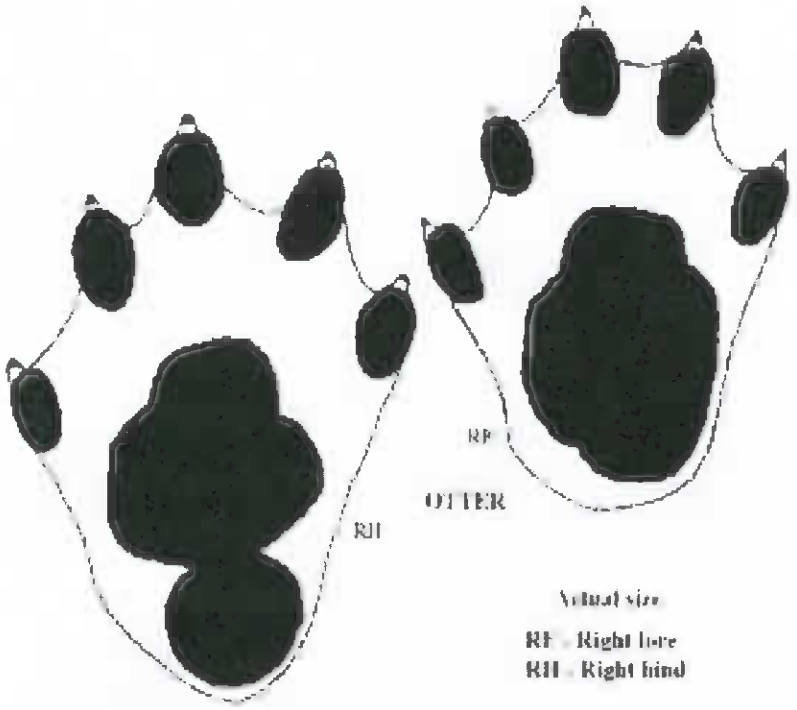
Table 7: Landmarks and Locations Utilised During the Otter Survey.

Area	Location	Survey Landmark	Grid Reference
1 - Stolford	1.a -Wick Moor Drove	Ledges under bridge entrance/exit	ST207452
1 - Stolford	1.b - Great Arch	Sluice entrance	ST227458
1 - Stolford	1.c - Groynes	Sluice gate exit	ST228460
1 - Stolford	1.d - Submarine forest	Mud on sea shore	ST228464
2 - Combwich	2.a - Estuary front	Mud by fencing towards estuary	ST263420
2 - Combwich	2.b - Tuckets Clyce	Mud by fencing towards estuary	ST266417
2 - Combwich	2.c - Fields (1)	Grass at stream exit into field	ST262418
2 - Combwich	2.d - Fields (2)	Mud/grass by thorn hedge	ST262420
2 - Combwich	2.e - Fields (3)	Mud/grass at gateway to road	ST261419
2 - Combwich	2.f - Fields (4)	Mud/grass at gateway to road	ST258417
2 - Combwich	2.g - Bolham Bridge	Ledges under bridge	ST256418
3 – Cannington	3.a - Cannington Brook	Ledges and rocks under bridges	ST258394
4 - Williton	4.a - Tumulus field	Large rocks in stream	ST075418
4 - Williton	4.b - Mamsey Bridge	Rocks in Stream and Ledge in culvert	ST073408
4- Williton	4.c - Stream	Rocks in stream	ST069400
4 - Williton	4.d - Stream	Ledges under bridge	ST067399
4 - Williton	4.e - High Bridge	Ledges under bridge	ST087417

4.1.3 Padding Evidence

Otter tracking was carried out at locations between water sources in soft terrain such as mud and sand or snow, if it was present, to enable the differentiation between terrestrial wildlife prints. Figure 13 illustrates the otter foot print and identifying features. The trail pattern of the otter pads was also considered when identifying tracks.

Photographs were taken of all otter padding recorded in the survey (appendix 4) and measurements were taken of the pad widths to assist in revealing the number of individual otter(s) utilising the locations.



Otter padding consists of the following features:

1. Five rounded toes are arranged in a semicircle
2. First and fifth toes are opposite on a diameter
3. Nails are inconspicuous
4. Long Heel with a gap in front of it
5. Bitch- 40-90mm width
   Dog - 60–100mm width

(Channin 2003; Somerset Wildlife Group Otter Trust 2010)

Figure 13: Annotated Otter Pad Marks
(Taken from Sussex Otter Group 2009)

4.1.4 Spraint Evidence

Otter spraint was identified during the survey by examining the characteristics of the faeces as described in Table 8. Identification took place with the use of a natural stick (such as a branch or twig) to break down the spraint in order to analyse it and mark that it had been recorded without disturbing the scent left by the otter. Confirmed spraint was recorded as fresh or recent (Figures 14a and 14b). Spraint more than approximately 4 days old was classed as 'old spraint' and was not recorded in this survey.

Table 8: Characteristics of Otter Spraint for Identification Purposes:

Characteristic	**Fresh Spraint** (< 12 hours old)	**Recent Spraint** (< 4 days old)	**Old Spraint** (> 4 days old)
Colour	Shiny Black - Khaki	Black - Grey	Grey - White
Shape and Size	Tubular or lump-like.. Varying size	Slightly flattened, tubular or lump-like. Varying size	Slight lumps but mostly flattened. Varying size
Consistency	Moist with oily coating. Contains fish bones. scales and occasionally feathers.	Charcoal – like. Contains fish bones. scales and occasionally feathers	Powdery with fish shrapnel
Smell	Sweet. musty and of fresh fish	Slightly musty and of fish	Weak smell of fish

(Information taken from: Mason and Macdonald 1986; Mason and MacDonald 1987; Kruux 1992; Kruux 2006; Somerset Wildlife Trust Otter Group 2010)

Figure 14a: Fresh Otter Spraint
(Taken from: Sussex Otter Group 2009)

Figure 14b: Recent Otter Spraint
(Taken from: Cornwall Rivers 2009)

The presence of anal jelly was also recorded in this survey and used as an indication of recent otter evidence since it is believed to dry up within 48 hours (Mason and Macdonald 1987).

4.2 Nuclear Power Station Development Plans

The master plans for the Hinkley Point C development[15] were analysed for the four areas utilised in this study. The plans were analysed in conjunction with the survey findings in order to determine possible impairments and threats to the otters' habitats and foraging routes. Safety mitigations were put forward to ENTEC planning consultants under the name of the Somerset Wildlife Trust Otter Group.

[15] In accordance with legal requirements, the application plans for the Hinkley Point development C are accessible to the public in local county council libraries.

4.3 Public Opinion Survey

4.3.1 The Questionnaire

The following questionnaire was put forward to consenting participants:

Please circle the appropriate answers for the following five questions:

1) Are you aware that otters are present within your surrounding area?

YES NO

2) A recent survey carried out by the Somerset Wildlife Trust Otter Group estimated that there are 60 - 70 otters distributed around Somerset. Are you surprised by this?

YES - thought there were more YES – thought there were less NO

3) The European otter is protected within the UK under the *Wildlife and Countryside Act 1981*
Do you agree with the protection of this species?

YES NO

4) Are you aware that the new Hinkley Point Development plan is likely to have an impact on the safety of otters within the local area?

YES NO

5) Do you think that precautions should be put into place in order to minimise the impact made on the otters within the local area?

YES NO

4.3.2 Sample Techniques

The questionnaire was carried out on people living within the immediate surroundings (within five miles) of the four survey locations. Randomly selected samples of twenty participants were utilised in each area. Samples were equally divided into age groups of 16-40 years and <40 years.

4.3.3 Data Collection

Random subjects were approached in public areas (schools, churches, supermarkets, farmers markets and post offices) and asked if they would be happy to answer five questions for the purpose of this study.

4.4 Method of Statistical Analysis

The attained survey data for each location within an area were statistically analysed using Chi squared to determine significant differences between the observed and expected findings. An overall analysis of the four areas was carried out using Kruskal –Wallis to highlight significant differences ($P = < 0.05$). Chi squared was used determine whether or not there was a significant difference in the amount of overall positive survey findings (where there is recent evidence of otter presence) between the observed (this study) findings and the expected (EDF's survey).

Data from the questionnaires was analysed using Chi squared to determine the significant differences between the observed and expected results.

All statistical tests were carried out using Minitab 15 Statistical Software (Minitab Ltd)

4.5 Ethical Considerations

The welfare of the otters was considered during this study. Due to the evidence-based tracking approach utilised during this study, there was no direct impact on the otters. Evidence such as scent markings was not removed, but marked with a stick to avoid disturbing their scent marking systems. Approval for use of land was granted in all necessary survey locations pre study.

5. RESULTS

5.1 Survey Results

Table 9: Overall Findings of Otter Evidence During 18 Surveys in Each Location

Location	Grid Reference	FS	RS	AJ	Padding
1a. Stolford - Wicke Moor Drove	ST207457	3	7	1	0
1b. Stolford - Great Arch	ST228459	1	3	0	0
1c. Stolford - Groynes	ST229460	2	3	0	0
1d. Stolford - Mud by sea	ST228464	0	0	0	8 (U)
2a.Combwich Estuary	ST264419	0	0	0	13(49mm) 3(38mm)
2b. Combwich -Tuckets Clyce	ST265417	0	0	0	11 (49mm) 3(38mm)
2c.Combwich Field - Stream exit	ST263418	10	7	1	0
2d. Combwich field-road crossing	ST262420	4	0	0	1(49mm) 1 (38mm)
2e. Combwich field - Gate to road	ST261419	7	4	0	1(49mm) 1 (38mm)
2f. Combwich field - Gate	ST258417	2	3	0	0
2g.Combwich- Bolham Bridge	ST254417	11	13	2	0
3a. Cannington Brook	ST258394	20	20	4	3 (70mm) 3(45mm)
4a. Williton - Tumulus	ST074418	4	4	0	0
4b. Williton - Mamsey Bridge	ST074409	3	5	1	0
4c. Williton - Stream	ST069400	7	14	0	0
4d. Williton - Stream Bridge	ST066399	5	8	0	0
4e. Williton - High Bridge	ST087417	6	12	0	0

(F.S = Fresh Spraint. R.S = Recent Spraint, A.J = Anal Jelly. P = Padding/prints (cm = width of print). 0 = No evidence)

Positive otter evidence was found at every location during the 18 visits of the survey. The highest number of fresh and recent spraints and anal jelly were found at Cannington Brook (location 3a). Padding evidence was also recorded there. The two measurements of padding in locations Combwich Estuary, Tuckets Clyce, and two field- pond crossings (2a, 2b, 2d and 2e) remained the same throughout (table 9)

There was no significant difference between the expected and observed findings of the four locations within Stolford (area 1) (Chi- Squared = 1.66667, df = 3, P = 0.644).

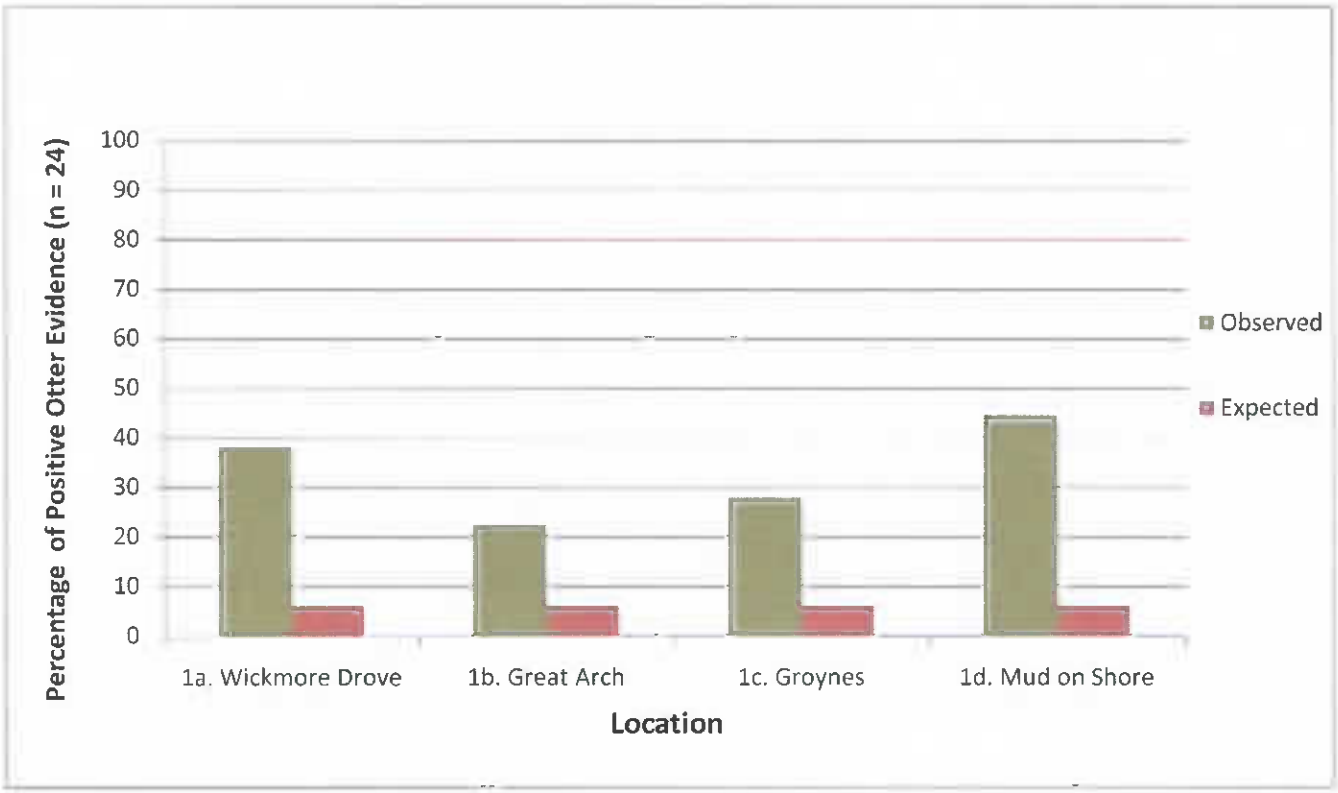


Figure 15: A Comparison of the Expected (red) and Observed (brown) Percentage of Positive Otter Evidence Findings in Four Locations within Stolford (Area 1).

The most otter evidence was observed at location 1d with 44.4% of positive visits. The least was observed at location 1b with half the amount of positive visits at 22.2% (figure 15)

There was no significant difference between the expected and observed findings in the seven locations within Combwich (area 2) (Chi- Squared = 9.62162, df = 4, P = 0.142).

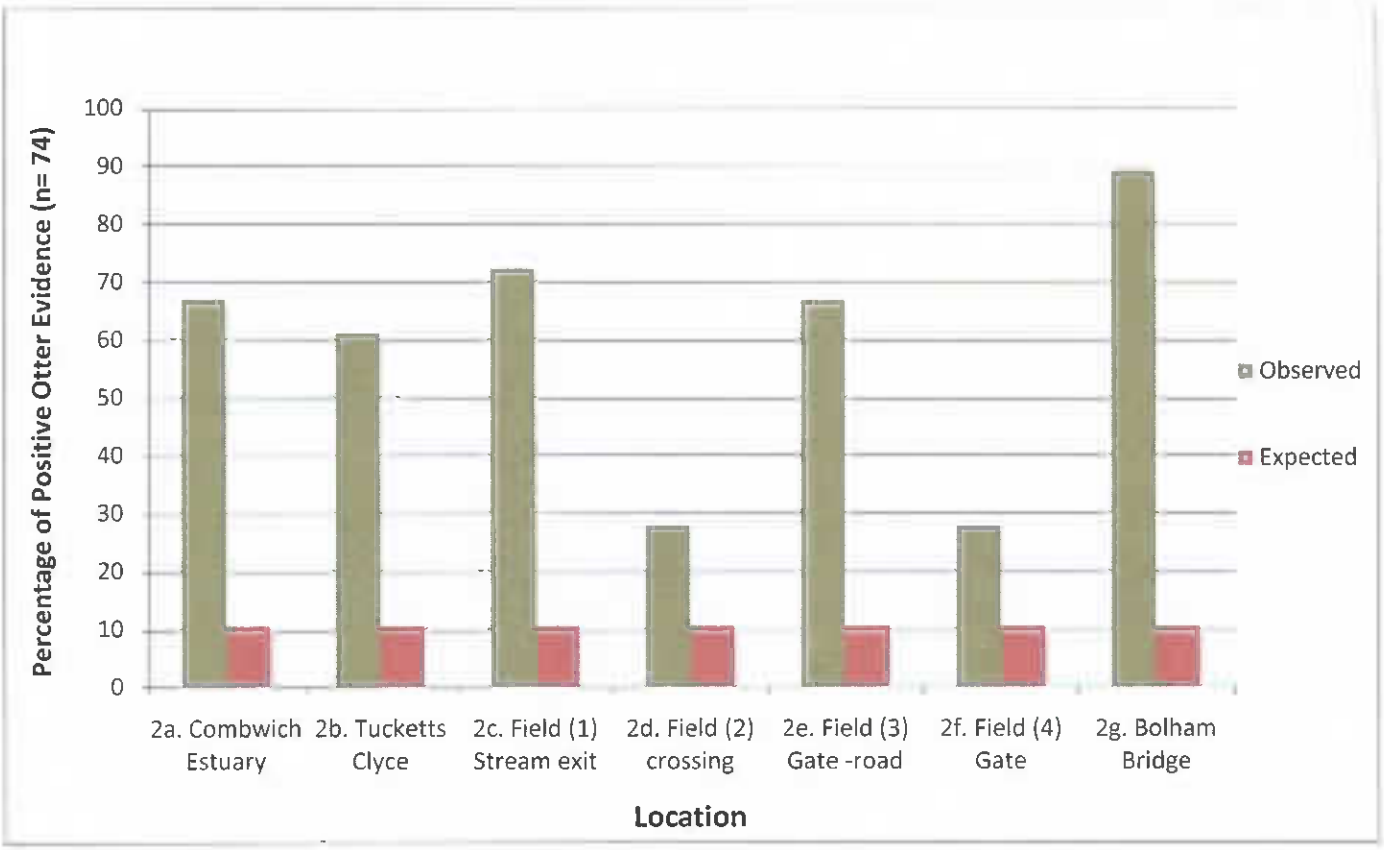


Figure 16: A Comparison of the Expected (red) and Observed (brown) Percentage of Positive Otter Evidence Findings in Seven Locations within Combwich (Area 2).

The most otter evidence was observed at location 2g with 88.9% of positive visits. The least amount of otter evidence was observed at locations 2d and 2f, both of which had 27.8% of positive visits (figure 16)

There was no significant difference between the expected and observed findings in the four locations within Williton (area 4) (Chi- Squared = 4.39216, df = 4, P = 0.356).

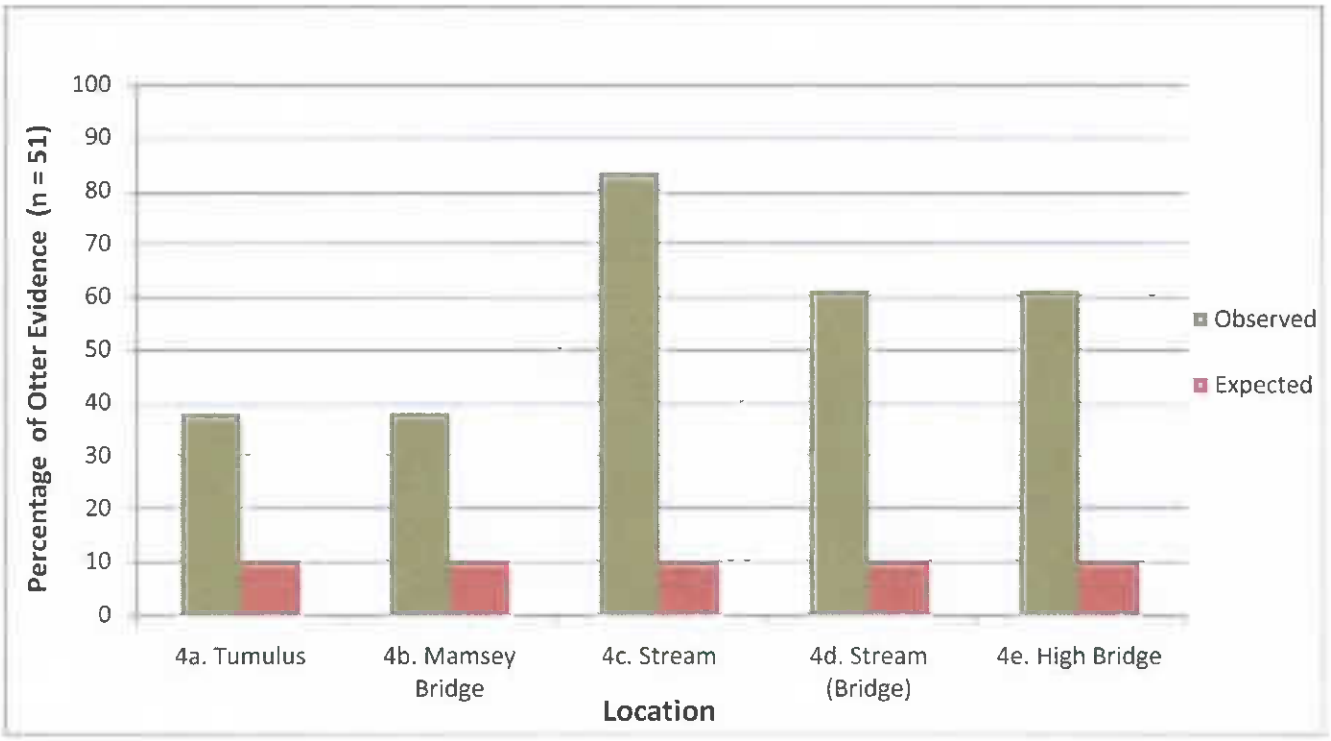


Figure 17: A Comparison of the Expected (red) and Observed (brown) Percentage of Positive Otter Evidence Findings in Seven Locations within Williton (Area 4).

The most otter evidence was observed at location 4c with 83.3% of positive visits. Locations 4d and 4e had 61.1% of positive observations and locations 4a and 4b had 38% (figure 17)

There was no significant difference in overall mean percentage of otter usage between the four observed areas (Kruskal – Wallis test: H = 6.17, df = 3. P = 0.104).

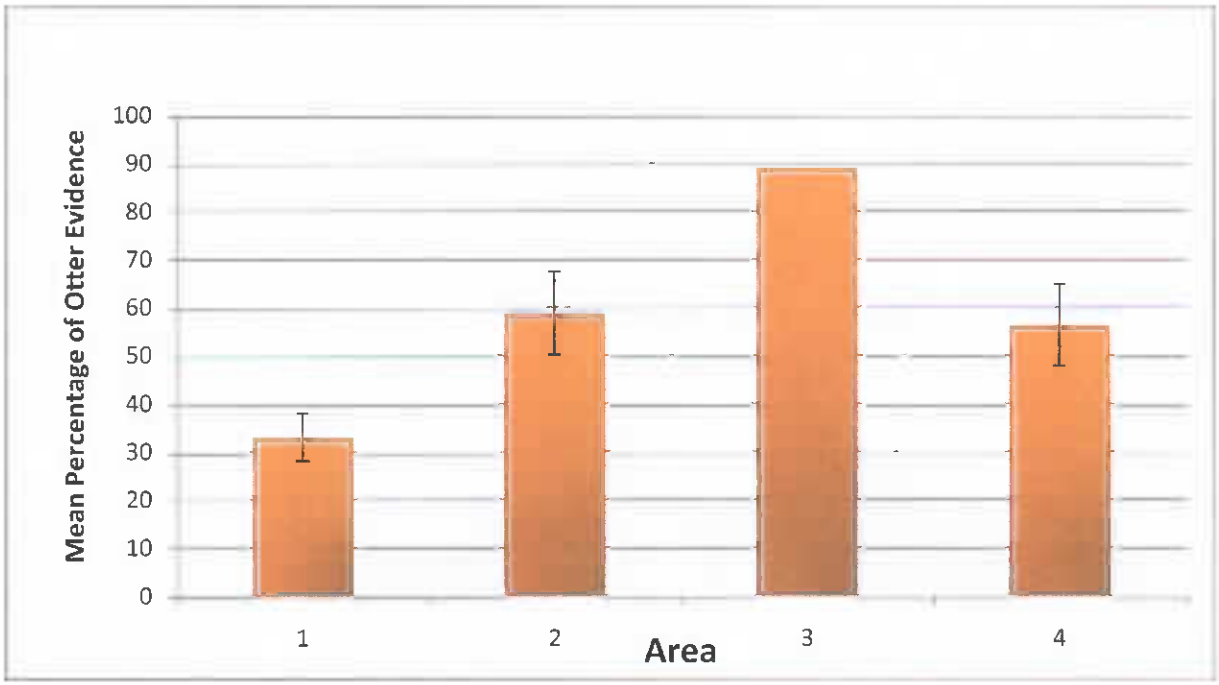


Figure 18: The Overall Mean Percentage of Otter Usage within Areas 1 – 4 (area 1 = Stolford. area 2 = Combwich, area 3 = Cannington, area 4 = Williton)) (+/- 1 standard error of the mean).

Area 3 was utilised most by the otters with 89% usage (30.21% more than area 2 and 32.7% more than area 4) and area 1 was utilised the least at 33.1% (figure 18)

There was a significant difference between EDF's and the observed overall mean percentage of positive otter evidence (2 Sample T-test: T-value= 3.97, d.f = 3, P= 0.029).

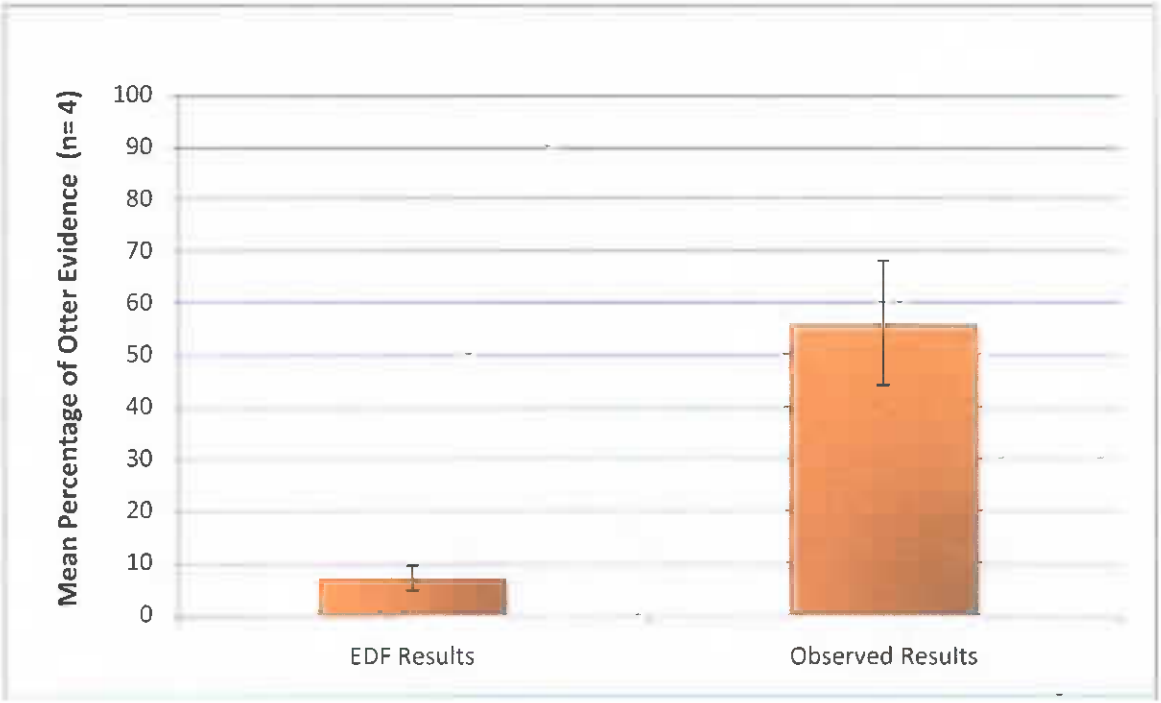


Figure 19: A Comparison of the Overall EDF (provision of ENTEC) and Observed Findings of Positive Otter Evidence in Four Areas. (+/- 1 standard error of the mean).

There is a high mean percentage of positive evidence observed (56.1%) compared to EDF's lower findings (7%) (figure 19).

5.2 Questionnaire Results

Table 10: Questionnaire Results

Question	Participants Answers		
	YES		NO
1. Are you aware that otters are present within your surrounding area?		39	41
2. A recent survey carried out by the Somerset Wildlife Trust Otter Group estimated that there are 60 - 70 otters distributed around Somerset. Are you surprised by this?	Thought more 44	Thought less 18	18
3. The European otter is protected within the UK under the *Wildlife and Countryside Act 1981* Do you agree with the protection of this species?		78	2
4. Are you aware that the new Hinkley Point Development plan is likely to have an impact on the safety of otters within the local area?		17	63
5. Do you think that precautions should be put into place in order to minimise the impact made on the otters within the local area?		72	8

There was no significant difference between the expected and observed outcome to question 1. (Chi-Square = 0.05, n = 80, P = 0.823).

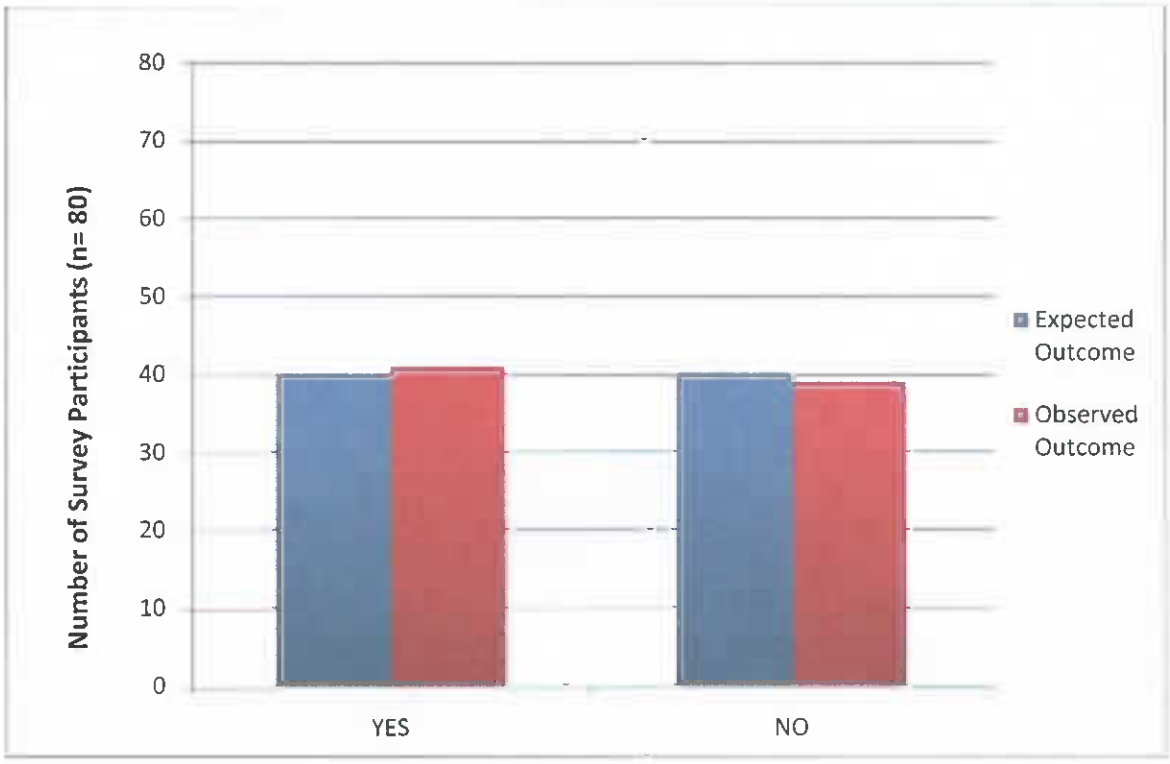


Figure 20: A Comparison of Expected and Observed Survey Results for Question 1: Are you aware that otters are present within your surrounding area?

Two more participants were aware that otters are present within their surrounding areas than those that are not aware (figure 20).

There was a significant difference between the expected and observed outcome to question 2. (Chi-Square = 16.9 , n = 80, P = 0.000).

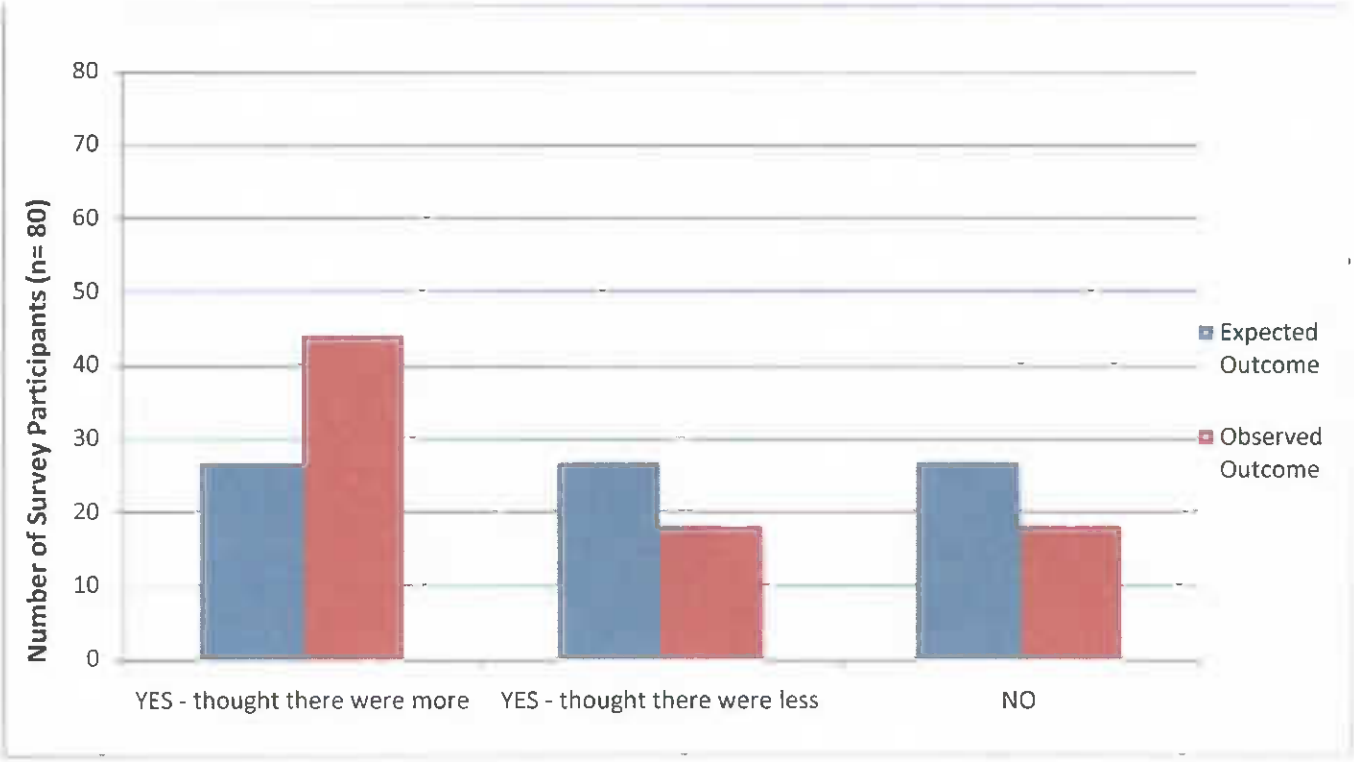


Figure 21: A Comparison of Expected and Observed Survey Results for Question 2: A recent survey carried out by the Somerset Wildlife Trust Otter Group estimated that there are 60 - 70 otters distributed around Somerset. Are you surprised by this?

Of the 80 questionnaire participants; 40 thought there were more otters in Somerset compared to 18 that were not surprised by this figure and 18 thought there were less (figure 21).

There was a significant difference between the expected and observed outcome to question 3. (Chi-Square = 72.2 , n = 80. P = 0.000).

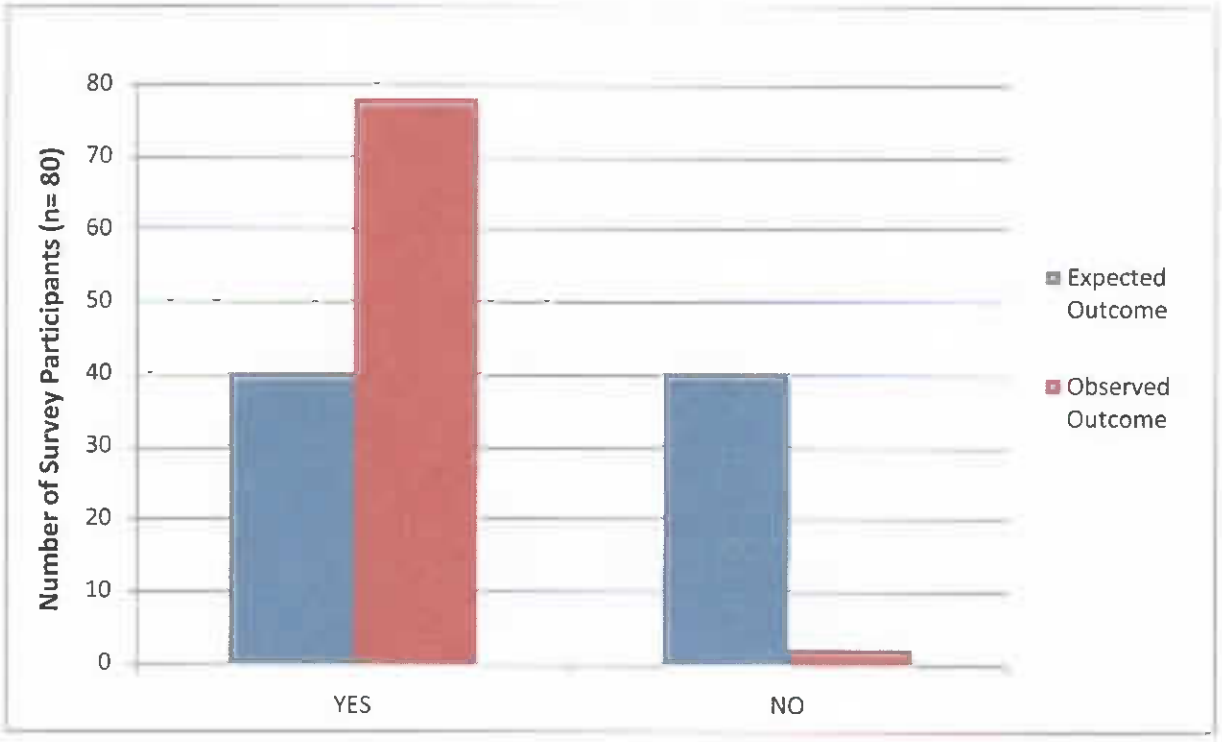


Figure 22: A Comparison of Expected and Observed Survey Results for Question 3: The European otter is protected within the UK under the *Wildlife and Countryside Act 1981* Do you agree with the protection of this species?

Of the 80 questionnaire participants; 78 agreed with the protection of the otter compared to 2 that did not (figure 22).

There was a significant difference between the expected and observed outcome to question 4. (Chi-Square = 26.45 , n = 80, P = 0.000).

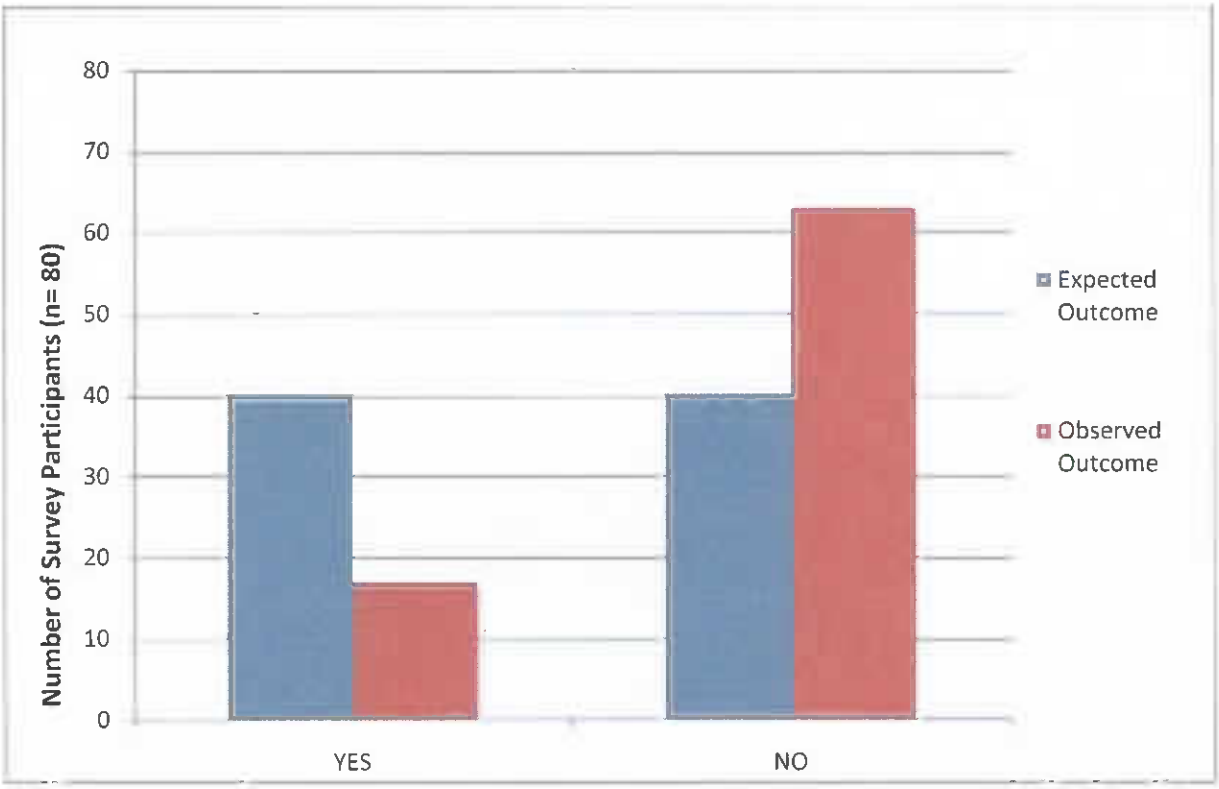


Figure 23: A Comparison of Expected and Observed Survey Results for Question 4: Are you aware that the new Hinkley Point Development plan is likely to have an impact on the safety of otters within the local area?

There was 63 participants that were not aware that the Hinkley Point development plans are likely to have an impact on the local otter populations compared to 17 who were aware (figure 23).

There was a significant difference between the expected and observed outcome to question 5. (Chi-Square = 51.2 , n = 80, P = 0.000).

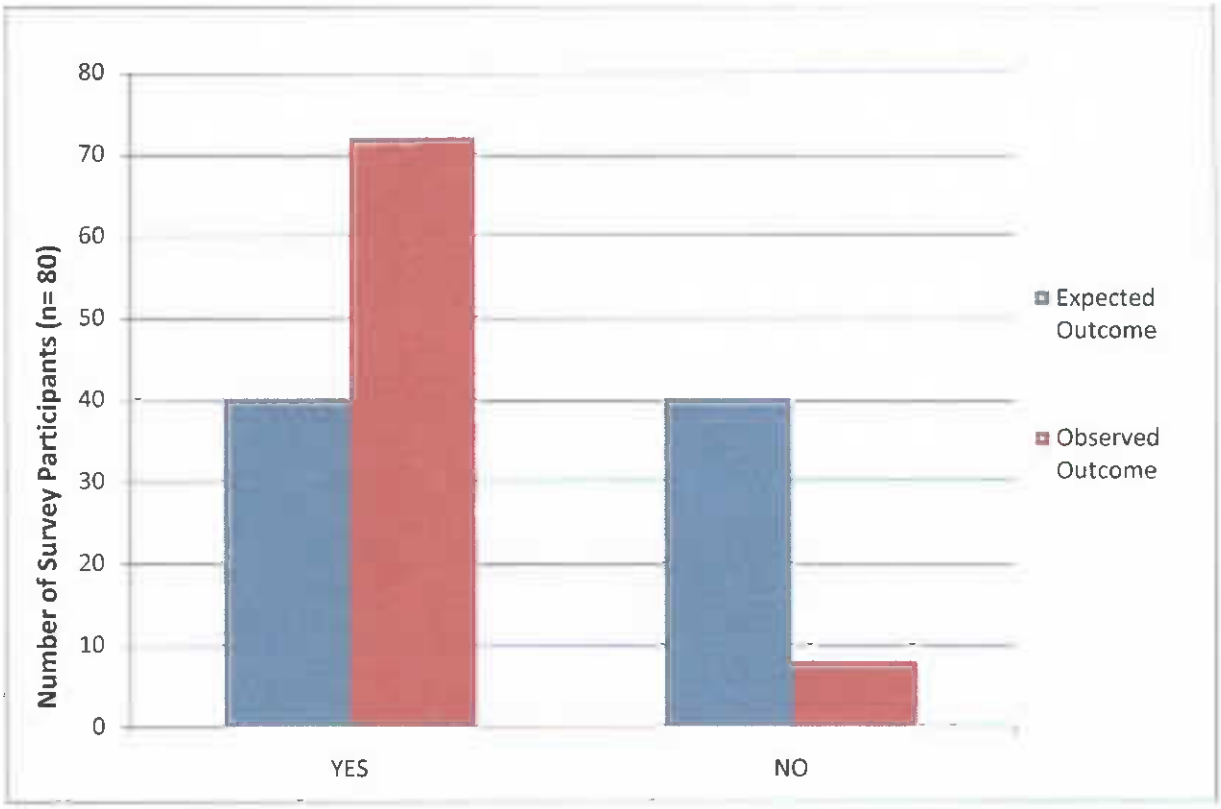


Figure 24: A Comparison of Expected and Observed Survey Results for Question 5: Do you think that precautions should be put into place in order to minimise the impact made on the otters within the local area?

Only 8 of the 80 participants were not in favour of precautions being placed to protect the otter within the local area. This is compared to the 72 that were in favour of it (figure 24).

6. DISCUSSION

6.1 Otter Survey

The results from the otter survey fulfil the initial aim of determining whether or not the European otter utilises areas facing major development plans. Positive evidence was observed in all locations within Stolford, Combwich, Cannington and Williton in at least 1 of the 18 surveys (table 9). There was no significant difference between the usages observed within the four areas (figure 18) which indicates a consistency of data.

Hypothesis 1.

The expected results were that all locations would have an even distribution of usage (figures 15 – 17). The null hypothesis can be applied according to data collected in this study:

H_0 - There is no significant difference between the expected and observed findings of positive otter evidence within areas of proposed development in West Somerset

Hypothesis 2.

The expected results according to the survey carried out by EDF Energy were 0% - 10% of positive findings (figure 19). The alternative hypothesis is true according to data collated in this study:

H_0 - There is a significant difference between the overall percentage of positive otter evidence observed by EDF Energy and this study

There were some variations in overall percentages of positive otter evidence observed between locations (Figures 15 – 17). There are no apparent trends or patterns demonstrated by the results (appendices 6a -6d). Variations appear random, for example in survey 5, the amount of locations with positive findings were 0 in Stolford, 6 in Combwich, 1 in Cannington and 1 in Williton.

6.1.1 Positive Otter Evidence

In Stolford (area 1) the highest amount of evidence was observed on the shore mud (location 1d) (figure 15). A possible explanation for this may be that more than one otter is coming to the sea from various streams, not just those surveyed in this study. This would support the theory proposed by the Environment Agency (2010) following the 5th National Survey (section 2.1.5.1). Otter evidence was observed in all of the 18 surveys carried out in Combwich (area 2), but only 58.7% of sites were used in average (appendix 6.1). This data, together with the number of small streams evident in the area (appendix 2), suggests the otter(s) utilise the area by a multiplicity of routes. The one location within Cannington (area 3) had the highest positive findings along with location 2g (Bolham Bridge) which is an adjoining stream (appendix 2). Cannington Brook is a wide stream with a constant water flow, and is not surrounded by many other water sources. Subsequent to this; the result may not indicate more otter usage than other locations, but a more isolated sprainting site. Similarly, the most utilised locations within Williton (area 4) were Stream. Stream Bridge and High Bridge. (figure 17). These streams are wider and have a more regular water flow compared to Tumulus and Mamsey Bridge.

6.1.2 Padding Evidence

Evidence derived from otter prints is more limited due to its dependence on terrain. The most padding evidence was observed at Combwich Estuary and Tucketts Clyce (area 2). Here, the prints were shown going in and out of the sea (appendix 7) at the Estuary (location 2a) and out of the sea towards land at Tuckets Clyce (location 2b). From this it can be assumed that the otter(s) enter the sea at the Estuary (2a) and swim either South to Tuckets Clyce or North to an un-surveyed location (Appendix 6b). The print measurements taken from Combwich were 49mm on 13 occasions and 38mm on 3 occasions (Table 9). These measurements would suggest the regular usage by a bitch otter, accompanied infrequently by her cub (Channin 2003). The cub was present at random occurrences (Appendix 7). Measurements of padding at Cannington Brook (location 3a) would suggest a bitch otter and dog otter were present (table 9). The measurements are typical of male and female otters (Channin 2003) and the pattern of prints indicate the possible mating pair were present together (appendix 7). The European otter is a non-seasonal breeder (Kruux 2006; William 2000) so there is no research to dispute this. Padding measurements were not attainable at Stolford due to safety risk

however prints were recorded both singularly and in pairs signifying another possible mating pair or bitch and cub.

6.2 Predicted Foraging Routes

Evidence of sprainting sites along with the location and direction of padding was used to predict foraging routes utilised by the otters. Previous research advocates that the European otter is likely to inhabit rest areas in fresh water sources such as lakes, large ponds, river banks and reservoirs where there is little human activity (Beja 1992; Kruuk *et al* 1989; Kruuk and Hewson 1978). This was also taken into consideration when devising possible foraging routes along recent survey data provided by the SWTOG.

6.2.1 Predicted Foraging Routes in Stolford (Area 1)

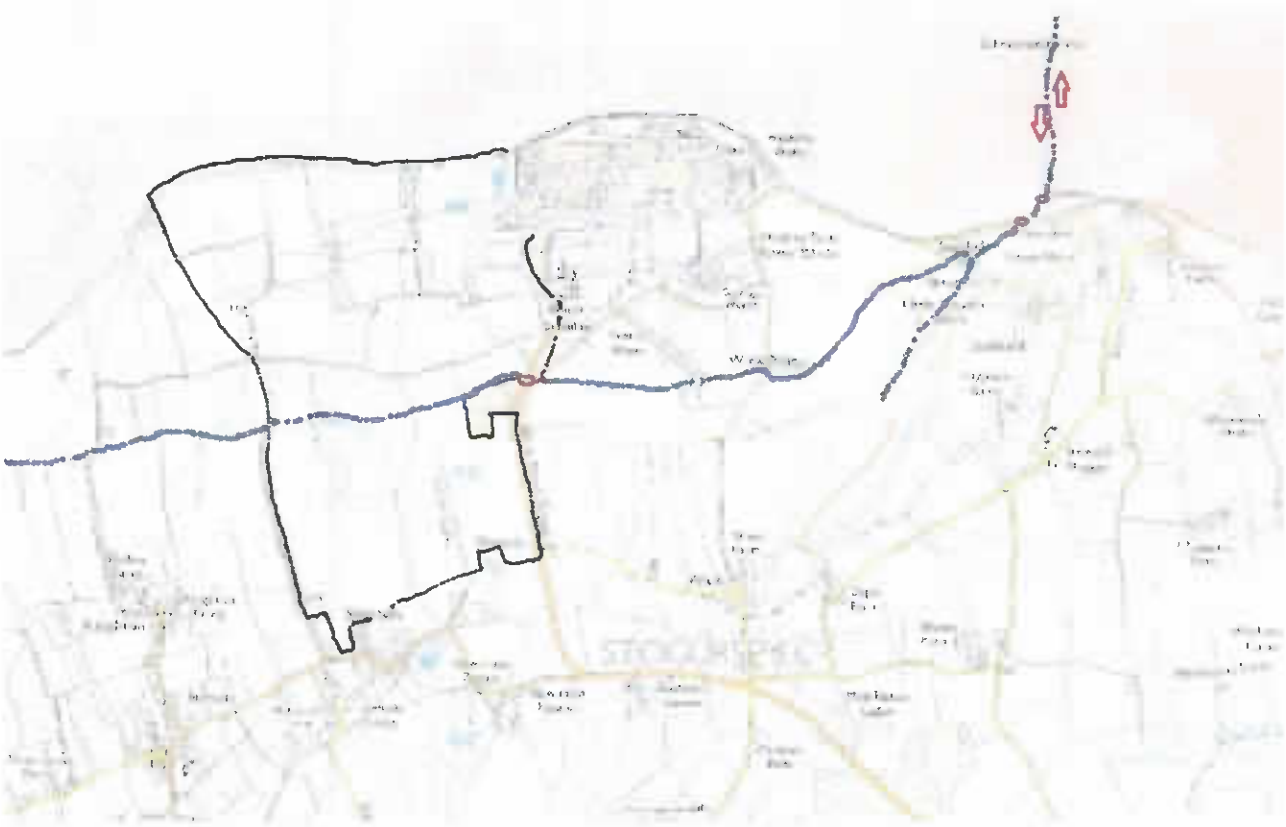


Figure 25: Predicted Foraging Route (blue lines) of the Otter in Stolford.
(Sprainting sites = red circle, direction of padding = red arrows, proposed development area = black outline)
(Edited from OS Ordnance Survey Map)

The direction of padding confirms that the otters both enter and exit the sea at location 1d point on at least some occasions. The spraint recorded at the sluice entrance (Great Arch) and exit (Groynes) supports this theory. To get to the sluice, or exit from it, the otters follow the only stream running through Wick Moor Drove. The Spraint observed at Wick Moor Drove (location 1a) aids this supposition. Otter evidence has recently been recorded in Kilve (SWTOG January 2011, Personal communication) 3km west along the coast, to which the stream would eventually lead. The development site would pose a threat to this otter(s) as it will block an established foraging route (figure 25).

6.2.2 Predicted Foraging Routes in Combwich (Area 2)

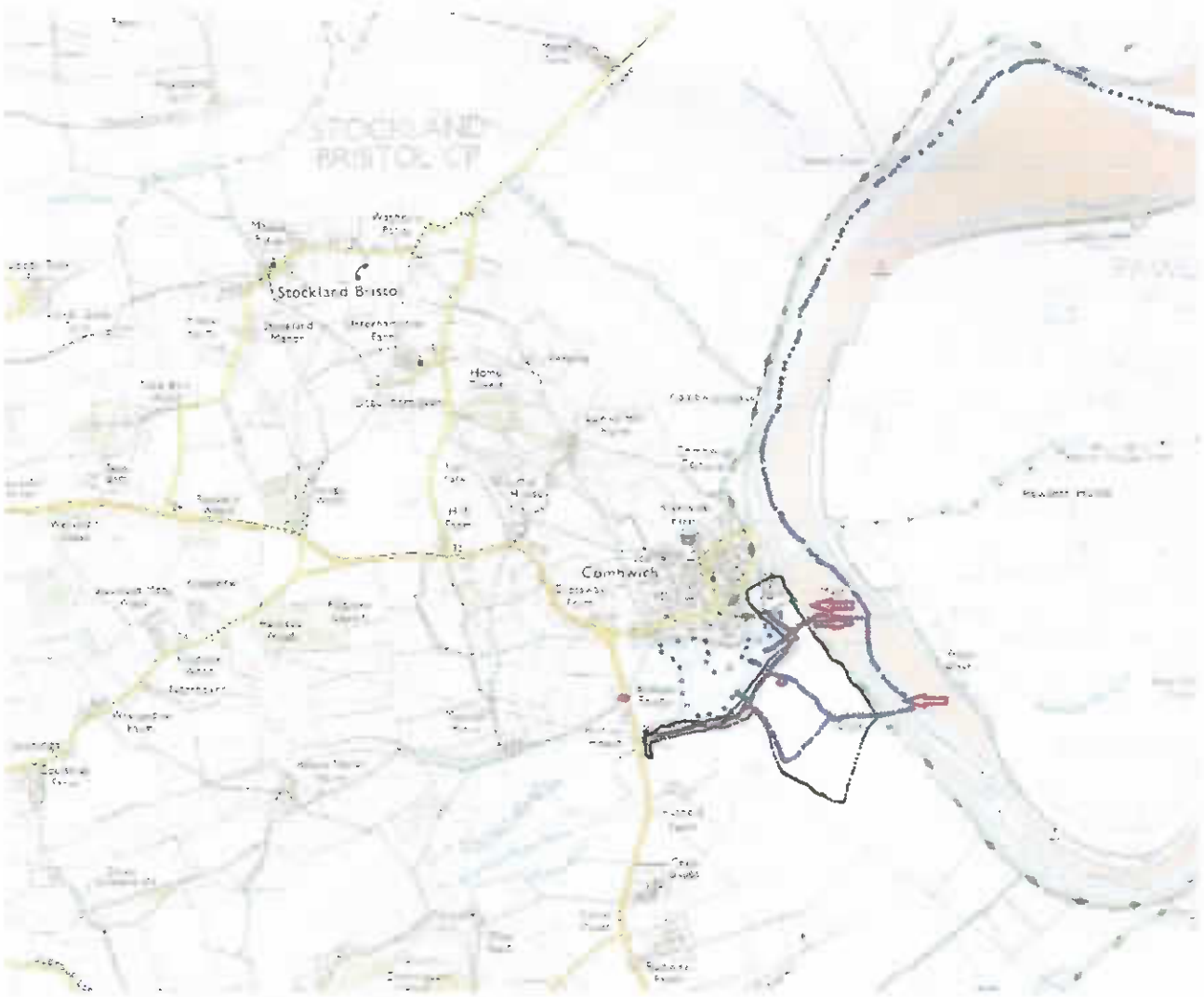


Figure 26: Predicted Foraging Route (blue line) of the Otter in Combwich.
(Sprainting sites = red circle, direction of padding = red arrows, HGV road = purple line, proposed development area = black outline)
(Edited from OS Ordnance Survey Map)

The survey established that once the otter(s) have entered the estuary, they may swim north to forage (towards Otterhampton) and return back to the ponds via the same route (location 2a). Spraint has recently been observed by the SWTOG confirming otter usage in Otterhampton. The majority of evidence suggests that otters leave the ponds by crossing the pathway into the estuary (location 2d – 2a) and complete a circuit back to the ponds; Otters exit the estuary at Tuckets Clyce (location 2b) and enter the immediate stream. The high recording of spraints as otters exit the stream (location 2c) followed by padding across one of the field - road crossings (2d, 2e and 2f) implies that they head to the pond which is a suitable habitat for resting and breeding holts (SWTOG 2010). The streams running through the field are not going to be affected by the proposed plans (Hinkley Point 2009) but will surround the construction work. The biggest threat to the otters is anticipated to be the HGV road which they regularly cross according to data derived from this study (figure 26).

6.2.3 Predicted Foraging Routes in Cannington (Area 3)

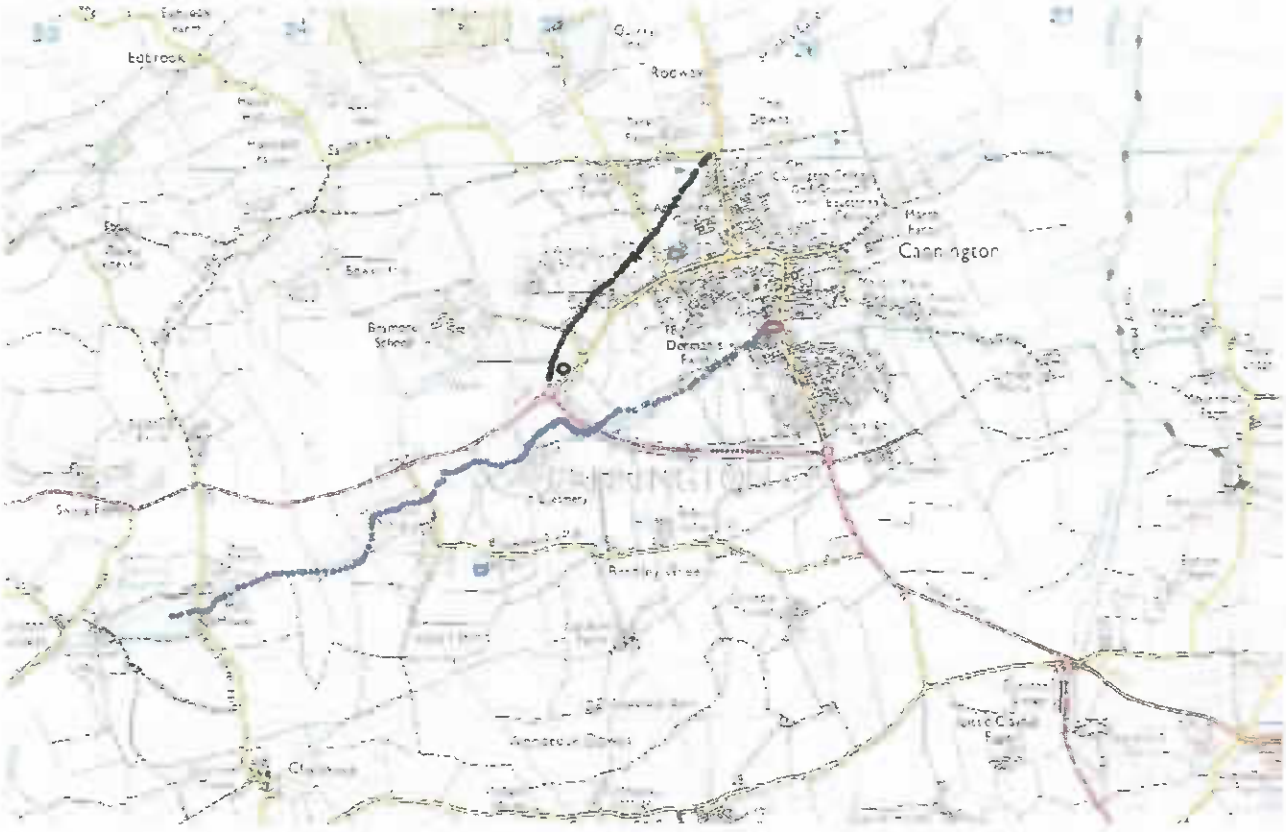


Figure 27: Predicted Foraging Route (blue line) of the Otter in Cannington.
(Sprainting sites = red circle, direction of padding = red arrows, proposed bypass = black outline. Proposed balancing pond = black circle)
(Edited from OS Ordnance Survey Map)

The measurement of prints at Cannington Brook (location 3a) indicates that the otters utilising this area are different from those at Combwich. Based on the strongly supported theory that otters exploit their own territory (Erlinge 1968; Channin 2003: Kranz 1995; Williams 2000) it is unlikely that the suspected bitch and dog otters in Cannington are travelling to Combwich Estuary. The nearest suitable otter habitats are Ashford Reservoir and further south Hawkridge Reservoir. Otter holts and evidence have been identified by the SWTOG in both these water sources. The proposed bypass will force otters to cross over a potentially busy road unless mitigations are placed. Researchers proclaim that otters tend to explore all water sources en-route, and via the most direct route (Pfeiffer 1998: Channin 1986; Channin 2003: Williams 2000). A consequence of the proposed balancing pond is likely to be the exploration of it by otters. The most direct route for the otters to take from their predicted foraging route to the balancing pond is across the roundabout (figure 27).

6.2.4 Predicted Foraging Routes in Williton (Area 4)

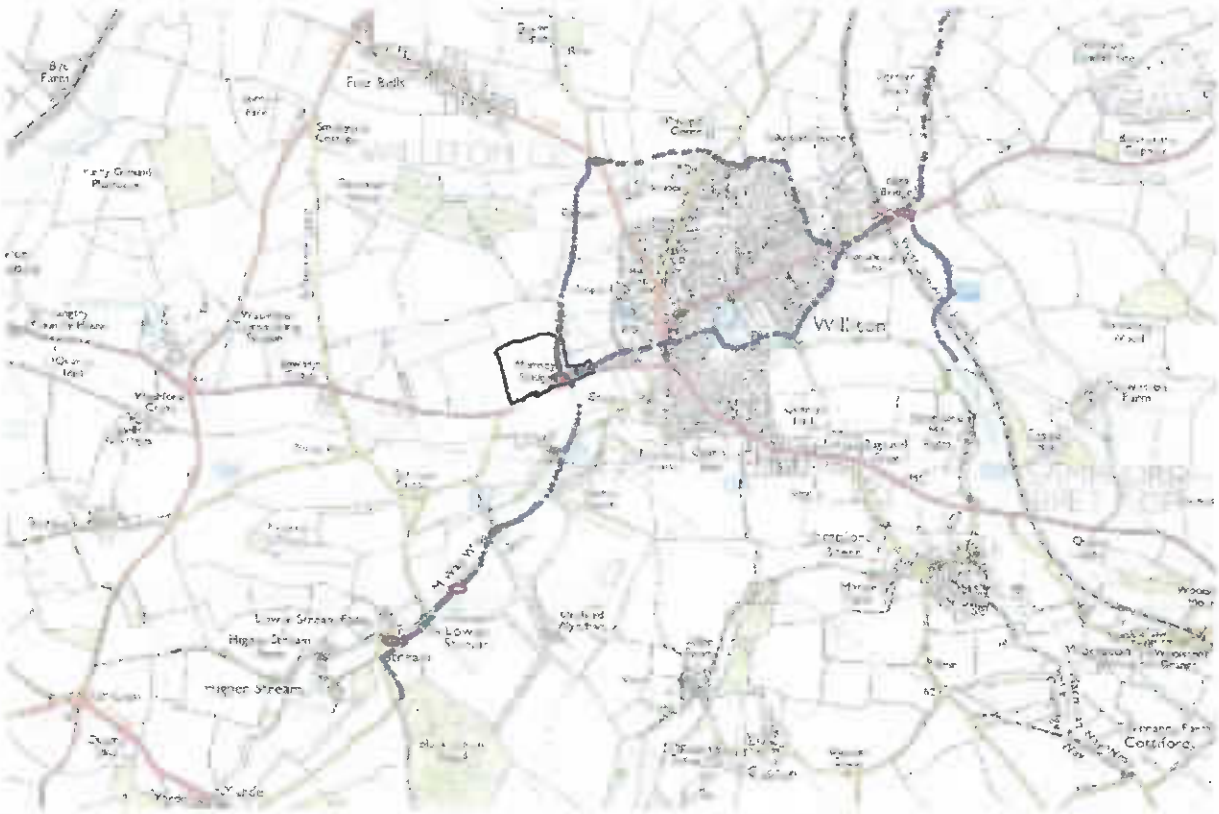


Figure 28: Predicted Foraging Route (blue line) of the Otter in Williton.
(Sprainting sites = red circle, proposed development = black outline)
(Edited from OS Ordnance Survey Map)

The streams in Williton surround the town with a continuous circuit route. It cannot be concluded from the data collected, how many otters utilise this area. It is possible that the otter usage recorded in High Bridge (location 4e) is not the same otter that produced evidence in Stream (location 4c). The data does suggest that the otter(s) utilise routes passing through Williton which includes passing through Mamsey Bridge (location 4b). The proposed development will expose otters to consistent road vehicle threats and possible fragment part of an established foraging circuit (figure 28).

6.3 Questionnaire

6.3.1 Question 1: Are you aware that otters are present within your surrounding area?

It was expected that 50% of the subjects would be aware of otters within their surrounding area. The results support this (figure 20). Since otters are elusive, they are not a species that will be spotted unless observation methods are made. Further to this, a solitary otter utilising up to 8km of land/water resources results in a scarce distribution of the species. The SWTOG claims that raising public awareness of otter presence is a valuable conservation tool. Surveys have shown the otter is a favourable mammal (Wildlife Trust 2009) but people are often unaware of its presence.

6.3.2 Question 2: A recent survey carried out by the Somerset Wildlife Trust Otter Group estimated that there are 60 - 70 otters distributed around Somerset. Are you surprised by this?

Otter population is often a source of wildlife media attention therefore a mixed result was expected. The majority of participants (44) were surprised by the predicted 67 otters inhabiting in Somerset as they thought there were more (figure 21). Recent media coverage has related to the population growth of otters since their near extinction in the 1990's (Western Morning News 2010). This may be an explanation why people assume there is a higher distribution inhabiting Somerset. It may be that the estimated 67 is misleading as the accuracy of surveying otter is disputed (section 6.6.1). The ecology of the species lends itself to a wide distribution therefore a predicted 60 – 70 otters may be an optimal number for populations within Somerset. There is no evident research assessing optimal populations of the otter.

6.3.3 Question 3: The European otter is protected within the UK under the *Wildlife and Countryside Act 1981.* Do you agree with the protection of this species?

Despite public opinions on otter distribution and presence, a collective view is that protection is agreed for this species (figure 22). This result supports the aesthetic argument for the European otter (section 2.3.3). Disputably, it could be considered effortless for people to agree with protection of this species and other means of its value may need to be assessed. The value of the European otter can be analysed by means of economic worth. A study by White *et al* (1997) investigated this using a contingent valuation method[16] which compared the economic worth of the otter to the water vole *Arvicola terrestris* within the UK. Results suggested that the otter has a higher economic worth with an average mean willingness to pay of £11.91 compared to £7.44 for the water vole. This is arguably a pragmatic representation of the otters' value since finance is a valuable source within society.

6.3.4 Question 4: Are you aware that the new Hinkley Point Development plan is likely to have an impact on the safety of otters within the local area?

A large majority of participants had not considered that the Hinkley Point development may oppose a threat to the local otter population. The outcome of question 1 was likely to have affected this result since just fewer than 50% of participants were not aware of otters within their surrounding area (figure 20). It is also plausible that due to the otter's elusive nature, the general public lack knowledge regarding the species ecological needs. Subsequently, opposing threats are not obvious.

6.3.5 Question 5: Do you think that precautions should be put into place in order to minimise the impact made on the otters within the local area?

Significantly more people agreed that safety mitigations should be placed for the protection of the species (figure 24). The outcome of this question may have been different had it been asked prior to the previous four questions which raised awareness of the otters distribution

[16] The study investigated the relative economic worth of the otter and water vole inhabiting in the UK. Both these species share similar habitats and face comparable threats. Data was collected by asking people how much money they would be willing to pay as conservation measures for each of the species. Mean willingness to pay values were obtained (White *et al* 1997)

and the potential impacts on it. Putting this question forward to the beginning and end of the questionnaire would have tested the success of raising awareness.

The survey of public opinion is vital when developing such controversial plans such as those for the power station. It is imperative to achieve public support since it is inevitably the public tax payers' money which funds such investments.

6.4 Suggested Safety Mitigations

The following safety mitigations were put forward to EDF Energy, via Entec, based on findings from this study (appendix 9.2).

Suggestions for Safety Mitigations for the Otters

Stolford - Hinkley Point site:

I understand that your own surveys proposed there was little evidence of otter use on the Bum Brook road. You will see from the 1st Table that over the study period of 6 weeks, the survey indicates otters are utilizing this area at least 22-44% of the time therefore it is an established and permanent part of their route. The main site development covers a whole stretch of the stream utilised by the otters. It is unclear of the exact plans with regards to the stream. If the stream is intended to remain undisturbed, perhaps it could be fenced off during construction work to minimise disruption?

Combwich Freight:

The otters regularly travel from the ponds in Combwich to the estuary and return via the streams in the field. There are 3 crossing points utilised by them along the pathway which is intended to become a HGV road. The placement of 3 culverts running under the road in these locations would be an appropriate measure to prevent the otters from potential road traffic accidents, as the evidence strongly suggests they use all 3 crossing sites on a regular basis (>27 % time)

Cannington:

The Cannington Brook has a lot of otter use, according to the survey; evidence was found 89% of the time during the survey period. Evidence was also found along the route of the proposed by-pass up to Ashford and Hawkridge reservoirs which are popular breeding sites for otters. The plans for the by-pass illustrates a balancing pond near to the round-about which the otters are likely to cross to get to this pond to investigate before returning to the stream. In order to prevent this, could a barrier be implemented to prevent them getting out of the stream and crossing the roundabout?

Williton:

There was strong evidence suggesting that this is still an established area for otter populations. Positive evidence found at Mamsey Bridge (38%) and surrounding locations reiterates the concern regarding the car park that will be built there and what measures will be made to protect the otters. It is likely that again, the otters will leave the stream (at the designated proposed car park entrance) and cross the road to visit the balancing pond. A Possible solution would be to move the entrance of the car park to avoid this?

6.5 Outcome of Study

Personal Communication with Entec (14th March 2011) revealed that the 3 culverts would be put in place in Combwich in locations 2d, 2e and 2f of this study as a safety mitigation for the otters. The data from this study provided strong evidence of otter usage in Williton, in and around Mamsey Bridge. As a result of this, the location of the Williton park and ride has been moved to a pre-existing lorry park (appendix 9.3). Further reviews will be carried out on proposals in Cannington and Stolford with regards to the protection of the otters. Modified plans will be released later in the year.

Williton park and ride

Key change:

- We are proposing to change the location for the Williton park and ride facility from a greenfield site at Mamsey Lane to the existing Smithyard Terminal (known as the Lorry Park) on the B3190.

The new preferred site is situated approximately 2km west of Williton and 500m from a group of houses called Five Bells Access to the site is provided via a priority junction on the B3190

This new site has been chosen as a direct response to concerns raised at Stage 2 consultation about the location of the park and ride on a greenfield site. Whilst the original site had the advantage of convenience for workers based in Williton, bus services from the lorry park site will be able to pick up workers based in Williton en route.

Although overall projected workforce numbers have increased since Stage 2, we now estimate that demand from workers wanting to use the Williton park and ride facility will be less than originally envisaged. This, together with our sustainable transport proposals, means we can reduce the number of park and ride spaces from 328 spaces to 160 spaces.

We anticipate that the facility will revert back to a lorry park after the construction of Hinkley Point C

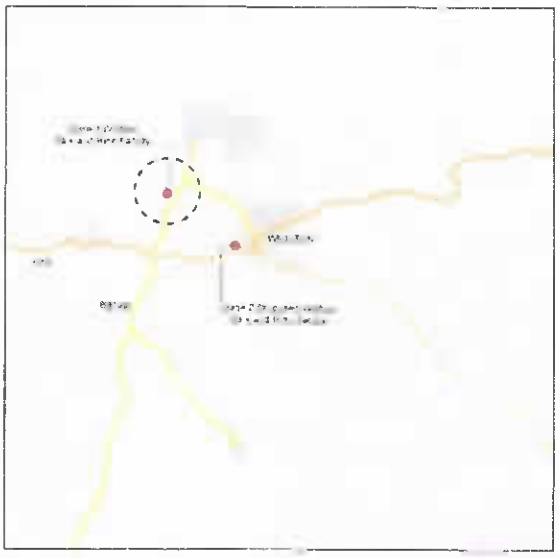


Figure 14. Previous Stage 2 proposal and current park and ride locations at Williton

Figure 15. Current proposal - Indicative plan of Williton park and ride facility (Smithyard Terminal – Lorry Park)

Figure 29: Altered Proposal Location of Williton Park and Ride due to Otter Safety Mitigations
(Taken from Hinkley Point C 2011)

The outcome of this study has fulfilled the aim of identifying threats to an established otter population. Safety mitigations will be put in place as a result of this. The initial aim of determining the presence of otters was benefitted by training provided by the SWTOG. By working in cooperation with a recognised and trusted name within the ecological conservation field was an advantage when offering data, collated during this study, to Entec and EDF Energy.

The outcome of the questionnaire shows undoubted support for the protection of otters against potential threats from the development plans for Hinkley Point C. According to this study, the initial plans proposed by EDF Energy for the four major developments assessed in this study, did not meet the desire of surrounding local communities.

6.6 Limitations

6.6.1 Limitations of Otter Surveys

While the presence of otters was indicated during this study, limitations are apparent when using otter evidence as a survey method. Physical evidence was assessed in this study in specific pre-determined locations. Research suggests otters scent mark repeatedly in the same locations (Rostain *et al* 2004; Hutchings and White 2001; Kruux 2006). Arguably, an otter may scent mark in a different location or skip a location on some occasions. It is possible that an otter was present during this study but not recorded as an alternative spraining site was used. A case study by Gallant *et al* (2007) compared the production of faeces sites to actual numbers of river otter[17] *Lontra canadensis* in Kouchibouguac National Park, Canada. From the results, Gallant claims that the number of faeces sites poorly reflected actual populations of otter. In contrast to this, Ruiz –Olmo *et al* (2001) carried out a case study which tested the significance and precision of three different methods used to estimate European otter density within an area. Radio-tracking[18], visual censuses and evidence-based surveys were simultaneously conducted. Results showed no significant difference between methods although the evidence-based survey slightly over estimated the density of otters in one area. Environmental factors such as weather were anticipated to affect the foraging behaviour of the otter. The survey occurred over winter months with a variety of extreme weather

[17] Filmography was used to detect the presence of otters
[18] Otters were tagged with transmitters prior to the study

conditions, including freezing temperatures and snow, but evidence was observed in every survey. This would suggest that weather is not a limiting factor. An explanation to support this would be that the otter's physiology requires it to forage daily despite environmental challenges. It is plausible to state that evidenced-based surveys are limited to determining the presence of otters in an area, therefore may be considered a valuable monitoring method. Further studies would be necessary to assess population densities and individual locomotive patterns.

.6.6.2 Limitations of Measuring the Threats Propounded by Urban Development on the European Otter

The direct effects of the physical construction works were analysed during this study. Safety mitigations have been enabled from this. The plans do not specify the potential dangers of pollutants on the natural environment. Studies such as Kruuk and Conroy (1991) in Shetland, revealed from post mortem examinations that over 50% of otters had traces of PCB's, organochlorines DDE, lindane and mercury in them. This was thought to be the cause of death in only 11% which could suggest long term suffering. This arguably indicates that the welfare of otters is heavily impacted by urban developments. This study was limited to assessing the physical aspects of the development which means chemical aspects remain a threat.

6.6.3 Limitations of the Questionnaire

The devised questions may be considered subjective and subsequently influencing the participants answer. A more objective approach could have been executed. For example question 4 states:

Are you aware that the new Hinkley Point Development plan is likely to have an impact on the safety of otters within the local area?

This could be interpreted in a number of ways but the emphasis is on '*likely to have an impact*'. An unbiased version of this question could be:

Have you considered possible impacts of the new Hinkley Point Development plans on otters within the local area?

In order to gain the scope of public opinion, a large and evenly varied sample size is required (Loughborough University 2011). The sample size and variation were limiting factors for the questionnaire used in this study.

6.7 Recommendations

6.7.1 Survey Recommendations

The precision of the otter survey could have been increased by surveying more locations within an area. Locations were determined within, and immediately surrounding, development boundaries. Geographically expanding the locations would provide a more accurate conception of the foraging routes utilised by the otters. Surveys were carried out at three day intervals[19]. The frequency of location usage could have been obtained by carrying out daily surveys. All surveys were carried out by one person. Although survey training was undertaken prior to the study, two or more people would have reduced the possibility of human error.

6.7.2 Analysis of Development Plan Recommendations

All publicly available development plans were assessed in detail and with accuracy with regards to potential otter threats. Suitable mitigations were put forward and accepted by EDF Energy therefore the only recommendation from this study would be the monitoring of these mitigations to insure they are effective.

[19] Intervals were up to 5 days in December due to snow making the survey locations inaccessible

6.7.3 Questionnaire Recommendations

A larger sample would be beneficial in obtaining comprehensive results. A stratified survey would ensure wide-ranging opinions. Questions could be put forward to various establishments already involved in the planning of Hinkley Point C and those that will be affected by it. Suggested groups are:

- Government Body – DEFRA
- Conservationists – Wildlife Trust Members
- Tourist Board – English Heritage Tourist Board
- Development Planners – Regulators and Highway Maintenance
- Local Communities – Rural Inhabitants
- Local Communities – Urban Inhabitants

6.8 Progression of Study

Detection of otters via physical evidence is sufficient only for this purpose but offers restrictive data. Little research is available on the genetic composition and population barriers between otters. Constant re-capturing of the animal for analysis or radio-tracking pose welfare issues. Alternative methods are being developed to allow individual identification; Dallas and Piertney (1998) utilize DNA profiles derived from otter scats to formulate primers for microsatellite markers. Analysis of faeces is non-invasive and can provide diet and physiological indications (Kruuk 2006).

To ensure long term protection of the otter populations in the Hinkley Point development areas will require constant monitoring of distributions. Risk of chemical pollution should be assessed regularly. This would involve water quality control and post mortem examination of otter carcasses.

This study has assisted in detecting the presence of a species vulnerable to man-made developments and alleviated major threats. The same process should be carried out for all wildlife species in order to retain biodiversity.

6.9 Conclusion

Historical research suggests that the European otter is adapted to fresh water sources and not marine sources (Channin 1985; Kranz 1995; Kruuk *et al* 1989). This study has proven the presence of the European otter in four coastal locations in Somerset. Urban development is continuous within the UK. It may be that there are fewer otters inland due to lack of resources and so they have moved out towards the coast. Further research would be necessary to determine if these otters are coastal dwellers which feed on sea fish. such as the analysis of spraint contents.

The previous near extinction of the European otter verifies the need for considerations towards its welfare and habitat. This study also suggests that although conservation establishments are employed by planners to collate species statistics as an initial precaution, input by organizations such as the Wildlife Trusts can enhance the adequacy of data.

The legally binding protection placed on the European otter plays an imperative role in conserving the species. The safety mitigations adopted by EDF Energy from this study is an example of existing and successful legislation which is supported by public opinion.

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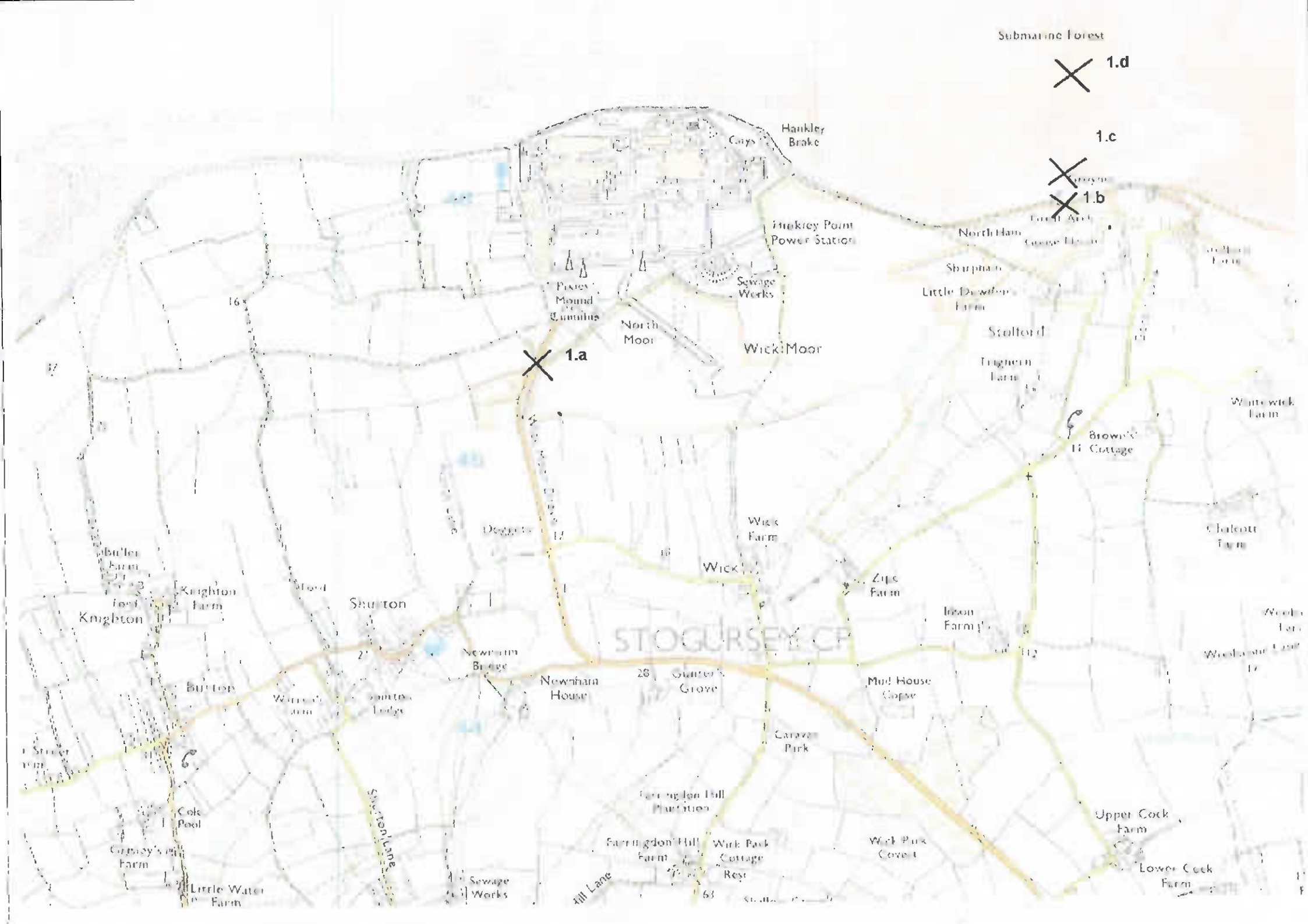
Submarine Forest
1.d
1.c
1.b
1.a
Hinkley Point Power Station
Sewage Works
North Moor
Wick Moor
Stolford
Shurton
Knighton
Button
Newnham House
Gunter's Grove
Mud House Copse
Caravan Park
Upper Cock Farm
Lower Cock Farm
Wick Park Covert
Wick Park Cottage
Sewage Works
Little Water Farm
Cole Pool
Wick Farm
Zips Farm
Ibson Farm
Brown's Cottage
Whitewick Farm
Chalcott Farm
STOGURSEY CP

Tabel 11: Stolford (Area 1) – Otter Survey Results

Location / Survey	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total Positive Evidence/Location	Percentage
1a. Wickmore Drove	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	1	1	7	38%
1b. Great Arch	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	4	22.20%
1c. Groynes	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	5	27.80%
1d. Mud on Shore	1	0	1	0	0	1	0	0	1	1	1	0	0	0	1	0	1	0	8	44.40%
Total Positive Evidence/Survey	**4**	**0**	**2**	**1**	**0**	**2**	**0**	**0**	**3**	**4**	**1**	**0**	**0**	**0**	**1**	**1**	**4**	**0**		**33.30%**

There were positive otter findings in 10 out of 18 surveys. The most evidence was observed in locations 1d (mud on shore) and 1a (Wickmore Drove). Other than during survey number 6, there is a correlation of results between locations 1b (Great Arch) and 1c (Groynes).

Table 12: Combwich (Area 2) – Otter Survey Results

Location / Survey	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total Positive Evidence/Location	Percentage
2a. Combwich Estuary	1	0	1	1	1	1	0	0	1	1	1	0	1	1	0	1	1	0	12	67%
2b. Tucketts Clyce	1	0	1	1	0	1	0	0	1	1	1	0	1	1	0	1	1	0	11	61.10%
2c. Field (1) Stream exit	1	0	1	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	13	72.20%
2d. Field (2) crossing	0	0	1	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	5	27.80%
2e. Field (3) Gate -road	1	0	1	1	0	1	1	0	0	1	1	1	1	1	0	1	1	0	12	66.70%
2f. Field (4) Gate	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	1	5	27.80%
2g. Bolham Bridge	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	16	88.90%
Total Positive Evidence/Survey	**5**	**1**	**7**	**5**	**3**	**6**	**3**	**1**	**6**	**5**	**5**	**3**	**5**	**5**	**1**	**6**	**4**	**3**		**58.70%**

Positive otter evidence was found in area 2 (Combwich), in at least one location, during every survey. The most evidence was observed at location 2g (Bolham Bridge) in 16 surveys (88.9%). Other than during survey number 5, findings are the same in locations 2a (Estuary) and 2b (Tucketts Clyce).

Table 13: Cannington (Area 3) – Otter Survey Results

Location / Survey	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total Positive Evidence/Location	Percentage
3a. Cannington Brook	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	16	88.9%
Total Positive Evidence/survey	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**		**88.9%**

Positive otter evidence was observed during 16 out of the 18 surveys carried out at location 3a (Cannington Brook). The 2 negative findings were observed during the same surveys (numbers 7 and 17) as location 2g (Bolham Bridge).

Table 14: Williton (Area 4) – Otter Survey Results

Location / Survey	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total Positive Evidence/Location	Percentage
4a. Tumulus	0	1	0	1	1	0	0	1	0	0	0	0	1	1	0	0	0	1	7	38%
4b. Mamsey Bridge	0	1	0	1	0	0	0	0	1	0	0	0	1	1	0	0	1	1	7	38.00%
4c. Stream	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	15	83.30%
4d. Stream (Bridge)	1	1	0	0	0	1	0	1	1	1	0	0	1	1	0	1	1	1	11	61.10%
4e. High Bridge	0	1	1	1	0	0	0	1	0	0	1	0	1	1	1	1	1	1	11	61.10%
Total Positive Evidence/survey	**2**	**5**	**2**	**3**	**1**	**2**	**0**	**4**	**3**	**2**	**2**	**1**	**5**	**5**	**2**	**3**	**4**	**5**		**43.30%**

Positive otter evidence was observed during 17 out of the 18 surveys carried out. Location 4c (Stream) had the highest number of positive findings (83.3%).