Professional Placement Report

MPhil in Conservation Leadership

(March and District Museum)

An Assessment of the Viability of Innovative Funding Options (IFO's) for Fenland Restoration in South Lincolnshire

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Date: 27 August 2014

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Acknowledgements

First and foremost I would like to thank my course supervisors, Dr. Nigel Leader-Williams and Dr. Chris Sandbrook (Department of Geography, University of Cambridge). I have learnt so much during the MPhil course and this is largely due to the efforts that both of you have invested in designing and implementing a programme to develop future Conservation Leaders. The lessons learnt during the taught element of the MPhil have proved extremely valuable to completing this report. I would particularly like to thank Nigel for having the faith to accept an accountant with little conservation experience onto his course. I've always wanted to pursue a career in conservation but was not sure how to start this journey. I am really appreciative for the opportunity that Nigel has given me; it has been a brilliant introduction into the conservation world.

I would like to thank my placement supervisor, Caroline Steel (Head of Conservation, *Lincolnshire Wildlife Trust*), for kindly offering to work with me at extremely short notice and for all the time and effort that Caroline has invested in making my project a great learning experience. I would also like to acknowledge the support of stakeholders from within the *Lincolnshire Wildlife Trust* and *South Lincolnshire Fenland Partnership*. A particular thanks goes to Amanda Jenkins, Jo Finlow, and Mart Tarttellin for going the extra mile to support me wherever possible.

I am truly amazed by the amount of time that the people I interviewed during this placement have given me. This ranges from landowners why invested half a day to show me around their farms, to conservationists, such as Owen Mountford, who travelled the length of the country to come and talk with me. A particular thanks goes to Dr. Francine Hughes for the support that she gave me in relation to ecosystem services assessments. This report would not have been possible without such kind gestures.

Finally, I would like to thank my fellow Conservation Leadership students. I have learnt so much from you all and wish you every success in your future careers.

Executive Summary

The conservation funding shortfall is one of the fundamental constraints to halting the loss of biodiversity (Waldron *et al.* 2013). The traditional approach to solving this problem has been to apply for grant funding. However, the scale of the funding shortfall has encouraged conservationists to search for alternative approaches (Hein *et al*. 2013). For the purpose of this report, these approaches are termed *innovative funding options* (IFO's), and include, among other things, *incentive*- and *market-based* tools such as *ecotourism*, *green certified commodities*, and *payments for ecosystem services* (PES). The fundamental difference between IFO's and grant funding is that they provide opportunities to harness the financial resources of a wider range of actors (Reid 2011).

The UK has lost the majority of its semi-natural habitats. However, ecological restoration projects such as the *South Lincolnshire Fenlands Partnership* (SLFP) offer hope that the loss of biodiversity can be reversed. The SLFP has a mission of increasing the amount of Fenland habitat in south Lincolnshire from 170 hectares (ha) to 800ha by 2060. However, limited funding is proving a major constraint.

Placement Leadership Challenge

To identify and assess the viability of IFO's in the context of the *South Lincolnshire Fenlands Partnership (SLFP)* project area. This is with a view to generating funding strategy recommendations.

The viability of IFO's was assessed by applying a bespoke version of Johnson *et al.'s* (2007) *Suitability, Feasibility, Acceptability (SFA)* framework. The data collection process consisted of a literature review, semi-structured interviews, and observations.

59 IFO's were identified in total. None of the IFO's were deemed to have *high* viability and only 5 had *medium* viability. The vast majority, 43, had *low* viability, whilst 11 were data-deficient. The *medium* viability IFO's are: *adventure Fenland; private solar farms; community solar farms; conservation agriculture;* and *the restoration of former gravel extraction sites to Fenland.* It is recommended that the SLFP should investigate these IFO's further with a view to incorporating them into their funding strategy. The vast majority of IFO's had *low* viability because they were financially unsuitable in terms of their ability to

generate income or incentives for Fenland restoration. The results highlight how difficult it is to devise viable IFO's for the project area.

The viability assessments of 4 short-listed IFO's (*honey production, PES*, *solar farms*, and *offsetting)* are included within this report. Due to word limit constraints, it was not possible to include all 59 viability assessments. However, an analysis of some of the key traits identified across the various IFO's is included. A summary of these traits and associated recommendations is outlined below:

- The viability of tourism and recreation (T&R) focused IFO's, such as *cycle hire*, was generally low. This is due to three constraints: limited demand, lack of appropriate infrastructure; and an inability to share fixed labour costs across other activities. An additional underlying constraint is that restoration sites are usually selected based on their conservation credentials as opposed to their potential to generate income. Consequently, it is recommended that a broader set of criteria should be considered when selecting future restoration sites.

- The viability of Fenland commodity (FC) focused IFO's, such as *hay* and *honey production*, was generally low. The key constraint for FC's is that only a small area of Fenland, 170ha, is available on which to produce such commodities. This creates supply bottlenecks and makes it difficult to achieve economies of scale.

- Many of the IFO's, such as *PES* and *solar farms*, rely on providing incentives for the conversion of arable land (the dominant land-use in the area) to Fenland. The high opportunity costs associated with arable land dictate that it is difficult for IFO's to provide the necessary incentives to be financially suitable. Consequently, it is recommended that the SLFP should focus restoration efforts on land with lower opportunity costs, such as former gravel extraction sites.

- Some conservationists expressed a low acceptance of particular IFO's which ultimately impacted their overall viability. Sometimes this low acceptance coincided with the IFO's negative conservation impacts. However, for options such as *solar farms* and *adventure Fenland*, the low acceptance of some interviewees was founded on, among other things, a very precious, prescriptive mind-set of what conservation habitats should look like. Conservationists who are confined by such mind-sets will find it more difficult to devise creative solutions to funding challenges.

- There is a group of 6 IFO's that would generate minimal funding, but offer substantial *other benefits*, are neutral or positive for biodiversity, and require minimal resource inputs. These IFO's are: *activities for disabled people*; *Fenland art*; *fen-skating*; *school visits*; *elderflower cordial*; and *links to universities*. The *other benefits* on offer would add to the overall *value* of Fenland sites and therefore indirectly enhance the income generation potential of such locations. Consequently, the SLFP should consider implementing some of these IFO's.

- Several IFO's were identified by tracking government policies and incentives (e.g. subsidies) relating to renewable energy and land-use more generally. IFO's identified by using this approach include: *community solar farms*; *processing Fenland biomass through Anaerobic Digesters*; *willow biomass; etc.* Identifying viable IFO's by adopting this approach is difficult due to several key constraints. However, the *community solar farm* IFO highlights that potentially lucrative opportunities are out there. Therefore, the SLFP should consider tracking a broader set of policy areas in order to identify viable IFO's.

Many of the constraints outlined above are common to other conservation contexts. This serves to highlight that devising viable IFO's within the conservation sector is extremely challenging. But this does not mean that IFO's are destined to fail. The 5 *medium* viability IFO's identified support this assertion. Furthermore, there are changes that conservation organisations can make to their own practices to make it easier to identify, capitalise upon, and implement viable IFO's. Critically, we have to keep looking for innovative solutions to the funding challenge. At least this gives us a chance of protecting biodiversity. The alternative is that we continue on the same disappointing path.

Words (9,994)

Introduction

Leadership Challenge

Tackling the loss of biodiversity is a leadership challenge that is proving difficult to solve. Global biodiversity has been declining since the 1970's. Furthermore, the international community failed in its *Convention on Biological Diversity* (CBD) commitment to achieve a significant reduction of the rate of biodiversity loss by 2010 (Butchart *et al.* 2010).

Various frameworks classify the causes of biodiversity loss (Forester and Machlis 1996; Salafsky *et al.* 2008; Balmford *et al.* 2009). These causes range from indirect factors, such as population growth, to direct factors, such as habitat conversion. Tackling each cause is a challenge in its own right. However, a fundamental constraint to tackling these causes is a lack of funding. Consequently, solving the funding problem is a major conservation leadership challenge (Hein *et al.* 2013; McCarthy 2013; Waldron *et al.* 2013).

Aichi target 11 is to have 17% of terrestrial and 10% of marine habitats within protected areas by 2020. Target 12 is to sustain or improve the conservation status of threatened species by 2020 (CBD 2011). Achieving these targets will cost $78.1billion/annum (McCarthy *et al.* 2012). Current global conservation expenditure is only $21.5billion/annum (Waldron *et al.* 2013). This highlights the scale of the funding problem.

The traditional approach to securing funding is to apply for grants, a significant proportion of which come from the public sector (Reid 2011). However, the scale of the funding shortfall in conjunction with stagnating public sector budgets has encouraged conservationists to search for alternative approaches (Evans *et al.* 2012; Pirard 2012; Hein *et al*. 2013). Some of these approaches are discussed below.

Ecotourism as "responsible travel to natural areas that conserves the environment" (TIES) (2013). Ecotourism rose to prominence following the *Rio Summit* (1992) (Diamantis 1999; Weaver 2001,) and ecotourism revenue today exceeds US$29billion/annum (Kirkby *et al.*

2011). An element of this revenue is captured by conservation organisations. However, the main premise of ecotourism is that revenue is retained by local stakeholders and this incentivises them to conserve the biodiversity on which their income is founded (Kiss 2004). Consequently, it is a form of in-kind funding that provides additional conservation resources.

Child (1995) noted that the extractive use of living resources, if done sustainably, can generate funds and provide incentives for conservation. This concept is not new; some of the earliest reserves were created to protect mega-fauna for game hunting. However, the concept of ***green certified commodities*** (GCC) such as *Rainforest Alliance* coffee is relatively new. The amount of funds involved in GCC's is $2.6billion/annum (Parker *et al.* 2012).

In 1997, Constanza *et al.* estimated the value of the biosphere at $33trillion. Since then there has been a focus on putting monetary values on services that nature provides (McCauley 2006). These services have been termed *ecosystem services (ES)*. From an economic perspective, ES's are treated as externalities as they provide benefits that are not paid for (Kosoy and Corbera 2010). They include services such as carbon sequestration and water regulation (MEA 2001). Various stakeholders argue that the loss of biodiversity can be reversed through ***payments for ecosystem services*** **(PES).** PES is defined as a transaction where an ES is bought by a buyer on the basis that the provider secures the provision of the service (Wunder 2005). Common PES schemes include watershed conservation initiatives and carbon sequestration programs such as *Reducing Emissions from Deforestation and Forest Degradation* (REDD) (Corbera *et al*. 2007). PES provides monetary incentives to protect biodiversity and therefore amounts to in-kind funding.

Many of these approaches are what Hutton and Leader-Williams (2003) classify as *incentive-based conservation* as they "motivate people to conserve wild living resources". Another term that has been used is *market-based instruments* on the basis that monetary values are applied to nature (Pirard 2012). A fundamental difference between these types of approaches and traditional grant funding is that they provide opportunities to harness the financial resources of a wider range of actors (Reid 2011). Consequently, they have the potential to reduce the conservation funding shortfall. From here-on-in all alternative approaches will be referred to as *innovative funding options* (IFO's) to distinguish them from grant funding.

There are well-publicised examples of IFO's achieving positive conservation outcomes, e.g. the Catskill/Delaware watershed PES project (McCauley 2006), and ecotourism in the Galapagos (Nash 2009). However, many IFO's face conceptual and practical challenges. For example, many conservationists are uncomfortable with the concept of valuing nature. This creates challenges for PES and similar approaches. There are also technical challenges, such as how to value ES's. The *TESSA* (Peh *et al.* 2013) and *TEEB* (2010) frameworks mitigate this problem but by no means solve it. There are examples where PES and ecotourism projects have experience implementation difficulties which have resulted in adverse biodiversity impacts (Krüger 2005; Angelsen 2008; Waylen *et al.* 2009; Sandbrook *et al.* 2010). Furthermore, particular IFO's are simply inappropriate in some instances. For example, there are locations where ecotourism revenue is too low to provide adequate incentives (Krüger 2005; Hein *et al.* 2013). Similarly, there are sites where particular GCC's would not be viable for financial and conservation reasons (Hein *et al.* 2013). Such issues dictate that IFO's are unlikely to provide a silver bullet solution to the funding shortfall (McCauley 2006). However, they can help solve the problem (Redford *et al.* 2013). A critical leadership challenge is to devise IFO's that can be practically implemented and are relevant to the specific conservation context.

Many developed countries have lost most of their natural habitats and biodiversity is hanging on in small isolated areas. Arguably, these countries have failed the challenge of conserving biodiversity. In conjunction with the intensification of agriculture since WW2, the UK has lost most of its semi-natural habitats, including 97% of its flower-rich meadows and half of all ancient woodlands (NE 2008; OWWT 2010). England's best remaining examples of semi-natural habitat are designated as *Sites of Special Scientific Interest* (SSSI's). SSSI's only cover 8% of the country; they are fragmented, isolated, and 65% are in unfavourable conditions (Lawton 2010; NE 2014). Furthermore, the overall picture in the UK is still one of decline (Reid 2011).

However, *ecological restoration* (ER) offers hope for countries such as the UK. ER is "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (SER 2004). Although ER is a relatively new concept (Menz *et al.* 2013), it is becoming a major conservation paradigm and is seen as a key tool for tackling biodiversity loss (Hobbs and Harris 2001; Roberts *et al.* 2009). Aichi target 15 is to restore 15% of degraded ecosystems (CBD 2011). Furthermore, a target from the *Rio+20 Conference* (2012) is to restore 150m hectares (ha) of degraded land by 2020. This is expected to cost $18billion/annum (Menz *et al.* 2013). Sourcing the funding for this is a significant leadership challenge.

In 2010, a UK government commissioned review was published, *Making Space for Nature* (Lawton 2010). Lawton (2010) recommends that, in order to create coherent and resilient ecological networks in England, an ER approach must be taken. Consequently, there has been an acceleration in the number of ER projects (NE 2013). One of the main landscape-scale ER projects is the *Fens for the Future Partnership* (FFP). FFP's vision is to see sustainable Fenland habitat restored and reconnected across its traditional range in eastern England (known as *the Fens*) (SLFP 2012).

Fen is one of four main types of wetland habitat. It is fed by alkaline groundwater or surface water, and tends to be dominated by grasses and sedges. The underlying soil type is usually peat or silt. The other main Fenland habitat types include open water, reed-bed, and wet woodland. *The Fens* used to be England's largest wetland and rich in biodiversity. However, they have suffered extensive drainage since the 1700's in order to covert the land to arable agricultural (Charlton and Hilts 1989; Morris *et al.* 2000; Oates 2002); less than 1% of the original Fenland remains (SLFP 2012). What is left is small, fragmented, and degraded. The remaining habitat harbours over 13,400species and is home to 25% of the UKs rarest wildlife (Mossman *et al.* 2012). Given the high biodiversity value of Fenland, and the fact that so little remains, achieving FFP's restoration vision would go some way to reversing the decline of biodiversity in the UK.

There are numerous individual restoration projects within FFP, e.g. *Wicken Fen Vision*, the *Great Fen*, and the *South Lincolnshire Fenlands Partnership*. These projects have long-term restoration targets and are at various stages of achieving them (NT 2010). What the majority of these projects have in common is that they received large grants to acquire and restore a proportion of the targeted land. However, given public sector budget cuts (CCL 2014) and the global conservation funding shortfall generally, the challenge moving forward is attaining funding to:

- Restore more Fenland.
- Cover day-to-day running costs.

IFO's could provide possible solutions to this challenge. The *Great Fen Socio-Economic Report* (CCL 2014) provides a list of funding options that might be appropriate for the *Great Fen*. However, a comprehensive assessment of which IFO's are viable in a Fenland Restoration context has not been completed.

Specific Leadership Challenge

To identify and assess the viability of IFO's in the context of the *South Lincolnshire Fenlands Partnership (SLFP)* project area. This is with a view to generating funding strategy recommendations.

Project Area

The SLFP was formed in 2005 and is the youngest restoration project within FFP. SLFP is managed by the Lincolnshire Wildlife Trust (LTW) in collaboration with nine partners.

Figure 1: List of SLFP partners

1	**Lincolnshire Wildlife Trust**
2	Baston Environment Group
3	Environment Agency
4	Lincolnshire County Council
5	Natural England
6	Sustrans
7	South Holland District Council
8	South Kesteven District Council
9	Welland & Deepings IDB
10	Waterside Garden Centre, Baston

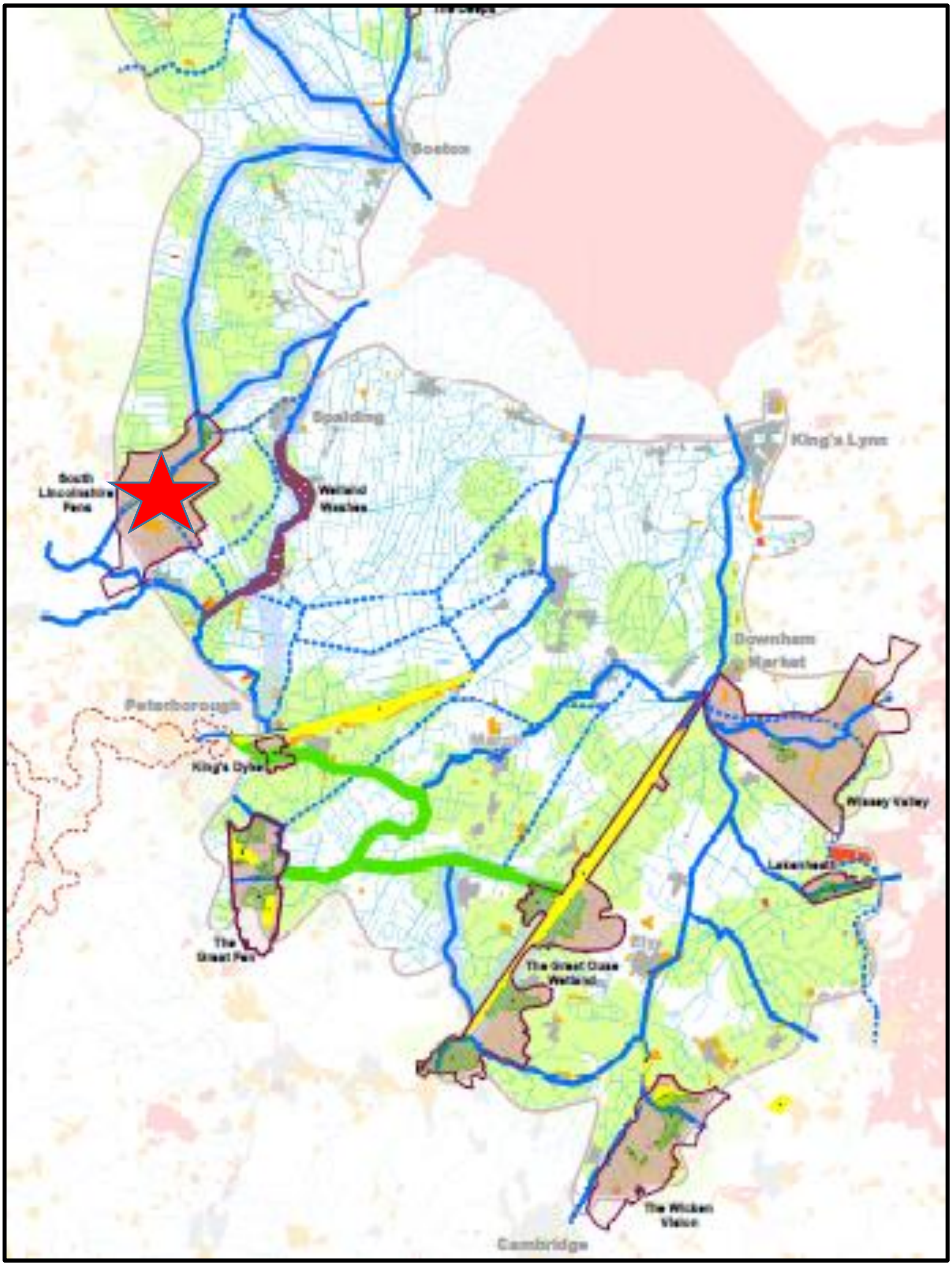
(SLFP 2013)

The SLFP project area is 7,000ha and located within south Lincolnshire (Figure 2). SLFP's mission is to increase the amount of Fenland within the project area to 800ha by 2060. The drainage of Fenland in Lincolnshire has been more extensive than elsewhere; only 0.1% of the original 1,000km2 remains. The best examples of Fenland in Lincolnshire are Baston Fen (BF) and Thurlby Fen (TF) (56ha in total). Both sites are SSSI's and situated within the project area. In 2009, a 114ha site known as Willow Tree Fen (WTF) was restored. These three sites amount to 170ha and represent the extent of Fenland within the project area. Consequently, a further 630ha needs to be restored to achieve the 800ha target (SLFP 2013).

Figure 2a: Map of England highlighting where *The Fens* are located

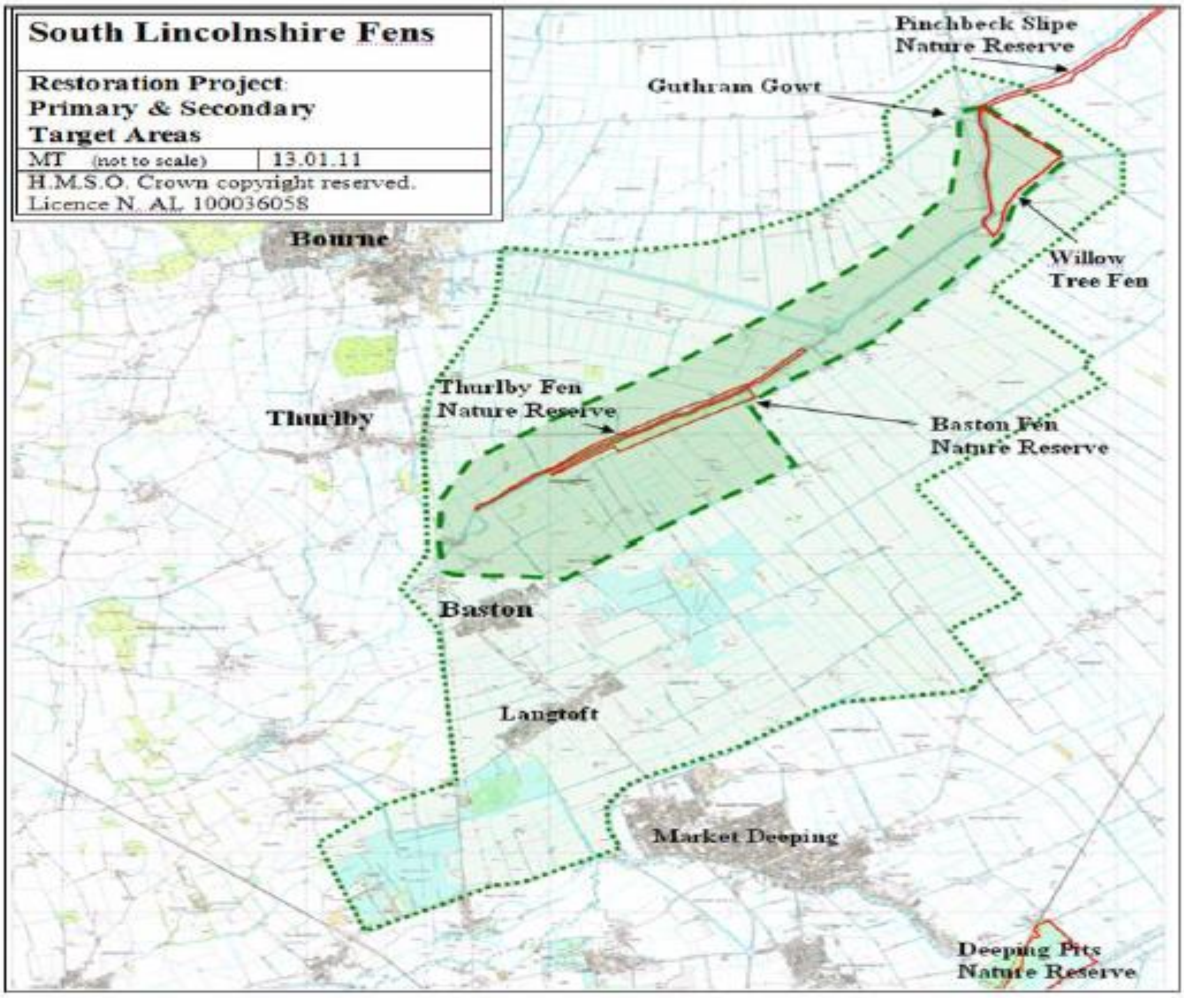
(Morris *et al*. 2000)

Figure 2b: Detailed map of the FFP area with the SLFP denoted by a red star



(SLFP 2012)

Figure 2c: Detailed map of the SLFP project area



(SLFP 2013)

The acquisition and restoration of WTF cost £2.4m and was funded by grants from Natural England, Heritage Lottery Fund, and the Environment Agency. Achieving the 800ha target is budgeted to cost a further £15.5m (SLFP 2013).

Compared to other Fenland projects, the SLFP sites receive few visitors. WTF receives 1,600visitors/year, whereas Wicken Fen receives 50,000 (NT 2014). BF and TF have few amenities whilst WTF has basic facilities such as hides, toilets, and a former barn which is used for events. A limited number of visitor focused activities such as open days, pond dipping, and school visits have taken place at WTF to date.

Similarly to the rest of *the Fens*, the project area is low-lying, flat, and dominated by large fields separated by drainage ditches. The land is extremely productive due to the rich peat and silt soils. Consequently, arable agriculture accounts for 90% of the land-use. Another significant land-use is gravel extraction (SLFP 2013). The River Glen passes by all the existing Fenland sites. The McMillan Way, a public footpath that spans the width of England, follows the course of the River Glen (TMMA 2014). The main population centres within the area are the villages of Baston and Langtoft. South Lincolnshire is sparsely populated compared to most of England, has a lower than average income per capita, and lacks economic diversity (GLLEP 2014).

Prior to the drainage of the area, local inhabitants had developed a way of life linked to the wetland environment. Common activities included reed and sedge harvesting; thatching; eel catching; decoying; willow weaving; and pastoral farming. Ice-skating on frozen Fen was a popular activity on BF until 1970. In short, the area has is a rich socio-historical dimension.

Aims

1) Identify a long-list of IFO's.

2) Complete a *basic assessment* of the *viability* of the *long-listed options*.

3) Select a *short-list* of 4 IFO's and complete an *in-depth assessment* of their *viability*.

4) Provide funding strategy recommendations.

IFO's are defined as options that either:

- Generate income from existing Fenland sites.
- Provide incentives for the restoration of additional Fenland areas.
- Provide incentives for the creation of buffer habitats to core Fenland sites.

The *viability* of the IFO's is determined by applying the *viability framework* (see below). The distinction between a *basic* and *in-depth assessment* is outlined within the *viability framework* section.

Report Structure

The Methodology is outlined first, followed by a findings section, conclusions, and personal lessons learned. The findings section commences by stating the long-listed IFO's. The subsequent four chapters are the in-depth assessments of the shortlisted IFO’s. Word limit constraints dictated that it was not possible to include the assessments of the long-listed options. However, the findings section is concluded by analysing some of the general traits identified across the various IFO’s. Recommendations are included throughout the report.

Methodology

A qualitative research approach was applied because:

- This placement required an exploratory approach as there were a lot of initial unknowns in terms of possible IFO's and their viability.
- Understanding the local context and stakeholders was central to determining viability.

Qualitative research is suited to these characteristics (Newing 2010).

The placement was split into sequential phases:

Phase 1. 1st May-8th June

A literature review and discussions with key internal SLFP stakeholders was conducted to:

1. Identify a long-list of IFO's.
2. Complete a basic viability assessment of IFO's.
3. Agree which options to short-list.

Phase 2. 9th June-31st July

Interviews, observations, and a continuation of the literature review were conducted to attain:

1. Information for the in-depth viability assessments.
2. Any necessary additional information for the basic viability assessments.

There was a degree of overlap between phases. For example, if interviewees identified new, high potential IFO's during phase 2, basic assessments would be completed.

Research Methods

The methods used were designed to attain the necessary information per the *viability framework*.

Literature Review

Academic literature was drawn upon. However, *grey literature* was also used, such as unpublished academic papers. A lot of grey literature is recent (Debachere 1995); having recent information is critical for a study of this nature which has to be up-to-date with rapidly changing factors such as the economic context. *Grey literature* also provided information on local issues that was unavailable elsewhere.

The *Web of Science* and *Google* were utilised to source academic and *grey literature* respectively. The search terms used became increasingly specific as the placement progressed. Sources were also identified through discussions with interviewees and internal SLFP stakeholders.

Semi-structured Interviews

Semi-structured interviews were used because they enabled interviewees to express their broad understanding of the topic whilst ensuring that key pieces of information were collected. I prepared interview guides with discussion points. These points were based on the principle of attaining information per the *viability framework*. The questions became increasingly targeted as the placement progressed and the amount of information gaps reduced.

Targeted sampling was adopted, whereby interviewees were selected based on their ability to provide information on the viability of IFO’s. There was a focus on selecting interviewees who could provide information on short-listed IFO’s. However, interviewees with general knowledge of IFO’s were also selected to attain necessary information on long-listed options. Interviewees were identified through discussions with internal SLFP stakeholders and through the Phase 1 literature review. *Snowball sampling* was applied when interviewees were difficult to identify or attain contact details for. In addition to interviewees from south Lincolnshire, interviewees from Cambridgeshire were targeted due to the number of Fenland projects within the county, and because I was living in Cambridge. An introductory email, followed up with a phone call when necessary, was the preferred communication method. I also secured interviews by approaching people at events and conferences.

Observations

Information was attained from *observations* made at field visits, events and conferences. One participatory observation was conducted.

Sample Size

The concept of *saturation*[1] was applied, alongside a consideration of time constraints, to determine the appropriate number of interviews and observations (Newing 2010). In practice, saturation meant attaining enough information to complete the IFO assessments per the viability framework.

To determine when saturation had been attained, I continually assessed the transcripts throughout the placement to determine what information was still required and adapted the sampling strategy accordingly to fill in any information gaps. To assist with this, I applied a coding technique based on the elements within the *viability framework*. I also applied the principle of *triangulation*[2]. Once the gaps had been filled, saturation had been attained and, therefore after this point, no further information was collected.

[1] *Saturation:* A qualitative research concept that helps determine an appropriate sample size. Saturation is attained when additional samples no longer reveal new information or themes (Newing 2010).

[2] *Triangulation*: refers to the application and combination of various research methodologies in the study of the same phenomenon (Bogdan and Biklen 2006). This is with a view to increasing the validity of the results.

Figure 3 (part 1): List of interviews conducted

Interview Number	Interviewee Name	Stakeholder Category	Role	Organisation	Contact Details	Innovative Funding Option (IFO) category	Date	Interview Duration
1	Dr Steve Boreham	Academic	Senior Technical Officer [Geographical Services Officer]	University of Cambridge, Dept Geography	steve.boreham@geog.cam.ac.uk	Various	15/05/2014	1 hr
2	Sarah Inge Parker	Academic	Doctoral Researcher at Environmental Change Institute (ECI)	University of Oxford	SarahParker@linacre.ox.ac.uk	Renewable Energy	11/06/2014	15 mins
3	Mark Ullyett	Conservationist	Great Fen Restoration Officer	Great Fen Project	07734 478459	Various	11/06/2014	15 mins
4	Dawn Isaac	Conservationist	Senior External Funding Specialist	Natural England	Dawn.Isaac@naturalengland.org.uk	Traditional Funding Options	13/06/2014	20 mins
5	Steve Welch	Private Sector	IT and Finance Manager	Waterside Garden Centre	steve@watersidegardencentre.co.uk	Various	13/06/2014	1 hr 15 mins
6	Peter Bircham	Conservationist	Chair, Wicken Research and Recording Group	Wicken Committee	pmb22@hotmail.co.uk	Various	17/06/2014	1 hr 10 mins
7	Lois Baker	Conservationist	Community Manager, Wicken Fen	National Trust	lois.baker@nationaltrust.org.uk	Various	17/06/2014	1 hr 20 mins
8	Esmond Gadd	Local Resident	Local Bee Farmer	Lincolnshire Honey	esmondgadd@btconnect.com 07860493114	Honey Production	18/06/2014	1 hr
9	Laurence Duncan	Private Sector	Managing Director	Free-watt Energy	07584028105 laurence@freewatt.co.uk	Solar Farm	18/06/2014	35 mins
10	Richard Jones	Private Sector	Regional Director	Energy My Way	r.j@energymyway.co.uk	Renewable Energy	18/06/2014	20 mins
11	Gillian Richardson	Private Sector	Business Development Manager	Select Lincolnshire	Gillian.Richardson@lincs-chamber.co.uk	Fenland Commodities	18/06/2014	20 mins
12	Jo Finlow	Conservationist	Coastal Country Parks and Fenland Lead	Lincolnshire Wildlife Trust	01529 968204	Various	20/06/2014	20 mins
13	Peter Rayner	Local Resident	Director	Baston Environment Group	furniconsult@ifca.demon.co.uk	Various	20/06/2014	45 mins
14	Paul Forecast	Conservationist	Regional Director for East of England	RSPB	Paul.Forecast@rspb.org.uk	Various	20/06/2014	25 mins
15	Cara Reece	Private Sector	Essex and Ribble Valley Offset Pilot Lead	Environment Bank	07527 035359 creece@environmentbank.com	Offsetting	24/06/2014	1 hr 30 mins
16	Professor Rhys Green	Academic	Principal Rearch Biologist at the RSPB	University of Cambridge, Dept Zoology	reg29@cam.ac.uk	Various	24/06/2014	15 mins
17	Dave Rodgers	Conservationist	Lakenheath Fen, Site Manager	RSPB	Dave.Rodgers@rspb.org.uk	Various	25/06/2014	30 mins
18	Dr John Hopkins	Academic	Honorary Fellow in the College of Life and Environmental Sciences	University of Exeter	j.hopkins@exeter.ac.uk	Various	25/06/2014	30 mins
19	Kate Carver	Conservationist	Great Fen Project Manager	Great Fen Project	01954 713513	Various	25/06/2014	20 mins
20	Matt Hamilton	Conservationist	Reserves Manager and West Cambs	Cambridgeshire Wildlife Trust	01954 713521	Various	25/06/2014	15 mins
21	Rebekah O'Driscoll	Conservationist	Reserve Warden for Woodwalton Fen and Holme Fen NNRs	Natural England	Rebekah.O'Driscoll@naturalengland.org.uk	Various	25/06/2014	40 mins
22	Liz Harris	Conservationist	Nature After Minerals Restoration Adviser	Nature After Minerals, RSPB	Liz.Harris@rspb.org.uk	Restoration of Former Gravel Works	25/06/2014	45 mins
23	Chris Hudson	Conservationist	Site Manager, RSPB Hanson-Ouse Fen	RSPB	Chris.Hudson@rspb.org.uk	Various	27/06/2014	1 hr 15 mins
24	Chris Soans	Conservationist	Consultancy Manager for East of England	National Trust	chris.soans@nationaltrust.org.uk	Various	27/06/2014	1 hr 20 mins
25	Joan Childs	Conservationist	Wicken Fen General Manager	National Trust	joan.childs@nationaltrust.org.uk	Various	04/07/2014	25 mins

Figure 3 (part 2): List of interviews conducted

Interview Number	Interviewee Name	Stakeholder Category	Role	Organisation	Contact Details	Innovative Funding Option (IFO) category	Date	Interview Duration
26	Mark Nokkert	Conservationist	Programme Manager	Ouse Washes Landscape Partnership	mark.nokkert@cambsacre.org.uk	Various	04/07/2014	20 mins
27	Tony	Private Sector	Stall Manager at Spalding Farmers Market	Smith's Smokery (Eels)	01754 820262	Fenland Commodities	06/07/2014	30 mins
28	Rex Sly	Agriculture	Local Lincolnshire Farmer and Fenland Author	Local Farmer and Fenland Author	rex.turfpits@gmail.com	Various	07/07/2014	3 hrs
29	Judy Lyon	Private Sector	Deputy Supply Chain Manager. *Love Local* range lead	Cooperative Supermarket	JLyon@lincolnshire.coop	Fenland Commodities	08/07/2014	1 hr
30	Darren Smith	Public Sector	Integrated env planning specialist & Member of Fens Agricultural Water Group	Environment Agency	darren.smith@environment-agency.gov.uk	Various	08/07/2014	1 hr 15 mins
31	Doug Robinson	Public Sector	Sustainability Team Leader	Lincolnshire County Council	Douglas.Robinson@lincolnshire.gov.uk	Renewable Energy	09/07/2014	1 hr
32	Maisie Jepson	Agriculture	Rural Surveyor	Country Land and Business Association Limited (CLA)	maisie.jepson@cla.org.uk	Various	09/07/2014	1 hr 30 mins
33	Paul Separovic	Public Sector	Fens waterways Link Partnerships Manager & Acting Team Leader for Waterways Operations (Great Ouse & Stour Navigations)	Fens Waterway Link, Environment Agency	01733 464 327	Tourism and Recreation, Payment for Ecosystem Services	10/07/2014	1 hr
34	Owen Mountford	Academic	Plant Ecologist. Former Chair of Wicken Fen Committee	Centre for Ecology and Hydrology	om@ceh.ac.uk	Various	10/07/2014	2 hr
35	John ?	Conservationist	new Warden, Willow Tree Fen (and other sites)	Lincolnshire Wildlife Trust	slincs@lincstrust.co.uk	Various	11/07/2014	2 hr
36	Grace Evans	Local Resident	Local Honey Producer (Baston)	Local Resident	evansandevans30@yahoo.co.uk	Honey Production	11/07/2014	2 hr 30 mins
37	Sue Green	Agriculture	Senior Agent	National Farmers Union (NFU), Bourne branch, Lincolnshire	sue_green@nfumutual.co.uk	Various	14/07/2014	1 hr 30 mins
38	Tony Reynolds	Agriculture	Local Farmer who practices Conservation Agriculture	Local Farmer	rreyn34366@aol.com	Conservation Agriculture	16/07/2014	3 hr
39	Dave Bromwich	Conservationist	Head of Reserves	Lincolnshire Wildlife Trust	DBromwich@lincstrust.co.uk	Various	16/07/2014	30 mins
40	Geoff Taylor	Private Sector	Manager	Chain Bridge Forge	chainbridgeforge@gmail.com	Fenland Art	16/07/2014	45 mins
41	Andrew Freeman	Agriculture	Farmer, owner of current and restored gravel extraction sites, applied for planning permission for solar farm on his land	Farmer	clf612@btconnect.com	Solar Farms, Gravel Extraction, Payment for Ecosystem Services	21/07/2014	3h 30 mins
42	Dr Francine Hughes FHE	Academic	Reader in wetland ecology and conservation	Anglia Ruskin University	francine.hughes@anglia.ac.uk	Various	26/07/2014	1 hr 20 mins
43	Martin Redding	Various	Assistant Engineering Manager and Env. Officer	Witham Fourth District Internal Drainage Board	Martin@w4idb.co.uk	Various	various	25 mins
44	Sarah Evans	Conservationist	Warden, Willow Tree Fen (and other sites)	Lincolnshire Wildlife Trust	slincs@lincstrust.co.uk	Various	various	2 hr 15 mins
45	Catherine Weightman	Conservationist	Partnerships Team - Senior Advisor	Fens for the Future Partnership, Natural England	Catherine.Weightman@naturalengland.org.uk	Various	various	40 mins
46	Caroline Steel	Conservationist	Head of Conservation	Lincolnshire Wildlife Trust	CSteel@lincstrust.co.uk	Various	various	7 hr
47	Amanda Jenkins	Conservationist	South Lincolnshire Fenlands Project Officer	South Lincolnshire Fenland Partnership, Lincolnshire Wildlife Trust	slincsfens@lincstrust.co.uk	Various	various	7 hr
48	Mark Tarttelin	Conservationist	Consultant. Former South Lincolnshire Fenlands Project Officer	Wild Planet Ltd.	marktarttelin@wildplanet.org.uk	Various	various	3 hr
49	Richard Green	Private Sector	Green Business Management Support	LARK Energy	marktarttelin@wildplanet.org.uk	Renewable Energy	various	30 mins

Total Interview Time	**65 hr**

Figure 4: List of observations and participatory observations conducted

Observation Number	Observation / Participatory Observation	Type	Description	IFO Category	Date	Duration (hours & minutes)
1	Observation	Event	Willow Tree Fen five year anniversary	Various	20/06/2014	4 hr
2	Observation	Conference	CCF Symposium on habitat restoration	Various	25/06/2014	6 hr
3	Observation	Conference	Fen the Future Quarterly Meeting	Various	04/07/2014	5 hr
4	Observation	Event	Spalding Farmers Market	Fenland Commodities	06/07/2014	1 hr 30 mins
5	Observation	Conference	Community Energy Conference, University of Cambridge	Renewable Energy	11/06/2014	2 hr
6	Observation	Event	Lincolnshire Show	Various	18/06/2014	4 hr
7	Observation	Field Visit	McMillan Way walk between Willow Tree Fen and Waterside Garden Centre	Various	05/07/2014	6 hr
8	Observation	Field Visit	Cowbit and Crowland Washes	Various	07/07/2013	45 mins
9	Participatory Observation	Participatory Observation	Experienced how a bee hive operates	Honey production	11/07/2014	2 hr
10	Observation	Conference	Conservation Agriculture Conference	Conservation Agriculture	12/05/2014	2 hr
11	Observation	Field Visit	Baytrees Garden Centre	Fenland Commodities	11/07/2014	20 mins
12	Observation	Field Visit	Vine House Farm Shop	Fenland Commodities	11/07/2014	20 mins
13	Observation	Field Visit	Tony Reynolds farm visit	Conservation Agriculture	16/07/2014	3 hr
14	Observation	Field Visit	Andrew Freemand solar farm visit	Solar Farm	21/07/2014	3 hr
15	Observation	Field Visit	Waterside Garden Centre	Various	Various	1 hr
16	Observation	Field Visit	Willow Tree Fen	Various	Various	7 hr
17	Observation	Field Visit	Baston Fen	Various	Various	2 hr
18	Observation	Field Visit	Thurlby Fen	Various	Various	1 hr
19	Observation	Field Visit	Wicken Fen	Various	Various	3 hr
20	Observation	Field Visit	Ouse Fen, Cambridgeshire	Various	22/07/2014	1 hr

Total Duration	**55 hr**

Short-listing Rationale

Short-listed IFO's were selected on the following criteria:

1) IFO's that were deemed to have the highest viability potential were prioritised.

2) IFO's that the SLFP were interested in implementing were prioritised.

3) IFO's that would best help me put into practice the knowledge gained through the MPhil were prioritised.

Viability Framework

To assess the viability of IFO's, Johnson *et al.'s* (2007) *Suitability, Feasibility, Acceptability (SFA)* framework was applied. The framework is designed to evaluate the viability of business strategies. Given that IFO's amount to strategies to generate funding, it is an appropriate framework to apply.

The SFA framework evaluates 3 different factors to determine viability: suitability, feasibility, and acceptability. Within each factor, business strategies are assessed against key questions. For this placement, the IFO's were assessed against 4 questions (figure 5).

Figure 5: Table describing the 3 factors within the SFA framework and outlining the key questions for each factor

SFA	Description	Key Questions
Suitability	This relates to whether the business strategy can achieve the organisations main objectives. For this placement, this was interpreted as whether the IFO generates funding whilst ensuring no harm to biodiversity.	**1. Does the IFO generate income or provide incentives for either Fenland restoration or the creation of buffer habitats?**
		2. Is this done in a manner that ensures no negative impacts on biodiversity?
Feasibility	This relates to whether the business strategy can be practically implemented. In the case of IFO's there are numerous feasibility considerations such as: does the SLFP have the required internal competencies and resources; can the necessary financial capital be raised; is there land available to purchase for restoration; etc.	**3. Can the IFO be practically implemented?**
Acceptability	This relates to whether the business strategy acceptable to key stakeholders	**4. Is the IFO acceptable to key stakeholders?**

One additional question was added that does not fit into the SFA framework:

5. Does the IFO provide *other benefits* besides generating funding?

Based on the information collected, each IFO was given a colour rating for each question (figure 6).

Figure 6: Viability Framework rating system

Question No.	SFA		Red	Yellow	Green
1	Financial Suitability	Income generating potential or incentive for restoration	low	medium	high
2	Conservation Suitability	biodiversity impact	negative	neutral	positive
3	Feasibility		low	medium	high
4	Acceptability		low	medium	high
5	Other Benefits		low	medium	high
	Overall Viability		**low**	**medium**	**high**

The overall viability rating of each IFO was determined by evaluating the ratings for each question. The rating process was not an exact science; personal judgement was utilised. Nonetheless, some general principles were applied:

- Acceptability ratings were determined by assessing the acceptance levels of stakeholders through interviews and the literature review. More weight was given to high-power-high-interest stakeholders.
- IFO's with a low rating for question 1 received a low overall viability rating as the purpose of this placement was to identify IFO's that can generate funds.

Basic vs In-depth Viability Assessments

The *basic assessment* was designed to provide enough information to decide whether the IFO has potential and should be investigated further. The *in-depth assessment* was designed to provide enough information to decide whether the IFO should be implemented or not. The differences in the way that the framework was applied for *basic* and *in-depth assessments* are outlined below:

- More information was attained for the *in-depth* assessments than for the *basic assessments*.
- For question 1, comprehensive financial analyses were completed for the *in-depth* assessments. This included net present value (NPV) cost-benefit analyses based on UK government guidelines (HM Treasury 2011) (figure 7). Calculations such as pay-back

period[3] and internal rate of return (IRR)[4] were also applied wherever appropriate. Basic income and expense calculations were completed for long-listed options.

- For *in-depth* assessments, combined *SWOT-PESTEL* analyses[5] were completed to provide appropriate background information. This is in line with the approach outlined by Kaplan (2010). This step was omitted for *long-listed* options.
- For question 4 (acceptability), all key stakeholder groups were considered for the *in-depth assessments*. However, for the *basic assessments*, the views of conservationists only were considered. This is due to time constraints and because, for long-listed IFO's to have a possibility of being viable, it is essential that conservationists find them acceptable.

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[3] Pay-back Period: "The length of time required to recover the cost of an investment. The payback period of a given investment or project is an important determinant of whether to undertake the position or project, as longer payback periods are typically not desirable for investment positions" (Investopedia 2014b).

[4] Internal Rate of Return (IRR): "The discount rate often used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero. Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project. As such, IRR can be used to rank several prospective projects a firm is considering. Assuming all other factors are equal among the various projects, the project with the highest IRR would probably be considered the best and undertaken first." (Investopedia 2014c).

[5] Combined SWOT-PESTEL analyses: A SWOT analysis outlines the strengths, weaknesses, opportunities, and threats to a strategy. A PESTEL analysis outlines the politicial, economic, social, technological, environmental, and legal factors that impact on a business strategy. A combined SWOT-PESTEL analysis is a SWOT analysis that is cross-structured into the different PESTEL categories. The SWOT-PESTEL analyses for each shortlisted IFO are included within the *Appendices* section.

Figure 7: Principles applied when completing net present value (NVP) cost-benefit analysis calculations for in-depth viability assessments

NVP Definition	"The difference between the present value of cash inflows and the present value of cash outflows" (Investopedia 2014).
Discount rate	**A discount rate of 3.5% was applied** for all in-depth viability assessments in line with HM Treasury (2011) guidelines. Discounting is used to compare costs and benefits that occur in different time periods. It is based on the principle that, generally, people prefer to receive goods and services now rather than in the future. This is known as time preference. Discount rates are used to convert costs and benefits to present value, so they can be compared.
Cash flows	NPV calculations are based purely on future cash flows (HM Treasury 2011) therefore **sunk costs were not considered, neither were accounting devises such as depreciation.**
NPV time period	**The useful life of the main assets included within the IFO's was used to determine the time period over which the NPV was assessed.** This is in line with HM Treasury (2011) guidelines that the "costs and benefits considered should be extended to cover the period of the useful life of the assets encompassed by the option under consideration".
Tax considerations	**NPV calculations were completed on a pre-tax basis.** This is because it was difficult to ascertain the tax regimes for various governance structures. It is also because many of the IFO's would be implemented under a charity governance structure whereby corporation tax is unlikely to apply.
Conservative approach	HM Treasury (2011) suggests that NPV calculations should be cross-examined by several people to minimise the possibility of optimism bias. It was not feasible to get people to cross examine my calculations. Consequently**, I adopted a conservative approach in order to minimise the possibility of optimism bias**. In practice, this meant, were there was uncertainly in relation to the value of costs or benefits and with all other factors being equal, the minimum value for benefits and the maximum value for costs were applied.
Materiality Concept	The accounting concept of *materiality* was applied to all calculations. Financial information is deemed *material* if its omission or mis-statement could influence the decisions taken on the basis of the NPV calculations (Accounting-simplified.com 2013). Financial information that was *immaterial* (i.e. would not impact on the calculations in a material manner) was not considered.
Financial Assumptions	All financial assumptions that were applied to determine NPV calculations are stated within the appendices section.

Findings

IFO’s Identified

59 IFO’s were identified. They are listed in figure 8 below. Short-listed IFO’s are highlighted green.

Figure 8: Long-list of IFO's. The 4 IFO's that were *short-listed* for *in-depth* viability assessments are highlighted green

IFO Number	IFO Category	IFO	IFO Description / Additional Information (If not self explanatory)
1	Tourism & Recreation (T&R)	Activities for people with disabilities	There are often activities organised for people with disabilities within local communities, e.g. swimming, pottery, sports, etc. This option involves putting on activities at Willow Tree Fen (WTF) and charging a fee per person for this.
2	Tourism & Recreation (T&R)	Adventure Fenland (similar to Bewilderwood concept)	This option involves a private company acquiring additional land in the project area, restoring it to Fenland, and then branding it as an adventure playground for children. The maintenance of the site would be funded by gate fees. This idea is similar to the Be-Wilderwood site in Norfolk (see BeWilderwood 2014).
3	Tourism & Recreation (T&R)	Assault courses, e.g. Tough Mudder	This option involves organising assault courses or similar events at Willow Tree Fen. Participants would pay a fee for this activity.
4	Tourism & Recreation (T&R)	Biodiversity courses, e.g. moths, invertebrates, molluscs.	This involves local experts on specialist areas of biodiversity (moths, bees, molluscs, aquatic beetles, etc) running experiential courses at WTF.
5	Tourism & Recreation (T&R)	Boat trips	This IFO involves organising boat trips along the river Glen from WTF
6	Tourism & Recreation (T&R)	Canoeing	This IFO involves organising canoeing along the river Glen from WTF
7	Tourism & Recreation (T&R)	Caravan store	at WTF
8	Tourism & Recreation (T&R)	Cow Safaris	This involves WTF wardens taking visitors around WTF and along the banks of the river Glen to observe cows. This is an activity that *interviewee 21* mentioned was happening at some other nature reserves.
9	Tourism & Recreation (T&R)	Cycle hire	This IFO involves having a cycle hire option at Waterside Garden Centre. Customers would be able to go on a cycle routes that incorporate the various fenland sites. The SLFP would receive a share of any income.
10	Tourism & Recreation (T&R)	Eco-cabins / camping	At WTF
11	Tourism & Recreation (T&R)	Fen festival	At WTF
12	Tourism & Recreation (T&R)	Fenland Art	This involves a local artist designing sculptures and locating them on the various Fenland sites.
13	Tourism & Recreation (T&R)	Fishing / angling	At WTF along the river Glen
14	Tourism & Recreation (T&R)	Foraging	At various Fenland sites. Could also incorporate non-Fenland nature reserves.
15	Tourism & Recreation (T&R)	Geocaching & orienteering	At WTF
16	Tourism & Recreation (T&R)	Horse riding	encorporating the different Fenland sites
17	Tourism & Recreation (T&R)	Iceskating	This involves bringing back the traditional activity of Fen-staking to WTF.
18	Tourism & Recreation (T&R)	Laundry services and other basic amenities for boating	At WTF
19	Tourism & Recreation (T&R)	LIDAR Technology	There is an organisation that specialises in collecting data from sites with a view to creating a 3-D virtual image of what the site would have looked like *x* number of years ago. It is possible to download the data onto an i-pad and walk around the site to see what it used to look like. People might be willing to pay for this type of experience if it was implemented at Fenland sites
20	Tourism & Recreation (T&R)	Mini-orditorium	At WTF

Figure 8 (part 2):

IFO Number	IFO Category	IFO	IFO Description / Additional Information (If not self explanatory)
21	Tourism & Recreation (T&R)	Paddle boarding	Basically standing up on a large surf board and paddling along a watercourse. This could be implemented at WTF along the river Glen.
22	Tourism & Recreation (T&R)	Premium priced Fenland tours by wardens	At the various Fenland sites
23	Tourism & Recreation (T&R)	Rental cottages on-site (premium priced)	At WTF
24	Tourism & Recreation (T&R)	School visits	At WTF
25	Tourism & Recreation (T&R)	Visitor café and ship	At WTF
26	Fenland Commodities	Beef production	from cows that graze existing Fenland sites
27	Fenland Commodities	Bog oak as an artisan material	This relates to using local bog oak to make furniture and other items.
28	Fenland Commodities	Cranberry production	Cranberry is a traditional Fenland species. This option involves establishing cranberries within existing Fenland sites and harvesting them to sell at a premium price at outlets such as garden centres, farmers markets, and online.
29	Fenland Commodities	Elderflower cordial	There is a lot of Elderflower at WTF. This option relates to producing Elderflower cordial and selling it at a premium
30	Fenland Commodities	Hay production	This relates to producing hay at Fenland sites and selling it to local farmers
31	Fenland Commodities	Handicrafts produced by wardens from local materials	
32	**Fenland Commodities**	**Honey Production**	**By keeping bee-hives at existing and and any future Fenland sites**
33	Fenland Commodities	Reedscreens	Produced from willow trees at Fenland sites
34	Fenland Commodities	Smoked Eels	Smith's Smokery is a Fenland based organisation that catches eels, smokes them, and sells them at local farmers markets and online at premium prices. A possible option would be for Smith's Smokery to catch eels from restored Fenland and to pay the SLFP a fee for this. The product could also be marketed as Fenland eel.
35	Fenland Commodities	Thatching	This option involves contractors paying for the right to harvest reed and sedge from existing Fenland sites for the thatching industry.
36	Fenland Commodities	Wildfowl shooting on existing Fenland	This relates to small-scale wildfowl shooting on existing Fenland.
37	Fenland Commodities	Wildfowl shooting on Fenland created and managed specifically for shoots	This option relates to restoring additional Fenland with a view to managing the habitat for large scale wildfowl harvesting. This could be achieved by encouraging an existing landowner to convert their land to Fenland.
38	Fenland Commodities	Zander and pike (fish)	This relates to harvesting zander and pike from Fenland sites and selling them predominantly to the resident eastern European population. Such products are very popular in some eastern European countries.
39	**Payment for Ecosystem Services (PES)**	**Payment for Ecosystem Services**	**This IFO relates to the restoration of a 200ha multi-functional Fenland habitat (MFH). The MFH would be designed to maximise its ES value. It is envisage that beneficiaries of these services would pay for the restoration work and ongoing management.**
40	**Offsetting**	**Offsetting**	**In 2013, the UK government published a consultation paper (DEFRA 2013) outlining the possibility of introducing a habitat offsetting system. There have also been six offsetting pilot projects implemented between 2012-2014 (CEP 2013). The government is currently assessing feedback on the consultation paper and evaluating the pilot projects. A response from the government on whether an offsetting system will be implemented is expected shortly. This IFO considers whether an offsetting system could provide incentives for Fenland restoration.**

Figure 8 (part 3):

IFO Number	IFO Category	IFO	IFO Description / Additional Information (If not self explanatory)
41	Renewable Energy	Anearobic Digestion (AD) of ditch biomass	Anearobic Digestors are traditionally used to convert maize and other forms of biomass into renewable energy. This option considers whether income could be generated by harvesting biomass materials from Fen ditches and road verges and using it to fuel AD plants.
42	Renewable Energy	Biomass brickets from reeds	The Department for Energy and Climate Change (DECC) and the RSPB are currently implimenting a £2m project to investigate whether it is financially viable to turn reed biomass into brickets that can be used as biofuel (interview 14). This option considers the viability of producing reed brickets from Fenland sites within the project area.
43	**Renewable Energy**	**Solar Farms buffer habitat (private ownership)**	**This option relates to a proposed 19.5MW, 45ha large-scale solar farm (SF) functioning as a conservation buffer habitat. A pension fund (PF) would own the SF. The landowner of the proposed site would lease the land to the PF for 25years. This is the length of a SF's useful life (LARK 2014). This governance structure is common for large-scale SF's (Interview 13&41).**
44	Renewable Energy	Solar Farms as buffer habitat (community ownership)	This option is similar to the solar farm option above (IFO #43) except a proportion of the solar farm would be under community ownership.
45	Renewable Energy	Willow Biomass	This relates to restoring additional Fenland that has a significant amount of willow on it. The willow would be coppiced and used to produce biofuel.
46	Renewable Energy	Woodland biomass	This option is similar to IFO #44 above except woodland would be planted instead of willow. This woodland would be coppiced for biofuel.
47	other	Car parking fees	This relates to charging visitors for car parking at the various Fenland sites
48	other	Community farm	This IFO relates to restoring an additional area of Fenland that would have various crops within it that the local community could farm.
49	other	Conservation Agriculture (CA) as buffer habitats	CA is also known as no-till farming. "Conservation agriculture systems utilize soils for the production of crops with the aim of reducing excessive mixing of the soil and maintaining crop residues on the soil surface in order to minimize damage to the environment" (FAO 2007)
50	other	Entrance fees	Charging entrance fees for existing Fenland sites.
51	other	Environmentally-friendly agriculture as buffer	There is an RSPB owned farm at knapwell where they practice conventional agriculture but test and implement environmentally friendly practices such as skylark plots (interview 16). This option involves encouraging farmers to work together to implement environmentally friendly practices on their land.
52	other	former gravel site restoration to Fenland	This IFO involves working with the mineral extraction companies that have gravel operations in the project area in order to encourage them to restore former gravel extraction sites to Fenland. Similar projects have already occurred in other locations, e.g. the RSPB-Hanson partnership at Ouse Fen.
53	other	Green space provider for conferences	At WTF.
54	other	Income from health care providers for using site as health and wellbeing location	At WTF.
55	other	Links to universities and research institutions	This involves encouraging universities to conduct research on SLFP Fenland sites in a similar way that the University of Cambridge and Angia Ruskin University have good working relationships with Wicken Fen. This could be a direct funding source, i.e. the universities could give funding to the SLFP in return for conducting research on the Fenland sites. Or it coud be an indirect funding source as research conducted on Fenland sites is likely to create spin-off opportunities (interview 6).
56	other	Naming landmarks after funders, e.g. veriodor walk, tebney fen	This is something that has taken place at Wicken Fen (interview 7).
57	other	Nursery/crèche	At WTF
58	other	Sponsor a Fenland animal, e.g. water vole, otter, cow.	
59	other	Stocking rare breeds such as konik ponies to create income from stud animals	For example, the konik ponies at Wicken Fen are used as stud animals.

Short-listed IFO: Honey Production

This involves a local honey producer, Grace Evans (*interview 36*), locating her beehives on Fenland sites. She would manage the hives and sell the jars of honey produced to SLFP at a price that covers her costs. These jars would be branded as *Fenland Honey* and sold in local outlets at a premium price. Grace would also provide beekeeping courses at WTF.

Financial Suitability

There is excess demand for local honey within south Lincolnshire. Grace cannot meet the existing demand of her customers, whilst the *Cooperative Supermarket* could sell an additional 3,000jars/year through their Lincolnshire *Love Local* range (*interview 29*).

Local honey retails at £3.80-£5.25 (*observations 11,12,15*). *Fenland Honey* would be produced from a *natural* habitat with profits going to charity. These selling points differentiate the product from other brands. Consequently, it seems probable that customers would be willing to pay £4.50/jar. Grace stated that she would be willing to sell honey produced from Fenland sites to the SLFP for £3.00/jar. Consequently, a profit of £1.50/jar seems achievable.

However, supply-side limitations dictate that income potential is low. This is because 170ha of Fenland can only support a small number of hives. Even with additional restoration sites, honey production would still be limited by a finite availability of pollen. Factors such as weather conditions and diseases can also hinder supply (Edwards 2011).

Grace has offered to run beekeeping courses with all profits going to SLFP, and WTF beehives and facilities could be utilised for the courses. Consequently, running costs would be low and profit margins high. The current popularity of beekeeping and the fact that there are no beekeeping courses within the area (Thorne 2014) suggests that demand could be high. However, as comparable providers only have sufficient demand for one course annually (Thorne 2014), overall income potential is low.

The 5-year NPV (£9,657) and fifth year profits (£3,450) (Figure 9) highlight the low suitability of honey production and support the opinions of several interviewees who suggested this option is unlikely to be lucrative (*interviews 24,25,28,48*). However, it must be recognised that such income is achievable with limited SLFP resource input. The short payback period of 0.7years highlights this. Also, the risks that SLFP would be exposed to are minimal as the SLFP would simply purchase the honey from Grace and sell it on.

Figure 9: Financial calculations for the in-depth viability assessment of Honey Production. 5-year NPV, payback period, and year 5 profits are all included

Discount Rate (*8)
3.50%

	Honey Production					Bee-Keeping Training Course				
Yr	No. hives (*1)	1lb jars / hive / annum (*2)	1lb jars produced	profit / jar (*3)	Cashflow / annum	Ppl / course / annum (*4)	Price / person / course (*5 & 6)	Cost: 15 all-in-one bee suit @ £40 each (*7). Plus £100 for learning materials	cashflow / annum	Total cashflow per annum
0								-£700	-£700	-£700
1	3	60	180	£1.5	£270.00	10	£70		£700	£970
2	9	60	540	£1.5	£810.00	15	£70		£1,050	£1,860
3	15	60	900	£1.5	£1,350.00	15	£70		£1,050	£2,400
4	20	60	1200	£1.5	£1,800.00	15	£80		£1,200	£3,000
5	25	60	1500	£1.5	£2,250.00	15	£80		£1,200	£3,450

5 yr NPV	£9,657
Payback period (yrs)	0.7
yr 5 profit	£3,450

Note: A comprehensive list of the financial assumptions on which these calculations are based is included within appendix 5.

Conservation Suitability

Honeybees provide pollination services to wild flowers. These services are arguably of increasing conservation importance given the reduction in wild bee populations (DFB 2013). Honeybees are considered native species that have co-existed with wild bees for millennia (Hudewenz and Klein 2013). However, Evertz (1995) hypothesises that wild bees might be negatively affected by competition from honeybees. This hypothesise has been tested, and Steffan-Dewenter and Tscharntke (*2000*), and Forup and Memmott (*2005*) found that honeybees had no or weak effects on wild bees. However, other studies indicate a negative effect on species richness (Hudewenz and Klein 2013), abundance (Evertz 1995), and worker size (Goulson and Sparrow 2009). More research is needed on this topic (Hudewenz and Klein 2013). A carrying capacity of 20 hives/site is recommended by Bush (2007). However, I have assumed a stocking rate of 5 hives/site in recognition of potential impacts on wild bees. This represents an income trade-off; at 20 hives/site year-5 profit would be £6,750 higher However, given current knowledge gaps and that existing Fenland sites harbour rare species, it is debateable whether any number of hives is appropriate from a conservation perspective.

Feasibility

Grace is enthusiastic about locating her beehives on Fenland. This is critical because beekeeping is a technical activity (Edwards 2011); SLFP does not have the internal competencies to produce honey. Grace has also inspected the Fenland sites and believes they have the necessary traits to host beehives: available pollen source; water; dry, quiet areas to locate beehives; etc.

Retail outlets have been identified. Waterside Garden Centre (WGC) have said that the honey could be sold from the garden centre, and that they would not require any financial returns from the arrangement (*interview 5*). Vine House farm shop is another possible outlet as the owner is closely involved with the SLFP.

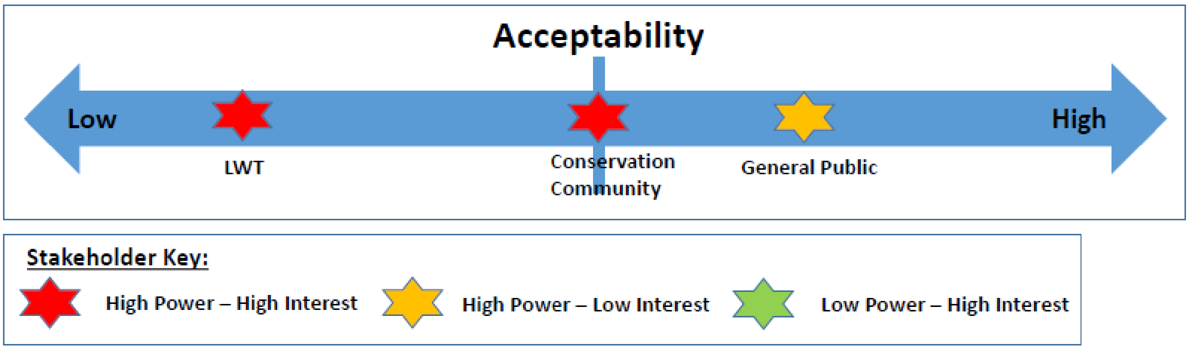
Grace has been beekeeping for two years. There is a slight risk that she would experience difficulties scaling-up her business. She would also have to become familiar with the *Food Safety Regulations* (1995) to sell honey through WGC. However, such regulations would not require significant changes to her production process. Finally, if Grace decided to stop beekeeping, there is only one other beekeeper in the area so it might be difficult to locate alternative producers.

Acceptability

- The LWT's *Head of Reserves* is against keeping honeybees on Fenland due to their potential impact on wild bees (*interview 39*). Although other LWT interviewees were more accepting, buy-in from the *Head of Reserves* is essential as he has authority over decisions at Fenland sites.
- Although Hudewenz and Klein (2013) note that some conservationists are against keeping hives on nature reserves, all but three conservationist interviewees were neutral or positive about this IFO due to its pollination services and *other benefits*.

- Given the popularity of local honey and the *other benefits* available, it seems likely that the public would favour this IFO. Concerns about bee stings are unlikely to be significant as the hives would be located in areas not frequently visited.

Figure 10: Diagram showing the level of acceptance for honey production across different key stakeholder groups



Other Benefits

- Fenland branded honey could raise awareness about the SLFP and encourage residents to visit Fenland.
- Involving residents such as Grace encourages community buy-in to SLFP's mission.
- The beekeeper course is a recreational service.
- Beehives could provide an educational service; looking into hives tells a story about landscape biodiversity (DFB 2013).
- The service that pollinators provide to UK agriculture is valued at £440m/year (The Guardian 2010). Given declining bee numbers, this IFO could provide a valuable pollination service to farmers (*interview 8*).
- Producing honey could mitigate the perception that Fenland restoration takes good land out of production.
- Baston residents purchase local honey due to anecdotal evidence that it alleviates hay-fever (The Telegraph 2013a).

Summary

This IFO's low income generating potential dictates that it has a low viability. However, the other benefits, high feasibility, and low resource input requirements mean that it is potentially worth pursuing. However, the unknown conservation consequences and resulting low acceptance from the LWT's *Head of Reserves* dictates that implementing this IFO would be inappropriate at present.

Figure 11: Diagram showing the overall viability of Honey Production

Suitability		Feasibility	Acceptability	Other Benefits	**Overall Viability**
income generation potential or incentive for restoration	biodiversity impact				
LOW	UNKNOWN	HIGH	LOW	HIGH	**LOW**

Short-listed IFO: Payment for Ecosystem Services

This IFO relates to the restoration of a 200ha multi-functional Fenland habitat (MFH). The MFH would be designed to maximise its ES value. It is envisaged that beneficiaries of these services would pay for the restoration work and ongoing management.

Financial Suitability

In theory, for the MFH to be suitable, its ES value should exceed the value of the habitat that it would replace. To assess this, the TESSA methodology (Peh *et al.* 2013) was applied to compare the ES value of the MFH verses the ES value of arable land (AL) (the area's predominant land-use). As TESSA only allows for comparisons at a point of time, HM Treasury's (2011) methodology was applied to convert the TESSA output into a 30-year NPV comparison.

Conducting a TESSA assessment takes more time than was available for this placement. Consequently, I applied some key principles[6] which allowed me to attain adequately reliable results in a limited time period.

Figure 12 shows that the annual ES value of the MFH is -£4,732 compared to £58,757 for AL. The MFH's 30-year NPV is £1,468,701 less than AL's NPV. Consequently, the suitability of this approach appears low.

Due to difficulties associated with measuring some ES's included within TESSA (Peh *et al.* 2013), it was not possible to provide ES values for *water quality improvement services* or *water used for domestic purposes and Irrigation*. Furthermore, TESSA does not account for all ES's, e.g. cultural services are excluded. If such services could be incorporated into the assessment, it is possible that the NPV of the MFH might exceed the NPV of AL. However, the value of these ES's would have to exceed £79,855/annum for this to be the case. Some

[6] Key principles applied to attain adequately reliable TESSA assessment results in a limited time period:

- TESSA assessments for Ouse Fen (Jia and Blaen 2014), Lakenheath (Smith 2013), and Wicken Fen (Peh et al. 2014) already exist. These sites have similarities to the project area. I utilised data from these studies to help determine ES values. Although these assessments are unpublished, the raw data within them is adequate to use.
- A conservative approach was taken in the respect that, other factors being equal, assumptions were applied that favoured the MFH over the AL. This ultimately increases the level of confidence in the results if AL is determined to have a higher value than the MFH. In practice, this meant applying the most conservative assumptions from the existing assessments. It also meant including as many types of ES's as possible and assuming minimal trade-offs between them.

might argue that the value of such ES's far exceeds £79,855/annum. However, difficulties associated with quantifying such ES's dictates that using ES calculations to justify Fenland restoration is challenging.

Figure 12: Financial calculations for the in-depth viability assessment of the Payment for Ecosystem Services IFO. The table shows a comparison of the annual ES value of a 200ha MFH verses the ES value of a 200ha plot of arable land. The 30-year NPV comparison is also included.

Ecosystem Service	Arable Land (AL)	Multi-functional Fenland Habitat (MFH)	Difference
Global Climate Regulating Services (*3)	-£17,958	-£4,908	£13,050
Harvest Wild Goods (*4)	£0	£9,800	£9,800
Cultivated Goods (*5)	£209,804	£0	-£209,804
Nature-based Recreation (*6)	£3,275	£10,917	£7,642
Annual Management Costs (*7)	-£136,364	-£37,179	£99,185
Flood Protection Benefit (*8)	£0	£16,638	£16,638
Total Ecosystem Service Value per annum	£58,757	-£4,732	-£63,489

Year 0 Initial Restoration Costs (*2)	0	-£301,002	-£301,002

30-Year NPV (*1) based on 3.5% discount rate	£1,080,659	-£388,042	-£1,468,701

Additional Ecosystem Services required per annum for the multi-functional Fenland habitat to have the same 30 yr NPV as the arable land		£79,855

Note: A comprehensive list of the financial assumptions on which these calculations are based is included within appendix 7.

I also used data from TESSA assessments completed for Ouse Fen (Jia and Blaen 2014), Lakenheath (Smith 2013), and Wicken Fen (Peh *et al*. 2014) to complete NPV calculations for these sites. At Ouse Fen the AL scenario had a higher value than the restored habitat. However, Wicken's and Lakenheath's NPV's were significantly higher than the AL scenarios (Figures 13&14). This indicates that MFH's could be suitable in other Fenland contexts.

Figures 13&14 have been removed from this version of the report due to data confidentiality considerations.

The reasons why the project area assessment favoured AL, whilst the Wicken and Lakenheath assessments favoured restored habitat are twofold:

- *Nature-based recreation* is valued significantly higher for restored Fenland at Wicken and Lakenheath compared to the project area. This is because project area visitor numbers and their willingness to pay are low.
- *Global climate regulating services* is a significant contributor to the Lakenheath and Wicken results. This was not the case for the project area as a lower carbon price (DECC 2013e) was applied in order to be compliant with HM Treasury (2011).

Even if the ES value of the MFH exceeded of the ES value of AL, payment for these services would still be required to attain financial suitability. These payments would, in practice, have to cover the landowner's opportunity costs, and restoration and management costs. Unfortunately there are no readily accessible markets through which payments could be received. Furthermore, the beneficiaries of some ES's (e.g. climate regulation) span the entire world. These beneficiaries are used to receiving such services for free and it would be difficult to extract payments from them.

This IFO would also require substantial upfront payments because the most likely way to cover landowner opportunity costs is to purchase the land. Not many beneficiaries are able to pay upfront with a view to waiting a long time to break-even.

UK and EU governmental bodies might be willing to pay for ES projects of this nature as they represent the beneficiaries (i.e. the public) of many of the MFH's ES's. The UK government has the resources to pay upfront. They also look favourably upon projects that distribute benefits equitably across society; this is arguably an advantage of the MFH over AL. Furthermore, governments require projects to show *value for money* (VfM) (HM Treasury 2011); the ES approach is conducive to highlighting VfM. The UK government and EU channel funds through the *Greater Lincolnshire Local Enterprise Partnership* (GLLEP). The GLLEP funds projects that facilitate local growth with a focus on water management, agriculture, and recreation (GLLEP 2014). Consequently, the GLLEP could possibly provide the necessary payments for this IFO. Alternative bodies with the resources and potential motivations to provide upfront payments for ES's include Insurance and water companies. However, developments in such areas are at an early stage (*interviews 14,48*).

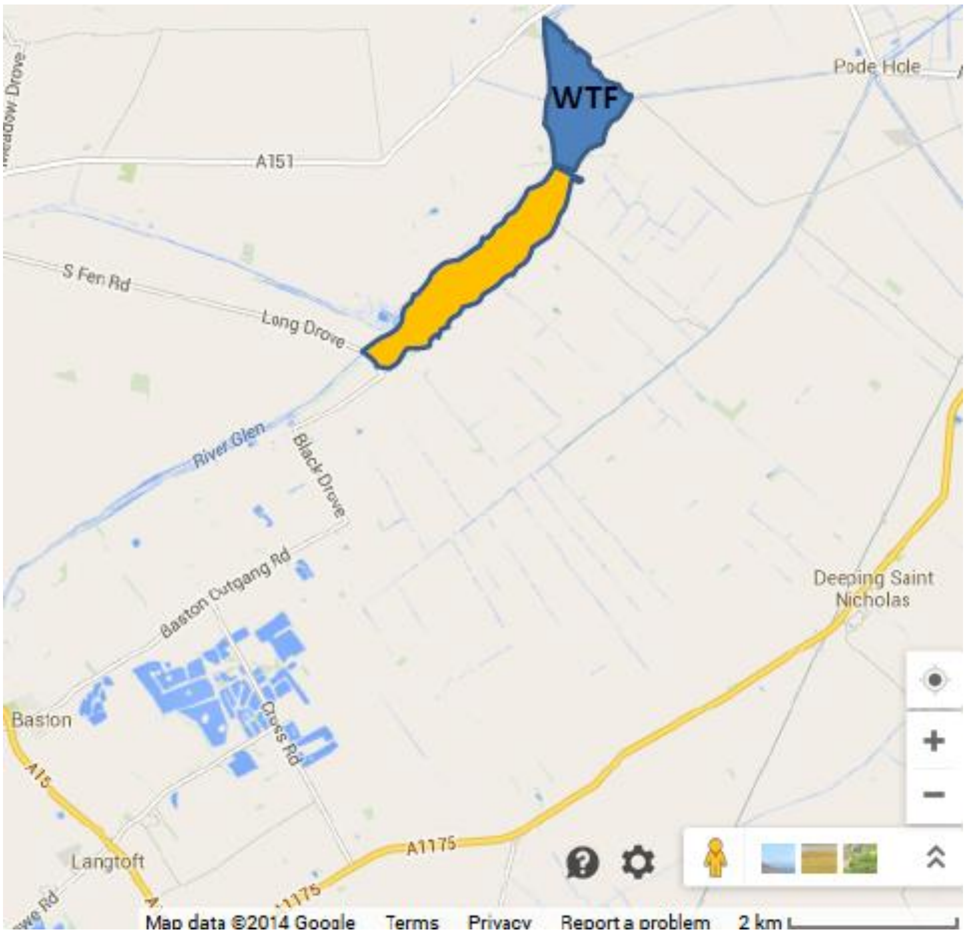
Conservation Suitability

A MFH would experience trade-offs between biodiversity and other ES's. For example, to maximise irrigation services, deep, steep sided water-bodies are preferable. Such attributes are not ideal for Fenland biodiversity. Similarly, high visitation rates increase recreational value but could have detrimental conservation impacts. However, in a restoration context, the alternative to MFH's is usually AL or single-purpose habitats, such as irrigation reservoirs. A well-managed MFH, even with trade-offs, would undoubtedly have a higher conservation value than these alternative land-uses.

Feasibility

A plot within the area highlighted in figure 15 would potentially be appropriate for the MFH. This location, between two water courses, would be favourable for flood protection and water quality services, whilst ensuring minimum impact on the drainage of surrounding land. Furthermore, there is demand for additional irrigation services within the area, whilst *Anglian Water* have previously discussed the need for additional water services.

Figure 15: Map of a section of south Lincolnshire. The area which would potentially be appropriate for a MFH is highlighted orange. Willow Tree Fen (WTF) is highlighted blue.



(Google 2014)

During interviews and the literature review process I only found one example of a MFH design (Appendix 8). Although there might be designs that I failed to locate, additional work is certainly required to determine the details of what the MFH would look like.

The individual beneficiaries of the MFH often have solutions to their own problems. For example, farmers have irrigation reservoirs and drainage ditches; conservationists pay their subscriptions to protect wildlife; etc. There is also distrust between some beneficiaries, e.g. farmers and conservationists. Consequently, a MFH would only be feasible if leadership was provided to:

- Build social capital between stakeholders
- Convince stakeholders that it is possible to achieve mutually acceptable trade-off solutions.

An appropriate governance structure to facilitate the process would also be required.

Acceptability

There was high acceptance among conservationists and farmers for the MFH concept. However, I observed discussions between conservationists, farmers and other stakeholders where they were unwilling to accept trade-offs on key issues. Given the trade-offs that would be required to implement the MFH, I sense that the actual level of acceptance would be considerably lower.

For reasons stated above, the UK government is likely to be in favour of the concept. However, unless the MFH can be shown to have a higher value than AL, the actual level of acceptance would be low.

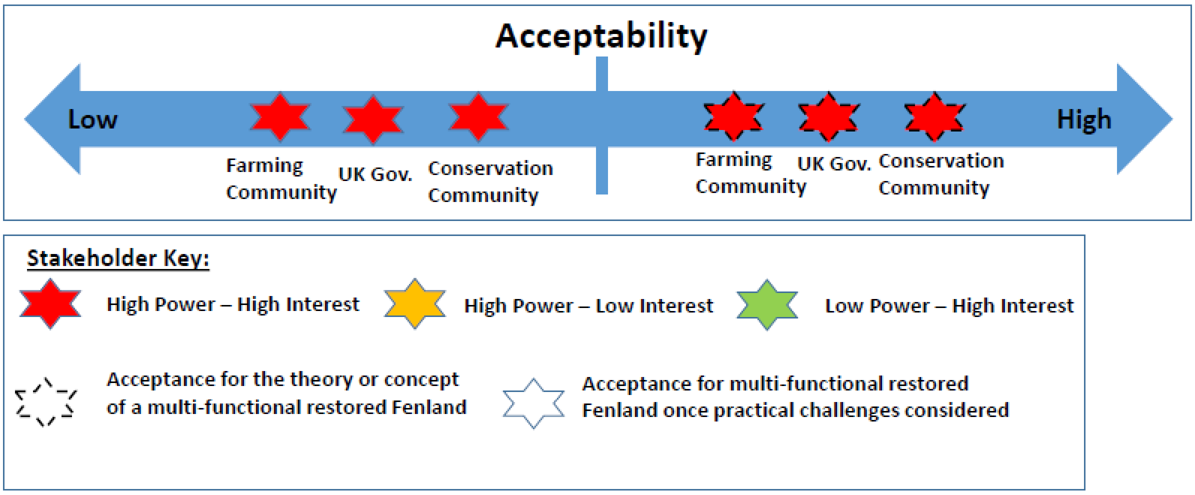
An issue that hinders acceptability across different stakeholders is that there are different assumptions that can be applied to ES calculations. This increases the likelihood of stakeholders disregarding the results as they disagree with the assumptions. As an accountant who has used TESSA, it is evident that personal ideologies can impact on what assumptions are applied, and thus what results are attained.

I have seen instances where the ES approach produced unpopular results. These results were subsequently misrepresented within the written report. Such practices create mistrust and reduce acceptance levels.

Recommendation 1

Never misrepresent ES assessment results.

Figure 16: Diagram showing the level of acceptance for *Payments for Ecosystem Services* across different key stakeholder groups



Other Benefits

- The ES's discussed above.

Summary

Given that the ES value of the MFH is lower than the value of AL, financial suitability and overall viability are low. Although an appropriate MFH location has been identified, the lack of an appropriate leadership / governance structure, and a limited understanding of what a MFH would look like hinder feasibility. The amount of unpopular trade-offs that would be required to implement this IFO dictates that the actual level of acceptance would be low.

Figure 17: Diagram showing the overall viability of *Payments for Ecosystem Services*

Suitability		Feasibility	Acceptability	Other Benefits	**Overall Viability**
income generation potential or incentive for restoration	biodiversity impact				
LOW	POSITIVE	LOW	LOW	HIGH	LOW

Recommendation 2

Even though this IFO is unviable, the fact that Lakenheath's and Wicken Fen's NPV's are higher than the NPV of AL indicates that PES approaches could be viable elsewhere. Conservationists should be on the lookout for restoration projects where PES approaches might be appropriate.

Recommendation 3

TESSA should be developed further so that it can be used to help justify habitat restoration. Specifically:

- New methods should be developed to value ES's that are difficult to measure.
- Where possible, TESSA should be more prescriptive about what assumptions are appropriate.
- TESSA should be developed to provide ES values over time in an NPV format. Although this will be difficult, it is essential if TESSA is going to be utilised to convince stakeholders, such as the UK government, to provide payments for ES's. Principles from HM Treasury (2011) should be used to assist with this development.

Recommendation 4

As new methods become available to value ES's and receive payments for them, it is possible that this IFO could become viable within the project area. The SLFP should therefore continue tracking this IFO's viability.

Short-listed IFO: Solar Farm Buffer Habitat

This option relates to a proposed 19.5MW, 45ha large-scale solar farm (SF) (figure 18) functioning as a conservation buffer habitat.

A pension fund (PF) would own the SF. The landowner of the proposed site would lease the land to the PF for 25years. This is the length of a SF's *useful life* (LARK 2014). This governance structure is common for large-scale SF's.

Figure 18: Map of Baston showing the proposed 19.5 MW solar farm highlighted orange

Financial Suitability

The landowner of the proposed SF has been offered £2,224/ha/year to enter into a SF lease agreement. This is in line with the market rate for such agreements (Freewatt 2014). The £2,224 would increase annually in line with the retail price index (RPI). In comparison, the net income from arable farming is £594/ha (Lang 2012). This highlights how lucrative SF's are for landowners, especially considering they receive a guaranteed price for 25years, they don't have to invest time in farming, and the land can be returned back to agriculture afterwards. Lease agreements exceed the opportunity cost of farming and incentivise landowners to diversify into SF's. Consequently, this IFO has high financial suitability. The 25-year NPV suggests that the landowner would be £899,048 better off under the SF scenario compared to the arable alternative (figure 19).

Figure 19: NPV calculation comparing the value of arable land vs the value of the proposed solar farm to the landowner

Discount Rate	3.50%

Annual net inome	Arable Agriculture	Solar Farm	Difference
Lease Payment to Land Owner (*1)		£ 81,000	£ 81,000
Arable Cultivation (net income) (*2)	£ 26,451		-£ 26,451
Internal drainage board rates (*3)	-£ 1,320	-£ 1,320	£ -
Total value	£ 25,131	£ 79,680	£ 54,549
25 Year Pre-tax NPV	£ 414,199	£ 1,313,247	£ 899,048

Note: A comprehensive list of the financial assumptions on which these calculations are based is included within appendix 10.

The SF is also lucrative for the PF who achieve a NPV of £33,587,798 on an investment of £24,520,000, a payback period of 5years, and an IRR of 19.6% (Figure 20).

Figure 20: Calculations showing the value of the proposed 19.5 MW solar farm to the Pension Fund (PF)

Initial Capital Investment (Year 0) (*1)	
Solar Farm Installation	£ 24,000,000
Connection to Grid	£ 400,000
Planning Application Process	£ 120,000
Total Initial Investment	**£ 24,520,000**

Discount Rate	3.50%

	Income / Annum							Expense /Annum (*10)						
Year (*2)	UK annual average Watt hour (Wh) / Watt power (Wp) ratio (*3)	Efficiency Factor (*4)	MWp (*5)	Daylight Hours / Annum (*6)	Energy / Annum (MWh) (*7)	Strike Price £/MWh (*8)	Income / Annum (£) (*9)	Lease Payment to Land Owner (*11)	Operations, Maintenance, Monitoring, Security (*12)	Internal drainage board rates (*13)	Insurance (*14)	Total Expense / Annum (£)	Decommission Costs (*15)	Net Cashflow
1	77%	100%	19.5	2920	43,958	£ 120	£ 5,274,922	£ 81,000	£ 185,250	£ 1,320	£ 39,000	£ 306,570		£ 4,968,352
2	77%	99%	19.5	2920	43,518	£ 123	£ 5,335,915	£ 83,098	£ 190,048	£ 1,354.19	£ 40,010	£ 314,510		£ 5,021,404
3	77%	98%	19.5	2920	43,079	£ 125	£ 5,397,062	£ 85,250	£ 194,970	£ 1,389.26	£ 41,046	£ 322,656		£ 5,074,406
4	77%	97%	19.5	2920	42,639	£ 128	£ 5,458,342	£ 87,458	£ 200,020	£ 1,425.24	£ 42,109	£ 331,013		£ 5,127,329
5	77%	96%	19.5	2920	42,199	£ 131	£ 5,519,731	£ 89,723	£ 205,200	£ 1,462.16	£ 43,200	£ 339,586		£ 5,180,145
6	77%	95%	19.5	2920	41,760	£ 134	£ 5,581,204	£ 92,047	£ 210,515	£ 1,500.03	£ 44,319	£ 348,381		£ 5,232,823
7	77%	94%	19.5	2920	41,320	£ 137	£ 5,642,737	£ 94,431	£ 215,967	£ 1,538.88	£ 45,467	£ 357,404		£ 5,285,333
8	77%	93%	19.5	2920	40,881	£ 140	£ 5,704,303	£ 96,877	£ 221,561	£ 1,578.73	£ 46,644	£ 366,661		£ 5,337,642
9	77%	92%	19.5	2920	40,441	£ 143	£ 5,765,874	£ 99,386	£ 227,299	£ 1,619.62	£ 47,853	£ 376,158		£ 5,389,716
10	77%	91%	19.5	2920	40,001	£ 146	£ 5,827,421	£ 101,960	£ 233,187	£ 1,661.57	£ 49,092	£ 385,900		£ 5,441,521
11	77%	90%	19.5	2920	39,562	£ 149	£ 5,888,913	£ 104,601	£ 239,226	£ 1,704.61	£ 50,363	£ 395,895		£ 5,493,018
12	77%	89%	19.5	2920	39,122	£ 152	£ 5,950,320	£ 107,310	£ 245,422	£ 1,748.76	£ 51,668	£ 406,149		£ 5,544,171
13	77%	88%	19.5	2920	38,683	£ 155	£ 6,011,608	£ 110,089	£ 251,778	£ 1,794.05	£ 53,006	£ 416,668		£ 5,594,940
14	77%	87%	19.5	2920	38,243	£ 159	£ 6,072,743	£ 112,941	£ 258,300	£ 1,840.51	£ 54,379	£ 427,460		£ 5,645,283
15	77%	86%	19.5	2920	37,804	£ 162	£ 6,133,689	£ 115,866	£ 264,989	£ 1,888.18	£ 55,787	£ 438,531		£ 5,695,158
16	77%	85%	19.5	2920	37,364		£ -	£ 118,867	£ 271,853	£ 1,937.09	£ 57,232	£ 449,889		-£ 449,889
17	77%	84%	19.5	2920	36,924		£ -	£ 121,945	£ 278,894	£ 1,987.26	£ 58,714	£ 461,541		-£ 461,541
18	77%	83%	19.5	2920	36,485		£ -	£ 125,104	£ 286,117	£ 2,038.73	£ 60,235	£ 473,495		-£ 473,495
19	77%	82%	19.5	2920	36,045		£ -	£ 128,344	£ 293,527	£ 2,091.53	£ 61,795	£ 485,758		-£ 485,758
20	77%	81%	19.5	2920	35,606		£ -	£ 131,668	£ 301,130	£ 2,145.70	£ 63,396	£ 498,339		-£ 498,339
21	77%	80%	19.5	2920	35,166		£ -	£ 135,078	£ 308,929	£ 2,201.28	£ 65,038	£ 511,246		-£ 511,246
22	77%	79%	19.5	2920	34,727		£ -	£ 138,577	£ 316,930	£ 2,258.29	£ 66,722	£ 524,488		-£ 524,488
23	77%	78%	19.5	2920	34,287		£ -	£ 142,166	£ 325,139	£ 2,316.78	£ 68,450	£ 538,072		-£ 538,072
24	77%	77%	19.5	2920	33,847		£ -	£ 145,848	£ 333,560	£ 2,376.78	£ 70,223	£ 552,008		-£ 552,008
25	77%	76%	19.5	2920	33,408		£ -	£ 149,626	£ 342,199	£ 2,438.34	£ 72,042	£ 566,305		-£ 566,305
26													£ 1,137,330	-£ 1,137,330

Year 1-26 Pre-tax Cashflow	£ 73,832,771
26 Year Pre-tax NPV (*16)	£ 33,587,798
Internal Rate of Return (IRR) (*17)	19.6%
Pay Back Period (Years)	5

Note: A comprehensive list of the financial assumptions on which these calculations are based is included within appendix 10.

Conservation Suitability

SF's leave 95% of land area undisturbed (BRE 2014) which means that pro-conservation habitats can be created on the remaining area. Figure 21 outlines some of the possible pro-conservation options. It would even be feasible to raise the water-table on some SF's to create habitats with Fenland characteristics (*interview 9*).

Figure 21: List of some of the pro-conservation habitats that can be implemented on solar farms

Pro-conservation habitat options
field margins
wild flower meadows
ponds
winter bird crops
nectar rich areas
ditches
security fence can be used for climbers
gap at the bottom of security fence of 20-30 cm enables badgers, etc. to pass through
hibernacula's
log piles
bug hotels
bird boxes
bat boxes
hedgerows outside of security fence

(BRE 2014)

The landowner has opted for extensive sheep grazing and a small area of woodland on the proposed site. This dictates that the landowner would only receive lease payments for 36ha of the 45ha because the panels would have to be sparsely distributed, and absent from the woodland. However, this has been factored into the above NPV calculations, and highlights that landowners can opt for pro-conservation practices and still attain lucrative returns.

Compared to arable farming, extensive grazing can result in improved soil health (BRE 2014), preservation of peat, and reduced carbon emissions (*interview 42*). SF's can also result in improved local water quality as they do not require agri-chemical inputs (Phillips 2013). Furthermore, SF's experience minimal human disturbance (LARK 2014). Minimal disturbance over 25years could result in high levels of biodiversity (BRE 2014). More research is needed on the impacts of birds, bats and insects mistaking solar panels for water bodies (Turney and Fthenakis 2011), however, in an otherwise *intensive agricultural desert* the net conservation impact of well managed SF's is a positive one (NE 2011).

There is a risk of landowners converting SF's back to agriculture after the lease expires. This arguably means that the net conservation benefit is zero. However, another perspective is that, because there is limited conservation habitat in the project area, a SF habitat would *buy time* for biodiversity. After 25years there might be more funding available to achieve SLFP's aims.

Taking land out of arable production for SF's could result in the conversion of high biodiversity habitats elsewhere to meet food demand. However, the scale of UK SF's compared to the global food market and the multitude of factors influencing it dictates that the impact is unlikely to be significant. Furthermore, energy production is essential; SF's could be cost competitive with natural gas within a decade (SPP 2014), and they produce low-carbon energy more efficiently, in terms of land area used, than other energy crops (LARK 2013b).

There is an environmental footprint associated with producing solar panels (Fthenakis 2009). However, Jackson and Oliver (2000) suggest that production can be sustainable, especially with recent technological advances (The Independent 2014).

Feasibility

A key requirement for SF's is having an appropriate power-line nearby to connect to (SolarExpert 2013). The proposed site meets this requirement.

Given the lucrative nature of SF lease agreements, the landowner is in favour of the proposed SF and is in the process of attaining planning permission (*interview 41*). NIMBY-ism can be a significant obstacle to attaining planning permission. Lincolnshire is sparsely populated and therefore arguably less exposed to NIMBY issues. However, the landowner's motivations for including pro-conservation elements to the proposed SF is to help ensure planning permission is granted (*interview 41*). Consequently, the planning process arguably enhances this IFO's feasibility as it gives residents and conservationists' opportunities to ensure that proposed SF's create biodiversity benefits.

The landowner envisages applying for permission to extract gravel from the proposed site at the end of the SF's *useful life*. This reduces the likelihood of the site retaining its conservation benefits beyond 25years. The landowner is also looking to attain permission for gravel extraction on a site bordering BF (*interview 41*). It is possible that the SLFP would object to this, and this is likely to prevent the landowner from engaging with the SLFP in relation to the SF.

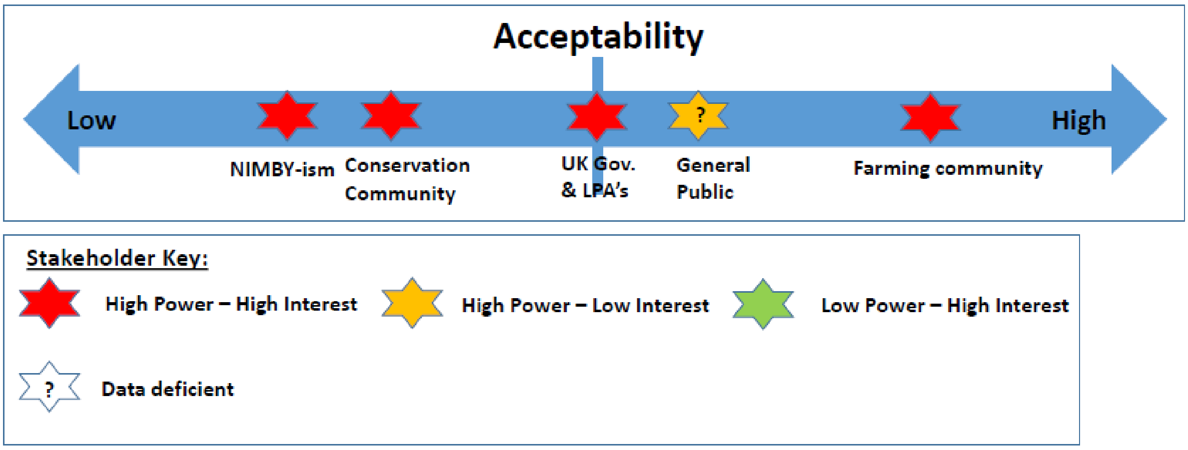
Acceptability

Conservationist interviewees tended to have neutral or negative opinions of SF's; few of them viewed SF's as opportunities. There was limited understanding of the conservation credentials of SF's, and opinions seemed to be based largely on aesthetic considerations. There was also a view that SF's should not be located in conservation areas. The *Great Fen Socio-Economic Report's* (CCL 2014) negative stance towards having commercial renewables within the Great Fen area highlights this point. The Wiltshire Wildlife Trust's community SF is an example of conservationists engaging with SF's (WWT 2012). However, such projects are rare.

The UK government has sent out negative signals about SF's (The Telegraph 2013b). For example, there are concerns that changes to SF subsidies from April 2015 (DECC 2014a) will prevent large-scale SF's from being financially viable. However, the calculations within Figures 19&20 are based on the new subsidy system (*Contracts for Difference*) and clearly show that both the landowner and PF stand to make lucrative returns. This suggests that the negative political rhetoric might not be completely aligned to reality, especially since SF's have significant potential to help the UK achieve its renewable targets. Local Planning Authorities (LPA's) who are responsible for planning applications can be less accepting due to NIMBY considerations. However, it seems that the April 2015 policy changes might introduce SF *business rates*, which could prove lucrative for LPA's and enhance their level of acceptance.

Landowners are in favour of SF's (NFU 2013) as they provide lucrative diversification opportunities.

Figure 22: Diagram showing the level of acceptance for the proposed Solar Farm across different key stakeholder groups



Other Benefits

- *Clean* energy.
- Enhanced energy security.

Summary

This IFO has a high financial and conservation suitability. Viability ultimately hinges on whether planning permission is granted. This depends on the level of acceptance from key local stakeholders. The fact that the landowner has added conservation benefits into the planning application increases the possibility of the SF being accepted. However, additional biodiversity and community benefits would further enhance the possibility of receiving planning permission. Given the potential financial returns available to the landowner and PF, they are in positions to offer such benefits. Finally, it must be recognised that this IFO is vulnerable to government policy changes. Overall viability is rated as *medium.*

Figure 23: Diagram showing the overall viability of *the proposed Solar Farm*

Suitability		Feasibility	Acceptability	Other Benefits	**Overall Viability**
income generation potential or incentive for restoration	biodiversity impact				
HIGH	POSITIVE	MEDIUM	MEDIUM	MEDIUM	**MEDIUM**

Recommendation 5

The SLFP should work in collaboration with the LPA, landowner, PF, and other relevant stakeholders to ensure that the biodiversity value of the proposed SF is maximised. The SLFP should use their influencing skills throughout the planning process in order to achieve the best deal for nature.

Community SF (CSF) Opportunity

A government consultation paper (DECC 2014b) indicates that CSF's up to 10MW's will be eligible for favourable *Feed-in-Tariff* subsidies from April 2015. This policy change represents an opportunity for conservation organisations:

If the proposed SF gets rejected due to NIMBY-ism, one of the best ways to get a SF accepted might be to attain community buy-in by proposing a CSF. This could be structured by having a 10MW CSF adjacent to a 9.5MW SF owned by the PF: 19.5MW in total. The financial returns would potentially be greater than the existing proposal (Figure 20) as the CSF would be eligible for favourable *Feed-In-Tariff* subsidies. The advantage of CSF's is that profits get re-invested locally instead of the PF retaining the income. Consequently, some of the profits could be used for Fenland restoration. DECC (2014b) indicates that only *Community Interest Company's* (CIC) will be eligible to implement CSF's. Charities such as the LWT are well positioned to establish CIC's due to their not-for-profit statuses and established community links (DECC 2014b).

A significant obstacle is whether the CIC could access finance to cover the initial capital costs; this would amount to roughly half of the £24.52m in figure 20. Given that the IRR for the proposed SF is 19.6%, if the CIC could borrow money at less than 19.6% the CSF is likely to be financially suitable. Numerous institutions provide finance for less than 19.6%. Furthermore, the government is looking into ways to facilitate the financing of CSF's (DECC 2014b). It is possible that the PF would be willing to provide debt-finance as:

- The PF would attain reasonable returns on the debt.
- It would increase the PF's probability of attaining planning permission for the adjacent 9.5MW SF.

- The PF would achieve economy of scale savings by having a 10MW CSF adjoining their 9.5MW SF. For example, only one grid connection would be required for both SF's. DECC (2014b) acknowledge the advantage of having SF's adjacent to each other.

Local residents might be interested in buying CIC equity shares.

Borrowing significant sums of money might appear risky. However, the CIC would be a separate legal entity for which the liability of trustees would be limited to a nominal amount, and the liability of shareholders would be limited to their initial investment (The Guardian 2009). Financial risks are also minimised as *Feed-In-Tariff* subsidies provide guaranteed prices for up to 20years for energy produced (DECC 2014b). Wiltshire Wildlife Trust has already engaged with a smaller-scale CSF which appears to be proving successful (WWT 2012).

Recommendation 6

If the planning permission for the proposed SF is rejected, the SLFP should investigate setting up a CSF.

Recommendation 7

More research is required on the biodiversity value of SF's. If a SF is implemented, the SLFP should collaborate with research institutions to investigate the long-term biodiversity value of

Short-listed IFO: Offsetting

The in-depth assessment of this IFO has been included in appendix 11 in order to keep within word limit stipulations.

Figure 24: Diagram showing the overall viability of *offsetting*

Suitability		Feasibility	Acceptability	Other Benefits	**Overall Viability**
income generation potential or incentive for restoration	biodiversity impact				
LOW	UNKNOWN	LOW	MEDIUM	LOW	LOW

Analysis of General Traits Identified

None of the IFO's identified were deemed to have high viability and only 5 had medium viability. The vast majority, 43, had low viability, whilst 11 were data-deficient due to time constraints. The main driver of this low viability trend is that 42 IFO's had a low financial suitability in terms of generating income or incentives for Fenland restoration (Figure 25). This information highlights how difficult it is to devise viable IFO's for the project area. Furthermore, as many of the issues experienced are common to other conservation contexts, it also highlights that the general leadership challenge of devising workable IFO's is extremely difficult.

Figure 25: Table showing the suitability, feasibility,acceptability, and overall viability rating of each IFO

IFO Number	IFO Category	IFO	Suitability: Financial suitability: income generation potential or incentive for restoration	Suitability: Conservation suitability: biodiversity impact	Feasibility	Acceptability (conservationist perspective only)	Other Benefits	Overall Viability
1	Tourism & Recreation (T&R)	Activities for people with disabilities						
2	Tourism & Recreation (T&R)	Adventure Fenland (similar to Bewilderwood concept)						
3	Tourism & Recreation (T&R)	Assault courses, e.g. Tough Mudder						
4	Tourism & Recreation (T&R)	Biodiversity courses, e.g. moths, invertebrates, molluscs.						
5	Tourism & Recreation (T&R)	Boat trips						
6	Tourism & Recreation (T&R)	Canoeing						
7	Tourism & Recreation (T&R)	Caravan store						
8	Tourism & Recreation (T&R)	Cow Safaris						
9	Tourism & Recreation (T&R)	Cycle hire						
10	Tourism & Recreation (T&R)	Eco-cabins / camping						
11	Tourism & Recreation (T&R)	Fen festival						
12	Tourism & Recreation (T&R)	Fenland Art						
13	Tourism & Recreation (T&R)	Fishing / angling						
14	Tourism & Recreation (T&R)	Foraging						
15	Tourism & Recreation (T&R)	Geocaching & orienteering						
16	Tourism & Recreation (T&R)	Horse riding						
17	Tourism & Recreation (T&R)	Iceskating						
18	Tourism & Recreation (T&R)	Laundry services and other basic amenities for boating						
19	Tourism & Recreation (T&R)	LIDAR Technology						
20	Tourism & Recreation (T&R)	Mini-orditorium						
21	Tourism & Recreation (T&R)	Paddle boarding						
22	Tourism & Recreation (T&R)	Premium priced Fenland tours by wardens						
23	Tourism & Recreation (T&R)	Rental cottages on-site (premium priced)						
24	Tourism & Recreation (T&R)	School visits						
25	Tourism & Recreation (T&R)	Visitor café and ship						
26	Fenland Commodities (FC)	Beef production						
27	Fenland Commodities (FC)	Bog oak as an artisan material						
28	Fenland Commodities (FC)	Cranberry production						
29	Fenland Commodities (FC)	Elderflower cordial						

Figure 25 (part 2):

IFO Number	IFO Category	IFO	Suitability		Feasibility	Acceptability (conservationist perspective only)	Other Benefits	Overall Viability
			Financial suitability: income generation potential or incentive for restoration	Conservation suitability: biodiversity impact				
30	Fenland Commodities (FC)	Hay production						
31	Fenland Commodities (FC)	Handicrafts produced by wardens from local materials						
32	Fenland Commodities (FC)	Honey Production		UNKNOWN				
33	Fenland Commodities (FC)	Reedscreens						
34	Fenland Commodities (FC)	Smoked Eels						
35	Fenland Commodities (FC)	Thatching						
36	Fenland Commodities (FC)	Wildfowl shooting on existing Fenland						
37	Fenland Commodities (FC)	Wildfowl shooting on Fenland created and managed specifically for shoots						
38	Fenland Commodities (FC)	Zander and pike (fish)						
39	Payment for Ecosystem Serv	Payment for Ecosystem Services						
40	Offsetting	Offsetting		UNKNOWN				
41	Renewable Energy	Anearobic Digestion (AD) of ditch biomass						
42	Renewable Energy	Biomass brickets from reeds	UNKNOWN					
43	Renewable Energy	Solar Farms as buffer habitat (private ownership)						
44	Renewable Energy	Solar Farms as buffer habitat (community ownership)						
45	Renewable Energy	Willow Biomass						
46	Renewable Energy	Woodland biomass						
47	other	Car parking fees						
48	other	Community farm						
49	other	Conservation Agriculture (CA) (no-till farming) as buffer habitats						
50	other	Entrance fees						
51	other	Environmentally-friendly agriculture as buffer						
52	other	former gravel site restoration to Fenland						
53	other	Green space provider for conferences						
54	other	Income from health care providers for using site as health and wellbeing location						
55	other	Links to universities and research institutions						
56	other	Naming landmarks after funders, e.g. veriodor walk, tebney fen						
57	other	Nursery/crèche						
58	other	Sponsor a Fenland animal, e.g. water vole, otter, cow.						
59	other	Stocking rare breeds such as konik ponies to create income from stud animals						

Note: black boxes denote that, due to time constraints, sufficient data could not be collected to determine a rating.
Note: Refer to figure 6 for a reminder of the colour rating system.

Recommendation 8

The SLFP should consider investigating the medium viability IFO's further. This is with a view to determining whether to incorporate the IFO's into their funding strategy. The medium viability IFO's are: Adventure Fenland; SF as buffer habitat (private ownership); SF as buffer habitat (community ownership); Conservation Agriculture as buffer habitat; Former gravel site restoration to Fenland.

Tourism and Recreation (T&R)

22 of the 25 T&R IFO's were unsuitable from an income generation perspective. There are some common constraints among these IFO's that result in this being the case.

Constraints:

- **Limited demand:** The project area is sparsely populated with a low GDP per capita. This hinders the demand for T&R. South Lincolnshire also attracts fewer tourists than the national average. Owen Mountford (*interview 34*) explained that "Lincolnshire is a bypassed county, people don't want to come here". These factors have a negative impact on the number of visitors and revenue that T&R can generate.
- **Lack of infrastructure:** This can result in sites such as WTF being unable to capitalise on demand. For example, *cycle hire* would not generate income because there are no cycle routes. The potential for boating-related activities is hindered because the River Glen is not connected to other waterways and the river banks are too high to be able to view surrounding countryside. Finally, the Fenland sites are only accessible by minor roads. In contrast, Wicken is easily accessible by road, has cycle routes, and well-connected waterways with good countryside views (*observations 16,17,18,19*).
- **Inability to share fixed labour costs:** Wicken Fen employees tend to work across numerous T&R activities because many activities do not require full-time staff, e.g. boat trips require 3labour hours/day. Given the high cost of labour, this sharing of costs across activities is vital to the financial suitability of many IFO's; for example, *bike hire* at

Wicken would not be suitable without this approach. In the event of a T&R activity being implemented at WTF, allocating labour costs across various activities would be problematic because there are few other activities taking place. This issue could be mitigated by using volunteers. However, WTF has few volunteers and many activities require paid employees.

Even though Wicken Fen is not particularly restricted by these constraints, the T&R activities that they implement do not generate significant income. One argument as to why it is difficult to generate income from T&R is because restoration sites tend to be selected on two main criteria:

- The sites conservation potential.
- Availability on the market at an appropriate price.

Whether a site is appropriate to generate income from T&R is rarely a key consideration for conservation organisations at the acquisition stage (*interview 34*). In contrast, commercial organisations make investment decisions based on the potential returns available. Even then, such investments do not always succeed in generating income.

Recommendation 9

If the SLFP or other conservation organisations wish to generate income from T&R IFO's, it is critical that restoration sites are selected, acquired, and restored with this in mind. This also applies to other IFO's, e.g. selecting and restoring a site to maximum PES potential.

Recommendation 10

The SLFP should consider acquiring and restoring a site adjacent to Waterside Garden Centre (WGC). WGC appears to attracts more visitors than anywhere else in the project area (*observation 15),* consequently it would mitigate the T&R demand constraint. It is also on a main road, and next to the River Glen and McMillan Way. Furthermore, the owner of WGC is a supporter of the SLFP and is likely to be willing to allow Fenland visitors to access WCG's facilities. There could also be the possibility of sharing labour and other overhead costs.

However, it is recognised that acquiring appropriate sites is difficult for conservation organisations as, unlike many commercial ventures, factors other than financial returns must also be considered. It is also true that appropriate, affordable sites are rarely available (*interview 34*).

Fenland Commodities (FC)

All but one of the FC IFO's had low financial suitability. The key constraint for FC's is that only a small area of Fenland currently exists. This causes two fundamental problems:

1. It creates supply bottlenecks. For example, *honey* and *elderflower cordial* could be sold at premium prices and generate high profit margins/unit. However, 170ha of Fenland can only produce a small number of units. Consequently, income generating potential is low.

2. It is difficult to achieve adequate economies of scale to generate profits. For example, the small amount of hay produced at WTF does not warrant investing in the necessary machinery to harvest it. Consequently, cutting is outsourced to local farmers for a nominal fee (*interview 44*). Conversely, at the Great Fen there is more restored Fenland. Consequently, it makes financial sense to purchase the necessary equipment because the volume of hay produced means that a healthy *return on investment* is achievable. However, hay production appears to generates income at the Great Fen because they received grants to purchase the land. If the cost of land acquisition was considered, it is unlikely that hay production, or other FC's that require additional land, would be financially suitable.

A local farmer suggested that farms less than 250ha struggles to generate adequate income for the landowner (*interview 28*). Given that only 170ha of Fenland exists and *production* is not its sole purpose, FC's are unlikely to be financially suitable unless substantial additional land can be acquired through grants.

High Opportunity Costs

There are numerous IFO's that provide incentives for the conversion of land to Fenland, e.g. PES, solar farms, etc. Such incentives must cover landowner opportunity costs for IFO's to be financially suitable. Given that the main land-use in the project area, arable agriculture, has high opportunity costs, it is extremely difficult for IFO's to provide the necessary incentives to be financially suitable. However, the opportunity cost of the former gravel extraction sites is much lower as their income generating prospects are limited (*interview 22*).

> **Recommendation 11**
>
> The SLFP should focus restoration efforts on former gravel sites as the opportunity costs are low and therefore the level of incentives required for IFO's to be financially suitable is significantly diminished. Other restoration projects should also consider targeting lower valued land.

Barriers to Acceptability

There is a significant minority of conservationists that expressed a low acceptance towards many IFO's. Sometimes this coincided with the IFO's negative conservation impacts. However, there were numerous instances where the conservation impact of the IFO was neutral or positive, yet the interviewees level of acceptance was low, e.g. SF's, Conservation Agriculture (CA), Adventure Fenland, and PES. I believe there are two dominant reasons for this:

1. As only small patches of semi-natural habitat (SSSI's) remain, conservationists are rightly precious about what activities can take place on these sites. I believe some conservationists are applying this precious mind-set when assessing various IFO's. However, this mind-set is arguably less applicable in a restoration context. This is because the starting point is usually an intensive agricultural desert (not a SSSI) and therefore any IFO that is implemented, even if it involves substantial trade-offs, is likely to be better than the alternative. To clarify the point, some interviewees had a low acceptance for the Adventure Fenland IFO because the idea of having children running around disturbing biodiversity was a trade-off that they were uncomfortable with. When the interviewees made this judgement, they were comparing the Adventure Fenland to a *pristine* Fenland. But in reality, the alternative is an agriculture field because if the Adventure Fenland is not implemented, there is no alternative funding available to restore the site. The net result is that the Adventure Fenland received a low acceptability rating even though it would be advantageous for biodiversity.

2. In the UK, conservation has a socio-historical dimension; it is not a concept founded solely on preserving biodiversity. Conservationists tend to look back to what habitats used to be like during a particular period with a view to restoring them to their former state. Egan and Howell (2005) refer to these relic habitat types as *reference ecosystems*. I believe this mind-set of looking back is partly responsible for some interviewees having a negative perception of recent innovations such as SF's and CA. My opinion is that this mind-set is short-sighted because climate change and other factors dictate that *reference ecosystems* are extremely difficult to replicate. Recent innovations can also create new opportunities for biodiversity. For example, it is possible that the shading qualities of SF's could create novel ecosystems (Turney and Fthenakis 2011) that protect species susceptible to climate change.

These factors dictate that IFO's that would otherwise be viable might not be implemented due to acceptability barriers. Furthermore, conservationists who are confined by such mind-sets

Recommendation 12

In a restoration context, conservationists should adopt a less precious, less prescriptive mind-set.

will find it more difficult to devise creative solutions to funding challenges.

IFO's With Substantial *Other Benefits*

Recommendation 13

The SLFP should consider incorporating novel habitats such as SF's, Adventure Fenland, and CA into their vision; maybe even as core habitats in their own right as opposed to buffers. A local farmer, Tony Reynolds, is already practicing CA and appears to be achieving positive outcomes (*interview 38; observation 10*). The SLFP should consider engaging with him. Peter Bircham (*interview 6*) mentioned that south Lincolnshire is a good place to implement novel habitats because limited restoration habitat currently exists. Once a significant area of habitat has been restored, people become more precious about what has been created and therefore are more likely to oppose novel habitats.

Figure 26: List of Other Benefit IFO's (OBIFO's)

IFO Number	IFO Category	IFO	Suitability: Financial suitability: income generation potential or incentive for restoration	Suitability: Conservation suitability: biodiversity impact	Feasibility	Acceptability (conservationist perspective only)	Other Benefits	Overall Viability
1	Tourism & Recreation (T&R)	Activities for people with disabilities						
12	Tourism & Recreation (T&R)	Fenland Art						
17	Tourism & Recreation (T&R)	Iceskating						
24	Tourism & Recreation (T&R)	School visits						
29	Fenland Commodities (FC)	Elderflower cordial						
55	other	Links to universities and research institutions						

There are a group of IFO's that have a low financial suitability but offer substantial other benefits, are neutral or positive for biodiversity, and require minimal resource inputs. These IFO's are listed in figure 26 and will be referred to as *other benefit* IFO's (OBIFO's).

Figure 27: Diagram showing some of the other benefits that OBIFO's offer

Although OBIFO's do not create much income directly, they have the potential to increase the overall *value* of Fenland sites due to the other benefits that they provide. Increasing a site's *value* indirectly enhances income generation potential. For example, implementing OBIFO's would increase the number of volunteers and staff on site. This would reduce barriers such as the *Inability to share fixed labour costs* which, in turn, would increase the viability of T&R IFO's. Realising these other benefits would also help increase the strength of grant funding proposals. Peter Bircham (*interview 6*) is an advocate of OBIFO's. He has been involved with Wicken Fen since 1960 and has seen how activities such as creating links with universities generates income in various indirect ways. He stated that one of the reasons why restoration projects have 100year visions is because building up the value of a site takes time. The SLFP has just started its journey; implementing some of these OBIFO's could help build the foundations for future success.

There seemed to be a slight reluctance among some SLFP stakeholders to implement OBIFO's. Certainly, only limited activities have been implemented at WTF to date. This

Recommendation 14

Consider implementing OBIFO's and increase the amount of activities that take place at WTF. In a restoration context, the SLFP and conservation organisations more generally should consider accepting calculated short-term biodiversity trade-offs to achieve long-term visions.

reluctance is possibly founded on a mind-set to minimise the amount of activities that occur on WTF in order to minimise biodiversity impacts. This mind-set is understandable. However, in a landscape-scale restoration context, a small biodiversity trade-off at WTF is arguably a price worth paying if it helps attain the funding to restore an additional 600ha and achieve the long-term vision.

Tracking a Broader Set of Government Policies

The UK government uses incentives such as subsidies and tax-breaks to stimulate particular sectors. Renewable energy companies have a strategy of tracking government policy changes to identify incentives and profit from them (*interviews 9,10; observation 6*). I decided to apply a similar approach and tracked policies, particularly those relating to renewable energy and land-use, to try and identify IFO opportunities. However, such opportunities were difficult to find in practice for several reasons, including:

- The life-cycle of incentive schemes is often short and therefore you have to be quick to capitalise on opportunities and achieve financial returns (*interview 9*).
- Many opportunities require large amounts of financial capital. Most conservation organisations tend to be averse to debt-finance and do not have large monetary reserves.
- Many of the incentive schemes are developed with particular investors in mind. These investors are generally not conservation organisations. For example, Anaerobic Digesters (AD's) can generate profits for farmers that grow maize and have a lot of pre-packed food waste. However, when I investigated whether income could be generated by processing Fenland ditch biomass through AD's, the associated transportation costs were prohibitive.

Nonetheless, the CSF opportunity discussed above highlights that tracking government policies does have the potential to be extremely lucrative.

Recommendation 15

The SLFP and conservation organisations generally should not be confined to tracking government policies that relate directly to conservation. They should consider investing time tracking a broader set of policy areas, particularly those relating to renewable energies and land-use, in order to identify IFO's. Conservation organisations should consider applying techniques such as *scenario planning* (Schoemaker 1995) to help them respond rapidly to, and ultimately capitalise on emerging opportunities. A less risk averse approach to accessing debt-finance should also be considered to help take advantage of opportunities.

IFO’s and Traditional Grant Funding

There are numerous IFO’s that have the potential to be viable with the assistance of some form of grant funding. As discussed earlier, hay production could generate income if grants were available to acquire large areas of land, whilst the viability of many T&R IFO’s would increase significantly if funding were available for infrastructure and facility improvements. Furthermore, although the PES option is classed as an IFO, it has a strong grant funding component because the most likely stakeholder to pay for the ES’s is the UK government or EU. Such payments would effectively be grants.

Recommendation 16

Conservation organisations should seek to identify and capitalise on synergistic relationships between grant funding and IFO’s.

Further Recommendations

Recommendation 17

Stakeholders from other restoration projects are encouraged to utilise the outputs from this placement in order to facilitate the development and implementation of viable, context specific funding strategies.

Recommendation 18

Conservation organisations should consider three fundamental questions when determining appropriate funding strategies for restoration projects:

1) What are the project’s aims and vision?
2) What is the risk appetite and internal competencies of the conservation organisation (internal environment)?
3) What are the specific characteristics of the project area (external environment)?

For particular IFO’s to be appropriate funding options, it is critical that they align well with the answers to these questions.

Conclusion

This report highlights that it is extremely difficult to devise viable IFO's within the SLFP context. This is partly due to factors that are specific to the project area. However, many of the constraints highlighted are relevant to conservation organisations and projects more generally. Consequently, this report shows that identifying IFO's that work is challenging and that IFO's are unlikely to provide a silver bullet solution to the conservation funding problem.

Fundamentally, options that generate income or provide incentives for conservation are difficult to find because so many of the benefits that biodiversity offers are externalised in monetary terms. Trying to change this structural issue with concepts such as PES is no easy task. In contrast, in the private sector, where there is a benefit, there is usually an income stream. But this does not mean that IFO's are destined to fail. Examples such as the SF IFO support this assertion. However, it does mean that we as conservationists have to work harder than some other sectors to achieve our goals. Critically, there are changes that conservation organisations can make to their own practices to make it easier to identify, capitalise upon, and implement viable IFO's. Some of these changes are specific to the restoration context as opposed to conservation more broadly. This is partly because the restoration starting point is usually a degraded or destroyed habitat as opposed to a pristine ecosystem. Conservationists must first acknowledge this fundamental difference in order to be comfortable with making the necessary changes, such as adopting a less precious, less prescriptive mind-set.

McCauley (2006) argues that there is scant evidence that *market-based instruments* (a form of IFO) work and that we should therefore move away from such approaches and revert to protecting nature for nature's sake. I have sympathies with such views. However, given the scale of the funding problem, if conservationists are going to have any chance of halting biodiversity loss we cannot afford to close the door on such IFO's. Conservationists should continue to devise innovative solutions to the conservation funding challenge. At least this gives us a chance of protecting biodiversity. The alternative is that we continue on the same disappointing path.

Words (9,994)

Appendices

Appendix 1: Personal Lessons Learned from this Placement

Removed from this version of the report as not relevant to SLFP stakeholders

Appendix 2: Personal Motivations for Selecting this Placement

Removed from this version of the report as not relevant to SLFP stakeholders

Appendix 3: Acronyms

AL – Agricultural Land

BF – Baston Fen

CfD – Contracts for Difference (subsidie)

CIC – Community Interest Company

CSF – Community Solar Farm

EB – The Environment Bank

ER – Ecological Restoration

ES – Ecosystem Services

FFP – Fens For The Future Partnership

GCC – Green Certified Commodities

GLLEP – Greater Lincolnshire Local Enterprise Partnership

Ha – Hectare

IFO – Innovative Funding Option

IRR – Internal Rate of Return

KV – Kilo-volt

LPA – Local Planning Authority

LWT – Lincolnshire Wildlife Trust

MFH – Multi-functional Fenland Habitat

MPhil – Conservation Leadership Masters of Philosophy

MW – Mega-watt

NIMBY – Not in My Back Yard

NNN – No Net Loss

NPPF - National Planning Policy Framework

OBIFO – Other Benefit Innovative Funding Option

PES – Payment for Ecosystem Services

PF – Pension Fund

RPI – Retail Price Index

SF – Solar Farm

SFA – Suitability, Feasibility, Acceptability

SLFP – South Lincolnshire Fenland Partnership

SSSI – Site of Special Scientific Interest

T&R – Tourism and Recreation

TEEB - The Economics of Ecosystems and Biodiversity

TESSA - Toolkit for Ecosystem Service Site-based Assessment

TF – Thurlby Fen

UK – United Kingdom

VfM – Value for Money

WGC – Waterside Garden Centre

WLT – Wiltshire Wildlife Trust

WW2 – World War Two

Appendix 4: Honey Production IFO: SWOT - PESTEL Analysis

Key:

political
Economic
Social
Technological
Environmental
Legal
Other

Strengths
Zero capital investment and minimum input of resources for SLFP
Favourable sale terms and distribution outlet: Steve Welch from Waterside Garden Centre said that it is likely that they would be willing to let the SLFP sell honey on site and that they would not request a share of any profits.
Favourable mark-up on cost of production: For any honey produced on SLFP sites, Grace Evans (local honey producer) would require £3 per 1Ib jar produced. This would cover her costs and allow any mark-up on the sale of the honey to be retained by SLFP as profit.
Financial and other risks to SLFP are minimised by the fact that the bee hives (and honey production) would be owned and managed by Grace Evans (local honey producer).
The local honey market is dominated by small scale producers as opposed to large commercial farmers (and their associated economies of scale) (Patterson 2010). This dictates that **economic *barriers of entry* into the market place are not as significant as they might otherwise be.**
Aligns well with the localism movement: The local honey market appears to be growing. Glace Evens sold 38 jars of honey from her doorstep in the village of Baston in one weekend. It appears that people are particularly interested in honey that is produced near to where they live due to the perceived benefit of reducing the symptoms of hay fever. Judy Lyons from the Cooperative supermarket mentioned that local honey is an extremely popular product within the organisations Love Local range and supply does not keep up with demand.

Developing links with the local community: Having a local resident using Fenland to produce honey will help create a sense of community ownership and buy-in to the SLFP project.
Raising awareness about restored Fenland: Branding the product as Fenland Honey, putting a map of the recreated Fenland area on the jar, and selling the product locally will all help raise awareness of the SLFP project. Awareness of Willow Tree Fen is currently low in villages such as Baston (*interview 36*) and this will undoubtedly be having a negative impact on visitor numbers.
Bee's provide a valuable pollination service (DFB 2013). Edmond Gadd (*interview 8*), a Linconshire honey farmer explained that some farmers will pay to have bee hives next to their fields due the the pollination service provided. The presence of bees will also provide a pollination service for restored Fenland habitat. This point is particularly relevant due to the recent, well publicised declines in bee populations (DFB 2013). The retail value of what bees pollinate is estimated to be worth £1bn each year in the UK (DFB 2013)
Limited pollen competition between sites: Although bees travel up to 2 miles radius from their hives (Bush 2007). The distance between Baston Fen and Willow Tree Fen would mean that bees could be kept at both sites with minimum competition for pollen between the two sites. Reducing the competition for pollen will help ensure high honey yields.
Enthusiastic local producer: A Baston honey producer, Grace Evans, has asked previously to put her bee hives on Willow Tree Fen. She is still enthusiastic about keeping bees on the site and expanding the amount of bee hives that she has.
Quality of local honey: I have tasted honey that Grace Evans has produced from hives within the project area. It tasted really good and is really popular with Baston residence.
Willow Tree Fen is one of the largest areas of wildlife habitats in an otherwise intensive agricultural landscape. This is likely to help create a perception that any honey produced from the site is of high quality.
Long shelf life: honey has a shelf life of at least 2 years (TBBA 2011)

Weaknesses
Fluctuating supply: The amount of honey produced from a hive can vary significantly from one season to the next depending on factors such as swarming, disease, and weather conditions (Edwards 2011). Consequently, there is a risk that production targets might not be realised.
Limited supply: Given that there is only roughly 170ha of Fenland in the project area at present, this limits the amount of honey that can practically be produced. It is unlikely that SLFP would be able to match supply with

demand and therefore income potential is likely to be hindered due to a supply side bottleneck.
Perceived threat of Bees: Some people are scared of bees and the presence of beehives might deter people from visiting Fenland. However, the interviews conducted suggest that this is not a significant concern and it could be mitigated by locating the hives in areas where the public rarely visit. There are wild bee nests relatively close to visitor activity at Wicken Fen and the staff do not perceive this as a significant threat to visitor numbers (*interview 7*).
Limited pollen on recently restored Fenland: Recently recreated Fenland such as Willow Tree Fen does not have the same pollen levels as some more established habitats. This could impact on the supply of honey in the short term. However, honey bees will supplement the pollen that they harvest from restored Fenland with pollen from surrounding agricultural fields so this is unlikely to be a significant problem. Pollen sources on restored Fenland will also improve over time (interview 35).
Production regulations: Grace Evans currently only sells honey from her house. Grace would have to meet certain health, safety, and hygiene regulations in order to supply honey to Waterside Garden Centre or farm shops. These regulations do not appear to be particularly restrictive and are unlikely to be prohibitive in terms of increasing the cost of production. However, it is something that Grace Evans would have to learn more about. The standard that would have to be complied with are as follows: Honey Regulations, 2005; Food Safety (General Food Hygiene) Regulations, 1995; Food Labelling Regulations, 1996; Weights & Measures Act, 1985; The Food Safety Act, 1990 (1014).

Opportunities
Use of other sites to produce Fenland honey: If this option is successful, there are other sites within the project area which, although not formally part of the SLFP project, could be used to keep bee hives. For example, Nicolas Watt's and Waterside Garden Centre's nature reserves. This would help scale up supply. **Future distribution channel:** Judy Lyon (Deputy Supply Chain Manager, Lincolnshire Cooperative Supermarket) (*interview 29*) mentioned that the Cooperative often have additional demand for local honey from their customers and that they would be interested in selling Local Fenland honey as part of their *Love Local* range. She also mentioned the possibility of offering the SLFP favourable sale terms due to the SLFP's focus on local nature conservation. Judy estimated that the Cooperative would be able to sell 3000 jars / annum through the Cooperatives 80 Lincolnshire stores.

Threat
Risk that honey bees will outcompete wild bees for pollen. This could have an adverse impact on wild bee

numbers (Evertz *1995*).
There is a risk that members of the public could attempt to take legal action if they are stung by bees on Fenland sites. This risk is mitigated by the fact that all members of the British Beekeepers Association are covered by public liability insurance (TBBA 2013). Furthermore, I could not find any examples of beekeepers being successfully sued in the UK as a result of *their* bees stinging members of the public.
Potential loss of enthusiasm from Grave Evans for beekeeping on Fenland sites.
Limited number of appropriate honey producers in the area: There is only one other beekeeper that I am aware of in the project area. If Grave Evans were to decide that she no longer wanted to be involved with this IFO, it might be difficult to locate another appropriate honey producer.
Theft / Vandalism: there have been instances where beehives have been stolen or vandalised. However, it would be possible to locate the hives in appropriate areas in order to mitigate this threat.

Appendix 5: Honey Production IFO: Financial Assumptions to NPV Calculations

The NPV calculation is based on a 5 year life span. This time period has been used as assets such as beehives and beehive equipment might reasonably expect to have a useful life of 5 years. The 5 year NPV calculation is therefore in line with HR Treasury's (2011) guideline of using the useful life of assets to determine the NPV time period. The level of uncertainties and unknowns after 5 years is also a strong justification for applying the 5 year life span.

1lb jar size assumed. This is the standard jar size.

The increase in the number of hives per year (*1) is based on having 1 hive each on Baston Fen, Thurlby Fen, and Willow Tree Fen in year 1, 3 hives on each site in year 2, 5 hives on each site in year 3. In year 4 and 5, the increase in the number of hives is based on the assumption that the number of sites that are appropriate for bee hives will increase in line with the increasing area of restored Fenland within the project area. The assumption is that by yr 5, there will be 5 sites with 5 hives on each.

Assumed 60*1lb jars of honey produced per hive (*2): Based on average amount of honey produced per hive in the UK (Edwards 2011). In comparison to Grace Evans current production levels in the area, this is a conservative estimate.

Profit per jar (*3) determined by subtracting the expected cost of production, £3, from the expected retail price, £4.50. The expected cost of production is based on conversation that I had with Grace Evans, she suggested she would require £3 per jar in order to cover her costs. The expected retail price is based on observations of the retail prices of comparable jars of honey in farm shops, farmers markets, and garden centres within 10 miles of the project area. The observed retail price range varied from £3.80 to £5.25.

No inflationary increase presumed for the gross profit per jar over the course of the 5 years. This ensures that calculations remain conservative. It also recognises that any increase in retail price could potentially be matched by increases in the cost of production.

Assumed jar labelling design costs are free. This is based on the fact that Waterside Garden Centre and other stakeholders have offered similar services for free in the past. It is also based on the fact that the local label supplier, *Thorne Beehives*, provides a diversity of label designs free of charge when honey producers buy labels (see: http://www.thorne.co.uk/labels/l1-to-l26/L1-labels-personalised-100).

Assumed no income from other beehive products. It is possible to produce other products such as candles from beehives. Potential income from such products was excluded from the calculations as I have attained limited information in terms of market potential. This is also in line with ensuring that calculations remain conservative.

Assumed number of people per course starts at 10 in year 1 and rises at 15 from year two onwards (*4). This is based on Information from Grace Evans that there are usually 15 to 20 people an each course. The lower limit of 15 has been applied in keeping with the conservative ethos of calculations in this report.

£70 per person per course assumed for *Bee Keeping Training Course* (*5). This is based on the current market price for such courses in the area (Thorne 2014).

Assumed *Bee Keeping Training Course* price will rise to £80 per person per course during year 4 due to inflation (*6). This is in line with current rates of inflation.

Assumed that Bee Keeping Training Course can be provided for free by Grace Evans (excluding the purchase of the bee suits). This seems reasonable given that Grace Evans stated she would be willing to provide the course on a volunteer basis. A £100 nominal cost for learning materials has been included.

Price of all-in-one bee suit (£40) based on current market rate (*7) (see: http://www.amazon.co.uk/Beekeepers-bee-suit-fencing-veil/dp/B009R4SZO8/ref=sr_1_4?ie=UTF8&qid=1405268703&sr=8-4&keywords=beekeeping+suit)

Discount rate of 3.5% applied (*8) in line with HM Treasury (2011) Guidelines.

Appendix 6: Payment for Ecosystem Services IFO: SWOT - PESTEL Analysis

Key:

political
Economic
Social
Technological
Environmental
Legal
Other

Strengths
The Lakenheath and Wicken TESSA assessments highlight that restored Fenland habitat can have a higher ES value than AL.
Conservation trade-offs would be inevitable when implementing a MFH. However, given that the alternative is an intensive agricultural field, the conservation impact of a MFH would undoubtedly be a positive one.
An area of land within the project area where a potential MFH could be located has been identified
Various farmers in the project area have suggested that there is demand for additional irrigation services. Whilst Anglian Water have previously discussed the need for additional domestic water services in south Lincolnshire. This suggests there could be demand for a MFH in the project area.

Weaknesses
The TESSA ES value of the MFH is significantly less than the ES value of AL.
There are few beneficiaries who would be willing to pay for the ES's provided
It would be difficult to source the capital to fund the upfront land acquisition and restoration costs. Beneficiaries of a MFH's ES's might be reluctant to provide the funds due to the long payback period on their investment.
Wicken and Lakenheath have high *Nature-based Recreation* ES values which ultimately results in these two sites having a higher overall ES value than surrounding AL. Unfortunately, the *Nature-based Recreation* potential is somewhat less in the SLFP project area.

There is no existing government structure or pre-existing leadership within the project area to facilitate the creation of a MFH.
There is a degree of mistrust between the different stakeholders who might be involved with establishing a MFH.
Due to difficulties associated with measuring some water-based ES included within the TESSA methodology (Peh *et al.* 2013), it was not possible to provide ES values for *water quality improvement services* or *water used for domestic Purposes and Irrigation*.
The TESSA framework does not provide methodologies to value all ES types.
TESSA and similar frameworks rely on numerous assumptions in order to determine ES values. Such assumptions increase the likelihood of stakeholders disregarding the results of TESSA as they disagree with the assumptions.
There is no practical design for what a MFH that maximises ES value might look like.
Some conservationists are uncomfortable with the concept of putting a value on nature
The potential beneficiaries of a MFH often have tried and tested solutions to their own problems. Consequently, they might be less reluctant to invest time in creating a MFH.
I have seen instances where the ES approach produced unpopular results for the stakeholders who commissioned the studies. These results were ultimately misrepresented within the written report. Such practices create mistrust and reduce acceptance levels.

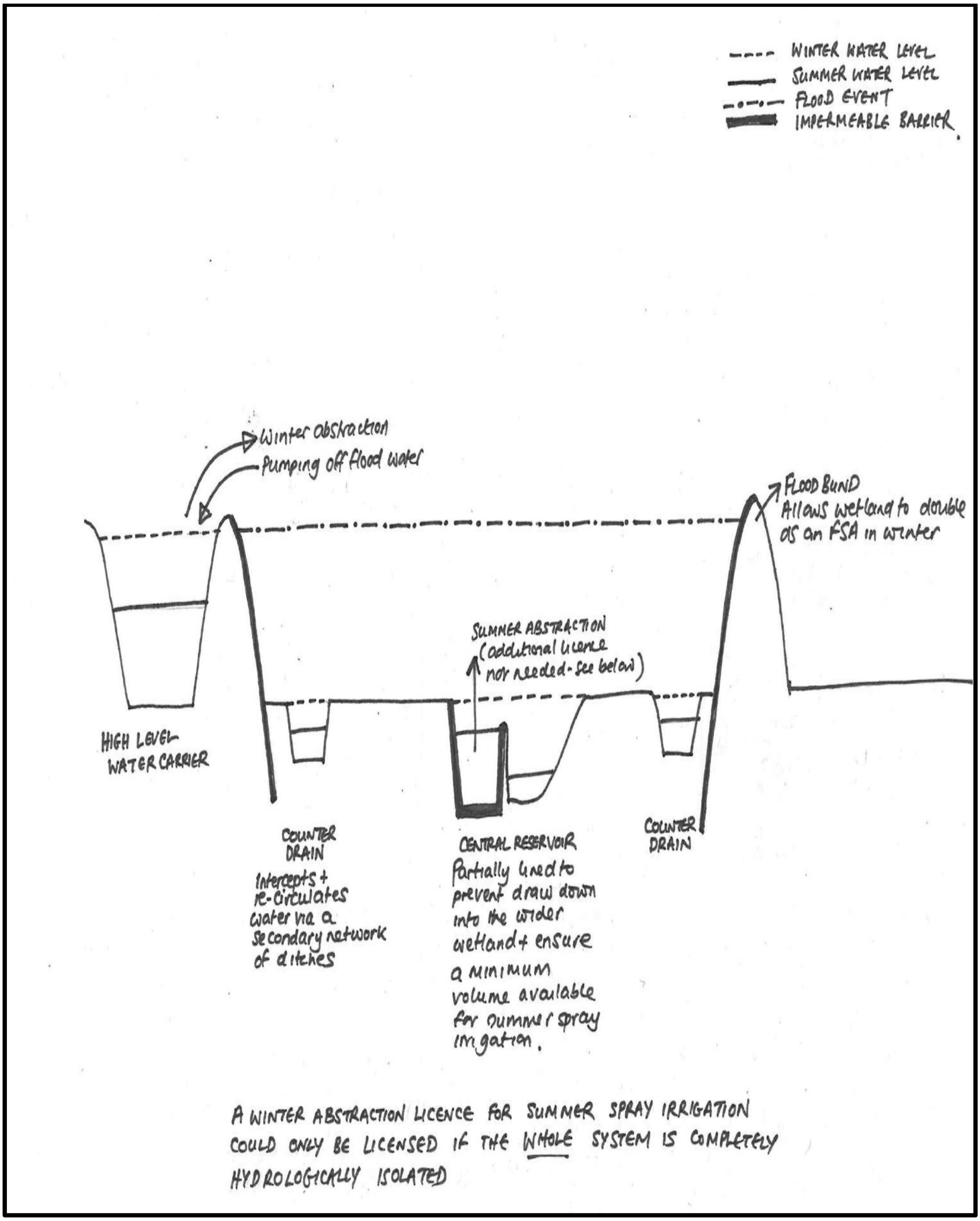
Opportunities
UK and EU governmental bodies might be willing to pay for ES projects of this nature as they represent the beneficiaries (i.e. the general public) of many of the MFH's ES's. The UK government has the resources to cover upfront costs. They also look favourably upon projects that distribute benefits equitably across society; this is arguably an advantage of the MFH compared to AL. Furthermore, governments require projects to show *value for money* (VfM) (HM Treasury 2011); the ES approach is conducive to highlighting VfM. The UK government and EU channel significant funds through the *Greater Lincolnshire Local Enterprise Partnership* (GLLEP). The GLLEP funds projects that facilitate local growth with a particular focus on water management, agriculture, and recreation (GLLEP 2014). Consequently, the GLLEP could provide a possible source of payment for this IFO.
Insurance companies and water companies are potential beneficiaries of MFH ES's. They are the type of stakeholders that have the financial resources to provide upfront payments for the initial restoration costs.
It is possible that the TESSA framework will be able to provide methodologies to value more ES types in the future. This increases the probability of being able to show that a MFH is financially suitable.

Appendix 7: Payment for Ecosystem Services IFO: Financial Assumptions to NPV Calculations

This appendix has been omitted as some of the data within it is confidential

Appendix 8: Draft diagram of a potential MFH

This diagram was forwarded to me by Maisie Jepson (*interview 32*) and was originally designed by Dominic Coath, Environment Agency.



Appendix 9: Solar Farm Buffer Habitat IFO: SWOT – PESTEL Analysis

Key:

political
Economic
Social
Technological
Environmental
Legal
Other

Strengths
Government subsidies on SF's offer guaranteed prices for energy over long periods of time. This gives investors' confidence in the level of income that they will attain. Solar farms <5MW's are eligible for the Feed-in-tariff (FIT) subsidy which provides guaranteed payments for 20 years for each Wh of energy produced (EST 2014). Larger solar farms currently attain subsidies through the Renewables Obligation Certificates (ROC) scheme. ROCs are valid for 20 years (LARK 2014). DECC's (2014a) consultation paper suggests that the ROC scheme will be replaced in April 2015 by a scheme called *Contracts for Difference* (CfD). Although this subsidy scheme is less favourable than ROC's, it still seems that it will provide investors with favourable prices that are guaranteed for 15 years. These prices increase throughout the 15 years in line with the *consumer price index* (CPI) (DECC 2013b).
Farmers are offered roughly £2224 per ha per year to locate solar panels on their land. This usually takes the form of a 25 year lease agreement with the £2224 increasing each year in line with the *retail price index* (RPI) (Freewatt 2014; Solafields 2014). £2224 per ha is in excess of 3 times what a farmer would earn from arable agriculture. Consequently, farmers are generally in favour of locating SF's on their land (NFU 2013).
In some circumstances farmers can still apply for environmental stewardship schemes around the perimeter of SF's (LARK 2014)
Possibility for farmers to attain additional income from solar farms through activities such as sheep grazing, and providing security services and panel cleaning services for the site (interview 41).
Low intensity sheep farming on SF's can reduce the management costs of the site. It can also minimise the need

for the application of agricultural chemicals.
Solar energy is already cheaper to produce than offshore wind energy, will soon be cheaper than onshore wind, and could feasibly be cheaper than natural gas within a decade (SPP 2014)
One of the UKs largest solar installation providers, LARK, is located in close proximity (Bourne) to the Fenland project area. Using a local provider could create jobs and income for the local area.
DECC's (2013a) opinion poll tracker shows solar enjoys its highest public approval ratings ever at 85%. Although this does not distinguish between roof-top solar panels and SF's.
Very low levels of noise pollution (WWT 2012) and therefore low impact on local residents
Sparse population of target area means less likely site will be in view of objecting residence
It only takes roughly 16 weeks to install a large-scale SF (LARK 2013b). This helps minimise the amount of disturbance to the local community from installation activities.
Pro-conservation habitats can be created on SF's, e.g. hedgerows; field margins, wild flower meadows; bird boxes; ponds; winter bird crops; nectar rich areas; ditches; security fence can be used for climbers; gap at the bottom of fence of 20-30 cm enables badgers, etc. to get in without jeopardising site security; could have hedge outside security hence; hibernacula's; log piles; bug hotels; bird and bat boxes (BRE 2014).
Solar panels can be installed and removed (at end of useful life) with minimal disturbance (LARK 2014)
Solar panel maintenance requires periodic panel cleaning and checking of equipment, wiring, etc. The site is likely to be secured in order to prevent illegal access. In summary, there is likely to be limited disturbance on the site (LARK 2014). This increases the biodiversity potential of the site.
Solar farms leave 95% of land area undisturbed (BRE 2014).
Solar panels have a useful life in excess of 25 years which is a long time for a site to achieve biodiversity gains (LARK 2014).
SF can play an important role in soil sustainability, soil health, and resting soils (BRE 2014). On peat soils, SF's may provide opportunity for peat preservation or even peat accumulation; conserving the soil and its carbon store.
Potential to improve local water quality (Phillips 2013) due to reduced agri-chemical usage compared to alternative agricultural land uses.
Research conducted by (Phillips 2013) concludes that PV solar power can be considered sustainable at a high level. Turney and Fthenakis (2011) also conclude that large-scale SF's are environmentally positive compared to traditional energy sources.
Per land area used, solar provides more energy than crops grown for energy such as oil seed rape. Therefore less land intensive (LARK 2013)
Solar power is a renewable energy source and has minimal CO2 emissions compared to non-renewable sources

(WWT 2012).
Flat landscape of Fens is ideal for solar energy production (LARK 2014).
Wiltshire Wildlife Trust is already implementing a solar farm project for the good of conservation (BRE 2014).

Weaknesses
Only small livestock such as sheep can graze the site. Larger grazers could damage the panels (BRE 2014).
There could be up to 100 lorry deliveries for a 40 acre site over a 16 week period (LARK 2013b). This could upset local residence
Percieved loss of visual amenity (Phillips 2013).
Building solar farms on high grade arable land is against the Solar Trade Associations *10 Commitments* (STA 2013). The land within the project area is generally high agricultural grade land (grade 2). However, the 10 Commitments are voluntary and solar farms do still get built on high grade land.

Opportunities
Although the government is planning changes to solar subsidies that could make the economic case for large-scale SF's less appealing (DECC 2014a). These proposed changes also include an increase in the maximum size of community solar projects – the limit is expected to increases from 5MWs to 10 MWs (DECC 2014b) – 10 MW's roughly equates to a SF the size of 30 football pitches.
Given that one of the UK's largest solar installation providers, LARK, is located in close proximity to the project area, they are more likely to engage in a way that is most beneficial for the local society and environment
Limited research on the conservation impact of PV solar farms (Turney and Fthenakis 2011). There is therefore a potential opportunity to conduct research on the conservation impacts of SF's in proximity to the project area.
LARK energy (local solar farm installation provider) has worked with Hanson to convert former gravel sites into Solar farms (LARK 2013a). There could be an opportunity to do something similar with the gravel sites in the project area in a way that is also environmentally beneficial.

Threats
National government has blocked the planning permission for SF's on several occasions even though the permission was originally granted by the relevant local authority (The Telegraph 2013b).
Concern that Coalition government is planning to reduce / remove financial incentives for large-scale SF's on greenfield sites due to NIMBY concerns and risk that solar energy production could exceed governments target

and therefore cause problems for the national grid. Following a consultation period, it is likely that changes will come into effect in 04/2015. Likely changes include cutting subsidies for solar farms of > 5MW (roughly 15 football pitches). Such solar farms would be subsidised under the *Contracts for Difference* (CfD) scheme (DECC 2014a). However, the recently released *strike prices* under the proposed CfD scheme do not appear particularly prohibitive in terms of still being able to make a financial return from large-scale SF's. However, it does seem that there will be a cap to the total pot of many that is available for large-scale renewable energy projects (DECC 2013b). This could potentially reduce the number of SF's that gain approval under the CfD scheme.
Potential NIMBY resistance to large-scale SF's as highlighted by a recent case in Suffolk (The Telegraph 2013b).
By taking high grade agricultural land out of production, there is a risk that land with high biodiversity value will be converted to agriculture in other areas in response to reduced supply, e.g. land being converted in other parts of Europe.
The mining of natural resources for solar panels (e.g. thin-film silicon, cadmium telluride, and copper-indium-gallium-selenide) could cause environmental damage in other locations (Fthenakis 2009). However, Jackson and Oliver (2000) suggests that PV panel production can be sustainable.
There has been limited research on the conservation impact of PV solar farms (Turney and Fthenakis 2011). As such, there is a risk of unforeseen conservation consequences. However, given that the alternative to SF's in many cases is an intensive agricultural deserts, it seems unlikely that well managed SF's would have a net negative conservation impact.

Appendix 10: Solar Farm Buffer Habitat IFO: Financial Assumptions to NPV calculations

Financial Assumptions for Pension Fund

Initial Capital Investment (Year 0) (*1): Based on the actual costs of the proposed 19.5MW solar farm bordering the SLFP project area. This information was given to me by the landowner, Andrew Freeman (interview 41). I have also verified these figures 1) during discussion with stakeholders from various solar energy companies and 2) by reviewing available literature on similar sized solar farms (SPP 2013).

Years (*2): 26 years was chosen for the length of the NPV calculation because 1) solar companies tend to enter into 25 year lease contracts with the landowners (Freewatt 2014; Solafields 2014), 2) 25 years is the minimum estimate for the useful life of a solar farm (LARK 2014). The 26th year relates to decommissioning activity.

UK annual average Watt hour (Wh) / Watt power (Wp) ratio (*3): This is a ratio which is based on the average efficiency of SF's in the UK (The University of Sheffield 2014). This ratio also aligns to data provided by the *National Renewable Energy Laboratory* (Solar Industry 2014). There are various factors that result in solar panels not being 100% efficient in terms of delivering the maximum amount of energy (Wh) per panel. These include factors such as the amount of solar irradiation and shading (SMA 2013).

Efficiency Factor (*4): The performance of SF's reduces by between 0.8% (PSECC 2013) and 1% per annum over the useful life of the panels (Freewatt 2014). The calculations assume the upper limit of 1% in line with the conservative approach of all calculations within this study.

MWp (*5): based on the size of the proposed solar farm – 19.5MW.

Daylight Hours / Annum (*6): 10 hours of daylight per day have been assumed for each of the 365 days in a year. This is conservative as there are, on average, 12 daylight hours per day (Barrow 2013). PV solar farms require daylight to generate energy, as opposed to direct sunlight.

Energy / Annum (MWh) (*7): energy produced year (MWh) = Power (MW) x time (hrs) = (*3)*(*4)*(*5)*(*6)

Strike Price £/MWh (*8): This is the price per MWh that the owner of the solar farm will receive. It is based on the proposed subsidy system that is proposed to be introduced from April 2015 – this is called Contracts for Difference (CfD). The government has already released the proposed price (strike price) for the 2015 -2016 period - £120 / MWh (DECC 2013c). This price is guaranteed for a 15 year period and increases each year in line with the *consumer price index* (CPI) (DECC 2013d). Consequently, I have assumed that payment for energy produced will only be received for the first 15 of the 25 years. This is very conservative as the useful life of the solar farm is 25 years and it is very likely that there will be a buyer for the energy produced for the remaining 10 years, even if it is based on the market price as opposed to the higher CfD subsidy price. The CPI index was calculated by applying the average CPI for the previous 20 years – 2.178 % per annum (Office for National Statistics 2014)

Income / Annum (£) (*9): strike price * energy produced per annum.

Expense /Annum (*10): All annual expenses are assumed to increase be the *retail price index* (RPI) each year. The RPI was used because it is higher than the CPI and therefore more conservative as it results in a lower overall NPV. The RPI assumed was 2.56% per annum which is based on the average RPI over the previous 20 years (SwanlowPark 2014).

Lease Payment to Land Owner (*11): based on the rate that the landowner will attain for the proposed 19.5MW solar farm. This is £2224/ha per annum for ~36ha of the proposed 45ha site. The reason why the calculation has not been applied to the total 45ha is because the solar panels could have been sited on the ~36ha, it was the landowner's personal choice to distribute them more sparsely, i.e. over 45ha. The £2,224/ha per year is aligned to the market rate for similar lease agreements of this nature (Freewatt 2014; Solafields 2014).

Operations, Maintenance, Monitoring, Security (*12): based on an estimate provided to me by a LARK Energy representative. LARK is a significant player within the solar energy installation and maintenance sector within the UK. They are also based within south Lincolnshire and are therefore well aware of the local context.

Internal drainage board rates (*13): The rate applied of £12 per acre is based on the maximum drainage rates per acre within the *Witham Fourth District Internal Drainage Board* area (WFDIDB 2014). The particular site in question does not require much drainage so this estimate is conservative. Furthermore, the landowner was not aware of the exact drainage rate for the site but suggested that it would be significantly less than £12 per acre.

Insurance (*14): This is based on an estimate of £2,000 per MW per year to cover all insurance costs for solar farms. This estimate was provided by a LARK Energy representative.

Decommission Costs (*15): This is based on an estimate of £30,000 per MW provided by a LARK Energy representative. The total cost is factored up to take into account inflation (RPI).

26 Year Pre-tax NPV (*16): The final NPV calculation does not factor in any tax costs ("Pre-tax NPV"). This is because I wanted to determine the total value of this option without considering who governed it. For example, if it was a community interest company (CIC) that owned the project, tax costs are likely to be minimal. It is also likely that, due to the way that large corporations such as PF's are structured, the amount of tax that they pay might be less than expected. The government are currently considering whether to add business rates to the cost of solar farms under the proposed changes for April 2015. There is currently no indication of what these costs might be. Nonetheless, they have been excluded because they are a type of tax

Internal Rate of Return (IRR) (*17): is the discount rate at which the NPV would be 0. In effect, if it is possible to borrow money at a rate lower than the IRR to fund a particular project, then the project is financially viable, i.e. the project will still create a financial return for the owner even after considering the interest payments on the capital borrowed.

Financial Assumptions for the landowner

Lease Payment to Land Owner (*1): the landowner will receive £2224/ha/annum for ~36ha of the proposed 45ha site. The reason why the calculation has not been applied to the total 45ha is because the solar panels could have been sited on the ~36ha, it was the landowner's personal choice to distribute them more sparsely, i.e. over 45ha. The £2224/ha/year is aligned to the market rate for similar lease agreements of this nature (Freewatt 2014; Solafields 2014).

Arable Cultivation (net income) (*2): This is based on the net income (income less expenses) that the landowner would receive if the proposed solar farm site was used for intensive arable agriculture. These calculations are based on the *Farm Business Income* data specific to *The Fens* (Lang 2012). They also include payments from EU subsidies (agri-environment scheme and single payment scheme) (RBR 2013) and are based on a cereals (wheat) to general cropping (potatoes, sugar beet, linseed, oilseed rape) ratio of 51:49 – this is broadly in line with the cropping characteristics of the SLFP project area.

Internal drainage board rates (*3): The rate applied of £12 per acre is based on the maximum drainage rates per acre within the *Witham Fourth Internal Drainage Board* area (WFDIDB 2014). The particular site in question does not require much drainage so this estimate is conservative. Furthermore, the landowner (interview 41) was not aware of the exact drainage rate for the site but suggested that it would be significantly less than £12 per acre.

Inflation: Although the lease agreement increases in value each year in line with the RPI, this has not been considered in the 25 year pre-tax calculation. This is because 1) it is equally possible that the *arable agriculture* scenario could also increase (or decrease) in value over the 25 years but it is difficult to quantify this, and 2) this approach is in keeping with the conservative ethos of all calculations within this study.

Appendix 11: Short-listed IFO: Offsetting – in-depth viability assessment

Offsetting is based on the concept that, if biodiversity is lost in one location as a result of development, the amount of loss is measured and the developer provides funding to recreate a habitat of the same value elsewhere (Bull *et al.* 2013). In 2013, the UK government published a consultation paper (DEFRA 2013) outlining the possibility of introducing a habitat offsetting system. There have also been six offsetting pilot projects implemented between 2012-2014 (CEP 2013). The government is currently assessing feedback on the consultation paper and evaluating the pilot projects. A response from the government on whether an offsetting system will be implemented is expected shortly (*interview 15*). This IFO considers whether an offsetting system could provide incentives for Fenland restoration.

Financial Suitability

It has not been possible to provide an offsetting NPV calculation because:

- There is no publicly available financial data on the pilot studies to support the calculations.
- The financials for each offsetting scenario would be different because the habitats in question vary from case-to-case.

However, there are some key factors to consider when analysing offsetting's financial suitability.

In theory, developers buy offset credits (credits) which pay for habitat restoration. The restored habitat *replaces* the habitat lost through development activity. The price of credits would broadly depend on landowner opportunity costs, and initial restoration and ongoing management costs. Developers would opt to buy the cheapest credits (interview 15). The opportunity cost of agricultural land in the project area is high and therefore buying credits for the restoration of such land would be expensive. However, credits for former gravel sites would be cheaper due to lower opportunity costs. It is possible that an offset system would allow credits to be purchased for the improvement of existing habitats such as WTF (*interview 15*). The opportunity cost of such conservation land is low and therefore credits would be cheap. Consequently, former gravel sites and conservation land are likely to be the most suitable offset locations. Conservation organisations are also well placed to restore and manage offset habitats cheaply compared to other landowners due to their internal competencies. This further increases the potential cost-competitiveness of credits for conservation land, it also creates a potential opportunity for conservation organisations to generate income from restoring and managing other landowner's offset sites. Offset credits for larger areas of land are likely to be cheaper per unit area due to economies of scale in relation to restoration and management costs (DEFRA 2013). This is advantageous from the perspective of the SLFP's large-scale restoration vision.

It is likely that a future offset policy would require restoration sites to be in proximity to the development (DEFRA 2013). Given that south Lincolnshire is sparsely populated and experiences limited development activities, the demand for credits is likely to be low. Furthermore, the intensive agricultural nature of the landscape dictates that there are few habitats that would demand a high number of credits if lost.

The suitability of this option also depends on whether future offset policies dictate that lost habitat must be replaced by the same habitat type. If this is the case, offsetting would be unsuitable as the net increase in Fenland would be zero. However, if the policy allows for Fenland to offset losses of other habitats then offsetting could be suitable. Although, it must be recognised that this would result in a net loss of other habitats.

Conservation Suitability

Offsetting is founded on the concept of *no net loss* (NNL) as biodiversity lost in one place must be replaced elsewhere (BBOP 2012). Various studies outline principles to follow to ensure *NNL* (BBOP 2012; Bull *et al.* 2013; Gardner *et al.* 2013). These principles are summarised in the table below:

	Best Practice Principles
Mitigation Hierarchy	The mitigation hierarchy must always be applied
Thresholds	Certain habitats, such as ancient woodlands cannot be offset
Metrics	Appropriate metrics are required to ensure that habitat losses and gains are camparible
Additionality	Any habitat that is restored must be additional to what would have been restored in the event of the offset not occuring.
Offset Locally	the restored habitat should be located in close proximity to the habitat that has been lost due to development
Longevity	Offset schemes should last as least as long as the impact of the development
Time Lags	When determining the level of offset required, the time lag between restoring the habitat and it achieving the same level of biodiversity as the lost habitat must be factored into the metric.
Uncertainty	When determining the level of offset required, the uncertainty in terms of being able to attain the desired outcome must be factored into the metric.

Some offsetting programmes have had negative biodiversity impacts (Quigley and Harper 2005; Mack and Micacchion 2006; Gibbons and Lindenmayer 2007; Matthews and Endress 2008). This suggests that successfully implementing these principles and achieving NNL can be difficult. For example, devising *matrices* that recognise the complexities of ecosystems is challenging (interview 34), and *Uncertainty* is also difficult to account for (DEADP 2007). Although progress has been made in developing good practices, more research is needed to create robust offsetting programmes (Gardner *et al.* 2013). Currently, the domain within which offsetting delivers *NNL* is small (Maron *et al.* 2012).

Fenland can be restored relatively easily and quickly, and existing habitats in the SLFP area tend not to be ecologically complex. These factors increase the likelihood of being able to successfully apply the above principles and achieve NNL. Furthermore, there are examples where NNL has been achieved (Norton 2009). Ultimately, offsetting's conservation suitability will depend on the details of any future policies.

Achieving NNL when comparing pre- and post-development scenarios is the literature's preferred barometer of offsetting's success. An alternative approach is to compare contrasting frameworks – offsetting verses the current planning framework. The reason I suggest this is because the current planning framework arguably results in biodiversity losses when development occurs (*observation 2*). If offsetting can have a lower negative impact than the current framework (even without achieving NNL) it is still arguably favourable from a conservation perspective, especially if, over time, our understanding of offsetting improves to the extent that NNL becomes a reality.

Feasibility

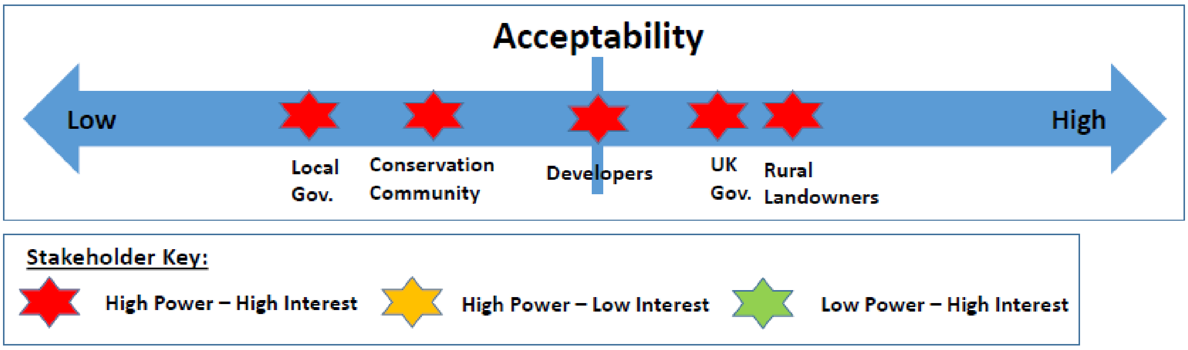
If offsetting becomes mandatory in England, several factors suggest it could be feasible. The government has already developed a matric system (DEFRA 2012), and can draw experience from pilot studies and other established offset systems. The *Environment Bank* (EB) is an established UK organisation that specialises in brokering deals between developers and landowners. Furthermore, concepts that are central to offsetting such as *mitigation* and *compensation* are already established within the *National Planning Policy Framework* (NPPF) (DCLG 2012).

However, the *Conservation Suitability* section shows that implementation can be problematic. The interim evaluation of the pilot projects (CEP 2013) highlights issues such as resource constraints and limited understanding of key concepts; and few offset agreements were actually signed during the pilot studies due to a lack of appropriate development activities and restoration sites (*interviews 15,32*). Although it might be feasible to implement a mandatory system, the above issues highlight that this would take time and resources to get right.

If mandatory offsetting is not stipulated, local planning authorities (LPA's) could voluntarily implement offsetting to help fulfil the NPPF's *sustainable development* criteria (EB 2014). The EB believes a voluntary system is feasible (*interview 15*). However, given the difficulties associated with a mandatory system, I disagree. A voluntary system is unlikely to attract government resources to improve the matrices or instil the system at LPA level. An EB representative (*interview 15*) suggested that the EB would help provide the resources and expertise to implement offsetting within the project area. However, the EB's resources are likely to diminish if offsetting is taken off the policy agenda, so it is doubtful whether they would be able to provide the required assistance.

Acceptability

- Offsetting divides opinion among conservationists (The Guardian 2014b). Some believe offsetting, if implemented appropriately, can be beneficial. However, a slight majority of conservationists appear to be opposed to offsetting for reasons such as:
    - They distrust the motives of politicians and believe there is an agenda to push through developments at nature's expense (Walker *et al.* 2009).
    - The inability of matrices to value biodiversity and ensure NNL (*interview 3; observation 2*).
- Landowners generally favour offsetting as it represents a diversification opportunity that provides long-term income (*interviews 28,32,37,41*).
- Developers are concerned about cost implications. Conversely, offsetting could potentially speed up the planning process (*interview 32*).
- DEFRA (2014) implies that offsetting could simplify the planning process; this is attractive to the government as it aligns with their mantra of cutting red tape.
- LPA's are unlikely to be in favour of introducing an offsetting system due to resource constraints.



Other Benefits

- Potential for more efficient planning process.

Summary

Former gravel sites and existing conservation land such as WTF would be ideal locations for offsetting lost habitats. This is because the opportunity cost associated with such sites is lower than the opportunity cost of arable land, and therefore it would be relatively cheap for developers to buy offset credits to restore such locations. However, there is limited demand for development within the project area and there are few semi-natural habitats that would require substantial offset credits were they to be lost. These two factors dictate that the demand for offset land is likely to be low. It is also true that, if any future offset policy dictates that lost habitat must be offset by the same habitat type, by definition this IFO would not be able to achieve a net increase in Fenland. Consequently, the financial suitability and overall viability of this IFO is low.

Offsetting's impact on biodiversity is currently unknown and would ultimately depend on the details of any future UK offset policies. Although there are factors that suggest that offsetting might be relatively feasible. Experience from the pilot studies, and the implementation difficulties associated with other offsetting systems suggest that it would take a lot of time and resources to get right.

A slight majority of conservationists appear to be opposed to offsetting. However, the UK government is in favour of the concept. Landowners are positive about offsetting whilst developers are anxiously waiting to hear the details of any future policies.

Suitability		Feasibility	Acceptability	Other Benefits	**Overall Viability**
income generation potential or incentive for restoration	biodiversity impact				
LOW	UNKNOWN	LOW	MEDIUM	LOW	LOW

Appendix 12: Offsetting IFO: SWOT - PESTEL Analysis

Key:

political
Economic
Social
Technological
Environmental
Legal
Other

Strengths
Landowner opportunity costs, restoration costs, and ongoing management costs will all be included in the price that developers have to pay to purchase offset credits for Fenland restoration. There are few other funding mechanisms that have the potential to cover all of the necessary costs of restoration in *perpetuity*.
The SLFP vision to create a large area of restored Fenland is advantageous from an offsetting perspective. This is because if a large continuous area of land is designated for offset restoration, economies of scale in terms of restoration and management costs are likely to result in the cost of offset credits being low compared to other options (DEFRA 2013).
Offsetting provides a welcomed opportunity for landowners to diversify their income stream.
There are a significant number of former and current gravel extraction sites within the SLFP project area. Landowners are limited in terms of the type of activities and amount of income that they can generate from such sites. Offsetting is one possible solution to this issue.
A UK based organisation called the Environment Bank specialises in the essential offsetting services of registering land for offsets and brokering deals between developers and landowners.
Offsetting systems have already been implemented in many other countries. The UK has the luxury of being able to learn from these various case studies from around the world
The UK government is currently implementing 6 pilot offsetting projects.
Many of the key concepts of offsetting such as the mitigation hierarchy and compensation for habitat loss are

well established within the UK National Planning Policy Framework (DCLG 2012).

Weaknesses
There are few development pressures in sparsely populated rural populations such as the SLFP project area. This is likely to reduce the demand for offset restoration sites.
Due to the intensive agricultural character of south Lincolnshire, there are only a limited number of habitats within the project area that are likely to be eligible for offset credits in the event of them being damaged. This is likely to limit the demand for offset restoration sites.
There are many examples across the world where offsetting has not been successful at achieving NNL.
More research is required on the best way to implement offsetting systems in order to ensure favourable conservation outcomes.
An interim assessment of the 6 pilot studies suggests that they have experienced a lot of problems. This view is supported by various interviewees who have knowledge about the pilot studies.

Opportunities
It is likely that the government will shortly be announcing its offsetting policy plans. This could result in opportunities to achieve favourable conservation outcomes.
Conservation organisations are well placed to restore and manage restored habitats relatively cheaply compared to offer landowners due to their internal competencies in this area. This not only reduces the potential cost of credits for conservation land, it also provides a potential opportunity for conservation organisations to generate income from restoring and managing offset sites of other landowners.

Threats
It is likely that the government will shortly be announcing their offsetting policy plans. There is a risk that they could decide not to implement an offsetting system in England. There is also a risk that any new system could cause harm to biodiversity.
If a future offset policy requires lost habitats to be replaced like-for-like, there would be no opportunity for offsetting to increase the amount of restored Fenland in the project area because Fenland would only be restored

if Fenland was lost elsewhere.

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