OAKLANDS FARM SOLAR PARK

Applicant: Oaklands Farm Solar Ltd

Environmental Statement
Appendix 6.13 – River Conditions Assessment Report
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Oaklands Farm Solar Park - Environmental Statement Volume 3

Appendix 6.13: River Conditions Assessment Report

Final report
Prepared by LUC
January 2024

Oaklands Farm Solar Limited

Oaklands Farm Solar Park
Biodiversity Net Gain, Baseline River Condition Assessment

Version	Status	Prepared	Checked	Approved	Date
1.	Version 1	G. Siskos / R. Warwick-Haller	D. Green	D. Green	25.04.2023
2.	Draft Version 2 – updated in line with revised scheme design	H. Gillon / R. Warwick-Haller	R. Turner	D. Green	08.01.2024

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Chapter 1
Introduction

Terms of Reference

1.1 In April 2021, LUC was appointed by Oaklands Farm Solar Limited to provide ecological support to inform an application to construct and operate Oaklands Farm Solar Park, a proposed solar photovoltaic (PV) electricity generating facility, hereafter referred to as 'the Proposed Development'. A River Module Survey was conducted to supplement the Defra 3.1 Biodiversity Net Gain (BNG) calculations of the proposals, reported on separately (**ES Volume 3, Appendix 6.12: Biodiversity Net Gain Assessment**).

1.2 This report forms a Technical Appendix, which has informed an Ecological Impact Assessment (EcIA) and will form part of the Environmental Statement (ES), in support of a planning application for the Proposed Development. Assessment of impacts, mitigation requirements, and enhancement measures will be provided as part of the ES Chapter and are not detailed within this report.

This report relates to the Park Farm, Fairfield Farm, and Oaklands Farm areas only [1], hereafter referred to as 'the Site'.

1.3 BNG assessments of the Habitats and Linear features (hedgerows) are reported separately (**ES Volume 3, Appendix 6.12: Biodiversity Net Gain Assessment**), and must be read in conjunction with this report.

1.4 The River Module Survey assessment includes the linear water bodies (rivers and streams) which lie within and directly adjacent to the Site. Within the Site the resultant BNG change from the proposals was assessed through the Defra 3.1 metric.

[1] See Figure 1.3: Areas of the Site in Volume 2 of the ES

1.5 In line with the River Metric Survey and its associated methods, this assessment focuses solely on the quantification, assessment, and overall impact of the application on the linear aquatic systems within and adjacent to the Site.

1.6 This report has been prepared for the exclusive use of Oaklands Farm Solar Limited. No part of this report should be considered as legal advice.

Chapter 2
Methodology

River Metric Survey

2.1 Desktop analysis confirmed the four watercourses required assessment. A map showing the extent of watercourses within the Site is provided in **Appendix A.**

2.2 Two streams join in the central southern part of the Site to form a single stream that flows northwards through the centre and north of the Site. The streams are not named and are therefore referred to as "Tributary of River Trent" for the purposes of this report.

2.3 A Rivers and Streams Condition Assessment (RCA) was conducted along each reach to record the extent, diversity, and structure of observed physical features in the river channel and riparian zone, and the extent and types of human modification or disturbance. The RCA was used to inform condition inputs into the Defra metric and develop a strategy to increase the condition of the river through proposed intervention. The RCA was undertaken by Rosalind Warwick-Haller BSc (Hons) MSc Qualifying Member of CIEEM and George Siskos ACIEEM BSc (Hons) who are accredited RMS surveyors.

2.4 Defra River Metric Survey (RMS) methodology was used to conduct the RCA [2]. This included a modular field-based Modular River Assessment (MoRPh) assessment of water courses within the Site and a desk-based assessment of the river type (MoRPh River Type). The cartographer.io software package was used to generate the assessment outputs.

2.5 Five contiguous MoRPh module surveys (MoRPh-5) were conducted along sub-reaches [3] of the assessed watercourses, sufficient to survey a minimum of 20% the length of the

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[2] A.M.Gurnell, J. England, S.J.Scott, L.J. Shuker. (March, 2020) *A Guide To Assessing River Condition: Part of the Rivers and Streams Component of the Biodiversity Net Gain Metric* Environment Agency (Beta test version, March 2020).

[3] Each sub-reach was subject to five MoRPh module surveys, which were combined within a MoRPh5 dataset which represents each sub-reach. The sub-reach MoRPh5 surveys were repeated to capture at least 20% of the total river length within the Site.

watercourse within the application boundary. The assessment covered the bank full width, riverbanks and the first 10m of land extending outwards from the top of the riverbank.

2.6 Data on the presence and abundance of features was entered into the cartographer.io software package to generate numerical values for 32 condition indicators (RCI) for each sub-reach. RCIs quantify the geo-morphic features of the bank top, bank face, channel to water margin, and channel bed in the context of habitat condition. Positive RCIs are scored between 0 and 4 and Negative RCIs are scored between -4 and 0, whereby a high number signifies a condition indicator in optimum condition.

2.7 Following the field survey, a MoRPh River Type desk assessment was undertaken on a homogenous reach of River, incorporating river habitat within the Site. Online geo-spatial data was used to calculate the valley confinement and planform of the reach and data from the field component of the RCA was used to determine average bed material size along the reach. Data was entered into the cartographer.io software package and the reach was assigned a river type from the 13 river types likely to be encountered in England [4].

2.8 Through the cartographer.io software the results of the MoRPh River Type desk assessment were then used to assign weight to RCI data (dependant on river type) and calculate a final condition score for each sub-reach. Final condition scores are presented in the results section. Further detail and classification inputs for each individual MoRPh-5, including detailed RCI data, can be found in the data tables in **Appendix B**.

Assessment of Interventions

2.9 Proposed Development work plans and phasing were reviewed to identify any river modifications, temporary losses, permanent losses and proposed enhancements.

2.10 Where applicable, scenarios of potential enhancements were entered into the cartographer.io software to model any change of condition post-intervention.

[4] M. Rinaldi, A.M. Gurnell, M. Gonzalez del Tanago, M. Bussenttini. & D. Hendriks. 2016. Classification of river morphology and hydrology to support management and restoration. Aquatic Sciences, 78(1): 17-33.

River Biodiversity Units

2.11 BNG Calculations were carried out in cognisance of Biodiversity Net Gain: Good Practice Principles for Development guidance [5], and were made through the rivers and streams component of the Defra Metric [6]. The metric approach is the established method for calculating BNG and provides a quantitative approach to losses and gains resulting from development or land management changes.

2.12 Where post intervention creation and enhancements were identified a metric risk modifier was applied to reflect the technical difficulty of specific habitat creation interventions. Where condition changes (condition can be improved by enhancing the condition of the same river type or enhancing the river to a high distinctiveness type) were identified a time to create, enhance or restore modifier was applied. This is based on the complexity of intervention needed to raise the condition of a watercourse and the 'lag time' for biological communities to re-establish.

2.13 To calculate the river baseline unit for the Site the following data and assessments were collated to apply numerical modifiers to the calculations [7]:

- Length of each watercourse within the red line boundary was measured using open-source satellite data.
- River condition was determined through the RCA by an accredited assessor.

[5] Baker J., Hoskins R. and Butterworth T. (2019). *Biodiversity Net Gain. Good practice principles for development: A practical guide*. Ciria, London.

[6] Panks S., White N., Newsome A., Nash M., Potter J., Heydon M., Mayhew E., Alvarez M., Russell T., Cashon C., Goddard F., Scott S.J., Heaver M., Scott S.H., Treweek J., Butcher B. and Stone D. (2022). *The Biodiversity Metric 3.1: Auditing and accounting for biodiversity value - User Guide* (21st April 2022). Natural England, York.

[7] With the exception of length, modifiers were pre-set in line with the guidance within refence 8 above.

- Through a desk-based review of available online mapping and catchment data [8, 9, 10] a River Naturalness Assessment was conducted to determine the distinctiveness class [11] of each watercourse. Where data was unavailable river naturalness was assessed through the RCA field visits.
- River Basin Plans, Catchment Plans and Local plans were reviewed to identify strategic significance of each watercourse. Further to this, a spatial multiplier was applied as a connectivity and strategic importance modifier.

2.14 Collated data and assessments were entered into the Defra 3.1 metric to calculate resultant change in River Biodiversity Units.

Quality control

2.15 Quality control and approval was provided by David Green MCIEEM, who is an Associate Director with over 18 years of experience. David is highly experienced and has delivered BNG for a range of technically challenging projects.

2.16 As well as having experience in Habitats Regulations Assessment and Environmental Impact Assessment for Nationally Significant Infrastructure Projects and small to medium scale river works. David has managed and led the assessment and design of wetland restoration.

2.17 An additional update to the report was undertaken in December 2023, to include agreed river BNG enhancement following revised scheme design. The assessment of interventions and enhancement BNG delivery was undertaken by Rosalind Warwick-Haller, with reporting undertaken by Holly Gillon MSci (Hons), a Qualifying Member of CIEEM. Quality control and approval of this update was provided by Rebecca Turner (BSc MSc ACIEEM) who is Associate Ecologist with eight years of professional experience and Ella Moseley (BSc FCIWEM, C.WEM,

[8]https://environment.data.gov.uk/DefraDataDownload/?mapService=NE/PriorityRiverHabitatRiversEngland&Mode=spatial

[9] See: http://priorityhab.wpengine.com/

[10] Accessible at: http://environment.data.gov.uk/catchment-planning/WaterBody/GB109054032450

[11] Distinctiveness classes for Rivers and Streams range from 'Very High' to 'High' to 'Medium'. They are based on broad parameters for instance, 'Very Hill' equates to the feature being listed on the 'Priority Habitat Rivers Map' and 'High' could equate to a Chalk River.

C.Env, FRGS, CGEOG, FLS), who is an Associate Director with over 9 years of experience. Ella is highly experienced and acts as Technical Lead in the assessment of Biodiversity Net Gain and has delivered BNG for a range of technically challenging projects.

2.18 As well as having experience in the Water Framework Directive for Nationally Significant Infrastructure Projects and small to medium scale river works. Ella has managed and led the assessment and design of wetland restoration and Biodiversity Net Gain projects on and in proximity to main rivers for the Environment Agency and their partners.

Chapter 3
River Condition Assessment Results

Baseline River Metric Survey

3.1 Full calculations and condition scores for baseline sub-reaches of the Tributaries of the River Trent are presented in **Appendix B** with final condition assessment in the table below.

3.2 The length of tributaries assessed were 1.71km and 0.63km long respectively. The river types were Type H, confined.

Table 3.1: Final Condition Score Results for the Tributaries of the River Trent

Reach	Sub-reach ID	Central Grid Reference [12]	Preliminary Condition	Final Condition Score
East	A	SK 23489 17209	1.5425102	Moderate
	B	SK 23380 17470	1.3805668	Moderate
	C	SK 23447 17633	1.4291497	Moderate
	D	SK 23477 17996	1.6032388	Fairly Good
	E	SK 23566 18120	1.4331983	Moderate

[12] Demarking the mid-point of the MoRPh-5 survey.

Reach	Sub-reach ID	Central Grid Reference [12]	Preliminary Condition	Final Condition Score
West	Y	SK 23109 17204	1.3076923	Moderate
	Z	SK 23321 17322	1.1700405	Moderate

Proposal Assessment Inputs

3.3 Full RCA input data is presented in Appendix B.

3.4 Manipulation of The River Condition Assessment Cartographer tool, applying various assumptions, has demonstrated that the two tributaries are in a Moderate to Fairly Good condition.

Retained, Removed and Enhanced Habitats

3.5 The development proposals do not include any direct losses to riparian habits. Within sub-reach B, there may be some minor encroachment onto bank tops within 10m of the stream due to installation of the construction access track with some additional scrub clearance proposed within sub-reach E to the north. However, the adjacent arable habitats will be replaced with higher value grassland, and will likely have reduced future encroachment post development. Aside from the minor encroachment, the riparian habitats within the development boundary and within 10m of the banks will either be retained or enhanced.

Enhancements

3.6 The proposals include enhancement of three sub-reaches of the river within Site, shown on the Landscape Strategy Plan **(ES Volume 2, Appendix 5.6: Figures 5.8a and 5.8b)**. Sub-reaches A and B will be enhanced from moderate to fairly good condition through the proposed planting of scrub, trees and species rich grassland along the bank tops. Sub-reach Y will be increased from a moderate to fairly-good condition through the same enhancements, and marginal planting such as emergent reeds on the bank face.

3.7 The marginal planting will include aquatic species, such as rushes *Juncus* sp, greater pond sedge *Carex riparia*, *Typha* species, *Glyceria* species, watercress, and *Rorippa* species. Establishment will be through the use of plug planting within the ditch channel, and could include the use of a marginal aquatic seed mix along the ditch faces and banks (e.g. EP1 Pond Edge Mixture or similar).

3.8 Further details of the river enhancements are detailed within the Biodiversity Net Gain Report (**ES Volume 3, Appendix 6.12**) and within **Technical Appendix 5.6: Outline Landscape Ecological Management Plan.**

3.9 In addition to the above, the proposals include general enhancements to habitats around the streams both within the 10m bank top vegetation and outside the 10m bank top vegetation, the latter would not contribute to an increase in condition through the MoRPh methodology. Enhancements include:

- Transition of artificial managed ground cover (arable and pasture) within 10m of the bank top to species rich grassland.
- Increase in tree feature richness through creations of woodland understorey within the Site and planting of watercourse trees consisting of alder *Alnus glutinosa* and crack willow *Salix fragilis*.
- Species rich grassland.
- Sensitive management of existing woodland and scrub planting.

Chapter 4
Discussion

Discussion

4.1 There are currently no proposed permanent interventions required as part of the planning application within the channel or 10m riparian zone. A minor removal of scrub within the riparian zone is proposed within sub-reach E in the north of the stream for the cable corridor installation, detailed within **ES Volume 3, Appendix 6.14: Arboricultural Survey Report.** As such, the extent of riparian encroachment has been defined as 'Minor' within the BNG Metric.

4.2 Manipulation of The River Condition Assessment Cartographer tool, applying various assumptions, has demonstrated that streams have a moderate to fairly-good condition, as such, achieving +10% BNG for the river element of the BNG requires numerous enhancements. In addition to the river enhancement proposed in **Chapter 3,** the existing ditch network is to be enhanced, and a new wet ditch created south of the river (**ES Volume 2, Appendix 5.6: Figures 5.8a and 5.8b, Landscape Strategy Plan).**

Conclusion

4.3 Through the Rivers and Streams module of the Defra 3.1 metric, is it demonstrated that proposals achieve a net gain in biodiversity for river units, as below:

- **A net gain** of 4.18 river units which is a **19.82% increase** from baseline units.

4.4 This increase in river units will be achieved in part through the enhancement of the three sub-reaches, A, B and Y, from moderate to fairly good condition shown on the Landscape Strategy Plan **(ES Volume 2, Appendix 5.6: Figures 5.8a and 5.8b).** For sub-reaches **A** and **B**, this will be achieved through the proposed planting of scrub, trees, and species rich grassland along the bank tops. Enhancement of sub-reach Y will comprise the same enhancements, with the addition of marginal planting on the bank face. Additional river unit increases will be delivered through enhancement of the existing ditch network, and wet ditch

creation, also on the Landscape Strategy Plan **(ES Volume 2, Appendix 5.6: Figures 5.8a and 5.8b).**

4.5 The wider BNG assessment concludes that in the context of the wider project, the scheme will provide significant biodiversity benefits detailed within the BNG report (**ES Volume 3, Appendix 6.12: Biodiversity Net Gain Assessment**). These include:

- A demonstrated significant terrestrial BNG, providing a biodiverse landscape and additional opportunities for interaction between riparian and terrestrial species.
- Change of agricultural practice from intensive pasture and crops to species rich-grassland will improve soil health and reduce surface run-off.

Additional Recommendations

4.6 It should be noted that the field MoRPh survey identified additional opportunities to provide enhancements. The condition of these watercourses was constrained by the proximity and intensity of adjacent agricultural operations outside of the client zone of influence. This is likely to have limited the RCI score of bank top features.

4.7 The project presents an opportunity to relax the agricultural management adjacent to the watercourses which would create significant benefits. Indeed, any reduction in baseline agricultural edge effects would act to significantly increase the ecological potential of the area. These enhancements cannot be captured within the RCA approach, but is outlined within the Biodiversity Net Gain report (**ES Volume 3, Appendix 6.12: Biodiversity Net Gain Assessment**).

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Appendix A
River Survey Mapping

- Figure 6.13.1: Watercourses within the Site
- Figure 6.13.2: RCA Survey Areas

Oaklands Farm Solar Park
for Oaklands Farm Solar Ltd

Figure 6.13.1: Watercourses within the site

Site boundary
Watercourse

0 0.5 1 Km

Map scale 1:16,000 @ A3

PINS reference: EN010122

Oaklands Farm Solar Park
for Oaklands Farm Solar Ltd

Figure 6.13.2: RCA Survey Area

Site boundary
Watercourse
RCA survey area

0 0.5 1 Km

Map scale 1:16,000 @ A3

PINS reference: EN010122

Appendix B
River Condition Assessment Data

River Condition Indicator Results

B.1 RCI results are outlined below, for ease when interpreting these data, the following colour coding has been adopted:

- Green indicates an RCI in optimal condition and no enhancement options are available.
- Yellow indicates an RCI where some enhancement options may be available.
- Red indicates an RCI where significant enhancement options may be available.

Table B.1: River Condition Indicator Results

Condition Indicator	Sub-reach A	Sub-reach B	Sub-reach C	Sub-reach D	Sub-reach E	Sub-reach Y	Sub-reach Z	Comments
River Type	H	H	H	H	H	H	H	
Bank Top Positive Indicators								
Bank top vegetation structure	2	3	3	3	3	4	3	Relatively diverse vegetation structure from mosses, grasses, scrub and trees.
Bank top tree feature richness	2	0	0	4	1	3	0	Mainly saplings and mature trees, with small amounts of large trees.

Condition Indicator	Sub-reach A	Sub-reach B	Sub-reach C	Sub-reach D	Sub-reach E	Sub-reach Y	Sub-reach Z	Comments
River Type	H	H	H	H	H	H	H	
Bank top water-related features	2	1	0	2	0	0	0	No water related features on the bank tops for the majority of the stream, with small areas of marginal vegetation.
Bank Top Negative Indicators								
Bank top NNIPS cover	0	0	0	0	0	0	0	No non-native invasive plant species (within 10m of the bank edge).
Bank top managed ground cover	-3	-4	-4	-3	-4	-4	-4	Consisted of arable fields on both bank tops.
Bank Face Positive Indicators								
Bank face riparian vegetation structure	2	3	3	2	3	3	3	Vegetation structure is diverse with mosses, grasses, scrub, saplings and trees.
Bank face tree feature richness	3	3	3	4	3	3	3	Large areas of trees and shrubs on the bank face.

Condition Indicator	Sub-reach A	Sub-reach B	Sub-reach C	Sub-reach D	Sub-reach E	Sub-reach Y	Sub-reach Z	Comments
River Type	H	H	H	H	H	H	H	
Bank face natural bank profile extent	3	3	3	2	3	3	3	The majority of the stream possessed a natural bank profile.
Bank face natural bank profile richness	4	4	3	4	4	3	3	Bank face profile is typical of low gradient rivers.
Bank face natural bank material richness	1	1	1	2	1	1	1	Mainly dominant earth sediment with small areas of silt.
Bank face bare sediment extent	3	4	3	1	4	3	1	Sub-reaches D and Z had larger areas of bare sediment.
Bank Face Negative Indicators								
Bank face artificial	0	0	0	0	0	0	0	No artificial bank profile.

Condition Indicator	Sub-reach A	Sub-reach B	Sub-reach C	Sub-reach D	Sub-reach E	Sub-reach Y	Sub-reach Z	Comments
River Type	H	H	H	H	H	H	H	
bank profile extent								
Bank face reinforcement extent	0	0	0	0	0	0	0	No bank reinforcement along the bank face.
Bank face reinforcement material severity	0	0	0	0	0	0	0	No bank reinforcement along the bank face.
Bank face NNIPS cover	0	0	0	0	0	0	0	No non-native invasive plant species.
Channel Margin Positive Indicators								
Channel margin aquatic vegetation extent	1	1	1	2	1	1	1	Aquatic vegetation is partially present along the channel margins.

Condition Indicator	Sub-reach A	Sub-reach B	Sub-reach C	Sub-reach D	Sub-reach E	Sub-reach Y	Sub-reach Z	Comments
River Type	H	H	H	H	H	H	H	
Channel margin aquatic morphotype richness	0	0	0	1	0	1	0	Little variety in the aquatic morphotypes.
Channel margin physical feature extent	2	3	3	2	3	2	2	Nest holes present on some of the bank faces.
Channel margin physical feature richness	3	1	1	3	1	1	1	Little variety in channel margin physical features.
Channel Margin Negative Indicators								
Channel margin artificial features	0	0	0	0	0	0	0	No artificial features.
Channel Aquatic Positive Indicators								

Condition Indicator	Sub-reach A	Sub-reach B	Sub-reach C	Sub-reach D	Sub-reach E	Sub-reach Y	Sub-reach Z	Comments
River Type	H	H	H	H	H	H	H	
Channel aquatic morphotype richness	1	2	3	2	2	1	1	Some variety in the aquatic morphotypes, in areas less shaded by trees.
Channel Bed Positive Indicators								
Channel bed tree features richness	3	2	2	4	3	3	3	Majority of the channel beds were shaded by trees.
Channel bed hydraulic features richness	2	0	1	3	1	2	2	Little variety in hydraulic features, due to low flow rate.
Channel bed natural features extent	3	1	0	3	0	0	1	Reaches A and D had areas such as pools and riffles.
Channel bed natural	2	0	0	1	0	0	0	Little variety in channel bed features.

Condition Indicator	Sub-reach A	Sub-reach B	Sub-reach C	Sub-reach D	Sub-reach E	Sub-reach Y	Sub-reach Z	Comments
River Type	H	H	H	H	H	H	H	
features richness								
Channel bed material richness	2	3	3	3	3	4	3	Channel bed had variety of different material including gravel/pebble, sand, organic matter.
Channel Bed Negative Indicators								
Channel bed siltation	-3	-2	0	-4	-2	-2	-1	Sub-reaches A and D had deep layers of silt on the channel bed, whilst the remaining reaches had little silt.
Channel bed reinforcement extent	0	0	0	0	0	0	0	No channel bed reinforcements.
Channel bed reinforcement severity	0	0	0	0	0	0	0	No channel bed reinforcements.

Condition Indicator	Sub-reach A	Sub-reach B	Sub-reach C	Sub-reach D	Sub-reach E	Sub-reach Y	Sub-reach Z	Comments
River Type	H	H	H	H	H	H	H	
Channel bed artificial features severity	-1	0	0	-3	0	-3	-1	Majority of reaches had no or little artificial features, however, reaches D and Y had small organic weirs.
Channel bed NNIPS extent	0	0	0	0	0	0	0	No non-native invasive plant species.
Channel bed filamentous algae extent	-1	0	0	-2	0	0	0	Little filamentous algae identified.
Final Condition Assessment [13]	Moderate	Moderate	Moderate	Fairly Good	Moderate	Moderate	Moderate	

[13] Average of RCI's (subject to weighting by river type) and calculated through cartographer.io software.