



**Natural Capital Planning Tool
Assessment Report for
Malvern Hills & Herefordshire
Developments**

- **Single Dwelling at Oak Tree Cottage**
- **24 Dwellings at Marlbank Road, Welland**
- **625 Dwellings at Viaduct Site**

19th August 2019

Produced by



For



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1. Introduction

The Natural Capital Planning Tool (NCPT) is a site assessment tool developed specifically for the planning context. The NCPT allows the indicative but systematic assessment of the likely impact of proposed plans and developments on green infrastructure and the ecosystem services it provides to people such as improving air quality or providing opportunities for outdoor recreation.

In its 25 Year Environment Plan, the Government makes a commitment *“to put the environment at the heart of planning and development...”* and to *“seek to embed a ‘net environmental gain’ principle for development...”*¹ The Government ambition for environmental net-gain was adopted in the revised National Planning Policy Framework (NPPF) where it states that: *“Planning policies and decisions should encourage multiple benefits [...] to achieve net environmental gains.”*² The NCPT was developed to enable planners and developers to meaningfully assess the impact of a proposal on ecosystem services; and to assess to what extent environmental net-gains are achieved.

Essentially, the NCPT automatically calculates an impact score for 10 ecosystem services indicating both, the direction and magnitude of the impact of a (proposed) plan or development. The impact scores are based on a set of habitat scores (e.g. the air quality regulation potential of a certain land-use) as well as a range of multipliers taking into account the local context (e.g. is air quality an issue in the location) and demand (how many people benefit). The land-use scores and multipliers were informed by expert and stakeholder groups. Impacts are indicated over a timescale of 25 years post-development. A wide range of project partners were engaged in the development and testing of the NCPT including academics, government agencies, planning authorities, industry partners and NGOs:



¹ HM Government 2018.

² MH CLG 2018.

2. Approach and Methods

This report covers 3 NCPT assessments for 3 different development projects:

1. **Single Dwelling at Oak Tree Cottage:** The erection of a single dwelling at Oak Tree Cottage in the Centre-East of the Malvern Hills AONB for which planning permission has been recently granted
2. **24 Dwellings at Marlbank Road, Welland:** A retrospective assessment for a 24-dwelling housing development at the eastern edge of the Malvern hills AONB. This planning application was initially declined but granted after appeal.
3. **625 Dwellings at Viaduct Site:** A live application for a mixed-use development including up to 625 dwellings at the northern edge of Ledbury, just outside the South-Western boundary of the Malvern hills AONB.

The NCPT assessments for these sites were based on plans for the pre- and (proposed) post-development site state. Land-use plans were available in PDF format and were manually digitalised by CEEP for the purpose of this assessment. The digitalised land-use information was accompanied by relevant information available from planning documents such as ecology reports.

Geographic Information Software (GIS) was used to overlay the pre- and post-development land-use information together with other relevant spatial layers such as:

- Agricultural Land Classification (ALC) Grade
- Risk of Flooding from Rivers and Seas and Surface Water, and
- Soil Carbon Stocks

To inform the assessments some assumptions have been made which are outlined in Appendix A of this report. For more details on how the NCPT works see the [NCPT Introduction & User Guide](#).

3. Assessed Ecosystem Services

Harvested products

The ecosystem service 'harvested products' refers to what we physically gather from nature such as food and timber. The Impact Score is either based on the average harvested products score attached to the land-use type or, especially for land-use types common in agricultural rotation, the Agricultural Land Classification (ALC) grade of the land as land-use types may change several times during the assessment timescale.

Biodiversity

Biodiversity refers to people's general preference for high species diversity and is not related to actually experiencing (e.g. watching) diverse animals and plants. Biodiversity also has a supporting function for other ecosystem services such as aesthetic values as well as a resilience function making ecosystems more resilient for example to the effects of climate change. The Impact Score is based on (1) the biodiversity score attached to each land-use type as well as (2) the importance within the ecological network of each area offering biodiversity values. Not included in the NCPT model are for example the condition or designation of habitats.

Aesthetic values

Aesthetic values refer to people's general preference for a high-quality natural environment and its visual amenity including attached mental health benefits. Physical access as for recreation is not required to benefit from aesthetic values. The Impact Score is based on (1) the visual amenity score attached to each land-use type as well as (2) the local population density indicating the local demand for aesthetic values.

Not included in the NCPT model are for example the local importance of specific places which may have for example spiritual values as well. Neither does the tool model account for the visibility, specific design and condition of land-uses. Assessing the impact of the Viaduct Site development on views from the Malvern hills AONB was not covered. Such analysis is beyond the scope of NCPT assessments.

Recreation

Recreation refers to the benefits of 'doing things' in a natural environment such as walking, picnicking and sports; all including their attached physical and mental health benefits. Physical access is required for recreation. The Impact Score is based on (1) the recreational value attached to each land-use type (only if publicly accessible), (2) the total size of a greenspace site, as well as (3) the local population density indicating the demand for recreational opportunities. Not included in the NCPT model are for example the quality and tidiness of a place or the value to visitors and tourists from outside the area.

Water quality regulation

Water quality regulation refers to the ability of vegetation to improve water quality including attached treatment cost savings to water companies and the end costumers. The Impact Score is based on (1) the water quality regulation value attached to each land-use type, (2) the flood risk zone because vegetation is more effective cleaning water when water is running through more frequently, and (3) if the area is located within a drinking water safeguard zone as such areas have a higher demand for clean water.

Not included in the NCPT model are for example the effects of specific design interventions such as engineered water treatment facilities. The NCPT only accounts for the water quality impacts of natural vegetation.

Flood risk regulation

Flood risk regulation refers to the ability of vegetation to slow and store water in a flooding event which would otherwise harm properties, infrastructure and potentially people's lives. The Impact Score is based on (1) the flood risk regulation score attached to each land-use type, (2) the flood risk zone indicating a higher likelihood to act as flood risk regulator, (3) the soil drainage which determines how well flooding water can be stored in soils, and (4) the local proportion of build-up area indicating the demand for flood protection as well as the availability of substitute flood risk regulating areas. Not included in the NCPT model are for example the effects of constructed flood walls or other engineered measures.

Air quality regulation

Air quality regulation refers to the ability of vegetation to clean the air including attached health benefits. The Impact Score is based on (1) the air quality regulation score attached to each land-use type, (2) if the area is located within an Air Quality Management Area (AQMA) indicating a higher demand, and (3) the local proportion of build-up areas indicating the demand for air quality regulation as well as the availability of substitute air quality regulating areas.

Not included in the NCPT model are for example the different effects of specific tree species and locations. Poor design can for example lead to declining local air quality if tree cover creates a 'roof' over busy streets preventing poor air to move out of the street canyon quickly.

Local climate regulation

Local climate regulation refers to the ability of vegetation to mitigate high temperatures and heatwaves including attached health benefits. This is particularly important in urban areas to mitigating against the Urban Heat Island Effect (UHIE) and the impacts of climate change. It also includes the availability of tree shade to provide cover from sun exposure. The Impact Score is based on (1) the local climate regulation score attached to each land-use type, (2) the projected average maximum regional summer temperatures in the 2050s, (3) the general local population density indicating the demand, (4) the local population density of high risk people

(aged 0-4 and 75+) indicating additional demand by particularly vulnerable people to high temperatures, and (5) the local proportion of build-up areas indicating the availability of substitute local climate regulating greenspaces.

Not included in the NCPT model is for example the shading effect vegetation can provide to buildings which can reduce energy consumption for heating and air conditioning as they depend on the fine detail design of a site.

Global climate regulation

Global climate regulation refers to the ability of vegetation and soils to sequester and store carbon from the atmosphere; mitigating climate change. The Impact Score is based on (1) the carbon sequestration/storage capacity score attached to each land-use type, (2) the carbon released due to soil disturbance when a land-use change occurs, and (3) the soil carbon stock as it affects how much carbon can be released if disturbed.

The 'soil disturbance score' is based on the impact of the land-use changes on the carbon stored in disturbed soils. If soil is disturbed then a proportion of the stored carbon will be released to the atmosphere.

Not included in the NCPT model are for example the effect of other Greenhouse Gasses (GHGs) such as Methane produced by livestock.

Soil Contamination

Not applicable.

4. Results

The results in Figures 1-3 indicate the average impact of the (proposed) development designs as compared to keeping the sites as they are (were). The assessment timescale is 25 years post-development and the scores reflect the average impact during that timescale.

4.1 Single Dwelling at Oak Tree Cottage

For the single dwelling at Oak Tree Cottage, Natural Capital Net-Gains are indicated for 4 services. There were net gains for biodiversity, aesthetic values, and water quality. There are also minor positive effects indicated for flood risk regulation (within margin of error). The positive effects are mainly due to the creation of a new pond and because a proportion of amenity grassland is converted neutral grassland. Please note that the creation of 150m² of neutral grassland was an assumption (see Appendix A).

Negative impacts are indicated for air quality regulation due to additional soil sealing (paved areas), local climate regulation (because paved and gravel areas are expanded), and global climate regulation (due to soil disturbance and more paved/gravel areas).

No effect has been indicated for harvested products, recreation (only public recreation is considered and the site is not publicly accessible), and soil contamination which is not applicable.

Figure 1. NCPT Results for the Single Dwelling at Oak Tree Cottage

Natural Capital Impact of Single Dwelling at Oak Tree Cottage				
Average per-hectare score over 25 years				
Ecosystem Services	Max Possible	Natural Capital Impact Score	Min Possible	Natural Capital Net-Gains
1. Harvested Products	+105	+0	+0	No
2. Biodiversity	+466	+10	-34	Yes
3. Aesthetic Values	+200	+25	-100	Yes
4. Recreation	+300	+0	+0	No
5. Water Quality Regulation	+178	+19	-306	Yes
6. Flood Risk Regulation	+96	+2	-4	Yes
7. Air Quality Regulation	+60	-10	-30	No
8. Local Climate Regulation	+243	-31	-88	No
9. Global Climate Regulation	+446	-28	-54	No
10. Soil Contamination		+0		No
Natural Capital Net-Gains (number of services achieving net-gain)				4 /10

4.2 24 Dwellings at Marlbank Road, Welland

For the development of 24 dwellings at Marlbank Land, Welland, Natural Capital Net-Gains are indicated for 4 out of 9 services (soil contamination not applicable). The highest net-gains are indicated for water quality regulation followed by aesthetic values and also some gains for recreation and air quality regulation.

Net-gains for water quality regulation have been achieved by replacing intensive arable land (which has a negative score) with green infrastructure features such as parkland and gardens. Aesthetic values are also increased due to the creation of green infrastructure which outweigh the impact of hard standing creations. There is also a limited positive effect on recreational opportunities due to the creation of small accessible greenspaces. Some air quality gains can be explained by the creation of parkland trees.

The most significant negative impact is indicated for harvested products as would be expected when developing on predominantly agricultural land. Other negative impacts are indicated for global climate regulation (because of soil disturbance and the creation of hard standings), local climate regulation (because of increased man-made infrastructure such as roads), biodiversity (because created features are of limited biodiversity value which cannot compensate for the existing features), and a minimal negative effect on flood risk regulation (within the margins of error). Soil contamination is not applicable.

Figure 2. NCPT Results for 24 Dwellings at Marlbank Road, Welland

Natural Capital Impact of 24 Dwellings at Marlbank Road				
Average per-hectare score over 25 years				
Ecosystem Services	Max Possible	Natural Capital Impact Score	Min Possible	Natural Capital Net-Gains
1. Harvested Products	+1	-250	-299	No
2. Biodiversity	+456	-9	-44	No
3. Aesthetic Values	+133	+32	-67	Yes
4. Recreation	+200	+7	+0	Yes
5. Water Quality Regulation	+330	+69	-166	Yes
6. Flood Risk Regulation	+94	-2	-6	No
7. Air Quality Regulation	+60	+7	-30	Yes
8. Local Climate Regulation	+205	-21	-103	No
9. Global Climate Regulation	+426	-34	-74	No
10. Soil Contamination		+0		No
Natural Capital Net-Gains (number of services achieving net-gain)				4 /10

4.3 625 Dwellings at Viaduct Site just outside the AONB

For the proposed mixed-use development north of Ledbury, which is by far largest site assessed within this report, Natural Capital Net-Gains are indicated for 3 ecosystem services. The highest positive effect is indicated for recreation due to the creation of new accessible green infrastructure including a new canal section. This is followed by aesthetic values due to the creation of visibly pleasant green infrastructure features. There are also minimal gains indicated for biodiversity (within margin of error).

The strongest negative impacts are indicated for harvested products because the proposed development is mainly on agricultural land. Strong negative impacts are also indicated for local and global climate regulation because of soil disturbance and because extensive ‘grey infrastructure’ is being built. Air quality regulation services are also reduced because built-up areas do very little to improve the air and this cannot be compensated by the creation of proposed green infrastructure features. Smaller negative impacts are also indicated for water and flood risk regulation services (both within the margins of error). The former is because negative impacts from agricultural land are substituted by negative impacts from built-up areas. The latter is because of increased surface sealing. Soil contamination is not applicable.

Figure 3. NCPT Results for 625 Dwellings at Viaduct Site

Natural Capital Impact of Viaduct Site				
Average per-hectare score over 25 years				
Ecosystem Services	Max Possible	Natural Capital Impact Score	Min Possible	Natural Capital Net-Gains
1. Harvested Products	+0	-278	-329	No
2. Biodiversity	+449	+2	-51	Yes
3. Aesthetic Values	+194	+30	-106	Yes
4. Recreation	+300	+42	+0	Yes
5. Water Quality Regulation	+150	-5	-86	No
6. Flood Risk Regulation	+92	-5	-8	No
7. Air Quality Regulation	+58	-15	-32	No
8. Local Climate Regulation	+239	-52	-130	No
9. Global Climate Regulation	+417	-54	-83	No
10. Soil Contamination		+0		No
Natural Capital Net-Gains (number of services achieving net-gain)				3 /10

5. Conclusions

The NCPT results are intended to assist decision makers in consideration of the extent to which a proposed development delivers net environmental gains. The tool provides an additional information source indicating the overall impact of the land-use changes on the ecosystem services provided by the development sites.

Each development should be seen within its own context. Whilst impacts of a single dwelling on ecosystem services (both, positive and negative) are often neglected, the cumulative impact can be more significant.

Larger-scale developments can have more significant impacts on their own. Both larger plans are somewhat limited in clearly defining which green infrastructure elements are implemented. Neither design seems to pay particular attention to introducing habitats of high biodiversity value or areas of woodland. This would likely mitigate negative and enhance positive impacts on ecosystem services.

Overall, assessments of the impact of new development on ecosystem services would benefit from more detailed green infrastructure information.

6. Disclaimer

The tool developer and project partners decline any responsibility for errors or deficiencies in the NCPT database or software or in the documentation accompanying it, for program maintenance and upgrading as well as for any damage that may arise from them. The tool developer also declines any responsibility for updating the data and assume no responsibility for errors and omissions in the data provided.

7. References

HM Government. 2018. *A Green Future: Our 25 Year Plan to Improve the Environment*. London: HM Government.

MH CLG. 2018. *National Planning Policy Framework*. London: Ministry of Housing, Communities and Local Government.

Appendix A: Assumptions

Single Dwelling at Oak Tree Cottage

- The removal of the greenhouse (about 6 m²) has not been assessed because no appropriate category could be identified.
- The created rain garden (LUC 03) has been categorised as pond. Scores for biodiversity, aesthetic values, water quality regulation and flood risk regulation have been manually increased.
- The created permeable car park (LUC 06) has been categorised as paved area. The flood risk regulation score was slightly increased to acknowledge the permeable function.
- The created bicycle shelter (LUC 07) was categorised as paved area.
- The assumption has been made that 50% of bare ground (pre-development) becomes gravel as indicated by the plan (categorised as bare ground).
- The plan does not specify how much of the existing grass area (assumed to be amenity grassland) becomes species-rich grassland (mapped as other neutral grassland). The assumption has been made that this will be about 150 m².

The assessment was based on the proposed floor plans (19-00059-FUL_Plans _1987 3001C.pdf), accompanied by information from other planning documents.

24 Dwellings at Marlbank Road, Welland

- The dominant pre-development land-use is intensively managed agricultural land (as per ecology report).
- Most hedgerows appears to be retained (Google satellite); apart from the one to the south of the site which was removed.
- The new parkland surrounding buildings is assumed to be (effectively) non-accessible to the public.
- New parkland in the North-East to the centre of the site and the South-East stretch is assumed to be accessible.

The assessment was based on the Phase 1 habitat assessment (Ecological Report, p 14) and the Preliminary Site Layout.

625 Dwellings at Viaduct Site

- The red-line boundaries of the pre- and post-development plan do not exactly match. This only applies to very small sections outside the main development area. Only areas where the plans match have been assessed because for other areas either the pre- or the post-development land-use information was not available.
- All pre-development land is assumed to be non-accessible.
- Water detention basins are assumed to be non-accessible and planted with species-rich grassland, according to the biodiversity report 2, p. 35 (categorised as other neutral grassland).
- New parkland and amenity grassland alongside footpaths/the new canal is assumed to be publicly accessible.

- Existing ruderal vegetation has been categorised as 'other tall herb and fern'.
- The retained water course (ditch) buffer to be retained as per design and access statement (p. 97) appears to be too wide. It overlaps for example with arable land which is unlikely to remain on site. If there is an overlap with arable land then a land-use change has been assumed. Otherwise it is assumed that existing habitats are retained.
- The spine route is assumed to be a connection road with green features (design and access statement, p. 109).

The assessment was based on the Phase 1 habitat assessment (biodiversity report, p. 47) and the illustrative masterplan.