

Biodiversity indicators for construction projects

R Woodall BRE

D Crowhurst BRE

dti

Department of Trade and Industry



CIRIA *sharing knowledge ■ building best practice*

6 Storey's Gate, Westminster, London SW1P 3AU
TEL +44 (0)20 7222 8891 FAX +44 (0)20 7222 1708
EMAIL enquiries@ciria.org.uk
WEBSITE www.ciria.org.uk

Summary

Biodiversity indicators for construction projects

Woodall, R and Crowhurst, D

Construction Industry Research and Information Association

W005

© 2003 CIRIA

RP662

| | |
|---|---|
| Keywords Benchmarking and KPIs, sustainable construction | |
| Reader interest Construction clients, project managers, environmental managers, environmental consultants, ecologists | Classification AVAILABILITY Unrestricted CONTENT Advice/guidance STATUS Committee-guided USER Construction clients and professionals |

Published by CIRIA, 6 Storey's Gate, Westminster, London SW1P 3AU, UK.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any other means, including photocopying and recording, without the written permission of the copyright-holder, application for which should be addressed to the publisher. Such written permission must also be obtained before any part of this publication is stored in a retrieval system of any nature.

This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. It is sold and/or distributed with the understanding that neither the authors nor the publisher are thereby engaged in rendering a specific legal or any other professional service. While every effort has been made to ensure the accuracy and completeness of the publication, no warranty or fitness is provided or implied, and the authors and publisher shall have neither liability nor responsibility to any person or entity with respect to any loss or damage arising from its use.

Note

Recent UK Government reorganisation has meant that DETR responsibilities have been moved variously to the Department of Trade and Industry (DTI), the Office of the Deputy Prime Minister (ODPM), the Department for Environment, Food and Rural Affairs (DEFRA) and the Department for Transport (DfT). References made to government agencies in this publication should be read in this context.

For clarification, readers should contact the Department of Trade and Industry.

Executive summary

Construction projects, whether commercial developments, housing estates, infrastructure or public-sector projects, all have the potential to damage natural habitats, threatening wildlife and plant species. The construction industry therefore has an important role to play in protecting sensitive sites and minimising damage to ecology. There is generally a poor understanding of biodiversity issues within the construction industry, however. To help the industry tackle this, BRE and CIRIA have developed the following set of complementary biodiversity indicators that allow the impact of construction projects on biodiversity to be measured:

1. Impact on biodiversity: product.
2. Impact on biodiversity: construction process.
3. Area of habitat.

The three indicators are presented in this report. A wide range of stakeholders – including ecologists, developers, constructors, consultants and construction clients – was involved in their development. This has enabled the indicators to be developed so as to be as appropriate as possible to both industry users and environmentalists. They were designed for simplicity of use and wide applicability to different construction project types. A piloting exercise that was conducted with current or recently completed construction projects showed this generally to have been achieved.

The biodiversity indicators have been adapted for inclusion in the DTI/Constructing excellence KPI pack, published in June 2003. This is significant, as it is likely to greatly increase awareness of the indicators across the industry and encourage their uptake. It is also significant that DTI will collect and publish data on the three biodiversity indicators annually. This will enable ongoing industry improvement to be monitored, and demonstrated to stakeholders. It will also ensure that the benchmarks against which projects are measured remain current.

Acknowledgements

Research contractor This report results from CIRIA Research Project 662, “Developing biodiversity benchmarks for construction projects”. It forms part of CIRIA’s ongoing programme of work on sustainable construction. CIRIA’s research partner for this project was **BRE**.

Authors Dr **David Crowhurst** is director of the Centre for Sustainable Construction at BRE. He has worked extensively on the development of indicators and benchmarks for the Government Construction Client’s Panel, the Movement for Innovation, and CRISP, a European thematic network for sustainability indicators. He is a member of the National Construction Benchmarking Forum.

Ruth Woodall joined the Centre for Sustainable Construction in 2002. Her work within this field includes project management of MaSC, a new management tool to help companies assess their current position in relation to sustainability and introduce more sustainable working practices.

Steering group Following CIRIA’s usual practice, the research was guided by a steering group. The role of the steering group was to provide advice and support to the project team and to act as a review body to ensure that the project operated in a manner consistent with the requirements of its major funders and target audience.

Chairman Mr Bob Packham National Construction Benchmarking Forum

Members

| | |
|--------------------|---------------------------|
| Mr Martin Bolton | SEEDA |
| Ms Helen Doran | English Nature |
| Ms Gemma Fenn | Carillion |
| Mr Matthew Frith | Peabody Trust |
| Dr Alex Hazel | Environment Agency |
| Dr Mervyn Jones | Davis Langdon Consultancy |
| Mr Tim Lemon | Scottish Executive |
| Mr Alan McKirdy | Scottish Natural Heritage |
| Dr David Crowhurst | BRE. |

Research manager CIRIA’s research manager for the project was Mr **Martin Hunt**.

Funders The project was funded by the Department of Trade and Industry through the *Partners In Innovation* Programme, the Environment Agency, English Nature and Scottish Natural Heritage.

CIRIA gratefully acknowledges the support of these funding organisations and the technical advice and help provided by members of the steering group. Contributions do not imply that individual funders necessarily endorse all views expressed in published outputs.

Contributors CIRIA also acknowledges the contributions of the following organisations that took part in the pilot study:

Buro Happold
Channel Tunnel Rail Link – Rail Link Engineering
Laban
Middlemarch Environmental
Peabody Trust
Willmott Dixon.

Contents

| | |
|---|-----------|
| Summary | 2 |
| Executive summary | 3 |
| Acknowledgements | 4 |
| Glossary and abbreviations..... | 6 |
| 1 Introduction | 9 |
| 2 Development of the indicators..... | 10 |
| 2.1 Indicator development and consultation | 10 |
| 2.2 Indicator piloting..... | 10 |
| 3 Indicators | 11 |
| 3.1 Recommended indicators..... | 11 |
| 4 Data collection | 16 |
| 4.1 DTI quarterly KPI client survey..... | 16 |
| 4.2 Benchmark data | 17 |
| 4.3 Use of the DTI/KPI wallchart graph | 18 |
| 5 Discussion..... | 19 |
| 5.1 Discussion of the approach adopted..... | 19 |
| 5.2 Adoption of the indicators..... | 19 |
| 6 Conclusions and recommendations..... | 20 |
| 6.1 Conclusions..... | 20 |
| 6.2 Recommendations | 20 |
| Appendices | 21 |
| A1 Summary of feedback and KPI scores achieved by the six pilot projects | 21 |
| A2 Initial list of 17 potential indicators of construction project impact on biodiversity | 26 |
| A3 Pilot study questionnaire | 27 |
| References | 29 |

Glossary and abbreviations

Benchmark – The best performance achieved.

Benchmarking – Comparing performance against others, and using lessons from the best performers to make targeted improvements.

Biodiversity – The variety of life on earth. It includes all species – animal, plants, fungi, algae, bacteria and the habitats that they depend upon.

Client – The client that commissioned the project.

Ecology – The science of how living creatures interact within their environments.

Ecologically valuable habitat – Habitat that supports nationally, regionally or locally important biodiversity, and/or is in itself nationally, regionally or locally important. It includes any habitat listed in the UK Biodiversity Action Plan (UK BAP) or local biodiversity action plan LBAP¹, those protected within statutory sites (eg SSSIs) or those within non-statutory sites identified in local plans².

Examples of habitat types that may fall under this definition include the following:

- ancient/species-rich hedgerows.
- industrial sites such as demolition sites, disused railway lands or unexploited industrial land that have been derelict and undisturbed for a sufficiently long period to enable the establishment of a range of native species
- fens
- lowland meadows
- heathland
- beech and yew woodland
- native pine woodland
- upland oak wood
- upland mixed ash woods
- reedbeds.

The UK BAP website lists 45 specific habitats to be safeguarded and enhanced: <http://www.ukbap.org.uk/habitats.htm>. In order to identify habitats that are of importance in a given locality, visit: <http://www.ukbap.org.uk/Mapper/Mapper.htm>.

Ecologically valuable habitat does not generally include playing fields or monoculture crop planting (for example, fields of cereal crops), although it may include the margins of cereal fields.

¹ Habitat types that are included in LBAPs for each area of UK are shown at: <http://www.ukbap.org.uk/Mapper/Mapper.htm>.

² Where possible, a trained ecologist (eg a member of AWCT – see www.awtc.co.uk, or full member of IEEM, see www.ieem.org.uk) should be employed to help identify ecologically valuable habitat.

Habitat – The area in which a plant or animal lives.

Key performance indicator (KPI) – A measure of a factor critical to success.

Local biodiversity action plan (LBAP) – Framework for action to maintain and enhance biodiversity, set at a local level³.

Species – A group of individual animal, plant or fungal types that interbreed with each other but not with other species.

Stakeholders – Any party with an interest in the project (including client, employees, local communities etc).

Total area of the site – The area within the site boundary.

UK Biodiversity Action Plan (BAP) – The UK Government’s initiative to maintain and enhance biodiversity at a national level. It includes species action plans and habitat action plans.

Workforce – All site workers including direct employees and contractors.

ABBREVIATIONS

AWTC Association of Wildlife Trust Consultancies

BAP biodiversity action plan

BREEAM BRE Environmental Assessment Method

DTI Department of Trade and Industry

IEEM Institute of Ecology and Environmental Management

KPI key performance indicator

LBAP local biodiversity action plan

UKBAP United Kingdom Biodiversity Action Plan

³ More information on LBAP can be found at: www.ukbap.org.uk.

1

Introduction

In 1992, the United Kingdom signed the Biodiversity Convention, which pledged the UK to conserve biodiversity. This commitment led to the preservation and enhancement of biodiversity being one of the ten themes for action identified within *Building a better quality of life* (DTI, 2000).

Construction projects, whether commercial, residential, public sector or infrastructure projects all have the potential to damage natural habitats, threatening wildlife and plant species. The construction industry therefore has an important role to play protecting sensitive sites and minimising damage to ecology. However, the industry has a poor understanding about nature conservation issues and biodiversity. Before this project started, there were no agreed indicators to measure the impact of construction projects on biodiversity. When the Movement for Innovation commissioned work recently to collate existing environmental data relating to construction, to produce a set of environmental performance indicators (Movement for Innovation, 2001), no data relating to biodiversity was available.

To help the industry address this, BRE and CIRIA have developed a set of three biodiversity indicators that allow the impact of construction projects on biodiversity to be measured. They will help users to measure the impact of their construction product and construction processes on biodiversity. Design teams and construction teams will also be able to use them to monitor their own performance. The indicators are intended to be simple to use, acceptable to both industry and environmental stakeholders, and appropriate to a wide range of project types and sizes. It is anticipated that the indicators will not only facilitate the design and construction of more ecologically sound projects, but also will place the principles of biodiversity protection and enhancement firmly in the mindset of practitioners and be used as an accepted framework for measurement of construction's impact on biodiversity. The indicators presented in this report have been adapted to form part of the set of environment key performance indicators (KPIs) published by DTI (Department of Trade and Industry)/Constructing Excellence for use across the construction industry (DTI/Constructing Excellence, 2003).

2 Development of the indicators

2.1 INDICATOR DEVELOPMENT AND CONSULTATION

To ensure that the indicators are appropriate and practical to use, an initial selection of 17 possible indicators (listed in Appendix 2) was reduced to five, and refined through consultation within the project steering group. This was followed by a consultation workshop open for any interested member of the public to attend. Delegates included ecologists, developers, constructors, consultants and construction clients. The outcome of the workshop was to reduce the list of proposed indicators to three, and to further refine them to make them more acceptable. Finally, a web-based consultation was undertaken. This attracted responses from ecologists and construction consultants and resulted in a further refinement of the three indicators.

The action items that appear in the indicators presented on the following pages were developed through a desk study that drew on a range of sources, including those listed in the References section of this report (p 29). The consultation and pilot exercises also contributed to the development of these action items.

2.2 INDICATOR PILOTING

Following the consultation exercises, a pilot study was undertaken. Representatives from organisations involved in the following six current (or recently completed) construction projects used the three indicators to assess their projects:

- BedZED (a housing development in Sutton, Surrey)
- Channel Tunnel Rail Link (Section 1 from Gravesend to Folkestone, Kent)
- Desborough–Rothwell Bypass, Northamptonshire
- Laban (a dance centre in Deptford, south-east London)
- A large office development in London
- Weston Village Primary School, near Crewe, Cheshire.

After the projects had been assessed using the indicators, a member of the BRE project team visited each project to discuss how practical the indicators were to use and how useful they had been and to go through the scores achieved. Discussions were based on a detailed questionnaire (given in Appendix 3). The pilot study provided valuable feedback, which was generally of a more practical and detailed nature than that provided through the earlier consultation exercises. A short summary of the feedback received from the pilot exercise is given in Appendix 1. Overall, the pilot projects found the indicators easy to use and helpful as measures of a project's impact on biodiversity.

3 Indicators

3.1 RECOMMENDED INDICATORS

The recommended biodiversity indicators are presented below. They are:

- Impact on biodiversity: product
- Impact on biodiversity: construction process
- Area of habitat retained/created

| Impact on biodiversity – product and construction process | |
|--|---|
| Purpose | To determine the overall impact on biodiversity of the completed product/facility and the construction process. |
| Definitions | <p>There are two indicators – one for the product/facility and one for the construction process.</p> <ol style="list-style-type: none"> 1. How satisfied was the client that the impact on biodiversity was taken into account in the finished product/facility (this could be determined in consultation with the ecology or project manager), using a 1 to 10 scale where: <ul style="list-style-type: none"> 10 = thorough consideration of biodiversity 8 = good level of consideration of biodiversity 5/6 = fair consideration of biodiversity 3 = some consideration of biodiversity 1 = no consideration of biodiversity. 2. How satisfied was the client that the impact on biodiversity was controlled during the construction process (this could be determined in consultation with the ecology or project manager), using a 1 to 10 scale where: <ul style="list-style-type: none"> 10 = very effective control 8 = good control 5/6 = fair control 3 = little control 1 = no effective control. |
| Method | During construction (for the Construction process KPI) and at completion of the project (for the Product KPI), carry out a survey with the client to determine how satisfied the client was that the impact on biodiversity was taken into account in the finished product/facility and controlled during the construction process on a scale of 1 to 10. |
| | <p>Scoring the impact on biodiversity KPIs</p> <p>Use the following checklists of actions to arrive at a score between 1 and 10. Each box ticked gives a score of one point. The minimum possible score is “1”, which indicates that no consideration of biodiversity has been made. Total the boxes ticked to arrive at the project’s score.</p> |

| Impact on biodiversity – product and construction process (contd) | |
|--|---|
| Method <i>(continued)</i> | <p>Product</p> <p><i>No consideration of biodiversity</i></p> <p><input type="checkbox"/> No consideration of biodiversity (ie none of the boxes below can be ticked).</p> <p><i>Some consideration of biodiversity</i></p> <p><input type="checkbox"/> Some consideration of biodiversity (tick one or more boxes below to indicate how biodiversity was taken into consideration).</p> <p><input type="checkbox"/> All relevant legislation relating to biodiversity was complied with.</p> <p><input type="checkbox"/> Advice from a recognised authority was obtained and acted upon in project design.</p> <p><input type="checkbox"/> Biodiversity was included in the site audit, which was used as a basis for biodiversity enhancement/protection measures.</p> <p><input type="checkbox"/> Local biodiversity expertise (eg local wildlife trust) was used to help identify ecologically important habitats/species on site, to be addressed during the project.</p> <p><input type="checkbox"/> Where impact on biodiversity was unavoidable, steps were taken to create new ecologically valuable habitat.</p> <p><input type="checkbox"/> Actions to protect/enhance biodiversity took full account of UK Biodiversity Action Plan (UK BAP) and local biodiversity action plan (LBAP).</p> <p><input type="checkbox"/> Steps were included in the construction programme to reduce the potential impact of the project on biodiversity.</p> <p><input type="checkbox"/> Appropriate management of protected features, new, existing or enhanced habitats was ensured for at least five years after project completion.</p> <p><input type="checkbox"/> A site-level biodiversity action plan (BAP) was created and implemented to facilitate long-term improvements beyond completion of the project.</p> |
| | <p>Construction process</p> <p><i>No control of impact on biodiversity</i></p> <p><input type="checkbox"/> No control of impact on biodiversity (ie none of the boxes below can be ticked).</p> <p><i>Some control of impact on biodiversity</i></p> <p><input type="checkbox"/> Some consideration of biodiversity (tick one or more boxes below to indicate how biodiversity was taken into consideration).</p> <p><input type="checkbox"/> All relevant legislation relating to biodiversity was complied with.</p> <p><input type="checkbox"/> The contractors carried out all actions relating to biodiversity protection and enhancement to the client's satisfaction.</p> |

| Impact on biodiversity – product and construction process (contd) | |
|---|---|
| Method (continued) | <input type="checkbox"/> A site biodiversity assessment was completed at or before feasibility stage as a basis for biodiversity protection measures. <input type="checkbox"/> Advice from a recognised authority was obtained and acted upon during the construction process. <input type="checkbox"/> A biodiversity champion with authority to influence site activities was assigned to ensure impacts on biodiversity on site were minimised. <input type="checkbox"/> Work was scheduled to be carried out at an appropriate time of year so as to minimise disturbance to wildlife. <input type="checkbox"/> Protection measures of all existing ecological features on the site were put in place. <input type="checkbox"/> Training was carried out as part of the site induction for all site workforce on how to protect the site ecology during the project. <input type="checkbox"/> The actions taken and their effectiveness to protect biodiversity were monitored throughout the construction phase, and were made publicly available. |
| Example | <p>During a post-project review, the client ticked six of the actions above in the “Product” list and seven under “Construction process”. The client therefore gave the project a score of 6 out of 10 for the degree to which the impact on biodiversity was taken into consideration in the finished product, and 7 out of 10 for the degree to which the impact on the biodiversity was controlled during the construction process.</p> |
| Notes | <p>This indicator may be completed as part of a more comprehensive survey or post-project review with the project manager or ecology manager (where applicable).</p> |
| | <p>Compliance with legislation</p> <p>For details of legislation relating to biodiversity, visit the following:</p> <ul style="list-style-type: none"> • The Stationery Office website includes the full text of all legislation enacted by the UK Parliament. Relevant documents can be found using the search engine: www.legislation.hmso.gov.uk. • On the Department of the Environment Food and Rural Affairs (DEFRA) website, the “Environmental protection” section and “A–Z subject index” are useful starting-points: www.defra.gov.uk. • The Environment Agency’s Netregs website provides user-friendly guidance on environmental legislation for small- and medium-sized enterprises (SMEs) and includes a section specifically for construction: www.environment-agency.gov.uk/netregs • English Nature (www.english-nature.org.uk), the Countryside Council for Wales (www.ccw.gov.uk), the Environment and Heritage Service (Northern Ireland)(www.ehsni.gov.uk) and Scottish Natural Heritage (www.snh.org.uk) are also useful starting-points for information on issues such as protected sites. |
| | <p>Advice from recognised bodies</p> <p>Advice on measures to protect or enhance biodiversity can be obtained from suitably qualified professionals with expertise in ecology. This will usually involve them carrying out a site assessment. A professional from a recognised body, such as those listed below, can be approached:</p> <ul style="list-style-type: none"> • the Association of Wildlife Trust Consultancies (AWTC) (www.awtc.co.uk) • a full member of the Institute of Ecology and Environmental Management (IEEM) (www.ieem.org.uk). |

| Impact on biodiversity – product and construction process (contd) | |
|--|---|
| Notes (continued) | <p>Site biodiversity appraisal</p> <p>An appraisal of site biodiversity/features of ecological value existing on site before construction can be included as part of the site audit. This should be completed at or before feasibility/outline proposal stage. The appraisal of site biodiversity should usually be carried out by a qualified ecologist or an individual with a thorough understanding of ecology.</p> |
| | <p>Creation of habitat</p> <p>Creating new habitat is generally of less ecological value than protecting and enhancing existing habitat. However, selectively planting native species of plants can provide important habitat for wildlife, as can adding wetland areas or other appropriate features and creating conditions for habitat to develop naturally.</p> |
| | <p>UK Biodiversity Action Plan (UKBAP)/local biodiversity action plan (LBAP)</p> <p>LBAPs are not fully developed for all areas of the UK. However, significant areas of the UK do have them. Some local authorities have an officer responsible for the LBAP who may be able to provide advice on whether your activities are fully integrated into the wider UK biodiversity targets and should also be able to assist with specialist monitoring. Alternatively, refer to: www.ukbap.org.uk, which provides details of both LBAPs and UKBAP.</p> <p>Where an area does not yet have an LBAP project design should take full account of UKBAP, and any known locally important biodiversity.</p> |
| | <p>Construction programme</p> <p>Timing of works may have a significant impact on biodiversity, for example, breeding birds, flowering plants, seed germination, amphibians etc. Actions such as phased clearance of vegetation may help to mitigate ecological impacts. Disturbance at or near known nesting sites should be avoided at certain sensitive times.</p> |
| | <p>Site-level biodiversity action plan</p> <p>Steps to produce a site-level BAP are outlined in the UK Business and Biodiversity Resource Centre website, hosted by Earthwatch Europe⁴: http://www.businessandbiodiversity.org under “your sector”.</p> |
| | <p>Protection of existing features</p> <p>If there are no ecological features on site you can achieve this credit by default. However, it is important to note that even in inner urban developments, where it is frequently assumed that there are no ecological features, there often is biodiversity that should be protected.</p> |

⁴ Earthwatch Europe works with more than 20 FTSE100 companies and is funded by DEFRA and Innogy to host the UK Business and Biodiversity Resource Centre.

| Area of habitat retained/created | |
|---|---|
| Purpose | To measure the proportion of ecologically valuable habitat created and/or retained within the total area of the site for a completed product/facility. |
| Definition | The difference in the area of ecologically valuable habitat within the total site area at completion of the project and at the start of the project expressed as a percentage of the site area. |
| Method | <p>On completion of the project, ascertain:</p> <ul style="list-style-type: none"> • <i>Area 1</i>: the area of ecologically valuable habitat within the total area of the site at the start of the project • <i>Area 2</i>: the area of ecologically valuable habitat within the total area of the site at completion of the project • <i>Area total</i>: the total area of the site. <p>See notes below.</p> $\text{Performance score (\%)} = \frac{\text{Area 2} - \text{Area 1}}{\text{Area total}} \times 100$ <p>Note that the performance score can be either a positive percentage, zero or a negative percentage (ie between -100% and +100%).</p> <p>Some actions that can be taken on site to enhance biodiversity cannot easily be measured in terms of area using the method above. If such actions (see notes below) have been carried out on your project, keep a record of them and use it to qualify the benchmark score from this KPI.</p> |
| Example | <p>The area of ecologically valuable habitat at the start of the project (<i>Area 1</i>) was 15 ha and at the completion of the project (<i>Area 2</i>) is 10 ha. The total area of the site (<i>area total</i>) is 50 ha.</p> $\text{Area of habitat} = \frac{10 - 15}{50} \times 100 = -10\%$ <p>The following actions were taken to enhance biodiversity:</p> <ul style="list-style-type: none"> • bat boxes were put up • money was donated to a local initiative to enhance biodiversity in a neighbouring area. |
| Notes | <p>Site survey carried out by an ecologist. The most accurate way of assessing the change in area of ecologically valuable habitat on site is to employ a qualified ecologist. Professionals from a range of recognised bodies can be approached. These include:</p> <ul style="list-style-type: none"> • the Association of Wildlife Trust Consultancies (AWTC), see www.awtc.co.uk • a full member of the Institute of Ecology and Environmental Management (IEEM); www.ieem.org.uk. <p>A qualified ecologist will also be able to advise on measures to protect or enhance biodiversity on site.</p> |
| | <p>Retaining and protecting existing habitat is always preferable to creating new habitat. However, creation of new habitat or conditions for habitat to develop naturally can be considered alongside this, or where damage to existing areas is unavoidable.</p> |
| | <p>Opportunities to enhance existing habitat include reducing fragmentation of habitat areas (so that species can travel easily between the areas), better management of existing sites, planting of native species, or adding wetland areas or other appropriate features. It can also include off-site habitat enhancement within the same locality. It is important that habitat enhancement is in keeping with the existing habitat types in the area of the site.</p> |

4 Data collection

4.1 DTI QUARTERLY KPI CLIENT SURVEY

Data is collected four times each year on a wide range of indicators of construction project performance via the DTI Quarterly KPI client survey. The survey is sent out to clients, drawn from a database of construction projects completed each quarter. The sample size and spread contains data that provides at least a 95 per cent degree of confidence of its representation across the construction industry. The results are published as the *Construction industry KPIs* (DTI/Constructing Excellence, 2003).

For the first time, the 2002/3 DTI client survey included questions on biodiversity, which naturally formed part of the list of possible indicators to develop through this project, set out in Appendix 2, that were included in the consultation exercises. The recommendations of the steering group and participants at the consultation workshop endorsed the development of the two indicators “Impact on Biodiversity: Product” and “Impact on biodiversity: construction process” that are included in the survey. Data has therefore been collected from a wide range of projects on the “Impact on biodiversity: product”, and “Impact on biodiversity: construction process”.

The DTI survey questionnaire does not include a detailed explanation of the questions on any one subject, so the detailed check-box method and guidance notes shown in the indicators above are not included in the survey. More comprehensive guidance notes (based on this work) are available in the *KPI handbook*, published to accompany the survey results as presented on the *Environment KPIs wallchart* (DTI/Constructing Excellence, 2003). These can be used when benchmarking projects against these two biodiversity KPIs.

An indicator relating to the “Area of habitat” was also included in the 2002/3 DTI client survey. However, the steering group for this project and consultation workshop participants felt that a slightly different approach to the one used in the survey was more appropriate. Although data has been collected relating to the area of habitat on site before and after construction through the DTI survey, the results are presented in a different form so cannot be used to derive a benchmark curve for the “Area of habitat created/retained” indicator described in the previous chapter. Data will be collected on the “Area of habitat created/retained” indicator in the 2003/4 and subsequent DTI surveys, and is referred to in the 2003 *KPI handbook*.

4.2

BENCHMARK DATA

Figure 4.1 shows the benchmark curves for the biodiversity indicators, “Impact on biodiversity product”, and “Impact on biodiversity: construction process” based on data collected via the DTI survey. The graph is published on the *Environment KPI wallchart*, which is to be used in conjunction with the *Environment KPI handbook* (DTI/Constructing Excellence, 2003). It can also be used alongside the indicators presented above to benchmark projects.

Box 4.1 *Environment KPI handbook*

There are some small differences in the way the “Impact on biodiversity: product”, and “Impact on biodiversity: construction process” indicators are presented in the *Environment KPI handbook*.

Instead of a series of tick-boxes, where the number of boxes ticked determines the project score, as outlined in this report, the *KPI handbook* presents the same list of actions as a bulleted list. Users of the *Handbook* are advised to refer to the list to assist them in arriving at judgement of their performance score, but there is no requirement for them to have necessarily carried out any of the listed items in order to take a view that they score highly. This alternative method is aimed at keeping the approach to scoring performance against the biodiversity indicators in line with that of other KPIs in the pack. It does, however, make the approach adopted in the *Handbook* much more subjective than that adopted here.

After some careful consideration, the steering group for this project chose to recommend and retain the tick-box version of the indicators as presented in Chapter 3 of this report. It was felt that this produces a more robust (less subjective) score that allows a higher level of comparison between projects and a more consistent approach, particularly for internal benchmarking. The tick-box method was evaluated with the six pilot projects (see Appendix 1) and received favourable feedback.

The steering group nevertheless recognised the need for the biodiversity indicators to be kept in line with the approach adopted for other KPIs, acknowledging the approach adopted in the *Environment KPI handbook*, and agreed that, although not ideal, at this time this was necessary for general use with the headline “Environment KPIs”.

4.3

USE OF THE DTI/KPI WALLCHART GRAPH

Once data has been collected on the project's performance, it can be compared with industry data, shown in Figure 1 to provide a benchmark score.

1. Plot the measured performance on the vertical axis (1).
2. Read across to the relevant performance graph line (2).
3. Read down to the horizontal axis. This is the benchmark score out of 100% (3).

For example, a client rated the degree to which biodiversity was taken into consideration during the construction process of their project as 7 using the 1–10 scale. Reference to the graph in Figure 1, shows that a performance of 7 equates to a benchmark score of 67 per cent. This means that 67 per cent of projects nationally have equal or lower performance and 33 per cent of projects have higher performance than the project being assessed.

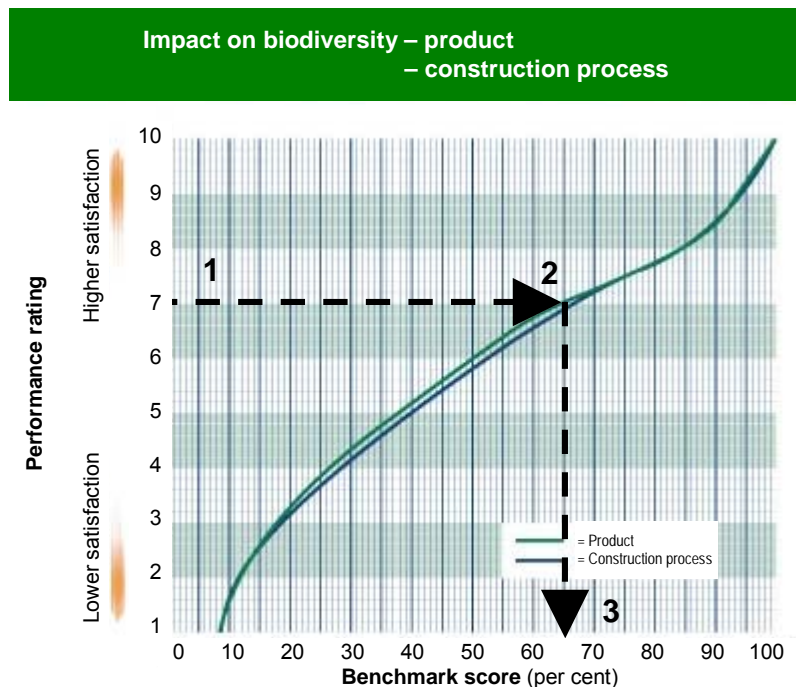


Figure 4.1 *Benchmark curves for biodiversity indicators from the Environment KPI wallchart (DTI/Constructing Excellence, 2003)*

5 Discussion

5.1 DISCUSSION OF THE APPROACH ADOPTED

The project set out to develop practical, simple and acceptable indicators to measure the consequences of project design and site practices upon biodiversity. This aim has been achieved through the development of a set of three complementary indicators.

Because of the wide range of construction project types, sizes, timescales and land-use types it was concluded that the “action-based” approach adopted in the KPIs for “Impact on biodiversity: product” and “Impact on biodiversity: construction process” was more appropriate than the other indicators proposed in the early stages of the project, which would have tended to be more project-specific (see Appendix 3). This was confirmed by feedback received by the pilot projects. The “Area of habitat created and retained” indicator may be less appropriate to such a wide range of projects, but remains a useful and simple numerical measure of project impact.

5.2 ADOPTION OF THE INDICATORS

In addition to the inclusion of the biodiversity indicators in the *Environment KPI handbook* and the *Environment KPI wallchart* (the principal routes for their dissemination), the indicators presented in this report will also be considered in future updates of BREEAM. BREEAM recognises the relevance of the biodiversity indicators. The degree to which they may be effectively incorporated into BREEAM and the measurement system to be adopted is not yet established, however, and will be subject to review and consultation for inclusion in future versions of BREEAM schemes.

6 Conclusions and discussion

6.1 CONCLUSIONS

The construction industry has a major impact on biodiversity, and so has an important role to play in minimising damage to ecology. However, there is a poor understanding of biodiversity issues within the construction industry, hence the need for a set of indicators both to enable measurement and benchmarking of industry performance in this important area and to raise awareness of the issues within the industry.

This report has presented a set of three complementary indicators of construction project impact on biodiversity. A wide range of stakeholders – including ecologists, developers, constructors, consultants and construction clients – was involved in their development. This has enabled the indicators to be designed so as to be as appropriate as possible to both industry users and environmentalists. The indicators were also intended to be simple to use and applicable to a wide range of construction project types. The piloting exercise that was conducted showed this generally to have been achieved.

The project team and steering group consider the versions of the biodiversity indicators presented in this report to be robust, allowing fair comparison between projects.

Feedback from the piloting exercise was positive, and it is anticipated that the indicators will have a significant influence on the degree to which construction takes account of its impact on biodiversity. The inclusion of the three biodiversity indicators in the DTI/Constructing Excellence *Environment KPI handbook*, the *Environment KPI wallchart* and the industry client survey is likely to enhance their potential impact by increasing the level of their dissemination, and also through annual data collection and publication, ensuring that benchmark graphs remain current.

6.2 RECOMMENDATIONS

It is recommended that the biodiversity indicators be used in construction projects wherever possible. It is expected that this will encourage improvement in the important area of biodiversity protection and enhancement, and raise awareness of the issues more widely within the construction industry.

For future editions of the *KPI handbook* the DTI should reconsider adopting the more thorough approach outlined in this report, once familiarity with the existing indicators and biodiversity across the industry has grown.

Clients planning a rigorous appraisal of the impact of their construction projects on biodiversity should use the version of the indicators outlined in this report internally to measure performance change. Use of this version will enable these clients to trace more easily (and less subjectively) where changes in performance have been made, in addition to producing an overall score.

The indicators presented in this report should be considered for inclusion in BREEAM, as this will further raise the industry's awareness of biodiversity issues and allow for consistent measurement methods across the industry.

A1 Summary of feedback and KPI scores achieved by the six pilot projects

A1.1 SUMMARIES OF FEEDBACK AND SCORES ACHIEVED

Scores achieved against each of the three biodiversity indicators by the six pilot projects are given below, alongside a short summary of the feedback from each project on how practical and useful they found the indicators to be. Projects piloted earlier versions of the indicators than those presented in this report, so without a copy of these earlier versions a full list of feedback comments would be confusing to the reader. The feedback summaries below are therefore brief.

BedZED, Sutton

Impact on biodiversity – product score: Information not available

Impact on biodiversity – construction process score: Information not available

Area of habitat score: +17%

Background to the project

BedZED, the Beddington Zero Energy Development, is an environment-friendly, energy-efficient mix of housing and workspace in Beddington, Sutton. It consists of 100 properties in addition to green space, including private gardens. The site was formerly a sewage works. The BedZED site was identified in 1996. The Peabody Trust housing association came forward as developers in 1998 and achieved planning permission in 1999. The scheme was completed in June 2001.

Actions carried out to protect/enhance biodiversity

Workspace roofs are colonised for gardens. The client was not able to provide any further details, as the project was completed over a year ago and the relevant information was not readily available.

Key feedback on the three indicators

Checklists and guidance are clear and pitched at the right level.

Channel Tunnel Rail Link (Section 1: Gravesend to Folkestone)

Impact on biodiversity – product score: 10

Impact on biodiversity – construction process score: 10

Area of habitat score: Not applicable (see below)

Background to the project

The Channel Tunnel Rail Link is the UK's first modern high-speed railway and the country's largest construction project. The first environmental studies for the project were carried out in 1990, the environmental statement was published in 1994, and the

project was authorised by the Channel Tunnel Rail Link Act of 1996. Construction of Section 1 of the link began in October 1998 and is effectively complete. At the time of this report going to press, Eurostar commissioning trials are taking place and the railway is due to open for passenger service in late September 2003.

One of the remits for the project promoters and designers was to set high environmental standards that could be applied to future projects.

Actions carried out to protect/enhance biodiversity

CTRL client Union Railways and designer/project manager Rail Link Engineering have been instrumental in establishing and implementing an environmental management system within which the project's environmental commitments, including those related to biodiversity, have been delivered. The project employs a large environment team including an ecology manager and assistant ecologists. Extensive survey work was undertaken to bring the ES ecological data up to date. Strategies were developed for the protection of habitats and protected species such as ancient woodlands, rare and scarce flora, dormouse, badger, bats, amphibians and reptiles. Wherever possible, efforts were made to avoid or minimise damage or disturbance, and only when absolutely necessary was translocation (under the appropriate licence) undertaken to suitable habitats off-line. More than 90 ecologists including those from local wildlife groups (eg mammal, badger and bat groups) have been engaged in this work.

New habitat created as part of the project was designed to fit with existing habitat, and was in excess of that lost. Fragmentation of habitat was avoided in two locations by creating "habitat bridges". Specific actions to retain and enhance biodiversity included the relocation of soils from existing ancient woodland to newly created areas of woodland, resulting in a rich ground flora from seeds and propagules contained in the donor soils. In wetland areas, nine ponds were built to replace the seven that were lost to construction.

To assist the delivery of the project's environmental commitments, an Environment Forum was established comprising the project's environmental specialists and the lead environmental consultees, which included English Nature, the Environment Agency and Kent Wildlife Trust. An Ecology Sub-Group was set up to review engineering designs for areas of key ecological importance and feed back modifications where appropriate.

Key feedback on the three indicators

The "Area of habitat" KPI could not meaningfully be completed for a project of this scale, where the site area is arbitrary and the full extent of the constituent habitat types cannot accurately be measured (where do they begin and end?) to feed into the equation. Areas of interesting habitat lost and of new habitat created have been measured and documented, with a positive balance achieved. In addition, features such as habitat bridges have more ecological value than their actual area, as they form a link between habitats that would otherwise be fragmented. Reuse of material (such as woodland soils) to speed the development of valuable habitat will also have greater ecological benefit than a simple planting area measurement. Expressing them as an area of "ecologically valuable habitat" could be confusing.

Comments such as those above prompted the addition of a recommendation that users of the "Area of habitat created/retained" indicator qualify their score with details of further actions such as creation of habitat bridges.

Desborough–Rothwell Bypass

Impact on biodiversity – product score: 10

Impact on biodiversity – construction process score: 10

Area of habitat score: +50%

Background to the project

The bypass was designed in 1992, and let under a design-and-build tender from the Highways Agency. In awarding the contract, 40 per cent was based on cost and 60 per cent on quality, of which 15 per cent were environmental issues (8 per cent during construction and 7 per cent in the final design). There were some mandatory elements within the Highways Agency design scheme such as landscaping; the rest was illustrative. On the site before construction there were nesting birds, badgers, great crested newts and bats (but no bat roosts).

Actions carried out to protect/enhance biodiversity

A wide range of features to enhance and protect biodiversity on site has been added. These include reedbeds, a bat hibernatory, a newt pond and 12 badger tunnels under the new bypass; attenuation pools for road drainage are to include wetland habitat. New planting was matched to existing habitats as much as possible and included an additional 5 ha of wild flower meadow and 50 000–60 000 trees.

The Environment Agency and English Nature were consulted for the Highways Agency desk study. The project also had a qualified ecologist as ecological clerk of works. The Northamptonshire and UK BAPs were consulted at the design stage. Health and safety training for site workers included a video on the environment. Selected staff were briefed on site-specific issues relating to timing of works.

Key feedback on the three indicators

Provide some examples of habitats that fall under “ecologically valuable land” and some that do not, to help people allocate areas on their site appropriately. It is best not to use complex definitions, as these would require a qualified ecologist to use meaningfully.

Examples have been incorporated into the final indicators as suggested.

The person responsible for ecology on the project would be better placed than the client to measure the project against the indicators (see p 7 definitions).

This is acknowledged and, in response to comments such as the above, the suggestion that the two “Impact on biodiversity” indicators could be used as part of a more comprehensive survey undertaken by the project manager or ecology manager in order to arrive at a score was added to the notes section of the indicator. It is felt that this would keep the score unbiased.

Laban dance centre, Deptford

Impact on biodiversity - product score: 8

Impact on biodiversity – construction process score: 7.5

Area of habitat score: +60%

Background to the project

The Laban opened at the beginning of February 2003. Although the landscaping of the site is not yet complete, a key feature is the centre's roof. It is the first aggregate-based roof built for biodiversity in the UK (secondary aggregates were used). It provides habitat specific for black redstarts, which are listed as a priority species in the London Biodiversity Action Plan. The site was previously a refuse dump.

Actions carried out to protect/enhance biodiversity

The development took account of the local BAP as outlined above and steps were included in the construction schedules to reduce the potential impact on biodiversity during construction. Local biodiversity expertise was employed during design of the project, which was considered to be of key importance in identifying locally important biodiversity.

Key feedback on the three indicators

Commented that it was not easy to decide which areas of land fell into the category "ecologically valuable".

Suggested adding a tick box in the "Impact on biodiversity: product" indicator, to credit the use of local biodiversity expertise in the project.

These suggestions were both addressed in the final indicators.

Large office development, London

Impact on biodiversity – product score: 4

Impact on biodiversity – construction process score: 3

Area of habitat score: -22.6%

Background to the project

The construction period of the development was two and a half years. The site area was approximately 6.5 ha, and it was previously a brownfield area that had been derelict for around 10 years.

Actions carried out to protect/enhance biodiversity

As part of a BREEAM assessment of the development, an ecological appraisal of the site was conducted. Advice from recognised ecologist was obtained and acted upon during design and construction, and where impact on biodiversity was unavoidable, steps were taken to create new ecologically valuable habitat.

Key feedback on the three indicators

Suggested that more details and examples of legislation could be given to accompany the “Impact on biodiversity” indicators.

Commented that a clearer definition of “ecologically valuable habitat” would be helpful.

Production of the final set of indicators took account of both these suggestions.

Weston Village Primary School

Impact on biodiversity – product score: 6

Impact on biodiversity – construction process score: 5

Area of habitat score: -71%

Background to the project

The project had a 32-week construction period (from January to August 2002). The building is a single-storey steel-frame, brick-clad school. Before construction began, the site was part brownfield and part monoculture arable land.

Actions carried out to protect/enhance biodiversity

Work was scheduled to be carried out at a time of year that would minimise disturbance to wildlife, and protection measures of all existing ecological features on site were put in place. Appropriate management of protected features and new or enhanced habitats was ensured for at least five years after project completion.

Key feedback on the three indicators

KPIs are clear and were easy to complete.

Suggested that more details of what constitutes “ecologically valuable habitat” could be provided.

The latter comment was taken account of in the final indicators.

A2

Initial list of 17 potential indicators of construction project impact on biodiversity

An initial selection of 17 possible indicators of construction project impact on biodiversity was proposed at the beginning of the project and are listed below. This list was reduced in length and refined through various consultation exercises.

1. Ecological value of the site prior to construction.
2. Change in ecological value of the site.
3. Ecological enhancement.
4. Protection of ecological features.
5. Index of wild birds.
6. Net change in local BAP species.
7. Net change in local BAP habitat.
8. Change in plant species diversity.
9. Butterflies.
10. Cost of environmental improvements.
11. Area of habitat designed and created.
12. Number of non-conformance certificates issued by £ turnover.
13. Environmental assessment.
14. The number of native trees removed from the site.
15. The area of pond destroyed and created.
16. The degree to which biodiversity issues were taken into account in the design of the project on a scale of 1 to 10.
17. The degree to which biodiversity issues were taken into account in the construction process on a scale of 1 to 10.

A3

Pilot study questionnaire

The questionnaire reproduced below formed the basis for obtaining feedback from the projects that participated in the indicator pilot study.

Background to project

KPI 1 score

KPI 2 score

KPI 3 score

Feedback questionnaire

1. Checklist items in KPI1 and KPI2 are listed in order of ease of attainment. Do you agree that each item has been placed in the most appropriate position on the list?
2.
 - a. Did you require any terms to be defined that are not already listed in the “definition” section?
 - b. Did you find any of the definitions in this section difficult or understand, or insufficient explanation given?
3. How long did it take you to complete an assessment of your project using each of the following?
 - a. KPI1
 - b. KPI2
 - c. KPI3
4. Did you find any of the checklist items in either of the following indicators difficult to understand, or unclear whether to award the credit to your project?
 - a. KPI1
 - b. KPI2
5. Did you feel that any of the checklist items in either of the following KPIs were inappropriate to include?
 - a. KPI1
 - b. KPI2
6. Please list the checklist items for each of the following indicators that you feel could have been achieved realistically (within a realistic timeframe and budget and with the resources available) on your project if the team had set out from the start to minimise impact on biodiversity:
 - a. KPI1
 - b. KPI2

7. Were the guidance notes at the end of any of the KPIs unclear or confusing?
8. Did you encounter any difficulties accessing relevant information from any of the websites listed?
9.
 - a. Do you think the supply chain should be included as a checklist item in KPI1 (eg Construction materials were selected in order to have minimum ecological impact, eg use of FSC timber)?
 - b. If this had been included would your project have achieved this credit?
10.
 - a. How easy did you find it to calculate the “Area of habitat” score?
 - b. How easy did you find it to decide which land on the site classed as “ecologically valuable”?
 - c. How easy did you find it to measure/estimate the area figures required for the calculation?
11. Did you carry out any actions to protect or enhance biodiversity that could not be credited in KPI3 as they did not increase area of habitat, but rather quality (please supply details)?
12. Any further comments.

References

1. *Building a better quality of life: a strategy for more sustainable construction* (DTI, 2000, ISBN 0 419 19930 6)
2. *Environment key performance indicator handbook* (DTI/Constructing Excellence, 2003)
3. *Environmental performance indicators* (Movement for Innovation Sustainability Working Group, 2001)
4. www.ukbap.org.uk
5. www.awtc.co.uk
6. www.ieem.org.uk
7. www.businessandbiodiversity.org
8. *Working with wildlife: training pack* (CIRIA, 2003 in preparation)