Impact Mitigation in EIA: paper promises or the basis of consent conditions?

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ABSTRACT

Whilst mitigation of negative impacts is accepted as being one of the main aims of the environmental impact assessment process, ameliorating measures must be implemented if environmental impacts are to be effectively addressed. The English planning system can facilitate the implementation of mitigation measures identified in an Environmental Impact Statement (EIS) through planning conditions and obligations.

This study analyses details of 40 planning applications in the East of England to investigate the practice of translating paper recommendations in the EIS into legal conditions and obligations.

A high proportion of mitigation measures suggested in EISs were not translated into planning conditions or obligations. On the other hand, a significant number of conditions or obligations were imposed on developers which had no basis in the EIS. Guidance on mitigation and planning had not significantly affected the process. The proportion of mitigation measures translated into conditions or obligations was affected by the environmental aspect studied. Several recommendations are made to improve the coverage of mitigation measures, including the use of Environmental Management Plans.

KEYWORDS

Mitigation; conditions; planning obligations; effectiveness of mitigation; environmental impact assessment; UK; Environmental Management Plans

INTRODUCTION

Environmental Impact Assessment (EIA) is a systematic, cyclical process which examines the environmental consequences of planned developments (Glasson *et al.*, 1999). A key component of the process is mitigation of predicted impacts (Wood, 2003). Indeed, mitigation could be considered as the foundation of the whole EIA process, in that it is the requirement to identify mitigation measures which translates the findings from the environmental assessment into recommendations to reduce the environmental impacts (Marshall, 2001; Carroll and Turpin, 2002; Environment Agency, 2002). This paper reports the findings from research into the practice of implementing recommended mitigation measures, using a range of planning applications under the English development control system.

EIA became mandatory in all European Union (EU) Member States in 1988 through the implementation of the Environmental Assessment Directive 85/337/EEC (Council of the European Communities, 1985), subsequently amended by Directive 97/11/EC (Council of the European Union, 1997) and 2003/35/EC (European Parliament and the Council of the European Union, 2003). The Directive does not use the term 'mitigation' but requires, where significant adverse effects are identified, that "*measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse effects*" are proposed. Arguably, therefore, the Directive has the mitigation of project impacts as one of its main aims (Wood, 2003). The key role of mitigation was recognised in a research report produced for the Department of the Environment, Transport and the Regions in 1997 (Department of the Environment Transport and the Regions, 1997), which reviewed detailed current practice at the time, detailed best practice and recommended that specific guidance on good practice relating to mitigation measures and their enforcement should be produced. Whilst further guidance has not been issued, the publication of the research report itself might be considered as guidance and this research will examine whether it has influenced practice.

Impacts that require mitigation may be identified throughout the whole EIA process, possibly after the preparation of the Environmental Impact Statement (EIS) (Wood, 2003). Almost by definition, therefore, there is a merging of a range of mitigation approaches throughout the development control process. In addition, because mitigation is inherent in all aspects of the EIA system (Glasson *et al.*, 1999), it is subject to the same

constraints and weaknesses as impact evaluation. For example, mitigation measures proposed often do not give any indication as to their potential effectiveness in ameliorating significant impacts (Byron, 2000). Hence, they are of little use to decision makers. Similar considerations apply in terms of feasibility of proposed measures: there is a need for at least technical, operational and economic tests to be applied (Marshall, 2001). Again, recommendations that do not comply with these criteria are of questionable use. Lastly, and most crucially, is the aspect of verification. In many cases, mitigation is viewed in the UK as a series of non-binding proposals in an EIS (Morrison-Saunders *et al.*, 2001). Conditions and recommendations need to be monitored and enforced to ensure implementation and, therefore, effective mitigation (Marshall, 2001; Wood, 2003). It is this area of enforceability throughout the development control process that is the focus of this research.

The detailed description of the implementation of the Environmental Assessment Directive in the UK is covered adequately elsewhere (see, for example, Bond, 1997; Weston, 1997; Glasson *et al.*, 1999). Of relevance to this research is that, in England & Wales, projects subject to planning control are dealt with under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 293), while those outside planning control are dealt with by a range of sectoral EIA regulations (for example, pipelines, highways, land drainage schemes, ports, etc.) (Department of the Environment Transport and the Regions / National Assembly for Wales, 2000).

The number of projects subject to EIA under the planning regulations is not clear from existing literature. For example, Glasson *et al.* (1999) report that projects falling under the planning regulations in England and Wales comprise approximately 60% of all EIAs carried out in the UK. Bellanger and Frost (1997) report that 91% of all EISs completed between July 1988 and January 1997 were submitted under the EIA planning regulations (in either England & Wales, Scotland or Northern Ireland). On the other hand, Essex Planning Officers' Association (2002) estimate that approximately 80% of projects in England requiring EIA are subject to planning control. In the aggregate, this evidence thus indicates that the EISs submitted under the planning regulations in England comprise a significant proportion of all those submitted in the UK as a whole.

However, the role of EIA in decision making within the UK planning system needs to be placed into context. Weston (2002) reports that only 0.1% of all planning applications are subject to EIA. For those that are, the EIS submitted with the planning application is considered to be 'material evidence' along with policy guidance, public comments and good practice guidance. All these are secondary to the policies in the local plan in terms of decision making on planning applications (Weston, 1997). Thus, EIA is not afforded great significance in the planning system and it is not surprising that information in the EIS, including the mitigation measures, is not legally binding.

In the UK, planning permissions are subject to conditions concerning the time limits for carrying out a development, but most also contain specific conditions imposed by local planning authorities (Cullingworth and Nadin, 2002). Whilst the power to impose conditions is not limitless, as the conditions have to be appropriate from a planning point of view, they can be used to enhance the quality of a development and mitigate against adverse effects. Such conditions may incorporate mitigation measures proposed in the EIS, although planning authorities may also compile lists of model or standard conditions (Department of the Environment, 1995). There are two main forms of planning conditions, those which require actions to be taken before development commences, and those which require compliance with specified controls during the life of the development (Department of the Environment, 1995). Failure to comply with planning conditions may result in a breach of condition notice being served by the planning authority (Department of the Environment, 1995), suggesting that the inclusion of mitigation measures in planning conditions is an effective method to ensure their implementation.

Where conditions are insufficient to overcome planning objections to a development, planning obligations may be used. Obligations are regulated under Section 106 of the Town and Country Planning Act 1990 and are enforced through contract law in the form of a legal agreement between the developer and the planning authority (Carroll and Turpin, 2002). Planning obligations may restrict the development of land, require certain activities to be carried out, require land to be used in a specified way, or require payments to be made to the planning authority (Department of the Environment, 1997a). They are more appropriate than conditions for the long term management of land, or for measures affecting land outside the development site (Essex Planning Officers' Association, 2002). Obligations thus offer a broader scope than conditions, and can provide a means of

reconciling the interests of a developer with the need to safeguard the local environment (Department of the Environment, 1997a).

However, one potential problem with the use of conditions and obligations to ensure mitigation implementation is that, unless the EIS is very precise about specific mitigation measures, it is not possible to create a valid condition requiring the development to be *"in accordance with the EIS"* (Department of the Environment Transport and the Regions, 1997, p. 52). Any such condition must also refer to a specific section of the EIS, rather than the entire document (Department of the Environment Transport and the Regions, 1999). This means that, in general, the EIS can be used as a starting point only for the drafting of conditions and obligations. On the other hand, failure by developers to implement mitigation measures discussed in an EIS, by not translating them into planning conditions, has sometimes led to the inclusion of very detailed conditions in the planning permissions of other, subsequent developments (Singleton *et al.*, 1999).

Research has found that it is very rare for planning conditions to cover all the aspects of project design and implementation which could mitigate environmental impacts (Department of the Environment Transport and the Regions, 1997). This is possibly because, in order to ensure that all the mitigation measures could be enforced, conditions would need to be specified for each measure, resulting in an unfeasibly large number of conditions. As a result, planning authorities often prioritise the measures considered most necessary for delivering an acceptable development (Department of the Environment Transport and the Regions, 1997). The importance of consultation in establishing mitigation measures may lead to the formulation of conditions relating to measures which were not mentioned in the EIS. The time lapse between submission of an EIS and granting of planning permission may mean that the EIS is out of date by the time planning conditions are formulated, significantly reducing its usefulness in determining mitigation (Department of the Environment Transport and the Regions, 1997).

A key factor which needs to be considered is that local planning authorities have a high degree of independence and autonomy over EIA implementation for projects under their jurisdiction, despite the presence of government guidance documents. This may lead to local and regional variations in the use of the EIS in the planning process (Leu *et al.*, 1996).

One possible means of improving the link between predictions made, mitigation measures specified in an EIS and their implementation, is the Environmental Management Plan (EMP). EMPs are defined by the World Bank (1999a, p.1) as documents that *"outline the mitigation, monitoring, and institutional measures to be taken during project implementation and operation to avoid or control adverse environmental impacts, and the actions needed to implement these measures*". An EMP thus forms a more systematic and explicit document to be used by planning authorities in formulating conditions (Brew and Lee, 1996), increasing the likelihood that mitigation measures identified and described in the EIS will be implemented. Although there is no requirement currently for EMPs to be prepared under the English planning system, they are increasingly advocated by the World Bank (1999b) for use internationally, and have been used in the UK on a voluntary basis (Hickie and Wade, 1997).

This paper describes research which investigated how mitigation measures are translated into practice through the use of planning conditions and obligations in England, with a view to developing recommendations for improving the effectiveness of this process. The research also aims to determine whether research published by the Government on 'Mitigation Measures in Environmental Statement' (Department of the Environment Transport and the Regions, 1997) had any effect on this translation into conditions and obligations. The next section is devoted to the description and justification of the methodology adopted for the study. This is followed by a presentation of the results and associated discussion. Finally, the conclusions are presented, along with recommendations for improving the conversion of suggested mitigation measures into contractual conditions and obligations.

METHODOLOGY

Selection and collection of data

The focus of the research was on the relationship between mitigation measures identified in the EIS and actual conditions and obligations detailed in the development control decision. Consequently, the selection had to be based on developments that were subject

to planning control where permission had been granted, and where an EIA had been carried out.

Reference has already been made to the small proportion of planning applications that require an EIS (Weston, 2002). Other evidence suggests that many planning authorities have received few, if any, EISs (Gwilliam, 2002). Therefore, to ensure a viable sample size, an area approach was adopted for collection of the information, and the selection included all developments with an EIS from 1988, when the EIA regulations were first introduced, until 2003. Forty developments were identified from a group of local planning authorities in four counties in eastern England: Norfolk, Suffolk, Cambridgeshire and Hertfordshire. The spatial coverage of the developments is displayed in Figure 1. To ensure a range of development types, cases were included from district, county and unitary authority level. Table 1 sets out the selected developments categorised according to their main use from which it is clear that two categories, waste management facilities and mineral extraction, accounted for twenty five of the forty applications examined.

Data collection was carried out at the planning offices in two stages. Having identified the developments that fitted the criteria, all the mitigation measures proposed in the EISs were recorded For this research, no attempt was made to evaluate the significance of the measures proposed, or to analyse the quality of the EIS. A second stage involved studying the planning files for the developments, and recording the planning conditions from the decision notices. If the development had a Section 106 Agreement containing planning obligations, these were also recorded. Only those conditions and obligations relevant to impact mitigation were considered – all others, such as those concerning the timing of the development, were excluded. Clearly this approach is subject to error through mis-classification on behalf of the researcher, or through failure to identify mitigation measures, although a degree of consistency of interpretation is expected through the use of a single researcher for this task.

In addition, the EISs were examined to determine whether an EMP was in place, or whether there was any commitment to prepare one, as part of a strategy to improve the fulfilling of mitigation measures set out in the statement.

Data analysis

Therivel and Morris (2001) present advice on carrying out EIA in compliance with the UK EIA regulations and with the Environmental Assessment Directive. Their categorisation of environmental components was used in this research as it reflects those commonly discussed in UK EISs, although this list differs slightly from those components identified in the UK regulations. Thus, mitigation measures, planning conditions and obligations were categorised under the following: landscape; air and climate; water; ecology; soil and geology; noise; socio-economic; cultural heritage; and transport.

In addition, the mitigation measures were also classified into types taking into account the 'mitigation hierarchy' – 'avoid', 'reduce', 'repair', 'compensate' and 'enhance' (Mitchell, 1997).

For each of the development cases considered, data were also categorised according to the use of mitigation measures in development consent decisions: mitigation measures covered by conditions; mitigation measures covered by obligations; mitigations measures not covered by conditions or obligations; extra conditions not based on mitigation measures; extra obligations not based on mitigation measures.

As such, data gathered take the form of a frequency distribution using nominal data. The appropriate statistical technique for test hypotheses for such data is the goodness of fit chi-square test (Burns, 2000), although it is only possible to test associations to determine whether frequency distributions match a distribution predicted by the null hypothesis.

Chi square tests were thus carried out to determine whether environmental aspect has any influence on each of the five categories of the use of mitigation measures in development consent decisions. The null hypothesis being that there is no influence and similar numbers of mitigation measures, conditions, or obligations can expect to be recorded for each environmental aspect. This analysis was repeated for the types of mitigation measure with the null hypothesis being that there is no difference between the five type of mitigation measure and each of the five categories of the use of mitigation measures in development consent decisions.

Chi square tests are also suitable for data classified into categories based on two variables to check whether they are independent or associated (Burns, 2000). Contingency tables are used to test for the independence of row and column variables and, for these data, one contingency table was used to test the categories of use of mitigation measures against environmental aspect, and another to test the categories of use of mitigation measures against mitigation type.

The data for waste management facilities and mineral extractions were divided into applications submitted between 1988-97 and 1998-2003 (as these were the only development categories in the sample where the planning application had been accompanied by an EIS in the 1988-97 period) in order to assess whether the Department of the Environment Transport and the Region's (1997) study affected planning practice. The submission date was used in order to prevent applications prepared before the study was published, but determined after 1997, being categorised as having occurred after the study. This precaution thus avoided the possibility that those applications which were in the pipeline when the study was published could affect the analysis.

RESULTS AND DISCUSSION

Summary and overview

The results from the research into forty separate planning applications accompanied by EISs revealed that only a minority (686 or 42%) of the total mitigation measures identified from the examination of the EISs were covered by planning conditions; a further 133 (8%) were covered by obligations and 831 (50%) were not covered. The relatively high numbers of mitigation measures not covered by conditions in the planning permission, coupled with the large numbers (638) of extra conditions (i.e. those not deriving from mitigation measures proposed in the EIS), suggest that other factors are extremely important in formulating planning conditions relating to mitigation of environmental impacts.

Whilst the majority of planning obligations imposed (133 or 59%) covered mitigation measures identified in the EISs, a large minority (92 or 41%) of the obligations required were not mentioned in the statements. This suggests that other factors (apart from the

existence of an EIS) also play a key role in formulating obligations under the English development control system.

These findings (i.e. many mitigation measures are not converted into planning conditions, plus a large number of non-identified conditions and obligations are imposed) are in agreement with the Department of the Environment Transport and the Regions' (1997) study. A possible reason for this could be that changes in project design between EIS submission and the granting of permission may result in many mitigation measures being irrelevant (Department of the Environment Transport and the Regions, 1997; Frost, 1997). In addition, a degree of prioritisation will have to be exercised by the planning authority – the sheer number of conditions necessary to cover all the measures identified in an EIS may make decision making too complex (Department of the Environment Transport and the Regions, 1997; Department of the Environment Transport and the Regions, 1999).

Legitimate concern arises from the fact that half the mitigation measures recommended in the EISs are not addressed in the planning decision, meaning that their implementation would be discretionary. There could be a lack of commitment to put these measures in place, despite their being listed in the EIS (Morrison-Saunders *et al.*, 2001).

Turning to the relatively large proportion of extra planning conditions and obligations imposed, there are potentially several factors influencing this situation. Decisions on the trade-offs between permitting development and mitigation of expected impacts may occur at many stages in the planning process (Glasson *et al.*, 1999). In addition, consultations with statutory consultees and other interested parties can lead to extra conditions being formulated (Department of the Environment Transport and the Regions, 1997; Wood and Jones, 1997). More specifically, obligations beyond those detailed in an EIS can result from negotiations between interested parties (Department of the Environment, 1997a). As previously discussed, planning authorities may develop their own standard conditions, particularly if they have had relatively more experience of examining EISs, again possibly leading to more conditions being imposed (Department of the Environment Transport and the Regions, 1997). There may even be some cynical developers attempting to create an impression of making compromises with planning authorities, by

withholding mitigation measures until after the planning application is submitted (Singleton *et al.*, 1999).

At a summary level, all these influences could be operating to affect the coverage. The data were then analysed to examine whether environmental aspects, development types or types of mitigation exercised a significant influence.

Environmental Aspects

Figure 2 shows a clear difference in the proportion of mitigation measures covered by conditions and obligations between the environmental aspects, suggesting variable treatment. The null hypothesis for the Chi Square test was that environmental aspect had no significant effect on the use of mitigation measures in development consent decisions. Table 2 indicates that the null hypothesis is rejected for four of the use of mitigation measures categories at a confidence level of 99.9% showing that environmental aspect does have a significant effect on the use of mitigation measures in development consent decisions. The one remaining category, that of additional obligations imposed (not based on mitigation measures in the ES) could not be analysed due to insufficient data. A chi square test using a contingency table was carried out to determine if there was an association between the category of environmental aspect against the use of mitigation measures. Data based on additional obligations or conditions was omitted because of low data numbers in some environmental aspect categories (Burns, 2000) so the test was only against mitigation measures translated into conditions, obligations or not covered at all. The null hypothesis was that there was no association, and the result was a $?^2$ value of 129.1 (16 degrees of freedom). The null hypothesis was therefore rejected and we can say that the environmental aspect and use of mitigation measures are not independent variables.

An attempt was made to classify mitigation measures against environmental aspect to determine whether some common patterns could be detected. Clearly the data reflect two separate groups: the mitigation measures proposed reflect expertise and decisions on behalf of consultants and developers; the obligations and conditions imposed reflect expertise on behalf of planners. Figure 3 plots the additional number of conditions and obligations imposed (representing the views of planners and not those of developers/consultants) against mitigation measures which were not translated into

conditions or obligations (representing the views of consultants and developers and not those of planners). The idea is to identify differences in the treatment of the environmental aspects by the different groups involved and Figure 3 places the axes as the average number recorded.

Figure 4 also plots the total number of conditions and obligations imposed, but this time against the all mitigation measures suggested, whether translated into conditions or obligations or not, as such it compares the overall views of planners against the overall views of developers and consultants for each environmental aspect.

Figure 4 indicates that planners and developers/consultants agree over the importance of mitigating landscape impacts and that landscape mitigation measures detailed in the EISs influence the conditions imposed in the planning permissions, but also that other factors must have been used in setting the extra conditions (Figure 3). The inherent subjectivity in the evaluation of landscape impacts could be a contributory issue, since the quality and character of landscapes, and the significance of impacts on those landscapes, remains essentially a matter of judgement (Hankinson, 1999).

The number of extra conditions and obligations for 'soil and geology' (Figure 3) far exceeds the numbers of covered and uncovered mitigation measures (Figure 4), suggesting that mitigation for this aspect may be poorly addressed by the EISs and that the planning authorities have to rely on other factors when formulating conditions. There is extensive guidance available for both planners and developers on geological impacts (Hodson *et al.*, 2001), and soil protection and restoration in Planning Policy Guidance Note 7 (PPG7) (Department of the Environment, 1997b) and Minerals Planning Guidance Note 7 (MPG7) (Department of the Environment, 1996), leading to the suggestion that guidance directed primarily at planners is used primarily by planners, and that developers and consultants use other sources of guidance to direct their treatment of these issues.

Most EIAs do not address noise vibration effectively (Therivel and Breslin, 2001), and the evidence suggests that large numbers of additional conditions and obligations are not imposed by planners. The suggestion here is that better guidance might needed for all groups involved in order to better deal with noise impacts in EIA and in decision making.

Previous research has identified socio-economic impacts as the "The Poor Relations in British Environmental Impact Statements" (Glasson and Heaney, 1993; Chadwick, 2002). Research has further claimed that there is confusion amongst EIA practitioners over the need and scope for their inclusion, plus there is no clear government guidance on the treatment of these issues (Chadwick, 2002). This research, however, indicates that socio-economic impacts are very well represented in terms of suggested mitigation measures, and also by the numbers of additional conditions and obligations imposed, reflecting an understanding of their importance (see Figure 4). At the same time, it is clear from Figure 3 that there is significant disagreement between planners and developers/consultants, perhaps reflecting both the subjectivity of the issue and also confirming the lack of clear government guidance on the treatment of these issues.

The relatively low numbers of 'air and climate' mitigation measures suggested and the comparatively low number of extra conditions and obligations and even lower numbers of additional conditions and obligations suggest that this component is not addressed by the planning system alone. Other legislation, such as various pollution control regulations which are applied outside the planning system, could explain this apparently light touch in terms of conditions imposed (Elsom, 2001). Indeed, government guidance specifically states that the planning system should not formulate controls which will duplicate those required by other statutory bodies (Department of the Environment, 1995).

Morris *et al.* (2001) indicate that 'water' is well regulated and a large number of standards control water quality in particular. The fact that proposals for mitigation of water impacts are relatively abundant suggests this is an area with considerable expertise amongst consultants/developers. Figure 3 suggests that planners ignore a relatively high proportion of the mitigation measures proposed as well as imposing conditions and obligations of their own. This reflects a degree of disagreement which warrants further investigation.

Figure 3 and Figure 4 suggest agreement between planners and consultants/developers over the need to mitigate ecological impacts. Figure 3 suggests that consultants/developers emphasise these impacts slightly more than planners. It is notoriously difficult to predict the impacts of ecological changes arising from individual developments, due to unavailability of data, lack of understanding of complex ecosystem processes, and the problems of isolating the impacts related to a specific development

from cumulative or ongoing changes (Treweek, 1996; Atkinson *et al.*, 2000; Byron *et al.*, 2000; Morris and Emberton, 2001). Consequently, if the mitigation measures set out in the EIS are based on no more than vague predictions, it is not practical for the planning authority to set out specific conditions to achieve them.

The relatively small numbers of suggested mitigation measures and of imposed conditions obligations may be indicative of a need for a much more comprehensive approach to the assessment of cultural heritage impacts in the EIA process (Teller and Bond, 2002). There was very little disagreement between the planners and developers/consultant over this environmental aspect which, the evidence shows has assessment restricted to designated sites as opposed to public valuations of cultural heritage. The suggestion is that, if properly done, assessment of cultural heritage aspects should be more subjective, and guidance is being prepared to facilitate this (Bond *et al.*, 2004).

Mitigation Types

Mitchell's (1997) mitigation hierarchy advocates greater use of mitigation measures to avoid and reduce impacts, and, if this were followed in practice, the results would show preferential coverage of these mitigation types for both conditions and obligations.

The differences between coverage of different mitigation types (Figure 5 indicates the patterns for mitigations measures covered by conditions and obligations and those not covered, the pattern for additional conditions and obligations is the same) were found to be statistically significant (Table 3). In addition, a contingency table testing for an association between mitigation type and use of mitigation measures obtained a $?^2$ value of 36.2 (8 degrees of freedom). Data based on additional obligations or conditions was again omitted because of low data numbers in some environmental aspect categories (Burns, 2000) so the test was only against mitigation measures translated into conditions, obligations or not covered at all. The null hypothesis was therefore rejected and we can say that the mitigation type and use of mitigation measures are not independent variables.

The greatest number of planning conditions in the EISs (and in terms of extra conditions imposed) were for measures to reduce impacts, followed by those to avoid, repair,

enhance and compensate (Figure 5). The number of conditions for impact reduction was more than four times greater than the next highest mitigation type, clearly indicating that impact reduction is the preferred mitigation option for both developers and planning authorities. Relatively low numbers under the 'avoid' category could point to the fact that the relevant measures have already been implemented before the EIS has been presented, particularly those which do not affect the development significantly (Glasson *et al.*, 1999). On the other hand, it may be more cost-effective and less controversial to reduce impacts rather than avoid them altogether (Marshall, 2001).

The pattern of extra planning obligations is similar to that for conditions, although the differences are slight.

Change over time

Due to lack of availability of planning applications accompanied by an EIS, only two categories of development were included in this analysis: waste management facilities and mineral extractions. Figure 6 has normalised the data into the numbers per EIS to allow for different sample sizes in the two time periods under study (see Table 1). The figure suggests that there was no change in the average number of measures covered by either conditions or obligations between applications from 1988-1997 and 1998-2003. There was, however, nearly a doubling of the number of mitigation measures suggested in the EIS and not subsequently covered by conditions or obligations. A chi square test using a contingency table was carried to determine if there was an association between the two time periods and the use of mitigation measures (based on the original data prior to normalisation). The null hypothesis was that there was no association, and the result was a $?^2$ value of 39.6 (4 degrees of freedom). The null hypothesis was therefore rejected and we can say that the two time periods and the use of mitigation measures are not independent variables. It is, however, inappropriate to postulate that the DETR study (Department of the Environment Transport and the Regions, 1997) had influenced the use of mitigation measures as the sample size was small and many other reasons could also explain the association. Indeed, EIA legislation in the UK changed in 1999, during the second time period (see Table 5), and a contingency table examining the use of mitigation measures before and after the legislation was introduced provides a $?^2$ value of 18.4 (4 degrees of freedom) indicating that that the two time periods (before and after new

legislation was adopted in 1999) and the use of mitigation measures are not independent variables.

Where next for mitigation in EIA?

Results from this study, therefore, indicate that there is room for improvement both in terms of translating mitigation measures identified in EISs into conditions and obligations, and also in terms of increasing the relevance to decision makers of these issues in the presented EIS. In addition, it is not evident from the research that the availability of the research document (Department of the Environment Transport and the Regions, 1997) has led to a significant increase in planning authorities' use of mitigation measures covered in the EIS.

One solution to the problem of how to improve the effectiveness of EIA and planning in implementing mitigation could be the use of EMPs. As discussed previously, these plans have been promoted by the World Bank (1999b), but Figure 7 suggests that there has been a very low voluntary uptake of EMPs in England, at least in the sectors covered. This indicates that developers may be reluctant to expend extra time and resources on the preparation of another document which is not legally required. However, several developments in the study did use EMPs, or were committed to at least a partial plan. In addition, the Environment Agency has set an example and now recognises the use of Environmental Action Plans, EAPs (similar to EMPs), as a key component of good environmental practice (Hickie and Wade, 1997). Their experience shows that EAPs can be prepared relatively quickly with minimal extra cost if a standard format is used (Hickie and Wade, 1997). To increase their effectiveness EMPs would form the last section of EISs, and detail implementation arrangements and commitments for the mitigation proposed earlier in the EIS. To comply with best practice, they would also include monitoring and liaison arrangements, the objectives of the mitigation, and checklists to ensure that mitigation is effectively implemented (Hickie and Wade, 1997).

EMPs under this model would, therefore, play a key role in the implementation of mitigation measures, because they provide a link between the project planning phase, identification of impacts, and mitigation in EISs, and the construction and operational phases (World Bank, 1999b). Unlike EISs, EMPs can continue to evolve throughout the

project authorisation stage (Tomlinson, 1997), allowing the addition of any extra mitigation measures required by consultees and the planning authorities.

However, it is clear from the research and other studies (e.g. Brew and Lee, 1996) that the current situation in terms of the interrelationship between EIA and planning authorisations, will not lead to a significant increase in the voluntary uptake of EMPs. As a minimum requirement, guidance would be necessary, as recommended in the 1997 research report published by the Department for Environment, Transport and the Regions, for both developers and planning authorities, to ensure that EMPs are properly enforced by planning conditions and obligations. Even given this advance, there would still be significant changes necessary to the planning and EIA systems to ensure EMPs would be an effective tool in addressing the apparent shortfalls in implementation of mitigation measures.

A possible alternative to EMPs is the use of a schedule of mitigation commitments. This clarifies the mitigation measures a developer is committed to implementing and can be progressively updated as the project evolves (Carroll and Turpin, 2002). The schedules should include details of implementation and enforcement for the mitigation, although they require less detail than an EMP and may thus be more popular with developers. The aim of such mitigation schedules is to establish clearly the commitment of a developer to mitigation in a form which can easily be used as the basis for formulating planning conditions and obligations (Department of the Environment Transport and the Regions, 1997). Alternatively, planning conditions can require schemes of mitigation to be submitted before development begins (Department of the Environment Transport and the Regions, 1999). This allows the planning authority to ensure that an approved programme of mitigation is prepared and implemented.

Turning to the more general issues of how to improve the record of implementation of mitigation measures, then further advances are required. This issue was identified by the Environment Agency who suggest appropriate mitigation measures in their Scoping Handbook for a range of development types (Environment Agency, 2002). There is also a recognised need to improve the quality of EISs, since poor statement quality may be an important reason for the lack of reliance on the EIS in formulating conditions and obligations (Department of the Environment Transport and the Regions, 1997). In

addition, if EMPs or schedules of commitment are not used, the descriptions of mitigation in the EIS itself must be detailed and precise enough to enable them to be translated easily into planning conditions (Carroll and Turpin, 2002). Arguably, more guidance on the use of criteria in drafting effective mitigation measures would aid this process. Marshall (2001) has proposed criteria and frameworks which could be incorporated into such a guidance document.

5. CONCLUSIONS.

This research has demonstrated that approximately a half of mitigation measures in the EISs were found not to be covered by planning conditions or obligations, casting doubt over whether they would be implemented. Significant variations were found in the coverage of mitigation between different environmental aspects, further complicating the issue. The presence of large numbers of extra conditions and obligations not based on the EISs suggested that other factors, such as consultation and expert judgement, were also important in the drafting of planning controls. The proportion of extra conditions and obligations compared to those based on EISs and uncovered mitigation measures was shown to be influenced by environmental aspect.

These conclusions should be interpreted in the light of difficulties experienced in assigning mitigation measures to the various stages in the simplified version of Mitchell's (1997) mitigation hierarchy. Mitigation seems to behave as a continuum, rather than a series of discrete types, making it difficult to ascribe some of the measures to one particular stage in the hierarchy. This meant that the division was somewhat artificial, but care was taken to ensure consistency in the allocation of different 'types' to the various measures.

These findings all suggest that the English EIA and planning systems are not totally effective in ensuring that mitigation measures proposed in EISs are implemented. This is a great concern for the ability of the EIA process in England to combat environmental impacts, as "*mitigation measures are of little or no value unless they are implemented*" (Glasson *et al.*, 1999, p.156). Another critical point, however, is that the review of cases covered part of just one English planning region. The results do raise questions about the way in which mitigation measures are translated into planning conditions and obligations,

but it is not possible to assume the same conclusions are valid for other English regions, nor for Wales, Northern Ireland and Scotland.

A major improvement in the coverage of mitigation measures by planning conditions and obligations is thus suggested as being necessary to ensure increased implementation across the UK. However, the study has also found that publications which may have been expected to improve mitigation, in the form of Mitchell's (1997) mitigation hierarchy and the Department of the Environment Transport and the Regions' (1997) report, cannot be isolated as significant influences on the use of planning controls to secure mitigation. Therefore, the following recommendations are made to improve the effectiveness of the EIA and planning systems in ensuring mitigation implementation:

- Increase the use of EMPs to facilitate the formulation of conditions and obligations.
- Provide guidance to planning authorities to ensure that the contents of EMPs are covered by planning controls.
- If imposing mandatory EMPs is seen as impractical, the use of schedules of mitigation commitments or mitigation schemes is recommended instead.
- Improvements in EIS quality to facilitate the formulation of planning controls, possibly including the use of criteria for drafting mitigation measures.

Improvement in the implementation of mitigation measures is vital if EIA is to live up to its potential as an instrument to protect the environment and encourage sustainable development (Wood, 2003). This study has shown that there is much still to be done before the English EIA and planning systems become fully effective in ensuring this most crucial aspect of the EIA process. Other systems across Europe and in other parts of the world may suffer from similar weaknesses and further research will be needed to determine the extent of current practice of translating mitigation measures into enforceable obligations.

Whilst the research clearly suggests some failings in the translation of suggested mitigation measures into planning conditions and obligations, further research needs to not only investigate the scale of this problem (both in the UK and overseas), as mentioned above, it also needs to identify the reasons why this may happen. It may be that revealing

insights into the credibility of EIS predictions for certain environmental aspects, as perceived by decision makers, remain to be considered.

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Table 1 Categorisation of developments according to main use

- waste management facility (11 developments, 4 in 1988-1997 sample and 7 in 1998-2003)
- mineral extraction (14 developments, 3 in 1988-1997 sample and 11 in 1998-2003)
- residential (1 development)
- agricultural (2 developments)
- golf course (3 developments)
- commercial (1 development)
- industrial (1 development)
- road (2 developments)
- flood defence (1 development)
- mixed-use (4 developments)

Table 2 Results of the $?^2$ test testing for randomness of use of mitigation measures against environmental aspects

	landscape	air	water	ecology	soil	noise	socio	cultural	transport		$?^2$	d.f.	Significance level
conditions based on EIS	132	89	81	130	55	43	78	38	40		138.0	8	0.001
obligations based on EIS	7	4	25	46	1	9	25	5	11		114.6	8	0.001
not covered	55	79	149	169	56	79	156	23	65		235.7	8	0.001
extra conditions	149	25	71	42	131	61	83	9	67		236.2	8	0.001
extra obligations	10	0	7	28	2	0	15	5	25				

The analysis shows that the variation in the numbers of conditions based on the EIS, on the numbers of obligations based on the EIS, on the numbers of mitigation measures in the EIS not covered by obligations or conditions, and on the extra numbers of conditions across environmental aspect is not down to chance. That is, they are not equally distributed across the environmental aspects. There are too few data in some categories of environmental aspect for extra obligations not covered by mitigation measures in the EIS, hence no $?^2$ value has been calculated.

Table 3 Results of the ? ^{2} test testing for randomness of use of mitigation measures against mitigation level

	avoid	reduce	repair	compensate	enhance		? ^{2}	d.f.	Significance level
conditions based on EIS	92	430	60	16	88		807.9	4	0.001
obligations based on EIS	24	63	8	7	31		78.2	4	0.001
not covered	101	566	47	31	86		1221.5	4	0.001
extra conditions	106	430	79	2	21		951.5	4	0.001
extra obligations	17	46	7	6	16		57.2	4	0.001

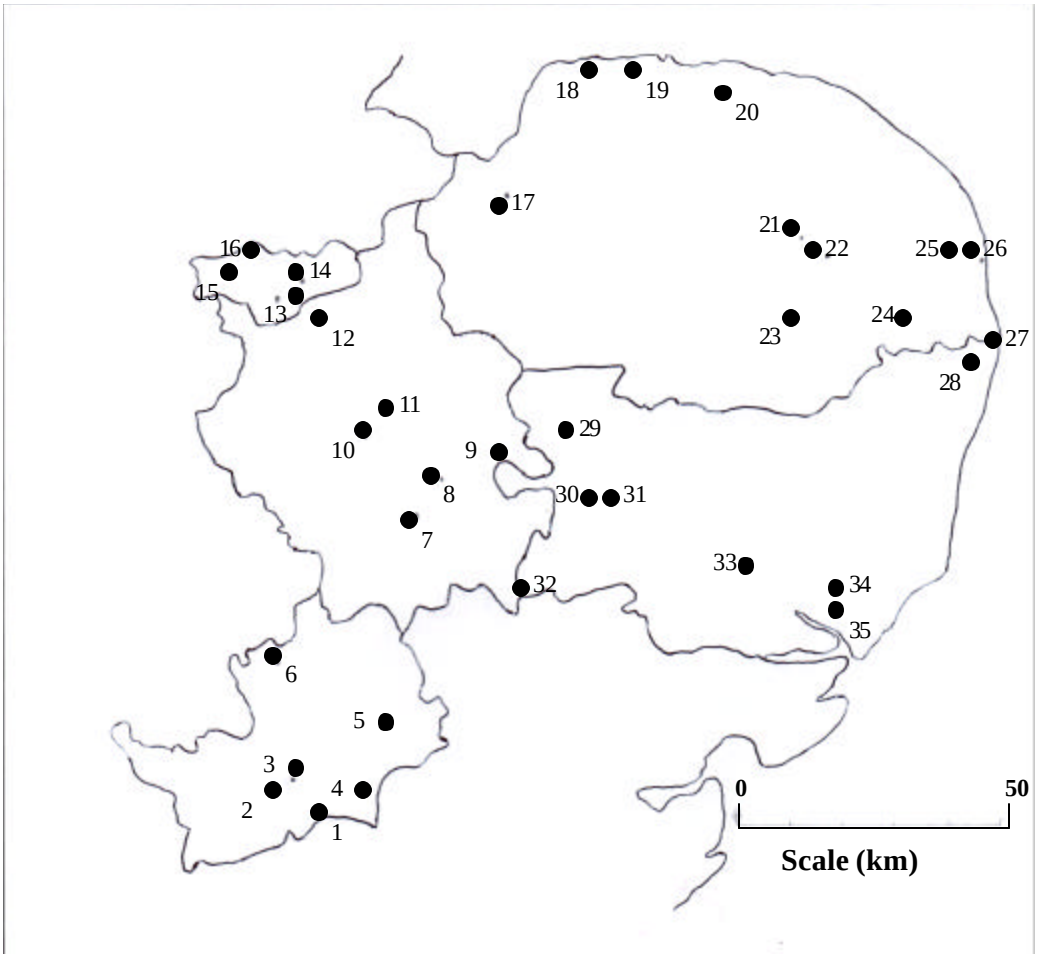
The analysis shows that the variation in the numbers of conditions based on the EIS, on the numbers of obligations based on the EIS, on the numbers of mitigation measures in the EIS not covered by obligations or conditions, and on the extra numbers of both conditions and obligations across mitigation types is not down to chance. That is, they are not equally distributed across the mitigation types.

Table 4 Use of mitigation measures before and after publication of report on mitigation measures in Environmental Statements (Department of the Environment Transport and the Regions, 1997)

	1988-1997	1998-2003
conditions based on EIS	122	307
obligations based on EIS	12	39
not covered	77	371
extra conditions	174	320
extra obligations	17	41

Table 5 Use of mitigation measures before and after adoption of new EIA legislation (Department of Environment Transport and the Regions, 1999)

	1988-1999	2000-2003
conditions based on EIS	312	117
obligations based on EIS	46	5
not covered	288	160
extra conditions	346	148
extra obligations	39	19



Key:

1 – Barnet.
2 – Tyttenhangar.
3 – Hatfield.
4 – Turnford.
5 – Colliers End.
6 – Holwell.
7 – Cambridge.
8 – Waterbeach.
9 – Fordham.
10 – Needingworth.
11 – Colne Fen.
12 – Whittlesey.
13 – Fletton.
14 – Eye (2 devs.).
15 – Southorpe.
16 – Maxey.
17 – King's Lynn (3 devs.)
18 – Brancaster (2 devs.).
19 – Burnham Overy.
20 – Holt.
21 – Costessey.
22 – Norwich.
23 – Tharston.
24 – Norton Subcourse.
25 – Halvergate Marshes.
26 – Great Yarmouth.
27 – Lowestoft.
28 – Gisleham.
29 – Lackford.
30 – Fornham (2 devs).
31 – Bury St Edmunds.
32 – Haverhill.
33 – Bramford.
34 – Foxhall.
35 – Bucklesham.

Figure 1 Locations of the developments studied.

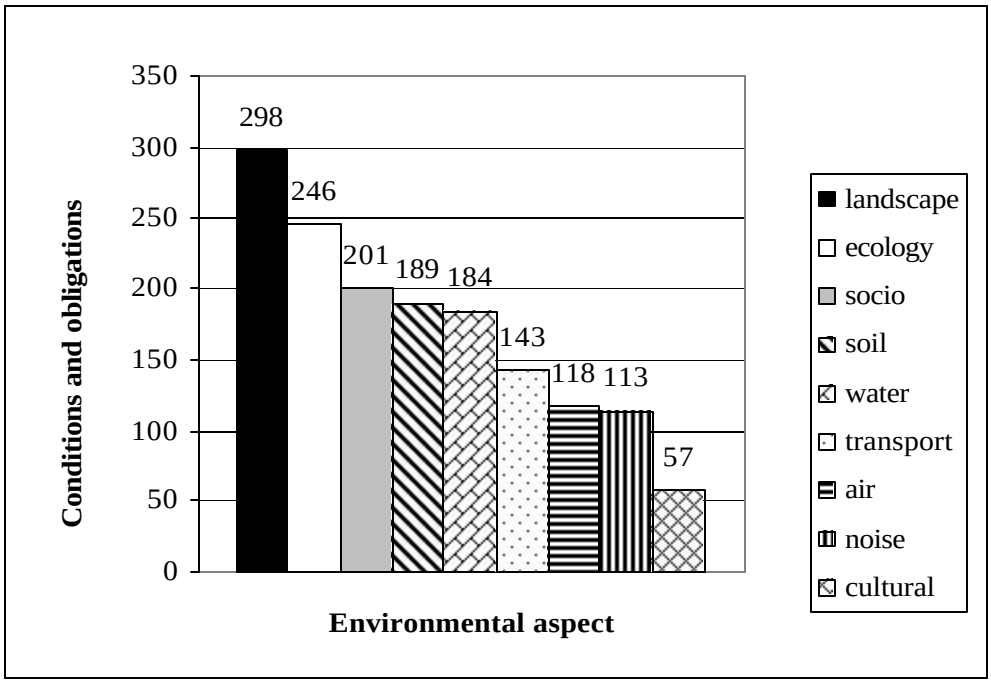


Figure 2 Numbers of conditions and obligations imposed on planning permissions, categorised by environmental aspect

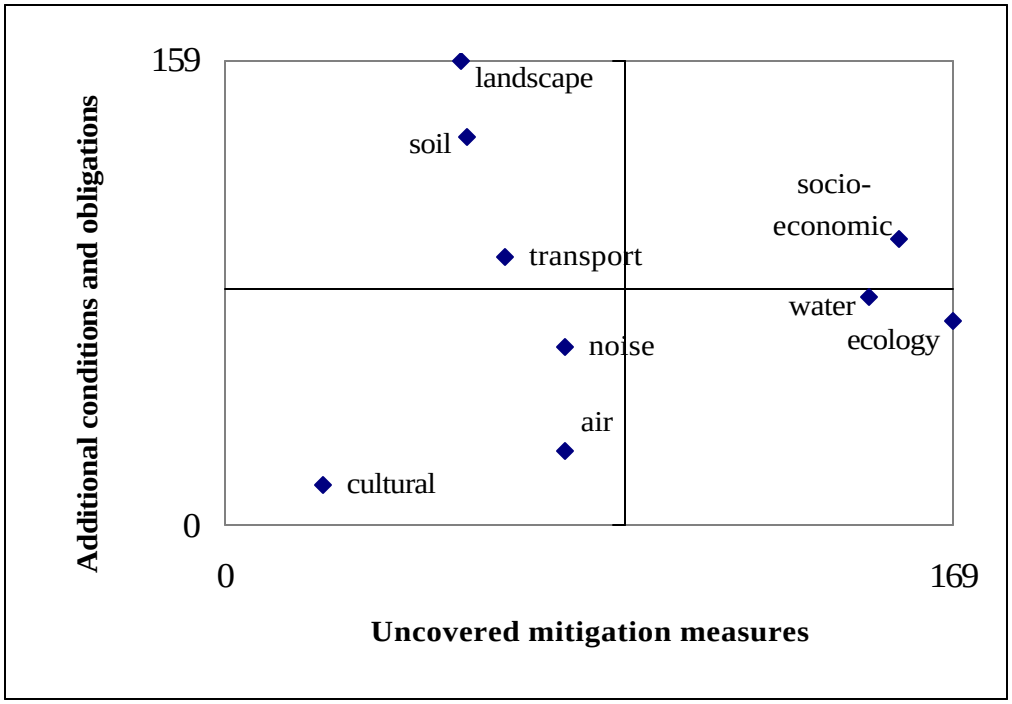


Figure 3 Numbers of additional conditions and obligations (not based on mitigation measures in the ES) imposed on planning decisions compared against the numbers of mitigation measures written into an ES but not imposed through conditions and obligations. The axes are drawn at the average value for each data set.

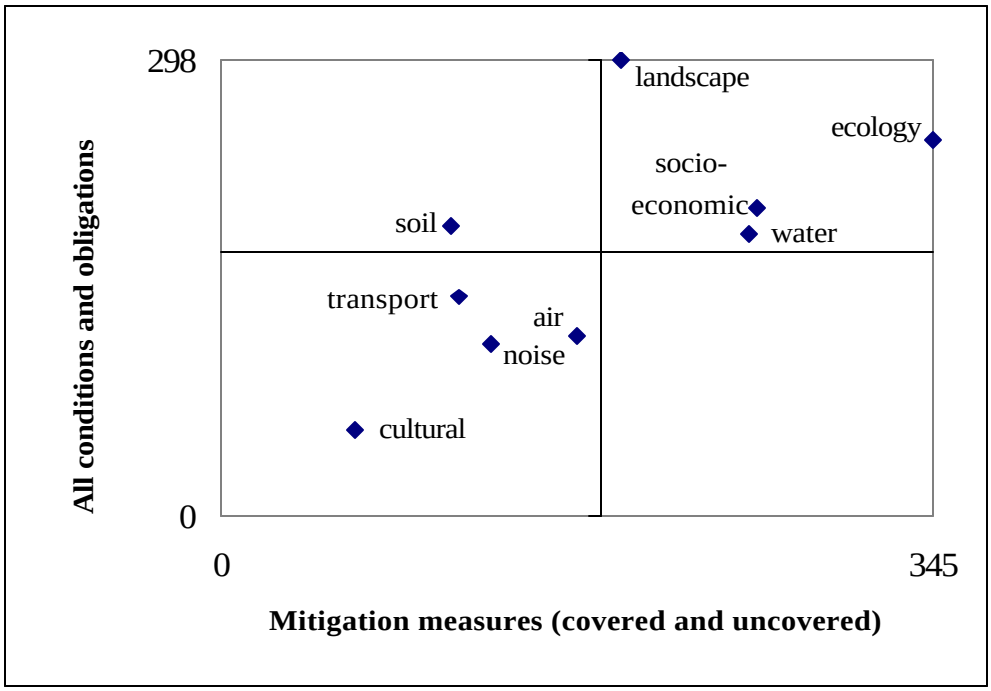


Figure 4 Total numbers of conditions and obligations imposed on planning decisions compared against the total numbers of mitigation measures written into an ES. The axes are drawn at the average value for e ach data set.

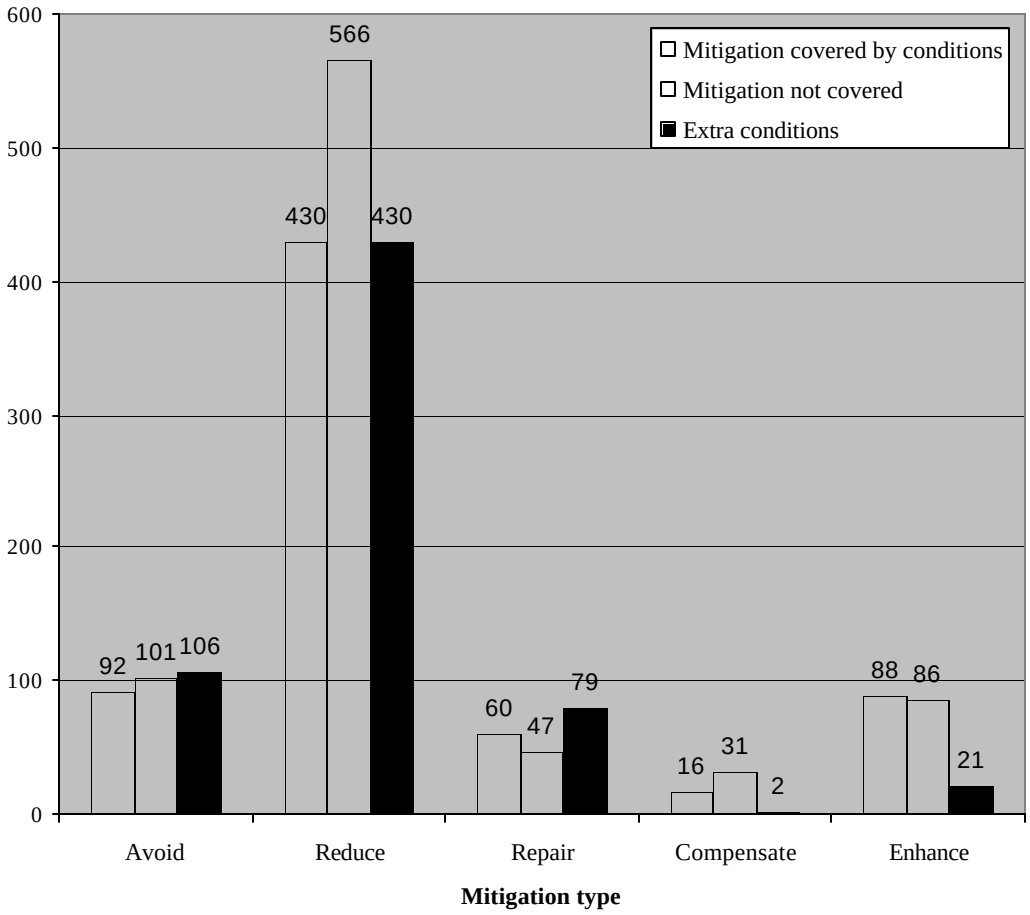


Figure 5 Coverage of mitigation measures by conditions, and the number of extra conditions, for different mitigation types

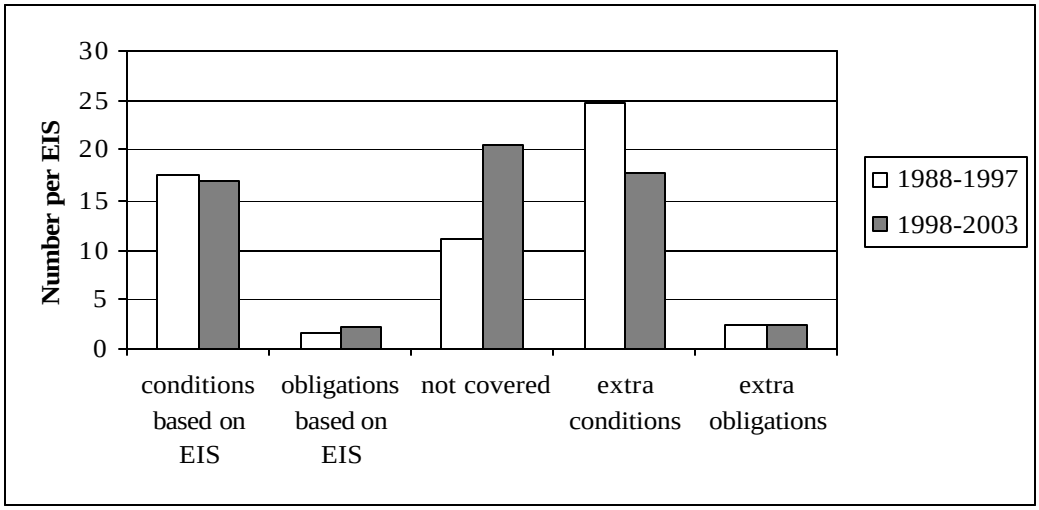


Figure 6 Use of mitigation measures before and after publication of report on mitigation measures in Environmental Statements (Department of the Environment Transport and the Regions, 1997), normalised per EIS.

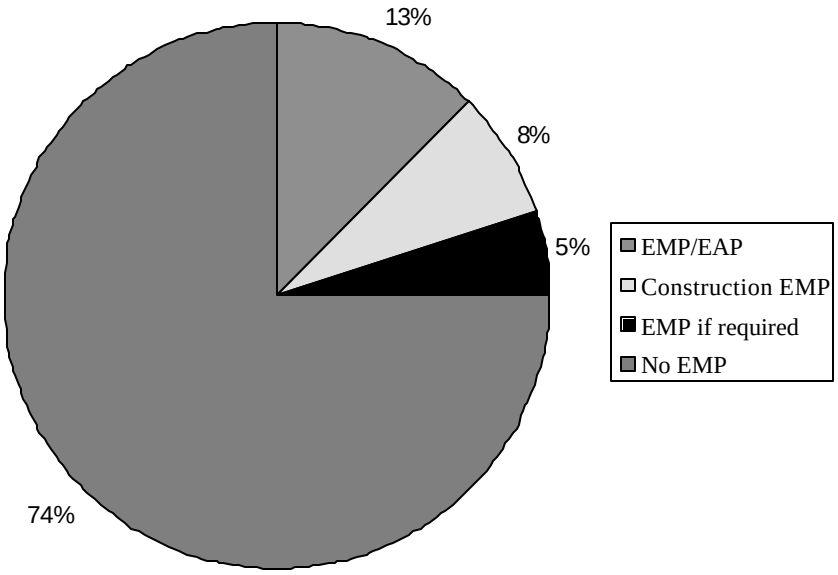


Figure 7 Percentage of developments with an EMP