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PUBLIC POLICY AND THE DIGITAL GEOSPATIAL REPRESENTATION OF DESIGNATED LAND USE IN THE UK – PART 1

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ABSTRACT – In the post-war period, since the National Parks and Access to the Countryside Act 1949, successive UK governments have developed policies for the management of land use and marine conservation. This process accelerated at the Millennium with the passage of the Countryside and Rights of Way Act. Now, in 2006, the present Government has promoted the passage through Parliament of both the Commons Act and the Natural Environment and Rural Communities Act, and a new Marine Bill is not far behind. If successful such measures will further expand and develop the means to secure and protect designated land and the marine environment. An important issue here is how the Government plans to embrace digital geospatial techniques in the development of policy towards the conservation and management of such geographic space. A more specific issue concerns the prospects for conversion from paper to digital form of maps of open country, commons, town and village greens and public rights of way that carry conclusive or definitive status in court. This paper, presented in two parts, looks at current developments and recent research on these topics and assesses the feasibility of such transition. In doing so it takes account of eGovernment and transformational policies and the mechanism to promote digitisation of records set out in the Electronic Communications Act 2000. It concludes that the adoption of geospatial techniques as a tool for developing policy towards designated land and the marine environment has much to commend it, as does development of a national geographic information strategy for government as a whole. Whilst the paper focuses on developments in UK law, the policy issues raised are applicable to all governments and jurisdictions.

PART I

1. Introduction

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Establishing legal identity in land designation is a growing and under-rated problem for policymakers, but one of considerable practical importance. The issue is, nevertheless, a familiar one for government lawyers, as it represents the legislative or evidential foundation upon which a great deal of policy-making depends. For the past ten years or so governments, in many jurisdictions, have been designing policies for the delivery of more efficient and effective public administration, through the utilisation of the information and communication technologies (ICT). In recent years this has led to the announcement by such administrations of eGovernment strategies. These are designed to create more accessible public services and improved information sharing, both within government and to the public at large and are built around more efficient engagement with digital technology. More recently, the vehicle of eGovernment has given way to a 'transformational agenda' in many jurisdictions.¹ The latter is more closely concerned with measuring the performance of government in relation to deployment of ICT than in discussing how to engineer the process itself. The need to improve the quality of a wide range of policies, measured by a test of 'public value', appears uppermost.

The practical outcome of much of this has involved considerable internal reorganisation within the public sector. For the UK the tendency has been to disperse the delivery of this agenda among a number of new policy units and offices within the Cabinet Office and HM Treasury. For local government the lead has been taken through the Office of the Deputy Prime Minister (ODPM). In May 2006, however, following a Cabinet 'reshuffle', it became the Department for Communities and Local Government (DCLG). Cutting across these developments, both at European and domestic level, is a 'better regulation agenda',² designed to reduce costs and unnecessary regulation, operating under the guiding principle that "less is more". At the same time there has been a general widening of the gap between policy making and delivery in the UK, evidenced by the growing number of agencies and statutory bodies applying policy in a range of different fields. Devolution has also contributed here. This trend can be particularly observed in the case of rural policy in terms of the management of designated land use. The efficient regulation of land use policy carries with it a high level of responsibility and the prospect of a broader range of government policies and service delivery obligations that intersect with that use. Improving the quality of land management through better coordination of the diffuse policies and duties involved, and improved communication between statutory undertakers, is increasingly vital to the success of this agenda.

The development of ICT has brought with it new tools to assist government in the performance of its central tasks. In terms of understanding the issues and building policies in respect of land use and the marine environment, the growth of tools based on digital spatial representation of such geographic space has been significant. Its

¹ See note 51, post. The new policy was announced by the Government during the 'Transforming Public Services Conference' that took place in Manchester in November 2005 under the UK Presidency of the EU. See further: <http://www.egov2005conference.gov.uk/>.

² *Regulation – Less is More – Reducing Burdens, Improving Outcomes – A BRTF report to the Prime Minister* (Better Regulation Task Force, March 2005). See further: http://www.betterregulation.gov.uk/about_us.aspx. See also *Reducing administrative burdens: effective inspection and enforcement* (Philip Hampton, HM Treasury March 2005). Delivery of this agenda is in the hands of a Better Regulation Executive, supported by an independent Better Regulation Commission.

topographic features and the capacity to add layers of added-value information offer a powerful resource to policy makers and other interested parties. At issue, however, is the extent to which the Government is making good use of digital geospatial resources to enhance land use and marine conservation policy or whether what is happening is taking place more by default than as a result of any purposeful strategy? There is also a question about government attitudes towards digital conversion of definitive paper maps and map registers that carry evidential value in court.

The objective of this paper, then, is to critically examine the extent to which digital geospatial resources are being successfully assimilated in UK administration of designated land use and policy towards the marine environment. It will be argued that such digital resources are becoming increasingly valuable as tools to assist understanding of the impact of policy and policy connections in these fields, with potential to contribute, at some future stage, to the management process itself. Part I of the paper begins with analysis of post war developments in designated land use and marine conservation policy in the UK. This is followed by discussion of the evolution of domestic mapping technology and geospatial resources. The central role of Ordnance Survey, working with successive governments to build an efficient spatial data infrastructure is identified and assessed, and linked to specific applications in the subject area.

Part II of the paper considers policy towards the establishment of conclusive and definitive maps and records in electronic formats. Specifically, it explores the legislative steps in the Commons Bill 2005 [HL 173] to permit digital conversion of registers of common land and greens, and for conclusive maps of access land provided for in the Countryside and Rights of Way Act 2000 (c.37) (CROW Act 2000). The case is presented for extending this approach to electronic definitive maps and statements of public rights of way under statutory powers available to trigger such action in the Electronic Communications Act 2000 (c.7) (ECA 2000). The paper concludes that adoption of a national geographic information strategy within UK public administration would benefit government as a whole and advance both existing policy for eGovernment as well as the new 'transformational government' agenda launched in 2005.

2. Post War developments in designated land use

Outside the framework of general land use planning and highways legislation, UK policy for land conservation, since World War II, has been driven by a legislative process that identifies and provides for specific areas or categories of land or land use. This has been accompanied by the formation of appropriate statutory bodies, with responsibility for the discharge of the obligations laid down for the purposes designated. This policy for conservation of the habitat, through site designation, is evidenced by the National Parks and Access to the Countryside Act 1949 (c.97) (NPACA 1949). Part II of NPACA 1949 provided for the designation of national parks and for the establishment of a National Parks Commission to oversee their management and conservation, in partnership with the relevant County Councils.³

³ The first 10 British national parks were designated in the 1950's. An eleventh "equivalent" was established in the Norfolk and Suffolk Broads in 1988. The New Forest was designated a national park

Section 87 also designated areas of outstanding natural beauty (AONB) outside National Parks supervision. Local Planning authorities were further given powers to conserve and enhance the areas identified. NPACA 1949 also built on the Rights of Way Act 1932 by establishing procedures for recording the existence and location of public rights of way (PROWs). This took place on definitive maps, representing conclusive evidence in court of the rights in question. These provisions were later replaced by the Wildlife and Countryside Act 1981 (c.69) (WCA 1981).⁴

In the 1960's there were further developments with common land and country parks. The Commons Registration Act 1965 (c.64) (CRA 1965) was introduced to establish definitive registers of common land in England and Wales. Commons, for the most part, comprise land which escaped inclosure in the 18th and 19th centuries. They range from "the large hill commons of Wales and the north and south west of England, to the smaller commons of south east England."⁵ The Countryside Act 1968 (c.41) also created country parks⁶ - areas of public open space, usually near towns and cities that provided a rural atmosphere. Responsibility for these passed to local authorities. Many country parks were designated in the 1970's. In the 1980's the process continued with the creation of sites with special scientific interest (SSSI). These were designated by section 28 WCA 1981 to create "areas of special interest by reason of their flora, fauna, geological or physiographical features..... the best examples of our natural heritage."⁷ The Act also established marine nature reserves (MNRs) with similar status to National Nature Reserves (NNRs).⁸

In the decade following, relevant legislation focused on improving the land management process. Measures also sought to enhance the quality of service and find better ways of achieving the original objectives implicit in the designations. The Rights of Way Act 1990 (c.24) made provision to control interference by farmers with rights of way, through ploughing or positioning of crops. New powers were granted to local authorities for this purpose. The Environmental Protection Act 1990 (c.43) reshaped the Nature Conservancy Council, handing responsibility for nature conservancy⁹ to bodies representing England, Scotland and Wales.¹⁰ A further

on 1 March 2005. The South Downs is currently in the process of completing its designation as a national park.

⁴ WCA 1981 (c.69), ss. 53-66.

⁵ About 936,000 hectares or 7% of the total land area of England (13,307,189 hectares) has been mapped as open country or registered common land. *Countryside Agency's media briefing – Introduction of the Countryside and Rights of Way Act 2000, Part I* (27 October 2005). See: <http://www.defra.gov.uk/wildlife-countryside/cl/accessopen/briefing.pdf>.

⁶ There are approximately 250 designated country parks in the UK.

⁷ www.defra.gov.uk/wildlife-countryside/cl/bill/factsheet/. Around 5,000 sites have been identified. From 1949 local authorities were notified of SSSI by Nature Conservancy so that this could be taken into account during the planning process.

⁸ www.naturenet.net/status/mnr.html. The site reports that only a handful of sites have yet been designated. NNRs are of national importance, usually owned and managed by statutory authorities under Ss16-29 NPACA 1949. Section 21 also provided for the designation of local nature reserves containing wildlife or geographic features of special local interest.

⁹ Under section 131(6) of the Act, "nature conservation" means the conservation of flora, fauna or geological or physiographical features.

¹⁰ In 1991, following the passage of the Environmental Protection Act, 1990 and the Natural Heritage (Scotland) Act, 1991, the Nature Conservancy Council was regionalised by division into English Nature, Scottish Natural Heritage, and the Countryside Council for Wales, with the Joint Nature Conservation Committee acting as a national coordinating body for these three country agencies. Source: en.wikipedia.org/wiki/Nature_Conservancy_Council.

measure, in the form of the Environment Act 1995 (c.25), gave each National Park its own National Parks Authority (NPA). Each was vested with statutory duties to conserve and enhance “the natural beauty, wildlife and cultural heritage of the areas specified ...[while] promoting opportunities for the understanding and enjoyment of the special qualities of those areas by the public.”¹¹ New agencies and standards were also established for environmental protection.¹²

Significant further changes to the regulatory framework of designated land use took place in 2000 with the passage of CROW Act 2000. The Act introduced a new right for the general public to “enter and remain on any access land for the purposes of open-air recreation.”¹³ By section 1, “access land” includes registered common land as well as “open country”, i.e. land that the appropriate countryside body for England and Wales identifies as consisting “wholly or predominantly of mountain, moor, heath or down.”¹⁴ Section 4 imposed a duty on the appropriate agency to map all access land and to produce ‘conclusive maps’ (as defined by section 9) once the process of issuing draft maps and dealing with appeals was undertaken and completed. Such maps were required to distinguish between open country and registered common land, although there was no obligation to distinguish between the different categories of open country. By section 11 (3) of the Act, the power to issue regulations was granted to permit publication in electronic form, provided the same map was capable of being reproduced as a printed copy. On 31 October 2005 the new ‘right to roam’ came into effect across the whole of England, embracing an area of 4000 square miles. According to the Countryside Agency (CAg), 80% of the land was ‘new’ access land to which, up to 2005, no statutory right of access existed.¹⁵

Of particular significance for future development of accurate definitive maps is the introduction of a scheme, set out in CROW Act 2000, to identify presently unrecorded PROWs and to set a cut-off date for this purpose. Sections 53-56 of the Act stipulate that those rights of way in existence before 1949, that have remained unrecorded, will not be added to the definitive map after 1 January 2026. The date is extended by five years with respect to unrecorded PROWs that came into being after 1949.¹⁶ The CAg, at the request of the Government, has since commenced a “lost ways” project,

¹¹ Environment Act 1995 c.25 s. 61(1) substituting s.5(1) NPACA 1949 c97. See further: www.nationalparks.gov.uk/index/anpa_core/work_of_the_parks.htm.

¹² The Environment Agency of England and Wales took over the roles and responsibilities of the National Rivers Authority, Her Majesty’s Inspectorate of Pollution (HMIP) and the waste regulation authorities in England and Wales including the London Waste Regulation Authority. All of the predecessor bodies were disbanded and the local authorities relinquished their waste regulatory role. Source: http://en.wikipedia.org/wiki/Environment_Agency.

¹³ CROW Act 2000 c.37 s.2(1).

¹⁴ Ibid s.1(2). The appropriate countryside body for England is the Countryside Agency and for Wales, the Countryside Council for Wales. “Mountain” is defined as “any land situated for than 600 metres above sea level.” Exceptions to access land are listed in Schedule 1 of the Act.

¹⁵ See note 108, post. Source: www.defra.gov.uk/wildlife-countryside/cl/accessopen/briefing.pdf. The Forestry Commission for example has dedicated 700 square miles of forestry as ‘access land’. The Countryside Agency, which is funded by DEFRA, was established by the Government in 1999 to “conserve and enhance England’s countryside, spread social and economic opportunity for the people who live there, and, help everyone, wherever they live and whatever their background to enjoy the countryside and share in this priceless asset.” Its role is changing following the 2004 publication of DEFRA’s *Rural Strategy*. See further:

www.countryside.gov.uk/WhoWeAreAndWhatWeDo/Index.asp.

¹⁶ Section 55 introduces similar arrangements for bridleways.

designed to locate and register as many PROWs and bridleways as can be found within the designated period.¹⁷

In 2005-06 the accelerating trend towards further regulation of designated land continued with the passage of two additional measures through their Parliamentary stages. The Commons Bill 2005¹⁸ was introduced in the House of Lords on 27 June 2005 with the aim of improving the commons registration system brought in by CRA 1965. This includes a statutory process for the establishment of electronic registers. It also restricts de-registration or severance of common land in order to preserve its continuity.¹⁹ In addition, the Bill provides scope for the Secretary of State, or National Assembly of Wales, to appoint statutory Commons Associations (CAs) to bring commoners, landowners and other interested parties together to manage commons more effectively and, in particular, to develop sustainable agricultural use.²⁰ Schemes can be introduced in respect of agricultural activities and the management of vegetation and rights of common.²¹

A second measure is the Natural Environment and Rural Communities Act 2006 (c.16) (NERC Act 2006) which implements key aspects of the Government's Rural Strategy that was published by the Department for Environment Food and Rural Affairs (DEFRA) in 2004.²² This includes the merger into a single independent integrated agency – Natural England – of the functions previously discharged by English Nature, the CAg and the Rural Development Service (a DEFRA Directorate). The aim is for Natural England to "ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations".²³ It must also "work in close partnership with other organisations that have a major role in relation to the natural environment; in particular the Environment Agency, the Forestry Commission and English Heritage."²⁴ Within this framework, a Commission for Rural Communities is also established to represent Natural England in promoting "rural needs", i.e. the social and economic needs of the inhabitants of rural areas.²⁵ The Act also extends to all public authorities duties to conserve biodiversity,²⁶ and

¹⁷ Ss. 53-56 CROW Act 2000. See further: www.countryside.gov.uk/LAR/Recreation/DLW/index.asp. See further note 228, post.

¹⁸ Commons Bill [HL 49] 2005. See:

www.publications.parliament.uk/pa/ld200506/ldbills/049/2006049.htm. The current version of the Bill as of 22 June 2006 is Commons Bill [HL 173] as amended in Standing Committee D and ordered to be printed on 27 April 2006. See: <http://www.publications.parliament.uk/pa/pabills.htm#c>.

¹⁹ Ibid Part I – Registration. Clause 16 [HL 173] provides a number of conditions for deregistration with powers to turn down applications, e.g., if not in the interests of the neighbourhood. Clause 9 provides a prohibition on severance of commons rights designed to prevent commoners from selling, leasing or letting their rights away from the property to which the rights are attached. See note 164, post.

²⁰ Ibid Part 2 – Management. See further, note 162, post.

²¹ *Commons Bill 2005* [HL 49] *Explanatory Note*, clause 27. See:

www.publications.parliament.uk/pa/ld200506/ldbills/011/en/06011x--.htm. See further note 160 post.

²² *Rural Strategy 2004* (DEFRA, July 2004) at:

www.defra.gov.uk/rural/pdfs/strategy/rural_strategy_2004.pdf. The Bill received Royal Assent on 30 March 2006.

²³ NERC Act 2006, s.2 (1).

²⁴ *Natural Environment and Rural Communities Bill – Explanatory Notes*, 13 October 2005 at: www.publications.parliament.uk/pa/cm200506/cmbills/003/en/06003x--.htm.

²⁵ NERC Act 2006, Chapter 2. The new Commission will take over some of the functions of the CAg.

²⁶ In 1993, the UK government consulted over three hundred organisations throughout the UK and held a two day seminar to debate the key issues raised by the Convention on Biological Diversity (see:

strengthens the law governing pesticides harmful to wildlife, the protection of birds, the treatment of invasive non-native species, enforcement powers in connection with wildlife, and the protection of SSSIs.²⁷ Thus, the trend to create ‘distance’ between the policy and delivery functions in environmental regulation continues.

In addition to the statutory land designations just outlined, additional classifications of land use for various conservation purposes are provided via EU directives and other international treaties that relate to the United Kingdom or the waters around it. For example, the EC Directive on the Conservation of Wild Birds²⁸ provides, in Article 4, for the identification of Special Protection Areas (SPAs). This deals with the conservation of species either in danger of extinction, vulnerable to changes in habitat, or otherwise considered rare or in need of special attention. A total of 246 SPAs have been classified in the UK to date, with another 13 under consideration.²⁹ In addition, the EC Species and Habitats Directive³⁰ creates protected Special Areas of Conservation (SACs), designed to conserve the 189 habitat types and 788 animal and plant species (excluding birds) considered most in need of protection.³¹ 608 designations have been made so far in respect of the UK, covering an area of 4.36 million hectares.³²

More recently there has also been considerable regulatory activity in relation to water, where accurate digital spatial representation of the designation and character of geographic space can offer a potential planning and management tool. The Water Framework Directive³³ imposes water quality standards on all inland and coastal water authorities by 2015.³⁴ This will require the precise identification of inland surface waters, transitional waters, coastal waters and groundwater areas in relation to which a variety of obligations and duties arise. This has been implemented in the UK by statutory instrument in respect of river basin districts in England and Wales.³⁵

<http://www.biodiv.org/default.shtml>). The product of this was the launch of ‘Biodiversity: the UK Action Plan’ in 1994. The UK Biodiversity Partnership replaced the UK Biodiversity Group in 2002. See: www.ukbap.org.uk/default.aspx.

The new provisions are found in Part 3 NERC Act 2006, ss. 40-42.

²⁷ NERC Act 2006 ss. 43-58.

²⁸ Council Directive of 2 April 1979 on the conservation of wild birds (79/409/EEC); europa.eu.int/eurlex/en/consleg/pdf/1979/en_1979L0409_do_001.pdf. The directive was introduced in response to the 1979 Bern Convention on the conservation of European habitats and species. The annexes identifying species were amended by the Environment Chapter of the Treaty of Accession 2003.

²⁹ SPA sites cover an area of 1.482 million hectares in the UK. Source: <http://www.jncc.gov.uk/page-1399>.

³⁰ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. The directive has been transposed into UK law by The Conservation (Natural Habitats, &c.) Regulations 1994 SI 1994 No.2716. See also note 87, post.

³¹ 76 such habitats and 43 species are considered native to, and normally resident in the UK. Source: www.jncc.gov.uk/page-23.

³² This covers SAC’s adopted by the European Commission and formally designated by the Government of the Member State (i.e. UK); Sites of Community Importance (SCI’s) adopted but not yet formally designated and Candidate or possible SAC’s submitted or being considered for submission to the EC.

³³ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for community action in the field of water policy.

See: europa.eu.int/eur-lex/pri/en/oj/dat/2000/l_327/l_32720001222en00010072.pdf.

³⁴ Ibid see Article 4.

³⁵ The Water Environment (Water Framework Directive (England and Wales) Regulations 2003 (SI 2003 No. 3242) at: www.opsi.gov.uk/si/si2003/20033242.htm. See further note 87, post.

Also, the Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention)³⁶ provides an international framework for protecting the marine environment and addressing sources of pollution that might affect the maritime area.³⁷ The OSPAR Commission³⁸ also operates strategies for marine protection in relation to biological diversity and ecosystems, eutrophication,³⁹ hazardous substances, offshore oil and gas, and radioactive substances.

In terms of the marine environment, a substantial amount of work is currently underway to implement the Government's vision for "clean, healthy, safe, productive and biologically diverse oceans and seas". In December 2004 the Prime Minister and Secretary of State for DEFRA launched the Department's five year strategy.⁴⁰ This included plans for a new Marine Bill which also became a Manifesto commitment for the re-elected Labour Government in 2005. The 2005 Queen's Speech committed the Government to publication of a draft Bill by November 2006.⁴¹ The aim of the Bill will be to provide an improved system for ensuring sustainable development of the marine and coastal environment that will tackle both the use and protection of marine resources and the conflicting demands imposed by energy, aggregates, shipping and fishing.

Implicit within the proposal for the Bill is the acceptance that governance of the marine environment can only be protected through integrated stewardship, involving all the relevant interests and statutory undertakers.⁴² The point has been made that,

³⁶ Convention for the Protection of the Marine Environment of the North-east Atlantic adopted in Paris on 22 September 1992. See: www.ospar.org/eng/html/welcome.html. It replaces the earlier Oslo and Paris Conventions. See further: www.ospar.org/eng/html/welcome.html. The Convention came into force in 1998 supported by the original 14 contracting states.

³⁷ The OSPAR Commission website states that the sea area covered by the Oslo Convention 1972, the Paris Convention 1974 and the OSPAR Convention 1992 is the North-East Atlantic. This is defined as "extending westwards to the east coast of Greenland, eastwards to the continental North Sea coast, south to the Straits of Gibraltar and northwards to the North Pole. This maritime area does not include the Baltic or Mediterranean seas; the Helsinki and Barcelona Conventions apply in these sea areas." Source: www.ospar.org/eng/html/welcome.html.

³⁸ The OSPAR Commission is the forum through which the contracting parties cooperate.

³⁹ "Eutrophication" means "the enrichment of water by nutrients causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned, and therefore refers to the undesirable effects resulting from anthropogenic enrichment by nutrients as described in the OSPAR Common Procedure. Source: www.ospar.org/eng/html/welcome.html.

⁴⁰ *Delivering the Essentials of Life – Defra's Five Year Strategy* Cm 6411 (presented to Parliament by the Secretary of State for Environment, Food and Rural Affairs by Command of Her Majesty, December 2004) See: <http://www.defra.gov.uk/corporate/5year-strategy/index.htm>.

⁴¹ On 29 March 2006 a consultation document on the Marine Bill was published viz., *A Marine Bill – A consultation document of the Department for Environment, Food and Rural Affairs* (DEFRA, March 2006). The consultation covered "four key areas: planning in the marine area, licensing marine activities, how to take forward marine nature conservation proposals and the potential for a new marine management organisation". The consultation period closed on 23 June 2006. For details of the Bill itself see: www.defra.gov.uk/environment/water/marine/uk/policy/marine-bill/key.htm.

⁴² *Safeguarding our Seas- A Strategy for the Conservation and Sustainable Development of our Marine Environment* (DEFRA May 2002) at:

www.defra.gov.uk/environment/water/marine/uk/stewardship/pdf/marine_stewardship.pdf. The first integrated assessment of the state of the seas across the whole continental shelf took place in March 2005: *Charting Progress – An Integrated Assessment of the State of UK Seas* (Scottish Executive, Department of the Environment, Welsh Assembly Government and DEFRA, 1 March 2005) at: www.defra.gov.uk/environment/water/marine/uk/stateofsea/chartprogress.pdf. See further note 85 et seq, post.

whereas a reasonably well developed land use planning system exists in the UK, there is no overall framework in existence for planning the use of the sea.⁴³ To remedy this problem the Government has proposed a Marine Spatial Planning (MSP) model for the management of activities in the marine environment. The Department for Environment, Food and Rural Affairs (DEFRA) has offered a definition of the concept as “a strategic plan for regulating, managing and protecting the marine environment that addresses the multiple, cumulative and potentially conflicting uses of the sea”.⁴⁴ The plan is seen as a better way of ensuring that sectoral activities, for example oil and gas development, permit the wider context to be considered during strategic environmental assessments. If good plans can be produced, developers will have a clearer advance indication of what types of development might be acceptable, while regulators will be better able to address the “cumulative impacts on marine biodiversity of multiple developments in a given area”. The upshot of that could be “sustainable development” that includes “economic, social and environmental objectives”.⁴⁵

This paper could continue to identify an ever more detailed breakdown of categories of land, land use and marine areas, identified by a regular stream of new designations and duties. Such categorisations encompass major conservation issues related to climate change, earth heritage, animal species, plants and habitats etc., in addition to further delineations arising from statutory obligations, already discussed, placed on responsible authorities here in the UK. On top of these is the extensive range of related designations of land, marine uses and boundaries arising, inter alia, from planning, housing, utilities, health and safety, defence, emergency services and other service obligations. In times of emergency, accurate geospatial information will be crucial to an effective response of the kind that might be required, for example, in the event of the spread of avian influenza in the UK.⁴⁶ Similarly, the need for accurate and in some cases conclusive maps, preferably available in digital form to the public at large, is a necessary requirement where individuals may be exposed to civil or criminal liability in respect of activities or events taking place within geographic space. A range of control orders or permissive licensing may also be involved, in which case the availability of accurate geographic information may be crucial to understanding and performance of the duty. If Government and its appointed agencies are to administer these responsibilities to the best of their ability, the relevant designations of land and marine uses will need to be spatially identified and the links and intersections, both physically and in terms of responsibility, made clear.

Suffice it to say that government faces a major challenge here if it is to grasp this complexity and develop modern management solutions to embrace these responsibilities. All governments operate at a level of inefficiency. Mistakes and

⁴³ *Potential benefits of marine spatial planning to economic activity in the UK* (Final report to RSPB by GHK Consulting Ltd, in association with Scott Wilson, December 2004) para 1.2 at: www.rspb.org.uk/Images/MSPUK_tcm5-66082.pdf.

⁴⁴ *Safeguarding Sea Life – The Joint UK response to the Review of Marine Nature Conservation* (Welsh Assembly Government, Department of Agriculture and Rural Development, Scottish Executive and DEFRA, December 2005) p.32 Recommendation 7 at: www.defra.gov.uk/wildlife-countryside/ewd/rmnc/pdf/rmnc-review-1205.pdf.

⁴⁵ Speech by Elliot Morley MP, Minister of State, Climate Change and Environment at the “Coastal Futures 2005” conference, The Brunei Gallery SOAS University of London 19 January 2005.

⁴⁶ See for example, *Consultation on plans to implement Council Directive 2005/94/EC on the control of avian influenza* (DEFRA 13 February 2006).

inefficiencies are an inevitable part of the process of planning and decision making within a democracy. However, the policy issue here concerns the failure, until recently, of public administration to approach land use planning as a whole and begin to utilise geospatial planning techniques in policy development of the kind now proposed for the marine environment. The potential exists for the expansion of digital geospatial tools among a wide range of planning and management tasks affecting land and land use.⁴⁷ Arguably what is needed to support this process is a geographic information strategy. This might help determine when such techniques should be applied, what technical specification should be adopted in each case and who should be involved in developing and accessing the tools concerned.⁴⁸ The additional formulation of schemes for conclusive and definitive maps might also add value to the policy and help determine priorities for implementation.

Evidence that the Government has recognised this issue came in April 2005 with the appointment of an independent Geographic Information Panel (GI Panel). Its terms of reference were defined on appointment as offering “high-level advice to ODPM Ministers on geographic information issues of national importance for the United Kingdom” and encouraging “more effective, extensive and systematic use of geographic information” within the public sector.⁴⁹ The Panel commented at the time that an effective GI strategy would reduce duplication and cost thus ensuring “effective and consistent provision, management and utilisation of geographic information, to support and sustain the needs of the citizen, business and government”.⁵⁰

It is submitted that, while public administration has of course over time developed its land use planning capabilities, digital geospatial techniques can add value to such activities and, in so doing, contribute something to the Government’s modernisation and now ‘transformational government’ agendas. The process of utilising ICT to improve the delivery of public services could be applied across a wide range of public sector activities.⁵¹ As a result, policy insights might be gained, the cumulative effect being to offer the potential of improved performance and cost efficiencies in the

⁴⁷ For example, accurate digital maps of ‘set-aside land’ under the Single Payment Scheme supported by satellite imagery to test compliance would go a long way towards eradicating fraud and securing land management that is compliant with environmental considerations.

⁴⁸ See further: Dr. Stephen Saxby, ‘Public policy and the development of a UK National Geographic Information strategy’, [2006] 14 *International Journal of Law and Information Technology* No. 2 pp. 147-194. See also note 229, post.

⁴⁹ See further: <http://www.gipanel.org.uk/gipanel/announcement.html>. Composition of the group aims to balance the interests of the GI community. Its Chair is Vanessa Lawrence, Director General and Chief Executive of Ordnance Survey.

⁵⁰ *Work to date on GI strategies in the United Kingdom – Background Paper* GIP 1/05 (Geographic Information Panel, 16 March 2005).

⁵¹ There is a substantial volume of official publications on this issue. See further: Dr. Stephen Saxby, ‘A critical analysis of the synergy between eGovernment and related policies in the UK’ [2006] 12 *C.T.L.R.* Issue 6. Sources of original eGovernment policy, published in 1999-2000, are: *Modernising Government* Cm 4310 (The Stationery Office, London, March 1999); *eGovernment: a strategic framework for public services in the information age* (Cabinet Office, April 2000); *Successful IT: Modernising the Government in Action* (Cabinet Office, May 2000); and *Electronic Government Services in the 21st Century* (Performance and Innovation Unit, Cabinet Office, September 2000). The move to a ‘transformation’ policy came in 2005-06 with *Transformational Government – Enabled by Technology*, Cm6683 (The Cabinet Office, November 2005); *Transformational Local Government-Discussion Paper* (Cabinet Office, Chief Information Officer Council, 28 March 2006); and *Transformational Government – Implementation Plan* (Cabinet Office, 29 March 2006).

delivery of such tasks that might never have been achievable prior to digitisation. In the context of land use planning, geospatial techniques will have an important role to play in providing the base lines for studies and monitoring the impacts of policies and their delivery. Whilst it is right to caution against attributing too much, too soon, to the contribution of geospatial techniques as a management tool,⁵² such a role should not be ruled out or underestimated in the future.

Within the conservation arena the challenge is clear. At a basic level the different land and marine uses and designations need to be mapped. Traditionally that would have been on paper. Now such data can be held and interrogated digitally in databases and communicated via computer screens and mobile devices. Increasingly this encompasses spatial satellite imagery as well. Consideration of an aspect of this issue surfaced, in the mid 1990's, when the then Department of Environment (DOE)⁵³ began to argue that there was a "paucity of information about the extent and distribution of land use in the United Kingdom," which was detrimental to good government.⁵⁴ Research conducted during this period suggested a need for basic data from which to "monitor changes in land use in both urban and rural environments".⁵⁵ To accomplish this task the DOE and its successor departments drew on the continuing work of the Natural Environment Research Council (NERC) in maintaining the Countryside Survey⁵⁶ and to Ordnance Survey (OS®) for assistance in developing geospatial tools. In the UK the history of mapping and, therefore, of exploitation of geospatial representation i.e. information that is referenced by geographic location, goes back two centuries. In OS lies a pool of expertise that spans this entire period.

3. Key stages in the development of mapping technology

In practical terms the UK has already gone quite some way towards establishing standards and infrastructure for possible development of the geospatial model just described. The history of map making and its transition from offline to online format can be firmly linked to the work of Ordnance Survey which has, for many decades, developed and maintained a national UK topographic database, now known as the

⁵² I am grateful to the reviewers of this paper for making this point.

⁵³ The DoE subsequently became the Department for the Environment, Transport and the Regions (DETR); then Department for Transport, Local Government and the Regions (DTLR). This became the Office of the Deputy Prime Minister (ODPM) in May 2002, following machinery of government changes. ODPM became the Department for Communities and Local Government (DCLG) in May 2006. Environmental policy on sustainable development passed to the new Department for Environment Food and Rural Affairs (DEFRA) on its establishment in June 2001.

⁵⁴ *Full National Land Use Database: County Demonstrator* (Infoterra Limited for Office of the Deputy Prime Minister, November 2005) p. 9. For further notes 94-99 & 102, post.

⁵⁵ *Ibid.*

⁵⁶ The Government and its partners have for 20 years supported a major programme of monitoring the countryside. The most recent study *Countryside Survey 2000* was conducted by the Centre for Ecology and Hydrology of NERC and co-funded by DEFRA. See <http://www.cs2000.org.uk/>. The data obtained was used in the development of Land Cover Map 2000. See: http://www.cs2000.org.uk/mod7_info.htm and *Countryside Survey 2000 Module 7 Land Cover Map 2000 Final Report* (Centre for Ecology and Hydrology, NERC, 1 March 2002). See also: *Countryside Information for Policy – The lessons from CS2000* Compiled by Prof. David Briggs – A report on behalf of DEFRA and CEH, NERC, 3 January 2003).

National Geographic Database (NGD).⁵⁷ In its offline existence the physical form of the map defined its nature. This was “usually a rectangular sheet of paper with a simplified abstraction of part of the world’s surface depicted on it.”⁵⁸ When the first national set of mapping was completed in 1895 it was based on a scale of 25 inches to the mile.⁵⁹ Later on, in 1938, following the Davidson Committee Report,⁶⁰ retriangulation into a national grid system⁶¹ took place, based on the international metre unit of measurement. Further improvements subsequently occurred in photographic and printing technologies. These gradually increased scope for more complex depictions of features, including the use of colour.⁶²

Initial elementary engagement with digital technology during the 1970’s resulted in progression towards greater complexity in the use of “width, colour and line type as part of the plot program”. This could distinguish, for example, “building outlines from road edges.”⁶³ But more significantly, the concept of a ‘map’ as a ‘data set’ accessible by screen display emerged. Through use of software, crude forms of ‘processing’ map data became possible for the first time. This led in 1971 to the commencement of a project by OS to digitise its 230,000 large scale paper map sheets. The primary purpose was to secure efficiencies in internal map production.⁶⁴ The first generation of the NGD was completed in 1995.⁶⁵ This underpinned the launch of OS’ first ‘flagship’ digital business product - ‘Land-Line®’ - and other data sets.⁶⁶ Land-Line comprised, in effect, a set of digital lines depicting man-made and natural features. These ranged from houses, factories, roads and rivers to marshland and administrative boundaries. The data were drawn to three separate scales: 1:1,250 for urban (larger towns, cities); 1:2,500 for rural (rural areas, small towns); and 1:10,000 for moorland (sparsely populated areas, mountains and estuaries).⁶⁷ Due to its linear structure Land-Line was limited, however, to the extent that a geographic feature, such as a building boundary, would be recognisable only as a building boundary rather than the actual

⁵⁷ See further: *Annual Report and Accounts 2004-05* (Ordnance Survey, 23 June 2005) pp. 48 & 51.

⁵⁸ Dr. Robert Barr, OSMM – the vision – How Ordnance Survey led the world in the creation of a new type of national geospatial data set, *GI News March/April 2004*, p. 30.

⁵⁹ Vanessa Lawrence, *The changing role of national mapping organisations: A case study of Ordnance Survey* at: www.gisdevelopment.net/policy/international/pdf/mi04003.pdf.

⁶⁰ *Ministry of Agriculture and Fisheries, Final Report of the Departmental Committee on the Ordnance Survey*, Chair: Viscount Davidson (London, HMSO 1938 SO Code: 1938 24.142). The Report recommended that “a National Grid should be superimposed on all large scale plans and on smaller scale maps, to provide one reference system for the maps of the whole country.” See further: www.ordnancesurvey.co.uk/oswebsite/freefun/geofacts/geo0667.html.

⁶¹ A metric grid based on the Transverse Mercator Projection developed by Ordnance Survey in 1936 for use in Great Britain. Referred to in GIS by the code "OSGB36[®]" it is the *de facto* standard projection for display of mapping in Great Britain. Triangulation was a traditional cartographer’s technique using triangles to calculate the position of points relative to base lines.

⁶² Colour was first used on large scale maps in the 1880-1890’s – using hand colour washes to highlight buildings and rivers etc.

⁶³ Op cit note 58 ante, p. 30.

⁶⁴ Op cit note 59 ante.

⁶⁵ The database required 36 gigabytes of storage space at that time and about 1000 tiles of data, representing individual map sheets, were updated each day through various types of update activity. Source: *Ordnance Survey Annual Report and Accounts 1999-2000*, p. 17 at: www.ordnancesurvey.co.uk/oswebsite/aboutus/reports/annualreport/99-00/docs/00artext.pdf.

⁶⁶ Full details of the range of OS business products available can be found at: www.ordnancesurvey.co.uk/osweb site/ products/. Data from this programme has been available to customers since the early 1980’s. However, in 1992 it was decided to give the product a brand name to ease identification and description as other OS digital mapping data sets began to emerge.

⁶⁷ See: www.ordnancesurvey.co.uk/oswebsite/products/landline/.

physical feature occupying that space. The boundary line would not disclose, for example, whether the physical structure concerned was a fence or a party wall.⁶⁸

In April 2000, a further important step forward was taken when OS announced a programme to convert the “unstructured, tile-based data” of Land-Line into an “object-based, seamless data set” that would form the basis of its new second generation digital product - OS MasterMap® (OSMM).⁶⁹ As its name implies, Land-line was primarily a set of digital lines coded according to what those lines depicted.⁷⁰ In OSMM, however, real-world objects would be represented by closed polygons⁷¹ and depicted as a series of area, point, line and text features.⁷² This would offer greater scope, accuracy and versatility in digital mapping that would assist policymakers in the sense of the additional data it disclosed and the new applications to which it could be applied. To make this transition possible, every fixed feature of Land-Line needed to be “cleaned, restructured, polygonised and reclassified” so as to create the Topographic Layer of OSMM. It was decided to locate these topographic features within nine themes: roads, tracks and paths; land; buildings; water; rail; height; heritage; structures; and administrative boundaries.⁷³ Each feature was also assigned a unique topographical identifier (TOID)⁷⁴ linked to a polygon that defined a particular feature on the database. Within a year more than 400 million TOIDs were produced, although this has always been a movable number as demolitions and new build projects change the TOID count.⁷⁵

OSMM was launched by OS in November 2001 using 1:1,250, 1:2,500 and 1:10,000 scales in its Topography Layer for urban, rural and mountain/moorland areas respectively. This represented its most “detailed, flexible and intelligent” mapping product to date.⁷⁶ It was structured in a manner compliant with the Digital National Framework (DNF) - the industry standard for “integrating and sharing business and geographic information from multiple sources.”⁷⁷ Since 1999 the DNF has evolved as an ‘open initiative’ with the aim of becoming a “definitive, inclusive, structured, reliable, cost effective and flexible means for integrating all kinds of information that has location as a common denominator”. OSMM has provided the main foundation for the DNF, giving users the power to select precise geographical areas within the

⁶⁸ Ibid.

⁶⁹ *OSMM® User Guide Product Specification V6.0.1* (Ordnance Survey, October 2005) p. 150. OSMM is currently at version 6.1.

⁷⁰ Op cit note 58 ante, p. 30.

⁷¹ A polygon is defined as a closed line or perimeter which completely encloses a contiguous space and is made up of one or more links that may be shared between polygons.

⁷² A complete list of the real-world objects and their feature representations in the Topography Layer is given in the *OSMM Real-World Object Catalogue* (v1.0 November 2001) at: <http://www.ordnancesurvey.co.uk/oswebsite/products/osmastermap/pdf/realWorldObjectCatalogue.pdf>. Concepts such as a boundary without a physical presence can also be depicted e.g. by a red dashed line.

⁷³ Op cit note 59 ante, p 5.

⁷⁴ A TOID is a 16 digit integer that uniquely identifies the feature it represents. It holds no intelligence as such and is allocated sequentially as updates occur to the database. Data associated to the TOID is data attached to the whole feature.

⁷⁵ Op cit note 58 ante, p. 30. When streets, addresses and other data are added to the new integrated database it will exceed 1 billion items very quickly.

⁷⁶ *Pan-government portfolio* (Ordnance Survey at: www.ordnancesurvey.co.uk/oswebsite/business/sectors/government/central/pga/pan-government-portfolio.pdf, p.4.

⁷⁷ *Introducing the Digital National Framework*, at: www.dnf.org.

specific themes required, such as roads or buildings etc., and to integrate them, if desired, within the customers' own specific data sets. As such, it offers greater potential for the exploitation of digital geospatial information within government administration than did Land-Line.

OS makes five quantifiable quality statements for OSMM, which is important to maintaining the integrity and currency of the product and its value to government. The most important of these is positional accuracy. To a great extent the history of map making⁷⁸ is inextricably linked to the development of tools, such as the map, to translate the physical world into an ever more accurate and detailed model. The systematic breakdown of Great Britain into progressively smaller grid areas, as part of the National Grid,⁷⁹ provoked the first set of approximations to be made to maps that, up to that point, had been based on much less precise projections.⁸⁰ There were problems, in particular, with the 1:2500 conversion in rural areas that had been derived from the old County map series that predated the National Grid. In such cases positional errors of up to 13 metres were identified. Such concerns led, in April 2001, to the launch of the OS Positional Accuracy Improvement Programme (PAI) for the 1:2,500 scale. This is designed to resolve inaccuracies over a five year period using a uniform resurvey specification.⁸¹ OS argued that modern quality standards demanded greater accuracy, particularly now that new tools such as Global Positioning System (GPS)⁸² surveying technology and digitally scanned aerial photography were available for the collection of mapping data. The PAI programme then is a major 'one off' exercise, taking place outside the normal five year updating cycle for rural revision.

The speed with which OSMM has come into being creating a seamless, layered geospatial database of geographic information for Great Britain is no small achievement. This is especially so given the fact that, by using common standards and principles defined within the DNF, the path is open for OSMM to become a template for a wide range of GIS applications within Great Britain. Such has been OSMM's success that a timetable for the withdrawal of its Land-Line predecessor after March 2008 is now firmly under consideration.⁸³

4. Digital geospatial technology and its potential as a policy tool

⁷⁸ For a guide to small scale maps of Ordnance Survey held in the British Library see: www.bl.uk/collections/map_os_smallscale.html#6.

⁷⁹ See notes 59-62 ante. The introduction of the National Grid after 1938 led to map scales being changed. 6" to one mile became 1:10,000; 25" to one mile became 1:2,500 and 50" to one mile became 1:1,250.

⁸⁰ Until the 1940's, for example, the County series of maps in the UK existed on their own local projections. Source: Timms, D'Souza and Kaira, Positional accuracy improvement – what it means and what to do, *GI News* Jan/Feb 2003.

⁸¹ Ibid. The full programme involves upgrading rural areas mainly through aerial photographic methods and small towns involving more ground re-survey work upgrading to 1:1,250 survey specification in some cases. See: *Project Acacia Pilot Project Research Topic 5 – Impact of OSMM/PAI Dichotomy* (Acacia Research Sub Group 5, June 2004, p. 4 at: www.ordnancesurvey.co.uk/oswebsite/aboutus/reports/acacia/AcaciaRT5_ReportImpactofOSMMPAIDichotomyv2.2.pdf).

⁸² For more information on GPS see: www.gps.gov.uk.

⁸³ *Public consultation on the withdrawal of Ordnance Survey Land-Line large-scale data set – summary of results and next steps* (Ordnance Survey, November 2005).

The bold decision by the incoming Director General of OS to order work to commence on a 'DNF compatible' conversion of the NGD was an act of faith in the concept that an over-worked OS remarkably achieved within a 14 month timescale.⁸⁴ It is submitted that, as a tool, OSMM and the pool of knowledge and experience gained through its development, has much to offer other data providers, policy makers and statutory undertakers as they build their own managerial capabilities in relation to land management and marine conservation. By embracing the vision of the evolving DNF, including now its extension offshore, OSMM has delivered a flexible tool for potential geospatial integration of all kinds of information.

For example, through collaboration between OS, British Geological Survey (BGS) and UK Hydrographic Office (UKHO), an integrated coastal zone mapping project (ICZMap®) commenced in April 2001 and ran for two years. The result is the staged development of a marine topographic map produced by SeaZone Solutions Ltd., (SSL) - a company set up by UKHO. SSL is "working closely" with OS to ensure that its marine base reference information is "interoperable at the coast with OSMM". It also now extends the DNF to UK territorial water limits⁸⁵ and satisfies the need for "joined up data at the land-sea interface" welcomed by the 145 local authorities with responsibility for the coastline. During the course of the ICZMap project the case was stated thus:

"Historically the coastline has formed the boundary of Ordnance Survey mapping (down to mean low water) and United Kingdom Hydrographic Office chart data (up to mean high water). An integrated approach to the management of the coastal zone is therefore being investigated. The provision of geographic information is important in this context. A major problem is the way this information is currently made available to the public, managers and policy makers. Currently it is only available as diverse terrestrial and marine data sets from various providers, not as an integrated and accessible common package from one source."⁸⁶

The key drivers here are legislation, such as the Water Framework and Habitats directives, and the need to assess the risks arising from climate change, coastal erosion and flooding.⁸⁷ OS asserts that this initiative will assist the Government in fulfilling its commitment to monitor and assess these impacts and help it conduct research into potential solutions. It argues that providing data sets that are "readily interoperable" will "drastically reduce the time spent in data preparation and

⁸⁴ For a more detailed picture of the task facing OS see Dr. Robert Barr's paper op cit note 58 ante.

⁸⁵ This is accomplished by a new mapping product 'SeaZone Hydrospatial'. See further: <http://www.seazone.com/pressreleases/SZPR5%20DNF.pdf>. See also Dr. Mike Osborne, SeaZone Solutions Ltd., 'Extending the Digital National Framework Offshore' at: <http://www.dnf.org/Publications> and <http://www.seazone.com/dnf.htm>.

⁸⁶ See further: <http://www.iczmap.com/iczmap/background/>. The coastal zone is defined initially as 5km inland and 20km offshore, inclusive of tidal rivers. This may change, however, as a result of "user consultation and as the needs of the partnership organisations emerge". The project came at a time when UKHO had created electronic navigation charts for UK waters, BGS had digitised their holdings (the Digimap series) and OS had launched OSMM. OS observed that "the industry had move on and in the new data economy 'interoperability' between such definitive data sets" was a "key need". Ibid note 87, post p. Ev 140.

⁸⁷ *Marine Environment Sixth Report of Session 2003-2004 – Report, together with formal minutes, oral and written evidence* HC 76 (including HC 1285-I Session 2002-03 (House of Commons Environment, Food and Rural Affairs Committee, The Stationery Office, 21 March 2004) Memorandum submitted by the Ordnance Survey Ev 140-143. See also notes 30-35 ante.

independent consultancy” and produce a “common framework upon which decisions at the coastline could be shared”.

At the core of OSMM is its ability to “link multiple information sources to a definitive location reference” through unique identifiers – TOIDS - within a ‘create once, use many’ model environment.⁸⁸ Its endorsement of DNF principles, moreover, has the potential to widen adoption of the standard, with resulting future benefits for data sharing of the kind just illustrated. It will also stimulate reduced costs in data handling and maintenance. OSMM, by adhering to the guiding principles of the DNF, has committed itself to the positive requirement that data should be “captured at the highest resolution whenever economically possible”. This offers the prospect of a more versatile resource for a wider range of applications.⁸⁹ The DNF’s adherence to information integrity in georeferencing is also met in OSMM’s ‘intelligent’ feature-based Topography Layer data set, through its quality assurance statements, PAI and cyclical updating programmes.

In terms of land management, the potential of OSMM as a geospatial planning tool is best illustrated by the Government’s response to the perceived information gap, identified in the 1990’s, as to the extent and distribution of land use in England.⁹⁰ Out of this grew a proposal for a National Land Use Database (NLUD). Its objective was to “develop a complete, consistent and detailed geographical record” of land use and land cover⁹¹ in England that would be kept up to date. The aim was to deliver information to users that fulfilled certain business criteria.⁹² The release of OSMM in 2001 added impetus to the project since it underpinned the emerging DNF. In this respect OSMM was unlike contemporary data sets such as Land Cover Map 2000 (LCM2000) which had not followed suit due, in part, to its overlap in development with the DNF.⁹³ A pilot study, funded by the Department for Transport, Local Government and the Regions (now DCLG), considered the potential of OSMM for development of a “standardised land use classification to support integration of data from multiple sources”.⁹⁴ Subsequent research involving both OS and ODPM, created data sets with complete land use classification covering both urban and rural areas. To complete this task, a number of potential sources were investigated for obtaining the land use attributes. These included feature codes and text from OS digital mapping; ODPM land use change statistics; aerial photography; satellite and address-based data; and third party public sector data sets. The initial research concluded that

⁸⁸ Op cit notes 74-75 ante.

⁸⁹ Keith Murray, Bern Munday and Ian Bush, ‘United Kingdom Enabling Information Integrity within Spatial Data Infrastructures - The Digital National Framework Concept’, From Pharaohs to Geoinformatics FIG Working Week 2005 and GSDI-8 Cairo, Egypt April 16-21, 2005, p. 4.

⁹⁰ See note 54 ante.

⁹¹ The NLUD classification distinguishes between land use and land cover as separate dimensions of the land.

⁹² Op cit note 54 ante p. 9.

⁹³ See: http://www.cs2000.org.uk/mod7_info.htm. However, development of LCM2007 does appear to be moving tentatively in the DNF direction. See further: http://www.ceh.ac.uk/sections/seo/lcm_quest.html. The NLUD initiative is also developing a database of previously developed land and buildings in England (NLUD-PDL) that may be available for development, whether vacant, derelict or still in productive use. A data set for the whole country or for individual local authorities can be viewed at: www.iggi.gov.uk/nlud/nlud_default.asp.

⁹⁴ Op cit note 54, ante. The NLUD Pilot Study involved the generation of land use products for twelve sample sites in both urban and rural environments.

“significant levels of coverage and accuracy could be achieved” by attaching land use attributes to OSMM.⁹⁵

Current research has further explored the NLUD classification scheme in a County Demonstrator project that seeks to improve the methodology developed for the pilot study and to “test the effectiveness of its application over a wide area.”⁹⁶ The researchers also reported on progress made in allocating land use and land cover intelligence to OSMM polygons. This was essential given that OSMM’s Topography Layer does not prescribe formal land use classification. Although certain land use information can be derived from the descriptive attributes of OSMM features, such as the uses made of some buildings and structures e.g. as schools, public houses etc., the Topography Layer does not indicate the use, as such, or necessarily the land cover type at the location in question. The NLUD classification scheme has now come through several iterations. Its Version 4.4 which was developed and tested during the project period, contains 13 land use and 10 land cover classifications, broken down thereafter into groups of more detailed listings.⁹⁷ The project team⁹⁸ concluded that OSMM polygon data formed “an excellent topographic map base for land cover and land use mapping.”⁹⁹

The initial development of these applications, in conjunction with OSMM, creates new opportunities for agencies, such as the National Parks Authority, Natural England, the Forestry Commission and local authorities etc. They can now begin to adapt and develop this resource in the discharge of their own statutory conservation and land management obligations. This can be accomplished with greater spatial accuracy and polygon definition than has been the case up to now with LCM2000. ODPM anticipated that this collaboration would “provide a consistent nomenclature for land-based classification” across all parts and tiers of government and that, in due

⁹⁵ *National Land Use Database of Previously-Developed Land (NLUD-PDL)* at: www.nlud.org.uk/draft_one/baseline_pdl/baseline_index.htm. Among the data sets used in the pilot study were OS Address-Point; Code-Point; Valuation Office National Non-Domestic Rates (NNDR); Land Cover Map 2000 (LCM2000); and the Forestry Commission Woodland Inventory. Other data sets “researched and found useful for the County phase” were National Buildings Dataset; NLUD Previously Developed Land (PDL); OSCAR road data; and the Thomson and YellowPoint business directories (NBDS). LCM2000 data was used to populate OSMM polygons in rural environments and was used in a similar way in the County Demonstrator project.

⁹⁶ Op cit note 54 ante, p. 9. The former county of South Yorkshire, comprising the districts of Barnsley, Rotherham, Doncaster and Sheffield was selected for this research as it offered a range of urban environments, from small rural hamlets to large conurbations, with the rural landscape varying from managed agricultural fields to upland moor and heathland. The project reported completion rates of 99.5% for land cover and 82% for land use (increasing to 90.5% when inferred methods were taken into account).

⁹⁷ The land use classifications are: agricultural and fisheries; forestry; minerals; recreation and leisure; transport; utilities and infrastructure; residential; community services; retail; industry and business; previously developed land; defence; and unused land. Land cover classification consists of: cropped land; grass; woodland and shrub; heathland and bog; inland rock; water and wetland; coastal features; buildings and structures; permanent made surfaces; and general land surfaces. Source: *National Land Use Database (NLUD) Land Use and Land Cover Classification Version 4.4* (28 March 2003) at: www.nlud.org.uk/draft_one/land_use_class/pdf/NLUD_v44.pdf.

⁹⁸ The NLUD is now a partnership project between the Improvement & Development Agency (Local Government Information House), the ODPM, English Partnerships – the National Regeneration Agency, and Ordnance Survey.

⁹⁹ Op cit note 54 ante, p. 82.

course, it might become a de facto national standard.¹⁰⁰ It asserted that the two dimensional approach towards land use and land cover offered a flexible and effective classification scheme, particularly where the two were classified simultaneously and therefore capable of serving many different uses and applications.¹⁰¹ It is submitted that this form of collaborative arrangement, using OSMM, is illustrative of the kind of model that might be adopted by other projects in the future.

At issue, however, is where OS decides to draw the line in terms of adding to its own base line product specification. Over time it can expect pressure to be brought from a number of users and potential users to add new themes, features and other data attributes to the OSMM template. Once agreed upon, however, all such additions must thereafter be maintained. Careful judgment must therefore be exercised by OS to deal with customer requests for the integration of new features into its base map design. Decisions will need to be taken on an continuing basis to determine where changes would be prudent and beneficial to OSMM's evolution.¹⁰² Such changes are likely to be those that facilitate widespread 'added-value' to the customer base, enabling the latter to maximise their exploitation of the product. This contrasts with specific costly new commitments that may have only narrow application within the market place. This issue is likely to become more complex still should OS find itself reliant upon third party sources of data supply. OS must also be mindful of the fiscal rules that govern its operations. As a Trading Fund operator, OS is mandated to pay its way from the revenue generated from its commercial activities. In its case, this must come from the sale of maps and geospatial data sets, as well as income from licensing agreements reached with commercial partners. As its shareholding department OS must also make a return, through dividend payments, to HM Treasury.¹⁰³

A successful example of collaboration in the exploitation of OSMM has taken place between the CAg and Black & Veatch Consulting Information Solutions Group (BVC).¹⁰⁴ The latter has developed a long standing relationship with OS and is part of the OS Developer Programme. This offers "technical support to individuals or companies who have location or map-based applications or service ideas they want to develop for the market place."¹⁰⁵ CROW Act 2000 places a duty on the CAg to map the new access rights granted under the Act in respect of open country (mountain,

¹⁰⁰ See: www.nlud.org.uk/draft_one/land_use_class/land_use_class_index.htm.

¹⁰¹ Ibid.

¹⁰² For example the development of three dimensional data sets within OSMM. The NLUD County Demonstrator project suggested that a two dimensional topographic data set was not "entirely suitable for the complex three dimensional patterns of land use which are common in urban environments e.g. a multiple storey building with an underground car park, a retail complex at ground level, and numerous offices above."

¹⁰³ Under the framework document presented to Parliament by the ODPM in July 2004 OS is also required to make an average return of 5.5% on the capital it employs – currently around £40 million. Public debate on this issue surfaced in 2006 with the 'Free our Data' campaign by *The Guardian Newspaper* at <http://www.freeourdata.org.uk/>.

¹⁰⁴ The company was originally called Binnie, Black & Veatch. The GeoData Institute at Southampton University was part of the consultant team providing habitat and data collection expertise together with knowledge of mapping common land. See further: www.geodata.soton.ac.uk. Others provided media and print advice.

¹⁰⁵ The Programme was launched in September 2001 attracting 76 innovators in the first year. See: www.ordnancesurvey.co.uk/oswebsite/media/news/2002/sept/devprog.html.

moor, heath and down) and registered common land in England.¹⁰⁶ On 9 January 2001 a contract was signed with BVC to commence a £16 million mapping project over a five year period. In April 2001 work began on the first two of eight mapping areas defined by the CAG, involving staged completion of the task set out within a mapping timetable and consultation process laid down by the statutory scheme.¹⁰⁷ The first conclusive map was published on 4 May 2004 and this was followed by completion of the regional 'roll out' for all eight areas by 16 August 2005. The task was therefore completed ahead of schedule and certainly prior to the commencement of the new 'right to roam' on 31 October 2005.¹⁰⁸

This project has been the first to use OSMM on a national scale. This has involved the development of a methodology¹⁰⁹ containing a rule base for identifying the land types subject to the new access right that encompasses more than 7% of the total land area of England.¹¹⁰ This involved establishing working definitions of the relevant land types and locating the best data sets available to implement these definitions in the production of the initial consultation maps. The Moorland Map of England, drawn up by the Agricultural Development and Advisory Service¹¹¹ in 1992-93, supplemented by National Park maps of moor or heath¹¹² and appropriate Environmentally Sensitive Area (ESA) data,¹¹³ were used to identify mountain and moor. Heath and down were found using the relevant land cover classes¹¹⁴ within Phase 1 habitat survey. This locates the habitats contained within or making up a particular site.¹¹⁵ Subsequent testing and refining of the mapping methodology, using these definitions and data

¹⁰⁶ Ss. 4-7 CROW Act 2000. See further, section 1 of this paper and notes 173 & 210, post.

¹⁰⁷ Ibid ss 4-12.

¹⁰⁸ The Countryside and Rights of Way Act 2000 (Commencement No. 10) Order 2005 (SI 2005 No. 2752 (C.112)) at: www.opsi.gov.uk/si/si2005/20052752.htm. The right has been dubbed colloquially as the 'right to roam'. See note 15, ante.

¹⁰⁹ *Countryside and Rights of Way Act 2000 Mapping Methodology for England* (The Countryside Agency, Contract No: 2156 7955, 4 May 2004) at: www.openaccess.gov.uk/S4/resources/file/eb1d5808cf1b636/MappingMethodologyV4May04.pdf.

¹¹⁰ The Countryside Agency (Ordnance Survey) at: www.ordnancesurvey.co.uk/oswebsite/products/osmastermap/pdf/Countryside-Agency.pdf. This comprises approximately 936 hectares of land out of a total land area of England of 13,307,189 hectares.

¹¹¹ ADAS is a former governmental advisory service now an independent provider of environmental and rural solutions and policy advice. See: www.adas.co.uk/.

¹¹² Section 43 WCA 1981 imposed duties on County Planning authorities whose areas included national parks to prepare maps showing areas of moor and heath. See: www.jncc.gov.uk/PDF/waca1981_part2.pdf.

¹¹³ This scheme commenced in 1987 to encourage farmers to adopt agricultural practices which would safeguard and enhance parts of the country of particularly high landscape, wildlife or historic value. It was superseded in March 2005 by the Environment Stewardship Scheme. See: www.defra.gov.uk/erdp/schemes/esas/default.htm?searchText=&submit=Open+MAGIC.

¹¹⁴ See: www.planning-inspectorate.gov.uk/access/inspector_handbook/annexe5.3.htm.

¹¹⁵ Phase 1 habitat survey is a "technique for rapidly obtaining a record of the semi-natural vegetation and wildlife habitat over large areas of countryside. Extended Phase 1 habitat survey, based on Phase 1 methodology and habitat definitions, is a more detailed survey, generally carried out over a smaller area. The area is surveyed and the vegetation is mapped on to a large scale map. A standard numerical and colour code system is used, as specified by the Joint Nature Conservation Committee (JNCC) 1993. This then provides colour coded habitat maps which allow rapid visual assessment of the extent and distribution of different habitat types. The use of codes for dominant species provides a further subdivision of the habitat categories and a standard index of key words is used in compiling target notes." See: thomsonecology.com/eng-habitat-veg.htm.

sets, was led by the GeoData Institute at Southampton University, one of the partners within the project consortium.

An illustration of the benefits that can be obtained from collaboration within a digital mapping project of this sort was the agreement reached between the CA and the Wildlife and Access Advisory Group (WLAG)¹¹⁶ on those species and features considered to be most sensitive to increased access. Adopting this guidance, CAg “worked closely with English Nature to establish whether the presence of sensitive features, combined with increased visitor numbers” warranted intervention through “management measures or restrictions.”¹¹⁷ The result was that issues relating to access and nature conservation could be reconciled with respect to the vast majority of SSSIs on access land.¹¹⁸ Where appropriate, entry points and paths were carefully sited, together with provision of suitable information designed to “steer people away from sensitive features.”

Future collaborations among a wide range of projects and initiatives are also likely to be fostered as a result of the Multi-Agency Geographic Information for the Countryside (MAGIC) project, which commenced in April 2002. This involves a partnership which originally consisted of DEFRA, former ODPM, English Heritage, the Forestry Commission, the CAg, English Nature and the Rural Development Service. These organisations all have a role to play in development and implementation of rural policies for England.¹¹⁹ The project was led by DEFRA’s Geographic Information Unit and offered a “one-stop shop for rural and countryside information,” granting participating organisations access to a range of information supplied by other partners to the project.¹²⁰ In August 2003 the project launched a ‘download facility’ offering public access to a wide range of data sets of land management schemes, as well as countryside and environmental designations.¹²¹ A Coastal and Marine Resource Atlas¹²² was also commissioned by the project collaborators, updating the 1990 Government and Industry sponsored ‘coastal sensitivity’ maps produced by the Nature Conservancy Council. The Atlas, which has been designed as a web based tool, offers access to a wide range of information on coastal and marine resources and is intended to support strategic environmental planning. MAGIC also supplies links to ‘support information’, where more complex searches between websites and applications can occur. Summary data is additionally provided to the public via the Countryside Information System (CIS).¹²³ MAGIC

¹¹⁶ The WLAG comprises Royal Society for the Protection of Birds, National Trust, Wildlife Trusts, Joint Nature Conservation Committee, the Countryside Council for Wales, English Nature and the Countryside Agency.

¹¹⁷ *New right of public access to open country completed across England: 31 October 2005* at: www.countryside.gov.uk/Images/CROW%20media%20briefing%20Lords%20-%20final_tcm2-27812.pdf.

¹¹⁸ English Nature advised that partial exclusions were needed in only 44 out of the 1000 SSSI’s qualifying for access. See further notes 7 & 27, ante.

¹¹⁹ See: www.magic.gov.uk/about_partners.html. Presumably Natural England will become a participant now that the NERC Bill 2005 has become law. See notes 22-27 ante.

¹²⁰ See: www.magic.gov.uk/.

¹²¹ See: www.magic.gov.uk/datadoc/summary.asp. Since the project commenced this has extended to data sets from Scotland and Wales.

¹²² See: www.magic.gov.uk/camra.html.

¹²³ See: www.cis-web.org.uk/home/. CIS, version 8.0, contains a “wide range of environmental data - including landscape features, vegetation habitats and topography for each one kilometre square of Great Britain.”

contains the five scales of OS base mapping provided under the Pan Government Agreement.¹²⁴ The intent of MAGIC is to raise awareness within the participating organisations of each others' contributions to rural policy. By such means, a greater understanding of the respective roles of the participating agencies can be built, with resulting efficiencies and potential deeper insights into the development and pursuit of policy.

It is beyond the scope of this paper to proceed now into further analysis of how specific GIS applications are being developed among all those departments, authorities and agencies involved in land management and conservation. It is similarly unproductive to commence a detailed description of the extent to which OSMM or, indeed, any other geospatial planning product, might feature as a tool to aid the fulfilment of such obligations. Each agency needs to undertake its own cost/benefit analysis of the benefits, policy insights and efficiency gains to be obtained from investment in GIS technology. What is clear, however, is that a transition is now taking place towards more widespread routine adoption of GIS techniques within the mainstream of public administration. No doubt supported by the GI Panel,¹²⁵ an ad hoc pattern of reassessment and review now appears to be underway, evaluating how geospatial tools might contribute to fulfilment of the remits of these public sector organisations.

The above projects illustrate what can be achieved. They also illustrate how an interface is being built between the core template of OSMM and the data sets that define the specific applications that OSMM customers are developing to overlay upon the base map. This will often involve assembling data from several different sources to merge within OSMM. The form such integration takes will depend on the needs of the customer. It remains crucial then for OS to continue developing its products so as to provide as versatile, 'leading edge' and customer focused resource as it can. Nevertheless, the challenge should not be underestimated. One specialist observer commented that the problem here was that each user approached the issue of cover and use of land and property from a different perspective. This might be, for example, in relation to taxation, the environment or in pursuit of various forms of statistics. There was also a danger of duplication if separate geospatial projects were initiated that overlapped with existing programmes.¹²⁶ Whilst it was desirable to seek ways to "join up more", this represented "more of a challenge than first meets the eye" and obtaining funding for such collaborative activity was always likely to present problems.

¹²⁴ See note 128 post.

¹²⁵ See notes 49 and 229.

¹²⁶ See note 52 ante. Although OSMM Topography Layer and the new address layer2 have inherent land cover classification and LCM2007 is in development, the EC-ESA GMES (Global Monitoring for Environment and Security) 'land monitoring' pilot may "trump" these services by creating their own high resolution land cover database by 2008. GMES argues that "survey data and maps on land cover and land use, including air photographs and cadastres and geographic data, are widely collected at local, regional and national levels for a wide variety of applications. However, despite of recent progress, pan-European data sets needed to support GMES services addressing cross border issues such as flood mitigation or future Kyoto protocol verification remain underdeveloped". Source: *Global Monitoring for Environment and Security – Final Report for the GMES Initial Period (2001-2003)* (European Space Agency and European Commission, 10 February 2004) p.23. Existing UK activity is recorded on the GMES website at: <http://www.gmes.info/59.0.html>.

For central and local government, however, a support structure is available to stimulate and underpin this process. A range of interesting case studies, showing how OS GIS products are supporting e-Government transformation agendas, have been catalogued.¹²⁷ Two agreements have also been entered into by government with OS to help channel such resources through. In 2003 OS and ODPM announced a non-binding Pan Government Agreement to supply central government with access “to a portfolio of OS digital map products.”¹²⁸ This three year agreement is designed to help central government make better use of geographic information. By 2004, evidence showed that more than 200 central government customers had utilised the agreement.¹²⁹

In May 2005 a revised Mapping Services Agreement (MSA)¹³⁰ was also reached with local government, the first to be entered into through European competitive tendering processes.¹³¹ Under its terms The Improvement and Development Agency (IDeA) undertakes to secure “best value” for the supply of current digital mapping and geographic data, such as OSMM, to more than 500 local government organisations. The aim is to “use the power of geography to meet eGovernment targets”¹³² and to develop economies of scale in the development of better front-line services. This might take place, for example, through access to consistent topographic, address and integrated transport network data for use in the delivery of a wide range of services.

A key stance, that will assist OS in maintaining the integrity of OSMM, is its decision to retain control over TOID allocation. Topographical indicators offer users a robust

¹²⁷ See: www.ordnancesurvey.co.uk/oswebsite/business/sectors/government/local/news/index.html. The London Borough of Hammersmith for example has used OSMM to develop an authority wide GIS to store and manage its data sets.

¹²⁸ *Report on the Annual Review of the Performance of the Pan Government Agreement (PGA) for the supply of Ordnance Survey (OS) Data to Central Government* (Inter-Governmental Group on Geographic Information (IGGI) 5 November 2004), p.4. See: www.ordnancesurvey.co.uk/oswebsite/media/news/2003/may/pangov.html. The Pan Government Agreement expires on 30 September 2006 and the ‘PGA 2 Procurement process’ is being handled by DCLG.

¹²⁹ *Ordnance Survey – Annual Report and Accounts 2003-04*, HC 856 (The Stationery Office, 8 July 2004) p. 32. For a listing of participants see: www.ordnancesurvey.co.uk/oswebsite/business/sectors/government/central/pga/who.html.

¹³⁰ The MSA was initiated by Local Government Information House (LGIH) part of the Improvement and Development Agency (IDeA) working on behalf of the local government community. The agreement, which follows on from the previous 10 year service level agreement, covers all district, county and unitary councils, metropolitan borough councils, London boroughs, national park authorities and some emergency services such as local police and fire. It is hoped to save more than £100 million over a four year period.

¹³¹ See: Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors and Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts.

See further: Commission Regulation (EC) No. 2083/2005 of 19 December 2005 amending Directives 2004/17/EC and 2004/18/EC of the European Parliament and of the Council in respect of their application thresholds for the procedures for the award of contracts. UK implementation took place via: The Utilities Contracts Regulations 2006 (S.I. No. 6) and The Public Contracts Regulations 2006 (S.I. No. 5).

¹³² AGI, *Agreement sealed on mapping services for local government*, 3 June 2005. For a list of products available within the terms of the agreement see: www.ordnancesurvey.co.uk/oswebsite/business/sectors/government/local/Social%20care/msaproducts.html.

referencing system that stays with the feature throughout its life. However, to maintain the integrity of the scheme, it needs to be carefully administered. OS has, therefore, decided to control the distribution of TOIDs itself, rather than allow others into the process. In the past OS sometimes agreed to reserve a 'TOID number range' for those organisations wishing to issue their own identifiers. The plan in future is for an organisation to register a 'prefix id' first, so that they can then use their own range of numbers.¹³³ Beyond its descriptive characteristics it is important to note that the TOID does not link the feature it represents to National Grid coordinates, and therefore does not provide an inherent reference to geographic position. OS made this decision, it said, to retain the strength of the TOID scheme. Adding positional 'intelligence' to the TOID would impact upon the strength of the identifier, which stays the same throughout the life cycle of the feature. If coordinates were introduced and the position of the feature moved, its "coordinate position would change". This small but significant event would result in the issue of a new TOID thereby destroying any historical links previously tied to the feature.

This is a sensible decision for OS, not least because of the saving in maintenance costs that would otherwise accrue with adoption of geographic positioning. Nevertheless, given the reliable quality statements on positional accuracy that come with OSMM, which potentially expands its versatility, to what extent might the Topography Layer of OSMM be integrated within statutory schemes to accord definitive status¹³⁴ to the digital representation of certain types of feature? More precisely, under what circumstances might the statutory framework established under CROW Act 2000 to facilitate conclusive maps of access land, which also paves the way for their possible future digital conversion, offer a suitable model for legal recognition of other digital conversion schemes in respect of definitive maps and statements of public rights of way (PROW) as well as registers of commons and town or village greens?

¹³³ *Unique Object Identifiers within the Digital National Framework (DNF) – Consultation on proposed changes to identifier management* (DNF 14 November 2005) at:

www.dnf.org/Publications/papers.htm. This is currently in the hands of the DNF Expert Group.

¹³⁴ 'Definitive status' in this context means that the digital 'map' record has been designated by regulation as admissible in evidence of the information it discloses.