Institution: Middlesex University

Unit of Assessment: 17 Geography, Environmental Studies and Archaeology

a. Context

The Flood Hazard Research Centre (FHRC), Urban Pollution Research Centre (UPRC) and the Decision Analysis and Risk Management (DARM) research unit, which provide the basis for this UoA submission, have a long history of pursuing research closely linked to end users' needs. Indeed the ethos of active engagement with stakeholders and end-user communities is at the centre of our mission and embedded in our research culture. In consequence we have demonstrated a continuing commitment to pursuing and successfully finding 'smart' solutions - policy instruments, decision-support tools, impact algorithms, social mechanisms - that translate physical and social science for use at professional and public interfaces. Professor Edmund Penning Rowsell, the founding director of FHRC, was awarded the RGS Back Award (2011) 'for research contributing to national and international flood policy'.

In developing our research programme over the last 30 years we have established a network of robust linkages with a host of user groups that extend across public policy makers, policy implementers, practitioners, utility services and local communities in the UK and worldwide. In this REF period we have worked with a number of **international bodies** including the World Bank, the United Nations, the European Commission, the OECD, and donor organizations focused on environmental change in Bangladesh. In the UK our research users have comprised **national governmental bodies** in Scotland, England and Wales, and Ireland, including the Environment Agency, Defra, the Scottish Environmental Protection Agency and the Office of Public Works in Ireland, as well as **regional and local organizations,** such as Local Authorities and nature conservation bodies. Other users of our research comprise **voluntary and community organizations**, such as the Oxford Flood Alliance, Greenpeace and the National Flood Forum; and **private companies and industry associations,** including the British Airports Authority, private water utilities, Arup, CH2M Hill (formerly Halcrow), HR Wallingford, and the Construction Industry Research and Information Association (CIRIA).

This high level of user engagement in our research practice has created a variety of types of impact. In the realm of **professional practice**, impacts include providing user groups with research-based information and models, so that they can assess current and future policies and practices, as in the case of FHRC's publication of the 'Multi-Coloured Manual'. Our research impact is also apparent in terms of **framing and responding to environmental issues at particular sites**, through providing user groups with site-based evaluations of risk or environmental conditions that require new interventions involving investment decisions. One good example here includes UPRC's research with ACO Technologies on the mitigation of car park runoff. Our **impact on policy is delivered at a range of scales.** This is clearly evident in both impact case studies included here, as well as through Tapsell's participation in the ESRC-funded project (with Lancaster University) on recovery following the Hull floods, which won an ESRC award in 2013 for outstanding impact in public policy. Our critiques of existing policies and practices based on policy evaluation at a range of local, national and international scales are influential. For example DARM's collaboration with the Risk and Regulation Advisory Council of the Department of Business, Innovation and Skills on the management of risks to the public led to commissioned reports by Lord Young (2010) and Professor Löfstedt (2011) to implement their research findings. Finally, we continue to make a substantive **contribution to public debate** about a range of environmental issues in our research domain. For example, our Bangladesh based staff's research (funded by the Bill & Melinda Gates Foundation) on how floodplain community-based organisations cope with flood risk in Bangladesh.

b. Approach to impact

Our approach to impact is embedded in working collaboratively to develop and implement research that meets both current and emerging societal needs in relation to environmental quality. Our focus is a ***translated science approach***; one that seeks to translate complex social and physical science models and research findings into new policies and usable end-products. This approach goes beyond influencing policy making and extends to the evaluation and refinement of policy, the training of policy makers and practitioners, and the development of smart tools for policy

implementation.

The delivery of research impact to non-academic users and beneficiaries is enhanced by a strategy of supporting staff to develop the impact of their research activity, particularly through putting in place mentoring arrangements whereby staff with considerable experience of user engagement (e.g. Revitt; Penning-Rowsell; Parker; Ellis) can provide guidance to more junior staff. All staff liaise with the University's Research and Knowledge Transfer Office (RKTO). The RKTO provides support by providing information and identifying opportunities for policy and practice engagement. In addition the RKTO provides specialist technical knowledge (i.e. in relation to contracts), logistical support and a programme of training for all staff, for example in relation to legal aspects, managing innovation and business incubation.

Pathways to Impact

The translated science approach requires the development of close working relationships with target end-users. Staff are supported to engage with and develop relationships with key users through a number of related pathways. A primary mechanism here is via ***direct collaboration on research projects***. One case here is the Learning Alliances (LAs) model, which evolved out of the findings of the EC FP6 project SWITCH (Green, Lundy, Viavattene). This involved supporting the development of LAs in Belo Horizonte (Brazil) and Birmingham (UK) where UPRC researchers demonstrated and provided training in the use of stormwater management planning and mitigation tools. Another is the Flood Warning Benefits Pathway Model (FWBM) that FHRC developed in the FLOODSite project and which is now being taken up and used by the EA. Such collaboration frequently leads to impact through the ***development and delivery of practice-based tools, founded on innovative and 'smart' science***. Our work, led by Ellis and Revitt, developing and applying emerging green technologies to mitigate the specific characteristics of airport runoff to reduce its impact on receiving waters, exemplifies this approach.

A proven pathway to impact for our work is the running of ***specialist training/continuing professional development (CPD) events targeted at users***. FHRC has a particularly strong track record in this respect having run bespoke CPD courses for over 900 professionals at the EA in this REF period alone. Another is the participation of a number of **staff on the *steering committees of major research programmes*** such as FP6 SWITCH (Green, Lundy), FRMRC2 (Faulkner), FLOODsite (Penning-Rowsell), ScorePP (Lundy), and FP7 CapHaz-Net (Tapsell); Hull floods project (Tapsell). Advisory boards can provide an important mechanism to enable potential research users to feed into the development of research tools, as was the case in both the EU FP6 ScorePP project, where the advisory board included representation from national environmental regulators, water companies and chemical industry trade associations, and in the FRMRC2 consortium (see ECR Alexander output).

We also work with target ***end-users to develop better experiences of working with researchers***. The successful ESRC/NERC/EPSRC programme 'Integrating Social Science into Urban Environmental Systems' (ISSUES), developed a 'feed-forward' mechanism for integrating ecosystem service delivery into urban environmental design from a practitioner-focussed point of view (Lundy). ***Collaborative studentships*** provide a further pathway which we have pursued. Alexander (ECR) was awarded the 0.5 EPSRC Doctoral Training Award (DTA) and became a staff member of FHRC in September 2013, and Balogh, who recently completed his PhD, was co-funded by our EU FP6 projects SWITCH and ScorePP.

c. Strategy and plans

The Research Centres in this UoA will continue to place impact at the heart of their research, teaching, and knowledge exchange activities. Our strategy is to build on our established experience of generating research impact and use this in relation to areas of existing research strength, as well as the development of new areas. For example the UoA's presence within the larger school of Science and Technology provides new opportunities for exploring and exploiting synergies and collaborations with Computer Science (e.g. In the development of decision-support software and GIS tools to support Faulkner and Viavattene's work), and BioSciences (e.g. to develop the bio-indicator work of Garelick and Purchase). Both of these emergent areas could significantly benefit environmental decision-makers and practitioners. To maximize the reach and significance of our research impact we plan to:

Nurture the development and sustenance of excellent relationships with the professional base. We will do this through a continuation of our current practice which will build on our extensive existing networks and forge new relationships with users in emerging research areas;

Develop our staff. We will embed knowledge exchange, consultancy and user engagement activity targets within the performance appraisal of staff and they will be supported to achieve these through proven methods developed in this REF period (e.g. teaching and/or contract work 'buy-outs') and maximizing the use of available institutional support via the RKTO in relation to training and identifying funding opportunities;

Pursue diverse sources of research funding. As well as RCUK funds, a mix of government, EU, industrial and voluntary sector funding sources will permit us to undertake methodologically- and theoretically-driven research which includes a clear focus on engagement and implementation through non-academic partners. Our past experience has demonstrated how active engagement in consultancy research is often critical in ensuring the presence of our research in situations where policy and practice decisions are actually made;

Develop our interdisciplinary research agenda. Practitioners and policy makers seeking environmental solutions are receptive to academic research work that is able to move beyond traditional disciplinary boundaries. This area of existing strength will be developed through furthering our interdisciplinary research via collaborations with computer science, bio-sciences, art and design, law and planning;

Knowledge transfer and knowledge exchange activities. These will be developed through promoting awareness and knowledge of the potential of different types of activity (e.g. collaborative studentships, KTPs; secondments), and extending their use further.

d. Relationship to case studies

The impact case studies presented here are selected to demonstrate the significance and reach of our research and our broad approach to impact. The first illustrates how our research has informed the developing agenda on innovative Sustainable Urban Drainage Systems (SUDS). Research here has contributed to the adoption of SUDS into legislation in relation to achieving water quantity and quality objectives, and delivered designs, advice, and software to enhance delivery of this policy on the ground. In the second case study, we show how our research has significantly influenced the assessment of flood risk and flood alleviation investments, with our unique sets of models, data and techniques and related manuals becoming the UK's standard source in the FRM industry in the important area of damage estimation and appraisal, influencing all policy directions for investment in flood risk management and professional practice.

The case studies clearly illustrate the different types of impact of our research and the variety of users and beneficiaries. Influence on policy development at local, national and international scales is evident in both cases, with key users including policy makers within government departments and agencies (e.g. within Defra, EA). Strong impacts upon professional practice are also apparent, through the provision of a range of tools and manuals based upon our research as well as associated specialist CPD and postgraduate training for professional staff. Relations with private sector bodies (e.g. Arup, H R Wallingford) also provide the basis for future impact, for example through the future commercial exploitation of the SUDsloc tool. Beneficiaries also include the large numbers of people living in the areas affected by these changes in policy and practice.

The experience and knowledge acquired through these case studies has influenced the development of the various pathways to impact outlined above and informs the development of our future impact strategy and plans. For example, a critical element in both has been engaging closely with end users over extended periods of time to build trust and mutual understanding. They also demonstrate how the University's infrastructural and institutional support has facilitated implementation of the UoA's strategy for impact enhancement and delivery, with time and devolved finance being made available to teams of researchers to enable them to engage in interchange and debates with research users and beneficiaries on an ongoing basis.