

1. Introduction

The 3 principal cities in the East Midlands, Derby, Leicester and Nottingham, have invested in the development of transport asset management planning. In each of our authorities we have realised that an improved approach to the management of our highway drainage infrastructure is a high priority. To date we have been addressing this issue concurrently in different ways. We have recently begun working together to develop a consistent approach.

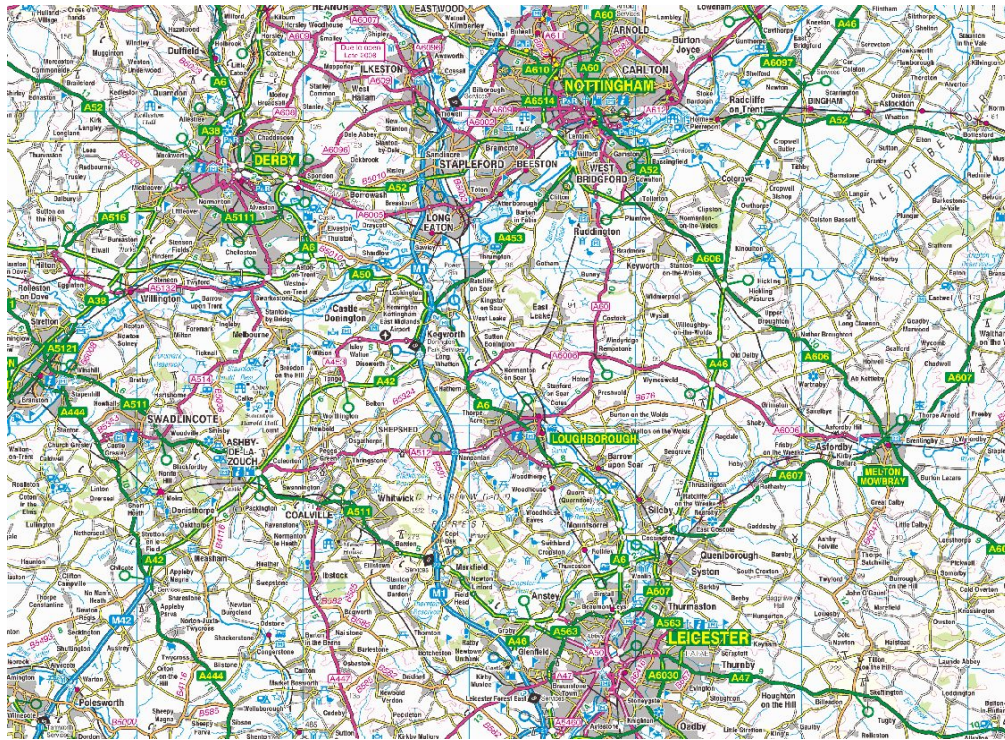


Fig 1 – Showing the 3 cities of Nottingham, Derby and Leicester

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	Derby	Leicester	Nottingham
Geographical Area (hectares)	7,803	7,309	7,500
Current Population (2001 Census)	233,200	280,000	267,000
Length of Highway Network (km)	745 km	803 km	792
Quantity of Drainage Asset	38,877 gullies	40-50,000 gullies	37,349
	(Estimate Only)	(Estimate Only)	Gullies
	Remainder	Remainder	Remainder
	Unknown	Unknown	Unknown

Fig 2 – overall statistics of the 3 cities of Nottingham, Derby and Leicester

By working together we will be able to access the benefit of sharing our resources and skills, be able to share development costs and to pool our ideas and experience. This approach will hasten our progress in creating appropriate methods of managing the risks associated with highway drainage infrastructure. The three cities are of similar size and face similar, but not identical, problems; it therefore makes sense for us to work together on issues that are common to predominantly urban but not metropolitan authorities.

Nottingham is well placed to lead the 3 cities in this approach and our submission to DfT, having been, alongside Leicester, one of the first urban authorities in the East Midlands to produce a Highway Asset Management Plan (HAMP). As part of the DfT's 2007 Review of TAMPs, Nottingham (having previously gained a "Local Transport Authority of the Year" award) was identified as an authority demonstrating good practice in the development of levels of service and lifecycle plans, which included the highway drainage asset.

Additionally, the 3 Cities are all members of the Midland Service Improvement Group (MSIG). The remit of this group is to share and debate matters, and to allow solutions to be found through co-operation. The MSIG technical sub-groups either impact on, or are involved in, infrastructure asset and network management. However, the split in MSIG between county councils and unitary authorities is such that there is a majority of county council representation in the ratio of almost 2:1. Although it is acknowledged that some of the issues facing predominantly urban unitary authorities can have a different focus than those faced by the county councils with a largely rural highway infrastructure, the emphasis on investigation and development work within the group usually follows the majority interest.

This submission outlines the work we have carried out to date and shows how this is being developed. Monies made available from the DfT would be used to accelerate the development and we believe that this will provide a model for urban highway drainage infrastructure management that could be adapted and used by any other urban highway authority.

Further development of our collaborative approach and sharing this with others within the MSIG group could bring significant benefits and efficiencies to other UK highway authorities

2. Background

One of the major difficulties facing urban authorities is in the field of highway drainage and in particular the increased risk of highway and property flooding exacerbated by poorly performing highway drainage systems.

In 1974, each of the Three Cities was granted an agency agreement with the then Water Authority (Severn Trent). By the late 1990's however all of these agreements had been terminated and most authority staff employed on drainage were transferred to Severn Trent Water (STW) under TUPE arrangements, leaving the unitary authorities with very little drainage expertise. During the 1980's and 1990's STW funded inventory surveys for their assets, and undertook drainage area planning based on catchment areas, but the highway drainage system was not surveyed as part of the STW data gathering exercise or included in their drainage area planning. Although STW has undertaken a number of improvements to the sewers in each of the cities, very little consideration of highway drainage or consultation with each of the cities highway departments has been undertaken.

Although there has been significant growth in each of the cities highway network, particularly since 1974, very little is currently known about this important and integral element of highway infrastructure. This growth in highway infrastructure, which includes drainage assets, is illustrated in the graph shown overleaf, taken from Nottingham City Council's HAMP, which shows an 80% increase in the size of the network in the last 30-or-so years.

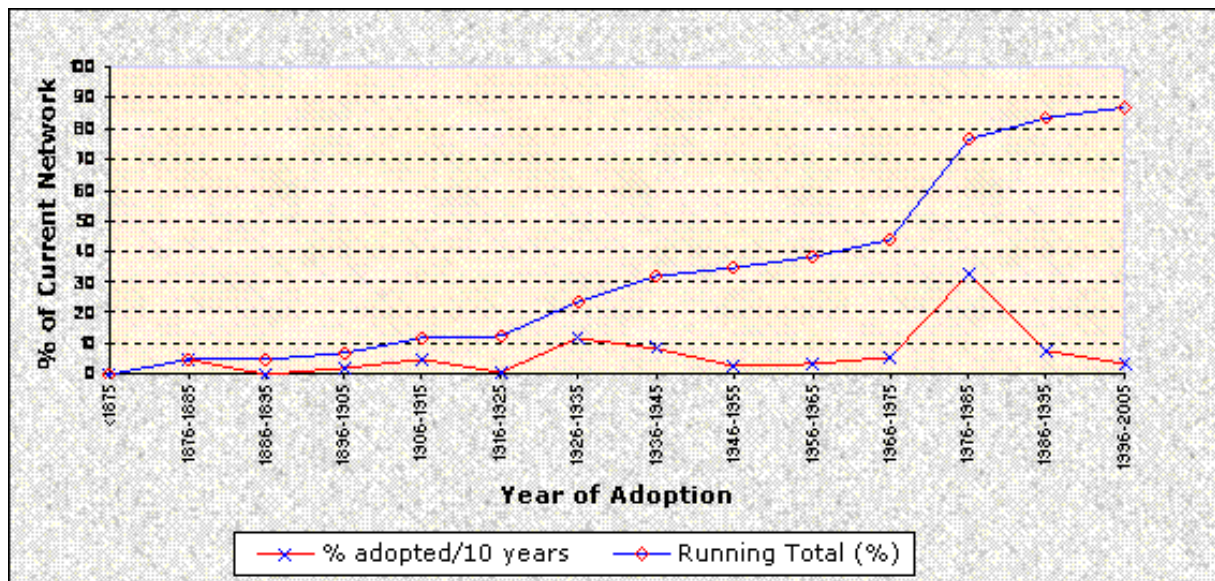


Fig 3 – Showing the growth of Nottingham highway infrastructure through Adoptions

Recent flash flooding events in the 3 cities caused by intensive localised storms and exacerbated by poorly performing drainage systems have highlighted the risk of highway and property flooding which could become more commonplace and severe in the future due to climate change and intensive redevelopment of our urban areas.

Flash flooding can also occur when sewers become overloaded. The resulting high pressure can cause water to burst out of manhole covers and road gullies. This type of flooding is particularly dangerous, as it can result in manhole covers being lifted and road surfaces being badly damaged. Serious injuries and even fatalities have occurred in previous flooding incidents in the UK when members of the public and responders have fallen into open manholes or drains. Although the Met office issues various types of weather warning, the Environment Agency is not able to issue flood warnings for flash flooding, so there is likely to be very little, if any, detailed warning of flash flooding occurring.

In many urban authorities, run-off from the roofs and yards of properties adjacent to the highway discharge directly (or indirectly) on to the highway and into the highway drains via highway gullies. The volume of run off from these properties has never been accurately determined, but may be a significant proportion of the run off entering the highway drains.

3. Implications of The Pitt Review:

Following the summer floods of 2007, the government asked Sir Michael Pitt to undertake an in-depth independent review of the floods. The final report was published on 25th June 2008 and contains 92 recommendations, involving a number of different organisations, including local authorities. Although many of the recommendations are applicable to local authorities the following are seen as most relevant to the management of highway drainage infrastructure:

- 15 Local authorities should positively tackle local problems of flooding by working with all relevant parties, establishing ownership and legal responsibility.
- 16 Local authorities should collate and map the main flood risk management and drainage assets (over and underground), including a record of their ownership and condition.
- 19 Local authorities should assess and, if appropriate, enhance their technical capabilities to deliver a wide range of responsibilities in relation to local flood risk management.

Although the Government is yet to publish its response to the Pitt Review, the three cities have begun the process of reviewing and implementing the key applicable recommendations contained within the review. This has also involved raising awareness of the Pitt review within the Council's at a senior management / member level and improving liaison with key stakeholders such as STW and the Environment Agency (EA).

Of particular concern is implementing recommendation 16; involving the mapping of existing drainage assets. Although the 3 Cities hold information on the large watercourses that run through their cities and under their highway networks via culverts, very little is known and recorded on the remainder of the highway drainage network making it difficult to currently determine the extent of the council's responsibility in tackling recommendation 15.

Collecting this missing highway drainage network information is an important, but potentially expensive, activity, when starting from the extremely low-level base of information that is currently held. The approach taken by the 3 cities in collecting this data follows the advice in the Implementation and Delivery Guide of the Pitt Report by using a process that prioritises and targets any data collection and implementation of drainage solutions at the areas of the highway most at risk of flooding. This approach taken by the 3 Cities in achieving this is explained further in the following sections.

4. Identifying Highway Drainage Issues

All three Cities have made progress in identifying problem highway drainage / flooding areas and establishing an initial understanding on the potential causes for the flooding.

Nottingham, in liaison with area managers, the drainage and highways maintenance teams and Severn Trent Water has begun compiling and mapping historical records of flooding locations across the city. This list currently contains 59 sites of which some 25 relate directly to highway flooding. Of the highway flooding sites identified 18 are located on, or immediately adjacent to, busy 'A' Roads. Initial investigations have attempted to understand the cause of the flooding; although much work (including field surveys) is yet to be undertaken to fully understand the causes behind the flooding, it is obvious that potential flooding sites are not confined to areas alongside the main watercourses.

A contributory factor to the flooding at a number of these sites may be the limited capacity of the STW storm water sewers and/or the EA major watercourses. To investigate this further it is necessary to clearly identify the extent of the highway drainage network through survey, determine its current capacity and contributing catchment that it is draining and from working with STW and the EA, understand the capacity of the receiving sewers / watercourses that the highway drainage systems discharge into.

Derby City Council have followed a similar approach. In their case, this has been thus far limited to highway maintenance and land drainage staff identifying areas of historical highway and property flooding and compiling this information on an excel spreadsheet of flooding "hot-spots". The spreadsheet has been developed to evaluate and prioritise flooding sites using a weighted-attributes method to ensure that the City's limited resources are targeted at the flooding areas of highest risk that should have early intervention. To date approx. 40 flooding "hot-spots" have been identified and recorded, but this list is not complete.

As with the Nottingham approach, much engineering investigation and survey work is still required to further evaluate each of the "hot-spots" and to fully understand the causes behind the highway flooding before appropriate cost-effective solutions can be developed to mitigate, reduce or even remove the flooding risk.

Leicester have been collecting detailed records of flood events over the last 10 years; they are now migrating the many individual flood incident logs into a flooding database so that this valuable data can be further analysed via their GIS system. Like Nottingham and Derby, they plan to use this information to target solutions at areas of greatest flood risk, but further, are also currently using this data to improve aspects of their highway maintenance service. An example of this is the installation in 2009 of a dynamic warning system linked to the River Soar water levels that will advise motorists when Braunstone Lane East is closed due to flooding and advises them of alternative diversion routes, providing a more responsive service and saving money in call-outs.

As part of this process of identifying and evaluating highway drainage issues, the 3 cities are looking to develop a common approach in understanding the effects on the highway network from surface water flooding and poorly-performing drainage systems. Factors to be considered include:

- highway safety, i.e. standing water remaining on carriageway and footway surfaces ;
- network availability, i.e. the adverse affect on network use / traffic congestion from the extent and duration of flooding events;
- potential damage to carriageway pavement structure;
- flooding risk to properties adjacent to the highway;
- poor public perception of the highway service.



Fig 4 – Flooding in St Albans St, Derby 2001

5. Understanding why the highway floods:

Although locations of historical highway flooding have been identified and initial attempts made to understand why these occurred, much work has still to be undertaken to fully understand the causes behind the flooding and determine the best cost effective solutions to mitigate against these. Although flooding problems will vary from one location to another, it is important to clearly understand the problems before looking at developing solutions. The detailed analysis of robust drainage network data is required for this process, much of which is currently missing.

The following outlines the type of network drainage data required:

- identify extent and type of highway drainage system that currently exists, e.g. different types of system components - gullies for instance have different flow characteristics / issues;
- ascertain network condition through CCTV survey to confirm satisfactory performance (i.e. pipe flowing free with no blockages & pipes in sound condition, with no breakages etc);
- collect dimensional information such as location, lengths, diameters and invert levels so that current system flow capacities can be determined;
- understanding outside drivers and constraints on the council drainage network (refer to stakeholders), i.e.
 - o what is contributing upstream of the highway catchment (development / EA);
 - o restricted capacity in receiving systems (e.g. STW sewers, high water levels in canals and EA rivers and major watercourses).

In 2003, Nottingham surveyed all of the road gullies on their highway network (some 37,349) and plotted their locations on the Council's Nomad GIS system. This information will be used to highlight the location of "vulnerable" gullies at known flooding problem areas and those in tree lined streets that require more frequent emptying than the annual cleanse. This information will also be used to review the cyclic gully emptying schedule and frequency and the sweeping of tree lined streets of leaf fall in the autumn to improve the overall service.

Leicester is currently in the process of surveying the location of all their highway gullies. In addition to obtaining location information, this project involves identifying each gully type, (particularly outlet configuration), condition and access arrangements (i.e. whether gully is blocked by parked cars). The project is due for completion in 2009.

Derby is currently in the process of procuring a contractor to survey the location of their highway gullies and is looking to draw on the experience of Nottingham and Derby to assist them with this process.

To date Derby's focus has been on understanding more about the large culverted watercourses that flow under their highways. By 2006 an extensive GPS survey programme had located approx. 38km of culverts and assessed the condition of 54% through CCTV survey. This Information has now been loaded into INFONET, a GPS based software package purposely designed as a drainage network management tool. This package locates all defects, stores CCTV data in a retrievable format, grades the condition of the network and can be used to locate and manage maintenance. This programme has identified approx. 9km of condition grade 4 and 5 in need of urgent rehabilitation within the next 1-2 years. Bids for LTP funding have been made to repair the highest priority culverts and it anticipated that further bids will be made to repair further grade 4 and 5 culverts in the near future. The experience gained to date through this process is invaluable and will be transferable to the survey and condition assessment of highway drainage assets.

6. Possible Solutions – Using Data to Target Options

Detailed, but targeted, drainage surveys provide the necessary information required to clearly understand the problems at each highway drainage "hot-spot". The solutions most likely to alleviate and rectify the problem (which may not necessarily involve capital works, but could include improvements to routine maintenance activities) can include:

- reactive gully emptying and pipe jetting;
- rationalisation of gully emptying schedules and frequency (coincide with seasonal variations and other demands e.g. autumn leaf fall);
- planned cyclical jetting of pipe runs in problem locations;
- the use of whole street-scene "spring-clean" approach to target works during road closures at assets not frequently maintained, e.g. gullies under parked cars;
- working with other stakeholders to improve system performance - street scene targeting sweeping of leaf areas prior to gully emptying and efficiency - shared traffic management on busy routes;
- identifying minor improvements (gully upgrading etc);
- Identifying major investment required (new pipes) due to capacity constraints.

7. Prioritising Works – Option Appraisal

Each of the 3 cities currently uses a different method of prioritising the treatment of highway drainage works. Like many aspects of highway management, it is likely that if we were ever able to afford to analyse the amount of potential improvement and deferred maintenance works required to our drainage systems, it would be prohibitively expensive.

We recognise we must live within our means, whilst at the same time identifying an appropriate investment in the management of the highway drainage asset. As part of our approach to highway drainage management, we plan to document processes for the evaluation of drainage remedial works. An appropriate form of economic analysis (using BCR or NPV of options) will be the basis of the evaluation method which will consider and appraise, cost, benefit and risk by assessing:

- what is the likelihood of flooding at this site?
 - as it is;
 - with remedial measures applied;
- what are the likely consequences of flooding at this site?
 - monetary;
 - traffic disruption;
 - property damage;
 - image of the council;
- what is the cost of the options available?
 - if we do nothing;
 - if we do the minimum possible;
 - if we do each of the available treatment options;
- what benefits will each of the options bring in regard to risk mitigation or the wider benefits to the authority and community?

8. Working with key stakeholders

The Pitt Review acknowledges the need to improve the engagement of relevant stakeholders to follow a more “joined-up” approach for the effective tackling of flooding problems (as highlighted by recommendation 15). These key stakeholders include:

- the public and elected members;
- Council planning offices and environmental services (gully emptying / street sweeping);
- regional water company (i.e. STW);
- British Waterways (canals);
- riparian owners;
- Environment Agency (major rivers);
- adjacent authorities (shire and district councils);
- Met. Office (flood warnings).

The 3 cities have each begun liaison with key stakeholders at a high level, in particular their elected members, STW and the EA. To improve the performance of each city’s highway drainage network over the long-term could require substantial changes to council practices and potential increases in the financial investment necessary for the drainage asset than is currently the case. To successfully achieve these changes there will need to be a sufficient mandate from senior management and members within each city. There is also a lack of formal liaison between the relevant stakeholders (STW/EA/City) at a tactical or officer level currently, e.g. there is a lack of interaction between the highway authority and STW regarding the capacity in the STW system to take highway surface water.

It is recognised that these key areas of stakeholder engagement will be a critical component in developing and delivering the collaborative highway drainage strategy in the future.

9. Further Development:

Currently, the further evaluation of highway drainage / flooding “hot-spots” is constrained due to the lack of robust data and skilled dedicated highway drainage resources being available in each authority. To progress this activity we are looking to secure a specialist drainage asset champions at each council.

The scope of these positions needs to be wide ranging to work at all levels of the organisation in facilitating change and making improvements in the management of the highway drainage asset. To achieve this we envisage the need to employ experienced civil / drainage engineers who can understand complex drainage problems and develop cost effective practical solutions to achieve desired results.

- The estimated cost to implement this is in the range of £300k over 2 years (£50k per authority per annum).

We also believe that to get the necessary momentum in the project and to coordinate and maximise the benefits of working together it would be beneficial to engage independent consultancy support to help facilitate this process over the next two years.

- We envisage that the costs to provide this would be in the range of £50k.

The ability to fully understand the drainage problems at each “hot-spot” and determine the best cost effective solution in improving drainage performance is currently hampered by a lack of robust highway drainage network data, particularly in regard to the extent, type, condition and capacity of the existing highway drainage network.

We need to improve the information that each authority holds on the drainage network over time by undertaking targeted in-depth drainage inventory and condition surveys at each hotspot.

- Indicative costs for undertaking the initial stage of this work by targeting in-depth surveys at the highest priority hot-spots identified to date is in the order of £600k (£200k per authority) based on an estimate of investing approx. £5k to £10k at each hot-spot. These costs are very much dependent on site location, (e.g. ‘A’ road with high TM considerations) size of contributing catchments to consider and the liaison required with key stakeholders (e.g. STW).
- Recording and analysing the data necessary to fully understand the problems and possible solutions for each flooding hot-spot will require the set-up and management of a suitable highway drainage database. Our preferred solution involves procuring a specialist software system for storing highway drainage inventory and condition information for each of the 3 cities and a single copy of a more advanced drainage network / catchment modelling programme to be operated by one organisation on behalf of the 3 cities. Indicative costs for these systems; including initial purchase, training and maintenance for 2 years is approx. £50k.

Summary of anticipated costs (for 3 cities) over 2 years:

- | | |
|---------------------------------------------------|------------|
| - Dedicated specialist highway drainage engineers | £300k |
| - Consultancy support | £ 50k |
| - In-depth Site survey and investigation | £600k |
| - Highway drainage software system | £ 50k |
| - Total | £1M |

10. Collaborative Working to Improve Efficiency:

Delivery of the 3 cities collaborative drainage strategy will be structured so that there is an overarching Steering Group drawn from the 3 cities, with a mandate to develop and manage the relationship within the cities and their key stakeholders, based on the premise of:

- providing clear leadership and direction;
- providing political support and authority;
- developing transparent and efficient processes that minimise cost and maximise value and
- establishing a clear and transparent performance management framework that delivers visibility, accountability and results.

In developing our relationship, the 3 cities are committed to working together on these terms and believe that this statement enables us to respectively focus on the importance of good relationships and identify how we can each add value to the partnership and the residents and service users of these Cities. We recognise getting the relationship right between the Steering Group, the highway drainage champions and other key suppliers/stakeholders is critical to the success of the project. The project will be measured and defined by an appropriate performance management framework.

The 3 cities will work together to:

- develop a collaborative and supportive environment where we can respectively challenge and evaluate current arrangements in order to add further value;
- establish a joint commitment to the minimisation of non-value activity;
- encourage joint working at every level in the organisation focussed on shared, vision, values and objectives;
- develop a culture focussed on impact and outcome rather than simply challenging / inspecting task and activity and
- provide confidence to stakeholders that services are delivered efficiently and effectively through a fully integrated approach based on Value engineering.

Defining the scope of the outcomes to be delivered under this project will be clarified within the project documents and at Steering Group level. The particular requirement to deliver these outcomes must be understood and fall into one of three categories:

1. the statutory obligations placed on the authorities;
2. the corporate requirement, which will include those activities which support each authority's policies;
3. political and service requirements, developed in the case of highways from the local transport plan and direction and feedback from the key stakeholders.

To illustrate how collaborative working could be implemented in practice, specific project tasks could be shared amongst the 3 cities so that limited officer resources are targeted at certain aspects rather than trying to undertake everything. Examples of this approach include:

- Although each city's drainage asset champion would have an over-riding responsibility for management of the drainage asset in their area, it is envisaged that each city could specialise in particular area, e.g. one authority (say Nottingham) could lead on the procurement of survey contractor and other services, while another authority (say Derby) could lead on detailed data analysis /catchment modelling while Leicester handles regional liaison with key regional stakeholders like STW and the EA etc.
- A more obvious benefit from collaborative working would involve joint procurement of drainage surveys and other services across the 3 cities which should leverage costs savings by increasing the size of the drainage data collection component of the project. The three cities are closely located to one another and will share many commonalities in regard to the types of surveys required, the location and the typical issues experienced at each survey site.

11. Sharing Experience with others:

The 3 cities overall philosophy for sharing good practice and experience with others is centered around the use of existing regional groups and national forums (e.g. highway-orientated conferences) where these exist, supplemented by an open invitation for others to visit each of the cities and view their approach working in practice.

As the 3 Cities are all members of the large 18-member MSIG, this provides an excellent, existing forum for sharing good practice and experience with a wider regional group. This could be achieved by the 3 cities leading a highway drainage sub-group that reports back into the larger MSIG asset management group.

As part of collaborative working, the 3 cities are looking into the practicalities of setting up a joint website to facilitate communication, share ideas and for posting queries to one another. Access to this website could again be opened up to the wider MSIG community.

Another possible option for disseminating good practice and experience to a wider group could involve the 3 cities developing a "good practice guide to urban highway infrastructure drainage management" if they were successful with their submission to DfT. The production of such an output would assist other authorities to target limited funding into appropriate data collection and analysis such that collectively we can work towards better management of the risks associated with owning and operating highway drainage infrastructure. Critically, such a guidance document would need to include outline methods for authorities to use in evaluating the potential benefits of dealing with known (and currently unknown) flooding sites.

12. Summary:

In submitting this bid, we believe that we have identified an innovative approach to resolving a long standing problem which is common to all urban highway authorities, in a project which will:

- *make good use of existing relationships between the 3 cities;*
- *examine the outcomes and recommendations of the Pitt report;*
- *examine typical problems and provide solutions for problems facing urban highway authorities;*
- *use robust project management and performance management ideals;*
- *use established reporting channels, both regionally and nationally.*