MANCHESTER CITY COUNCIL

# Highways Lifecycle Planning & Whole life cost approach

**Highways, Growth & Neighbourhoods**
**January 2022**

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# Highways Lifecycle Planning & Whole life cost approach

## Record of Amendments

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# 1. Introduction

1.1 Manchester City Council recognises the importance of its highway infrastructure and how an effectively maintained and managed network contributes to the achievement of its corporate goals.

1.2 The Council's Highways Asset Management Policy & Strategy (HAMS) sets out our approach for the management of all highway assets including lighting, drainage, bridges and structures, cycling infrastructure and signage.

1.3 The HAMS stresses the importance of having up to date and reliable information about the number and type of assets and their condition so that the asset location, condition and where they are in their lifecycle is known.

1.4 Lifecycle planning is an important aspect of asset management and involves drawing up long-term plans for managing an asset grouping with the aim of providing the required levels of service at the lowest whole life cost.

1.5 Lifecycle plans capture all information relating to the asset inventory, its condition and performance. They identify both the short-term routine maintenance needs and long-term capital costs and enable annual spend profiles per asset to be produced. They also enable long-term predictions about the deterioration of various assets and their maintenance needs to be forecast as well as measurement of the carbon footprint of different maintenance activities

1.6 Lifecycle plans also provide secondary benefits in enabling the 'institutional knowledge' i.e. the knowledge and judgement of key personnel, to be captured and documented, thereby enabling it to be shared and further developed. They also enable the Council to gather information on the costs for each treatment option and the effect that this expenditure has on performance improvement year on year. Once these are known benchmarking can then take place with other authorities / treatments etc.

1.7 Lifecycle Planning recognises that there are key stages in the life of each asset type and that investment options need to be considered at each of these stages to ensure that each part of the asset achieves its full expected life, at minimum cost. Each asset goes through the following stages during its lifecycle:

| | |
|---|---|
| **Creation or Acquisition** | Assets are created or acquired in response to either new development, to increase capacity or to improve performance. |
| **Routine Maintenance** | Carrying out minor works on a cyclical basis to maintain the asset in a serviceable condition. |
| **Renewal or Replacement** | Carrying out to return the asset to its "as new" capacity and condition. |
| **Upgrading** | Improve the asset above its original standard. |
| **Disposal** | Involves decommissioning, demolishing or selling old, obsolete or surplus assets. |

1.8 This document describes the outline approach to highways lifecycle planning to ensure that the asset is effectively and efficiently maintained in accordance with the objectives set the HAMS.

## 2. Highway Network

2.1 The HAMS is based on managing our assets on a holistic basis and recognises that as we cannot do everything all at once, we need to prioritise between our assets based on the relative importance that each asset group contributes towards our goal of delivering an effective transport system and achieve our broader economic, social and environmental goals.

2.2 Carriageways (roads) are by far the largest of the Council's assets and account for an estimated 65% of the total highways' asset value. Maintaining their condition and preserving their value is vital to the success of the Council's maintenance strategy and they are given budget priority above other elements of the highway asset.

2.3 In Manchester, there is approximately 1,400 km of carriageway maintained by the City Council. These are subdivided by class of road into the following:

| | |
|---|---|
| 'A' Roads & motorways | 159 km |
| 'B' Roads | 40 km |
| 'C' Roads | 102 km |
| Residential unclassified roads | 1,066 km |

2.4 At a Greater Manchester level, a Key Route Network (KRN) has been developed which includes all major routes in Manchester and covers about 10% of our road network (143 km). This enables the prioritisation of funding on network management and maintenance of those routes which have the most significant impact, particularly on our growth priorities.

2.5 We have also developed a 'Community Network' (CN) to help us prioritise those roads which provide access to community services like schools, hospitals, medical centres etc. so that we best meet our strategic objectives relating to growth and liveability. The CN comprises a total road length of approximately 456 km, about 33% of our network.

2.6 All of our roads are also classified in terms of network hierarchy, in accordance with the recommendations in the 'Well-Managed Highway Infrastructure' code of practice. This is used to partly define our highway inspection regime as well as prioritising funding decisions.

## 3. Highway Codes of Practice and Guidance

3.1 The carriageway lifecycle plan recognises that the authority has the duty of maintenance for highways maintainable at public expense as contained in the Highways Act 1980 Section 41 and the recommendations contained within various codes of practice, procedures and standards which include:

- UKRLG 'Well-Managed Highway Infrastructure' code of practice
- HMEP UKRLG Highway Infrastructure Asset Management Guidance
- Manual for Streets
- Design Manual for Roads and Bridges (Volume 7)
- HMEP Pothole Review

# 4. Levels of Service

4.1 It is important that the Council actively seeks the views of its customers and residents in order that it can understand their needs and adapt its services accordingly.

4.2 Our long-term vision for Manchester's future is set out in the 'Our Manchester' strategy. Tens of thousands of people were involved in the consultation which looked at how to make Manchester into the place people would want to live, work, play and do business in 2025.

4.3 As part of the 'Our Manchester' value for money budget campaign, several Highways focus communications events have taken place since 2017, which have included highways content shared across social media, press releases, e-bulletins and a twitter Q&A sessions with the Executive Member for Environment.

4.4 In addition, in order to better understand resident's views, we have commissioned the National Highways and Transport (NHT) Public Satisfaction Survey annually since 2017. The survey is carried out by IPSOS/MORI and allows comparison on performance at a local, regional and national level. This survey enables us to compare results year on year and modify our service objectives accordingly to drive continuous improvement.

4.5 The objectives set out in the 'Our Manchester' strategy have informed the defined asset management objectives set out in our HAMS. These are:

- Customer satisfaction;
- A safe & serviceable highway network;
- Delivering cost effective asset management;
- Encouraging active travel modes and reducing the carbon footprint of our projects;

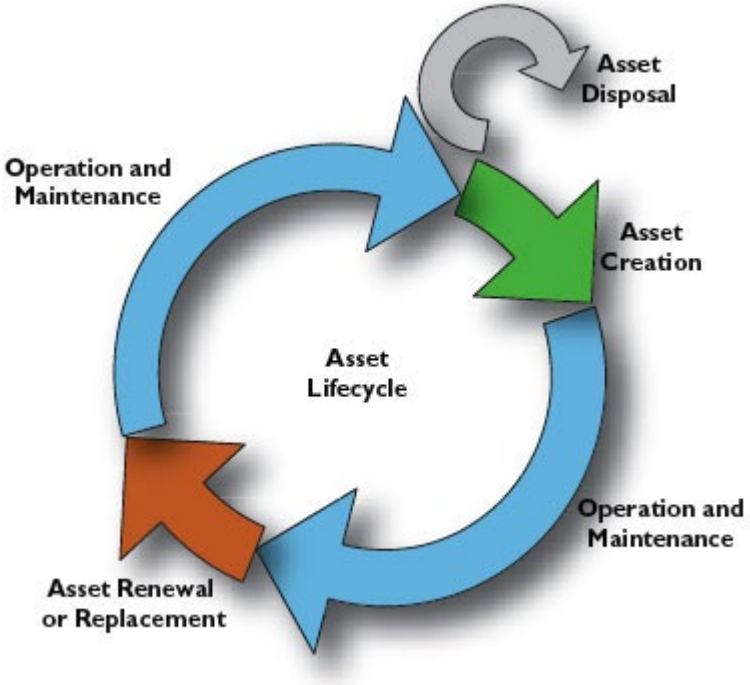
4.6 Lifecycle planning shows how different levels of funding will influence the extent to which these desirable levels of service can be achieved.

# 5. Lifecycle modelling

## 5.1 Asset Lifecycle

5.1.1 The following describes the stages in an assets life cycle that underpin our lifecycle modelling approach:

- **Asset Creation (Construction / Asset Acquisition)**
  New assets are typically acquired from either adoption or from taking over improvement works completed by contractors on behalf of the council. This is normally managed by the development control team using Section 38, 278 or 106 legal agreements.
  Newly constructed 'adoptable' streets are only adopted and added to Manchester's Asset Registers once they meet council specifications.




- **Operation and Maintenance (incl. Routine Maintenance)**
  Routine maintenance treatments are undertaken to ensure the highway asset is maintained at a minimum service level. Safety inspectors are responsible for identifying and assessing any defects which reduce the safety of the road user.
  Manchester's inspection and repair regime is outlined in the GM Framework for Highway Safety Inspections and accompanying MCC Highway Inspection Policy. This is implemented using a risk-based approach in line with the 'Well-Managed Highway Infrastructure' code of practice.

- **Asset Renewal**
  Planned maintenance treatments used on the network are a combination of preventative maintenance and resurfacing works. Surface treatments such as micro asphalt or surface dressing are applied at the optimum time to prolong the life of the carriageway and reduce the rate of deterioration. Resurfacing or reconstruction works are necessary once the asset has deteriorated to a poor state and is approaching the end of its lifecycle. We will look to utilize low carbon treatments and associated innovation to improve sustainability, reduce our carbon footprint and increase climate resilience.

- **Asset Disposal**
  In the case of highways, roads themselves are rarely fully decommissioned, although individual asset components are constantly being withdrawn, and may or may not be replaced, depending on current demand.

5.1.2 The following describes the lifecycle modelling approach currently used by the Council. The objectives of lifecycle planning are stated by the UK Roads Liaison Group in the Highway Infrastructure Asset Management Guidance as:

- Identify long term investment for highway infrastructure assets and develop an appropriate maintenance strategy;

- Support decision making, the case for investing in maintenance activities and demonstrate the impact of different funding scenarios;

- Predict future performance of highway infrastructure assets for different levels of investment and different maintenance strategies;

5.1.3 To address these objectives, we have established a lifecycle planning process aligned the recommendations of the guidance. It has implemented a rolling programme of lifecycle review and maintenance based on the principles of minimised whole life cost.

## 5.2 Deterioration & cost modelling

5.2.1 Our road (carriageway) and footway network has a condition survey carried out annually and divided into one of the following condition categories:

- Grade 5 (Red): Structurally impaired (no residual life)
- Grade 4 (Amber): Functionally impaired (approx. 1 to 3 years of residual life)
- Grade 3 (Green): Mid-life
- Grade 2 (Blue): Aesthetically impaired
- Grade 1 (Lilac): As new

5.2.2 The key to lifecycle investment and good highway asset management is knowing and understanding what treatments to apply at the right time that maximises the life of the asset at a minimum cost.

5.2.3 The majority of roads and bituminous footways that are in a mid-life condition can have their residual life extended by 7 to 10 years if preventative treatments (for example micro asphalt overlay) are applied before they deteriorate further. This is a cost-effective intervention given that the costs of preventative treatments are more than three times lower than the costs of resurfacing.

## 5.3 Carriageways & Footways

5.3.1 Our survey contractor, Gaist Solutions, in collaboration with York University and Blackpool Council, have developed an innovative cost and deterioration model for bituminous roads which builds on the available HMEP lifecycle toolkit but also adds the ability to produce optimised scenarios. These optimised scenarios select the most cost-effective treatments and applies them at the right time in the lifecycle of the road.

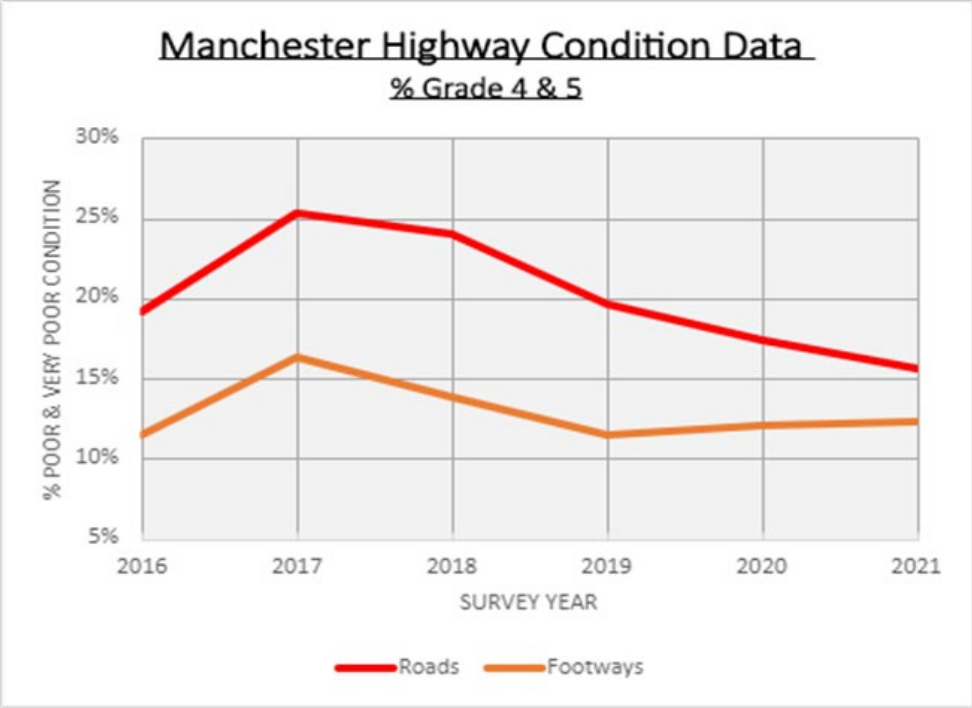
5.3.2 We have used this advanced modelling approach as well as the Highway Maintenance Appraisal (HMAT) and Highway Maintenance Economic Assessment (HMEA) toolkits, developed by the UK Roads Liaison Group (UKLRG), to determine the required long-term investment needed to effectively maintain our road & footway network This was successfully used to secure our current £100m Highway Investment Programme (2017-2022) and has been used to develop a further funding options appraisal which analyses the results of different funding scenarios over the next 5 years and sets out the benefits of providing continued highway investment.

5.3.3 By inputting our local costs for different maintenance treatments along with their expected deterioration rates, we can determine the optimum annual spend on each treatment and where these should be targeted.

5.3.4 The current investment programme (2017-2022) has been successful in halting the overall decline, from past under investment, in the condition of our roads and footways as well as enabling significant improvements to drainage and other highway infrastructure:

- We have treated over 2,000 roads & footways (over 3 million m2) and repaired over 40,000 potholes.
- The % of poor condition roads has fallen from 25% to about 17% over the last 4 years.
- Residents satisfaction of highway condition improved by 9% between 2018 and 2020 (national NHT survey).

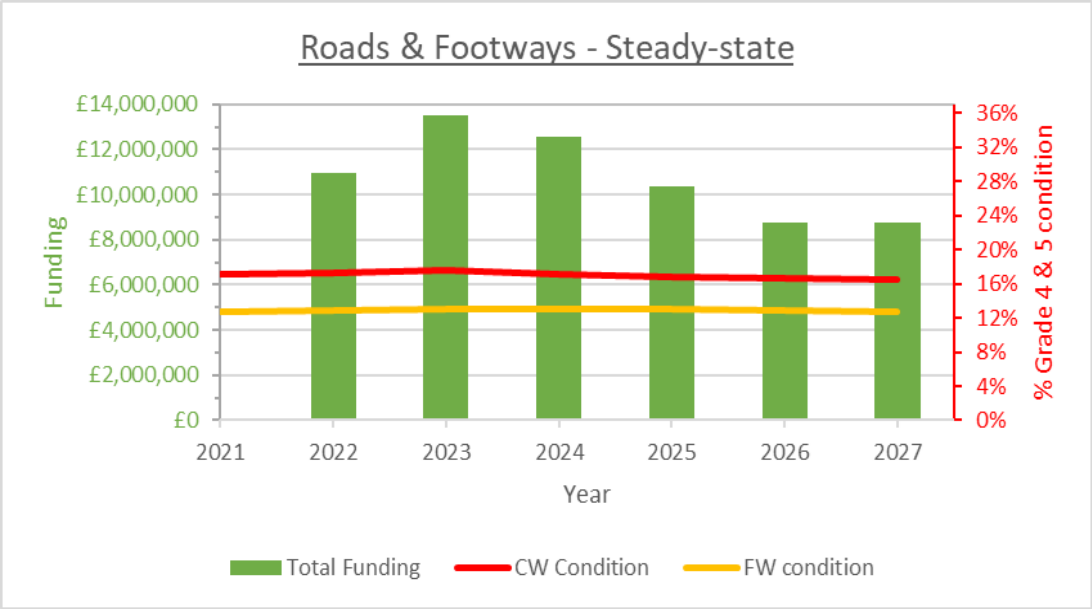
5.3.5 The graph below shows the percentage of our roads and footways at grade 4 or grade 5 (poor) condition since 2016.




5.3.6 To maintain the current condition (2021) of our highway network, modelling shows that planned maintenance spend of about £8m on roads and about £2.8m on footways each year is required over the next five-year period. The % of grade 4 & 5 (poor) condition roads and footways would be held at about 17% and 13% respectively, shown on the below graph.

5.3.7 Future investment would be targeted at improving the condition of local footways and roads, encouraging new travel habits of making more local walking and cycling journeys. The results from the model are used to justify investment decisions and enable a reduction in whole life costs. We develop 2 year rolling resurfacing / reconstruction programmes for all classification of highway to enable programming of the works at the optimum time. It is not practicable to develop a preventative treatment programme for more than one year,

because these roads may subsequently deteriorate beyond the point where these treatments would be effective.




5.3.8 Carriageway & footway lifecycle planning is refreshed annually, following the receipt of the condition survey results. Evidence arising from lifecycle modelling activity is used to demonstrate how funding and/or performance requirements are achieved by implementation of our maintenance strategies with the objective of minimising expenditure, while providing the required performance over a specified period of time.

## 5.4 Bridges & Structures

5.4.1 In order to carry out lifecycle planning for structures a robust inspection regime is required. The Inspection regime records the condition of bridges at element level for all components of a bridge e.g. main beams; bearings; piers; parapets etc. Currently each element is scored on severity and extent of any defect recorded in accordance with national standards.

5.4.2 Current inspection records for the Council's structures stock are not complete, so in 2017, Jacobs were appointed to undertake a Principal Bridge Inspection (PBI) risk ranking of MCC owned highway structures in accordance with Highways Agency Interim Advice Note 171/12 - Risk Based Principal Inspection Intervals (IAN 171/12).

5.4.3 A schedule of inspections has been defined to return MCC's inspection records to a compliant state within six years, and subsequently identify a prioritised list of required bridge maintenance work using a lifecycle planning approach.

5.4.4 When considering whole life costs, account needs to be taken of the direct and indirect costs associated with the asset group, including works, design and supervision, inspection and assessment. With highway bridges, which have a long life but are very expensive to

replace at the end of that life, it is essential to plan preventative maintenance works in a timely manner, since delays will increase the whole-life cost of the structure.

5.4.5 Greater Manchester authorities currently use Assetplan's PONTIS bridge management system, which allows storage of the condition data of each structure at element level as well as managing key asset holder functions such as Financial Planning, Prioritisation of Needs, Life Cycle Planning and Asset Valuation.

5.4.6 PONTIS has been amended to incorporate a risk ranking tool which follows the format set out in Appendix A of CS 450 – 'Inspection of highway structures'. Inspection data collected by Jacobs' operatives and MCC archive data has been used to populate the risk ranking tool.

5.4.7 Current work programmes are determined using the data in our bridge management system, and priority is given to the following: -

- structures with low BCICRIT values, i.e. those with structural defects which have a direct impact on their load-carrying capacity;
- structures with safety-related defects;
- structures with defects which, if not remedied, are likely to lead to more serious problems, for example failed waterproofing systems which will permit salt laden water ingress into decks, leading to corrosion of steel reinforcement and potential alkali silica reaction;

5.4.8 Available funding is allocated to each of the above work-types on an annual basis to suit the importance or criticality of the works identified. This strategy is intended to deliver the identified levels of service.

5.4.9 Precedence is given to highway bridges on the Key Route Network (KRN) and MCC Resilient Network, which carry the highest volumes of traffic and are key in ensuring network connectibility.

5.4.10 Currently, maintenance works are identified in an annual programme, with major schemes planned up to two years ahead. However, to assist with scheme delivery and overall financial planning, a two-year work programme is being developed, which will be subject to amendment in the event that a more critical scheme arises.

5.4.11 In many instances the existing age of bridge elements is unknown. The Structures Asset Valuation and Investment Tool (SAVI) was developed for the UK Bridges Board through DfT/UKRLG research funding to support local authorities and asset owners with the management of their structure stock. The tool has 3 main functions:

- Valuation – users can calculate both gross and depreciated valuation of their structures stock.
- Short term asset management planning – users can develop tactical short term (5-year) programmes of work.
- Long term asset management planning – users can develop long term asset management plans (up to 120 years), determine long-term intervention strategies and model variable budget scenarios against performance and whole life cost.

We will look to utilise this toolkit to help develop future work programmes.

5.4.12 Utilising the SAVI toolkit at structure level together with the powerful scenario analysis SQL tool within the PONTIS system will provide Manchester with comprehensive Life Cycle Planning capability for the structures assets. Delivery of this approach will support the implementation of the recommendations in the 'Well Managed Highways Infrastructure' Code of Practice.

## 5.5 Drainage

5.5.1 The current inventory of highway drainage assets across Manchester includes about 118,500 road gullies, as well as numerous linear drainage features. In addition to details about the location and specification of these assets, there is now information collected regarding their condition and silt level depths recorded during road gully cleaning operations conducted since 2018.

5.5.2 There are numerous gullies present in back alleys which we have not yet captured on our inventory, as well as some linear features (e.g. slot drains and ACO drains) and information around the location, condition and performance of most of the underground highway drains that remove surface water drainage. We intend to carry out targeted surveys to identify and record these features once funding allows.

5.5.3 The current programme of drainage investment (2017-2022) has allowed us to carry out cyclical cleansing on all our highway gullies (about 118,500) and spend about £8m on capital improvements since 2017. These improvements include replacement of gully lids and frames, pipe and brickwork replacement, CCTV studies and gully pot replacement.

5.5.4 Analysis of data is shown in the table below, plotting the number of gullies against the % silt level, split by road class:

| **Silt level:**<br>**Road class:** | **0%** | **25%** | **50%** | **75%** | **100%** | **Total** |
|---|---|---|---|---|---|---|
| Motorway | 7 | 209 | 262 | 569 | 299 | **1346** |
| A Road | 151 | 1777 | 3158 | 4593 | 3367 | **13046** |
| B Road/ Access road | 19 | 436 | 1016 | 1539 | 918 | **3928** |
| Local Road | 571 | 12020 | 33592 | 38457 | 23284 | **107924** |
| **Totals:** | **748** | **14442** | **38028** | **45158** | **27868** | **126244** |
| **Percentages:** | **0.6%** | **11.4%** | **30.1** | **35.8** | **22.1** | **100%** |

5.5.5 This shows that on average in the 1-year to 2-year period between the first pass cleanse and the 2nd / 3rd pass cleanses, 22% of our gullies have completely filled up, with a further 36% at 75% full and 30.1% at 50% full. This would suggest that to keep our drainage network running, we need to cleanse at least 88% of our gullies over any 2-year period and ideally at least 22% annually.

5.5.6 For streets where we know there are always parked cars present, we won't carry out cyclical visits, but will look to schedule 'community clean' days. Data from October 2020 until August 2021 suggests there are around 10,000 gullies that fall into this category.

5.5.7 We have developed a proposed programme of cleansing on the remaining gullies based on an indicative annual revenue budget of £500k using a risk-based approach.

5.5.8 The table below assumes that gullies / streets are indicatively split between 3 bandings.

| Risk score | Indicative number of gullies | £500k annual budget | |
|---|---|---|---|
| | | Frequency of Clean | Annual Cost |
| **High Risk** | 16,275 (15%) | Annual | £123.6k |
| **Medium Risk** | 27,125 (25%) | 2 yearly | £103k |
| **Low Risk** | 65,100 (60%) | 2 yearly | £247.2k |
| **TOTALS:** | **108,500** | | **£473.8k** |

5.5.9 The funding would allow us to cleanse high risk sites annually, and the remaining gullies every 2 years. This would only allow the highest risk 15% of our gullies to be cleansed annually – looking at the silt levels data above, it is likely that there would be about 7% of other gullies that would become blocked in any year, which wouldn't get cleaned until the following year.

5.5.10 In addition to the cleansing data, a list of the current outstanding capital drainage repairs (2021) has been extracted from the highways drainage database with an average cost applied for the works based on the 4 contractors appointed to the drainage capital repairs contract framework. This shows that the backlog of capital improvements needed is estimated to be about £8m.

5.5.11 While there is a need for a further investment programme to prevent degradation of drainage assets, there are options for the organisation as to how this funding requirement can be prioritised along with other capital investment need from across the capital programme.

5.5.12 Various capital funding scenarios have been modelled in terms of their impact on the current backlog of required repairs as well as factoring in an estimated 5% annual deterioration rate. This figure is based on historical data and is an estimate of how much the backlog of required repairs will increase year on year due to any failures.

- Investment of £0.5m per year of capital funding over 5 years (£2.5m in total) would allow the completion of required drainage improvements on key routes only (KRN and CN). It is estimated that these will comprise about a third of our drainage network (40,000 gullies). This option would keep key routes drained and less likely to flood. However, it would mean that the remaining gullies would be subject to reactive work, and funding would not be able to address all the current backlog of capital works.

- Investment of £2.2m per year of capital funding over the next five-year period (£11m in total) is needed to allow the completion of all current backlog improvements and address an estimated 5% annual deterioration rate over the investment period. This investment would prioritise the identified key routes but address all our drainage network. Once the backlog has been completed, we would just need to carry out cyclical cleansing using revenue budgets to maintain our drainage network in a good condition, plus any emergency work.
  Once the backlog of gully improvements is completed, this funding would also enable us to fully survey the linear drainage features, gullies in back alleys and uncharted culverts. Remaining funding would be used to deliver prioritised works towards the end of the investment period and based on funding available at this time.

5.5.13 The graphs below show the funding and corresponding drainage improvements backlog for these 2 options over time (funding for 2021 is that remaining from the £4m already secured).