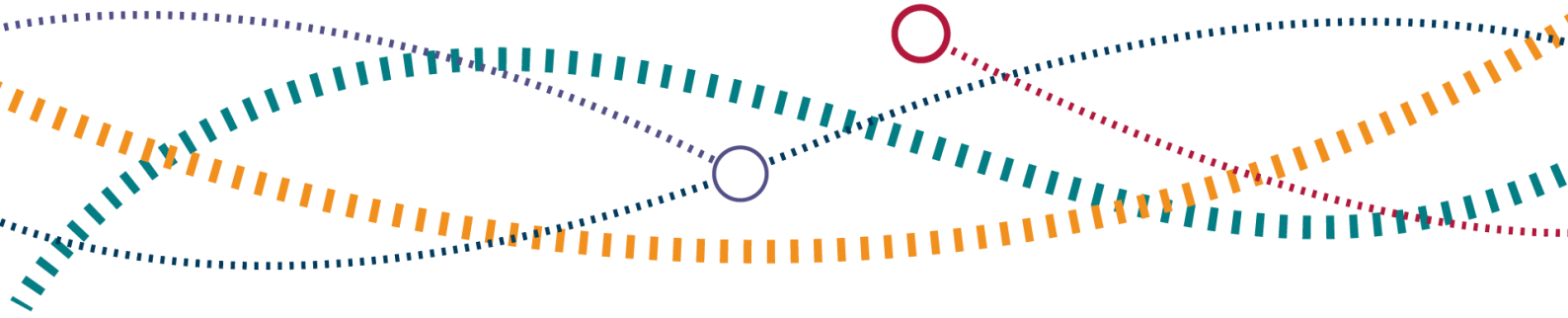
Drainage Maintenance

Targeted Assurance Review

25 May 2021



Contents

Acronyms and Abbreviations

CP6 - Control Period 6 (April 2019 – March 2024)

CP7 - Control Period 7 (April 2024 – March 2029)

DEAM – Director of Engineering and Asset Management

IME – Infrastructure Maintenance Engineer

MDU – Maintenance Delivery Unit

ORR – Office of Rail and Road

PPF – Putting Passengers First (the name of a national re-organisation programme within Network Rail)

PR23 – Periodic Review 2023 (ORR's review of Network Rail's 5-year plans for CP7)

RAM –Route Asset Manager(Note: in some Regions, this title is no longer used following Network Rail's national 'Putting Passengers First' re-organisation)

OTSM – Off-Track Section Manager

TME – Track Maintenance Engineer

Definitions

Maintain	“Maintaining the performance of the asset by cleaning (de-silting, vegetation removal, root cutting) and minor repairs.” (definition from Network Rail’s standard NR/L2/CIV/005 module 07 - Interventions).
Refurbish	“Restoring the performance of the asset by major repair, partial replacement, re-profiling etc.” (definition from Network Rail’s standard NR/L2/CIV/005 module 07 - Interventions).
Renew	“Wholesale replacement of the asset. May also include an element of asset improvement, for example to increase capacity to take account of future climate change.” (definition from Network Rail’s standard NR/L2/CIV/005 module 07 - Interventions).
New Build	“Installation of new assets to address a shortfall in drainage performance where there is currently no or insufficient drainage.” (definition from Network Rail’s standard NR/L2/CIV/005 module 07 - Interventions).
Wet Beds	A section of track where the ballast/sleepers become saturated through water contamination/leakage from either above or underground often resulting in a slight dip or reported "rough rides" in the track as trains pass over.

1. Executive Summary

Network Rail's approach to managing drainage has been undergoing significant internal changes for at least the last five years including: establishing 'drainage' as its own asset group; Network Rail's devolution into five autonomous Regions; and a change towards data-centric management of assets. Furthermore, drainage is central to discussions regarding external changes, including climate change and post-Covid funding scenarios.

Drainage assets are subject to flowing water, erosion, and a build-up of silt, leaves, and vegetation, all of which require regular planned work (i.e. inspection and cleaning) – more so than any other asset type. After severe weather events drainage assets require urgent attention (i.e. clearance and pumping out standing water). All of this planned and reactive work is delivered through 'maintenance'.

Through our regular engagement with Network Rail, we had become concerned about discrepancies between targets and priorities at Regional level; and the work being reported by Maintenance Delivery Units (MDUs), which could indicate ineffective or inefficient maintenance. So, we undertook this TAR to gain detailed information about processes, teams and behaviours in a sample of MDUs. We found a clear geographical divide in the behaviours of MDUs (irrespective of which Network Rail Region they are in):

- **East**: MDUs had historically managed drainage as a lower priority because it had not been a major source of performance delays. Asset information was centred on local knowledge, rather than centrally stored records and condition data. Recent increases in severe weather in the East have exposed these issues.
- **West**: Faced severe weather issues five or more years ago and are more mature in their collection and use of asset information. However, this new asset information means that MDUs in the West are locating forgotten, historical assets and gaining awareness of new system interactions, which were not part of their CP6 plans. This creating new issues around resourcing and processes.

We concluded that there is a lack of stability in current data usage and management processes, making it harder for MDUs to adapt to external changes. We also found a lack of alignment, with important discussions at Regional and national levels not engaging MDUs and the teams delivering maintenance work. We identified two recommendations:

(1) Network Technical Head to produce policies outlining a resilient, stable state for internal data usage and management – with Regional guidance.

(2) Network Technical Head and Regions (DEAMs) to produce guidance on alignment and communications between MDUs and other teams.

ORR will use the outputs from these recommendations to hold Network Rail to account for implementing best practice in CP6; and we will test for improvements in our PR23 review.

2. Introduction

2.1 Background

Network Rail's Drainage Asset Policy (Issue 4, March 2017) notes that maintenance is the most important element in the way they manage drainage, stating: "*The drainage asset has the shortest (serviceability) time to failure of all of NR's assets if regular routine maintenance is not carried out. The most cost effective way of addressing this on the higher criticality routes is to move to a regime of fixed interval drainage maintenance."* And also that other forms of intervention are done by exception, only when maintenance is no longer effective: "*Assets shall be renewed only when the risk to performance applicable to the asset requires it and it is cheaper, in whole life cost terms, than the maintenance or refurbishment needed to continue to meet the requirements of the route."*

As well as planned maintenance, most drainage issues (such as flooding, or blockages found on track walkovers) are initially treated through reactive maintenance, rather than refurbishments or renewals.

To understand the findings of this TAR, it is important to note that the Network Rail teams responsible for planning and delivering drainage maintenance have been through (and are still going through) major changes, including:

- **2008** – Network Rail's '2BC' re-organisation brought maintenance in-house from contractors and set boundaries for local 'Maintenance Delivery Units' (MDUs).
- **2015** – Following a series of wet winters with major flooding issues, Network Rail decided to separate out drainage as its own asset group. Previously it had been managed by track and earthworks, each discipline looking after their own drainage systems.
- **2018** – ORR issued a final determination on Network Rail's plans for the next 5-year funding period, (Control Period 6, or 'CP6'), with plans split into 8 'Routes'. In the PR18 determination we also required that Network Rail improve its understanding of its Drainage[1] asset information and cost information to support its ongoing planning process.
- **2019 - present** – Network Rail's 'Putting Passengers First' re-organisation devolves management of the network into 5 'Regions', with more autonomy and less reliance on national policies and strategies. This includes revising MDU boundaries.

[1] Clause 2.154 in 2018 periodic review final determination - Supplementary document - Review of Network Rail's proposed costs (orr.gov.uk)

2.2 Purpose

Following a number of significant drainage failures in the first two years of CP6 and national concerns about the impacts of climate change, we undertook this Targeted Assurance Review (TAR) to collect detailed evidence about the teams, processes and behaviours involved in the delivery of drainage maintenance. This will provide assurance that activities in CP6 are in line with best practice, and will consider any changes needed ahead of detailed planning for CP7.

2.3 Scope and Objectives

2.3.1 Scope

This TAR will consider the teams, processes and behaviours involved in delivering drainage maintenance, within Network Rail's Maintenance Delivery Units (MDUs). Figure 1 shows a typical organisational structure within a network Rail Region, with the relevant roles for this TAR shown in bold.

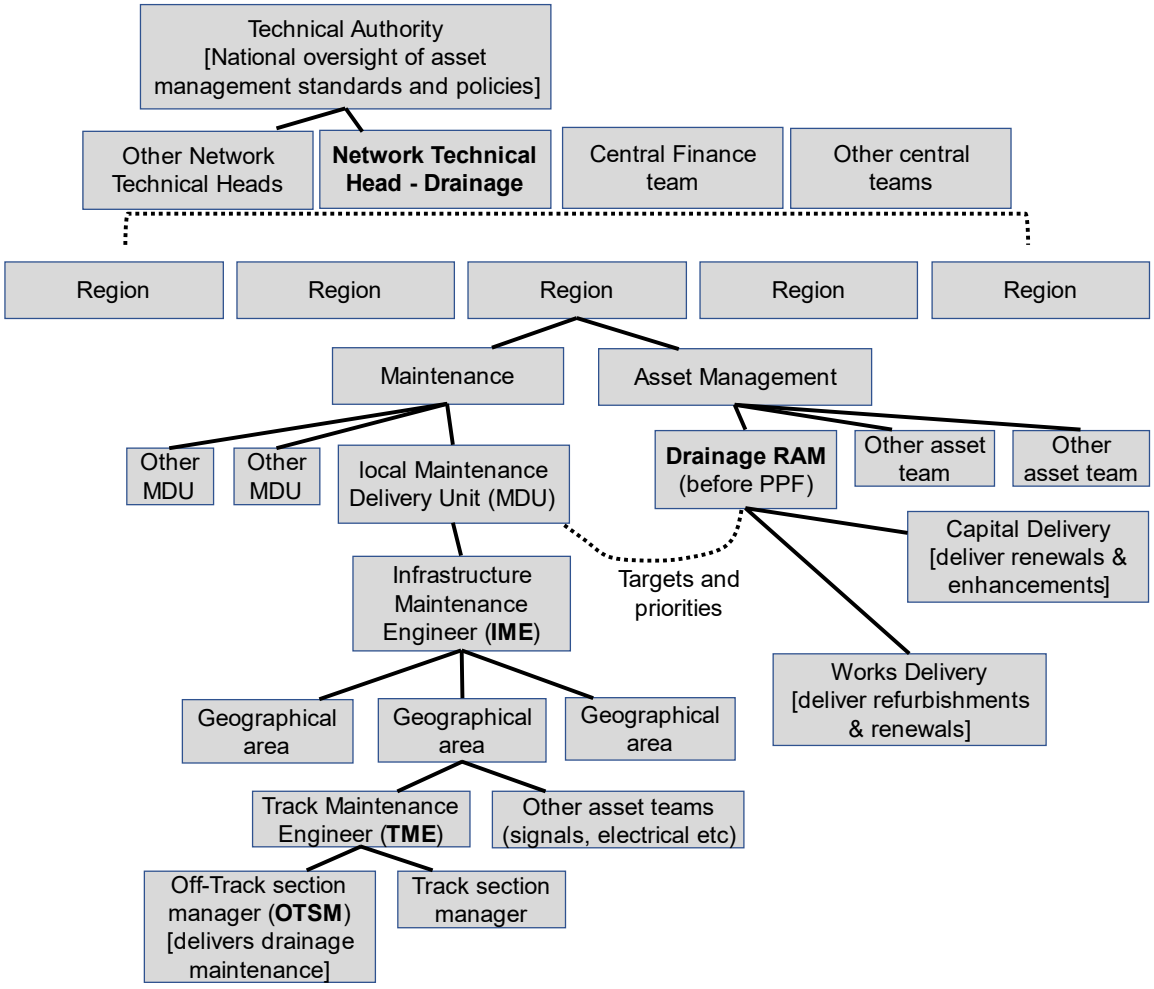


Figure 1 - Simplified Network Rail organisation chart, showing relevant roles for this TAR in red (note: after PPF, org-charts will differ between Regions)

During our regular engagement with the Network Technical Head for drainage and Route Asset Managers (RAMs) noted that the volume (number, or length) of maintenance works being delivered differed significantly from annual volume targets agreed between the MDUs and the RAMs. Based on the emerging concerns from our regular engagement, this TAR focusses on the three Regions with the largest discrepancies, which were: Eastern, Northwest & Central and Scotland. While we did not include Wales & Western in our detailed review, we did hold a discussion with the RAMs in that Region, for comparison.

We have also assessed evidence from Network Rail's 'Works Delivery' teams, which was collected from two other ORR TARs looking at weather resilience[2] and delivery of earthworks and drainage renewals[3].

2.3.2 Objectives

This TAR collected and summarised evidence to

(1) demonstrate whether current activities in CP6 are 'best practice' – and recommend improvements where necessary,

(2) identify any issues or opportunities, looking ahead to CP7 planning.

2.4 Methodical Approach

We sent a written request for information (RFI) to Network Rail's Network Technical Head and held interviews with the RAMs (interviews were carried out via video-calls, due to the Covid-19 pandemic). Their responses informed a separate questionnaire which was sent to 34 members of Network Rail maintenance delivery staff, across 14 MDUs ahead of video-call interviews. Interviewees provided evidence to support statements made in the interviews by email including: maintenance volume plans; targets and KPIs; site inspection records and photographs; and minutes of internal meetings. Finally, for additional validation, we held a video-call with Network Rail's central Finance team.

The location of Network Rail staff participating in the interviews is shown in Figure 2; including the locations where ORR collected information from Works Delivery (Network Rail's in-house delivery contractor) as part of other TARs.

[2] Earthworks and Drainage Weather Resilience TAR: https://www.orr.gov.uk/media/22457

[3] Earthworks Cost and Volume Transparency TAR: https://www.orr.gov.uk/media/22458

We are grateful to all contributors, for taking the time to assist with this TAR and for providing such open and honest information.

Interview questions are attached as Appendix B. Detailed responses are not included in this report due to the commercial sensitivity of the information, however a summary is provided in Appendix A and explained in detail in Section 3.

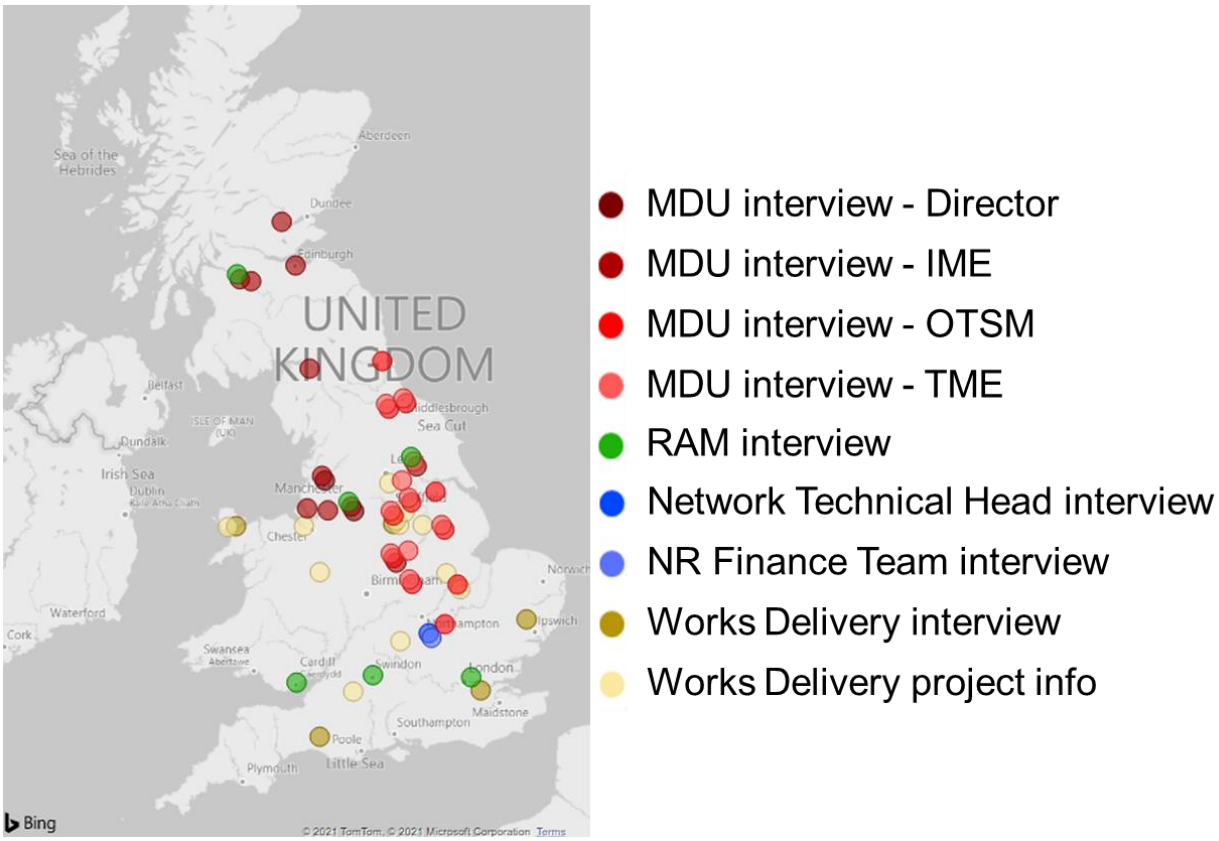


Figure 2 - Map showing locations of MDU staff interviewed for this TAR, as well as information from Works Delivery projects obtained from other TARs

3. Findings

Our interviews with MDU staff found that the team structures were generally similar in all MDUs – a typical example is shown in Figure 1. Drainage maintenance is being delivered by Off-Track Section Managers (OTSMs), who report to Track Maintenance Engineers (TMEs) then Infrastructure Maintenance Engineers (IMEs). In all MDUs, the Off-Track team were also responsible for other activities as well as drainage, including de-vegetation, boundary fencing and in some cases there were overlaps with track work, in particular level-crossings. Apart from these similarities, we found significant differences between MDUs and even between neighbouring MDUs within the same Region. Regions are devolved geographical areas within Network Rail, with their own policies, strategies and priorities, so we might expect all MDUs within a Region to show strong similarities, albeit with some local differences to account for urban, rural or main lines and local geographical features.

Our findings across all 14 MDUs are summarised graphically in Appendix A and are broken down and described in the following sections. While Network Rail provided large amounts of numerical evidence to support discussions at our interviews, some of the information around motivations and behaviours is based on ORR's informed interpretation of discussions in the interviews, therefore the results presented in figures are indicative.

3.1 The East - West divide

While individual MDUs showed significant variations, even to their neighbours within the same Region, we found that there was a pattern of similar responses from MDUs in the East of the map, and likewise a pattern of similar responses in the West. Crucially, this pattern continued into Scotland, with MDUs in Eastern Scotland having much more in common with Eastern England than with Western Scotland – even though Eastern and Western Scotland are in the same Network Rail Region. This indicated that local experience, geography and climate have a stronger influence on MDU behaviour than national or Regional policies and priorities. The importance of this geographical divide is demonstrated in the following Sections.

One explanation for this East - West divide is shown in Figure 3. In 2015 Network Rail established 'drainage' as a separate asset and the safety and performance impacts of drainage became a higher corporate priority, in response to several wet winters with significant flooding and impacts from drainage issues on other assets (notably earthworks, track and signals). The Figure 3a shows train delays due to flooding for 3 years, from 2015 to 2017; these delays are concentrated in the Western half of England. There is generally higher rainfall in the Western half of Great Britain, but in particular the delays are

concentrated on busy train lines, including the Great Western Mainline (London to Bristol) and the West Coast Mainline (London to Glasgow). So, when drainage became a higher priority after 2015, the focus was in the West.

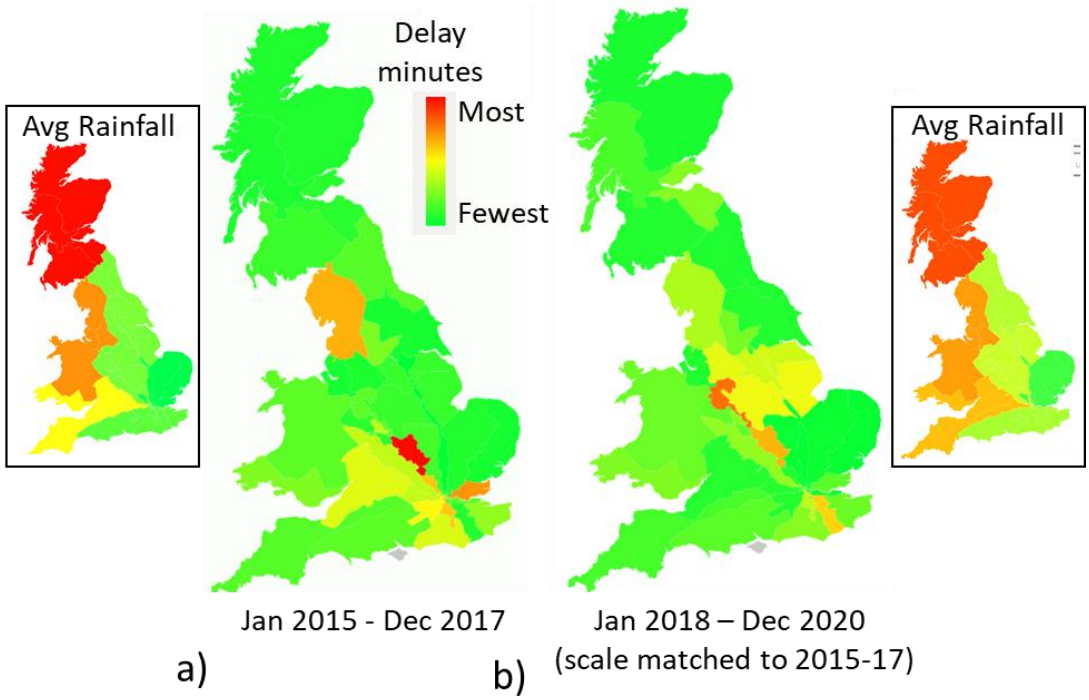


Figure 3 - Change in national pattern of delay minutes due to flooding (from 'Delay Minutes' data routinely reported from Network Rail report to ORR every 4-week period)

Figure 3b shows the recent situation, from 2018 to the end of 2020. There have been some improvements in Western England (more green areas), but also clear increases in delays in Eastern England and also parts of Eastern Scotland. This increase in the East could reflect a worsening condition of the drainage assets (as well as other asset management and operational factors), but the inset figures show an increase in the average rainfall in the East, so some of the increased delay is likely to be the result of this change in the weather. For example, the last few years have seen repeated, major flooding in Eastern England at locations where flooding was not previously considered to be a maintenance issue, such as the River Don which had not seen flooding since 2008 but which flooded in November 2019, then almost immediately faced the wettest February on record in 2020. Similarly, Eastern Scotland had unprecedented issues with sudden convective storms in the Summer of 2020, where it had previously been considered as "the dry coast" of Scotland (this phrase was repeated by several interviewees).

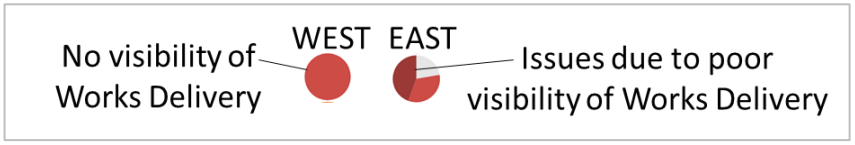
In the following sections, we will show how these changes over the last few years correspond to very different processes and behaviours in MDUs in the East and West.

3.2 Interaction between MDUs and Regional teams

All of the MDUs stated that the RAMs provided annual targets for the total volume of drainage maintenance. These were agreed between the RAMs and the MDUs before the start of the 5-year control period, as part of their bottom-up planning (referred to as Activity Based Planning, or ABP). However, the way the MDUs treated these targets varied significantly.

Most MDUs in the West were accepting the RAMs annual targets, then producing detailed plans for each 4-week period, showing when the volume would be delivered throughout the year. In contrast, more than half of MDUs in the East were establishing their own targets based on 'local knowledge', considering actual volumes from previous years and often including large volumes achieved by regular cycles of mechanical maintenance (jetting). In most MDUs in the East, annual volume targets were spread equally over the 13 periods, so actual volumes were often significantly above or below the 'target' in each 4-week period or in the year-to-date. Because drainage was a lower priority within these MDUs, their main goal was to deliver sufficient work to avoid performance impacts within the total budget for Off-Track, with less concern about the volume targets – there was flexibility within the Off-Track team to deliver more or less drainage maintenance, depending on the need for de-vegetation, boundary fencing, level crossings or any other Off-Track work.

In all Regions, Works Delivery are delivering refurbishments and renewals, at the direction of the RAM. All MDUs noted that they have a role in identifying sites where maintenance is no longer effective and escalating these sites to the RAM, to consider permanent solutions. For example, at Trafford Park (Manchester MDU) the site flooded and the MDU tried to vacuum out blockages from 37m of pipes but found they were blocked with concrete. So the MDU installed automatic pumps, but this was only a temporary solution as a pump failure would cause the site to flood again. So, this was escalated to the RAM who instructed Works Delivery to install new pipes and catch pits, funded from a regional Weather Resilience budget. The process for escalating issues varied, with most MDUs bringing these sites up at regular periodic meetings with the RAMs.



However, almost all MDUs noted that they have little or no visibility of Works Delivery's plans. Which

raises the following serious concerns about inefficiency and potential safety and performance risks.

MDUs and Works Delivery are both using the same data capture system (Ellipse) for planning and logging inspections and work volumes, but it was noted that MDUs and Works Delivery are using two separate parts of the same system and do not see each other's information. Examples were provided by several MDUs in the East, where Works Delivery were doing some (or all) drainage maintenance and the MDUs' lack of visibility of Works Delivery plans was leading to duplications and some sites not being maintained. As Works Delivery are acting under instructions from the RAM, we would expect the RAMs to be communicating plans and issues about Works Delivery to the MDUs at their regular meetings – in the same way that we expect MDUs to be clearly escalating problem sites to the RAM at these meetings. We would also expect both teams to have visibility of each other's data in Ellipse.

One example which was raised several times in the West was that the RAMs have identified lists of 'Critical Drainage sites', which require regular inspection and maintenance. MDUs understood that the RAMs had instructed Works Delivery to carry out renewals or refurbishments at some of these sites, to provide a permanent solution to drainage issues – and as a result, MDUs were no longer seeing drainage issues at some sites. However, the sites remained on the 'Critical Drainage' list, so the MDUs had to keep dedicating a lot of their resources to these sites. There was no clear feedback mechanism for the RAMs or Works Delivery to update the MDUs that they could reduce the maintenance at these sites, or remove sites from the MDU's 'Critical Drainage' list altogether.

In parallel with this TAR, ORR have completed another TAR looking at Network Rail's approach to 'Weather Resilience' for earthworks and drainage, including resilience to climate change. Various teams in Network Rail are engaging in detailed conversations about weather resilience and climate change, which has led to new strategies and specific projects at both national and Regional levels. In our interviews for this TAR, we asked MDUs whether they have been involved in any of these conversations about climate change. None of the MDU staff we interviewed had been involved in these conversations, either with Network Rail's central weather resilience teams, or in Regional discussions about approaches to climate change.

While they felt they had not been part of the conversation around climate change, more than half of the MDUs in the West noted that they are regularly escalating issues they see on site, which are a direct impact of climate change. For example, there have been clear

increases in the frequency and severity of storm events – both frontal, winter storms such as storms Ciara and Dennis in 2020 and storm Christoph in 2021; and also convective, summer storms as seen in Scotland and across Northern England in August 2020. The Northwest & Central Region had the clearest process for escalating these issues, with regular 'Star Chamber' meetings between MDUs and RAMs to identify sites with new and recurring flooding issues. Similarly, there were regular 'Water Management Groups' in Motherwell MDU (Western Scotland), to escalate problem sites to the RAM.

3.3 Types of drainage maintenance

Network Rail's reporting for drainage maintenance is split into the following 'standard jobs':

Manual types of maintenance	Mechanical types of maintenance
PIPE MAINTAIN MANUAL (yards) e.g. rodding between catch-pits to remove blockages (leaves, silt, litter, calcite etc)	PIPE MAINTAIN MECHANICAL (yards) e.g. using a high-pressure jetting/vacuum truck to wash out blockages
DITCH MAINTAIN MANUAL (yards) e.g. washing out silt etc, or removing vegetation from gravel-filled ditches	DITCH MAINTAIN MECHANICAL (yards) e.g. similar to manual, but using jets/vacuums to cover long lengths, faster
CHANNEL (lined or unlined) MAINTAIN MANUAL (yards) e.g. removing blockages (leaves, silt etc) or vegetation from open channels	CHANNEL (lined or unlined) MAINTAIN MECHANICAL (yards) e.g. similar to manual, but using jets/vacuums to cover long lengths, faster
CHAMBER MAINTAIN MANUAL (each) e.g. replacing missing lids, replacing concrete rings or removing blockages.	CHAMBER MAINTAIN MECHANICAL (each) e.g. using a high-pressure jetting/vacuum truck to wash out blockages
CULVERT MAINTAIN MANUAL (yards) Culverts are large pipes (diameter 450mm – up to several metres) crossing under the track or other infrastructure. Smaller culverts may be maintained similar to 'PIPES', but larger culverts require specialist staff to work inside the culvert. Also, important to note that the structural integrity of culverts is maintained separately (by the Structures team)	CULVERT MAINTAIN MECHANICAL (yards) e.g. similar to manual, but using jets/vacuums to cover long lengths, faster

All of these types of work can be 'planned' by the MDUs, where sites are identified in advance, usually on a regular cycle. Network Rail's standards and policies are not

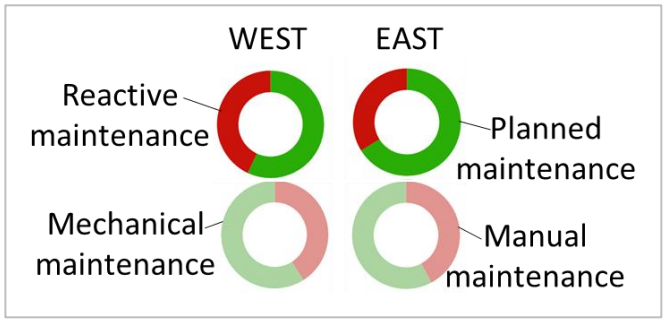
prescriptive on the frequency of maintenance and state (NR/L2/CIV/005/06 Drainage Evaluations) that this should be determined based on an evaluation and risk assessment of each asset.

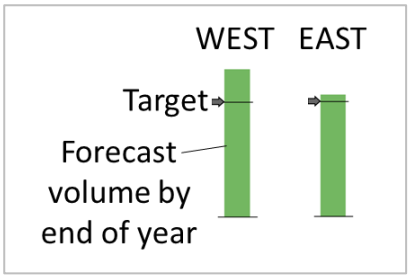
All of the MDUs we interviewed had strong, but conflicting opinions about whether manual or mechanical maintenance is more effective or more efficient for sustainably maintaining drainage. Arguments for mechanical maintenance were that rodding does not effectively remove all blockages and that jetting plant can deliver significantly more volume in a shift. Jetting was seen as more expensive 'per yard' for short lengths, but became more efficient than manual work if used over several hundred yards to miles. Many MDUs said they did not have enough resources in their team to meet their annual volume targets, without some large jetting jobs. However, arguments for manual maintenance were that jetting quickly damages modern plastic drainage pipes; some MDUs struggled with availability of jetting machines through their suppliers; and the equipment requires OLE isolations and may not be compatible with other work going on.

Network Rail procured their own high-output plant for drainage maintenance ("the Drain Train"). Of the 14 MDUs we interviewed, only 3 had used the Drain Train (Manchester, Glasgow and Edinburgh). One MDU and the Network Technical Head noted that there had been issues with the Drain Train breaking down when it was first used in these MDUs, but that these issues had been addressed. The 3 MDUs which used the Drain Train all stated that it had delivered more volume per shift than they had expected, that this made the costs more attractive and that they intended to use it again for larger volumes in the future. There was no evidence that these lessons learned were being shared with other MDUs – of the other 11 MDUs: one was aware of the Drain Train but was put off by the stated cost; 4 said they had not heard of it, when we asked about it; and the remaining 6 did not mention it.

As well as planned maintenance, MDUs also carry out 'reactive' maintenance, to fix drainage problems after they occur. These can be identified in several ways, including Network Rail teams or members of the public reporting flooding, in which case the MDU would respond urgently and might unblock pipes or channels to get water flowing again, or they might install temporary pumps to move water away from the track. In some cases there may be more time to plan a response, for example a blocked pipe might be spotted on a track walkover and logged as a 'defect inspection', before flooding occurs. Also, flooding incidents are a known precursor of wet-beds, where the track-bed becomes waterlogged, softens and impacts track geometry up to 6 months after the flooding occurred, unless maintenance is carried out to ensure the track bed is properly drained.

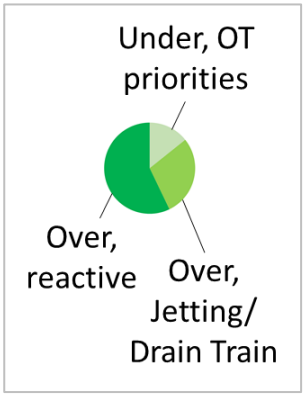
We found significant variation between the MDUs on the proportion of planned and reactive maintenance; and also the proportion of manual and mechanical maintenance. There was no clear pattern within any Region or between the East and West sides of the map. Network Rail's Drainage Asset Policy states "*There is a growing body of data to demonstrate the cross asset cost benefits of proactive drainage maintenance*", but our interviews and the evidence we collected during this TAR did not find any clear steer or guidance from the Regions or central Network Rail teams to the MDUs, about the benefits of planned vs reactive, or mechanical vs manual maintenance for drainage. This decision appears to have been made in each MDU based on the preferences of the OTSMs and TMEs.





On average the MDUs are 'over-delivering' this year – delivering more drainage maintenance than the target set by the RAM or by the MDU. All of the MDUs stated that failing to meet the target was a problem and would result in serious challenge from senior managers and the Finance team. However, there was no clear message from any part of Network Rail as to whether exceeding the target is a positive or a negative outcome. RAMs noted that they set volume targets by using a Drainage Decision Support Tool to calculate the minimum volumes required to satisfy Network Rail's policy requirements, then the RAM's team increase this number based on local factors, such as ensuring all drainage linked to high risk earthworks, tunnels or other critical assets is inspected and maintained more regularly. There is a logical argument that delivering more volume means more of the assets are being maintained, which should reduce the risk of flooding and delays.

However, the most common reason for over-delivering was because large volumes of reactive work were being done, which were not included in the plan. In a few MDUs in the West, this was reacting to 'new' assets which had been found in the network-wide surveys (this was the cause of the highest over-delivery out of all the MDUs). But in most cases, the MDUs acknowledged that their targets are based on planned, cyclic maintenance and if they need to react to urgent problems then this is 'extra' to the plan. So in fact, exceeding the volume target is likely to be an indicator of poor asset management – because a

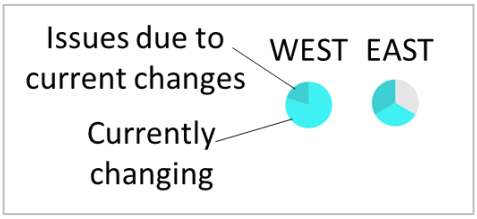


large number of drainage assets are failing and requiring reactive maintenance. Furthermore, many MDUs noted that the list of planned sites is not fixed and if the Off-track team is called upon to do reactive works, they can easily defer or cancel planned works. So, where MDUs exceeded their target due to large volumes of reactive works, they may have actually maintained less of the sites which they originally planned to.

It is important to note that the splits of planned vs reactive work shown in this report are based on conversations with MDU staff. We did not find any KPIs or clear data, recording the proportion of planned vs reactive work – so we had to ask MDU staff to give an approximate figure. The Network Technical Head noted that work requested through "works arising forms" is often (but not always) reactive, whereas work requested through Maintenance Standard Tasks is planned, so these could give some indication of the planned vs reactive split. In several cases we questioned whether the volume of reactive work was consistent year-to-year and MDUs in both the East and West noted that extreme weather events have been more frequent and more severe in recent years, leading to increased reactive work.

Network Rail's policies and processes allow the MDUs to operate differently, to focus on local issues and to assign the type and frequency of maintenance based on asset-level risk assessments. However, the lack of guidance or steer to the MDUs may be impacting the total volume delivered (including planned and reactive work) and the cost efficiency of the Regions, and there is a lack of transparency about what is driving this.

3.4 Roles and Priorities



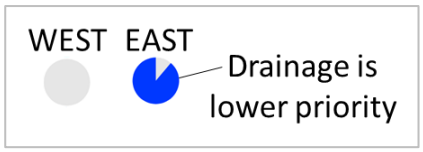
Almost all MDUs, across both the East and the West, stated that they were currently undergoing organisational changes to their team, their processes or the work they were expected to deliver. Most of the Off-Track teams covered smaller geographical areas within the MDU boundaries (for example the York MDU is split into Middlesbrough, York and Knottingley) and several of these areas were changing boundaries, merging or splitting as part of Network Rail's 'PPF' re-organisation.

As part of PPF, many teams were also changing personnel, with staff being transferred between roles within the MDU or between the MDU and Regional teams. Some teams were introducing new roles in the team, for example Edinburgh MDU had been trialling an additional TME for the last 18 months, so there was one TME for track and one dedicated to Off-Track (covering drainage). This trial had been successful locally and was being rolled out across all MDUs in Scotland.

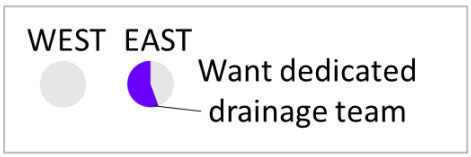
More significant changes involved transferring most or all of the drainage maintenance work from the MDU to Network Rail's Works Delivery team. There have also been some staff shortages due to Covid-19 and temporary recruitment freezes. These are shown on the Figures as "issues" for information, but it should be noted that this classification was based on personal accounts from NR staff and these were not the basis for conclusions or recommendations in this TAR.

Some MDUs noted that their OTSMs were a key source of local knowledge (in one case, the OTSM had been working in the area for more than 40 years) and that there was a risk of knowledge loss or skills shortages if these OTSMs left the role. This reliance on staff with extensive local knowledge is a concern and indicates an absence of good quality asset information and regular data available in Network Rail's data management systems. When we questioned other MDUs on potential loss of skills and information, some noted that they are less concerned about loss of knowledge or skills because they can retrain new staff – and their main challenge was recruiting staff capable of moving and operating heavy equipment on uneven, steep slopes safely.

3.4.1 Roles and Priorities - East



MDUs in the East of the map consistently stated that drainage is often treated as a lower priority than other Off-Track work. In some MDUs the higher priorities were well defined and well justified, for example Bedford Off-Track team noted that their main focus is de-vegetation, especially near overhead electric wires for the East Coast Mainline. Several other MDUs indicated that because they reported to TMEs (whose portfolio was mainly track assets), they would often react to issues affecting the track or level crossings as a priority over drainage further away from the track or at the top of earthworks.



Despite noting that drainage is often treated as a lower priority, more than half of MDUs in the East noted that drainage is a significant contribution to train delays; highlighting they would benefit from a dedicated, specialised drainage team. As noted above, Edinburgh MDU trialled having a dedicated Off-Track TME and the Off-Track team also undertook training in drainage inspections, with the RAM.

All of the MDUs in the Network Rail Eastern Region noted that some or all of the drainage maintenance in their areas is now being delivered by Works Delivery, rather than the MDUs. This had changed within the

last year and most teams were still adjusting to the change, having lost Off-Track staff and inspectors as a result. Prior to this change, Works Delivery had only been delivering refurbishments and renewals to the drainage assets. The Drainage RAM indicated that they had made this change as a direct result of MDUs failing to give priority to drainage assets, despite increasing delays due to flooding. The result is a situation where the MDUs had just started to recognise the need for more focus on drainage, but now the work has been reallocated to other teams within Network Rail. Without a clear transfer of information about asset performance and degradation rates, there is significant risk of losing knowledge about these assets and creating inefficiencies – for example, several MDUs noted that Works Delivery were maintaining assets which the MDU was still maintaining as well, or Works Delivery had not planned any work at sites which the MDU had stopped maintaining.

In our interview with Network Rail's central Finance team, they noted that Works Delivery may be recording the volume of maintenance they deliver and the costs using different codes to the MDUs ("x" codes as opposed to "y" codes). When the central Finance team extract data to compare the planned drainage maintenance against what was actually delivered, they will only look at the MDUs codes. There is a risk that Works Delivery could be duplicating maintenance which is still being done by the MDUs and the high-level reporting (which is seen by ORR and senior stakeholders in Network Rail) would not capture this. There is also a risk that the reporting could show little or no maintenance being delivered in some areas, when in fact it was being delivered successfully by Works Delivery. The Network Technical Head noted that their assurance reports look at all the codes and that, if Works Delivery are recording work done correctly in Ellipse, then it should be visible to MDUs, but they acknowledged the potential for incomplete reporting.

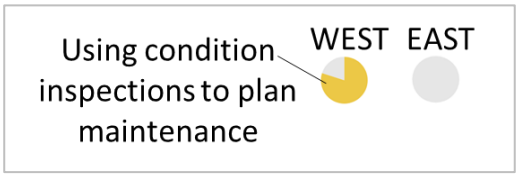
Network Rail's Drainage Asset Policy (Issue 4, 2017) notes that "Compared with the other principal NR asset types (track, earthworks, structures, buildings and signals) the NR drainage asset has historically been poorly known" and cites a review which found that acceptable information was only available for 35% of all assets.

In our PR18 determination we set out the requirement that Network Rail improved its understanding of its Drainage asset information and cost information to support its ongoing planning process. At the start of CP6, Network Rail committed to undertaking network-wide surveys, to establish the location of all assets and also to begin regular 'condition inspections' for every asset. These condition inspections provide a score of 0-5 for every asset, describing its physical condition and how well it is functioning. This is a major change from previous 'defect inspections', which only recorded any information about

drainage assets if they were found to be blocked and in need of repair, during walkover surveys. All MDUs in the East of the map noted that the network-wide surveys are being undertaken by Works Delivery and the MDUs are still relying on defect inspections. One MDU (Perth, in Eastern Scotland) noted they are starting to transition to condition inspections, rather than defect inspections. Conversely, all MDUs in the West of the map are already doing condition inspections and many of the MDUs are doing the network-wide surveys themselves, rather than using Works Delivery, so that the MDUs take ownership of the results.

In summary, the MDUs in the East of the map were characterised by drainage being a low a priority and a reliance on Works Delivery for condition inspections and some maintenance. These MDUs are rapidly recognising the need for more focus on drainage, following recent increases in flooding and drainage-related issues. Changes within the MDUs as part of PPF do not appear to be addressing all of these issues. Without good asset information recorded in the data management systems, there is a risk of losing local asset knowledge through these changes.

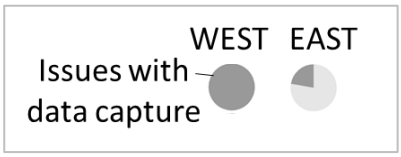
3.4.2 Roles and Priorities - West



As shown in Figure 3, drainage-related delays have been a significant issue for MDUs in the West of the map for more than 5 years. These MDUs have taken ownership of Network Wide condition inspections of all drainage assets. Crucially, most of these MDUs also said that they have started using these condition scores to understand how their assets degrade and to prioritise maintenance work. However, the Network Technical Head noted that some of this condition data is now out of data (some of it may be 10 years old) and the MDUs need to collect regular updates to the condition data, at least once each control period.

In contrast, no MDUs in the East have started using condition scores in this way – some MDUs in the East noted that they have started receiving condition scores from their RAM, but they were not clear how they were going to use them and in several cases said that prioritising by condition score was not useful, as it could direct resources towards assets with poor condition scores in areas with little impact on the railway, at the expense of assets which currently have good scores, but are liable to block at short notice.

However, most of the MDUs in the West noted that the network-wide surveys were creating serious issues. Firstly, they were finding a large number of additional assets, which they did not have sufficient staff or budget to maintain effectively, as these were not allowed for in their 5-year planning. As shown in section 3.2, all MDUs in the West noted that they are undergoing changes and several raised issues around these changes – these changes and issues were primarily around recruiting more staff to maintain the newly found assets and processing all the condition inspection data. All MDUs in the West noted some issues with Network Rail's asset data system (Ellipse) and most of these issues were in the Northwest & Central Region, where they are collecting survey data using a separate system (Polestar), then needing to re-process this data to put it into Ellipse. The remaining issues with Ellipse related to frequent human errors because the units in the system are a mix of miles, yards, kilometres and metres – some MDUs in the East also raised the same issue.



In summary, MDUs in the West of the map were characterised by more mature processes for drainage maintenance, taking more ownership of their drainage assets and making use of condition inspection data to understand their assets better. However, this maturity means that they are now starting to see the full extent of their drainage assets and the challenge they face in maintaining all of them – which they had not planned for effectively.

4. Conclusion and Recommendations

4.1 Conclusions

In Network Rail, drainage is still an immature asset group and different parts of the network are at different stages on a journey towards efficient, best practice asset management. At the same time, external drivers (i.e. climate and 3rd party neighbours) are also changing.

The West side of the network historically faced more performance impacts due to poor drainage (primarily flooding after storms). Consequently, they are more advanced in their asset knowledge, processes for prioritising maintenance and team competence. However, as more assets are surveyed and new climate risks are understood, this is exposing weaknesses in their current plans, resources and processes.

In the East, flooding and drainage historically had less of an impact on performance and were treated as a lower priority. Changes in weather patterns over recent years have highlighted the need for increased focus on drainage maintenance.

While the issues in the East and West were very different, they are indicative of two underlying themes: Stability and Alignment.

4.1.1 Stability

Fundamentally, drainage needs to handle surface and ground water from rainfall, or flowing from catchments extending outside of Network Rail's boundary. The climate and the wider catchment are not stable and will continue to change, outside of Network Rail's control. Network Rail's management of drainage – and in particular drainage maintenance, who are the first to encounter issues on the network – need to be capable of adapting to changes quickly and effectively.

As well as dealing with external instability, in this TAR we found evidence that all MDUs are undergoing significant internal changes including: use of asset data, allocation of work, priorities and team structures. This is resulting in a lack of internal stability, summarised schematically in Figure 4.

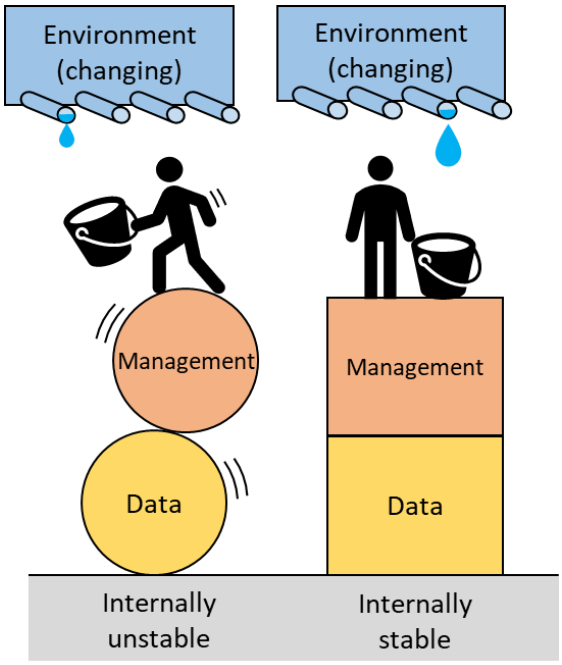


Figure 4 - Schematic, showing the challenge of multiple layers of instability

While these internal changes were intended to improve resilience in the long term, in the short term there is a lack of guidance about how the changes should be implemented, so they are causing resource issues, inefficiency and concern within the teams. The history of prioritising drainage (and drainage asset data) in the West of the network over the last five years, demonstrates that each set of changes quickly highlights new issues, which bring about new changes – and so on, without ever reaching a stable state.

For example, Network Rail has adopted an approach of improving their knowledge of their assets and how they behave, by undertaking network-wide surveys and establishing condition scores for all assets. However, MDUs in the East know these surveys are being undertaken by Works Delivery, but they have limited visibility of them. These MDUs have started receiving some condition scores, but they do not have a clear plan to utilise them. These MDUs know they are undergoing a change, which will impact the way they deliver maintenance, but they do not know what the end result of the change is supposed to be, i.e. the stable state that they are seeking to change to.

MDUs in the West went through this change several years ago, but as they continue to collect and use the new condition score data, it is creating new problems, i.e. data processing tools, resourcing to manage additional assets and developing processes for escalating and de-escalating 'Critical Drainage sites'. These MDUs are undergoing a change, but it is not clear what the stable state (required result) is, in terms of team structure or funding required to maintain all these assets, based on condition score data.

As well as data instability, Network Rail continue to undergo changes from a major, national re-organisation ('PPF'), changing from eight Routes with central oversight, to five devolved Regions with more autonomy. We recognise this is directly affecting drainage maintenance and changing: area boundaries; organisation charts; staff numbers; and who makes key decisions. If the PPF re-organisation settles as planned in the near future, other external factors could lead to further changes in Network Rail's organisational structure, or its approach to managing drainage assets in CP7.

We recognise there is a need for internal changes within Network Rail, but this TAR has found that the MDUs are more strongly influenced by current local issues than by Regional, or central, policies. This indicates a lack of guidance on the minimum requirements and best practice for effectively managing drainage – in terms of decision making, roles and interactions between teams. For example: who should be setting volume targets? should over-delivery be incentivised, or dis-incentivised? how much proactive vs reactive work is optimal? how should drainage be prioritised within Off-Track and Track maintenance portfolios? These issues are addressed in Recommendations R1, below.

It is vital that MDUs and Regions which manage to adapt to external changes are sharing lessons learned with the rest of the organisation. For example, climate projections indicate that in the coming years some parts of Northern Scotland may face high temperatures which are unprecedented locally, but which have been the subject of extensive investment and learning from recent hot summers in England.

4.1.2 Alignment

ISO55000 is a series of international standards which is acknowledged as asset management 'best practice' – and Network Rail has stated its intention to follow the principles of ISO55000. ISO55001 states that a core principle of asset management is 'alignment', also commonly referred to as 'line-of-sight'. The concept of alignment is that corporate objectives at a high-level in an organisation should be based on a set of clear principles and that these principles should then be visible, consistently across everything else the organisation does. The principles should be reflected in the organisation's policies and strategies, in the way funding is allocated, in the way teams and individuals are incentivised to make decisions, in the way data is collected and used, etc.

During interviews with Network Rail's Network Technical Head and drainage RAMs, they were all able to outline an approach to managing drainage as shown in Figure 5, where the foundation is asset knowledge (condition inspection scores) and this can be followed through the flowchart, down to MDUs and delivering maintenance work.

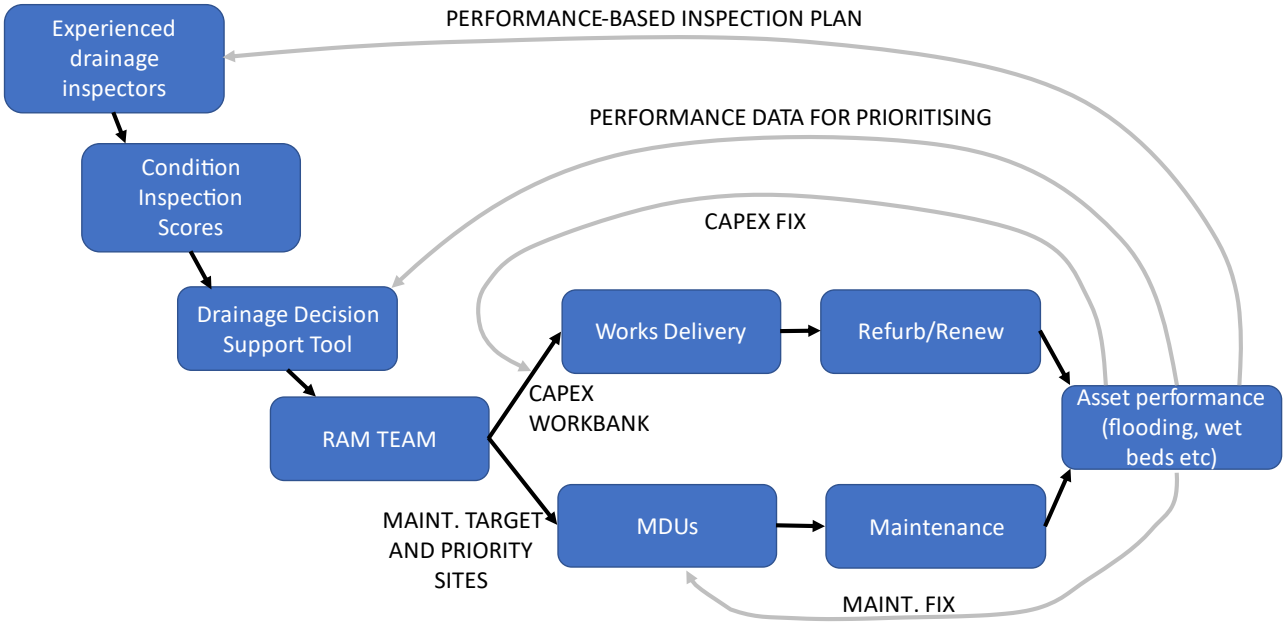


Figure 5 – Aligned approach to managing drainage

However, the evidence from this TAR indicates that there is not clear alignment of condition scores, targets and priorities from the RAM and Works Delivery to the MDUs. The two main issues are shown schematically in Figures 6 and 7. Figure 6 represents some MDUs in the East, where the MDUs were using their own local knowledge of the assets and their own defect inspections, to set their own targets and their own priorities for maintenance, as a 'closed loop', without clear feedback to the RAM or Works Delivery.

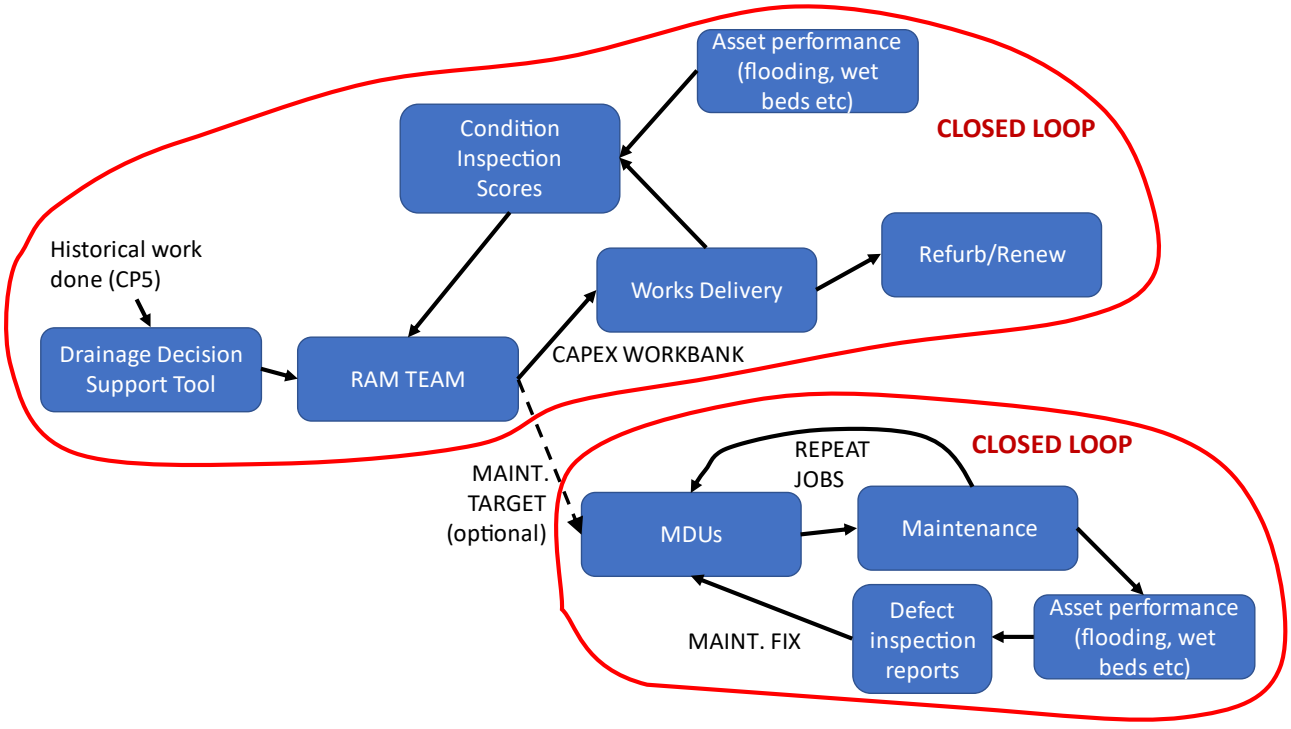


Figure 6 - Issues with alignment: closed loops

Meanwhile, in some areas Works Delivery are collecting condition inspection scores at the request of the RAM, reporting this back to the RAM and using this to plan renewals and refurbishments, as another 'closed loop', without giving any feedback to the MDUs. The consequence of this system is that maintenance is not being driven by condition scores, and Network Rail are not achieving their principle of making asset condition scores their foundation. As noted in Section 4.1.1 (Stability), the drainage asset group is trying to implement major changes and, in this 'closed loop' model, it is very difficult for RAMs or central teams to drive changes in the MDUs, because they are not working to an aligned set of motivations or principles – the only direct connection the RAM has is the volume target. The Network Technical Head indicated that this was a localised issue in parts of the Eastern Region but, unless there is clear alignment between the different teams, their data and their priorities, there is potential for this issue to occur in all Regions.

Figure 7 highlights further risk from a lack of alignment, which is potential duplication. MDUs have started to collect condition inspection scores and use them to prioritise their own maintenance. However, because they have no visibility of Works Delivery inspections, they may be duplicating inspections on the same assets or storing information in different places within the Ellipse system. In addition to conditions scores, defect inspections are being carried out and MDUs may place more emphasis on these (because the MDUs are less familiar with the new condition scores). At the same time, in some MDUs Works Delivery are undertaking maintenance activities and may be duplicating work already planned by the MDUs. The key point is that just getting the MDUs to adopt a new principle (i.e. focus on condition scores), does not produce an effective and efficient result, unless the whole process is clearly aligned. These issues around alignment are addressed in Recommendation R2, below.

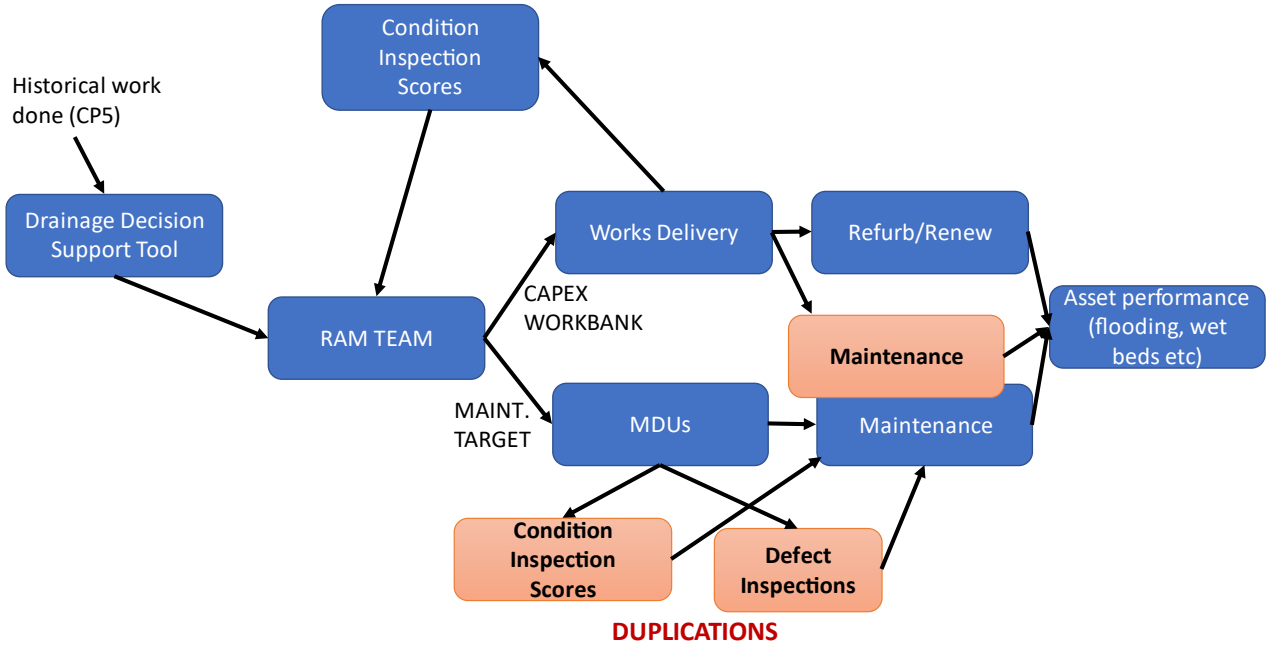


Figure 7 - Issues with alignment: duplications

4.2 Recommendations

We are aware that Network Rail's Technical Authority are currently in the process of developing a new 'Drainage Technical Strategy' and they are also proposing a new 'Water Management strategy' covering all assets. It may be possible to address some of the following recommendations through this mechanism.

- Red recommendations – where Network Rail may not be following best practice and we recommend action as soon as practicable.

REC R1 Improving internal stability: Network Rail (nationally) should develop a strategy, outlining a baseline 'stable state' which all MDUs are aiming for, to deliver changes to drainage asset knowledge and maintenance strategies effectively. This needs to be aligned to Regional and national requirements, which may continue to change to manage external changes.

This should draw upon lessons learned from Regions and MDUs which may have been through similar changes or faced different climate conditions.

Regions should provide clear guidance on the implementation of this strategy for MDUs and other delivery teams within their Regions.

a) Action on Network Technical Head for Drainage to provide a written strategy document; and

b) Action on DEAMs to provide written guidance documents.

REC R2 Improving alignment: Network Rail (Regionally, with national discussion) should develop clear guidance on how MDUs, Asset Management teams and other Regional or national teams can demonstrate alignment of their priorities. This should also cover transparency of how these priorities are being achieved through maintenance in the MDUs and CAPEX works by the asset Management team (through Works Delivery, Capital Delivery, or others).

This should include mechanisms for transparent feedback to be passed (in both directions) between MDUs and Regional or national teams who are discussing approaches to climate change resilience/adaptation.

a) Action on DEAMs to provide written guidance documents; and

b) Action on Network Technical Head for Drainage to provide evidence of feedback mechanisms between Regional and national CP7 strategy.

5. Appendix A – Graphical summaries of MDU responses

Figure A 1 – Responses for all 14 MDUs, summarised by total, East and West.

Figure A 2 – Responses for all 14 MDUs, collated for each MDU.

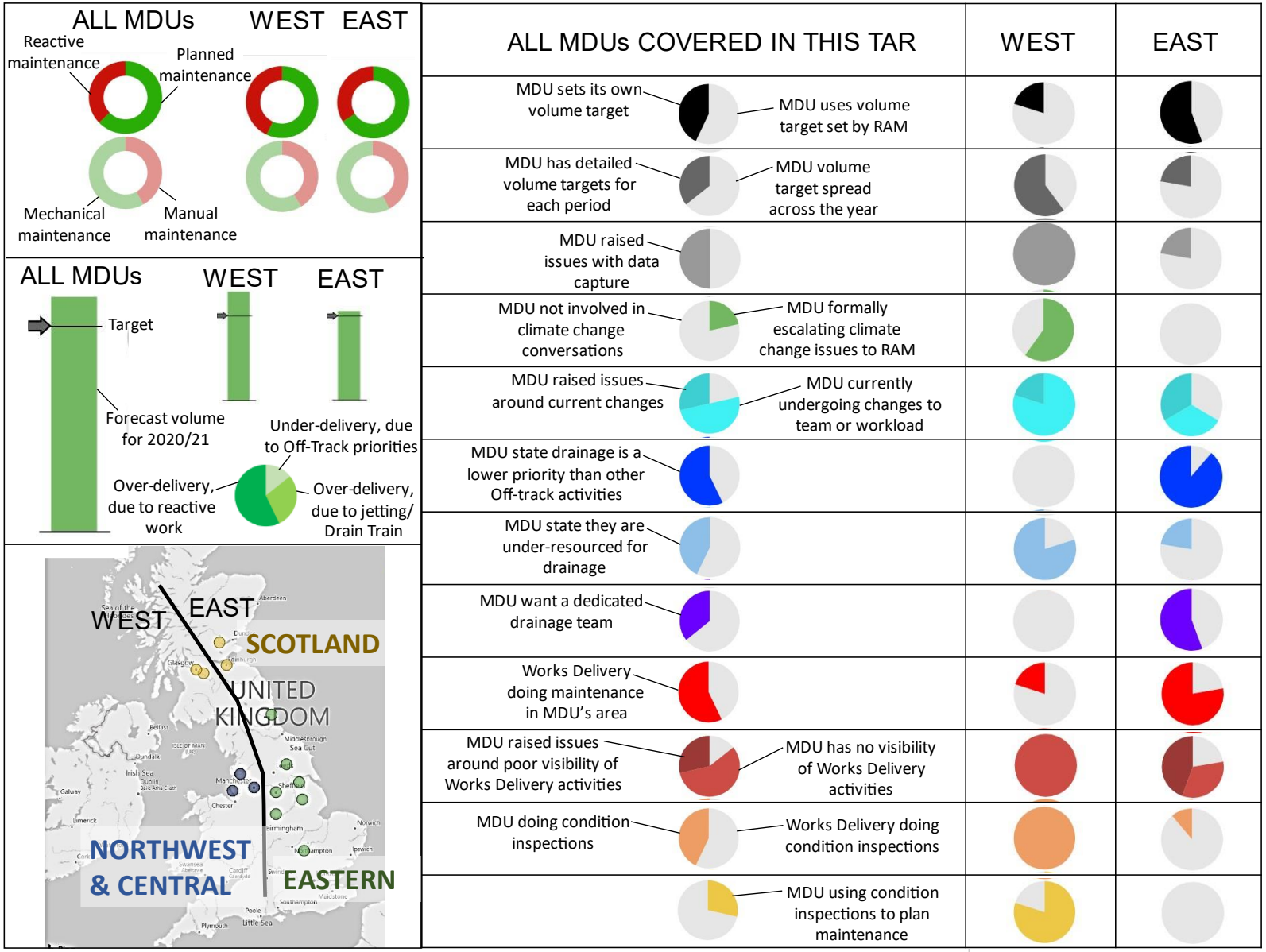


Figure A 1 – Responses for all 14 MDUs, summarised by total, East and West.

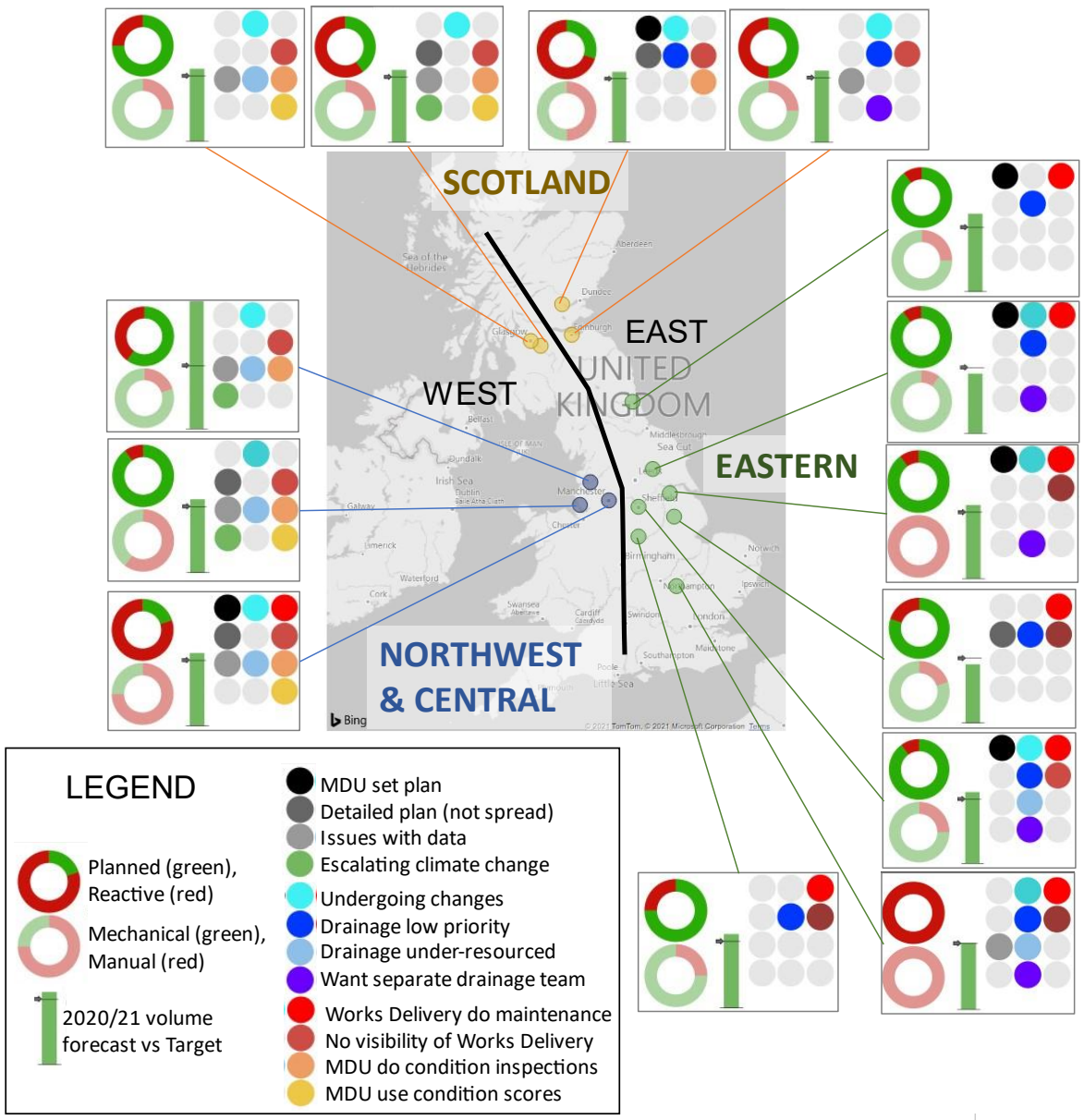


Figure A 2 – Responses for all 14 MDUs, collated for each MDU.

6. Appendix B – Questionnaires

6.1 Questionnaire sent to MDU staff, discussed at interviews, answers written up by ORR and sent to MDU staff for any comments.

Subject area	Question	Answer
External inputs	What targets/priorities are you given by the RAM?	
	EVIDENCE: please provide copies of CP6 YR2 targets, provided by the RAM	
	Are you given targets/priorities by anyone else, outside the DU?	
DU Planning	Please talk us through how you determine the "planned volume", for one MNT-sub-code (e.g. MNT073-DITCH MAINTAIN MANUAL)	
	When does this happen? E.g. 5-yearly ABP? Or RF reforecasts?	
	Is this different for "maintenance" and "inspection" tasks?	
	EVIDENCE: please provide an output from Ellipse, with planned volumes for CP6 YR2, by period, covering all drainage MNT-sub-codes (all sub-codes within MNT070 & 073) **Please provide as much granularity as you can** **e.g. if you have this broken down by individual job sites, please provide it.**	
	What drives your decision making: e.g. Maximise vols per period? Maximise time-on-tools? Maximise use of access? etc	
	What KPIs and targets do you have for these drivers?	
	EVIDENCE: please provide reports of these KPIs so far in CP6 YR2.	
	Who challenges the planned volumes, within the DU?	
	Who challenges the planned volumes, from NR, outside the DU (e.g. RAM? Route Finance? Central Maintenance - prof heads etc)	
	Who challenges the planned volumes, outisde of NR? (e.g. supply chain?)	
	Please talk us through how you assign costs to the planned volumes	
Actuals	Please talk us through the -ve factors, which make actual vols less than you planned	
	What KPIs and targets do you have for these -ve factors?	
	EVIDENCE: please provide reports of these KPIs so far in CP6 YR2.	
	Please talk us through the +ve factors, which make actual vols more than you planned	
	What KPIs and targets do you have for these +ve factors?	
	EVIDENCE: please provide reports of these KPIs so far in CP6 YR2.	
	Please talk us through how you record the actual volumes, into your reporting system	
	When you use contractors/subs, are there any extra steps in the process?	
	EVIDENCE: please provide an output from Ellipse, with actual volumes for CP6 YR2 (so far...), by period, covering all drainage MNT-sub-codes (all sub-codes within MNT070 & 073) **Please provide as much granularity as you can** **e.g. if you have this broken down by individual job sites, please provide it.**	
	Who reviews/challenges this recording?	
	How are costs recorded? (e.g. at the same time as vols, or separately?)	

6.2 Questionnaire discussed at interviews with RAMs in 3 Regions (Eastern, Scotland, Northwest & Central), answers written up by ORR and sent to RAMs for any comments.

Question	Answer
Route/Region	
Attendees	
Date	
Intro – purpose of this discussion	At the ORR-STE QLMs, there has never been consistency between "RAM Target" and "Planned" (MDU?) maintenance volumes – and the actual values rarely agree with either of these. ORR need to know what the target/budget values reported to us actually mean – and how this aligns to policy.
Q1: Were you aware of a difference between "RAM target" and "Planned"(DU)? **ANY ISSUES WITH MDU?**	
Q2: do you know which number is being reported to central finance as "budget"?	
Q3: Please talk me through how you determine your maintenance vol target? **HOW DOES THIS ALIGN TO POLICY?**	
Q4: to what extent is it broken down "by type"? e.g. by MNT07X+sub codes for condition inspect/function inspection/cleaning? Or is it just "send someone out to location X and do whatever needs doing"?	
Q5: Do you produce a prioritized list of sites needing maintenance?	
Q6: What are the consequences/risk levels if the actual maint. Volume falls below your target? **WHAT ACTIONS INITIATE IF TARGET IS MISSED?**	
Q7: Is there anything relating to DG maintenance which you want to do very differently in CP7?	
Q8: **Please can you suggest contact details for the right people to speak to in MDU?**	

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