national gas transmission

ENGINEERING JUSTIFICATION PAPER (EJP)

OFFICIAL- SENSITIVE

Civils

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RIIO-GT3 NGT_EJP19

Contents

1 Summary Table

Table 1: Civils summary table

Name of Project	Civils		
Scheme Reference	NGT_EJP19_Civils_RIIO-GT3		
Primary Investment Driver	Asset Health		
Project Initiation Year	FY2027		
Project Close Out Year	FY2031		
Total Installed Cost Estimate (£m, 2023/24)	£23.31m		
Cost Estimate Accuracy (%)	+/- 50%		
Project Spend to date (£m, 2023/24)	0		
Current Project Stage Gate	Stage 4.0		
Reporting Table Ref	6.4		
Outputs included in RIIO-GT2 Business Plan	No		
Spend Apportionment (£m)	**RIIO-T2**	**RIIO-GT3**	**RIIO-GT4**
	0	23.31	0

2 Executive Summary

2.1.1 This paper proposes £23.31m of baseline funding in RIIO-GT3 to address defects on approximately 4.38% of Civils assets across the NTS. This has been measured through a Non-Lead Asset PCD.

2.1.2 The primary driver for this investment is to uphold the asset health of our Civils assets to maintain compliance with various legislations including the Health and Safety at Work Act, Pipeline Safety Regulations, the Environment Act 2021 and Dangerous Substances and Explosive Atmosphere Regulations (DSEAR).

2.1.3 537 Civils interventions are required to ensure stable network risk, within this asset class, is maintained during RIIO-GT3. This delivers £0.29m of NARMs benefit.

2.1.4 Our Civils assets consists of 12,247 individual assets across the entire NTS and include access assets, buildings, security fencing and gates (not including enhanced physical security solutions), ducting, drainage, tanks and bunds. We considered 26 types of intervention across the Civils portfolio to establish an optimal programme that would deliver desired regulatory outputs. In summary, we are proposing the intervention mix in Table 2.

Table 2: RIIO-GT3 volumes proposed in this EJP

Asset Group	Access	Buildings	Security Fencing and Gates	Ducting	Drainage	Tanks and Bunds	Total
RIIO-GT3 volumes	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	**537**

2.1.5 In RIIO-T2 we are forecast to deliver 789 interventions for Civils assets, a reduction from the final determination volume of 2262, as shown in Table 3. Throughout RIIO-T2 site surveys were conducted to identify any defects with assets at our NTS sites, leading to a higher number than initially anticipated for the final determination, being identified for Civils assets. This required a reprioritisation of RIIO-T2 funding, requiring lower priority interventions to be removed from the plan or deferred, resulting in a lower volume of high-cost interventions to address the more significant defects. The lessons learned from the delivery of the RIIO-T2 Plan informed that of the RIIO-GT3 Business Plan for Civils. Analysis was carried out of the defect data for Civils assets to advise the bottom-up interventions determined for RIIO-GT3. A further deliverability assessment of these volumes resulted in a proposed investment with a lower volume of 537 interventions. Another contributor to the lower volume of interventions in RIIO-GT3 than in RIIO-T2, is the exclusion from Civils of Pipe Supports, Pits and Plinths.

Table 3: RIIO-T2 vs RIIO-GT3

	RIIO-T2 Business Plan Final Determination	RIIO-T2 Forecast Delivery	RIIO-GT3 Business Plan
Interventions	2262	789	537
Investment	£22.03m	£24.19m	£23.31m
Civils population	18.47%	6.44%	4.38%

2.1.6 A focused portfolio of investments for our Civils assets is required to for the continued safeguarding of our sites, operational assets and pipelines, as well as ensuring that there is limited environmental impact from NTS operations at our sites, and the public and personnel are protected from these operations.

2.1.7 Many of the interventions outlined for RIIO-GT3 within this document can be carried out with little to no outage impact to the operations of the sites they are located. Where this is not the case, interventions can be bundled and scheduled alongside other works. The profile of Civils assets investment across RIIO-GT3 is shown in Table 4.

Table 4: RIIO-GT3 funding request for Civils Assets (£m, 2023/24)

Asset	FY27	FY28	FY29	FY30	FY31	Total	Funding Mechanism
Civils	**£4.2m**	**£5.3m**	**£2.9m**	**£5.3m**	**£5.2m**	**£23.31**	**Baseline**

3 Introduction

3.1.1 This document outlines our approach to manage our Civils assets to meet the desired regulatory, stakeholder and financial outcomes. A 10-year view has been developed, covering the RIIO-GT3 regulatory period and beyond, to ensure a balanced lifecycle approach to asset management.

3.1.2 The Civils assets support our sites and pipelines to ensure they are safely operated, protected and limit the environmental impact of our assets. As such their continued provision of a basic required level of performance is necessary. As well as environmental obligations, we have a duty of care to ensure the public and employees are protected.

3.1.3 Civils assets are a widely variable asset base whose role is to provide safe support and protection to critical gas transmission assets, as well as enabling safe access 24/7 in all weather conditions.

3.1.4 Many elements of the Civils assets are suffering from deterioration to the point where inaction could compromise the safety and security of our assets, as well as risking our compliance with environmental permits. A proactive intervention programme is required to ensure that unmanageable levels of degradation, together with the associated increase in whole life costs, adverse impacts in the safety, operation and availability of the NTS and any potential legislative non-compliance, can be avoided.

3.1.5 The asset groups under Civils includes access equipment, access roads and pathways, security fencing and gates, ducting, drainage, tanks and bunds.

3.1.6 At National Gas sites, we have a responsibility to provide a safe working environment for those accessing and operating within the boundaries. Some sites have long access roads that are external to the site fence boundary and subject to public use, therefore National Gas has a duty of care to the public, environment and personnel to maintain these assets to a safe and acceptable standard.

3.1.7 In addition to age-related impacts, weather conditions contribute to the deterioration of our Civils assets, increasing their likelihood of failure and the need for appropriate mitigation. As a result of Climate Change, severe weather conditions are becoming more frequent and prolonged, accelerating the rate of deterioration. Heavy rainfall and extreme temperatures can create further hazards in the form of flooding or ice present at a site, as well as the deterioration or failure of operational located assets on site.

3.1.8 Civils investments have interactions with other asset themes as highlighted in Figure 1.

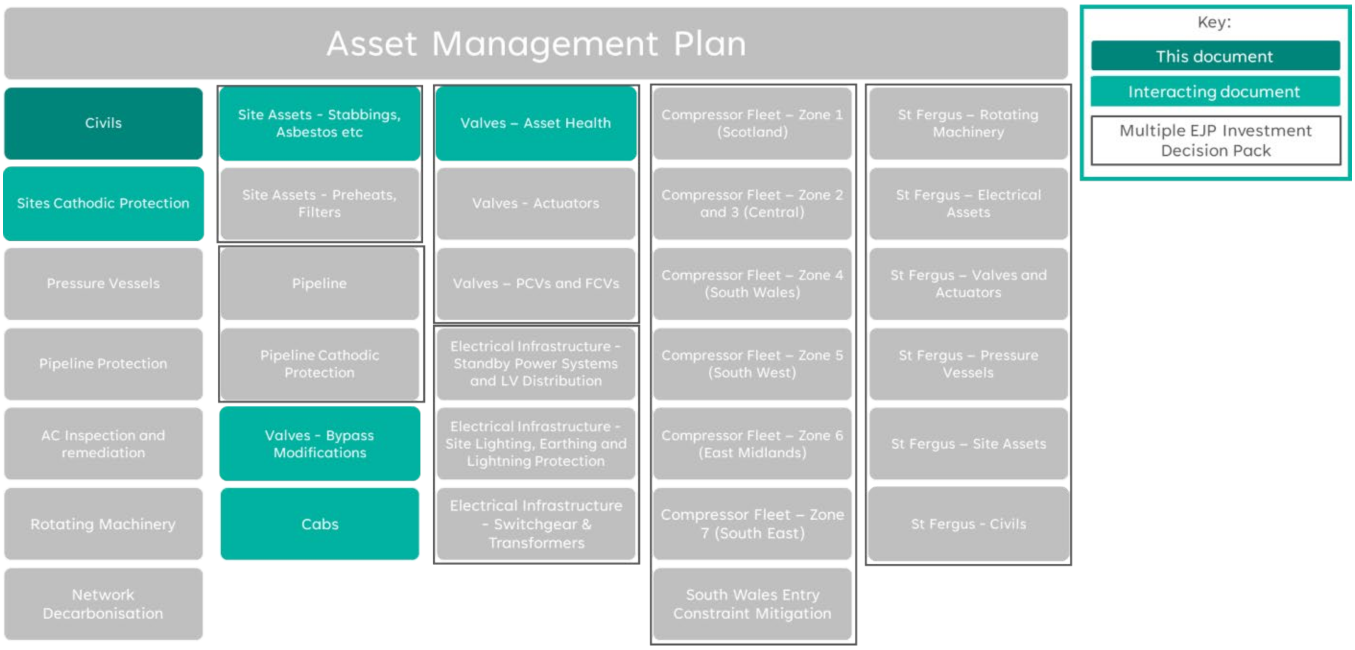

Figure 1: Asset Theme Interactions

3.1.9 The scope of this document is aligned with our Asset Management System (AMS) and relates to our Business Plan Commitments (BPCs), “Meeting our critical obligations every hour of every day” and “Delivering a resilient network fit for the future”. More information on our AMS and a description of our commitments is provided in

NGT_A08_Network Asset Management Strategy_RIIO_GT3 and our BPCs are detailed within NGT_Main_Business_Plan_RIIO_GT3.

3.1.10 This document has been structured into several chapters, with some of the chapters being specific to a group of Civils assets. The structure of document is outlined in Figure 2 below.

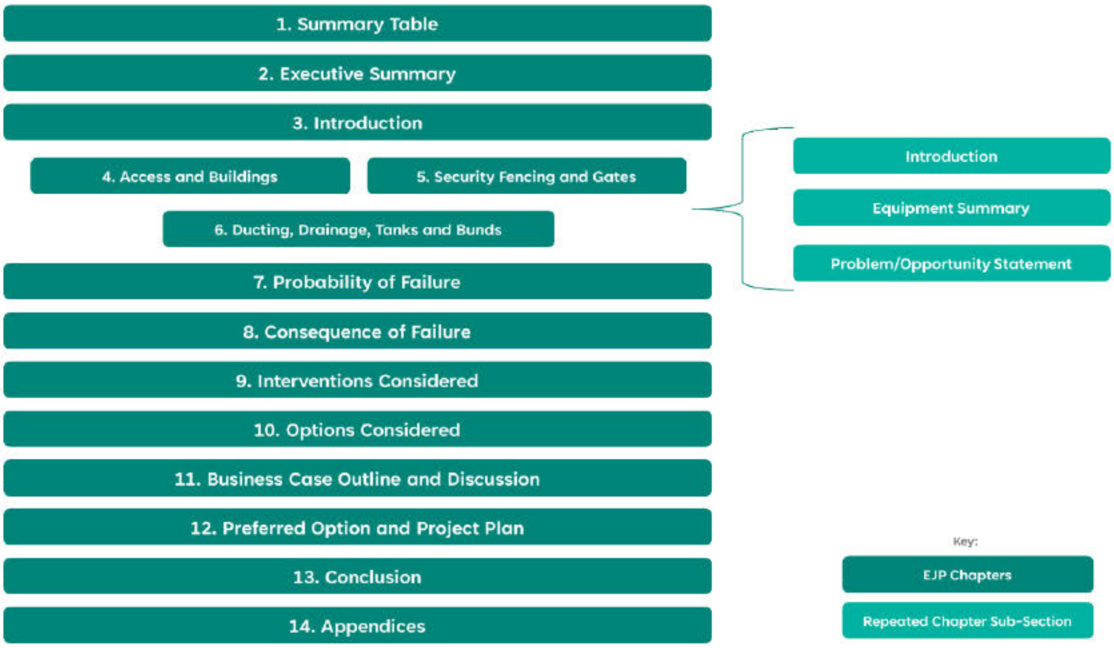

Figure 2: Document Structure

4 Access and Buildings - [redacted]

4.1 Introduction

4.1.1 This chapter provides detail on the different assets associated with access equipment and buildings found at various sites across the NTS. It also aims to outline the importance and uses of these assets, the impact of them failing and the process followed to determine the investments which are to be included in the Civils part of the RIIO-GT3 Business Plan.

4.2 Equipment Summary

4.2.1 Our access assets include roads, pathways, steps, ladders, platforms and handrail assets, and provide safe access to and around our NTS sites. For buildings assets, there are different types including kiosks, control buildings and instrument enclosures, which house and protect operational equipment for a site, or protections and safe working environments for staff and personnel.

4.2.2 The number of each asset type captured under this sub-theme are shown in Table 5, Table 6 and Table 7. Certain Civils assets may not be counted as standalone, but instead are encompassed as part of another asset. For example, guard rails may be considered part of an access platform and so not counted separately, leading to an apparent low volume count. Interventions and their associated costs can in these instances cover a range of works required to address defects on these assets. For details on interventions and their scopes, see *Chapter 9 – Interventions Considered*.

Table 5: Number of different Access Equipment assets across the NTS

Asset Type	Access - Guard Rail	Access - Ladders	Access - Platforms	Access - Stairs	Total
Volume	22	603	826	566	**2017**

Table 6: Number of different Access Roads and Pathways across the NTS

Asset Type	Pathways (Loose Stone)	Roads (Concrete)	Roads (Tarmac)	Security/Armco Barriers	Total
Volume	307	164	190	503	**1164**

Table 7: Number of different Buildings and Enclosures across the NTS

Asset Type	Boiler Room	Control Room	Instrument Enclosure	Man-Entry Kiosk	Office	Plant Room	Building - Other	Total
Volume	44	43	1134	226	28	1433	327	**3285**

4.2.3 Permanently fixed access and lifting equipment such as steps, ladders, platforms, beams and davit sockets to support mobile lifting equipment, enable safe and efficient access to operational assets across a site for operation and maintenance activities. These assets are key to allowing effective operation of a site whilst also maintaining the safety of personnel operating there, adhering to Health and Safety legislations in doing so.

4.2.4 Figure 3 illustrates an enclosure with associated access assets that can be found at sites across the NTS. The image shows an enclosure, with access equipment including steps, a raised platform and guard rails to allow safe access to and around the enclosure.

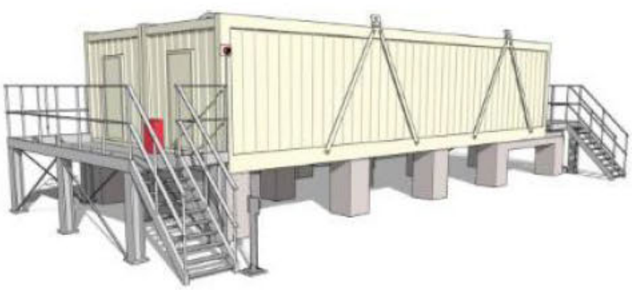

Figure 3: Site enclosure with access assets

4.2.5 Access roads and pathways include all access roads from the public highway, site roads and associated paving, kerbs, parking and lay-down areas, which provide safe ingress and egress during maintenance and operational activities. These can be made from either tarmac, concrete or be unbound, consisting of stone or gravel.

4.2.6 Bollards and steel barriers, sometimes known as Armco or crash barriers, can be present to protect nearby assets from damage by passing vehicles or machinery on the roads.

4.2.7 Buildings can consist of any man-entry sized building, kiosk or enclosure made from bricks or small glass-reinforced plastic (GRP). They create a safe and suitable workspace for maintenance, storage and repair operations, staff offices, control rooms and related facilities, as well housing for instrumentation and process equipment to protect them against damage or weathering. Figure 4 below illustrates some that can be found across NTS sites.

Figure 4: Types of buildings and enclosures

4.2.8 Asset age is a factor in the deterioration of assets. Access and building assets have a design life of 40 years. Many of the access assets and structures were installed when the NTS sites were first built, which leads to 94% of access equipment assets, 71% of roads and pathways assets, and 60% of buildings and enclosures being over 40 years old by the start of the RIIO-GT3 period. Further details on asset age can be found in Appendix 1.

4.2.9 Additional information on this equipment group such as the health score at the beginning and end of the price control and monetised risk are provided in the accompanying NGT_IDP08_Portfolio EJP Civils_RIIO-GT3.

4.3 Problem/Opportunity Statement

Why are we doing this work and what happens if we do nothing?

4.3.1 Investment in access and buildings assets is required for risk management. The main driver for investment is asset deterioration. All access assets and buildings are subject to deterioration due to aging, their use and natural weathering. Deterioration of assets can appear in different ways, depending on the type of asset.

4.3.2 Deterioration of steel assets, such as access equipment, can appear in the form of corrosion, which affects their structural integrity. This results in assets that are unsafe to use for operatives working on site, with slips, trips or falls becoming more likely if used. If left unaddressed, there is a higher risk of harm to personnel occurring, as well as non-compliance with the Health and Safety at Work Act.

4.3.3 Deterioration of roads and pathways can appear in the form of cracks and potholes on the surface, as well as damaged kerbs or eroded expansion joints for concrete surfaces. Left unaddressed these defects could lead to incidents such as the damage of vehicles using the roads, which in turn could cause harm to personnel on site, or damage to other assets located there. Such occurrences can also lead to non-compliance with legislations such as the Health and Safety at Work Act, resulting in financial penalties.

4.3.4 Buildings can deteriorate in various ways. Concrete or brick structures can crack or crumble, and roofs can also deteriorate increasing the risk of leaks and exposure to weathering. Enclosures that house operational equipment, such as electrical equipment, are at higher risk to damage due to being more exposed to external elements, which can lead to them tripping or breaking down as a result. In extreme cases, deteriorated buildings can become structurally unsound, posing a significant risk to personnel entering them, or equipment housed within them, and in turn the operation of the site.

4.3.5 Buildings with flat roofs are susceptible to deterioration due to gathering rainwater, which can result in water ingress to the building and structural damage. Deteriorated or damaged enclosures exposes equipment, leading to their damage or failure.

4.3.6 Climate change is a specific example which accelerates deterioration of assets through heavier rainfall and extreme temperatures. The increased frequency of freeze-thaw weathering due to climate change, accelerates the deterioration of concrete and tarmac infrastructure, leading to more significant defects and a higher volume.

Proposed RIIO-GT3 Investment

4.3.7 [redacted]

[redacted]

4.3.9 Further detail on the types of interventions considered, and how the final option of interventions was derived, can be found in Chapters 9 to 12.

What is the outcome that we want to achieve?

4.3.10 Within RIIO-GT3, the outcomes we want to achieve are:

- Continue to provide safe access to and around sites to support maintenance and operational activities.
- To enable access to equipment and fixed lifting equipment to support maintenance activities.
- To continue protecting vulnerable plant and equipment from damage and weathering.
- To continue to provide a safe and suitable workspace for maintenance, storage and repair operations, staff offices, control systems and related facilities.
- Where applicable continue to provide acoustic protection for site neighbours such as nearby residential properties.
- Provide a safe working environment for all our staff and maintain our duty of care to members of the public.
- Ensure buildings do not affect the long-term availability, safety and performance of the NTS including the compressors and AGIs.

How will we understand if the spend has been successful?

4.3.11 The spend will have been successful if:

- We provide a safe working environment for all our staff.
- We ensure that buildings and enclosures are not a cause of the accelerated deterioration of or damage to our operational assets.
- We provide safe access and egress to and from all our site.
- We maintain our duty of care to members of the public where we have roads and pavements that are subject to public access.
- Ensure legal compliance of all ladders and other relevant fixed access assets.

Narrative Real-Life Example of Problem

4.3.12 This section provides a real-life example of access and building assets that have deteriorated or been damaged. Further examples are available in Appendix 2.

4.3.13 Due to strong winds and asset deterioration, the blast roof of our enclosure on a shared site at [redacted] was lifted from the enclosure, exposing the interior to the elements, as shown in Figure 5.

Figure 5: Damaged roof of enclosure [redacted]

4.3.14 The extent of the damage poses a significant risk as electrical equipment within the enclosure is no longer protected from exposure to weather corrosion. This can result in unavailability of the equipment due to tripping and restrictions to the operations of the site. This could result in the power station having to cease operation impacting UK electricity supply. There is also a higher risk of third-party interference.

4.3.15 As the blast roof is no longer structurally sound there is a risk that it can become fully detached in high winds, acting as a projectile and creating a danger to nearby equipment or personnel.

Project Boundaries

4.3.16 The proposed investment for access and buildings assets covers any capex costs required for these asset groups. This covers:

- Steps, ladders, platforms, handrails and other lifting equipment on site, that allow personnel to manoeuvre and access assets and equipment safely.
- Any routes on or around the site boundary that provides safe access, movement and egress. These can consist of tarmac, concrete, stone or gravel; with kerbs and expansion joints where required.
- Security Armco barriers designed to protect on-site assets near roads.
- All buildings and enclosures that allow entry including control rooms or enclosures that house equipment for the site, for example kiosks for electrical equipment.
- Targeted interventions on individual assets such as doors, windows, roofs and walls.

4.3.17 Not in scope for this investment are:

- Access and buildings investments at the St Fergus Terminal – covered in NGT_EJP32_St Fergus: Civils_RIIO-GT3
- Compressor Acoustic Buildings (CABs) which house compressors – covered in NGT_EJP03_Cabs_RIIO-GT3
- Buildings earmarked for decommissioning – covered in NGT_EJP01_Site Assets - Asbestos, Stabbings and Redundant Assets_RIIO-GT3.

4.3.18 Certain assets are housed within small enclosures or kiosks which solely designed to protect operational equipment and do not require access e.g. Gas Quality, Metering and Telemetry. Any investment that includes or impacts these specific enclosures are covered under the relevant EJP.

5 Security Fencing and Gates - [redacted]

5.1 Introduction

5.1.1 This chapter provides detail on the different assets associated with security fencing and gates found at various sites across the NTS. It also outlines the importance and uses of these assets, the impact of them failing and the process followed to determine the investments which are to be included in the Civils part of the RIIO-GT3 Business Plan.

5.2 Equipment Summary

5.2.1 There are a range of different types of assets within the Security Fencing and Gates sub-theme. This group of assets consists of perimeter fencing which demarcate site boundaries, as well as fencing and gates intended to prevent unauthorised access to a site (this excludes enhanced physical security solutions). Table 8 below shows the number of the different types of assets that can be found.

Table 8: Number of different Security Fencing and Gates assets across the NTS

Asset Type	Security Fence - Standard	Electric Access Vehicle Gate	Electric Pedestrian Panic Gate	Manual Access Vehicle Gate	Manual Pedestrian Panic Gate	Security Gate - Other	Total
Volume	290	207	789	254	245	10	**1795**

5.2.2 Security fencing and gates assets demarcate site boundaries and acts to keep the public and non-authorised individuals away from potentially hazardous areas, as well as deter third-party entry interference. The design life of our security fencing assets is 20 to 30 years.

5.2.3 Fencing assets include metal or wooden fence posts and rails, as well as metal weld-mesh fences or panels. Sites can include both types for both demarcating the land boundary as well as the operational site boundary. Gates are installed for vehicular and pedestrian access and egress to site and for emergency purposes. Associated assets such as gate locking mechanisms also fall under here.

5.2.4 Asset age is a factor in the deterioration of assets. Fencing and gates have a design life of 30 years. Many of the security fencing and gates were installed when the NTS sites were first built, which leads to 53% of these assets across the NTS being over 30 years old by the start of the RIIO-GT3 period. Further details on asset age can be found in Appendix 1.

5.2.5 Additional information on this equipment group such as the health score at the beginning and end of the price control and monetised risk are provided in the accompanying NGT_IDP08_Portfolio EJP Civils_RIIO-GT3.

5.3 Problem/Opportunity Statement

Why are we doing this work and what happens if we do nothing?

5.3.1 Investment in security fencing and gates is required for risk management. The main drivers in meeting this requirement are outlined below.

5.3.2 All fencing and gates are subject to deterioration as they age, through their use and natural weathering effects, and can appear in different ways. Metal fencing and gates are subject to corrosion and rusting, which impacts the structural integrity of the assets. This poses a risk as unauthorised access to a site becomes more likely which in turn poses a risk of third-party interference to equipment located within the site perimeter. Wooden fencing and gates designed to demarcate NTS sites and protect the public from site operations, are subject to rotting. A significant risk of deteriorated fencing and gates which are no longer fit for purpose, is to the safety of the public against activities and operations at our sites. **BAU Innovation**

5.3.3 Climate change is a specific example which accelerates deterioration of assets through heavier rainfall and extreme temperatures, leading to acceleration of the corrosion of steel security fencing and gate assets, leading to higher volume of defects.

5.3.4 Many interventions were identified as required for fencing and gates across various NTS sites as part of the RIIO-T2 survey programme that was conducted to better assess the condition of different assets. 6 interventions identified for fencing and gates were either descoped or removed entirely, due to funding shortfalls and risk management assessments that required works to be reprioritised. Several other defects and signs of asset deterioration that were identified, had no interventions opted to resolve due to again to funding shortfalls. Waiting to intervene on these defects will lead to further deterioration occurring, resulting in higher probability and consequences of failure, and more costly interventions being required to resolve issues.

5.3.5 Certain sites may become more key to the operation of the NTS due to changing network condition. This may result in the installation of new or upgraded or operational equipment, requiring further investment for fencing and gates to manage a higher level of security risk.

5.3.6 Without intervening on deteriorated fencing and gates which protect our NTS sites, assets, personnel and the public, there is also a higher risk of non-compliance with legislations such as the Health and Safety at Work Act and Pipeline Safety Regulations (PSR).

5.3.7 In a worst-case scenario, a lack of investment in this area could compromise the operation of the NTS due to a security breach which leads to the tampering of assets.

Proposed RIIO-GT3 Investment

5.3.8 [redacted]

5.3.9 Further detail on the types of interventions considered, and how the final option of interventions was derived, can be found in Chapters 9 to 12.

What is the outcome that we want to achieve?

5.3.10 Within RIIO-GT3, the outcomes we want to achieve are:

- Meet legal requirements around demarcation of site boundaries.
- Provide a safe working environment for all our staff and maintain our duty of care to members of the public.
- Ensure integrity of security fencing and gates do not affect the long-term availability, safety and performance of the NTS including the compressors and AGIs.
- Mitigate the safety risks associated with deteriorating security fencing and gates.

How will we understand if the spend has been successful?

5.3.11 The spend will have been successful if we ensure the security on sites (not including those requiring enhanced security) is maintained to a level where the risk of third-party intrusion is managed and the detrimental effect on the operation of the assets is minimised.

Narrative Real-Life Example of Problem

5.3.12 Figure 6 is an example of issues that can occur to security fencing and gate assets. It shows the corroded gate and fence posts located at [redacted]. The fencing defects at this site were identified as part of the RIIO-T2 survey programme, after the final determination for Civils (then Structural Integrity). As funding for RIIO-T2 will not have been able to address this defect, it is proposed that intervention will need to be deferred to RIIO-GT3, along with similar defects identified after the final determination for RIIO-T2. This level of corrosion poses a significantly higher risk of third-party infiltration to the site, which could lead to potential damages or interferences to the operation of the site or parts of the NTS as a whole. Further examples of defects are provided in Appendix 2.

Figure 6: Corroded gate and fence posts at [redacted]

Project Boundaries

5.3.13 The spend covering investments for security fencing and gates covers any capex costs required for these asset groups, covering:

- Wooden and metal fences, including both inner and outer perimeter fences, or targeted interventions on individual assets such as fence posts, panels and barbed wire on or across fencing.
- Wooden and metal gates granting access to sites and sectioned areas on site, as well as individual investment on associated components such as hinges and locking mechanisms.
- Monitoring of perimeter fencing and gates.

5.3.14 Out of scope for this investment are:

- Security fencing and gates at the St Fergus gas terminal – these are covered in NGT_EJP32_St Fergus: Civils_RIIO-GT3
- Electrified fences at sites with enhanced security solutions – these are covered in NGT_EJP34_Physical Security Asset EJP_RIIO-GT3.

6 Ducting, Drainage, Tanks and Bunds - [redacted]

6.1 Introduction

6.1.1 This chapter provides detail on the different assets associated with ducting, drainage, tanks and bunds, found at various sites across the NTS. It also aims to outline the importance and uses of these assets, the impact of them failing and the process followed to determine the investments which are to be included our Civils investment theme in the RIIO-GT3 Business Plan.

6.2 Equipment Summary

6.2.1 Ducting provides safe routing of instrumentation, electrical cabling and pipework around a site. Drainage assets stops untreated liquid pollutants from leaving a site and helps to prevents flooding. Tanks include waste oil tanks for lubrication or diesel oils, while bunding provides liquid containment in case of liquid pollutants leak or spill. Table 9 shows the number of these different assets that can be found.

Table 9: Number of Ducting, Drainage, Tanks and Bunds across the NTS

Asset Type	Drainage Assets	Ducting Assets	Chamber Assets	Bunds	Storage Tanks	Total
Volume	642	510	2694	94	46	**3986**

Ducting and Drainage

6.2.2 Ducting includes concrete units for the safe routing of site cabling and pipework laid between buildings and plant equipment located around the site. Ducts may also be used to house fluid transfer lines e.g., lube oil. Ducting protects the cabling or pipework laid within and prevents trip hazards.

6.2.3 Drainage is designed to prevent flooding and to stop liquid pollution leaving site. It comprises all aspects of drainage including sewage treatment systems, pipework, interceptor structures, land drains, manholes and manhole covers, and associated assets such as interceptors designed to stop pollutants leaving the site.

6.2.4 Chambers can be located across NTS site and are used as access points for drainage and other assets at those sites. The size of these can vary according to their purpose and requirements, and as well as the walled structure itself, can consist of a man-hole cover to protect the assets inside.

6.2.5 The design life of ducting and drainage assets are 40 years. Of these assets across the NTS, 42% of these will be 40 years or older by the start of RIIO-GT3. Further details on asset age can be found in Appendix 1.

Tanks and Bunds

6.2.6 Tanks and bunds contain liquids for operational use or prior to disposal in the case of wastes, which have hazardous properties. Tanks can be either single skinned steel tanks with an external bund or double skinned plastic tanks with an integral bund. External bunds consist of a concrete or block-built containment wall.

6.2.7 Figure 7 illustrates a plastic storage tank (left) alongside a steel storage tank (right) with a concrete bund.

Figure 7: Storage tanks and bunds

6.2.8 The standard design life of tanks and bunds is approximately 30 years, with 19% of tanks and bunds across the NTS being 30 years or older by the start of RIIO-GT3. Further details on asset age can be found in Appendix 1.

6.2.9 Additional information on this equipment group such as the health score at the beginning and end of the price control and monetised risk are provided in the accompanying NGT_IDP08_Portfolio EJP Civils_RIIO-GT3.

6.3 Problem/Opportunity Statement

Why are we doing this work and what happens if we do nothing?

6.3.1 Investment in ducting, drainage, tanks and bunds is required for risk management. The main drivers in meeting this requirement are outlined below.

6.3.2 All ducting, drainage, tanks and bunds are subject to deterioration as they age, through their use and natural weathering effects. Investment is required to mitigate risks associated with deteriorated assets. Deterioration of these assets can appear in different ways. Concrete assets are subject to cracking and spalling, exposing cabling or pipework they are designed to protect. This could lead to the damage of cabling or pipework, which in turn can impact the effective operations of an NTS site.

6.3.3 Alternatively, deteriorated or faulty drainage assets can cause flooding across an NTS site, impairing site operations and accelerating the effects of deterioration of assets within the flooded area. In extreme cases, ineffective drainage of sites can lead to subsidence due to saturated grounds. This can result in the misalignment of other assets on site, such as pipework or operational equipment, potentially impairing the operations of a site and in worse case scenarios, cause loss of containment, pressure restrictions and gas supply issues.

6.3.4 Some pits contain drainage pipes to take flood water away. However, broken pipes can be hidden beneath flood water, and they can be difficult to repair due to the restricted space. Typically, these assets are the deepest on site and so often expensive to get to if required.

6.3.5 Similarly, concrete bunds which have deteriorated, are no longer effective in containing spilled or leaked hazardous fluids, potentially harming personnel operating on site, nearby public or cause pollution to the local area. Similar risks can result from deteriorated storage tanks, which are no longer effective in containing such hazardous substances but are not intervened on.

6.3.6 External Impacts such as ground movement and root ingress can impact the efficiency of ducting or drainage assets, and at some sites, significant ground movement has been seen, resulting in subsidence, unsafe conditions for operatives and stresses being placed on operational assets. Investment is required to mitigate these risks.

6.3.7 Climate change is seeing heavier rainfall, resulting in drainage systems that are no longer suitable for the weather conditions, particularly as many of these systems were installed over 40 years ago. Proper investment is required to equip sites with the ability to manage these changing conditions and manage the removal of flood water and disperse the surface water.

6.3.8 As well as physical impacts from deteriorated assets, failure to intervene can result in non-compliance with legislations, such as the Health and Safety at Work Act, PSR and Dangerous Substances and Explosives Regulations (DSEAR).

Proposed RIIO-GT3 Investment

6.3.9 [redacted]

[redacted] [redacted]

[redacted] [redacted]

6.3.12 Further detail on the types of interventions considered, and how the final option of interventions was derived, can be found in Chapters 9 to 12.

What is the outcome that we want to achieve?

6.3.13 Within RIIO-GT3, the outcomes we want to achieve are:

- Meet legal requirements and agreed safety and environmental standards.
- Ensure ducting, drainage, tank and bund assets do not affect the long-term availability, safety and performance of the NTS including the compressors and AGIs.
- Mitigate the safety risks associated with deteriorating ducting, drainage, tank and bund assets.

- Ensure the risk of flooding and pollution from hazardous liquids on NTS sites is managed and that we maintain compliance with all Pollution Prevention and Control (PPC) Permits through effective foul drainage and sewage treatment.

How will we understand if the spend has been successful?

6.3.14 The spend will have been successful if we ensure the ducting, drainage, tank, and bund assets on sites are maintained to a level where the risk of deterioration including damage is managed and the detrimental effect on the operation of the assets is minimised.

Narrative Real-Life Example of Problem

6.3.15 Figure 8 shows a blocked drainage site at [redacted], identified in 2023. As the image below shows, the pipe was blocked and damaged, which prevents it from serving its purpose to remove excess water from the site and surrounding area. Several attempts have been made to unblock the drain, which have been partially successful, however these have only been temporary solutions. In order to fully resolve this issue, an excavation 4 metres deep has been proposed to reach the pipe, remove the blockage and repair the damage, currently scheduled for winter 2024/25.

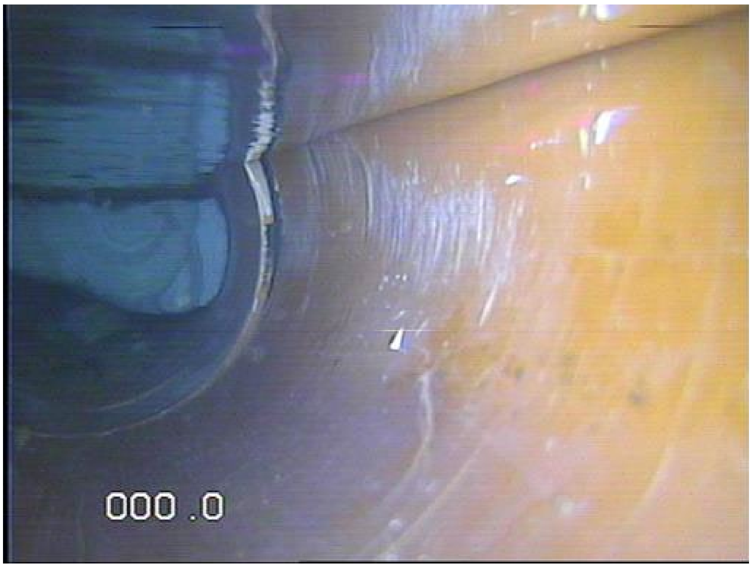

Figure 8: Blocked drainage pipe at [redacted]

6.3.16 Figure 9 is an example of real-life problems that have occurred with drainage assets across the NTS. We saw significant site flooding at a PIG Trap site [redacted] back in 2013. The flooding was the result of a period of heavy rainfall combined with blocked drainage trenches leading away from the site, which are designed to flow flood water away.

Figure 9: Flooding at [redacted]

6.3.17 The majority of the site was impacted and covered in flood water to a depth of 600mm, as well as around the pipework and operational assets. It disrupted telecommunications and inundated the security equipment. This resulted in limited access to the site and reduced operational capability. If it had taken longer to resolve the situation would have interfered with carrying out essential ILI runs.

6.3.18 In this instance, the flooding also had an impact to third parties residing nearby. Discussions were required with these third parties, as well as the Environment Agency, to discuss the appropriate intervention to address the problem. Following these discussions, investments were made to resolve the blocked drainage issue and restore the site to full operation.

6.3.19 A capex project was raised to rectify the damage caused by the floodings on our electrical, security and telemetry assets. This was completed in March 2017. The total cost of the recovery from the flooding event for this site was £2.492m, including System Operator (SO) costs of £0.289m.

6.3.20 Further defect examples are available in Appendix 2.

Project Boundaries

6.3.21 The spend covering investments for ducting, drainage, tanks and bunds covers any capex costs required for these asset groups covering:

- All components of duct access covers and chambers, including concrete slabs or metal grating.
- Any drainage channels, pipes and sewage treatment equipment, as well as investments for chambers containing drainage assets.
- Investments to address subsidence, along with refurbishment of assets, cleaning or replacement of any of these assets.
- Steel or plastic tanks used to store liquids on site.
- All types of bunds.

6.3.22 Out of scope of this investment are:

- Ducting, drainage, tanks and bunds at the St Fergus gas terminal – covered in the NGT_EJP32_St Fergus: Civils_RIIO-GT3
- Electrical pumps required for drainage or sewage treatment systems – captured in NGT_EJP12_Electrical Infrastructure: Site Lighting, Earthing and Lightning Protection_RIIO-GT3
- Condensate tanks – covered in NGT_EJP18_Pressure Vessels_RIIO-GT3

7 Probability of Failure

7.1 Failure Modes

7.1.1 Probability of failure (PoF) has been assessed utilising historical defects, results from surveys and utilising our Network Asset Risk Metric (NARMs) model. This model is built within our copperleaf asset management decision support tool to assess the forward-looking probability of failure. This provides a different lens to consider in addition to looking at historically captured defects.

7.1.2 Not all modelled failures will result in real-world asset failure and this forecast is not a prediction of how many defects will be identified.

7.1.3 Likely failure modes for Civils assets with an average proportion of failures of 0.5 or above are provided in Table 10, the full list of failure modes is available in the NARMS methodology.

Table 10: Civil asset likely failure modes

Failure Mode	Average Proportion of Failures
Vessel corrosion	0.7
Structural damage leak affecting electrical control equipment loss of control / monitoring	0.6
Security system failure	0.6
Vessel failure significant gas release	0.5

7.1.4 When applied to the asset count with an assumption that no investment is made, a forecast of failures across the RIIO-GT3 period is produced, shown in Table 11. The average failure rate represents the proportion of that asset type with an unresolved failure at that point in time; therefore it is cumulative. The forecast failures per year shows the quantity of new failures modelled to occur in that year.

Table 11: Civils Assets failures per year

Asset Type	No of Assets	Cumulative Average Failure Rate					Expected Failures per Year				
		2027	2028	2029	2030	2031	2027	2028	2029	2030	2031
Access Equipment	2017	0.68	0.69	0.71	0.73	0.75	0.85	0.89	0.93	0.92	0.80
Roads and Pathways	1164	0.54	0.56	0.58	0.60	0.62	11.62	11.87	12.15	12.44	12.73
Buildings and Enclosures	3285	0.44	0.45	0.47	0.48	0.49	36.01	37.11	34.53	35.53	36.72
Security Fencing and Gates	1795	0.64	0.66	0.67	0.68	0.69	11.31	11.03	10.77	10.77	10.74
Ducting	510	0.34	0.36	0.37	0.39	0.41	8.76	8.88	8.44	8.31	8.14
Drainage	3336	0.33	0.35	0.35	0.36	0.36	17.53	18.31	18.95	19.63	20.62
Tanks and Bunds	140	0.09	0.09	0.09	0.09	0.09	0.18	0.20	0.23	0.25	0.28

7.1.5 Unsurprisingly, the highest volume of forecast failures is seen on buildings and enclosures as they have the highest asset count. However, security fencing, gates and access equipment have the highest rate of failures, as these assets deteriorate at a higher rate.

Historical Defects

7.1.6 Defects are raised through inspection and maintenance activities and captured within our Maximo defect management system. For RIIO-T2, a site survey programme was undertaken to improve the identification of any faults, issues or defects, which were then logged to ensure the information was captured in our centralised system to advise appropriate interventions.

7.1.7 The number of historical defects that have been identified for each asset group is shown in Table 12. The average rate of historical defects is generally lower than the modelled failure rate, in some cases significantly lower. This reflects the fact that not every modelled failure would require intervention, some lead to increased maintenance and therefore would not be logged as a defect.

Table 12: Volume of Historical Defects

Sub-Asset Type	Volume of Historical Defects (2005 – 2024)	Average No. of Defects per year
Access (Equipment and Roads)	152	7.8
Buildings and Enclosures	110	5.6
Security Fencing and Gates	87	4.5
Ducting and Drainage	46	2.4
Tanks and Bunds	22	1.1

7.1.8 Defects have not been raised at a consistent rate, as shown in Figure 10. There has been an increase in the volume of defects raised in recent years because surveys to identify defects have become more frequent; they were not previously included in routine maintenance visits.

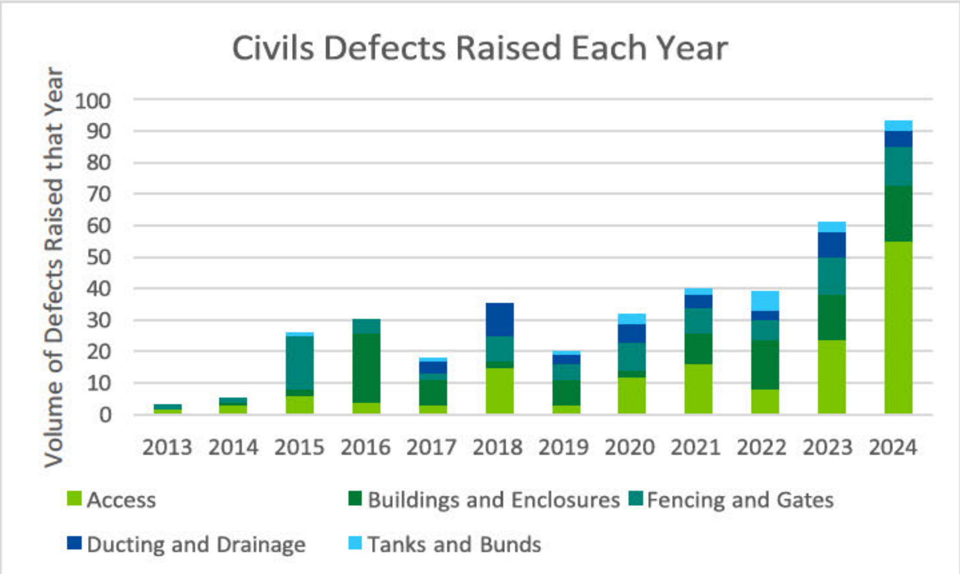

Figure 10: Historical defects raised each year by Civils sub-asset

7.1.9 Our bottom-up intervention volumes have primarily been based upon historical defects. Modelled failures rates are assessed within the NARMs methodology to calculate assets' monetised risk, which is then managed within Copperleaf to achieve varying levels of risk to generate Cost Benefit Analysis and additional interventions to maintain stable risk via Predictive Analytics.

Probability of Failure Data Assurance

7.1.10 Historical defect data presented above has been determined based on our Defect Management System. An extract from the system was undertaken in July 2024, with data analysis undertaken based on the columns of data exported from the system.

7.1.11 Information captured from surveys completed through our RIIO-T2 project delivery was utilised to inform the condition of assets, as defects were logged within our defect management system where faults were identified.

7.1.12 Modelled failure rates are calculated using the accepted NARMs Methodology and applied to all assets in our database. These rates help determine the likelihood of a consequence occurring. Assets can have multiple failure modes, and the impact of a failure depends on factors like the asset's age, location, and criticality. A failure may lead to various service risks, including environmental, health and safety, availability and reliability, societal, or financial impacts. Each asset type has specific failure modes and consequences outlined in the NARMs Methodology. For example, a condensate tank system might experience vessel corrosion, that in turn may lead to a health and safety incident, station unavailability, or increased maintenance.

8 Consequence of Failure

8.1.1 There are a range of potential impacts that can occur to site operations because of a failure of our Civils assets. An overview of the consequence of failure for each sub-asset type is presented below mapped against our NARMS Consequence of Failure service risk measures.

Table 13: Consequence of Failure Summary

Sub-Asset	Impact / Consequence				
	Availability	Environment	Financial	Safety	Other
Access Assets	Damage or defects to access assets could restrict access around a site or to operational equipment, restricting the operations and potentially leading to constraints on the network.		Failure or severe deterioration of access assets would result in higher maintenance costs incurred to replace or refurbish them.	Damaged and faulty access equipment and roads poses a risk to personnel using them, leading to possible injuries if the assets were to completely fail during use. Defective assets that do not comply with safety standards can lead to fines and penalties.	
Buildings and Enclosures	Structural breakdown of buildings and enclosures can lead to an inability to access operational equipment, or damage to equipment housed inside	Failures in the structural integrity of buildings and enclosures, could result in gas emissions to the environment by assets housed within them.	Costs to refurbish damaged or deteriorated buildings would be incurred, as well as potential costs to repair or replace equipment housed within them that have been damaged.	Structural failures to buildings pose a significant safety risk to the safety of staff and personnel accessing them.	
Security Fencing and Gates	Third-party access due to damaged or failed fencing or gates can result in interference to operational assets. Damaged gates that do not open and close properly, could restrict access to a site by personnel.	Third-party access and interference could damage operational assets on site, leading to leaking of harmful gas or fluids.	Costs to refurbish damaged or failed fencing and gates would be incurred, as well as potential costs to repair or replace operational equipment damaged by third-party interference.	Fencing and gates that fail to prevent public access can put them at harm from ongoing site operations. The safety of staff or personnel would be put at risk with damaged fencing or gates due to third-party interference or parts of the assets e.g. gates falling on staff when being opened.	There is a societal risk in failing to protect the public effectively. There is also an external threat risk from third parties that can potentially disrupt supplies or access to the network.
Ducting	Exposed cables and pipework that keep a site operational can be damaged and restrict the operations of a site.	Ducting which fails to protect pipework, could result in their damage and gas emissions or the leaking of harmful fluids/waste.	Costs to refurbish damaged or deteriorated ducting would be incurred, as well as potential costs to repair or replace cabling and pipework protected by the ducting.	Damaged ducting can expose electrical cables, posing a risk to personnel who come into contact with them. Damaged or misaligned ducting slabs present trip hazard to staff and personnel moving around the site.	
Drainage	Failure of drainage systems can lead to flooding of a site, restricting access and therefore the operation of that site. Flooding of a site can lead to the deterioration/corrosion and the failure of operational assets on site, leading to constraints.	Ineffective drainage can lead to the build-up of contaminants that can leak into the environment. Wastewater that is not properly treated before being released from a site can lead to penalty fines due.	Damaged or failed drainage systems will incur costs to refurbish or replace them. Damage to operational assets onsite due to improper drainage can lead to costs to refurbish or replace them.	Flooding of a site due to ineffective drainage can present slip hazards for personnel and staff moving around a site. Flooding can also conceal trip hazards in the form of potholes, pits or chambers that have become filled with water.	Improper treatment of water and waste released from a site could have a societal impact from the public and nearby residents.
Tanks and Bunds	Failed tanks and bunds lead to the release of harmful fluids, restricting	Failure of tanks or bunds results in the release of harmful fluids and	Damaged tanks or bunds will incur costs to refurbish or replace them.	Failure of tanks or bunds would result in the release of harmful substances across a site,	There is a societal risk that would result from the

Sub-Asset	Impact / Consequence				
	Availability	Environment	Financial	Safety	Other
	access, ceasing its operation and causing potential restraints to the network. Leaking of corrosive substances can lead to damage of operational assets located on site, impacting their availability and reliability.	substances to the environment, causing damage to plant and wildlife in the area, water sources and potential harm to nearby public.	Damage to operational assets leading to a loss of containment of harmful fluids can incur costs to refurbish or replace them. Loss of fluids from tanks can incur costs to clean up and/or decontaminate a site. Impacts to the environment due to leaked fluids can incur fines and penalties.	posing a significant risk to staff and personnel located on site. The release of any harmful substances can also pose a risk to health and safety the public.	failure of tanks and bunds to contain harmful substances that make their way into the environment.

8.1.2 Without a managed programme of investment to look after our Civils assets, failure of these assets could become a major risk to the health and safety of staff and the public, as well as a significant risk to the environment. In the more severe instances, failure of Civils assets can have a major risk to the continued safe and efficient operation of the NTS, depending on the scale of failure and impacts to a site.

8.1.3 The Civils theme consists of a wide range of assets of various ages and in various stages of deterioration. Doing nothing to these assets increases the consequences of any failures and a backloading of investment required to fix them, reaching a point where we may no longer be able to keep on top of defects across the set of assets.

9 Interventions Considered

9.1 Interventions

9.1.1 A range of interventions have been considered for our Civils assets in RIIO-GT3 to address the drivers for investment. There are a wide range of civil asset types, each with specific investment scopes. However, the interventions for each asset group can be categorised into the following types:

- Counterfactual (Do Nothing)
- Refurbish Asset (Pre-emptively or on Failure)
- Replace Asset (Pre-emptively or on Failure)
- Decommission
- Site Specific

Counterfactual (Do Nothing)

9.1.2 This intervention remains the same for all asset groups. With this intervention, all assets under Civils are maintained as per the policy T/SP/CE/15. If defects are identified and logged, they will be resolved through maintenance if the budget is available.

9.1.3 The benefit of this intervention is that there are no capex costs; action is taken only to conduct required maintenance or to simply monitor the condition of assets.

9.1.4 The downside is that an increasing number of defects are being identified which, if left without intervention, will eventually result in the complete failure of the assets. This then poses significant risks related to financial, safety, environmental and asset availability and reliability.

Refurbish and Replace (Pre-emptively or On Failure)

9.1.5 Table 14 lists different refurbishment and replacement interventions being considered for Civils assets.

Table 14: Civils Refurbish and Replace Interventions

Intervention	Scope
Access Platforms and Stairs Relifing	Involves activities such as adding self-closing gates to raised platforms where needed, re-paint, replace elements that no longer conform to current specifications, add kicker boards, additional steps, etc. Extend railings to close any gaps. This does not include the replacement of vertical fixed ladders with staircases.
Replace Sewage Treatment System	Replacement of site sewage treatment system with a modern more effective equipment. Statutory. Ensures compliance to environmental Health legislation relating to pollution control
Replacement of Chamber Cover/Repair of Chambers side wall	Change covers and frames of manhole chambers where needed and renew individual chambers where necessary.
Repair Damaged or Broken Drainage assets	Undertaking of inspection of drainage system, then full drain down and replacement of all moving parts, renew soak away bed material and replace broken sections of pipe
Refurbish Access Road/Path (Tarmac)	Planning off the top layers of tarmac and lay a new topping surface. Replace any gullies and broken kerbs. This does not include the sub-base and reconstruction
Refurbish Access Road/Path (Concrete)	Planning off the top layers of Concrete and lay a new topping surface. Replace any gullies and broken kerbs. This does not include the sub-base and reconstruction
Repair Access Road/Path (Tarmac)	Repairing Tarmac access roads and paths. Includes Pot-hole filling, patch repairing, kerbs and renew white / yellow demarcation lines, Jet washing and removing algae from the roadway.
Repair Access Road/Path (Concrete)	Repairing concrete access roads and paths on a fix-on-fail basis. Includes Pot-hole filling, patch repairing, re-levelling slabs, kerbs and renew white / yellow demarcation lines. Renewing/repairing the expansion joints between concrete road panels. Cut out of current expansion Joint and installation of a new joint between concrete road panels
Construct new access road/path (Concrete)	Installation of extension to Concrete access road, for new road or extended hammerhead road to facilitate access to new connection equipment, such as GRAID connection point. Includes installation of new subbase and concrete pads and expansion joints. Includes new gullies and kerbs as necessary
Replace plastic waste oil tank	Drain down, conduct integrity testing of internal and external surfaces and thickness measurements. If testing fails, complete removal of failed tank and installation of replacement tank.
Replace steel tanks	Drain down, conduct integrity testing of internal and external surfaces and thickness measurements. If testing fails, complete removal of failed tank and installation of replacement tank.
Repair steel tanks	Remove loose materials from drained tank, prepare the surface and provide suitable coating/painting where required in accordance with PAT/10 requirements.
Relifing or repair of tank bunds	Remove existing tank and any bunding and pumping arrangements and rebuild as new. There is the option if it is structurally sound to retain the concrete bund, modifying supports to suit new tank. New

	ancillary assets are installed including covers / fixings / drains / sump pumps. Plastic, internally bunded, tanks are replaced in their entirety.
Building Major Refurb	Major refurbishment of a building (incl. new roofs, removing asbestos, structural repairs)
Replace gate and associated furniture	Replacing a gate and associated furniture i.e., handles, locks, latches etc.
Replace fencing	Replacing fencing perimeters
Repair site fencing	Repairing Site fencing includes, replacement of individual fencing panels or sections of fencing panels, individual or a number of fence posts, or the removal of barbed wire or other similar assets
Relifing of Site Ducting	Replace all lids and relay any sunk or damaged lengths of duct and jointing chambers
Monitoring of Buildings & Enclosures	Visual or where appropriate by physical survey / Non-destructive Testing (NDT) and formal record / report, all conducted by an appropriate specialist and to include remnant life assessment on our Buildings and Enclosures Assets
Monitoring of Fuel Tanks & Bunds	Visual or where appropriate by physical survey / Non-destructive Testing (NDT) and formal record / report, all conducted by an appropriate specialist and to include remnant life assessment on our Fuel tanks and Bunds Assets.
Building Minor Refurb	Minor Refurbishment are repair type activities such as replacing any broken elements such as gutters, downpipes, hinges, locks, handles, small roof repairs. Patch paint. Wholescale improvement of the building is outside the scope. Also includes the repair to asset enclosures.

9.1.6 The positives and negatives of interventions to Civils assets can differ depending on whether interventions are carried out proactively or reactively. These are summarised in Table 15.

Table 15: Proactive vs Reactive Intervention Comparison

Intervention		Positives	Negatives
Refurbishment	**Proactive**	Reduces the risk of assets failing or working inefficiently which could lead to operational constraints. Delivery of maintenance can be managed better around peaks and troughs in delivery programmes. Defects are not allowed to worsen, causing secondary damage to other assets.	Proactive interventions result in remedying defects earlier. This means that over an assets lifetime the asset will be intervened on more times which in turn could result in more outages.
	Reactive	Potentially lower capex costs for RIIO-GT3 due to a lower volume of refurbishments undertaken.	Failure of assets could lead to more significant implications such as legislative non-compliance, third-party interference or impacts to the environment and public. Unprecedented refurbishment work could result in insufficient funding to carry out the required works Unplanned outages required to carry out refurbishments could have an impact in the operations of the site or network, or other maintenance ongoing in the vicinity.
Replacement	**Proactive**	Avoids failure of the Civils asset and damage of operational equipment they are designed to protect, adhering to safety legislations. The delivery of maintenance can be managed better around peaks and troughs in delivery programmes.	There is a risk that carrying out pre-emptive replacements could be a waste of money, where we replace an asset that could have continue to function for several more years before failing. Proactive interventions result in remedying defects earlier. This means that over an assets lifetime the asset will be intervened on more times which in turn could result in more outages
	Reactive	Potentially lower capex costs for RIIO-GT3 due to a lower volume of replacements undertaken.	Unprecedented replacement of assets can hinder or halt the operations of a site until works can be completed, leading to constraints. Failure of the assets could lead to more significant implications which would incur significantly higher costs than if investment was carried out prior. Unplanned outages required to carry out replacements could have an impact in the operations of the site or network, or other maintenance ongoing in the vicinity.

9.1.7 A secondary consideration for many interventions on Civils assets is that they provide future climate change benefits, extending their asset life and making them more capable of withstanding the impacts of flooding or extreme temperatures and weather events. Under Civils, there are interventions which aim to mitigate the impacts of climate change, specifically drainage interventions which intend to address flooding at NTS sites. These are outlined in more detail further on in this section.

9.1.8 For certain assets, a full replacement may not be the most ideal option but instead the maintaining and refurbishment of existing assets may be seen as a more appropriate intervention. For example, for fencing where corrosion or damage has been identified, it may be more cost effective and practical to carry out an intervention on a specific fence post or panel, rather than replacing the entire fence.

Decommission

9.1.9 In some instances, assets may be best suited for decommissioning. This would apply to assets that no longer suit their purpose or have reached the end of their design life. This can be driven by newer, more efficient assets being installed or utilisation of a site may become reduced and in turn the level of asset infrastructure required is reduced.

9.1.10 In instances where entire sites are no longer required or fit for purpose, the decommissioning of associated Civils assets for that site would be included in an overarching project to decommission the whole site.

9.1.11 The benefit of this option is that we would no longer need to invest in managing the asset health of assets of redundant assets.

9.1.12 However, this option is not being taken forward as all the assets proposed to be intervened on in RIIO-GT3 are still required to enable efficient NTS operation.

Site Specific

9.1.13 Certain civil asset groups require interventions specific to site requirements. These site-specific interventions are outlined as follows:

- **Flood Risk Interventions** – Due to the effects of climate change, heavier rainfall is being seen more frequently, increasing the risks of flooding across our sites. Specific interventions that aim to mitigate these risks are being proposed for RIIO-GT3. Temporary Drainage Facilities, in the form of mobile water pumps, will aim to assist existing drainage systems in removing storm water out of pits and away from critical operational assets located on site, while studies across our NTS sites will determine where permanent mitigation measures are required to tackle heavy rainfall and flooding as the result of climate change.
- **Address Site Subsidence** - Subsidence can cause misalignment or damage to buildings or operational equipment located at a site, often as the result of improper drainage or burrowing animals. Intervention can be taken to stabilise the ground where subsidence is present, with simple methods such as installing earth or stone to support the ground, or more complex methods such as injecting appropriate polymers into the ground.
- **Rodent Protection** – Wildlife such as rabbits can often burrow under and around fencing and operational equipment on site, causing instability to the assets located there. To protect against these issues, ground guards can be installed at relevant sites.

9.2 Intervention Summary

9.2.1 Table 16 shows a summary of all the interventions considered.

Table 16: Civils Interventions Technical Summary Table

Intervention	Equipment Design Life	Positives	Negatives	Taken Forward
Access Platforms & Stairs Relifing	40	Enhances safety and returns the assets to their original design intent without the need to replace the assets	None.	Yes
Replace Sewage Treatment System	20	Ensures compliance to environmental Health legislation relating to pollution control.	More expensive than relifing	Yes
Replacement of Chamber Cover/Repair of Chambers side wall	40	Enhances safety and returns the assets to their original design intent.	None.	Yes
Repair Damaged or Broken Drainage assets	20	Returns the assets to their original design intent to enable efficient drainage operation.	None	Yes
Refurbish Site Road/Path (Tarmac)	25	Replaces the top layers of tarmac including gullies and kerbs to enable safe access and egress.	Does not include road/path sub-base and reconstruction so could result in additional works being required.	Yes
Refurbish Site Road/Path (Concrete)	25	Replaces the top layers of concrete including gullies and kerbs to enable safe access and egress.	Does not include road/path sub-base and reconstruction so could	Yes

Intervention	Equipment Design Life	Positives	Negatives	Taken Forward
			result in additional works being required.	
Repair Site Road/Path (Tarmac)	15	Returns the tarmac road/path to its original design intent through pothole filling, patch repairs, kerb repairs, including jet washing.	None.	Yes
Repair Site Road/Path (Concrete) incl. renew concrete expansion joints	15	Returns the concrete road/path to its original design intent through pothole filling, patch repairs, kerb repairs, expansion joint interventions, including slab re-levelling.	None.	Yes
Construct road/path Extension (Concrete)	40	Provides access and egress to new connection equipment.	None.	Yes
Replace plastic waste oil tank	15	Restoration of original design intent for the storage and management of waste oil.	More expensive than repairing.	Yes
Replace steel tanks	40	Restoration of the original design intent of steel tank storage function by replacing those that have deteriorated or corroded beyond economical repair.	More expensive than repairing.	Yes
Repair steel tanks	20	Restoration of the original design intent of steel tank storage function by repairing/refurbishing those that have deteriorated or corroded.	None	Yes
Relifing or repair of Tank bund	40	Restoration of the original design intent of tank bund function.	None.	Yes
Building Major Refurb	25	Restores the building to its original design intent of protecting vulnerable plant and equipment from damage and weathering, and create a safe and suitable workspace for maintenance, storage and repair operations, staff offices, control systems and related facilities.	None	Yes
Replace gate and associated furniture	20	Minimise the opportunities for unauthorised entry or damage to our assets.	None.	Yes
Replace fencing	20	Restores the original design intent of protecting our sites and assets from breaches by external parties. It provides a safe working environment for our primary and secondary assets.	More expensive than repairing.	Yes
Repair Site Fencing	5		None.	Yes
Relifing of Site Ducting	40	Restores the original design intent of site ducting through replacement of lids and relay of any sunk or damaged lengths of duct and joining chambers.	None.	Yes
Monitoring of Buildings & Enclosures Assets	N/A	Through surveys and NDT this provides key information on the remnant life assessment of our assets enabling targeted and timely interventions.	None.	Yes
Monitoring of Fuel Tanks & Bunds Assets	N/A		None.	Yes
Building Minor Refurb	10	Returns the buildings to their original design intent through sub-component repair activities.	None.	Yes
Address Site Subsidence (Simple)	20	Arrests and addresses the rate of subsidence on our sites to stabilise ground movement thus preventing undue stresses that have the potential to damage our assets.	None.	Yes
Address Site Subsidence (Complex)	20		None.	Yes
Flood Risk – Temporary Flood Interventions for identified impacted sites	0	Provides a critical immediate temporary solution to impacts of flooding from all sources on our assets, resulting from Climate Change, while a permanent flood management solution is being developed.	None.	Yes
Flood Risk – Studies to develop Permanent Mitigation Measures	0	Provides a long-term view of the impact of Climate Change related impacts of flooding from all sources on our assets to develop long term solutions for flood risk management.	None.	Yes
Install Ground Guards (Rodent Protection)	40	Provides deterrents to rodents accessing sites to damage assets.	None.	Yes

9.3 Volume Derivation

9.3.1 Bottom-up volumes were derived from identified defects for Civils assets captured through the RIIO-T2 survey programme from 138 sites, and then extrapolating this data across the number of sites across the NTS. The surveyed sites were geographically spread across the country, both inland and coastal, and reflect the full range of site types within NTS network (Multi-junctions, Block Valves, Offtakes, Pig Trap sites).

9.3.2 Table 17 summarises how the bottom-up intervention volumes have been developed.

Table 17: Development of bottom-up Civil intervention volumes for RIIO-GT3

Intervention	Volume	Unit of Measure	How this volume has been developed
Access Platforms & Stairs Relifing	[redacted]	Per asset	
Replace Sewage Treatment System	[redacted]	Per Asset	

Intervention	Volume	Unit of Measure	How this volume has been developed
Replacement of Chamber Cover/Repair of Chambers side wall	[redacted]	Per Asset	• Identification of the number and type of Civils assets located across the NTS. • Collation and review of targeted survey outputs to capture defects. • Review of the number of issues from our defect management system, Maximo. • Assessed survey and Maximo outputs with stakeholders across the business to capture the volumes of identified Civils defects and recommended interventions. • Where appropriate the volumes of proposed RIIO-T2 interventions were extrapolated across the total number of Civils assets to develop volumes.
Repair Damaged or Broken Drainage assets	[redacted]	Per Site	
Refurbish Site Road/Path (Tarmac)	[redacted]	Per Site	
Refurbish Site Road/Path (Concrete)	[redacted]	Per Site	
Repair Site Road/Path (Tarmac)	[redacted]	Per Site	
Repair Site Road/Path (Concrete) incl. renew concrete expansion joints	[redacted]	Per Site	
Construct road/path Extension (Concrete)	[redacted]	Per Site	
Replace plastic waste oil tank	[redacted]	Per Asset	
Replace steel tanks	[redacted]	Per Asset	
Repair steel tanks	[redacted]	Per Asset	
Relifing or repair of Tank bund	[redacted]	Per Asset	
Building Major Refurb	[redacted]	Per Building	
Replace gate and associated furniture	[redacted]	Per Asset	
Replace fencing	[redacted]	Per Site	
Repair Site Fencing	[redacted]	Per Site	
Relifing of Site Ducting	[redacted]	Per Site	
Monitoring of Buildings & Enclosures Assets	[redacted]	Per Asset	
Monitoring of Fuel Tanks & Bunds Assets	[redacted]	Per Asset	
Building Minor Refurb	[redacted]	Per Asset	
Address Subsidence (Simple)	[redacted]	Per Site	
Address Site Subsidence (Complex)	[redacted]	Per Site	
Flood Risk – Temporary Flood Interventions for identified impacted sites	[redacted]	Per Site	
Flood Risk – Studies to develop Permanent Mitigation Measures	[redacted]	Per Site	
Install Ground Guards (Rodent Protection)	[redacted]	Per Asset	
Total	**542**		

9.4 Unit Cost Derivation

9.4.1 The costs have been derived using a robust methodology using known data for historical activities which share the scope with the interventions within this EJP, and constructed estimations based on details and assumptions provided by subject matter experts. A summary is provided in Table 18 with a further breakdown in Appendix 3 – Cost Breakdown

Table 18: Civil Intervention Unit Cost Summary Table (£, 2023/24)

Intervention	Unit of Measure	Unit Cost	Cost Accuracy	Number of Data Points	Source Data
Access Platforms & Stairs Relifing	Per asset	[redacted]	+/- 10%	8	Estimate at Cost of Completion
Replace Sewage Treatment System	Per Asset	[redacted]	+/- 20%	0	First principles – derived using known rates/activities
Replacement of Chamber Cover/Repair of Chambers side wall	Per Asset	[redacted]	+/- 50%	0	First principles – derived using known rates/activities
Repair Damaged or Broken Drainage assets	Per Site	[redacted]	+/- 50%	9	Estimate at Cost of Completion
Refurbish Site Road/Path (Tarmac)	Per Site	[redacted]	+/- 15%	0	First principles – derived using known rates/activities
Refurbish Site Road/Path (Concrete)	Per Site	[redacted]	+/- 15%	0	First principles – derived using known rates/activities
Repair Site Road/Path (Tarmac)	Per Site	[redacted]	+/- 50%	1	Historical Outturn
Repair Site Road/Path (Concrete) incl. renew concrete expansion joints	Per Site	[redacted]	+/- 50%	1	Historical Outturn
Construct road/path Extension (Concrete)	Per Site	[redacted]	+/- 15%	0	First principles – derived using known rates/activities
Replace plastic waste oil tank	Per Asset	[redacted]	+/- 30%	0	First principles – derived using known rates/activities
Replace steel tanks	Per Asset	[redacted]	+/- 10%	0	First principles – derived using known rates/activities
Repair steel tanks	Per Asset	[redacted]	+/- 10%	0	First principles – derived using known rates/activities
Relifing or repair of Tank bund	Per Asset	[redacted]	+/- 50%	2	Historical Outturn
Building Major Refurb	Per Building	[redacted]	+/- 15%	0	First principles – derived using known rates/activities

Intervention	Unit of Measure	Unit Cost	Cost Accuracy	Number of Data Points	Source Data
Replace gate and associated furniture	Per Asset	[redacted]	+/- 30%	0	First principles – derived using known rates/activities
Replace fencing	Per Site	[redacted]	+/- 30%	7	Estimate at Cost of Completion
Repair Site Fencing	Per Site	[redacted]	+/- 10%	0	First principles – derived using known rates/activities
Relifing of Site Ducting	Per Site	[redacted]	+/- 30%	5	Estimate at Cost of Completion
Monitoring of Buildings & Enclosures Assets	Per Asset	[redacted]	+/- 30%	51	Estimate at Cost of Completion
Monitoring of Fuel Tanks & Bunds Assets	Per Asset	[redacted]	+/- 50%	9	Estimate at Cost of Completion
Building Minor Refurb	Per Asset	[redacted]	+/- 10%	1	Historical Outturn
Address Subsidence (Simple)	Per Site	[redacted]	+/- 20%	0	First principles – derived using known rates/activities
Address Site Subsidence (Complex)	Per Site	[redacted]	+/- 20%	0	First principles – derived using known rates/activities
Flood Risk – Temporary Flood Interventions for identified impacted sites	Per Site	[redacted]	+/- 10%	0	Mix of assumptions and real data
Flood Risk – Studies to develop Permanent Mitigation Measures	Per Site	[redacted]	+/- 10%	0	Mix of assumptions and real data
Install Ground Guards (Rodent Protection)	Per Asset	[redacted]	+/- 10%	0	First principles – derived using known rates/activities

9.4.2 Our cost accuracies are determined based on the type of cost data available, the quantity of this data (i.e. the number of data points) and the similarity of the scope of these historical data points against our RIIO-GT3 investment programme.

9.4.3 Interventions in our Civils investment theme with a +/-50% accuracy are where they have been derived from RIIO-1 unit costs, acknowledging the time since these interventions have been delivered.

9.4.4 A specific example of how we have developed costs for Civils works is a recent construction estimate for a scope of "Refurb Tarmac Road". This intervention was calculated at a value of [redacted] (2023/24 price base) and encapsulates a series of Civils activities including: the resurfacing of pavement, installation or replacement of drainage chambers, associated kerbing works and the reinstatement of road markings upon completion. The surfacing costs assumed a 50mm wearing course and allowed for a single manhole every 25m. Due to the relatively small nature of the works, there have been additional allowances included to allow for small quantities or minimum order values. Part of the costs for this intervention were generated utilising the [redacted] with additional considerations taken from site intelligence and known internal National Gas supervision. A 15% National Gas contingency was applied to this estimate.

9.4.5 The unit costs for the *Building Major Refurb* intervention, was derived for a building 3m in height and with a squared footage of approximately 42m². The unit cost accounts for the replacement of doors, repairs to roofs, including coverings, fixings and any explosion relief aspects, as well as louvres and guttering repairs or replacements. [redacted]

9.4.6 Some interventions encompass work on assets of different sizes. For example, the intervention to *Replace steel tank*, can refer to a small or a large steel tank. In estimating a unit cost for this intervention, an estimate was determined for each size, and the unit cost used within the plan is an average of each, [redacted]

10 Options Considered

10.1 Portfolio Approach

10.1.1 In developing our plans, we focused on value for money and deliverability, while managing the risks of aging assets. We evaluated the cost-effectiveness of our investment program through a full Cost Benefit Analysis (CBA) using the NARMs Methodology within the Copperleaf Decision support tool.

10.1.2 We have assessed the benefit from options across the entire Civils portfolio to meet investment drivers, business plan commitments, and consumer priorities. Therefore, a single CBA covers Access, Buildings, Security Fencing, Gates, Ducting, Drainage, Tanks and Bunds.

10.1.3 The options considered combine the interventions discussed previously in varying combinations and volumes to identify the optimal investment for Civils assets.

10.1.4 In Line with HM Treasury Green Book advice and Ofgem guidance, we assessed the value of investing in Civils across the RIIO-GT3 period by analysing the cost benefit over a 20-year horizon.

10.1.5 We derived bottom-up intervention volumes using the engineering assessments described in the previous chapters. Each investment was assessed via the Ofgem-approved NARMs Methodology embedded in Copperleaf, quantifying risk reduction and Long-Term Risk Benefit (LTRB). Analysing this performance, Copperleaf Predictive Analytics is then able to select further NARM driven interventions to create further options to satisfy certain criteria, such as stable risk across the portfolio.

10.1.6 Only interventions assigned to a specific asset have been assessed in the CBA, as benefits cannot be applied to interventions that are assigned to various locations (e.g. based on forecast defects). Therefore, certain interventions, such as those for access equipment and roads, have not been modelled or included in the option costs. Interventions which have been discounted (e.g. because they do not meet legislative requirements) have also not been modelled.

10.2 Options

10.2.1 Using the Predictive Analytics Optimisation Module (PA) within Copperleaf, our Civils assets have been optimised against the NARMs Methodology to ensure the portfolio achieves a variety of outcome risk levels, to satisfy stakeholder needs.

10.2.2 All the options described below have been assessed against our Option 0, Counterfactual (Do Nothing) option, which considers no investment over and above maintenance and corrective repairs.

10.2.3 In all options (except the counterfactual) we include 542 investment volumes that have been developed through our bottom-up intervention development, to address know defects and obsolescence issues. These bottom-up volumes were summarised in Table 17.

Option 1: Total Monetised Risk Stable to RIIO-T2 Start

10.2.4 In this option we have utilised our Copperleaf Portfolio optimisation tool to constrain the overall level of NARMS risk at the end of the RIIO-GT3 period to remain consistent with the levels of risk at the start of the RIIO-T2 period. Individual NARMS service risk measures are not individually constrained, however overall risk outcome is.

10.2.5 The total proposed volume of interventions in this option is 1440, with a proposed spend of £33.42m (2023/24) which addresses known and forecast defects. Our Predictive Analytics model has selected the most cost beneficial interventions, including the addition of volumes above the identified bottom-up volumes, to keep overall NARMs risk stable. The proposed intervention volumes and the associated spend for this option are shown in Table 19.

Table 19: Option 1 Summary (£m, 2023/24)

Intervention	Volumes	RIIO-GT3 Value
Bottom-Up Interventions	[redacted]	[redacted]
Building Major Refurb	[redacted]	[redacted]
Building Minor Refurb		
Repair Site Fencing		
Replace Fencing		
Total	1440	£33,422,789

Option 1A: Post Deliverability

10.2.6 This option takes Option 1 following Deliverability Assessment, after which we are left with a more optimised investment proposal.

10.2.7 The total proposed volume of interventions in this option is 537, with a proposed spend of £23.31m (2023/24). To arrive at this proposed investment, the investment for Option 1 was taken through a deliverability assessment in order to optimise the plan. From this assessment, it was deemed that the higher volume and spend of interventions outlined in other options provided a higher risk to deliver than the benefit that would have been gained. Therefore, Option 1A proposes an optimise plan of interventions, with lower volumes and spend. The proposed intervention volumes and spend for this option can be found in Table 20 below.

Table 20: Option 1A Summary (£m, 2024/23)

Intervention	Volumes	RIIO-GT3 Value
Access Platforms & Stairs Relifing	[redacted]	[redacted]
Replace Sewage Treatment System	[redacted]	[redacted]
Replacement of Chamber Cover/Repair of Chambers side wall	[redacted]	[redacted]
Repair Damaged or Broken Drainage assets	[redacted]	[redacted]
Refurbish Site Road/Path (Tarmac)	[redacted]	[redacted]
Refurbish Site Road/Path (Concrete)	[redacted]	[redacted]
Repair Site Road/Path (Tarmac)	[redacted]	[redacted]
Repair Site Road/Path (Concrete) inc renew concrete expansion joints	[redacted]	[redacted]
Construct road/path Extension (Concrete)	[redacted]	[redacted]
Replace plastic waste oil tank	[redacted]	[redacted]
Replace steel tanks	[redacted]	[redacted]
Repair steel tanks	[redacted]	[redacted]
Relifing or repair of Tank bund	[redacted]	[redacted]
Building Major Refurb	[redacted]	[redacted]
Replace gate and associated furniture	[redacted]	[redacted]
Replace fencing	[redacted]	[redacted]
Repair Site Fencing	[redacted]	[redacted]
Relifing of Site Ducting	[redacted]	[redacted]
Monitoring of Buildings & Enclosures Assets	[redacted]	[redacted]
Monitoring of Fuel Tanks & Bunds Assets	[redacted]	[redacted]
Building Minor Refurb	[redacted]	[redacted]
Address Site Subsidence (Simple)	[redacted]	[redacted]
Address Site Subsidence (Complex)	[redacted]	[redacted]
CCA - Flood Risk - Temporary flood interventions for identified impacted sites	[redacted]	[redacted]
CCA - Flood Risk - Studies to develop permanent mitigation measures	[redacted]	[redacted]
Install Ground Guards (Rodent Protection)	[redacted]	[redacted]
Total	537	£23,313,794

Option 2: 10% Additional Risk Reduction

10.2.8 In this option, we applied optimisation to achieve a 10% additional monetised risk reduction by the end of the RIIO-GT3 period. Copperleaf has selected the most cost-effective investments to meet the lower risk constraint.

10.2.9 The total proposed volume of interventions in this option is 2524, with a proposed spend of £99.2m (2023/24) which has greater spend in comparison to Option 1 as the optimisation requires additional interventions to achieve the stricter risk constraint. Given the most cost-effective investments have already been selected in Option 1, further interventions are needed to meet the overall constraint resulting in the increased cost.

Table 21: Option 2 Summary (£m, 2023/24)

Intervention	Volumes	RIIO-GT3 Value
Bottom-Up Interventions	542	£24,561,289
Building Major Refurb	[redacted]	[redacted]
Building Minor Refurb	[redacted]	[redacted]
Repair Site Fencing	[redacted]	[redacted]
Replace Fencing	[redacted]	[redacted]
Relifing of Site Ducting	[redacted]	[redacted]
Repair Damaged or Broken Drainage assets	[redacted]	[redacted]
Replacement of Chamber Cover/Repair of Chambers side wall	[redacted]	[redacted]
Relifing or repair of Tank bund	[redacted]	[redacted]
Replace Plastic Waste Oil Tank	[redacted]	[redacted]
Total	**2524**	**£99,197,894**

Option 3: Lowest WLC

10.2.10 In this option, we applied optimisation to select interventions with the lowest Whole Life Cost (WLC). Copperleaf identifies the most beneficial interventions, and no investment is selected if the cost exceeds the asset's lifetime benefit, as per the NARMs methodology.

10.2.11 The total proposed volume of interventions in this option is 1140, with a proposed spend of £33.42m (2023/24). The PA model for this option aims to intervene on assets where the cost of intervening is outweighed by the benefit gained, regardless of how small that margin might be. In the case of Civils, this option is identical to Option 1, showing that the investment to achieve Total Monetised Risk and the Lowest Whole-Life Cost, are one in the same.

Table 22: Option 3 Summary (£m, 2023/24)

Intervention	Volumes	RIIO-GT3 Value
Bottom-Up Interventions	542	£24,561,289
Building Major Refurb	[redacted]	[redacted]
Building Minor Refurb	[redacted]	[redacted]
Repair Site Fencing	[redacted]	[redacted]
Replace Fencing	[redacted]	[redacted]
Total	**1440**	**£33,422,789**

Option 4: Maximise Risk Benefit

10.2.12 In this option, the model was allowed to maximise risk benefit from all applicable interventions and available assets. This resulted in a high-value, high-cost option for comparison purposes.

10.2.13 The total proposed volume of interventions in this option is 2150, with a proposed spend of £110.16m (2023/34), which shows how the option is attempting to carry out more work, ignoring certain SRMs such as Financial and Health & Safety. This option is summarised in Table 23.

Table 23: Option 4 Summary (£m, 2023/24)

Intervention	Volumes	RIIO-GT3 Value
Bottom-Up Interventions	542	£24,561,289
Address Site Subsidence (Simple)	[redacted]	[redacted]
Access Platform & Stairs Relifing	[redacted]	[redacted]
Refurbish Site Road/Path (Unbound)	[redacted]	[redacted]
Repair Site Road/Path (Unbound)	[redacted]	[redacted]
Construct Road/Path Extension (Concrete)	[redacted]	[redacted]
Building Major Refurb	[redacted]	[redacted]
Replace Fencing	[redacted]	[redacted]
Building Minor Refurb	[redacted]	[redacted]
Total	**2150**	**£110,159,852**

Option 5: Remove 1 Intervention and Maximise Risk Benefit

10.2.14 In this option, the model was allowed to maximise risk benefit from all applicable interventions and available assets, as in Option 4, however the intervention [redacted] was removed because it had been highly selected by the model in other options.

10.2.15 The total proposed volume of interventions in this option is 2150, identical to that of Option 4. The volumes from the removed intervention were instead spread out to [redacted]. As these volumes were deferred to interventions with lower unit costs, the total proposed spend for Option 5 is £37.7m (2023/24), significantly lower than that of Option 4. This option is summarised in Table 24.

Table 24: Option 5 Summary (£m, 2023/24)

Intervention	Volumes	RIIO-GT3 Value
Bottom-Up Interventions	542	**£24,561,289**
Address Site Subsidence (Simple)	[redacted]	[redacted]
Access Platform & Stairs Relifing	[redacted]	[redacted]
Refurbish Site Road/Path (Unbound)	[redacted]	[redacted]
Repair Site Road/Path (Unbound)	[redacted]	[redacted]
Construct Road/Path Extension (Concrete)	[redacted]	[redacted]
Replace Fencing	[redacted]	[redacted]
Building Minor Refurb	[redacted]	[redacted]
Total	**2150**	**£37,701,098**

10.3 Option Summary

10.3.1 Table 25 presents the technical summary table comparing our Options.

Table 25: Options Technical Summary Table (£m, 2023/24)

Option	First Year of Spend	Final Year of Spend	Total Volume of Interventions	Investment Design Life	% of Assets Intervened On	Total Spend Request
Option 0: Counterfactual (Do Nothing)	N/A	N/A	0	N/A	0%	0.0
Option 1: Total Monetised Risk Stable to RIIO-T2 Start	FY27	FY31	1440	5 to 40 yrs	11.76%	£32.71m
Option 1A: Post Deliverability	FY27	FY31	537	5 to 40 yrs	4.38%	£23.31m
Option 2: 10% Additional Risk Reduction	FY27	FY31	2524	5 to 40 yrs	20.61%	£98.49m
Option 3: Lowest WLC	FY27	FY31	1440	5 to 40 yrs	11.76%	£32.71m
Option 4: Maximise Risk Benefit	FY27	FY31	2150	5 to 40 yrs	17.56%	£109.45m
Option 5: Remove 1 Intervention and Maximise Risk Benefit	FY27	FY31	2150	5 to 40 yrs	17.56%	£36.99m

11 Business Case Outline and Discussion

11.1 Key Business Case Drivers Description

11.1.1 Civils assets deteriorate over time through their use and through age-based asset deterioration mechanisms. This in turn can result in being unable to perform their required functions and non-compliance with current and future legislative requirements.

11.1.2 As a result of this, a range of investment drivers have been identified which support the development of our investment proposal including Legislative Requirements, Health and Safety, Asset Deterioration and Obsolescence.

11.1.3 Managing the risk outcomes from the range of investment drivers is important to ensure that our Civils assets can continue to provide safe and reliable access to and around NTS sites, as well as provide protection to sites and operational assets from damage, third-party interference or deterioration. Our proposed investment for Civils assets will ensure that we maintain an appropriate level of risk across all these outcomes.

11.1.4 Specific outcomes associated with this investment are:

- Continue to provide ingress, egress, and access around NTS sites.
- Protect sites and operational assets from environmental and third-party Impacts.
- Provide a safe working environment for staff and personnel accessing and operating on site.
- Protect the public and environment from any impacts because of operations ongoing at our NTS sites, such as the containment of hazardous waste materials.

11.1.5 A variety of technical interventions have been considered and combined to create a range of CBA options, the results of which are presented in *Options Considered*, with payback graph in Figure 11. The graph illustrates the Net Present Value (NPV) of each option over a 20-year period, from 2031 (the end of RIIO-GT3), to 2051. As can be seen from the graph, *Option 5 – Remove 1 Intervention and Maximise Benefit* shows the lowest net NPV, followed by *Option 1A – Post Deliverability*. Option 1A however proposes a significantly lower volume of interventions with a lower proposed spend. *Option 1 – Total Monetised Risk Stable to T2 Start* and *Option 3 – Lowest Whole Life Cost*, appear to have identical investments, and *Option 2 – Additional 10% Risk Reduction* and *Option 4 – Maximise Risk Benefit*, have the lowest NPVs, with higher spend and volumes within these investments, illustrating significantly higher risk for this option. The graph also shows that none of the options provide enough benefit from the investment being proposed to allow them to be paid back within the 20-year period.

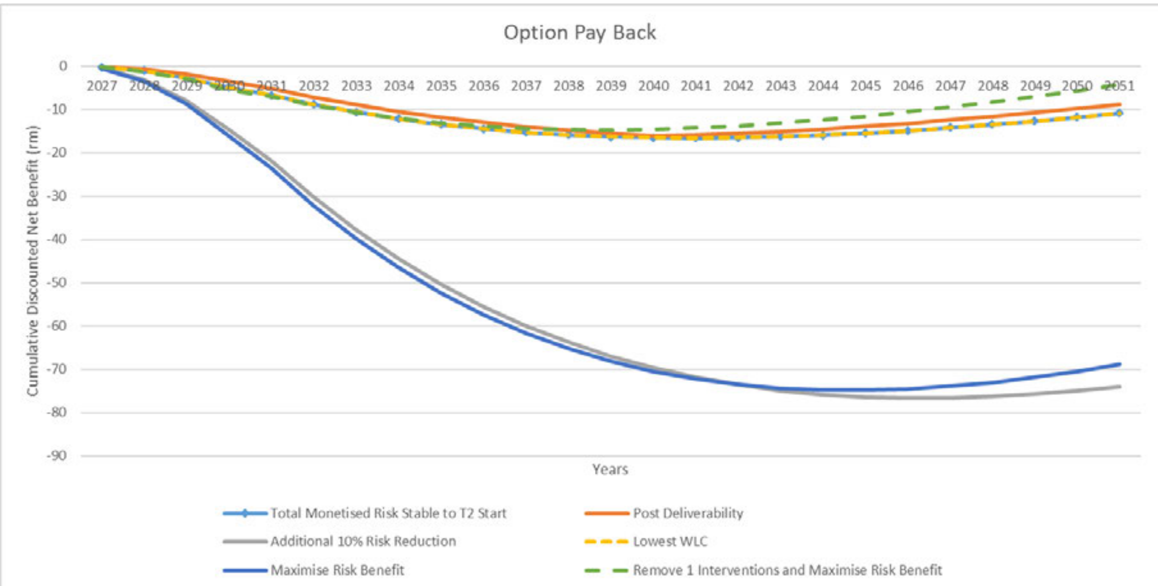

Figure 11: Graphical representation of Portfolio Option payback periods

Table 26: Option summary of headline business case metrics (£m, 2023/24)

Option	Total Volume of Interventions	Total Spend Request (£m)	Outcome Risk End of RIIO-GT3	% change in comparison to start of RIIO-T2	PV Costs	PV Benefits	NPV	CB Ratio	Payback Period from 2031	% change in service risk measures compared to start of RIIO–T2				
										Financial	Availability / Reliability	Environmental	Health & Safety	Societal
Option 0: Counterfactual (Do Nothing)	0	0.0	£3.56m	136.84%			N/A		N/A	99.23%	148.75%	89.17%	0.02%	300.00%
Option 1: Total Monetised Risk Stable to T2 Start	1440	33.42	£2.32m	89.10%	32.19	21.39	10.80	0.66	Does not payback in the period	89.38%	89.56%	15.09%	0.02%	300.00%
Option 1A: Post Deliverability	537	23.31	£3.27m	125.85%	22.45	13.56	8.89	0.60	Does not payback in the period	91.45%	137.19%	15.09%	0.02%	300.00%
Option 2: Additional 10% Risk Reduction	2524	99.20	£2.31m	88.88%	95.52	21.47	74.06	0.22	Does not payback in the period	88.49%	89.56%	10.50%	0.02%	300.00%
Option 3: Lowest WLC	1440	33.42	£2.32m	89.10%	32.19	21.39	10.80	0.66	Does not payback in the period	89.38%	89.56%	15.09%	0.02%	300.00%
Option4: Maximise Risk Benefit	2150	110.16	£1.32m	50.93%	106.17	37.28	68.89	0.35	Does not payback in the period	84.58%	40.88%	15.09%	0.02%	300.00%
Option 5: Remove 1 Interventions and Maximise Risk Benefit	2150	37.70	£1.66m	63.88%	36.35	32.07	4.28	0.88	Does not payback in the period	85.69%	57.57%	10.50%	0.02%	300.00%

12 Preferred Option Scope and Project Plan

12.1 Preferred Option

12.1.1 The preferred option to manage our Civils assets is Option 1: Total Monetised Risk Stable to RIIO-T2 Start. Our programme of investments on Civils has been taken through a deliverability assessment which assesses this programme of works against outputs across our entire capital investment plan. This results in a slightly adjusted Option 1A: Post Deliverability, which includes the mixture of interventions listed in Table 27.

12.1.2 Our proposed investment manages known obsolescence risks, addresses safety risks posed by our current assets and rising levels of defects on these installations to ensure these assets continue to support our critical site operations, maintain health and safety standards and manage the cost to consumers. It also contains investment for predicted defects in the RIIO-GT3 period.

Table 27: Preferred option summary (£m, 2023/24)

Intervention	Primary Driver	Volume	Unit of Measure	% Assets Intervened Upon	Total RIIO-GT3 Request	Funding Mechanism	PCD Measure
Access Platforms & Stairs Relifing	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Replace Sewage Treatment System	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Replacement of Chamber Cover/Repair of Chambers side wall	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Repair Damaged or Broken Drainage assets	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Refurbish Site Road/Path (Tarmac)	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Refurbish Site Road/Path (Concrete)	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Repair Site Road/Path (Tarmac)	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Repair Site Road/Path (Concrete) incl. renew concrete expansion joints	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Construct road/path Extension (Concrete)	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Replace plastic waste oil tank	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Replace steel tanks	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Repair steel tanks	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Relifing or repair of Tank bund	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Building Major Refurb	AH-Risk Management	[redacted]	Per Building	[redacted]	[redacted]	Baseline	Non-Lead Asset
Replace gate and associated furniture	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Replace fencing	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Repair Site Fencing	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Relifing of Site Ducting	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Monitoring of Buildings & Enclosures Assets	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Monitoring of Fuel Tanks & Bunds Assets	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Building Minor Refurb	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Address Subsidence (Simple)	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Address Site Subsidence (Complex)	AH-Risk Management	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Flood Risk – Temporary Flood Interventions for identified impacted sites	Climate Change Adaptation	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset
Flood Risk – Studies to develop Permanent Mitigation Measures	Climate Change Adaptation	[redacted]	Per Site	[redacted]	[redacted]	Baseline	Non-Lead Asset

Intervention	Primary Driver	Volume	Unit of Measure	% Assets Intervened Upon	Total RIIO-GT3 Request	Funding Mechanism	PCD Measure
Install Ground Guards (Rodent Protection)	AH-Risk Management	[redacted]	Per Asset	[redacted]	[redacted]	Baseline	Non-Lead Asset
Total		[redacted]			[redacted]		

12.1.3 Our costs have been derived by using a robust methodology using known data for historical activities, and assumptions provided by subject matter experts, while volumes have been built through the identification of defects for Civils assets captured through the RIIO-T2 survey programme and data extrapolation. We therefore propose the investment within this EJP is funded via Baseline funding and will be assessed using NARMs methodology.

12.1.4 The outputs from this investment will be included in the Non-Lead Asset PCD reporting mechanism, and cost variance managed through the TIM mechanism.

12.2 Asset Health Spend Profile

12.2.1 [redacted]

[redacted]

12.3 Investment Risk Discussion

12.3.1 The risk associated with our preferred options revolves around the difference in condition between the information utilised to build our investment proposals, defect information, condition surveys, and that identified through surveys at the time of delivery. This has the potential to increase the volume and scope more than that identified through the development of the plan.

12.3.2 Our costs have been built through unit cost analysis and estimates from the market, however there is a risk that costs of materials may increase due to macro-economic conditions.

12.3.3 Many of the interventions detailed in this EJP do not require site outages or restrictions to be in place in order to carry them out, therefore can be enacted with little interference to the operations of the NTS. Where investments may interfere with the operations of a site, these will be aligned with scheduled site outages to avoid constraints to the wider network.

12.3.4 Any decision to disconnect or decommission a site identified for Civils interventions would result in the need to review our proposals.

12.4 Project Plan

12.4.1 Project delivery has been split into three phases which align with our Network Development Process (ND500) as follows. Commissioning dates are not relevant to all intervention types but take place at the end of the delivery phase.

Table 28: Delivery phase alignment with ND500

Delivery Phase	ND500 Stage Gate(s)
Preparation	T0, T1, F1 (Scope establishment), T2, F2 (Option selection), T3, F3 (Conceptual Design Development and Long Lead Items Purchase), T4
Delivery	F4 (Execute Project), T5, Available for Commercial Load (ACL), T6
Close Out	F5 (Reconcile and Close)

12.4.2 The below table shows the summary plan and provisional delivery phases for Civils sanctions within RIIO-GT3. Internal stakeholder engagement has identified when we can obtain network access, where required, to complete these works. All investments in the preferred option, are proposed to be delivered through the 8 sanctions outlined in Table 29 below.

Table 29: Portfolio Programme for RIIO-GT3 period

Sanction	RIIO-T2		RIIO-GT3					
	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32
T3_Bacton_Civils		Preparation	Delivery	Delivery	Delivery	Delivery	Close Out	
T3_Climate Change Adaptation		Preparation	Delivery	Delivery	Close Out			
T3_Sites_AGI_Construction_FY28			Preparation	Delivery	Close Out			
T3_Sites_AGI_NGS_FY27		Preparation	Delivery	Delivery	Delivery	Delivery	Close Out	
T3_Sites_AGI_NGS_FY28			Preparation	Delivery	Close Out			
T3_Sites_AGI_NGS_FY29				Preparation	Delivery	Close Out		
T3_Sites_AGI_NGS_FY30					Preparation	Delivery	Close Out	
T3_Sites_AGI_NGS_FY31						Preparation	Delivery	Close Out

12.4.3 The work has been profiled based on a deliverability assessment across the whole our plan. Civils investments are aligned to Sites AGI sanctions, whose work are aligned to ILI outages.

12.5 Key Business Risks and Opportunities

12.5.1 Changes to system operation or supply and demand scenarios is unlikely to impact upon the proposal in this EJP. Significant changes could mean that particular assets or sites become redundant which would remove the need for some interventions but in general would still require them to be maintained until the point at which decommissioning is completed.

12.5.2 Fast tracking of the transition to hydrogen, within RIIO-GT3 would result in the need to redesign the NTS impacting the materials used to design our assets and this would have an impact on the proposals in this EJP.

12.5.3 The interventions scopes identified within this EJP are clearly identified and understood. We have delivered similar scopes in RIIO-T2 with limited change to these scopes proposed in RIIO-GT3.

12.6 Outputs included in RIIO-T2 Plans

12.6.1 There are no specific outputs from RIIO-T2 plans to be included within RIIO-GT3. However, the difference between the proposed RIIO-T2 Final Determination, and the forecast delivery of interventions for RIIO-T2, helped advise the proposed plan for RIIO-GT3.

12.6.2 For RIIO-T2 Final Determination, 2262 interventions were proposed for Civils, with an investment of £22.03m. During RIIO-T2, a site survey programmed identified more defects than were initially anticipated, requiring reprioritisation of funding to address. This resulted in a lower volume of interventions forecast for RIIO-T2 than was in the final determination. For RIIO-GT3, the bottom-up volume of interventions proposed were supported by the defects identified through the RIIO-T2 site survey programme, resulting in fewer high-cost interventions, such as replacements and relifing, rather than a high volume of low-cost interventions, such as repairs.

13 Appendices

13.1 Appendix 1 – Asset Ages

13.1.1 The graphs below illustrate the absolute age of the assets i.e. the age since assets were installed. Since their initial installation, they will have been replaced or refurbished throughout their lives and so the effective age of the asset may be less than what is shown.

13.1.2 As shown in Figure 13, 1492 of access assets will be 40 years old or older by the start of RIIO-GT3, approximately 94% of the total number of access assets across the NTS.

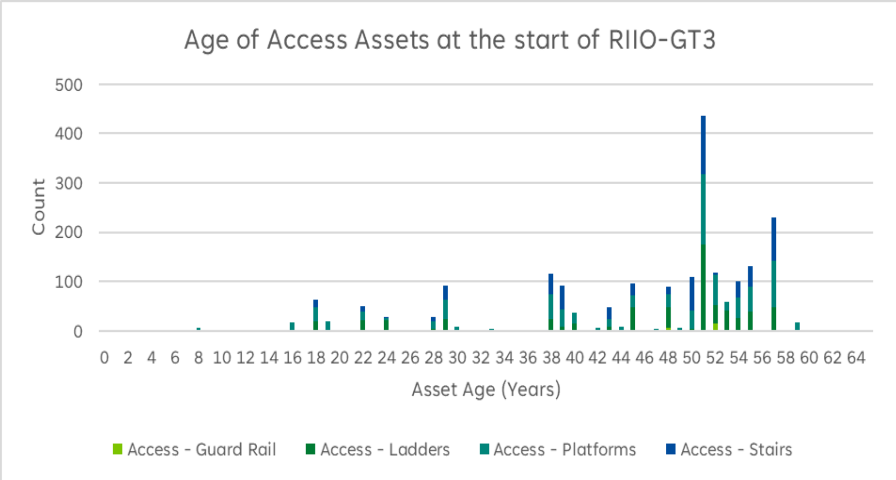

Figure 13: Age of Access Assets at the start of RIIO-GT3

13.1.3 Figure 14 shows the ages of 1164 roads and pathways assets located at sites across the NTS at the start of RIIO-GT3. As shown, 828 of these assets will be 40 years old or older by the start of RIIO-GT3, approximately 71% of the roads and pathways across the NTS. For roads, we will have undertaken patch repairs since their initial installation to refurbish things such as potholes or broken kerbs.

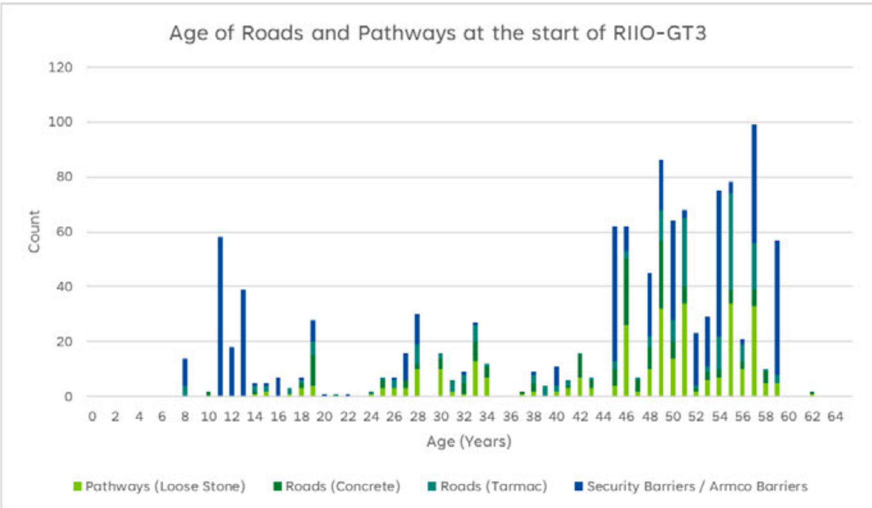

Figure 14: Age of Roads and Pathways at the Start of RIIO-GT3

13.1.4 The graph shown in Figure 15 below, shows the ages at the start of RIIO-GT3 of the 3285 different types of buildings located at sites across the NTS. As shown, 1958 of these assets will be 40 years old or older at the start of RIIO-GT3, approximately 60% of the buildings across the NTS.

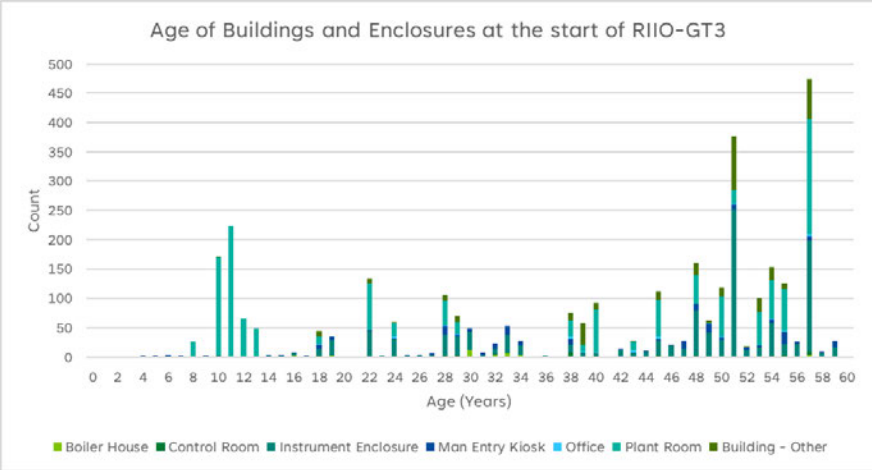

Figure 15: Age of Buildings and Enclosures at the start of RIIO-GT3

13.1.5 Figure 16 below shows the ages of the 1795 different security fences and gates located across NTS sites at the start of RIIO-GT3. As shown, 947 of fences and gates will be 30 years or older at the start of RIIO-GT3, which is approximately 53% of the total number of assets.

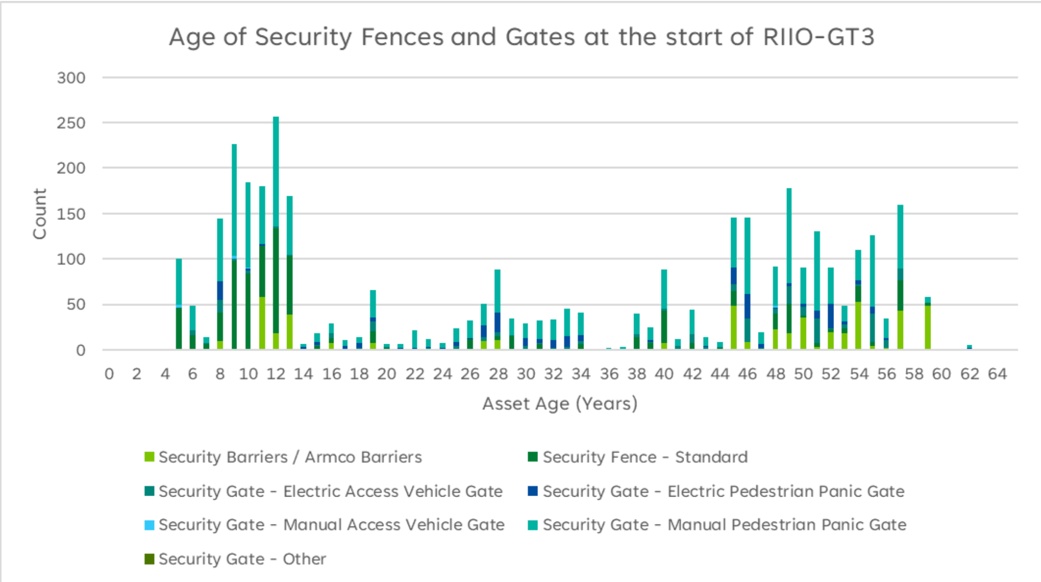

Figure 16: Age of Security Fences and Gates at the start of RIIO-GT3

13.1.6 Figure 17 shows the ages of 510 ducting assets,642 drainage assets and 2694 chamber assets at the start of RIIO-GT3. As shown, 221 ducting assets will be 40 years or older at the start of RIIO-GT3, approximately 43% of the ducting assets. 342 of drainage assets will be 40 years or older at the start of RIIO-GT3, approximately 53% of drainage assets. 1049 chamber assets will be 40 years or older at the start of RIIO-GT3, approximately 39% of all chamber assets.

13.1.7 Of the total 3846 assets outlined in Figure 17, approximately 42% of them will be 40 years or older at the start of RIIO-GT3, which exceeds their recommended design life.

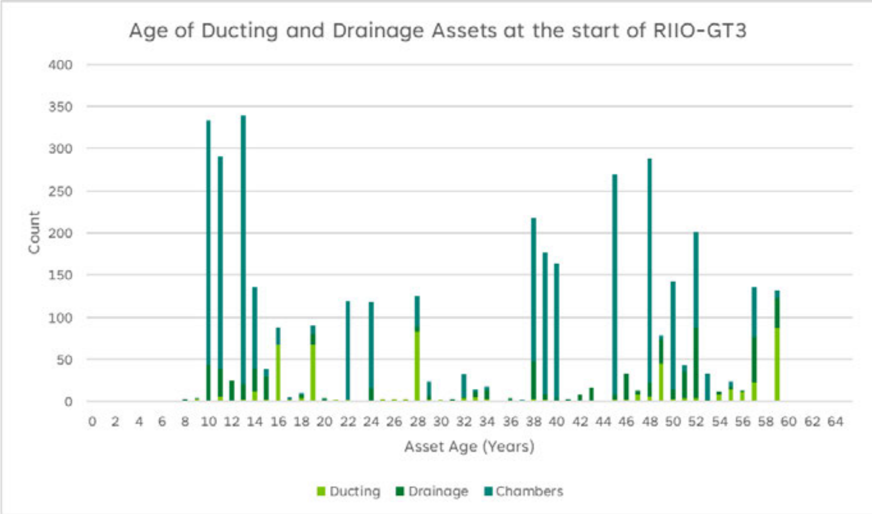

Figure 17: Age of Ducting and Drainage Assets at the start of RIIO-GT3

13.1.8 Figure 18 below shows the ages of the 140 tanks and bunds assets at the start of RIIO-GT3. As shown, 27 of these will be 30 years old or older at the start of RIIO-GT3, approximately 19% of the total number.

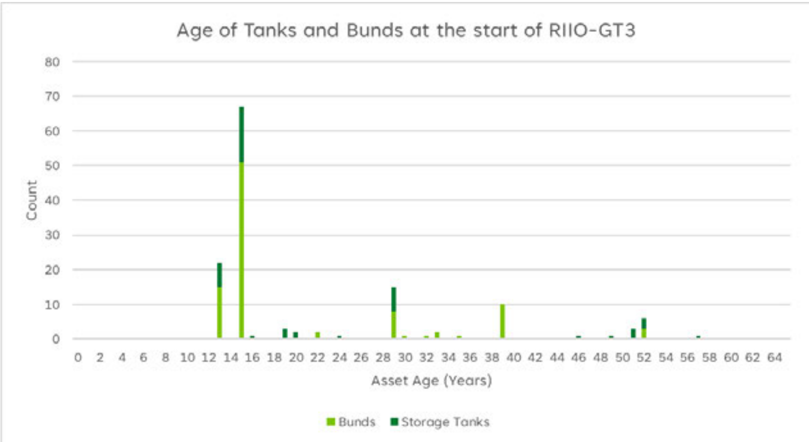

Figure 18: Age of Tanks and Bunds at the start of RIIO-GT3

13.2 Appendix 2 – Additional real-life examples of Civils issues

Access Equipment

13.2.1 Figure 19 below show examples of access platforms at the [redacted], identified in 2013.

Figure 19: [redacted]

13.2.2 The access platforms exhibit signs of corrosion and rusting, which reduces the structural integrity of the assets. Such signs of deterioration result in a higher risk of incidences such as slips, trips or falls as the condition of the assets make them unfit for their purpose in providing safe access for personnel to operational assets on site.

13.2.3 Additionally, the platforms shown in the images above do not meet legislative standards set out by The Work at Height Regulations 2005. Current standards require appropriate guard rails to be in place on raised platforms to prevent falls, which the above do not provide. Without intervention, these assets will continue to deteriorate, increasing the probability and consequence of failures. A complete replacement of the platforms and associated access assets would be required to comply with existing legislation.

Roads and Pathways

13.2.4 Figure 20 shows significant potholes that are present on an access road leading to [redacted], identified as part of the RIIO-T2 site survey programme. Left unaddressed, the condition of this road could result in trip-hazards to personnel or public, or substantial damage to vehicles using the road.

Figure 20: Potholes on access road [redacted]

Security Fencing

Figure 21: [redacted]

13.2.5 Figure 21 shows a damaged wooden fence and gate at [redacted] identified as part of the RIIO-T2 site survey programme. At the time of the issues being identified, it was determined that approximately 30-40 metres of the fence was damaged to such an extent that it needed replacing.

13.2.6 Interventions for defects in the examples above, amongst other defects identified during the RIIO-T2 period, were not progressed and instead were removed, descoped or deferred to RIIO-GT3, due to volume and funding constraints, requiring reprioritisation of works following risk management assessments. As shown in the images the deterioration shows a deterioration of structural integrity with a potential risk to the safety of personnel and damage to operational assets located at site through unauthorised access. Without intervention, these risks would continue to occur and rate of deterioration would accelerate with more defects.

Ducting

13.2.7 Figure 22 shows an example from [redacted] where the ducting has broken and deteriorated to such an extent that the cabling it is intended to protect is clearly visible and exposed. In this instance the ducting has become ineffective in its purpose to protect the cabling running through the site.

Figure 22: Broken ducting [redacted]

13.2.8 If left, there is a higher risk and likelihood that damage to the cabling will occur due to rodents or environmental impacts, potentially impacting the operations at [redacted] This in turn, could present a potential supply constraint risk if systems at the site were to trip or shut down as a result. The broken and misaligned ducting also presents a significant trip hazard to individuals moving around the site.

Subsidence

13.2.9 Figure 23 shows an example of site subsidence that occurred at [redacted] and the works taken to remediate (right).

Figure 23: Site subsidence [redacted]

13.2.10 As can be seen in the image, there has been significant destabilisation of the ground around valves located at the site due to burrowing animals, which has caused the assets to shift and misalign. Ground saturation could also have contributed to the destabilisation of the ground due to ineffective drainage at the site. There are visible signs of corrosion to the pipework and other assets due to their exposure to the environment. Left unaddressed, further destabilisation of the ground would cause damage or failure of the assets, which in turn causes significant restrictions to the operation of parts of the network. Intervention was taken to stabilise the ground around the site.

13.3 Appendix 3 – Cost Breakdown

Intervention Name	External Cost	External %	NG Cost	NG %	Pre build Cost	Pre build %	Materials, Plant & Equipment Cost	Materials, Plant & Equipment %	Risk & Contingency cost	Risk & Contingency (% of total cost)	Total Cost
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]			[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]			[redacted]
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