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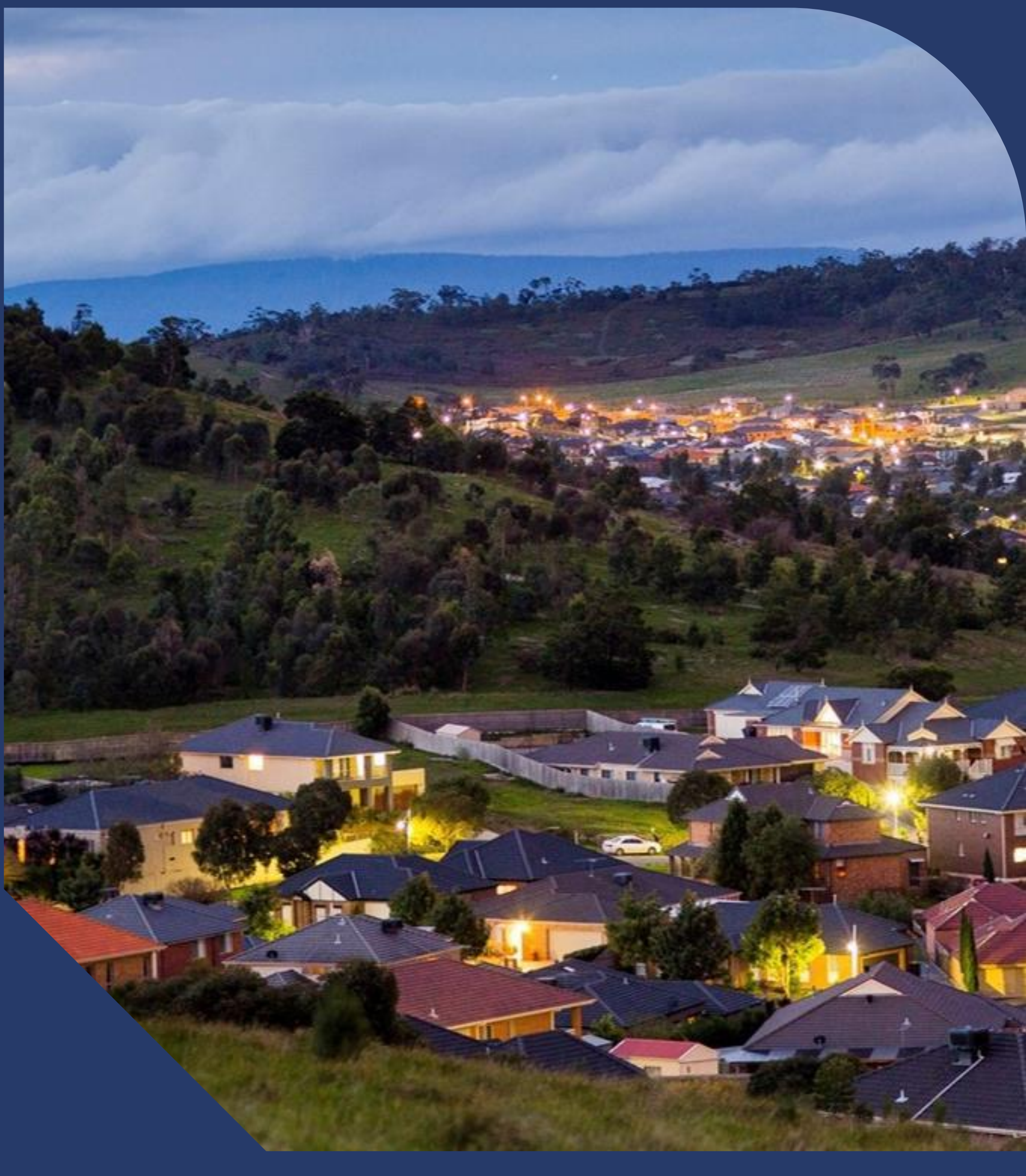
Public Lighting

AMS – Electricity Distribution Network



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1. Introduction

1.1 Purpose

The purpose of this document is to outline the inspection, maintenance, replacement and monitoring activities identified for economic life cycle management of Public Lighting in AusNet's Victorian electricity distribution network. This document is intended to be used to inform asset management decisions and communicate the basis for activities.

In addition, this document forms part of our Asset Management System for compliance with relevant standards and regulatory requirements. This document demonstrates responsible asset management practices by outlining economically justified outcomes.

1.2 Scope

This Asset Management Strategy applies to all public lighting installations located within AusNet Services' electricity distribution network. The strategy focuses on public lighting luminaires, lanterns, PE Cells and electronic ballast.

Public lighting poles are not included in this strategy and are covered by AMS 20-70 Pole Strategy.

1.3 Asset Management Objectives

The high-level asset management objectives are outlined in *AMS 01-01 Asset Management System Overview*.

The electricity distribution network objectives are stated in *AMS 20-01 Electricity Distribution Network Asset Management Strategy*.

2. Abbreviations and definitions

TERM	DEFINITION
CFL	Compact Fluorescent Lamps
LED	Light Emitting Diode
MV	Mercury Vapour
HPS	High Pressure Sodium
W	Watts
PE CELL	Photoelectric Cell
GSL	Guaranteed Service Levels
DOMS	Distribution and Outage Management System
NUOS	Network Use of System
OMR	Operation, Maintenance and Replacement
HID	High-Intensity Discharge

3. Asset Description

Function

Public lighting serves to ensure the safety and security of both vehicular and pedestrian traffic. Installed on major roads, minor streets, and public recreational areas, public lighting enhances visibility, thereby reducing the risk of accidents and improving overall public safety. The primary purpose of Category V (Vehicle) lighting is to meet the visual requirements of motorists, ensuring that major thoroughfares are adequately illuminated to facilitate safe driving conditions. Conversely, Category P (Pedestrian) lighting is tailored to the needs of pedestrians, providing sufficient illumination on minor roads and public spaces to ensure safe passage and enhance personal security during evening and night-time hours.

Incorporating both standard and non-standard luminaires, public lighting within the distribution network is designed to distribute, filter, and transform the light emitted by lamps. This involves a technical approval process to ensure that all luminaires meet safety and performance criteria before installation. By integrating advanced lighting solutions with the broader electrical infrastructure, public lighting not only enhances community safety but also contributes to the aesthetic and functional quality of urban and suburban environments.

Population

Population Considerations

The population profile for public lighting is crucial for effective lifecycle management. This profile includes detailed data on the quantity, types, locations, and specifications of these assets within the electrical distribution network. A comprehensive understanding of the population profile allows asset managers to:

- **Identify critical assets**: Determine which public lighting installations are essential for maintaining the safety and reliability of the network. For example, streetlights on major roads in high-traffic areas may be deemed essential and require more frequent inspections to ensure uninterrupted service.
- **Allocate resources efficiently**: Plan and allocate maintenance resources effectively by knowing the exact number and location of assets. For instance, knowing that a certain region has a high concentration of LED streetlights can help in scheduling maintenance activities more efficiently.
- **Risk management**: Assess and manage risks associated with different assets. For example, if the population profile indicates that certain sections of lighting installations are in flood-prone areas, additional protective measures can be implemented in those areas.
- **Optimise maintenance schedules**: Develop optimised maintenance schedules based on the distribution and condition of assets. For instance, luminaires on major roadways might be scheduled for more frequent inspections and maintenance to prevent any potential failures.
- **Enhance reliability and safety**: Ensure that all components, including luminaires, PE Cells, and electronic ballasts, meet the required standards for reliability and safety. For example, if the profile reveals that certain installations have outdated components that no longer meet safety standards, these can be prioritised for replacement.
- **Support strategic planning**: Inform long-term strategic planning and investment decisions. For instance, the population profile might show that a significant portion of luminaires in a rapidly developing suburban area need upgrading to support increased demand, guiding future investment in that region.

Geographic Impact Areas

The AusNet Services electrical distribution network covers a significant portion of Victoria, including Melbourne's northern and eastern suburbs, and extends across eastern and north-eastern Victoria. This region encompasses a diverse range of geographic locations, each with specific environmental impacts on public lighting. Understanding these impacts is essential for effective asset management within the AusNet Services electrical distribution network. Notable examples include:

- **High Wind Areas**: High wind areas, particularly in elevated regions and open plains, subject lighting installations to significant stress and fatigue. Example: The structural integrity of lighting installations in the elevated regions of the Dandenong Ranges must be robust enough to withstand high wind speeds, ensuring they remain securely in place and do not fail under stress.
- **Corrosive Areas**: Coastal areas and industrial regions where salt and pollutants are prevalent can cause corrosion of metallic components in lighting installations. Example: Regular maintenance and the use of corrosion-resistant materials are crucial to prolong the lifespan of these installations. Lighting installations in coastal towns like Wonthaggi require regular inspections and maintenance to mitigate the effects of salt-induced corrosion.
- **Bushfire Areas**: Bushfire-prone areas, common in many parts of Victoria, pose a risk of fire damage to lighting infrastructure. Example: Fire-resistant materials and strategic vegetation management around lighting installations are essential for reducing this risk. In the bushfire-prone regions of the Yarra Valley, lighting installations must be designed to withstand high temperatures, and installations must be cleared of nearby vegetation to prevent fire spread.
- **Flood-Prone Areas**: Areas prone to flooding can impact the performance and integrity of underground lighting cables. Example: Proper waterproofing and drainage systems are essential to protect these assets. In regions like Gippsland, where flooding is more frequent, underground lighting cables must be installed with robust waterproofing measures to prevent water ingress and subsequent failures.
- **Seismic Zones**: Though less common, areas with potential seismic activity may require lighting installations to be constructed with flexibility and resilience to absorb and dissipate seismic forces, reducing the risk of structural failure. Example: In areas near fault lines, lighting installations may need to incorporate seismic-resistant features to ensure stability during earth tremors.

Population by Type

Level One Asset Types

Luminaires

- **Summary Explanation of Form and Function**: A luminaire, often referred to as a light fixture, is the complete lighting unit that includes all the necessary components to produce and direct light. It comprises the lamp (or light source), the housing, optical elements (such as reflectors and lenses), electrical components (such as ballasts or drivers), and mounting hardware.
- **Purpose within the Asset Class**: The luminaire serves to maintain and regulate the lighting levels within public spaces, ensuring consistent and reliable illumination for both vehicular and pedestrian traffic.
- **Purpose within the Network Design**: In the network design, luminaires are strategically installed along roadways, footpaths, and public spaces to provide adequate lighting. Their purpose is to ensure safety, visibility, and security in these areas.
- **Process Function**: The luminaire directs the light emitted by the lamp to ensure optimal illumination, minimising glare and light pollution while maximising efficiency and effectiveness.

Lanterns

- **Summary Explanation of Form and Function**: Lanterns are a type of luminaire designed specifically for public lighting applications. They typically house the lamp and other necessary components in a protective casing, often with a distinctive aesthetic design.
- **Purpose within the Asset Class**: Lanterns provide essential lighting for pedestrian pathways, parks, and other public recreational areas, enhancing safety and visibility.
- **Purpose within the Network Design**: In the network design, lanterns are used to illuminate areas where aesthetic and functional qualities are important, such as in public parks and historical districts.
- **Process Function**: Lanterns distribute and filter the light emitted by the lamp, ensuring it is appropriately directed to illuminate the intended area while adding to the aesthetic appeal of the environment.

Level Two Asset Types - Lamps

Compact Fluorescent Lamps (CFLs)

- Summary Explanation of Form and Function: Compact Fluorescent Lamps (CFLs) are energy-efficient lighting devices that use a tube containing argon and a small amount of mercury vapour. When an electric current passes through, it generates ultraviolet light that excites a fluorescent coating (phosphor) inside the tube, producing visible light. CFLs are known for their long lifespan and higher energy efficiency compared to traditional incandescent bulbs.
- Purpose within the Asset Class: Within the public lighting asset class, CFLs are used to provide moderate lumen output with relatively warm colour temperature, enhancing visibility and safety in public recreational areas and minor roads.
- Purpose within the Network Design: CFLs are typically installed in pedestrian lighting (Category P) applications. Their moderate light output and energy efficiency make them suitable for lighting pathways, parks, and other pedestrian areas.
- Process Function: CFLs convert electrical energy into visible light through the excitation of phosphor by ultraviolet light. This process ensures effective illumination with reduced energy consumption, making them a practical choice for energy-efficient public lighting.

Metal Halide Lamps

- **Summary Explanation of Form and Function**: Metal Halide lamps are high-intensity discharge (HID) lamps that produce light by passing an electric arc through a mixture of gases, including mercury and metal halides. They are known for their high luminous efficacy and excellent colour rendering properties.
- **Purpose within the Asset Class**: Metal Halide lamps are used in public lighting to provide bright, white light that improves the visibility of road markings and signs, enhancing motorist safety on major roads (Category V).
- **Purpose within the Network Design**: In the network design, Metal Halide lamps are installed on major roadways and intersections where high-quality illumination is required. Their ability to produce bright and clear light makes them ideal for enhancing road safety.
- **Process Function**: Metal Halide lamps generate light by passing an electric arc through vaporised mercury and metal halides. This process produces a bright and high-quality light, improving visibility and safety for road users.

Light Emitting Diode (LED) Lamps

- **Summary Explanation of Form and Function**: LEDs are semiconductor devices that emit light through electroluminescence when an electric current passes through them. They are highly versatile and can produce a wide range of colour temperatures and light distributions.
- **Purpose within the Asset Class**: LEDs are used extensively in public lighting due to their exceptional energy efficiency, long lifespan, and superior light quality. They are suitable for both major (Category V) and minor (Category P) road applications.
- **Purpose within the Network Design**: LEDs are integrated into public lighting systems to provide efficient and reliable illumination for various applications. Their versatility and efficiency make them ideal for enhancing network performance and reducing operational costs.
- **Process Function**: LEDs emit light by passing an electric current through a semiconductor material. This process results in high-efficiency light output with minimal energy consumption, contributing to overall network efficiency and reliability.

Mercury Vapour Lamps

- **Summary Explanation of Form and Function**: Mercury Vapour lamps are HID lamps that produce light by passing an electric arc through vaporised mercury. They provide a bluish-white light and have a long operational life.
- **Purpose within the Asset Class**: Mercury Vapour lamps are used in older public lighting installations and industrial zones where colour rendering is not a primary concern.

- **Purpose within the Network Design**: In the network design, Mercury Vapour lamps are used in areas where long operational life and moderate efficiency are acceptable. They are commonly found in industrial and older public lighting infrastructure.
- **Process Function**: Mercury Vapour lamps generate light by passing an electric arc through vaporised mercury, producing a bluish-white light. They are less efficient than newer technologies and are gradually being replaced by more efficient lighting solutions like LEDs.

High Pressure Sodium (HPS) Lamps

- **Summary Explanation of Form and Function**: HPS lamps produce light by passing an electric arc through a mixture of xenon, sodium, and mercury gases. They are known for their high efficiency and long life span, producing a characteristic orange-yellow glow.
- **Purpose within the Asset Class**: HPS lamps are used in public lighting for major road (Category V) applications where high lumen output is necessary for motorist visibility and safety.
- **Purpose within the Network Design**: HPS lamps are installed on major roadways and highways to provide efficient and reliable illumination. Their high lumen output and efficiency make them suitable for large-scale outdoor lighting applications.
- **Process Function**: HPS lamps generate light by passing an electric arc through xenon, sodium, and mercury gases. This process results in high-efficiency light output, enhancing visibility and safety for road users.

T5 Fluorescent Lamps

- **Summary Explanation of Form and Function**: T5 Fluorescent lamps are thin, energy-efficient linear fluorescent lights. They operate by driving an electric current through a tube containing mercury vapour and inert gas, causing the phosphor coating on the inside of the tube to emit visible light.
- **Purpose within the Asset Class**: T5 lamps are used in public lighting for applications requiring uniform, diffuse light, such as underpasses, pedestrian pathways (Category P), and public recreational areas.
- **Purpose within the Network Design**: T5 lamps are installed in areas where consistent and high-quality illumination is required. Their efficiency and excellent colour rendering make them valuable components of the lighting infrastructure.
- **Process Function**: T5 lamps convert electrical energy into visible light through the excitation of phosphor by ultraviolet light. This process ensures effective and uniform illumination with high energy efficiency.

Level Two Asset Types - Luminaires

Summary of Luminaire Types

80W Mercury Vapour (MV)

- **Summary Explanation of Form and Function**: An 80W Mercury Vapour lamp is a type of high-intensity discharge (HID) lamp that produces light by passing an electric arc through vaporised mercury. It provides a bluish-white light and has been widely used in public lighting due to its moderate efficiency and long life.
- **Purpose within the Asset Class**: These luminaires are used in public lighting installations where moderate efficiency and long operational life are acceptable. However, their use is declining due to environmental concerns and lower luminous efficacy compared to newer technologies.
- **Purpose within the Network Design**: In the network design, 80W Mercury Vapour lamps are used in older installations and areas where high-quality colour rendering is not essential. They are gradually being replaced by more efficient lighting technologies.
- **Process Function**: The luminaire generates light by passing an electric arc through vaporised mercury, producing a bluish-white light. It provides reliable illumination but is less efficient than newer lighting solutions.

Sustainable 14W and 28W T5

- **Summary Explanation of Form and Function**: T5 fluorescent lamps are high-efficiency linear fluorescent lights that are thinner and more efficient than older models. The 14W and 28W T5 lamps offer excellent luminous efficacy and colour rendering.
- **Purpose within the Asset Class**: These luminaires are used in sustainable public lighting applications, particularly in pedestrian areas and underpasses, due to their uniform light distribution and energy efficiency.
- **Purpose within the Network Design**: T5 lamps are integrated into public lighting systems to provide consistent and high-quality illumination in areas requiring uniform lighting. Their efficiency and excellent colour rendering make them valuable components of the lighting infrastructure.
- **Process Function**: T5 lamps convert electrical energy into visible light through the excitation of phosphor by ultraviolet light, providing effective and uniform illumination with high energy efficiency.

Sustainable 32W & 42W Compact Fluorescent (CF)

- **Summary Explanation of Form and Function**: Compact Fluorescent Lamps (CFLs) in 32W and 42W versions are designed for high energy efficiency and long lifespan. These lamps provide adequate illumination with reduced energy consumption.
- **Purpose within the Asset Class**: CFLs are used in both pedestrian and vehicular public lighting applications, offering a warm colour temperature that enhances visibility and safety in public spaces.
- **Purpose within the Network Design**: In the network design, CFLs are installed to provide efficient and reliable illumination for various applications, contributing to overall network efficiency and reducing operational costs.
- **Process Function**: CFLs convert electrical energy into visible light through the excitation of phosphor by ultraviolet light, ensuring effective illumination with reduced energy consumption.

Sustainable LED Luminaire

- **Summary Explanation of Form and Function**: Sustainable LED Luminaires represent the latest in public lighting technology, offering exceptional energy efficiency, long lifespan, and superior light quality. LEDs can be configured to provide various colour temperatures and light distributions.
- **Purpose within the Asset Class**: LEDs are used extensively in public lighting due to their versatility, efficiency, and reliability. They are suitable for both major and minor road lighting applications.
- **Purpose within the Network Design**: LEDs are integrated into public lighting systems to provide efficient and reliable illumination for various applications. Their versatility and efficiency make them ideal for enhancing network performance and reducing operational costs.
- **Process Function**: LEDs emit light by passing an electric current through a semiconductor material, resulting in high-efficiency light output with minimal energy consumption, contributing to overall network efficiency and reliability.

Level Three Asset Types (Luminaire Sub-Components)

PE Cell (Photoelectric Cell)

- **Summary Explanation of Form and Function**: A Photoelectric Cell (PE Cell) is a light-sensitive device used to control the operation of the luminaire. It automatically switches the light on at dusk and off at dawn based on ambient light levels.
- **Purpose within the Asset Class**: PE Cells ensure that public lighting operates only when necessary, enhancing energy efficiency and reducing operational costs.
- **Purpose within the Network Design**: In the network design, PE Cells are integrated with luminaires to automate lighting operations, ensuring consistent and reliable illumination based on natural light conditions.
- **Process Function**: The PE Cell detects changes in ambient light levels and activates or deactivates the luminaire, accordingly, ensuring efficient energy use and extending the lifespan of the lighting components.

Electronic Ballast

- **Summary Explanation of Form and Function**: An Electronic Ballast is a device that regulates the electrical current supplied to discharge lamps such as fluorescent or high-intensity discharge (HID) lamps. It replaces traditional magnetic ballasts, offering several advantages, including higher energy efficiency, reduced flicker, and improved control over the lamp's operation.
- **Purpose within the Asset Class**: Electronic Ballasts enhance the performance and efficiency of public lighting installations, ensuring stable and reliable operation of the lamps.
- **Purpose within the Network Design**: In the network design, Electronic Ballasts are used to manage the electrical supply to luminaires, ensuring consistent light output and reducing energy consumption.
- **Process Function**: The Electronic Ballast converts standard mains voltage to a higher frequency, allowing for more efficient and stable operation of the lamp, resulting in better light quality and longer lamp life.

Housing

- **Summary Explanation of Form and Function**: The Housing of a luminaire is the protective enclosure that contains and supports all internal components, including the lamp, ballast, and optical elements. It is designed to shield these components from environmental factors such as rain, dust, wind, and vandalism.
- **Purpose within the Asset Class**: The Housing ensures the durability and longevity of the luminaire by protecting its internal components from environmental stress and damage.
- **Purpose within the Network Design**: In the network design, the Housing is designed to be durable and reliable, ensuring the luminaire operates effectively in various weather conditions. It also includes features for heat dissipation to maintain optimal performance.
- **Process Function**: The Housing protects the internal components of the luminaire, ensuring they remain functional and efficient. It also contributes to the overall aesthetic appeal of the lighting installation and includes mounting hardware for easy installation.

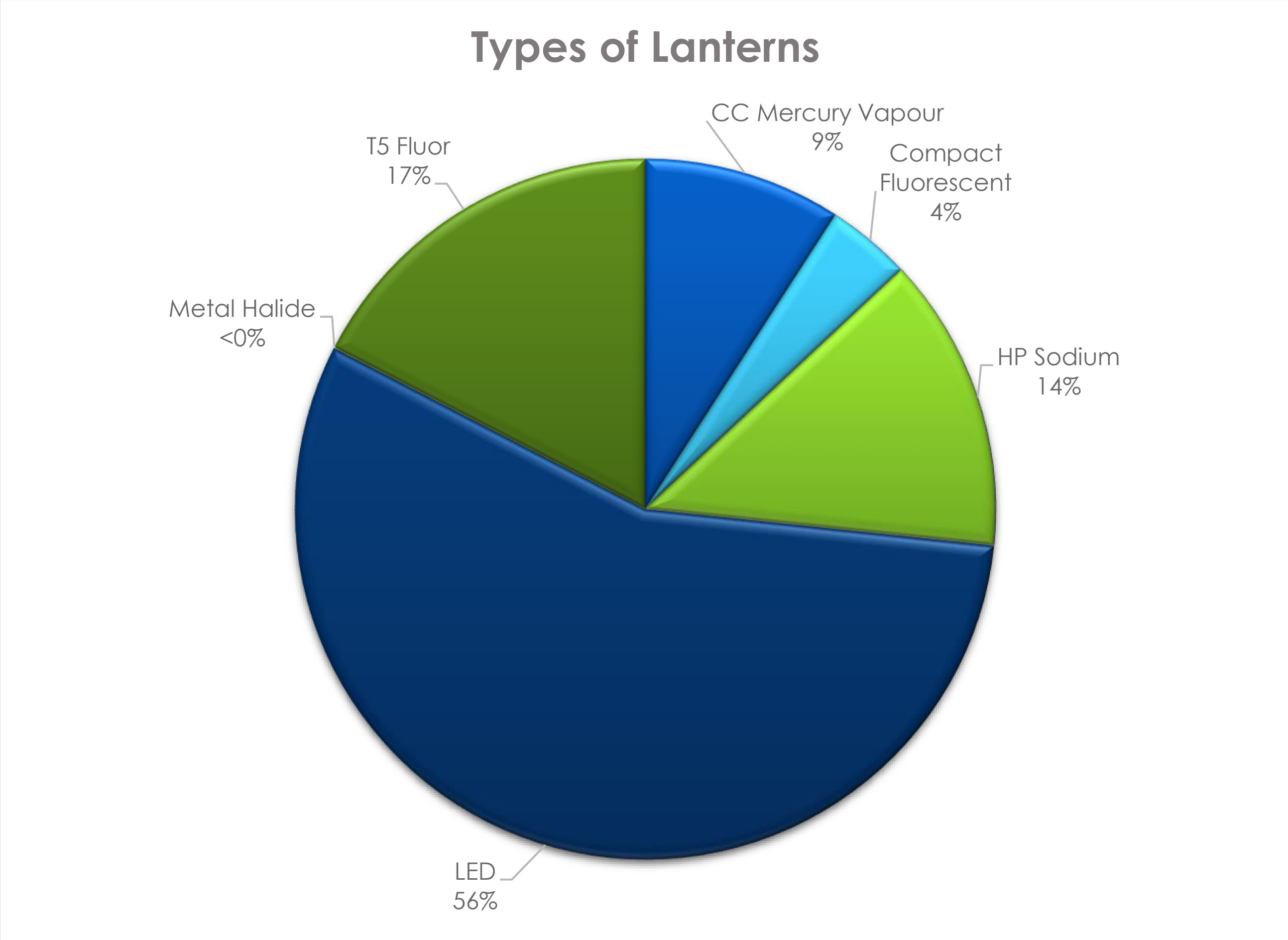
Targeted Activities (Population by Type)

Ongoing manufacturing constraints for all lamp types will cause supply issues, this will need to be monitored and multiple solutions might be needed to ensure compliance with the public lighting code.

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Replacing HP Sodium lantern with LED's once remaining stock of globes is exhausted
02	Replacing Mercury Vapour lanterns or lamp with LED's once remaining stock of globes is exhausted
03	Replacing Compact Fluorescent lanterns with LED's once remaining stock of globes is exhausted
04	Replacing T5 Fluorescent Lanterns with LED's once remaining stock of globes is exhausted

Population Profile

There are approximately 180,000 public lights located on AusNet Services' distribution network serving more than 30 local government and state authorities in the north and eastern regions of Victoria. The lights are situated on major roads, minor streets and public recreational areas, and are designated by lantern type and wattage.



Age

Age Considerations

Understanding the age profile of public lighting assets is essential for effective asset management and lifecycle planning. Knowing the age distribution of these assets helps in predicting their remaining useful life and planning maintenance, upgrades, or replacements accordingly.

Age Profile for Level One Asset Types

- **Luminaires**: The age profile of luminaires can indicate potential issues related to housing degradation and component wear. Older luminaires may require more frequent inspections and condition assessments to ensure they continue to operate safely and efficiently. For example, proactive testing and monitoring of lighting output in older luminaires can prevent unexpected failures and extend their service life.
- **Lamps**: Over time, lanterns can experience wear and tear due to environmental exposure and material ageing. By analysing the age profile, asset managers can identify lanterns that are at higher risk of failure and prioritise them for maintenance or replacement. For instance, replacing aging lanterns in public parks can prevent safety hazards and enhance the visual appeal of the area.

Age Profile for Level Two Asset Types

Lamps

- **Compact Fluorescent Lamps (CFLs)**: The age profile of CFLs can indicate potential issues related to phosphor degradation and mercury evaporation. Older CFLs may require more frequent inspections and replacements to ensure they continue to operate efficiently and safely.

- **Metal Halide Lamps**: Over time, Metal Halide lamps can experience lumen depreciation and changes in colour rendering. By analysing the age profile, asset managers can identify lamps that are at higher risk of failure and prioritise them for replacement.
- **Light Emitting Diode (LED) Lamps**: LED lamps have a long lifespan, but their performance can degrade over time due to factors such as thermal stress and electrical surges. Monitoring the age profile of LEDs helps in planning proactive replacements to maintain high performance.
- **Mercury Vapour Lamps**: Mercury Vapour lamps can suffer from reduced efficiency and lumen output as they age. Understanding their age profile allows for targeted interventions to replace outdated lamps and improve overall lighting quality.
- **High Pressure Sodium (HPS) Lamps**: The age profile of HPS lamps can reveal areas where lumen depreciation and changes in light colour are likely. Regular inspections and replacements based on age-related data can ensure these lamps remain effective and reliable.
- **T5 Fluorescent Lamps**: T5 Fluorescent lamps can experience phosphor degradation and reduced lumen output over time. Knowing the age profile helps in scheduling timely replacements to maintain consistent lighting quality.

Luminaires

- **80W Mercury Vapour (MV)**: The age profile of 80W Mercury Vapour luminaires can indicate potential issues related to housing degradation and component wear. Older luminaires may require more frequent inspections and replacements to ensure they continue to operate safely and efficiently.
- **Sustainable 14W and 28W T5**: T5 luminaires can experience wear and tear over time due to environmental exposure and material ageing. By analysing the age profile, asset managers can identify luminaires that are at higher risk of failure and prioritise them for replacement.
- **Sustainable 32W & 42W Compact Fluorescent (CF)**: The age profile of CFL luminaires helps in identifying areas where performance degradation and component failures are likely. Regular inspections and maintenance based on age-related data can ensure these luminaires remain safe and functional.
- **Sustainable LED Luminaire**: LEDs have a long lifespan, but their performance can degrade over time due to factors such as thermal stress and electrical surges. Monitoring the age profile of LED luminaires helps in planning proactive replacements to maintain high performance.

Age Profile for Level Three Asset Types

Luminaire Sub-Components

- **PE Cell (Photoelectric Cell)**: PE Cells can suffer from sensor degradation and electronic failures as they age. Understanding their age profile allows for targeted interventions to replace or refurbish cells that are most vulnerable.
- **Electronic Ballast**: The age profile of electronic ballasts can reveal areas where performance degradation is likely. Regular inspections and maintenance based on age-related data can ensure these components remain safe and functional.
- **Housing**: The age profile of luminaire housing can indicate potential issues related to material degradation and environmental exposure. Older housings may require more frequent inspections and replacements to ensure they continue to protect the internal components effectively.

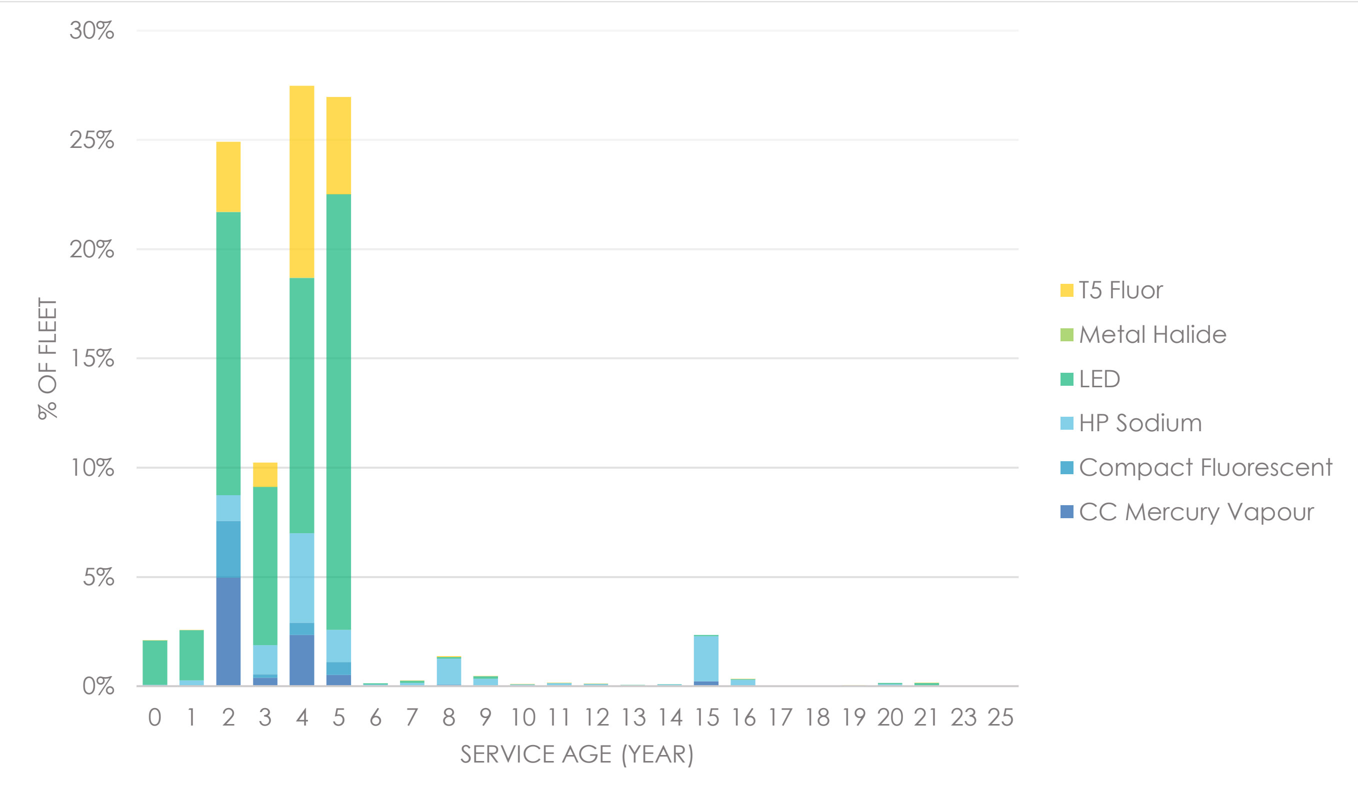
Expected Service Lives

Below see details of expected Service Lives for Public Lighting Asset types:

	Consumable Replacement Interval			Nominal Life (Housing)
Luminaire	**Lantern**	**PE Cell**	**Electronic Ballast**	
80W MV	4 years	8 years	n/a	20 years
Sustainable 14W and 28W T5	4 years	8 years	8 years	20 years
Sustainable 32W & 42W CF	4 years	8 years	8 years	20 years
Sustainable LED Luminaire	20 years	8 years	n/a	20 years

Age Profile

The Age profile for various types of public lighting installed on the electricity network is shown below.



4. Strategic Asset Management

Condition

Detail of the Public Light Code

There are specific requirements for assessing the condition of Public Lighting, as per the 2015 Public Light Code. As directed by The Code, the condition of the public light is maintained by routine inspection and replacement as outlined in the Public Lighting Code

This code outlines the standards and procedures for maintaining public lighting infrastructure to ensure safety, reliability, and efficiency. One critical aspect of this code involves the regular inspection and assessment of the condition of public lighting assets.

- Condition and Inspections Requirements: The Public Lighting Code in Victoria specifies stringent requirements for the inspection and maintenance of public lighting assets. The primary objectives are to ensure that the lighting infrastructure operates efficiently, remains safe for public use, and provides adequate illumination for both motorists and pedestrians.
- Frequency of Inspections:
    - Public lighting assets, including luminaires on major and minor roads, must be inspected at regular intervals. Typically, these inspections are conducted annually or biennially, depending on the asset's location and usage intensity.
- Types of Inspections:
    - Visual Inspections: Conducted to identify obvious defects or damages, such as broken lamps, cracked housings, or misaligned luminaires. These inspections also check for obstructions like overgrown vegetation that may impede light distribution.
    - Functional Inspections: Ensure that the luminaires are operating correctly. This includes verifying that the lights turn on and off at the appropriate times (dusk and dawn) and that there are no flickering or dimming issues.
    - Electrical Inspections: Involve checking the electrical components of the luminaires, such as the PE cells, electronic ballasts, and wiring, to ensure they meet safety and operational standards.

All of this must inform the Condition Assessment Protocols for Public Lighting.

Criticality

Failure Modes

Failure Modes by Asset Types

Assessing failure modes and utilising the detailed information about each mode plays a crucial role in various aspects of Asset Management Planning. Understanding failure modes enhances the effectiveness of risk management efforts and ensures the optimal performance and reliability of assets within the electrical distribution network. Some notable failure modes for public lighting assets are detailed below.

Common Failure Modes – Lamps

- **Socket Corrosion**: Corrosion of the lamp socket can lead to poor electrical contact and intermittent operation. Importance: Moderate. Socket corrosion can cause flickering or complete failure but is usually easy to identify and repair.

- **Environmental Exposure**: Exposure to harsh weather conditions, such as rain, UV radiation, and temperature fluctuations, can degrade lamp components and reduce lifespan. Importance: High. Environmental exposure can accelerate degradation of lamp materials and increase the likelihood of premature failure. Regular maintenance and protective measures are essential to mitigate this risk.

Specific Failure Modes Public Lighting Lamps

- **Compact Fluorescent Lamps (CFLs)**
  - **End-of-Life Failure**: As CFLs age, they may experience degradation of the phosphor coating, resulting in reduced light output and eventual failure. **Performance**: High. End-of-life failure can lead to decreased illumination levels and increased maintenance costs.
- **Metal Halide Lamps**
  - **Arc Tube Failure**: The arc tube inside the lamp can fail due to thermal stress, resulting in loss of light output and eventual lamp failure. **Performance:** High. Arc tube failure can lead to sudden and complete loss of illumination, impacting safety and visibility.
- **Light Emitting Diode (LED) Lamps**
  - **LED Chip Failure**: Individual LED chips within the luminaire may fail due to manufacturing defects, thermal stress, or electrical overloading. **Performance**: Moderate. LED chip failure can lead to reduced light output but is often mitigated by the redundancy of multiple LEDs in a luminaire.
- **Mercury Vapour Lamps**
  - **Electrode Failure**: The electrodes inside the lamp can degrade over time, leading to flickering, reduced light output, and eventual lamp failure. **Performance**: Moderate. Electrode failure can impact lamp performance but is typically gradual and predictable.
- **High Pressure Sodium (HPS) Lamps**
  - **Sodium Migration**: Over time, sodium can migrate from the arc tube onto the lamp's inner surface, causing a reduction in light output and colour consistency. **Performance**: Moderate. Sodium migration can affect the quality of illumination but does not typically result in sudden failure.
- **T5 Fluorescent Lamps**
  - **Ballast Failure**: The electronic ballast that regulates the electrical current to the lamp can fail due to component degradation or electrical faults. **Performance**: High. Ballast failure can result in complete lamp failure and may require replacement of the entire luminaire.

Common Failure Modes - Luminaire

- **Photoelectric Cell (PE Cell) Malfunction**: The PE cell, responsible for automatically switching the luminaire on and off based on ambient light levels, may malfunction due to dust accumulation, moisture ingress, or electrical faults. Importance: High. PE cell malfunction can result in improper lighting operation, leading to safety hazards and energy wastage.
- **Housing Degradation**: Exposure to harsh weather conditions and UV radiation can cause degradation of the luminaire housing, leading to corrosion, cracks, or water ingress. Importance: High. Housing degradation can compromise the structural integrity of the luminaire, increasing the risk of electrical hazards and premature failure.

Specific Failure Modes for Public Lighting Luminaires

- **80W Mercury Vapour (MV) Luminaire**
  - **Arc Tube Degradation**: Over time, the arc tube inside the luminaire can degrade due to thermal stress and chemical reactions, leading to reduced light output and eventual failure. **Performance**: High. Arc tube degradation can result in significant reduction in illumination levels, impacting visibility and safety on roads and public spaces.
- **Sustainable 14W and 28W T5 Fluorescent Luminaire**

    - **Ballast Failure**: The electronic ballast that regulates the electrical current to the lamp can fail due to component degradation or electrical faults. **Performance**: High. Ballast failure can result in complete luminaire failure and may necessitate replacement.

- **Sustainable 32W & 42W Compact Fluorescent (CF) Luminaire**
    - **Lamp End-of-Life**: CFL lamps have a limited lifespan and may fail when they reach the end of their operational life, resulting in reduced light output or complete failure. **Performance**: High. Lamp end-of-life failure can lead to decreased illumination levels and increased maintenance costs.
- **Sustainable LED Luminaire**
    - **LED Chip Failure**: Individual LED chips within the luminaire may fail due to manufacturing defects, thermal stress, or electrical overloading. **Performance**: Moderate. LED chip failure can lead to reduced light output but is often mitigated by the redundancy of multiple LEDs in a luminaire.

Common Failure Modes Across Luminaire Types

- **Photoelectric Cell (PE Cell) Malfunction**: The PE cell, responsible for automatically switching the luminaire on and off based on ambient light levels, may malfunction due to dust accumulation, moisture ingress, or electrical faults. **Performance**: High. PE cell malfunction can result in improper lighting operation, leading to safety hazards and energy wastage.
- **Housing Degradation**: Exposure to harsh weather conditions and UV radiation can cause degradation of the luminaire housing, leading to corrosion, cracks, or water ingress. **Performance**: High. Housing degradation can compromise the structural integrity of the luminaire, increasing the risk of electrical hazards and premature failure.

Specific Failure Modes for Public Lighting Luminaires (Sub-Components)

Photoelectric Cell (PE Cell)

- PE Cell Malfunction
    - Summary Explanation of Form and Function: The PE cell, responsible for automatically switching the luminaire on and off based on ambient light levels, may malfunction due to dust accumulation, moisture ingress, or electrical faults.
    - Purpose within the Asset Class: Ensures automated and energy-efficient operation of public lighting.
    - Purpose within the Network Design: Automates lighting operations based on natural light conditions, ensuring consistent and reliable illumination.
    - Process Function: The PE Cell detects changes in ambient light levels and activates or deactivates the luminaire accordingly, ensuring efficient energy use and extending the lifespan of the lighting components.

Electronic Ballast

- Ballast Failure
    - Summary Explanation of Form and Function: The electronic ballast regulating the electrical current to discharge lamps such as fluorescent or high-intensity discharge (HID) lamps can fail due to component degradation or electrical faults.
    - Purpose within the Asset Class: Enhances the performance and efficiency of public lighting installations.
    - Purpose within the Network Design: Manages the electrical supply to luminaires, ensuring consistent light output and reducing energy consumption.
    - Process Function: The Electronic Ballast converts standard mains voltage to a higher frequency, allowing for more efficient and stable operation of the lamp, resulting in better light quality and longer lamp life.

Housing

- Housing Degradation
  - Summary Explanation of Form and Function: Exposure to harsh weather conditions and UV radiation can cause degradation of the luminaire housing, leading to corrosion, cracks, or water ingress.
  - Purpose within the Asset Class: Protects the internal components of the luminaire from environmental stress and damage.
  - Purpose within the Network Design: Ensures the luminaire operates effectively in various weather conditions.
  - Process Function: The Housing shields the internal components, ensuring they remain functional and efficient while contributing to the overall aesthetic appeal of the lighting installation.

Performance

Performance Analysis

In the context of asset management for public lighting, assessing asset performance is a vital tool for effective lifecycle management. Performance information provides a comprehensive understanding of how these assets behave under various conditions, enabling asset managers to make informed decisions that enhance the reliability, safety, and efficiency of the electrical distribution network.

Performance data helps identify trends and patterns in asset behaviour, which are crucial for making strategic decisions regarding maintenance, upgrades, and replacements. Understanding how assets perform over time allows for proactive management, reducing the risk of unexpected failures. The assessment employed by AusNet involves analysing failure trends and any significant impacts resulting from failure, which provides valuable insights into the health and reliability of the assets.

Specific Performance Considerations

Performance Criteria

The performance criteria for road and public space lighting schemes can include any or all the three basic aims of:

- Facilitation of safe movement
- The discouragement of illegal acts
- Contributing to the amenity of an area through increased aesthetic appeal

Public light distributes, filters or transforms light given by a lamp, which includes all the items necessary for fixing and protecting these lamps. There are two categories of public lighting:

- Major Roads, or Category V (Vehicle) lighting: Lighting that is applicable to roads on which the visual requirements of motorists are dominant
- Minor Roads, or Category P (Pedestrian) lighting: Lighting that is applicable to roads and other outdoor public spaces on which the visual requirements of pedestrians are dominant

Technical Approval of Luminaires

All types of luminaires (Category P and V) must undergo a technical approval process before they are allowed to install on AusNet Services' distribution network.

There are two categories of public lighting luminaires approved:

- Standard
- Non-standard

A list of the approved luminaires can be found in:

- EDS 10-02 – Public Lighting – Non- standard lanterns, Steel Poles and Outreach Arms
- EDS 10-03 – Public Lighting – Standard lanterns and Poles

Customer Impact

Guaranteed Service Levels

Failure criticality for public lights is measured by the impact of guaranteed service levels (GSL). In accordance with the GSL, where a distributor does not repair a public light within 2 business days of a fault report or a period otherwise agreed between the distributor and the person, it must pay the first person who reported the fault if that person is the occupier of an immediately neighbouring residence or is the proprietor of an immediately neighbouring business.

AusNet Services is obligated to report annual GSL payment4 to the AER. Historical reported figures are shown below.

	2022 (April – Dec)	2023	2024 (Jan – June)
Street lights – GSL Payment (number)	260	479	347

Low Light Levels

Street light repair response times are reported to AER.

(Number incurred)	2022 (April – Dec)	2023	2024 (Jan – June)
Repairing streetlights within five days	113	185	55
Repairing streetlights within seven days	22	36	30
Repairing streetlights after seven days	31	76	54
Not Completed	91	182	208

5. Related Matters

Regulatory Framework

Compliance Factors

Regulatory and Legislative Reference

Effectively managing compliance obligations specific to legislation and policies is a core element of Asset Class Planning and supports the sustainable operation and management of Network Assets. Ensuring adherence to relevant laws, policies and codes helps prevent legal and regulatory breaches, which can lead to significant penalties, operational disruptions, and reputational damage.

Note: further to the above, **Section Eight (8)** provides a quick reference table for the legislative and regulatory laws, acts, and policies that are of material consideration for this Asset Class (with links to the reference material).

2015 Public Lighting Code

In managing the Public Lighting asset class within an electrical distribution network in Melbourne, Victoria, it is essential to adhere to various regulatory and compliance requirements. The primary legislation that governs public lighting in Victoria is the Public Lighting Code, issued by the Essential Services Commission (ESC) in 2015. This code outlines the responsibilities of distribution companies in providing public lighting services, including installation, maintenance, and replacement of public lighting assets.

The Purpose of the Code

The purpose of the Public Lighting Code, issued by the Essential Services Commission in 2015, is to regulate the provision of public lighting by specifying minimum standards and certain obligations of distributors and public lighting customers. The objective of the regulation is to provide a safe visual environment for pedestrian and vehicular movement during times of inadequate natural light.

The Code applies to a Network Service Provider under its distribution licence only in respect of the public lighting assets owned by the Business (i.e. not councils or private customers).

The Business must use best endeavours to:

- record the type, rated power and location of its luminaires and identify the relevant public lighting customer(s) for each luminaire;
- assess and monitor the condition and performance of public lighting assets;
- develop and implement plans for the operation, maintenance, refurbishment, replacement, repair and disposal of its public lighting assets:
  - to comply with the laws and other performance obligations which apply to the provision of public lighting services including those contained in the Code;
  - to minimise the risks associated with the failure or reduced performance of public lighting assets; and
  - in a way which minimises costs to public lighting customers.

The Code proceeds to outline the following topics:

- the minimum standards for performance of public lighting
- application of management charges
- qualifications for Guaranteed Service Levels (GSLs)
- process for management of new public lighting
- alterations to existing public lighting
- provision of data for reporting and billing information

- dispute resolution

The Code generally implies, and is further supported through AER audits, that the Network Service Provider must have robust systems and procedures to accurately collect, assess and process data to demonstrate a professional approach to public lighting asset management.

The Network Service Provider has a regulatory obligation to report annually the number of streetlights on the network, the number of faults reported, the average time to repair the faults and the number of missed GSLs and associated payments to customers. This reporting is managed through the Regulatory Information Notice (RIN) process.

Technical Standards and Procedures

Effectively managing compliance with technical standards and operational procedures is an important element of Asset Class Planning. Adhering to these standards ensures that the assets are designed, constructed, maintained, and operated in a manner that meets industry best practices, enhances safety, and ensures reliability. Compliance with technical standards helps prevent asset failures, reduces risks, and ensures interoperability within the electrical distribution network. For example, ensuring that all components of various asset types are installed and maintained according to Australian Standards can prevent unplanned failure and operational faults, enhancing network reliability.

Targeted Activities (Compliance Factors)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	2015 Public Lighting Code, as noted above

External Factors

Technical Factors

Understanding and managing the technical factors that can directly impact the lifecycle planning for Network Assets across all the AusNet Asset Classes is a core element of effective asset management. These factors encompass various design, engineering, and technical performance considerations that directly impact the ability to manage and maintain these assets efficiently. Ensuring that Network Assets meet specific technical performance standards is vital for maintaining the reliability and safety of the electrical distribution network. For example, selecting construction materials with appropriate durability and weather resistance is essential to prevent faults and ensure consistent performance under varying environmental conditions.

Environmental Factors

Environmental Management

Effectively managing obligations specific to environmental management is a core element of Asset Class Planning and supports the sustainable operation and management of Civil Infrastructure. Ensuring adherence to relevant environmental laws and standards helps prevent legal and regulatory breaches, which can lead to significant penalties, operational disruptions, and reputational damage.

Minamata Convention on Mercury

The Minamata Convention on Mercury is a key international treaty that aims to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. This convention significantly impacts the management of lighting assets, particularly those containing mercury, such as Mercury Vapour (MV) lamps.

The Convention aims to protect human health and the environment by addressing releases of mercury through its lifecycle: mining, import and export; manufacture into products and associated emissions and releases; contaminated sites, waste management, and recovery and reuse.

The Convention came into force on 16 August 2017 and over 90 countries have so far ratified it. Specifically, the Minamata Convention calls for banning the import, export and manufacture of HPMV lamps by 2020. Ratification of the Convention by Australia would therefore ban the import and manufacture of HPMV lamps here from 1 January 2021. Ongoing use of existing lamp stocks already in-country would still be permitted.

Targeted Activities (Environmental Factors)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Minamata Convention on Mercury

Stakeholder/ Social Factors

Social Factors

Understanding social factors is essential for the effective management of critical network infrastructure assets. Social factors, including community expectations, public safety, and environmental impacts, play a significant role in shaping asset management strategies. Ensuring that these social considerations are addressed helps build public trust, maintain social license to operate, and enhance the organisation's reputation. For instance, ensuring that maintenance activities for Civil Infrastructure do not disrupt local communities or pose safety risks is crucial for maintaining public support and compliance with social responsibilities.

Targeted Activities (Social Factors)

Some customers (Councils)are utilising the ability of LED lights to have different correlated colour temperatures. They are requesting that they can install 'softer or warmer' lighting. These lights are called 3000K luminaires.

Traditional lights have a correlated colour temperature of 4000K.

The use of 3000K by customers is occurring in areas where there is high interaction between nocturnal marsupials and public lights.

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Utilising non-standard light types for 3000K correlated colour temperatures.

Stakeholder Factors

Understanding the requirements of stakeholders with a direct interest in the assets associated with the Public Lighting asset class is an important aspect of effective asset management. Key stakeholders, including customers, regulatory bodies, and industry partners, have specific expectations that influence asset management strategies and operational decisions. Ensuring clear communication and alignment with these requirements helps maintain regulatory compliance, enhance service reliability, and build robust partnerships. For example, customers expect reliable infrastructure and timely responses to issues, which requires minimal disruption during maintenance activities of Civil Infrastructure. Similarly, regulatory bodies impose standards that must be adhered to, such as safety requirements for buildings and environmental systems, to avoid legal penalties and ensure operational legitimacy.

Internal Factors

Resource Management Factors

Resource Management is a core element of asset class planning for Network Assets. Proper oversight ensures that the management of AusNet's resource bases meets stringent quality and performance standards, which is essential for preventing asset failures, managing risks, and maintaining compliance with regulatory requirements. Effective resource management contributes to cost efficiency via activities such as leveraging the expertise of specialised in-house skills and contractors while avoiding hidden costs associated with inefficiencies and non-compliance.

There are three sub-categories of consideration for this factor, which are:

- Resourcing strategies
- Outsourcing
- Supply Chain Management

Targeted Activities (Resource Management Factors)

Ongoing manufacturing constraints for all lamp types will cause supply issues, this will need to be monitored and multiple solutions might be needed to ensure compliance with the public lighting code.

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Replacing HP Sodium lantern with LED's once remaining stock of globes is exhausted
02	Replacing Mercury Vapour lanterns or lamp with LED's once remaining stock of globes is exhausted
03	Replacing Compact Fluorescent lanterns with LED's once remaining stock of globes is exhausted
04	Replacing T5 Fluorescent Lanterns with LED's once remaining stock of globes is exhausted

Economic Factors

Economic factors significantly influence the lifecycle management of network assets, impacting financial stability, investment decisions, and overall network performance. Major contracts being tendered, such as those for infrastructure development, maintenance, and technology upgrades, can materially affect asset management. These contracts involve substantial investments, requiring rigorous management to align with long-term asset goals, mitigate risks, and control costs. Effective contract management ensures that service providers deliver value, supporting the network's reliability and performance while maintaining financial health.

Material developments and significant commercial agreements also play pivotal roles in the economic landscape of asset management. Commercial agreements, including customer service agreements, dictate service levels, performance metrics, and penalties, impacting operational priorities. Regular reviews of these agreements ensure adaptability to changing economic conditions, customer expectations, and regulatory landscapes. Additionally, planned renewal programmes and changes to asset types and purchasing strategies must be evaluated for their financial impact to ensure efficient resource allocation. By addressing these economic factors, AusNet can manage financial risks, optimise investments, and support robust lifecycle models, aligning financial planning with operational goals and regulatory requirements.

Service Agreements

AusNet Services has contractual agreements in place with third-party service providers to deliver the public lighting services obligations. The contractual agreements include requirements to accept, issue, rectify and report on public lighting faults. The Service Delivery division of AusNet Services manages the third party service provider contractual agreements through the procurement process. The third party contractor is responsible for:

- Accepting and deciphering public lighting incidents issued by the DOMs system following the reporting of a fault.
- Allocating resources and materials to attend to the fault, and where possible, rectifying the fault within 2 business days.

- Accurately closing out public lighting incidents in DOMs.
- Carrying out routine patrols of major roads across the AusNet Services network during lighting service hours to identify faulty lights, and report them through DOMs as incidents.
- Following up any incidents that require more than 2 business days to rectify, such as pole replacement works, underground faults, non-standard lights and fuse panel repairs, and report them to the relevant Service Delivery co-ordinators.
- Issuing a monthly report detailing the number of hours worked, any safety incidents that were encountered, the number of repairs and replacements completed, the number of lights and PE cells changed on the Bulk Change program and the kilometres patrolled for the month by area. A proforma template is to be used that tracks this information annually.

Ownership and Service Charges

Apart from designated Council-installed non-standard lights, ownership of all public lighting is attributed to AusNet Services. This includes minor road lanterns less than 125W in residential streets to major road lanterns up to 400W, although some major road lanterns are owned by Vic Roads.

Lanterns owned by Vic Roads are not covered under AusNet Services' Public Lighting Policy. These Installations are owned and operated by Vic Roads and AusNet Services does not provide any services to these lighting installations other than Network Use of System (NUoS) charges. These installations are metered and charges for NUoS for VicRoads are like any other network customer charges.

Service charges to councils are for operation, maintenance and replacement (OMR) of lanterns on a routine basis. These routine activities are regulated by the Australian Energy Regulator (AER). The programs instigated by Councils for the replacement of MV80s to later models of sustainable lanterns are not regulated and may be requested separately at a council's discretion. Unregulated lantern types include; Compact Fluorescents, High Pressure Sodiums and Light Emitting Diodes, The new lanterns installed under these programs ultimately become the property of AusNet Services, to which OMR charges are applied in future.

Targeted Activities (Economic Factors)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Service Agreements
02	Ownership and Service Charges

Future Developments

Technology and Innovation Factors

Effectively managing the process of tracking future technology developments and innovations is a core element of asset class planning. Staying informed about technological advancements ensures that asset management practices remain up-to-date, efficient, and competitive. Innovations can lead to improved materials, better monitoring systems, and enhanced maintenance techniques that increase the reliability, safety, and longevity of critical infrastructure. For example, advancements in diagnostic tools for detecting early signs of wear and the development of advanced materials for asset components can significantly enhance their performance and maintenance. **For technology and innovation, this is a process that looks to existing technologies, processes, or practices that have been proven in the market and have already been taken to market**.

Targeted Activities (Technology and Innovation Factors)

Continue to monitor the development of smart public lighting networks, this will be Customer (Council) driven but we will need to ensure we capable of operating and maintaining these networks when necessary.

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Development of Smart Public Lighting Systems

6. Asset Strategies

New Assets

New Asset Considerations

A strategic asset strategy for the introduction of new assets provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the aspects of asset upgrades or changes, detailing the conditions under which new assets may be introduced into the network. This is not a like-for-like replacement but rather a strategic change or upgrade to a different type of asset to enhance reliability, improve efficiency, and incorporate advanced technologies. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for integrating new assets into the AusNet network.

Targeted Activities (New Asset Strategies)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Where practical, most new installations will use underground cable circuits, rather than ABC.
02	Promote and assist councils initiating bulk retrofitting of lanterns with low-energy lanterns
03	Continue to monitor failure and fire trends, and rectify issues as per the Public Lighting Code within 2 business days
04	Determine process to replace Mercury Vapour globe with LED globe on existing Mercury Vapour lanterns.
05	Promote and support approval process for standard and non-standard poles and bracket

Inspections and Monitoring

A strategic plan for inspections and monitoring provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the ideal framework and objectives for conducting inspections and monitoring activities, such as enhancing reliability, improving efficiency, and incorporating advanced technologies. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for establishing comprehensive inspection and monitoring protocols within the AusNet network.

Targeted Activities (Inspection and Monitoring Strategies)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Continue current interval of public lighting patrols at 3 times per annum combining data collection of age, condition and specifications
02	Inspect and monitor public lighting as per the Public Lighting Code

Maintenance Planning

A strategic plan for maintenance provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the ideal framework and objectives for conducting maintenance activities, such as enhancing reliability, improving efficiency, and incorporating advanced technologies. It serves as a roadmap that guides the decision-making process for establishing comprehensive maintenance protocols within the AusNet network. This involves creating a structured approach to regular maintenance activities to ensure optimal performance and longevity.

Targeted Activities (Inspection and Monitoring Strategies)

REF	DETAILS OF MATERIAL CONSIDERATIONS
01	Maintain public light as per the Public Lighting Code and the Standard Operating Procedure SOP 30-04.
02	Review the maintenance frequency for more reliable low energy lighting alternatives supported by economic and life cycle cost analysis, to assist decisions on accelerating the implementation of LED lamps.

Renewals Planning

A strategic asset strategy for renewals and replacements provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the aspects of asset refurbishments or like-for-like replacements, detailing the conditions under which existing assets may be renewed or replaced within the network. This process ensures continued reliability and efficiency, manages obsolescence, and maintains adequate spares. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for renewing or replacing assets within the AusNet network.

Decommissioning

A strategic asset strategy for decommissioning provides high-level guiding principles and overarching goals for asset management, focusing on long-term planning and sustainability. This strategy outlines the aspects of safely and efficiently removing assets from service, detailing the conditions under which decommissioning may occur. It ensures that the process is conducted in a way that minimises disruption, manages environmental impacts, and complies with regulatory requirements. It serves as a roadmap that is ideal to follow if possible, guiding the decision-making process for decommissioning assets from within the AusNet network.

7. Risk and Options Analysis

This section outlines the key risks presented by MV FSD and to discuss how these risks should be addressed.

Risks

Lanterns' replacement is driven by the below 3 factors:

- Minamata Convention on MercuryReplacement
- Reactive Replacement of Lantern
- Availability of replacement lamps for all lantern types besides LED's.

Options

Proactive Replacement

As directed by the 2015 Public Light Code, the condition of the public light is maintained by routine inspection and replacement as outlined in the Public Lighting Code

Reactive Replacement

Reactive replacement of lantern is recorded in the Distribution and Outage Management System (DOMS). Since 2012, an average of 1,731 heads replacement per annum is observed (Reactive Replacement).

Overall Replacement Forecast

Manufacturers are now making many types of different LED luminaires designed to be able to replace the 'older' types of luminaires.

As such our delivery partners cannot source enough spare bulbs to complete the bulb change programs.

Many of the luminaires will need be replaced with a LED luminaire in the next EDPR period when the bulb has reached its end-of-life period.

8. Legislative References

NO.	TITLE	LINK
1	Public Lighting Code	Essential Services Commission - Public Lighting Code

9. Resource References

NO.	TITLE	LINK
1	Standard Operating Procedure	SOP 30-04

Appendices

Appendix One – Asset Type Descriptions

Summary of the Core Components

- Lamp: A lamp is the component within a luminaire that produces light. Commonly referred to as the light bulb, the lamp includes various types such as incandescent, fluorescent, high-intensity discharge (HID), and light-emitting diode (LED) sources. The lamp converts electrical energy into visible light, and its characteristics—such as light output (measured in lumens), colour temperature, and lifespan—are critical to the overall performance of the luminaire. Different types of lamps offer varying efficiencies, colour rendering properties, and maintenance requirements, making the choice of lamp crucial for achieving the desired lighting outcomes.
- Luminaire: A luminaire, often referred to as a light fixture, is the complete lighting unit that includes all the necessary components to produce and direct light. It comprises the lamp (or light source), the housing, optical elements (such as reflectors and lenses), electrical components (such as ballasts or drivers), and mounting hardware. The luminaire is designed to distribute, filter, and transform the light emitted by the lamp to meet specific lighting requirements. It ensures that the light is directed appropriately, minimising glare and light pollution while maximising efficiency and effectiveness. In public lighting, luminaires undergo a rigorous technical approval process to ensure they meet safety, performance, and energy efficiency standards. They are classified into standard and non-standard categories based on their design and application within the network.

Summary of Lamp types

- **Compact Fluorescent:** Compact Fluorescent Lamps (CFLs) are a type of energy-efficient lighting widely used in public lighting applications. These lamps function by driving an electric current through a tube containing argon and a small amount of mercury vapour. This process generates ultraviolet light, which then excites a fluorescent coating (phosphor) inside the tube, producing visible light. CFLs are known for their longer lifespan and higher energy efficiency compared to traditional incandescent bulbs. They are particularly useful in pedestrian lighting (Category P) due to their moderate lumen output and relatively warm colour temperature, which enhances visibility and safety in public recreational areas and minor roads.
- **Metal Halide:** Metal Halide lamps are high-intensity discharge (HID) lamps that produce light by passing an electric arc through a mixture of gases, including mercury and metal halides. These lamps are characterised by their high luminous efficacy and excellent colour rendering properties, making them suitable for applications where high-quality illumination is required. In the context of public lighting, Metal Halide lamps are often used for major roads (Category V) due to their ability to provide bright, white light that improves the visibility of road markings and signs, thus enhancing motorist safety. However, they require a warm-up period to reach full brightness and have a relatively shorter lifespan compared to other lighting technologies.
- **Light Emitting Diode (LED):** Light Emitting Diode (LED) technology has revolutionised public lighting due to its exceptional energy efficiency, long lifespan, and superior light quality. LEDs operate by passing an electrical current through a semiconductor material, which emits light through electroluminescence. These lamps are highly versatile and can be configured to produce a wide range of colour temperatures and light distributions. In public lighting, LEDs are used extensively in both major (Category V) and minor (Category P) road applications. They offer significant advantages in terms of reduced energy consumption, lower maintenance costs, and enhanced control capabilities, such as dimming and smart lighting systems, which contribute to overall network efficiency and reliability.
- **Mercury Vapour:** Mercury Vapour lamps are another type of HID lamp that generates light by an electric arc through vaporised mercury. These lamps are among the older types of HID technology and provide a bluish-white light with moderate efficiency and long operational life. They are commonly used in areas where colour rendering is not a primary concern, such as industrial zones and older public lighting installations. Due to their lower luminous efficacy and environmental concerns related to mercury content, their use in new installations has decreased. However, they can still be found in existing infrastructure and may require ongoing management and eventual replacement with more efficient technologies like LEDs.

- **High Pressure Sodium (HP Sodium):** High Pressure Sodium (HPS) lamps are widely recognised for their high efficiency and long life span. They produce light by passing an electric arc through a mixture of xenon, sodium, and mercury gases, resulting in a characteristic orange-yellow glow. HPS lamps are particularly effective for major road (Category V) lighting where high lumen output is necessary for motorist visibility and safety. Their robust performance in various weather conditions and low energy consumption make them a cost-effective choice for large-scale outdoor lighting applications. However, their colour rendering is relatively poor, which can be a disadvantage in areas where distinguishing colours accurately is important.
- **T5 Fluorescent:** T5 Fluorescent lamps are a type of linear fluorescent lamp that is thinner (16mm diameter) and more efficient than older T8 and T12 models. They operate by driving an electric current through a tube containing mercury vapour and inert gas, causing the phosphor coating on the inside of the tube to emit visible light. T5 lamps are noted for their high luminous efficacy, excellent colour rendering, and long life span. In public lighting, T5 fluorescents are often used in applications where uniform, diffuse light is required, such as underpasses, pedestrian pathways (Category P), and public recreational areas. Their ability to provide consistent, high-quality illumination while maintaining energy efficiency makes them a valuable component of the lighting infrastructure.

Summary of Luminaire Types

- **80W Mercury Vapour (MV):** An 80W Mercury Vapour lamp is a type of high-intensity discharge (HID) lamp that produces light by passing an electric arc through vaporised mercury. It provides a bluish-white light and has been widely used in public lighting due to its moderate efficiency and long life. However, due to environmental concerns and lower luminous efficacy compared to newer technologies, its use has been declining.
- **Sustainable 14W and 28W T5:** T5 fluorescent lamps are high-efficiency linear fluorescent lights that are thinner and more efficient than older models. The 14W and 28W T5 lamps offer excellent luminous efficacy and colour rendering, making them suitable for sustainable public lighting applications. They are often used in pedestrian areas and underpasses due to their uniform light distribution and energy efficiency.
- **Sustainable 32W & 42W Compact Fluorescent (CF):** Compact Fluorescent Lamps (CFLs) in 32W and 42W versions are designed for high energy efficiency and long lifespan. These lamps are suitable for both pedestrian and vehicular public lighting applications, providing adequate illumination with reduced energy consumption. They offer a warm colour temperature that enhances visibility and safety in public spaces.
- **Sustainable LED Luminaire:** Sustainable LED Luminaires represent the latest in public lighting technology, offering exceptional energy efficiency, long lifespan, and superior light quality. LEDs can be configured to provide various colour temperatures and light distributions, making them highly versatile for both major and minor road lighting applications. Their advantages include low energy consumption, minimal maintenance requirements, and the capability to integrate with smart lighting systems for enhanced control and efficiency.

Summary of Luminaire Sub-Components

- **PE Cell (Photoelectric Cell):** A Photoelectric Cell (PE Cell) is a light-sensitive device used to control the operation of the luminaire. It automatically switches the light on at dusk and off at dawn based on ambient light levels. The PE Cell consists of a photosensitive sensor that detects the amount of natural light. When the light level falls below a predetermined threshold, the sensor activates the luminaire. Conversely, when the light level exceeds the threshold, the sensor deactivates the luminaire. This automation enhances energy efficiency by ensuring that the lights operate only when necessary, thus reducing electricity consumption and extending the lifespan of the lamps. The PE Cell is typically mounted on the exterior of the luminaire housing, where it can accurately detect changes in ambient light.
- **Electronic Ballast:** An Electronic Ballast is a device that regulates the electrical current supplied to discharge lamps such as fluorescent or high-intensity discharge (HID) lamps. It replaces traditional magnetic ballasts, offering several advantages, including higher energy efficiency, reduced flicker, and improved control over the lamp's operation. The Electronic Ballast operates by converting the standard mains voltage to a higher frequency, which allows for more efficient and stable operation of the lamp. This results in better light quality and longer lamp life. Additionally, electronic ballasts can include features such as dimming capabilities and compatibility with smart lighting systems, further enhancing the functionality of the luminaire.
- **Housing:** The Housing of a luminaire is the protective enclosure that contains and supports all internal components, including the lamp, ballast, and optical elements. It is designed to shield these components

from environmental factors such as rain, dust, wind, and vandalism. The housing is typically constructed from durable materials such as aluminium, stainless steel, or high-impact plastic, ensuring longevity and reliability in various weather conditions. It also includes features for heat dissipation to prevent overheating of the internal components, thus maintaining optimal performance. Additionally, the housing is designed to be aesthetically pleasing, blending with the urban environment, and is equipped with mounting hardware for installation on poles, walls, or other structures. The design and quality of the housing are crucial for the overall durability and effectiveness of the luminaire.

Schedule of revisions

ISSUE	DATE	AUTHOR	DETAILS OF CHANGE	APPROVED BY
1	02/02/2009	M Butson A Walley	First Release	
2	04/01/2010	G Lukies	Editorial Review	G Towns
3	14/04/2015	D Meade S De Silva D Hale E Howie	Editorial Review	J Bridge
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AusNet

Level 31
2 Southbank Boulevard
Southbank VIC 3006
T +613 9695 6000
F +613 9695 6666
Locked Bag 14051 Melbourne City Mail Centre Melbourne VIC 8001
www.AusNetservices.com.au

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