3. STATE OF LOCAL INFRASTRUCTURE

This chapter provides the following details regarding the state of the City's infrastructure as of December 2019:

- Summary of assets in each category and respective quantities
- Financial accounting valuation and replacement cost valuation
- Average asset age distribution and average asset age as a proportion of expected useful life
- Asset condition

The data gathering is based on:

- PSAB 3150 tangible capital asset data: 2009
- City's 25 year Life Cycle Reserve Studies: 2019
- Department current asset inventory information (e.g. GIS mapping)
- Various departments current asset management strategy/program/practice

The asset classes were reviewed at a medium – high level based on available data. Subsequent detailed reviews and studies are recommended on an annual basis as more information becomes available over time.

3.1 DEFINITIONS

- **Average Asset Age:** defined as the age of the asset since the original construction date. As each asset class has various components, the average asset age is used.
- **Average Asset Life cycle:** defined as the period of time that the asset is expected to be of use and fully functional to the City. As each asset class has various components, the average asset life cycle is used.
- **Remaining Asset Useful Life:** defined as the estimated remaining useful life of the asset based on the age only.
- **Book Value:** defined as the data/inventory collected in 2019 for the City's Tangible Capital Asset (TCA), Public Sector Accounting Board (PSAB).
- **Core Assets:** as per O. Reg. 588/17, Water Asset, Wastewater Asset, Stormwater Management Asset, Roads and Bridges/Culverts are considered as core assets.
- **Life cycle Cost:** cost of activities undertaken with respect to a municipal asset over its service life including reconstructing, maintaining, renewing, operating and decommissioning including associated design and engineering fees. For this update staff is using 2019 dollars that were submitted in early 2020.
- **Non-Core Assets:** tangible assets that are not included in the definition of Core Assets; Facilities, Fleet, ITS Infrastructure and Parks are Non-Core Assets.
- **Plan Rehabilitation/Replacement:** this action involves determining the scope of work and required funding.
- **Replacement Cost:** defined as the cost in 2019 dollars to rebuild the entire asset regardless of maintenance/rehabilitation strategies. It is assumed as a complete new build of the asset, not including the land acquisition cost. The unit replacement costs were estimated using current standard budgeting values that are based on data such as historical tender pricing and current market replacement value.
- **Schedule Rehabilitation/Replacement:** this action involves the scheduling of project following finalizing the scope and identifying the funding source.
- **Useful Life Ratio:** defined as the Average Asset Useful Life Age divided by the Average Asset Life cycle.

3.1.1 Asset Condition

The basic approach to estimating the state of an asset is to use its remaining useful life that is based on age in lieu of other condition data that is based on actual condition assessment of the same asset. This, however, is not the best approach to assessing the useful life of an asset and its condition, as assets have the potential of outperforming their engineered useful life expectancy. To rely solely on age in certain assessments may lead to misrepresentation of an asset's performance. There exist a number of factors that will determine an asset's useful life expectancy, some of these factors could include the conditions under which they were operated and maintained. On the other end of the spectrum, poorly built and/or neglected assets may fail many years before their useful life expectancy. Therefore it is important for asset owners to exercise diligence in establishing robust monitoring and maintenance programs based on condition data attained from a well-developed condition assessment program.

When assets are installed they will naturally pass through a life cycle of maintenance processes which include: repair, rehabilitation, refurbishment and perhaps complete replacement in order to ensure the continuous delivery of defined service levels. Based on the asset, the best combination of information is the inclusion of age as well as condition assessment data and any other relevant information such as: records of historical repair, rehabilitation, refurbishments and expert analysis. Therefore, although the "Remaining Useful Life" indicates the average remaining life of an asset class, it does not reflect the life cycle activity that should be applied to the asset class.

For the purpose of this report, a 5-Point Asset Condition Rating System was developed as illustrated in the table below. This system prioritizes the evaluation of assets based on qualitative scoring i.e. data from actual condition assessment in-lieu of an evaluation based on remaining useful life where data availability made it possible. This rating system and related definitions were developed with reference to industry best practices and standards. A two-pronged approach provided an estimated rating of the current condition of the City's assets:

- **By Age:** where actual condition assessment data was unavailable, asset age and average asset useful life was considered to provide each asset an age-based useful life ratio with an associated scale representing the condition of the asset. The majority of the data was rated based solely on the age of the asset, excluding Bridges/Culverts, Facilities, Information Technology Assets and Road Assets where there was inclusion of condition data for rating purposes.
- **By Actual Condition Assessment:** To obtain the best assessment of an asset in addition to age data, asset owners should assess an asset against various data sources including: asset condition assessments; industry ratings; and evaluations based on cyclic inspection/audit programs and expert judgement to ultimately assess the assets condition and how it is performing against its intended use.

Each asset is assessed based on the table below with asset conditions of Very Good, Good, Fair, Poor or Very Poor.

Table 1: City of Markham Asset Condition Rating

Condition	Design Fulfillment	Service Level	Remaining Useful Life %	Action
Very Good	Performing as Designed	Provides desired service level with basic/ necessary preventative maintenance	>80	No Action Required
Good	Performing as Designed	Provides desired service level with monitoring and preventative maintenance	60 – 80	No Action Required
Fair	Performing as Designed	Provides desired service level with occasional disruption due to repair/ maintenance	40 – 59	No Action Required
Poor	Performance issues due to design limitation *and/or* may perform as designed with high risk of failure	Frequently out of service requiring extensive repairs *and/or* needs ongoing monitoring and frequent maintenance to achieve service levels	20 – 39	Plan Rehabilitation/ Replacement
Very Poor	May fail to meet current applicable codes, standards or legislations	Asset is becoming or may become health and/or safety concern; Unserviceable *and/or* approaching end of service life	<20	Schedule Rehabilitation/ Replacement

This approach has been applied to all asset classes included in this AMP. Although components of the asset classes may rate higher or lower than the overall rating for the Asset type, this is an average rating for the entire Asset class. Consideration must be taken to understand the components that make up the Asset class and the current state of those components as there is generally a spectrum of conditions that make up the average rating.

Understanding the rating condition for each of the assets is the first step in asset planning for replacement and major rehabilitation activities. By employing detailed asset management planning, the intelligence gained from monitoring the assets that are nearing or have exceeded their useful life, the asset owners can make informed decisions and in some cases re-direct focus to those assets with the increasing probability of failure and subsequently deteriorating levels of service.

3.2 CITY INFRASTRUCTURE

The City owns the following assets:

3.2.1 Core Assets

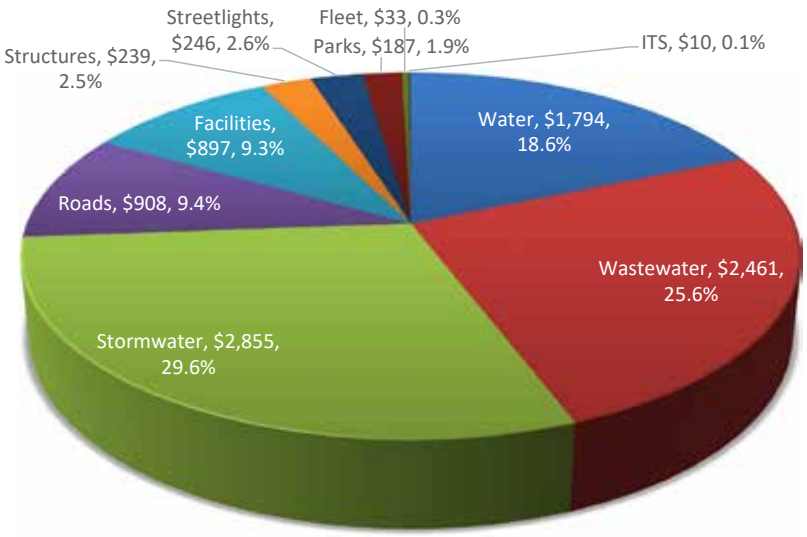
- Water Assets
- Wastewater Assets
- Stormwater Management Assets
- Roads
- Structures (Bridges and Culverts)

3.2.2 Non-Core Assets

- Facilities
- Parks
- Streetlights
- Fleet
- Information Technology Infrastructure Hardware

The total approximate replacement cost of City of Markham core and non-core Assets is $9.63B in infrastructure assets, with primarily 85.7 per cent of these assets representing Core Assets.

Figure 3-1: Asset Distribution (%) by Replacement Value ($M) – Citywide



$9.630B

Note 1: Watercourses, erosion sites and stormwater ponds were not assigned replacement value due to the nature of the asset.
Note 2: Assets not inventoried were not included due to lack of data.

3.3 WATER INFRASTRUCTURE

The City of Markham's Water assets represents the 3rd largest proportion of the total replacement value of overall City assets, at approximately 18.6 per cent of the City's total infrastructure portfolio. The replacement cost of Water assets is estimated at approximately $1.79B.

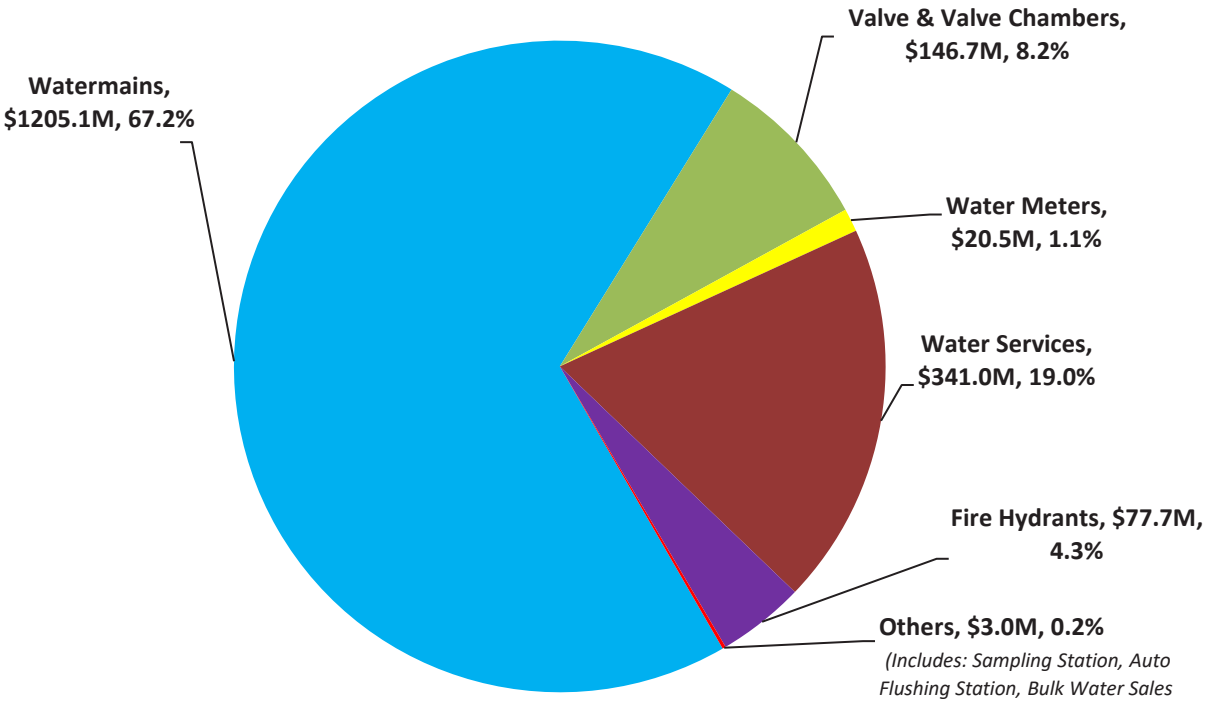
The City of Markham operates and maintains distribution watermains, valves, hydrants and water meters. In addition, in order to ensure the quality of the water per Drinking Water Quality Management Standards) (DWQMS) requirement, the City has a continuous chlorine analyzer, dead-end flushing stations and sampling stations throughout its distribution system.

3.3.1 Inventory – Water Infrastructure

The City is responsible for all water distribution infrastructures totaling $1.794B. This includes:

- Watermains (1,089 kilometers)
- Water Meters (83,179)
- Valve Chamber+Valve Boxes (11,200)
- Water Service/Curb Boxes (83,179)
- Fire Hydrants (8,795),
- Other: Sampling Stations (105), Auto Flushing Stations (12), Bulk Water Sales Stations (2), Suspended Watermain Insulation (13 locations)

Figure 3-2: Asset Distribution (%) by Replacement Value ($M) – Water Infrastructure

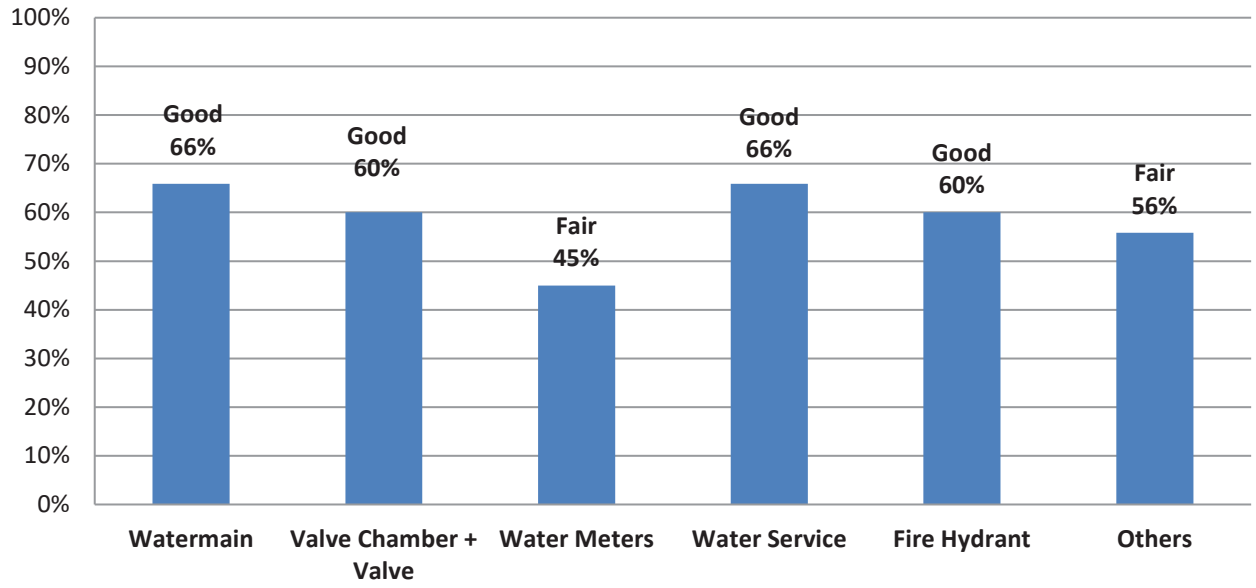


Book Value: $589M

3.3.2 Asset Life Cycle and Useful Life

Assets	Average Asset Life Cycle (years)	Average Asset Age (years)	Remaining Asset Useful Life (years)	Estimated Remaining Service Life (%)
Watermains	85	29	56	66%
ValveChamber+Valves	60	24	36	60%
Water Meters	20	11	9	45%
Water Service	85	29	56	66%
Fire Hydrants	60	24	36	60%

Figure 3-3: % Useful Life by Component and Condition Rating by Age – Water

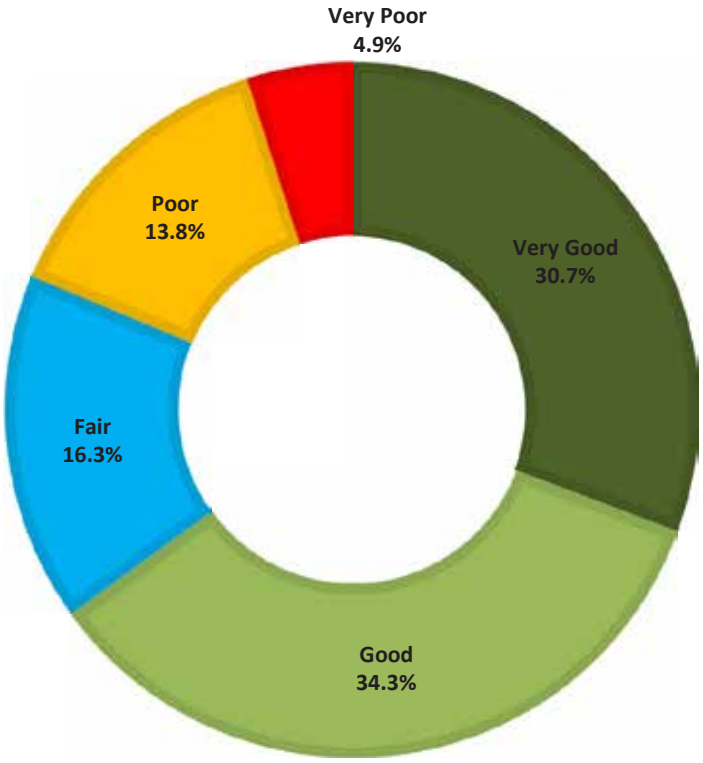


The overall condition rating of the City's water infrastructure is "Good" based on age. The age distribution of the asset components provide a better picture of assets that are near its end of life. Figure 3-4 illustrates the distribution of condition rating of watermains (including water service) based on associated replacement value. The combined replacement value of the watermains and water service is $1.54B, where approximately five per cent are at or in their last 20 per cent (~17 years) useful life of 85 years with an approximate value of $75.8M.

The Figure below shows that approximately five per cent of watermains (Cast Iron pipes) are in very poor condition based on age and are approaching the end of their service life. The City has developed a plan to replace these pipes within the next 12 years in order to provide the required level of service. In addition, the City has also planned to replace/rehabilitate another 14 per cent of watermain pipes of various pipe materials (based on their age) as they approach the end of their service life.

The City manages all of its assets regardless of age distribution, however, currently, the City is only investing in a small proportion of assets nearing their end of service life. Due to the City's significant growth since the 1970s, the AMP data shows the City will have to manage and plan the life cycle activities for almost three times the current number of water-mains scheduled for replacement for example, in the next 20 years; infrastructure demands/needs beyond the next 20 years will be significant. There are a significant number of assets that are relatively young within their life cycle and presently do not require significant attention such as resources/investment at present.

Figure 3-4: Average Asset Condition Distribution by Replacement Value – Watermains



3.4 WASTEWATER INFRASTRUCTURE

The City of Markham's Wastewater assets represent the 2nd largest proportion of the total replacement value of overall City assets, at approximately 25.6 per cent of the City's total infrastructure portfolio. The replacement value of this asset is estimated at approximately $2.461B.

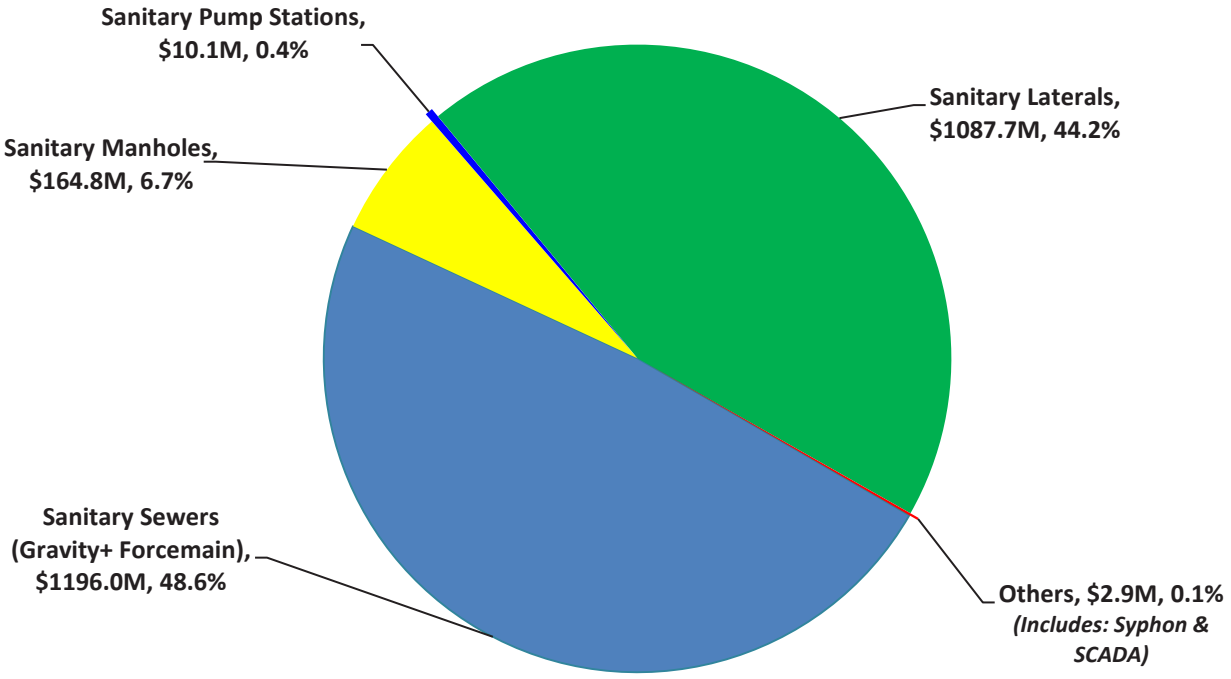
The City of Markham is responsible for managing and maintaining its own sanitary sewers, laterals, manholes, syphons, pump stations and Supervisory Control and Data Acquisition (SCADA) instrumentation. City of Markham does not own or operate a sewage treatment plant and conveys its wastewater to the Region of York's trunk sewer. Markham wastewater is treated at the Dufferin's Creek Wastewater Treatment Plant in Pickering, Ontario which is jointly owned by the Regions of York and Durham. The effluent or treated water is released back into Lake Ontario.

3.4.1 Inventory – Wastewater Infrastructure

The various asset components of Wasterwater Infrastructure includes:

- Sanitary Sewers (Gravity and Force Mains) - (918 kilometers)
- Sanitary Laterals - (82,094)
- Sanitary Manholes - (14,331)
- Sanitary Pump Stations - (5)

Figure 3-5: Asset Distribution (%) by Replacement Value ($M) – Wastewater

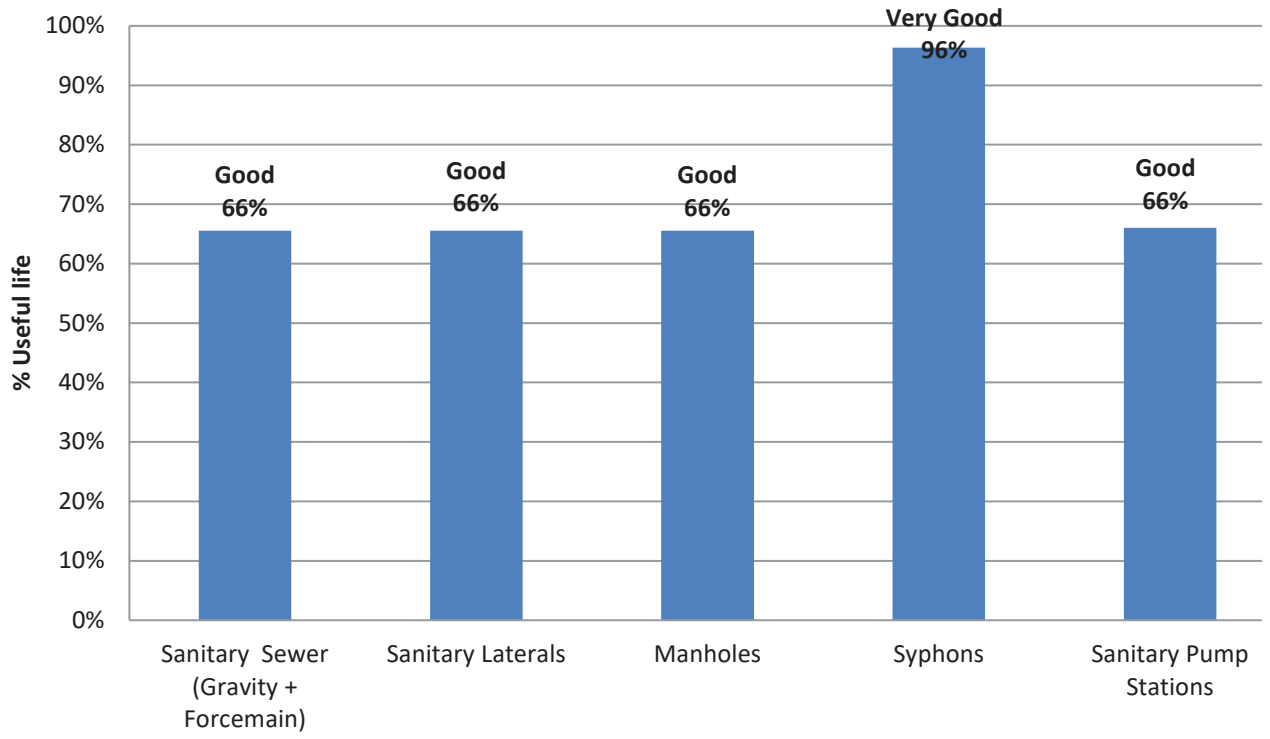


Book Value: $482M

3.4.2 Asset Life Cycle and Useful Life

Assets	Average Asset Life Cycle (years)	Average Asset Age (years)	Remaining Asset Useful Life (years)	Estimated Remaining Service Life (%)
Sanitary Sewers (Gravity and Forcemain)	90	31	59	66%
Sanitary Laterals	90	31	59	66%
Sanitary Manholes	90	31	59	66%
Syphons	55	2	53	96%
Sanitary Pump Stations	100	34	66	66%

Figure 3-6: % Useful Life by Component and Condition Rating by Age – Wastewater

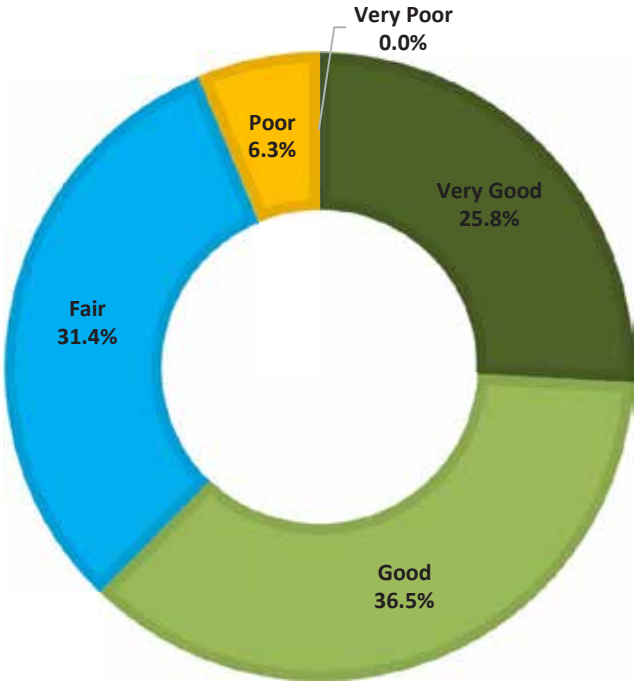


The overall condition rating of the City's wastewater infrastructure is "Good" (average rating 72 per cent) based on age. The age distribution of the asset components provide a better picture of assets that are near its end of life. Figure 3-7 below illustrates the average condition distribution of sanitary sewers based on the associated replacement value. The total replacement value of the sanitary sewers component is $1.19B, where none of the sewer mains are evaluated to be in "Very Poor" condition.

Figure 3-6 shows a breakdown of sanitary sewers evaluated based on remaining useful life in the five condition categories as a proportion of the total replacement cost.

6 per cent of sanitary sewers have a remaining service life of less than 40 per cent (35 years) but are performing as designed with ongoing monitoring to achieve required service levels. Based on CCTV condition inspection results, deficient sewers will be rehabilitated.

Figure 3-7: Average Asset Condition Distribution by Replacement Value – Wastewater (Sanitary Sewers)

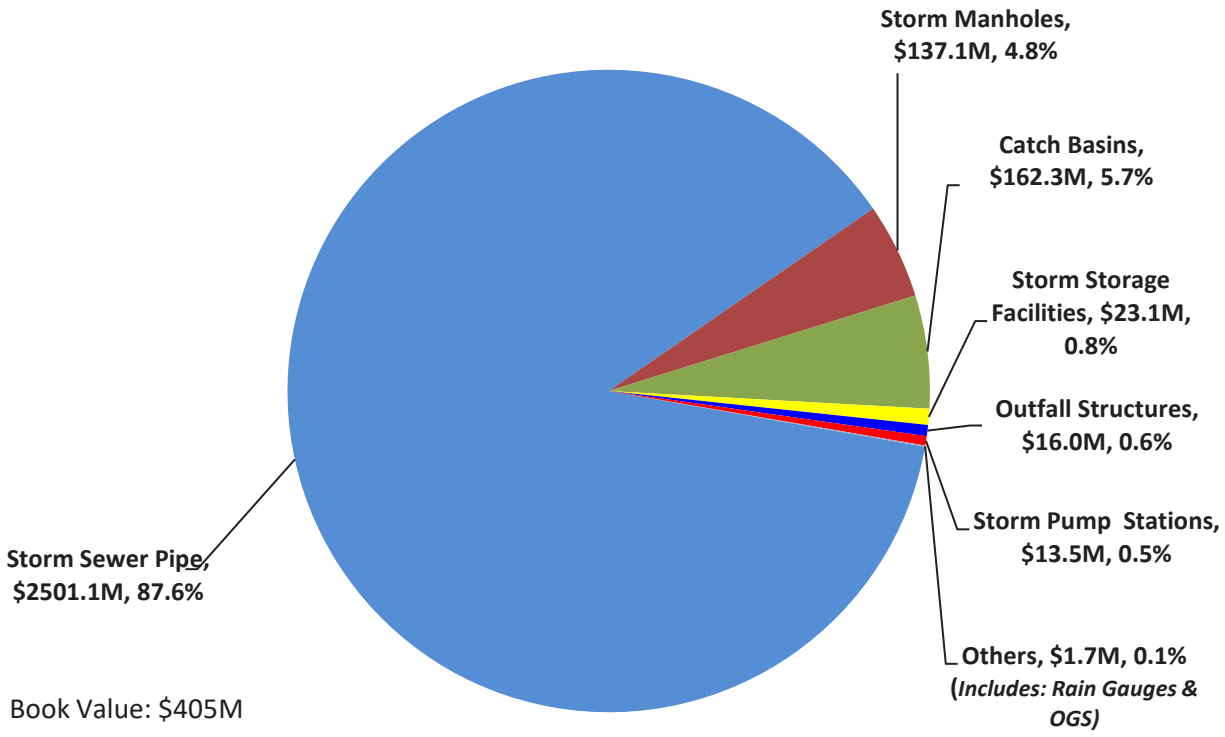


3.5 STORMWATER INFRASTRUCTURE

The storm sewer network makes up the largest proportion of the total replacement value of overall City assets, at a replacement value of $2.85B. This asset category represents approximately 29.6 per cent of the City's total infrastructure portfolio and includes the following assets:

- Stormwater Pipes (AC/Concrete/PVC/CSP) – 920km
- Storm Manholes – 14,431
- Catch Basins – 23,046
- Outfall Structures – 367
- Storm Storage Facilities – 5
- Storm Pumping Stations – 2
- Oil Grit Separators (OGS) – 40
- Rain Gauges – 13

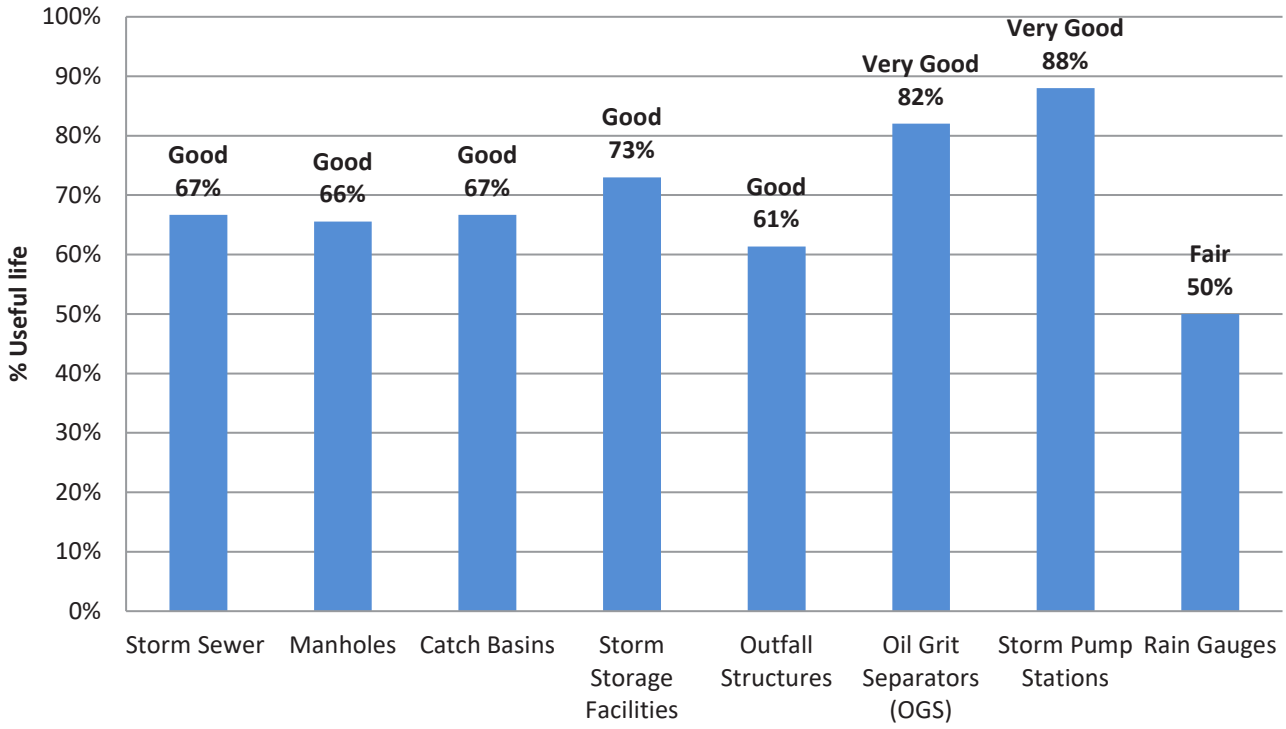
Figure 3-8: Asset Distribution (%) by Replacement Value ($M) – Stormwater



3.5.1 Asset Life Cycle and Useful Life

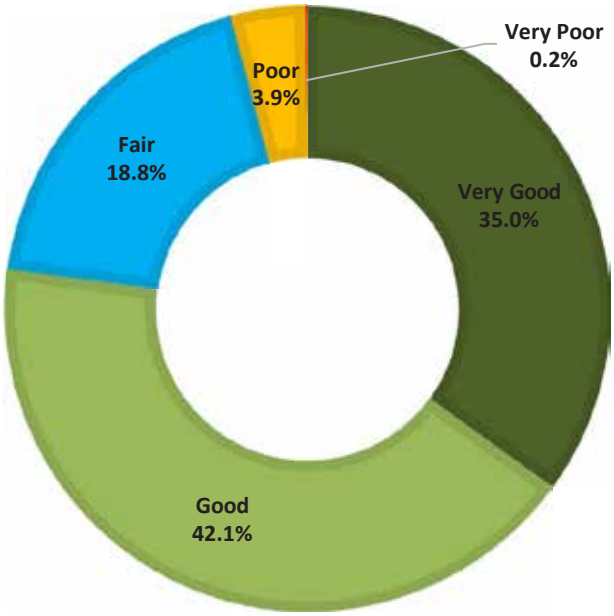
Assets	Average Asset Life Cycle (years)	Average Asset Age (years)	Remaining Asset Useful Life (years)	Estimated Remaining Service Life (%)
Storm Sewers	90	30	60	67%
Manholes	90	31	59	66%
Catch Basins	90	30	60	67%
Storm Storage Facilities	100	27	73	73%
Outfall Structures	75	29	46	61%
Oil Grit Separators (OGS)	50	9	41	82%
Storm Pump Stations	100	12	88	88%
Rain Gauges	10	5	5	50%

Figure 3-9: % Useful Life by Component and Condition Rating by Age – Stormwater



The overall average condition rating of the City's stormwater infrastructure in the ROW is "Good" based on age. The age distribution of the asset component provides a better picture of assets that are near its end of life. Figure 3-10 illustrates the average condition distribution of storm sewers based on the associated replacement value. The replacement value of the storm sewers (including manholes and catch basins) is $2.8B, where 0.2 per cent are within 20 per cent (0-18 years) of useful life with an approximate value of $5.6M. The City has developed a plan to replace these storm sewers within next 10 years in order to provide the required level of service.

Figure 3-10: Average Asset Condition Distribution by Replacement Value – Storm Sewers



3.6 STORMWATER MANAGEMENT (SWM) PONDS / NATURAL INFRASTRUCTURE

Assets	Inventory/ Quantity (#)	Book Value ($)	Replacement Cost ($)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Useful Life Ratio
Wet Ponds	57	$53M	N/A	19	N/A	N/A	N/A
Dry Ponds	41		N/A	29	N/A	N/A	N/A
ErosionSites	458		N/A	N/A	N/A	N/A	N/A

Note 1: Replacement value is not applicable to stormwater ponds due to the nature of the asset. Asset will not be completely replaced but continue to function through regular maintenance and rehabilitation programs.
Note 2: Average asset life cycle is not applicable as there is no end of life for these assets.

3.6.1 Inventory

The City of Markham is responsible for the management of stormwater infrastructure including: SWM ponds that are City-owned, erosion sites in river systems, and a storm channel as noted below:

- Wet Ponds – 57
- Dry Ponds – 41
- Erosion Sites – 458
- Storm Channel – 2 (Don Mills, Rodick/Miller Ditch)

3.6.2 Asset Life Cycle

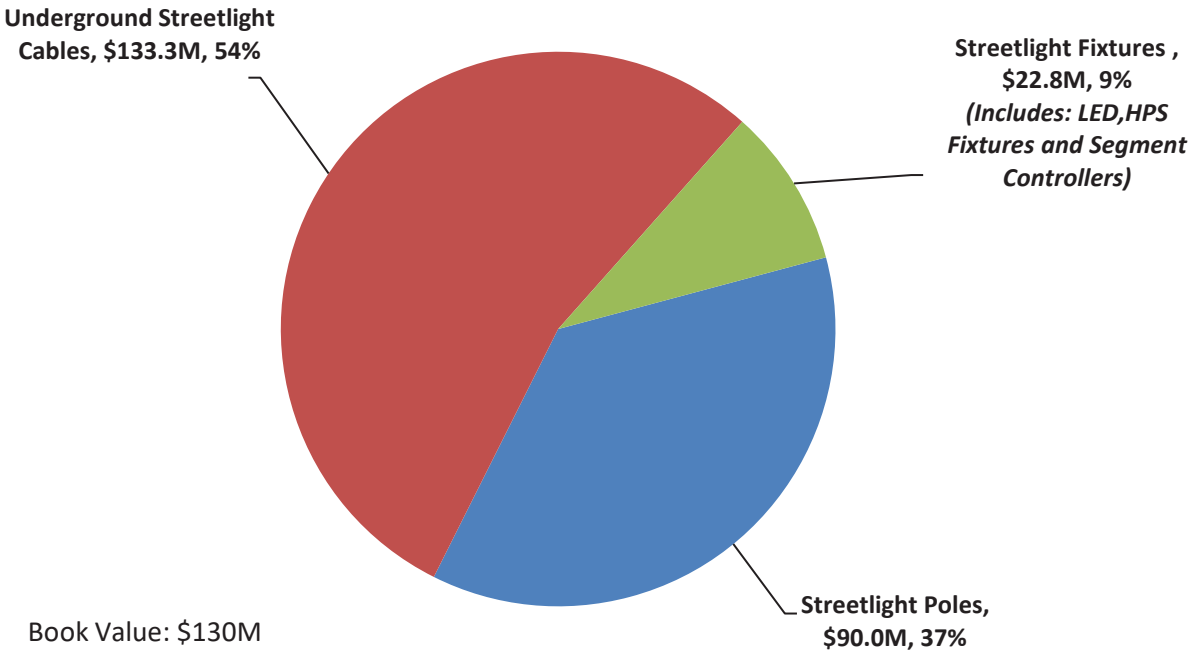
The useful life is not applicable on these assets.

3.7 STREETLIGHTS

The City is responsible for all streetlight infrastructure excluding regional road intersections with a total replacement value of $246M, which represent approximately 2.6 per cent of the City's total infrastructure portfolio. This includes:

- Streetlight Poles – 25,182
- Underground Streetlight Cables – 1,025 km
- Streetlight Fixtures (LED) – 14,111
- Streetlight Fixtures (HPS) – 15,016
- Segment Controllers – 10

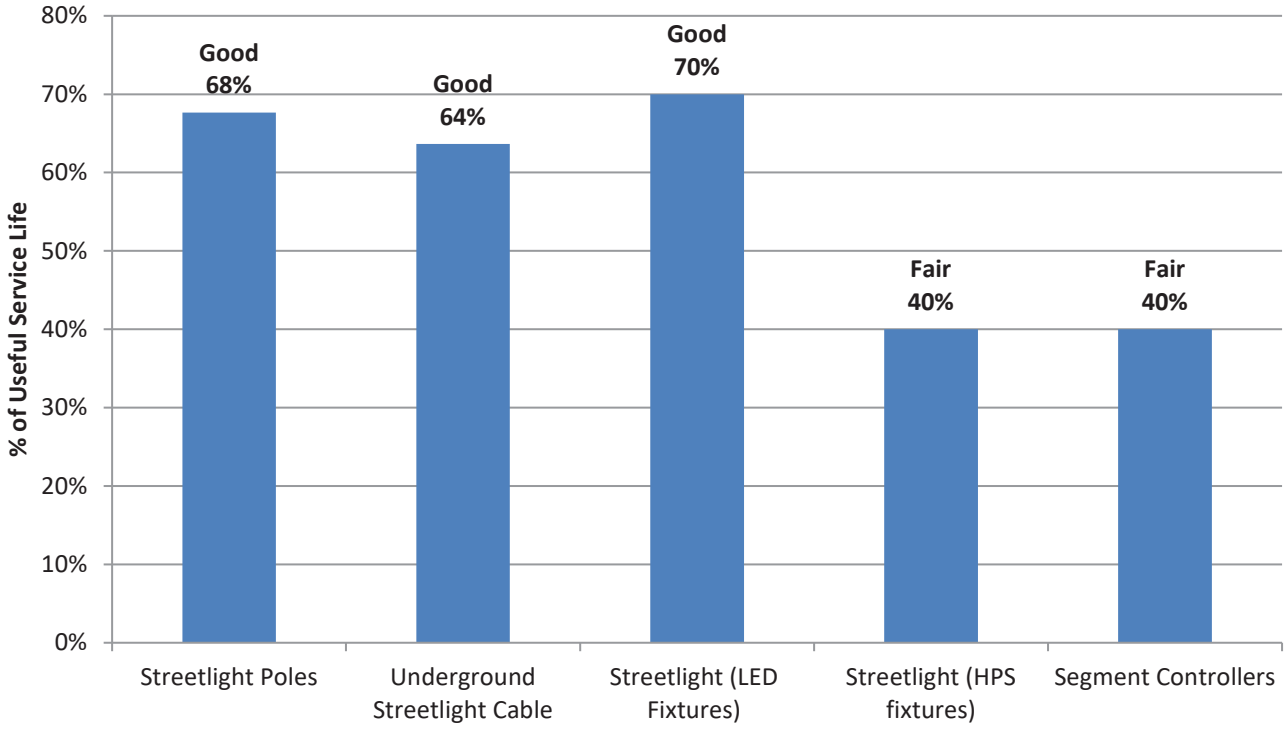
Figure 3-11: Asset Distribution (%) by Replacement Value ($M) – Streetlights



3.7.1 Asset Life Cycle and Useful Life

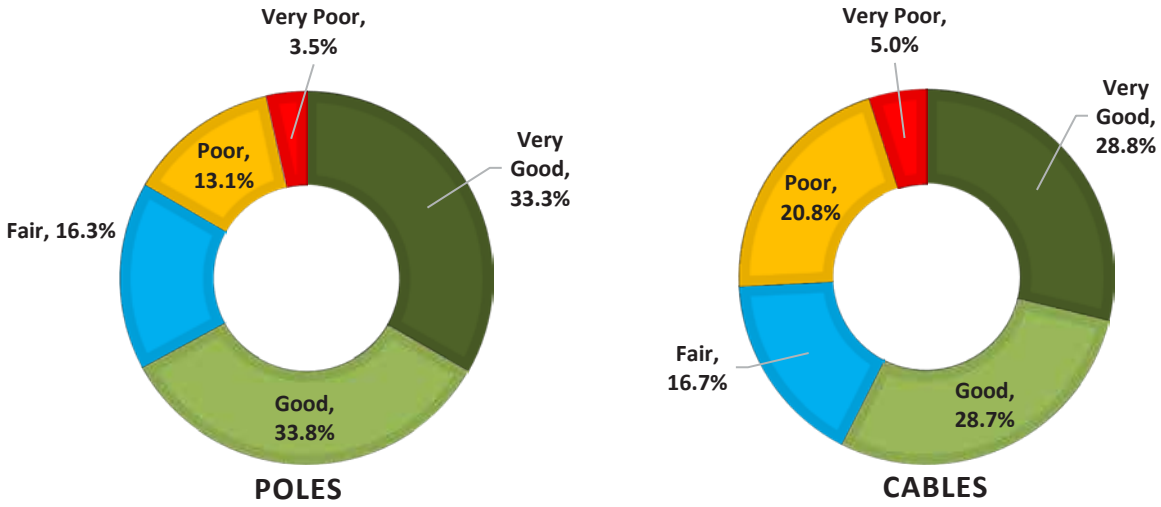
Assets	Average Asset Life Cycle (years)	Average Asset Age (years)	Remaining Asset Useful Life (years)	Estimated Remaining Service Life (%)
Streetlight Poles	68	22	46	68%
Underground Streetlight Cables	55	20	35	64%
Streetlight Fixtures (LED)	20	6	14	70%
Streetlight Fixtures (HPS)	20	12	8	40%
Segment Controllers	10	6	4	40%

Figure 3-12: Useful Life by Component and Condition Rating by Age – Streetlights



The overall condition rating of the City's streetlight infrastructure is "Good" based on age. The majority of streetlight infra- structure is composed of poles and cables at a replacement value of $223M. Figure 3-13 below illustrates the condition distribution of poles and cables based on the associated replacement value. 3.5 per cent of the poles and five per cent of the cables are within their 20 per cent (10-15 years) of useful life with an approximate combined value of $9.8M. The City has developed a plan to replace these poles and cable sections within next 10-12 years in order to provide the required level of service.

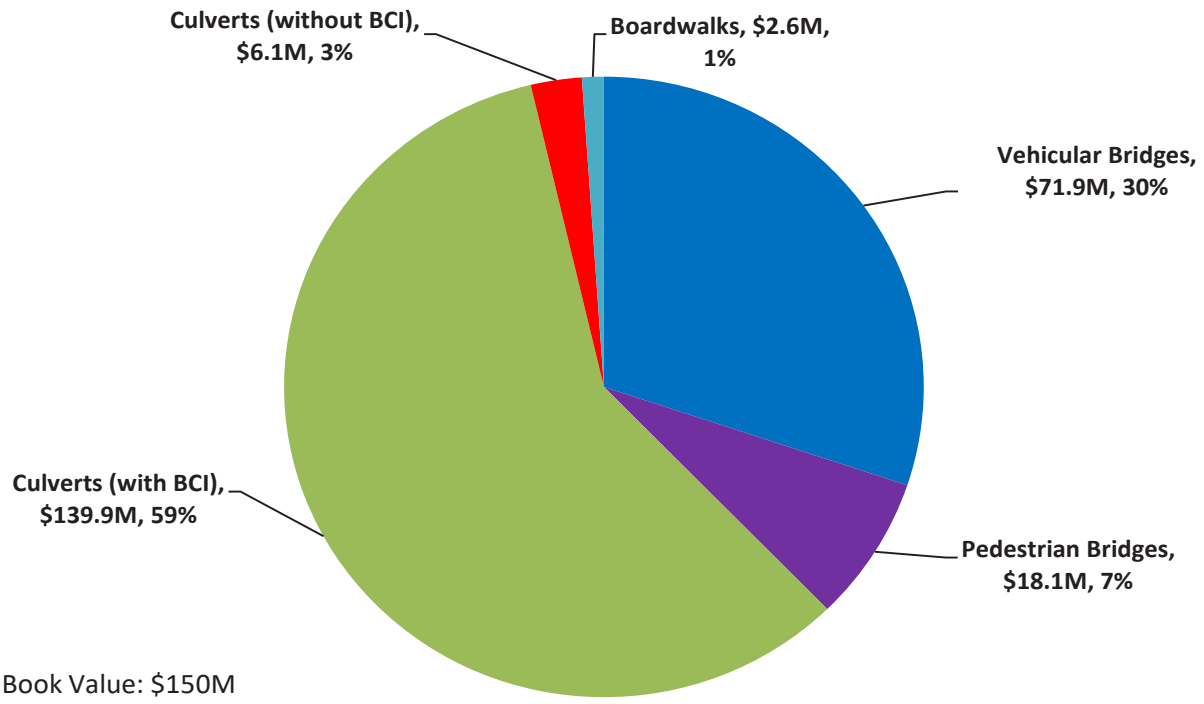
Figure 3-13: Average Asset Condition Distribution by Replacement Value – Streetlight Poles and Cables



3.8 STRUCTURE – VEHICULAR BRIDGES, PEDESTRIAN BRIDGES, CULVERTS

The City's structure program includes all vehicular bridges, pedestrian bridges, boardwalks and culverts in the City with exception to those located on Regional roads which are owned by the Region. There are 351 structures (25 vehicular bridges, 78 pedestrian bridges, 10 boardwalks and 237 culverts) within the City of Markham, with a replacement cost of $239M, which represents approximately 2.5 per cent of the City's total infrastructure portfolio.

Figure 3-14: Asset Distribution (%) by Replacement Value ($M) – Structure

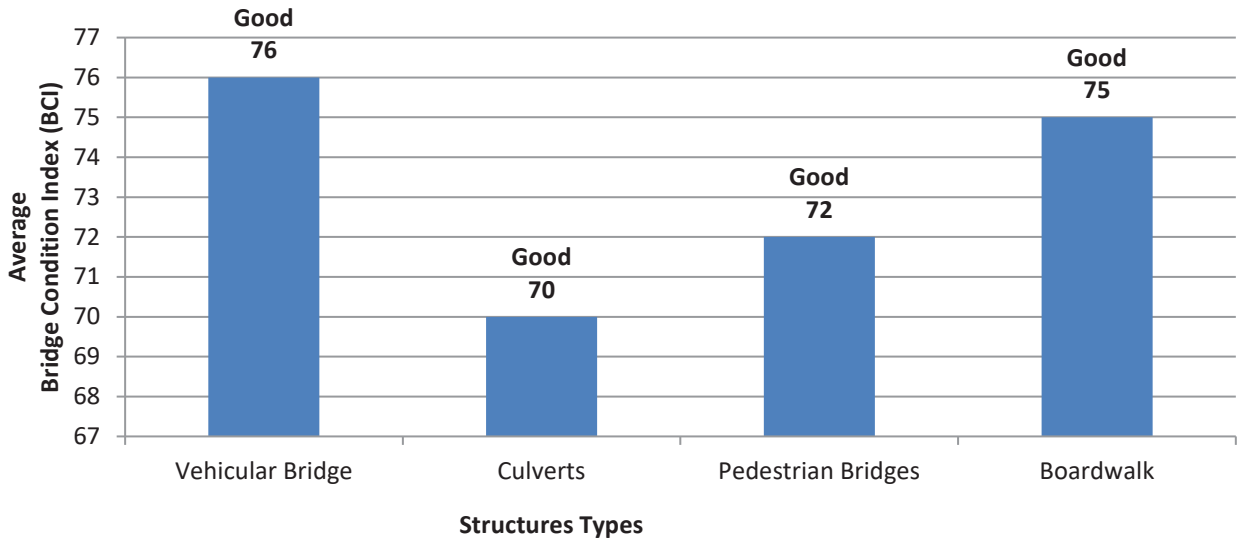


3.8.1 Asset Life Cycle and Useful Life

The useful life of the structures depends on the material.

Assets	Average Asset Life Cycle (year)	Average Asset Age (year)	Remaining Asset Useful Life (year)
Vehicular Bridges	75 -100 years	28	56
Culverts	Average 50 years	24	26
Concrete (open & closed box)	75 years		
Corrugated Steel Pipe (CSP)	30-50 years		
High-Density Polyethylene (HDPE)	50 years		
Pedestrian Bridges	Average 47 years	25	22
Concrete & steel truss and or beam	50 years		
Timber structures	30 years		
Boardwalks	50 Years	5	25

Figure 3-15: Average Bridge Condition Index (BCI) by Structure Type



Note: BCI is calculated for culverts larger than 1.2m diameter (96 per cent of the culverts replacement cost). Culverts with lesser than 1.2m diameter are inspected every four years using CCTV and are currently in good condition.

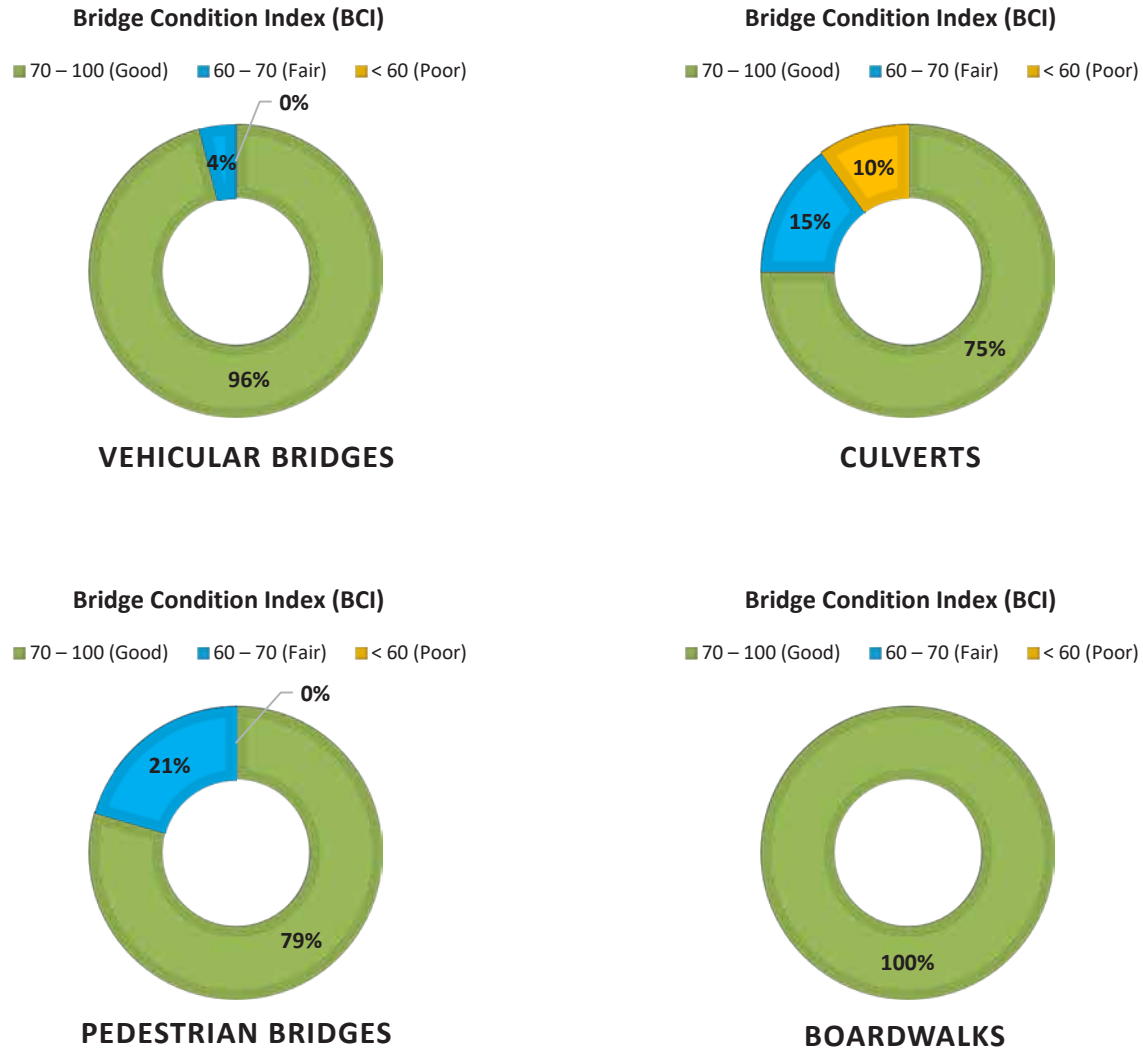
Bridge Condition Index (BCI) is an indication of a structure's current condition and dictates its rehabilitation/replacement needs. All City structures (except culverts less than 1.2m diameter) are inspected in accordance with the Ministry of Transportation (MTO) Ontario Structures Inspection Manual (OSIM, 2008) and are rated according to three condition states (good, fair and poor), as shown in the table below. The weighted average of all structural elements and their condition states is then summarized in a Bridge Condition Index (BCI) using MTO specifications.

BCI Condition Rating (MTO Standard)

BCI Values	Condition
70 – 100	Good
60 – 70	Fair
< 60	Poor

The overall condition rating of the City's structures is "Good" based on inspections. Figure 3-16 illustrates the condition distribution of vehicle bridges, culverts, pedestrian bridges and boardwalks based on their associated replacement value. There are no vehicular bridges, pedestrian bridges or boardwalks with a BCI less than 60; however there are about 10 per cent of culverts that have a BCI below 60 (with a replacement cost of $14M). These culverts are planned for rehabilitation/replacement in the next 10-12 years.

Figure 3-16: Bridge Condition Index Distribution by Replacement Value – Vehicular Bridges

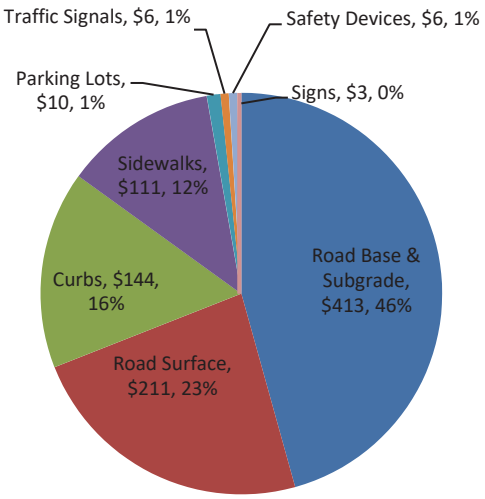


3.9 ROADS AND SAFETY DEVICES

The City is responsible for 1,111.5 km (centreline) of road assets, including safety devices. The total replacement value of these assets is $908M, which represents approximately 9.4 per cent of the City's total infrastructure portfolio. Below are the included assets:

- Sidewalks – 1,118 km
- Curbs – 1,916 km
- Safety devices such as fences (5,423m), guiderails (14,646m), retaining walls (4,301m), entrance features (144), signs (30,989), and railway crossings (13)
- Traffic signals - 101 at City intersections, including approximately 6,800 critical components. Additionally, the City also manages 24 speed-display boards, five solar powered flashing beacons, and one pedestrian crossover.
- Parking lots – 101

Figure 3-17: Asset Distribution (%) by Replacement Value ($M) – Roads



Asset Class	Inventory/ Quantity (#)	Book Value ($)
Roads	2,223 ln-km	$708,434,549
Parking Lots	101	$9,146,760
Fencing	5,423 m	$1,207,123
Retaining Walls	4,301 m	$8,242,472
Signs	30,989	$2,859,847
Entrance Features	144	$2,706,436
Traffic Signals	101	$15,636,888

3.9.1 Asset Life Cycle and Useful Life

The useful life varies depending on the component as shown in table below.

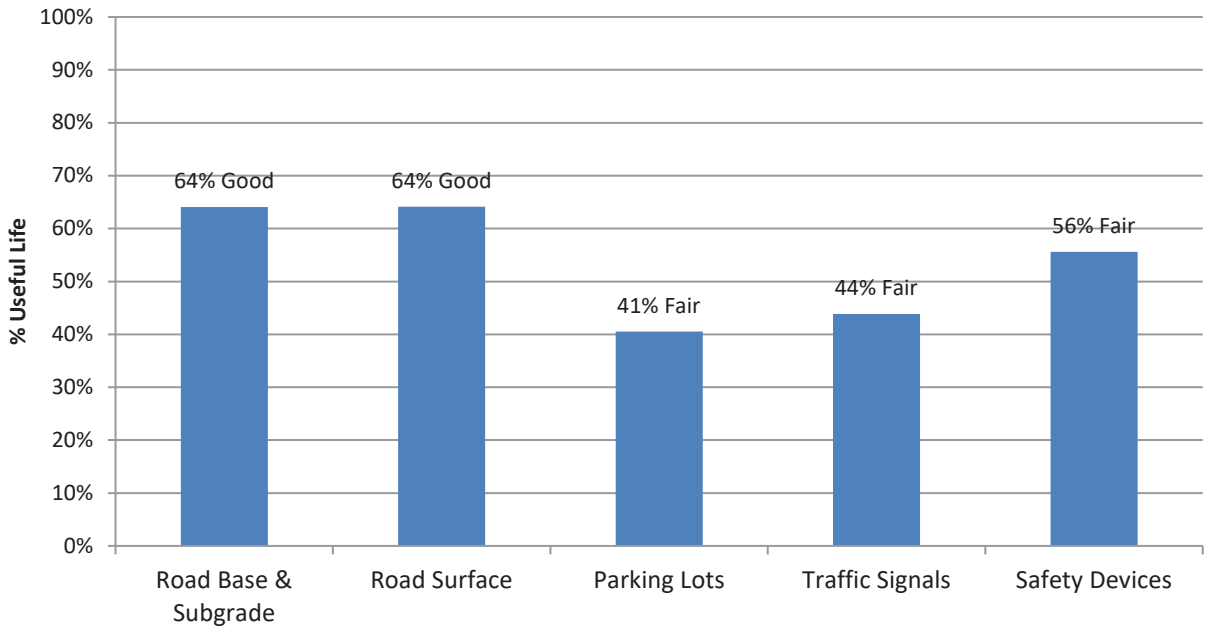
Assets	Average Asset Age (year)	Average Asset Life Cycle (years)	Remaining Asset Useful Life (year)
Roads	17	47 (Note1)	30 (Note1)
Sidewalks	NA	40	NA
Curbs	NA	40	NA
Parking Lots	15	25	10
Guiderails	13	20	7
Fencing	NA	15	NA
Railway Crossings	5	8	3
Retaining Walls	NA	25	NA
Signs	NA	Posts: 25, Signs: 15	NA
Entrance Features	NA	25	NA
Traffic signals	Varies, Average 8 year	Varies, Average 14.5 year	Varies, Average 6.5 year

Note 1: Average asset life cycle of a road is 36 years, however, based on the condition survey and the City's pavement preservation program, the average asset life cycle of a road structure can reach 47 years. The asset's useful life age is also based on a condition survey and the overall condition index, and not strictly based on the age of the road pavement. The age of Sidewalks, Curbs, Fencing and Retaining Walls is not tracked as their maintenance is performed under an annual program as part of operations and maintenance.

The road structure with respect to the overall condition index and its age provides an indication of the health of the road. The methodology is not completely dependent on the age of the road structure, as the class of roadway, loading condition of the road, and different levels of deterioration all contribute to the overall condition. Therefore, the following methodology is used to calculate the service life of the road structure and determine its condition rating:

- The Remaining Service Life (RSL) of pavement is the estimated/predicted number of years remaining until a pavement section reaches its Threshold Value (Th) based on the surveyed Pavement Condition Index (PCI).
- The RSL is calculated using a straight-line relationship beginning when the pavement segment was constructed or rehabilitated (the PCI at this point is 100) and the age when the condition is surveyed. The RSL equals the number of years that the road segment will take to reach the Th, assuming an extension of this straight line relationship. Currently the Th of all road segments is 50.
- The Service Life (SL) of a pavement section is the actual number of years the pavement is expected to serve the travelling public beginning at construction until rehabilitation, or between two consecutive rehabilitation activities. Hence the SL of any pavement section is equal to the sum of its current Age (number of years since construction or last major rehabilitation until present) and the RSL.

Figure 3-18: % Remaining Useful Life by Component and Condition Rating – Roads



Note 2: Only guiderails, RWIS stations and railway crossings were used to represent the % useful life of the safety devices.

The overall condition rating of the City's road infrastructure is "Good to Fair" based on the age and condition assessment as demonstrated in Figure 3-19 below.

The road structure component comprises 69 per cent of the overall road infrastructure at replacement value of $624M with a useful life of 47 years. Road functional classes (Laneways, Locals and Collectors) are included in the figures below which illustrate the condition distribution of the road structure based on the associated replacement value.

Figure 3-19: Average Asset Condition Distribution by Replacement Value – Roadway Classes

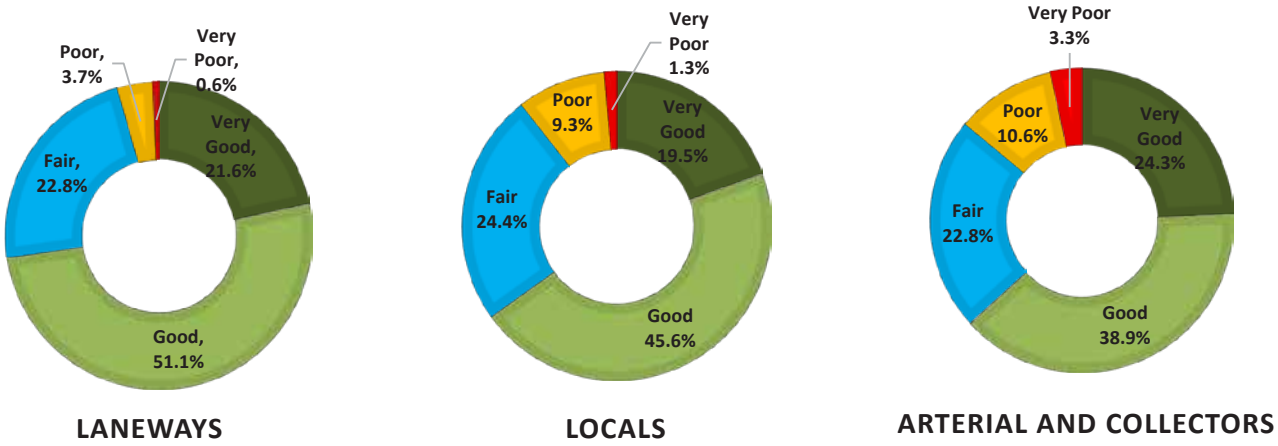


Table below illustrates the breakdown of road structures that are below 60 per cent of their service life and the associated replacement value. The road rehabilitation program is developed while taking into account the class of the road.

Class of Roadway	Useful Life Remaining			Replacement Value
	0% to 19%	20% to 39%	40% to 59%	
Laneways	0.6%	3.7%	22.8%	$5,316,253
Locals	1.3%	9.3%	24.4%	$122,261,485
Arterials & Collectors	3.3%	10.6%	22.8%	$93,122,137
Total				$220,699,874

3.10 FACILITIES

2.9.1 Inventory

The City owns and manages 176 facilities with a total square footage of approximately 2.3 million sq.ft. This includes the following, by building construction type:

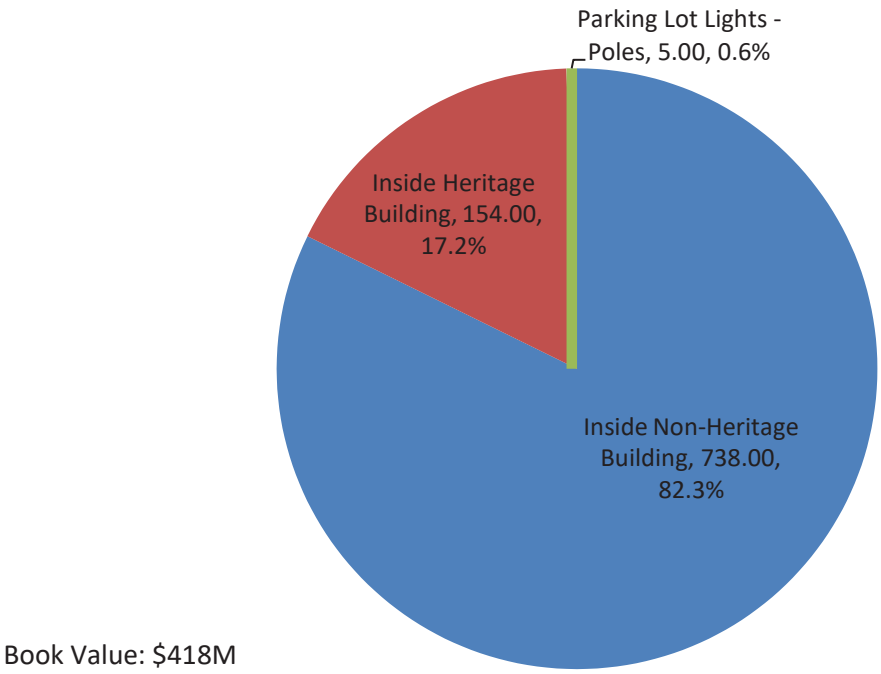
- Administrative Buildings (4)
- Cultural Facilities (6)
- Fire Stations (9)
- Industrial Type Construction (78)
- Libraries (Standalone, excluding at recreation centres) (3)
- Recreation Facilities (26)
- Residential Type Construction Buildings (48)
- School Buildings (2)

A facility is defined as the building assets within the building as well as assets outside of the building footprint within the property line including but not limited to:

- Building envelope (windows, roof, walls,etc.)
- Architectural assets (interior finishes,etc.)
- Mechanical and Electrical equipment
- Hard surfaces (pavers and walkways adjacent to building)
- Parking Lot Lights (light poles and fixtures)

The facilities infrastructure has a Replacement Cost of $897M (2020), with a Book Value of $418M (2020). The replacement of our facility infrastructure (excluding waterworks) represents approximately 9.3 per cent of the City's total infrastructure portfolio. Replacement Cost is calculated based on the weighted average current cost per square foot of the different construction types of each facility.

Figure 3-20: Asset Distribution (%) by Replacement Value ($M) – Facilities



3.10.2 Asset Life Cycle and Useful Life

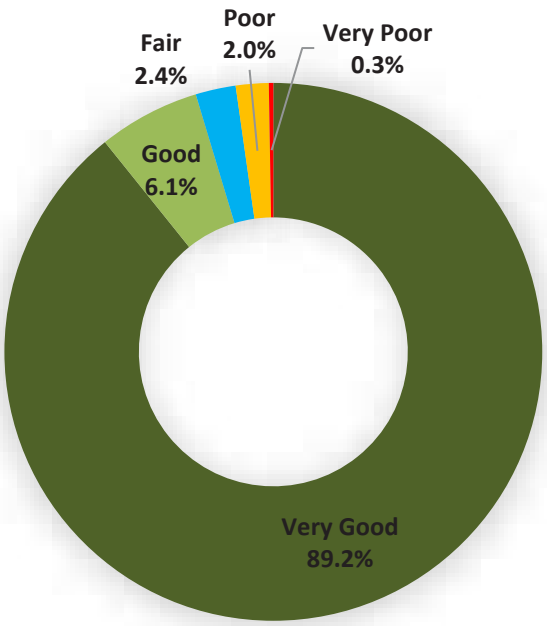
All facility components have been assigned a life cycle based on industry accepted standards. However the actual useful life may vary due to a number of reasons:

- Construction type (e.g. residential, commercial, institutional, etc.)
- The life cycle of an asset component varies, for example, windows 20-25 years, paint 5- 7 years etc.
- Level of use, and operational and maintenance activities also affect the component's useful life

Assets	Inventory/Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Average Remaining Asset Useful Life (year)	Average Estimated Remaining Service Life (%)
Facilities					
Heritage	0.43 Million Sq-Ft	119	NA	NA	NA
Non-Heritage	1.86 Million Sq-Ft	45	100	55	55%
Parking Lot Lights	416	21	45	24	53%

Note1: Assets outside of the building such as underground services have not been inventoried, therefore no replacement value has been assigned.

Figure 3-21: Average Asset Condition Distribution by Replacement Value – Facilities



The overall condition rating of the City's facility infrastructure is "Very Good" based on FCI (Facility Condition Index), only 4.7 per cent of facilities has an FCI greater than five per cent. FCI or Facility Condition Index indicates the condition of a facility in terms of ratio of necessary Repair/Replacement Cost and Total Replacement Cost of the facility. The higher the FCI the poorer the condition of the facility and vice versa. Please refer to section 4.8 for more details on FCI.

The City of Markham's strategy for Facility Assets is to keep a minimum of 80 per cent of the assets by cost in "Very Good" condition. A few facilities (four per cent of total Facility Assets) have been excluded from this study due to unavailable data and they will be included in future reports.

3.11 PARKS

The City is responsible for the maintenance of approximately 270 Parks locations, representing 19.69 hectares of parkland and 200 km of pathways. Services include maintenance of park amenities and structures, such as playground elements (229), inclusive of individual play stations, adult exercise equipment, splash pads and specialized safety surfacing and sports fields (265). Park infrastructure has a replacement cost of $187M and represents approximately 1.9 per cent of the City's total infrastructure portfolio. The following outlines the components as well as the asset life cycle.

3.11.1 Pathways Inventory and Asset Life Cycle

- 200 km
- Pathway Resurfacing: Asphalt 20-25 years,
- Stairway Repairs: Concrete stairways 30 years, wood 15 years

Asset Class	Inventory/ Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (%)
Stairway Repairs	73	20	30	10	33%

3.11.2 Sports Fields Inventory and Asset Life Cycle

Asset	Inventory/ Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (%)
Soccer	107	NA	NA	NA	NA
Baseball	61	NA	NA	NA	NA
Cricket	3	NA	NA	NA	NA
Rugby	1	NA	NA	NA	NA
Tennis Courts, Basketball Courts	89	6	14	8	57%
Artificial Turf (2 in partnership with YRDSB)	4	8	10	2	20%
Bleachers – Concrete	11	10	35	25	71%
Bleachers – Metal Frames Large	56	12	30	18	60%
Bleachers – Metal Frame Small	16	11	30	19	63%
Bleachers (Wood Metal)	38	15	20	5	25%
Player Benches	222	10	20	10	50%
Fence – Backstop	72	11	35	24	69%
Fence – Soccer Backstop surrounds	23	15	35	20	57%
Fence – Outfield	31	15	35	20	57%
Talc Metal Cabinets	53	25	30	5	17%
Goal Posts	123	17	30	13	43%
Cricket Cage Practice Areas	1	10	30	20	67%
Cricket Pitch / Baseball Outfield Screening	5	3	12	9	75%
Beach Volleyball Courts	1	7	25	18	72%
Fence Tennis Courts	22	17	35	18	51%

3.11.3 Electrical Structures and Lighting Inventory and Asset Life Cycle

- Floodlights (complete with Poles) – 45 Units with Average Asset Life Cycle of 30 years

3.11.4 Park Structures Inventory and Asset Life Cycle

Asset Class	Inventory/ Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (%)
Gazebo-Major	36	9	28	19	68%
Gazebo-Minor	28	12	30	18	60%
Pavilions	2	12	30	18	60%
Skateboard Parks	6	8	25	17	68%
Clock Towers	3	7	30	23	77%
Fountain-Decorative	6	7	25	18	72%
Parks Entrance Gateways	34	-	-	-	-
Ping Pong Tables	39	7	15	8	53%
Trellis / Pergola	67	10	28	18	64%
Fencing - General (including cemetery)	317	25	35	10	29%

3.11.5 Park Amenities Inventory and Asset Life Cycle

Asset Class	Inventory/ Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (%)
City Park Furniture/Amenities	11,117	15	25	10	40%
Eco Media Portable Zero Waste Bins	20	8	15	7	47%
Heritage Waste Receptacles	46	8	12	4	33%
Recycling Containers	580	9	20	11	55%
Big Bellies	11	8	10	2	20%
Concrete Planters - Civic Centre	70	1	15	14	93%
Wood and Concrete Planters - Yonge between Thornhill Summit and John	30	11	15	4	27%
Wood Planters - Baythorne and Yonge	11	18	15	NA	NA
Park Name Signs	468	3	15	12	80%

3.11.6 Playground Inventory and Asset Life Cycle

Asset Class	Inventory/ Quantity (#)	Average Asset Age (year)	Average Asset Life-cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (%)
Rubberized Surfaces	49	7	15	8	53%
FIBAR Surfaces	12	4	8	4	50%
Exer-Station Equipment Structures	61	6	18	12	67%
Playground Structures	192	5	17	12	71%
Water-play	28	9	21	12	57%

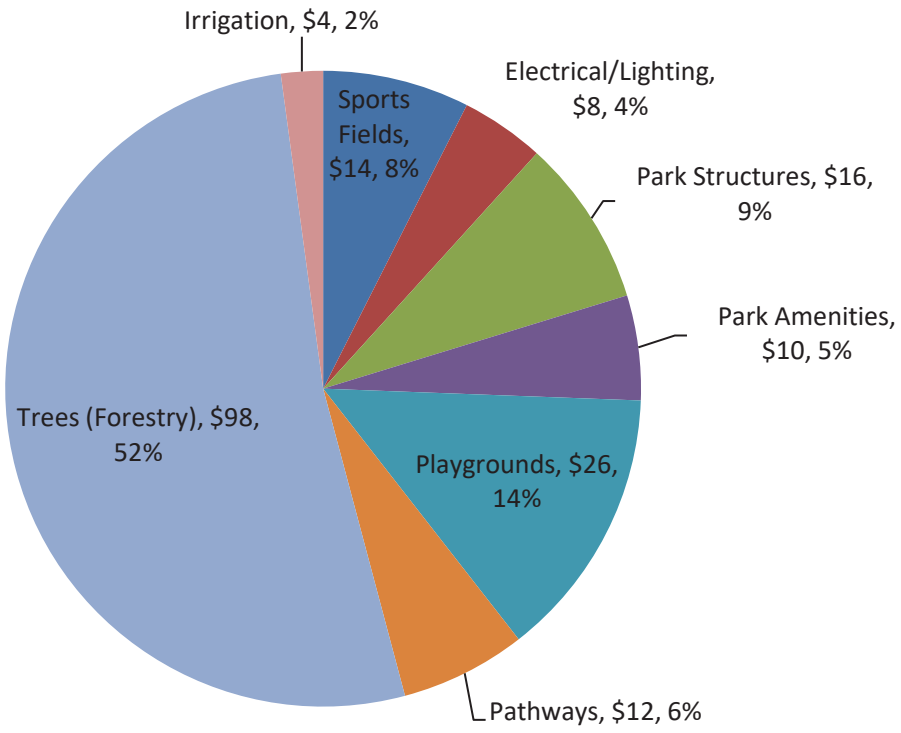
3.11.7 Trees (Forestry) Inventory and Asset Life Cycle

- 177,368 Trees with Average Asset Life Cycle of 40 year; Average Remaining Useful Life is 20 years

3.11.8 Irrigation

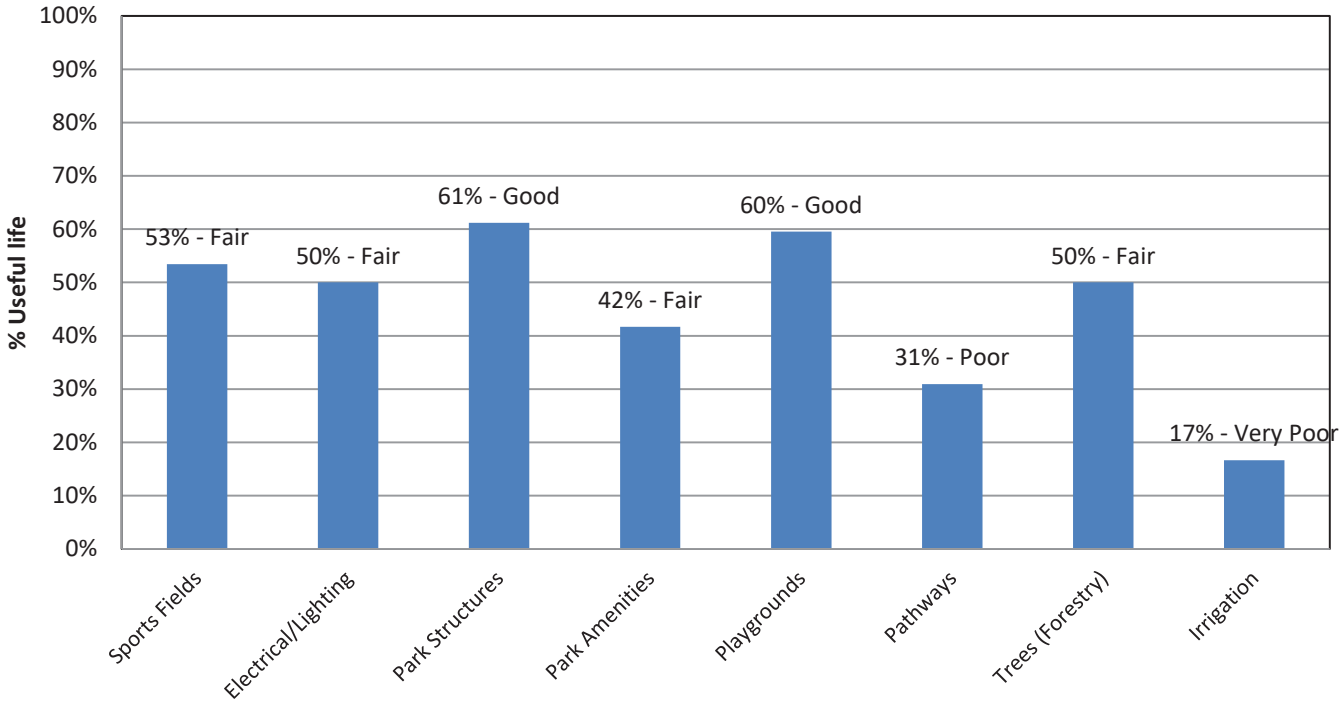
- 98 systems with Average Asset Life Cycle of 30 year; Average Remaining Useful Life is 5 years

Figure 3-22: Asset Distribution (%) by Replacement Value ($M) – Parks



Asset Class	Quantity (#)	Book Value ($)
Sports Fields	767	14,462,380
Electrical Structures/Lighting	45	8,292,664
Park Structures	538	15,967,648
Park Amenities	12,353	9,604,607
Playgrounds	342	25,550,504
Pathways and Stairways	200 km & 73	12,294,106
Trees	177,368	97,552,400
Irrigation	98	3,519,736

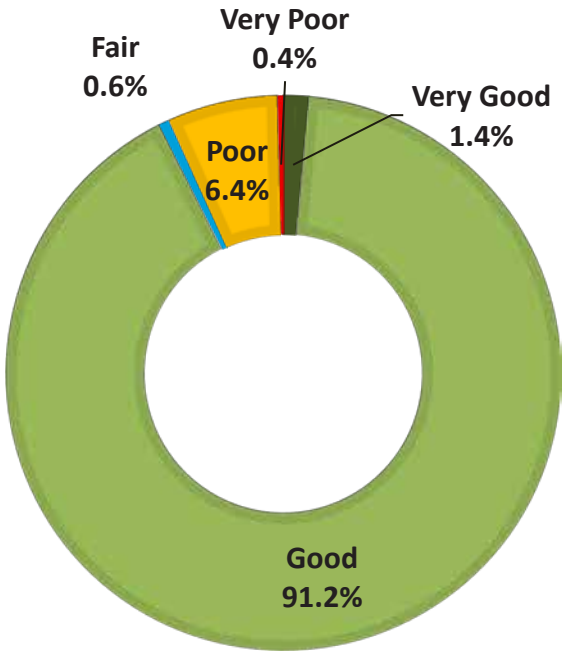
Figure 3-23: % Useful Life by Component – Parks



Gaps seen in the 2016 AMP for Parks assets are filled with improved data. Parks will explore opportunities to further improve their asset inventory and condition data that includes but is not limited to hiring consulting services and/or using summer students.

Figure 3-24 illustrates the average asset condition of Parks asset distributed based on the replacement value. Over 92 per cent of Parks asset are in "Very Good" to "Good" condition. 0.4 per cent of the "Very Poor" asset includes the aging general fencing (including cemeteries) that will be rehabilitated/replaced in the near future. Assets rated as "Poor" will be planned for rehabilitation/replacement in the next five to 10 years.

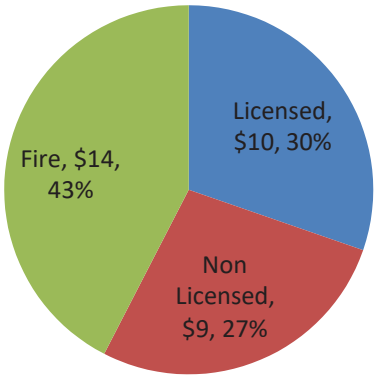
Figure 3-24: Average Asset Condition Distribution by Replacement Value – Parks



3.12 FLEET

The City manages 202 licensed fleet vehicles, with a mixture of light-duty and heavy-duty vehicles as well as 167 non-licensed units, including tractors, loaders, roads, parks, turf and sidewalk maintenance equipment, ice resurfacers, and material handling equipment such as a stockpiling conveyor for stocking winter maintenance materials in storage domes, and 49 Fire units/apparatus. Fleet infrastructure has a replacement value of $33M and represents approximately 0.3 per cent of the City's total infrastructure portfolio.

Figure 3-25: Asset Distribution (%) by Replacement Value ($M) – Fleet



Asset Class	Quantity (#)	Valuation ($)
Licensed	202	$8,082,478
Fire	29	
Non- Licensed	155	$6,654,387
Zamboni	12	
Fire Apparatus	20	10,577,482

Book Value: 25.3M

3.12.1 Asset Life Cycle and Useful Life

Assets	Quantity (#)	Average Asset Age (year)	Average Asset Life Cycle (year)	Remaining Asset Useful Life (year)	Estimated Remaining Service Life (year)
Licensed	202	4.8	9	4.2	47%
Non- Licensed	155	6	11	5	45%
Zambonis	12	6.5	9	2.5	28%
Fire	29	6.2	9.2	3	33%
Fire Apparatus	20	7.2	10.8	3.6	33%

Figure 3-26: % Useful Life by Component and Condition Rating by Age – Fleet

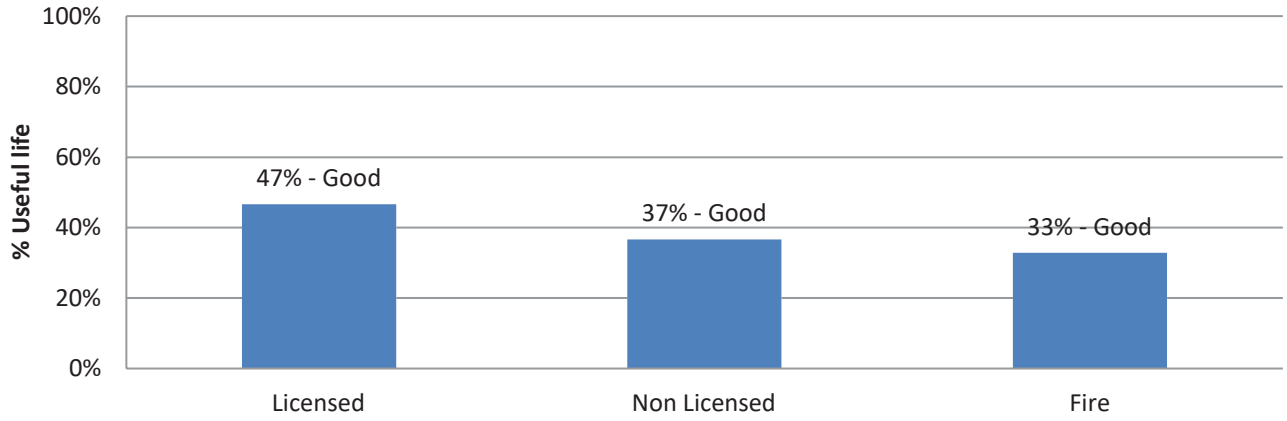


Figure 3-26 illustrates the average remaining useful life of different Fleet assets. The overall condition rating of the City's Fleet assets based on actual condition is "Good". This indicates the effectiveness of the program in place to maintain the state of good repairs for the City's fleet.

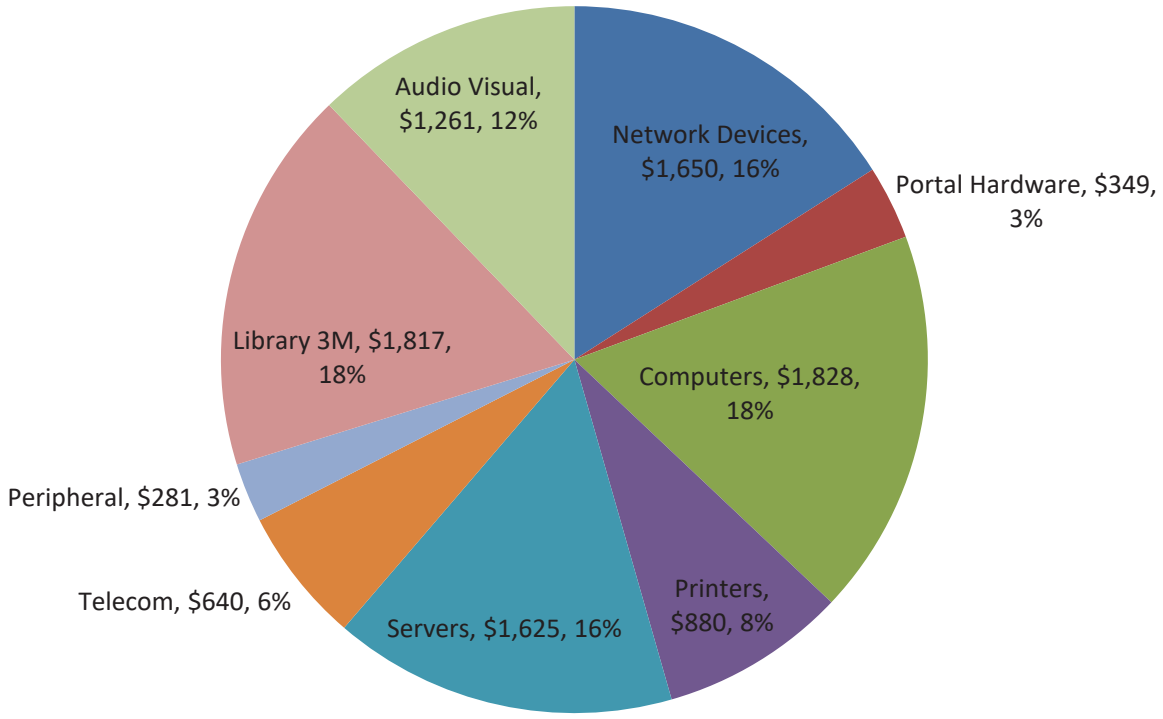
Figure 3-27: Average Asset Condition Distribution by Replacement Value – Fleet

3.13 INFORMATION TECHNOLOGY INFRASTRUCTURE HARDWARE

The City manages more than 5,394 devices with a replacement value of $10M which represents approximately 0.1 per cent of the City's total infrastructure portfolio. Devices and equipment include are:

- Network Devices
- Portal Hardware
- Computers
- Printers
- Servers
- Telecom
- Peripheral
- Library 3M
- Audio Visual

Figure 3-28: Asset Distribution (%) by Replacement Value ($000s) – IT



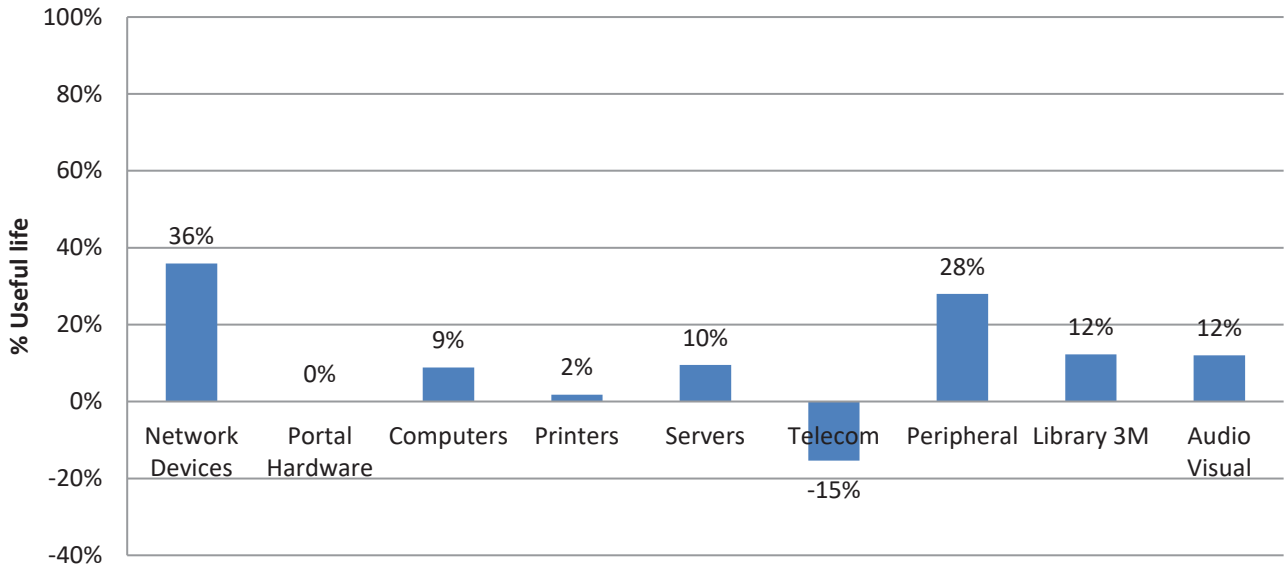
Book Value: $9.9M

3.13.1 Asset Life Cycle

Useful life of the IT assets are specific to the device. The overall range is anywhere from 2.5 years to 9 Years. The other areas identified fall under the following approximate duration:

- Peripheral: 2.5 – 7Years
- Data Centre Hardware: 6Years
- Network and Telecom equipment: 7Years
- Computers & Audio Visuals: 6 Years
- Printers & Library 3M hardware: 8 Years

Figure 3-29: % Useful Life by Component and Condition Rating by Age – IT



IT assets have a relatively shorter lifespan and even upon the end of their useful life they tend to continue providing the desired level of service with a higher risk of failure.

Figure 3-30 illustrates the distribution of IT assets in different condition ratings with reference to replacement value. The condition was evaluated based on a combination of age, maintenance support and actual condition. Funding has been approved for the replacement of assets rated from "Very Poor" to "Fair" condition. These assets were scheduled for replacement from 2020-2022, however the replacement projects were deferred during the COVID-19 pandemic. Upon completion of the replacement of these assets, approximately 90 per cent of IT assets will be rated as "Very Good".

Figure 3-30: Average Asset Condition Distribution by Replacement Value – IT