ONSITE
Engineering Ltd.

Asset Management Plan

Prepared for:

The Village of Gold River

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1.0 Executive Summary

The Village of Gold River administers the municipal infrastructure that provides standard municipal services to local residents. As part of the effective management, the Village is looking to optimize the performance and lifecycle of their assets, while maintaining an acceptable Level of Service. The intent is for the Asset Management Plan ("AMP") to provide guidance in this endeavor, and enable staff to make sound and practical decisions regarding the renewal and replacement of the infrastructure.

This Asset Management Plan will outline the upcoming responsibilities and implications the Village will incur while at a certain Level of Service. The infrastructure assets covered by this Asset Management Plan were broken down into 4 major Asset Classes, as is standard for a municipality. The administration of the provides the community with the basic services and amenities to facilitate transportation, water and sewer service, and adequate drainage of stormwater.

- Roads
- Linear Water (not including dam/reservoir or treatment facilities)
- Linear Sanitary Sewer (not including lift stations or treatment)
- Linear Storm Drainage

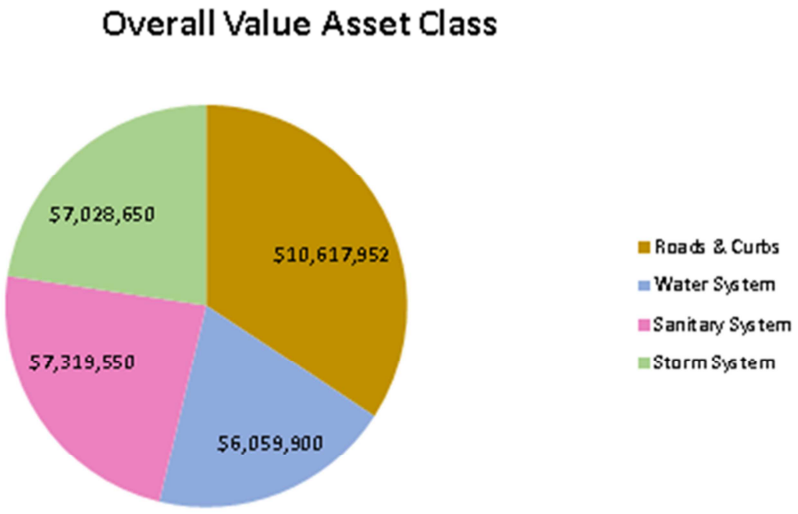
The Asset Management Plan is meant to be an ongoing effort, and additional Asset Classes, as well as components missing from the Asset Classes mentioned above, will continue to be added as the Village moves forward with the Asset Management effort.

The importance of these assets to the community and their significance in the Village's capital, operations and maintenance budgets, means that the management of these assets is a critical part of Council's long term financial and service delivery planning. Ultimately, the Village wants to manage its capital assets in such a way that it can provide an acceptable Level of Service, which may change over time, without undue risk of failure and while minimizing the lifecycle costs of those assets.

The total current replacement value of Villages linear assets is approximately $31,000,000. The renewal and replacement of assets will be an ongoing effort well into the future. The economic responsibility associated with the renewal and replacement of the assets is substantial and the Village is looking to the AMP to maximize this effort. Knowing the upcoming financial responsibilities will allow the Village to manage the required investment and allow greater opportunity to maximize or economize any potential funding opportunities that could reduce the incurred long-term costs.

This AMP includes a breakdown of the Village assets and includes lifecycle analysis as well as recommendations that can be incorporated in future efforts. The plan has used the Asset Management BC ("AMBC") as guidance with the intent of achieving the minimum "basic" level of asset management as defined in the document. Adopting this AM Strategy will assist the Village of Gold River in providing services to the community in a financially sustainable manner.

An overall summary of the assets is included below:



Major Asset Class	Asset Breakdown for Data entry	Total Quantity	Cost of Replacement	Annual Deprecation
Roads & Curbs	Roads - (Main)	11375 m	$8,920,342	$148,672
	Curbs & Walkways	17258 m	$1,697,610	$17,704
Water System	W-Lines (Mains)	15289 m	$5,361,550	$80,255
	Water-Points (Appurt)	504 pcs	$698,350	$17,134
Sanitary System	San-Lines (Mains)	16827 m	$5,942,550	$109,657
	San-Points (Appurt)	306 pcs	$1,377,000	$30,600
Storm System	Stm-Lines (Mains)	12216 m	$5,375,150	$90,892
	Stm-Points (Appurt.)	479 pcs	$1,653,500	$41,437
Totals			$31,026,052	$536,350

2.0 Project Background

The Village of Gold River is small Village located near the Northwest end of Vancouver Island. In the beginning of 2017, as part of a long-term planning effort, the Village took on an Asset Management approach to help with the management and optimization of their municipal infrastructure. The intent was to address the four (4) major Asset Classes with an Asset Management Plan "AMP", as well as an accompanying Asset Management Strategy.

Due to the nature and scope of this assignment, Onsite has addressed the Villages Assets in one single Asset Management Plan that includes an Asset Management Strategy. Where distinction is required between the Asset Classes, or there are items that need to be addressed to a specific Asset Class, Onsite will separate the issues of each Asset Classes, and address them individually. In an effort to facilitate the navigation of the infrastructure data, Onsite has made efforts to provide continuity in the way the information is listed, by way of order and color, whenever the four Asset Classes are listed. The four (4) major Asset Classes are listed below:

- 1 - Roads - brown/dark orange
- 2 - Linear Water (not including dam/reservoir or treatment facilities) - blue
- 3 - Linear Sanitary Sewer (not including lift stations or treatment) - pink
- 4 - Linear Storm Drainage – green

Onsite Engineering was hired to provide the following key inputs related to the infrastructure Asset Classes noted above when developing the AM Strategy and AM Plan.

- Updated capital asset inventories
- GIS mapping and attribute assignment of linear assets
- Field evaluation including high level physical condition assessment of roads and manholes
- Lifecycle analysis, deterioration models, remaining useful life, estimated replacement costs
- Detailed risk assessment
- Provide a tool that would give guidance to staff in the prioritization of Capital Works
- Offer recommendations for the Asset Management effort going forward

In performing the task set out by the Village, Onsite has taken guidance from the Asset Management BC website, particularly the Road Map. Additionally, Onsite has taken direction and adopted certain methodologies that came from National Asset Management Strategy (NAMS) guidelines. The intent of this AMP and Strategy is meant to achieve the "basic level" of the AMBC Roadmap, and will be delivered in adherence to the guiding principles in the AMBC's "Asset Management for Sustainable Service Delivery: A BC Framework. As noted in these guiding documents, the implementation of a long-term Asset Management system is an ongoing process. The Strategy and AMP will require updating to reflect changing data and other aspects that could improve or benefit the Strategy.

The AMBC Road Map identifies the following modules:

Roadmap Module	Requirements for Basic Level AM
Know your assets	Basic asset inventory, componentized inventory, data software and tools
Know your financial situation	Current asset investment, current operating and maintenance costs, future capital costs, funding sources
Understand decision making	Evaluate decision processes, improvement plan and process, prioritized plan
Manage your asset lifecycle	Asset condition, level of service, assess asset renewal alternatives, assess asset management strategy
Know the rules	Strategic goals, legislation, policy and standards
Sustainability monitoring	Sustainability assessment, coordinating infrastructure works

Additionally, field observations were performed during the summer and fall seasons of 2017. Observations included a road evaluation in which a rating of the current pavement condition was recorded. The condition assessments of the road evaluation were recorded and populated into the data spreadsheet that was part of the project.

As well, a portion of the total manholes from the Villages gravity system were evaluated and given a condition rating. Approximate 130 of over 500 manholes have been addressed at this time and the effort is ongoing as time and budget allow. These condition assessments ratings have been recorded and populated into the digital portion of this project.

3.0 Levels of Service

Below is an outline that defines the Villages Level of Service for the services covered in this report. These guidance documents should be updated periodically to reflect an accurate portrayal of the delivery of the services.

3.1 Community Levels of Service - Roads

Community Level of Service - Roads				
Key Performance Measure	**Service Objective**	**Performance Measure Process**	**Current Level of Service/Performance**	**Desired Level of Service/Performance**
COMMUNITY OUTCOMES: Provide a safe, efficient transportation system				
USER LEVELS OF SERVICE				
Quality	Road/pathway provides safe, efficient conveyance for vehicles, cyclist & pedestrians	Perform regular road evaluations	Generally, an appropriate level of service	To be determined if required
Function	Road/Pathway system that accommodates all user types	Maintain log of customer complaints/downtime incidents & other incidents that affect user groups		
Capacity/ Utilisation	Road/Pathway system used by all user types	• Additional traffic counts, monitoring & Analysis • Trail User counts		

3.2 Community Levels of Service – Water

Community Level of Service - Water

Key Performance Measure	Service Objective	Performance Measure Process	Current Level of Service/Performance	Desired Level of Service/Performance
COMMUNITY OUTCOMES: Provide clean, healthy drinking water in an effective and practical manner e				
USER LEVELS OF SERVICE				
Quality	Provide clean, healthy drinking water for rate payers	Perform mandated quality checks	meets or exceeds demands and expectations of residents	To be determined if required
Function	Healthy water is available as per terms of servicing	Maintain log of customer complaints/downtime incidents an other incidents that affect user groups		
Capacity/ Utilization	Consumption rates of users	Use metering data to compare with design demand guidelines/household averages		
		System adheres to fire flow requirements		
		System can perform adequately in a Canadian climate		

3.3 Community Levels of Service - Sanitary

Community Level of Service - Sanitary				
Key Performance Measure	**Service Objective**	**Performance Measure Process**	**Current Level of Service/Performance**	**Desired Level of Service/Performance**
COMMUNITY OUTCOMES: Provide effective safe collection of sanitary effluent from services. Provide safe, contained conveyance of effluent to the Village treatment center for disposal				
USER LEVELS OF SERVICE				
Quality	Provide effective collection and conveyance of sanitary effluent for rate payers	Perform mandated quality checks	meets or exceeds demands and expectations of residents	To be determined if required
Function	Collection is performing as required	Maintain log of customer complaints/downtime incidents an other incidents that affect user groups		
Capacity/ Utilization	Conveyance remains uninhibited	Use metering data from treatment plant to compare with design guidelines/household averages		
		System adheres to health mandates		
		Storm events have no adverse effects on collection		

3.4 Community Levels of Service - Drainage

Community Level of Service - Drainage

Key Performance Measure	Service Objective	Performance Measure Process	Current Level of Service/Performance	Desired Level of Service/Performance
COMMUNITY OUTCOMES: Provide safe, effective drainage of storm events and winter runoff				
USER LEVELS OF SERVICE				
Quality	Provide effective drainage that protects residents and Village assets	Perform visual checks of problematic areas immediately after storm events	meets or exceeds demands and expectations of residents	To be determined if required
Function		Maintain log of customer complaints/downtime incidents an other incidents that affect user groups		
Capacity/ Utilization	The system addresses the intensity and volume of the storm events that affect the Village of Gold River	Safety of residents and property assets are maintained		
		System can perform adequately in a Canadian climate		

4.0 Asset Management Strategy

4.1 Goals

The Goal of the Asset Management Strategy is to:

> Ensure long-term optimization, sustainability, and affordability of Village assets while maintaining an appropriate level of service for residents and stakeholders.

Activities to achieve this goal include:

- Improved stewardship and accountability for assets
- Develop at a corporate level, appropriate stakeholder buy-in to implement holistic Asset Management practices aimed at:
    - Improved stewardship
    - Improved long term financial planning in keeping with financial and budget constraints
- Enable the Village to effectively plan the renewal and replacement of infrastructure through a capital program that is:
        - informed and based on the needs and use of the community
        - the physical parameters and behaviors of assets
        - operational feedback
- Ensure fundamentals of Asset Management practices are to be applied consistently to all jurisdictions of the organization with the intent to effectively manage and sustain the Villages infrastructure at a desired service level
- Ensure ongoing assessment and improvement of current Operation and Maintenance practices, including the determination and allotment of renewal construction efforts
- Allow the integration of Asset Management practices into all corporate guiding documents, including, but not limited to:
    - Official Community Plan
    - Council's strategic priorities
    - 5 Year Financial Plan
    - corporate operating plans
    - policies and procedures regarding levels of service
    - individual asset class management plans, especially where integrated capital works are contemplated.

4.2 Roles and Responsibilities

As the implementation of an Asset Management effort is a collaborative effort, it is worthwhile to note the pertinent stakeholders, as well as their roles and responsibilities, to ensure the implementation of the AMP is successful. These have been tabulated below:

Table 4.2

Key Stakeholder	Role and Responsibilities
Mayor & Council	Represent needs of community/shareholders
	Allocate resources to meet the organization's objectives in providing services while managing risks,
	Ensure organization is financial sustainable.
Administrator	Act as liaison and communicator from Council to administration
Finance	Oversees effort to align financial reporting with funding of assets
Public Works	Oversees effort to maintain PW asset inventory

4.3 Legislative Requirements

In addition to the corporate responsibilities, the organization has to meet many legislative requirements including Canadian and Provincial (BC) regulations. These include:

Table 4.3

Legislation	Requirement
Local Government Act	Sets out role, purpose, responsibilities and powers of local governments including the preparation of a long term financial plan supported by asset management plans for sustainable service delivery.
Island Health Authority	Mandates health parameters with regard to public drinking water and treatment of sanitary system disposal
Community Charter	A guiding document for administration that reflects priorities of residents and council
Transportation Association of Canada	Mandates design and construction guidelines for public roads
BC Building Code	Mandates design and construction guidelines for public buildings
MMCD	Provincial guiding document providing construction standards of municipal infrastructure

The default parameters of design for the Villages municipal assets generally fall, where possible, to Provincial and Federal design standards such as TAC Manual (Roads) and BC Building Code (Buildings). If specific standards fall outside the scope of these documents, the Village may look to neighboring more

established communities (ex. Campbell River, Nanaimo, Victoria) for further guidance. Currently, in a general sense, the districts assets are sized appropriately and are performing as per expectations.

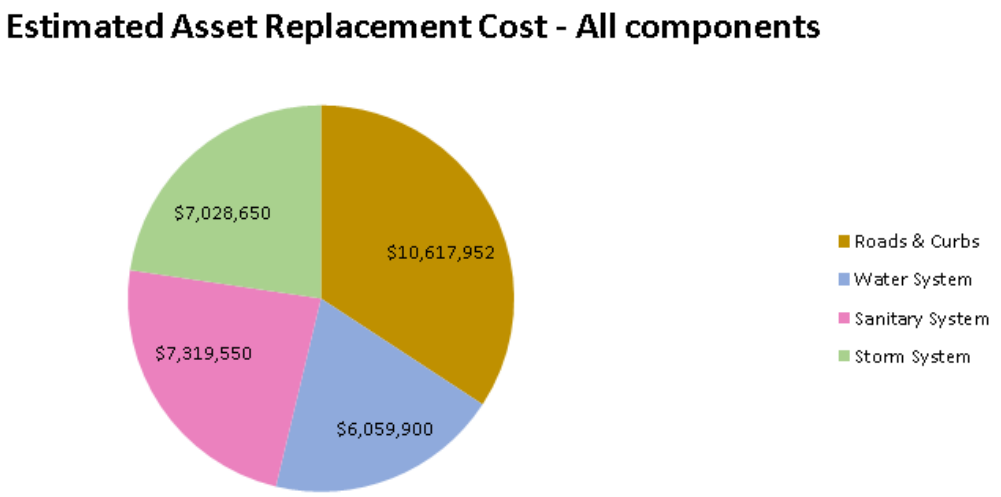
4.4 Asset Hierarchy

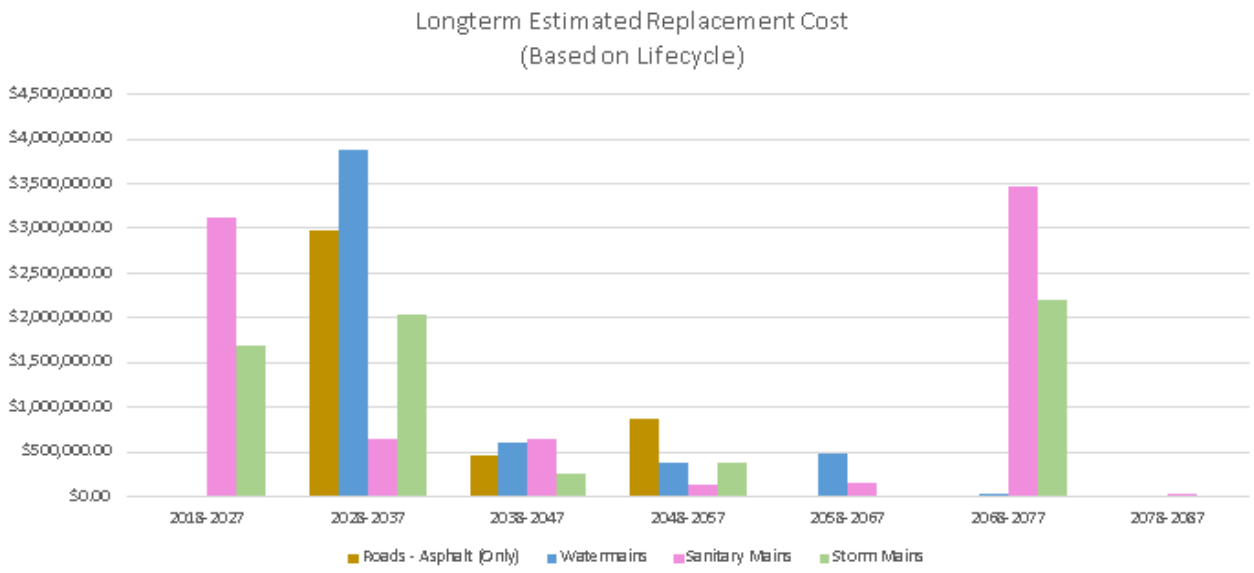
Service Hierarchy	Service Levels Objective
Transportation	Provide a safe, convenient, and compatible means for moving people and products to, from and within Gold River
Water/Sanitary	Provide Utilities at service levels that meet the needs of Gold River residents and that meet provincial and national environmental, health and safety standards appropriate to the level of urban development, within the financial means of the tax base or those of other utility providing agencies
Storm Drainage	Provide Utilities at service levels that meet the needs of Gold River residents and that meet provincial and national environmental, health and safety standards appropriate to the level of urban development, within the financial means of the tax base or those of other utility providing agencies

4.4.1 Replacement Costs and Dates

The following tables and charts show the over value and breakdown of the four (4) classes that are part of this Asset Management Plan

Asset Class	Total Estimated Replacement Cost	Current Age Range (Yrs)	Total Estimated Repl. Cost (20 Yr)	Annual Capital Investment (Ave. over 20 Yr)	Estimated Remaining Life Expectancy Range
Roads - Asphalt only	$5,352,205	28 - 51	$2,974,715	$148,736	0 - 32
Wat-Lines (Mains)	$5,361,550	19 - 53	$3,887,300	$194,365	0 - 56
San-Lines (Mains)	$5,942,550	27 - 53	$3,774,050	$188,703	0 - 48
Stm-Lines (Mains)	$5,375,150	27 - 52	$3,716,250	$185,813	0 - 48
	$22,031,455		**$14,352,315**	**$792,795**	





4.4.2 Evaluation

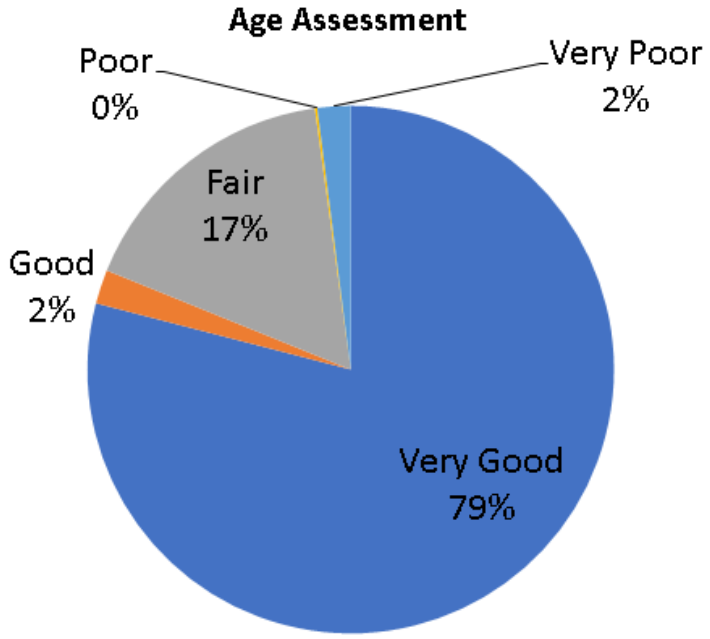
Asset Management is dependent on a number of variables specific to the assets to perform analysis. The intent is for the analysis to provide an overview of the implications and risks that will be part of the long term maintenance of a given system. These variables include physical parameters, age, condition, material, Level of Service required, cost and others. The variables used for the analysis are further explained in Section 6.1 and 6.2. As part of the Asset Hierarchy, an overview of breakdown of all the assets has been provided. They are included below:

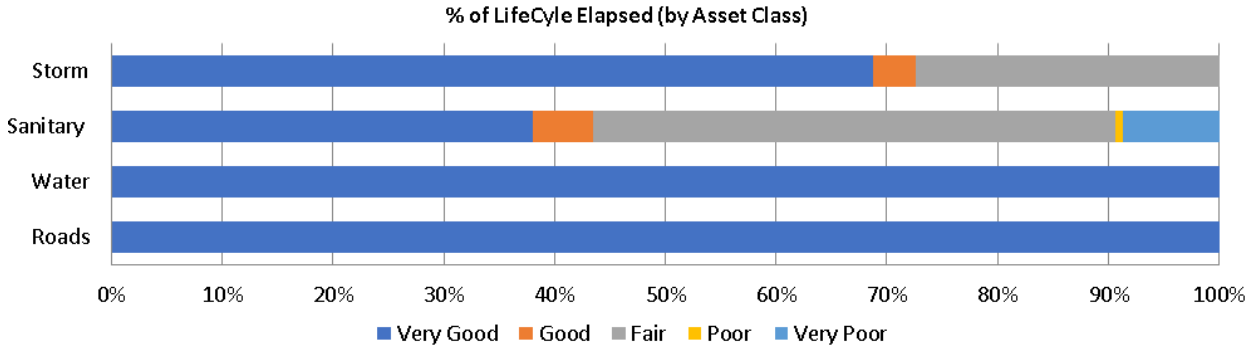
4.4.3 Age Assessment

The age of the infrastructure is plotted below along with a scoring chart. The systems are in good shape with very small percentage starting to show significant age.

The breakdown shown is by cost of construction.

Rating	Description
Very Good	Not yet reached 85% of lifecycle
Good	Final 15% of lifecycle
Fair	Exceeded Lifecycle by max. 10%
Poor	Exceeded Lifecyle by between 10% and 20%
Very Poor	Exceeded Lifecyle by more than 20%





4.4.4 Risk Assessment

Risk is variable that is assessed to assets for a number of reasons including determining priority. It is generally a function of Likelihood and Consequence, each of which can be measured differently depending on the asset class. Two sections for each asset that incurred the highest risk rating have been included below:

Risk Rating						
Likelihood		**Consequences**				
		Insignificant 1	**Minor 2**	**Moderate 3**	**Major 4**	**Catastrophic 5**
Rare	**1**	L (1)	L (2)	L (3)	M (4)	H (5)
Unlikely	**2**	L (2)	L (4)	M (6)	M (8)	C (10)
Possible	**3**	L (3)	M (6)	M (9)	C (12)	H (15)
Likely	**4**	M (4)	M (8)	C (12)	H (16)	VH (20)
Almost Certain	**5**	M (5)	C (10)	H (15)	VH (20)	VH (25)

Risk Matrix Score		NAMS Scale
0-4	Low	1
5-9	Moderate	2
9-13	Considerable	3
15-19	High	4
20-25	Extreme	5

Replacement/Renewal Project	Est. Repl. Cost	Age	Risk Score
Nimpkish - From Dogwood To Highway - Roads	$232,564	51	2.91
Nimpkish - From Eagle Cres. S To Dogwood - Roads	$542,197	51	2.91
Highway - From N. Nootka To Scout Lake Road - Water	$222,764	52	3.2
Highway - From Nimpkish To N. Nootka - Water	$333,057	52	3.2
Non-Road - From WWTP To WWTP -Sanitary	$340,041	52	3.40
Non-Road - From Corner of Nootka & Maquinna To -Sanitary	$123,940	52	3.496
Nootka - From Chamiss Cres. South To Matchlee Dr. - Storm	$97,126	51	2.836
Non-Road - From South of Ucona Rd To Muchalat to Hike road - Storm	$126,193	52	2.160

The table below summarizes the current priority ranking are based on the information currently available. It is, for the most part, a function of Condition, Material and Risk. Additional factors such as Performance and Capacity should be addressed as part the final ranking system. The Operations and Maintenance team should be consulted and their input addressed within the process for ranking.

4.4.5 Overall Infrastructure Capital Works priority ranking

Asset Class	Renewal Project	Unit (m)	Est. Repl. Cost	Age	Priority Ranking
Roads	Hilke Road S. of Pump House #2 - From WWTP To Pump House #2 -Roads	339	$241,103	51	2.691
Roads	Hilke Road N. of Booster Sta. - From WWTP To Footbridge - Roads	90	$64,010	51	2.691
Water	Highway - From N. Nootka To Scout Lake Road - Water	290	$222,764	52	3.36
Water	Highway - From Nimpkish To N. Nootka - Water	455	$333,057	52	3.36
Sanitary	Non-Road - From Corner of Nootka & Maquinna To odd footprint - Sanitary	291	$123,940	52	3.496
Sanitary	Non-Road - From West of Dogwood To S of Peppercorn -Sanitary	233	$112,679	52	3.496
Storm	Nootka - From Chamiss Cres. South To Matchlee Dr. - Storm	164	$97,126	51	2.836
Storm	Highway - From N. Nootka To Scout Lake Road - Storm	293	$203,683	51	2.224

4.4.6 Resource and Funding

The goal of long term asset management financial planning is to ensure that assets are maintained and replaced at the optimum time to ensure best value to the taxpayers over the life of the asset (lifecycle cost). The Village has a variety of sources to fund the maintenance, renewal and replacement of capital assets. These sources can include current funding to help finance assets or to set aside funds for future funding. In addition the Village has funds set aside specifically in Reserves for Capital Asset Renewal. Through the Federal Gas Tax Program there are additional funds reserved for future funding of the Village's Capital Assets. In addition, the Gas Tax Program provides approximately $100,000 annually to the Village of Gold River that is available for Capital Renewal. This Asset Management Report will provide Council with a high level snapshot of investments required over the long term. Council will need to consider how and when funds will be made available to support the Asset Management Strategy.

Potential funding sources include the following:

- property taxes (1% increase in property taxes ~ $8,600 based on 2016 tax rates)
- parcel taxes
- debt
- user fees (water and sewer)
- grants (federal and provincial governments)
- reserves.

The availability of grant programs at the time of asset replacement, and the community's ability and willingness to pay higher taxes and utility fees to fund asset management will be a significant determinant in the Asset renewal timing. Alternatively, debt could be used but those costs will translate into taxes or user fees over the long term.

Although capital reserves have been allocated for Capital Expenditures there have not been regular contributions made to these reserve accounts for capital replacement. The balance of these Reserves accrues interest but in recent years capital expenditures have exceeded the interest revenue earned on the Capital Asset Reserves. The following table summarizes statutory capital reserve balances and the balance of other capital funding (Gas Tax Funds) available to the Village:

A summary of the funding is tabulated below:

	Balance per 12/31/2016 Financial Statements	
Capital Reserves:		
Capital Works, General Fund	$	1,469,000
Capital Works, Water Fund	$	724,000
Capital Works, Sewer Fund	$	607,000
Municipal Dock Maintenance	$	933,000
Total Capital Reserves	**$**	**3,733,000**

Other:		
Community Works (Gas Tax) Funds ***(note that this may already be notionally earmarked for other critical infrastructure projects).***	$	925,000

The Village also has unrestricted Surplus Funds ($2,218,000) and internally restricted Surplus Funds ($3,623,000) but these funds have not been designated for Capital Expenditures.

4.4.7 Conclusions and Recommendations

The infrastructure of Gold River is standard for small municipalities located in BC and is behaving as it should. While there may be small, sporadic problematic issues, the infrastructure is behaving well and in some cases outperforming its predicted life.

Putting in place an Asset Management Plan is a significant effort requiring the assimilation of large amounts of data. It is generally understood that reaching a more advanced level of Asset Management system may require several efforts. It is not reasonable to think that it can all be done in one sitting. With that in mind, this AMP has valuable information and will serve as an excellent foundation for efforts going forward.

It is also important to remember that additional tasks that will improve the system are not necessarily "project based". Much of the desired information will come from performing day to day tasks, particularly within the realm of Operations and Maintenance. The most important thing is to try and record this information into the system when it transpires.

Having had a chance to look at the Villages data, Onsite would recommend the following:

Task #	Task	Responsibility
1	Adopt the Asset Management effort as appropriate for Council resolution	Consultant, CAO, Public Works Staff
2	Develop a process that records the behavior, performance and failures of infrastructure classes that form part of the plan.	Public Works
3	Develop a process that records maintenance efforts, both planned and unplanned for asset maintenance	Public Works
4	Develop Long Term Financial Plan (over appropriate time horizons) that incorporates financial planning, spending and funding for infrastructure. A portion of maintenance should be allotted for investigation of asset condition	Finance, CAO, Public Works
5	Put in place a process that accommodates the disposal and creation of assets to the data register. This would include adding data to the system that already exists. This should cater to the needs of both Finance and Public Works	Finance, Public Works
6	Establish a process that brings the current financial reporting requirements in tandem to the updating of the Asset Register	Finance, Public Works
7	Establish mechanism that allows residents and other stakeholders to communicate with Village Staff with regard to infrastructure performance and suitability	Finance, CAO, Public Works
8	Update Asset Management Strategy and Plans as required	As required

5.0 Current State of Assets

5.1 Roads

5.1.1 Executive Summary

Based on unit rates and calculated quantities, the total cost of replacement for the Villages Road is approximately $8.9M. Long term forecasts, using the given lifecycles and install years indicate that the renewal cost of the asphalt is approximately $3.0M over the next 20 years. This equates to a normalized cost of $149K per year.

The conditions of the roads, evaluated in late 2017, indicated that the majority were still in good shape (using NAMS 1-5 scale) with a small portion in fair condition, and handful having reached the poor condition.

Current priority ranking is based on the information currently available and is a function of Condition and Risk. Additional factors such as Performance and Capacity should be addressed as part the final ranking system. The Operations and Maintenance team should be consulted and their input addressed within the process for ranking.

Below is a summary of the inventory included in the Roads Asset Class.

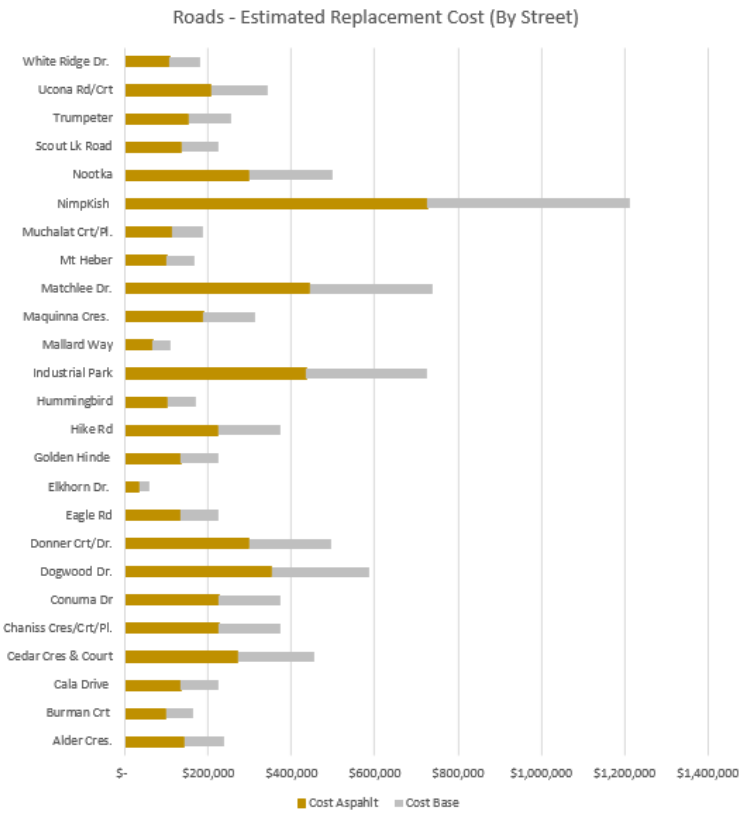
5.1.2 Inventory

Inventory		
Linear (m)		11375
Area (m2)		99166.8
Replacement Cost	$	8,920,342
(Asphalt Layer)	$	5,554,175
Top Layer Useful Life (yrs)		60
Base Layer Useful Life (yrs)		60

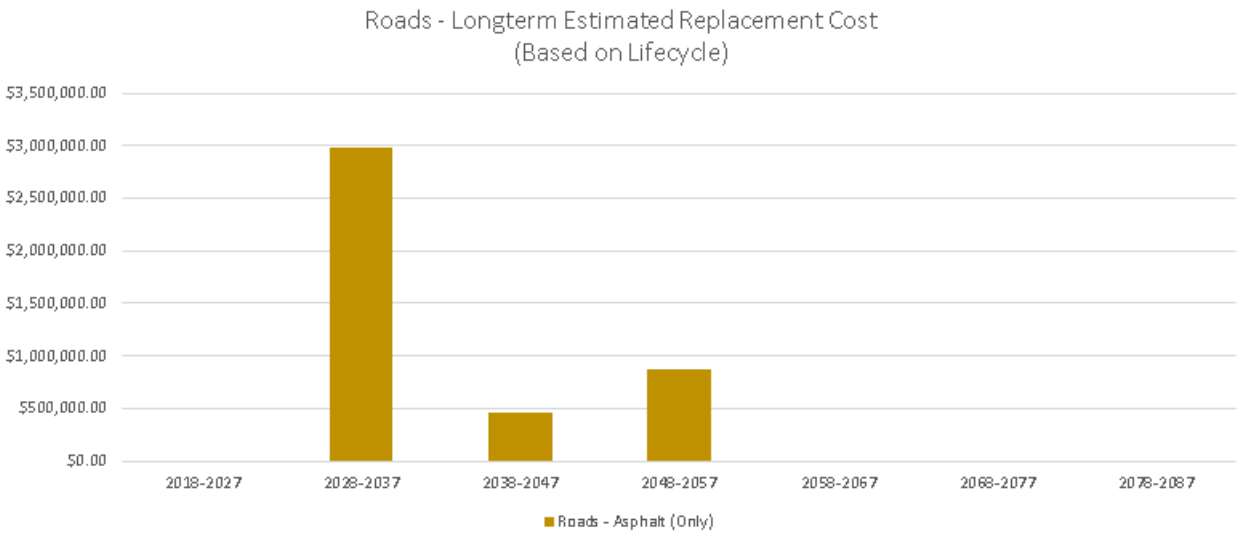
The table below summarizes the estimated renewal costs for a 20-yr horizon based on lifecycle and a linear deterioration curve, as well as the cost of reconstruction per street.

5.1.3 Projected Replacement Costs

Roads Infrastructure	Current Age	20 (Yr.) Investment	Average Annual Investment (20yr)
Road - Asphalt only	28-35	$2,974,715	$148,736



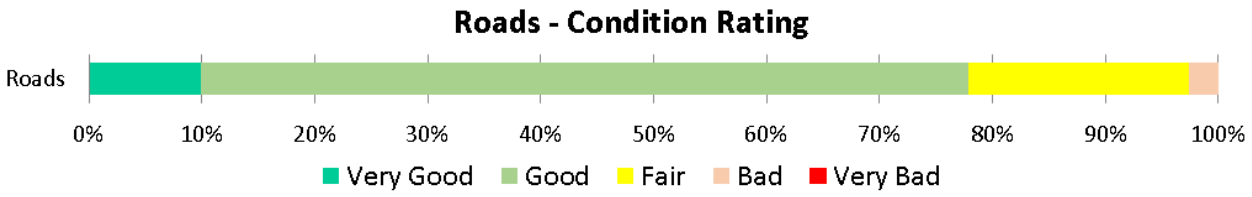
The following chart summarizes the estimated renewal cost and expected years of install for the asphalt portion of the Villages roads. Estimates are based on unit rates, lifecycle and year of install.



5.1.4 Condition Assessments

A condition assessment was performed in 2017 using the NAMS scale evaluation criteria. The scoring chart and findings are summarized below.

Grade	Summary	Physical Condition
1	Very Good	Asset as new or near new condition, only planned maintenance is required
2	Good	Asset showing initial signs of deterioration or minor damage that may affect performance. Minor maintenance required plus planned maintenance
3	Fair	Asset condition needs some attention but is still functioning. Significant maintenance required
4	Poor	Asset in poor condition or functioning poorly; action needed soon. Significant renewal/rehabilitation required
5	Very Poor	Asset in need of urgent attention or unserviceable and/or beyond rehabilitation



5.1.5 Risk Assessments

One variable that was taken into account for Priority ranking was Risk. Risk was taken as the product of Likelihood and Consequence. At this point, Likelihood was taken as a function of age and Consequence was a function of how many users would be affected. Further breakdown of the two variables are summarized in the Asset Management Strategy. The scoring chart is reproduced below.

Risk Matrix Score		NAMS Scale
0-4	Low	1
5-9	Moderate	2
9-13	Considerable	3
15-19	High	4
20-25	Extreme	5

The majority of the roads are considered “Considerable” risk. Assumptions derived to get these rankings should be confirmed with the Public Works staff.

5.1.6 Road Replacement Priority Ranking

The table below summarizes the current priority ranking are based on the information currently available and is a function of Condition and Risk. Additional factors such as Performance and Capacity should be addressed as part the final ranking system. The Operations and Maintenance team should be consulted and their input addressed within the process for ranking.

Section of Road	Length	Estimated Replacement Cost	Age	Priority Ranking Score
Hilke Road S. of Pump Sta. #2 - From WWTP To Pump House #2 - Roads	339	$241,103	51	2.691
Hilke Road N. of Pump Sta. #2 - From Pmp Sta. #2 To Footbridge - Roads	90	$64,010	51	2.691
Industrial Park place - From Industrial Park To Industrial - Roads	727	$936,178	40	2.457
Matchlee Dr. - From Nootka To Muchalat - Roads	82	$137,272	42	2.280
Nimpkish - From Dogwood To Highway - Roads	172	$232,564	51	2.183
Hummingbird - From Nimpkish To Eagle - Roads	336	$220,587	51	2.091
Muchalat Pl. - From Muchalat Dr. To End - Roads	239	$196,132	51	1.891
Cedar Cres. - From Nimpkish To Alder Cres. E - Roads	59	$61,329	51	1.891
Matchlee Dr. - From Mt Heber To Bridge - Roads	204	$288,966	42	1.880
Nimpkish - From Eagle Cres. S To Dogwood - Roads	401	$542,197	51	1.783

5.1.7 Conclusions and Recommendation

Within a Canadian climate, there is no doubt that roads will break down. Indications are that upkeep of the roads will be approx. $150k a year. It should be noted that the road evaluations came back with some positive results. This is an indication that roads are lasting longer than their expected lifecycle. Public Works could potentially look into using longer lifecycles to better represent the local conditions.

Due to the remote location, effort could be made to condense paving efforts to one occurrence over several years. This could prove to be an economic benefit and would serve well to generate interest from contractors.

5.2 Water

5.2.1 Executive Summary

Based on unit rates and calculated quantities, the total cost of replacement for the Villages Linear Water system is approximately $6.1M. Long term forecasts, using the given lifecycles and install years indicate that the renewal cost of the system to be approximately $4.5M over the next 20 years. This equates to a normalized cost of $227K per year.

Due to the inherent difficulty in performing condition assessments of water pipe, no condition data is available. There are no records of valve or hydrant condition testing, nor any records of break history. As such the vulnerability of the system was based on Age, Material and Risk. Age has been represented as percentage of lifecycle. Less durable or desirable building materials have been captured in the scoring matrix within the Likelihood variable.

Current priority ranking are based on the information currently available of the variables noted above. Additional factors such as Performance and Capacity should be addressed as part the final ranking system. The Operations and Maintenance team should be consulted and their input addressed within the process for ranking.

Below is a summary of the inventory included in the Water Asset Class.

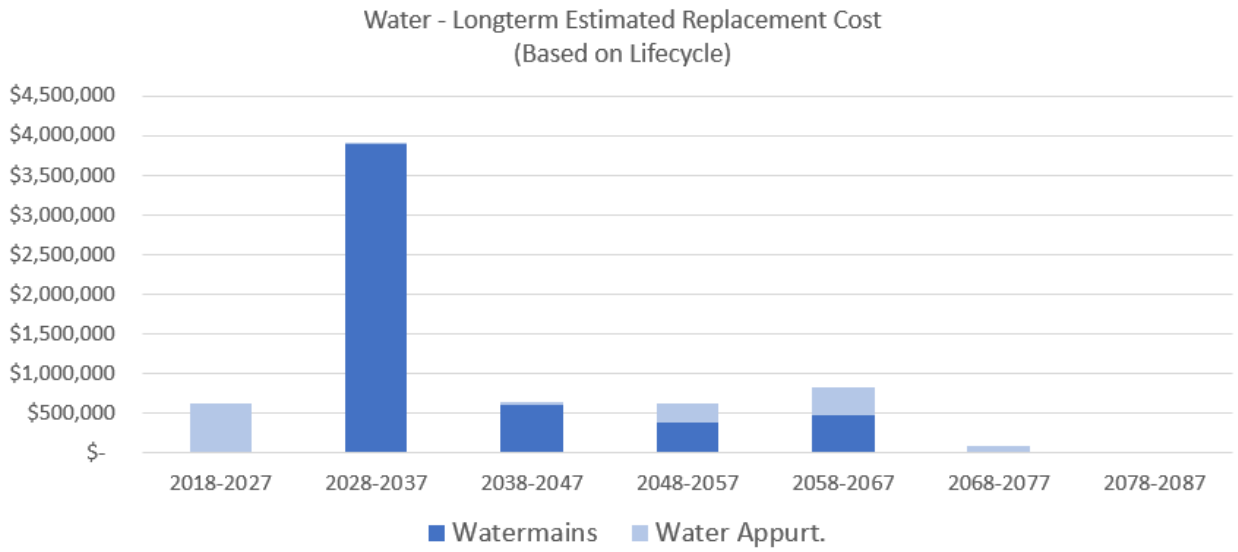
5.2.2 Inventory

Inventory		
Linear (m)		15289
Hydrants (ea.)		74
Valves (ea.)		144
Replacement Cost Total	$	6,059,900
Watermains (m)	$	5,361,550
Hydrants (ea.)	$	438,000
Valves (ea.)	$	260,350
Useful Life (Yrs)		35
Watermains (ea.)		65 - 75
Hydrants(ea.)		45
Valves(ea.)		35

5.2.3 Linear Water system replacement costs

The table below summarizes the estimated renewal costs for a 20-yr horizon based on lifecycle and a linear deterioration curve, as well as the cost of reconstruction per meter of pipe.

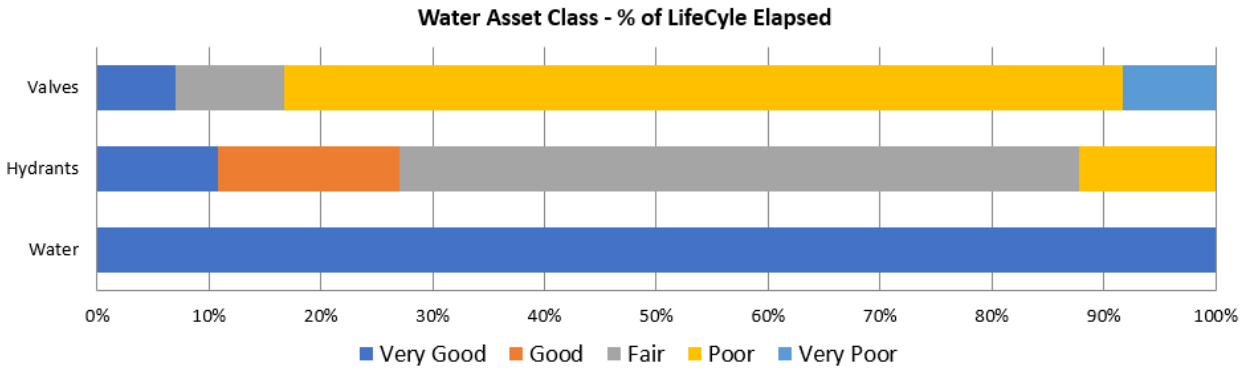
Linear Water Infrastructure	Expected Life Cycle	(20 Yr) Investment	Average Annual Investment (20yr)
Watermains	65 - 75 yrs	$ 3,887,300	$ 194,365
Hydrants & Valves	35 - 45 yrs	$ 656,350	$ 32,818
Total		$ 4,543,650	$ 227,183



5.2.4 Age Assessment

The age of the infrastructure is plotted below along with the scoring chart. The pipes portion of the water system remains significantly within its current lifecyle. The hydrants are starting to age and the valves even more so.

Rating	Description
Very Good	Not yet reached 85% of lifecycle
Good	Final 15% of lifecycle
Fair	Exceeded Lifecycle by max. 10%
Poor	Exceeded Lifecyle by between 10% and 20%
Very Poor	Exceeded Lifecyle by more than 20%

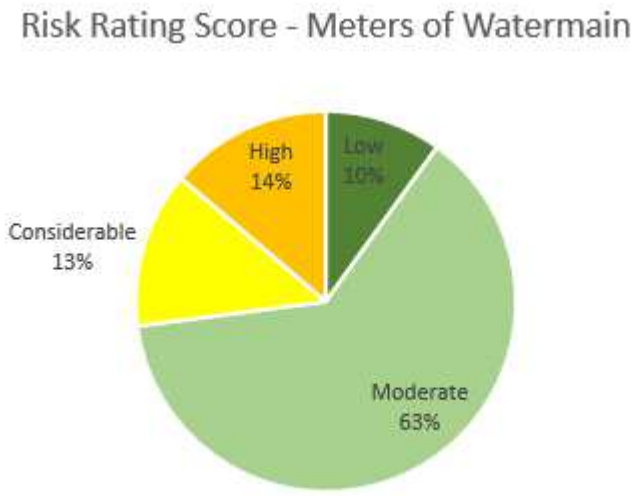


5.2.5 Risk Assessment

For the Watermains, Risk was taken as the product of Likelihood and Consequence. At this point, Likelihood was taken as a function of age, and Consequence was a function of how many users would be affected. Further breakdown of the two variables are summarized in the Asset Management Strategy. The scoring chart is reproduced below.

Risk Matrix Score		NAMS Scale
0-4	Low	1
5-9	Moderate	2
9-13	Considerable	3
15-19	High	4
20-25	Extreme	5

The majority of the watermains are considered “Moderate” risk. Assumptions derived to get these rankings should be confirmed with the Public Works staff.



5.2.6 Linear Water Replacement Priority Ranking

The table below summarizes the current priority ranking are based on the information currently available and is a function of Condition and Risk. Additional factors such as Performance and Capacity should be addressed as part the final ranking system. The Operations and Maintenance team should be consulted and their input addressed within the process for ranking.

Section of Watermain	Length	Estimated Cost	Age	Priority Ranking
Highway - From N. Nootka To Scout Lake Road - Water	290	$222,764	52	3.36
Highway - From Nimpkish To N. Nootka - Water	455	$333,057	52	3.36
Highway - From Bridge To Trumpeter - Water	594	$429,204	52	3.36

5.2.7 Linear Water – Conclusions and Recommendations

From the analysis, the “Moderate” risk rating, being based on age, seems to track well.

Water is notoriously hard to evaluate for condition., seems in line with the data. As such, it is imperative that PW crews keep an accurate record of break history and other maintenance (planned and unplanned) of the system going forward.

If not already in place, a rotation of inspection of hydrants and valves should be undertaken

Decision makers should also keep in mind that water supply and storage (wells and reservoirs) are part of the Water system and are potentially more critical to the system. This should be included in the next version of the Asset Management Plan and appropriate funding should be allotted

5.3 Sanitary

5.3.1 Executive Summary

Based on unit rates and calculated quantities, the total cost of replacement for the Villages Linear Sanitary system is approximately $7.3M. Long term forecasts, using the given lifecycles and install years indicate that the renewal cost of the system to be approximately $3.0M over the next 20 years. This equates to a normalized cost of $149K per year.

Condition assessments for a portion of the sanitary pipes and sanitary manholes have been performed. However, the condition assessment for the sanitary pipe (gravity) was divided into three efforts performed in 2000, 2007 and 2011. With the initial efforts being more than 10 years old, these efforts were deemed as no longer valid. The effort that was performed in 2011 was slightly newer, but still 7 years old. Though it was a bit of a judgement call as to wether to include this data, it was ultimately decided to omit it mainly because it was done for only a very small portion of the system (less than 10%). There are no records of break history. This being the case, the vulnerability of the system was based on Age, Material and Risk. Age has been represented as percentage of lifecycle. Less durable or desirable building materials have been captured in the scoring of Likelihood. There is further discussion on this issue in the summary of this chapter.

The condition assessment of the sanitary manholes was done in 2016/2017. Though only approximately one third of the manholes being assessed, it was included in the data. The results of the roughly one third that were assessed were fairly positive, with a small percentage dipping down to a ranking of “Fair”

Current priority ranking are based on the information currently available taking into account the issues noted above. Additional factors such as Performance and Capacity should be addressed as part the final ranking system. The Operations and Maintenance team should be consulted and their input addressed within the process for ranking.

Below is a summary of the inventory included in the Water Asset Class.

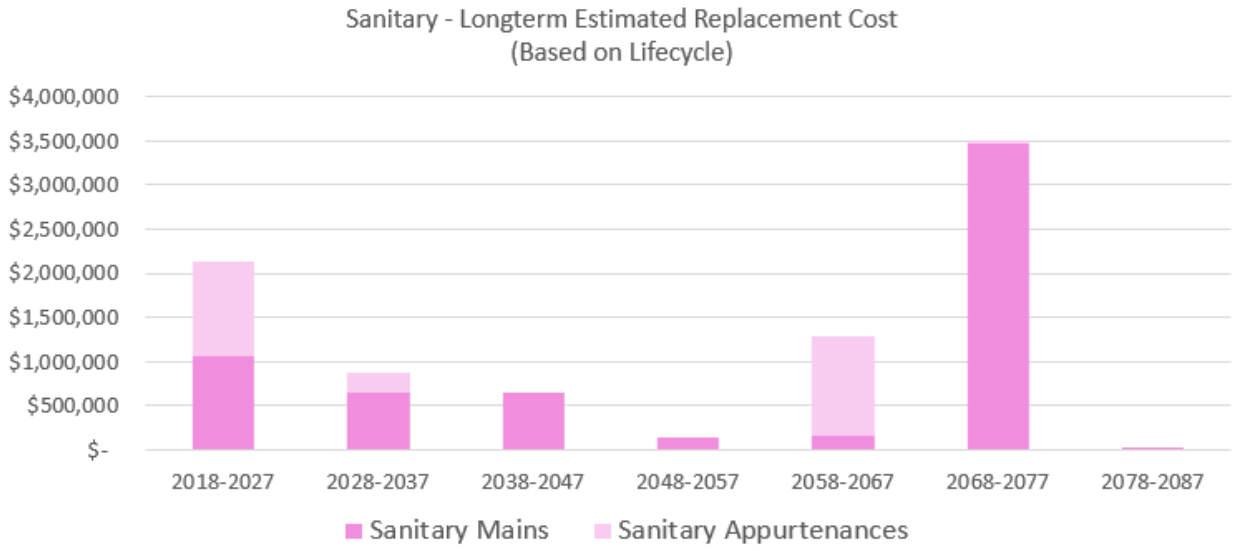
5.3.2 Inventory

Inventory		Replacement Value	Useful Lives (yrs)
Gravity (m)	15802	$ 5,384,550	50 - 75yrs
Forcemains (m)	1025	$ 558,000	35 - 35yrs
Manholes (ea.)	306	$ 1,377,000	45
Totals		$ 7,319,550	

The table below summarizes the estimated renewal costs for a 20-yr horizon based on lifecycle and linear deterioration curve, as well as the cost of reconstruction per meter of pipe.

5.3.3 Replacement Costs and Dates

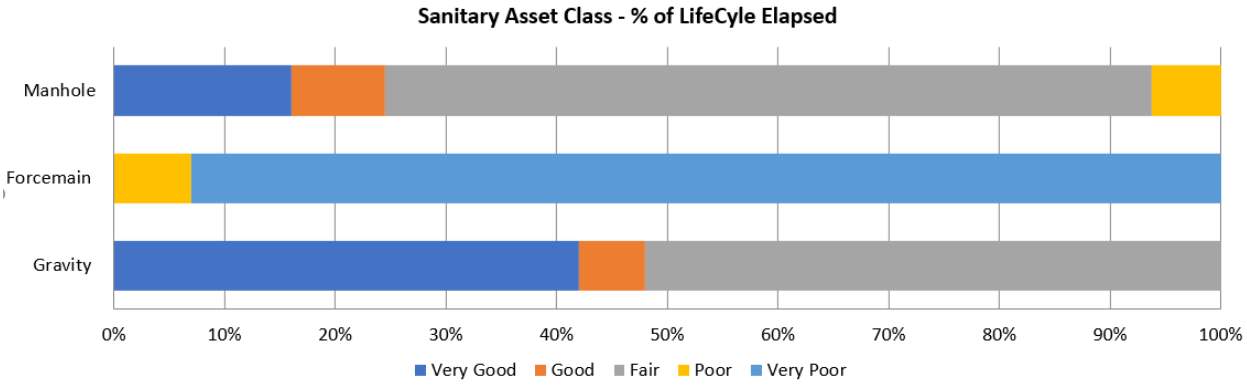
Sanitary Sewer Infrastructure	Estimated Life Expectancy	20 Year investment	Annual Average Investment (20yr)
Linear	35 - 75yrs	$ 1,714,150	$ 85,708
Manholes	45	$ 1,282,500	$ 64,125
Total		$ 2,996,600	$ 149,833



5.3.4 Age Assessment

The age of the infrastructure is plotted below along with the scoring chart. The pipes portion of the sanitary (gravity) system are shown to be in average condition, with the sections of forcemain significantly beyond the assigned lifecycle.

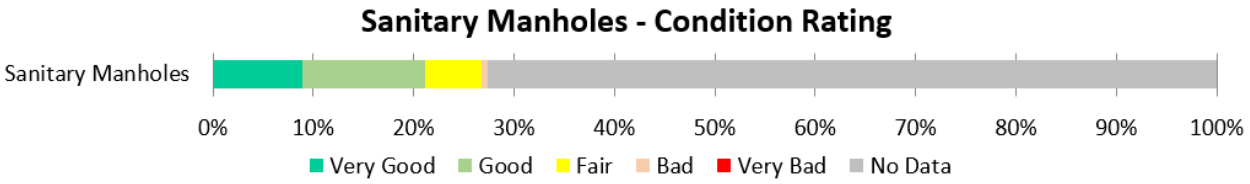
Rating	Description
Very Good	Not yet reached 85% of lifecycle
Good	Final 15% of lifecycle
Fair	Exceeded Lifecycle by max. 10%
Poor	Exceeded Lifecyle by between 10% and 20%
Very Poor	Exceeded Lifecyle by more than 20%



5.3.5 Condition Assessment

The condition assessment of the sanitary manholes was done in 2016/2017. Approximately one third of the manholes were assessed. The results of the manholes assessed were fairly positive, with a small percentage dipping down to a ranking of "Fair"

Grade	Summary	Physical Condition
1	Very Good	Asset as new or near new condition, only planned maintenance is required
2	Good	Asset showing initial signs of deterioration or minor damage that may affect performance. Minor maintenance required plus planned maintenance
3	Fair	Asset condition needs some attention but is still functioning. Significant maintenance required
4	Poor	Asset in poor condition or functioning poorly; action needed soon. Significant renewal/rehabilitation required
5	Very Poor	Asset in need of urgent attention or unserviceable and/or beyond rehabilitation

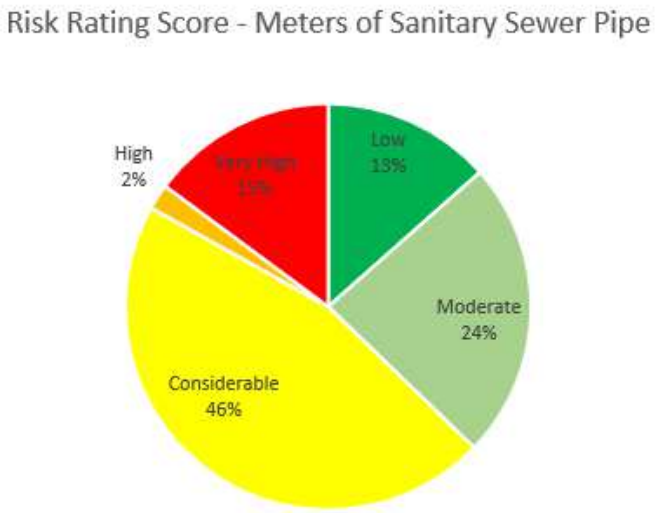


5.3.6 Risk Assessment

For the Sanitary Mains, Risk was taken as the product of Likelihood and Consequence. At this point, Likelihood was taken as a function of age, and Consequence was a function of how many users would be affected. Further breakdown of the two variables are summarized in the Asset Management Strategy. The scoring chart is reproduced below.

Risk Matrix Score		NAMS Scale
0-4	Low	1
5-9	Moderate	2
9-13	Considerable	3
15-19	High	4
20-25	Extreme	5

The majority of the sanitary mains are considered “Considerable” risk. This is in line with what was reflected in from the Age analysis and is consistent with the useful life assigned to the asset.



5.3.7 The Sanitary Sewer Replacement Priority Ranking

The table below summarizes the current priority ranking are based on the information currently available and is a function of Condition and Risk. Additional factors such as Performance and Capacity should be addressed as part the final ranking system. The Operations and Maintenance team should be consulted and their input addressed within the process for ranking.

Section of Sanitary Main	Length (m)	Estimated Cost.	Age	Priority Ranking
Non-Road - From Corner of Nootka & Maquinna To extent of ROW - Sanitary	291	$123,940	52	3.496
Non-Road - From West of Dogwood To S of Peppercorn -Sanitary	233	$112,679	52	3.496
Nootka - From Matchlee Dr. To Chamiss Cres. South -Sanitary	210	$101,073	52	3.496

5.3.8 Sanitary Sewer Conclusion and Recommendations

The analysis indicates that all manholes indicate that they have reached the end of their lifecycle. This seems overly harsh considering the results of the manhole condition assessments and that several repairs have been made to the Village's forcemain. It would be beneficial to communicate with the O&M team to get input on the need for manhole replacement. Additionally, install dates used for the sections of forcemain should be verified and updated to reflect the maintenance that was performed.

From the condition assessments that were performed on the sections of gravity pipe, it was worthwhile noting that all three efforts were performed in the same area. With few exceptions, it was only this part of the Village that was assessed. This could be an indication of a problematic or labor intensive area that may require additional attention and funding beyond the AM calculations performed in this report.

5.4 Storm

5.4.1 Executive Summary

Based on unit rates and calculated quantities, the total cost of replacement for the Villages Linear Storm system is approximately $7.0M. Long term forecasts, using the given lifecycles and install years indicate that the renewal cost of the system to be approximately $5.2M over the next 20 years. This equates to a normalized cost of $185K per year.

Condition assessments were performed for storm manholes in 2016/2017. The results of the roughly 15% that were assessed were fairly positive. No other condition assessments have been performed for this asset class. As such the vulnerability of the mains will be a function of Age, Material & Risk.

Current priority ranking are based on the information currently available of the variables noted above. Additional factors such as Performance and Capacity should be addressed as part the final ranking system. The Operations and Maintenance team should be consulted and their input addressed within the process for ranking.

Below is a summary of the inventory included in the Storm Asset Class

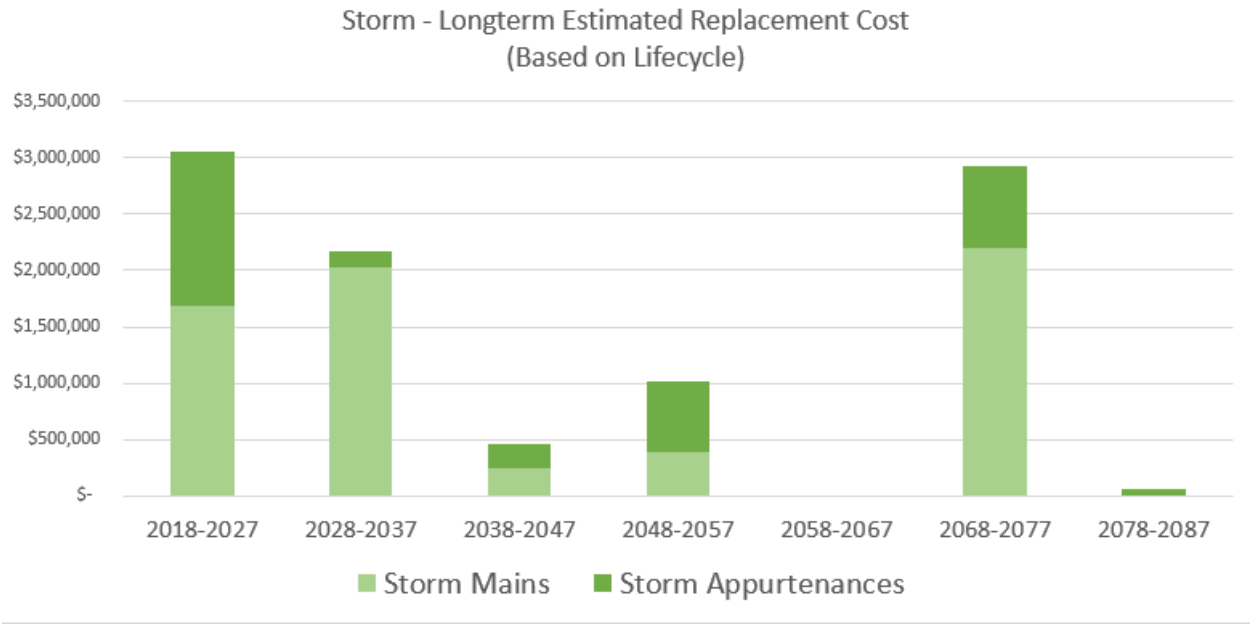
5.4.2 Inventory

Inventory	Quantity	Replacement Cost (Total)	Useful Life
Linear (m)	12216	$ 5,375,150	50 - 75 yrs
Manholes (ea.)	228	$ 1,026,000	50 yrs
Catch basins (ea.)	251	$ 627,500	30 yrs
Totals		$ 7,023,650	

5.4.3 Projected Replacement Costs

The table below summarizes the estimated renewal costs for a 20-yr horizon based on lifecycle and a linear deterioration curve, as well as the cost of reconstruction per meter of pipe.

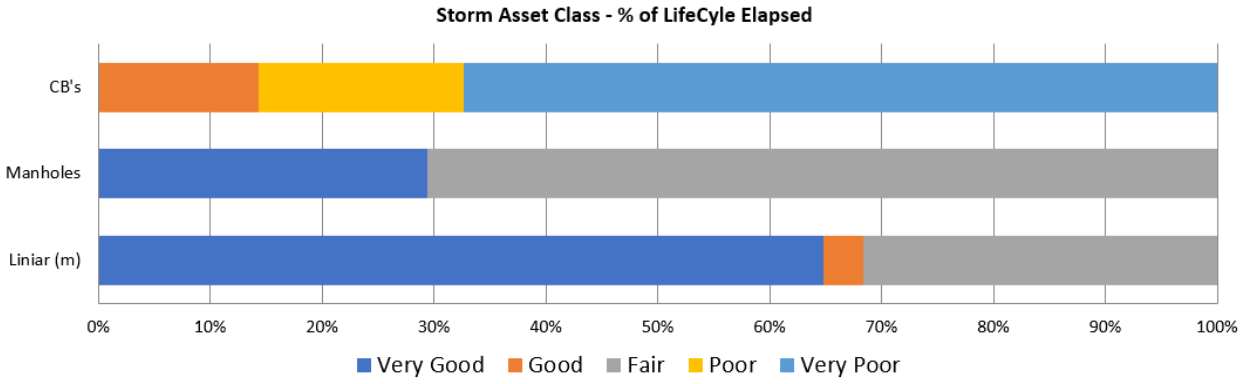
Strom Drainage Infrastructure	Expected remaining Life	20 Yr Investment	Average Annual Investment (20yr)
Linear	0-23yrs	$ 3,716,250	$ 185,813
Manholes	0-25yrs	$ 930,753	$ 46,538
CB's	0-3yrs	$ 569,247	$ 28,462
		$ 5,216,250	$ 260,813



5.4.4 Age Assessment

The age of the infrastructure is plotted below along with the scoring chart. Generally, the storm infrastructure is in satisfactory shape, with the CB's indicating they are coming to the end of their lifecycle.

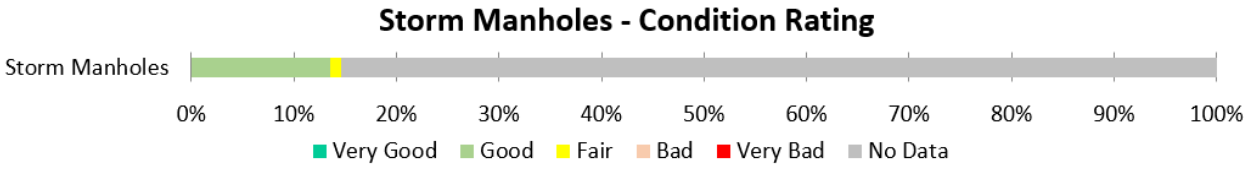
Rating	Description
Very Good	Not yet reached 85% of lifecycle
Good	Final 15% of lifecycle
Fair	Exceeded Lifecycle by max. 10%
Poor	Exceeded Lifecyle by between 10% and 20%
Very Poor	Exceeded Lifecyle by more than 20%



5.4.5 Condition Assessment

The condition assessment of the storm manholes was done in 2016/2017. Approximately 15% of the manholes were assessed. The results of the manholes assessed were positive.

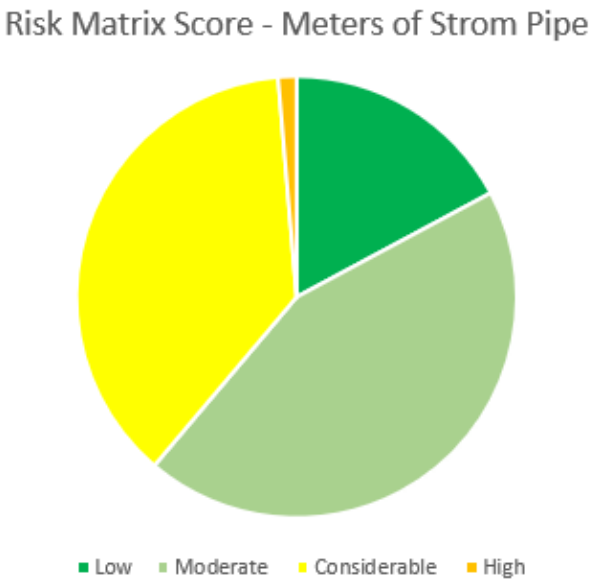
Grade	Summary	Physical Condition
1	Very Good	Asset as new or near new condition, only planned maintenance is required
2	Good	Asset showing initial signs of deterioration or minor damage that may affect performance. Minor maintenance required plus planned maintenance
3	Fair	Asset condition needs some attention but is still functioning. Significant maintenance required
4	Poor	Asset in poor condition or functioning poorly; action needed soon. Significant renewal/rehabilitation required
5	Very Poor	Asset in need of urgent attention or unserviceable and/or beyond rehabilitation



5.4.6 Risk Assessment

For the Storm Mains, Risk was taken as the product of Likelihood and Consequence. At this point, Likelihood was taken as a function of age, and Consequence was a function of how many users would be affected. Further breakdown of the two variables are summarized in the Asset Management Strategy. The scoring chart is reproduced below.

Risk Matrix Score		NAMS Scale
0-4	Low	1
5-9	Moderate	2
9-13	Considerable	3
15-19	High	4
20-25	Extreme	5



5.4.7 Storm Sewer Priority Replacement

The table below summarizes the current priority ranking are based on the information currently available and is a function of Condition and Risk. Additional factors such as Performance and Capacity should be addressed as part the final ranking system. The Operations and Maintenance team should be consulted and their input addressed within the process for ranking.

Section of Storm Main	Length (m)	Estimated Replacement Cost	Age	Priority Ranking
Nootka - From Chamiss Cres. South To Matchlee Dr. - Storm	164	$97,126	51	2.836
Highway - From N. Nootka To Scout Lake Road - Storm	293	$203,683	51	2.224
Non-Road - From cross footprint To Between Dogwood & Minmkish - Storm	165	$78,334	51	2.224

5.4.8 Storm Sewer Conclusion and Recommendation

Indications are that the system is performing relatively well. Public Works should recorded problematic areas and nuisance flooding. A review of lifecycle values used for the analysis should be checked for veracity.