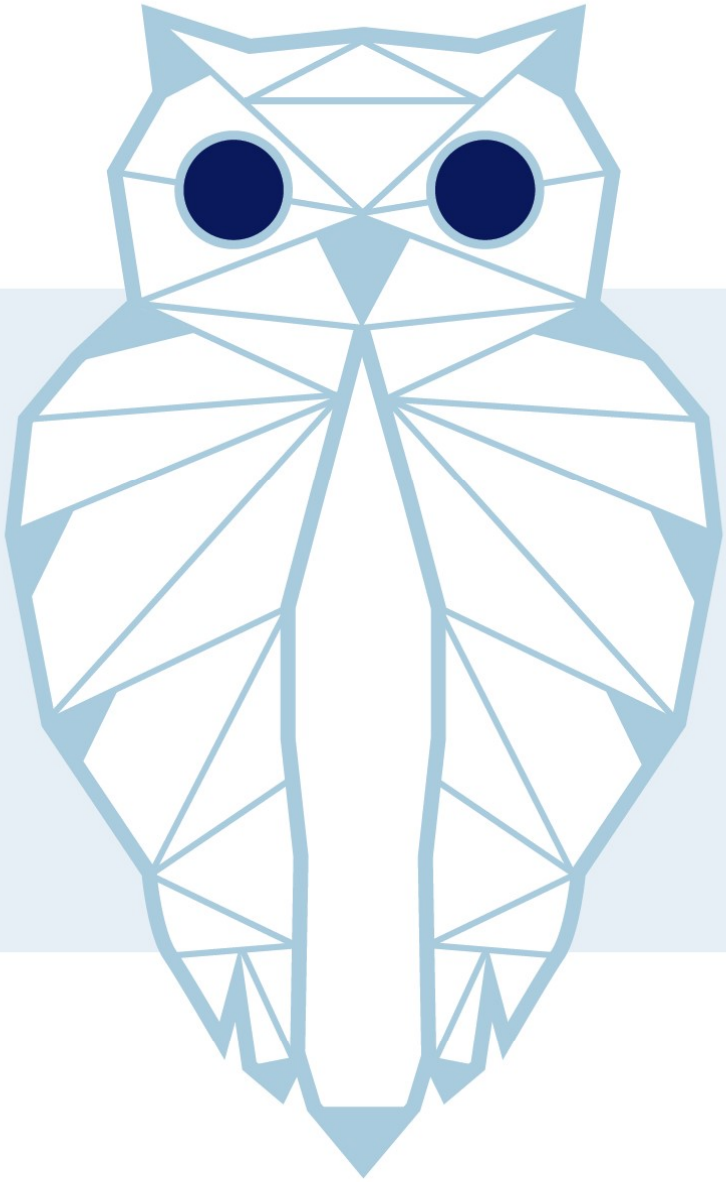
Local Government Association of Queensland
Asset Management Maturity Assessment

November 2019



MINERVA
INSIGHT THROUGH INNOVATION

DETECTION SERVICES
PIPELINE INSPECTION AND ANALYSIS

M023-R001 -1

Executive Summary

Queensland's 77 local governments are collectively responsible for providing water and sewerage services to over 4.3 million people across 370 communities. Whilst being service focussed, the councils are asset dependant with over 42,000 km of water main, 33,500 km of sewer pipes, and 666 water and sewerage treatment assets required to maintain service to customers (QWRAP Annual Report 2018).

Failure to adequately maintain these assets can have far reaching consequences for the water utility and the customers and communities they serve, with the potential to cause significant supply interruption, physical damage, societal disruption and economic impact when they fail.

Throughout Queensland, local governments have historically dealt with a diverse range of geographical, topographical and climatic challenges. However, in addition to these, several emerging issues are increasing the demands on local government resources. The need to balance the impact of rapid population growth, climate change and the infrastructure cliff with the ever-more challenging expectations of customers and regulators, is making the optimisation of asset operation and maintenance more important than ever before.

Successfully implementing effective asset management requires investment in new systems and data as well as a degree of specialist knowledge and expertise. While Queensland's larger water utilities are adequately financed and resourced to meet this challenge, there are a large number of smaller councils where funding and specialist asset management capability is limited. Although LGAQ and QWRAP work to support water and waste water related collaboration and knowledge sharing across Queensland's local governments, there is concern that the current asset management approach has the potential to result in sub-optimal outcomes for customers living in rural communities. It was also felt by stakeholders that a greater degree of structured collaboration and consistency of approach could result in state-wide improvements in overall quality and efficiency of asset management related activities and investment.

In March 2019, LGAQ commissioned DS Minerva to undertake a structured assessment of the Queensland local government approach to water and waste water infrastructure asset management, with the aim of providing a meaningful gap analysis and maturity assessment which could be used to enhance overall asset management capability, consistency of approach, and improve overall water and waste water related outcomes across the state.

DS Minerva's standard Strategic Review and Scoping Study (SRSS) is a comprehensive, structured and independent review of a specific water utilities asset management practices and future objectives in relation to water and waste water assets, with gap analysis employed to develop a roadmap for achieving the objectives in a way which is effective, economical and sustainable.

As this assessment covers a large number of councils, as opposed to a single utility, a bespoke questionnaire has been developed with LGAQ and QWRAP which consists of approximately 40 multiple-choice questions in relation to management of above and below ground water and waste water assets. The questions are grouped under the following headings:

1. **Strategic Planning** – Alignment of corporate drivers, strategies & policies with operation and maintenance of relevant assets
2. **Asset Criticality Profiling** – Activities undertaken in the Analysis of Water Service Impact, Third Party Damage Impact and Economic impact resulting from the failure of relevant assets.
3. **Asset Health Profiling** – Activities undertaken to determine the integrity of assets in relation to the likelihood of failure, remaining service life and operational performance capability.
4. **Investment Planning & Delivery** – An organisations approach to Operational, Capital, Enhancement and Integrated Totex in relation to relevant assets.
5. **Asset Operation & Reactive Maintenance** – Activities undertaken in relation to Response & Recovery, Contingency Planning and Strategic Monitoring in relation to relevant assets.
6. **Data Collection and Management** – Includes utilisation, integration and management of data and information relevant to planning, operation and maintenance of relevant assets.

The questionnaire was then presented to councils in a cloud-base survey form, with the results being subject to structured analysis which has resulted in the conclusions and recommendations as presented within this report. Of Queensland's 77 local councils, 54 were invited to participate in the survey, of which 34 submitted a response.

The data collected through this process has provided a range of useful insights into how water and waste water assets are currently managed within the state of Queensland, highlighting several key issues and opportunities. It should however be noted that the analysis and recommendations included within this report are based solely on the results of the questionnaire, which is representative of the Councils' 'own' view of their asset management system and processes. No additional council specific data or documentation was reviewed in the compilation of this report.

Several key themes were identified through analysis of the response data. The most significant of these was the general disparity and inconsistency across the state in relation to the sophistication and completeness of asset management systems, with the systems developed by some councils being relatively primitive, while other authorities demonstrate a very high-level of maturity and sophistication. It was also noted that while most councils are actively pursuing a more sophisticated proactive approach to risk-based asset management, and have at least some highly capable staff, at least 50% of councils do not have the number of such staff necessary to fulfil this objective. General consistency was also identified in the way in which councils prioritise asset class investment regardless of size or region, with management of above-ground assets being consistently prioritised over in-ground infrastructure. This reinforces the risks highlighted by the Research Report 5.1 (Infrastructure Cliff) produced by the Queensland Water Regional Alliance Programme (QWRAP), which emphasised historic underinvestment in in-ground water and waste water assets, and the potential impacts this may have on water and waste water services in the future.

A number of other key gaps were also identified within specific assessment categories:

STRATEGIC PLANNING

Effective and defensible asset management requires a structured, coherent and logical framework is in place where framework process and process elements provide a clear line-of-sight from controls and influences through to the outcomes delivered for both customers and stakeholders

The survey found that corporate level asset management policies and strategies appear to be in place and well maintained for most councils, however this was less true at asset class level, with the majority of councils having gaps in relation to asset criticality frameworks and strategies for one or more asset class.

In relation to the way in which councils drive investment decisions, the requirements of state and national governments were robustly accounted for in the decision-making process of most councils, however customer preferences did not appear to be a primary driver, with 50% of respondents not undertaking any form of structured customer research and analysis.

CONSEQUENSE OF FAILURE

A risk-based asset management system requires a structured, comprehensive and quantitative approach to the understanding consequence of asset failure. The system should account for service impact, third party impact and cost, and should utilise robust data, analysis and validation.

Whilst service impact assessments are carried out to some degree by most councils for most asset classes, damage impact and cost of failure analysis was less prevalent, with 44% of respondents not undertaking any form of property damage or societal impact assessment, and most having no cost of failure model.

The quality and completeness of consequence of failure data was also identified as an issue with 50% of councils stating that their current data set was inadequate, with a further 50% of councils again stating that they did not have enough specialist asset management staff to address this issue.

LIKELIHOOD OF FAILURE

Accurately understanding asset integrity is an essential component of risk-based asset management, with the information used to calculate risk and prioritise intervention. To undertake likelihood analysis effectively requires a strategic approach which combines multiple data gathering and analytical activities with overarching integration and analysis.

Approximately a third of respondents employ a likelihood of failure model for all asset classes. This increased to between 50-60% for remaining service life models. In most cases, councils stated that a combination of field, desktop and laboratory analysis was undertaken to establish likelihood of failure, however only a small number were found to undertake advanced analysis, with the resulting data not being used to calibrate deterioration models for any asset class.

The disparity between above-ground and in-ground assets (both water and waste water infrastructure) was particularly prevalent in relation to condition assessment, with the majority of councils undertaking condition assessment on less than 10% of their below-ground assets, and a significant number of Council's having little or no data at all.

INVESTMENT PLANNING

The accurate definition and prioritisation of risk-based interventions is necessary to optimise the performance and reliability of water and waste water assets.

While the vast majority of respondents have discreet planning procedures in place for the development of operational, capital and enhancement portfolios, only 19% have, and consistently utilise, an integrated Totex planning framework.

Of the planning procedures that are in place, the majority incorporate some form of cost-benefit analysis, with less than 50% enabling scenario modelling, and only 20%-30% supporting sensitivity analysis.

OPERATION & MAINTENANCE

Robust and effective operation monitoring and maintenance of infrastructure assets is essential to the overall performance of the organisation.

While most respondents carry out regular proactive maintenance to some degree across all asset classes, above ground assets were found to receive more attention than below ground assets. Valves and pipe bridges/crossings were identified as areas where the sophistication and frequency of maintenance could be improved.

Although highly beneficial in improving the reliability and performance of water services, the use of critical asset monitoring was noticeably limited.

DATA MANAGEMENT

Complete, accurate and well managed asset data is fundamental to an organisations ability to undertake effective asset management.

Councils responded across all asset classes with regards to quality, completeness and spatial accuracy, with GIS and water quality applications being the most frequently maintained and up to date, however, key data gaps were identified in relation to both consequence and likelihood of failure.

Councils also stated that investment prioritisation software and field data software were their poorest applications for maintenance.

It is possible that the disparity in asset management approach can be at least partly explained by the current institutional model, with water and waste water services disseminated across many individual councils, which can have highly dispersed communities with varying priorities, populations, resources and availability of expertise. A particularly important factor is the large number of small isolated communities, with two thirds of potable schemes servicing towns with fewer than 1000 residents, and 50% servicing fewer than 500 people. It was also considered that the current regulatory model may not provide the direction and stimulus necessary to drive the continual improvement and consistency of approach needed to fully realise the benefits of effective asset management.

LGAQ and the Queensland Water Directorate (QWD) attempt to address some of these challenges by providing a state-wide platform for research, collaboration and knowledge sharing.

The most recent LGAQ Strategy document provides a high-level plan for the new initiatives that will be rolled out across the Association. Whilst there are no specific initiatives detailed within the Strategy, it does offer an insight into how LGAQ plan to align member Councils through similar asset management objectives and technological approaches. The acknowledgement that Councils should align their objectives and policies will lead to improvements in asset performance, and ultimately improve customer service, confidence and satisfaction.

Given the large number of individual councils involved, it would be both costly and impractical to use the data generated by this survey to attempt to support councils in addressing their needs on an individual basis. Whilst several opportunities for improvement have been identified at management system component level, development of key centralised shared support initiatives would be more effective and would provide greater value, with the information form this survey used to prioritise development and delivery.

The following initiatives are considered to offer the greatest overall benefit for both local council and state:

State-wide Asset Management Framework & Delivery Support Platform (together, the 'Shared Asset Management System'): The development of shared, state-wide template-based asset management framework and delivery support platform, incorporating best-practice approach for all aspects of asset operation and maintenance, would provide a range of substantial benefits. However, it is acknowledged that there are several practical and political challenges which would need to be overcome for this to be delivered. Development of such a platform would require the co-operation, commitment and agreement of many councils as well as an up-front and ongoing technical and financial contribution, with some councils realising greater benefits than others. Consideration should be given to the following when contemplating development of such a system:

- The system would need to balance the need for consistency, structure and governance with the requirement for councils to maintain overall independence, autonomy and accountability within QLD's current institutional urban water services model.
- The system should account for the management of all water and waste water assets from source to tap and from bath to bay.
- It should account for the full range of QLD's water service scenarios, from dense urban to ultra-rural, and from large well-resourced and data rich water utilities to small councils with limited data and staffing.
- It should also account for localised nuances in relation to risk and prioritisation.

Whilst development of such a system would be ambitious, the development of content and functionality could be scoped and phased appropriately over time. Were this to be undertaken it is envisaged that the following benefits would be realised:

- By aligning methodologies, processes and data governance, risks can be comparatively ranked throughout the state, providing an asset register that outputs consequence and likelihood scoring using a consistent methodology. Regions, Councils and individual assets can then be easily classified and prioritised based on their scores, and intervention and support targeted in an appropriate and defensible manner.
- Implementation of the system would have the potential to reduce the burden on existing budgets and resources by providing standard templates for data models and data capture, as well as providing a degree of automated analysis and reporting
- The standard of asset management approach would be increased across the state, resulting in improved strategic outcomes for councils and service outcomes for customers.
- Creation of asset operation and risk profiles in a standard format would improve the ability to undertake regional and state-wide strategy and resilience planning.
- Several of the efficiencies and technical benefits of being part of a larger regional body would be realised without the need for formal aggregation.

Development of the framework and delivery support platform would require specialist skills and expertise. There are several highly skilled and experienced asset management professionals currently working within Queensland's Water authorities who have already developed and implemented a number of sophisticated asset management systems. The collaboration of a select group of these individuals, together with specialist consultancy support to develop a QLD specific best practice methodology, would result in the most effective outcome.

Whilst the majority of respondents agreed that there would be benefit in having access to such a platform, the majority of respondents also answered that they would be unwilling to pay for it. Such an initiative may require a compromise funding model with state subsidisation for development of the system with a small means-based ongoing maintenance subscription paid by local authorities.

State-wide Asset Management Working Group: The results of the questionnaire highlight a significant level of interest in state-wide infrastructure initiatives. Further collaboration across the state would greatly benefit how all assets are managed, maintained and renewed, whilst improving levels of service and customer satisfaction. Although several formal collaborations between Councils are currently facilitated through QWRAP, it is not known at what level of detail these initiatives operate at. In light of this, it is recommended that a state-wide working group is created that focusses on which initiatives to develop further as part of an overall state management process and how to develop them in a coordinated manner. In particular, customer research, consequence of failure, asset health and asset management process are areas which Councils feel they would benefit from having state-wide guidance or collaboration.

Shared Strategic Services Resource: It is evident from the survey that the variation in responses can be linked to the large differences in Council geographical area, population, and the number and level of specialist staff available. For several of the smaller and more remote councils, employing specialist water and sewer asset management professionals is impractical in terms of both cost and availability. As a result, councils may either rely on expensive consultancy support or defer certain asset management activities. Establishment of a central team of specialist water and sewer asset management professionals to support these councils in maintaining their essential water and sewer assets, would result in benefits for not only the individual councils but collectively for QLD's rural communities. Economy of scale and the implementation of consistent, high-quality asset management practices would improve outcomes for customers while reducing the burden on existing council resources.

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Rev No	**Date**	**Description**	**Author(s)**	**Reviewed**	**Authorised**
01		Draft for Comment	RF, ER, GW	AS	RF

Related Documents		
No.	**Name**	**Format**
1	Draft Questionnaire v1.0	Word

CONTENTS

Figures

Tables

Glossary of Terms		
No.	**Name**	**Description**
1	RCA	Root Cause Analysis
2	I&T	Inspection & Testing
3	TOTEX	Total expenditure including both OPEX and CAPEX
4	LGAQ	Local Government Association of Queensland
5	MDM	Master Data Management
6	EAMS	Enterprise Asset Management Software
7	GIS	Geographical Information System
8	QWRAP	Queensland Water Regional Alliance Program
9	QLD	Queensland
10	SWIM	State-wide Water Information Management
11	SRSS	Strategic Review and Scoping Study

1 INTRODUCTION

1.1 BACKGROUND

Queensland's 77 local governments are collectively responsible for providing water and sewerage services to over 4.3 million people across 370 communities. Whilst being service focussed, the councils are asset dependant with over 42,000 km of water main, 33,500 km of sewer pipes, and 666 water and sewerage treatment assets required to maintain service to customers (QWRAP Annual Report 2018).

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Successfully implementing effective asset management requires investment in new systems and data as well as a degree of specialist knowledge and expertise. While Queensland's larger water utilities are adequately financed and resourced to meet this challenge, there are a large number of smaller councils where funding and specialist asset management capability is limited. Although LGAQ and QWRAP work to support water and waste water related collaboration and knowledge sharing across Queensland's local governments, there is concern that the current state-level asset management approach has the potential to result in sub-optimal outcomes for customers living in rural communities. It was also felt by stakeholders that a greater degree of collaboration and consistency of approach could result in state-wide improvements in overall quality and efficiency of asset management, related activities and investment.

In March 2019, LGAQ commissioned DS Minerva to undertake a structured assessment of the Queensland local government approach to water and waste water infrastructure asset management, with the aim of providing a meaningful maturity assessment and gap analysis which could be used to enhance overall asset management capability, consistency of approach, and improve overall water and waste water related outcomes across Queensland.

1.2 PROJECT SCOPE

DS Minerva's standard Strategic Review and Scoping Study (SRSS) is a comprehensive, structured and independent review of a specific water utilities asset management practices and future objectives in relation to water and waste water assets, with gap analysis employed to develop a roadmap for achieving the objectives in a way which is effective, economical and sustainable.

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The questionnaire was then presented to councils in a cloud-base survey form, with the results being subject to structured analysis which has resulted in the conclusions and recommendations as presented within this report.

1.3 QUESTIONNAIRE FORMAT

The questionnaire was made available to Councils through the online Survey Monkey platform. This allowed a variety of different question types to be displayed, whilst also allowing Councils to add text in freely if they felt that further information was required. Whilst Survey Monkey outputs a summary of each question, including charts, it does not cleanse or analysis any of the data. As such, a significant amount of cleansing was undertaken on the final extract to reclassify the data, including removing duplicate Councils and blank entries. The response rate and duplicate entries are discussed further in the Results section.

The questionnaire can be found as a supplementary document.

1.4 RESULTS FORMAT & METHODOLOGY

The aggregate results have been created for each Council by accumulating the scores for each question. Each answer within every question was assigned an individual score with the total used to rank the Councils into High, Intermediate and Low categories. For example, a question with an answer of "Yes – Advanced" would score 3, whereas an answer of "No" would score 0.5. Responses with "Don't know" and blank responses were assigned 0 points to provide insight into Councils that may have poor knowledge of their asset management systems and processes, and therefore performing worse than those that have a clear "Yes" or "No" answer.

The scoring categories were assigned as a percentage of the total possible score:

- High - =>70%
- Intermediate - =>45 & <70%
- Low - =>10% & <45%
- Incomplete - <10%

Each section has been split into the 4 assets categories; above-ground water, in-ground water, above-ground sewer and in-ground sewer. An additional information section has been added to sections that have questions that may not be asset specific. Within each of these, results have been aggregated and summarised. A recommendations section closes each section. A summary of conclusions and recommended next steps closes the report.

2 RESULTS

This section presents the results of each of the 8 sections from the questionnaire. Where applicable, these are summarised based on results for the four asset classes; above-ground water, in-ground water, above-ground sewerage and in-ground sewerage. Additional information captured within each of the sections is also summarised.

Above-ground water assets may include:

- Water Treatment Works
- Pumping Station
- Service Reservoirs
- Break Pressure Tanks
- Pipe Bridges
- Desalination Plants

In-ground water assets may include:

- Buried pipelines (bulk transfer and reticulation)
- Buried assets, such as valves and hydrants

Above-ground sewer assets may include:

- Waste Water Treatment Works
- Sewage Pumping Stations

In-ground sewer assets may include:

- Buried pipelines (sewers and other collection systems)
- Chambers
- Manholes

2.1 COUNCIL ATTRIBUTES

2.1.1 OVERVIEW

Of Queensland's 77 local councils, 54 were invited to participate in the survey, with 34 choosing to submit a response. Of those who took part, there were several Councils that submitted multiple responses. Townsville Council submitted 3 questionnaires, and Douglas Shire and Livingstone Councils submitted 2 questionnaires each. For Douglas Shire, the responses from response ID 10876569902 were included as it was fully complete. For Livingstone Council, the responses were different for the two that were submitted. However, the response ID 10873938608 was fully complete so was included; the other submission was removed. For Townsville Council, the most complete questionnaire was included with Response ID 10859399813. The other two submissions were removed. Mount Isa City Council also responded with two submissions, which were undertaken by two different people. The most complete submission was used.

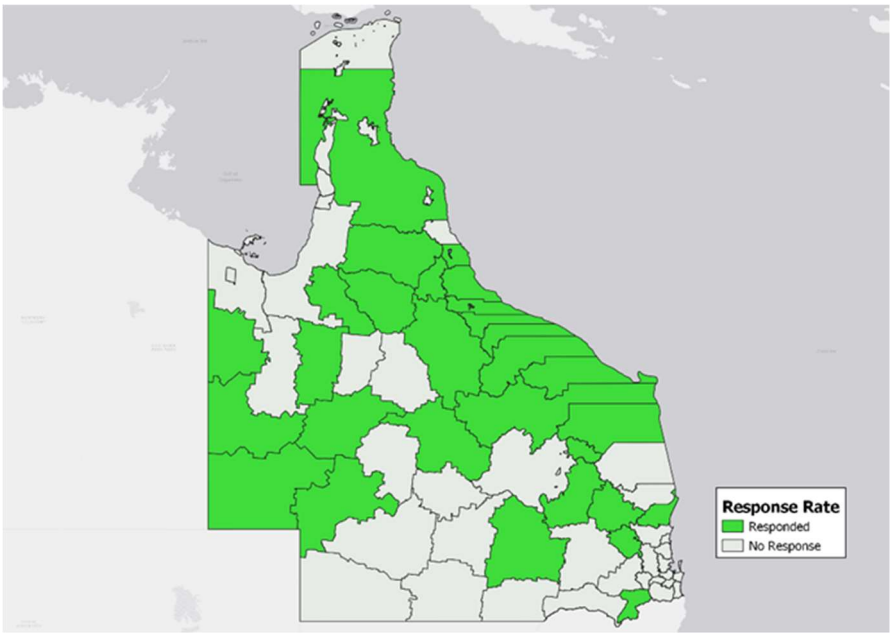


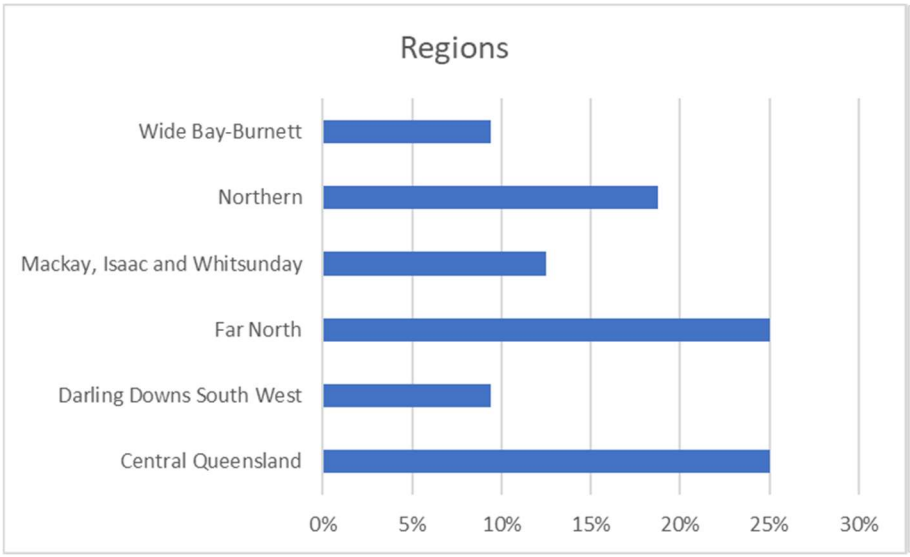
Figure 1 – Response Overview

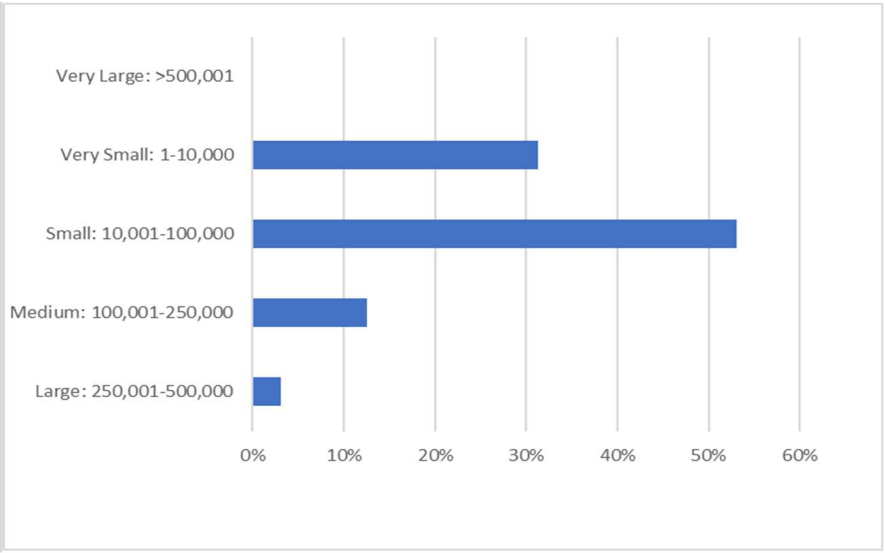
Furthermore, 12 respondents filled out less than 11% of the questionnaire. This percentage includes those questions that were used to collect individual council attributes. Unfortunately, this highlights that a number of councils did not complete anything past the initial contact and general information sections. A total of 34 councils initiated the questionnaire, 86% recorded their council name. These were:

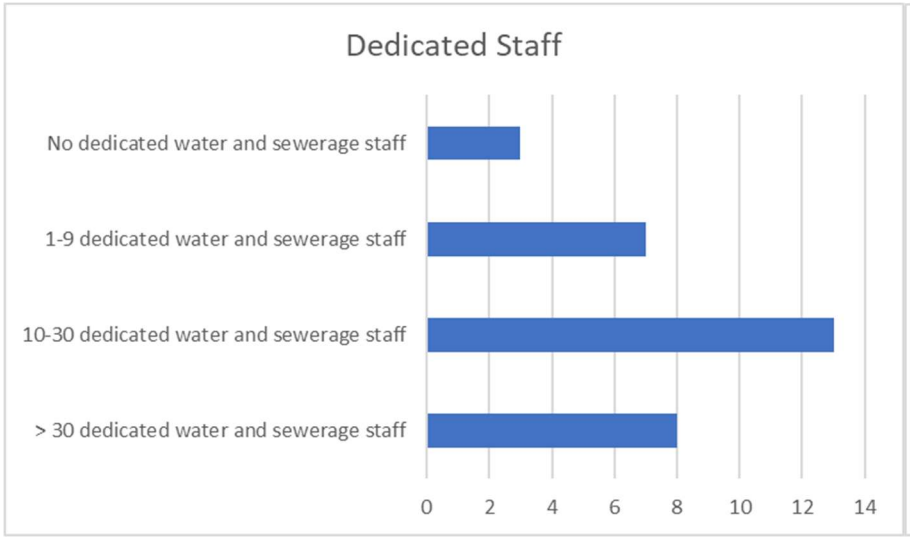
ID	Council	Introduction	Strategic Planning	Consequence of Failure	Likelihood of Failure	Investment Planning	O & M	DC&M	LGAQ
10879179649	<Unknown 1>	0%	8%	0%	0%	0%	0%	0%	0%
10874204548	<Unknown 2>	0%	8%	0%	0%	0%	0%	0%	0%
10832188624	<Unknown 3>	50%	8%	0%	0%	0%	0%	0%	0%
10832131709	<Unknown 4>	0%	8%	0%	0%	0%	0%	0%	0%
10866627997	Banana Shire Council	100%	100%	83%	86%	81%	100%	100%	100%
10859328813	Barcaldine Regional Council	100%	8%	0%	0%	0%	0%	0%	0%
10861094265	Barcoo Shire Council	100%	8%	0%	0%	0%	0%	0%	0%
10894265801	Boulia Shire Council	100%	68%	53%	11%	4%	8%	0%	43%
10861532436	Burdekin Shire Council	100%	100%	67%	70%	69%	100%	100%	100%
10874155125	Cairns Regional Council	100%	8%	0%	0%	0%	0%	0%	0%
10861285191	Cassowary Coast Regional Council	100%	55%	0%	0%	0%	0%	0%	0%
10851894477	Charters Towers Regional Council	100%	8%	0%	0%	0%	0%	0%	0%
10874002099	Cook Shire Council	100%	8%	0%	0%	0%	0%	0%	0%
10851709379	Croydon Shire Council	100%	63%	49%	50%	54%	50%	75%	79%
10861435490	Diamantina Shire Council	100%	96%	83%	100%	84%	100%	100%	100%
10876569902	Douglas Shire Council	100%	100%	91%	96%	100%	100%	100%	100%
10858923874	Etheridge Shire Council	100%	95%	86%	96%	100%	100%	67%	50%
10861736079	Fraser Coast Regional Council	100%	99%	0%	0%	0%	0%	0%	0%
10861694821	Hinchinbrook Shire Council	100%	100%	81%	88%	82%	75%	100%	100%
10861432356	Isaac Regional Council	100%	8%	0%	0%	0%	0%	0%	0%
10873938608	Livingstone Shire Council	100%	100%	97%	99%	100%	100%	100%	100%
10858926170	Mackay Regional Council	100%	98%	83%	96%	100%	100%	100%	100%
10861602676	Maranoa Regional Council	100%	100%	89%	100%	100%	100%	100%	100%
10874053011	Mareeba Shire Council	100%	96%	83%	82%	83%	100%	100%	100%
10874885704	McKinlay Shire Council	100%	100%	83%	91%	100%	100%	100%	100%
10858038038	Mount Isa City Council	75%	100%	86%	100%	100%	100%	100%	50%
10859127513	North Burnett Regional Council	100%	100%	83%	96%	92%	100%	100%	100%
10833065140	Rockhampton Regional Council	100%	46%	0%	0%	0%	6%	0%	0%
10866470294	South Burnett Regional Council	100%	95%	80%	66%	65%	59%	83%	0%
10866279192	Southern Downs Regional Council	100%	8%	0%	0%	0%	0%	0%	0%
10872997499	Tablelands Regional Council	100%	100%	83%	88%	100%	100%	100%	100%
10859399813	Townsville City Council	100%	100%	83%	96%	100%	100%	100%	100%
10851897162	Whitsunday Regional Council	100%	8%	0%	0%	0%	0%	0%	0%
10869733163	Winton Shire Council	100%	81%	0%	0%	0%	0%	0%	0%

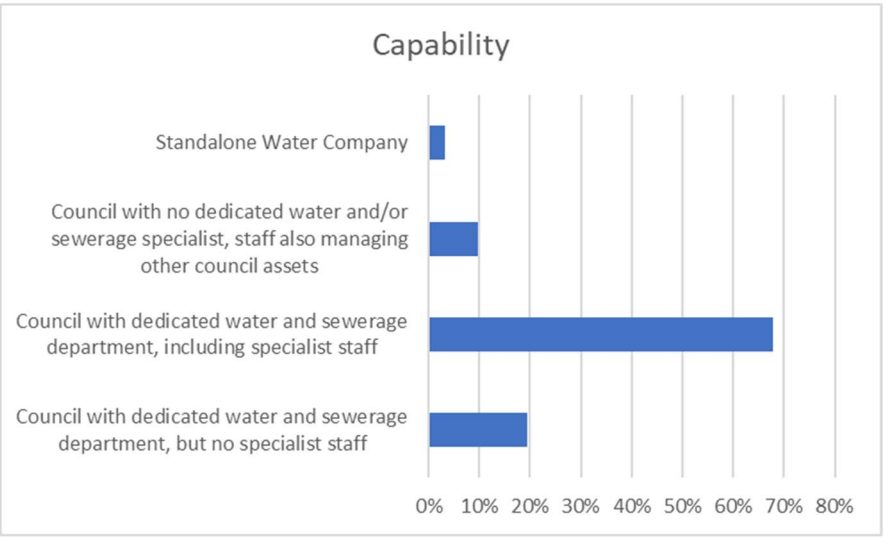
Table 1 - Survey Completion

Councils from the Far North and Central Queensland regions provided the most responses. The majority of Councils had a population of between 10,000 and 100,000 people. No respondents had a customer supply population of greater than 500,000. Both of these questions had a 91% completion rate based on initiated questionnaires. Almost 70% of Councils stated they had a dedicated water and sewerage department with specialist staff. Three Councils replied stating they had no dedicated water and sewerage staff. The response rate for both of these questions was 89% for initiated questionnaires.


Regions
Wide Bay-Burnett
Northern
Mackay, Isaac and Whitsunday
Far North
Darling Downs South West
Central Queensland
0%
5%
10%
15%
20%
25%
30%


Very Large: >500,001
Very Small: 1-10,000
Small: 10,001-100,000
Medium: 100,001-250,000
Large: 250,001-500,000
0%
10%
20%
30%
40%
50%
60%


Dedicated Staff
No dedicated water and sewerage staff
1-9 dedicated water and sewerage staff
10-30 dedicated water and sewerage staff
> 30 dedicated water and sewerage staff
0
2
4
6
8
10
12
14


Capability
Standalone Water Company
Council with no dedicated water and/or sewerage specialist, staff also managing other council assets
Council with dedicated water and sewerage department, including specialist staff
Council with dedicated water and sewerage department, but no specialist staff
0%
10%
20%
30%
40%
50%
60%
70%
80%

2.2 STRATEGIC PLANNING

For the purposes of this assessment, Strategic Planning refers to high-level strategies, policies and management systems, and how these are directly applied to the management of assets. This assessment aims to establish whether a structured, coherent and logical framework is in place where framework process and process elements provide a clear line-of-sight from controls and influences through to the outcomes delivered for both customers and stakeholders.

2.2.1 ABOVE-GROUND WATER ASSETS

2.2.1.1 AGGREGATE RESULTS

The total response rate across all submissions within the above-ground water assets for Strategic Planning was 60%. The percentage completed varied between individual questions. If the incomplete questionnaires are discounted, the analysis reveals that 15% of the councils have a relative high score with regards to their strategic planning. A further 38% performed to an intermediate level. The following three pages present the geographical distribution of Councils and their overall score for above-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Strategic Planning section for Above-ground Water Assets is also presented.

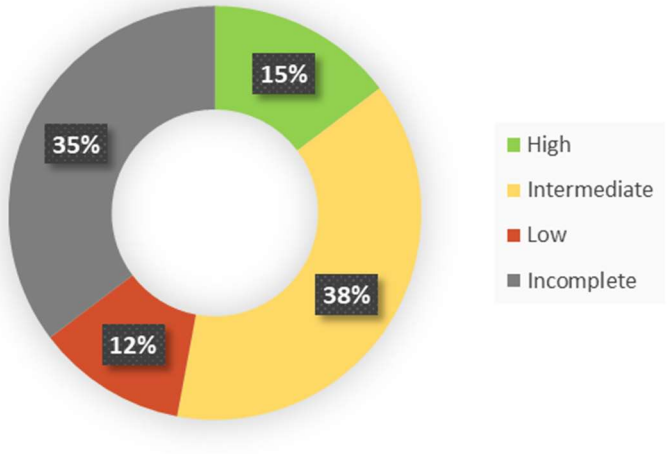


Figure 2 – Overall Strategic Planning Score – Above-ground Water Assets

2.2.1.2 COMMENTS

Although a higher completion and response rate would have been beneficial in quantifying council strategic direction, the results do provide some valuable insight and a basis for recommendation:

1. **Staff Capability** - Councils are highly likely to have capable staff that are specialised in the field of asset management for above-ground assets. However, this is somewhat contradicted with the responses in terms of adequate staff to fulfil the asset management activities, with only 50% answering in a positive manner. This suggests that dedicated asset management teams may be stretched or over-reliant on a small number of qualified staff within each Council.

2. **Risk Appetite** – There is a positive result in terms of defined levels of risk threshold Councils are willing to tolerate with regards to water supply interruption, environmental impact and damage impact. However, the cost of failure is noticeably less well defined. These results apply to both above and below groundwater assets.

3. **Customer Engagement** - In general terms, the results highlight only a limited number of customer engagement options are utilised to determine Council level of service, with customer forums being the most widely used. However, on further analysis, only 6 Councils have no customer engagement methods whatsoever, with the remaining 24 Councils demonstrating at least one, if not multiple methods of engagement. Four Councils use 3 or more methods to determine customer engagement.

Council responses indicate the data captured in these surveys is used primarily to help inform Council strategic direction and levels of service. There appears to be less focus on informing risk thresholds and investment planning, with no data captured from customers used to inform risk thresholds in a formal manner. The free text option provided a number of insights, including that most planning was not done via customer preferences but on cost and service impact. In some cases, corporate plans were described as incorporating customer preferences.

In contrast, staff engagement in setting levels of services and in asset management decisions was extremely positive. Almost 80% of Councils that completed the question returned a positive response.

4. **Strategy Documentation** - Maintenance of strategic documents such as corporate business plans, long term strategic direction and long-term financial plans are all generally, frequently well maintained. Only a small percentage of respondents have answered negatively to this question.

Maintenance of risk and asset documents, such as asset management strategy, asset criticality framework and asset management plans are less well maintained. There were significant positive responses to asset management strategy and strategic asset management documents, but asset criticality frameworks and strategies for specific assets were considerably less well maintained.

5. **QEMS** - There is a largely positive response to the application of the Council's Quality and Environmental Management Systems in terms of managing above-ground water assets. Quality Management Systems receive slightly more positive responses than Environmental Management Systems.

6. **External Collaboration** - Generally, Councils have responded positively to working with external agencies in the event of an emergency affecting above-ground assets. Over 80% of Councils work with external agencies in terms of regular liaison and for developing document plans. However, only approximately 50% of Councils plan to test mock incidents and trials with external agencies.

2.2.2 IN-GROUND WATER ASSETS

2.2.2.1 AGGREGATE RESULTS

The total response rate across all submissions within the in-ground water assets for Strategic Planning was 59%. The percentage completed varied between individual questions. The results mirror the responses for above-ground assets. The analysis reveals that 18% of the councils have a relative high score with regards to their strategic planning. A further 35% performed to an intermediate level. The following three pages present the geographical distribution of Councils and their overall score for in-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Strategic Planning section for In-ground Water Assets is also presented.

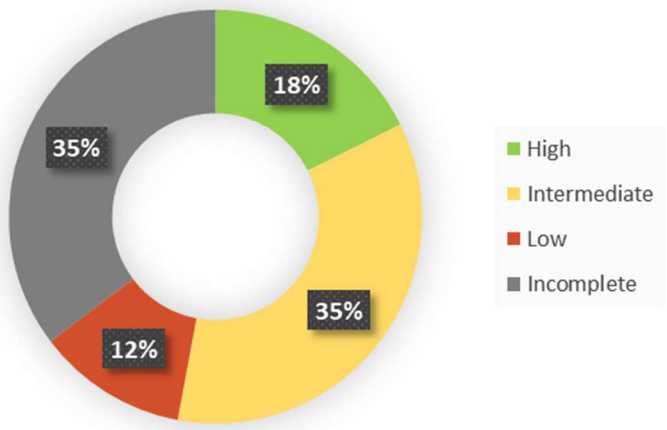


Figure 3 – Overall Strategic Planning Score – In-ground Water Assets

2.2.2.2 COMMENTS

Although a higher completion and response rate would have been beneficial in quantifying council strategic direction, the results do provide some valuable insight and a basis for recommendation:

1. **Staff Capability** - As with above-ground assets, Councils are highly likely to have capable staff that are specialised in the field of asset management for in-ground assets with almost identical results. However, this is somewhat contradicted with the responses in terms of adequate staff to fulfil the asset management activities, with only 50% answering in a positive manner. This suggests that dedicated asset management teams may be stretched or over-reliant on a small number of qualified staff within each Council.

2. **Customer Engagement** - In general terms, the results highlight only a limited number of customer engagement options are utilised to determine Council level of service, with customer forums being the most widely used. However, on further analysis, only 6 Councils have no customer engagement methods whatsoever, with the remaining 24 Councils demonstrating at least one, if not multiple methods of engagement. Four Councils use 3 or more methods to determine customer engagement.

Council responses indicate the data captured in these surveys is used primarily to help inform Council strategic direction and levels of service. There appears to be less focus on informing risk thresholds and investment planning, with no data captured from customers used to inform risk thresholds in a formal manner. Again, these results generally align with the above-ground water assets.

In contrast, staff engagement in setting levels of services and in asset management decisions was extremely positive. Almost 85% of Councils that completed the question returned a positive response.

3. **Strategy Documentation** - Maintenance of strategic documents such as corporate business plans, long term strategic direction and long-term financial plans are all generally, frequently well maintained. Only a small percentage of respondents have answered negatively to this question. Compared to the above-ground assets, only long-term financial documents score slightly less positively.

Maintenance of risk and asset documents, such as asset management strategy, asset criticality framework and asset management plans are less well maintained. There were significant positive responses to asset management strategy and strategic asset management documents, but asset criticality frameworks, and strategies for specific assets were considerably less well maintained.

5. **QEMS** - There is a largely positive response to the application of Council's Quality and Environmental Management Systems in terms of managing above-ground water assets. Quality Management Systems receive slightly more positive responses than Environmental Management Systems.

6. **External Collaboration** - Generally, Councils have responded positively to working with external agencies in the event of an emergency affecting in-ground water assets although there is a small drop compared with above-ground water assets. Over 80% of Councils work with external agencies in terms of regular liaison and for developing document plans. However, only approximately 35% of Councils plan to test mock incidents and trials with external agencies.

2.2.3 ABOVE-GROUND SEWER ASSETS

2.2.3.1 AGGREGATE RESULTS

The total response rate across all submissions within the above-ground sewer assets for Strategic Planning was 58%. The percentage completed varied between individual questions. The analysis reveals that 9% of the councils have a relative high score with regards to their strategic planning. A further 41% performed to an intermediate level. The following three pages present the geographical distribution of Councils and their overall score for above-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Strategic Planning section for above-ground sewer assets is also presented.

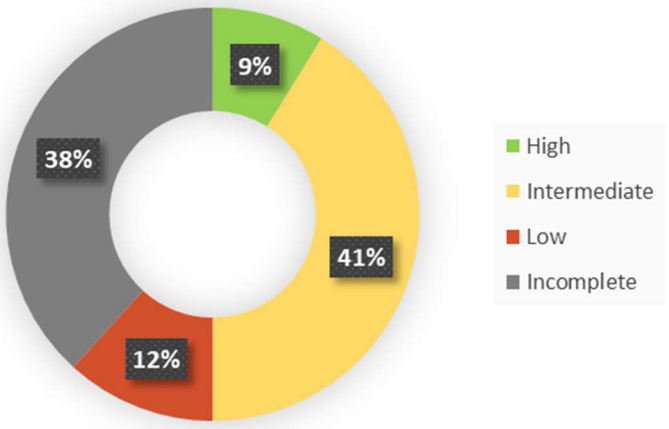


Figure 4 – Overall Strategic Planning Score – Above-ground Sewer Assets

2.2.3.2 COMMENTS

1. **Staff Capability** - Councils are highly likely to have capable staff that are specialised in the field of asset management for above-ground assets although the figure is slightly lower than that of water assets. However, as with water assets, this is somewhat contradicted with the responses in terms of adequate staff to fulfil the asset management activities, with only ~50% answering in a positive manner. This suggests that dedicated asset management teams may be stretched or over-reliant on a small number of qualified staff within each Council.

2. **Customer Engagement** - In general terms, the results highlight only a limited number of customer engagement options are utilised to determine Council level of service, with customer forums being the most widely used. This is a similar result to the water assets. A total of 7 Councils have no customer engagement methods whatsoever, one more than water assets, with the remaining Councils demonstrating at least one, if not multiple methods of engagement. Only two Councils use 3 or more methods to determine customer engagement.

In a similar manner to the water assets, Council responses indicate the data captured in these surveys is used primarily to help inform Council strategic direction and levels of service. Again, there appears to be less focus on informing risk thresholds and investment planning, with only one respondent using the data captured from customers used to inform risk thresholds in a formal manner.

In contrast, staff engagement in setting levels of services and in asset management decisions, was extremely positive, slightly more so than water assets. Almost 85% of Councils that completed the question returned a positive response.

3. **Strategy Documentation** - Maintenance of strategic documents such as corporate business plans, long term strategic direction and long-term financial plans are all generally, frequently well maintained. Only a small percentage of respondents have answered negatively to this question.

Maintenance of risk and asset documents, such as asset management strategy, asset criticality framework and asset management plans are less well maintained. There were significant positive responses to asset management strategy and strategic asset management documents, but asset criticality frameworks and strategies for specific assets were considerably less well maintained.

4. **QEMS** - There is a largely positive response to the application of the Council's Quality and Environmental Management Systems in terms of managing above-ground sewer assets. Quality Management Systems receive slightly more positive responses than Environmental Management Systems. Two Councils responded with "completely disagreed" to the application of the Environmental Management Systems in managing above-ground sewer assets.

5. **External Collaboration** - Generally, Councils have responded positively to working with external agencies in the event of an emergency affecting above-ground assets. Almost 85% of Councils work with external agencies in terms of regular liaison and for developing document plans. However, only approximately 50% of Councils plan to test mock incidents and trials with external agencies.

2.2.4 IN-GROUND SEWER ASSETS

2.2.4.1 AGGREGATE RESULTS

The total response rate across all submissions within the in-ground sewer assets for Strategic Planning was 54%. The percentage completed varied between individual questions. The analysis reveals that 9% of the councils have a relatively high score with regards to their strategic planning. A further 29% performed to an intermediate level. The following three pages present the geographical distribution of Councils and their overall score for above-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Strategic Planning section for in-ground sewer assets is also presented.

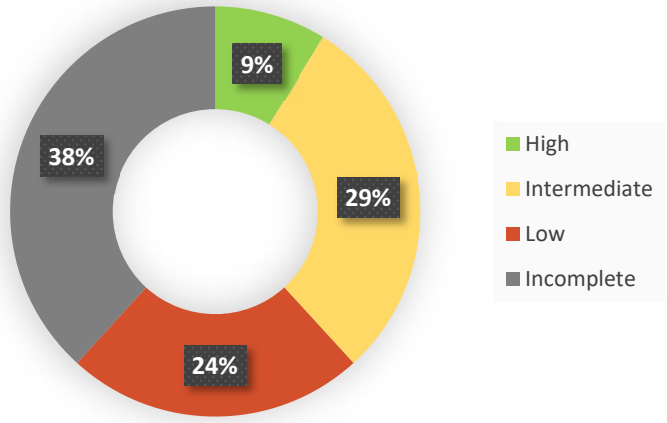


Figure 5 – Overall Strategy Planning Score – In-ground Sewer Assets

2.2.4.2 COMMENTS

1. **Staff Capability** - Councils are highly likely to have capable staff that are specialised in the field of asset management for in-ground assets although the figure is slightly lower than that of water assets. However, as with water assets and above-ground sewer assets, this is somewhat contradicted with the responses in terms of adequate staff to fulfil the asset management activities, with only ~50% answering in a positive manner. This suggests that dedicated asset management teams may be stretched or over-reliant on a small number of qualified staff within each Council.

2. **Customer Engagement** - In general terms, the results highlight only a limited number of customer engagement options are utilised to determine Council level of service. In contrast to the other assets, random surveys, targeted interviews and customer forums are the most widely used. A total of 7 Councils have no customer engagement methods whatsoever, one more than water assets, with the remaining Councils demonstrating at least one, if not multiple methods of engagement. Only 3 Councils use 3 or more methods to determine customer engagement.

In a similar manner to previous assets, Council responses indicate the data captured in these surveys is used primarily to help inform Council strategic direction and levels of service, answering marginally more positively for strategic direction planning, than above-ground sewer assets. Again, there appears to be less focus on informing risk thresholds and investment planning, with no data captured from customers used to inform risk thresholds in a formal manner.

In contrast, staff engagement in setting levels of services and in asset management decisions, was extremely positive, slightly more so than other assets. Almost 85% of Councils that completed the question returned a positive response.

3. **Strategy Documentation** - Although answers are less positive than above-ground sewer assets, maintenance of strategic documents such as corporate business plans, long term strategic direction and long-term financial plans are more frequently well maintained than not. Long term strategic objectives and strategic issues and priorities received the most negative responses for in-ground sewer assets.

Maintenance of risk and asset documents, such as asset management strategy, asset criticality framework and asset management plans are less well maintained. There were some positive responses to frequently maintained asset management strategies and

strategic asset management documents, but asset criticality frameworks, and strategies for specific assets, were considerably less well maintained. The responses were less positive than those for above-ground assets

4. **QEMS** - As with above-ground sewer assets, there is a largely positive response to the application of the Council's Quality and Environmental Management Systems in terms of managing in-ground sewer assets. Quality Management Systems receive slightly more positive responses than Environmental Management Systems. Two Councils answered with "completely disagreed" with the application of the Environmental Management Systems and one for the Quality Management System to manage above-ground sewer assets.

5. **External Collaboration** - Again, results mirrored the above-ground sewer assets, where generally, Councils have responded positively to working with external agencies in the event of an emergency affecting in-ground assets. Between 78% and 85% of Councils work with external agencies in terms of regular liaison and for developing document plans. However, only approximately 25% of Councils plan to test mock incidents and trials with external agencies.

2.2.5 ADDITIONAL INFORMATION

2.2.5.1 RESULTS

Figure 6 – External Requirements – Water & Sewer

External requirements are, as expected, relatively similar for both water and sewer assets. It is clear from the results that Councils generally put a lot of emphasis on documenting decisions for assets based on external requirements from state and national governments. In both cases, customer preferences are the one noticeable external control that does not perform as well, with almost 50% answering "No" or "Don't Know". Many Councils see room for improvement in the requirements for sewer assets in terms of economic pricing, considerably more so than water assets.

2.2.5.2 COMMENTS

Additionally, some Councils provided commentary to this section. Douglas Shire Council stated they used social media sites, and used water and sewer educational display at local shows; this comment was mirrored on a number of occasions. They also stated the operated a Customer Request Management System. A number of Councils stated that many of the options provided for answer were negated by the fact the Council were in close contact with much of the community, given how small some of the populations are, allowing for direct contact with portfolio and asset managers.

When working with other agencies in an emergency, one Council stated that although they worked well with external agencies during disaster operations, they were not specific to water and sewer assets; these were addressed as required. One Council also commented that they worked with external agencies when there is a regulatory requirement and also when a pre-emptive approach to emerging issues is required.

2.2.6 RECOMMENDATIONS

The responses to customer engagement were mixed, with some of the negative responses possibly explained due to the large differences in Council size, area and more informal interaction with the communities. It is recommended that Councils continue to engage with customers, but also try to increase the levels of documentation associated with responses, especially in smaller, more informal situations. A state-led, formal process that can incorporate a range of population sizes and geographical areas should be investigated. Implementing a clear and documented process to gather customer preference information, can form the basis for the development of risk statements and thresholds. Subsequently, this can be used to inform the cost of failure guidance and strategic direction.

On the basis of the current position, general asset management documentation is well established. Improvements can be made in a large number of Councils that have stated they have less confidence in the documentation on asset classes and specific assets, and almost no established position on criticality frameworks. A more cohesive approach, particularly on the poorly performing elements, that sets out documents and policies within a clear hierarchy should be established. Integration of these documents into a comprehensive and cohesive strategy, which takes account of all other relevant corporate policies and strategies, would support a more sustainable and inclusive approach, and provide clear overall alignment of drivers and objectives across and within asset classes. These documents would aim to align with generally well-performing quality and environmental management systems.

Whilst document planning and regular liaison have been answered positively, it would be beneficial for Councils to jointly explore mock incident planning, particularly extreme scenarios, such as major water supply interruptions or large-scale sewer collapse, with bordering Councils and across LGAQ. Identification of suitably significant failure scenarios for both in-ground and above-ground assets to run as a mock incident would provide useful insight into the realities and practicalities of joint response, as well as identifying proactive emergency planning opportunities. Additional reviews to include tankering, bottled water distribution, flood management, and some specialist technical resources may be beneficial in improving overall resilience, recovery options and risk analysis of the region.

2.3 CONSEQUENCE OF FAILURE

A risk-based asset management system requires a structured, comprehensive and quantitative approach to the understanding consequence of asset failure. The system should account for service impact, third party impact and cost, and should utilise robust data, analysis and validation.

The following questions could not be fully utilised and have been removed due to issues with the question setup and subsequent responses.

- Our council has a process for assessing the criticality of assets that integrates all consequence data.

2.3.1 ABOVE-GROUND WATER ASSETS

2.3.1.1 AGGREGATE RESULTS

The total response rate across all submissions within the above-ground water assets for Consequence was 49%. The percentage completed varied between individual questions. If the incomplete questionnaires are discounted, the analysis reveals that only 3% of the councils have a relatively high score with regards to their consequence assessments. A further 15% performed to an intermediate level. Incomplete questionnaires accounted for 47% of the submitted responses. The following three pages present the geographical distribution of Councils and their overall score for above-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Consequence for Above-ground Water Assets is also presented.

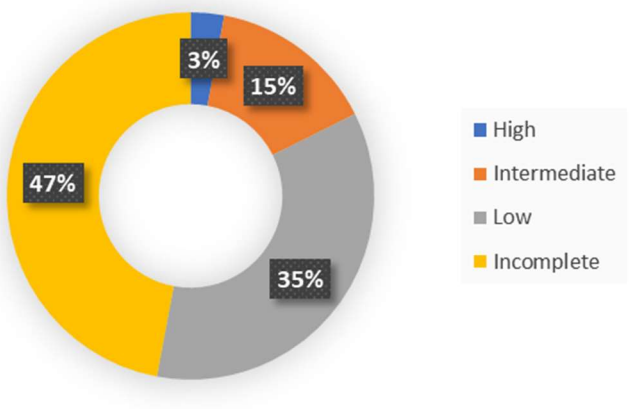


Figure 7 – Overall Consequence Score – Above-ground Water Assets

2.3.1.2 COMMENTS

Analysis of the in-ground water assets for the Consequence section is again unfortunately hampered by a reduced number of responses. As mentioned previously, this possibly suggest that there is little evidence of any consequence assessments within the majority of the Councils.

1. **Managing Criticality** - Councils generally provided positive responses to how they define assets in terms of criticality for their above-ground water assets, although a third do not believe assets are well managed against a criticality definition.

2. **Service Impact** - Only 10 Councils responded to the question regarding understanding service impact for above-ground assets, of which 50% stated a binary or static population could be associated with each asset in the event of failure. Only 2 Councils stated a dynamic population could be modelled over time for above-ground asset failure.

3. **Response & Recovery** - Approximately 28% of Councils stated they had no response and recovery modelling for above-ground water assets. A basic model that also incorporates disasters had the highest number of responses with 61% of Councils stating they had this capability. Only one Council had advanced response and recovery modelling.

4. **Failure Impact** - There was a mixed response to the failure impact of above-ground water assets. The majority of Councils indicate that they have some sort of process in place to identify impacts associated with asset failure across all 4 available categories (environmental, H&S, societal and property). Health & safety impact identification provided the highest number of positive responses (72%), whereby property and societal identification had the highest number of negative responses (44%); those Councils that had no process in place to identify such risks.

5. **Cost of Failure** - Councils generally stated they did not have any cost of failure model, although approximately 40% stated they had some kind of model associated with above-ground asset repair costs. Less than 30% stated they had a cost model for either 3rd party damage impact or water supply impact.

6. **Flood Impact** - The majority of Councils have no or basic flood impact modelling on above-ground water assets. This is particularly evident on the impact of 3rd parties in the event of an asset failure with approximately 60% of Councils having undertaken no flood analysis. This falls to about 30% for impact on assets from flooding.

7. **Drought Impact** - Approximately 40% of respondents stated that they had some sort of basic method for identifying the impact of drought on above-ground water assets. The remaining respondents stated they either had no way of identifying drought risk or did not know.

8. **Data Governance** - Councils were almost unanimous in their responses in the need for data quality, coverage, integration or ease of maintenance, to either be improved within their management systems. Furthermore, 50% of Councils stated that consequence data was not adequate in terms of quality, coverage, integration or ease of maintenance.

2.3.2 IN-GROUND WATER ASSETS

2.3.2.1 AGGREGATE RESULTS

The total response rate across all submissions within the in-ground water assets for Consequence was 48%. The percentage completed varied between individual questions. The analysis reveals that none of the Councils have a relative high score with regards to their consequence assessments. A further 27% performed to an intermediate level. Incomplete questionnaires accounted for 47% of the submitted responses. The following three pages present the geographical distribution of Councils and their overall score for in-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Consequence for In-ground Water Assets is also presented.

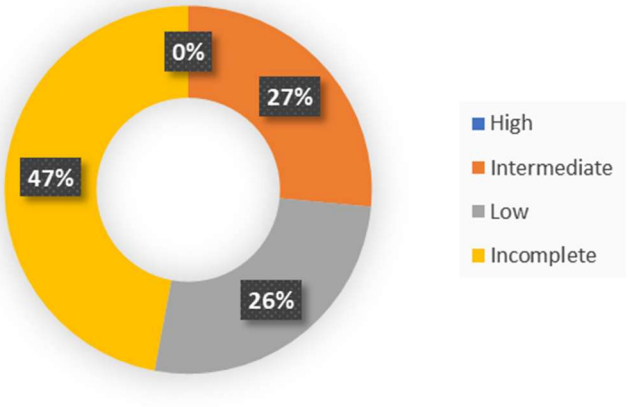


Figure 8 – Overall Consequence Score – In-ground Water Assets

2.3.2.2 COMMENTS

Analysis of the in-ground water assets for the Consequence section is again unfortunately hampered by a reduced number of responses. As mentioned previously, this possibly suggest that there is little evidence of any consequence assessments within the majority of the Councils.

1. **Managing Criticality** - Councils responded in a similar positive manner when defining and managing criticality, suggesting that the criticality for above and in-ground water assets are managed in the same way. As previously, a third do not believe assets are well managed against a criticality definition.

2. **Service Impact** - Fourteen Councils responded to how they understand service impact for in-ground assets, of which 35% stated a binary or static population could be associated with each asset in the event of failure. Only 3 Councils stated a dynamic population could be modelled over time for in-ground asset failure. Six Councils responded stating they did not know.

3. **Response & Recovery** - Approximately 28% of Councils stated they had no response and recovery modelling for in-ground water assets. A basic model that also incorporates disasters had the highest number of responses with 61% of Councils stating they had this capability. Only one Council had advanced response and recovery modelling. This mirrored above-ground assets.

4. **Failure Impact** - There was a mixed response to the failure impact of above-ground water assets. The majority of Councils indicate that they have some sort of process in place to identify impacts associated with asset failure across all 4 available categories (environmental, H&S, societal and property). Health & safety impact identification provided the highest number of positive

responses (76%), whereby property and societal identification had the highest number of negative responses (~40%); those Councils that had no process in place to identify such risks.

5. **Cost of Failure** - Councils generally stated they did not have any cost of failure model, although approximately 40% stated they had some kind of model associated with in-ground asset repair costs. Less than 30% stated they had a cost model for either 3rd party damage impact or water supply impact. The results mirrored those for above-ground water assets.

6. **Flood Impact** – As with above-ground assets, the majority of Councils have no or basic flood impact modelling on in-ground water assets. This is particularly evident on the impact of 3rd parties in the event of an asset failure with approximately 65-70% of Councils having undertaken no flood analysis. This falls to about 30% for impact on assets from flooding.

7. **Drought Impact** - There were only 4 respondents to the question of understanding the potential drought impact on in-ground assets. Two Councils stated they had a basic, system-wide understanding and two had no understanding.

8. **Data Governance** - Councils responses were almost identical to the above-ground answer, with the need for data quality, coverage, integration or ease of maintenance, to be improved within their management systems. Furthermore, 50% of Councils stated that consequence data was not adequate in terms of quality, coverage, integration or ease of maintenance. The quality of data was the only metric to have changed, showing a slight improvement.

2.3.3 ABOVE-GROUND SEWER ASSETS

2.3.3.1 AGGREGATE RESULTS

The total response rate across all submissions within the above-ground sewer assets for Consequence was 44%. The percentage completed varied between individual questions. The analysis reveals that one of the Councils has a relatively high score with regards to their consequence assessments. A further 26% performed to an intermediate level. Unfortunately, incomplete questionnaires accounted for 50% of the submitted responses. The following two pages present the geographical distribution of Councils and their overall score for above-ground sewer assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Consequence for above-ground sewer assets is also presented.

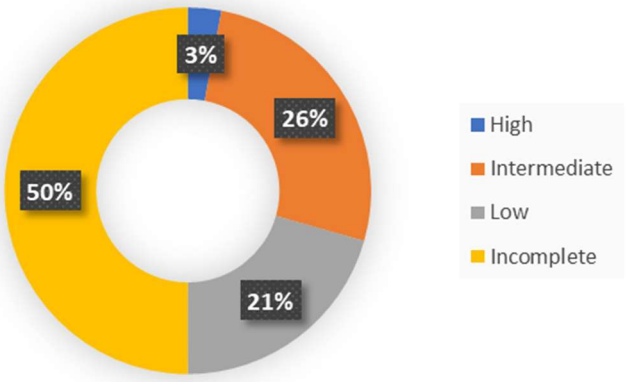


Figure 9 – Overall Consequence Score – Above-ground Sewer Assets

2.3.3.2 COMMENTS

The following comments were noted:

1. **Managing Criticality** - Councils responded in a similar positive manner when defining and managing criticality, suggesting that the criticality for sewer assets are similar to those for water assets. As previously, a third do not believe assets are well managed against a criticality definition.

2. **Response & Recovery** - Approximately 29% of Councils stated they had no response and recovery modelling for above-ground sewer assets. A basic model that also incorporates disasters had the highest number of responses with 58% of Councils

stating they had this capability. Only one Council had advanced response and recovery modelling. This was a similar response to water assets.

3. **Failure Impact** - As with water assets, there was a mixed response to the failure impact from above-ground sewer assets. In all cases, the majority of Councils indicate that they have some sort of process in place to identify impacts associated with asset failure across all 4 available categories (environmental, H&S, societal and property). Again, health & safety impact identification provided the highest number of positive responses (75%), whereby property and societal identification had the highest number of negative responses (~40%); those Councils that had no process in place to identify such risks.

4. **Cost of Failure** - Councils generally stated they did not have any cost of failure model, although approximately 40% stated they had some kind of model associated with above-ground asset repair costs. Less than 30% stated they had a cost model for either 3rd party damage impact or water supply impact. These results mirrored results for water assets.

5. **Flood Impact** – As with water assets, the majority of Councils have no or basic flood impact modelling on above-ground sewer assets. This is particularly evident on the impact of 3rd parties in the event of an asset failure with approximately 65-70% of Councils having undertaken no flood analysis. This falls to about 25-30% for impact on assets from flooding.

6. **Data Governance** - Councils responses were similar to water assets, with the general need for data quality, coverage, integration or ease of maintenance, to either be improved within their management systems or was not fit for purpose. Integration with corporate systems was the worst performer in terms of data management, with ~62% of Councils responded negatively. Coverage, quality and ease of maintenance all had a positive response of at least 50%.

2.3.4 IN-GROUND SEWER ASSETS

2.3.4.1 AGGREGATE RESULTS

The total response rate across all submissions within the in-ground sewer assets for Consequence was 45%. The percentage completed varied between individual questions. The analysis reveals that one of the Councils has a relatively high score with regards to their consequence assessments. A further 23% performed to an intermediate level which is a slight drop from the above-ground sewer assets. Unfortunately, incomplete questionnaires accounted for 50% of the submitted responses. The following two pages present the geographical distribution of Councils and their overall score for above-ground sewer assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Consequence for above-ground sewer assets is also presented.

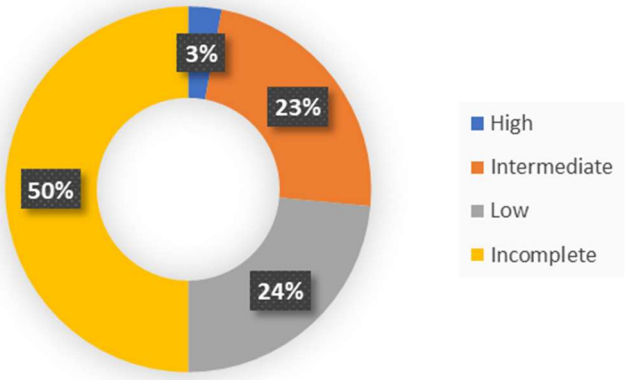


Figure 10 – Overall Consequence Score – In-ground Sewer Assets

2.3.4.2 COMMENTS

The following comments were noted:

1. **Managing Criticality** - Councils responded in a similar positive manner when defining and managing criticality, suggesting that the criticality for sewer assets are similar to those for water assets. As previously, a third do not believe assets are well managed against a criticality definition.

3. **Response & Recovery** - Approximately 29% of Councils stated they had no response and recovery modelling for in-ground sewer assets. A basic model that also incorporates disasters had the highest number of responses with 58% of Councils stating they had this capability. Only one Council had advanced response and recovery modelling. This was a similar response to water assets.

4. **Failure Impact** - As with above-ground assets, there was a mixed response to failure impact from in-ground sewer assets and respondents answered in exactly the same manner. In all cases, the majority of Councils indicate that they have some sort of process in place to identify impacts associated with asset failure across all 4 available categories (environmental, H&S, societal and property). Again, health & safety impact identification provided the highest number of positive responses (75%), whereby property and societal identification had the highest number of negative responses (~40%); those Councils that had no process in place to identify such risks.

5. **Cost of Failure** - Councils generally stated they did not have any cost of failure model, although approximately 40% stated they had some kind of model associated with in-ground asset repair costs. Less than 30% stated they had a cost model for either 3rd party damage impact or water supply impact. These results mirrored results for above-ground assets.

6. **Flood Impact** – As with water assets, the majority of Councils have no or basic flood impact modelling on in-ground sewer assets. This is particularly evident on the impact of 3rd parties in the event of an asset failure with approximately 62-70% of Councils having undertaken no flood analysis. Approximately 63-68% of Councils stated they had some sort of analysis on the impact on assets from flooding.

7. **Data Governance** - Councils responses were similar to previous assets, with the general need for data quality, coverage, integration or ease of maintenance, to either be improved within their management systems or was not fit for purpose. Integration with corporate systems was the worst performer in terms of data management, with ~62% of Councils responded negatively. Coverage and data quality were the only two categories to have a positive response of at least 50%

2.3.5 ADDITIONAL INFORMATION

In the commentary, one Council stated that criticality of assets was an area of the business that needed to be improved and that future assessments were planned. One Council also responded stating that they will become more advanced in assessing assets through the implementation of an asset edge software which will be used for programming and planning.

2.3.6 RECOMMENDATIONS

Development of a cost of failure model template would assist councils in determining the total cost incurred both internally and externally as a result of major asset failures. It is important to fully understand the total cost of failure for each asset in order to develop comprehensive risk profiles and ensure that cost-benefit can be properly undertaken during investment planning. Incorporating customer preference data would align these models with the Council's strategic direction and risk appetite.

It is recommended that a triple bottom line cost of failure method be employed, which includes:

1. Service Impact Cost (cost of alternative water supply and customer compensation)
2. Damage Impact Cost (cost of insurance and any other third-party damage costs)
3. Repair Cost (cost to repair main including all resources, equipment and materials)

Councils generally appear to have a limited understanding of potential impacts as a result of asset failure, particularly in terms of property damage. Universally, there is potential to improve awareness by quickly identifying structures at risk within a dynamic damage impact crater, derived from logged or modelled pressures. Further value would be added through the creation of a third-party damage impact 'at risk' register. This would allow structures and third-party assets to be categorised by type and risk.

Furthermore, desktop validation can help validate structures at risk, based on existing 3rd party, satellite and corporate spatial datasets, followed by more comprehensive field validation surveys to confirm local topography, structure proximity as well as the line and depth of the in-ground assets. It is recommended that a shared resource is used to undertake some of this work, particularly the field validation stages.

Additional analysis may include rolling ball flood modelling every 10m-15m on potential failures on in-ground assets of both asset classes that run through high-density or low-lying areas (in relation to pipelines). Across all assets, this analysis is currently either fairly basic or non-existent. Incorporating flood and drought assessments into an all-hazards risk on linear and major point assets, such as water and waste water treatment works, would provide a documented register of risks across the state.

No direct evidence has been provided to the contrary, therefore it is assumed that state-wide guidance of a developer stand-off policy does not exist. Development of this policy to account for variable stand-off based on a combination of maximum pressure and minimum access requirement would represent a more effective approach in managing in-ground water assets. Although maintenance of vegetation encroachment is covered in a later section, policies surrounding the management of this is not covered, but would be of benefit to all asset classes. This would help to manage failure events, reduce the consequence of failure and improve overall service. Policy development should be directly linked and referenced to the Vegetation Management Framework for Queensland to ensure the appropriate legislation and clearing options are followed.

2.4 LIKELIHOOD OF FAILURE

Accurately understanding asset integrity is an essential component of risk-based asset management, with the information used to calculate risk and prioritise intervention. To undertake likelihood analysis effectively requires a strategic approach which combines multiple data gathering and analytical activities with overarching integration and analysis.

2.4.1 ABOVE-GROUND WATER ASSETS

2.4.1.1 AGGREGATE RESULTS

The total response rate across all submissions within the above-ground water assets for Likelihood of Failure was 46%. The percentage completed varied between individual questions. The analysis reveals that 6% of the councils have a relatively high score with regards to their assessments and capability. A further 23% performed to an intermediate level. Incomplete questionnaires accounted for 48% of the submitted responses. The following two pages present the geographical distribution of Councils and their overall score for above-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Likelihood of Failure for Above-ground Water Assets is also presented.

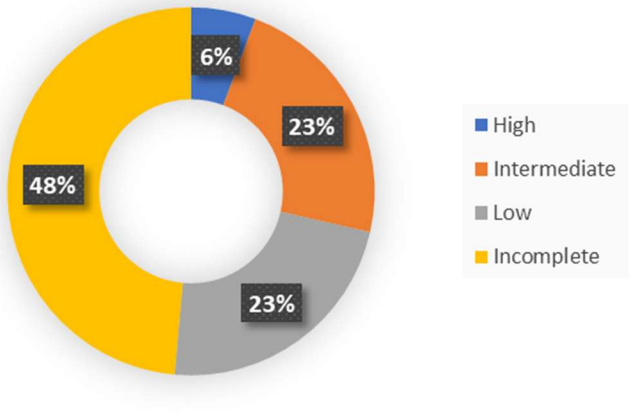


Figure 11 – Overall Likelihood of Failure Score – Above-ground Water Assets

2.4.1.2 COMMENTS

1. **Deterioration Models** - For deterioration models, about 30% employed a likelihood of failure model, whilst ~52% utilised remaining service life for above-ground water assets. However, only one Council was confident of the data produced.

2. **I&T Expertise** - Approximately 82% of Councils responded positively to internal inspection and testing expertise within the organisation. Only two Councils responded negatively to the question.

3. **Condition Assessment Coverage** - All Councils stated that less than 50% of their above-ground water assets were condition assessed. Two Councils stated that they did not believe any condition data existed for their above-ground assets.

4. **I&T Frequency** - Almost half of the respondents (44%) stated they undertake inspection and testing on their above-ground assets every 5 years. Three Councils only undertake condition assessments every 10 years, whilst one Council has a comprehensive inspection and testing framework setup.

5. **Likelihood Analysis** - Approximately 70% of Councils stated that they undertook some sort of field likelihood analysis on above-ground sewer assets. This figure dropped to ~56% for desktop analysis and down to 40% for laboratory analysis. Two councils stated they had advanced analysis in each of the 3 categories.

Over 70% of Councils responded negatively to whether they calibrate deterioration models using data from condition assessments and failures. Three Councils agreed that they undertook some form of calibration.

6. **Data Governance** - Councils were mainly positive about the maintainability and coverage of data for above-ground water assets. However, approximately 76% responded no to whether the data was of high quality and 50% responded no to the integration of data with corporate systems.

2.4.2 IN-GROUND WATER ASSETS

2.4.2.1 AGGREGATE RESULTS

The total response rate across all submissions within the in-ground water assets for Likelihood of Failure was 44%. The percentage completed varied between individual questions. The analysis reveals that no councils have a relatively high score with regards to their assessments and capability. A further 26% performed to an intermediate level. Incomplete questionnaires accounted for 50% of the submitted responses. The following two pages present the geographical distribution of Councils and their overall score for in-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Likelihood of Failure for Above-ground Water Assets is also presented.

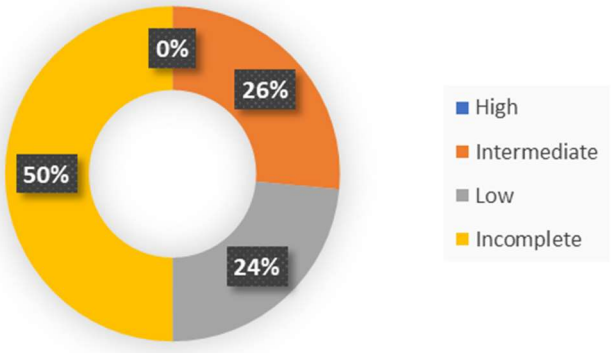


Figure 12 – Overall Likelihood of Failure Score – In-ground Water Assets

2.4.2.2 COMMENTS

1. **Deterioration Models** - For deterioration models, about 35% employed a likelihood of failure model, whilst ~56% utilised remaining service life for in-ground water assets. Two councils were confident of the data for the remaining service life model.

2. **I&T Expertise** - Results for internal inspection and testing expertise were almost identical to above-ground water assets, with approximately 82% of Councils responded positively. Again, only two Councils responded negatively to the question.

3. **Condition Assessment Coverage** - Results were noticeably poorer compared with above-ground water assets for the percentage of assets that were condition assessed. No Councils responded higher than 30%, with the majority responding between 1-10%. One Council stated that they did not believe any condition data existed for their above-ground assets.

4. **I&T Frequency** - Almost 60% of respondents stated that all condition assessment undertaken on in-ground assets were undertaken on an ad-hoc basis. Approximately 30% of Councils stated that assets were assessed every 5 years. No Councils have a comprehensive inspection and testing framework setup.

5. **Likelihood Analysis** - Approximately 66% of Councils stated that they undertook some sort of field likelihood analysis on in-ground water assets. This figure dropped to ~53% for desktop analysis. The laboratory analysis responses were marginally more positive than the above-ground assets, with 4 Councils stating they undertook advanced analysis.

Approximately 71% of Councils responded negatively to whether they calibrate deterioration models using data from condition assessments and failures. Three Councils agreed that they undertook some form of calibration.

6. **Data Governance** - Councils responded slightly positively to maintainability and coverage of data for in-ground water assets. However, approximately 85% responded no to whether the data was of high quality and 57% responded no to the integration of data with corporate systems.

2.4.3 ABOVE-GROUND SEWER ASSETS

2.4.3.1 AGGREGATE RESULTS

The total response rate across all submissions within the above-ground sewer assets for Likelihood of Failure was 42%. The percentage completed varied between individual questions. The analysis reveals that 6% of councils have a relatively high score with regards to their assessments and capability. A further 23% performed to an intermediate level. Incomplete questionnaires accounted for 53% of the submitted responses. The following two pages present the geographical distribution of Councils and their overall score for above-ground sewer assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Likelihood of Failure for Above-ground Sewer Assets is also presented.

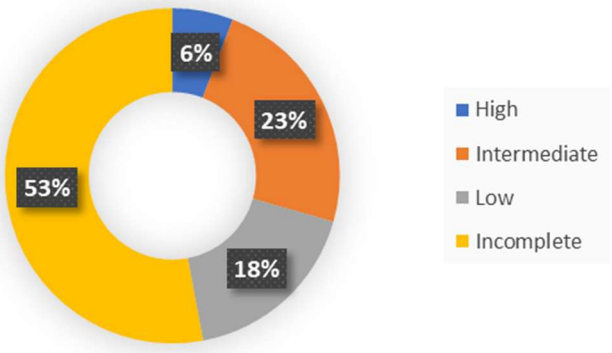


Figure 13 – Overall Likelihood of Failure Score – Above-ground Sewer Assets

2.4.3.2 COMMENTS

1. **Deterioration Models** - For deterioration models, about 28% employed a likelihood of failure model, whilst ~53% utilised remaining service life for in-ground water assets. As with above-ground water assets, one Council was confident of the data for the remaining service life model.

2. **I&T Expertise** - Results for internal inspection and testing expertise were almost identical to water assets, with approximately 82% of Councils responded positively. Three Councils responded negatively to the question.

3. **Condition Assessment Coverage** - Results were poorer compared with above-ground water assets for the percentage of assets that were condition assessed. Only 1 Councils responded higher than 40%, with the majority responding between 21-30%. One Council stated that they did not believe any condition data existed for their above-ground assets.

4. **I&T Frequency** - Almost 40% of respondents stated that condition assessments were undertaken on above-ground assets every 5 years. Approximately 19% of Councils stated that assets were assessed every year. As with above-ground water assets, one Council have a comprehensive inspection and testing framework setup.

5. **Likelihood Analysis** - Approximately 64% of Councils stated that they undertook some sort of field likelihood analysis on above-ground sewer assets. This figure dropped to ~46% for desktop analysis. The laboratory analysis responses were lower than for water assets. Two Councils stating they undertook advanced analysis on desktop and field analysis, and one undertook advanced laboratory analysis.

Approximately 69% of Councils responded negatively to whether they calibrate deterioration models using data from condition assessments and failures. Three Councils agreed that they undertook some form of calibration.

6. **Data Governance** - Councils responded positively (64% & 61%) to maintainability and coverage of data for above-ground sewer assets. However, approximately 83% responded no to whether the data was of high quality and 54% responded no to the integration of data with corporate systems.

2.4.4 IN-GROUND SEWER ASSETS

2.4.4.1 AGGREGATE RESULTS

The total response rate across all submissions within the in-ground sewer assets for Likelihood of Failure was 41%. The percentage completed varied between individual questions. The analysis reveals that no councils have a relatively high score with regards to their assessments and capability. A further 23% performed to an intermediate level. Incomplete questionnaires accounted for 53% of the submitted responses. The following two pages present the geographical distribution of Councils and their overall score for in-ground sewer assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with the Likelihood of Failure for In-ground Sewer Assets is also presented.

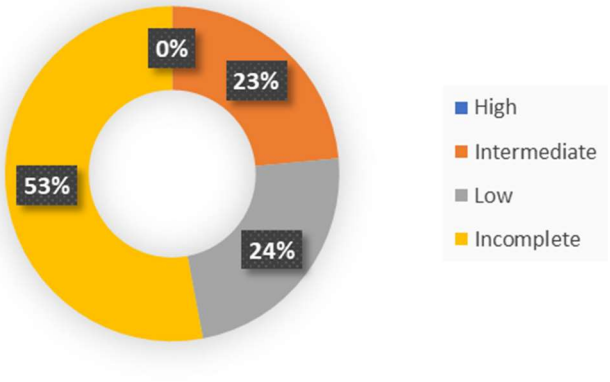


Figure 14 – Overall Likelihood of Failure Score – In-ground Sewer Assets

2.4.4.2 COMMENTS

1. **Deterioration Models** - For deterioration models, ~36% employed a likelihood of failure model, whilst ~60% utilised remaining service life for in-ground sewer assets; the highest of any asset. Only one Council was confident of the data for the remaining service life model.

2. **I&T Expertise** - Results for internal inspection and testing expertise were very closely aligned to previous assets, with 75% of Councils responded positively. Three Councils responded negatively to the question; a slight increase from above-ground sewer assets.

3. **Condition Assessment Coverage** - Results for condition assessment percentage suggested coverage was again fairly low. Only two Councils responded higher than 30%, with the majority responding between 1-10%. One Council stated that they did not believe any condition data existed for their above-ground assets.

4. **I&T Frequency** - Approximately 38% of respondents stated that all condition assessment undertaken on in-ground assets were undertaken on an ad-hoc basis. A similar percentage of Councils stated that assets were assessed every 5 years. No Councils have a comprehensive inspection and testing framework setup.

5. **Likelihood Analysis** - Approximately 64% of Councils stated that they undertook some sort of field likelihood analysis on in-ground sewer assets. This figure dropped to ~50% for desktop analysis. The laboratory analysis responses were the same as the above-ground sewer assets, with 4 Councils stating they undertook advanced analysis across the 3 categories.

Approximately 85% of Councils responded negatively to whether they calibrate deterioration models using data from condition assessments and failures. As with previous assets, 3 Councils agreed that they undertook some form of calibration.

6. **Data Governance** - Councils responded slightly positively to maintainability and coverage of data for in-ground water assets. However, over 90% responded no to whether the data was of a high quality, which appears to be an obvious trend across all assets, and 67% responded no to the integration of data with corporate systems.

2.4.5 RECOMMENDATIONS

Responses for the likelihood and deterioration analysis of assets has highlighted significant gaps across the majority of Councils. The development of new, or improvements of existing deterioration models, would result in significant improvements in accuracy over time, with the capture of new data, from both new failure events and condition data, further enhancing overall risk modelling and enabling more targeted and effective intervention. Collaborating to develop and implement these models across the state, whilst also integrating national and international databases, such as the National Mains Failure Database, would provide Councils with an up to date, innovative and wide-ranging platform for determining the likelihood of failure and remaining service life.

To support these models, the development of a standard root cause analysis (RCA) protocol and complimentary delivery support platform would improve consistency, quality and efficiency of the process. Having a standard process, format and templates adopted across multiple Councils would also create a powerful data set which would enable greater calibration and refinement of deterioration models. This would result in a model which more accurately reflects Queensland's water and sewer assets and would ensure that greater value is realised from investment in inspection, testing and RCA. It is noted however that smaller Councils may be unable to achieve these aims due to lack of necessary resource. Establishment of a shared strategic services team to provide specialist expertise and delivery support to smaller councils would enable them deliver effective RCA in a cost effective manner.

Many Councils appear to lack a regular inspection and testing programme across all asset types, with many only assessing on an ad-hoc basis. The reasons for this are unclear from this questionnaire. A state-wide inspection and testing framework, and associated guidance, should be developed to ensure the use of the most asset appropriate tools, improving technical outcomes and reducing operational risk. Internal processes could be further developed to provide guidance in relation to specification, planning, contingencies, enabling works, deployment, data interpretation and analysis. Creating these profiles within a corporate database (delivery support platform) would also enable the tools to be linked to projects, and for feedback/lessons learned to be captured and shared. A specification matrix to account for common scenarios across all asset classes, would also ensure quality, completeness and consistency across the various parties who are undertaking condition assessment activities.

The development and implementation of a shared cloud-based delivery support platform would improve overall effectiveness, efficiency, governance, data quality and data integration. It would also provide a central database linking contractors and technical experts throughout the state. The feasibility of centrally managed platforms should be investigated further.

2.5 INVESTMENT PLANNING FRAMEWORK

For the purposes of this assessment, investment planning refers to the targeted planning of risk-based interventions to optimise the performance and reliability of water and waste water assets.

The following questions could not be fully utilised and have been removed due to issues with the question setup and subsequent responses.

- Which of the following answers would best describe your council's approach to integration and optimisation of investment across operational and capital investment categories (Totex approach)? (Investment categories include Operational Maintenance, Capital Maintenance and Enhancement).

2.5.1 ABOVE-GROUND WATER ASSETS

2.5.1.1 AGGREGATE RESULTS

The total response rate across all submissions within the above-ground water assets for Investment Planning Framework was 47%. The percentage completed varied between individual questions. The analysis reveals that only 3% of the councils have a relatively high score with regards to their investment planning framework assessments. A further 26% performed to an intermediate level. Incomplete questionnaires accounted for 50% of the submitted responses. The following two pages present the geographical distribution of Councils and their overall score for above-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with an investment planning framework for Above-ground Water Assets is also presented.

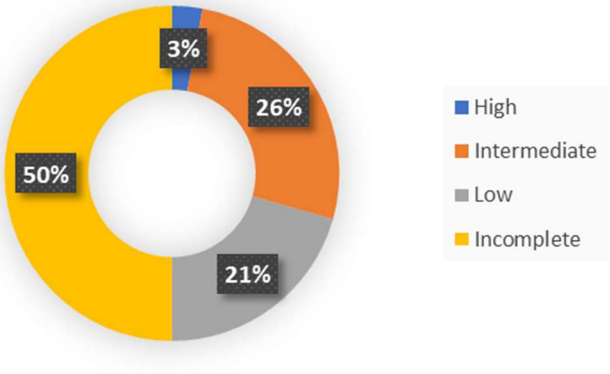


Figure 15 – Overall Investment Planning Framework Score – Above-ground Water Assets

2.5.1.2 COMMENTS

1. **Framework** - Almost 50% of Councils stated that an investment planning framework was currently in development. About 30% stated they already had a framework, although 11% stated that it wasn't used. Approximately 24% stated that no framework was in place.

2. **Operational Planning** - All 17 respondents stated they had some sort of operational planning procedure. Approximately 95% of Councils stated they had a capital maintenance planning procedure and approximately 75% of Councils stated they had a planning procedure for enhancement.

3. **Investment Planning** - Approximately 65% of respondents had some sort of investment planning process for cost/benefit analysis and just over 50% had a process for scenario modelling. However, only 31% had a process for understanding sensitivity analysis.

4. **Data Governance** - As with previous sections, Councils responded slightly positively to maintainability and coverage of data for above-ground assets. In comparison to previous sections, only 30% responded no to whether the data was of high quality, and 40% responded no to the integration of data with corporate systems.

2.5.2 IN-GROUND WATER ASSETS

2.5.2.1 AGGREGATE RESULTS

The total response rate across all submissions within the in-ground water assets for Investment Planning Framework was 47%. The percentage completed varied between individual questions. The analysis reveals that only 6% of the councils have a relatively high score with regards to their investment planning framework assessments. A further 21% performed to an intermediate level. Incomplete questionnaires accounted for 50% of the submitted responses. The following two pages present the geographical distribution of Councils and their overall score for in-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with an investment planning framework for In-ground Water Assets is also presented.

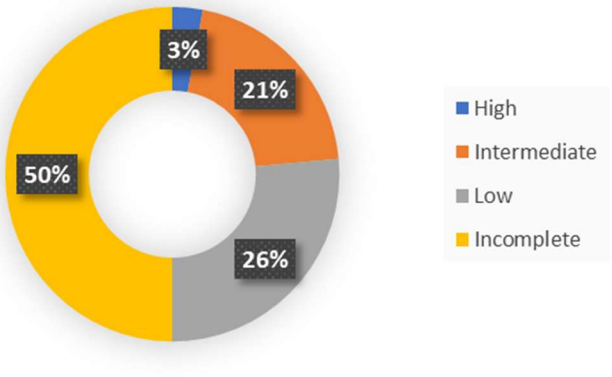


Figure 16 – Overall Investment Planning Framework Score – In-ground Water Assets

2.5.2.2 COMMENTS

1. **Framework** - Almost 50% of Councils stated that an investment planning framework was currently in development. About 30% stated they already had a framework, although 11% stated that it wasn't used. Approximately 24% stated that no framework was in place. The answers were identical to the above-ground assets.

2. **Operational Planning** - Approximately 95% of Councils stated they had some sort of formal operational planning procedure. Approximately 88% of Councils stated they had a capital maintenance planning procedure and 75% of Councils stated they had a planning procedure for enhancement.

3. **Investment Planning** - Approximately 65% of respondents had some sort of investment planning process for cost/benefit analysis and just over 50% had a process for scenario modelling. However, only 25% had a process for understanding sensitivity analysis.

4. **Data Governance** - As with previous sections, Councils responded slightly positively to maintainability and coverage of data for in-ground assets. Approximately 35% responded no to whether the data was of high quality, and 40% responded no to the integration of data with corporate systems.

2.5.3 ABOVE-GROUND SEWER ASSETS

2.5.3.1 AGGREGATE RESULTS

The total response rate across all submissions within the above-ground sewer assets for Investment Planning Framework was 44%. The percentage completed varied between individual questions. The analysis reveals that only 3% of the councils have a relatively high score with regards to their investment planning framework assessments. A further 26% performed to an intermediate level. Incomplete questionnaires accounted for 53% of the submitted responses. The following two pages present the geographical distribution of Councils and their overall score for above-ground sewer assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with an investment planning framework for Above-ground Sewer Assets is also presented.

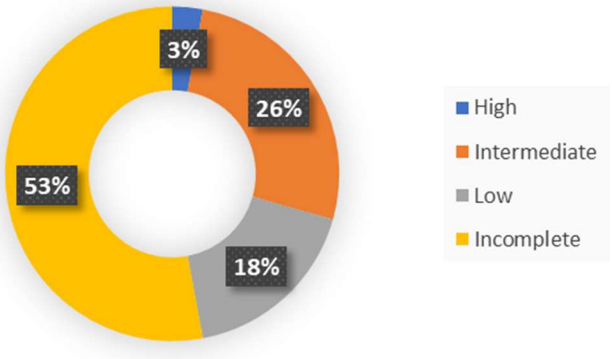


Figure 17 – Overall Investment Planning Framework Score – Above-ground Sewer Assets

2.5.3.2 COMMENTS

1. **Framework** - Almost 44% of Councils stated that an investment planning framework was currently in development. About 31% stated they already had a framework, although 13% stated that it wasn't used. Approximately 25% stated that no framework was in place.

2. **Operational Planning** - Approximately 94% of Councils stated they had some sort of operational planning and capital maintenance procedure. Approximately 82% of Councils stated they had a planning procedure for enhancement on above-ground sewer assets.

3. **Investment Planning** - Approximately 68% of respondents had some sort of investment planning process for cost/benefit analysis and 50% had a process for scenario modelling. Approximately 33% had a process for understanding sensitivity analysis.

4. **Data Governance** - As with previous sections, Councils responded generally positively to maintainability and coverage of data for above-ground assets. Approximately 38% responded no to whether the data was of high quality, and 43% responded no to the integration of data with corporate systems.

2.5.4 IN-GROUND SEWER ASSETS

2.5.4.1 AGGREGATE RESULTS

The total response rate across all submissions within the above in-ground sewer assets for Investment Planning Framework was 44%. The percentage completed varied between individual questions. The analysis reveals that only 3% of the councils have a relatively high score with regards to their investment planning framework assessments. A further 18% performed to an intermediate level. Incomplete questionnaires accounted for 53% of the submitted responses. The following two pages present the geographical distribution of Councils and their overall score for in-ground sewer assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with an investment planning framework for In-ground Sewer Assets is also presented.

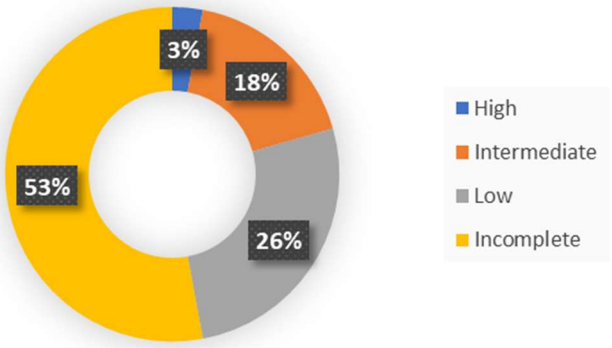


Figure 18 – Overall Investment Planning Framework Score – In-ground Sewer Assets

2.5.4.2 COMMENTS

1. **Framework** - The results for the in-ground sewer were identical for both sewer assets, with almost 44% of Councils stating that an investment planning framework was currently in development. About 31% stated they already had a framework, although 13% stated that it wasn't used. Approximately 25% stated that no framework was in place.

2. **Operational Planning** - Approximately 88% of Councils stated they had some sort of operational planning and capital maintenance procedure. Approximately 82% of Councils stated they had a planning procedure for enhancement on in-ground sewer assets.

3. **Investment Planning** - Approximately 57% of respondents had some sort of investment planning process for cost/benefit analysis and 38% had a process for scenario modelling. Only 20% of respondents had a process for understanding sensitivity analysis.

4. **Data Governance** - As with previous sections, Councils responded generally positively to maintainability and coverage of data for above-ground assets. Approximately 42% responded no to whether the data was of a high quality, and 43% responded no to the integration of data with corporate systems.

2.5.5 RECOMMENDATIONS

The answers in relation to planning framework were relatively consistent across the asset classes, and whilst the majority of councils either have an investment planning framework, or are in the process of developing one, there were 25% of respondents who do not have one at all. Of those who answered either yes or in development, 13% stated that the framework is not used consistently. Of the frameworks which are in place, the vast majority are considered to be basic, with only one council stating that they have an advanced framework and use it consistently. Development, implementation and governance of an investment planning framework can require significant input from internal stakeholders and specialist asset management consultants. Where this is currently being carried out across the entire state, this represents significant duplication of effort and expense, as well as potential for variation in quality of approach. Development of a best practice template and protocol which could be provided to those who currently do not have a formal investment planning framework, do, and do not use it consistently, or are in the process of developing one, would prevent unnecessary duplication, expenditure and effort, as well as ensuring consistent use of a high-quality method.

Responses to questions in relation to asset data were again relatively consistent across all four asset classes. Whilst the majority of respondents answered yes to having complete data sets which were easily maintainable, the majority of data was not considered to be high quality and was not integrated with wider corporate systems. Of the remainder of positive responses, the majority felt that there was room for improvement with regards to maintenance, integration, quality and coverage, with no respondents answering yes to having complete coverage of high-quality data. Whilst having a robust investment planning framework in place is important, the outcomes will only be as good as the data that is used. Development of standard data model and data management protocol would support councils in improving their overall asset intelligence, and realising the benefits of utilising high-quality data in investment optimisation.

Where a robust underlying planning framework and high-quality data sets are in place, this enables advanced analysis and optimisation of investment options. The vast majority of councils answered no to undertaking sensitivity analysis, cost benefit analysis and scenario modelling, with the majority of the remainder of respondents who gave a positive answer only having basic processes. Only one council claimed to have advanced processes in place for cost benefit analysis and scenario modelling, with none having advanced processes for sensitivity analysis. This appears to reflect the overall response to investment planning, with the relatively negative response being a factor of the underlying investment planning framework and asset data. Where standard protocols for investment planning and data management are developed, this would enable the incorporation of advanced process for sensitivity analysis, cost/benefit analysis and scenario modelling.

2.6 OPERATION & MAINTENANCE

Robust and effective operation and maintenance of strategic infrastructure assets is essential to the overall performance of the organisation. This section focuses on the key factors that are required to operate a strategic infrastructure inventory in a safe and reliable manner.

2.6.1 ABOVE-GROUND WATER ASSETS

2.6.1.1 AGGREGATE RESULTS

The total response rate across all submissions within the above-ground water assets for Operation & Maintenance was 48%. The percentage completed varied between individual questions. The analysis reveals that only 3% of the councils have a relatively high score with regards to their operation and maintenance assessments. A further 32% performed to an intermediate level. Incomplete questionnaires accounted for 50% of the submitted responses. The following page presents the geographical distribution of Councils and their overall score for above-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with Operation & Maintenance for Above-ground Water Assets is also presented.

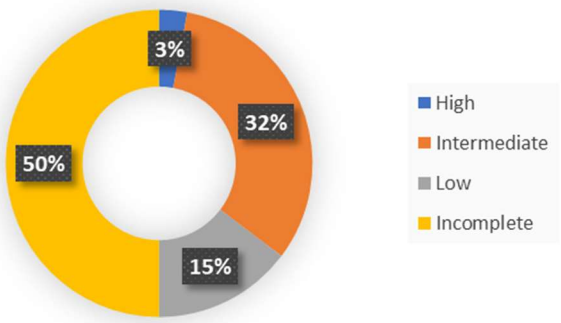


Figure 19 – Overall Operation & Maintenance Score – Above-ground Water Assets

2.6.1.2 COMMENTS

1. **Contingency Planning** - Approximately 58% of Council answered positively to whether they had operational contingency planning for critical above-ground water assets.

2. **Live Monitoring** - All Councils stated that had at least partial coverage for water quality monitoring of above-ground water assets. However, 50%-75% of Councils stated they had no monitoring for pressure, leakage or burst monitoring of above-ground assets. Only 6% had full coverage for these categories.

3. **Data Governance** - Councils responded generally positively to all data management questions regarding above-ground water assets. Maintainability and coverage of data were the best performing with about 75% answering positively. Approximately 33% responded no to whether the data was of high quality, and 40% responded no to the integration of data with corporate systems.

2.6.2 IN-GROUND WATER ASSETS

2.6.2.1 AGGREGATE RESULTS

The total response rate across all submissions within the in-ground water assets for Operation & Maintenance was 49%. The percentage completed varied between individual questions. The analysis reveals that only 3% of the councils have a relatively high score with regards to their operation & maintenance assessments. A further 26% performed to an intermediate level. Incomplete questionnaires accounted for 47% of the submitted responses. The following page presents the geographical distribution of Councils and their overall score for in-ground water assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with Operation & Maintenance for In-ground Water Assets is also presented.

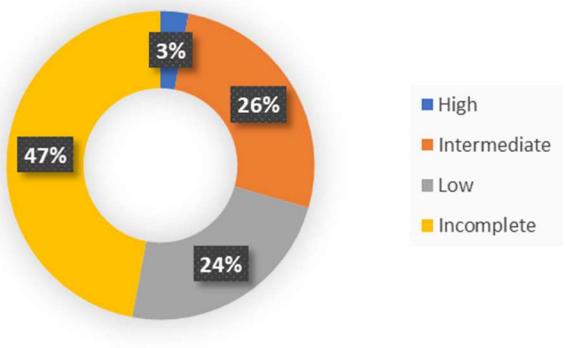


Figure 20 – Overall Operation & Maintenance Score – In-ground Water Assets

2.6.2.2 COMMENTS

1. **Contingency Planning** - Approximately 58% of Council answered positively to whether they had operational contingency planning for critical in-ground water assets. This mirrored the above-ground assets.

2. **Live Monitoring** - Approximately 81% of Councils stated that had at least partial coverage for water quality monitoring of in-ground water assets, 25% of which said this amounted to full coverage. However, 81% of Councils stated they had no monitoring for leakage or burst monitoring of in-ground assets and 50% stated they had monitoring for pressure.

3. **Data Governance** - Councils responded generally positively to all data management questions regarding above in water assets. Maintainability and coverage of data were the best performing with about 75% answering positively. Data quality was marginally higher than above-ground assets. Approximately 33% responded no to whether the data was of high quality, and 40% responded no to the integration of data with corporate systems.

2.6.3 ABOVE-GROUND SEWER ASSETS

2.6.3.1 AGGREGATE RESULTS

The total response rate across all submissions within the above-ground sewer assets for Operation & Maintenance was 45%. The percentage completed varied between individual questions. The analysis reveals that none of the councils have a relatively high score with regards to their operations and maintenance assessments. A further 26% performed to an intermediate level. Incomplete questionnaires accounted for 50% of the submitted responses. The following page presents the geographical distribution of Councils and their overall score for above-ground sewer assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with Operation & Maintenance for Above-ground Sewer Assets is also presented.

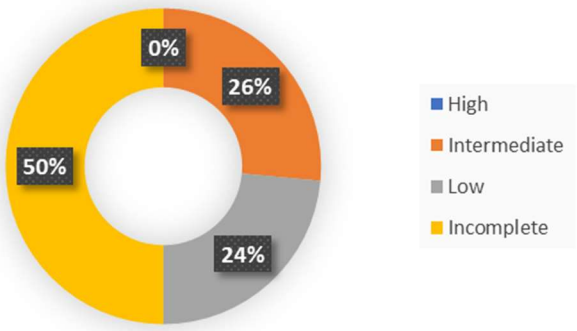


Figure 21 – Overall Operation & Maintenance Score – Above-ground Sewer Assets

2.6.3.2 COMMENTS

1. **Contingency Planning** - Approximately 56% of Council answered positively to whether they had operational contingency planning for critical above-ground sewer assets.

2. **Live Monitoring** - Approximately 66% of Councils stated that had at least partial coverage for water quality monitoring of above-ground sewer assets, 22% of which said this amounted to full coverage. However, 75-87% of Councils stated they had no monitoring for leakage, pressure or burst monitoring of above-ground assets.

3. **Data Governance** - Councils responded generally positively to all data management questions regarding above-ground water assets. Maintainability and coverage of data were the best performing with about 80% answering positively. Approximately 36% responded no to whether the data was of high quality, and 43% responded no to the integration of data with corporate systems.

2.6.4 IN-GROUND SEWER ASSETS

2.6.4.1 AGGREGATE RESULTS

The total response rate across all submissions within the in-ground sewer assets for Operation & Maintenance was 45%. The percentage completed varied between individual questions. The analysis reveals that none of the councils have a relatively high score with regards to their operations and maintenance assessments. A further 23% performed to an intermediate level. Incomplete questionnaires accounted for 53% of the submitted responses. The following page presents the geographical distribution of Councils and their overall score for in-ground sewer assets, in addition to the top 10 Councils ranked by score. A summary of questions associated with Operation & Maintenance for In-ground Water Assets is also presented.

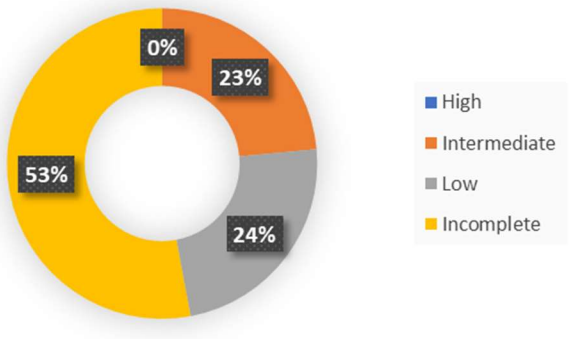


Figure 22 – Overall Operation & Maintenance Score – In-ground Sewer Assets

2.6.4.2 COMMENTS

1. **Contingency Planning** - Approximately 56% of Council answered positively to whether they had operational contingency planning for critical in-ground sewer assets.

2. **Live Monitoring** - Approximately 47% of Councils stated that had at least partial coverage for water quality monitoring of in-ground sewer assets, 12% of which said this amounted to full coverage. However, 75-94% of Councils stated they had no monitoring for leakage, pressure or burst monitoring of in-ground assets.

3. **Data Governance** - Councils responded generally positively to all data management questions regarding above-ground water assets. Maintainability and coverage of data were the best performing with about 80% answering positively. Approximately 36% responded no to whether the data was of high quality, and 43% responded no to the integration of data with corporate systems.

2.6.5 MAINTENANCE OVERVIEW (MULTI-ASSET)

Of those Councils that responded to questions relating to asset maintenance, pipe bridge maintenance and sewer pipeline corridor maintenance had the most negative responses on average across the three categories (46%). Maintenance surrounding water treatment process units, strategic valves and ancillaries, and water pipeline corridors were the assets highlighted that scored highest in having maintenance in place, but highlighted that these required improvement. Councils, on average, highlighted water storage and water pump maintenance as the most effective. This is potentially related to having the highest level of regulation surrounding stringent water quality controls.

2.6.6 RECOMMENDATIONS

The use of critical asset monitoring was noticeably limited in the research. As such, consideration should be given to modern monitoring technology which provides a broad range of risk and performance management opportunities. For in-ground assets, this includes monitoring for ground movement, third party intervention, leak, burst, and turbidity. Where utilised as a part of an overall risk-based strategic approach, monitoring can provide significant improvements in the quality and reliability of water service. A well-defined, state-wide approach to criticality, as mentioned previously, would be best suited to selecting the most critical assets for monitoring.

Councils that have a larger portion of urban coverage should consider optimisation of standard operating pressures and management of pressure transients. For pressure transients, the strategy should allow for both permanent monitoring in critical locations as well as a programme of targeted investigation, focussing on likely sources of transients such as pumps, PRVs and top users.

Risk analysis and prioritisation of specific assets would ensure consistency and continuity of approach in relation to asset management across Queensland. For example, the creation of a critical valve data model would support integration with shut plans and maintenance activities. As valves were highlighted as asset that would benefit from improved maintenance, the creation of state-wide maintenance protocols and the use of shared regional training rigs to allow operatives to be trained without any impact on the network, would be beneficial to operations and maintenance, whilst also improving technical confidence and capability. Access to shared specialist survey and maintenance teams could also provide both financial and technical benefits.

To address the negative responses to pipe bridge maintenance, it is recommended that a standard process is provided to enable councils to audit their pipe bridge inventories and ensure that they are being managed appropriately. This should include assessment of the infrastructure, supporting structure and health, safety and security arrangements.

The management of wayleave corridors, both for sewers and potable pipelines, and the encroachment of vegetation on above-ground assets, was noted as an area requiring improvement. Although no specific details are available through the process of this questionnaire, reviewing Council methodologies would help to identify gaps in data, processes and outputs. Undertaking near-term analysis using satellite and 3rd party datasets would quickly identify those areas that require immediate attention, particularly on more critical assets if undertaken in parallel with risk analysis. A yearly re-run of the analysis would help to identify risks before they become problematic, whilst helping to manage failure events, reduce the consequence of failure and improve overall service. This should align with Queensland's Vegetation Management Framework.

It is noted that the most recent collective strategy document highlights a number of initiatives that LGAQ are planning to develop and implement, including the use of new diagnostic and analytical tools to help effectively manage assets and operations. A detailed view of these tools has not been reviewed as part of this assessment.

2.7 OVERALL DATA MANAGEMENT

Data Management refers to the overall management of data and information directly in relation to their application to water and sewer assets. This assessment aims to gauge the current state and establish whether a consistent and effective approach is applied to the management of both corporate data and data from specific initiatives across different asset classes.

2.7.1 RESULTS

For data management across base register and for data collection and maintenance, Councils have consistently responded across all asset classes with either high or medium with regards to quality, completeness and spatial accuracy. Base register completeness has been identified as the best performing category across all assets, particularly on the above-ground assets for both water and sewer. The quality of data collection for both in-ground assets is the worst performing category.

Investment prioritisation software performed the most poorly out of data management systems, with almost all councils (87%) stated that they had none in place. Field data software was the second poorest performer, although 46% of respondents did state that the system was frequently maintained. Systems for water quality and GIS were the best performing, with 58% and 56% respectively for maintained frequently.

A summary can be found on the next two pages.

2.7.2 RECOMMENDATIONS

The survey results indicate high variability in current IT maturity between the different councils. However, it is understood from LGAQ's most recent strategy document (2019/2020) work is ongoing to develop an innovative digitisation initiative. This will potentially help to bridge many of the data and policy issues that have been identified, including the creation of a state-wide Local Government Data Lake and implementation of new technologies such as Blockchain. The absence of a current state-wide digital strategy to streamline planning and technology developments risks misalignment between councils and redundant strategic work. As part of this strategy, and if not already in place, we recommend that LGAQ engage a chief technical officer to elevate the importance of technology, data, and innovation in policymaking and focus on providing unbiased, authoritative insight to the councils through ongoing strategic conversations, prototype policy, and model impact scenarios for the future.

The respondents provided a mixed response to the availability of field data collection software. Several mobile data collection (MDC) platforms are available to collate field data using mobile devices. LGAQ should develop a framework to lead councils in choosing the appropriate MDC technology. This framework should involve the proper identification and prioritisation of selection criteria and application comparison matrix assessments.

Most organisation are currently undergoing through a digital transformation programme to integrate digital technologies such as mobile, analytics, IoT, AI, and cloud-based services, in the service of transforming how the business operates. As part of a successful digital transformation programme, LGAQ should lead councils to develop a Master Data Management (MDM) initiative to link all of its valuable data into a central system that provides a common point of reference. This initiative would reduce data duplication, increase data quality, enable broader data integration with Line of Business (LOB) applications such as GIS and EAMS, and eliminate redundant integration activities.

MDM consolidates master data together in a central hub to enable the employment of services such as data governance and stewardship, data quality, data security, metadata, hierarchy, and overall data lifecycle management and would ultimately to serve as the single source of truth for Council data. MDM initiatives would also facilitate the implementation of Investment prioritisation software in the future.

An increase in Council's awareness on the benefits of MDM practices, especially to top management who are responsible not only for creating vision, strategies and policies but also responsible in approving adequate financial and human resources to support the development and operation of such IT transformation programmes.

Councils should also improve their technological competence and their employee's expertise for supporting application integration with MDM. Engagement with a chief technical officer would also support successful digital transformations that deploy digital

technologies and tools such as cloud-based services, mobile internet-technologies, big data architecture (e.g. data lakes, modern data warehouse), Machine Learning, IoT, Artificial Intelligence, Robotic Process Automation and Business Intelligence. It was noted that the recent strategy document highlights the importance of developing digital skills as part of a digital transformation.

2.8 STATE-WIDE INFRASTRUCTURE MANAGEMENT

State-wide infrastructure management gauges Council opinion on their interest in a state-wide infrastructure asset management online portal which would be based on best practice asset management principles and would comprise of a number of individual elements. These elements would include support for a number of aspects of asset management which have been discussed throughout this assessment.

2.8.1 RESULTS

State-wide consequence assessments gained the most interest with a 76% positive response, however only 31% would be willing to pay for such a service. State-wide investment planning and optimisation support and asset management guidance were the next best supported with a 71% and 75% positive response. Willingness to pay for this service however dropped to 29% and 25% respectively. The least interest was generated by a state-wide asset data register and asset modelling support with a 58% response; willingness to pay was at 77% and 65% respectively. The results have been summarised across two charts shown below.

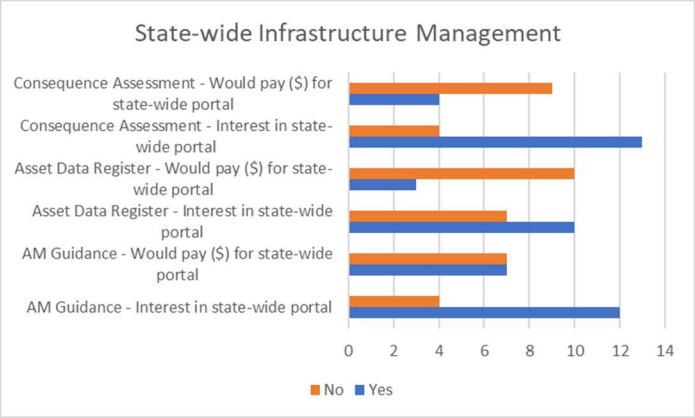


Figure 23 - State-wide Infrastructure Management Part 1

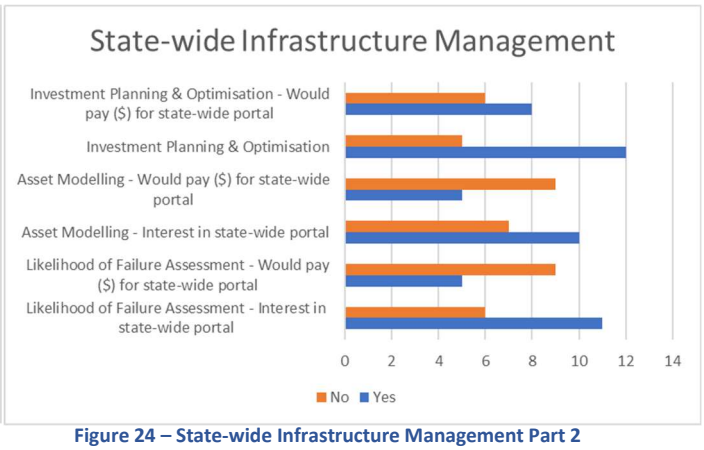


Figure 24 – State-wide Infrastructure Management Part 2

2.8.2 RECOMMENDATIONS

The results of the questionnaire highlight a significant level of interest in state-wide infrastructure initiatives. Further collaboration across the state would greatly benefit how all assets are managed, maintained and renewed, whilst improving levels of service and customer satisfaction. Although several formal collaborations between Councils are currently facilitated through QWRAP, it is not known at what level of detail these initiatives operate at. In light of this, it is recommended that a state-wide working group is created that focusses on which initiatives to develop further as part of an overall state management process and how to develop them in a coordinated manner. In particular, Consequence, likelihood of failure and asset management guidance are areas which Councils feel they would benefit from having state-wide guidance or collaboration.

3 CONCLUSIONS

3.1 SUMMARY FINDINGS

The data collected through this process has provided a range of useful insights into how water and waste water assets are currently managed within the state of Queensland, highlighting several key issues and opportunities. It should however be noted that the analysis and recommendations included within this report are based solely on the results of the questionnaire, which is representative of the Councils' 'own' view of their asset management system and processes. No additional council specific data or documentation was reviewed in the compilation of this report.

The main issue identified through analysis of the response data is the disparity across the state in relation to the sophistication and completeness of asset management systems, with the asset management systems developed by some councils being relatively primitive, while other authorities demonstrate a very high-level of maturity and sophistication.

The overall asset class responses do however suggest that there is some consistency in the way in which councils prioritise asset class investment regardless of size or region, with management of above-ground assets being consistently prioritised over in-ground infrastructure. This supports the outcomes highlighted by the Research Report 5.1 (Infrastructure Cliff) produced by the Queensland Water Regional Alliance Programme (QWRAP), which emphasised historic underinvestment in in-ground water and waste water assets, and the potential impacts this may have on water and waste water services in the future.

A number of other key gaps were identified within specific assessment categories. In-ground assets of both water and waste water infrastructure are particularly lacking in condition data, with a significant number of Council's having little or no data at all. In addition, the quality and completeness of consequence of failure data was also identified as an issue with 50% of councils stating that their current data set was inadequate, with a further 50% of councils also stating that they did not have enough specialist asset management staff to address these issues. A key opportunity for improvement was also identified in relation to business planning and the optimisation of asset investment.

It is possible that the disparity in asset management approach can be at least partly explained by the current institutional model, with water and waste water services disseminated across many individual councils, which can have highly dispersed communities with varying priorities, populations, resources and availability of expertise. A particularly important factor is the large number of small isolated communities, with two thirds of potable schemes servicing towns with fewer than 1000 residents, and 50% servicing fewer than 500 people. It was also considered that the current regulatory model may not provide the direction and stimulus necessary to drive the continual improvement and consistency of approach needed to fully realise the benefits of effective asset management.

LGAQ and the Queensland Water Directorate (QWD) attempt to address some of these challenges by providing a state-wide platform for research, collaboration and knowledge sharing.

The most recent LGAQ Strategy document provides a high-level plan for the new initiatives that will be rolled out across the Association. Whilst there are no specific initiatives detailed within the Strategy, it does offer an insight into how LGAQ plan to align member Councils through similar asset management objectives and technological approaches. The acknowledgement that Councils should align their objectives and policies will lead to improvements in asset performance, and ultimately improve customer service, confidence and satisfaction.

The following is a summary of the findings from each assessment category:

Strategic Planning

- **Staff Capability** - The majority of respondents believe they have highly capable staff that can manage multiple asset classes in terms of asset management. However, approximately 50% state they do not have adequate numbers of staff to fulfil these activities.
- **Risk Appetite** - Councils have well defined risk appetites in supply interruption, environmental impact and damage impact. Cost of failure is notably less well defined.
- **Customer Engagement** - Customer engagement provided mixed responses, with some Councils using multiple engagement methods. A number of councils however do not utilise any documented engagement methods. Staff engagement is extremely positive.
- **Strategy Documentation** - Corporate business plans, long term strategic direction and long-term financial plans are all generally frequently maintained. Asset criticality frameworks and strategies for specific assets received a poor response.
- **QEMS** - QEMS is largely well applied across all asset classes.
- **External Collaboration -** External Councils work well with external organisations for regular liaison and developing document plans. There was a much lower positive response to co-operation on mock trials and incidents.

Consequence of Failure

- **Managing Criticality** - Councils generally provided positive responses to how they define assets in terms of criticality for their assets, although a third do not believe assets are well managed against a criticality definition.
- **Service Impact** - Only 5 Councils stated a binary or static population could be associated with each asset in the event of failure. Only 2 Councils stated a dynamic population could be modelled over time and only one Council had advanced response and recovery modelling.
- **Response & Recovery** - Approximately a third of Councils stated they had no response and recovery modelling for their assets. A basic model that also incorporates disasters had the highest number of responses with two thirds of Councils stating they had this capability. Only one Council had advanced response and recovery modelling.
- **Failure Impact** - There was a mixed response to failure impact. The majority of Councils indicate that they have some sort of process in place to identify impacts associated with asset failure across all 4 available categories (environmental, H&S, societal and property). Health & safety impact identification provided the highest number of positive responses, whereby property and societal identification had the highest number of negative responses; those Councils that had no process in place to identify such risks.
- **Cost of Failure** - Councils generally stated they did not have any cost of failure model, although approximately 40% stated they had some kind of model associated with asset repair costs. Less than 30% stated they had a cost model for either 3rd party damage impact or water supply impact.
- **Flood Impact** - The majority of Councils have no or basic flood impact modelling on. This is particularly evident on the impact of 3rd parties in the event of an asset failure with approximately two thirds of Councils having undertaken no flood analysis. This falls to about a third for impact on assets from flooding.
- **Drought Impact** - Approximately 40% of respondents stated that they had some sort of basic method for identifying the impact of drought. The remaining respondents stated they either had no way of identifying drought risk or did not know. There were only 4 respondents to the question of understanding the potential drought impact. Two Councils stated they had a basic, system-wide understanding and two had no understanding.
- **Data Governance** - Councils were almost unanimous in their responses in the need for data quality, coverage, integration or ease of maintenance, to either be improved within their management systems. Furthermore, 50% of Councils stated that consequence data was not adequate in terms of quality, coverage, integration or ease of maintenance.

Likelihood of Failure

- **Deterioration Models** - Approximately a third of respondents employ a likelihood of failure model for all asset classes. This increased to between 50-60% for remaining service life models. There was limited confidence in the quality of the data produced by these models.
- **I&T Expertise** - Approximately 82% of Councils responded positively to their internal inspection and testing expertise. This was a similar result across all assets.
- **Condition Assessment Coverage** - All Councils stated that less than 50% of their assets were condition assessed. The results were considerably lower for in-ground assets compared to above-ground assets.
- **I&T Frequency** - Councils provided mixed responses to inspection frequency, which varied across assets. Inspection and testing frameworks are not currently broadly utilised. Inspections every 5 years was the most common response, although Councils also indicated that ad-hoc assessments were commonly used.
- **Likelihood Analysis** - In most cases, the majority of Councils stated that some sort of field, desktop and laboratory analysis was undertaken for likelihood, however only a small number responded with advanced analysis. There was a high level of negative responses to calibration of deterioration models across all assets.
- **Data Governance** - Councils responded mainly positively to maintainability and coverage of data. However, as with other categories, between 75%-90% responded no to whether the data was of a high quality. Data integration of data with corporate systems was also highlighted as being of a poor quality.

Investment Planning

- **Framework** - The results for an investment planning framework were fairly consistent across the asset classes, with between 44%-50% of respondents stating that a framework was in development. In each class, approximately 25% of respondents said no framework was in place.
- **Operational Planning** - Approximately all Councils has planning procedures in place, with at least 75% positive response rate across operational, maintenance and enhancement planning.
- **Investment Planning** – The majority (57%-68%) of Councils had an investment planning process of cost benefit analysis. This dropped to between 38%-50% for scenario modelling. Only approximately between 20%-30% of respondents had a process for understanding sensitivity analysis.
- **Data Governance** - Councils answered in a positive manner to questions about data management specific to operation and maintenance. Data integration across applications was the poorest performing category across all asset classes with approximately 40% negative response.

Operation & Maintenance

- **Contingency Planning** - Just over half of Councils across all asset classes answered positively to whether they had operational contingency planning for critical assets.
- **Live Monitoring** - Councils stated that water quality monitoring had good coverage, especially across the water assets. There was much lower coverage for monitoring of leakage, bursts and pressure, with between 50-75% having no coverage for water assets and between 75%-95% for sewer assets.
- **Data Governance** - Councils answered in a positive manner to questions about data management specific to operation and maintenance. Data integration across applications was the poorest performing category across all asset classes.

Data Management

- Councils have consistently responded across all asset classes with either high or medium with regards to quality, completeness and spatial accuracy.
- Base register completeness was the best performing category, whilst data collection quality was the poorest in the data category
- Councils GIS and water quality applications were the most frequently maintained and up to date
- Councils stated that investment prioritisation software and field data software were their poorest applications for maintenance.

State-Wide Infrastructure Management

- Councils have responded with a significant level of interest in state-wide infrastructure initiatives although there is less inclination to pay for a product or service.
- Consequence, likelihood of failure and asset management guidance received the most positive responses for interest.
- Councils were most willing to pay for asset management guidance and investment optimisation

3.2 RECOMMENDED NEXT STEPS

Given the large number of individual councils involved, it would be both costly and impractical to use the data generated by this survey to attempt to support councils in addressing their needs on an individual basis. Whilst several opportunities for improvement have been identified at management system component level, development of key centralised shared support initiatives would be more effective and would provide greater value, with the information form this survey used to prioritise development and delivery.

The following initiatives are considered to offer the greatest overall benefit for both local council and state:

State-wide Asset Management Framework & Delivery Support Platform (together, the 'Shared Asset Management System'): The development of shared, state-wide template-based asset management framework and delivery support platform, incorporating best-practice approach for all aspects of asset operation and maintenance, would provide a range of substantial benefits. However, it is acknowledged that there are several practical and political challenges which would need to be overcome for this to be delivered. Development of such a platform would require the co-operation, commitment and agreement of many councils as well as an up-front and ongoing technical and financial contribution, with some councils realising greater benefits than others. Consideration should be given to the following when contemplating development of such a system:

- The system would need to balance the need for consistency, structure and governance with the requirement for councils to maintain overall independence, autonomy and accountability within QLD's current institutional urban water services model.
- The system should account for the management of all water and waste water assets from source to tap and from bath to bay.
- It should account for the full range of QLD's water service scenarios, from dense urban to ultra-rural, and from large well-resourced and data rich water utilities to small councils with limited data and staffing.
- It should also account for localised nuances in relation to risk and prioritisation.

Whilst development of such a system would be ambitious, the development of content and functionality could be scoped and phased appropriately over time. Were this to be undertaken it is envisaged that the following benefits would be attained:

- By aligning methodologies, processes and data governance, risks can be comparatively ranked throughout the state, providing an asset register that outputs consistent consequence and likelihood scoring. Regions, Councils and individual assets can then be easily classified and prioritised based on their scores, and intervention and support targeted in an appropriate and defensible manner.
- Implementation of the system would have the potential to reduce the burden on existing budgets and resources by providing standard templates for data models and data capture, as well as providing a degree of automated analysis and reporting
- The standard of asset management approach would be increased across the state, resulting in improved strategic outcomes for councils and service outcomes for customers.
- Creation of asset operation and risk profiles in a standard format would improve the ability to undertake regional and state-wide strategy and resilience planning.
- Several of the efficiencies and technical benefits of being part of a larger regional body would be realised without the need for formal aggregation.

Development of the framework and delivery support platform would require specialist skills and expertise. There are several highly skilled and experienced asset management professionals currently working within Queensland's Water authorities who have already developed and implemented a number of sophisticated asset management systems. The collaboration of a select group of these individuals, together with specialist consultancy support to develop a QLD specific best practice methodology, would result in the most effective outcome.

Whilst the majority of respondents agreed that there would be benefit in having access to such a platform, the majority of respondents also answered that they would be unwilling to pay for it. Such an initiative may require a compromise funding model with state subsidisation for development of the system with a small means-based ongoing maintenance subscription paid by local authorities.

State-wide Asset Management Working Group: The results of the questionnaire highlight a significant level of interest in state-wide infrastructure initiatives. Further collaboration across the state would greatly benefit how all assets are managed, maintained and renewed, whilst improving levels of service and customer satisfaction. Although several formal collaborations between Councils are currently facilitated through QWRAP, it is not known at what level of detail these initiatives operate at. In light of this, it is recommended that a state-wide working group is created that focusses on which initiatives to develop further as part of an overall state management process and how to develop them in a coordinated manner. In particular, Consequence, likelihood of failure and asset management guidance are areas which Councils feel they would benefit from having state-wide guidance or collaboration.

Shared Strategic Services Resource: It is evident from the survey that the variation in responses can be linked to the large differences in Council geographical area, population, and the number and level of specialist staff available. For several of the smaller and more remote councils, employing specialist water and sewer asset management professionals is impractical in terms of both cost and availability. As a result, councils may either rely on expensive consultancy support or defer certain asset management activities. Establishment of a central team of specialist water and sewer asset management professionals to support these councils in maintaining their essential water and sewer assets, would result in benefits for not only the individual councils but collectively for QLD's rural communities. Economy of scale and the implementation of consistent, high-quality asset management practices would improve outcomes for customers while reducing the burden on existing council resources.

4 REFERENCES

Cosgrove, R. and Fearon, R, Queensland Water Regional Alliance Program – Infrastructure Cliff? Queensland's Ageing Water and Sewerage Assets. 1. In-ground network asset lives – QWRAP Research Report 51, April 2018

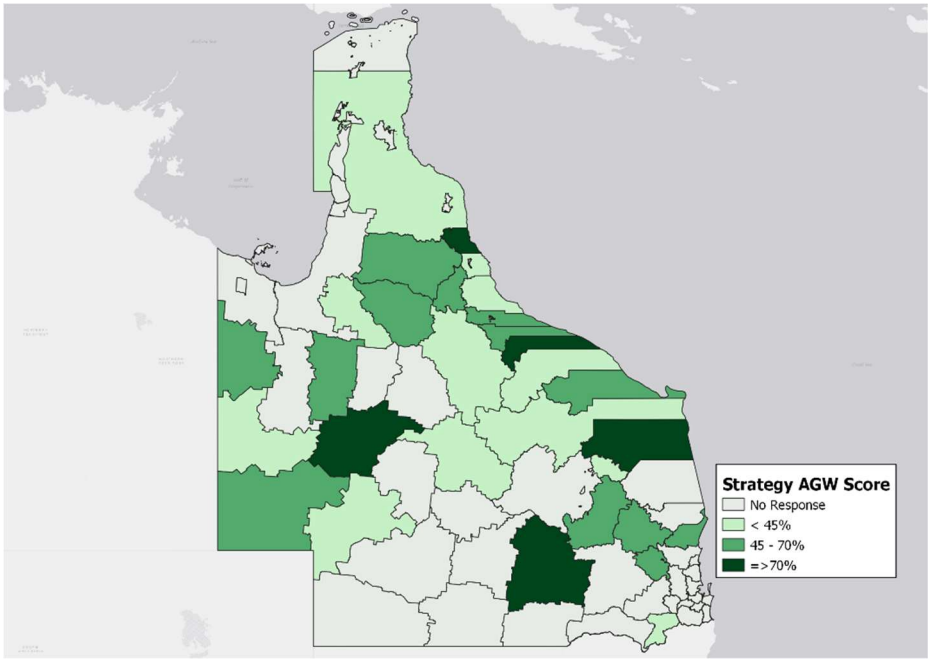
LGAQ Strategic Plan 2019-20

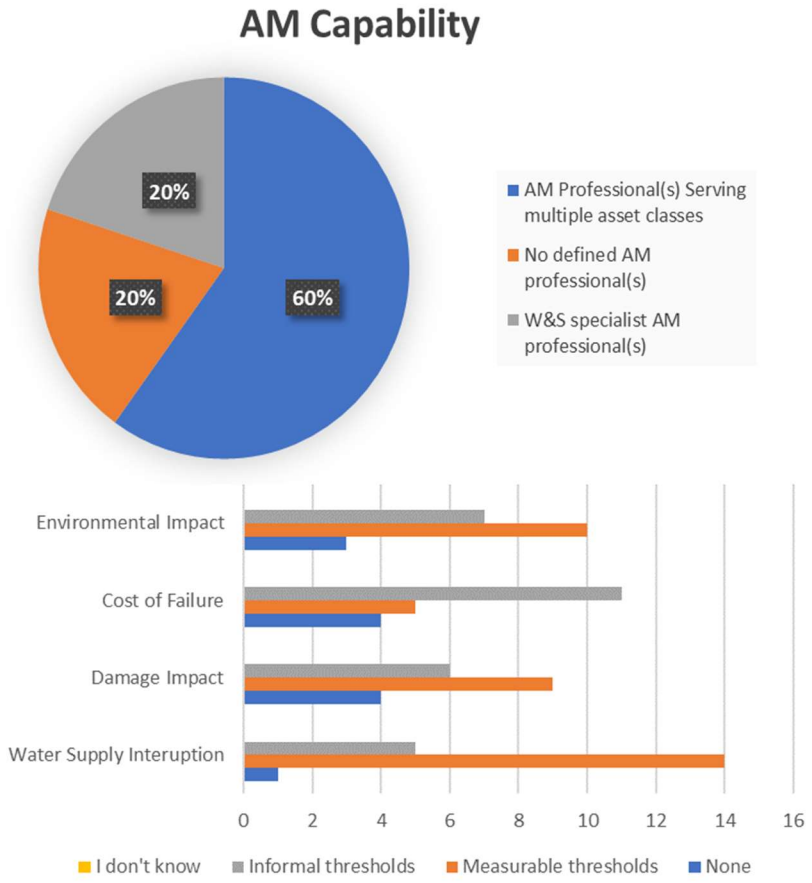
Queensland Water Regional Alliance Program – Annual Progress Report 2018, 2018

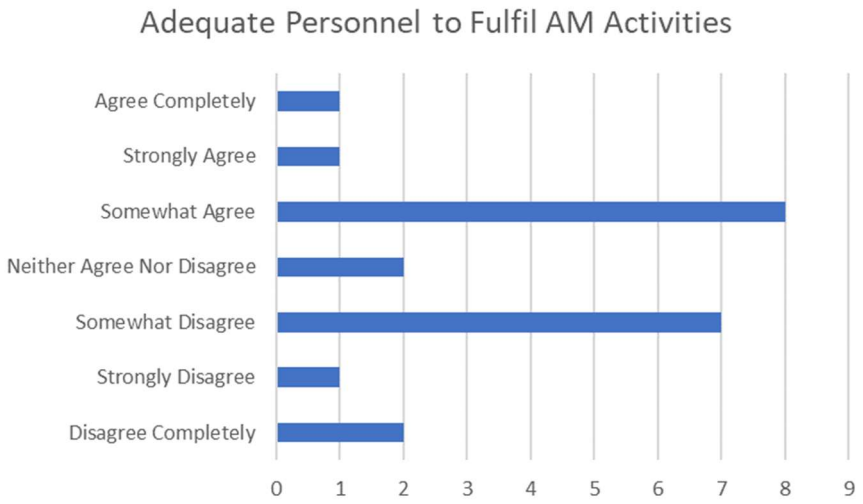
5 APPENDICES

5.1 STRATEGIC PLANNING RESPONSES

5.1.1 ABOVE-GROUND WATER ASSETS






Adequate Personnel to Fulfil AM Activities
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
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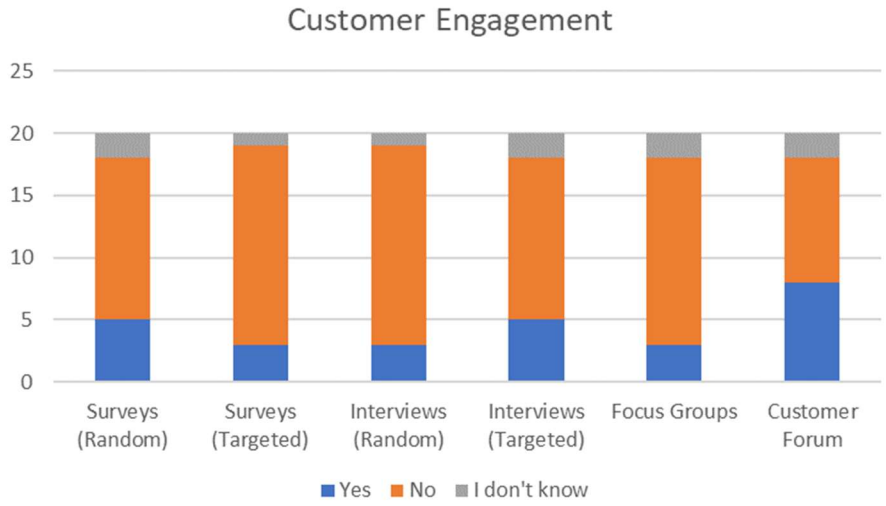
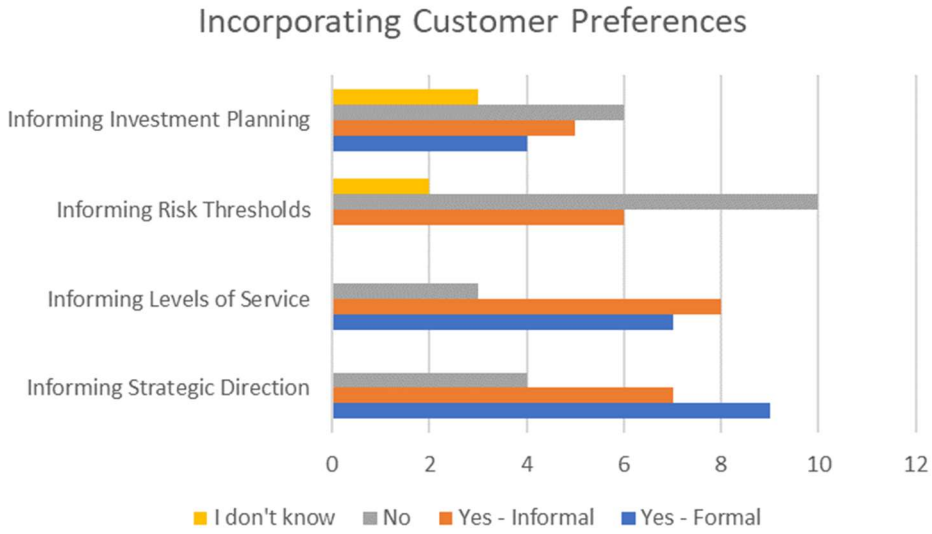
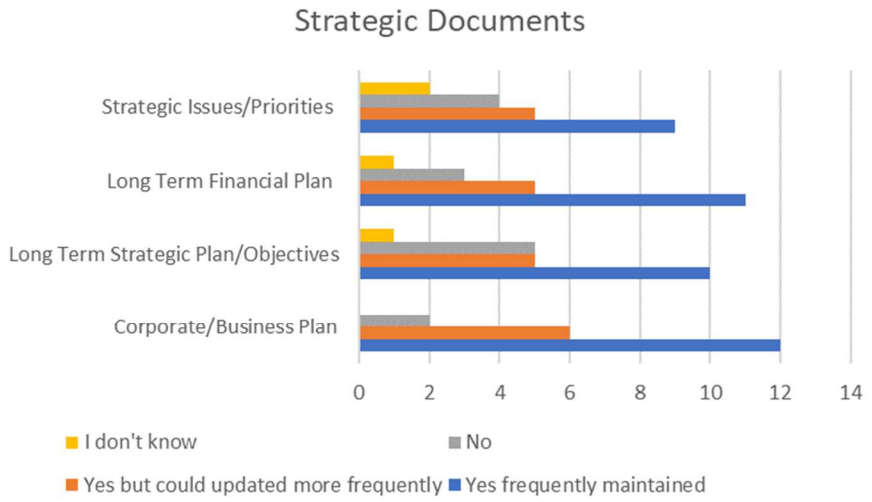
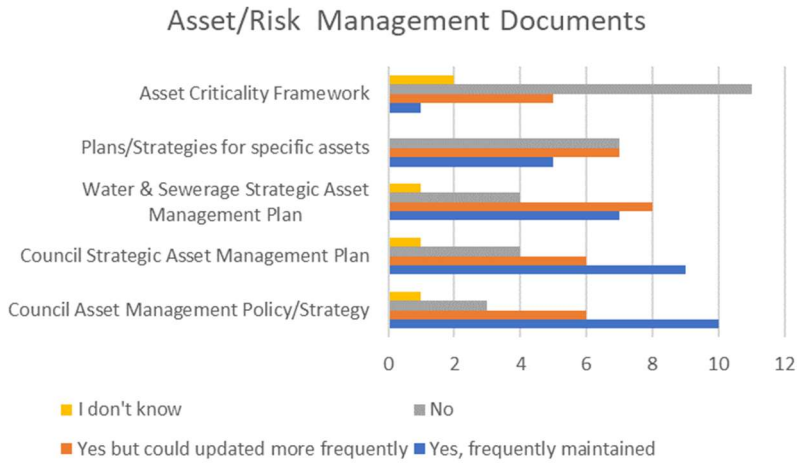
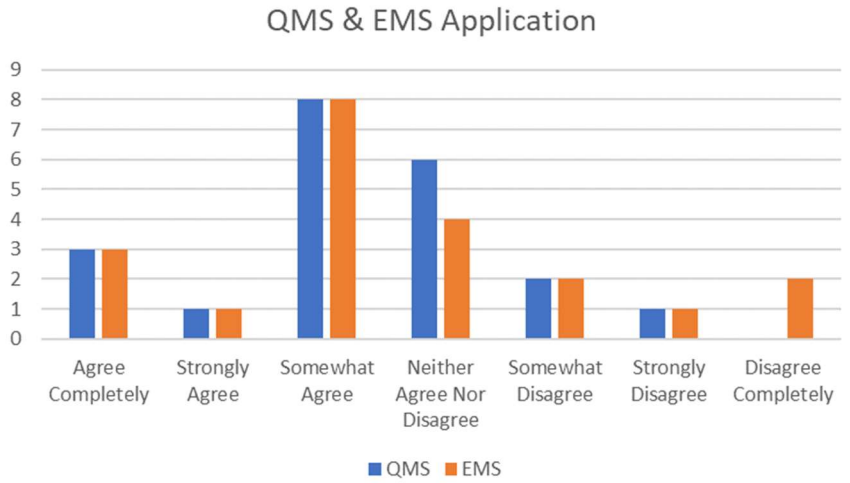
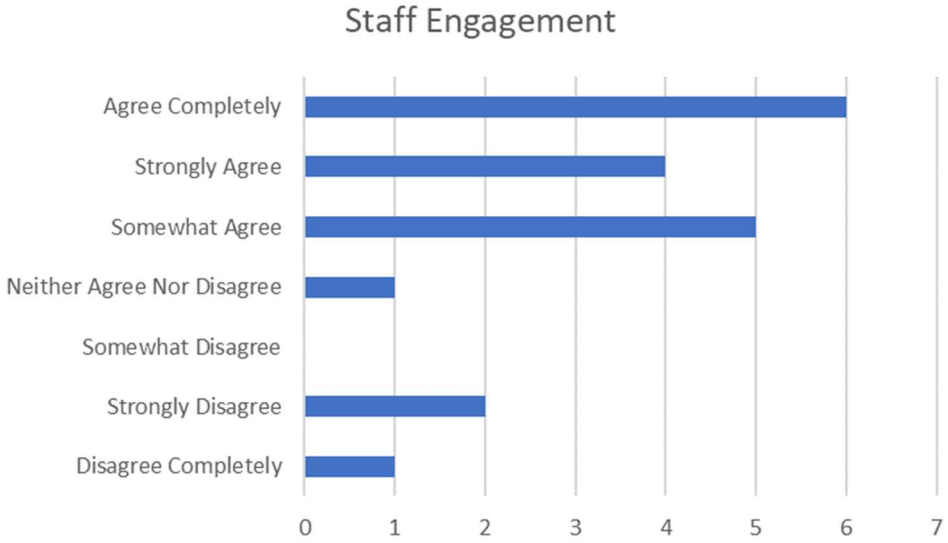

Customer Engagement
25
20
15
10
5
0
Surveys (Random)
Surveys (Targeted)
Interviews (Random)
Interviews (Targeted)
Focus Groups
Customer Forum
Yes
No
I don't know

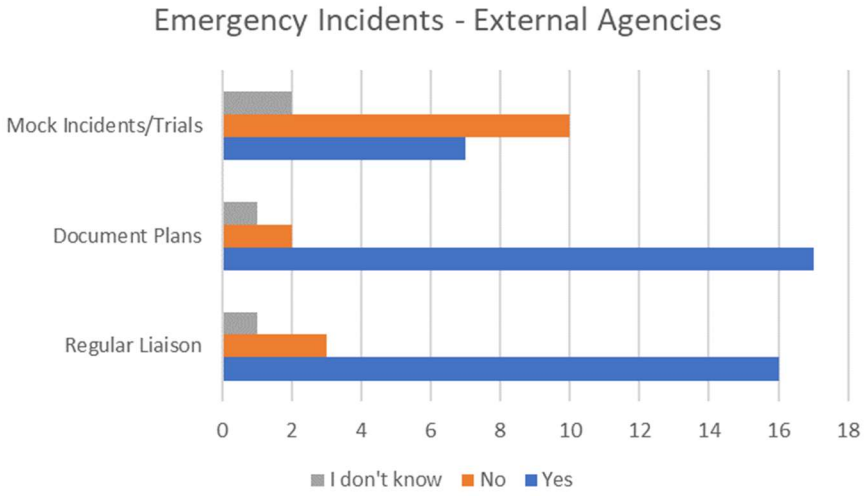

Incorporating Customer Preferences
Informing Investment Planning
Informing Risk Thresholds
Informing Levels of Service
Informing Strategic Direction
0
2
4
6
8
10
12
I don't know
No
Yes - Informal
Yes - Formal


Strategic Documents
Strategic Issues/Priorities
Long Term Financial Plan
Long Term Strategic Plan/Objectives
Corporate/Business Plan
0
2
4
6
8
10
12
14
I don't know
No
Yes but could updated more frequently
Yes frequently maintained


Asset/Risk Management Documents
Asset Criticality Framework
Plans/Strategies for specific assets
Water & Sewerage Strategic Asset Management Plan
Council Strategic Asset Management Plan
Council Asset Management Policy/Strategy
0
2
4
6
8
10
12
I don't know
No
Yes but could updated more frequently
Yes, frequently maintained


QMS & EMS Application
9
8
7
6
5
4
3
2
1
0
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
QMS
EMS


Staff Engagement
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
1
2
3
4
5
6
7


Emergency Incidents - External Agencies
Mock Incidents/Trials
Document Plans
Regular Liaison
0
2
4
6
8
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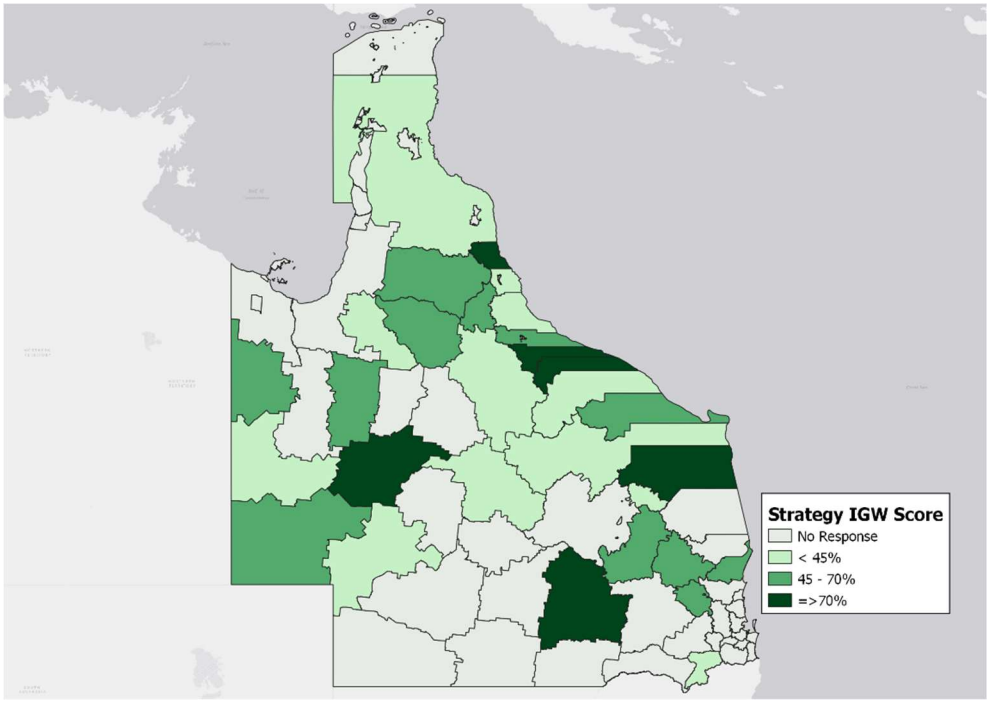
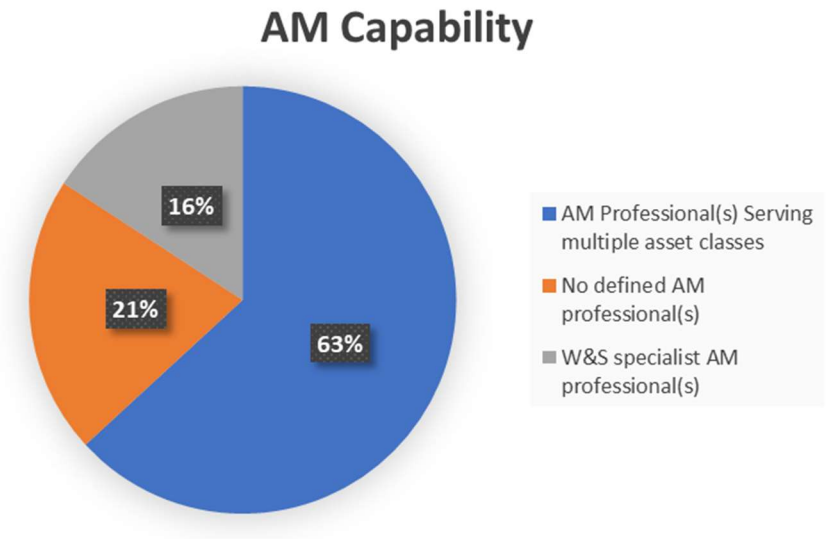
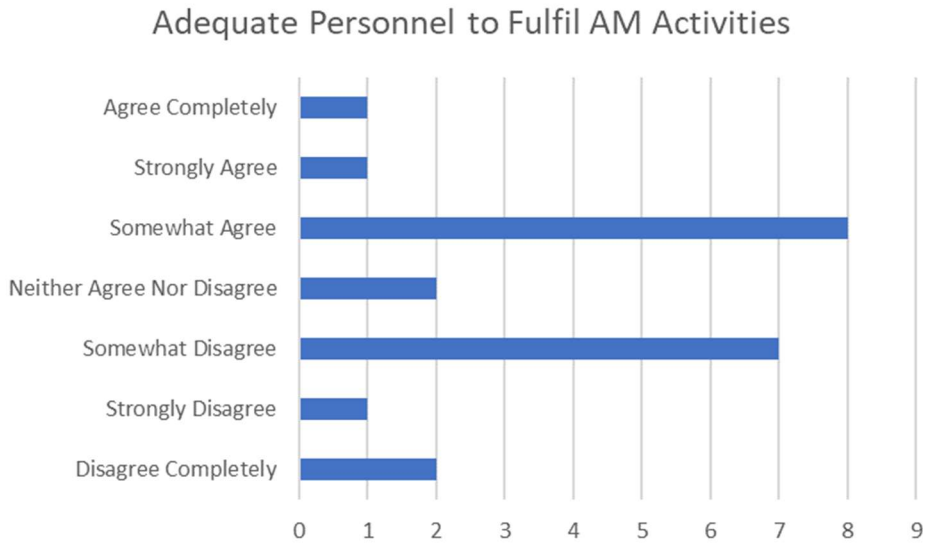
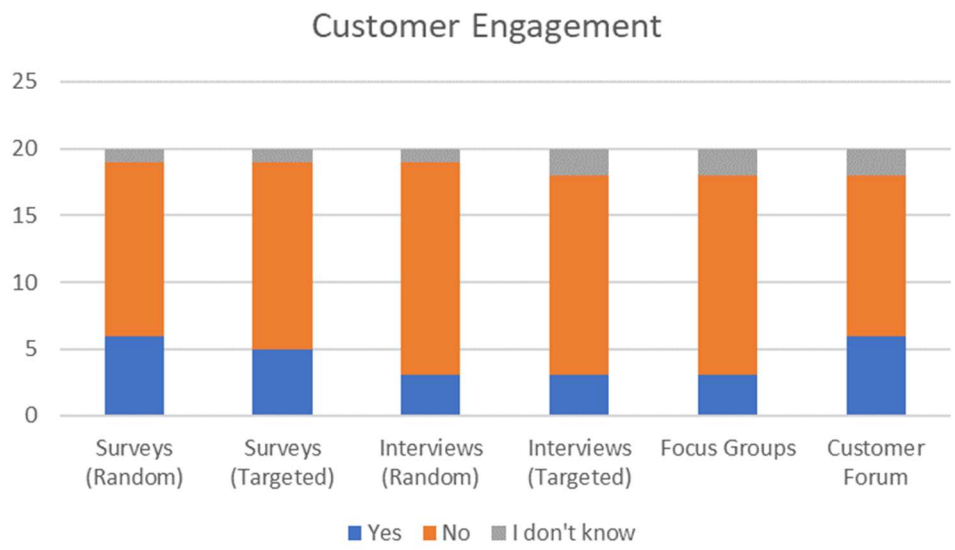
12
14
16
18
I don't know
No
Yes

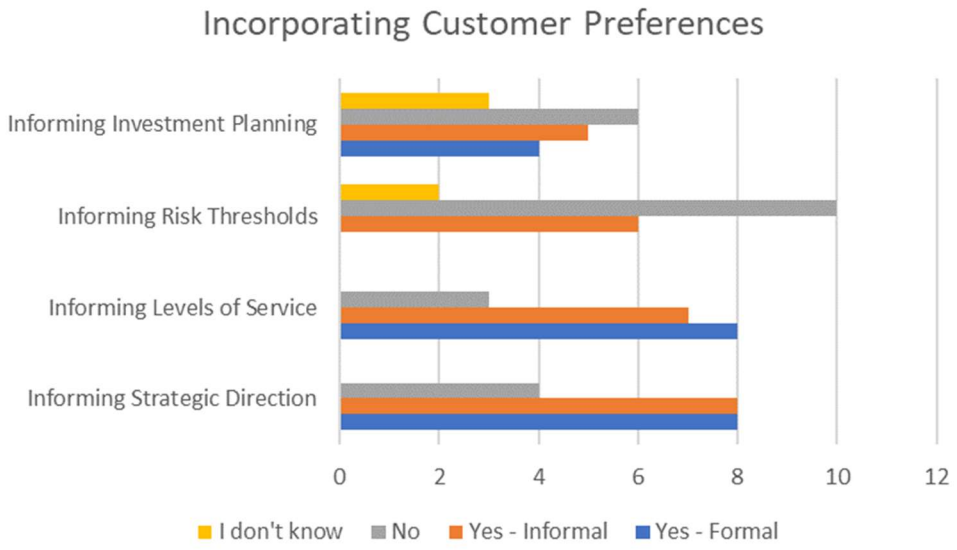
5.1.2 IN-GROUND WATER ASSETS








Customer Engagement
25
20
15
10
5
0
Surveys (Random)
Surveys (Targeted)
Interviews (Random)
Interviews (Targeted)
Focus Groups
Customer Forum
Yes
No
I don't know


Incorporating Customer Preferences
Informing Investment Planning
Informing Risk Thresholds
Informing Levels of Service
Informing Strategic Direction
0
2
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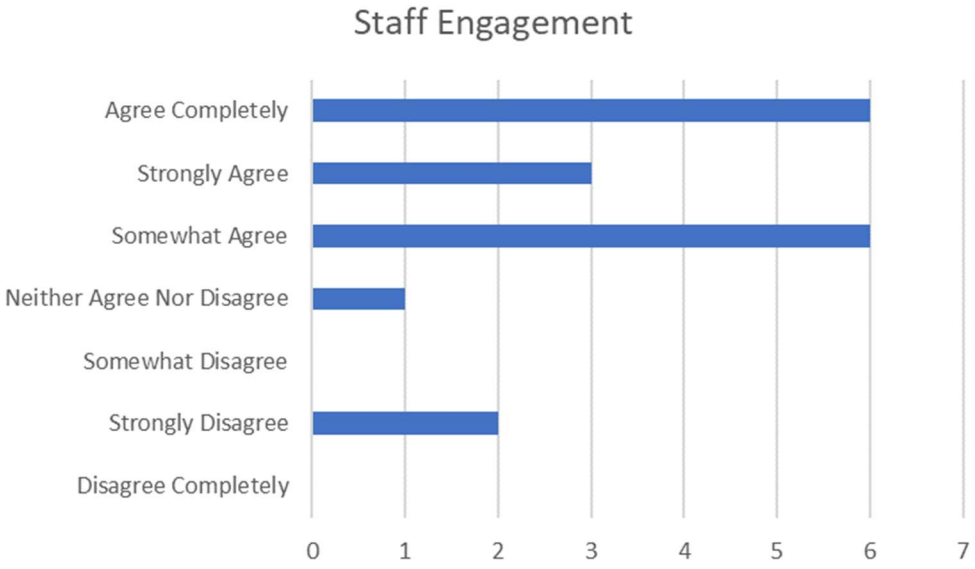
12
I don't know
No
Yes - Informal
Yes - Formal


Staff Engagement
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
1
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4
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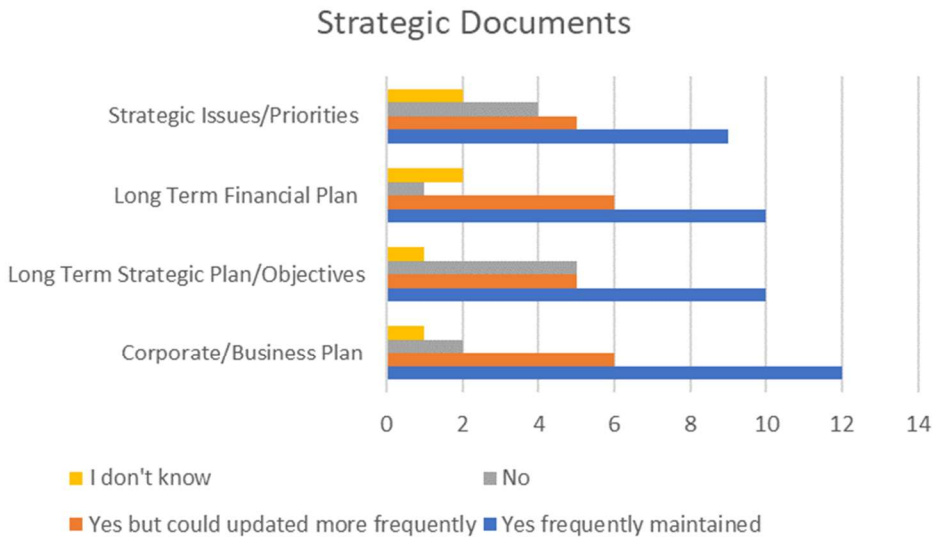
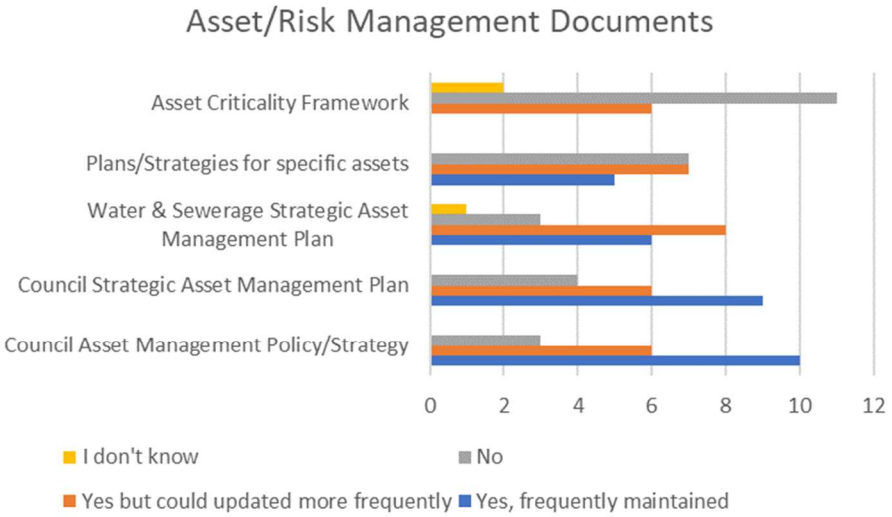
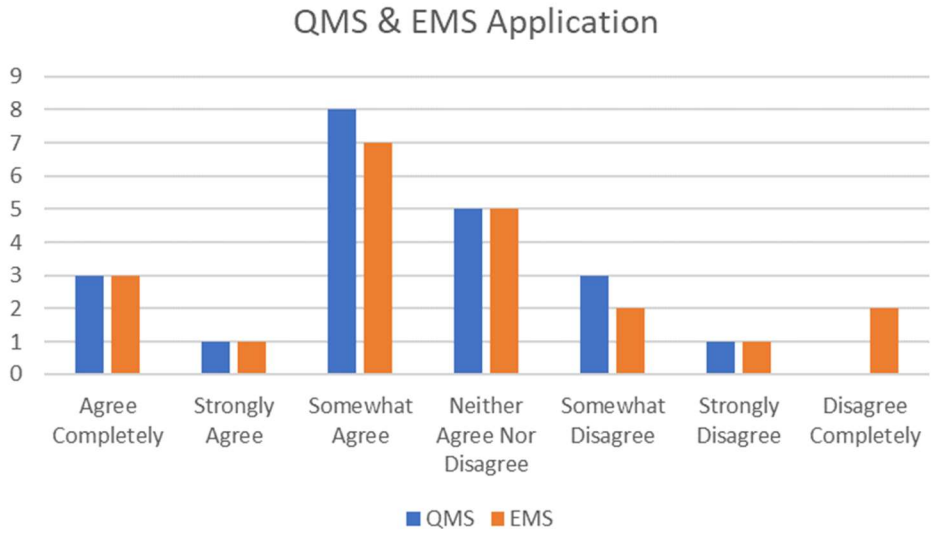
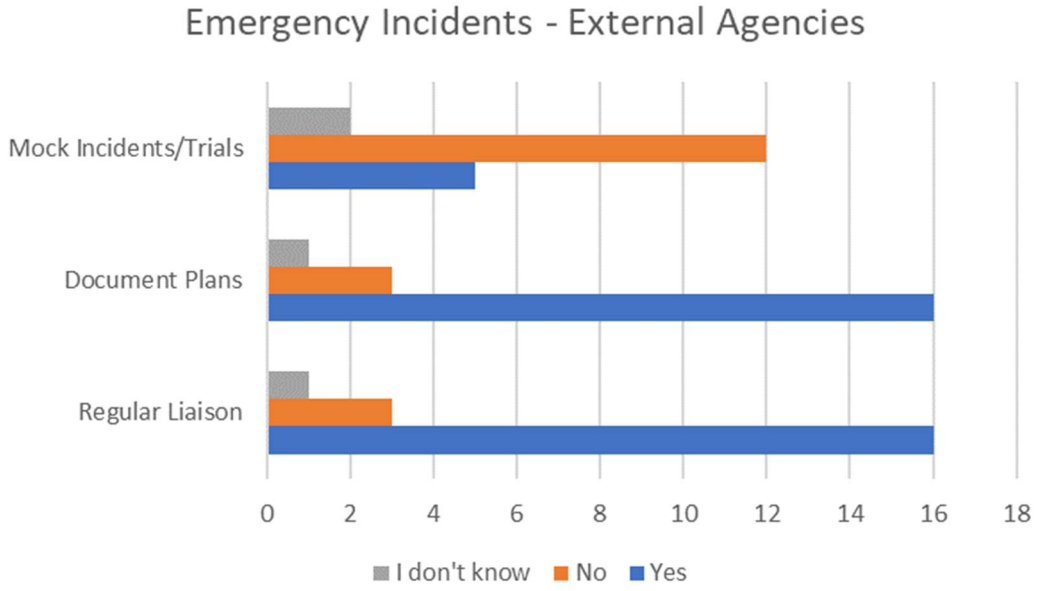
6
7

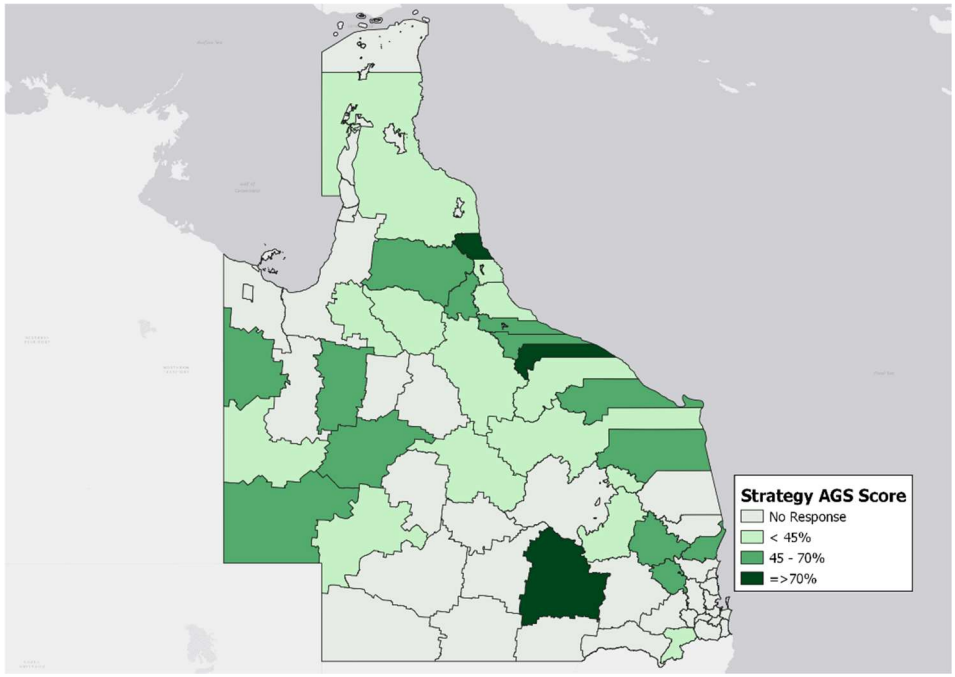

Strategic Documents
Strategic Issues/Priorities
Long Term Financial Plan
Long Term Strategic Plan/Objectives
Corporate/Business Plan
0
2
4
6
8
10
12
14
I don't know
No
Yes but could updated more frequently
Yes frequently maintained

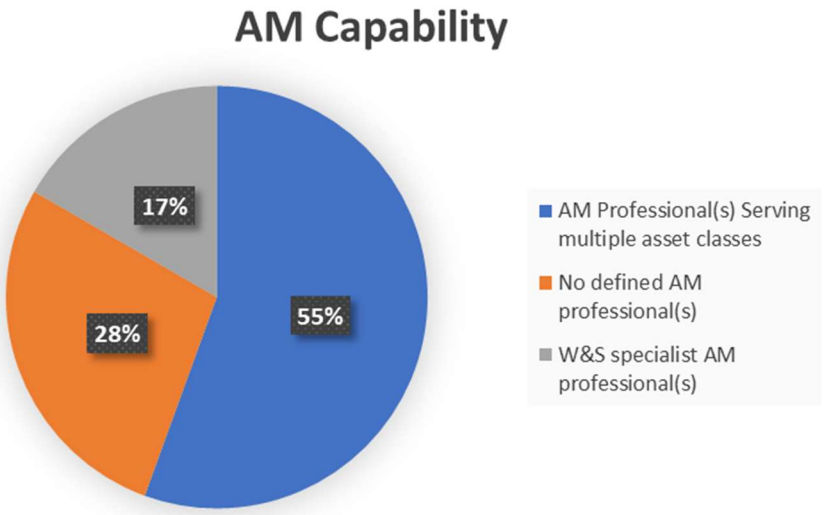

Asset/Risk Management Documents
Asset Criticality Framework
Plans/Strategies for specific assets
Water & Sewerage Strategic Asset Management Plan
Council Strategic Asset Management Plan
Council Asset Management Policy/Strategy
0
2
4
6
8
10
12
I don't know
No
Yes but could updated more frequently
Yes, frequently maintained

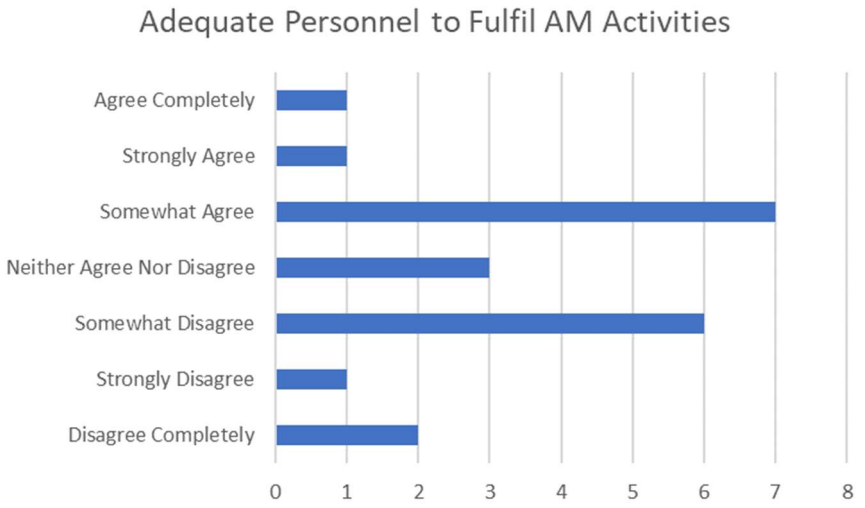

QMS & EMS Application
9
8
7
6
5
4
3
2
1
0
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
QMS
EMS

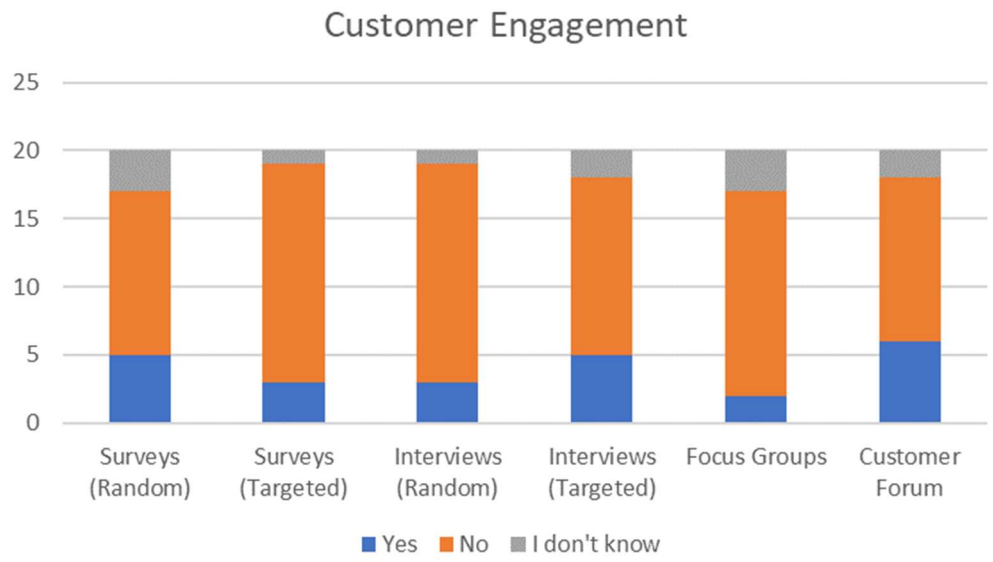

Emergency Incidents - External Agencies
Mock Incidents/Trials
Document Plans
Regular Liaison
0
2
4
6
8
10
12
14
16
18
I don't know
No
Yes

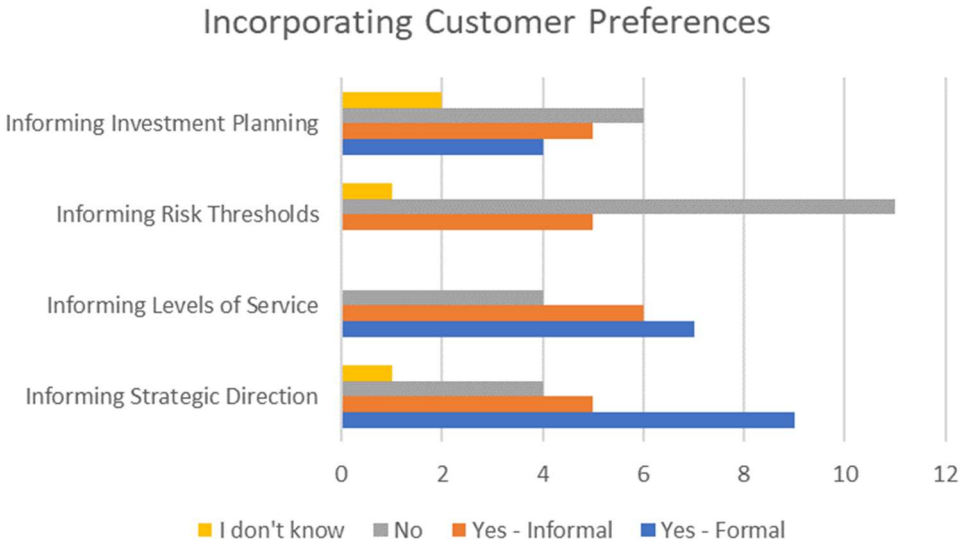
5.1.3 ABOVE-GROUND SEWER ASSETS

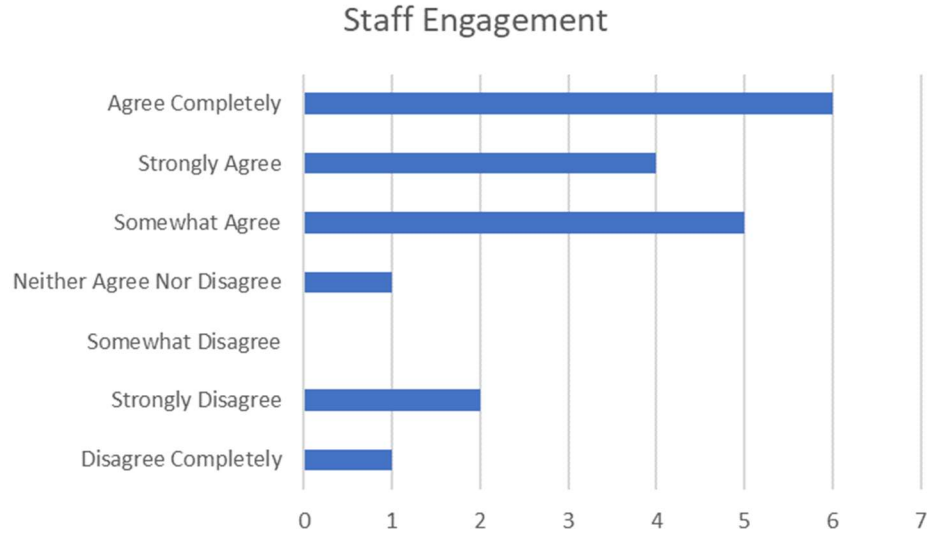







Customer Engagement
25
20
15
10
5
0
Surveys (Random)
Surveys (Targeted)
Interviews (Random)
Interviews (Targeted)
Focus Groups
Customer Forum
Yes
No
I don't know


Incorporating Customer Preferences
Informing Investment Planning
Informing Risk Thresholds
Informing Levels of Service
Informing Strategic Direction
0
2
4
6
8
10
12
I don't know
No
Yes - Informal
Yes - Formal


Staff Engagement
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
1
2
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6
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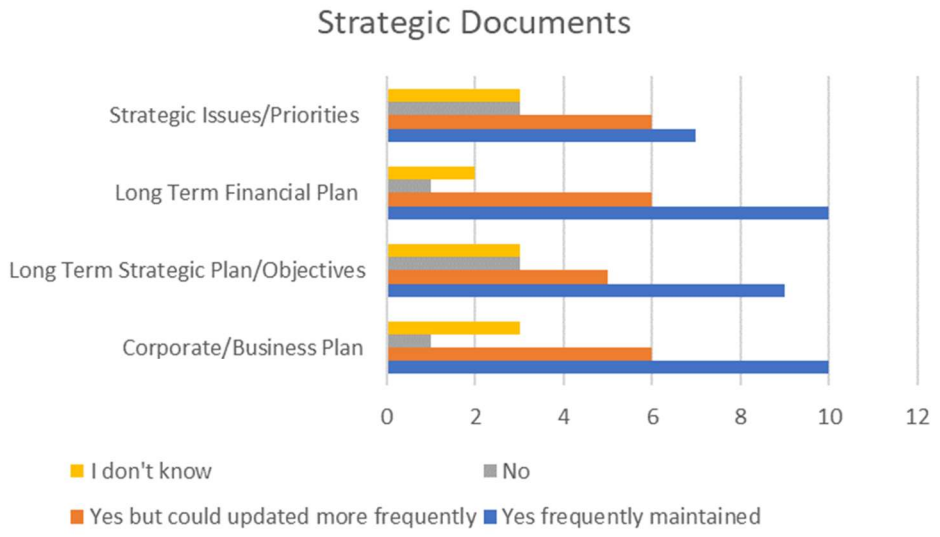
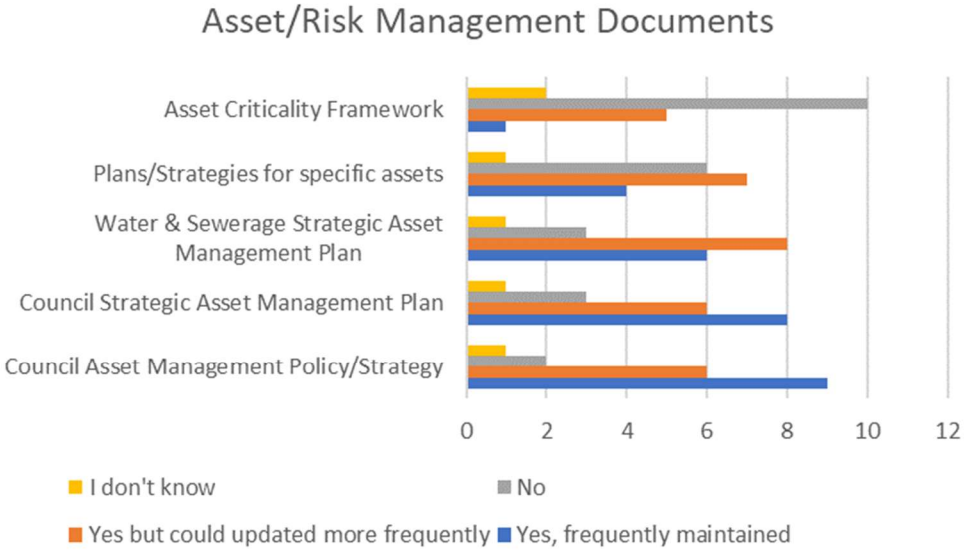
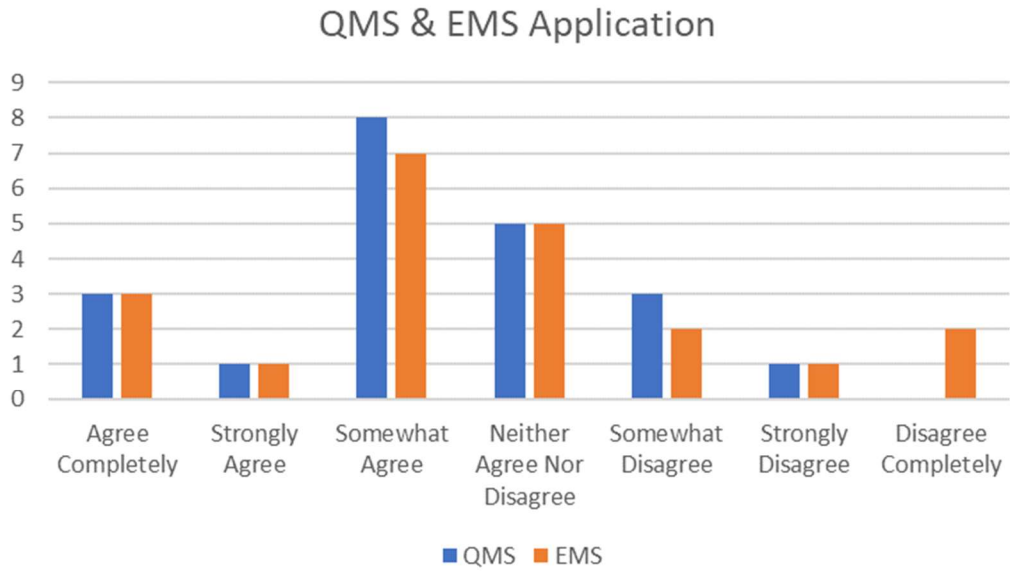
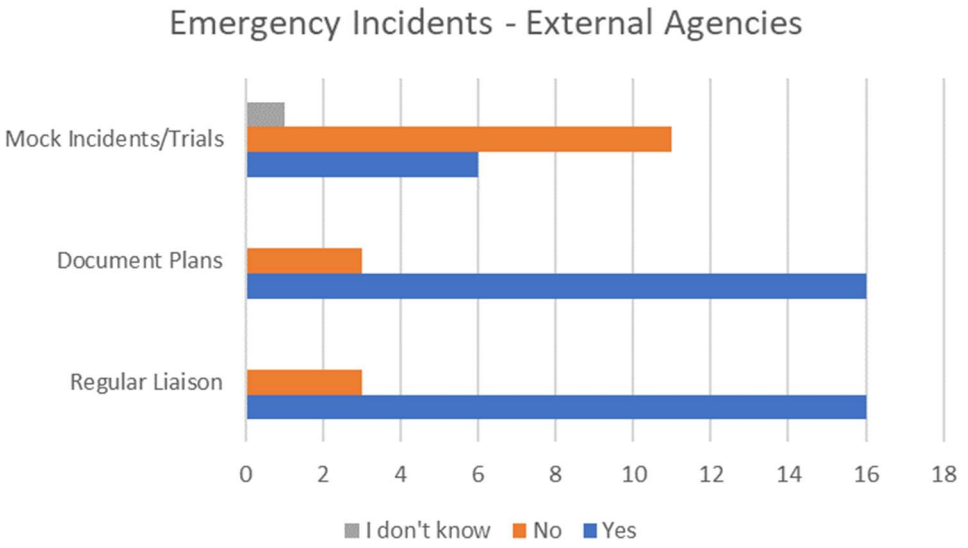
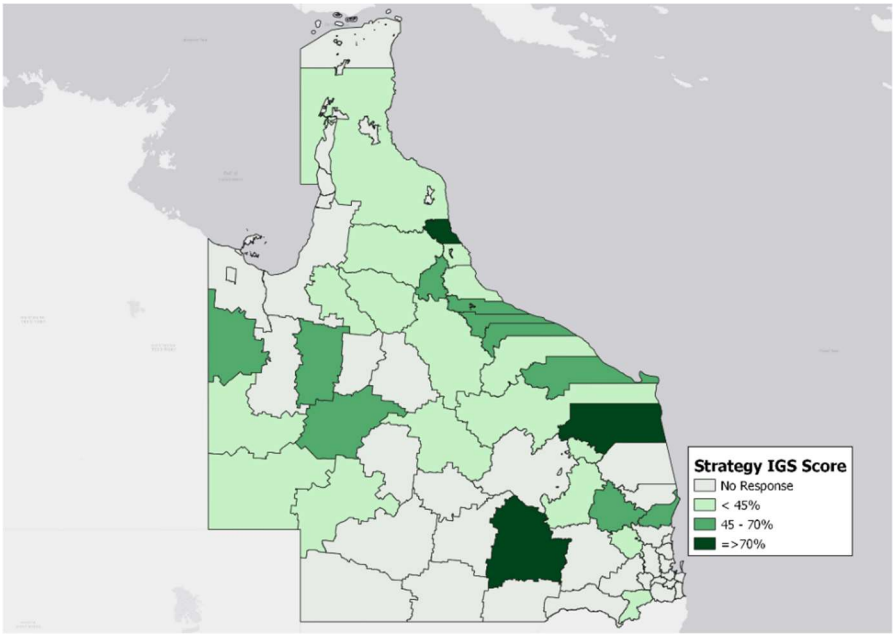

Strategic Documents
Strategic Issues/Priorities
Long Term Financial Plan
Long Term Strategic Plan/Objectives
Corporate/Business Plan
0
2
4
6
8
10
12
I don't know
No
Yes but could updated more frequently
Yes frequently maintained

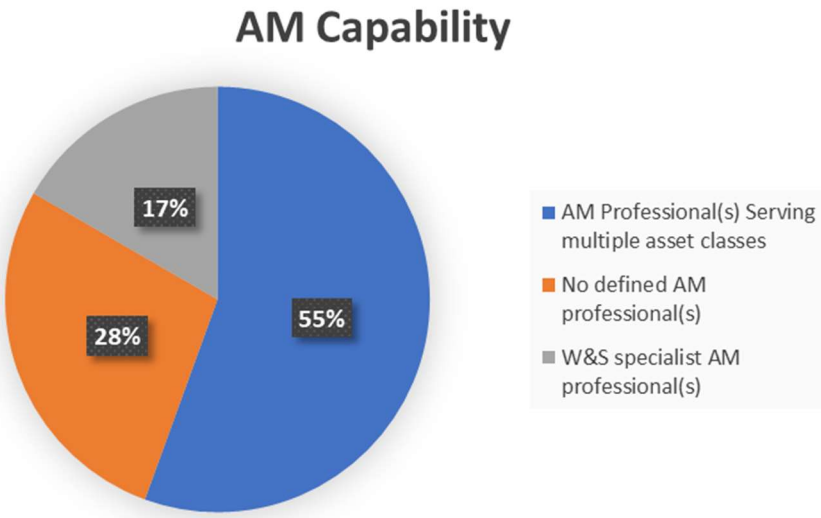

Asset/Risk Management Documents
Asset Criticality Framework
Plans/Strategies for specific assets
Water & Sewerage Strategic Asset Management Plan
Council Strategic Asset Management Plan
Council Asset Management Policy/Strategy
0
2
4
6
8
10
12
I don't know
No
Yes but could updated more frequently
Yes, frequently maintained

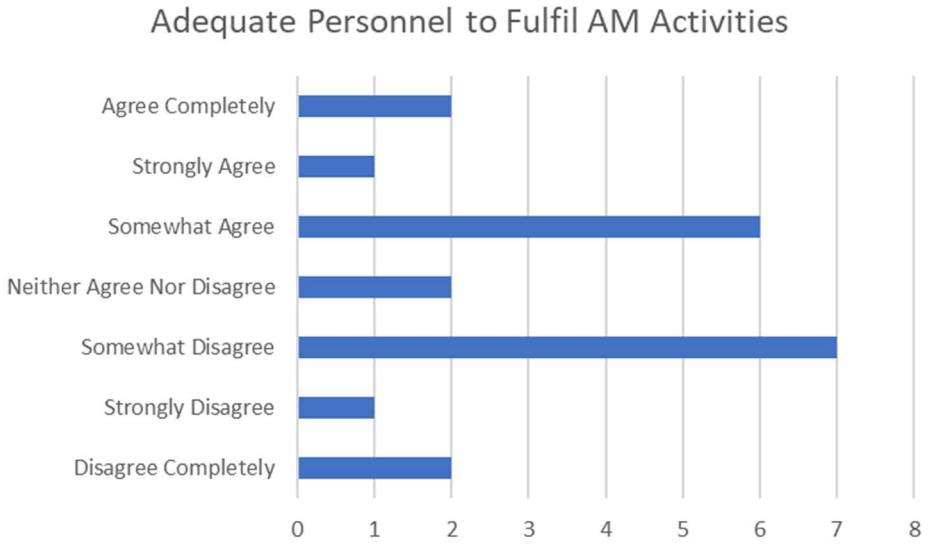

QMS & EMS Application
9
8
7
6
5
4
3
2
1
0
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
QMS
EMS

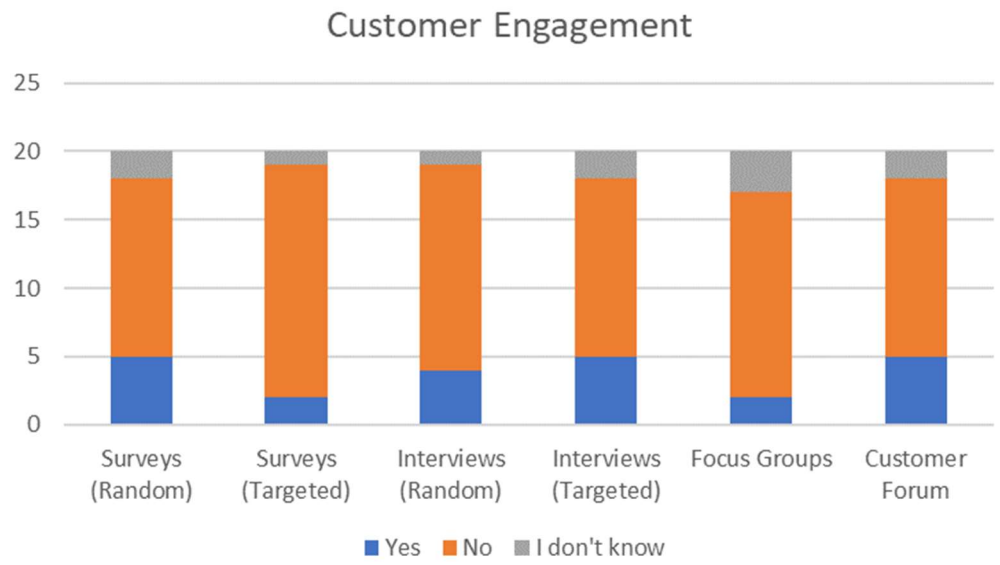

Emergency Incidents - External Agencies
Mock Incidents/Trials
Document Plans
Regular Liaison
0
2
4
6
8
10
12
14
16
18
I don't know
No
Yes

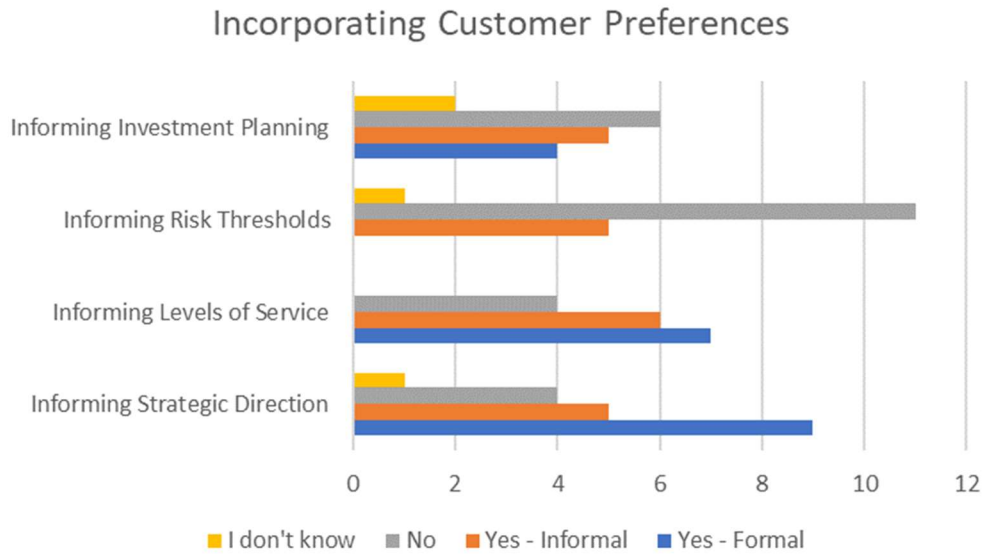
5.1.4 IN-GROUND SEWER ASSETS

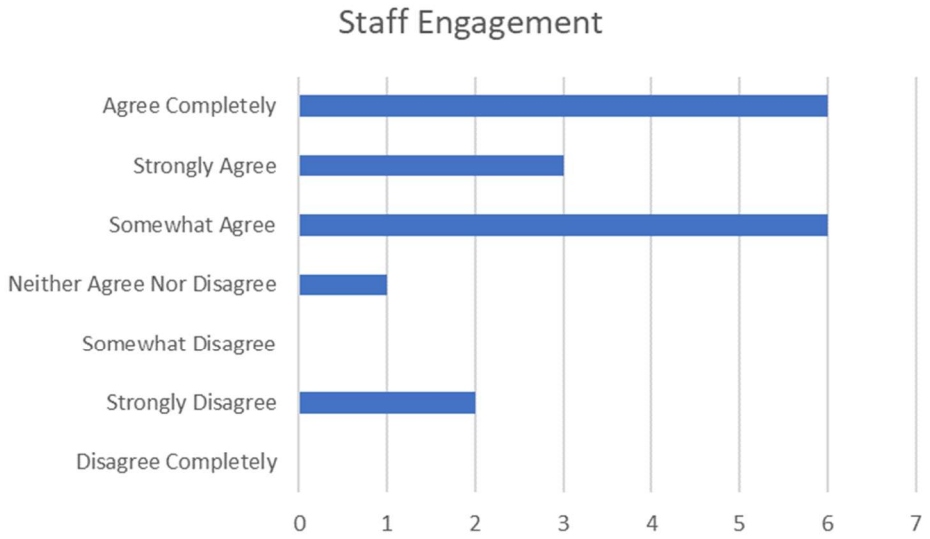


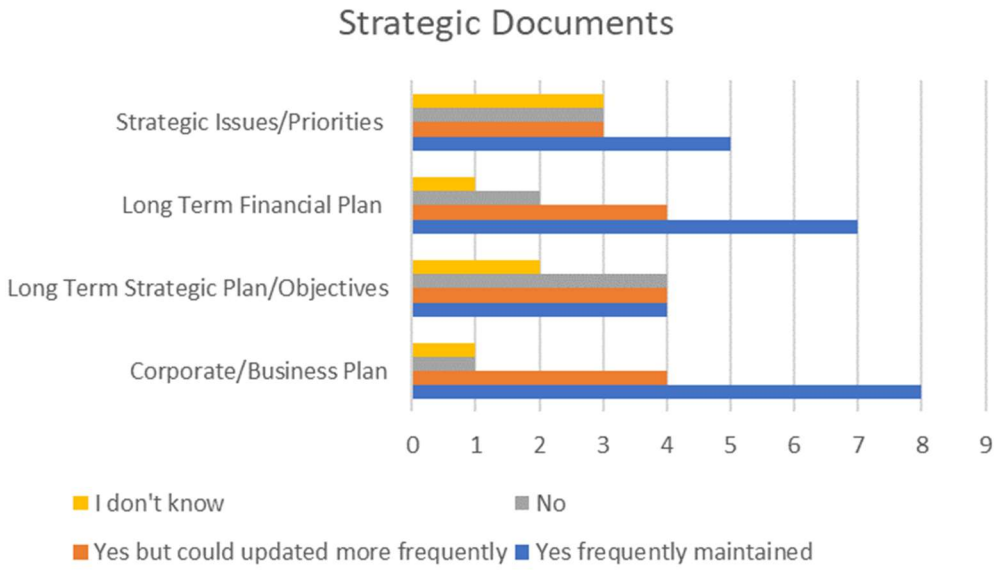


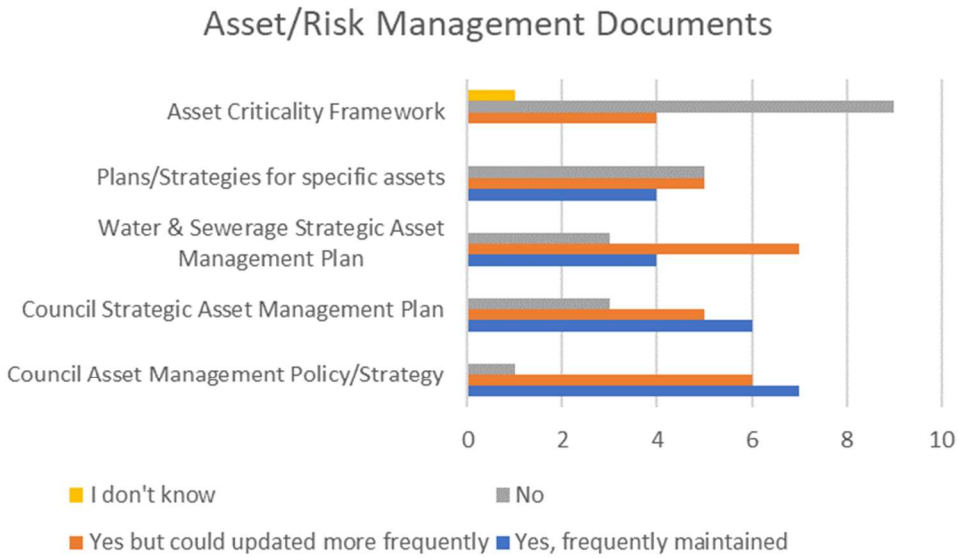


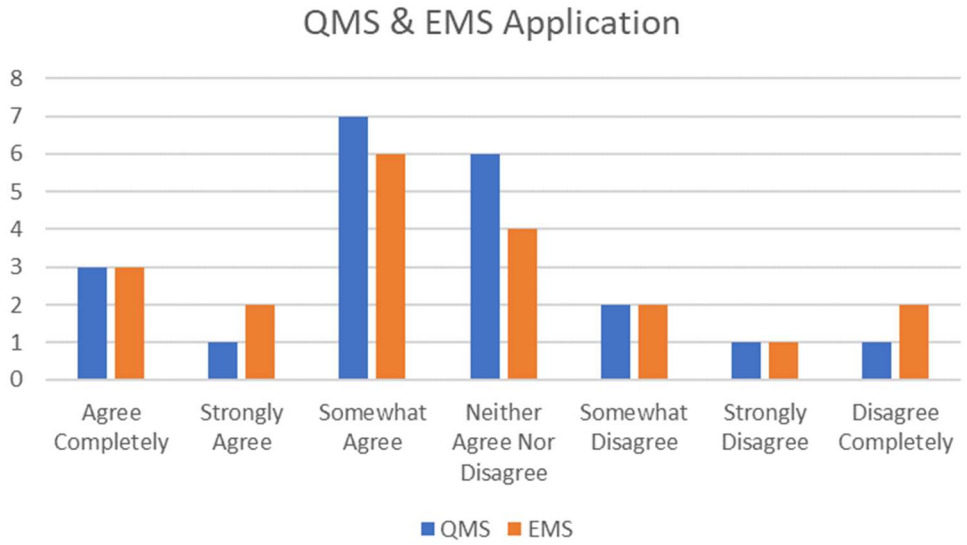

Customer Engagement
25
20
15
10
5
0
Surveys (Random)
Surveys (Targeted)
Interviews (Random)
Interviews (Targeted)
Focus Groups
Customer Forum
Yes
No
I don't know

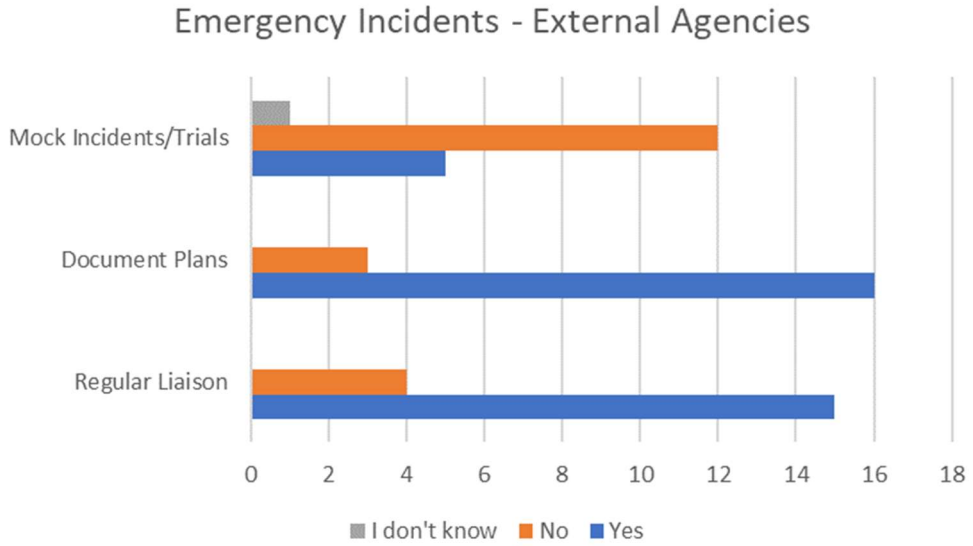

Incorporating Customer Preferences
Informing Investment Planning
Informing Risk Thresholds
Informing Levels of Service
Informing Strategic Direction
0
2
4
6
8
10
12
I don't know
No
Yes - Informal
Yes - Formal


Staff Engagement
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
1
2
3
4
5
6
7


Strategic Documents
Strategic Issues/Priorities
Long Term Financial Plan
Long Term Strategic Plan/Objectives
Corporate/Business Plan
0
1
2
3
4
5
6
7
8
9
I don't know
No
Yes but could updated more frequently
Yes frequently maintained

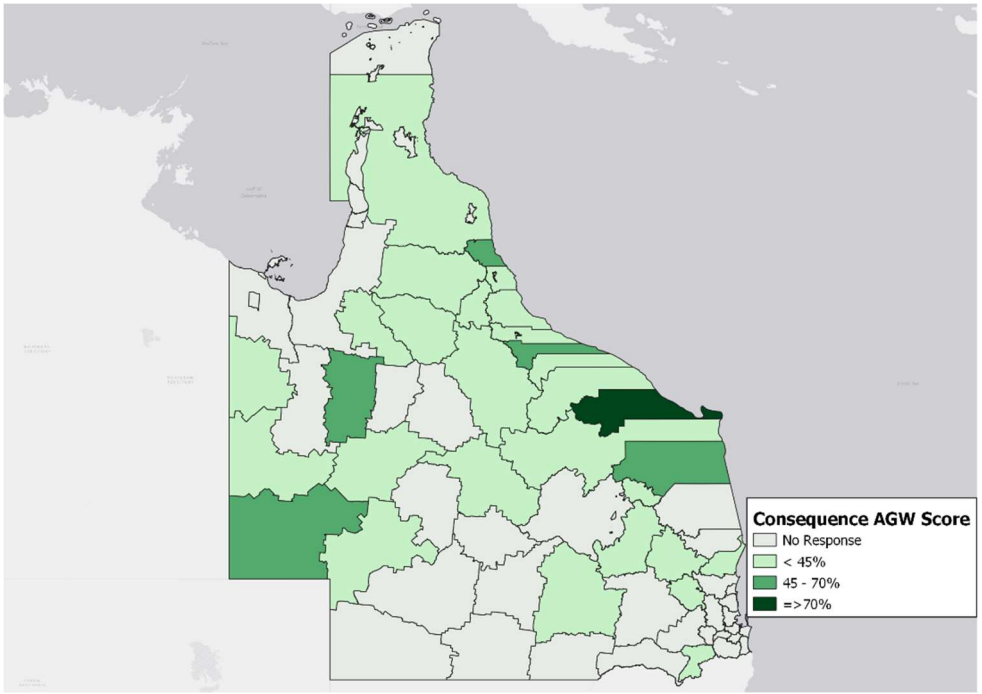

Asset/Risk Management Documents
Asset Criticality Framework
Plans/Strategies for specific assets
Water & Sewerage Strategic Asset Management Plan
Council Strategic Asset Management Plan
Council Asset Management Policy/Strategy
0
2
4
6
8
10
I don't know
No
Yes but could updated more frequently
Yes, frequently maintained

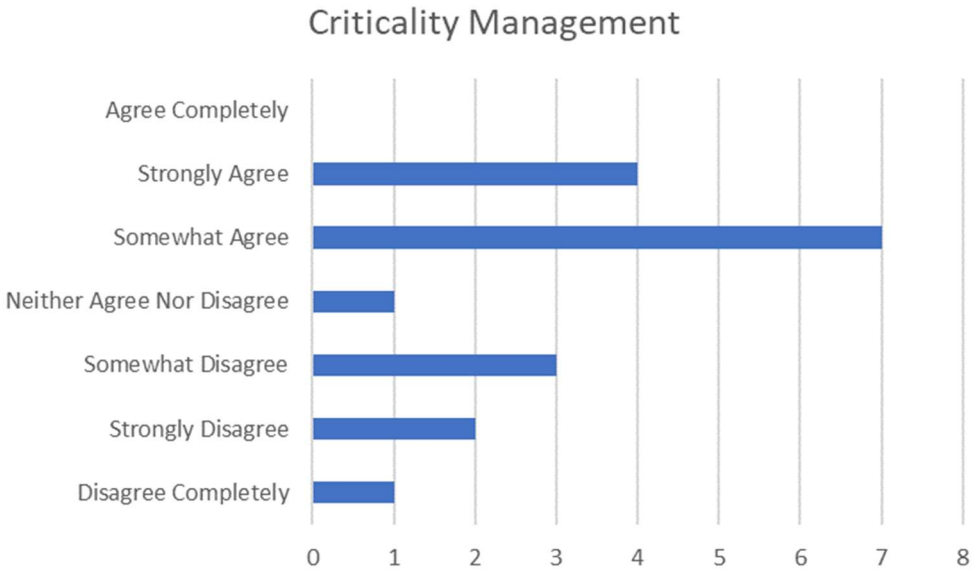

QMS & EMS Application
8
7
6
5
4
3
2
1
0
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
QMS
EMS

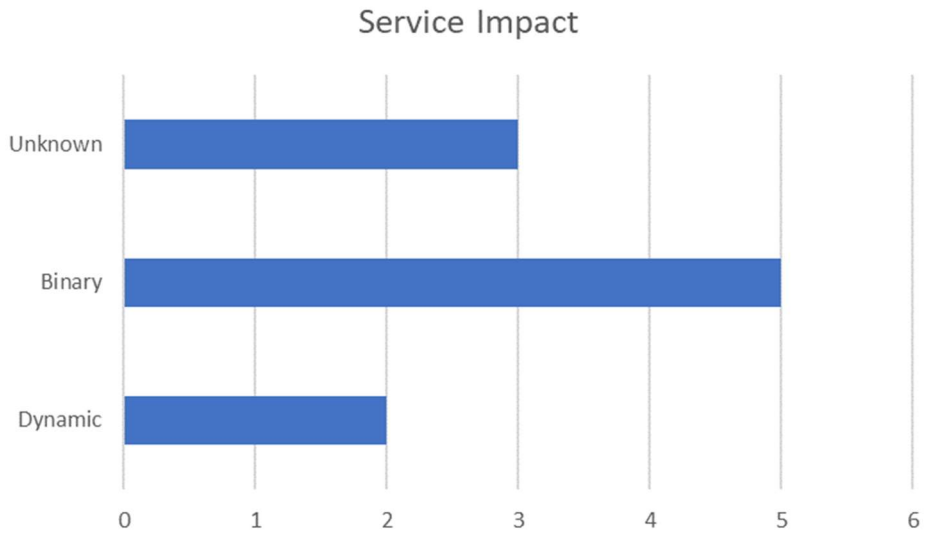

Emergency Incidents - External Agencies
Mock Incidents/Trials
Document Plans
Regular Liaison
0
2
4
6
8
10
12
14
16
18
I don't know
No
Yes

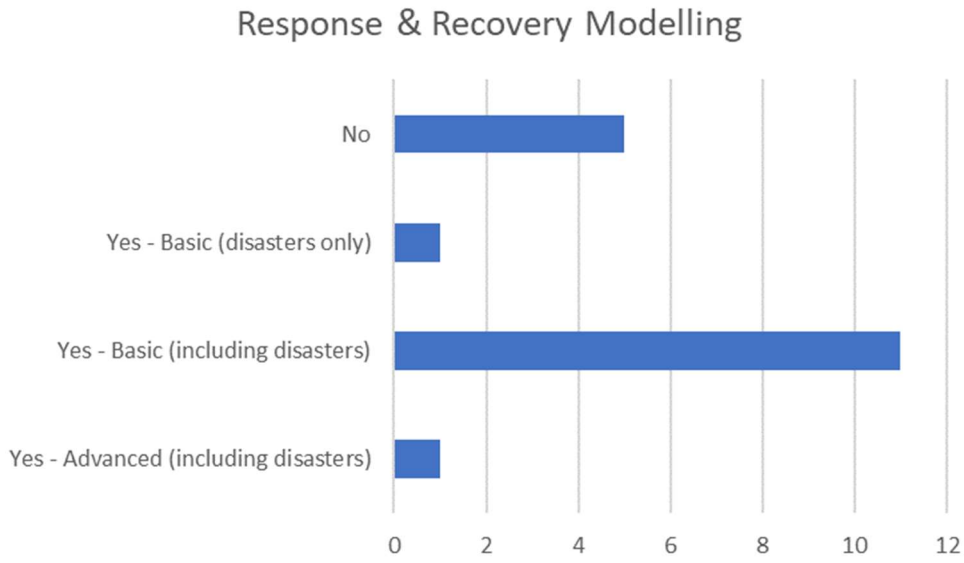
5.2 CONSEQUENCE OF FAILURE RESPONSES

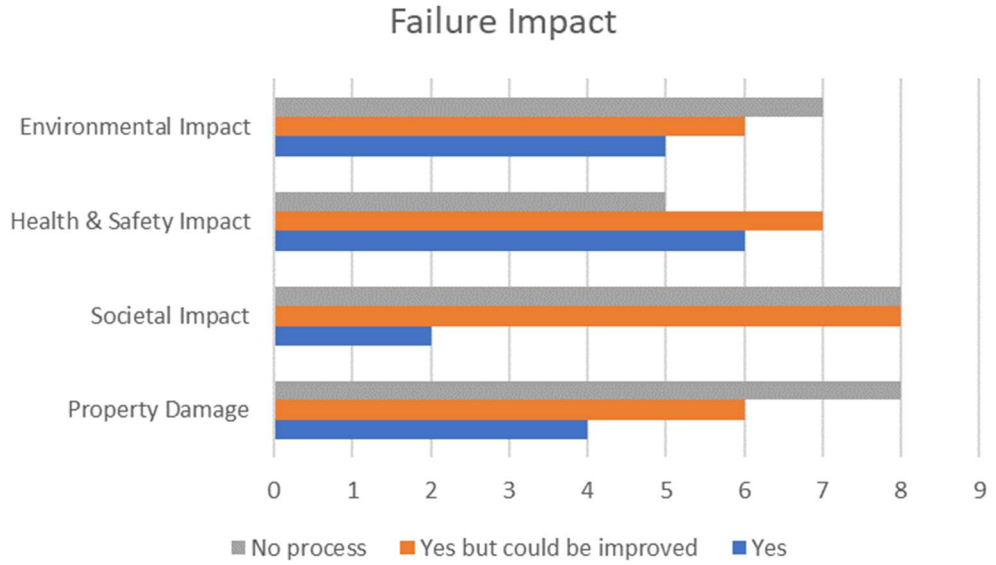
5.2.1 ABOVE-GROUND WATER ASSETS

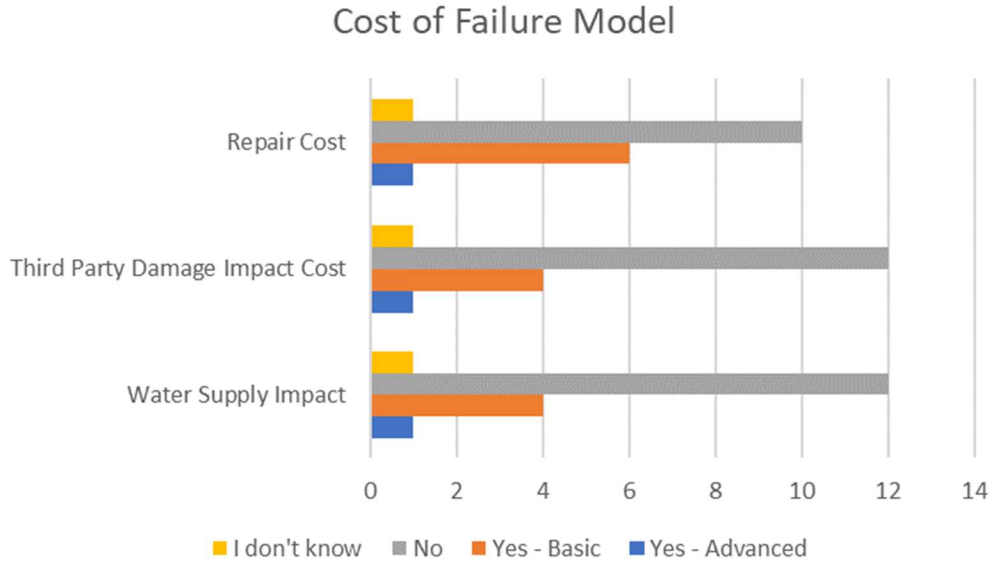


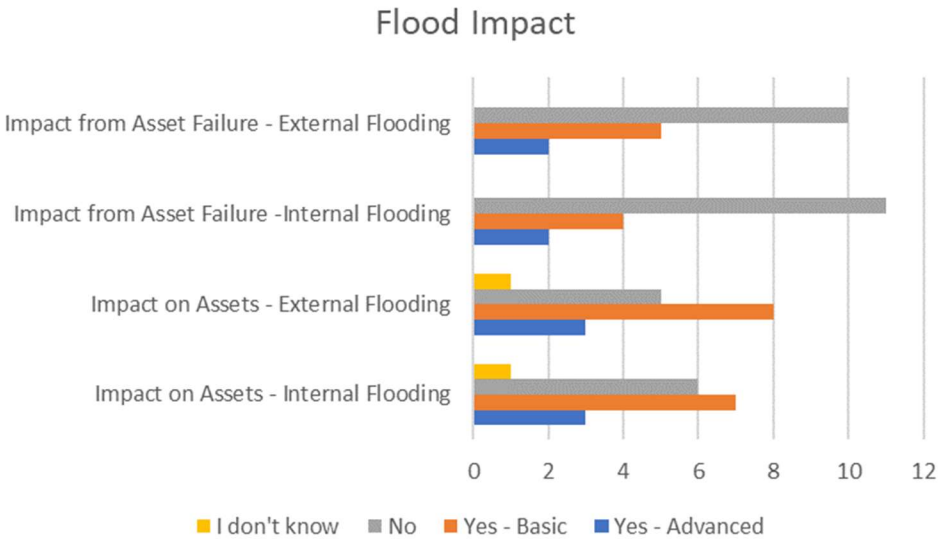


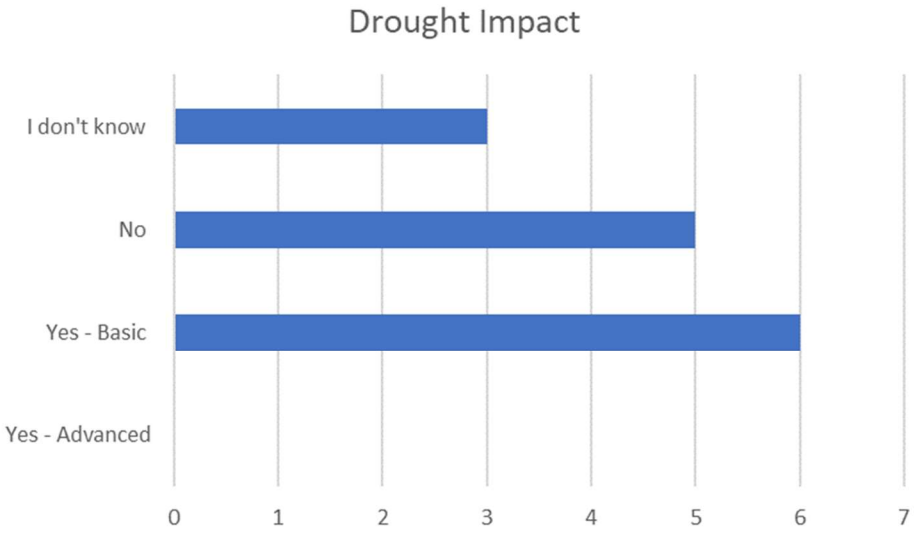

Service Impact
Unknown
Binary
Dynamic
0
1
2
3
4
5
6

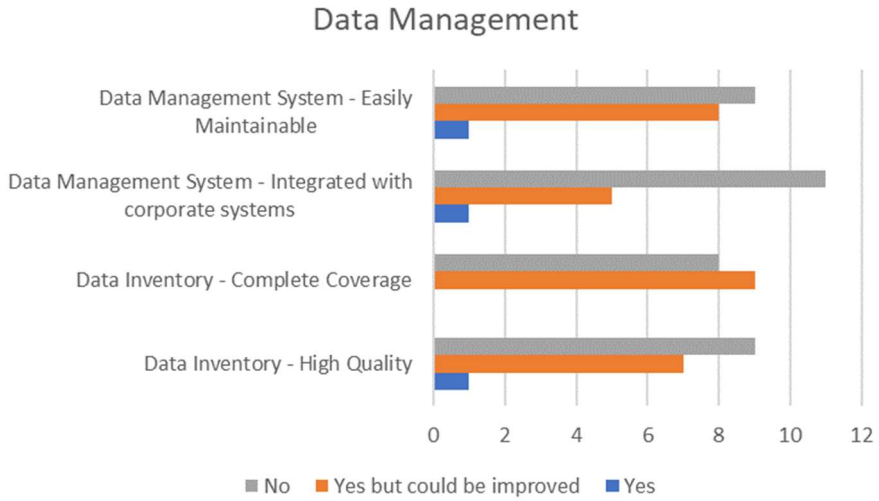

Response & Recovery Modelling
No
Yes - Basic (disasters only)
Yes - Basic (including disasters)
Yes - Advanced (including disasters)
0
2
4
6
8
10
12


Failure Impact
Environmental Impact
Health & Safety Impact
Societal Impact
Property Damage
0
1
2
3
4
5
6
7
8
9
No process
Yes but could be improved
Yes

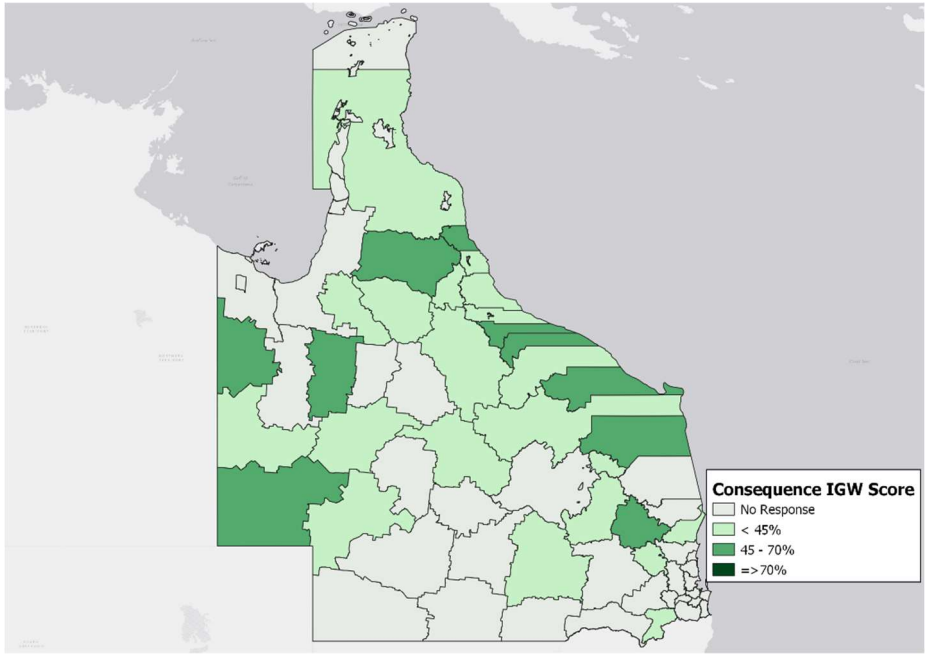

Cost of Failure Model
Repair Cost
Third Party Damage Impact Cost
Water Supply Impact
0
2
4
6
8
10
12
14
I don't know
No
Yes - Basic
Yes - Advanced

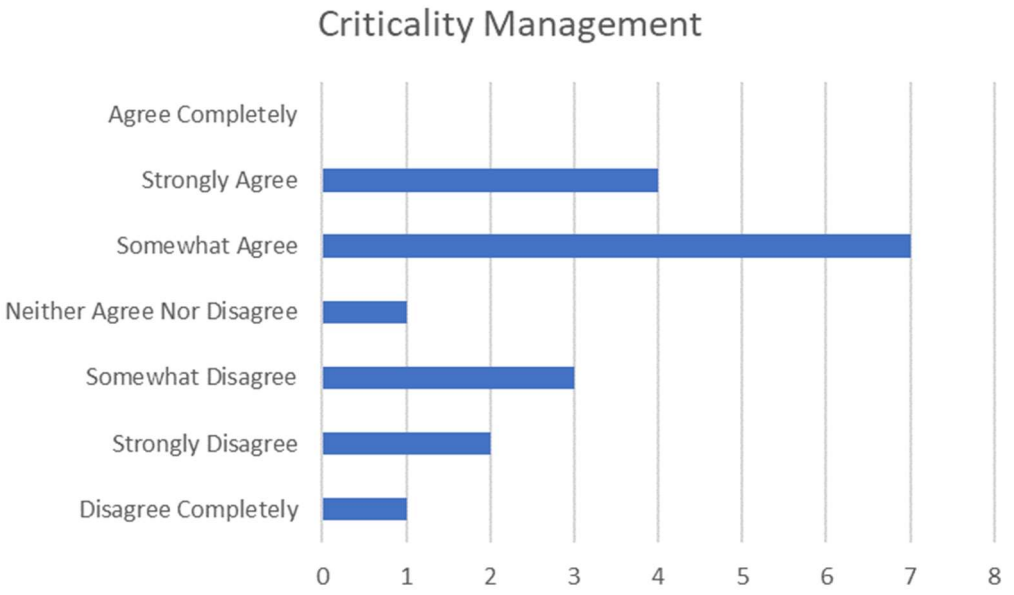

Flood Impact
Impact from Asset Failure - External Flooding
Impact from Asset Failure -Internal Flooding
Impact on Assets - External Flooding
Impact on Assets - Internal Flooding
0
2
4
6
8
10
12
I don't know
No
Yes - Basic
Yes - Advanced

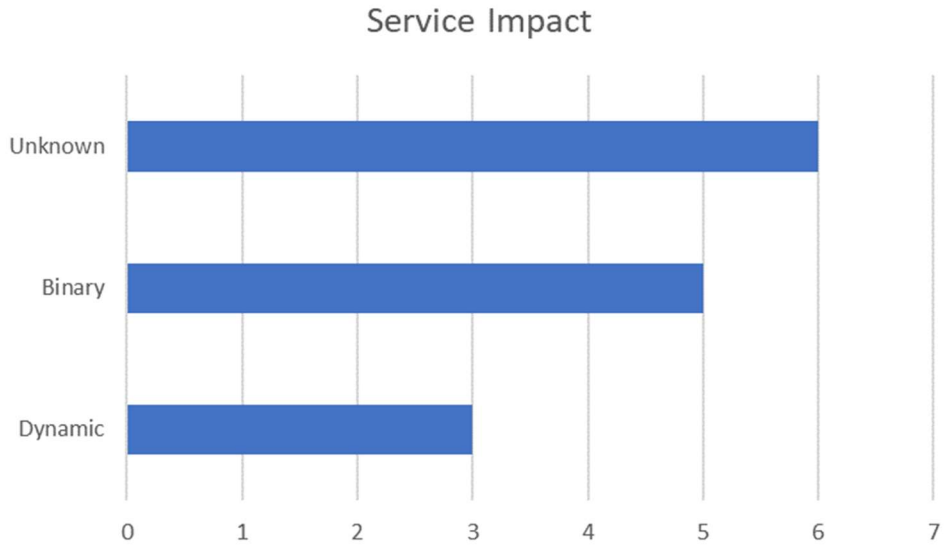

Drought Impact
I don't know
No
Yes - Basic
Yes - Advanced
0
1
2
3
4
5
6
7

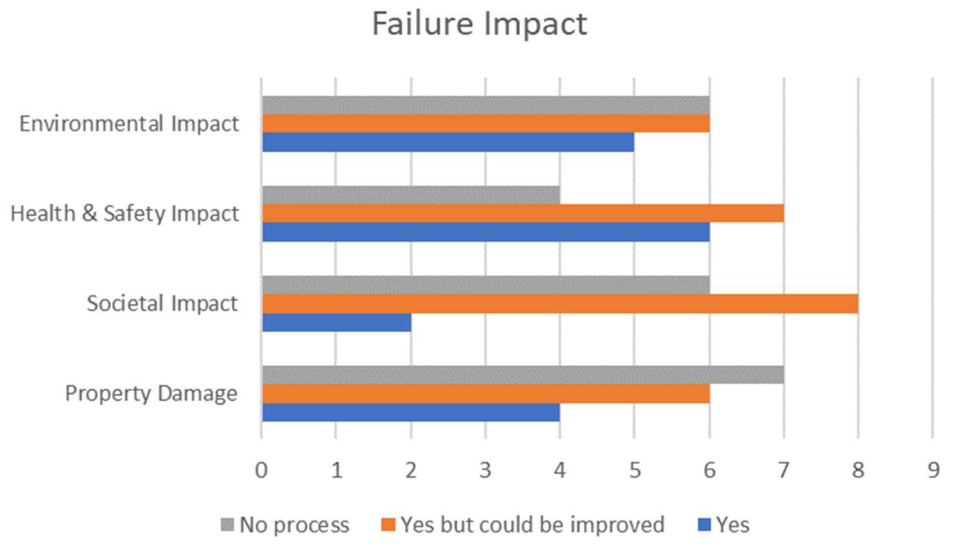

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
No
Yes but could be improved
Yes

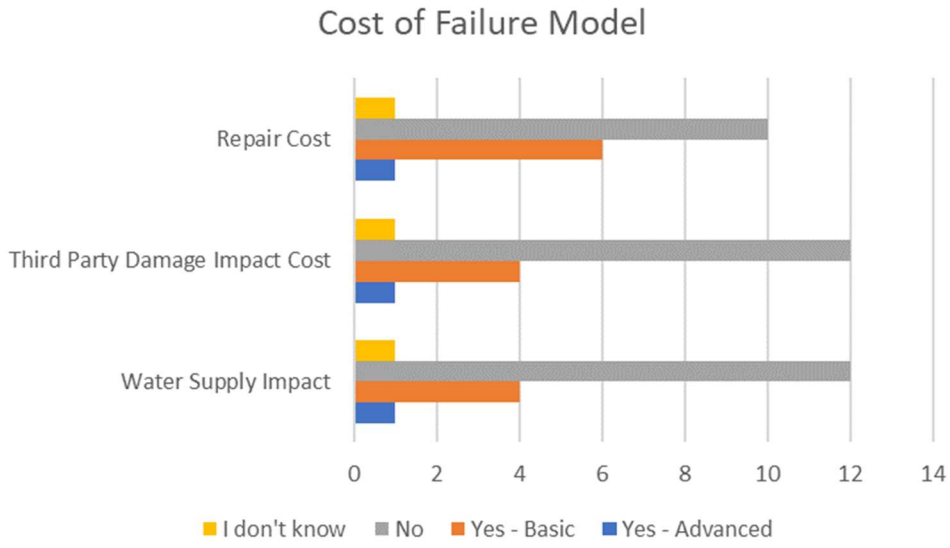
5.2.2 IN-GROUND WATER ASSETS

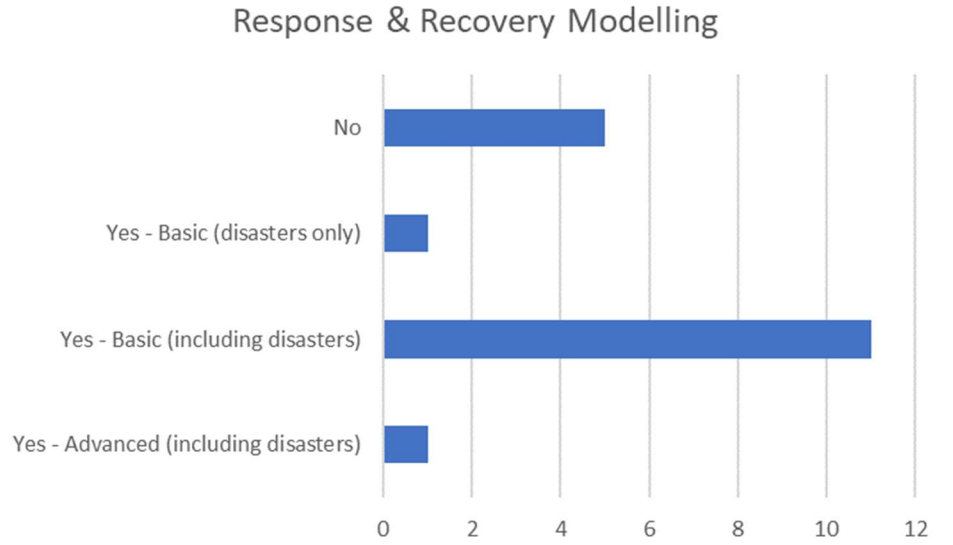


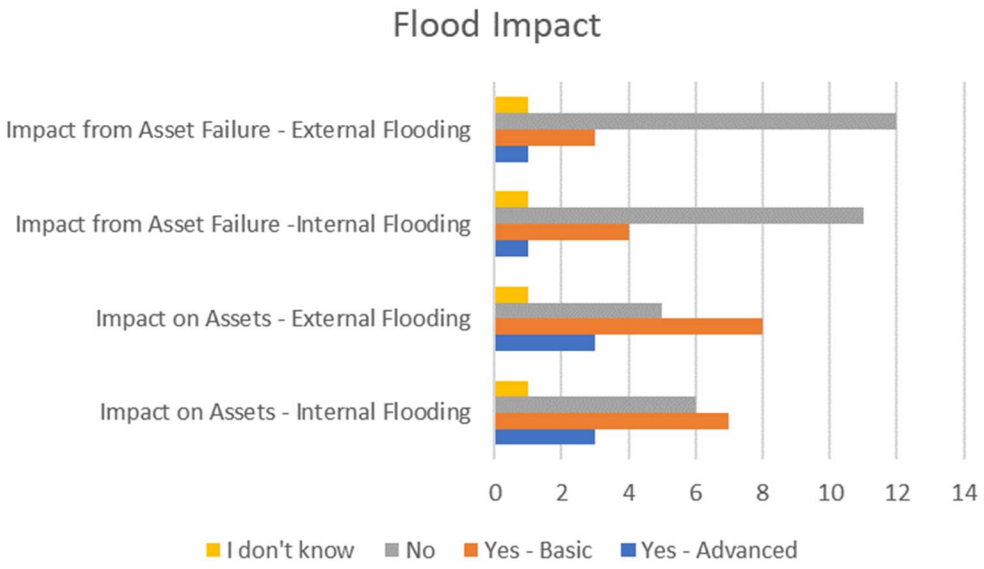


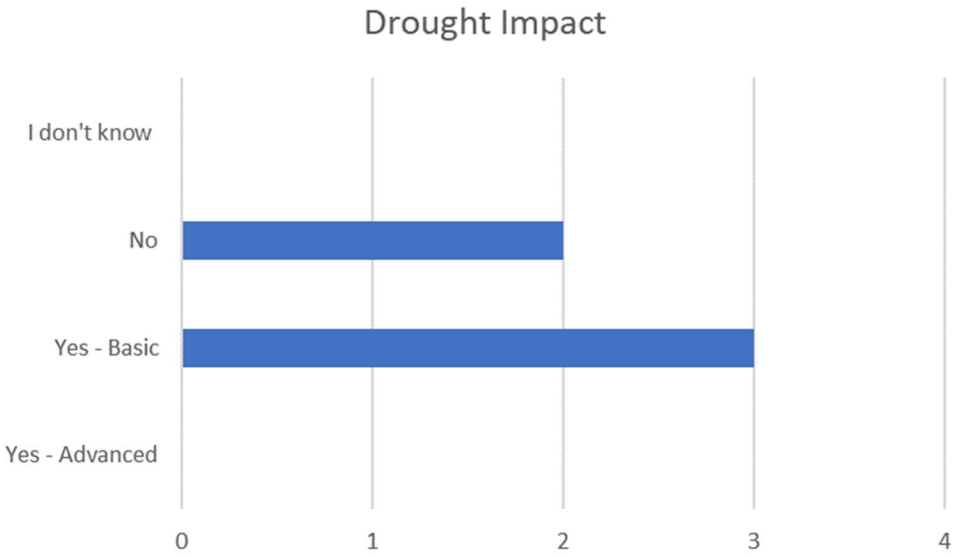

Service Impact
Unknown
Binary
Dynamic
0
1
2
3
4
5
6
7

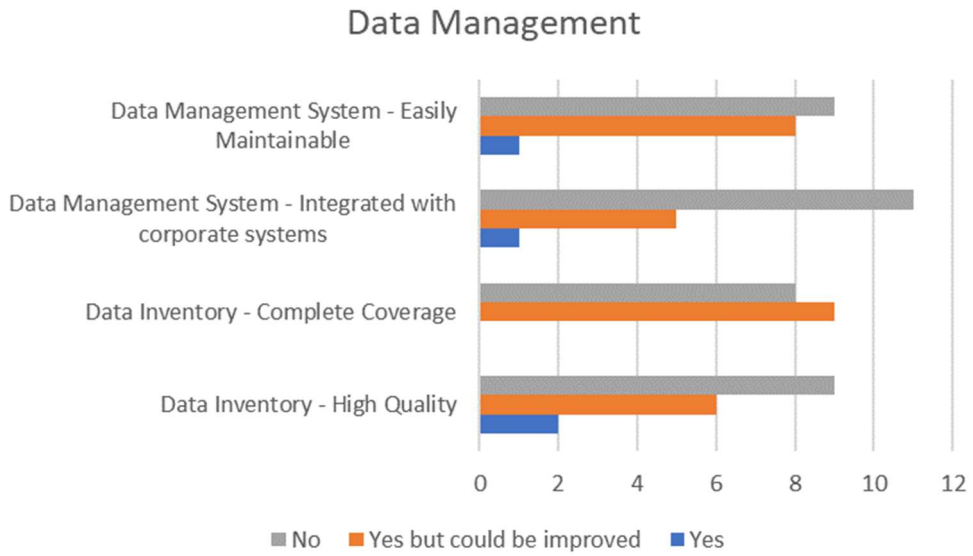

Failure Impact
Environmental Impact
Health & Safety Impact
Societal Impact
Property Damage
0
1
2
3
4
5
6
7
8
9
No process
Yes but could be improved
Yes


Cost of Failure Model
Repair Cost
Third Party Damage Impact Cost
Water Supply Impact
0
2
4
6
8
10
12
14
I don't know
No
Yes - Basic
Yes - Advanced

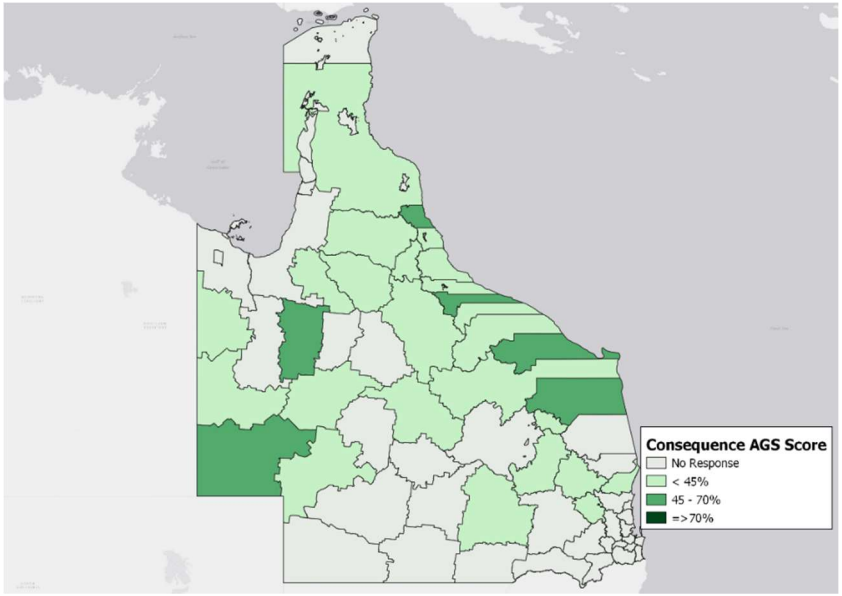

Response & Recovery Modelling
No
Yes - Basic (disasters only)
Yes - Basic (including disasters)
Yes - Advanced (including disasters)
0
2
4
6
8
10
12

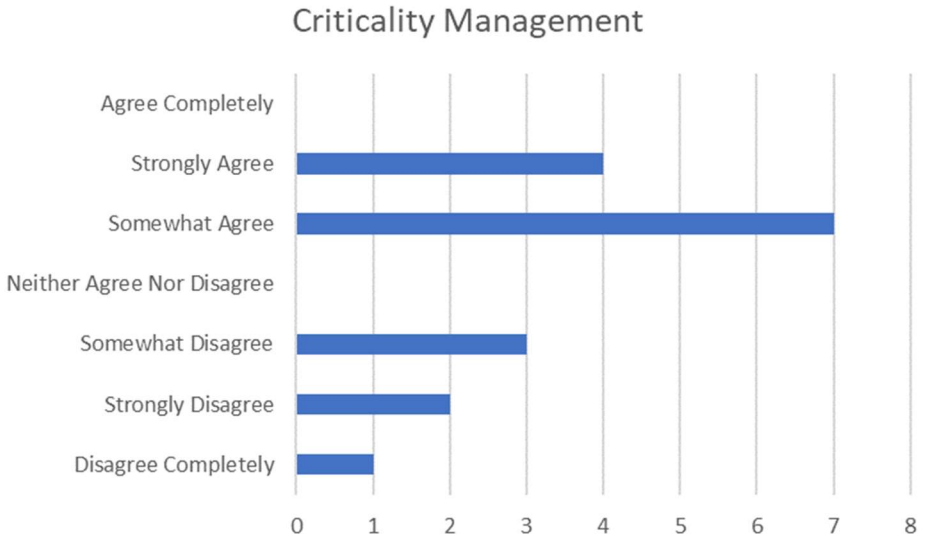

Flood Impact
Impact from Asset Failure - External Flooding
Impact from Asset Failure -Internal Flooding
Impact on Assets - External Flooding
Impact on Assets - Internal Flooding
0
2
4
6
8
10
12
14
I don't know
No
Yes - Basic
Yes - Advanced

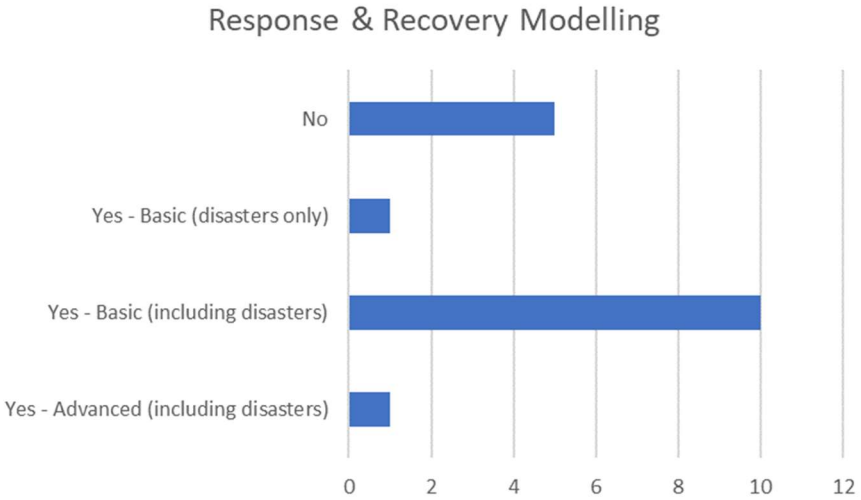

Drought Impact
I don't know
No
Yes - Basic
Yes - Advanced
0
1
2
3
4

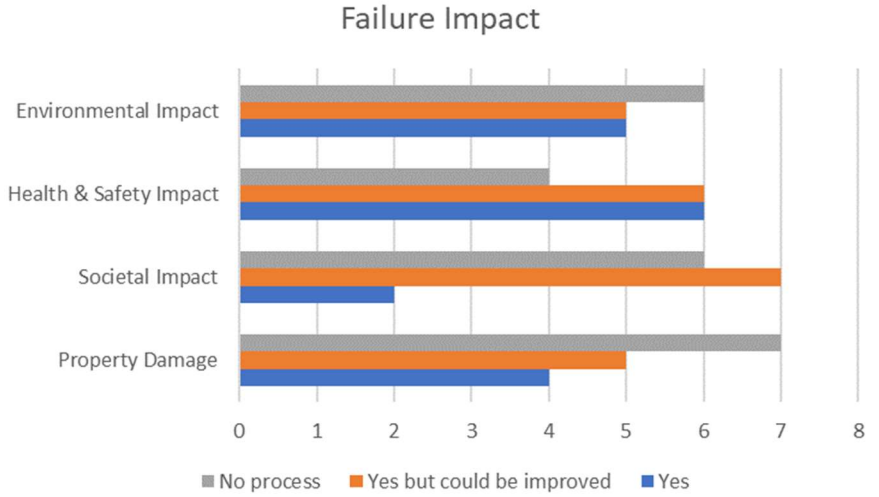

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
No
Yes but could be improved
Yes

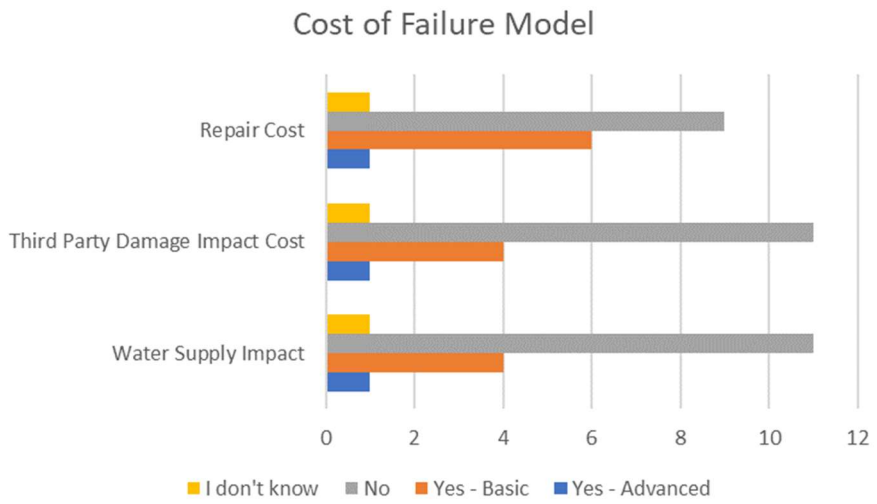
5.2.3 ABOVE-GROUND SEWER ASSETS

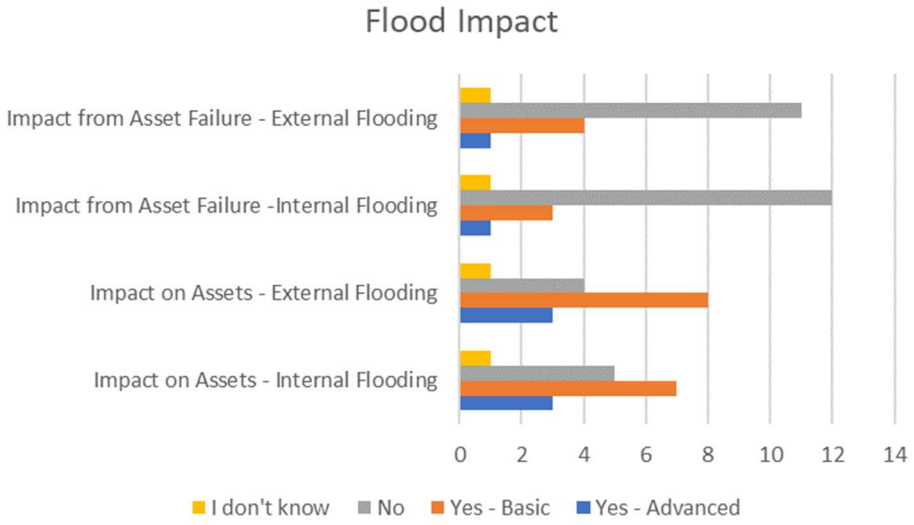


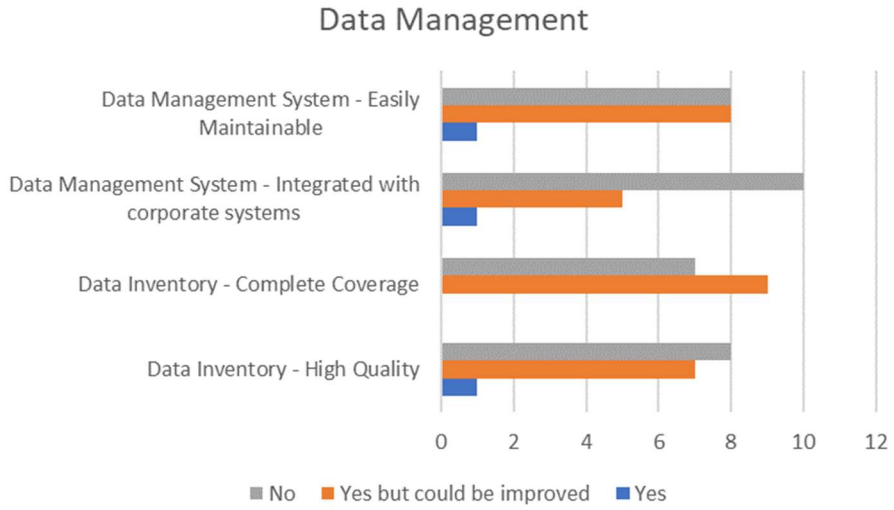




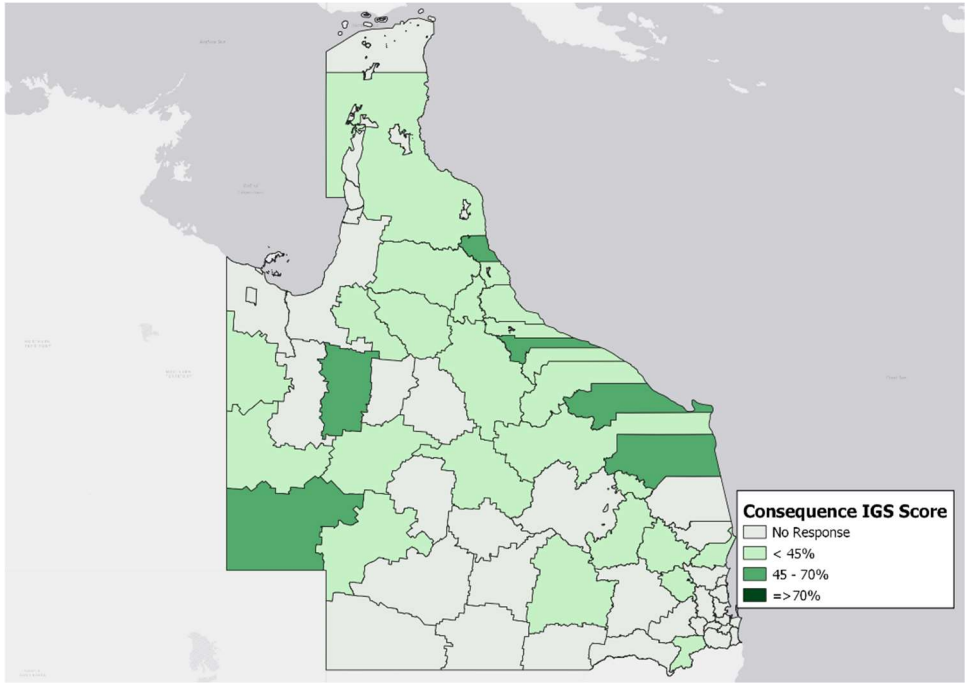


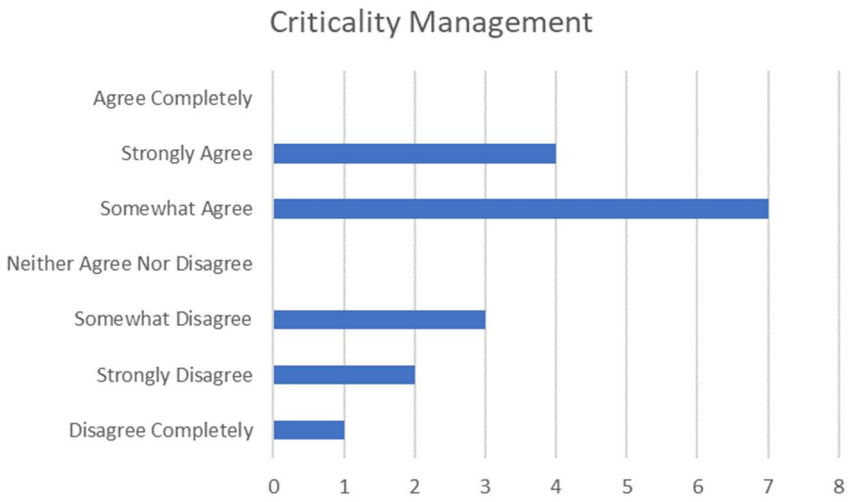

Cost of Failure Model
Repair Cost
Third Party Damage Impact Cost
Water Supply Impact
0
2
4
6
8
10
12
I don't know
No
Yes - Basic
Yes - Advanced

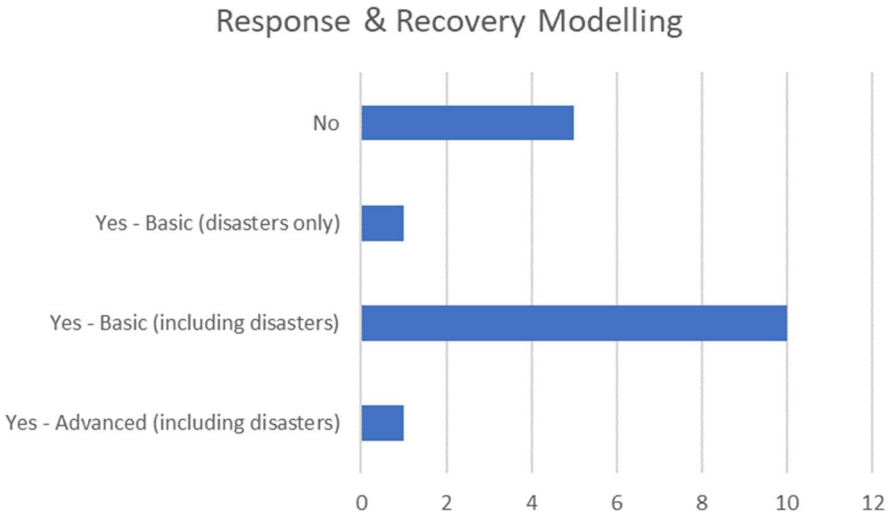

Flood Impact
Impact from Asset Failure - External Flooding
Impact from Asset Failure -Internal Flooding
Impact on Assets - External Flooding
Impact on Assets - Internal Flooding
0
2
4
6
8
10
12
14
I don't know
No
Yes - Basic
Yes - Advanced

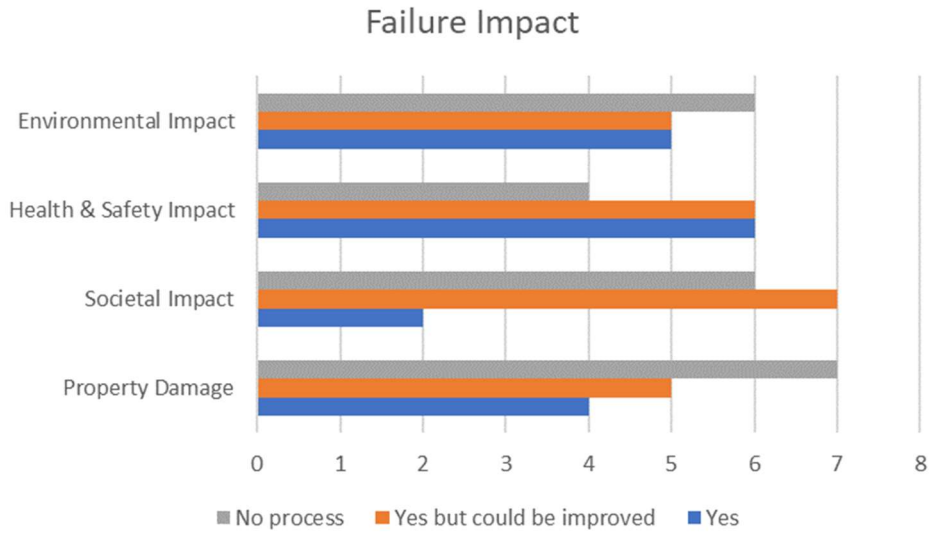

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
No
Yes but could be improved
Yes

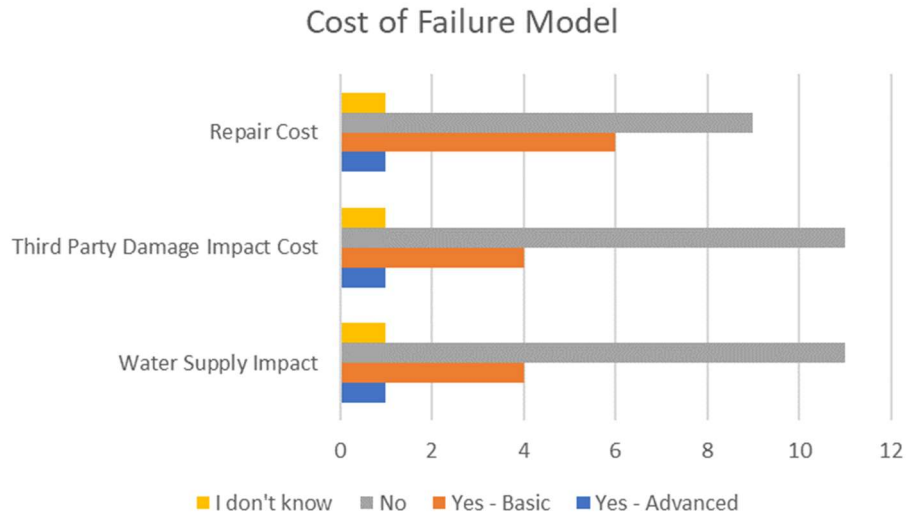
5.2.4 IN-GROUND SEWER ASSETS

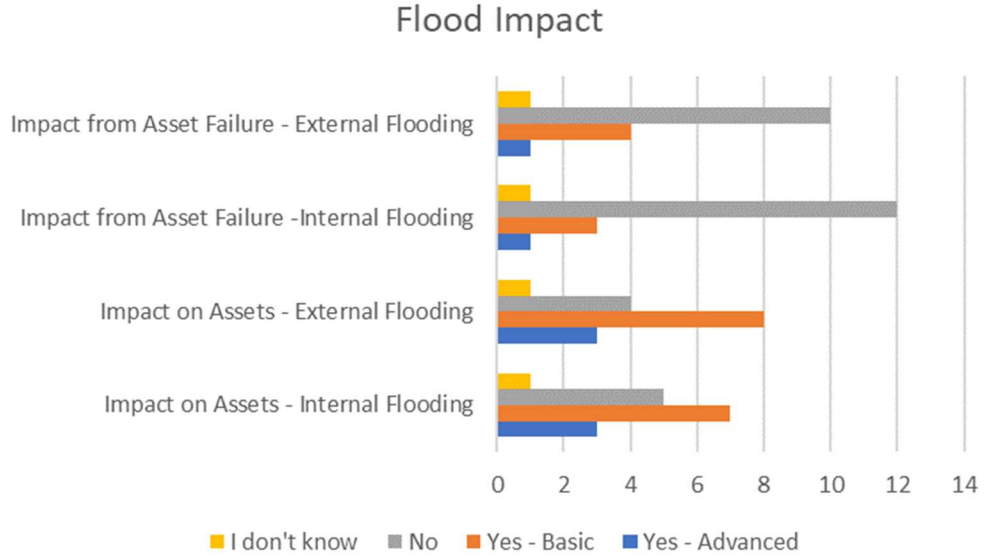


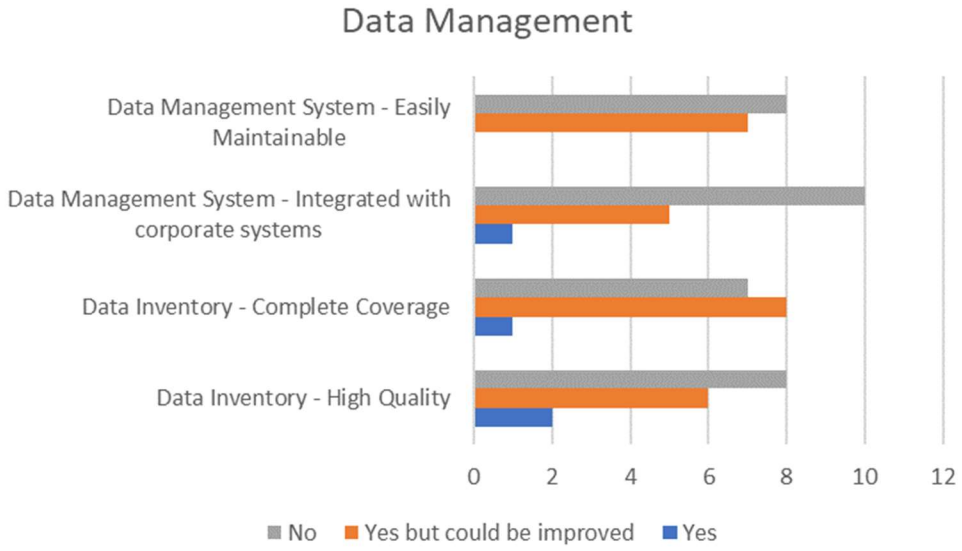





Failure Impact
Environmental Impact
Health & Safety Impact
Societal Impact
Property Damage
0
1
2
3
4
5
6
7
8
No process
Yes but could be improved
Yes

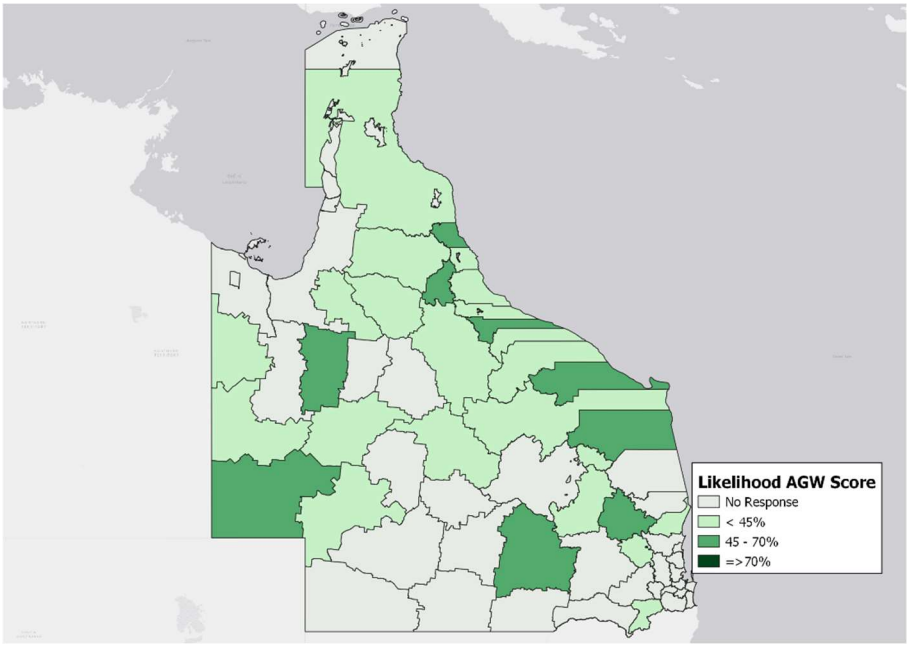

Cost of Failure Model
Repair Cost
Third Party Damage Impact Cost
Water Supply Impact
0
2
4
6
8
10
12
I don't know
No
Yes - Basic
Yes - Advanced

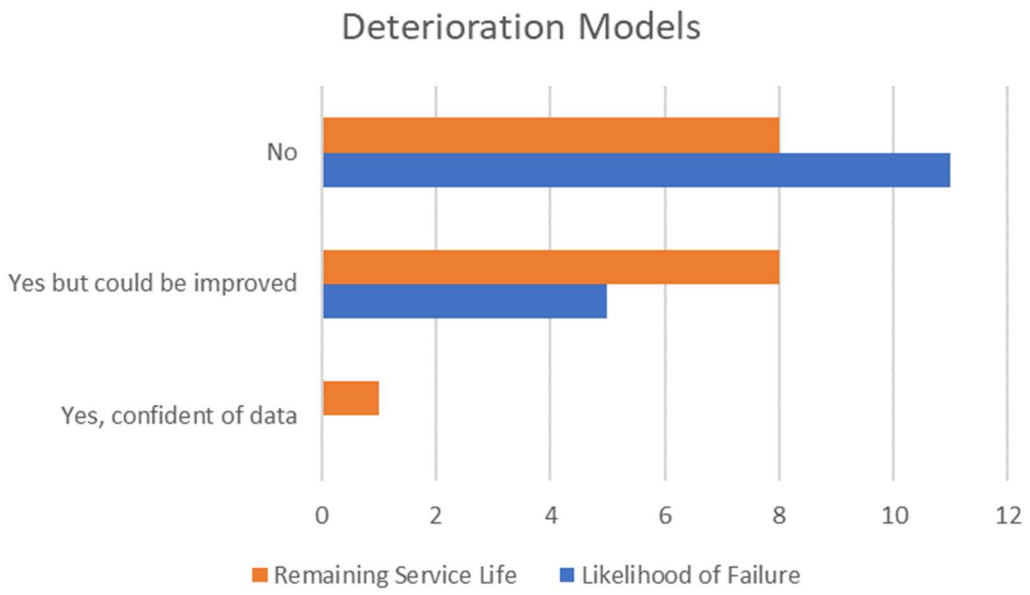

Flood Impact
Impact from Asset Failure - External Flooding
Impact from Asset Failure -Internal Flooding
Impact on Assets - External Flooding
Impact on Assets - Internal Flooding
0
2
4
6
8
10
12
14
I don't know
No
Yes - Basic
Yes - Advanced

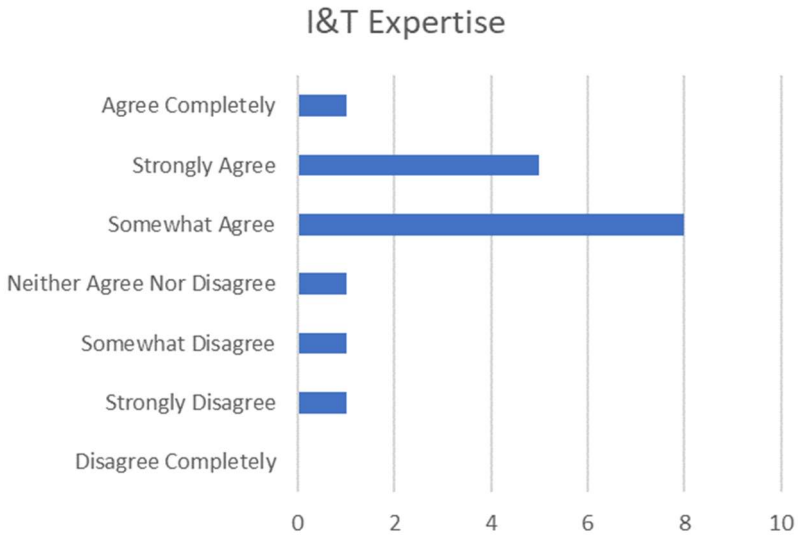

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
No
Yes but could be improved
Yes

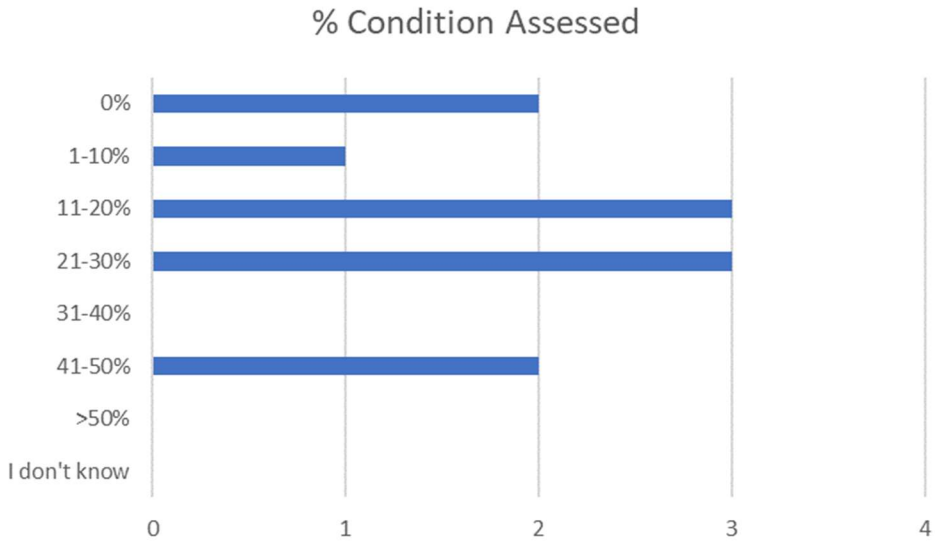
5.3 LIKELIHOOD OF FAILURE RESPONSES

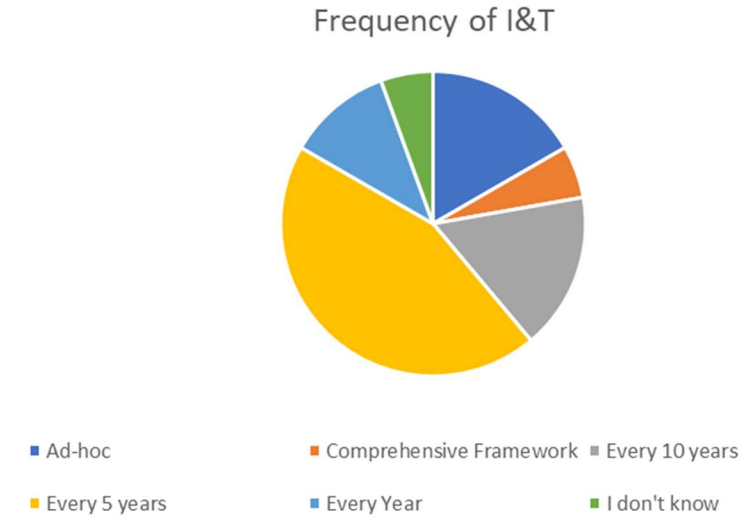
5.3.1 ABOVE-GROUND WATER ASSETS

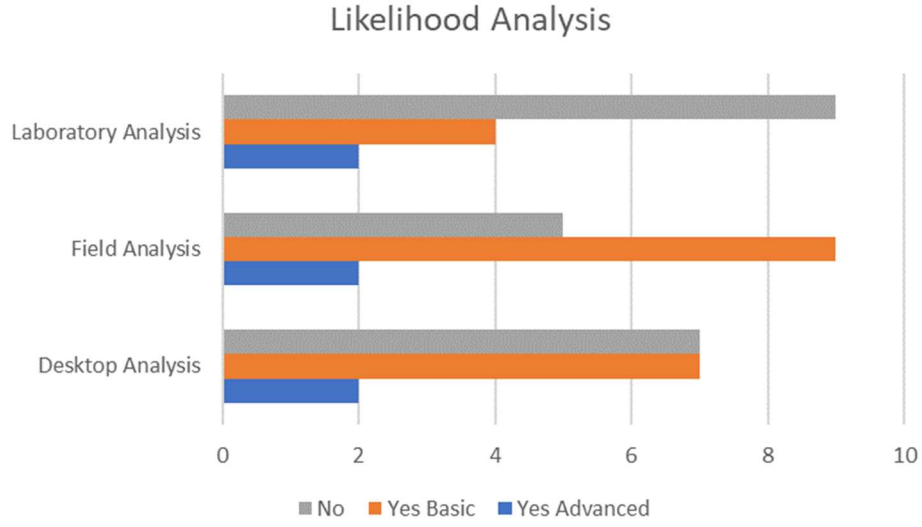


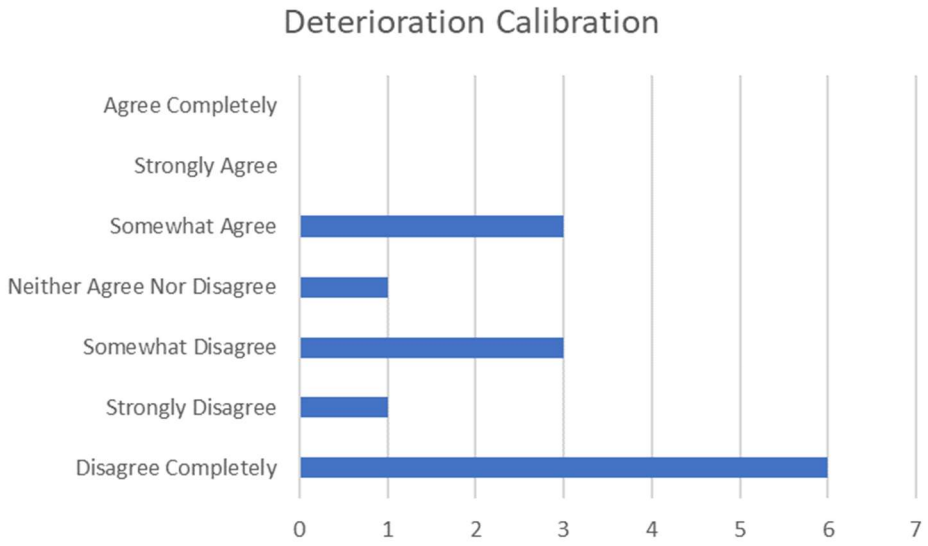


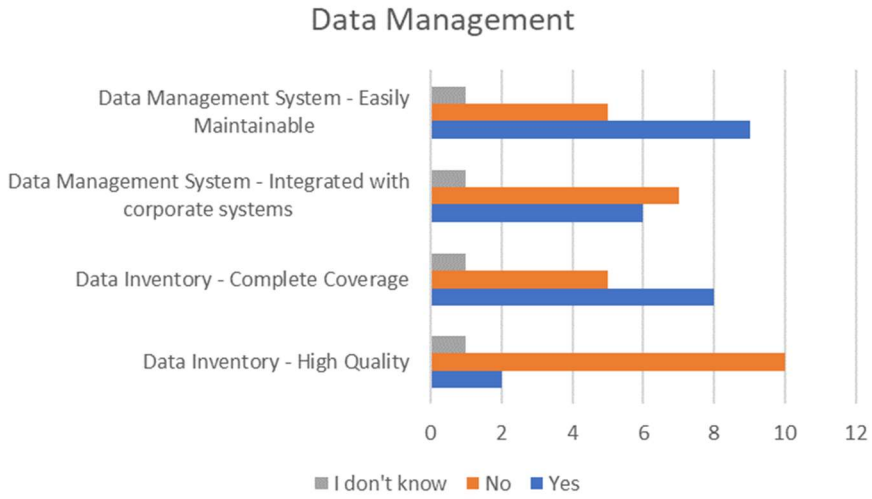

I&T Expertise
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
2
4
6
8
10


% Condition Assessed
0%
1-10%
11-20%
21-30%
31-40%
41-50%
>50%
I don't know
0
1
2
3
4

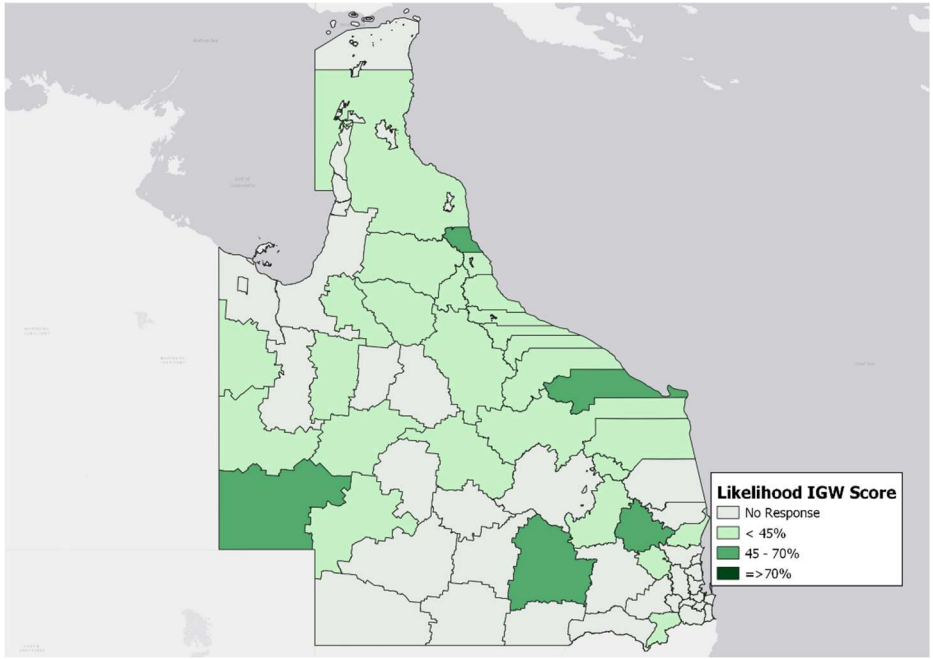

Frequency of I&T
Ad-hoc
Comprehensive Framework
Every 10 years
Every 5 years
Every Year
I don't know

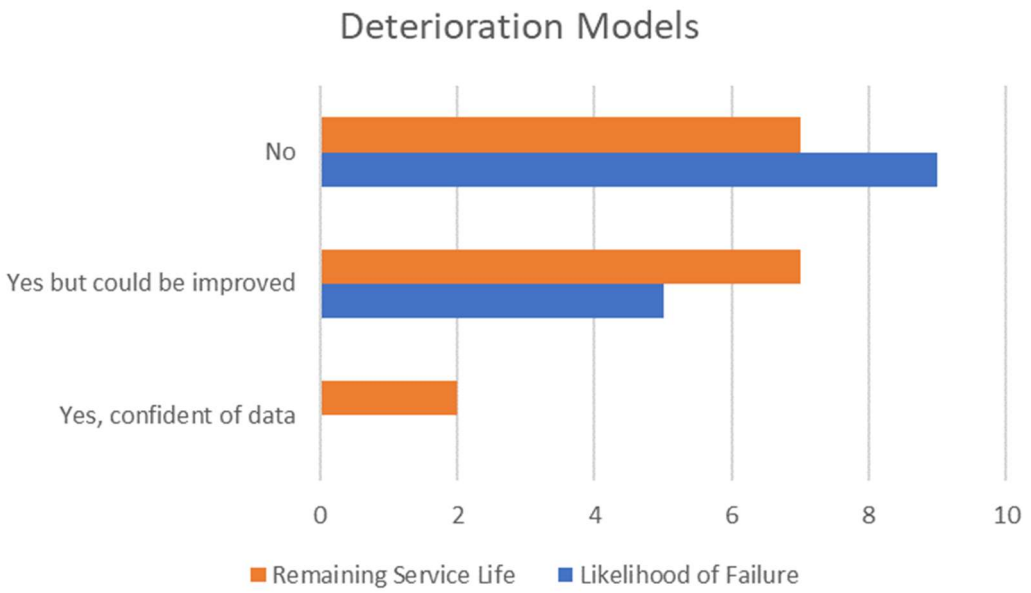

Likelihood Analysis
Laboratory Analysis
Field Analysis
Desktop Analysis
0
2
4
6
8
10
No
Yes Basic
Yes Advanced

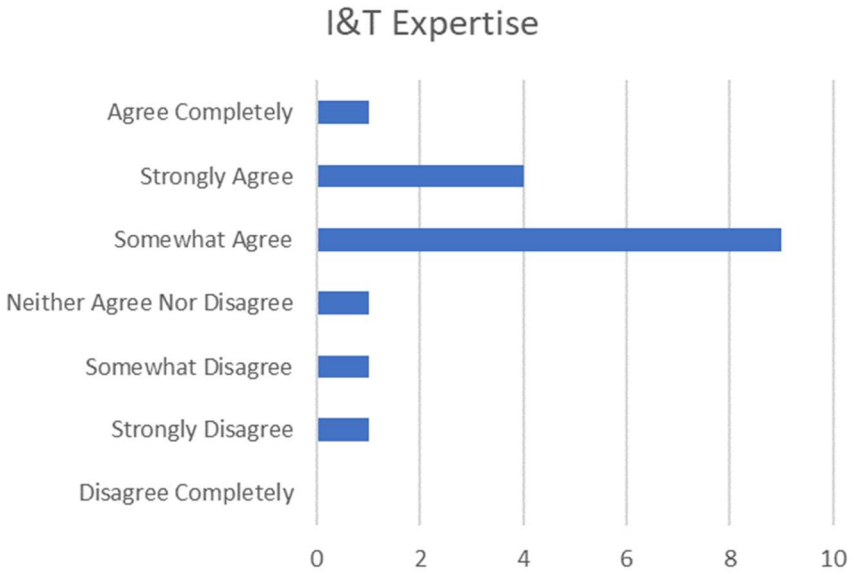

Deterioration Calibration
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
1
2
3
4
5
6
7

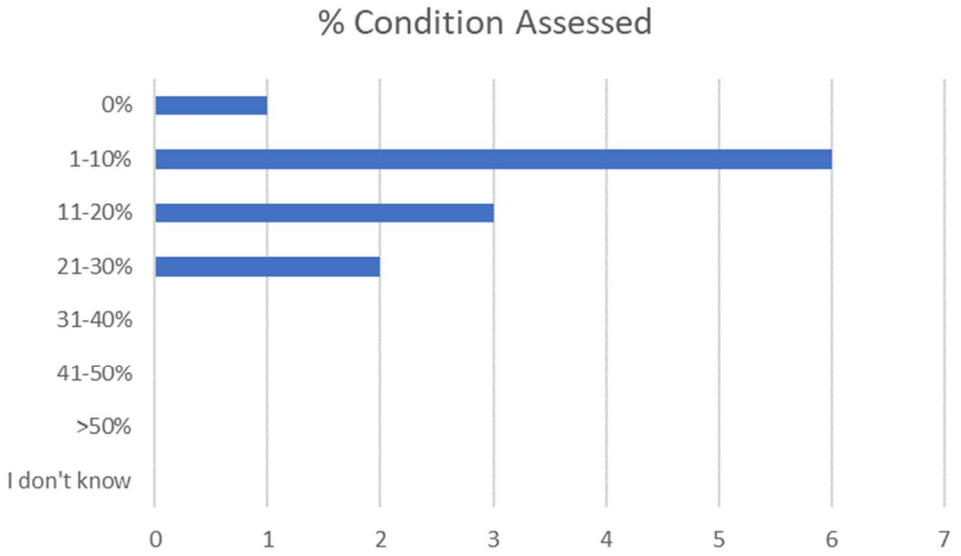

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
I don't know
No
Yes

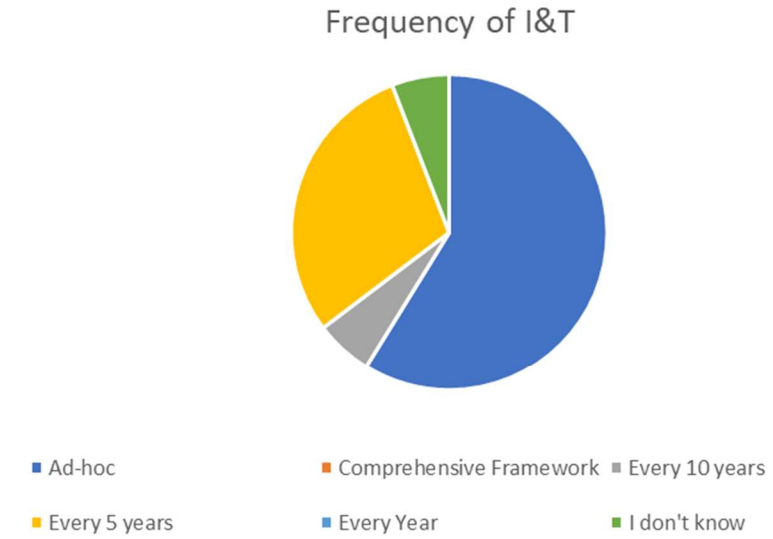
5.3.2 IN-GROUND WATER ASSETS

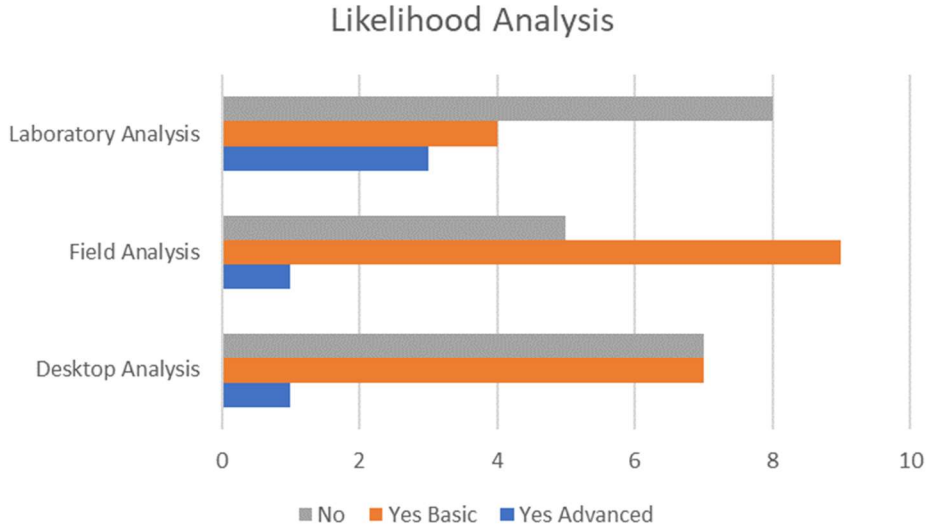


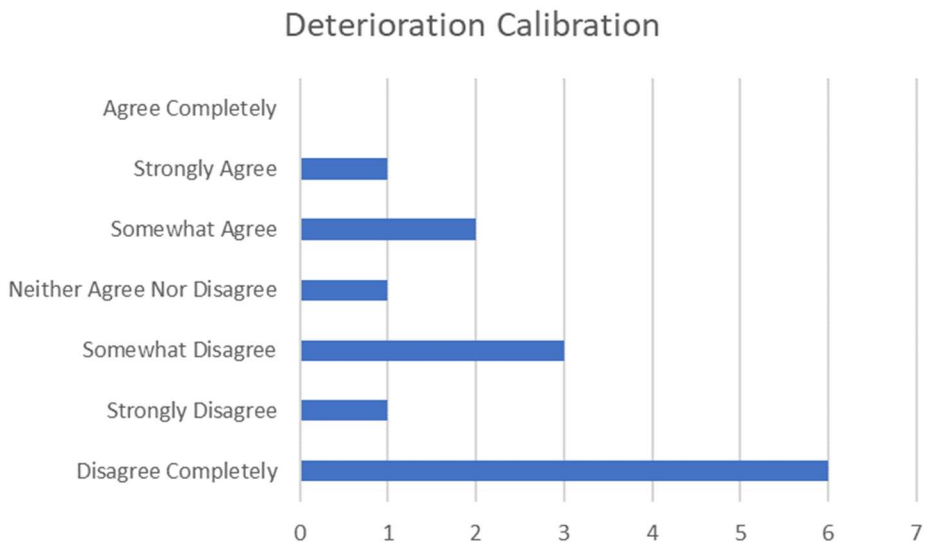


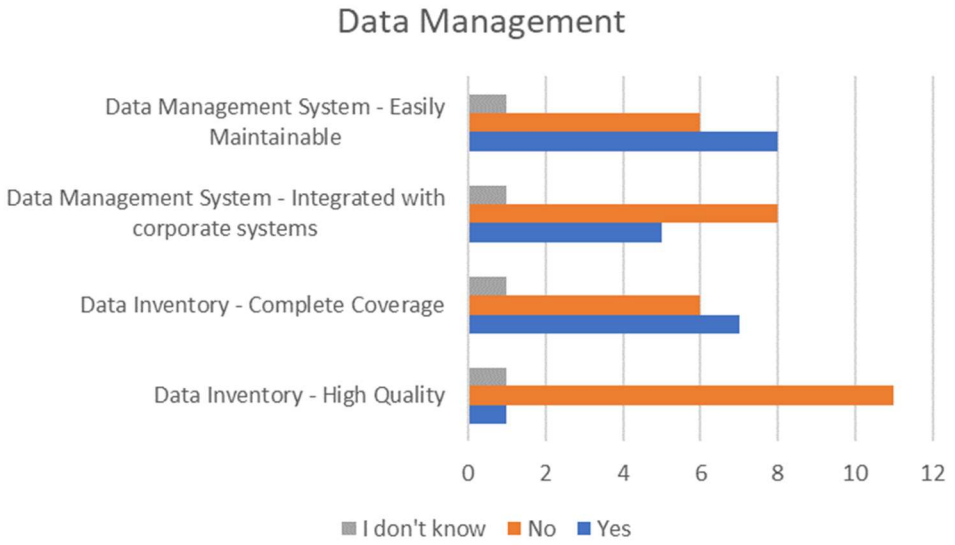

I&T Expertise
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
2
4
6
8
10


% Condition Assessed
0%
1-10%
11-20%
21-30%
31-40%
41-50%
>50%
I don't know
0
1
2
3
4
5
6
7

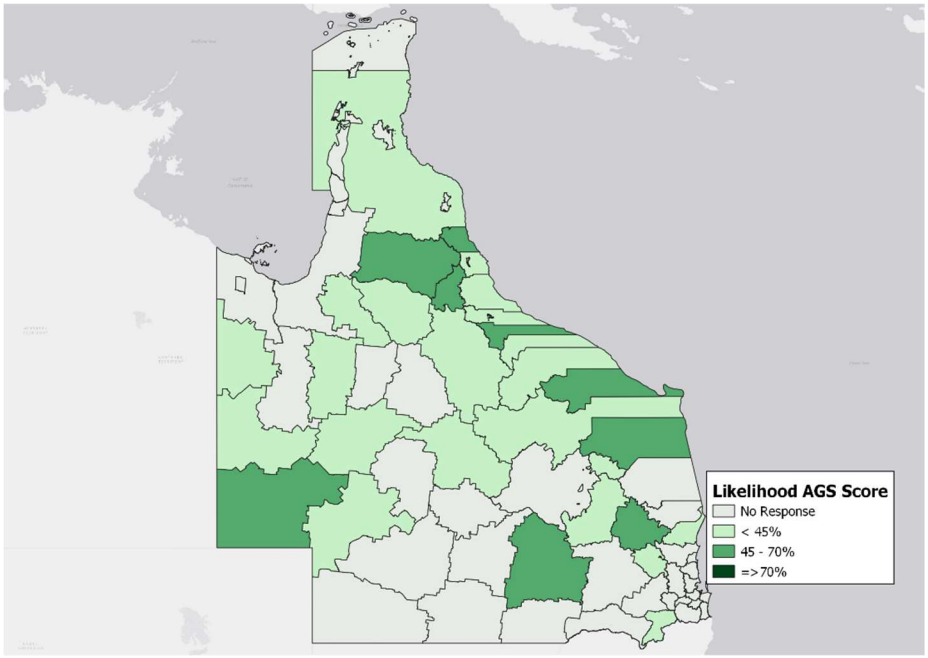

Frequency of I&T
Ad-hoc
Comprehensive Framework
Every 10 years
Every 5 years
Every Year
I don't know

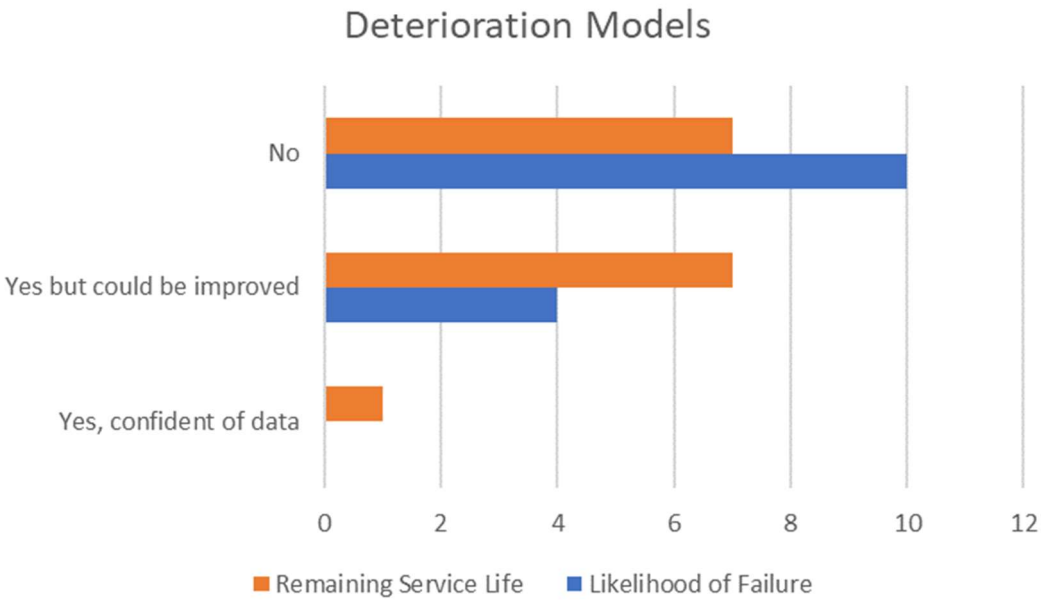

Likelihood Analysis
Laboratory Analysis
Field Analysis
Desktop Analysis
0
2
4
6
8
10
No
Yes Basic
Yes Advanced

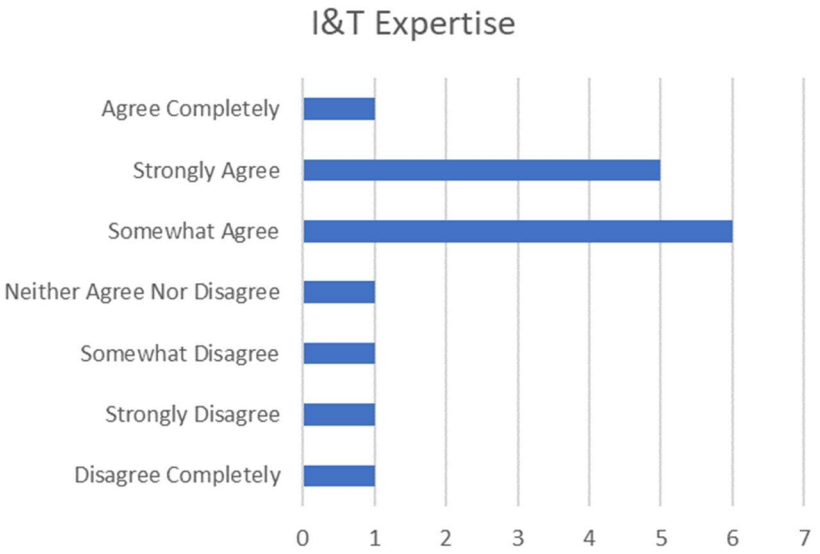

Deterioration Calibration
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
1
2
3
4
5
6
7

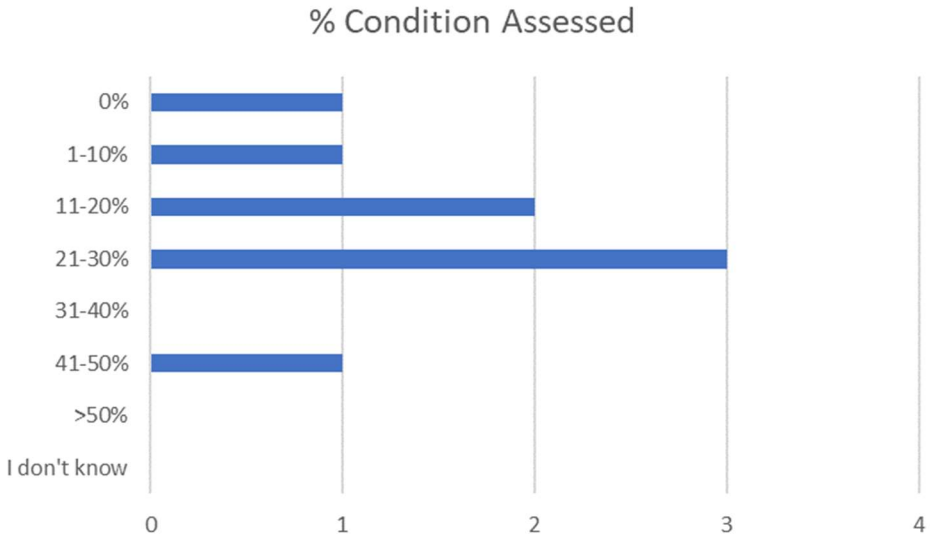

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
I don't know
No
Yes

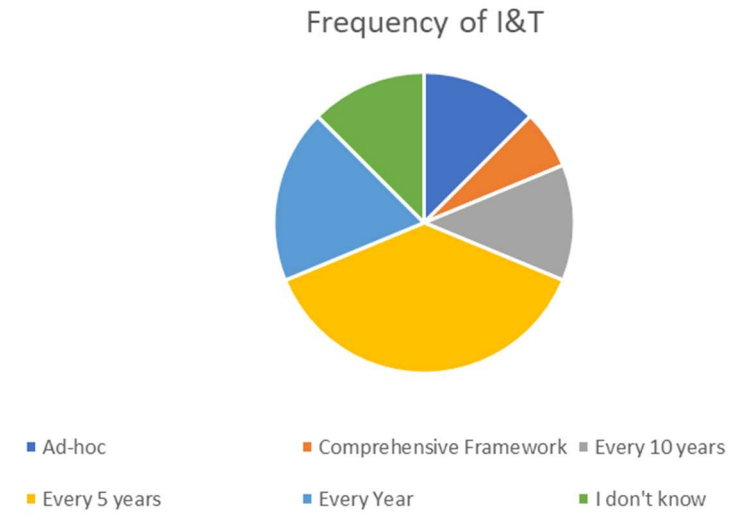
5.3.3 ABOVE-GROUND SEWER ASSETS

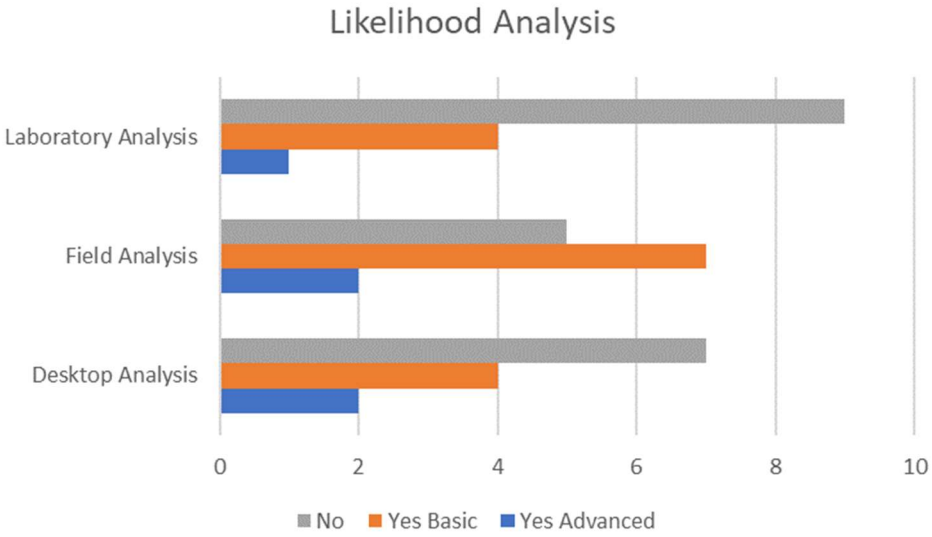


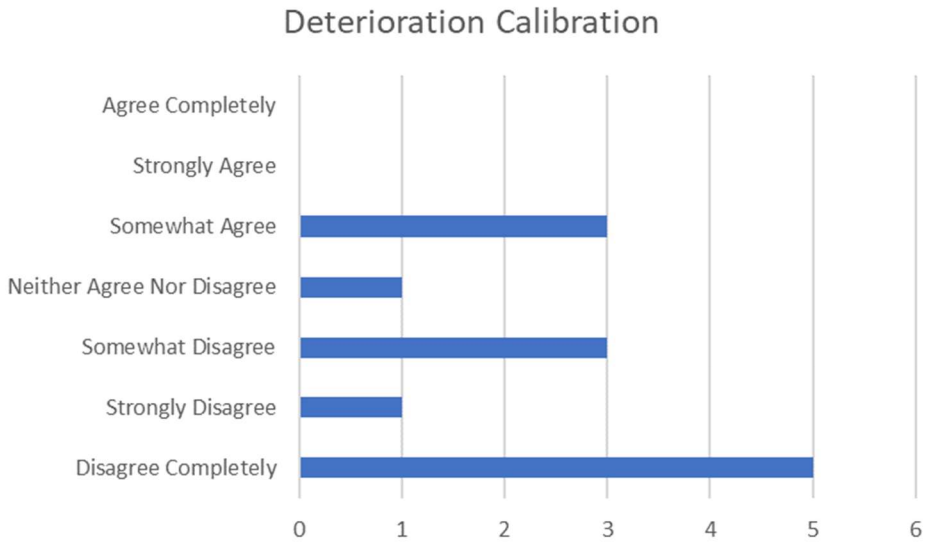


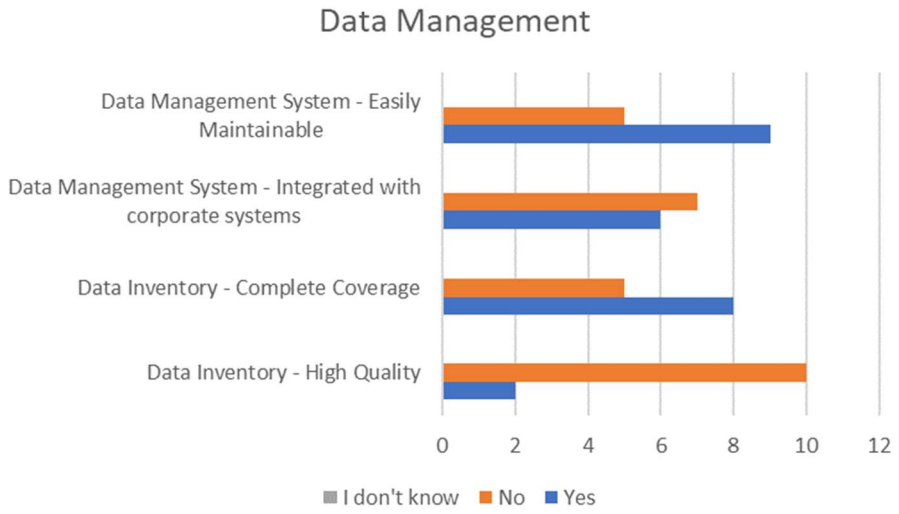

I&T Expertise
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
1
2
3
4
5
6
7


% Condition Assessed
0%
1-10%
11-20%
21-30%
31-40%
41-50%
>50%
I don't know
0
1
2
3
4

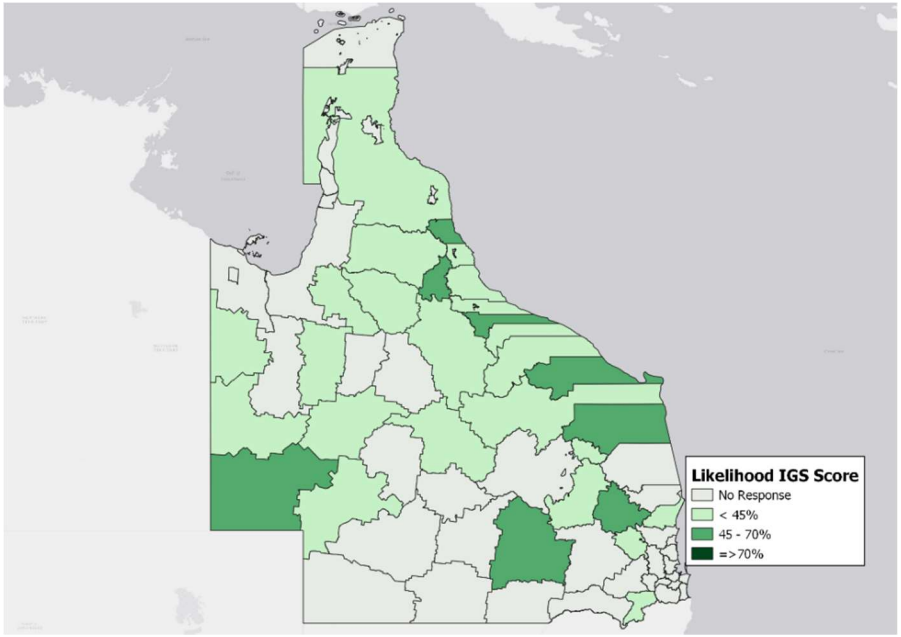

Frequency of I&T
Ad-hoc
Comprehensive Framework
Every 10 years
Every 5 years
Every Year
I don't know

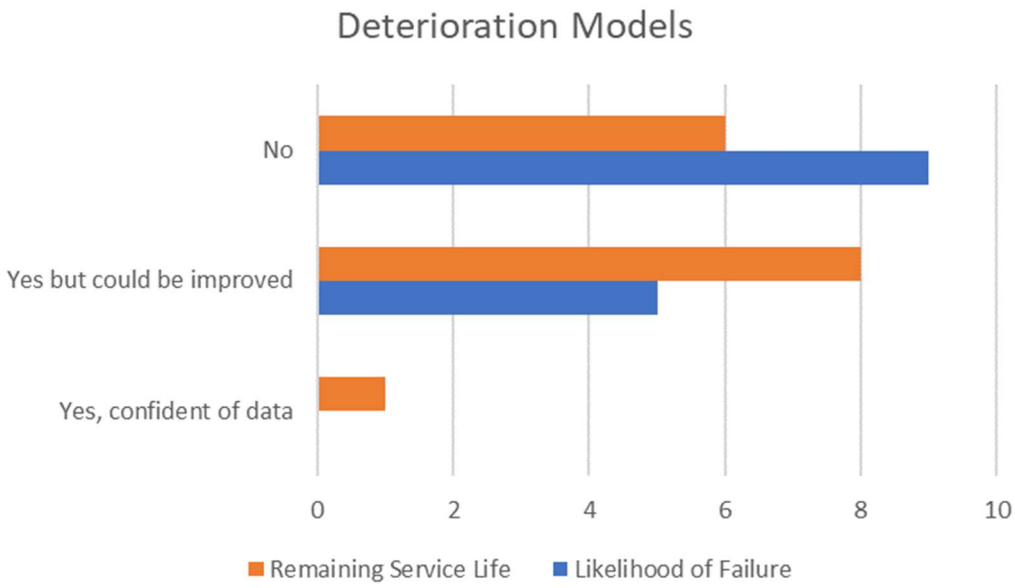

Likelihood Analysis
Laboratory Analysis
Field Analysis
Desktop Analysis
0
2
4
6
8
10
No
Yes Basic
Yes Advanced

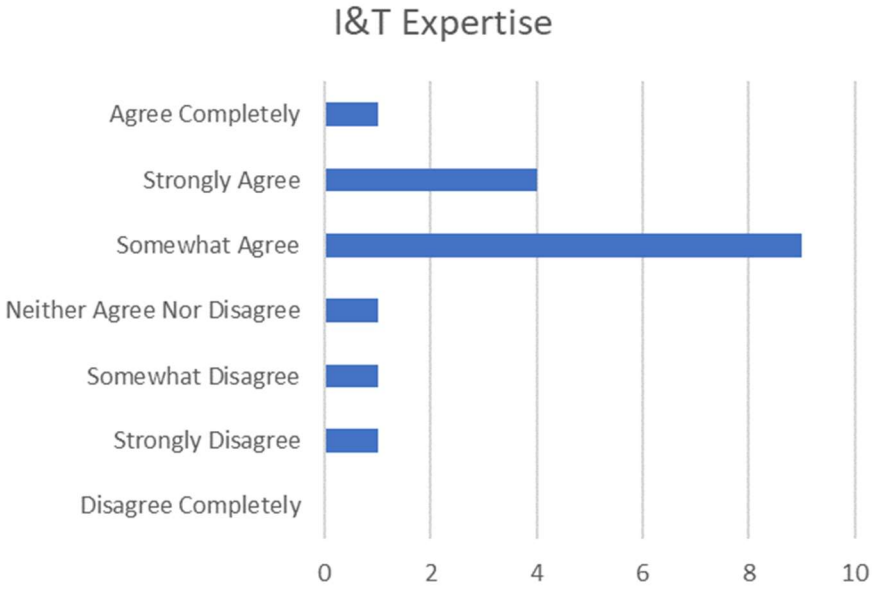

Deterioration Calibration
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
1
2
3
4
5
6

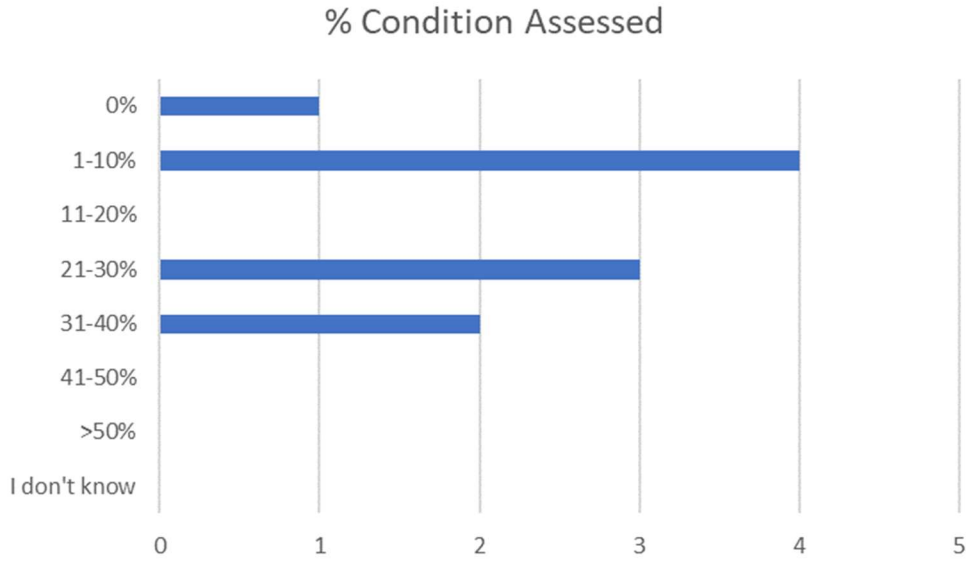

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
I don't know
No
Yes

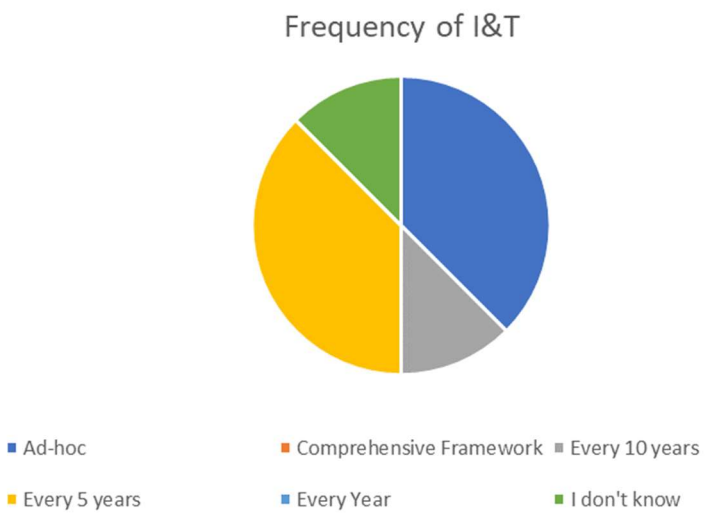
5.3.4 IN-GROUND SEWER ASSETS

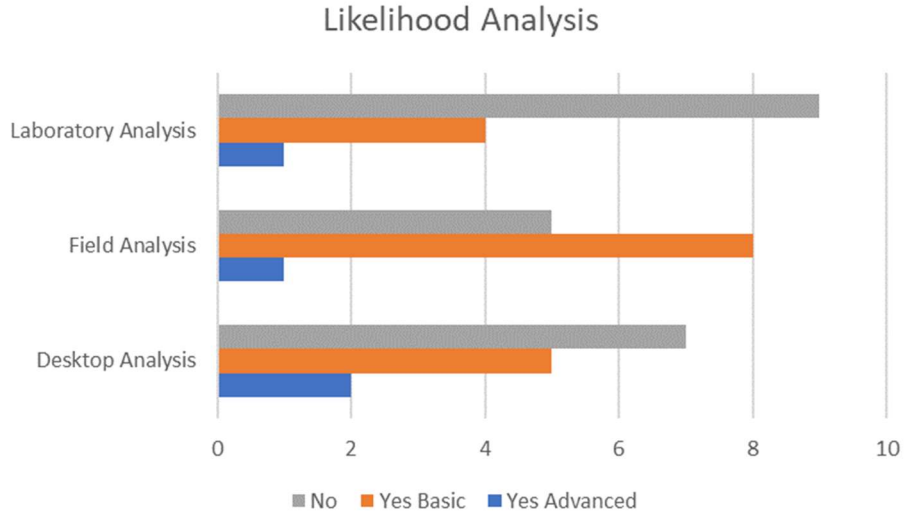


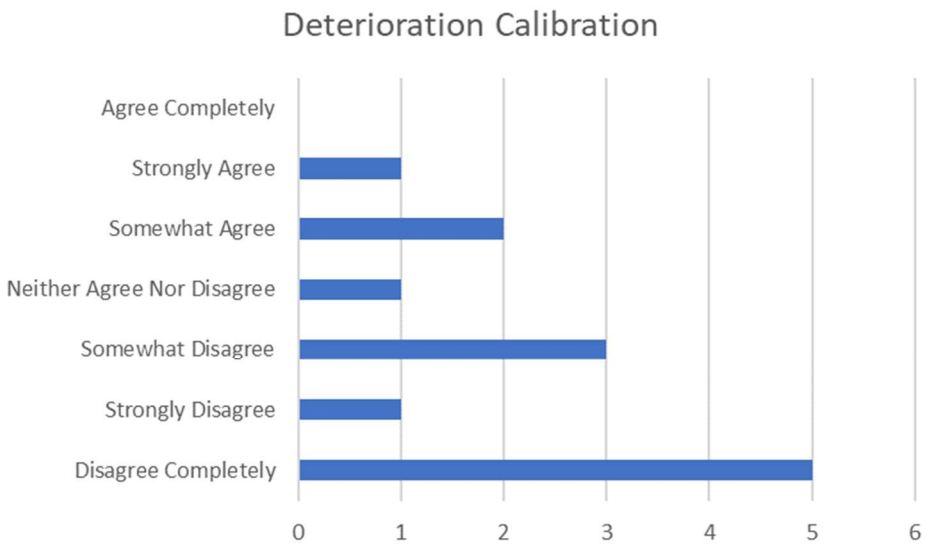


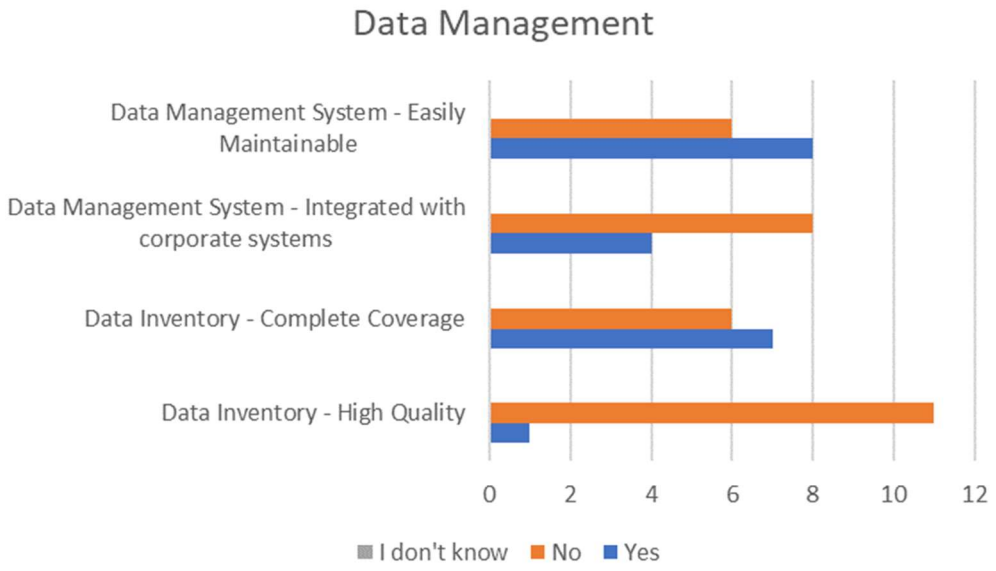

I&T Expertise
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
2
4
6
8
10


% Condition Assessed
0%
1-10%
11-20%
21-30%
31-40%
41-50%
>50%
I don't know
0
1
2
3
4
5


Frequency of I&T
Ad-hoc
Comprehensive Framework
Every 10 years
Every 5 years
Every Year
I don't know

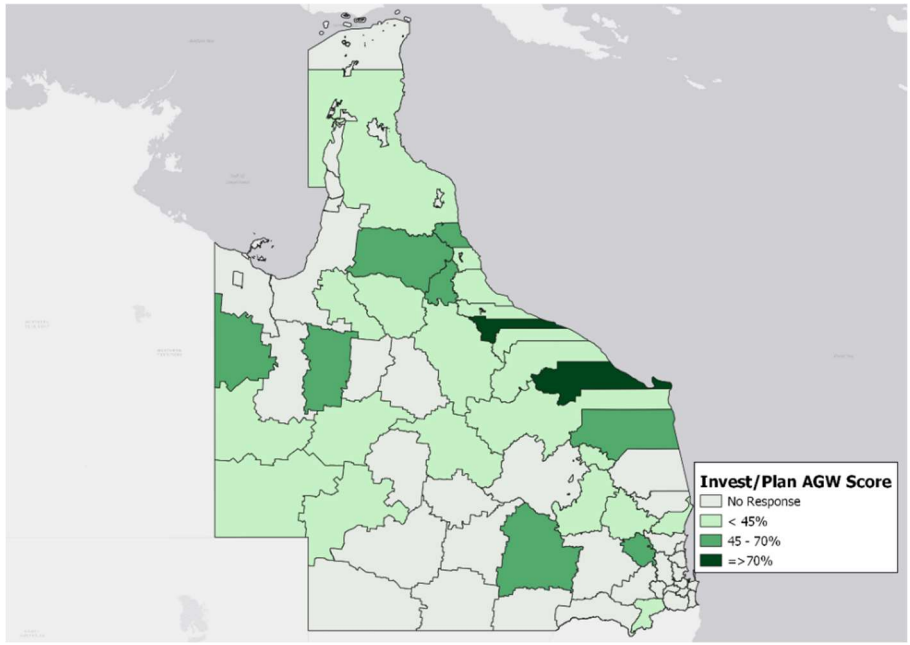

Likelihood Analysis
Laboratory Analysis
Field Analysis
Desktop Analysis
0
2
4
6
8
10
No
Yes Basic
Yes Advanced

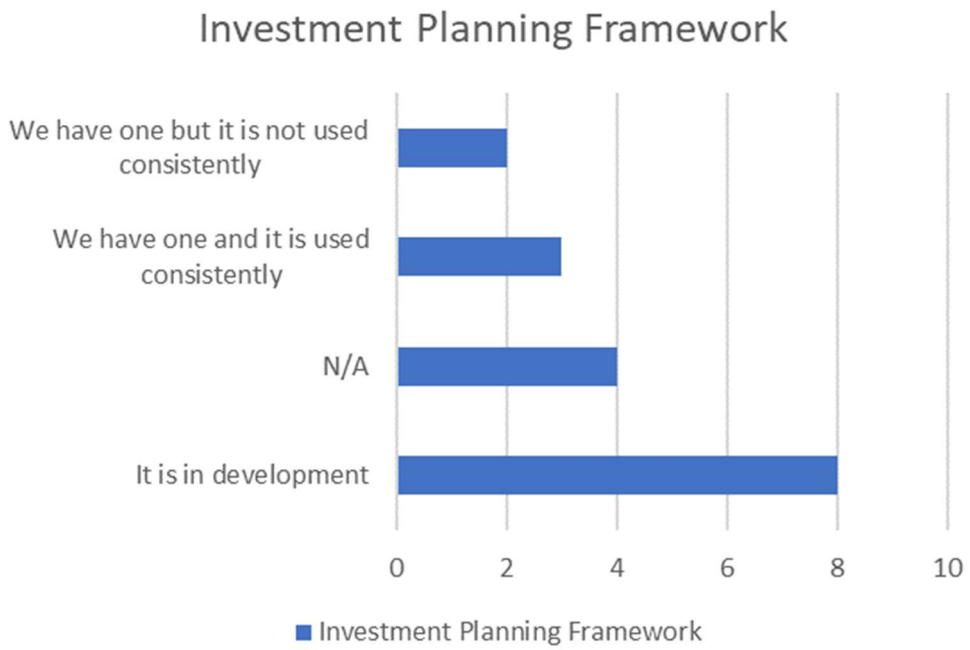

Deterioration Calibration
Agree Completely
Strongly Agree
Somewhat Agree
Neither Agree Nor Disagree
Somewhat Disagree
Strongly Disagree
Disagree Completely
0
1
2
3
4
5
6

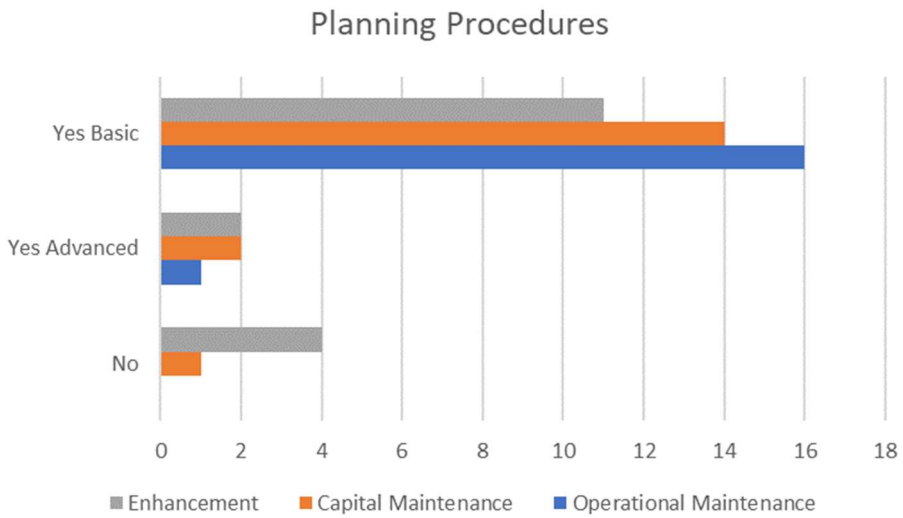

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
I don't know
No
Yes

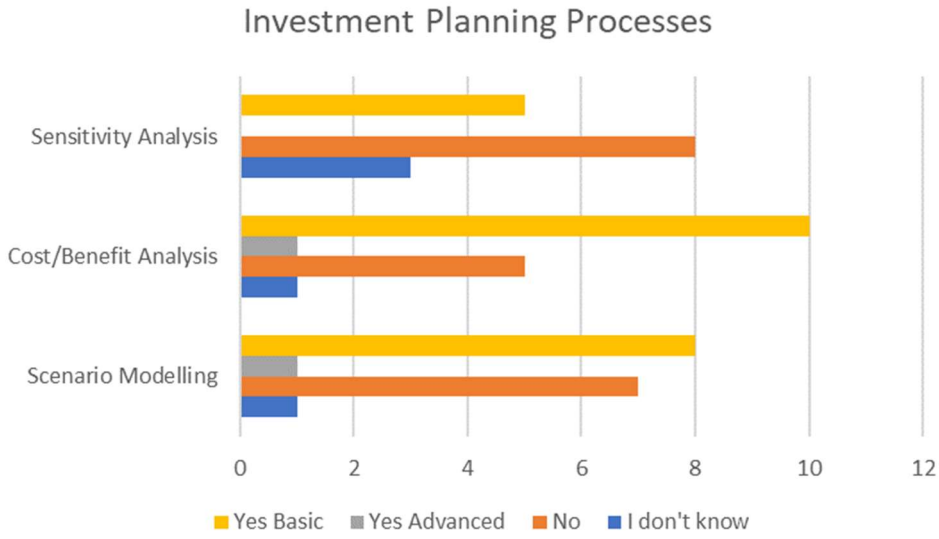
5.4 INVESTMENT PLANNING FRAMEWORK RESPONSES

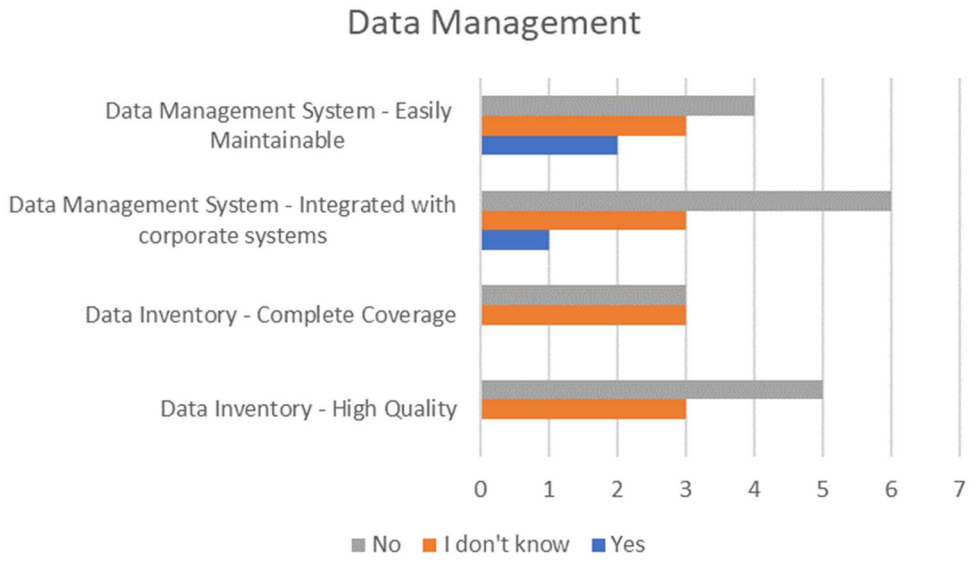
5.4.1 ABOVE-GROUND WATER ASSETS



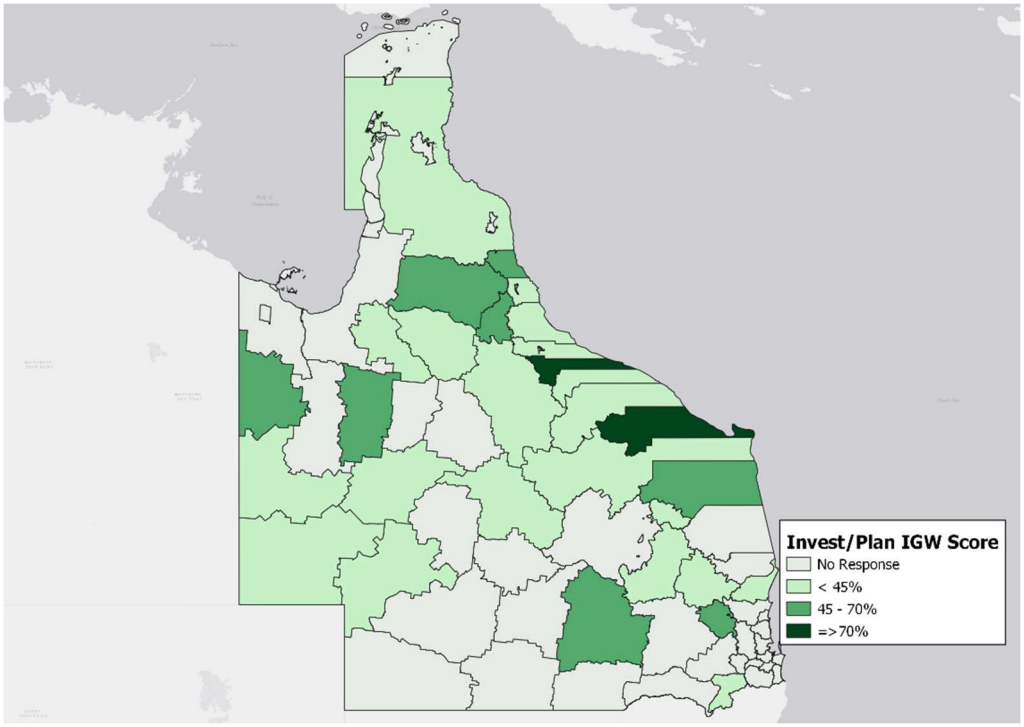


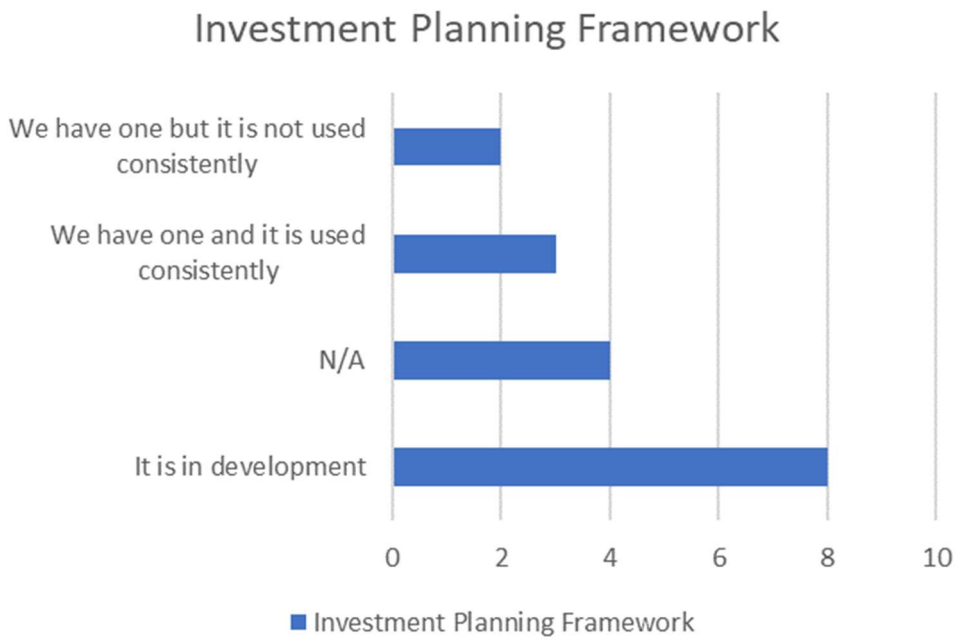

Planning Procedures
Yes Basic
Yes Advanced
No
0
2
4
6
8
10
12
14
16
18
Enhancement
Capital Maintenance
Operational Maintenance

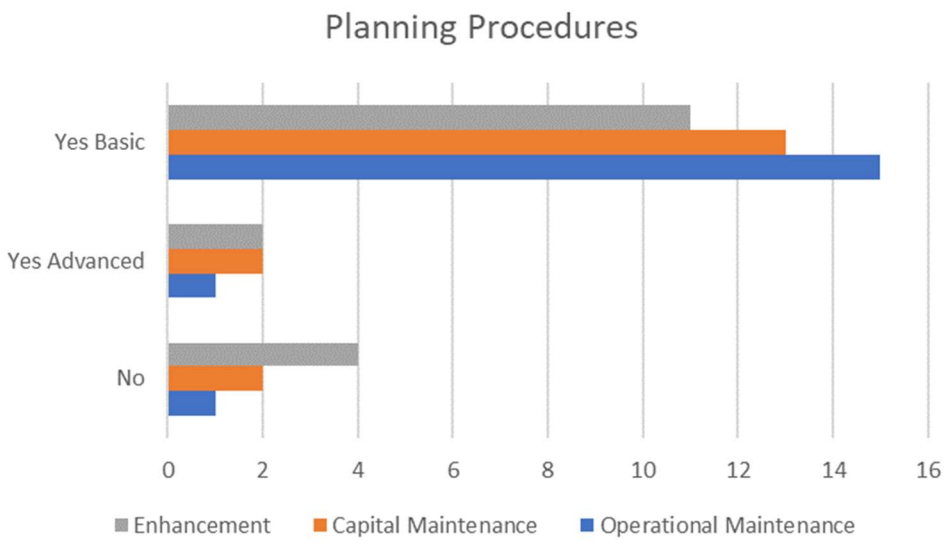

Investment Planning Processes
Sensitivity Analysis
Cost/Benefit Analysis
Scenario Modelling
0
2
4
6
8
10
12
Yes Basic
Yes Advanced
No
I don't know

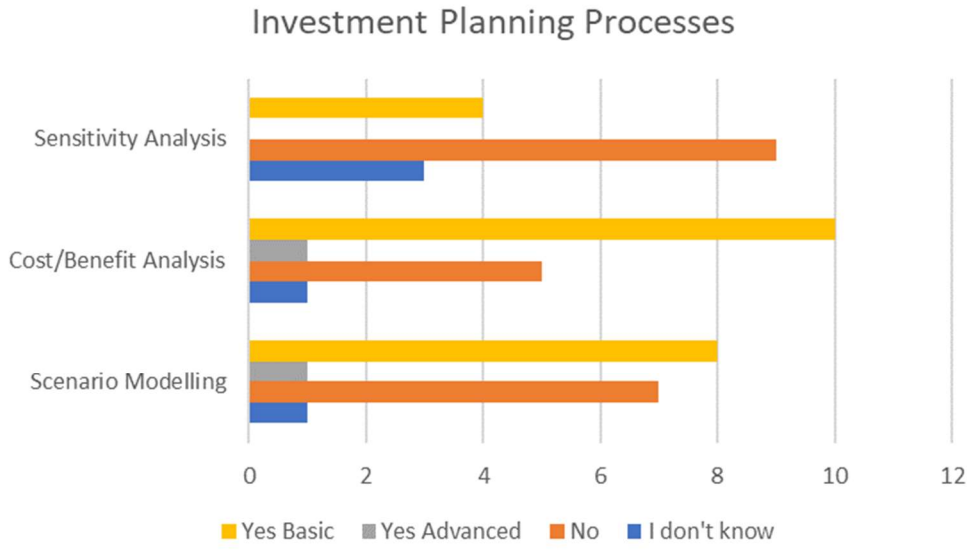

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
1
2
3
4
5
6
7
No
I don't know
Yes

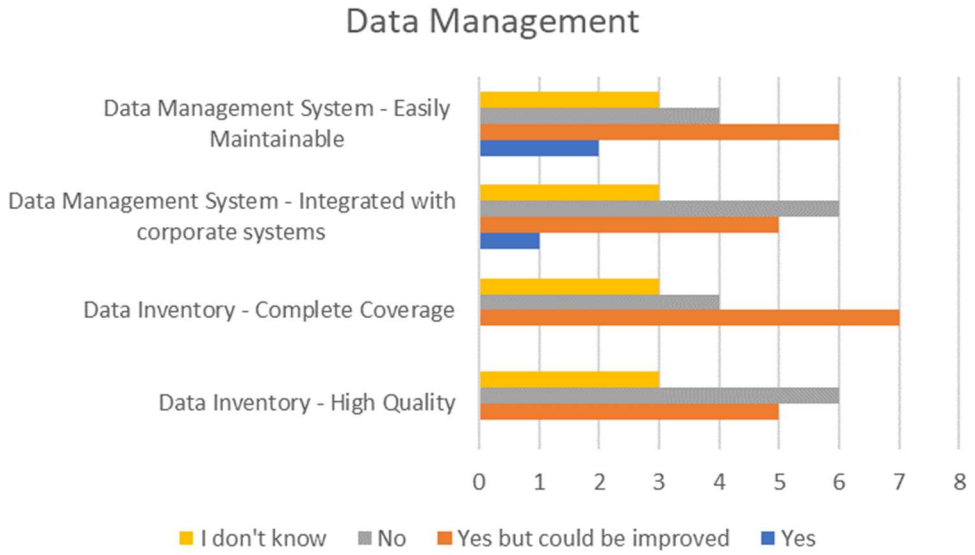
5.4.2 IN-GROUND WATER ASSETS



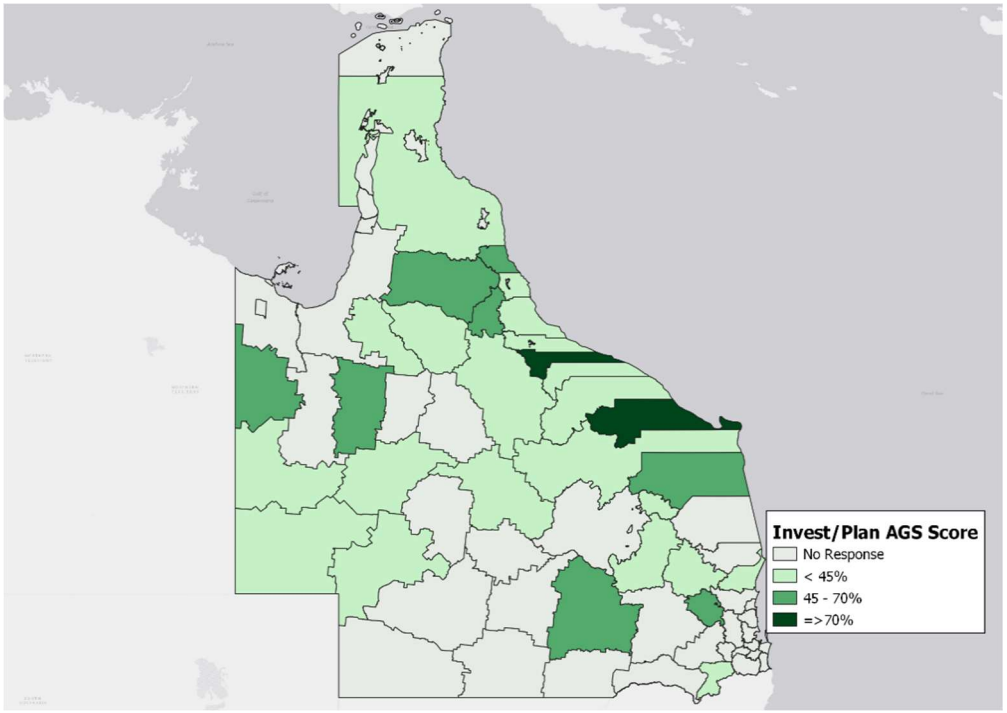


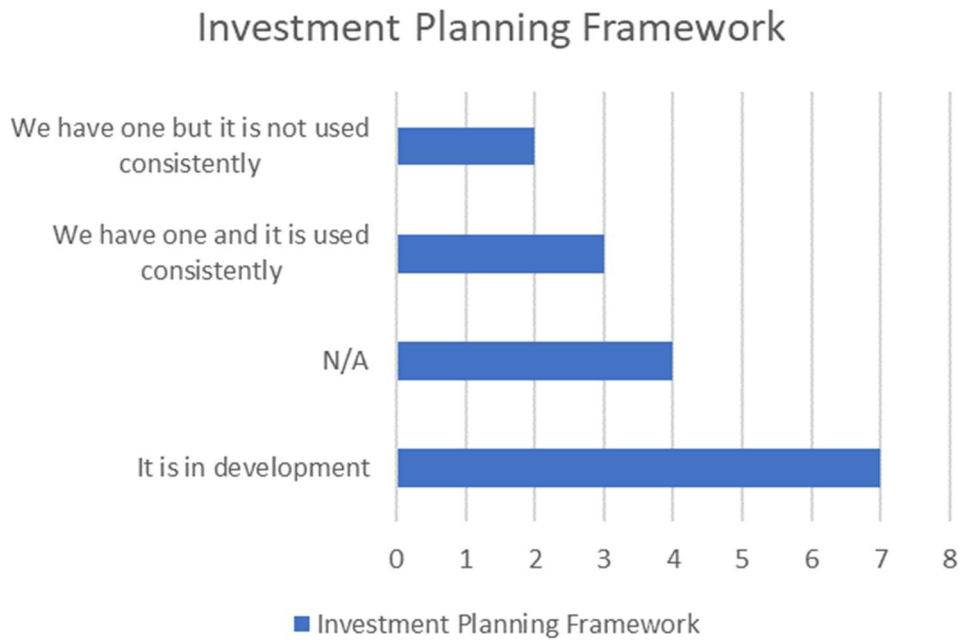

Planning Procedures
Yes Basic
Yes Advanced
No
0
2
4
6
8
10
12
14
16
Enhancement
Capital Maintenance
Operational Maintenance

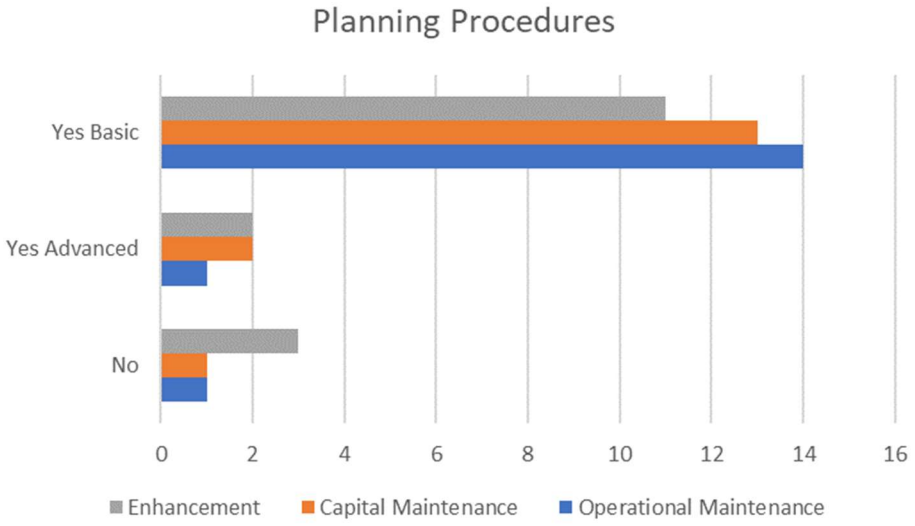

Investment Planning Processes
Sensitivity Analysis
Cost/Benefit Analysis
Scenario Modelling
0
2
4
6
8
10
12
Yes Basic
Yes Advanced
No
I don't know

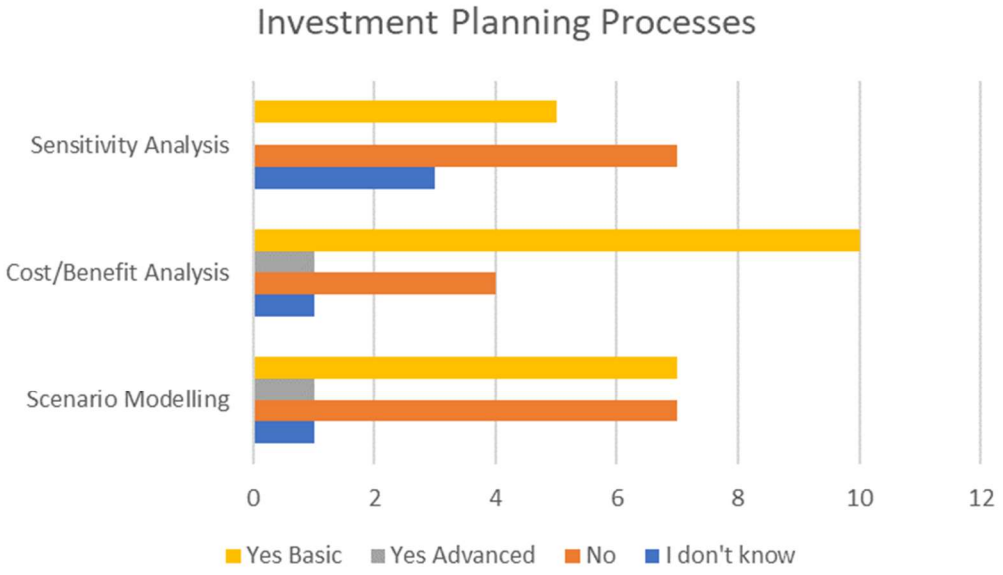

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
1
2
3
4
5
6
7
8
I don't know
No
Yes but could be improved
Yes

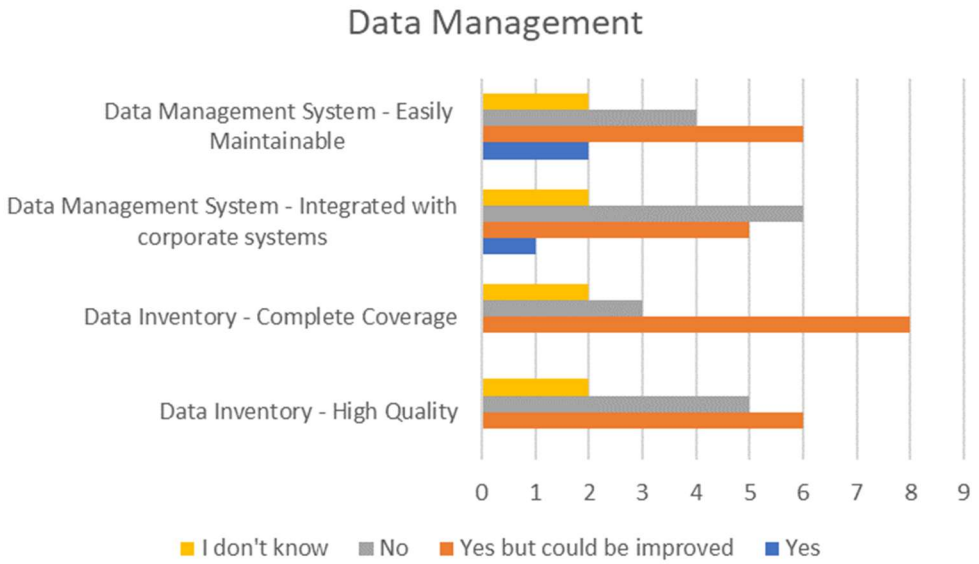
5.4.3 ABOVE-GROUND SEWER ASSETS



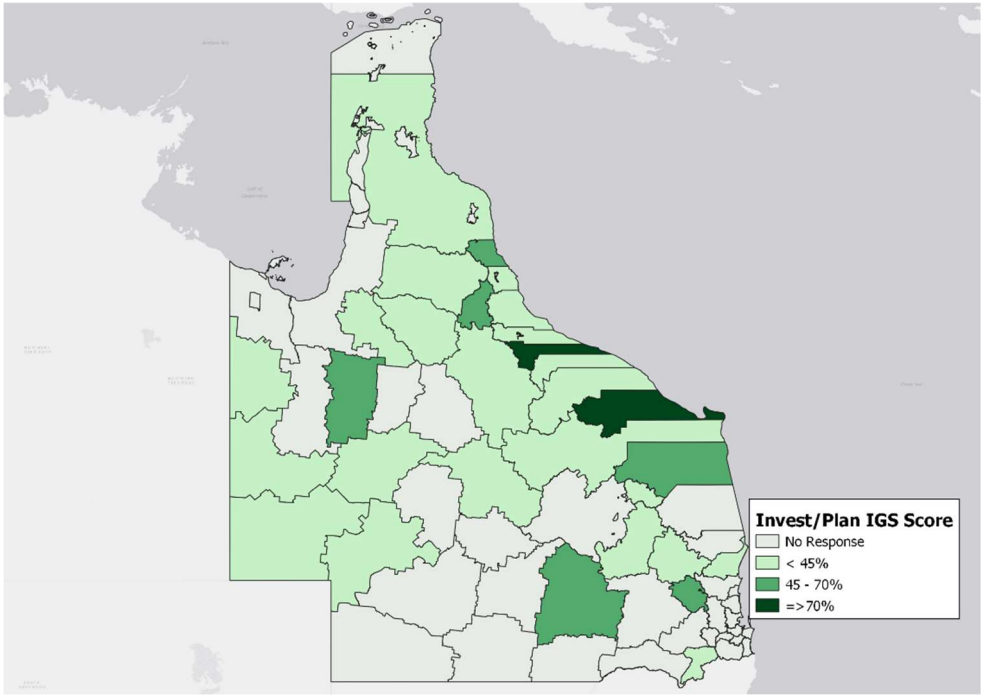


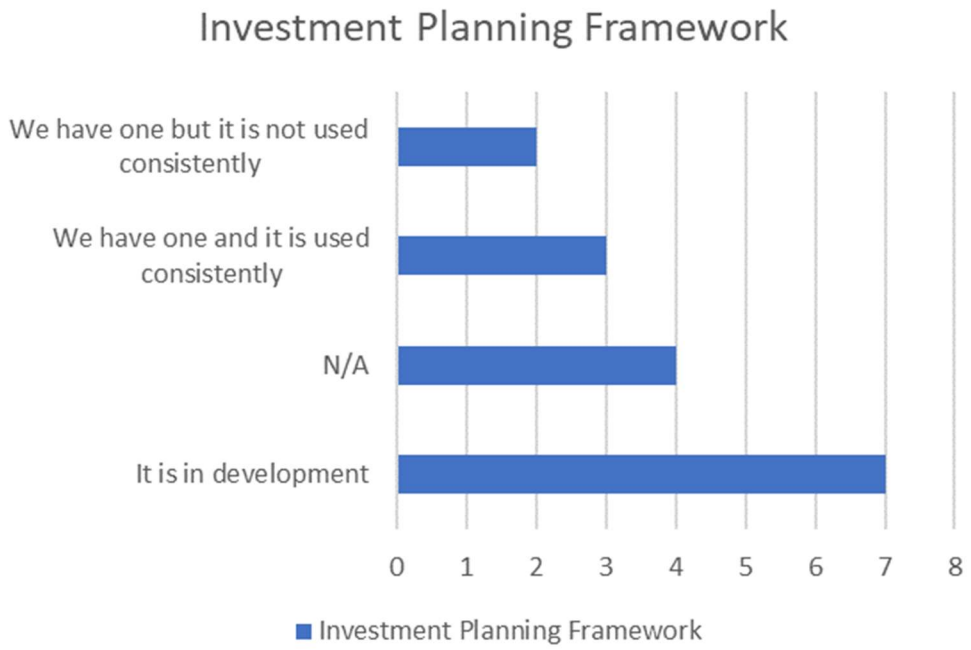

Planning Procedures
Yes Basic
Yes Advanced
No
0
2
4
6
8
10
12
14
16
Enhancement
Capital Maintenance
Operational Maintenance

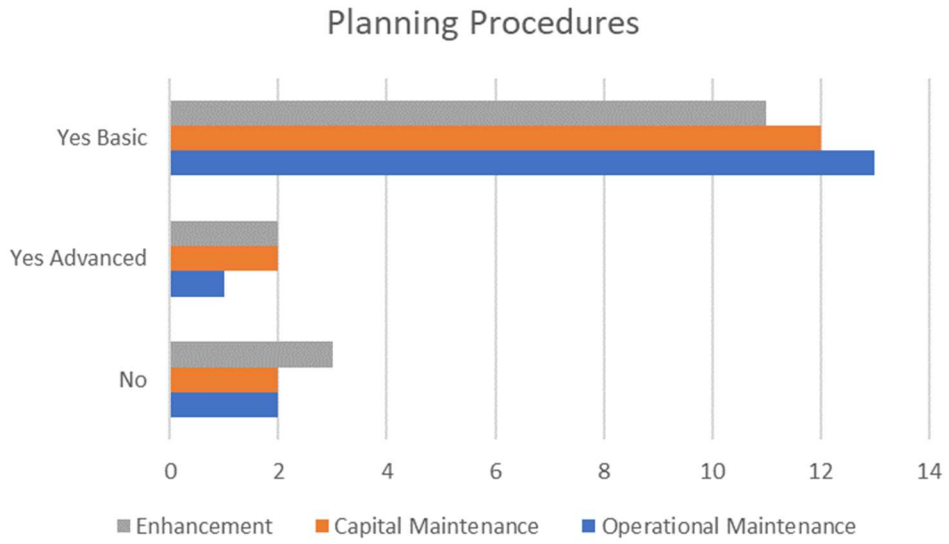

Investment Planning Processes
Sensitivity Analysis
Cost/Benefit Analysis
Scenario Modelling
0
2
4
6
8
10
12
Yes Basic
Yes Advanced
No
I don't know

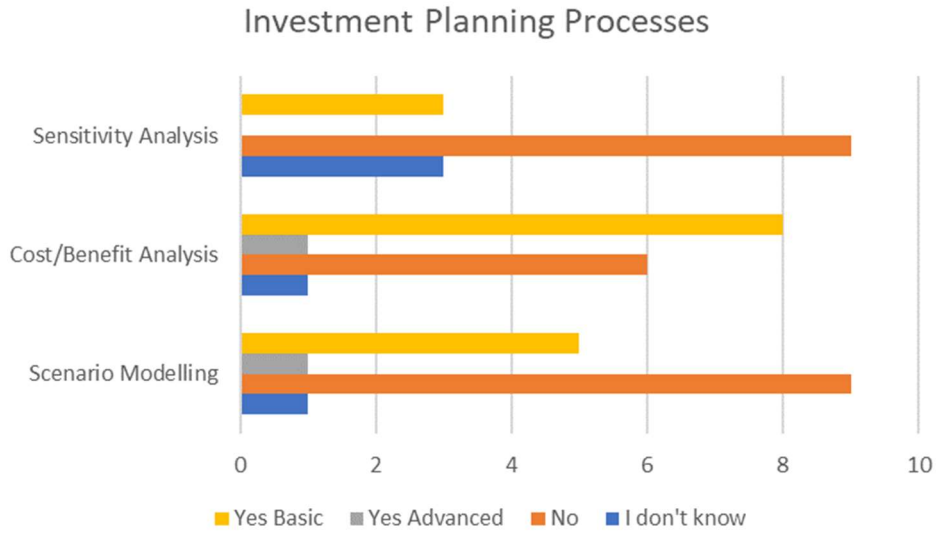

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
1
2
3
4
5
6
7
8
9
I don't know
No
Yes but could be improved
Yes

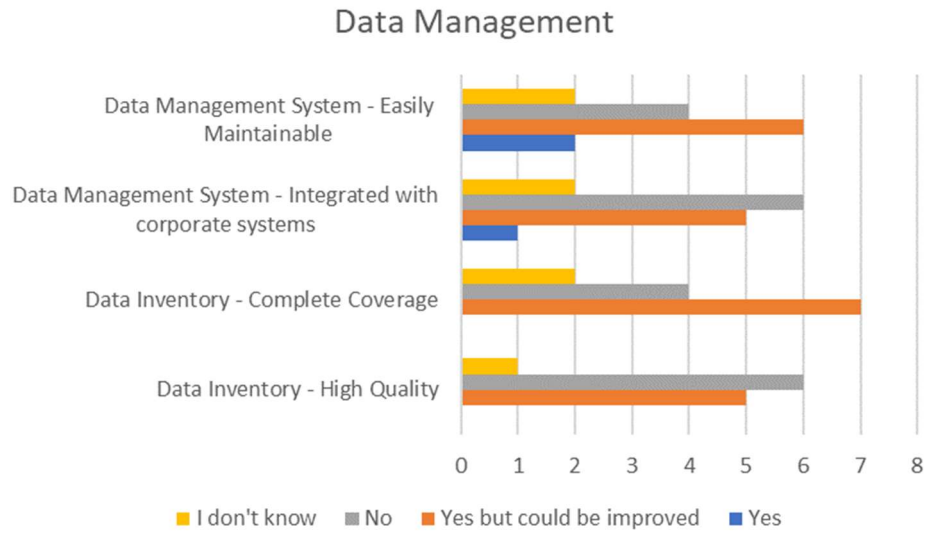
5.4.4 IN-GROUND SEWER ASSETS





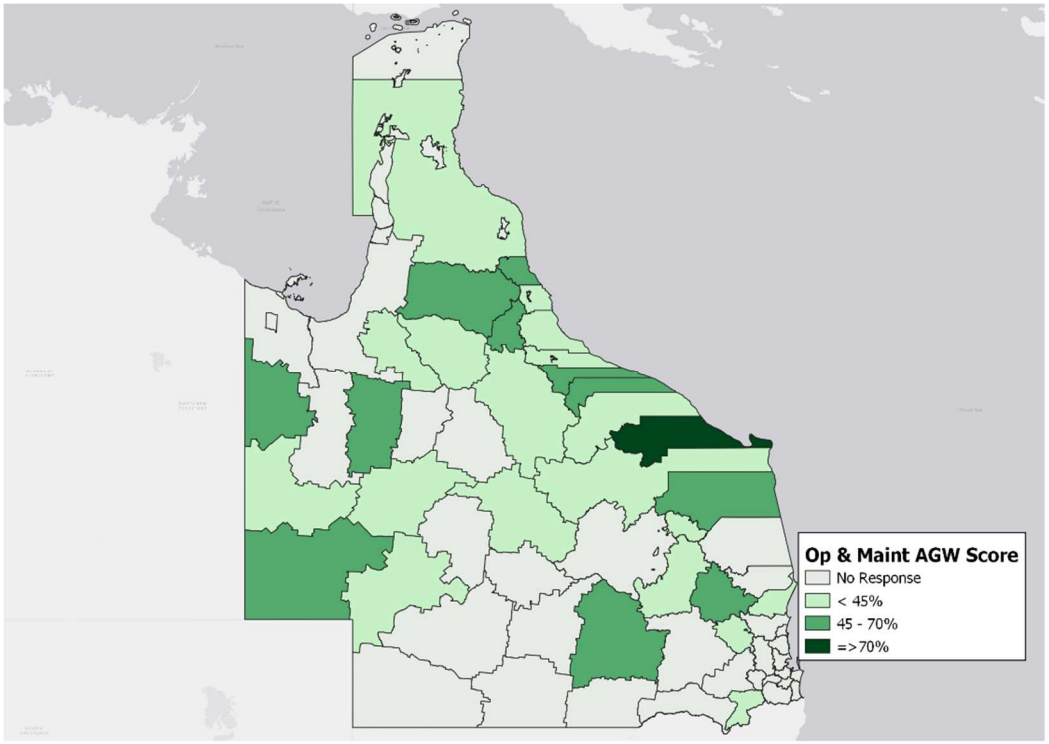

Planning Procedures
Yes Basic
Yes Advanced
No
0
2
4
6
8
10
12
14
Enhancement
Capital Maintenance
Operational Maintenance

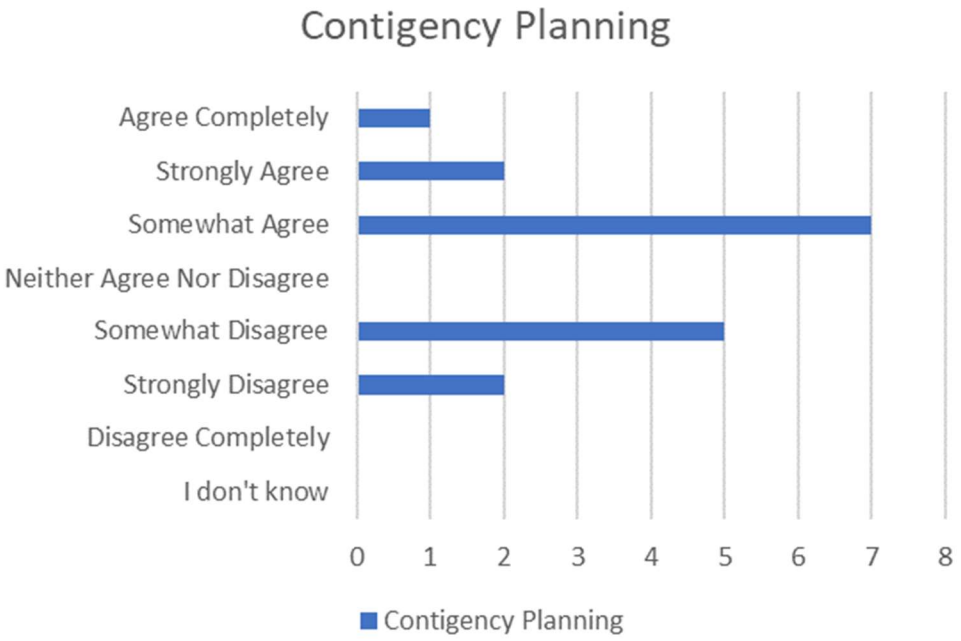

Investment Planning Processes
Sensitivity Analysis
Cost/Benefit Analysis
Scenario Modelling
0
2
4
6
8
10
Yes Basic
Yes Advanced
No
I don't know

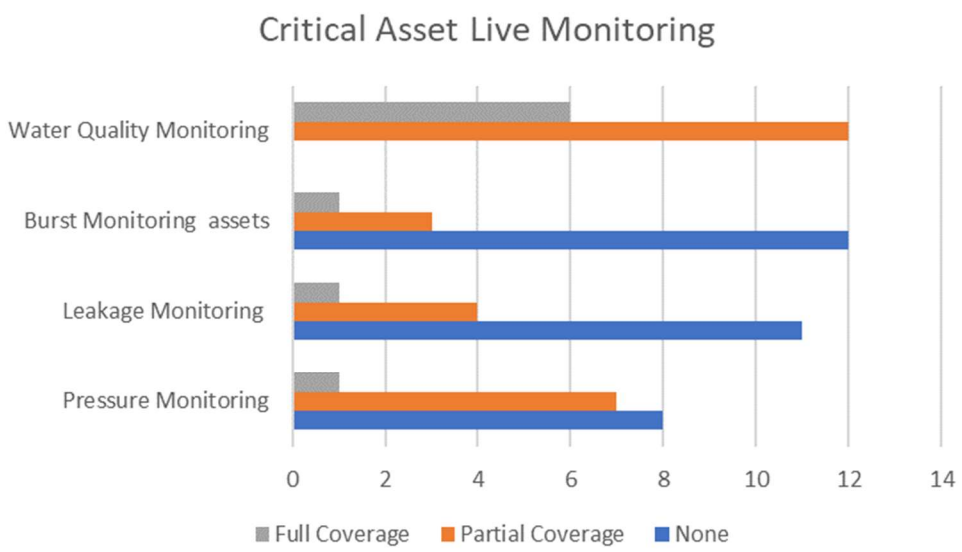

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
1
2
3
4
5
6
7
8
I don't know
No
Yes but could be improved
Yes

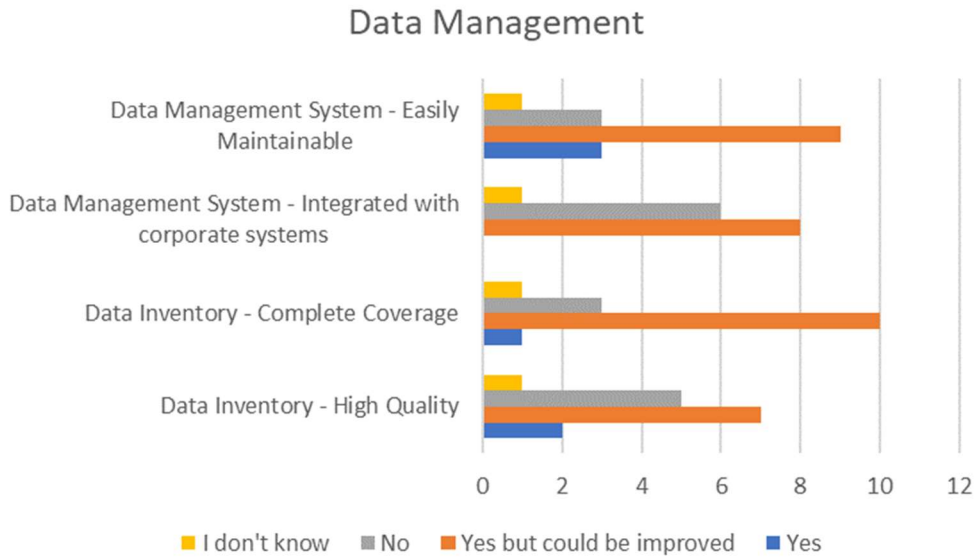
5.5 OPERATION & MAINTENANCE RESPONSES

5.5.1 ABOVE-GROUND WATER ASSETS

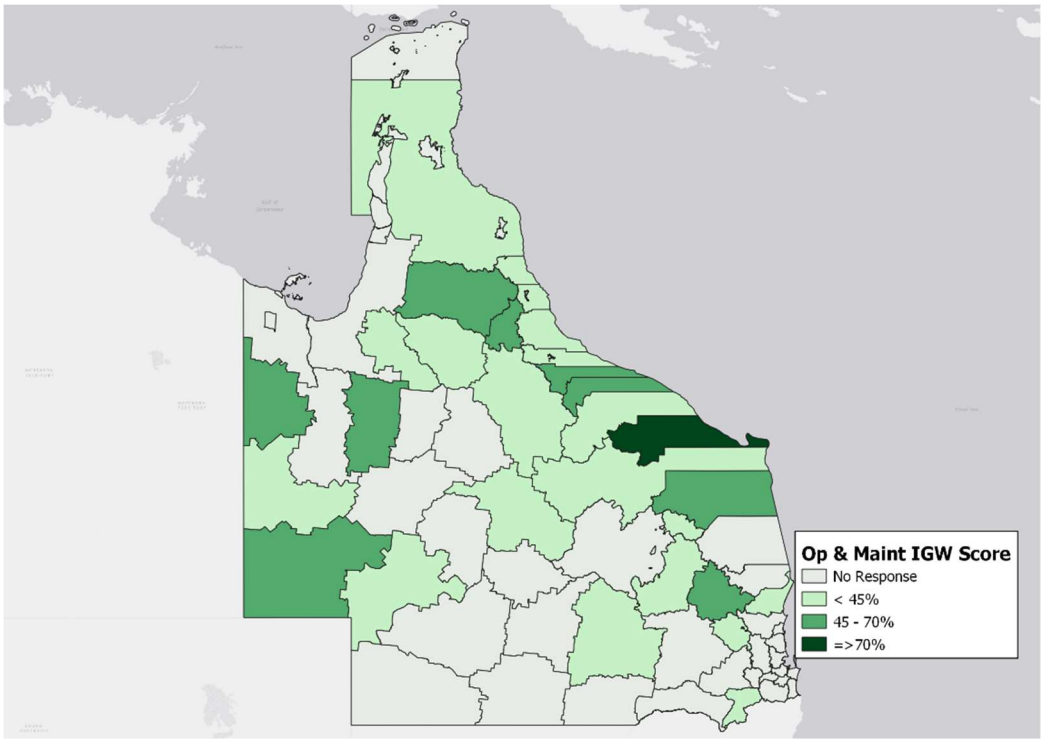


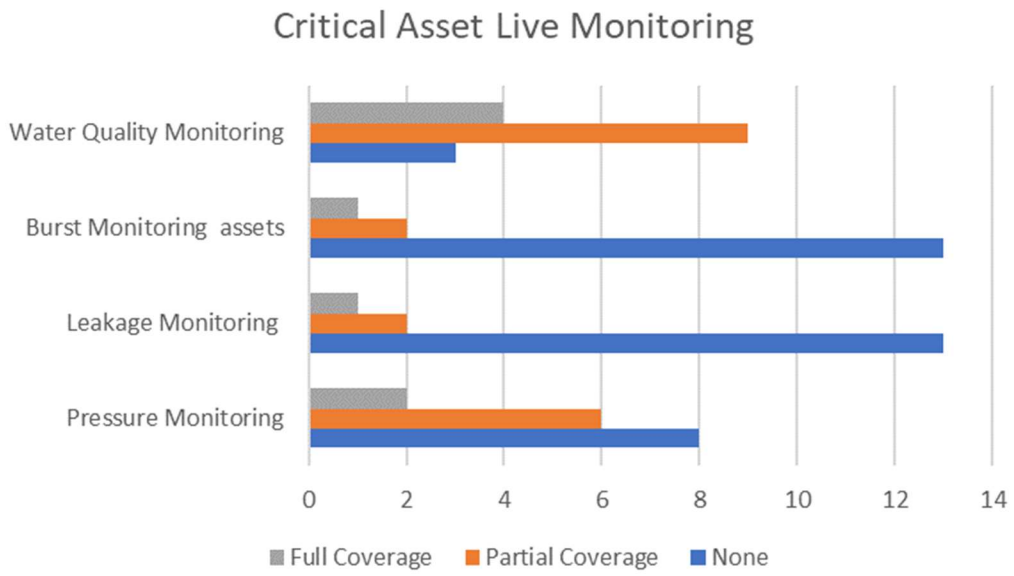


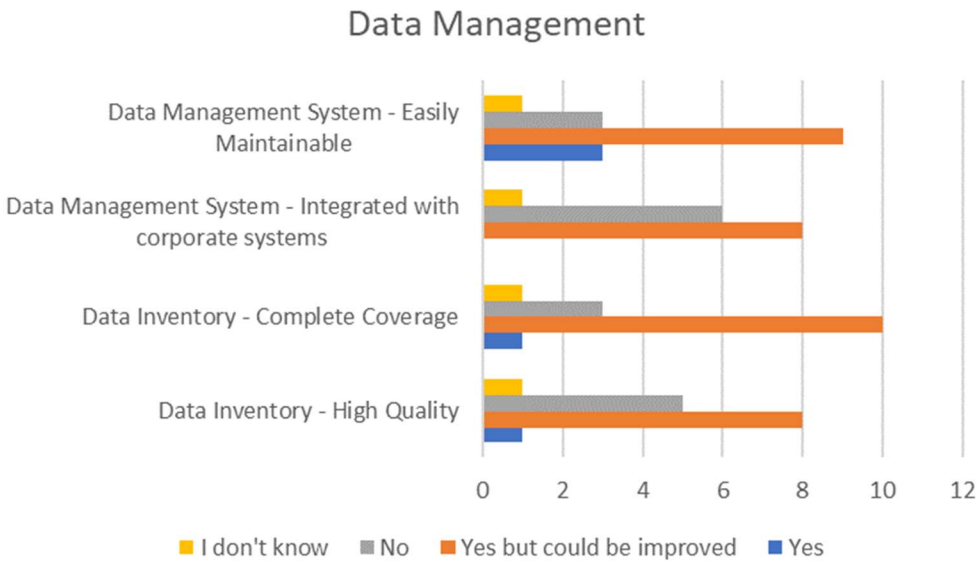

Critical Asset Live Monitoring
Water Quality Monitoring
Burst Monitoring assets
Leakage Monitoring
Pressure Monitoring
0
2
4
6
8
10
12
14
Full Coverage
Partial Coverage
None


Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
I don't know
No
Yes but could be improved
Yes

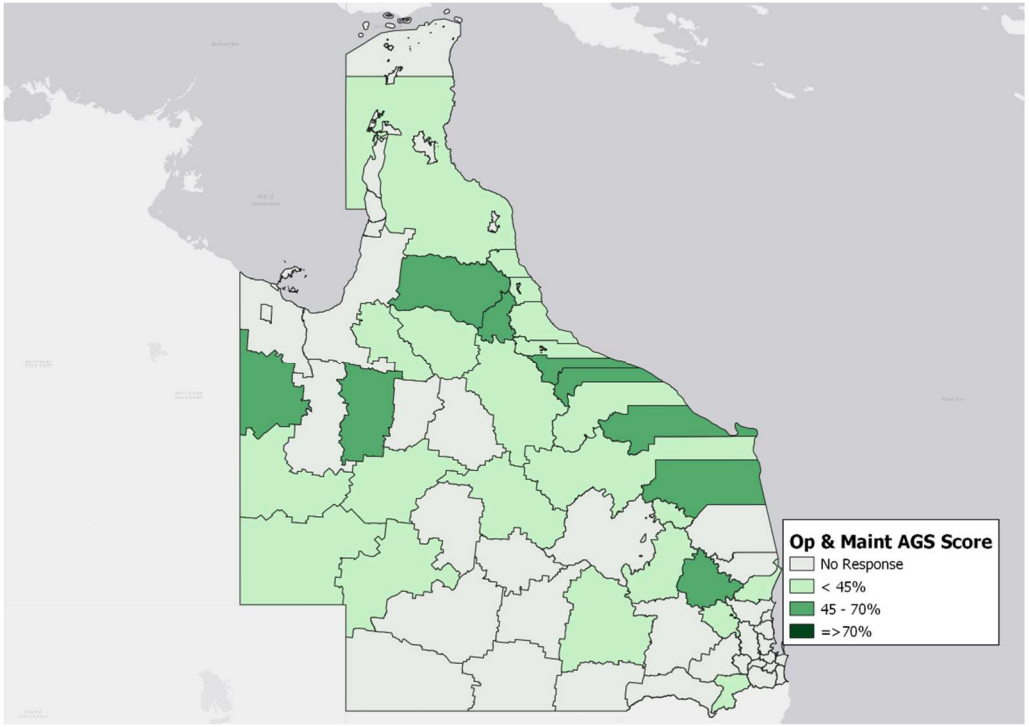
5.5.2 IN-GROUND WATER ASSETS

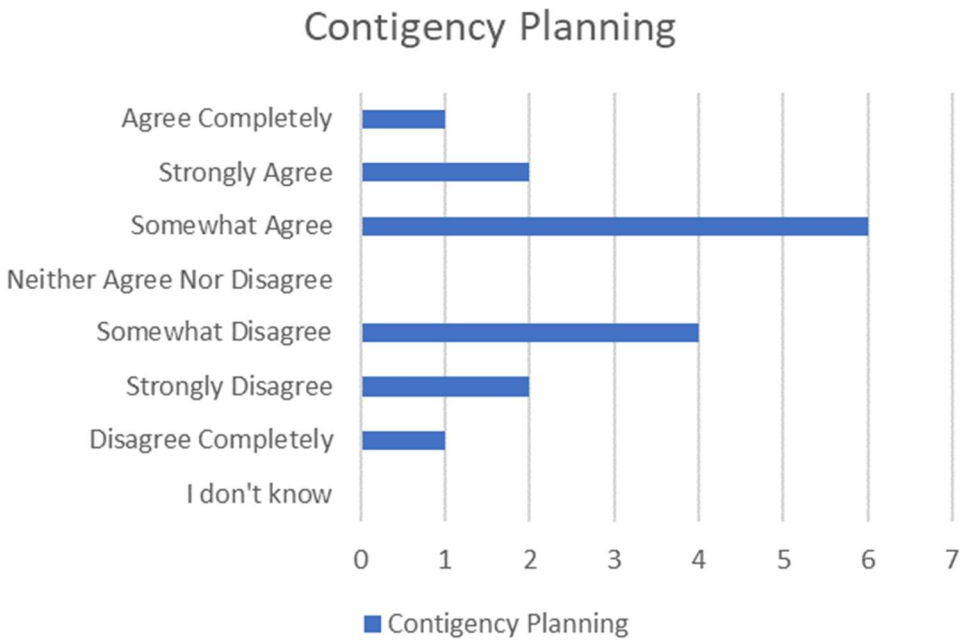


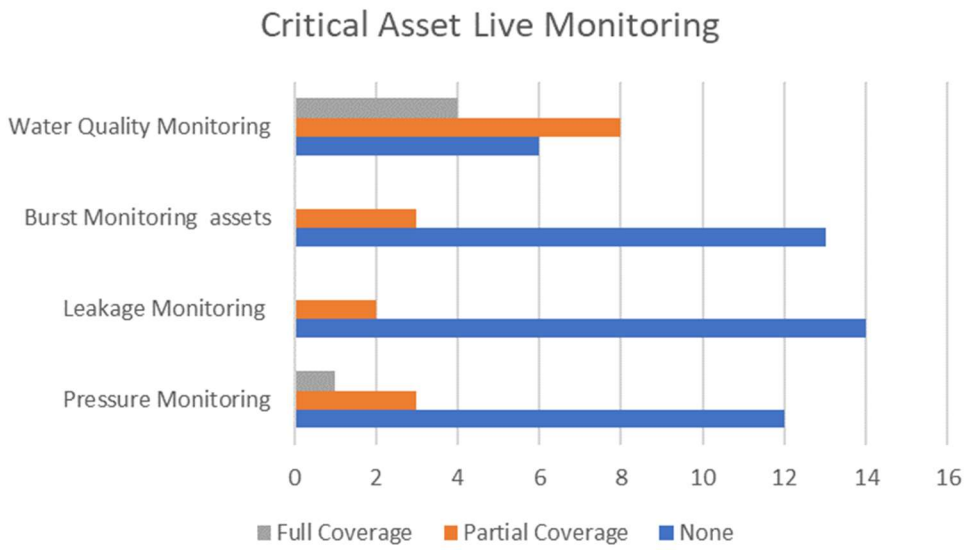

Critical Asset Live Monitoring
Water Quality Monitoring
Burst Monitoring assets
Leakage Monitoring
Pressure Monitoring
0
2
4
6
8
10
12
14
Full Coverage
Partial Coverage
None

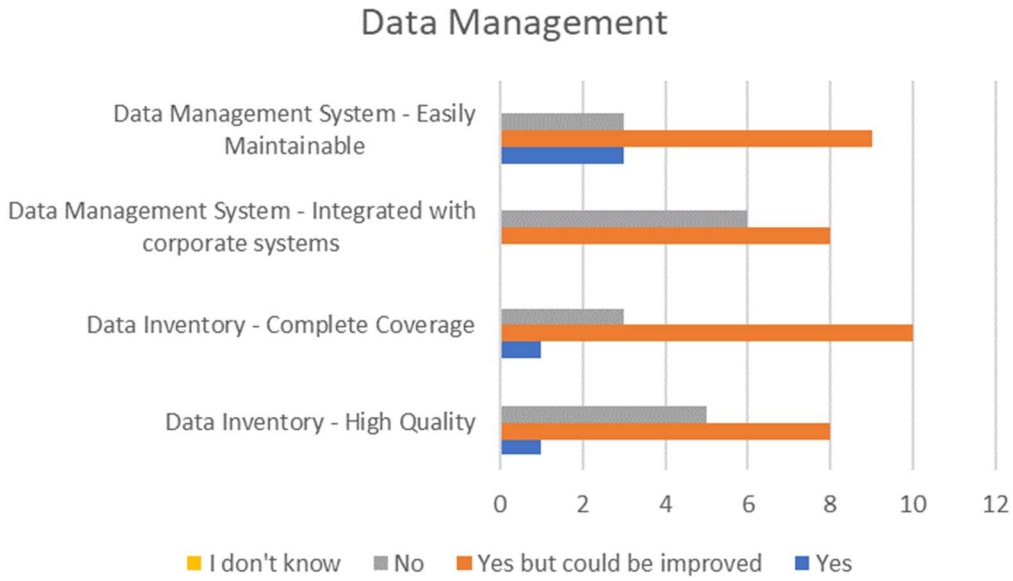

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
I don't know
No
Yes but could be improved
Yes

5.5.3 ABOVE-GROUND SEWER ASSETS

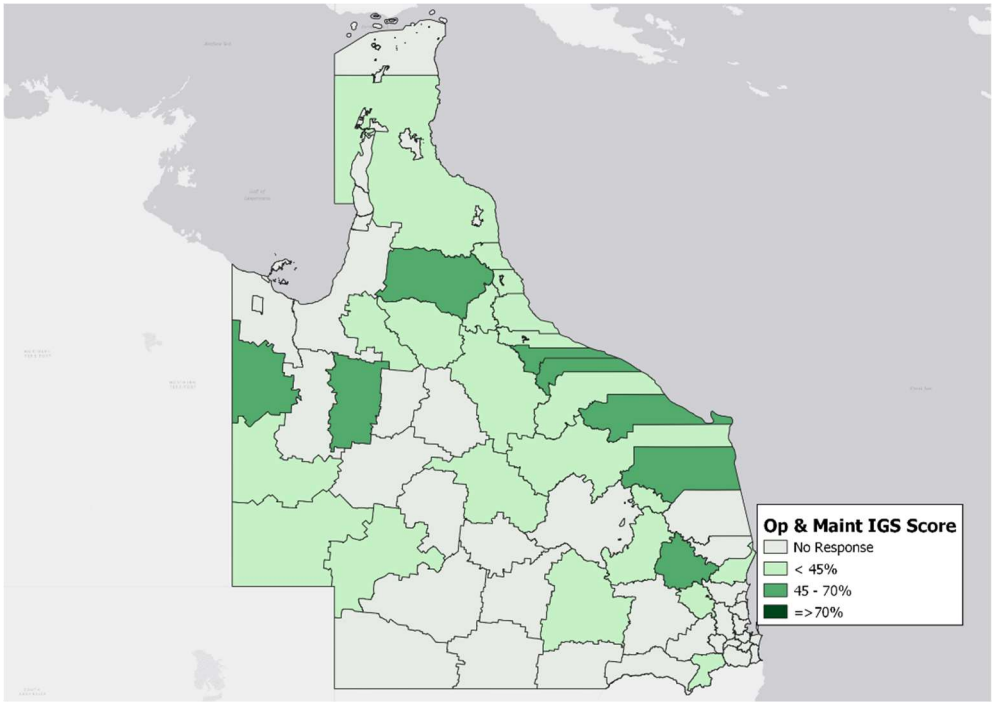


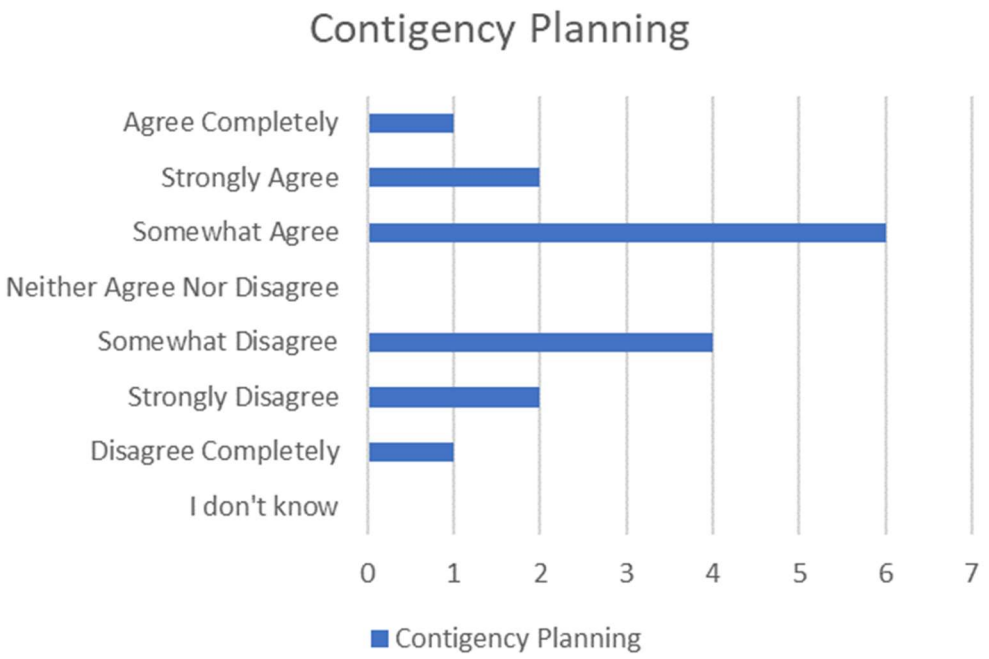


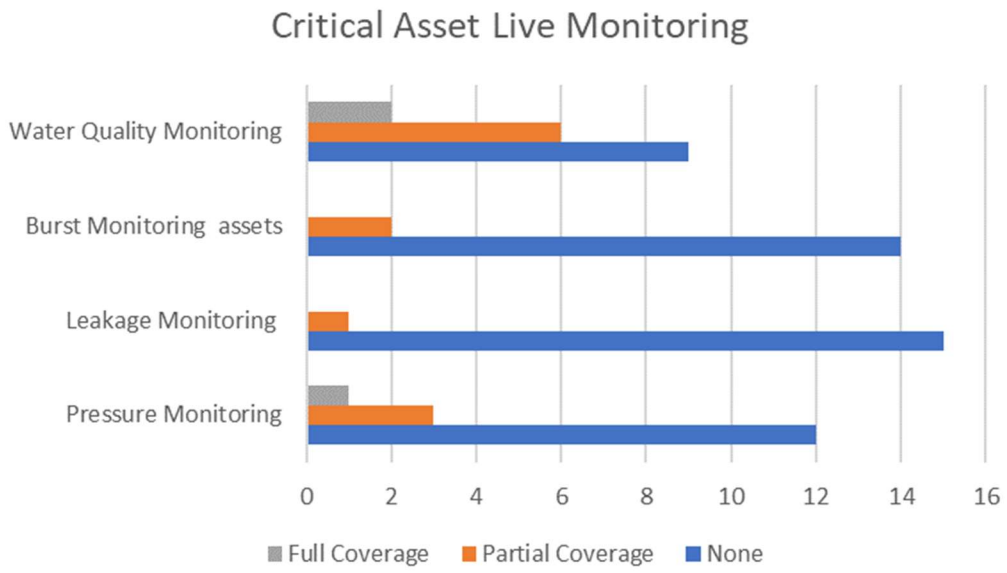

Critical Asset Live Monitoring
Water Quality Monitoring
Burst Monitoring assets
Leakage Monitoring
Pressure Monitoring
0
2
4
6
8
10
12
14
16
Full Coverage
Partial Coverage
None

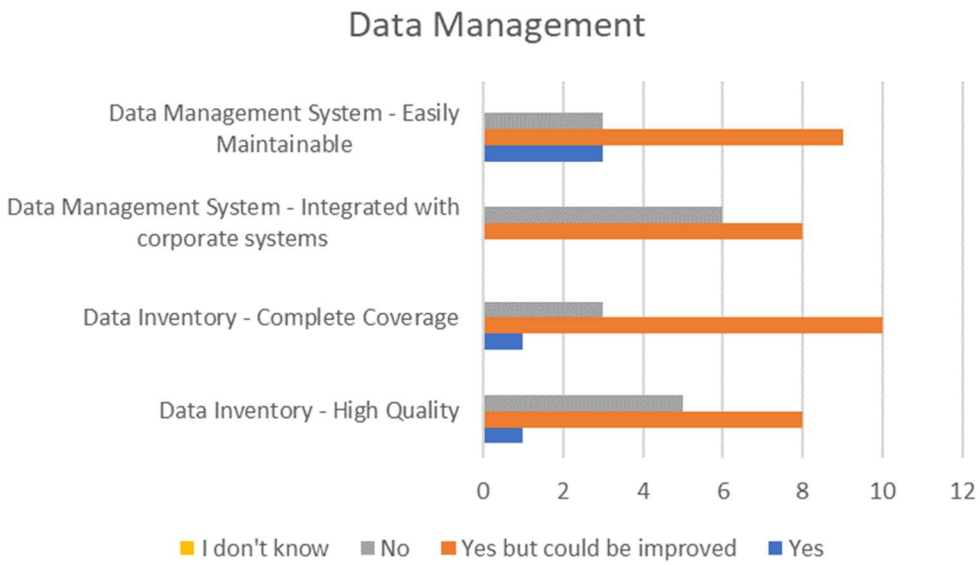

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
I don't know
No
Yes but could be improved
Yes

5.5.4 IN-GROUND SEWER ASSETS

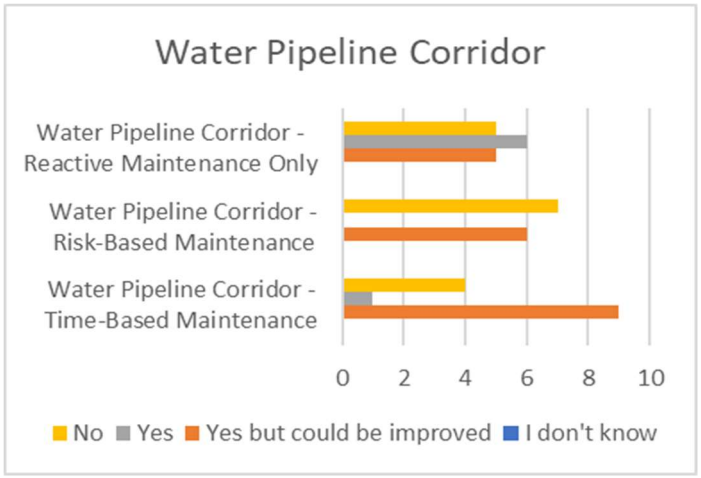


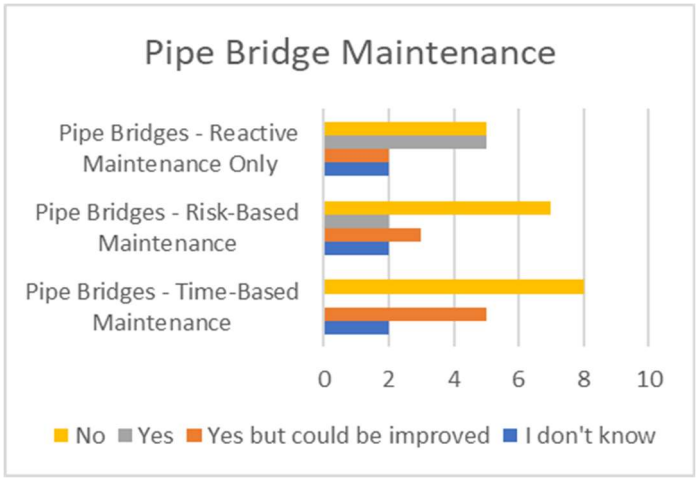


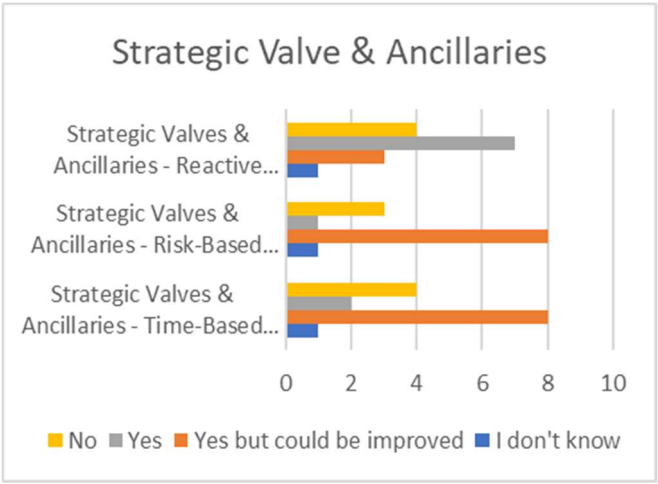

Critical Asset Live Monitoring
Water Quality Monitoring
Burst Monitoring assets
Leakage Monitoring
Pressure Monitoring
0
2
4
6
8
10
12
14
16
Full Coverage
Partial Coverage
None

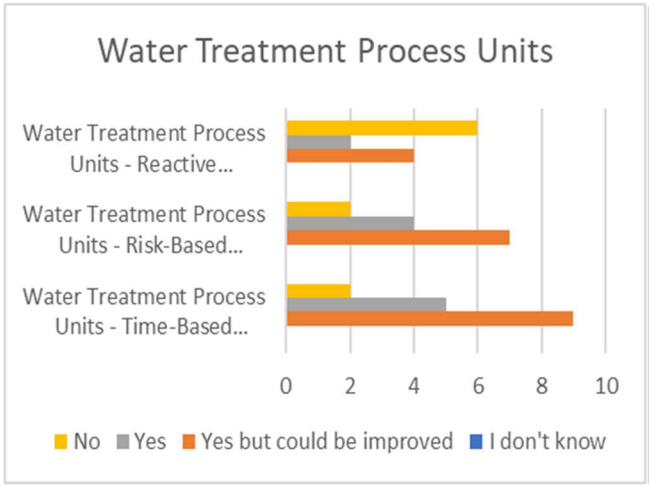

Data Management
Data Management System - Easily Maintainable
Data Management System - Integrated with corporate systems
Data Inventory - Complete Coverage
Data Inventory - High Quality
0
2
4
6
8
10
12
I don't know
No
Yes but could be improved
Yes

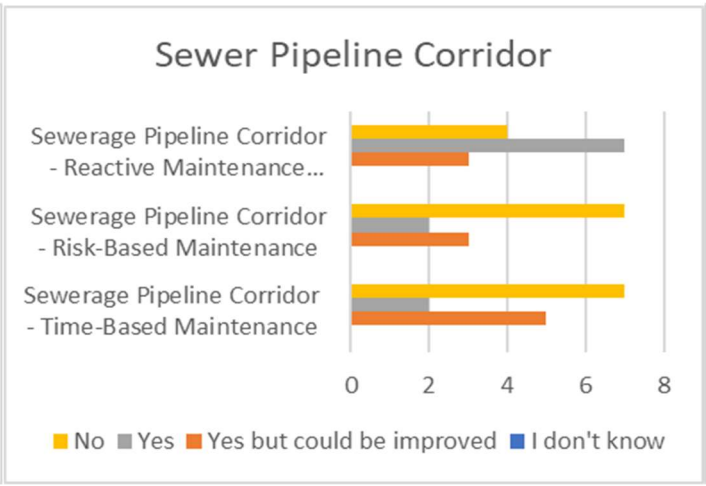
5.5.5 MAINTENANCE OVERVIEW (MULTI-ASSET)

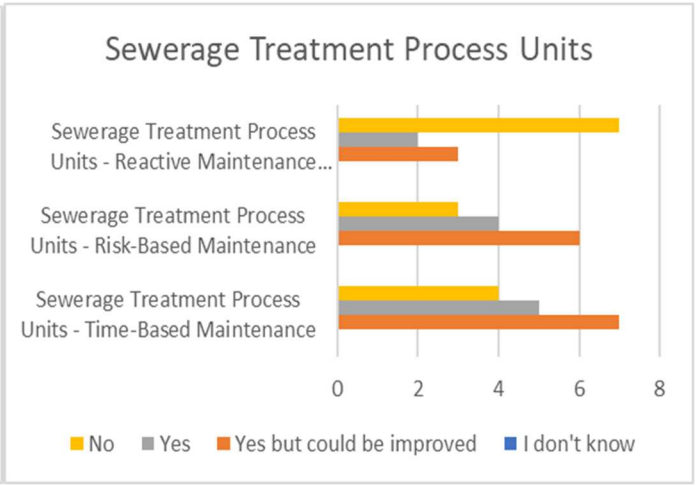


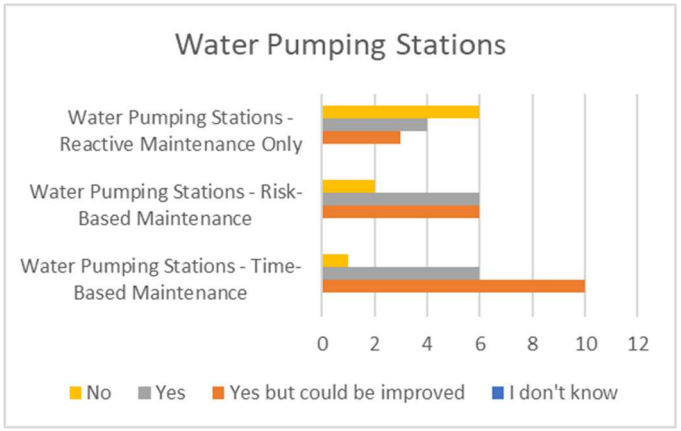


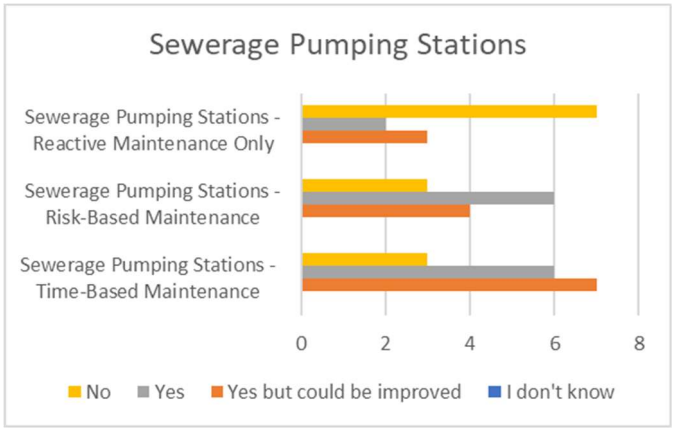


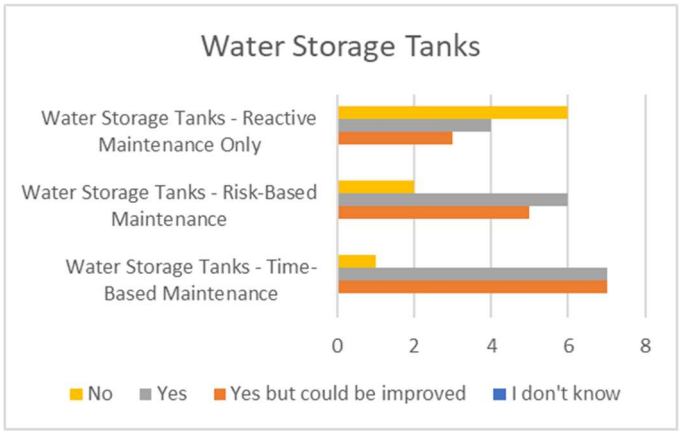




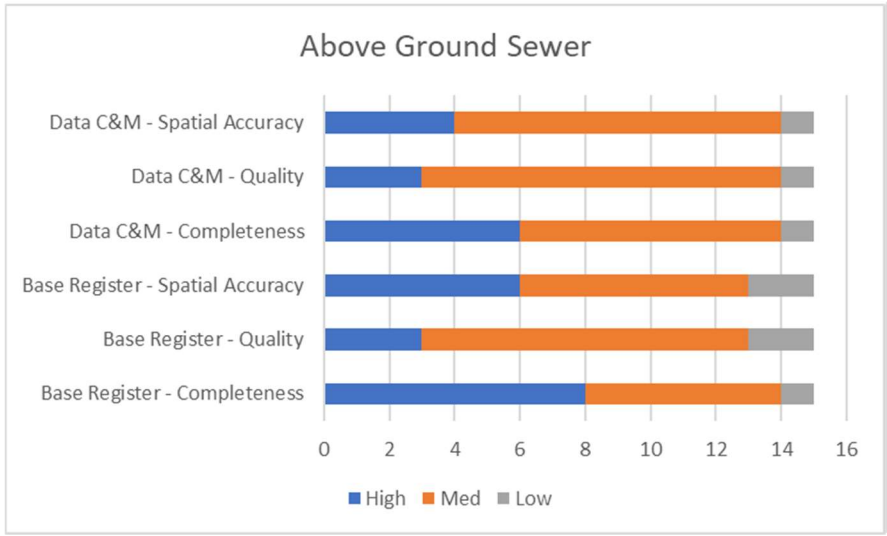


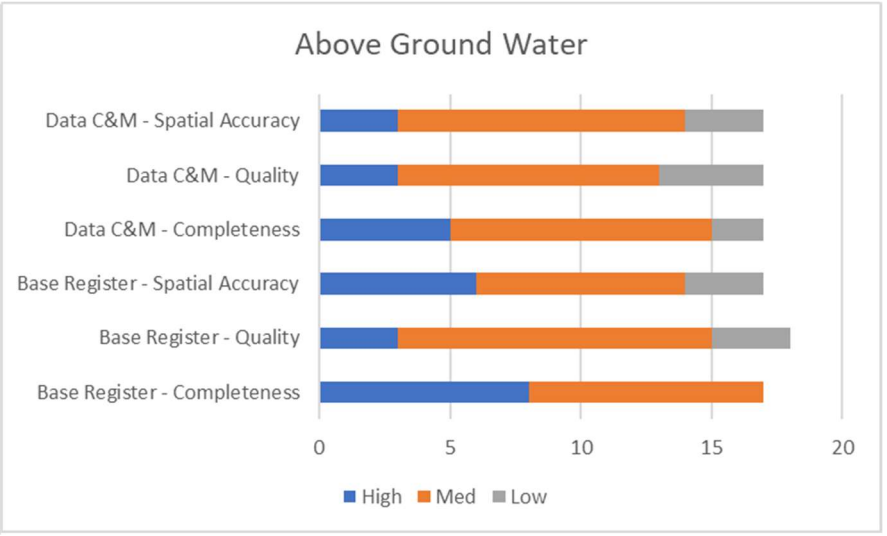

Water Pumping Stations
Water Pumping Stations - Reactive Maintenance Only
Water Pumping Stations - Risk-Based Maintenance
Water Pumping Stations - Time-Based Maintenance
0
2
4
6
8
10
12
No
Yes
Yes but could be improved
I don't know

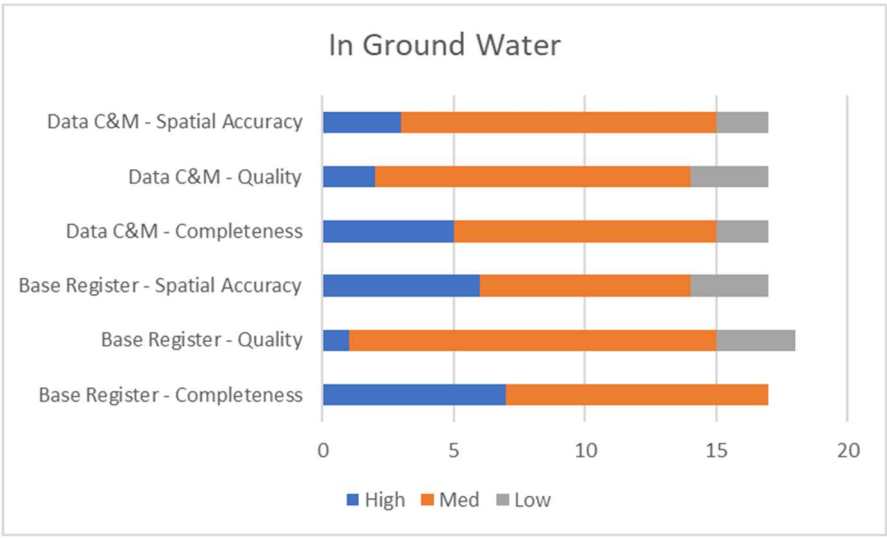

Sewerage Pumping Stations
Sewerage Pumping Stations - Reactive Maintenance Only
Sewerage Pumping Stations - Risk-Based Maintenance
Sewerage Pumping Stations - Time-Based Maintenance
0
2
4
6
8
No
Yes
Yes but could be improved
I don't know

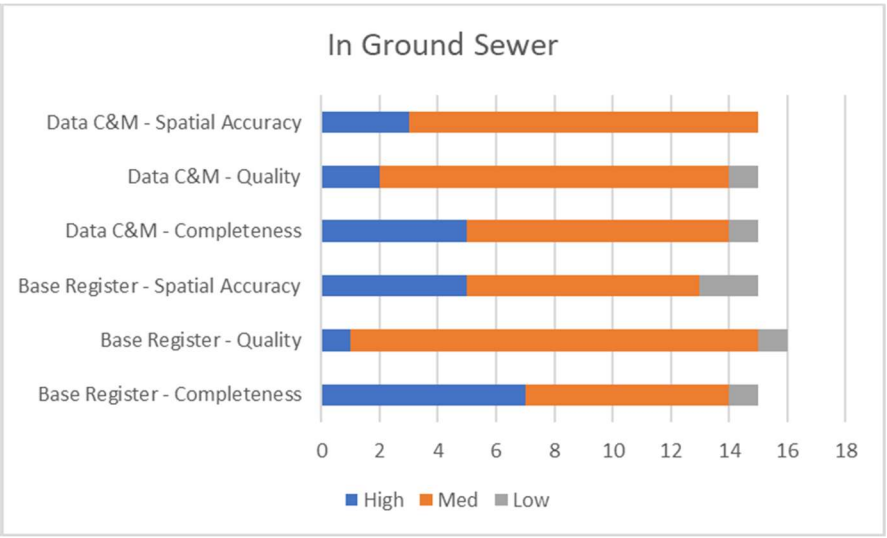

Water Storage Tanks
Water Storage Tanks - Reactive Maintenance Only
Water Storage Tanks - Risk-Based Maintenance
Water Storage Tanks - Time-Based Maintenance
0
2
4
6
8
No
Yes
Yes but could be improved
I don't know

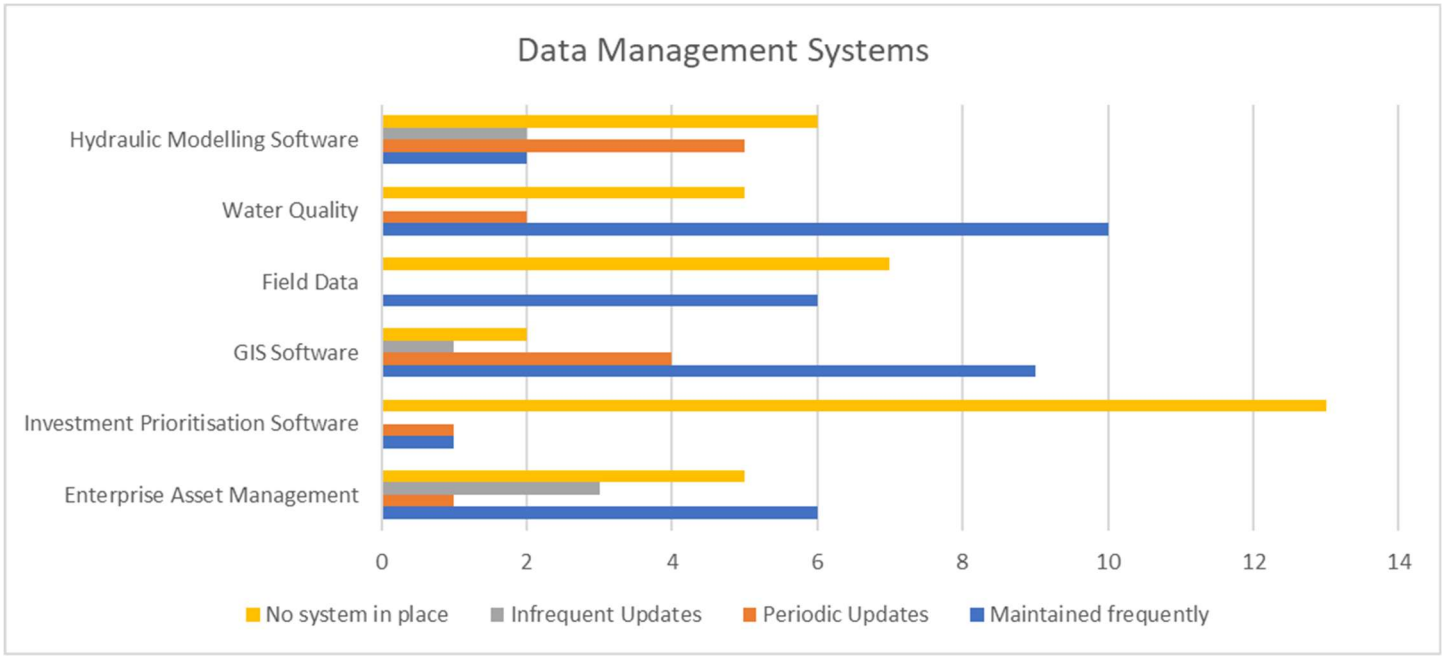
5.6 OVERALL DATA MANAGEMENT RESPONSES










Data Management Systems
Hydraulic Modelling Software
Water Quality
Field Data
GIS Software
Investment Prioritisation Software
Enterprise Asset Management
0
2
4
6
8
10
12
14
No system in place
Infrequent Updates
Periodic Updates
Maintained frequently