



Final Report

Quorn CWMS Static Digital Twin (Phase 1)

August 2025

Report:
Quorn CWMS
Dynamic Digital
Twin
Phase 2
Project Partner:
The Flinders
Ranges Council
Delivery
Partner: IoT
Consultants Pty
Ltd
Project
Duration: Aug –
Dec 2025

Project Partner: The Flinders Ranges Council
Delivery Partner: IoT Consultants Pty Ltd
Project Duration: May – July 2025

1	Report:
2	Contents
3	Executive Summary
4	Context
7	1.1 The Quorn CWMS

Contents

Executive Summary	3
1. Project background	4
What are CWMS?	4
Digital Twins	5
2. CWMS system at Quorn.....	6
CWMS Components.....	6
Present Operational Process.....	8
3. CWMS Digital Twin	10
Digital Twin Components.....	10
4. Methodology and Approach.....	14
Information Gathering.....	14
Step by Step Digital Twin Process	15
Project Outcomes.....	17
Strategic Benefits and Sector Impact.....	18
Deliverables and Milestones.....	18
Lessons Learned and Recommendations	19
Appendices.....	20
Appendix A: Gateway, and sensors placement.....	21
Appendix B: Service Schedule	23
Appendix C: Dashboard Mock-up Design	25
Appendix D: Data Input – SRMTMP V6	27
Appendix E: Data Input – STED Scheme Drawings	29
Appendix F: Data Input – STED Pump Manuals and Parts Lists.....	31
Appendix G: Data Input – Precast Concrete Pump Tank Manuals	33
Appendix H: Data Input – Pump Station Service Report.....	34
Appendix I: Preliminary Data Requested	35
Appendix J: Presentation for CWMS Conference and LGA SA.....	38
Appendix K: Acknowledgements and Contact Information	40

Executive Summary

This report documents the successful completion of Phase 1 of the Quorn Community Wastewater Management System (CWMS) Digital Twin Project, a collaboration between The Flinders Ranges Council (FRC) and IoT Consultants, with funding support from the Community Wastewater Innovation Fund¹ and in-kind contributions from FRC. The project forms part of a broader initiative to develop digital monitoring and management solutions for CWMS in both Quorn and Hawker, South Australia.

Phase 1 focused on delivering a high-fidelity, static digital twin of the CWMS in Quorn using IoT Consultants' proprietary Buinforma platform. The objective was to enhance asset visibility, support proactive planning, and lay the groundwork for future integration of real-time monitoring and sensor data.

Key deliverables – completed on time and within budget – include a detailed 3D model of the Quorn CWMS, a dashboard mock-up, and a comprehensive sensor identification plan. These outputs provide enduring value to FRC and establish a scalable blueprint for wastewater infrastructure management across regional South Australia.

The report also outlines the existing CWMS infrastructure, project requirements, and the rationale for using digital twin technology to address operational inefficiencies. Looking ahead, Phase 2 will focus on the implementation of a live proof of concept, incorporating sensors and a web-based interface to demonstrate the benefits of real-time monitoring, predictive maintenance, and live, information-driven asset management.

Despite operating under significant resource constraints, FRC has shown commendable leadership in embracing innovative approaches to infrastructure management. This project highlights the potential for small councils to transition from reactive, fail-to-run models to proactive, digitally enabled strategies—even within complex and constrained environments.

¹ <https://www.lga.sa.gov.au/members/financial-sustainability/grants/innovative-wastewater-projects>

1. Project background

The subject of this report is the CWMS facility located at Quorn, a town in the Flinders Ranges Council area. As shown in Figure 1, FRC is a local government area in South Australia², approximately 300 kilometres north of Adelaide. Spanning over 4,200 square kilometres, it encompasses two main population centres: Quorn (population ~1,150³), Hawker (population ~226⁴), and several smaller communities.

As shown in Figure 2, the region receives a scant average of 200–400 mm of rainfall annually⁵, making water management a key concern, especially for main population centres. This includes rainwater harvesting, groundwater usage, and wastewater management including possibility of recycling. The focus of this project is the management and safe disposal of greywater through the Community Wastewater Management Systems (CWMS) in Quorn and Hawker, and using digital transformation technologies and in particular digital twins to enhance operational efficiency, and ease of facility maintenance: an increasingly important activity⁶.

What are CWMS?

A CWMS consists of a network of underground pipes, motors, tanks, and evaporation or recycling ponds. These collect greywater from residential and commercial premises, as well as stormwater runoff, and channel it to storage or treatment facilities. Due to environmental and health issues, CWMS form a critical infrastructure in a locality and need to be continuously monitored and maintained to ensure reliable and consistent performance and minimise any risk of incidental flooding or seepage. A typical layout⁷ of a CWMS is shown in Figure 3.

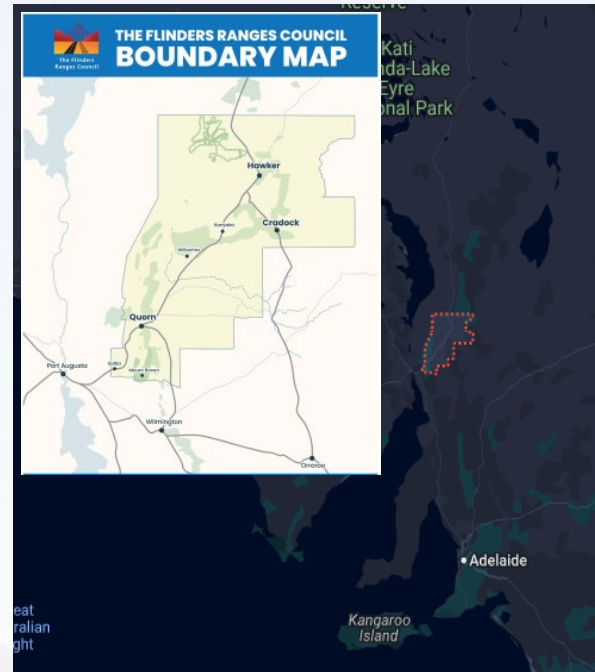


Figure 1: FRC boundaries

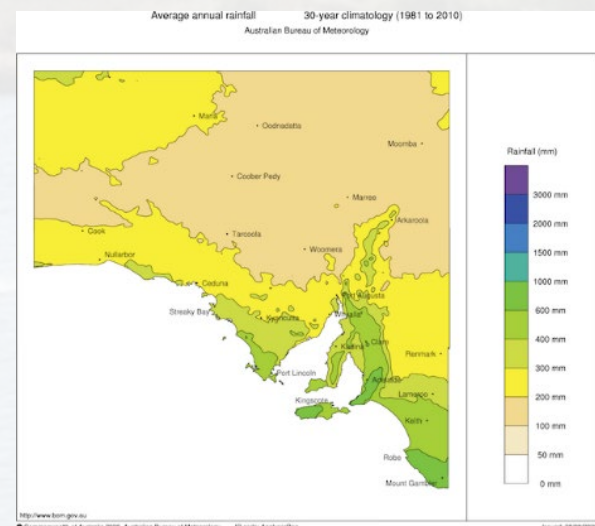


Figure 2: Average rainfall in South Australia

² Image from Google Maps and Council document <https://www.frc.sa.gov.au/council>

³ <https://www.abs.gov.au/census/find-census-data/quickstats/2021/UCL421034>

⁴ <https://www.abs.gov.au/census/find-census-data/quickstats/2021/UCL422021>

⁵ <https://enviro-friendly.com/information/average-rainfall/adelaide-rainfall/>

⁶ Inside Water: "Wastewater Pump Servicing Drives Expansion", pp 38-39, July/August 2025.

⁷ <https://www.lga.sa.gov.au/about/what-we-do/community-wastewater-management-systems/overview-of-cwms>

In arid regions like South Australia, CWMS offer opportunities to reuse non-potable water for irrigation and industrial applications. Efficiently managed CWMS infrastructure delivers substantial environmental and economic benefits to local communities.

This project was initiated as a result of discussions between FRC and IoT

Consultants to explore digital solutions for CWMS monitoring and management, with Quorn as the primary use case. The primary objective of Phase 1 was to digitize the CWMS infrastructure as a proof of concept aimed at evaluating appropriate technologies and defining system functionality in Quorn, creating a static 3D model to:

- Establish a digital baseline of all CWMS assets (e.g. pipes, pumps, lagoon, etc.)
- Improve infrastructure planning and lifecycle asset management.
- Identify opportunities for Opex and Capex savings through proactive planning.
- Determine optimal sensor placement for real-time monitoring in Phase 2.
- Develop a methodology that is replicable by other regional councils.

This project further addresses the Community Wastewater Innovation Fund's goals of promoting financial sustainability, adopting innovative technologies, and enhancing sector-wide collaboration.

Digital Twins

As part of the Community Wastewater Innovation Fund grant application, IoT Consultants proposed the development of a Digital Twin: a high-fidelity, interactive digital replica of the physical CWMS infrastructure at Quorn. Unlike traditional supervisory control and data acquisition (SCADA) systems, which focus on real-time monitoring and control, Digital Twins offer advanced data integration, visualization, and communication capabilities. Further, they enable stakeholders to observe asset performance, predict failures, and coordinate responses across different agencies. In the context of CWMS, Digital Twins provide continuous monitoring and proactive fault detection, enhancing service reliability and reducing operational costs. Moreover, they enable a high-fidelity visualization of the systems which facilitate information collection, storage, analysis and dissemination. This can be used to communicate with different stakeholders, with set access privileges, as organisations manage their critical (and non-critical) assets internally and with the help of third-party service providers.

Typical Community Wastewater Management System Town Layout

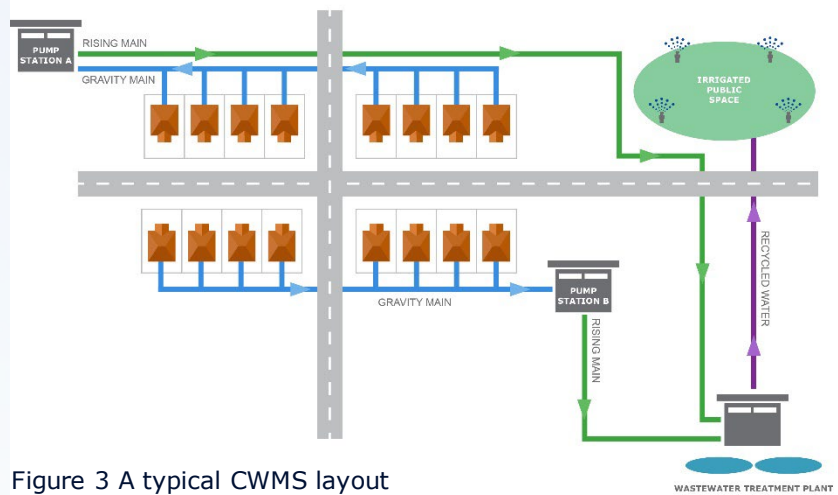


Figure 3 A typical CWMS layout

2. CWMS system at Quorn

Quorn, located approximately 320 km north of Adelaide, is the largest town within the FRC area. It serves as a gateway to the Flinders Ranges—a popular tourist destination with nearly one million annual visitors and provides one of the last points where visitors may stock up with necessities before entering the Ikara-Flinders Ranges National Park⁸. With growing tourism, Quorn is primely located to become a destination in itself and more than just a stopover on the way to Flinders Ranges. To make this a reality, FRC is planning several activities which can transform the town to become a venue for festivals, conferences, movie location, etc. Naturally there is an increasing need for reliable water infrastructure, including irrigation and potable water supply at public venues such as Quorn Oval to welcome these visitors.

According to FRC documents, the current CWMS in Quorn serves some 390⁹ premises. It is structured as:

- A network of underground pipes collecting greywater
- Two temporary storage tanks at Foster Road and First Street, collecting grey water from town premises
- Two pumps at each storage site, transferring greywater serially to an evaporation lagoon on the town's outskirts. The tanks have limited capacity, and pump malfunction risks localised flooding.
- The lagoon located on Pearce Road

CWMS Components

A more detailed definition of CWMS components are:

Pipes

Most Quorn homes and business premises are connected to storage tanks through underground pipes. According to the Council's Safety, Reliability, Maintenance and Technical Management Plan document, these pipes total more than 12 kilometres and have been in place for some 20 years¹⁰. Any new dwelling or structural development needs to be connected to this network. For example, any new developments associated with Quorn Oval may need to provision for new pipes to collect wastewater. This is in addition to any pipe system needed to serve underground irrigation of the Oval through re-use of the greywater.

⁸ <https://www.parks.sa.gov.au/parks/ikara-flinders-ranges-national-park>

⁹ The Flinders Ranges Council, "Safety, Reliability, Maintenance and Technical Management Plan", Version 6, August 2024.

¹⁰ ibid

Tanks

Two Flygt precast concrete packaged pumping station tanks temporarily buffer greywater before sending it to the lagoon. These tanks also act as buffers to mitigate flooding risk as pump capacity may not be sufficient in heavy rain events. Tanks are digitally modelled using IoT Consultant Buinforma software (see Figure 4 and video [link](#)), showing their dimensions and capacity specifications. The tanks are made of precast concrete, with a depth of 5 meters, constructed by Xylem¹¹.

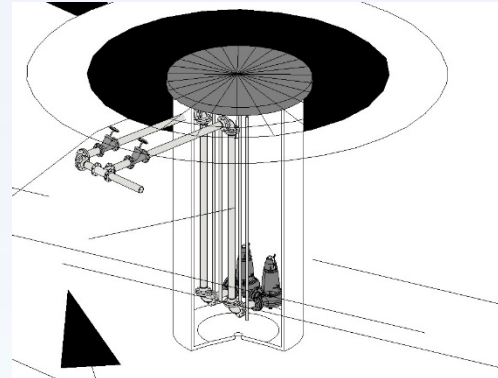


Figure 4 Water storage tank and pump

Pumps

Each Flygt tank has an electrical submerged pump which is automatically turned on when greywater raises above a certain level. The first Quorn storage tank and pumping station, located on Foster Road is shown in Figure 5. Each device is capable of pumping 4-95 litres per second¹², which is sufficient under normal operational condition for greywater inflow from town premises. The present pumps were installed in 2005, and are serviced regularly (see service schedule in Appendix C). A full digital twin of the pump is created to facilitate performance monitoring, fault predictions, and stakeholder communication. A model of the pumps and tanks has been developed in Buinforma, IoT Consultant proprietary software which facilitates information dissemination to third party contractors and other stakeholder.

The pump's digital twin, combined with sensors, is the most important deliverable in the design of the new process. It will



Figure 5 Pump and tank No 1

¹¹ <https://www.xylem.com/en-au/brands/flygt/flygt-engineering--expertise/pump-station-design/packaged-pump-stations/>

¹²

https://pumpselect.com.ua/assets/templates/images/flygt/Flygt%20Packaged%20Pump%20Stations.pdf?utm_source=chatgpt.com

facilitate a process re-design in line with the digital transformation of the CWMS, bringing about operational efficiencies and cost reductions.

Lagoon

The greywater from the two tanks is pumped to a lagoon in the outskirts of Quorn, where it is left to evaporate. The lagoon is made of several storage ponds as shown in Figure 6, with serial overflow from one to the next to ensure minimal probability of spillage into neighbouring fields.



Figure 6 Lagoon on Pearce Rd

Present Operational Process

To ensure that the CWMS is in good working order, both pumps and tanks are physically checked by FRC staff in on a regular schedule as detailed in Appendix. The council officer checks the operation of the pump, measures the water level and records the details. This requires travelling to both Quorn and Hawker CWMS sites and manually recording the performance metrics. In case of an abnormality, the process leads to further activities, including contacting external contractors. Regular service visits happen to monitor and ensure normal operations. The process diagram is shown in Figure 7.

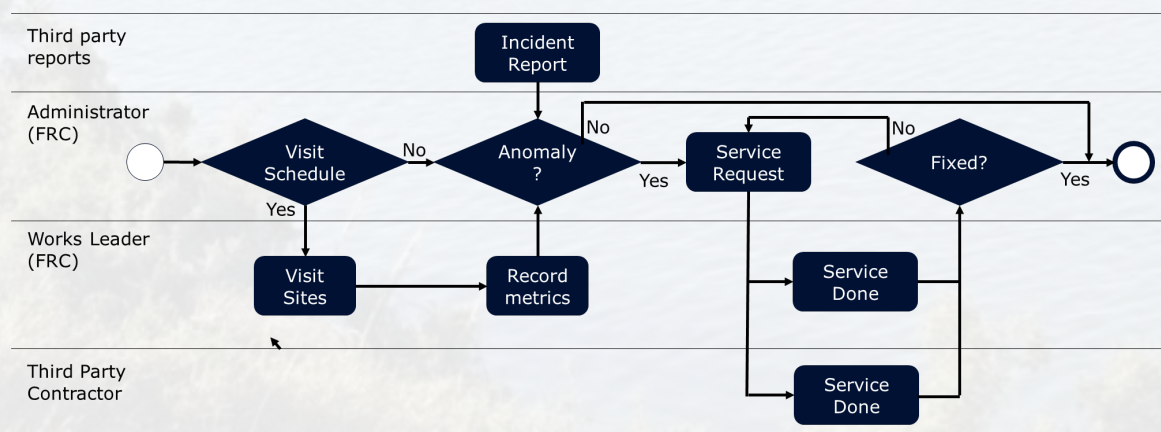


Figure 7 Present operational service process

The present operational service process has several shortcomings.

- Lack of continuous monitoring. It is possible the system can fail between visits.
- Lack of predictive ability as to when system needs service or replacement
- High operational cost: travelling to and from CWMS site takes time and resources.

- Lack of insight in how the system behaves under stress: severe weather events, or when pumps/pipes are blocked
- Lack of means to communicate fault/service issues to contractors who need to travel from outside town, etc.

It is desirable to create a digital automated process that addresses the above shortcoming and creates a more efficient and less costly CWMS monitoring and management regime. The new process adds a new actor to the diagram, namely the digital twin. While process diagram generally show human actors, the digital twin acts as an entity that can autonomously provide information and therefore enhance the process through automation. The new process is illustrated in Figure 8.

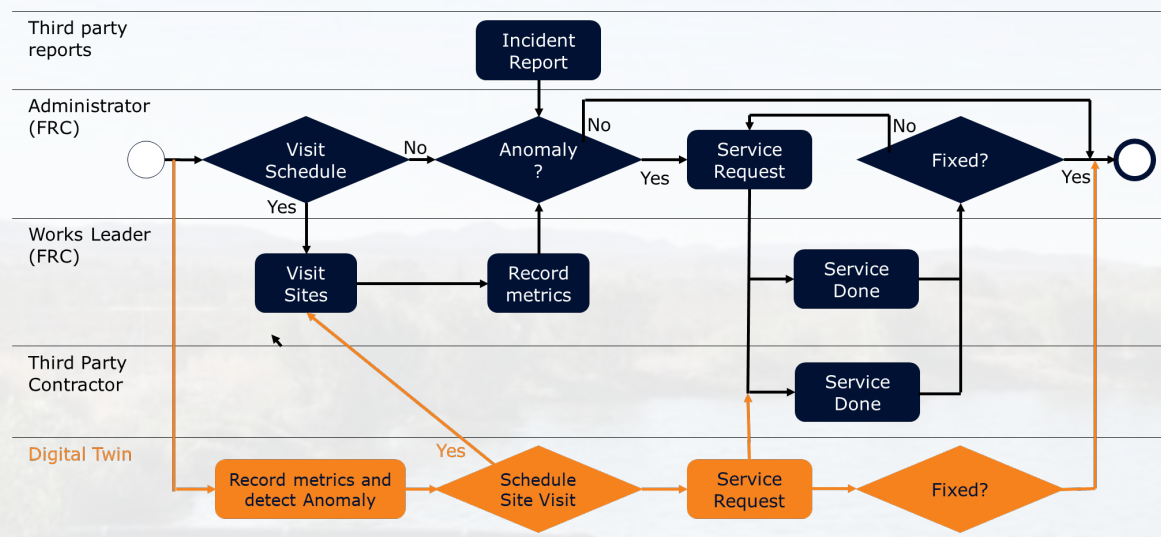


Figure 8 Future operational service process using a digital twin

3. CWMS Digital Twin

Given the operational challenges described earlier, the project proposed to LGA and the associated grant specifies the development of a Digital Twin, which replicates the physical and functional properties of the CWMS at Quorn. The proposed solution architect and information flow is shown in figure below. The new process collects information from different sources, and processes them as shown in Figure 9.

- Static data sources: maps of area, pump specifications, tank specifications, pipes, storage area, etc.
- Dynamic data sources: sensors, service schedules, and in the future, event schedules, Bureau of Meteorology (BOM) data, etc.

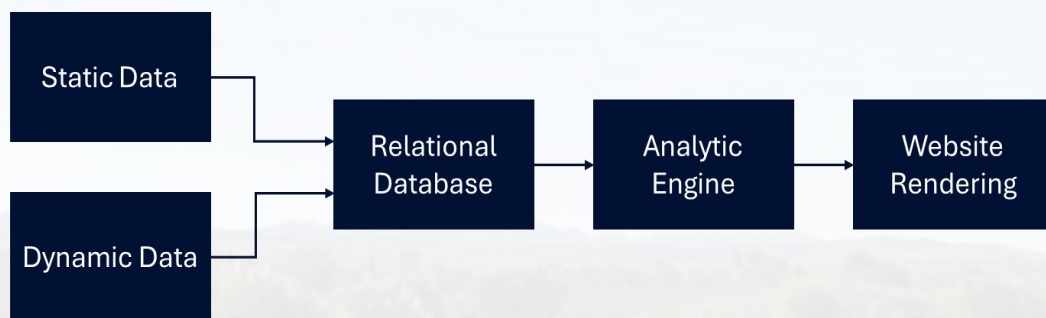


Figure 9 Water storage tank and pump

This information is then processed and stored to create a dynamic database, with automatic recording of system status, and any service activity. This database is used to analyse and create information to map to a live webpage. The analysis and presentation view consists of the following:

- Extraction and qualification of sensor data: how the system is behaving
- Sorting of historical view of sensor data: system behaviour over specific time periods
- (In the future) predictive system behaviour, using information such as from BOM
- Operational status: Green, Yellow, Red: when action needs to be taken
- Alerts for services based on preset and dynamic status of the system

The analysis is then disseminated through a live webpage to Flinders Ranges Council staff and other specified stakeholders. The redesigned process automates many of the process steps shown in Figure 7.

In addition, a visual digital twin is created and linked from the webpage which shows all components of the CWMS. These details can be shared with all Council staff and third-party contractors who may need to work on the system.

Digital Twin Components

The digital twin system consists of the following components

Sensors:

Three sensors are chosen for these two phases of projects. These are

Water level sensor(s): regularly measure the distance of water to the lid of the storage tank, from which it calculates the level of residue water. Monitoring of water level provides information on

- Risks of flooding
- Operation of the pump
- Community greywater volume generation statistics
- Stormwater volume statistics.

If the sensor cost is low, as we believe it is, then we choose to place two sensors to reduce the probability of failure. A typical list of possible sensors is shown in Appendix B. These sensors are commonly available: our main considerations in choosing are:

- Interoperability with communications gateway
- Battery usage
- Size and ease of installation
- Waterproofing
- Cost and ease of procurement
- Expected lifespan

The full implementation sensor may differ from these.

Pump sensor(s): we propose to install two types of sensors to monitor the operation of the pump. The main need is to ensure the pump is operational as expected. The secondary need is to measure and record the variation in pump operational power corresponding to non-water waste (solids). These objectives can be monitored by measuring the power used by the motor, and the sound of its operation.

Monitoring of pump power makes it possible to

- Ensure correct operation
- Determine and predict when servicing and repair need to be done
- Share information with third party contractors

The measurement of electric current passing through power supply wires. A list of possible sensors is included in Appendix B. Similar to water level sensors above, the following factors are considered when choosing the sensor for the next phase:

- Interoperability with communications gateway
- Battery usage
- Size and ease of installation
- Cost and ease of procurement
- Expected lifespan

Listening to the noise a motor generates has been a traditional method of verifying correct operation. We propose to install a microphone sensor to record and communicate the sound of the motor. The sound is analysed to detect anomalies, and predict time-to-service and time-to-failure metrics. Again similar factors are considered when choosing the sensor:

- Interoperability with communications gateway

- Battery usage
- Size and ease of installation
- Waterproofing
- Cost and ease of procurement
- Expected lifespan

Typical sensors are included in Appendix A. These are for the proof of concept stage and other sensor may be selected for the actual implementation. For example, an alternative sensor is liquid flow sensor, a non-intrusive sensor which monitors the rate of flow on the pipes, and whose data can be used to detect anomalies.

Gateway

A communication gateway conveys sensor data. Again, several alternatives gateways exist. The following factors are considered in choosing which gateway we will install during the second phase of the project.

- Approved to operate in Australia
- Communications technologies supported
 - With sensors
 - With public mobile standards (3G/4G)
- Range of communications (in meters)
- Size (whether it fits in the box)

We have been testing a gateway supplied by Wittra, a Swedish company. The device ticks all the boxes for this phase of the project, except whether it fits inside the electrical box – we may need to use a temporary housing. For long term deployments, factors such as power consumptions, warranty, parts, etc need also be considered. The link to supplier and specification has been included in Appendix A.

Database

We have chosen PHP MySQL database is used to capture data from sensors as delivered by the gateway and organise it to be consumed by the analytic and predictive engine. This database technology is most commonly used, is well-known and supported in the technology, and is fully suited to CWMS, a relatively simple with few variables application.

Analytics and Predictive Engine

IoT Consultants are developing software and algorithms which ingest CWMS data from sensors and council processes, and in the future from external sources such as Bureau of Meteorology, to produce following information to be visualised on the system dashboard:

- Water level
- Pump operation
- Alerts
- Scheduled services and site visits
- In the future, predictive behaviour

Website

A web-based dashboard as shown in Figure 10 below will be developed to render processed and analysed information produced by the Analytics and Predictive Engine. The dashboard further provides a digital twin of the pump and the CWMS components which can incorporate all technical and physical details. This includes pump components, which may be needed by third party contractors, a map of pipes within a 3D visualisation of Quorn, and other details of CWMS to be confirmed with FRC.

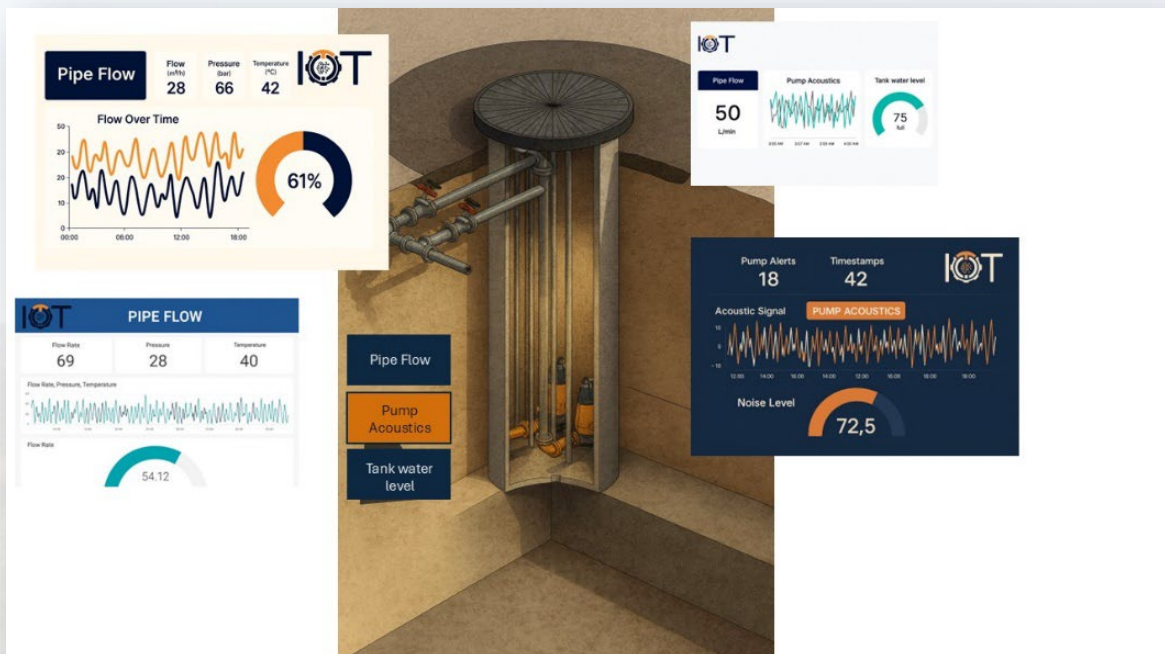


Figure 10 The main digital twin display page, showing performance metrics

CWMS operation process digital transformation

A new CWMS operation process is designed based on the ability of the CWMS to be *active*. The system can measure, analyse and disseminate information to stakeholders. These include alerts, service scheduling, and in the future prediction. Many process steps will have been automated, with better decision visibility and cost reductions. These are reflected in benefit sections shown below.

4. Methodology and Approach

The Quorn CWMS static digital twin was delivered through a structured and adaptive methodology designed to balance accuracy, practicality, and replicability. A major challenge during Phase 1 was the fragmented and siloed nature of asset information, a common issue in local government infrastructure management. Data related to CWMS infrastructure often resides across disconnected systems, paper archives, contractor records, and individual knowledge. In the case of Quorn, some historical information was available via scanned drawings or informal logs, while other insights were retained only in the memory of experienced staff—many of whom had already left the organization.

This is not a matter of fault, but rather a systemic issue in how information is captured, maintained, and shared within small councils. Local government organizations like FRC operate under significant constraints — limited staffing, stretched budgets, legacy systems, and the absence of centralized asset management platforms. In many cases, individual staff members go above and beyond to keep operations running, learning systems on the fly or helping each other informally. But when these people leave, that institutional knowledge is often lost.

Contractors who deliver capital works or reactive maintenance frequently hand over technical drawings in formats that are not readily digitized or easily understood. Without resourced and embedded processes to consolidate, standardize, and maintain infrastructure information, assets are managed reactively, and knowledge remains siloed across teams, systems, or filing cabinets.

This fragmentation also impacts risk management. While FRC leadership is committed to proactive governance, implementing formal risk controls — such as failure prediction, condition monitoring, and scenario planning — is often out of reach given the complexity, cost, and operational sensitivity of CWMS infrastructure. As a result, councils are left with little choice but to operate under a 'fail-to-run' model: doing the best they can with limited visibility and responding when problems surface. The creation of this digital twin represents a first step toward shifting that paradigm — making invisible systems visible and transforming reactive operations into planned interventions. Consequently, the project team had to adopt a flexible and transparent approach that combined available data with expert assumptions and clearly documented inference. This ensured that the resulting digital twin was functional, auditable, and structured for continuous improvement.

The methodology was structured around four key pillars: data gathering, model development, strategic planning for Phase 2, and user-centred interface design.

Information Gathering

Data Requested

To have a better understanding of the Information gathering process, the Appendix I provides the list which outlines the information originally sought at the beginning of the project. This list served as a reference to guide data collection. It helped inform the field inspection plan and focus areas for stakeholder engagement. As there expected, there were major gaps in the documentation, this summary helped the team extract

maximum value from the documentation that was available, whether formal, partial, or inferred.

Data Received

This section provides an overview of the most relevant technical documentation received during Phase 1 of the Quorn CWMS Digital Twin project. Even though some of these materials existed within the Council, they often conflicted with operational staff input and were scattered across multiple sources. In many cases, the information was inconsistent or incomplete. Our data engineering process helped transform and consolidate these materials so they could become a key input in shaping the digital twin model, informing assumptions, and guiding the prioritisation of future enhancements, particularly in preparation for Phase 2

The resources listed below were supplied by the Flinders Ranges Council. Each item contributed to the understanding and visualisation of the CWMS system in Quorn.

The documentation received includes:

- SRMTMP V6 – The Safety, Reliability, Maintenance and Technical Management Plan for the Flinders Ranges Council. (Details in Appendix D)
- STED Scheme Drawings – A set of 12 Septic Tank Effluent Disposal (STED) plans at 1:1000 scale. (Details in Appendix E)
- STED Pump Manuals and Parts Lists – Manufacturer documentation (Flygt/Xylem) for two pump models used in the CWMS. (Details in Appendix F)
- Precast Concrete Pump Tank Manuals – A partially scanned set of tank installation and specification sheets. (Details in Appendix G)
- Pump Station Service Report (Sep 2024) – A maintenance report from Xylem Water Solutions documenting operational inspections, service needs, and component status. (Details in Appendix H)

For additional information, the Appendixes D, E, F G and H expand on a deep analysis of the technical inputs received, their importance, and how they were used. Each source is reviewed for its relevance, contribution, and limitations in supporting the development of the static digital twin, particularly in areas such as system logic, risk modelling, and future sensor planning.

Step by Step Digital Twin Process

Step 1: Data Intake and Validation

- An initial visit and kick-off with FRC were held on 30 May 2025 to clarify project scope, deliverables, and communication channels.
- IoT Consultants provided a 22-point Data Input Checklist covering asset locations, conditions, operational history, pump specs, lagoon geometry, and water quality.
- Data received was partial. In many cases, assumptions were made based on engineering judgment, satellite data, or design norms.
- All assumptions were documented transparently and embedded into the digital twin metadata.

- Due to the absence of a Director of Assets, communications were maintained primarily with the CEO, with monthly status reviews in Adelaide.

Step 2: Asset Mapping and System Classification

- Existing FRC materials (sketches, logs, as-built drawings) were reviewed and structured into an asset register.
- Assets were classified as pipes (gravity or pressure), pump stations, lagoons, and disposal systems.
- Coordinates were recorded where possible; pipe slopes were estimated based on terrain models.
- Metadata for each asset included material, installation year, access status, and estimated condition.

Step 3: Static Digital Twin Development in Buinforma

- The asset register was integrated into Buinforma.
- A 3D layered environment was created showing system interconnections (e.g., pump-to-lagoon routing).
- Objects were colour-coded by type and condition.
- A logic model was added to simulate flow and system structure for better planning insights.
- All data gaps were noted explicitly to support future updates and auditability.

Step 4: Phase 2 Sensor Planning

- Failure points were simulated to assess where sensor data could reduce risk or improve performance.
- Three sensor locations were prioritised:
 - Pump station (to monitor flow rate and motor efficiency)
 - Lagoon inlet (to measure inflow volume and quality)
 - Lagoon outlet (to monitor discharge compliance)
- A Sensor Specification Sheet (Appendix B) outlines metrics, sensor types, and benefits.

Step 5: Dashboard Mock-up Design

- A low-fidelity dashboard was created showing potential real-time data visualisations.
- Focus was placed on usability for FRC staff without technical backgrounds.
- The dashboard includes condition status, alerts, performance charts, and asset logs.
- Design was informed by stakeholder feedback during the CWMS Conference in June 2025.

This process ensured a meaningful outcome despite data limitations, and delivered a static twin that is accurate, updatable, and valuable for planning and future sensor integration.

Project Outcomes

This section outlines the key deliverables and results of Phase 1

Outcome 1: Digital Twin of Quorn CWMS

- Delivered a high-fidelity, static 3D digital twin of Quorn's CWMS using the Buinforma platform.
- Model includes geo-referenced representations of gravity/pressure pipes, pump station, lagoon, and discharge system.
- Assets are layered, searchable, and embedded with metadata (e.g. year, material, estimated condition).
- Establishes a permanent baseline for planning, upgrades, and ongoing documentation.

Outcome 2: Planning Enablement and Cost Forecasting

- The model enables pre-visualisation of works and planning reviews without needing physical inspection.
- Identifies infrastructure inefficiencies, maintenance access issues, and upgrade opportunities.
- Allows for more accurate cost estimation and resourcing decisions.
- Estimated Opex Savings (conservative): ~\$14,500/year from reduced manual inspections and better remote planning.
- Estimated Capex Savings (long-term potential): Up to \$150,000 over 10 years, through improved upgrade design, early failure detection, and life extension.

Outcome 3: Real-Time Monitoring Preparation (Phase 2)

- Three priority sensor locations identified:
- Pump Station (flow rate, motor efficiency)
- Lagoon Inlet (inflow volume and load)
- Lagoon Outlet (compliance monitoring)
- Delivered sensor specification plan with recommended metrics and rationale.
- Establishes technical readiness for Phase 2's dynamic digital twin.

Outcome 4: Dashboard Concept and Design

- Developed a dashboard wireframe tailored to FRC operations.
- Includes views for asset condition, alert triggers, performance tracking, and maintenance logging.
- Informed by feedback from FRC and the June 2025 CWMS Conference.
- Serves as the interface foundation for Phase 2.

Outcome 5: Scalable Methodology for Other Councils

- The process was designed with small council resourcing in mind: low barrier, flexible intake, and stepwise delivery.
- Model and approach align with LGA SA sector goals around digital enablement, financial sustainability, and replicability.

Strategic Benefits and Sector Impact

Digital Asset Visibility

- For the first time, FRC has a consolidated, digital view of its CWMS assets.
- Enables internal coordination, training, and asset governance with improved confidence and clarity.

Cost Estimation and Resource Planning

- Creates a planning baseline that reduces reliance on undocumented knowledge or on-site revalidation.
- Enhances ability to plan upgrades and support future funding submissions.

Risk Mitigation

- Identifies vulnerable or undocumented segments and ageing assets.
- Enables more strategic, data-driven decisions to avoid reactive, fail-to-run operations.

Sector Replication Potential

- The methodology has already attracted attention across the CWMS network.
- Will be showcased at the CWMS Sector Conference and LGA SA Conference.

Enduring Value Post-Project

Even without sensors, the static twin continues to provide:

- A visual reference for planning, review, and diagnostics.
- A communication tool for stakeholders and external contractors.
- A structure for continuous update and digital maturity progression.

Phase 1 has met all strategic, technical, and financial expectations, laying a clear path forward into Phase 2 and beyond.

Broader Sector Alignment and Visibility

- The project contributes a proof-of-concept for South Australia's 175 CWMS systems.
- Provides a replicable framework for other councils using Buinforma as a low-barrier entry platform.
- Presents strategic alignment with LGA SA's objectives on CWMS innovation.
- The project was showcased at the CWMS Sector Conference (26-27 June 2025) and will be included in the LGA SA Conference & AGM (20-21 November 2025).¹³

Deliverables and Milestones

Milestone	Date	Status	Details
-----------	------	--------	---------

¹³ <https://www.lga.sa.gov.au/news-and-events/events/agm>

Project Kick-off & Data Gathering	30 May 2025	✓ Completed	Meeting minutes and checklist documented
Asset Identification & Mapping	16 June 2025	✓ Completed	CWMS assets mapped and categorised; geospatial overlay created
Static Digital Twin Development	30 June 2025	✓ Completed	Buinforma-hosted 3D model with asset layer filtering
Sensor Identification Plan	30 June 2025	✓ Completed	Sensor types, placement points and configuration guidance delivered
Dashboard Mock-up	17 July 2025	✓ Completed	Wireframe UI mock-up included in appendices
Final Report & Presentation	31 July 2025 (Extended to 8 August 2025)	✓ Completed	This document with presentation-ready summary

Lessons Learned and Recommendations

Lessons Learned:

- The success of this project underscores the importance of leadership in environments with limited resources. The CEO's commitment to collaboration, transparency, and sector innovation made delivery possible despite systemic information and staffing limitations.
- Focusing on Quorn was essential; documentation and staff knowledge made the digital twin feasible.
- Early data gathering using the 22-point checklist was critical to reduce modelling uncertainty.
- Coordination with council staff helped to create accurate assumptions and added long-term value.

Recommendations:

- For other councils: Begin with static twin development before committing to sensor investments.
- For FRC: Maintain the static twin with annual updates and consider expanding it to Hawker.
- For IoT Consultants: Continue developing reusable sector-specific templates within Buinforma.

Appendices

Appendix A: Gateway, and sensors placement

We have chosen Wittra Gateway¹⁴, a Swedish manufactured multi-technology system for our trial at Phase 2. We have been testing the gateway for the past three months and believe it is suitable for this testing.

Specification can be found at:

It features:

- Self Contained Cloud Gateway
- Cabled Ethernet for Connectivity
- Includes state of the art 6LoWPAN border router
- Pre-certified, Ready for Field Deployment
- Open standards / protocols
- Data is secured via Link Layer
- Easy to Set Up, Easy to Use



Three types of sensors have been identified as suitable: These are

Water level sensors

We have decided to use ultrasonic sensors. These sensors are suitable for tank as they can be placed under the lid. They emit an ultrasonic wave which upon reflection from the surface of the water calculates the distance. The following typical sensors exist, which work with the Wittra gateway:

- Multitech RBS306-US10M-US¹⁵
- Elsys ELT-2 with Ultrasonic Probe¹⁶
- Dragino LLDS Series (LLDS40/LLDS12)¹⁷



Electric current sensor

A current sensor detects whether the pump is operating, which in conjunction with water level data can create an alarm if there exist an anomaly. The sensor is non-intrusive and simple to install. It clips on the power cable and measures the current flow. The current sensor indicates if the pump is operational, and variations in power usage can indicate the existence of solids in the pipes. The following typical sensor which works with Wittra gateway.

- Pressac wireless current sensor¹⁸



¹⁴ <https://www.wittra.io/gateway/>

¹⁵ <https://multitech.com/all-products/wireless-sensors/proximity-sensors/>

¹⁶ <https://www.elsys.se/en/elt-ultrasonic/>

¹⁷ <https://www.dragino.com/products/distance-level-sensor/item/240-llds40.html>

¹⁸ <https://www.pressac.com/energy-sensors/current-monitoring-sensors/>

Noise level and sound sensor

Several sensors exist that measure the noise level and send an alert if it is above a set dBA level. What we prefer to install in the actual system is a microphone that can listen in and transmit sound back to the website. We propose a remote turn-on system where the system can be listened to in case of anomalies. The following sensors exist for operational with a Raspberry pi device. We are investigating the following sensor: however,



- ReSpeaker¹⁹ Mic Array can be connected to a computer which then can stream or record sound for playback.

Liquid Flow Sensor

An alternative for the third sensor is detecting liquid flow. This information also can demonstrate normal operation as well as any anomalies. The following sensor works with Wittra gateway:

- Dragino SW3L-LB LoRaWAN Flow Sensor²⁰

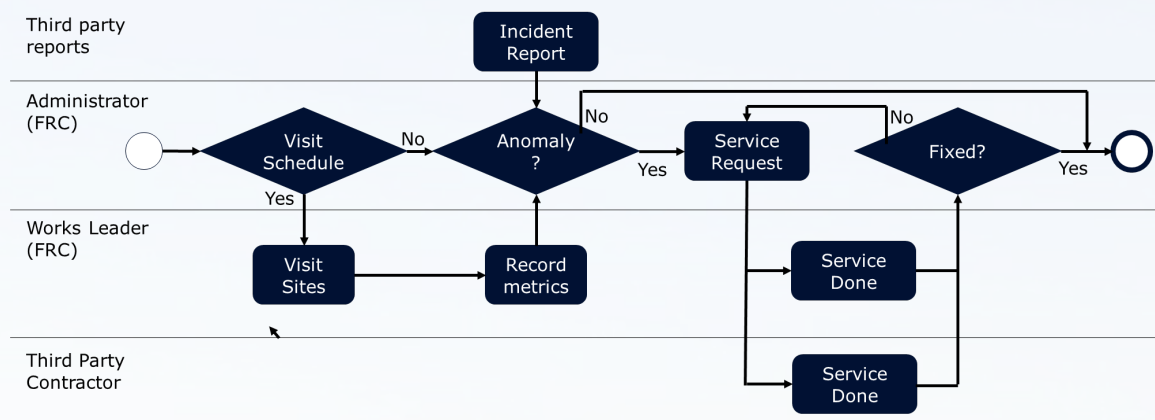


¹⁹ <https://core-electronics.com.au/respeaker-usb-mic-array.html>

²⁰ <https://www.dragino.com/products/water-meter-flow-sensor/item/269-sw3l-lb-ls.html>

Appendix B: Service Schedule

Detailed maintenance programmes and procedures for each system are states in the FRC operations and maintenance manual²¹. The details are as follows. We used this manual to draw a process flow diagram as shown in Figure 8, and replicated here:



For each system:

- Schedule Fortnightly - Pump Station
 - Various function checks / leaks
 - Record flow volume
- Schedule Monthly - Lagoon Inspection and Service
 - Inlet, transfer, overflow and diversion structures
 - Weed & mosquito control
 - Water colour and odour
 - Bank erosion
 - Perimeter fence damage
- Schedule Half Yearly - Pump Station
 - Detailed pump function, switchgear and electrical control equipment check
 - Lift and inspect if service provider available
- Schedule Annual - Gravity Line Flushing
 - Contractor with mobile tanker and high velocity drain cleaning equipment
 - Clean and wash manholes and inspect for water tightness
 - Lift and service to pumps by qualified technician
 - Pump Station desludging
- Schedule 2 to 4 Yearly - Septic Tank Desludging
 - 2 yearly for 1500 litre domestic tanks and 4 yearly for 3000 litre or larger tanks.
 - Equipment Required
- Schedule of necessary equipment for key tasks such as mains flushing and manhole access
- Standby pumps are also held, and an 8kVA generator is on permanent standby in Quorn as a contingency against regular local power failures

²¹ Flinders Ranges Council: “Safety, Reliability, Maintenance and Technical Management Plan”, Version 6, August 2024.

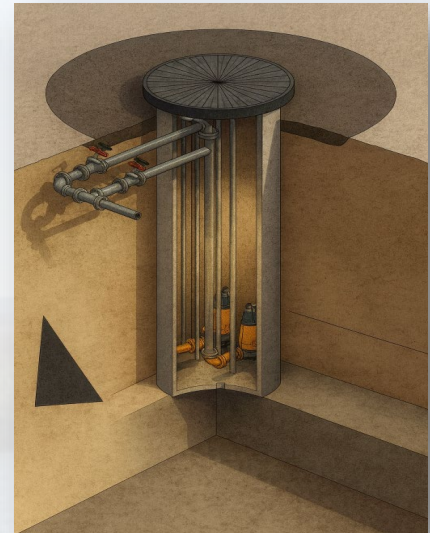
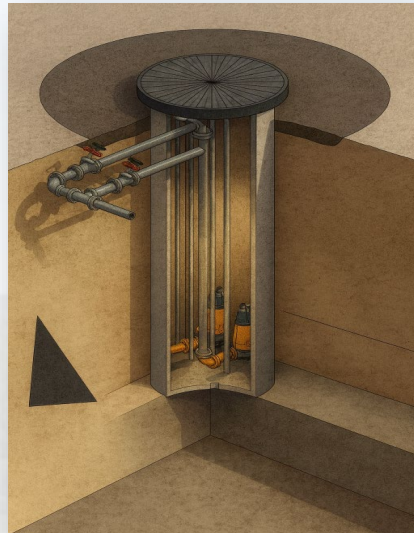
- Materials Required
 - Spare pipes, couplings etc, held in a secure undercover area and readily accessible
 - Out of service pumps to be repaired and returned as a spare
 - Safety and General Requirements
 - Manhole access and Confined Space policy and procedure requirements.

Appendix C: Dashboard Mock-up Design

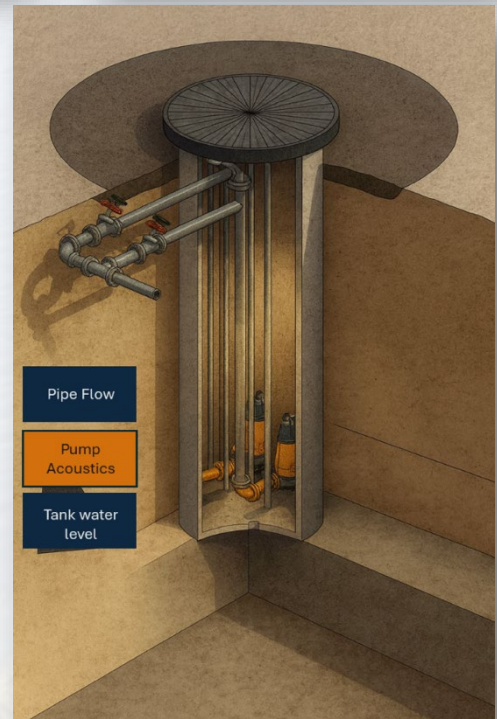
The dashboard is designed to provide a simple interface to the operational metrics provided by the sensors. It is also designed to visually demonstrate how the system is constructed and what components may need attention.

The digital twin differs from SCADA systems in that it integrates multiple data streams to create a whole picture. In the context of Quorn CWMS, we provide an easy to navigate dashboard, with links to how different components of the system are constructed to enable third party contractors to interact with the system and carry out diagnostics. They may also learn about faults and provide bids for repair or service.

First web page shows the two pump stations, clearly identified:



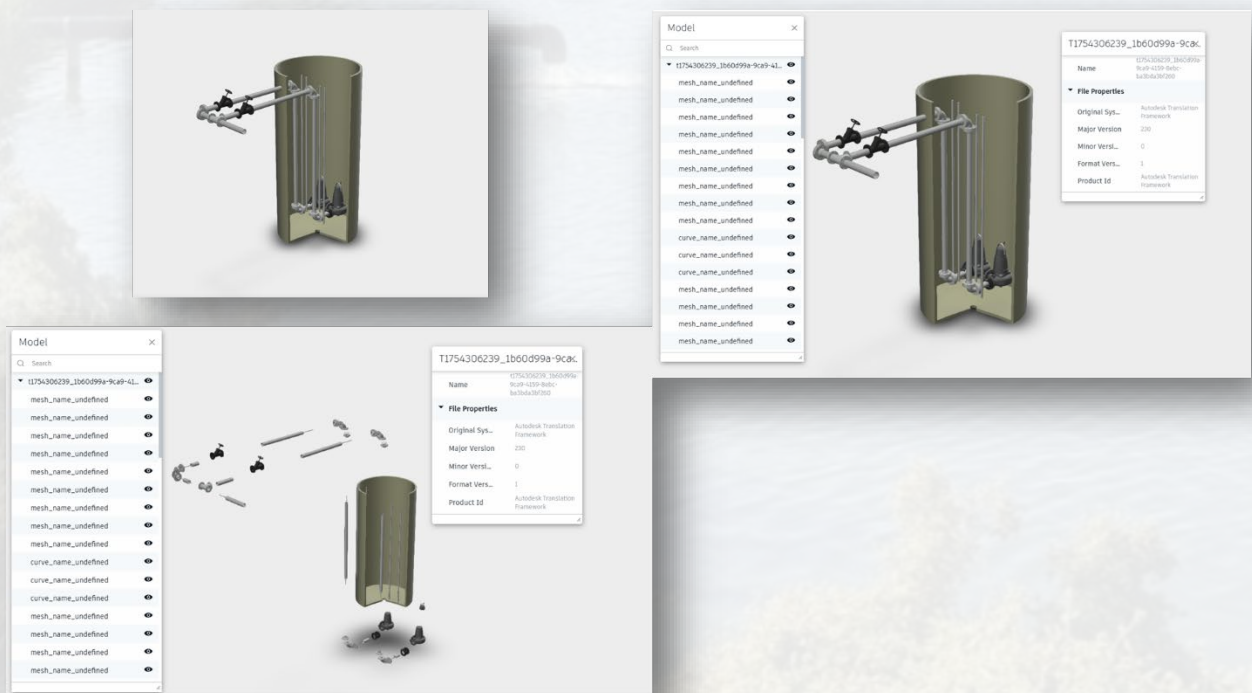
Second webpage shows the digital twin with buttons for important performance metrics:



Clicking on any of the buttons shows the current performance measures:
Clicking on the pump itself, shows the pump digital twin in Buinforma, where all



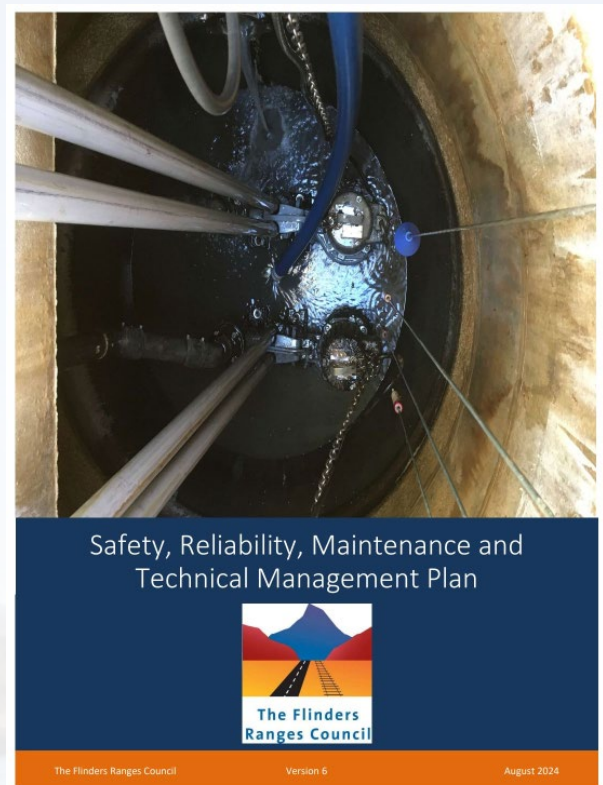
components can be shared with a third-party contractor:



Appendix D: Data Input – SRMTMP V6

The Flinders rangers council Safety, Reliability, Maintenance and Technical Management Plan (SRMTMP) documentation plays a key role in enhancing the quality of the digital twin by providing both qualitative context and quantitative insights into system configuration, operations, and risk posture. However, while it offered a valuable strategic framework, it was not a comprehensive or fully reliable dataset. Many details conflicted with operational staff input, and the information was fragmented across multiple documents, paper records, and individual knowledge. It also confirmed that the Council is actively addressing data fragmentation and working toward long-term digital maturity.

Our role involved reconciling these inconsistencies, validating against field and stakeholder insights, and transforming the available information into a structured, usable format. This was essential for enabling the SRMTMP content to move beyond a static reference and become a meaningful input into the digital twin model.



General contribution of the SRMTMP for the digital twin includes:

- Strategic Foundation: Provides a high-level framework of asset descriptions, maintenance strategies, identified risks, and planned improvement initiatives.
- Context for Data Gaps: Highlights incomplete and inconsistent datasets, identifying areas requiring validation, further investigation, or digitisation.
- Operational Baseline: Delivers practical operational insights that informed realistic system behaviour modelling and guided the design of key dashboard elements.

Expected technical contribution of the SRMTMP into Phase 1 of the project:

- Asset Classification and Placement: Details that could help with the classification and positioning of pump stations and lagoons within the digital twin model.
- Failure Point and Sensor Planning: Insights to inform failure-point simulation and guide sensor location strategies.
- Maintenance Framework: Formal references for maintenance frequency and asset condition assessments.
- Use of Assumptions: Examples of how engineering assumptions can be applied when data is incomplete or unavailable.

SRMTMP information gathered

Data Category	Technical Insights
CWMS Overview	The Quorn CWMS serves approx. 390 properties, comprising ~9,975 m of gravity main and ~2,900 m of pressure main (Section 2.1).
Pump Stations	Two pump stations (PS1 and PS2) operate with twin submersible pumps. PS1 is the primary station; PS2 is a lower-capacity booster station located on the western edge of town (Section 2.1.2).
Treatment System	Wastewater is treated in lagoons with a gravity-fed evaporation basin. Overflow proceeds through gravity and pressure mains to the treatment area northeast of Quorn (Section 2.2).
Asset Condition	Most assets are rated as "Good" or "Very Good". Condition ratings were available for major components such as mains and pumps (Appendix C).
Maintenance Activities	Routine tasks include monthly lagoon inspections, fortnightly pump checks, and quarterly flushing of low-flow areas (Section 5.2).
Contractors	Key service providers include Xylem (pumps), Finlay Electrical (electrical inspections), and Normet (flushing and jetting services). Contractor contact info is included in Appendix E.
Data Management Status	Asset data is being prepared for upload into a future digital system. Current data is fragmented across paper plans and staff knowledge (Section 5.1).

Information Gap Limitation and Our Process to Overcome It

Even though the Council cooperated in providing the information available, the level of accuracy in the supplied materials raised significant concerns. The drawings and system overviews were often inconsistent, the reporting regime lacked structure, and asset condition assessments could not be considered fully reliable. Maintenance activity reporting was similarly limited and unstructured, making it difficult to validate operational history or performance trends.

As this was an R&D project forming the foundation for information gathering and digitalisation, IoT Consultants applied engineering judgement and domain expertise to interpret, reconcile, and fill these gaps. We developed a structured platform for capturing, validating, and organising asset information so that over time, this data could be consolidated, made consistent, and ultimately meaningful for operational use and digital twin development.

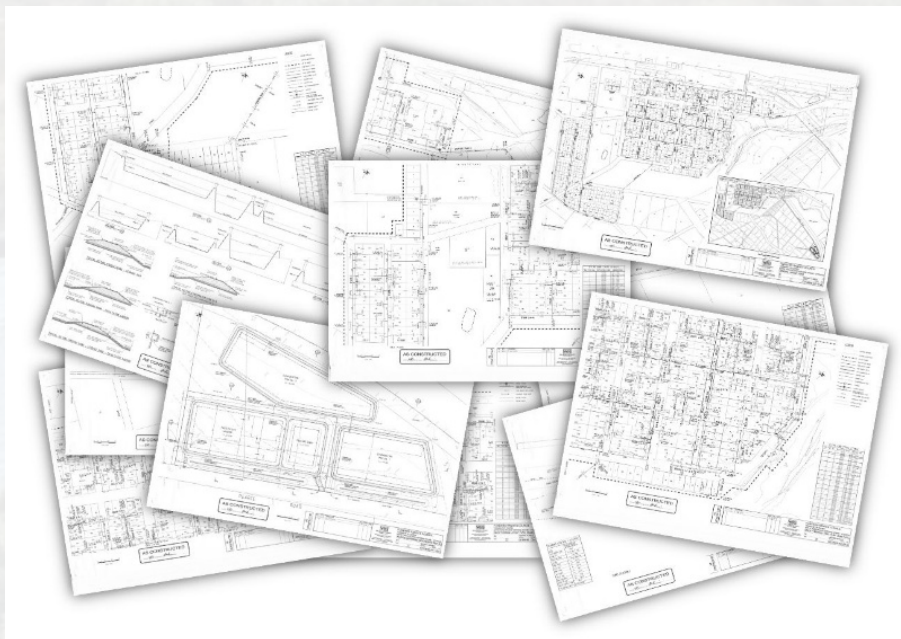
In summary, while the SRMTMP does not replace structured asset registers or live data, it served as an essential intermediary source that helped bridge information gaps and align the Phase 1 digital twin with current operational realities. Its inclusion also signals the Council's proactive intent to improve system governance, further supporting the strategic case for investing in digital twin capabilities.

Appendix E: Data Input – STED Scheme Drawings

The Septic Tank Effluent Disposal (STED) scheme drawings are technical maps illustrating the layout of wastewater infrastructure in areas where households discharge septic tank effluent into a shared, reticulated disposal network. These systems are common in regional towns like Quorn, where full sewer systems may not be economically viable.

STED drawings typically show effluent pipe alignments, connection points, inspection chambers, and the general flow direction from multiple properties to treatment or disposal sites. Produced at a 1:1000 scale, they provide a township-level overview of how effluent is collected and routed across the serviced area.

At the Flinders Ranges Council, the available STED drawings consisted of 12 schematic plans, forming a tiled view of the town's CWMS coverage. The first challenge was that these drawings existed only in PDF or paper-based format. They were segmented, meaning there was no single, consolidated drawing showing the entire town in one view. This made it difficult to gain an overall understanding of the system and created additional challenges in developing a complete, spatially accurate representation.



While these plans offered some useful spatial context, they were schematic in nature, lacked technical metadata, and in some cases conflicted with operational knowledge.

General contribution of the STED scheme drawings to the digital twin included:

High-Level Spatial Context: Provided a macro-level view of the town's layout, including roads, blocks, allotments, and effluent routing zones. This broad context helped locate and align infrastructure features (e.g., pipelines, inspection points, pump stations) relative to key landmarks and terrain.

Visual Confirmation of System Reach: Indicated the geographic coverage of the CWMS, including service zones and likely connection paths between septic tanks and the trunk network — particularly useful where no GIS layers or asset registers existed.

Support for Digital Twin Base Layer: Used as an initial reference to estimate pipe alignments, identify missing sections, and place known infrastructure.

Evidence of Historic Planning Approaches: Reflected legacy infrastructure planning methods from before structured asset digitisation, reinforcing the need to digitise and integrate such materials into modern asset governance systems.

Limitations and How They Were Addressed

Limitation	Mitigation Approach
Lack of metadata or drawing legends	Supplemented with assumptions and site observations
Absence of pipe sizes or materials	Engineering norms and SRMTMP references used to infer specs
No georeferencing or coordinates	Overlaid manually on satellite imagery and terrain models
Hand annotations and outdated naming	Interpreted with FRC staff and cleaned for consistency

Although the 12 STED scheme drawings were not suitable for direct import into a GIS environment or as engineering-ready references, they played a valuable role in establishing spatial continuity and topological logic across the Quorn CWMS. They helped the project team connect fragmented pieces of information into a more coherent digital foundation, and demonstrated how paper-based knowledge can be progressively integrated into digital asset management systems through structured twin modelling.

To make such important input data usable, IoT Consultants developed the baseline CAD model that became the foundation of the digital twin and the supporting engineering judgements for both the current and future projects. Using a combination of internally developed software tools and established processes, IoT Consultants transformed the segmented, paper-based drawings and PDF files into baseline CAD drawings and subsequently into 3D models.

This CAD model was created using the best available engineering judgement with the specific purpose of serving as a foundation for a data-rich digital replica. It is not only the starting point for ongoing model development, but also the reference standard for all future engineering work on the CWMS. Any future CAD updates or design work will need to remain consistent with this baseline model, ensuring that the evolving digital twin remains an accurate and coherent representation of the real-world system

Appendix F: Data Input – STED Pump Manuals and Parts Lists

After providing the overall systems overview, an important step in building a high-fidelity digital twin is creating detailed models of the subsystems. These subsystem twins are essential for achieving high-resolution modelling accuracy at the system level.

As part of the background data collection for Phase 1 of the Quorn CWMS Digital Twin project, IoT Consultants sourced detailed installation, operation, and maintenance manuals, along with parts lists, for the two primary STED pump models in use across the network: the Flygt 3057 and Flygt 3127 series.



While the manufacturer was still active and the paper-based manuals were available, no CAD models of these components existed. Although the manuals provided a basic understanding of pump operation, they lacked the depth of information required to create a true high-fidelity model. In other situations, manufacturers have gone bankrupt, resulting in the loss of all technical data — a risk that further highlights the importance of capturing and modelling this information now.

For these pumps, no 3D models were available, so IoT Consultants developed them from scratch using the available documentation and engineering judgement. These models are visually accurate from an aesthetic standpoint but, due to missing manufacturer-level technical data, some engineering details had to be inferred. This made the process more challenging, as the team needed to balance practical representation with realistic operating behaviour.

These documents and the reverse-engineered models were critical in enhancing the design quality and future readiness of the digital twin. While they were not directly visualised in Phase 1's static 3D model, they provided the foundation for logic modelling, sensor specification, and risk analysis that will be expanded in Phase 2.

Why subsystem (Pumps) twins are essential:

- Digital Logic Modelling: The manuals provide performance benchmarks for normal operation (e.g., flow rates, motor efficiency, pressure ranges), supporting the simulation of realistic system behaviour within the digital twin environment.
- Sensor Metric Definition: Data from the manuals informs metrics for real-time monitoring that can be expanded in Phase 2, including motor current and temperature, flow and head pressures, clogging or overload risks, and maintenance thresholds.
- Preventive Maintenance and Lifecycle Planning: The parts lists help identify common wear points and replacement intervals, enabling the future twin to incorporate predictive maintenance logic and generate alerts tied to asset conditions.

- Improved Asset Representation: Understanding the internal mechanics of each pump model allows for more accurate modelling in Buinforma and more precise monitoring strategies tailored to each asset's characteristics.

Document Types and Sources

Document Type	Pump Model	Relevance
Operation & Maintenance Manual	3057 3127	System parameters, usage patterns, failure modes Motor behaviour, flow curves, servicing cycles
Parts List	3057 3127	Detailed breakdown of internal components Inventory reference for repairs or replacements

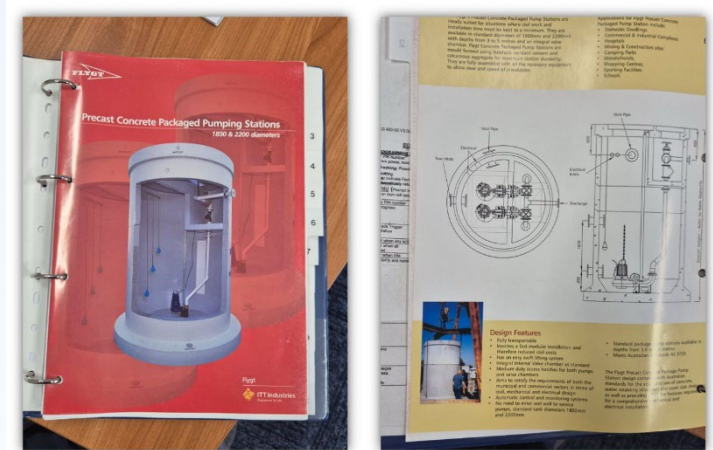
We requested detailed pump specifications as part of the data gathering process, and the Council provided the pump manuals and parts lists. While these documents were valuable, no CAD models of the pumps existed, meaning a fully precise digital representation was not possible from the supplied information alone. To address this, IoT Consultants developed the CAD models in-house, using the provided manuals, reference to similar pump models, and engineering judgement.

Although these CAD models are visually accurate and provide the level of detail required for the current phase of the project, some fine-level precision is inherently limited by the absence of manufacturer-supplied 3D data. These models nonetheless serve as a vital bridge between mechanical engineering detail and digital asset modelling, ensuring strong alignment between the virtual representation and the real-world system.

In the future, these models could be further refined — particularly if pump maintenance is brought in-house by the Council rather than managed solely through external contractors, enabling greater access to the physical assets and any additional technical information that becomes available.

Appendix G: Data Input – Precast Concrete Pump Tank Manuals

As part of the supplementary data provided by the Flinders Ranges Council, the project team received five scanned pages from manuals relating to Precast Concrete Packaged Pumping Stations for 1800 mm and 2200 mm diameter tanks.



A key challenge was that no 3D models of these pump stations existed. The details provided in the scanned manuals were partial and inconsistent when compared with the original PDF drawings and other available references. As a result, IoT Consultants had to apply engineering judgement to interpret the information and create the most accurate models possible for the current stage of the project.

Using the partial scans — which contained cues such as model naming, structural dimensions, and component layouts — IoT Consultants conducted targeted web-based research and compared against industry-standard designs to identify technically comparable pump well configurations. From there, assumption-based 3D model proxies were developed and clearly marked as provisional until more definitive specifications can be validated.

Value to Digital Twin Design:

- **Baseline Structure Identification:** The scanned documents provided enough detail on structural layouts, anchoring schemes, and pump positioning to guide assumptions on geometry, inlet/outlet connections, and internal volume.
- **Model Proxy Alignment:** By correlating scanned diagrams with known industry models from manufacturers such as Xylem and Rocla, the team created realistic proxies for 3D modelling in Buinforma while documenting all assumptions for transparency.
- **Sensor Integration Readiness:** The basic inlet/outlet layouts, cover types, and typical component placement informed likely sensor locations (e.g., flow meters, level sensors, vibration monitors) for Phase 2 planning.
- **Documentation Limitations:** The inconsistent quality of the scans, lack of specification tables, and variations between source documents made assumption-driven modelling unavoidable.

Although incomplete and inconsistent, the scanned documentation still provided enough reference material to allow IoT Consultants to develop the best-possible 3D models for this stage of the project. These models now form the baseline representation for the precast pump stations in the digital twin. Any future engineering work or asset updates will need to maintain alignment with these models to ensure consistency within the evolving digital replica.

Appendix H: Data Input – Pump Station Service Report

This document is a professional service report produced by Xylem Water Solutions for two CWMS pump stations (Foster Street and East Terrace) within the Flinders Ranges Council network in Quorn. It includes:

- Pump model numbers and serials
- Electrical test results (motor resistance, current, voltage, insulation resistance)
- Run-hour meter data, providing insight into pump usage and lifespan
- Operational issues identified, including corrosion, non-return valve failure, and seal leakage
- Recommended maintenance actions, such as part replacements and counter checks

Why It Matters for the Digital Twin:

- Pump specifications and electrical metrics were extracted to inform the digital twin's metadata fields for both sites.
- Usage and wear trends help prioritise risk scenarios and sensor placement for Phase 2.
- Maintenance history and performance anomalies directly contribute to condition modelling logic (e.g., known faults, expected failure points).
- The level sensors, switchgear condition, and pump integrity status provide real-world baselines against which dynamic sensor data will be later validated.
- Even though this report is static, it plays a vital role in helping infer likely system behaviours and validates elements of the 3D model logic tree.

Appendix I: Preliminary Data Requested

At the beginning of the project, IoT Consultants provided a 22-point checklist of desired data to support the digital modelling of the Quorn CWMS. This list served as a flexible reference rather than a strict requirement. While not all items were available or documented at the time, this wish list helped guide conversations with council staff, inform assumption strategies, and identify priorities for future data improvement.

#	Data Requested	Details	Why is this important?
1	The exact address / location of the assets	Precise geographic coordinates (latitude/longitude) or street address of all CWMS assets (e.g., pumping stations, lagoons).	Ensures geographic precision for site-specific modelling and planning site visits.
2	Asset list if possible (if not, to work out)	A comprehensive inventory of CWMS assets, including pumps, pipes, lagoons, and tanks; if unavailable, indicate we'll derive it from other data.	Identifies all components (e.g., pumps, pipes, lagoons) for accurate digital twin modelling.
3	Last work order details	Details of the most recent maintenance or repair work order, including date, type of work (e.g., pump repair), and parts replaced (e.g., impeller).	Provides recent maintenance history to identify recurring issues or upgrades for baseline.
4	Year it has been built	The construction year or installation date of the CWMS infrastructure (e.g., lagoons built in 1985, pumping stations in 1990).	Assesses asset age and condition, impacting longevity estimates and maintenance needs.
5	Underground/up per-ground infrastructure	Identification of whether components (e.g., pipes, pumps) are underground or above-ground, with approximate depths if buried (e.g., 1.5m).	Distinguishes buried pipes from surface components for accurate 3D modelling and sensor placement.
6	Flow process map	A diagram or description of the effluent flow process, from septic tanks through collection, treatment, and disposal/reuse (e.g., septic to pump to lagoon).	Maps effluent movement from septic tanks to treatment/disposal for simulation accuracy.
7	Type of pump	The specific make and model of pumps used (e.g., Grundfos centrifugal, Flygt submersible).	Informs pump performance modelling and sensor selection in Phase 2.
8	Pipe sizes	The diameter and material of all pipes in the collection network (e.g., 100mm PVC, 150mm concrete).	Enables hydraulic modelling and identifies potential design flaws in the digital twin.
9	Land survey, if possible	A topographic land survey or elevation data showing terrain slope around the CWMS (e.g., 2% grade), if available.	Supports gravity-fed system flow simulations and sensor placement (optional but beneficial).
10	CAD drawing, if available	Computer-Aided Design (CAD) files of the CWMS layout; if not existing, note unavailability for manual mapping.	Provides a precise digital baseline for Buinforma modelling; manual mapping if unavailable.
11	Pipe slopes	The gradient or angle of inclination for all pipes in the	Enhances flow accuracy in gravity systems for the digital

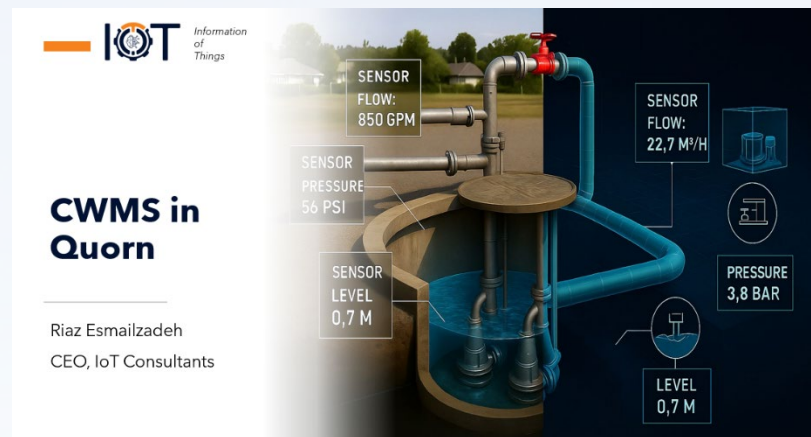
		network (e.g., 1:100 slope, 0.5% grade).	twin, complementing land survey.
12	Any drawings	Any available drawings, sketches, or plans of the CWMS (e.g., hand-drawn diagrams, engineering blueprints).	Captures all available visuals to support modelling if CAD drawings are unavailable.
13	Work history	A record of all maintenance activities over the CWMS's operational life (e.g., dates, repairs like pipe fixes, upgrades like pump replacements).	Offers long-term maintenance trends to enhance predictive analytics in Phase 2.
14	People involved, if possible	Names and contact details (if possible) of council staff or contractors involved in CWMS operations or maintenance (e.g., maintenance supervisor).	Identifies key personnel with operational knowledge for data collection and validation.
15	Treatment system specifications	Specifications of the treatment system, such as lagoon dimensions (length, width, depth in meters), type (e.g., facultative, aerated), or mechanical plant details (e.g., tank volume in m ³ , aeration method).	Models treat processes accurately and informs sensor selection in Phase 2.
16	Disposal/reuse system details	Details of the disposal or reuse system, including evaporation pond dimensions (e.g., 10m x 20m), irrigation area size (e.g., hectares), or wetland specifications.	Supports flow and environmental compliance modelling, key for Phase 2 benefits.
17	Pump specifications (capacity, power, condition)	Detailed pump specifications, including flow rate (e.g., 10 L/s), power rating (e.g., 5 kW), and current condition (e.g., new, worn).	Refines pump performance modelling and sensor selection beyond just type for Phase 2.
18	Historical or recent water quality data	Water quality measurements of effluent (e.g., Biochemical Oxygen Demand [BOD] in mg/L, Total Suspended Solids [TSS] in mg/L, pH) from treatment or disposal points, historical or recent if available.	Validates environmental compliance simulations and POC results, aligning with SA standards.
19	Breakdown of annual maintenance costs	A detailed breakdown of annual CWMS maintenance costs, specifying labour (hours/cost), parts (type/cost), and travel expenses (e.g., \$5,000/year).	Refines opex savings estimates (e.g., Maintenance Efficiency, Remote Monitoring).
20	Historical incident reports, if available	Records of past incidents (e.g., overflows, pump failures, pipe breaches), including dates, causes (e.g., blockage), and costs (e.g., \$15,000), if available.	Validates Environmental Compliance benefit (\$10,000–\$20,000/incident) and informs analytics.
21	Details of existing monitoring systems	Information on any current monitoring systems or sensors (e.g., manual gauges, flow meters), including type, location,	Ensures compatibility with Phase 2 sensors and avoids redundancy in Buinforma integration.

		and data output (e.g., daily readings).	
22	Soil type and environmental condition data	Soil type (e.g., sandy, clay) and environmental data (e.g., average annual rainfall in mm, temperature range in °C) around the CWMS site.	Refines lagoon performance and pipe integrity simulations, enhancing digital twin accuracy.

In summary, while data availability was uneven and sometimes informal, the project team successfully extracted high-value insights from the materials received. These inputs, when combined with site inspection, council engagement, and engineering judgement, enabled the creation of a functional, scalable, and auditable static digital twin. The documentation reviewed here will also serve as a foundation for future model refinement, sensor integration, and digital maturity across the CWMS network.

Appendix J: Presentation for CWMS Conference and LGA SA

As part of the broader engagement and knowledge-sharing strategy of the Quorn CWMS Digital Twin project, IoT Consultants was invited to present at the CWMS Sector Conference held on 27 June 2025. The presentation provided council representatives, regulators, and sector stakeholders with insight into the value and replicability of digital twin solutions for wastewater infrastructure management across South Australia.



The presentation titled “CWMS in Quorn” was delivered by Riaz Esmailzadeh and included the following key components:

1. Project Overview

- Introduction to IoT Consultants and the Buinforma platform.
- Outline of the Community Wastewater Innovation Fund–supported pilot for the Quorn CWMS digital twin.
- Emphasis on collaboration with Flinders Ranges Council and LGA SA.

2. Current Challenges

- Fragmented and informal data systems in local government CWMS operations.
- Lack of visibility, legacy documentation, and difficulty in proactive planning.
- Sector-wide constraints: limited budgets, dispersed infrastructure, and aging workforce.

3. Digital Twin Approach

- Explanation of how digital twins replicate both physical infrastructure and logical behaviour.
- Integration of asset metadata, operational simulation, and geospatial modelling.
- Phase 1 deliverables: 3D model, sensor identification, and dashboard concept.

4. Cost-Benefit Analysis

- Referenced savings based on benchmarks from McKinsey and Bentley Systems:
 - 5–10% Capex savings
 - 10–20% asset life extension
 - 10–15% operational efficiency gain
- Estimated Opex savings of ~\$14,500/year for Quorn through improved planning alone.

5. Strategic Value and Phase 2 Preview

- Phase 2 will integrate sensors into the static twin for real-time monitoring and alerting.
- Expected payback period under 3 years, demonstrating strong return on investment.
- Highlighted readiness for broader rollout to 175 CWMS schemes across South Australia.

6. Risk Mitigation and Sector Alignment

- Overview of key CWMS sector risks and how digital twins can reduce exposure:
 - Regulatory compliance
 - Asset failure
 - Emergency response
 - Public health
- Reinforced alignment with LGA SA's goals for innovation, financial sustainability, and resilience.

The presentation helped raise awareness of the practical applications of digital twins in small regional councils and contributed to positioning Flinders Ranges Council as an early adopter of next-generation asset management tools. It will also be presented at the LGA SA Conference and AGM on 20–21 November 2025, further promoting sector-wide replication. A copy of the presentation slides is sent with this report.

Appendix K: Acknowledgements and Contact Information

This project was made possible through the support, collaboration, and commitment of several key individuals and organisations:

- The Flinders Ranges Council (FRC). For their leadership in infrastructure innovation and ongoing partnership in delivering this pilot project.
- Community Wastewater Innovation Fund. For providing the funding that enabled this forward-thinking digital twin initiative.
- Local Government Association of South Australia (LGA SA) For sector-wide leadership and program coordination that enabled this project to align with state priorities and be shared with the broader CWMS network.
- CWMS Sector Stakeholders and Network Members. For their input during the CWMS Conference and interest in scalable digital transformation for wastewater infrastructure.

Special Thanks

We would like to extend special thanks to the following individuals whose leadership, expertise, and vision were critical to the success of this project:

- Sean Holden – CEO, Flinders Ranges Council. For his leadership, drive, and unwavering commitment to innovation in local government.
- David Eggers – CWMS Program Manager, LGA SA. For his sector-wide leadership and support in positioning this pilot within broader state priorities.
- Kristen Clark – Interim Director of Works, Flinders Ranges Council. For his operational guidance and support in navigating technical and contextual project details.
- Danny Martin – Team Leader Works, Flinders Ranges Council. For his tour of the CWMS in Quorn and explaining the intricacies of the system
- Crystal Price – CWMS Program Officer, LGA SA For her coordination and continued encouragement across the CWMS community.

Additional Contact Information

For further details regarding this project or to explore future collaboration opportunities, please contact:

Riaz Esmailzadeh, Chief Executive Officer, IoT Consultants Pty Ltd
riaz@iotconsultants.com.au

Mark Shariat, Chief Technology Officer, IoT Consultants Pty Ltd
mark.s@iotconsultants.com.au

Alfredo Veron, Chief Business Development Officer, IoT Consultants Pty Ltd
alfredo@iotconsultants.com.au