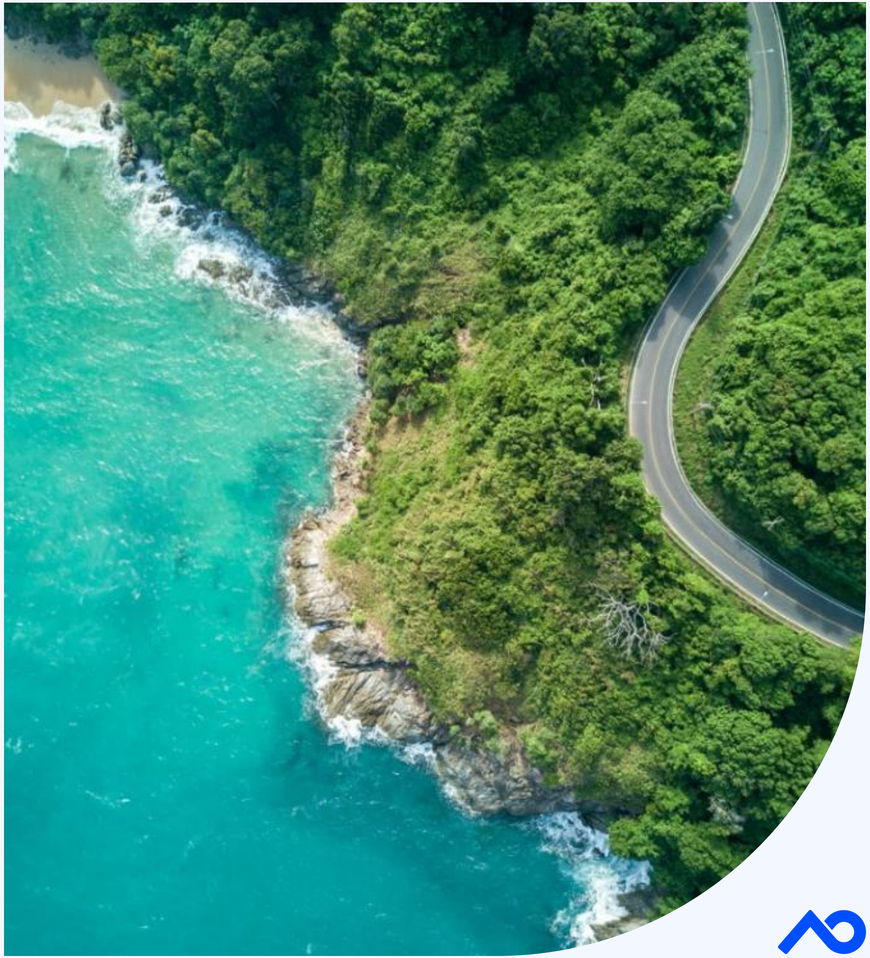
smec

an SJ company

# Leveraging Data to Transform the Water Sector: Key Insights

Mani Manivasakan, Chief Technical Principal

28/05/2026



"We acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community. We pay our respect to their Elders past and present and extend that respect to all First Nations peoples."

**'To make Life Better for All'**
Artist: Patrick Caruso, Eastern Arrernte Graphic Designer and Artist.

SMEC simplifies the complex. We unlock the potential of our people to look at infrastructure differently, creating better outcomes for the future.

engineering
positive
change

# Opening &
# Orientation

Insights

# Leveraging Data to Transform the Water Sector: Key Insights

**Motivating Forces in Water Sector**
Climate variability, rising demand, and aging infrastructure pressure water utilities to innovate and adapt.

**Data as a Strategic Asset**
Treating SCADA, meter, LiDAR, and asset data strategically unlocks operational and financial benefits.

**Challenges in Data Utilization**
Fragmented silos, inconsistent data quality, and limited analytics impede value generation.

**Promise of Digital Investments**
Modest digital investments plus operator engagement can reduce losses and delay capital costs.

Structure

# Presentation Structure: Challenges → Methodology → Case Studies & Roadmap

### Global Water Challenges

Climate extremes and rising demand increase operational complexity and require alternatives to constant capital upgrades.

### Methodology Approach

Combines engineering, data science, and digital governance in a repeatable cycle for practical, scalable solutions.

### Case Studies & Roadmap

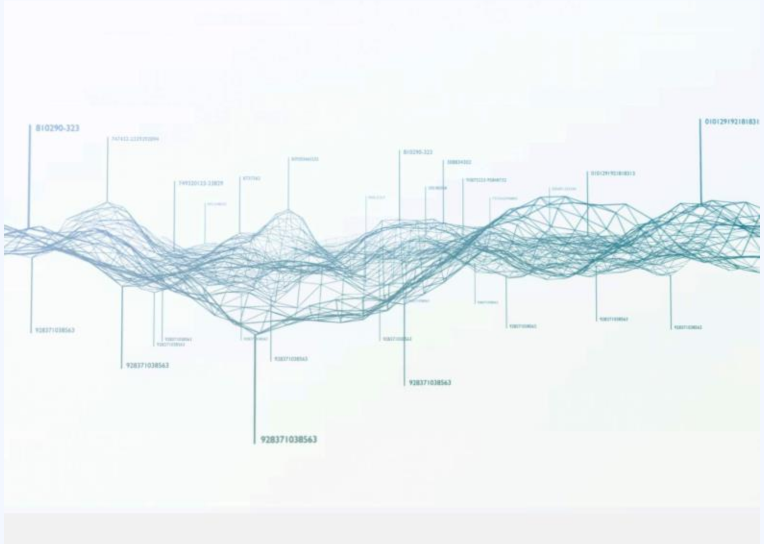
Real-world examples demonstrate measurable benefits like risk reduction, cost savings, and licensing opportunities.

# Context: Why Data-Driven Water Management Now

Challenges

# Global Water Sector Challenges: Climate, Demand, Aging Assets, and Data Silos

**Climate Variability Challenges**
Altered rainfall and increased evaporation cause supply volatility, while floods and heatwaves stress water networks and raise failure risks.

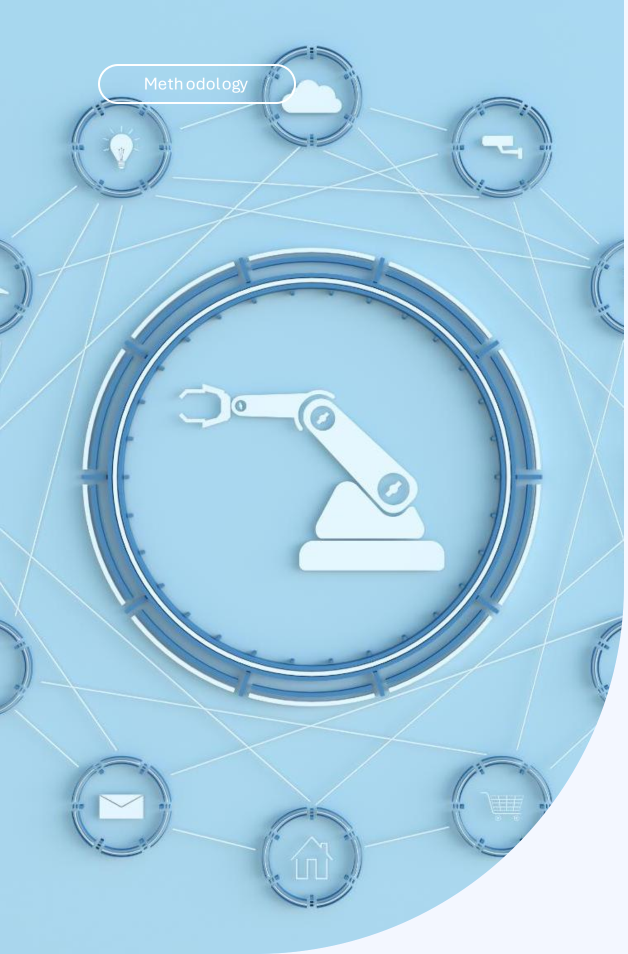



**Increasing Water Demand**
Urbanization, industrial growth, and agriculture intensification increase total and peak water demand, complicating capacity planning and scheduling.

**Aging Infrastructure Issues**
Many water assets exceed design life; costly upgrades are slow, but operational efficiency can extend asset value affordably.

**Data Fragmentation Challenges**
Separated operational, asset, customer, and environmental data prevent full visibility and hinder advanced analytics and AI implementation.

# Methodology:
# From Raw Data to Reliable Decisions




# Practical Methodology: Engineering + Data Science + Governance

**Problem Identification**

Teams identify operational inefficiencies and validate issues through workshops with operators and field staff.

**Data Collection and Cleaning**

Data from SCADA, LiDAR, asset registers, and logs is collected and cleaned with field team verification.

**Analysis and Engagement**

Statistical and geospatial analysis detect trends and anomalies, engaging operations for actionable decisions.

**Prediction and Optimisation**

Predictive models forecast risks and optimisation tools improve scheduling and capacity decisions.

Case Study

## Case Study 1:

# Irrigation Modernisation via Operational Optimisation (Low/No Capex)

**Context and Challenges**

A major irrigation district sought efficiency improvements without high capital expenditure due to budget and water availability uncertainties.

**Data-Driven Operational Review**

Analyzed SCADA data, channel geometry, operational logs, and delivery patterns to understand current inefficiencies and capacity.

**Key Findings and Inefficiencies**

Identified misaligned pump scheduling, inefficient pump operation, and avoidable losses from flow balancing and gate operations.

**Optimisation and Outcomes**

Used predictive analytics and scenario testing to optimize pump sequences and gate timing, saving water and deferring capex.

# Evidence: Case Studies Using SCADA, Analytics, and Integrated Data

Case Study

## Case Study 2:

# Reducing Erosion Risk with SCADA-Driven Operational Adjustments

- Problem: High Erosion Risk
  - Severe downstream erosion caused by high outlet velocities demanded costly structural fixes with high disruption.
- Data-Driven Operational Insights
  - SCADA data analysis revealed rapid gate openings during peak demand caused unsafe velocities up to 7 m/s.
- Optimized Gate Operation Strategies
  - Staged and coordinated gate openings reduced peak velocities below 3 m/s while maintaining delivery objectives.
- Benefits and Broader Implications
  - Updated protocols minimized erosion risk, extended asset life, and demonstrated value of data quality and operator role.

Case Study

## Case Study 3 (Part A)

# Discharge Coefficients — Options for Calibration and Cost

**Importance of Discharge Coefficients**

Discharge coefficients impact water delivery, control accuracy, billing, and operational certainty in utility systems.

**Calibration Pathways and Costs**

Three calibration options include physical models (high cost), CFD modelling (moderate cost), and SCADA analytics (cost-efficient).

**Tradeoffs Among Methods**

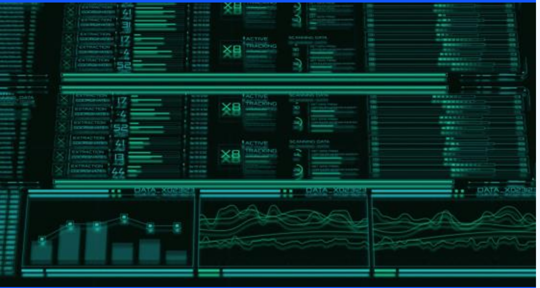
Physical models offer accuracy but need facilities and time; CFD is faster but costly; SCADA uses real data for timely calibration.

**Empirical Analytics Advantage**

SCADA analytics provide continuous, real-world calibration reflecting actual conditions, balancing cost, risk, and value.

Case Study

# Case Study 3 (Part B):



# SCADA-Derived Coefficients — Validation and Benefits

**SCADA Data Analytics Approach**
Historical SCADA data for flows and gate positions develop empirical discharge coefficient relationships.

**Statistical Filtering Importance**
Filtering removes noise and outliers to focus on stable operating regimes for reliable coefficient inference.

**Regime-Based Coefficient Adjustment**
Adjusting discharge coefficients by gate opening regime accounts for changing flow behavior and improves control accuracy.

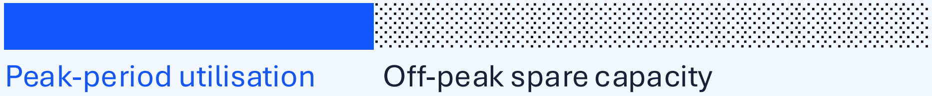
**Back-Testing and Validation**
Back-testing shows near-perfect match between calculated and observed flows, confirming coefficient accuracy.

Case Study

# Case Study 4:

- **Peak demand:** System sized for ~95th percentile demand
- **Off-peak:** Channels operating at **<40% capacity**

# Spare Channel Capacity and Off-Peak Licensing Opportunities




### Problem

Peak-period demand raised concerns about channel capacity

Traditional response: major channel upgrades

### Data-driven insight

SCADA flow data + customer ordering patterns analysed

Significant **spare capacity during off-peak periods**

### Outcome

Enabled **off-peak (Tier 2) water licensing**

Improved utilisation and flexibility

**Avoided or delayed capital upgrades**

Case Study

## Case Study 4:

# SCADA-Derived Coefficients - Validation and Benefits

| Date (sample) | Spare Channel Capacity (ML/d) | Demand (ML/d) | Interpretation |
|---|---|---|---|
| 2018-08-15 | 42.09 | 6.42 | Large off-peak headroom; opportunity to shift/enable deliveries |
| 2018-08-16 | 32.36 | 5.02 | Capacity still well above demand |
| 2018-08-17 | 25.49 | 5.30 | Spare capacity persists even as demand rises slightly |
| 2018-09-02 | 50.00 | 5.92 | Near-max spare capacity (cap proxy), very low demand |
| 2019-01-11 | 0.00 | 49.40 | Peak period example: demand consumes headroom; upgrades considered if sustained |
| 2019-02-10 | 0.34 | 0.00 | Very low demand; confirm data validity and operational state |

# Enablers, Scaling, and Closing

Data Quality

# Data Quality & Integration Foundations:
# Making Analytics and AI Trustworthy

**Core Data Quality Dimensions**

Accuracy, completeness, timeliness, consistency, and lineage are essential for reliable water operations data.

**Importance in Water Operations**

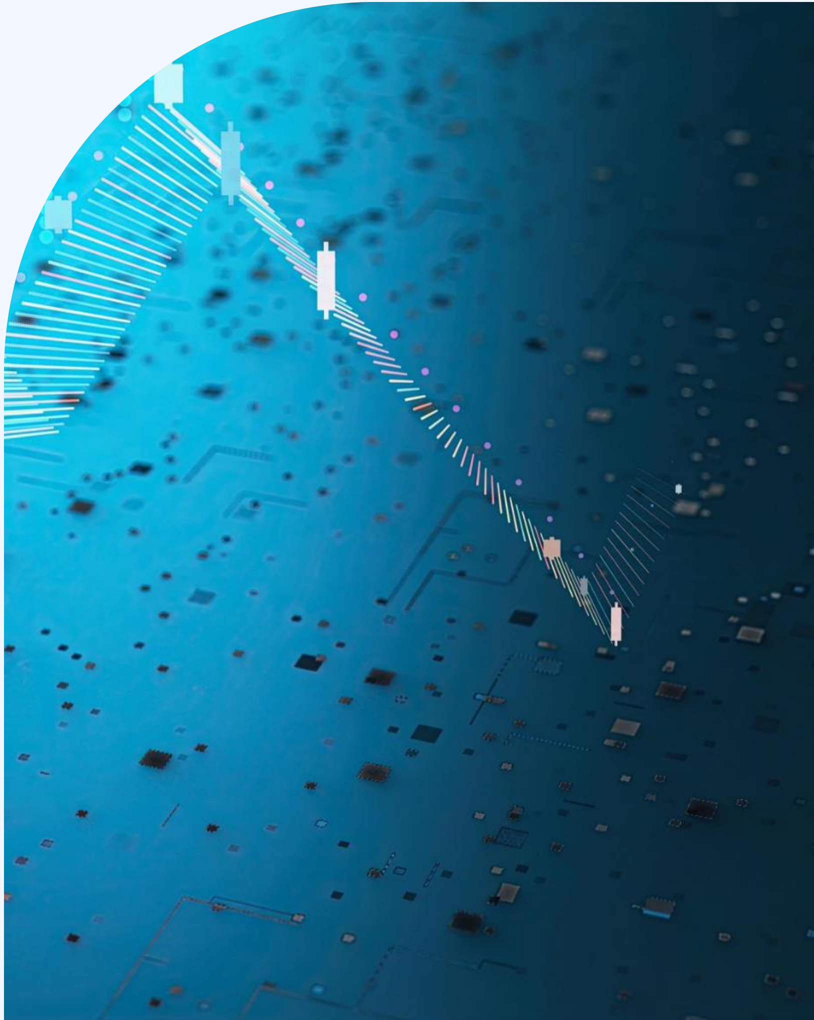
Data quality impacts operational decisions such as erosion assessment, anomaly response, and hydraulic analysis.

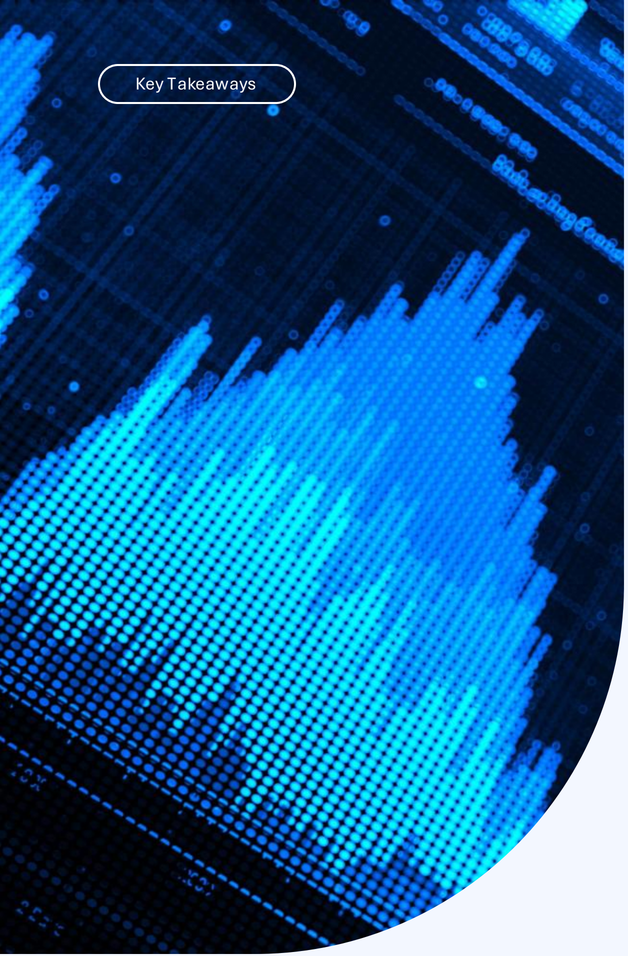
**Integration Architecture and Scalability**

Integrating diverse water data sources with scalable architecture ensures a single source of truth for analytics.

**Governance and AI Readiness**

Operator engagement and explainable inputs enable trustworthy AI for predictive maintenance and digital twins.






# Key Takeaways & Roadmap: Digital-First Value Before Major Capex

**Digital-First Value Principle**

Modest data analytics investments improve efficiency and resilience, delaying costly capital expenditures.

**Staged Roadmap Overview**

Four stages guide organisations from data visibility to advanced analytics and digital twins.

**Governance and Change Management**

Establish data ownership, standards, and integrate analytics into operations for sustained impact.

**Strategic Impact**

Data-driven strategies enhance climate resilience, affordability, and prepare for responsible AI adoption.

Example

# Asia–Pacific Example: WRMIS Pakistan — Platform-Based Digital Decision Support

**Integrated Data Architecture**
WRMIS Pakistan uses multiple data inputs integrated through ETL into structured databases for water management.

**Benefits of Platform Approach**
Standardized pipelines, shared dashboards, and modular decision tools enhance transparency and predictive planning.

**Use Case Modularization**
Reusable modules like SCADA calibration and erosion risk analytics enable replication across regions and asset types.

**Implementation Considerations**
Stakeholder alignment, governance, cybersecurity, and capacity building are key for sustaining the platform.

Q&A

# Q&A: Discussion and Application to Your System

- **Facilitating Interactive Discussion**
Encourage questions linking to methodology, SCADA analytics, governance, and operational changes with minimal disruption.

- **Addressing Operational Pain Points**
Focus on erosion, asset degradation, uncertainty in coefficients, peak capacity, and network underutilization issues.

- **Data and Quality Considerations**
Discuss datasets availability, quality issues like sensor drift, missing assets, and misaligned time bases impacting operations.

- **Strategic Implementation and Trust**
Emphasize measurable performance improvements and building trust for analytics to become enduring capabilities.

Conclusion

# Conclusion: Key Takeaways

**Data is a strategic asset:** SCADA, meter, LiDAR, and asset data unlock operational and financial value when treated strategically

**Data quality underpins everything:** Accuracy, completeness, and governance are essential foundations for trustworthy analytics and AI readiness

**Engineering + data science + governance:** A repeatable methodology combining problem identification, data cleaning, analytics, and predictive optimisation drives reliable decisions

**Digital-first, capex-last:** Modest digital investments improve efficiency and resilience, delaying costly capital upgrades through a staged roadmap approach

**Proven real-world impact:** Case studies demonstrate measurable benefits including reduced erosion risk, deferred capital expenditure, improved calibration accuracy, and new licensing revenue

**Scalable and replicable:** Platform-based approaches like WRMIS Pakistan show these methods can be modularised and deployed across regions and asset types

SJ smec

**For 75 years, SMEC has built a reputation as a trusted partner on major Transport, Water and Energy projects around the world.**

SMEC is committed to positively impact the people, the environment and the clients and communities we serve.  Through our network of global specialists, our specialist teams draw on deep expertise and systems thinking to simplify the complex and deliver integrated engineering solutions across a range of diverse environments.

Scan me


## Mani Manivasakan

*Chief Technical Principal*
*Water Resources*
Mani.Manivasakan@smec.com
Melbourne, VIC, Australia


Scan me

## Slide Pack

Download this presentation