

# Now you see it: Visual risk management

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## SUMMARY

In this complex and rapidly changing environment, effective risk management is essential for water utilities to continue to deliver safe services that meet customer and stakeholder expectations. Risks need not only to be assessed but managed. This paper examines the efficacy of visual tools in enhancing risk communication and understanding. Risk management is integral to water sector activities and enables prioritization of improvements, even in resource-constrained environments. While traditional spreadsheets are commonly used for risk assessment, the paper introduces two visual methods for effective risk communication: Bow-tie diagrams and Sankey diagrams.

The paper supports these techniques with three case studies, illustrating the practical applications of both bow-tie and sankey diagrams in the water sector, including water safety planning, project delivery framework improvement, and visualizing interlinks between risks in enterprise risk management systems.

## KEYWORDS

Bow-tie analysis, Sankey diagrams, risk visualisation

## INTRODUCTION

The water sector has risk management embedded throughout its activities. Risk assessments are conducted in areas including, water and sanitation plan, worker safety and to manage strategic risks. Risk management creates and protects value. An effective risk management process allows us to prioritize improvements in a resource constrained environment. While spreadsheets are commonly used for risk assessment, other tools such as bow-tie analysis can effectively capture risk information. Presenting risks visually improves risk communication and supports organization in understanding the effectiveness of their controls and the need for change.

## METHODS

This paper presents two methods to visually communicate risks: Bow-tie diagrams and Sankey diagrams.

### **Bow-tie diagrams**

Bow-Tie analysis is a graphical method that visually represents risk factors leading to an event (the knot) and the consequences of that event (the bow-tie wings). It provides a structured framework for analysing risks and barriers. Deficiencies in barrier effectiveness can be seen and improved as part of the risk management process. The method for building a bow-tie diagram is well documented and involves asking a structured set of questions in a logical sequence to build up the diagram step by step.

### **Sankey diagrams**

Sankey diagrams offer a valuable means of communicating risk by visualizing the distribution and potential consequences of various risk factors within a system or process. These diagrams can effectively depict the flow of risk probabilities or impacts, showing how different events or variables contribute to overall risk levels. By utilizing varying widths of interconnected lines or arrows, Sankey diagrams provide a clear and intuitive representation of the relative significance of each risk component. This visual approach allows stakeholders to identify critical risk pathways, prioritize mitigation efforts,

and make informed decisions to manage and reduce risk effectively. Sankey diagrams enhance risk communication by transforming complex data into a comprehensible and actionable format.

## **RESULTS AND DISCUSSION**

### **Case study 1 – Water Safety Plans**

Over the last decade, the author has completed hundreds of bow-tie diagrams through facilitating workshops as part of the development of water safety plans. The bow-ties examine the threats to water quality, the effectiveness of the barriers and actions to improve their effectiveness (see figure 1.1). The bow tie process:

- Encourages group participation and engagement
- Offers a graphical representation of hazards, causes, consequences, controls and control failures
- Enhances the transfer of operator knowledge during workshops, improving the assessment of controls and their failure
- Offer a versatile approach for recording hazards and hazardous events
- Illustrates hazard pathways and the presence (or absence) of multiple barriers, allowing for the evaluation of barrier effectiveness
- Can map with current documentation and procedures
- Produces outputs suitable for conveying risk information to a broad audience.

### **Case study 2 – Project Delivery Framework**

To support a water utility improve their project delivery framework, we utilised bow-tie. Workshop participants identified the existed controls, assessed whether they were sufficient or should be strengthened and whether additional barriers should be included. This analysis was then used as part of their digitalisation project to build the additional controls into the project delivery workflow.

### **Case study 3 – Visualizing interlinks between risks**

In a recent project developing an enterprise risk management system, we utilised Sankey diagrams to communicate the interconnectedness of risks. The diagram showed linkages between site visit observations, their risk domains and focus area impacts. The diagram highlights the issues of safety and asset planning and maintenance (Figure 1.2).

## **CONCLUSIONS**

We must ensure risks are not just assessed but managed. The utilization of visual tools, such as Bow-tie diagrams and Sankey diagrams support the sector in risk communication and understanding within this context.

The paper's case studies demonstrate the practical applications of these visual tools in throughout of the water sector. Bow-tie diagrams and Sankey diagrams foster active engagement, provide a clear graphical representation of risk elements and facilitate knowledge transfers. These visual tools empower organizations to identify critical risk pathways, evaluate the effectiveness of existing controls, and communicate risk information to a diverse audience. In an ever-evolving and complex environment, these visual risk communication tools are vital in ensuring the resilience and sustainability of water utilities.

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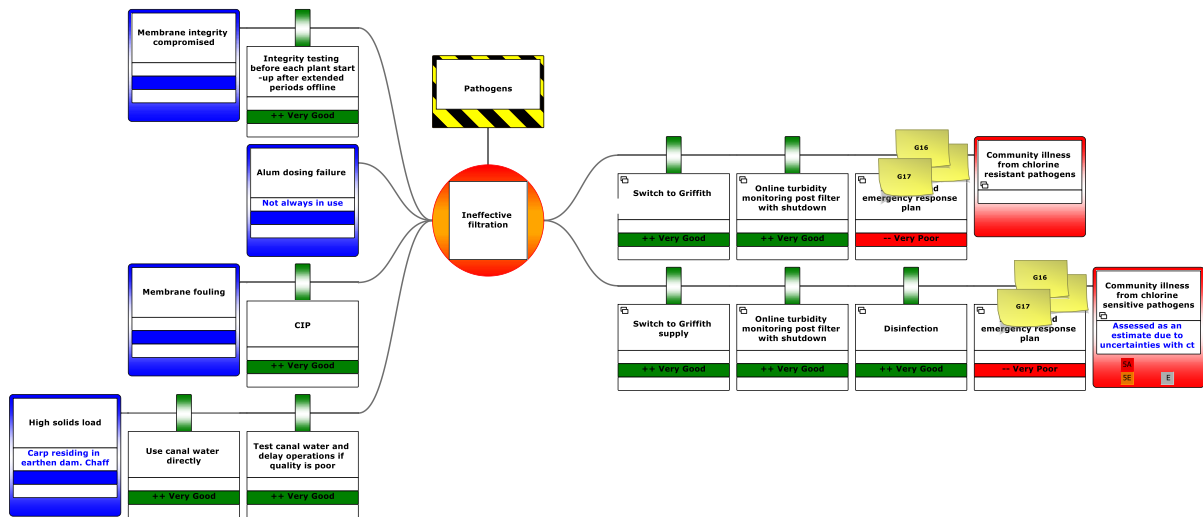


Figure 1.1 A bow-tie diagram for ineffective filtration

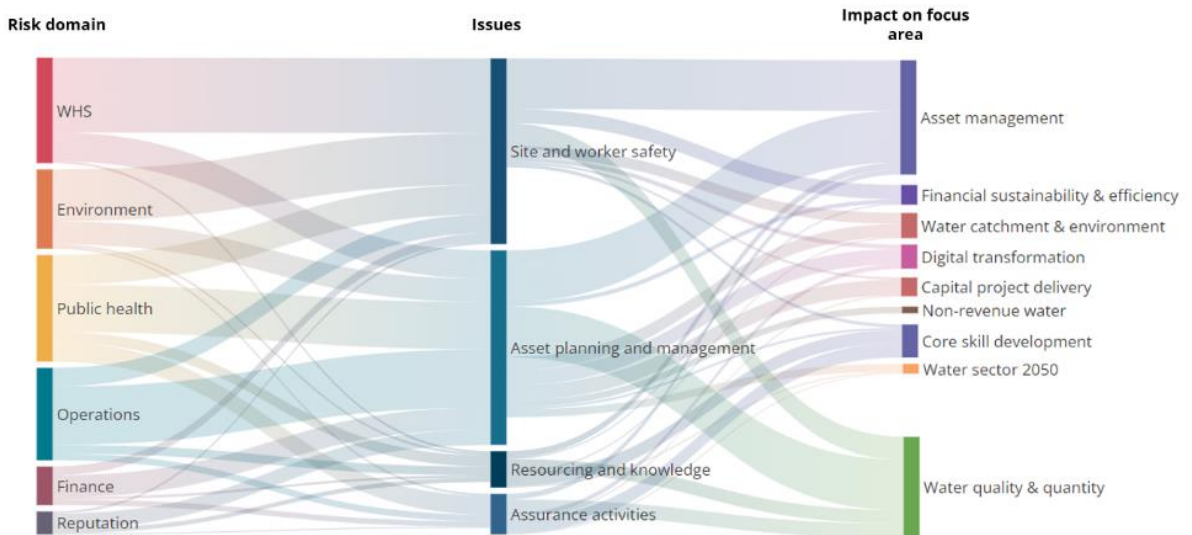


Figure 1.2 Relationship between site visit observations, their risk domains and focus area impacts