SYSTEM WIDE APPROACH TO MAPPING FIRST NATIONS VALUES

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KEYWORDS

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ABSTRACT

Sydney Water, in partnership with Aurecon, Nyikbar and Gadhungal Marring pioneered an innovative project integrating Aboriginal cultural values into water infrastructure planning to address the environmental, social and cultural impacts of wet weather overflow events from the wastewater network. This project developed a digital risk prioritisation model incorporating Aboriginal perspectives gathered through engagement with Aboriginal communities across Sydney Water's four largest coastal networks. Using a co-designed framework that respects Indigenous Cultural Intellectual Property, the project builds a sustainable methodology for embedding Aboriginal values into capital investment decisions, enhancing environmental management while fostering strong partnerships with Aboriginal communities.

INTRODUCTION

Many Aboriginal people consider water as a living entity, central to identity, spirituality, and custodianship. However, traditional water infrastructure risk assessments primarily focus on environmental and social impacts, often not considering Aboriginal cultural values which are deeply connected to Country, Sea Country and waterways. The Sydney Water Reconciliation Action Plan emphasises incorporating Aboriginal knowledge and Caring for Country principles into project planning. Sydney Water recognised this gap in the waterway value mapping for the Wet Weather Overflow Abatement (WWOA) Program. They sought to develop an approach that meaningfully incorporated Aboriginal knowledge into asset management and prioritisation of capital works.

The Aboriginal Cultural Values Mapping Project's (the project) purpose was to identify sites of cultural significance in proximity to waterways across Sydney Water's four largest coastal networks. This enables Sydney Water to prioritise investments that protect these sites from the impacts of wet weather overflows.

YEAR CASE STUDY WAS IMPLEMENTED

2023 to 2026

DISCUSSION

The issue

Sydney Water's wastewater network includes approximately 3,000 Emergency Relief Structures (ERS) designed to protect the system during wet weather. These structures allow excess wet weather flows to be discharged at designated locations, reducing the risk of uncontrolled spills elsewhere in the network. During rainfall events, ERS assets release flows into nearby waterways, with the frequency and volume of these discharges varying significantly across the system.

The key challenge is prioritising wastewater system investment to improve outcomes for Aboriginal people across Sydney. The performance of the wastewater network affects a diverse range of values areas. A consistent framework and methodology were required to understand and measure the value and risks of Aboriginal values and the impacts following overflow discharges from the wastewater system into the environment.

The problem

How do you consistently assess the risk of impact from wastewater system overflows on Aboriginal values across a city as large and diverse as Sydney?

Context

The Project faced a fundamental challenge: translating Aboriginal cultural values which are deeply personal, qualitative, and often shared through oral traditions, into a format compatible with Sydney Water's digital risk-prioritisation tool (refer to risk model section below), which depends on standardised, quantitative data. Existing risk frameworks used across the water industry do not comprehensively account for impacts on culturally significant Aboriginal sites. The need to protect Indigenous Cultural and Intellectual Property (ICIP) added further complexity, requiring careful control over how cultural information was handled, stored and shared.

The Project aimed to follow the existing risk prioritisation formula of **(cultural) value x impact = risk** (see Figure 1), through weaving Aboriginal knowledge into the approach. The project achieved this through co-design with Aboriginal knowledge holders across Sydney.

Designing a culturally safe and respectful engagement process was essential, particularly as the work required navigating technical discussions while ensuring diverse Aboriginal voices were meaningfully included. A major methodological hurdle involved finding a way to express intangible cultural significance into numerical terms without oversimplifying or misrepresenting meaning. The team also needed to establish a shared language and consistent data-collection approach that could be applied across the broader Sydney region, despite the inherently personal and context-specific nature of cultural values. Ultimately, integrating qualitative cultural insights into a quantitative risk framework required a careful balance between western risk-assessment logic and Aboriginal knowledge systems, ensuring both accuracy and cultural integrity.

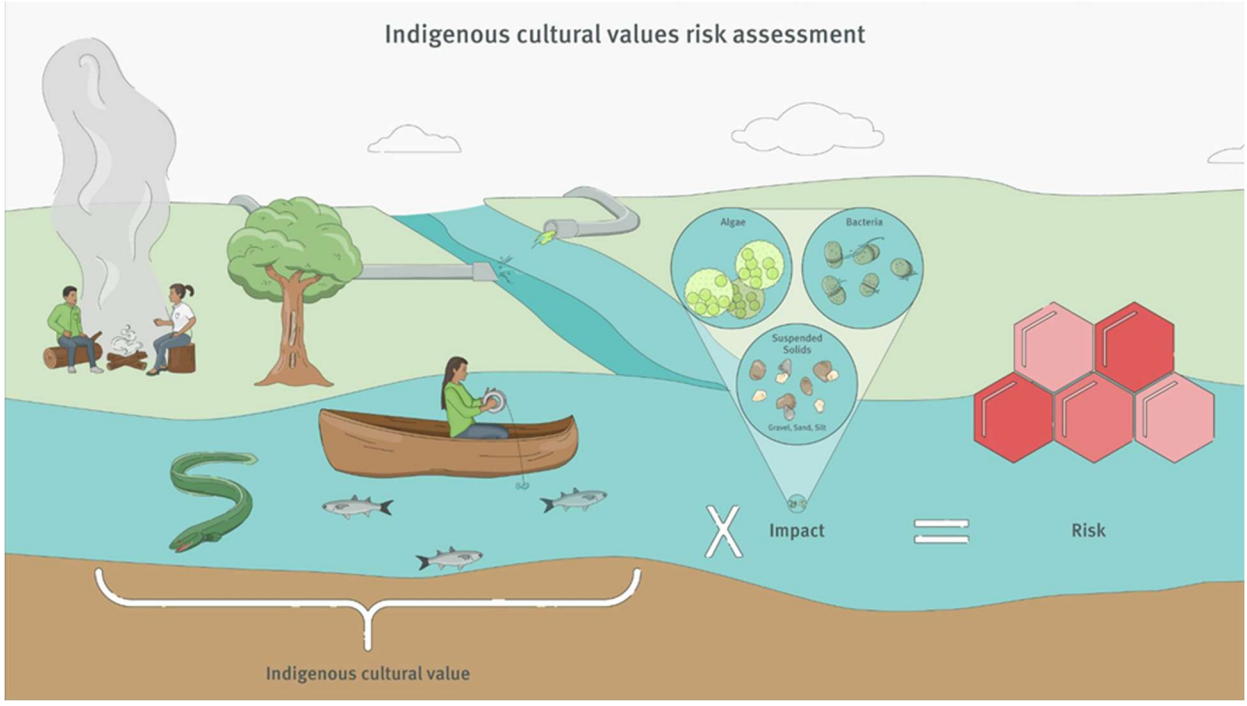

Figure 1: Risk assessment approach to assessing value and impact

Approach

This first-of-its-kind Project required a bespoke approach to align with the complex technical requirements. As a result, engagement occurred in two phases.

Phase one: the pilot phase (March 2024 to March 2025)where Sydney Water co-developed the approach and methodology for defining cultural values with a small group of Aboriginal Knowledge Holders (La Perouse Local Aboriginal Land Council (LALC), the Gamay Rangers, Traditional Owners and community) to ensure data and outcomes aligned with project requirements and an updated digital risk prioritisation model.

Phase two (April 2025 to April 2026) took lessons learned from phase one and engaged with a broader range of Aboriginal knowledge holders across the study area to identify sites of significance, define impact measures and develop the risk prioritisation approach.

Community input was central to managing engagement consent, data protection protocols, and the fair remuneration of participants, building trust and ensuring ethical conduct.

Engagement

At project initiation, Sydney Water undertook a literature review to understand relevant legislation and help shape the guiding principles by deepening the team's understanding of Aboriginal values associated with water. It highlighted that "Country is experienced and understood through the senses and seared into memory" (O'Brien 2011). In line with this, the project team sought to use Aboriginal methodologies to understand cultural values and build strong partnerships. Methods included yarning, cultural listening, and Walking on Country during a workshop in which community and stakeholders shared stories regarding fishing, childhood and connection to and wellness of Country.

Figure 2: Cultural values mapping workshop with Aunty Jeanie (left), walk on Country (middle), cultural values mapping workshop with Deerubbin LALC (right)

Engagement approach

Aboriginal-owned sub-consultancies, Nyikbar and Gadhungal Marring, provided culturally appropriate advice on the approach, connections with community members and stakeholders, engagement methods and other project aspects, ensuring the project was Aboriginal-led.

Engagement was also based on the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) Principles for Engagement ensuring ethical, culturally informed and competent, meaningful, and impact focused engagement.

Other guiding engagement principles included:

- **Self-determination and Aboriginal-led**: Aboriginal stakeholders had a central role in shaping engagement processes and project outcomes, ensuring Aboriginal voices drove decision-making.
- **Cultural safety and respect**: Engagement honoured Aboriginal cultural protocols, histories, and knowledge systems, creating a safe and inclusive space for participation.
- **Two-wWay knowledge sharing**: Where possible, Sydney Water sought to share knowledge, findings and answer stakeholder questions. All sites recorded were also provided back to the individual, community and stakeholder group in a usable digital format for their own record. Data was not shared between groups.
- **Long-term relationships**: Engagement was based on trust, transparency, and ongoing relationships rather than one-off consultations, ensuring meaningful and lasting outcomes.
- **Responsivity and appropriateness**: Aboriginal stakeholders received timely and culturally sensitive information, with a dedicated contact for enquiries. All stakeholders were engaged through clear, consistent, and transparent communication.

Defining cultural values

The project focused on establishing a defendable, repeatable and culturally grounded method for defining and mapping Aboriginal cultural values. To address the technical complexity of integrating cultural significance into

the digital risk prioritisation tool, the team developed a clear set of criteria: standardisation across different stakeholder groups, a shared and unbiased language, and a method for converting qualitative cultural knowledge into a consistent numerical value. These criteria aligned with challenges identified in technical documentation, which underscored the difficulty of representing intangible cultural significance without oversimplification.

Engagement and co-design with La Perouse LALC and the Gamay Rangers played a central role in addressing these challenges and criteria. Defining cultural values was determined through adapting the work of Dr Danièle Hromek's '*Aboriginal Cultural Values – An Approach for Engaging with Country'* (2020) and Victor Steffensen's *'Fire Country: How Aboriginal Fire Management Could Help Save Australia'* (2020), which were identfiied during the literature review.

This work was adapted to produce the project's **Connecting with Country Framework** (CwC Framework) (see Figure 5). The CwC Framework categorises cultural values into physical, human and sacred realms, includes an outer set of 'petals' used to assign numerical values. Through engagement, a further 24 petals were added, shaping the model to reflect project needs and community values. A definitions list, co-developed and endorsed by the Gamay Rangers, ensured consistency in language and interpretation. The CwC Framework provided a shared language and standardised criteria to evaluate cultural significance across diverse community inputs.

Culturally appropriate engagement methods, including yarning circles, storytelling, and Walking on Country, ensured Aboriginal knowledge systems guided the development of a numeric scoring system. Participants identified culturally significant places by marking story locations on maps, then collaboratively assigning value assigning the applicable CwC Framework petals. This 'yarn–draw–count' provided each story with a numerical value. For instance, a stakeholder group might share a story about mullet fishing, explaining its significance as a vital food source, a cultural practice, and an activity they are actively working to preserve.

The project team would invite participants to mark on printed maps where this practice takes place across the waterways. They would then discuss which CwC Framework petals the story aligns with. Because mullet is an animal, the *fauna* petal is counted, alongside *food*, *cultural practice*, and *revival and preservation* (see Figure 5). Together, these four petals produce a value score of 4, which is then applied within the formula **value (4) × impact = risk**.

Direct engagement with Aboriginal knowledege holders was the primary source for identifying sites of cultural values. Additional datasets were also incorporated to ensure a comprehensive cultural values layer: Aboriginal Heritage Information Management System (AHIMS) records (assigned a consistent baseline value), Declared Aboriginal Places (DAP) and recommended sources, such as La Perouse LALC's '*Sea Country Plan'*.

The methodology incorporated ICIP governance, co-developed with stakeholders, to safeguard sensitive information and uphold Aboriginal self-determination. The integration of Aboriginal perspectives into Sydney Water's GIS-based digital risk prioritisation model bridged scientific data and Aboriginal knowledge.

Engagement outcomes

Across the project we:

- Met with **11** stakeholder groups
- Met with **65** stakeholders
- Held more than **30** meetings and workshops held
- Attended **5** Walks on Country
- High value water-related sites identified through engagement: more than **190**
    - Total values identified: approximately **3700**
- Additional petals added to the CwC Framework: **24**

Defining impact measures

The team developed impact measures associated with cultural values. Proposed impact measures were determined by the 'Environmental Values and Uses' of each of the petals outlined on the CwC Framework. Each environmental value and use are linked to an 'Indicator' and 'Numerical Criteria' (or impact measure) which may impact the cultural value. For example, the Environmental Values and Uses of the CwC Framework petal 'Food' is aquaculture food.

This approach was tested with LALCs and Aboriginal knowledge holders who provided feedback on the approach (see Figure 3). The approach included using existing government sources for defining water quality impact measures to define impact measures to sites of values.

Figure 3: An impact workshop with Deerubin LALC following a walk on Country

As shown in Figure 1, cultural numerical value and the impact numerical score are multipled together in a formula of **value x impact = risk**. This is depicted geospatially on the risk prioritisation tool in the form of hexagonal data bins (hexagon), which provide a simplified visual representation of data consolidation to outline areas of high value or impact (see Figure 4). This process also enables the de-identification of ICIP, including site locations, descriptions and the relevant CwC Framework values or petals assigned. This ensures the formula output can be safely shared with external project stakeholders.

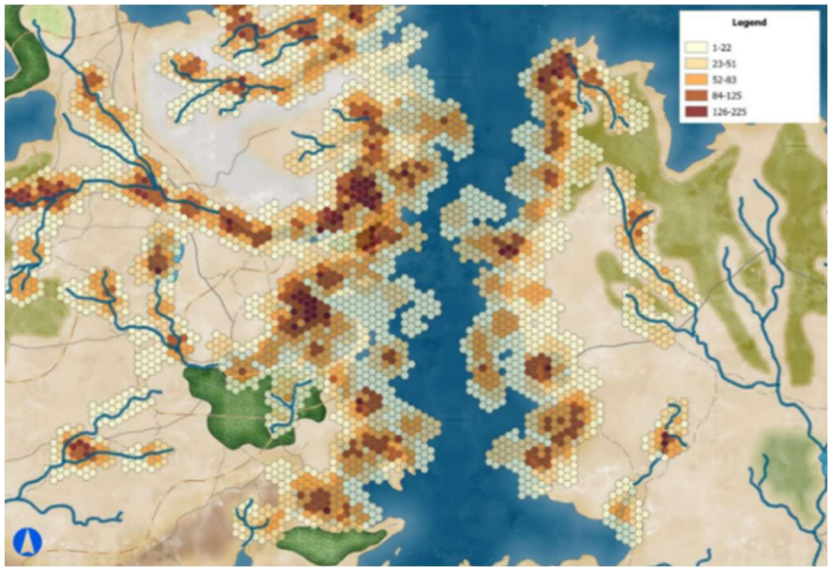

Figure 4: Visual outcome of the mapping, greater value areas denote by darker hexagons

Risk model

A geospatial, data-centric risk-based approach tool was developed. The tool incorporates a multitude of datasets and complex spatial algorithms to present the level of comparative risk of impact for every asset, from an Aboriginal perspective. The model shifts the focus from the individual asset to the receiving environment, ensuring that the investment has the greatest possible benefit to the health of Country.

Pressure – state – response

The risk-based prioritisation methodology aligns with the pressure–state–response (PSR) model, developed in the 1970s, that assumes a certain stress or pressure on a system is followed by an appropriate response ('stress–response' model). It provides a good basis for the explanation of environmental issues.
'**Pressure**' means the impacts that human activities have on their immediate environment and their natural surroundings. '**State**' is defined as the current and projected state (or condition) of the environment. '**Response**' refers to the response adopted to address the pressures on the environment (NSW Government, 1999).

The NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) apply the **Pressure–State–Response (PSR)** framework to guide environmental assessment and decision-making. This prioritisation methodology has adopted the approach as follows:

- **Pressure** from stormwater runoff and wastewater overflows is implicit in source data that define the state of waterway health

- **State** of waterway health is indicated by the likelihood and consequence of poor water quality events resulting from stormwater and wastewater inputs and the potential impact of that water quality on Aborginal values
- **Responses** to poor water quality will be prioritised at overflow points that have a greater contribution to ecological and/or community value impacts.

Risk prioritisation The compariteve risk assessment is based on the 'Likelihood' and 'Consequence' of an event occurring, which has been defined as:

- **Likelihood:** the chance of poor water quality that does not support public health or ecosystem health objectives
- **Consequence**: the extent or scale of potential water quality impacts on Aborginal values

The key steps in the risk allocation and categorisation process are:

1. Determine the risk of impact at each Aboriginal sensitive receptor following the likelihood x consequence approach described.
2. Assign a risk of impact value to each sensitive receptor, which is an absolute number defined by the source data used in the likelihood and consequence assessments.
3. Determine which overflow points may be causing the risk of impact to the sensitive receptor based on velocity of flow in the waterway and distance of the overflow point from the sensitive rectors.
4. Allocate the risk of impact from each sensitive receptor to each overflow point based on the relative distance between them, compared to all other overflow points, and severity of the wet weather overflows.
5. Sum the risk of impact allocated to an overflow point from all potentially impacted sensitive receptors to determine a cumulative risk score.
6. Allocate a risk category based on the relative cumulative risk score in comparison to all other overflow points in the study area.

Indigenous Cultural Intellectual Property

Indigenous Cultural Intellectual Property (ICIP) was central to the project. ICIP protections were co-designed with participants from the outset, ensuring requirements were defined together through consent agreements and ongoing dialogue throughout workshops and meetings. This approach recognised community authority over cultural knowledge and ensured ICIP protocols reflected the needs and expectations of each Knowledge Holder group.

The CwC framework supported cultural safety by enabling values-based scoring that does not require disclosure of sensitive ICIP. Participants could describe concepts, significance or themes without sharing restricted knowledge, ensuring cultural integrity while still allowing cultural values to shape planning outcomes.

ICIP was also embedded into the digital risk prioritisation tool through de-identification, sensitivity settings and data-access controls, allowing cultural values to inform decision-making without exposing specific sites or stories that communities wished to protect.

Challenges

The project encountered a range of methodological, cultural and operational challenges that shaped both the pace and the design of the work. One of the most significant challenges involved finding a credible and respectful way to integrate Aboriginal cultural and spiritual significance into a technical framework used for risk assessment. Existing datasets such as AHIMS were not sufficient for this purpose because they primarily document physical or archaeological sites rather than the spiritual, cultural or lived experience values that Knowledge Holders contribute. This meant that desktop research could not form the basis of the assessment and that direct engagement with Elders, Traditional Owners and community Knowledge Holders was essential for collecting meaningful and culturally grounded information. This meant that desktop research could not form the basis of the assessment and that direct engagement with Elders, Traditional Owners and community Knowledge Holders was essential for collecting meaningful and culturally grounded information.

Another major challenge related to the variability in stakeholder availability and capacity across different LALCs and community groups. Some LALCs were managing internal pressures or limited capacity, which reduced the consistency of their participation. In several cases, this meant shifting the engagement approach from LALC-led processes to broader community-focused conversations in order to maintain momentum. These dynamics required a flexible and adaptive method, as well as additional time to build rapport and establish conditions that supported culturally safe participation. LALC led processes to broader community focused

conversations in order to maintain momentum. These dynamics required a flexible and adaptive method, as well as additional time to build rapport and establish conditions that supported culturally safe participation.

The project team also created and promoted an Expression of Interest (EOI) process to reach a wider range of Knowledge Holders and ensure diverse representation. The EOI was advertised through *Koori Mail*, a fortnightly national Indigenous newspaper, and radio, but it did not receive any responses. This suggested that open invitations alone were not enough to generate engagement and that trust-based, relationship-driven outreach remained the most effective approach. The lack of responses reinforced the need to rely on existing networks and targeted contact rather than expecting community members to opt in through formal channels.

Protecting ICIP added another layer of complexity. The Project required clear consent processes, agreed protocols and careful handling of sensitive information. These considerations shaped the structure of engagement and the pace of data collection. Operational issues also emerged, including instances where delays in payment to Knowledge Holders risked damaging trust. Ensuring prompt payment became essential to maintaining culturally safe practice, particularly given the historic and ongoing experiences many Aboriginal stakeholders have had with government and institutional processes.

Lessons learnt

Several lessons emerged that will be useful for future work, such as using Aboriginal consultants to assist with engagement and workshops. Aboriginal leadership and meaningful partnership from the outset were essential for establishing credibility, trust, and cultural safety. The iterative co-design process demonstrated the need for careful translation between quantitative scientific frameworks and nuanced, qualitative Aboriginal knowledge to avoid oversimplification or misrepresentation of cultural significance. Protecting ICIP was not only ethically imperative but also foundational to building trust and enabling ongoing collaboration. Maintaining consistent participation from key stakeholders minimised the time spent revisiting project context, reducing fatigue and improving efficiency. Lastly, expanding engagement beyond formal Aboriginal governance bodies to include a broader range of community members ensured that a greater number of voices were heard, strengthening the cultural depth and representativeness of the insights gathered.

CONCLUSION

The Aboriginal Cultural Values Mapping Project has demonstrated that Aboriginal knowledge can be meaningfully embedded into Sydney Water's technical planning systems, reshaping how risk, significance and cultural connection are understood in wastewater infrastructure planning. Through extensive engagement – including 11 meetings with stakeholder groups, 65 stakeholder interactions, 28 meetings and workshops, five Walks on Country, a Traditional Owner meeting and four online sessions with the Gamay Rangers- the project identified 176 high value water related sites and a total of 3,636 cultural values across the region. These insights, along with DAP and AHIMs now form a strengthened and comprehensive cultural values layer within the digital risk prioritisation model.

The project's impacts extended well beyond data collection. Community feedback also refined the CwC Framework, such as adding 'Trade', and informed ICIP protocols, ensuring culturally sensitive information remains appropriately protected.

Two-way knowledge transfer was central. While Sydney Water gained access to cultural insights, community and stakeholders received a Google Earth file (.kmz) of their information to store and share site information, strengthening capacity for future projects and reducing repetitive consultation. During workshops, the Project team also allowed time for open discussions and to answer questions related to Sydney Water and the wet weather network.

By bringing Aboriginal Knowledge Systems together with scientific modelling, the project has enhanced environmental sustainability, strengthened cultural continuity and established a baseline for tracking changes in cultural value over time.

Ultimately, the project has set a new standard for approaching prioritisation of large-scale water infrastructure investments that respectfully includes Aboriginal Values. By honouring Country and elevating community voices, the project will help reduce pollution from wet weather overflows which will contribute to improved Aboriginal cultural, environmental and social values.

ACKNOWLEDGMENTS

We acknowledge the Traditional Owners of the many Countries across Sydney where this project took place and pay our respects to Elders past and present. We thank the Aboriginal Knowledge Holders, community members, Local Aboriginal Land Councils and partners whose cultural knowledge, stories and deep

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Figure 5: Connecting with Country Framework (CwC Framework)