BUILDING
INNOVATION
PARTNERSHIP

# Code of Practice for Three Waters Asset Data

## Part 1 – Development Context and Philosophy

Quake Centre
Delivering Industry Solutions

**Table 1: List of versions and modifications made in Part-1 (Development context and Philosophy) of COP for 3 Waters Asset Data**

| Version | Date | Prepared/Modified by | Approved by | Brief Description of Changes |
|---|---|---|---|---|
| 1.0. | 13/02/20 | Pulith Kapugama / James Thorne / Purvi Pancholy | Greg Preston | |
| 2.0. | 24/07/20 | James Thorne / Purvi Pancholy / Rachel Buer | Greg Preston | Added water supply and wastewater assets. New attribute tables and full document revision |
| | | | | |
| | | | | |

# Contents


## 1 Part 1 – Development context and philosophy ..... 1

1.1 Introduction ..... 1
1.2 Background ..... 1
1.3 Scope and coverage ..... 1
1.4 Objectives ..... 2
1.5 Relationship with the NZAMS ..... 3
1.6 CoP use philosophy ..... 4
1.7 Exclusions ..... 5
1.8 Technical specification ..... 5
1.9 Asset and activities coverage ..... 6
1.10 As-constructed data generation and collection ..... 6
1.11 Data collection rationale ..... 6
1.12 Complex asset ..... 7
1.13 Alignment with other data standards in New Zealand ..... 11
1.14 Changes from the NZAMS ..... 11
1.15 Data vs metadata ..... 14
1.16 Future work ..... 14
1.17 References ..... 16

Table 1: List of versions and modifications made in Part-1 (Development context and Philosophy) of COP for 3 Waters Asset Data ..... 3
Table 1-1 : CoP asset class coverage ..... 1
Table 1-3 Examples of complex asset attributes ..... 8
Table 1-4 Future work stages ..... 14
Table 1-5 Data elements to include in future ..... 15

Figure 1-1 Code of practice as a common foundation ..... 3
Figure 1-2 Data journey ..... 7
Figure 1-3 Waka Kotahi NZ Transport Agency complex asset schematic ..... 10

# 1 Part 1 – Development context and philosophy

## 1.1 Introduction

Part 1 of the Code of Practice for Three Waters Asset Data (CoP) explains the development context of the CoP, the philosophy, purpose and intended use of the CoP, and its relationship to the New Zealand Asset Metadata Standards (NZAMS).

## 1.2 Background

The provision of three waters services is critical for the efficient and safe functioning of all communities in New Zealand. Collecting, maintaining and using data about the assets that deliver these services is vital to ensuring that appropriate levels of service are delivered.

The New Zealand Asset Metadata Standards (NZAMS) were developed in 2016-17 to standardise the collection and recording of three waters assets data. Since publication, some organisations have implemented the NZAMS to varying degrees in terms of asset coverage and data coverage for each asset. There has not, however, been a significant industry-wide uptake in usage of the NZAMS.

## 1.3 Scope and coverage

The CoP provides guidance for the collection of core as-constructed data for selected conveyance assets within a water supply, wastewater and stormwater network.

The asset classes covered within the CoP are presented in Table 1-1. At this stage of the CoP development, the asset classes exclude those assets found on treatment plant and pump station sites.

**Table 1-1 : CoP asset class coverage**

| CoP asset class | Related NZAMS asset class |
|---|---|
| Pipe | Pipe, Siphon and vacuum systems |
| Chamber | Access chamber |
| Valve | Valve |
| Fitting | Fitting |
| Water meter | Instrument |
| Headwall | Wing wall |
| Retention structure | Retaining structure |

| CoP asset class | Related NZAMS asset class |
|---|---|
| Channel | Channel |

The following NZAMS asset classes are not covered in the CoP:

- *Containment structure*
- *Embankment*
- *Support structure*
- *Tunnel*
- *Conduit*
- *Pump station site*
- *Mechanical equipment*
- *Pump*
- *Cabling*
- *Equipment*
- *Instrument (only water meters are covered in the CoP)*
- *Well*
- *Node*
- *Cathodic protection*
- *Electrical equipment*

## 1.4 Objectives

The objectives of the CoP are to:

- Present a minimum viable standard for data collection for core as-constructed data.
- Present asset classes, attributes and code lists that are specific and workable for 3 waters assets.
- Provide a standard asset data format, language, and definition.
- Provide a common foundation for sharing and translating asset data.
- Clarify implementation of the NZAMS.
- Simplify implementation of the NZAMS.

The objective of providing a common foundation is presented in Figure 1-1 below:

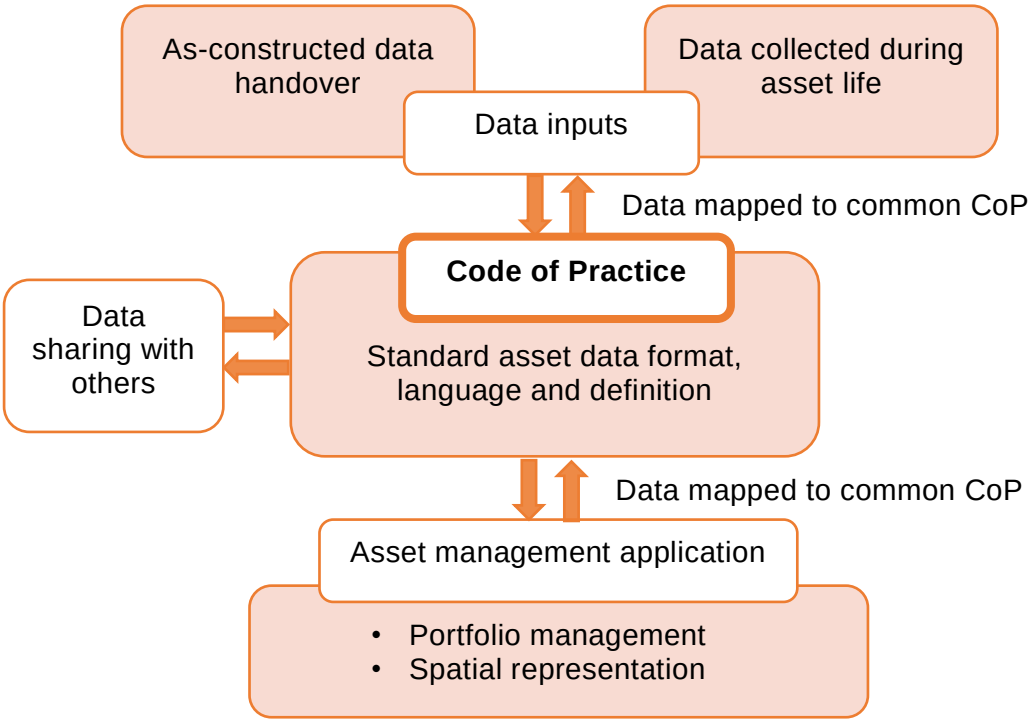


**Figure 1-1 Code of practice as a common foundation**

## 1.5 Relationship with the NZAMS

The CoP follows on from the NZAMS and addresses feedback provided by the industry. The NZAMS is a suite of documents covering different classes of asset portfolio and different data types, referred to as “Volumes”. The CoP specifically relates to:

NZAMS – Stormwater, Volume 1 As-constructed / As-built

NZAMS – Potable Water, Volume 1 As-constructed / As-built

NZAMS – Wastewater, Volume 1 As-constructed / As-built

The CoP should be referred to in conjunction with these three NZAMS Volume 1 documents. The relationship between the CoP and NZAMS is described below:

- The CoP specifically relates to the NZAMS Volume 1 documents. Familiarity with the NZAMS Volume 1 documents will be highly beneficial to effective usage of the CoP.
- The NZAMS Volume 2 documents describe the decision elements for making evidence-based investment decisions. The CoP does not provide guidance on decision elements. However, some as-constructed data within the scope of the CoP is also useful for decision elements as per the NZAMS Volume 2.

- The CoP condenses the guidance within the three separate waters (stormwater, potable water, wastewater) NZAMS Volume 1 documents into one place.
- The CoP assist users to better understand and implement the guidance provided in the NZAMS.
- Select definitions are provided to help clarify the meaning of asset classes and attributes.
- Select attribute tables are provided which supersede the data tables provided in the NZAMS.
- Select code lists are provided which supersede the code lists provided in the NZAMS.
- Guidance is provided on the measurement of selected data attributes (e.g. appropriate locations to measure geometry and level information).

The primary focus of the CoP is to provide greater clarity and consistency to allow collected data attributes to be mapped to a common data standard. NZAMS attribute tables presented a mix of attributes, metadata and technical specifications. Feedback on these tables indicated that inclusion of certain technical specifications made implementation prohibitively onerous. This CoP presents attribute tables in a simplified form, with technical specification elements significantly removed.

## 1.6 CoP use philosophy

- The CoP is in four parts:
  - Part 1 – Development context and philosophy
  - Part 2 – Implementation
  - Part 3 – Attribute tables
  - Part 4 – Working attribute tables.
- Part 3 of the CoP presents a list of data attributes for each asset class:
  - The list of attributes covers data attributes typically collected for an asset class.
  - The philosophy of the attribute tables and code lists broadly follows the 80/20 rule where just 20% of all available data is needed to provide 80% of the value for decision-making.
  - The lists distinguish where attribute data is deemed primary or secondary in nature. The primary data can be considered a core list of essential attribute data necessary to manage the asset portfolio.
  - The organisation should ultimately determine which attributes are required for collection to fulfil legislative requirements and business needs.
  - Additional attributes can be collected by organisations if desired.
  - Over time it is intended that the attribute tables are updated along with the CoP to ensure that collected data is justified according to the value added, and taking into account new data requirements.
  - Data attributes may serve as a prompt for organisations to collect data they would otherwise not have collected.
- Only attributes that are of use/future use to the organisation should be collected:

    - Data should be collected if it helps deliver levels of service or fulfils legislative requirements.
    - The CoP does not provide guidance on tailoring data capture based on asset criticality. Organisations may consider applying different data collection requirements depending on the importance of each asset, e.g. more data collected for assets with a high consequence of failure.
- Code lists are provided to force standard terminology for select data attribute fields.
- Validation rules are provided as criteria for ensuring correct data entry.
- The attribute lists and code lists are provided digitally (Excel and XSD format) to be easily compatible with data systems and software.
- The guidance provided in the CoP is system agnostic.
- Compliance with the data standard is recommended but not mandatory. The adoption of the standard will allow greater consistency of data.
- Organisations can adopt the CoP in stages beginning with particular asset classes only.
- As a minimum, the CoP allows organisations to transfer and share data in a common format. It also provides a basis for assessing the quality of an organisations data and informing data improvement programmes as necessary.

## 1.7 Exclusions

- The CoP does not propose a specific asset hierarchy with parent/child asset classes. Organisations can maintain their asset class hierarchy if desired by populating the related complex or component asset fields.
- The CoP does not specify business rules. Business rules stipulate what data to collect, frequency of collection, what personnel to use, etc. The guidance offers flexibility to enable organisations to implement their own business rules.
- The CoP does not compel owner organisations to make data available to other organisations. It is up to individual organisations to decide whether to share data based on their perception of the risks/benefits of data sharing.
- Classification systems such as Uniclass are considered independent of the CoP classification systems.
- Field survey or BIM quality spatial asset data specification is excluded. Some spatial definitions and level information pickup schematics are provided to ensure a core level of consistency.

## 1.8 Technical specification

The CoP provides a minimum viable standard to achieve consistency in the following elements:

- Asset classes
- Attribute names
- Attribute definitions
- Attribute values (specifically through the provided code lists)
- Units of measure

- Data types
- Consistency in physical measurement collection.

## 1.9 Asset and activities coverage

In most three waters networks, economic value is largely comprised of the "horizontal" infrastructure, i.e. the pipes and chambers dispersed over a large area. The CoP focusses guidance on the collection of data for these horizontal infrastructure assets.

"Vertical" infrastructure assets, such as elements included within buildings and on treatment and pumping station sites, could be included in future revisions of the CoP. These vertical infrastructure assets can be more specialist in nature and have different asset data requirements. Section 1.16 Future work includes extending the CoP to include vertical assets as part of developing advanced technical specifications in future.

## 1.10 As-constructed data generation and collection

Data is generated when an event is undertaken on or to an asset. An event can be any activity or undertaking that is completed in the management of the asset.

Data is collected by the actors who undertake the event. Data is collected from actual observations, measurements and design documentation. Data excludes interpolations and modelling outputs.

The initial data generated for an asset is typically as-constructed data. As-constructed data is considered to originate from handover of an asset from the contractor to the owner, but those same physical attributes can also be collected from events undertaken on the asset throughout its life.

Each event allows the collection of different data attributes. Guidance is provided on the different data attributes that can be collected for the events listed below (Refer to CoP Part 2 – Implementation):

- Asset handover
- Closed-circuit television (CCTV) video
- Repair

## 1.11 Data collection rationale

Data is only collected when it is useful to the organisation. The usefulness of data is generally related to the following:

- Fulfilling legislative requirements
- Making decisions to deliver levels of service in a cost-effective manner.

These two reasons should be considered when determining whether a particular data attribute should be collected. Where data does not serve these purposes, there may be justification to stop collecting data and managing that data within a database. This is particularly true for data that is used infrequently, not used at an

asset portfolio level, and/or can easily be retrieved from other sources such as electronic drawings or inexpensive field inspection.

Figure 1-2 below illustrates how three core aspects can be considered together as a rationale for collecting data. This shows the **When** (which event is a good time to collect data), the **What** (which attributes are collected, and in which format), and the **Why** (how the data will be used).

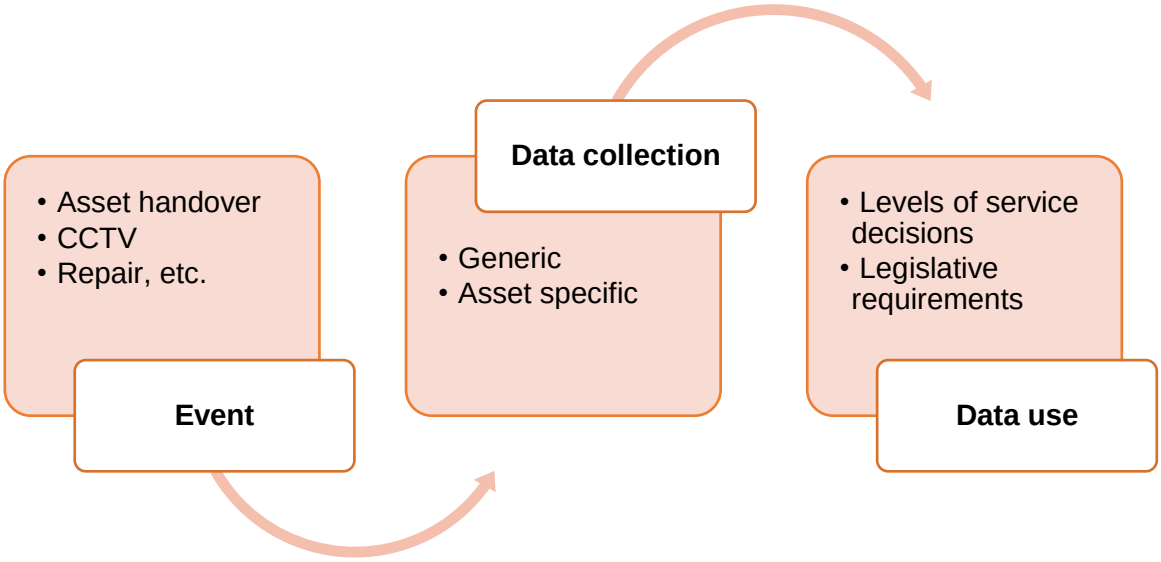


**Figure 1-2 Data journey**

The attribute tables within the CoP provide a list of data to be collected based on this rationale. The intent is that they provide a useful starting point for determining core data collection requirements.

Attributes have been categorised with a collection priority of either primary or secondary.

- Primary priority represents essential data
- Secondary priority represents non-essential but high valuable data.

Collection priority is categorised further according to how useful the data is to support different types of decision-making. The categories are:

- Portfolio asset management - how useful the data is when used at a portfolio level to inform asset management decisions across the whole network
- Spatial representation - how useful the data is for users of GIS platforms.

## 1.12 Complex asset

It is usual for asset classes to have some hierarchy where smaller assets are considered as components of larger assets. The CoP intentionally excludes asset hierarchy since different organisations typically have their own approach.

Instead of defining an asset hierarchy, the CoP provides an attribute field to capture links between complex assets and their components.

A complex asset is defined as an asset made up of components considered to be separate assets (component assets) and which are linked to the complex asset in the organisation's asset management system.

A complex asset will have attributes that are unique to the asset and collected at the complex asset level. Data attributes on component assets are collected at component asset level.

The link between the complex asset and the component asset can be collected as an attribute of each asset. Establishing a link between the complex asset and the component asset allows the functional asset hierarchy to be preserved without forcing the CoP to adopt a particular hierarchy.

Examples of complex assets and component assets are presented in Table 1-2.

**Table 1-2 Examples of complex asset attributes**

| Complex asset | Examples of attributes collected at complex asset level | Component asset | Examples of attributes collected at component asset level |
|---|---|---|---|
| **Retention structure (pond)** | ▪ Unique ID<br>▪ Storage volume<br>▪ Lining material | Chamber (manhole) | ▪ Unique ID<br>▪ Invert level<br>▪ Related complex asset ID |

The link between complex assets and component assets can be described/codified based on the organisation's requirements. An example of a complex asset/component asset relationship is presented in Case Study 1.

## Case Study 1 – Waka Kotahi NZ Transport Agency Maintenance Managed Asset

The maintenance and operations part of the asset lifecycle has the most detailed information needs, therefore the level of data aggregation required to manage an asset is targeted at these needs and is termed the 'Maintenance Managed Asset' (MMA). MMA refers to the level at which the asset unique identifier is assigned, and work orders should be recorded. The key consideration is the level at which the various elements and components making up this asset, and the level at which the asset can be meaningfully managed from a maintenance perspective, to be able to:

- Manage the lifecycle of maintainable units (equipment – 'maintenance managed items'), not components or parts.
- Understand and mitigate against failure and/or replace or repair an element or component.
- Maintain or repair an asset by replacing a component or part.

This MMA approach should not be confused with the financial management definition, where the lowest recorded unit is often defined using a limit on the monetary value of assets. Financial reporting is a separate concept, defined by a virtual 'Area', and distinct from the necessary level of data aggregation to manage the lifecycle of an asset.

Elements or components of an asset may have a critical part to play in the operation and maintenance of other assets. Therefore, they may be managed as a separate and discrete asset, simultaneously as an asset and an element of a larger asset. This will be managed through attributes and relationship elements/descriptors.

The Waka Kotahi NZ Transport Agency Asset Management Data Standard (AMDS) uses an asset–component model to manage complex assets. The link between the asset and component is codified using relationships.

Components are sub-entities, or objects, collectively serving a common purpose. They are the main parts of a structure such as a bridge (e.g. foundations, piers, deck) and can be managed or represented as independent assets or as parts that together represent an asset.

Sub-components are where a component is further broken down within this model. For example, this is the asset entity as a component set:

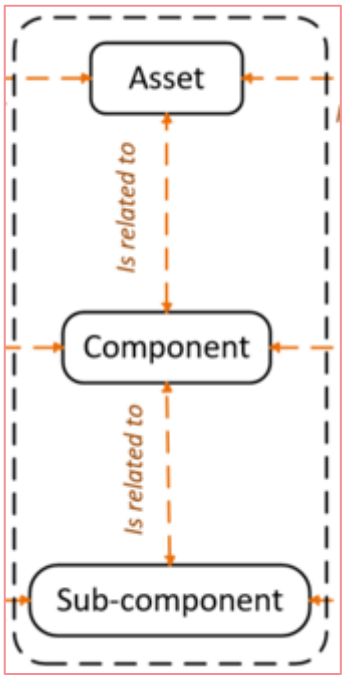


**Figure 1-3 Waka Kotahi NZ Transport Agency complex asset schematic**

The Waka Kotahi AMDS uses relationship elements to link assets. Relationships can be described and codified using business rules such as:

- Is a component of
- Is located by
- Is supported by
- Is controlled by
- Contributes to (asset to service aspect)
- Operates within zone (in NOC x, in council area y, in regional council area z, etc.).

## 1.13 Alignment with other data standards in New Zealand

This CoP was developed to meet the needs of the water sector in line with data management best practice. Other sectors in the infrastructure industry have also developed or are in the process of developing data standards. The application of data management best practice means there will be a high level of compatibility between standards. However, achieving total compatibility may require data collection processes that are not required for the entire water industry. In such cases, the organisation can choose which measures to adopt in order to achieve compatibility with other sectors in the infrastructure industry.

### Case Study 2 – Waka Kotahi NZ Transport Agency Asset Management Data Standard

The Waka Kotahi NZ Transport Agency AMDS presents an entity-based data model, design parameters and technical specifications. The CoP does not explicitly specify a data model; however, the attributes can be mapped to the Waka Kotahi NZ Transport Agency entities.

| Waka Kotahi NZ Transport Agency entity | NZAMS attribute |
|---|---|
| Asset | Unique identifier<br>Status<br>Pipe material |
| Role | Owner |
| Actor | Name of contractor who constructed the asset |
| Event | Asset handover<br>CCTV<br>Renewal |
| Zone | Operational management area |
| Location | Recorded spatially |

The technical specification provided in the Waka Kotahi NZ Transport Agency AMDS differs from the NZAMS. In such cases, the organisation can select which data specification to adopt. The attribute list and collection procedures listed in the NZAMS will provide the basis for data collection. Refer to Section 1.15 Data vs Metadata, for more information on technical specifications.

## 1.14 Changes from the NZAMS

This section describes the changes made from the NZAMS and the reasoning for them. The changes were made following consultation with industry.

## Combine three separate asset standards into a single standard

The NZAMS provided a separate standard for each of the three waters, whereas the CoP combines all three waters into a single standard. The type of service an asset provides (i.e. stormwater, potable water, or wastewater) is collected as an attribute.

## Remove repetition of generic asset attributes

Generic attributes are those attributes that can be collected for any asset class. In the NZAMS, the generic attributes were repeated in the attribute table for each asset class. This repetition adds to the length of the document and reduces the NZAMS's usability. In the CoP, the generic data attributes are presented in a separate table and are not repeated for each asset class.

## Provision for organisation-defined inputs

Provision is made in some data attributes to allow organisation-specific input. These attributes require organisation-specific inputs due to specific management practices that are unique to an organisation.

Code lists are provided to force consistency, however when users require data entry that is not covered in code list there is provision for custom entry. Over time the code lists can be updated to include commonly used custom entries.

## Remove Volume 2 attributes from the attribute table

The NZAMS presented Volume 2 attributes for the attribute data table for each asset class. This repetition adds to the length of the document and reduces the NZAMS's usability. In the CoP, Volume 2 attributes are not presented.

## Present metadata requirements separately

The NZAMS combined metadata and asset data in the data attribute tables. In the CoP metadata is presented separately (with the exception of data accuracy).

## Provide data collection guidance for events

Data should be collected when an event or activity is carried out on an asset. Each event allows for the collection of certain data attributes. The CoP presents a range of the most commonly occurring events and the data that can collected from each event – namely:

- Asset handover
- CCTV of asset
- Repair.

Refer to Part 2 – Implementation, for further information on the data collection from events.

## Present the attribute tables and code lists in digital format

The NZAMS provided asset data requirements in pdf tables. In the CoP the working tables are provided in digital format to make it easier for industry to implement them.

## Other changes

- Asset class definitions provided
- Attribute lists revised
- Attribute definitions revised
- Code lists revised
- Schematics revised
- Further validation rules provided
- Geometric data pickup shown clearly
- Collection priority guidance
- Data accuracy added as an attribute

See Part 3 – Attribute tables for the revised tables.

## 1.15 Data vs metadata

Metadata is a set of data that describes and gives information about other data.

The follow metadata attributes are separate from the attribute tables but are recommended for collection:

- Data record date (time stamp)
- Data reliability
- Data generation actor (who collected the data).

The data accuracy is part of the attribute tables and is required to be filled for all spatial data collection (i.e. the survey accuracy). A data confidence framework has not yet been developed for the CoP non-spatial data and is identified as future work in Section 1.16.

## 1.16 Future work

Further work will be required to build on the CoP objectives and cater for an increasing number of asset classes, data use cases and data element detail.

Identified future work is listed in Table 1-3 and Table 1-4:

**Table 1-3 Future work stages**

| Work stage | Description |
|---|---|
| Refine CoP following feedback | Refine attribute tables, code lists, schematics and definitions based on industry feedback gained through implementation |
| Expand asset classes | Expand the number of asset classes to include other 3 waters horizontal infrastructure |
| Include vertical assets | Expand the existing CoP or provide an accompanying CoP to include vertical infrastructure (i.e. assets in buildings, treatment plant and pumping station sites). |
| Additional data use cases | Expand the CoP to include data collection priority for other data use cases.<br>For example, to align with:<br>▪ 3 waters valuation data practices<br>▪ Operations and maintenance activities<br>▪ Faults and failure analysis<br>▪ As-constructed survey specification<br>▪ Detailed digital twin representation |

| Work stage | Description |
|---|---|
| Worked examples | Provide examples of the how the CoP is implemented for a set of asset classes and source data.<br>Provide data collection templates for different data collection events. |
| Asset hierarchy | Recommended consistent arrangement for how asset elements relate to an overall hierarchy of complex assets and their sub-components.<br>To inform the Parent/Child relationships and grouping at a geographic (ie street) level. |

**Table 1-4 Data elements to include in future**

| Element | Background |
|---|---|
| Natural Language label (Name) | Easily understandable label. |
| PascalCase label (Data object code) | To enable transformation by applications such as Feature Manipulation Engine (FME). |
| Definition or Description for use | Plain English definition of this element and/or how it is to be used within the standard schema. |
| Related term (Also known as) | Identifies other terms used for this element.<br>To ensure each element is included in the Standard once by referencing all terms that different organisations use for the same element.<br>Note: Each element must be a unique label. |
| Image (Illustration) | Image/s of example/s provide clarity. |
| Entity | To define the entity that each specific entity type is classified as. |
| Location reference | How the location of the entity (asset, business function, etc.) is described. |
| Graphical display | How the asset entity (asset, business function, etc.) is represented in a graphical display. |
| Other relationships | To define other relationships between entities (assets, business functions, etc.). |
| Valid location types | To insert the valid location types - linking to the appropriate location class so that users can click and read. |

| Element | Background |
|---|---|
| Polygon alignment | For Linear referencing/Polygon data classes to define if aligned or non-aligned. Defines location attributes for extracts. |
| Min | The minimum value the attribute can have where it is not defined within the Data Type or is required to be more restrictive.<br>Not completed when Value List or standard Data Type values are used. |
| Max | The maximum value the attribute can have where it is not defined within the Data Type or is required to be more restrictive.<br>Not completed when Value List or standard Data Type values are used. |
| Value List | Must be completed if Data Type is not used. |
| Business rule | Provides text only of business rules across attributes. |
| Data confidence | Provide a code that corresponds to a data confidence framework to reflect the confidence in each attribute data. |

## 1.17 References

New Zealand Treasury – National Infrastructure Unit. (2017). *New Zealand Asset Metadata Standards* (NZAMS 2017). Available from National.InfrastructureUnit@treasury.govt.nz


Holmes


BMC
BATCHELAR
McDOUGALL
CONSULTING
STRUCTURAL & CIVIL ENGINEERS


ENGEO
Expect Excellence


MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI


Trust
power


EQC
EARTHQUAKE COMMISSION
Kōmihana Rūwhenua


wsp


genesis


C. LUND & SON
MAIN CONTRACTORS & BUILDERS


Mercury


UC
UNIVERSITY OF
CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND


Auckland
Council
Te Kaunihera o Tāmaki Makaurau


Fletcher
Building


Fulton
Hogan


Christchurch
City Council


Beca


meridian


Absolutely Positively
Wellington City Council
Me Heke Ki Pōneke


Powell
Fenwick


JJS
JOHN JONES STEEL


Holcim