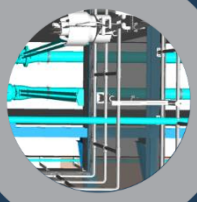

Digital Asset Information & Modelling

AS-BUILT 3D MODEL SPECIFICATION

Version: 1

Published Date: 26 January 2024

Watercare

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More information
If you have further queries, contact the Watercare Enterprise Model team or standards@water.co.nz

DOCUMENT CONTROL

Document owner

Role	Interface and Improvement Manager
Organisation	Watercare Services Limited

Version History

Version	Section	Description of revision	Date
0.1	N/A	The first draft shared for review and comment	16/12/2022
1	All Sections	Document revised	23/01/2024

Approvers / Reviewers

Name	Title	Role
Farzam Farzadi	Value Realisation Digital Programme Lead	Author
Waldo Strydom	Principal Asset Lifecycle Engineer	Reviewer
Tuan Hawke	Interface and Improvement Manager	Reviewer / Approver

Table of Contents

1. Purpose

1.1 Background

The purpose of this document is to provide clarity to model authors and reviewers ensuring consistency of as built modelling across Watercare. It is intended that this document will be appropriately referenced in Model Element Authoring (MEA) Schedules and Digital Engineering Execution Plans.

This document is one in a suite of Watercare documents which relate to Digital Engineering. It is assumed that the reader is familiar with the content of these documents shown below.

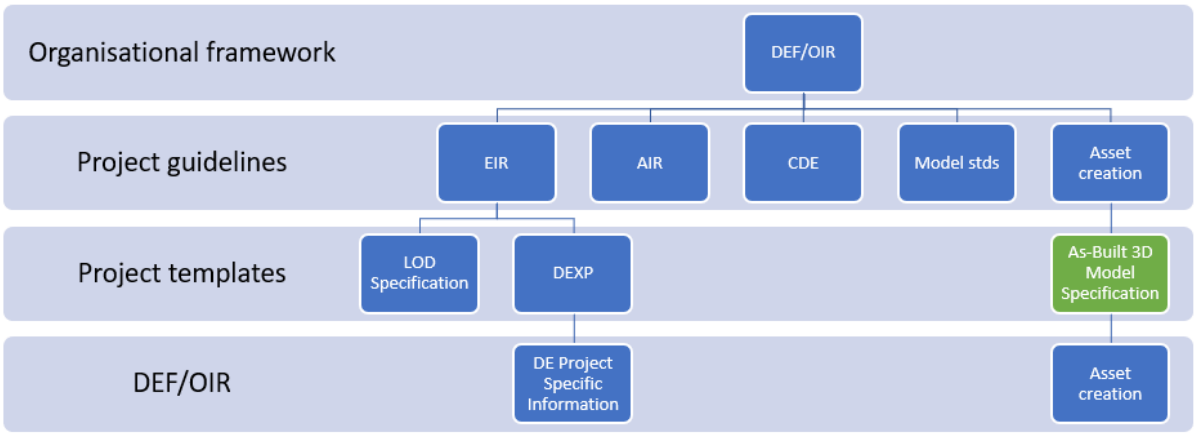

Figure 1 - Watercare Digital Delivery Documents

1.1.1 Updates to this document

This document will be reviewed regularly and in accordance with Watercare documentation and governance policies. The document owner is responsible for managing future updates. Any feedback or proposed changes should be sent to the document owner who will be responsible for revising, correcting, or updating this document.

The Document Owner commits to undertake the following:

- The updates are validated by those whom they affect. Changes to this plan may affect other plans.
- The changes will then be built into the next formal review process and an updated version will be identified.
- Seek approval from the Watercare Enterprise Model leadership group and Watercare Operations, Strategy and Planning, and Digital representatives regarding proposed changes to the document.
- Consult with and inform digital representatives of all contracted partners regarding proposed changes to the document.
- Takes responsibility for updating the controlled document status, communicating the changes, and circulating the revised plan.

1.2 Compliance requirements

This document needs to be utilised in conjunction with Watercare standards and other Digital Engineering documents listed in Section 1.3.

1.3 Watercare Supporting documentation

- Level of Development Specification – January 2024

- Digital Engineering Execution Plan – January 2024
- Digital Engineering Project Specific Information – January 2024

2. As-Built Classifications

The as-built status of model objects can be classified in several ways, The Watercare Enterprise Model approach to as-built model classification is defined in this document. It is expected that metadata will be assigned to 3D objects within the as-built model to record and communicate the extent and reliability of the as-built information.

2.1 Unverified As-Built (UAB)

Elements within the model have been constructed in accordance with the modelled design intent. These elements have not been verified on-site and the as-built model handover is typically the design intent model.

2.2 Visual As-Built (VAB)

Elements within the model have been constructed in accordance with the modelled design intent. These elements have been verified as built through a visual inspection and comparison of the as-constructed state against the design intent models with some isolated dimensional checks. Model elements have been updated to reflect any deviations to +/- in accordance with Section 5.

2.3 Drone Survey As-Built (DSAB)

Elements within the model have been constructed in accordance with the modelled design intent. These elements have been verified as built through the contractor's use of high-resolution aerial imageries and a comparison of point cloud data against the modelled elements. Model elements have been updated to reflect any deviations to +/- in accordance with Section 5.

2.4 RTK GNSS As-Built (RTKAB)

Elements within the model have been constructed in accordance with the modelled design intent. These elements have been verified as built through the contractor's use of RTK GNSS positioning unit and a comparison of the data against the modelled elements. Real-Time Kinematic (RTK) positioning is a satellite navigation technique adopted to enhance the precision of data derived from Global Navigation Satellite Systems (GNSS). Model elements have been updated to reflect any deviations to +/- in accordance with Section 5.

2.5 Total Station As-Built (TSAB)

Elements within the model have been constructed in accordance with the modelled design intent. These elements have been verified as built through the contractor's use of total station equipment and a comparison of the data against the modelled elements. A total station is an optical surveying instrument that uses electronics to calculate angles and distances. Model elements have been updated to reflect any deviations to +/- in accordance with Section 5.

2.6 Laser Scanned As-Built (LSAB)

Elements within the model have been constructed in accordance with the modelled design intent. These elements have been verified as built through the contractor's use of laser scanning and a comparison of the point cloud data against the modelled elements. Model elements have been updated to reflect any deviations to +/- in accordance with Section 5.

3. As-Built Object Metadata

The following metadata will be attributed to objects within the as-built models to indicate the as-built classification of the model element.

Table 1 – As-Built metadata attributes

Data Field	Input	Proposed Surveying Technique	Definition	Tolerance
WSL As-Built Status	Verified	N/A	Constructed on-site verification between the as-built state and the model.	N/A
	Unverified	N/A	Constructed on-site in accordance with the design intent model but not verified.	N/A
WSL As-Built Verification Source	Visual	N/A	Elements on site are visually verified against the model.	+/- 500mm
	Point Cloud	Drone Survey	Elements and surrounding area surveyed & georeferenced. Design models cross-referenced and compared with the point cloud data. Design models updated accordingly.	+/- 300mm
	Red Line Drawing	RTK GNSS	Elements verified as built using: Verified red line drawings or via RTK GNSS survey equipment and technique.	+/- 100mm
	Point Cloud	Total Station	Elements and surrounding area scanned & georeferenced. Design models cross-referenced and compared with the point cloud data. Design models updated accordingly.	+/- 50mm
	Red Line Drawing	Total Station	Elements verified as built using red line drawings that surveyed and verified via TS survey equipment. Design models updated accordingly.	+/- 50mm
	Point Cloud	Laser Scan	Elements and surrounding area laser scanned & georeferenced. Design models cross-referenced and compared with the point cloud data. Design models updated accordingly.	+/- 25mm

3.1 Native design model requirements

As-Built classification metadata is to be added to native design models during upgrade to As-Built level as per Table 2 below. Software specific requirements are detailed below.

3.1.1 Revit requirements

Shared parameters to be used in Revit (.rvt) models to provide the as-built classification metadata as per Table 2.

3.1.2 Plant 3D requirements

Attributes to be added to Plant3D (.dwg) models to provide the as-built classification metadata as per Table 2.

3.1.3 Civil3D requirements

For files that will be developed using Civil3D, The DDP Digital Engineering Manager and Civil Design Lead will need to confirm that the Civil3D models are upgraded to As-Built in accordance with the Digital Engineering Execution Plan, LOD and As-Built Specifications.

No attributes or as-built metadata are required to be added to Civil3D files.

3.2 As-Built metadata

Table 2 - As-Built classification metadata

WSL As-Built Status:	Verified (other as-built parameters need to be populated), or Unverified (other as-built parameters are not required)
WSL As-Built Status:	Visual, or Point Cloud, or Red Line Drawing
WSL As-Built Verification Tolerance:	+/- 500mm, or +/- 300mm, or +/- 100mm, or +/- 50mm, or +/- 25mm
WSL As-Built Verification Source Name:	e.g., 3258696_WWTP.rcp
WSL As-Built Verification Source Version:	e.g., V1
WSL As-Built Verifier:	e.g., FF (verifier initials)
WSL As-Built Verification date:	e.g., 08/12/2022

4. As-Built Models and Levels of Development

The 3-dimensional models developed within the digital engineering process transition through varying levels of development as design develops, typically ranging from LOD100 to 300 during design with some elements moving to LOD400 during fabrication and construction. LOD 500 commonly refers to as-built status. There is a common misconception that model elements need to transition through each LOD to reach as built status, this can be time consuming for the delivery team and costly for the client.

LOD 500 is defined as *"The Model Element is a site-verified representation in terms of size, shape, location, quantity, and orientation. Non-graphic information may also be attached to the Model Elements."*

It is important to note that LOD 500 relates to site verification and does not indicate a progression to a higher level of model element geometry or non-graphical information.

Therefore, to achieve as-built verification, LOD progression can jump immediately from LOD 200 or LOD 300 to LOD 500, if there isn't a requirement to achieve LOD 350 or LOD 400 from either Watercare or the project team.

5. As-Built Assets and Tolerances

The following section defines the Watercare requirements for As-Built Model objects including the minimum acceptable Level of Development, the minimum acceptable as-built classification, and the minimum acceptable as-built tolerances.

Table 3 - Model Element Author Key

Architectural and Landscape consultant	ARC
Structural consultant	STR
HVAC (Heating, ventilation, and air conditioning) consultant	HVA
Electrical, Instruments and Controls consultant (Process)	EIC
Fire consultant	FIR
Civil consultant	CIV

Process and Mechanical consultant	PCS
Contractor / Sub-contractor	CON
Fabricators, Suppliers and Vendors	SUP
Plumbing & Drainage consultant	PLU
Survey Consultant	SUR
Electrical Consultant (Services)	ELE

Table 4 – Level of Development (LOD) definitions

LOD	
100	Conceptual
200	Approximate Design Geometry
300	Accurate Design Geometry
350	Interface Coordination
400	Fabrication and Assembly
500	Site Verified

5.1 Tolerances

The tolerances in Table 5 are target tolerances between any two points in a vertical or horizontal direction over a distance of 100m for drone survey and 20m for other survey techniques. The contractor or surveyor undertaking the surveys shall provide an accuracy statement to accompany the survey information that is provided to design and construction partners and suppliers as part of the as building process.

5.2 As-Built Model Element Author

The following section assigns responsibilities to As-Built Model Elements via a Model Element Author (MEA) and defines the Level of Development of the model elements at the as-built stage as well as acceptable As-Built model tolerances.

Spatial-related elements such as site boundaries, grids, levels, zones, and spaces are not assigned a Level of Development because aren't technically elements that are modelled in 3 dimensions. There is a requirement to show them in the table below to make sure that they are assigned a model element author (MEA).

The LOD's indicated below are a minimum requirement by the end of each of the previous design and / or construction phase noted; the design and/or construction team may choose to implement a higher LOD.

Table 5 – As-Built MEAs and Asset Tolerance Schedule

Project Phase	Handover		Tolerance	As-Built Status	Proposed As-Built Verification Source	Proposed As-Built Surveying Technique
Responsible Parties	**DPP, CP & Suppliers**					
	MEA	**LOD**				
Spatial						
Site boundaries, setbacks	ARC	-	N/A	Unverified	N/A	N/A
Process Grids	PCS	-	N/A	Unverified	N/A	N/A
ARC Grids	ARC	-	N/A	Unverified	N/A	N/A
Building Levels	ARC	-	N/A	Unverified	N/A	N/A
Process Levels	PCS	-	N/A	Unverified	N/A	N/A
Process zones	PCS	-	N/A	Unverified	N/A	N/A
Process spaces, rooms	PCS	-	N/A	Unverified	N/A	N/A
ARC Spaces, rooms	ARC	-	N/A	Unverified	N/A	N/A
ARC zones	ARC	-	N/A	Unverified	N/A	N/A
Reality Capture	SUR	-	N/A	Unverified	N/A	N/A
Site						
Topography - Existing	CIV	200	+/- 300mm	Verified	Point Cloud	Drone Survey
Site Services & Utilities - Existing	CIV	200	+/- 300mm	Verified	Point Cloud	Drone Survey
Topography	CIV	300	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Site Water, Stormwater,	CIV	300	+/- 50mm	Verified	Point Cloud (preferably) or	Total Station

Project Phase	Handover		Tolerance	As-Built Status	Proposed As-Built Verification Source	Proposed As-Built Surveying Technique
Responsible Parties	**DPP, CP & Suppliers**					
	MEA	**LOD**				
Sewer pipe works					Red Line Drawing	
Roading	CIV	300	+/- 100mm	Verified	Red Line Drawing	RTK GNSS
Road kerb	CIV	300	+/- 100mm	Verified	Red Line Drawing	RTK GNSS
Surface finishes	CIV	300	+/- 100mm	Verified	Red Line Drawing	RTK GNSS
Parking	ARC	300	+/- 100mm	Verified	Red Line Drawing	RTK GNSS
Paths	ARC	300	+/- 100mm	Verified	Red Line Drawing	RTK GNSS
Fences	ARC	300	+/- 100mm	Verified	Red Line Drawing	RTK GNSS
Site Power	ELE	300	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Site Communications	ELE	300	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Site lighting	ELE	300	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Site Furniture (gates, Bollards, etc)	ARC	300	+/- 100mm	Verified	Red Line Drawing	RTK GNSS
Site landscaping	ARC	300	+/- 500mm	Verified	Visual	N/A
Process						
Plant - Existing	PCS	200	+/- 25mm	Verified	Point Cloud	Laser Scan
Plant - New	PCS	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Tanks	PCS	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Tanks - Vendor Supply	SUP	400	+/- 25mm	Verified	Point Cloud	Laser Scan
Plant – Vendor Supply	SUP	400	+/- 25mm	Verified	Point Cloud	Laser Scan
Plant - Foundations	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Plant Ground improvements	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan

Project Phase	Handover		Tolerance	As-Built Status	Proposed As-Built Verification Source	Proposed As-Built Surveying Technique
Responsible Parties	**DPP, CP & Suppliers**					
	MEA	**LOD**				
Mechanical and Process Pipework	PCS	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Mechanical and Process Pipework - Vendor Supply	SUP	400	+/- 25mm	Verified	Point Cloud	Laser Scan
Pipework Supports	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Pipework fittings, flanges, couplings, actuators, and valves	PCS	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Pipework fittings, flanges, couplings, actuators, and valves - Vendor Supply	SUP	400	+/- 25mm	Verified	Point Cloud	Laser Scan
Pipe Penetrations – non structural	ARC	300	-	N/A	Unverified	N/A
Pipe penetrations - structural	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Piping underground encasements	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Plant access structures	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Plant handrailing & gates	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Plant hold down bolts	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Pumps	PCS	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Pumps - Vendor Supply	SUP	400	+/- 25mm	Verified	Point Cloud	Laser Scan
Screening and Process Equipment	PCS	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Inline Instrumentation	EIC	300	+/- 25mm	Verified	Point Cloud	Laser Scan

Project Phase	Handover		Tolerance	As-Built Status	Proposed As-Built Verification Source	Proposed As-Built Surveying Technique
Responsible Parties	**DPP, CP & Suppliers**					
	MEA	**LOD**				
Instrumentation Tapping	EIC	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Switches	EIC	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Motors	EIC	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Motors - Vendor Supply	SUP	400	+/- 25mm	Verified	Point Cloud	Laser Scan
Indicators	EIC	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Junction boxes	EIC	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Cable trays	EIC	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Conduits	EIC	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Substructure						
Foundations	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Slabs	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Rafts	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Sumps	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Pits	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Ground Beams	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Thickenings	STR	300	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Underground encasements	STR	300	+/- 100 mm	Verified	Red Line Drawing	RTK GNSS
Ground improvements	STR	300	+/- 100 mm	Verified	Red Line Drawing	RTK GNSS
Retaining Walls	STR	300	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Pond	CIV	300	+/- 100 mm	Verified	Red Line Drawing	RTK GNSS
Chambers	CIV	300	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Manholes	CIV	300	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Building Structure						

Project Phase	Handover		Tolerance	As-Built Status	Proposed As-Built Verification Source	Proposed As-Built Surveying Technique
Responsible Parties	**DPP, CP & Suppliers**					
	MEA	**LOD**				
Structural Floors	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Cantilevered slabs	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Steel beams	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Concrete beams	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Shaft openings	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Wall openings – load bearing	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Penetrations	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Steel stairs, landings, and platforms	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Concrete stairs	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Ramps	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Walls – load bearing	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Steel columns	SUP	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Concrete columns	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
In-situ Concrete Elements	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Masonry Elements	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Secondary support frames carrying significant loads (>1000kg) where set-out can be frozen at the beginning of developed design	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Secondary support frames carrying significant loads (>1000kg)	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan

Project Phase	Handover		Tolerance	As-Built Status	Proposed As-Built Verification Source	Proposed As-Built Surveying Technique
Responsible Parties	**DPP, CP & Suppliers**					
	MEA	**LOD**				
where set-out is determined by an architectural element (wall / ceiling / cladding / feature etc.)						
Purlins	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Fly braces	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Seismic Restraint	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Precast Elements	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Building Enclosure						
Architectural Roofing	ARC	300	-	N/A	Unverified	N/A
Structural Roofing	STR	350	+/- 500mm	Verified	Visual	N/A
Cladding	ARC	300	-	N/A	Unverified	N/A
Column cladding	ARC	300	-	N/A	Unverified	N/A
Curtain walls	ARC	300	-	N/A	Unverified	N/A
Windows	ARC	300	-	N/A	Unverified	N/A
External doors	ARC	300	-	N/A	Unverified	N/A
Wall openings – non structural	ARC	300	-	N/A	Unverified	N/A
Building Interior						
Partitions	ARC	300	-	N/A	Unverified	N/A
Internal doors	ARC	300	-	N/A	Unverified	N/A
Internal openings – non structural	ARC	300	-	N/A	Unverified	N/A
Internal openings – structural	STR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Ceilings	ARC	300	-	N/A	Unverified	N/A
ARC Flooring	ARC	300	-	N/A	Unverified	N/A
Balustrading	ARC	300	-	N/A	Unverified	N/A
Furniture	ARC	300	-	N/A	Unverified	N/A
Fixtures	ARC	300	-	N/A	Unverified	N/A

Project Phase	Handover		Tolerance	As-Built Status	Proposed As-Built Verification Source	Proposed As-Built Surveying Technique
Responsible Parties	**DPP, CP & Suppliers**					
	MEA	**LOD**				
Fittings	ARC	300	-	N/A	Unverified	N/A
Equipment – non-services	ARC	300	-	N/A	Unverified	N/A
Signage	ARC	300	-	N/A	Unverified	N/A
Speed walls	ARC	300	-	N/A	Unverified	N/A
HVAC						
Fans	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Dampers	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Louvers	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Ductwork	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Registers	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Pipework	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Flexible pipes	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Controls	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Penetrations - Structural	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Mechanical services in risers	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Air circulator and ventilation	HVA	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Electrical						
Electrical fixtures	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Power outlets	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Switches	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Distribution boards	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Cable trays	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Lighting	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or	Total Station

Project Phase	Handover		Tolerance	As-Built Status	Proposed As-Built Verification Source	Proposed As-Built Surveying Technique
Responsible Parties	**DPP, CP & Suppliers**					
	MEA	**LOD**				
					Red Line Drawing	
Communications	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Security	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Controls	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Electrical services in risers	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Penetrations - Structural	STR	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Devices	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Transformers	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Security controls and devices	ELE	350	+/- 50mm	Verified	Point Cloud (preferably) or Red Line Drawing	Total Station
Plumbing & Drainage						
Sanitary fixtures	PLU	350	N/A	Unverified	N/A	N/A
Plant	PLU	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Equipment	PLU	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Pipework	PLU	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Plumbing & Drainage services in risers	PLU	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Penetrations - Structural	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Fire						

Project Phase	Handover		Tolerance	As-Built Status	Proposed As-Built Verification Source	Proposed As-Built Surveying Technique
Responsible Parties	**DPP, CP & Suppliers**					
	MEA	**LOD**				
Sprinklers	FIR	350300	+/- 25mm	Verified	Point Cloud	Laser Scan
Hydrants	FIR	300	+/- 25mm	Verified	Point Cloud	Laser Scan
Extinguishers	FIR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Pipework (main)	FIR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Pipework (branch)	FIR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Detection	FIR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Alarm systems	FIR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Fire services in risers	FIR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Penetrations - Structural	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Fire stopping elements	FIR	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Conveying						
Cranes	ARC	350	+/- 25mm	Verified	Point Cloud	Laser Scan
Structural supports	STR	350	+/- 25mm	Verified	Point Cloud	Laser Scan

6. Standard Terms and Definitions

Table 6 - Standard Terms and Definitions

Terms	Definitions
As-Built	Describing or representing the actual appearance, condition, structure, and location of a constructed asset
Civil3D	Civil 3D is a civil infrastructure design and documentation software solution.
Design Intent Model	A 3-dimensional model developed by a designer to communicate the proposed design
Drone Survey As-Built	Survey completed using drone to aerial imageries point cloud data.
DWG File	A Drawing file generated in Autodesk AutoCAD.
Global Navigation Satellite Systems	A constellation of satellites providing signals from space that transmit positioning and timing data to receivers to determine location.
Laser Scanning	The process of capturing digital information about the shape of an object with equipment that uses a laser to measure the distance between itself and the object.
Level of Development	A scale used to describe the level of completeness to which a model element can be relied on at different times during model development
Metadata	Commonly defined as data about data, though differing from the data itself. For example, in a BIM context, object size = 300mm – object size is metadata, 300mm is data.
Model Element Author	Ensures the model develops and is coordinated according to project requirements.
Native Design Model	The default design model.
Object	A modelled item within and asset.
Plant3D	An Autodesk application targeted to the design and layout of process plant facilities. It has the tools and features designers need to create detailed plant models.
Point Cloud Data	Data provided by laser technology which a building is scanned and information is shown in the form of dots.
Red Line Drawing	A ‘red line’ mark up of a 2-dimensional paper or electronic drawing
Revit	A native 3D Model file generated in Autodesk Revit.
RVT file	A native 3D Model file generated in Autodesk Revit.
Total Station	An optical instrument used for measuring horizontal angles, vertical angles and distance by analysing the slope between itself and a specific point.
Unverified As-Built	Elements within a 3D model have been constructed in accordance with the modelled design intent. These elements have not been verified on site and the As-Built model handover is typically the design intent model.
Verified As-Built	Elements within a 3D model that have been verified and updated to reflect the as constructed state of the new built asset.

6.1 Acronyms

Table 7 - Acronyms

Acronyms	Definitions
CP	Construction Partner
SPP	Strategic and Planning Partner
DDP	Design and Delivery Partner
DSAB	Drone Survey As-Built
GNSS	Global Navigation Satellite Systems
LOD	Level of Development
LSAR	Laser Scanned As-Built
MEA	Model Element Author
RTK	Real Time Kinematic