BIM Implementation

BUILDING TECHNOLOGY ENABLED DESIGN AND CONSTRUCTION CAPABILITY

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ABSTRACT

In 2018, Watercare commenced the agile development of digital capability across the business as part of its Strategic Transformation Programme (STP). A principle feature of the STP includes the development of the right tools, and the best processes to meet our business needs.

Watercare has a challenging capital plan of NZ $5B over the next decade. This is happening in an environment where delivery capability is stretched, the city's population is growing, and other infrastructure is undertaking similar transformational change.

Watercare's ambitious 40:20:20 target will drive a reduction in build carbon by 40 per cent, a reduction in cost of 20 per cent and a reduction in injuries year on year by 20 percent, all by 2024. These challenges are being met in the first instance by using a variety of digital strategies that have been developed by end-users to meet specific business goals including returning our workers home safe each day, driving a lower carbon footprint, employing sustainable principles, reducing cost, operating efficiently, and delivering greater certainty and financial control in forward planning. Three specific examples of this include:

- "Watercare's BIM Strategy" will be applied to the organisation and the supply chain. The governing standards, protocols and procedures are being developed to ensure data format and procedural consistency across engineering disciplines and asset stages. The BIM strategy provides the platform for the standardised solutions library where repeatable work becomes 'business as usual'.
- "Improved Designs" creates accepted products and standardised design solutions within an accessible catalogue, available through a portal to external users. The solutions library enables designers to utilise existing asset components in full or in part to inform new infrastructure. This process is constantly supplemented with further designs and enhancements from our community, where innovative and continual improvement behaviour is encouraged.
- "Digital Rehearsal" is a 4D technology which integrates programme and design models in a collaborative space. This allows a cross discipline team to work together on a single version of the project plan, consider scenarios, and develop optimum delivery solutions. In this environment we challenge methodologies and mobilise only when ready. This is not limited to just construction and can be used to optimise other activities such as commissioning.

Keywords: Technology, Digital, Design, Innovation

Presenter profile

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Nomenclature

STP - Strategic Transformation Programme

BIM - Building Information Modelling / ' Better Information Management

DfMA - Design for Manufacture & Assembly

PBD - Product Based Design

WSL - Watercare Services Limited

Watercare - Watercare Services Limited

4D - Linking 3D visualisation with scheduling information

3D - 3D Modeling is the visual representation of any surfaces in 3 dimensions

Agile - An iterative and incremental development process

P&IDs - Piping and instrumentation diagrams

FD's - Functional Descriptions

EM- Enterprise Model

BIM4WATER - UK Government backed advisory group tasked with promoting BIM in the UK water industry

PDT- Product Data Template

CDE - Common Data Environment To meet this, the construction industry must, grow, keep pace with innovation, and improve productivity.

GUID - Globally Unique Identifier, an alpha numeric train, unlikely to repeat to identify and item.

OEM - Original Equipment Manufacturer

SWOT - Strength, Weakness, Opportunity, and Threat analysis.

1 Introduction

New Zealand is now facing an unprecedented lift in Infrastructure Investment. Auckland needs to accommodate an estimated 40% population growth in the next 30 years. Watercare's capital delivery programme needs to expand to meet this need. The design and construction industry is constrained, leaving a gap that productivity improvements need to close. Furthermore, construction has been slow to engage with the digital revolution, even when digital tools are ubiquitous in our everyday lives, these technologies are unfamiliar to most construction sites.

The digital revolution however is coming to capital delivery and asset management and is poised to improve efficiency in all facets – from health and safety, through the supply chain, improving collaboration, reducing waste, reducing design and delivery time, costs and improving forecasts and better informing the operators. All these tools have a common base to build off – structured data and Better Information Management (BIM) is at the centre of this.

As an operating organisation with NZ$8 billion assets, Watercare is New Zealand's largest Water Company and is data rich – but we have not always collected, ordered and stored this in a consistently structured and accessible manner. This has limited the ability of this information to support decision-making. The BIM process guides the management of information for the life of these assets.

The New Zealand industry lack of scale, duration of capital projects and lack of certainty has worked against front end investment in systems and processes. Watercare's response is the 'Enterprise Model' a long-term capital delivery model. Digital tools are to be central to the workplace delivering these outcomes.

In 2018, Watercare commenced its Strategic Transformation Programme (STP). This is a complete end-to-end digital retooling of the business and has been implemented using specialist agile delivery squads within a cross-business collaborative environment. A principle feature of the STP applied to the entire business includes the development of the right tools, and the best processes to meet our business needs. These challenges are being met in the first instance by using a variety of digital engineering strategies that have been developed by end-users to meet specific business goals. The effectiveness of the tools that are enhanced by reliably structured source data. These tools must be delivered in an environment where capability is stretched and resourcing scarce.

To meet the challenges Watercare seeks to demonstrate leadership in the water industry through the implementation of digital engineering opportunities outlined in this paper.

There are so many touch points where structured data can improve business decisions. Two specific examples we address in this paper is of 4D digital rehearsals and Product Based Design (PBD) – both function more effectively upon a BIM platform. Digital rehearsal and PBD are two examples of digital engineering opportunities to deliver value for our customers.

2. The Problems

There is mixed quality of engineering information available for Watercare on legacy assets. Most of these assets are buried. Reduced confidence is a consequence of this inconsistency. In practice 'retrospective measurement' processes are often needed for even routine tasks. A 'field repair, for instance may require two mobilisations, the first to remeasure and verify, the second for repair. This requires an entire work process just to source and structure the field data, so the work teams can fix it. This double mobilisation is inefficient, slow, disruptive and costly. And it puts

people in higher risk environments for longer. Other known problems and issues are summarised as below:

Incorrect As-Built information - Complex assets such as treatment plants operate for very many years and are subject to cyclic maintenance, refitting and expansions. Inaccurate as built information leads to unforeseen redesign, delays and costly site changes when this work is undertaken.

Failure to Capture Information Historically the capture of comprehensive and accessible project information is mixed. An example is within project delivery where data is lost between the delivery phases (see fig1.). Other examples are:

- Original equipment manufacturer (OEM) metadata is not captured in a digital format at the procurement stage.
- Field data from buried asset interactions (from company and 3rd party sources) are not captured when they are opportunistically exposed- information that could improve future decisions.
- The business and agencies often capture data that would be useful (such as water meter locations mapped to a geospatial layer) but do not have systems in place to capture this for future reference.

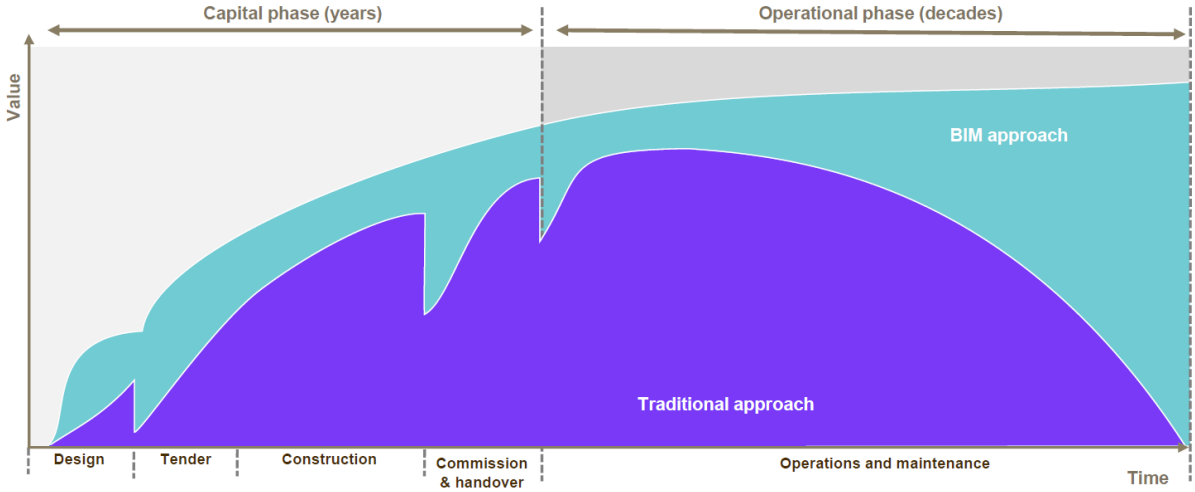

Figure 1 Loss of information in traditional project approach

Engagement with supply chain - Framework agreements reflecting BIM values through the supply chain are not in place, limiting the opportunities that BIM presents.

BIM Community immaturity: The adoption of BIM by client organisations is an important driver for economies developing digital capability. There is a low uptake in main client organisation in New Zealand.

Security - Central to the principals of BIM is the ability for partners to access and inform information within a Common Data Environment (CDE), this must have security protocols

Availability of information – the value of that information will not be realised if it cannot be easily accessed by stakeholders. Watercare project information is accessible to approved stakeholders through an approval process but it is not regularly utilised by the supply chain.

People and Capability - Awareness of the value of BIM is not evenly spread through the business. This limits the ability to adopt and a potential underperformance will erode support at early stages.

Information management conventions – Established habits in information management are very challenging to break, particularly within large organisations with many types of projects of different types and sizes.

Digital divide – While cloud technology is new, technical information management capability is not. Organisations often have isolated expertise in Information Management without a broad awareness through the rest of the business.

Investment challenges for industry - Many stakeholders are not yet on board the technology drive and construction firms have under-invested in digital tools and their people. A generation of managers in traditional fields like construction have no experience of this type of technical and behavioural disruption.

Leadership of digital adaption: BIM is seen as a technology investment, sometimes ignoring the institutional and cultural aspects which are crucial for adoption. This can lead to resistance.

3. Define Outcomes and Success

Watercare is a customer-centric organisation, with safety, carbon and cost goals and as such, the adoption of 'Better information Management' must compliment these goals. These relate to how the organisation manages information, how collaborative behaviour is encouraged and how continuous improvement cycles informs development and enables our assets to be confidently and expertly managed. Our desirable outcomes are arranged into Information, behaviours and refinements – to apply with maturity.

INFORMATION MANAGEMENT

Data management system is fit for purpose with all attributes fitting a common standard that is able to be easily adapted and applied by stakeholders at any time in the assets lifecycle.

Sensitive asset information is secure, yet data is available to approved stakeholders ensuring access for the time they are involved in the development process or responsible though their commercial obligations.

Stakeholders can confidently apply Watercare data standards to the entire delivery process in an ecosystem of their own or client hosted CDE ensuring the full complement of information is maintained and transferred

Development towards a fully client hosted CDE tailored for the asset life-cycle needs of Watercare which enables visibility and control to ensure project status is easily updated.

BEHAVIORS & PERSONAL ATTRIBUTES

Adoption is supported through all levels of the client organisation with awareness of the cultural implications and potential benefits

Adoption is supported through the supply chain whom can easily utilise the information to improve outcomes.

The structured data is interrogated and exploited by stakeholders to improve decision making

Business interaction behaviours support efficient collaboration.

Regional client infrastructure peers also adopt BIM and help to advance the industry.

Improved certainty simplifies physical interventions for maintenance or retro-fitting exercises - reducing time and cost and improving safety outcomes.

REFINEMENT

Collection of data is refined to concentrate on high value information areas, particularly areas that the organisation has whole of life interactions with.

Whole of life value chain is 'BIM enabled' and has autonomy to utilise information to improve outcomes

A continuous improvement cycle is in place to support human and system development to continually adjust to disruptions.

4. What we are doing

Watercare has recognised the need for a structured BIM implementation strategy and identified and engaged Mott MacDonald as an established subject expert consultant to support BIM adoption. Principal considerations in this appointment was a demonstrated experience in this role in a BIM environment that is more advanced. Watercare has also engaged with other water utilities whom are also considering BIM or in the case of some offshore examples further down the adoption journey. The insights from this experience and these relationships is informing the approach.

FRAMEWORK STEPS

The adoption strategy we have applied is structured around a five-step delivery framework: Shape, Define, Embed, Perform and Optimise (see fig2.), this provides a step-by-step approach to implementation. This process defines an Implementation Plan that aligns with Watercare's, processes and culture. The process ensures the plan will integrate with and support existing internal initiatives, including the Strategic Transformation Programme (STP), and the Enterprise Model (EM) to incorporate a BIM approach across the business.

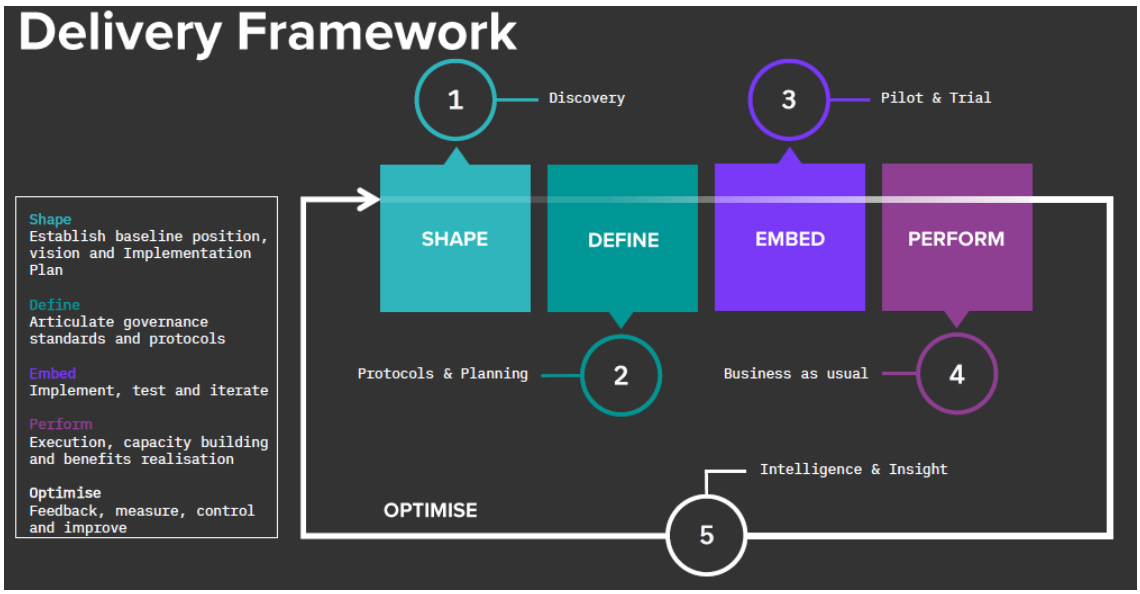

Figure 2 Framework steps to 'Better Information Management'

Shape

This involves the initial discovery period engaging with stakeholders across the business to understand business information management maturity through assessment process, workflows and transactions across the asset life-cycle. Enabling Watercare to allocate sufficient business resources in the 'Define' and 'Embed' steps.

As a starter, this can be as simple as a single A4 side from every business unit describing 1. Their information needs and 2. Their present information workflow.

Define

Describing the governing standards, protocols and procedures for the information management principles for BIM Adoption. This step refines the data management structures to improve information flow across the business and with partners during asset delivery and operation.

Embed

The accepted method internationally is to Implement BIM principles through selected 'Proof of Concept' pilot trials. Keeping this small and defined at first will mitigate change risk. Through a continuous improvement loop this approach offers the ability for testing and refinement prior to releasing BIM adoption to the wider business. Undertaking this with capable, experienced people in a controlled environment and carefully working through issues that appear so the business is confident that the end to end BIM workflow is ready for adoption.

Perform

Adoption of BIM across the business where good process and delivery become mandatory routine practice. This step requires quality assurance and proactive and supportive supervision to ensure the standards, protocols and procedures are embedded so that digital maturity can develop.

Optimise

A continuous improvement loop is an essential component of the BIM process. This involves the diagnosis of all steps, compiling lessons learnt and feedback that drives enhancements. This step measures, manages and improves performance by adopting digital tools such as data analytics and real-time reporting.

Watercare is using Agile - 'sprint' type development to deliver BIM outcomes. It is our experience that agile methodology results in high velocity toward outcomes through more intensive planning and preparation, more regular planning meetings, and greater clarity around user story grooming (definitions of feature), and acceptance criteria for completed work.

Project Road map

The project Road map defines a high-level timeline for BIM implementation. The principle short term objective is to establish a Minimum Viable Product (MVP) to run early pilot projects through the new Enterprise Delivery Model.

Through the initial discovery phases stakeholder groups were engaged.

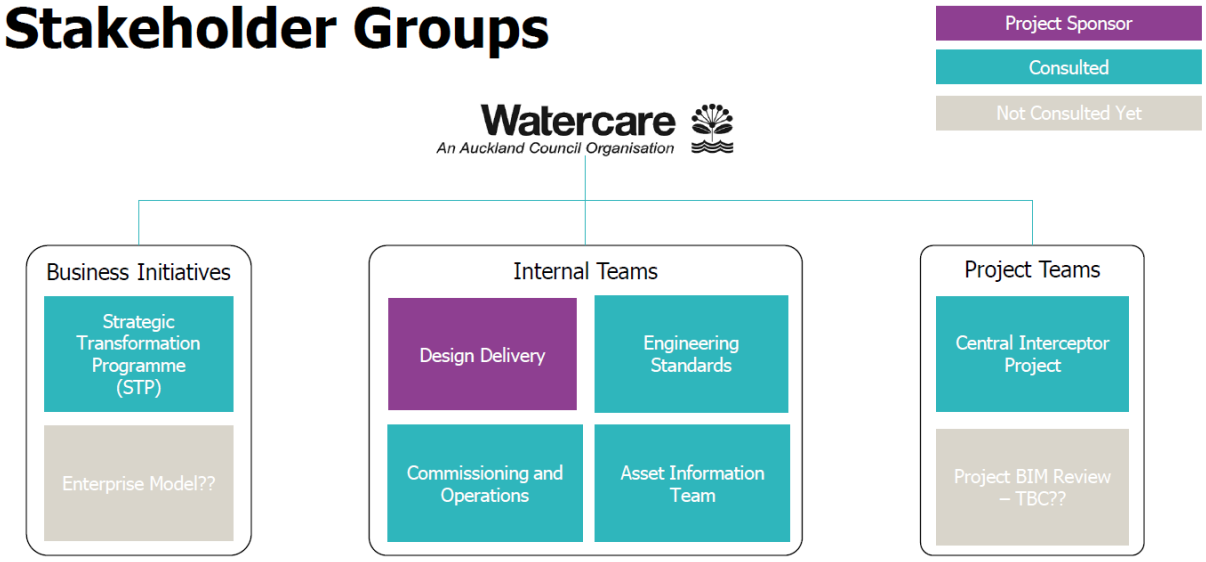

Figure 3 Watercare Stakeholder Groups

The stakeholder groups engaged were:

- Strategic Transformation Programme (STP)
- Enterprise Model (EM)
- Design Delivery
- Engineering Standards
- Operations Team
- Commissioning Team
- Asset Information Team
- Central Interceptor Project
- BIM Review Team

The topics work-shopped with these groups were:

- Document and Record Management principles
- Asset Information requirements and asset registration / upload process
- Common Data Environment (CDE) approaches
- Pilot Project requirements

A SWOT Analysis informs the review of these stakeholders by identifying what issues are helpful or a potential hindrance to BIM adoption. Having these issues identified as early as possible improve the end outcomes. Harmful and supportive issues are identified as below:

Identified Issues harmful or a threat for digital adoption

One concern that is highlighted is how to incorporate assets that are created by 3rd parties into the Watercare system. This refers to the infrastructure built by developers that are later vested to Watercare. Many of these are small and will not use sophisticated information systems.

The use of disparate (or competing) project information systems across the business and a historical flexibility across the business on how built information is codified and stored. For example project managers have had multiple information storage options available which has led to inconsistency.

Essential stakeholders for BIM adoption have not been engaged with BIM and are less aware than they need to be. Up-skilling for the BIM environment will be required. No training modules are in place for deployment yet.

Some portions of the supply chain may have limited capacity to develop BIM or meet requirements - this may incur additional cost or change the nature of engagements, this also could force choices that are complex to assess, such as the value of a compliant vendor versus that of a non-compliant whom adds value in other areas.

At the time of writing the Enterprise Model and Programme First approach is undefined as it is in a procurement phase leaving development of the capital delivery systems on hold.

Supportive attributes and opportunities

BIM adoption can be integrated into the Enterprise Model using the established agile planning and release processes now familiar to Watercare. This work can therefore be integrated into future development releases that STP is presently leading and can transfer into the business when the STP is complete. This provides a comparative planning and measurement mechanism that will also help the business prioritise work based on value and risk.

The behaviours of stakeholders within the Enterprise Model, the federation and sharing of information and the collaborative mandate are the same drivers as is required for successful BIM application. This promotes the value of BIM adoption within the Enterprise Model on-boarding period.

Asset and Information data standards for the business are well down the development path and are informed by international best practice.

Design and delivery partners within the Enterprise Model may provide impetus if their global reach has experience in the field - this can speed adoption and provide insights into where BIM efforts equate to the greatest value.

Relationships with leading BIM enabled utilities nationally and internationally can also inform development paths and exciting areas to be exploited. Recently the expectation of value within the life-cycle management of assets managed by BIM has been surfaced in a leading BIM national survey.

Using the Strategic Transformation Programme to drive adoption

The Strategic Transformation Programme has driven digital development and business functions together in an interconnected development environment. Through this, a good understanding of effort and reward has developed, of prioritisation and compromise. While the opportunities in the digital world are limitless - the resources to deliver and maintain them are not. The term ‘minimal viable product’ (MVP) has been delivered by the business and ‘subject matter experts’ (SME's), using the agile techniques. Sound, agile business decision making processes are needed for adoption.

What are the global leaders doing?

For a gauge on best practice internationally we engaged with BIM managers in leading water utilities offshore whom are further developed in their processes. These organisations have comparable drivers and opportunities. Principal to their approach is informed restraint on the BIM information collated - a concentration of effort on asset information that is interfaced with regularly, such as Mechanical and Electrical items, rotating equipment etc and a de-prioritisation of more inert build information -like finished built surfaces in buildings, windows etc. Though the

experience of several years of development they have an appreciation of the management requirements of data and the out sized impact of some types of data. All engaged have had difficulties articulating the 'value' of BIM adoption in their business approval processes. Often drivers are as much governance as perceived value. Managing expectations is also a common theme where both supporters and detractors must be managed.

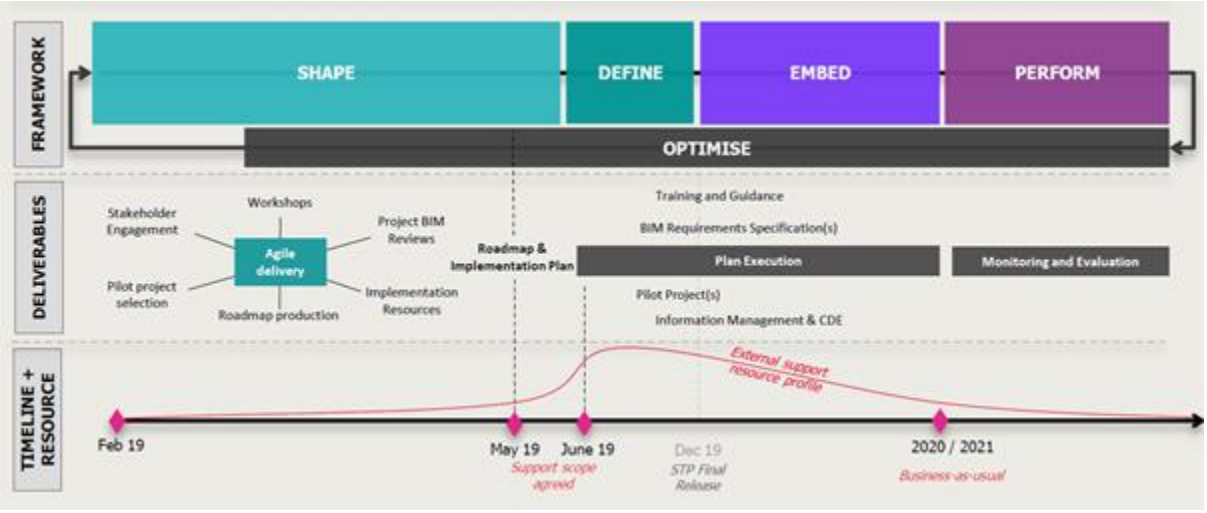

Figure 4 Framework, Deliverables and the resources 'bump'.

Road map

The roadmap is a sequential management tool designed to identify key features and how their development logically progresses (Fig.5) The key features cover four key management themes of Policy, Process, People and Technical. The delivery approach reflects Watercare's preference for agile planning principles that is familiar to most of the business by over 60% of the organisation being involved at some point. The feature board covers the broad outcomes desired by the organisation.

Pilot test and MVP

Identified early was the need to 'pilot test' the proposed asset information and data requirements on an actual asset. Through discussion with other international water utilities, in each case the same asset, a pump station has been used for this purpose. Using an agile developmental approach, we have trimmed the requirements of the road map to a Minimum Viable Product (MVP) to cover the minimum features needed to deliver an early BIM pilot project, (Fig 6). This limits the interest to the design and built information management ensuring the necessary approvals are followed and handovers of information are completed. It initially dispenses with the supply chain engagement through formalised framework agreements, integrated performance monitoring, product library, 4D 'programme' 5D 'Cost' and 6D 'carbon' and a continuous improvement loop. Once proven it is the intent to develop the other features in.

Figure 5 Product Roadmap 'Complete'

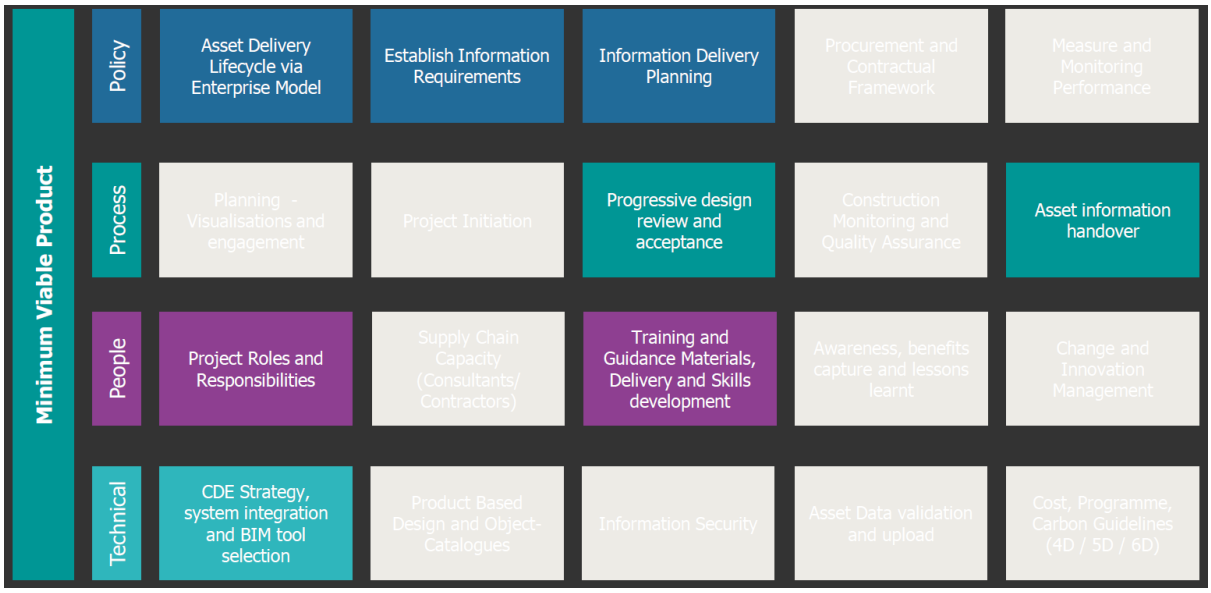

Figure 6 Product Roadmap - Trimmed for Minimum Viable Product (MVP) - Proof of Concept (PoC)

DATA ENVIRONMENT

A common data environment (CDE) is a key architectural component to facilitate sharing data and opportunities by federating data. The models are compared below:
International convention requires that data be transferable through a common data language. Two data languages are recognised internationally (Refer PAS BS 1192):

- IFC (.ifc, .ifcXML, .ifcZIP). Industry foundation classes – the file format used to exchange information between different applications.
- COBie. Construction Operations Building Information Exchange – the international standard relating to managed asset information (non-graphical) in digital format.

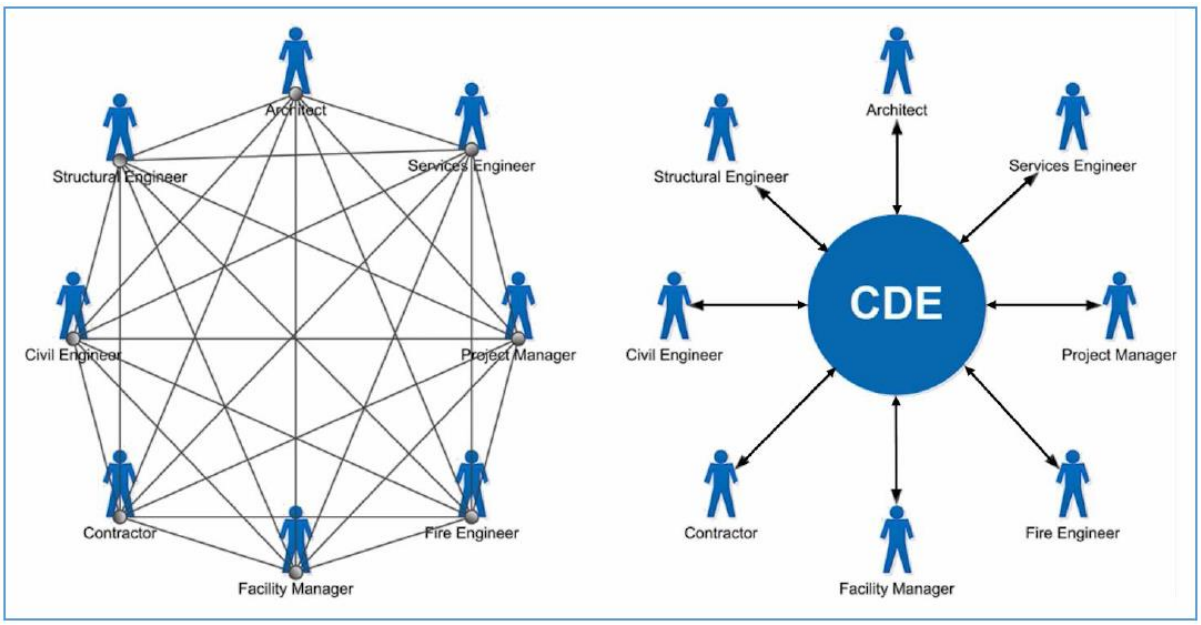

Figure 7 Complex approach of traditional information sharing and a Common Data Environment Approach

Selecting an Environment

Watercare's options for a CDE are partially informed by our existing core legacy systems for project and asset management (ProjectWise), geospatial (esri), and our Asset Data management system (infor). The questions that we are asking the business are:

- Do we use the existing systems as a design production environment?
- How will delivery, geospatial and asset information interface?
- Who will be the stakeholders and how will they interface with the CDE?
- How will BIM models be viewed, interrogated and validated in the CDE?
- What are the core CDE features needed for each stage of the asset lifecycle?

In considering how a CDE will be structured 3 'archetypes' have been considered. Single Project, Project-Client and Client hosted, (fig.8). Each have different attributes and requirements detailed in table 1.

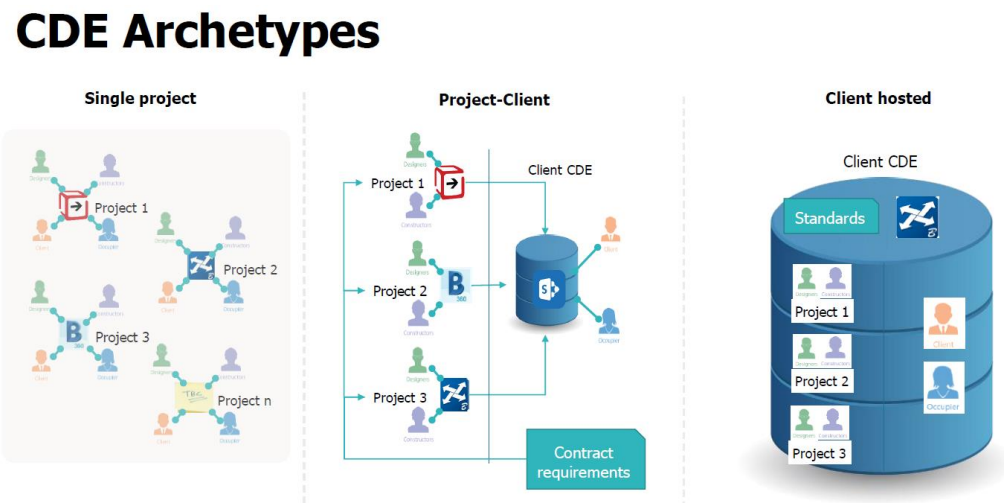

Figure 8 CDE Archetype Options

Archetype	Single Project	Project-client CDE	Client Hosted CDE
Setup - Level of investment needed to establish	No change	Operational focus	large investment
Resources - requirements to manage environments and support supply chain	Asset Information Team	Client Information Manager Supply chain support	Client Information Manager - Heavy utilisation Supply chain support
Procurement- consideration of which approach suits	Vested assets	Transmission and plant assets	Transmission and plant assets and major projects
Governance - suite of documents, standards and contractual agreements needed	CAD / Drawing template / PBD & Product Data Templates	Asset Information Requirements (AIR), Information Delivery Plan IDP	Focus on configuration set up & training - Standards are built into environment
Development- investment for ongoing	Existing Process	Evolve system to improve integration with Asset Information Systems	Upgrades of software integrations
Data use - availability of data for client use	Operational only	milestone reviews	full access to shared data
validation -timing of when validation can be undertaken	only at handover	sequentially	through workflow

Table 1 Archetype attributes

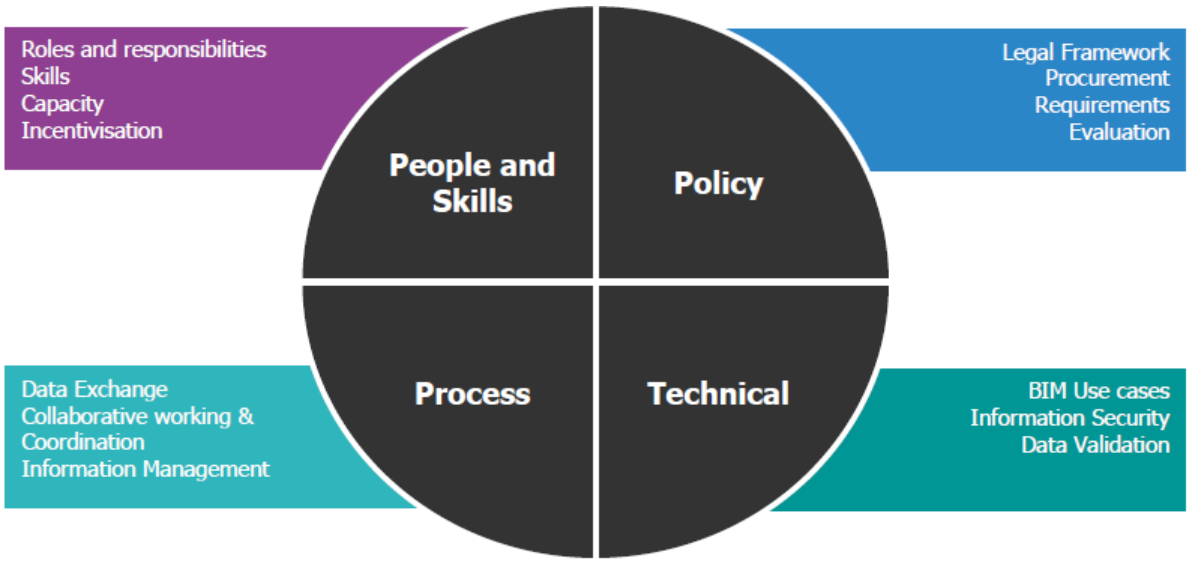

Figure 9 Addressing the business needs for BIM adoption

People, Policy, Process and Technical issues need to be addressed to implement BIM

Standards, Methods and Processes

To support the common data environment the data must be produced in accordance with standards, methods and processes. Through the STP, Watercare has established a data hierarchy, asset classification and the attribution of asset types within each asset class. Within this structure, Watercare has an established equipment numbering system to link field identification with the asset data model and drawings.

These standards are the basis on which Watercare will next need to construct the standard design models and link to object standards (BIM-MEPaus, ANZRS, etc.)

A well-developed set of requirements is needed for this based on ISO 19650 - *Organisation and Digitisation of Information*.....

OIR - *Organisational Information Requirements* - this defines why information is collected

AIR - *Asset Information Requirements* - this is the asset data and information standard

EIR - *Exchange Information Requirements* - Project standards,

PIR - *Project Information Requirements* - forms part of the project brief

Policy

Policy represents the contractual framework necessary to engage with the supply chain and embed BIM requirements into project outcomes. This includes the Asset delivery lifecycle, establishes information requirements aligned with ISO19650, procurement process and performance measuring and monitoring. This includes:

- Terms and conditions of contracts to ensure application of BIM principles and encourage collaborative behaviours
- Ensure tender evaluation includes the assessment of BIM attributes
- Ensure information is appropriate and does not encourage the over- generation of information - '*BIM wash*'.
- Develop enterprise governance around BIM.

Process

This ensures that BIM is integrated into the selected project delivery process.

Setting common data standards that are applied by all stakeholders.

Tools are developed collaboratively with the users so the user experience (UX) promotes adoption.

Establishing a solution to a Common Data Environment (CDE) – this could be a hybrid. In Watercare's situation all three archetypes could feasibly be applied. **Single projects**, developed completely outside of the CDE where the data is transferred on completion such as small subdivisions. **Project- Client CDE** – Where scale or simplicity infers a lighter management touch is needed such as delivery of standard plant. **Client Hosted CDE** – when all the attributes of BIM add value i.e. complex and / or large value works and if Watercare has the BIM capability to manage this.

Developing the capability of our people- Watercare recognises this development is needed.

5. EXAMPLES OF BIM ENABLED INNOVATIONS

DIGITAL REHEARSAL

BIM enabled 4D Digital rehearsal will be employed utilising a collaborative software platform to integrate Programme with design models (Engineering) data in a collaborative space. This will have a cross discipline team inclusive of site / construction and service expertise. Digital Rehearsal is not limited to construction – it can also be used to optimise any sequence of activities such as commissioning and procurement and showcasing to projects to stakeholders.

The collaborative space, is ideally a meeting room with large interactive screens.

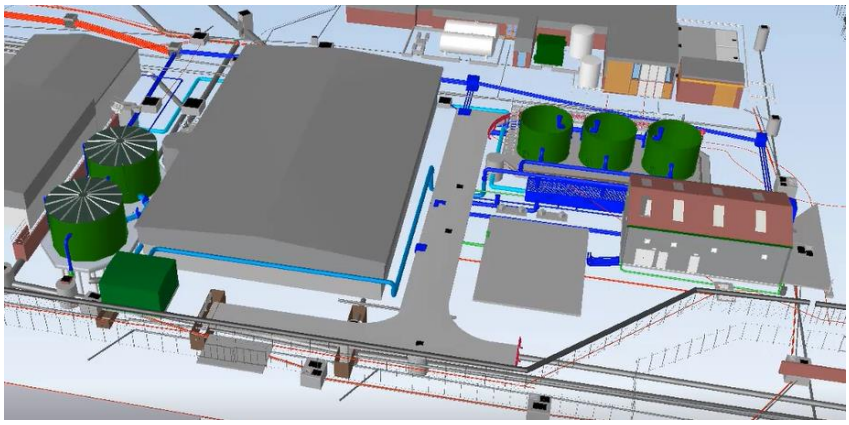

Figure 10 Screenshot of Digital Rehearsal of a water installation – supplied by @one Alliance

The cross discipline team can work together on a single version of the project plan – early. Consider scenarios and develop optimum delivery solutions. In this environment we can proactively challenge methodologies and mobilise only when ready.

International practice demonstrate around 50% of projects will be modified through this process. This enables greater worker safety, shorter committed site hours (up to 50%), greater ownership by construction crews and more efficient site works. This is a powerful BIM driven tool to engage the digital capability and evolve the right organisational behaviours for 40/20/20 to be a success.

Digital Rehearsal is not limited to construction – it can be used to optimise any sequence of activities such as commissioning and procurement. The tools are also of value to showcasing to projects. The requirements for this include equipment that are now more or less standard in offices and software and Ways of Working (WoW) that are new to Watercare but well referenced internationally and we are working with a select few of these practitioners to map a deployment strategy to make this successful in Watercare.

PRODUCT BASED DESIGN, BUILD OFFSITE, DESIGN FOR MANUFACTURE AND ASSEMBLY (DfMA)

Watercare's infrastructure needs to be safe to deliver and operate, resilient, affordable and sustainable. Under the Enterprise Model (EM), a broad programme management approach is being developed that considers the entire forward works, as opposed to discrete projects. This will inform a standardisation drive through a **'Product Based Design'** (PBD) platform developing standard designs conceived in advance of the programme needs. This also drives supply chain collaboration to improve and realise repetition efficiencies.

The identification of repeatable tasks, the valuation of these, and the prioritisation into 'projects' is a collaborative, integrated and on-going process. Input across all disciplines are needed to enhance the benefits.

All products will be integrated into a 3D product library. The library also acts as the repository for more enriched data, such as: design and process calculations, piping and instrumentation drawings (P&IDs), Base functional descriptions (FD's) and base coding modules, component lists, assembly plans, Base environmental effects assessments, additional information can inform stakeholder, consenting, and communications needs – smoothing the entire delivery route.

Delivery lends itself to either complete or modular (whole or in part) build off-site assembly. The UK water utility market noticed as a result a shift in managing Health and safety. Off-site construction reduced minor incidents where assemblies are managed in a known and controlled environment but likewise increased the management of moving larger assemblies of equipment on-site.

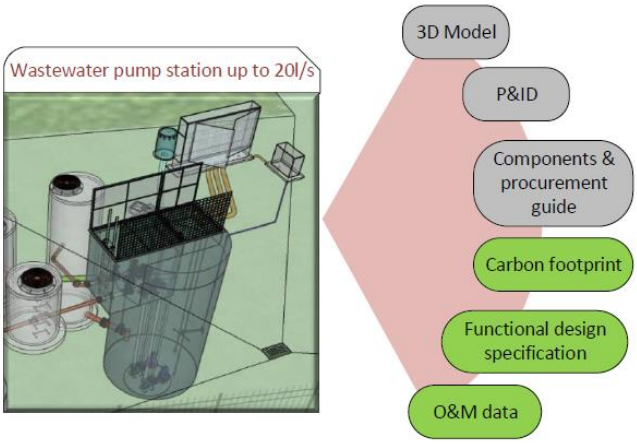

Figure 11 Typical Standard Plant

Building off-site provides for greater quality control and component testing before arrival on-site and reduces on-site presence (excavations open for shorter periods, business interruption etc.) and traffic management time frames. Trained staff are better managed for the specific tasks. Where some staff would be better applied for on-site connection work, others are better to specialize in assembling and testing.

The benefits of PBD include:

- Carbon footprint reduction through leaner design
- Reduction of delivery cost and time
- Increased component of offsite assembly
- Improvement in safety through greater familiarity and reduced site time
- Enhanced supply chain engagement and lifetime performance
- Improved operator familiarity
- Greater certainty of time and cost elements- lending to better decision making
- Ease of deployment of information to other clients
- Better information deployment

6 Conclusions

Auckland faces unprecedented infrastructure expansion in a constrained construction market where productivity has stalled, and improvements are needed. In addition, the construction industry has been slow to adapt to the digital world. In New Zealand, client-based organisations in the design and build field are now adopting BIM at pace but are 3-4 years behind the leading countries. Infrastructure client industries have been slower still to adopt.

Watercare has a mixed quality of engineering information available. The unreliability of some of this data reduces the confidence and quality of decisions adding time and cost to what should be routine duties.

Watercare is also undergoing changes in the ways of working with the Strategic Transformation Programme and the Enterprise Model both being collaborative, and outcome focused. The adoption of agile methodology, although requiring more intensive planning, has improved transparency, collaboration, and has been adopted through the wider business.

By adopting Better Information Management 'BIM' Watercare is promoting the framework to lift delivery productivity needed to meet a challenging capital delivery programme in the constrained New Zealand market. The success of this will be influenced by the extent of supply chain adoption of BIM collaboration principals and the institutional readiness of all stakeholders . BIM will also provide greater confidence for the management of built assets through their lifecycle that are built, and in most cases 'buried' allowing better informed decisions in future. BIM will also provide data environments that promote outcome focused collaboration with delivery stakeholders.

Large governmental infrastructure 'client' entities such as Watercare have an outsized ability to shape the industry wide adoption of BIM and improve outcomes for all infrastructure sectors. Watercare customer obligations with respect to value and resilience and where BIM adoption improves these should adopt.

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