



2017 Stormwater Victoria Conference



Where do our challenges lie?

We are tackling some really big problems...

Where do our challenges lie?

We are tackling some really big problems...

Interoperability

Affordability

Sustainability

Intergenerational Equity

Network Optimisation

Where do our challenges lie?

We are tackling some really big problems...

Interoperability

Affordability

Sustainability

Intergenerational Equity

Network Optimisation

Public Value

NZ's 'Strategy'

Competency through Standards, Models and Analytics

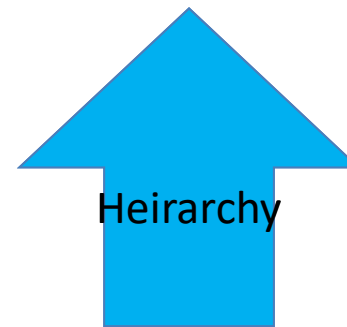
Interdisciplinary Model – Building Competency



WATER
ASSETS

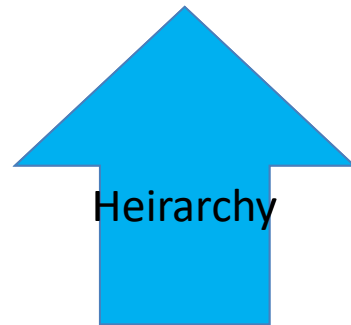
Interdisciplinary Model – Adopting Standards

International Standards
Local, Regional, National Standards
Design & Build Standards
Technical Standards
GIS Standards
Metadata Standards



International Stds	Local Regional National Stds	Design Stds	Technical Stds	GIS Stds	Meta-data Stds	WATER ASSETS
ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ	

Interdisciplinary Model – The Model Hierarchy



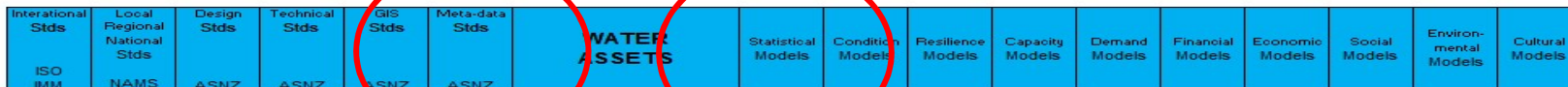
- Social Models
- Cultural Models
- Environmental Models
- Economic Models
- Financial Models
- Demand Models
- Capacity Models
- Resilience Models, Criticality Models
- Condition Models
- Statistical Models

International Std	Local Regional National Std	Design Std	Technical Std	GIS Std	Meta-data Std	WATER ASSETS											
ISO IMU	NAMS	ASN7	ASN7	ASN7	ASN7		Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models	

Interdisciplinary Model – The Model Hierarchy

Metadata Schema's &
Statistical Models

Fundamental Rethink



International Stds	Local Regional National Stds	Design Stds	Technical Stds	GIS Stds	Meta-data Stds	WATER ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models
ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ											

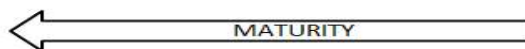
The most *fundamental* of all the building blocks are not / have never been established

Interdisciplinary Model – The first blocks

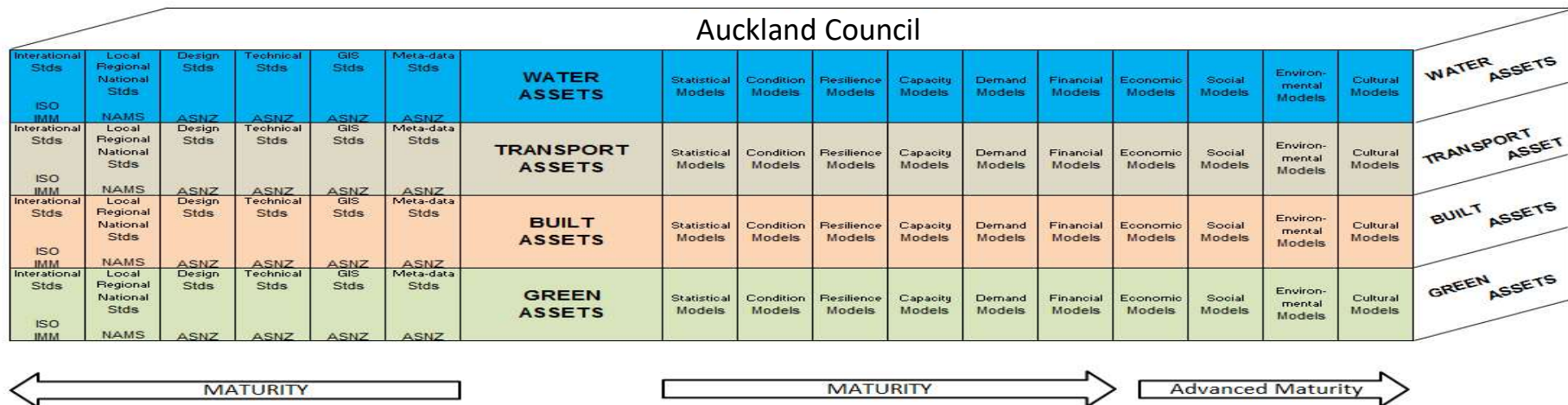


Interdisciplinary Model – Asset Agnostic

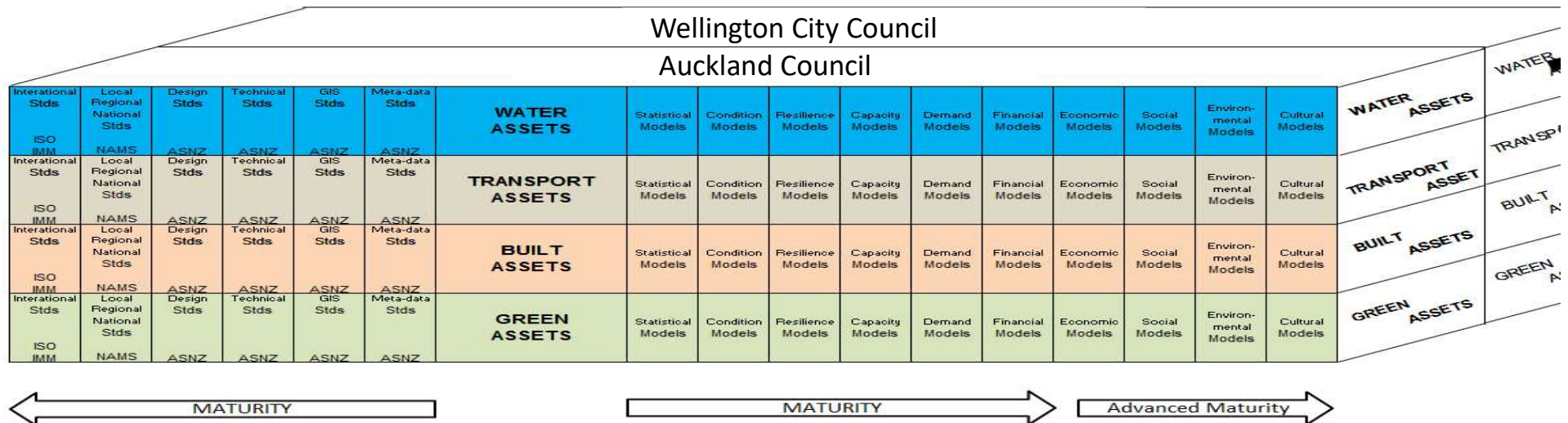
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ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ	WATER ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models
International Stds	Local Regional National Stds	Design Stds	Technical Stds	GIS Stds	Meta-data Stds	TRANSPORT ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models
ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ	TRANSPORT ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models
International Stds	Local Regional National Stds	Design Stds	Technical Stds	GIS Stds	Meta-data Stds	BUILT ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models
ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ	BUILT ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models
International Stds	Local Regional National Stds	Design Stds	Technical Stds	GIS Stds	Meta-data Stds	GREEN ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models
ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ	GREEN ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models



Interdisciplinary Model – One Asset Data Platform



Interdisciplinary Model – And.... Intra-sectoral



Interdisciplinary Model – And.... Intra-sectoral

Christchurch City Council, etc. etc.....

Wellington City Council
Auckland Council

International Stds	Local Regional National Stds	Design Stds	Technical Stds	GIS Stds	Meta-data Stds	WATER ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models	WATER ASSETS	WATER ASSETS
ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ	TRANSPORT ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models	TRANSPORT ASSET	TRANSP
International Stds	Local Regional National Stds	Design Stds	Technical Stds	GIS Stds	Meta-data Stds	BUILT ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models	BUILT ASSETS	BUILT A
ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ	GREEN ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models	GREEN ASSETS	GREEN A
International Stds	Local Regional National Stds	Design Stds	Technical Stds	GIS Stds	Meta-data Stds													
ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ													

← MATURITY

MATURITY →

→ Advanced Maturity

Interdisciplinary Model – And.... Intra-sectoral

Any Council

Christchurch City Council, etc. etc.....

Wellington City Council
Auckland Council

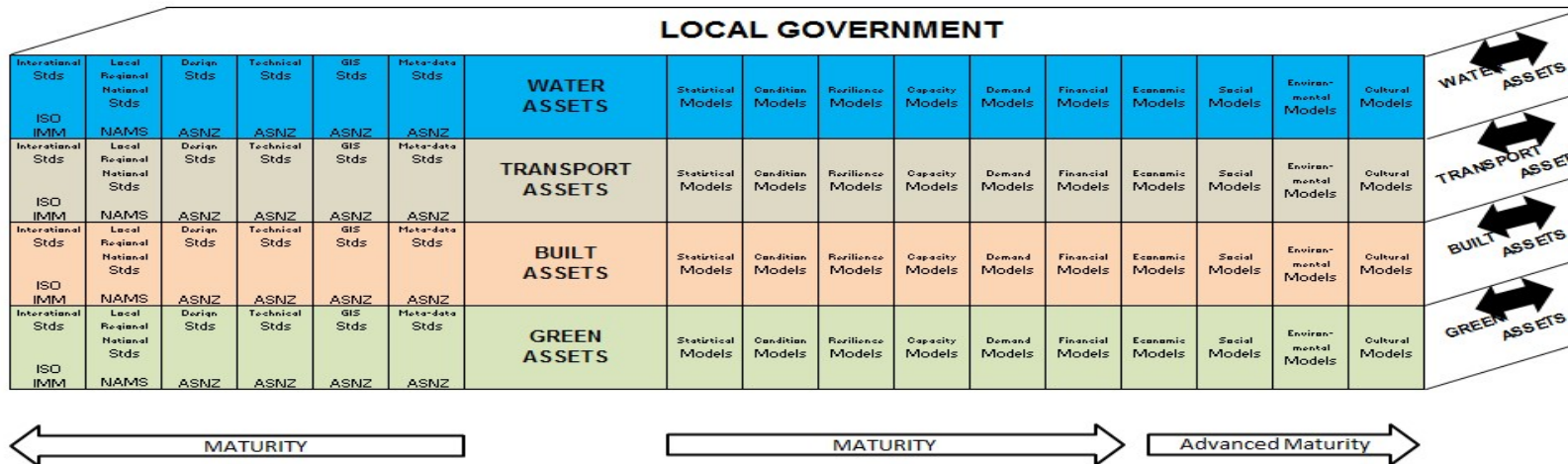
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ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ	TRANSPORT ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models	TRANSPORT ASSET	TRANSP
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ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ	GREEN ASSETS	Statistical Models	Condition Models	Resilience Models	Capacity Models	Demand Models	Financial Models	Economic Models	Social Models	Environ- mental Models	Cultural Models	GREEN ASSETS	GREEN A
International Stds	Local Regional National Stds	Design Stds	Technical Stds	GIS Stds	Meta-data Stds													
ISO IMM	NAMS	ASNZ	ASNZ	ASNZ	ASNZ													

← MATURITY

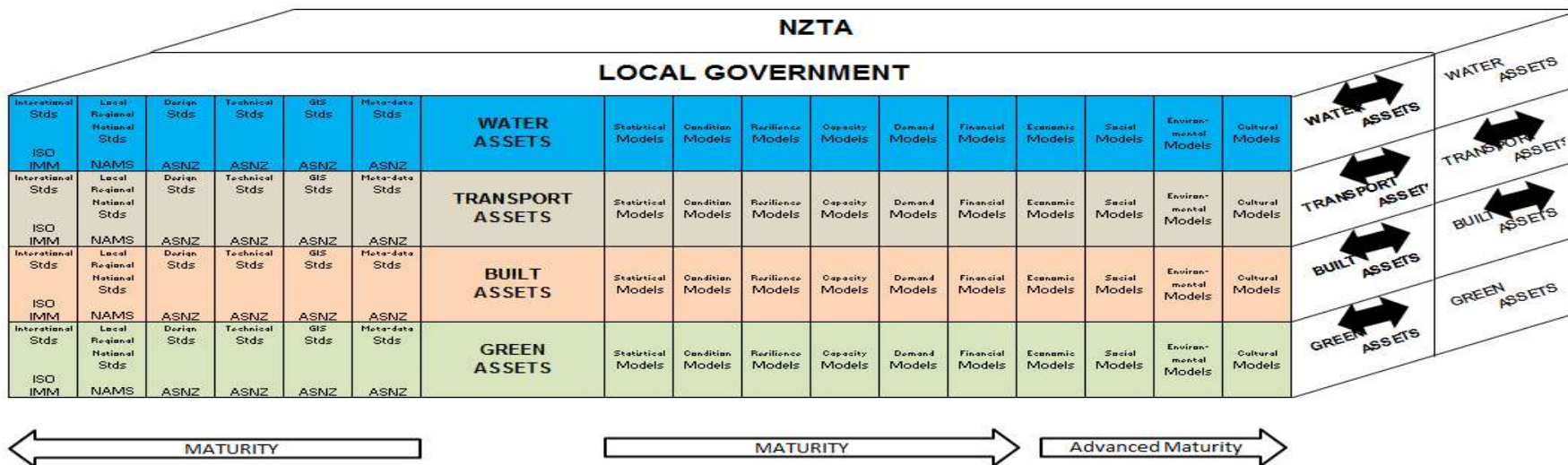
MATURITY →

→ Advanced Maturity

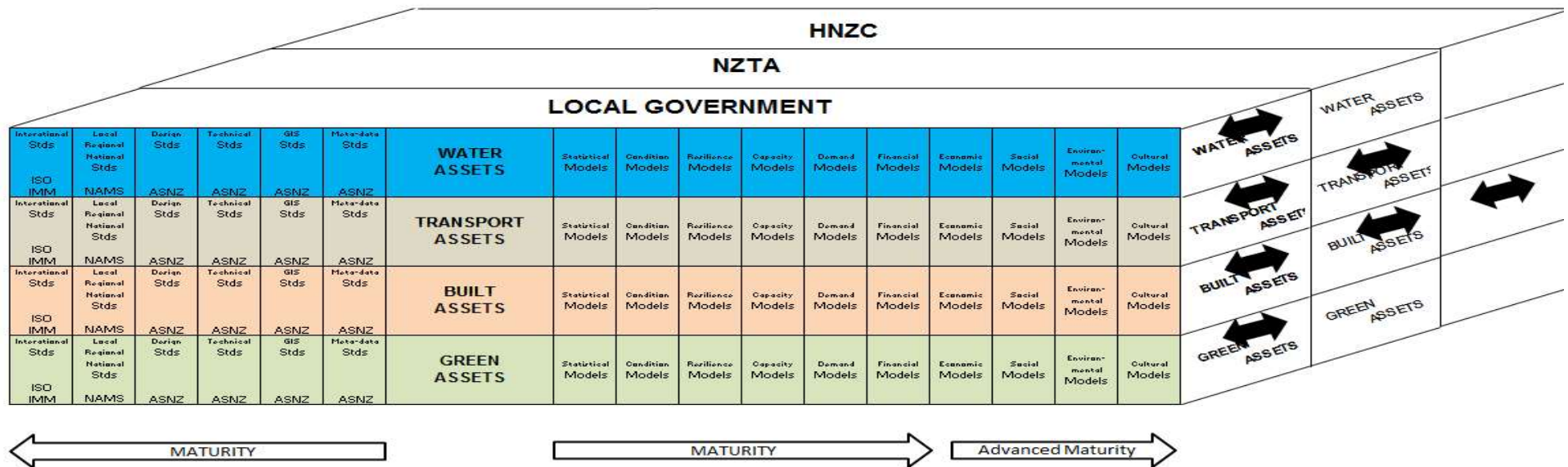
Interdisciplinary Model – The LG Sector.... but



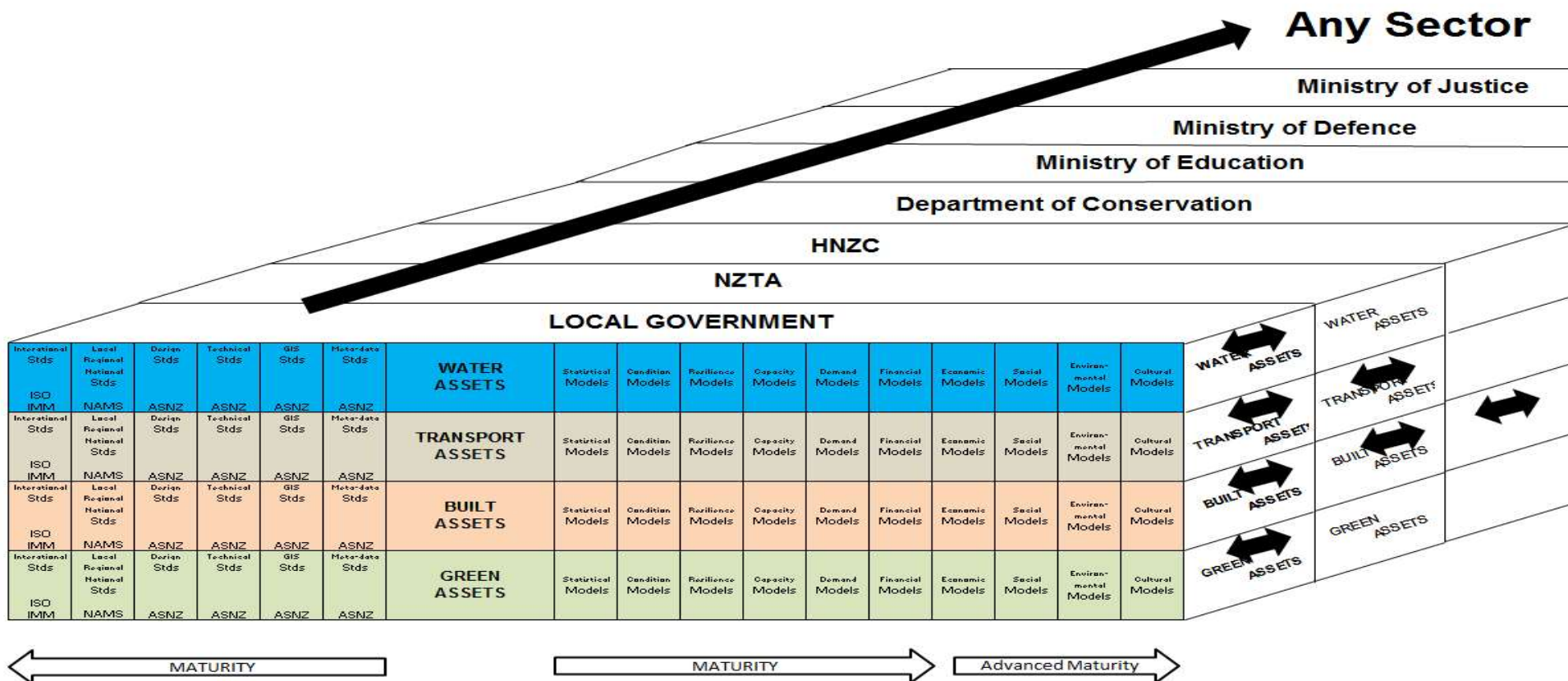
Interdisciplinary Model – Inter-Sectoral



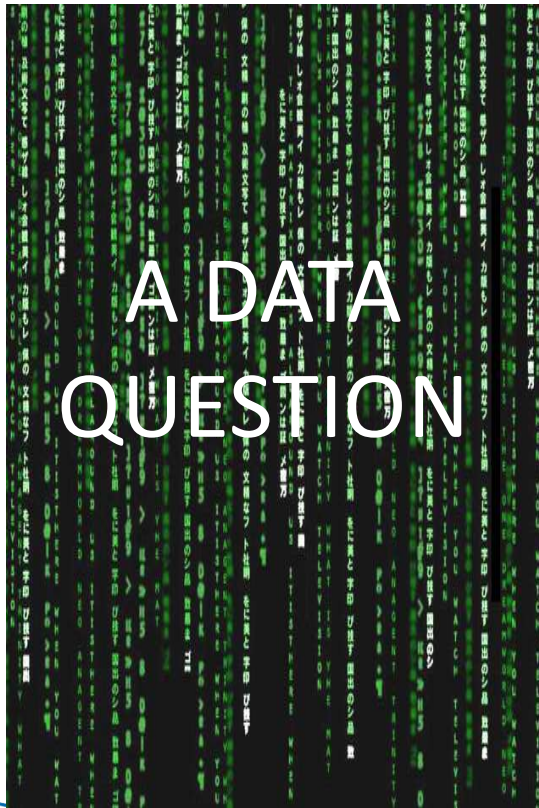
Interdisciplinary Model – Inter-Sectoral



Interdisciplinary Model – Inter-Sectoral



What we know....
Its a digital environment



And need to think in digital terms

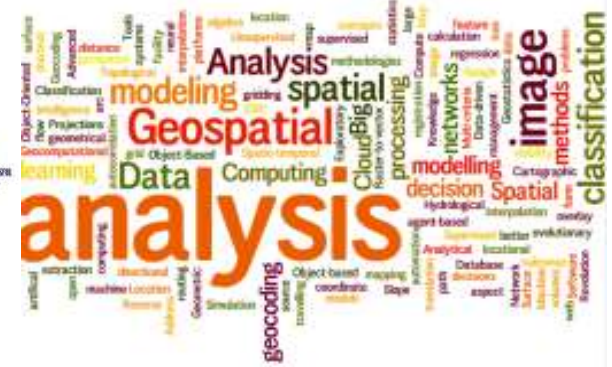
What we don't know....

A DATA QUESTION



What we **don't** know....
Is the **enormity** of it... and

A DATA QUESTION



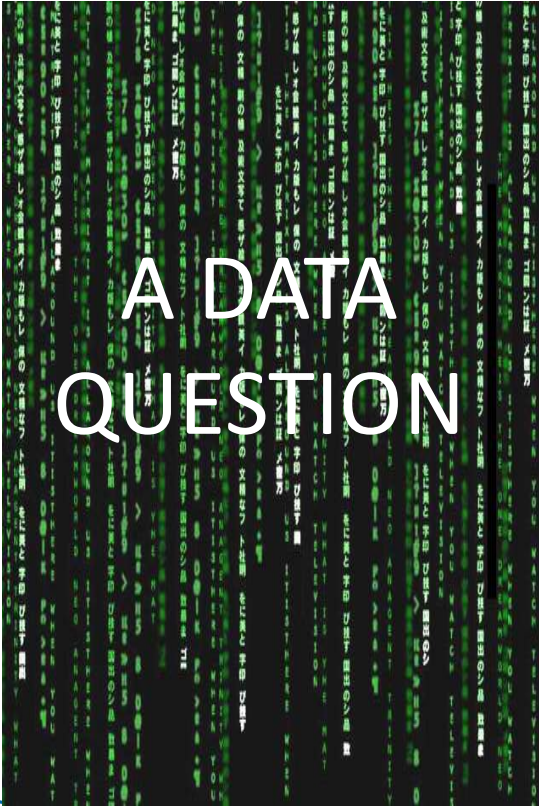
What we don't know....
Is the enormity of it

A DATA QUESTION



How to think in digital terms

What we **don't** know....
Is the **enormity** of it



A DATA QUESTION



How to think in digital terms
And our asset's **wider context**



Cohorts of Internal Data

- **Land Data Cohorts**
e.g. SHAs, Wards, Catchments
- **Infrastructure Data Cohorts**
e.g. AKLC, AT, Watercare et al. (Energy & Telco's)
- **Developers Data Cohorts**
e.g. Fletchers, Hugh's & Green et al.
- **Consenting / Construction Data Cohorts**
e.g. Building and resource (incl. 'pre application')
- **Activities & Events Data Cohorts**
e.g. Master games etc.

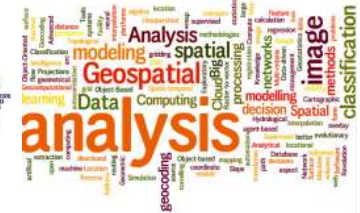




Cohorts of Internal Data

LINZ defines this cohort

- **Land Data Cohorts**
e.g. Parcels, Properties
- Infrastructure Data Cohorts
e.g. AKLC, AT, Watercare et al. (Energy & Telco's)
- Developers Data Cohorts
e.g. Fletchers, Hugh's & Green et al.
- Consenting / Construction Data Cohorts
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- Activities & Events Data Cohorts
e.g. Master games etc.





Cohorts of Internal Data

AKLC defines this cohort

- Land Data Cohorts
e.g. SHAs, Wards, Catchments
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- Consenting / Construction Data Cohorts
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e.g. **Building** and resource (incl. 'pre application')
- Activities & Events Data Cohorts
e.g. Master games etc.

And MBIE & AKLC defines this cohort

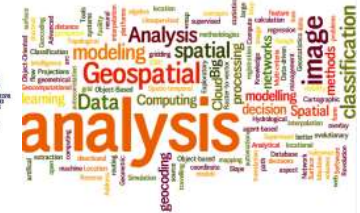




Cohorts of Internal Data

AKLC defines this cohort

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e.g. Master games etc.



Land must be 'spatially coherent' – Parcel Metadata

The screenshot displays the LINZ Data Service interface. On the left, a sidebar shows 'DATA TYPE' with 'All' selected, and a list of 'Layers' (1036), 'Tables' (28), and 'Sets' (27). The main map area shows a street view of Auckland with labels like 'ST PAUL ST', 'MOUNT ST', 'SYMONDS ST', 'GRANTON RD', and 'NORTHWESTERN MOTORWAY'. A search bar at the top left contains 'land parcels' and shows '1091 results for land parcels'. On the right, a panel titled 'NZ Parcels' shows 'LINZ / Survey & Title' data. A red circle highlights the 'ISO 19115/19139 Metadata XML PDF' link. Below this, the 'Metadata' section lists 'File Identifier' (1d0800c1-1586-d7e6-a874-e87fe7553da0), 'Language' (eng), 'Character Set' (utf8), 'Hierarchy Level' (Scope Code dataset), 'Hierarchy Level Name' (dataset), and 'Contact' information (Responsible Party: Individual Name, Organisation Name: LINZ - Land Information New Zealand, Contact info: Contact, Phone, Telephone).

Metadata

Granularity

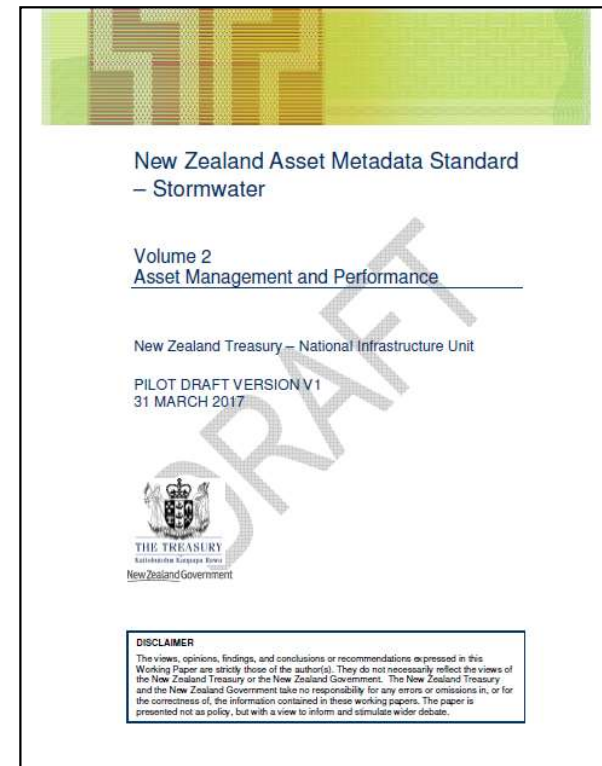
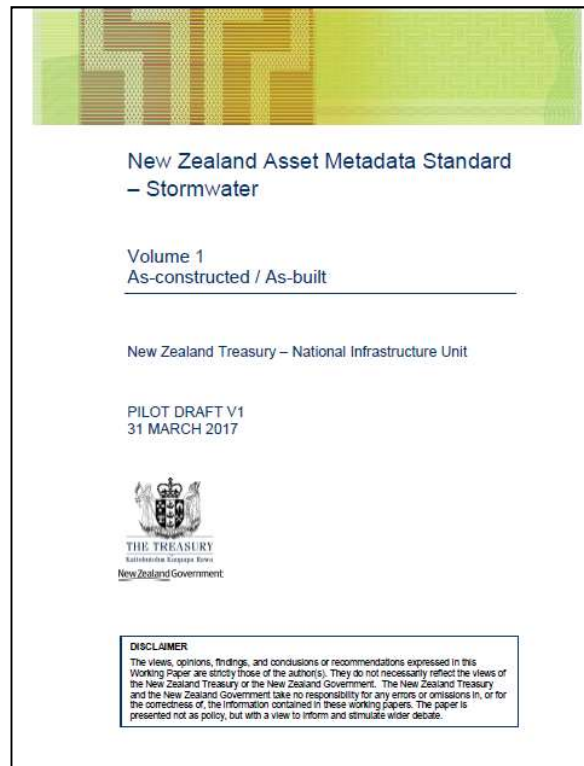
ParcelID

UPI – Unique
ParcelIDs

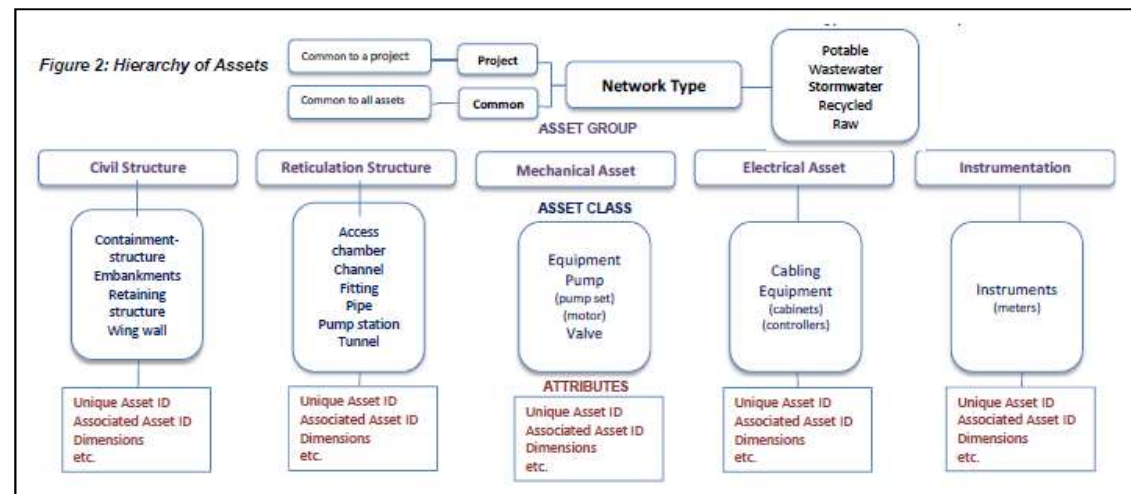


Infrastructure must be 'digitally coherent' – Infrastructure Metadata

NZAMS



What's in Volume 1



1.7 Hierarchy

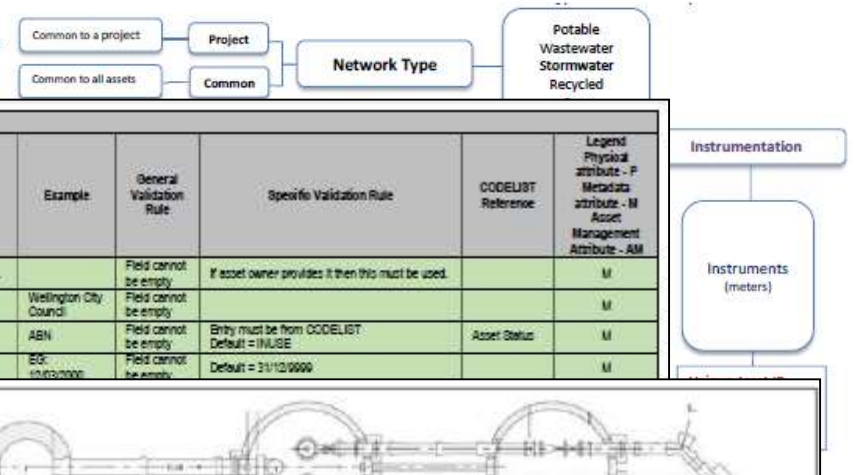
The hierarchy has been developed to list the relationship of the various asset types and their functions.

It can be used to determine:

- a single classification system for all assets
- the level of commonality of data requirements across various networks
- the level of commonality of data requirements across asset classes
- the level of detail to be collected for each asset type
- any differences between asset types across networks.

What's in Volume 1

Figure 2: Hierarchy of Assets



Channel Attributes & Validation File Format Instructions

Attribute Name - Abbreviated	Attribute Name - Full	Data Type	Units of Measure	Max Length	Comments	Contents	Example	General Validation Rule	Specific Validation Rule	CODELIST Reference	Legend: Physical attribute - P, Metadata attribute - M, Asset Management Attribute - AM
Unique_ID	Unique Identifier	Alpha / Numeric		20 chars	No commas included	Unique ID of the asset. Created by the data supplier.		Field cannot be empty	If asset owner provides it then this must be used.		M
Owner	Owner	Alpha / Numeric		100 chars	No commas included	Name of the asset owner.	Wellington City Council	Field cannot be empty			M
Status	Status	Alpha / Numeric		10 chars	No commas included	The current operational state of the asset.	ABN	Field cannot be empty	Entry must be from CODELIST Default = INUSE	Asset Status	M
Const_Date	Construction Date	Date	Time	n/a	dd/mm/yyyy	Date the asset was constructed/built/ installed	EG: 10/03/2006	Field cannot be empty	Default = 31/12/9999		M
Source	Source	Alpha / Numeric		10 chars	No commas included	Date source or method that was used to collect data and populate the attributes					
H_Prec	Horizontal Precision	Alpha / Numeric		10 chars	No commas included	Horizontal Precision to which the asset has been captured.					
V_Prec	Vertical Precision	Alpha / Numeric		10 chars	No commas included	Vertical Precision to which the asset has been captured.					
Des_Life	Design Life	Integer	Time	n/a	Whole number	Indicates the Manufactured Life / expected Design Life length in years.					
Cost	Cost	Decimal	Currency	n/a	2 decimal places	Cost of the asset determined at time of construction.					
Con_Ass_T	Condition Assessment Type	Alpha / Numeric		10 chars	No commas included	Condition Assessment Type					
Comments	Comments	Alpha / Numeric		250 chars	No commas included	Any additional comments that relate to this asset.					
Photo_Ref	Photographic Reference	Alpha / Numeric		250 chars	No commas included	Details relating to photographic records of the asset.					
Health_Sfty	Health And Safety Issues	Alpha / Numeric		250 chars	No commas included	Health and safety issues that need to be known.					
Condition	Condition	Integer		n/a	Whole number	Link field to Volume 2. Condition of Asset. The physical state of the asset which may or may not affect its ability to deliver intended design performance. Ranked 1 - 5, condition being 1.					

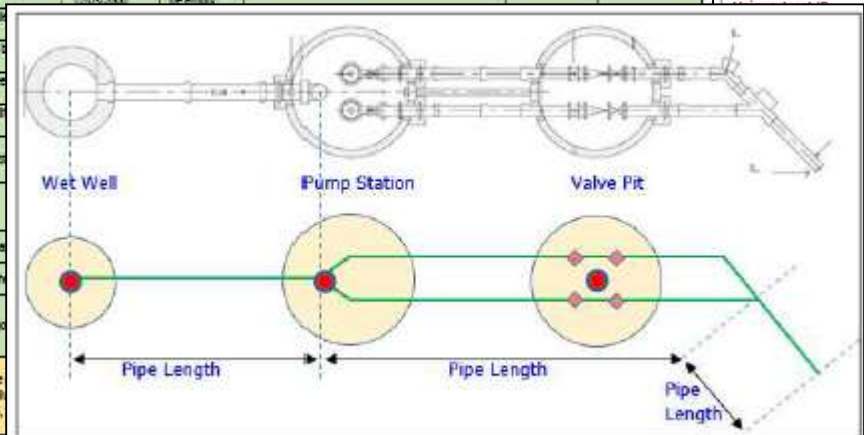
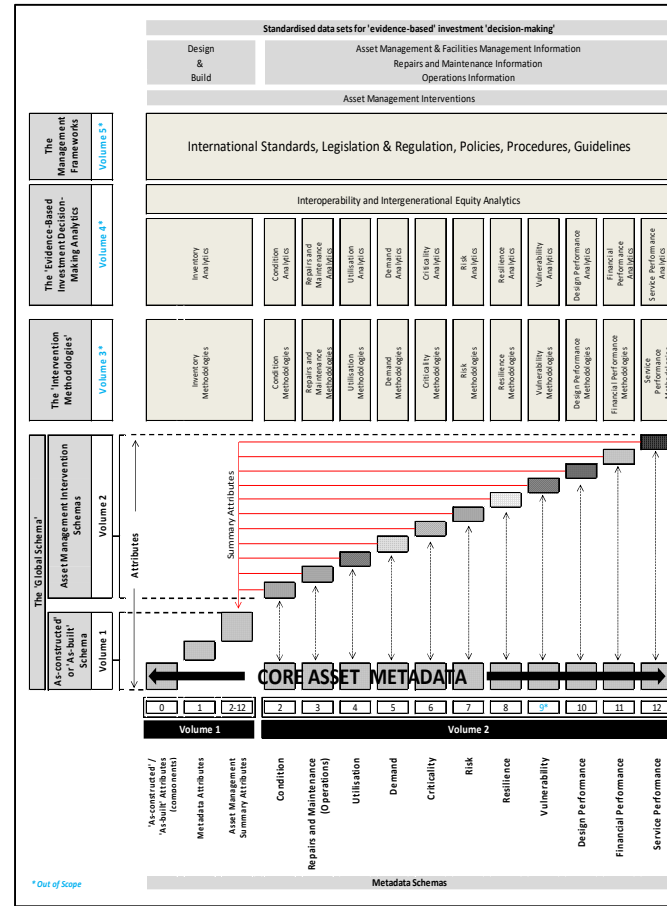
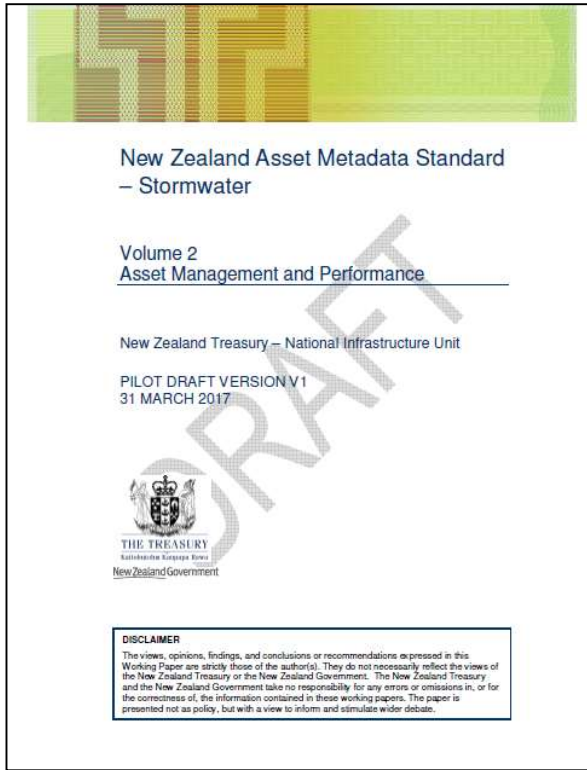


Figure 20: Example of a Pumping Station Asset Configuration

What's in Volume 2



Decision Elements

- Condition
- Repairs, Maintenance and Operations
- Utilisation
- Demand
- Vulnerability
- Criticality
- Risk
- Resilience
- Design Performance
- Financial Performance
- Service Performance

What's in Volume 2

Standardised data sets for 'evidence-based' investment 'decision-making'	
Design & Build	Asset Management & Facilities Management Information
	Repairs and Maintenance Information
	Operations Information
	Asset Management Interventions

Decision Elements

- Condition
- Repairs Maintenance

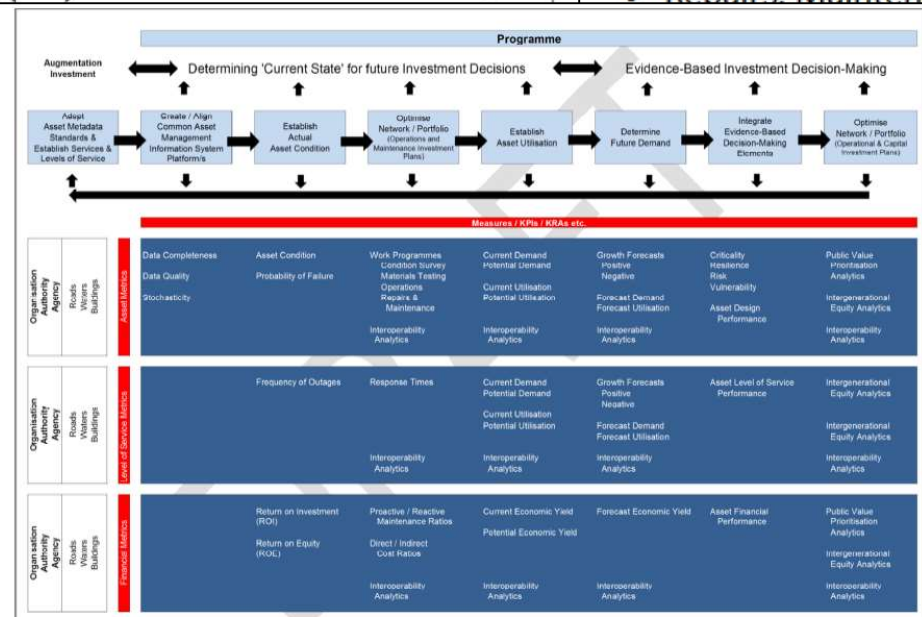
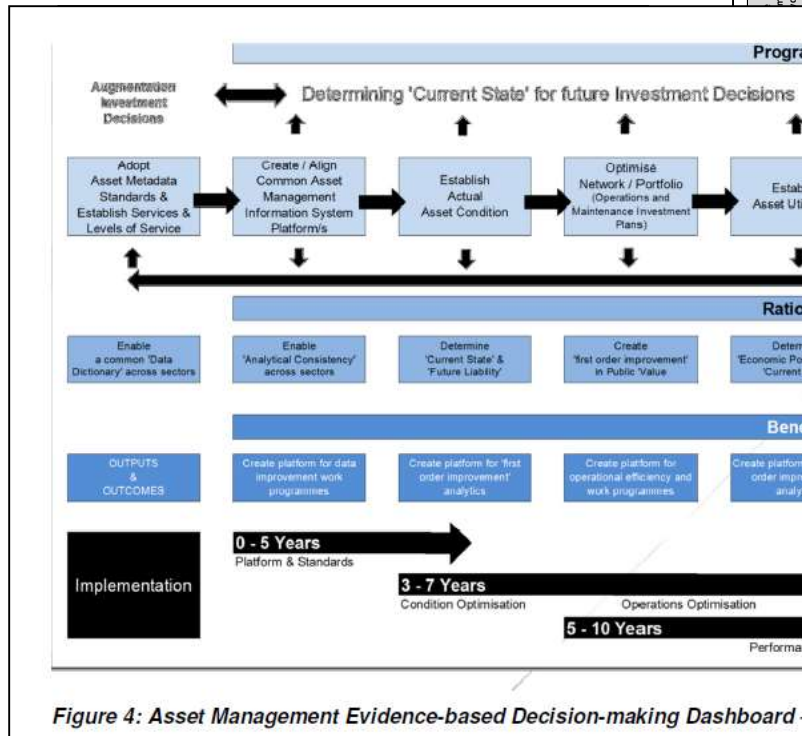
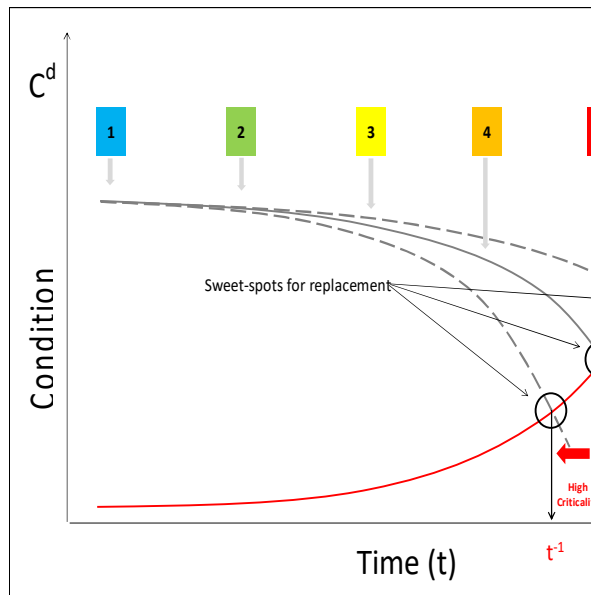


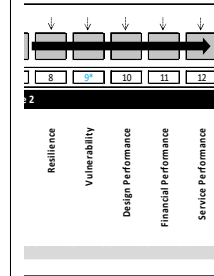
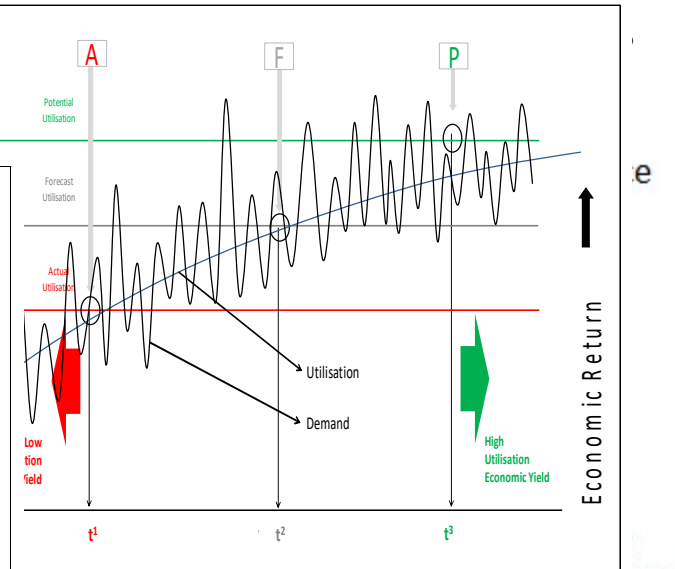
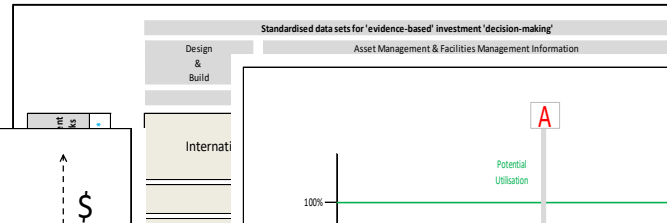
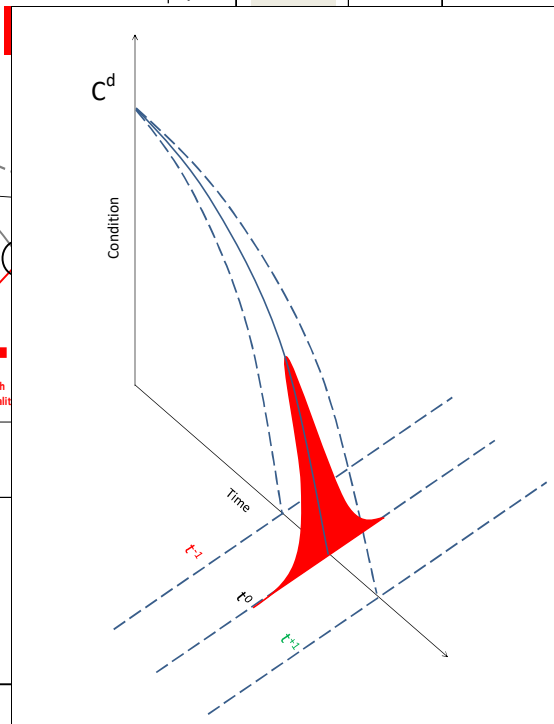
Figure 6: Asset Management Evidence-based Decision-making Dashboard – Proposed Tactical and Operational Response
Note: KPIs = key performance indicators; KRAs = key result areas

What's in Volume 2



DISCLAIMER

The views, opinions, findings, and conclusions or recommendations expressed in this Working Paper are strictly those of the author(s). They do not necessarily reflect the views of the New Zealand Treasury or the New Zealand Government. The New Zealand Treasury and the New Zealand Government take no responsibility for any errors or omissions in, or for the correctness of, the information contained in these working papers. The paper is presented not as policy, but with a view to inform and stimulate wider debate.

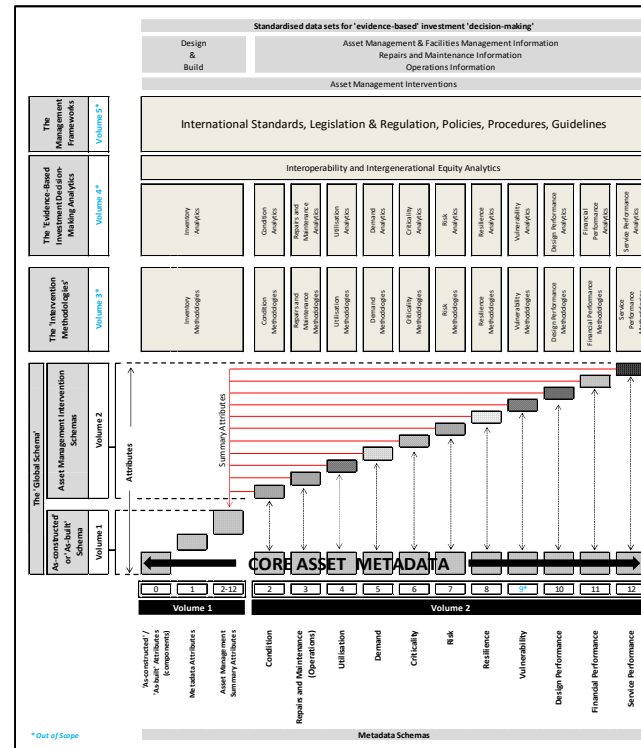
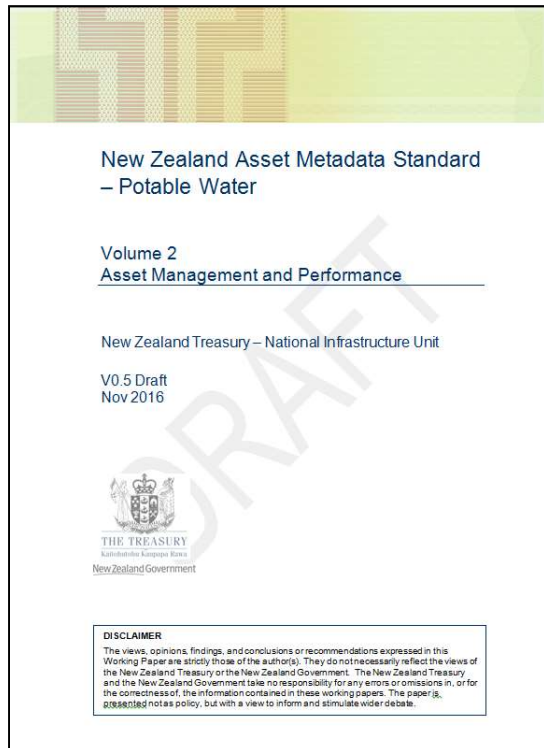


Financial Performance
Service Performance

So you do all that..... so what?

Or more accurately..... so what's next?

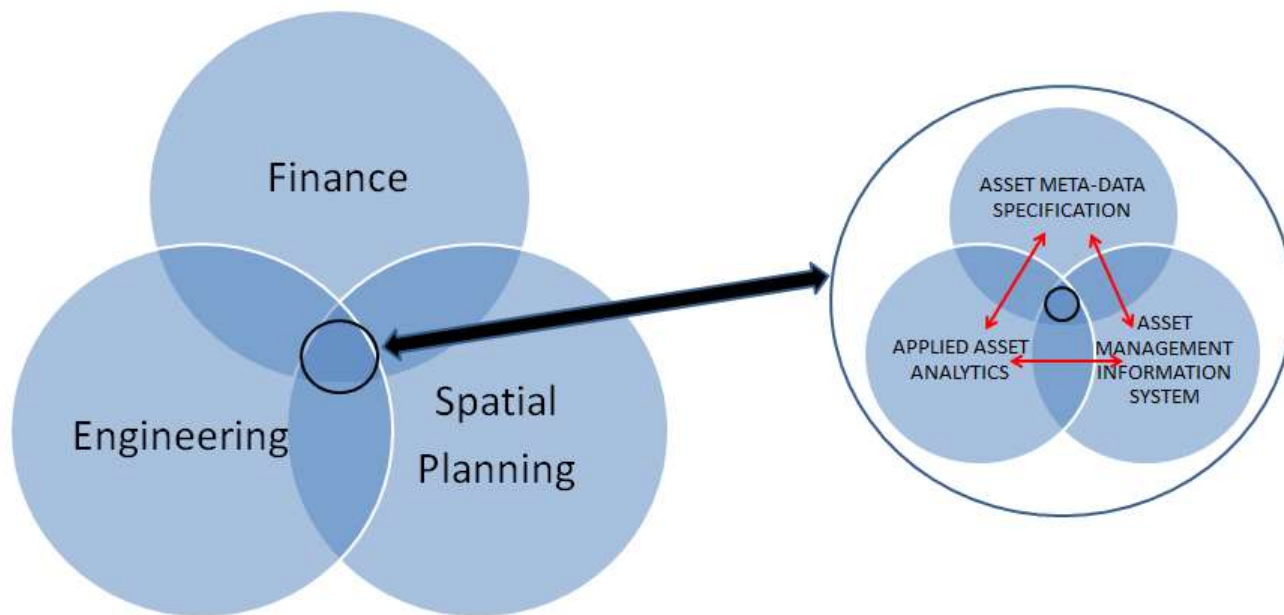
Infrastructure must be in a coalition with.....



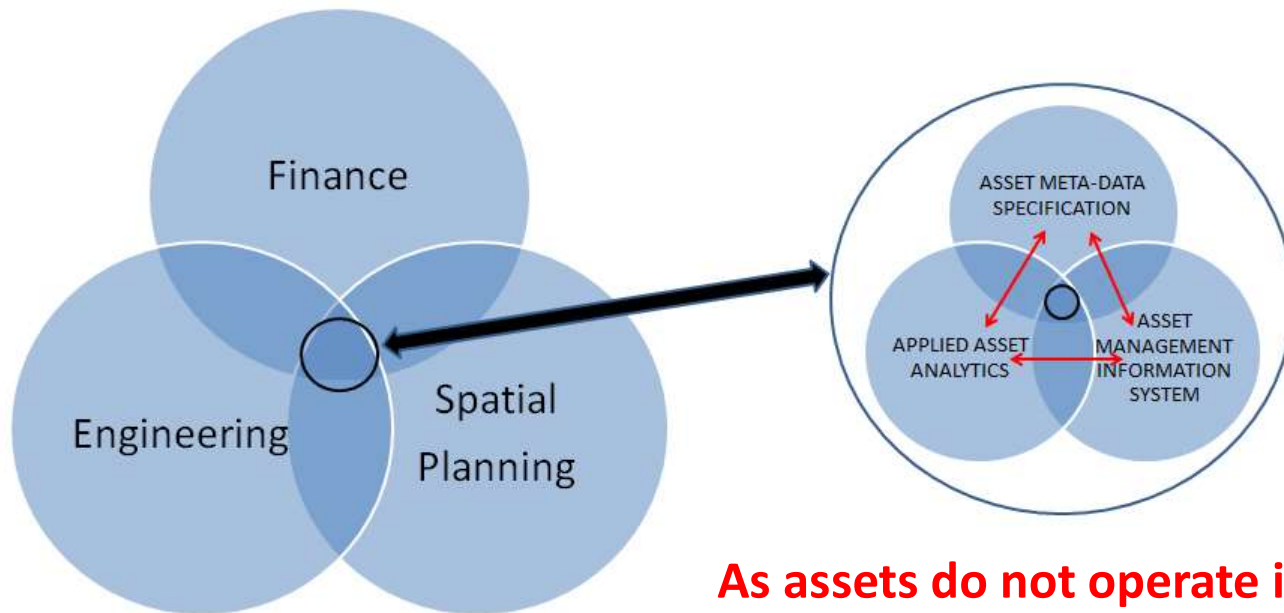
Decision Elements

- Condition
- Repairs, Maintenance and Operations
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- Criticality
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- Financial Performance
- Service Performance

Infrastructure must be in a coalition with..... Planning and Funding



Infrastructure must be in a coalition with.....
Planning and Funding



As assets do not operate in isolation!!!

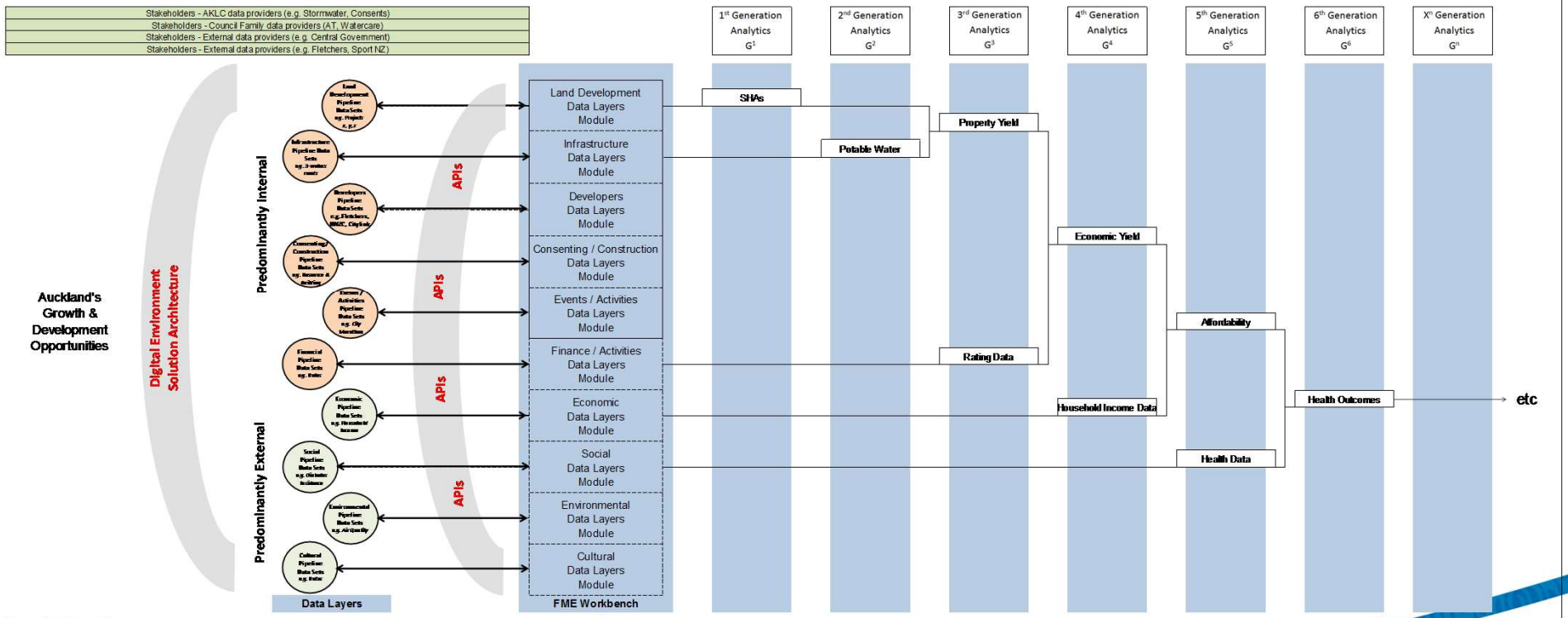
And, how do you find a way to
put all that data together....?

Because if you did you could tackle those really big problems...

Interoperability
Affordability
Sustainability
Intergenerational Equity
Optimisation
Public Value

Picking apart the 'Analytics'

The Analytical Platform - Interoperability Analytics



Haydn Read

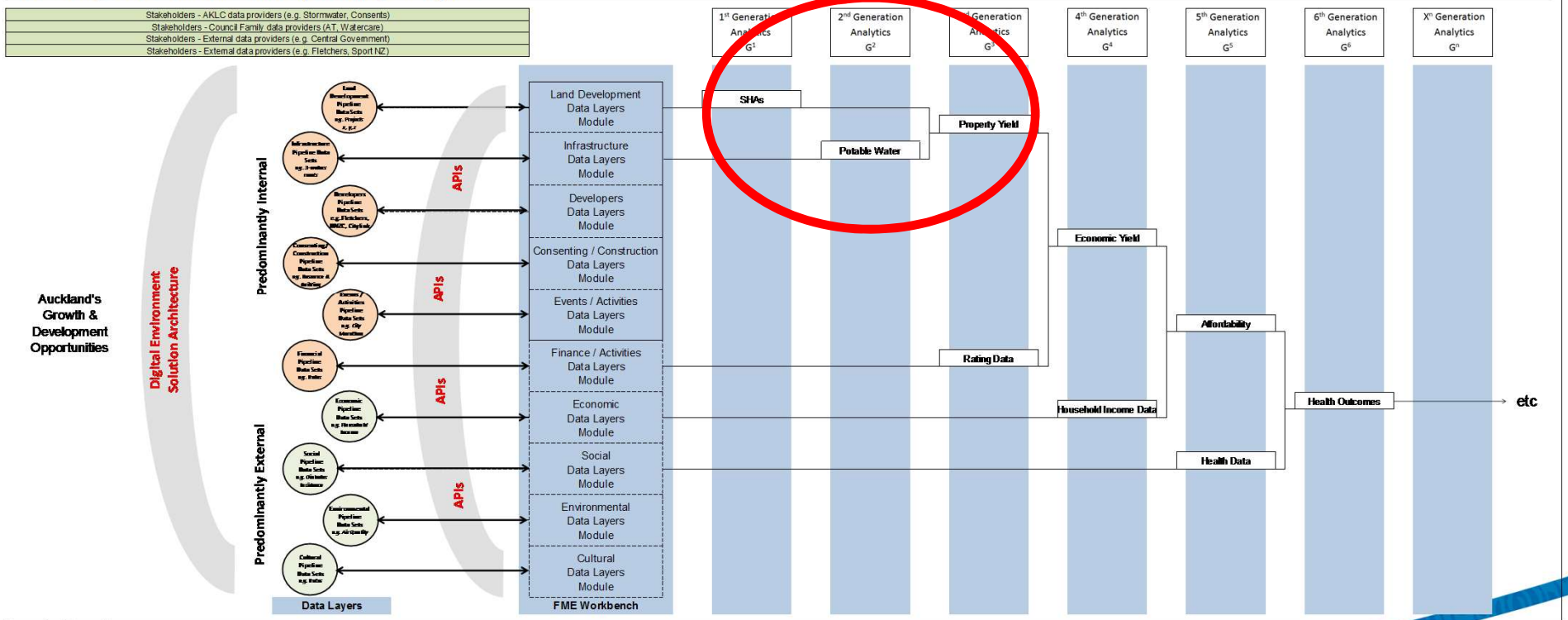
PhD Candidate (Victoria University)
BSC.(Hons.), MSc., NZIM, Adv. Dip Fin, MBA (Dist.),
MSIBA, MIPENZ, MIPWEA, MWaterNZ, MNZIoD

Head of Infrastructure Programmes

Development Programme Office | Infrastructure & Environmental Services

Picking apart the 'Analytics'

The Analytical Platform - Interoperability Analytics



Haydn Read

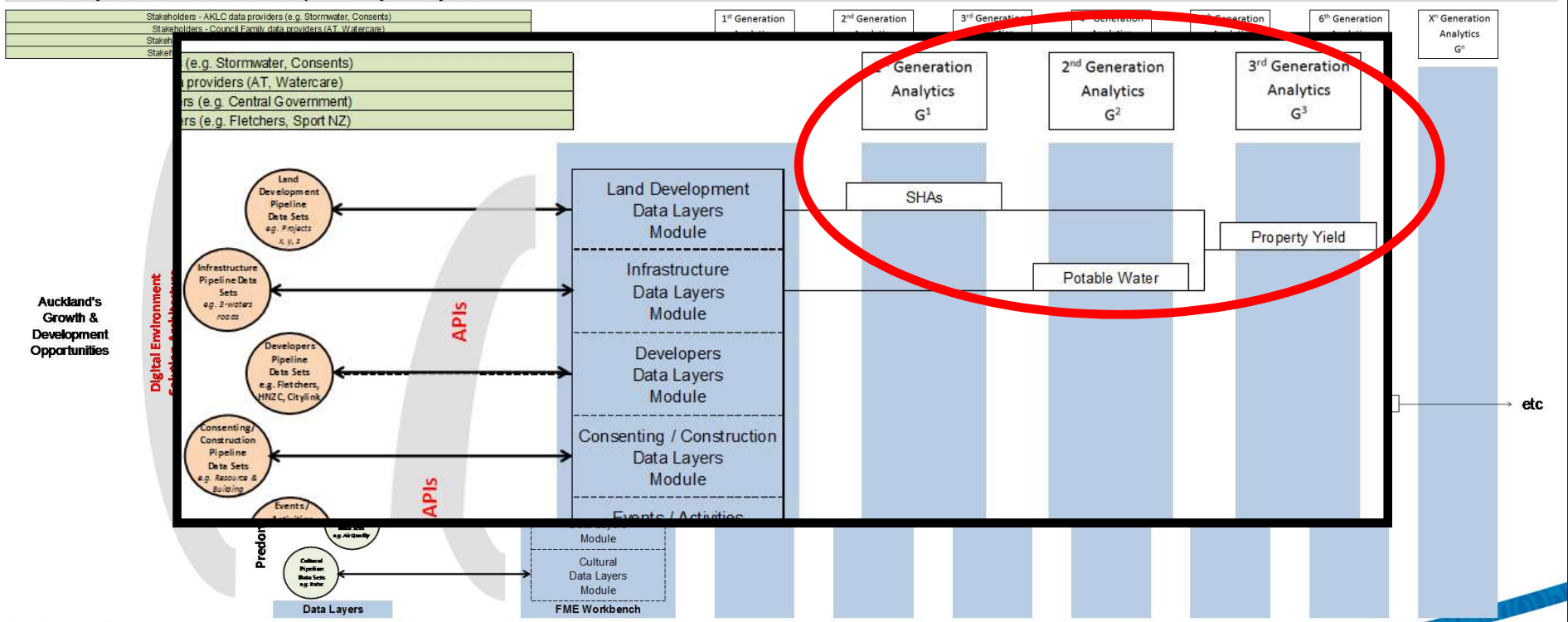
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Picking apart the *'Analytics'*

The Analytical Platform - Interoperability Analytics



Haydn Read

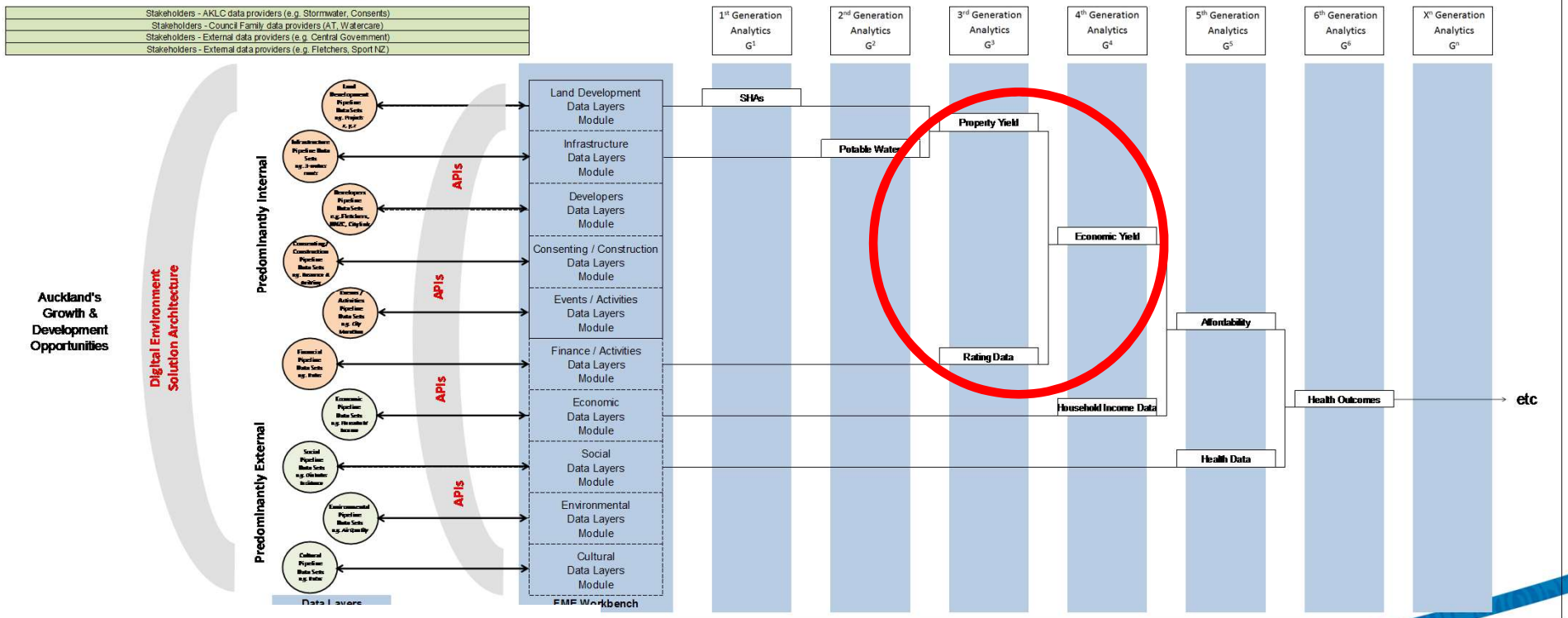
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Picking apart the 'Analytics'

The Analytical Platform - Interoperability Analytics



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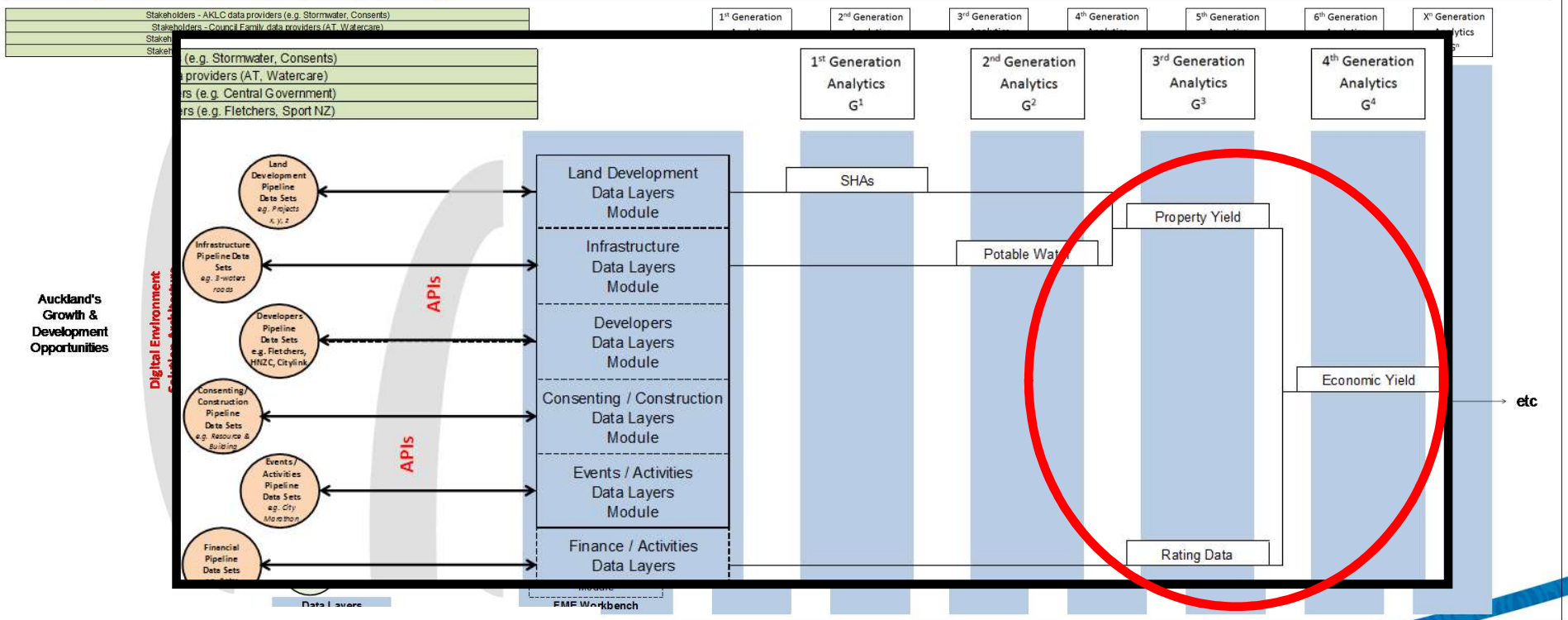
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The Analytical Platform - Interoperability Analytics



Haydn Read

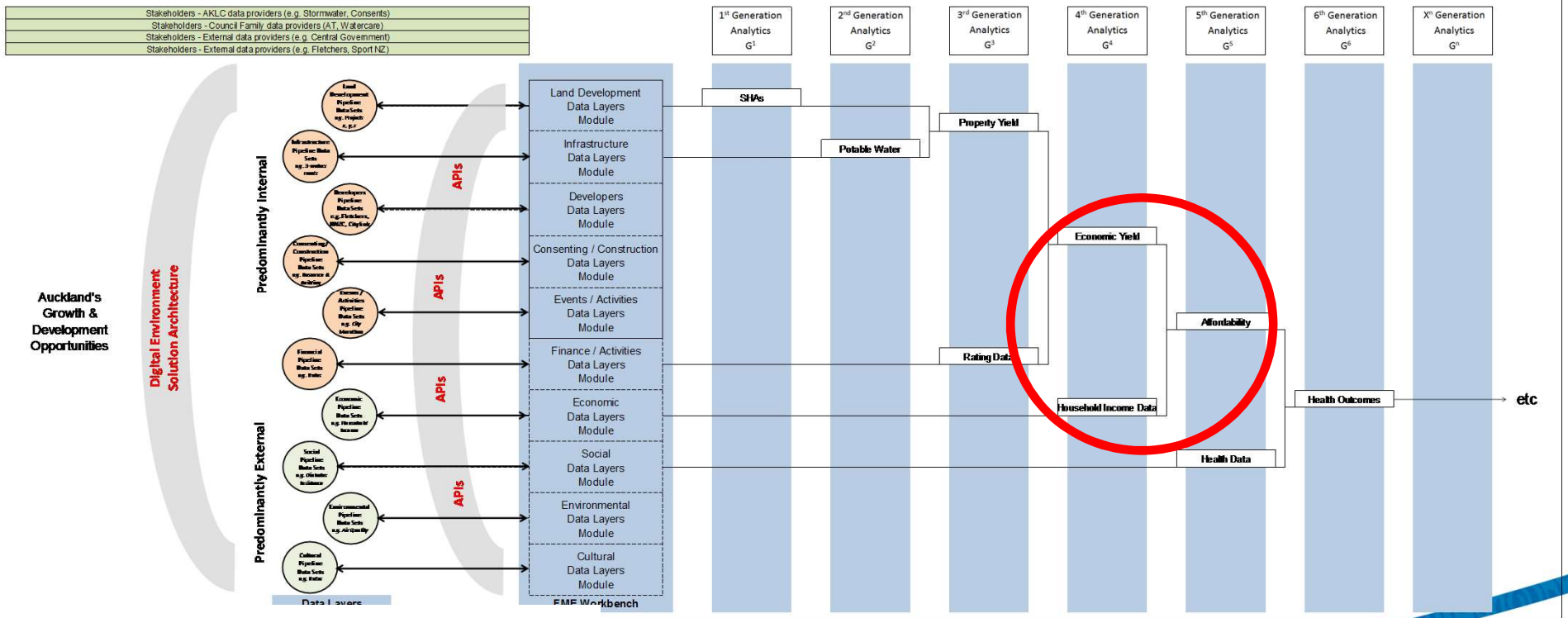
PhD Candidate (Victoria University)
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MSIBA, MIPENZ, MIPWEA, MWaterNZ, MNZIoD

Head of Infrastructure Programmes

Development Programme Office | Infrastructure & Environmental Services

Picking apart the 'Analytics'

The Analytical Platform - Interoperability Analytics



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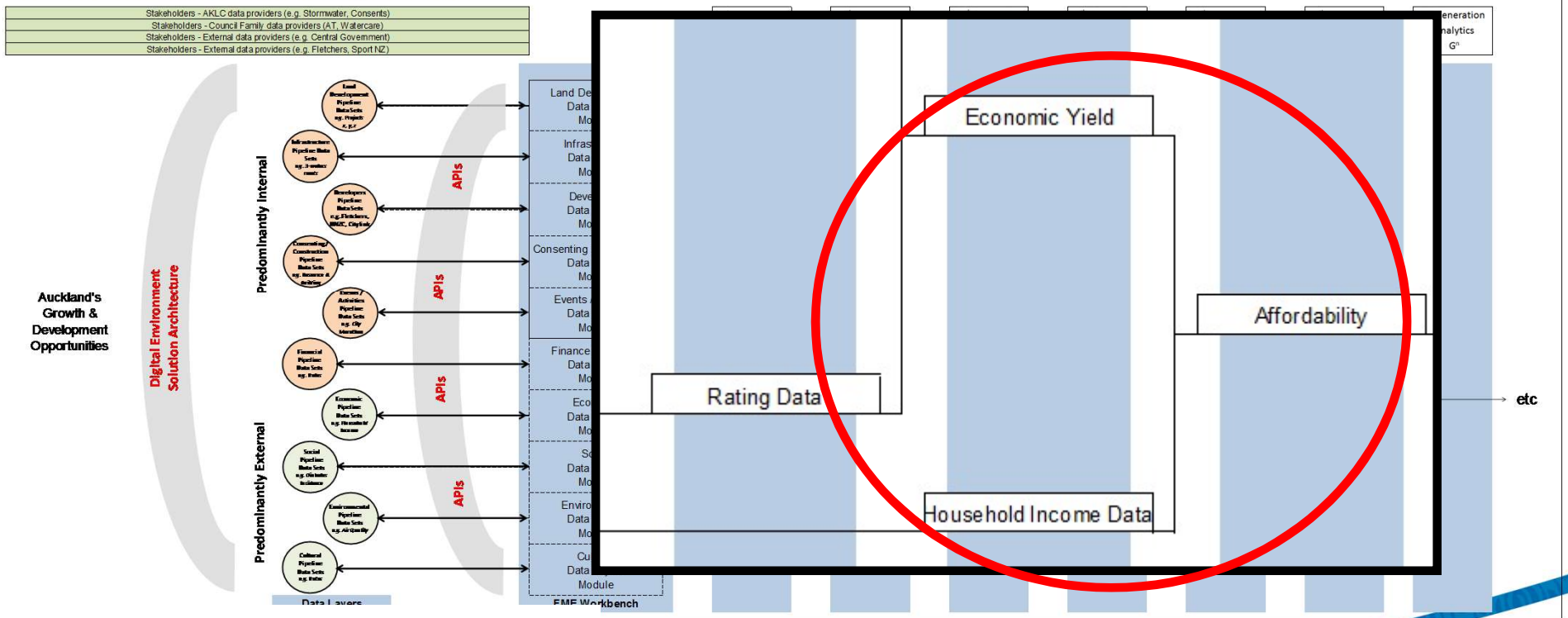
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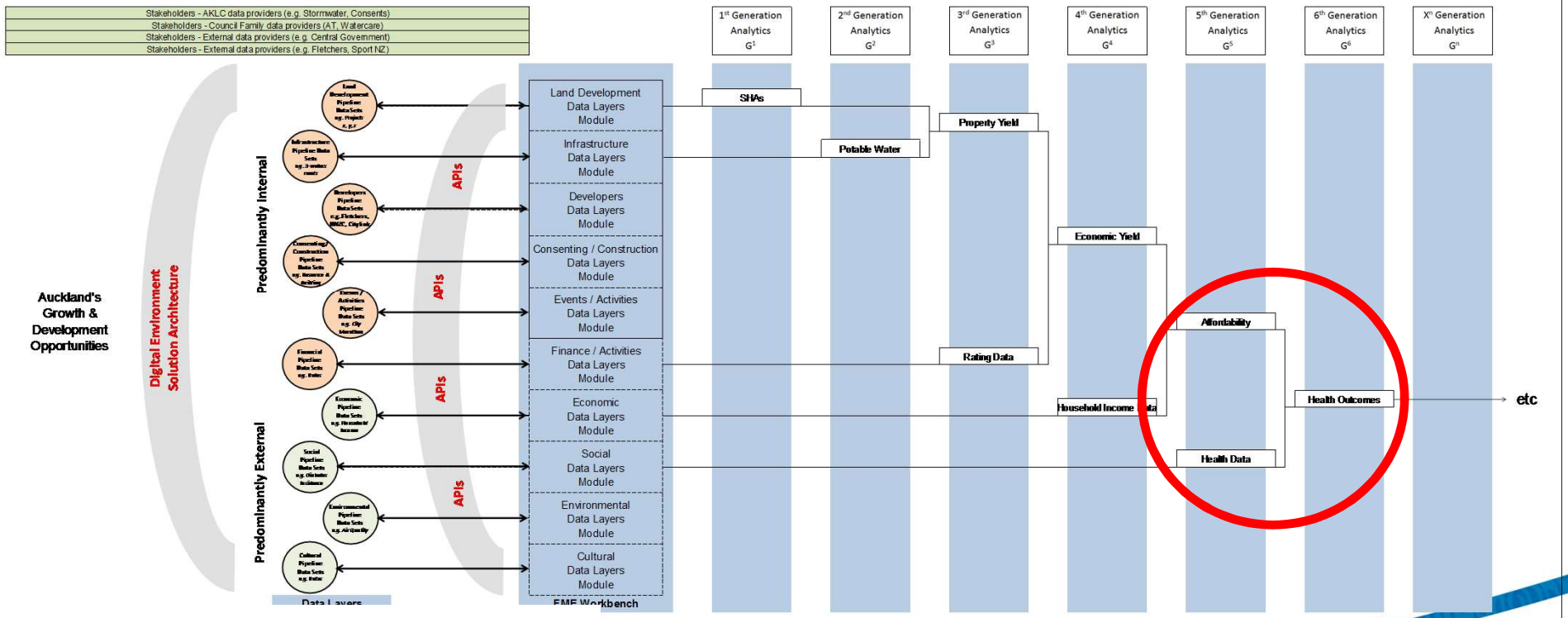
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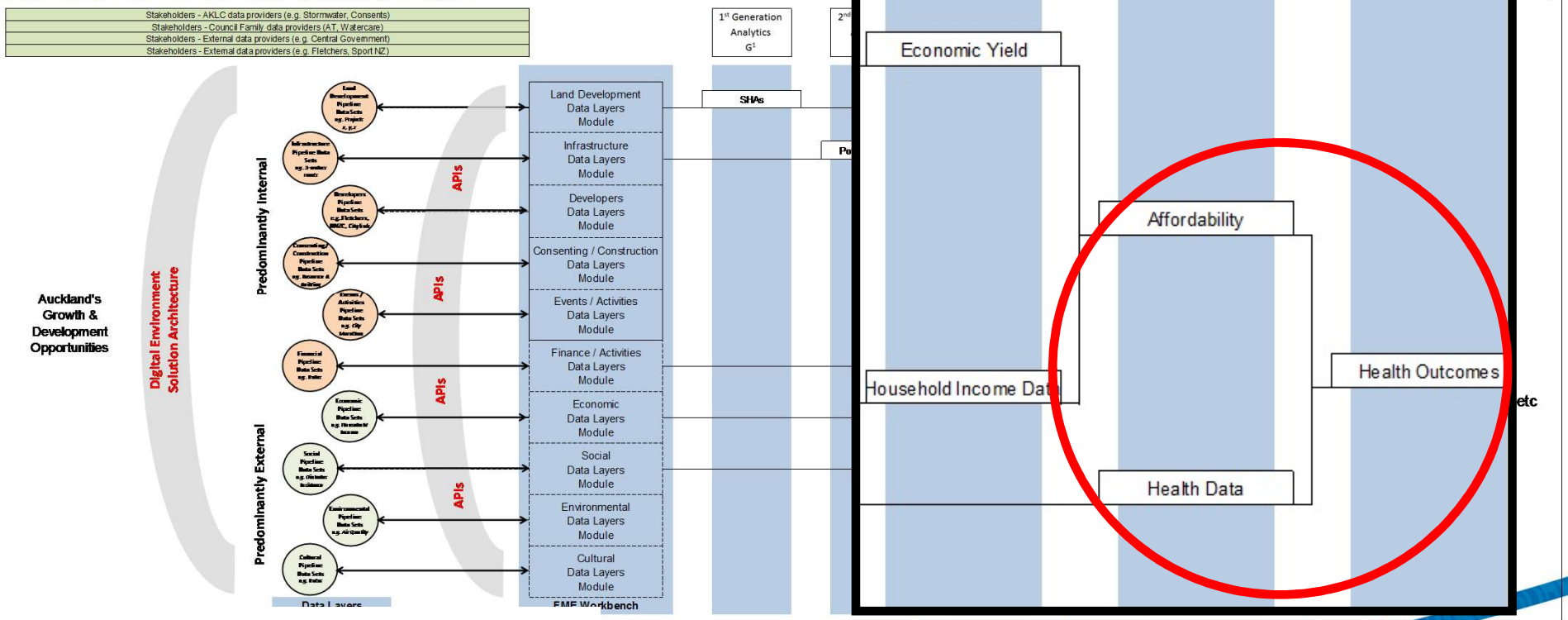
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Remember...

Because if you did you could tackle those really big problems...

Interoperability

Affordability

Sustainability

Intergenerational Equity

Optimisation

Public Value

We've started.....

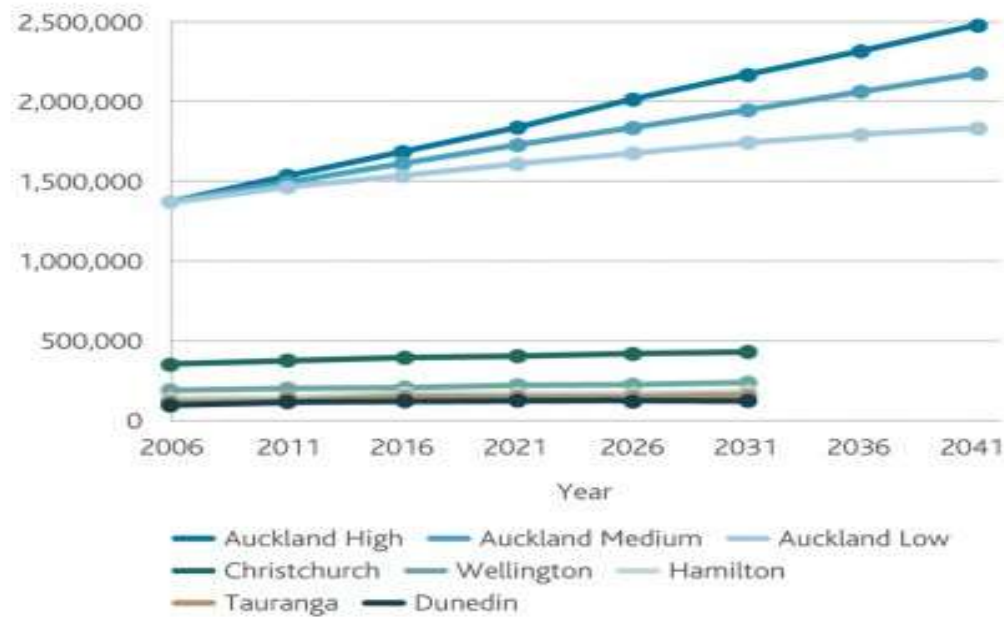
The two worlds meet – implementing in practice

Auckland Council
Using standards and analytical outputs
(with some help from Wellington City Council)

**How is
council
responding to
the growth challenge?**



Auckland's Growth



Source: Statistics NZ and Auckland Council



What this means for Auckland.... *every week*

856
New residents



117
Additional seniors
over 65



2.5
New doctors



527
New jobs are created



54
Additional students



1879
Additional public
transport trips
are taken



193
New dwellings are
consented



2.3
New teachers



38
additional bus loads of
passengers



Real World (Asset) Problem....

How to determine the Core and Social Infrastructure Deficits
with respect of Auckland's recent Unitary Plan and FULSS

Both;
Inside the Development Envelope, and
Outside the Development Envelope

And within;
Greenfield's and Brownfield's developments

What our thinking is....

Develop a way in which we can analyse existing and planned infrastructure networks, to determine these deficits.

In order to maintain what we have, and enable growth with efficiency and effectiveness.

With respect to community outcomes

In a **coherent, standardised and harmonised** way

What our thinking is....

Principles

- Consolidate information into one place – **select priorities carefully**
- Create an ***analytical hub*** which interpolates infrastructure and infrastructure investment into outcomes through service provision
 - Social, Economic, Environmental, Cultural
- Make it easy to access, and monitor 'value'

Analyse data in ways which are currently out of our reach of 'everyone'.

Why ? **"evidenced-based investment decisions"**

What our thinking is....

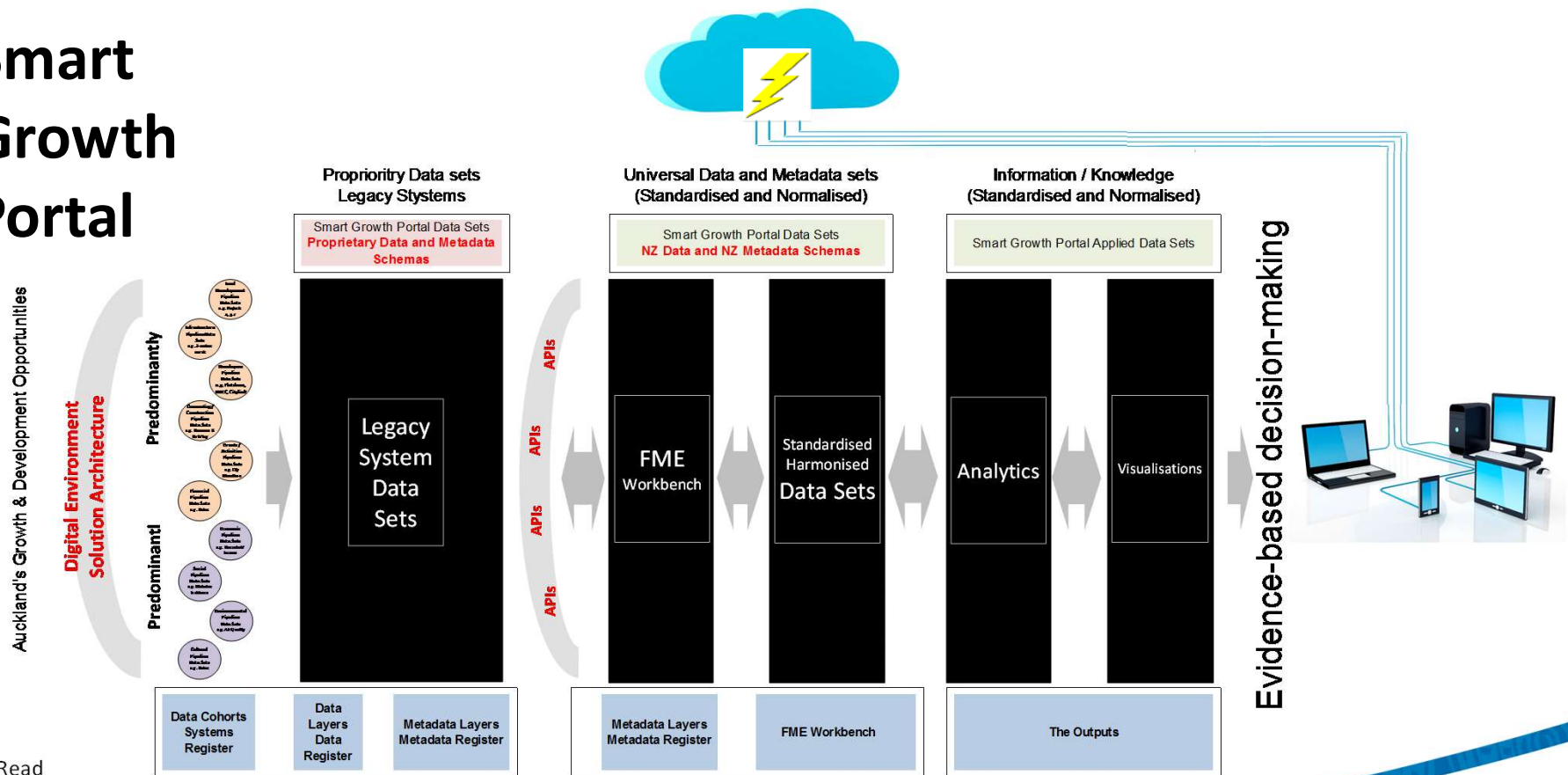
Principles

- Consolidate information into one place – **select priorities carefully**
- Create an ***analytical hub*** which interpolates infrastructure and infrastructure investment into outcomes through service provision
 - Social, Economic, Environmental, Cultural
- Make it easy to access, and monitor 'value'

So we built this.....

The Analytical Platform - A Cloud Solution for Standardised Data / Analytics & Visualisations

Smart Growth Portal



Haydn Read

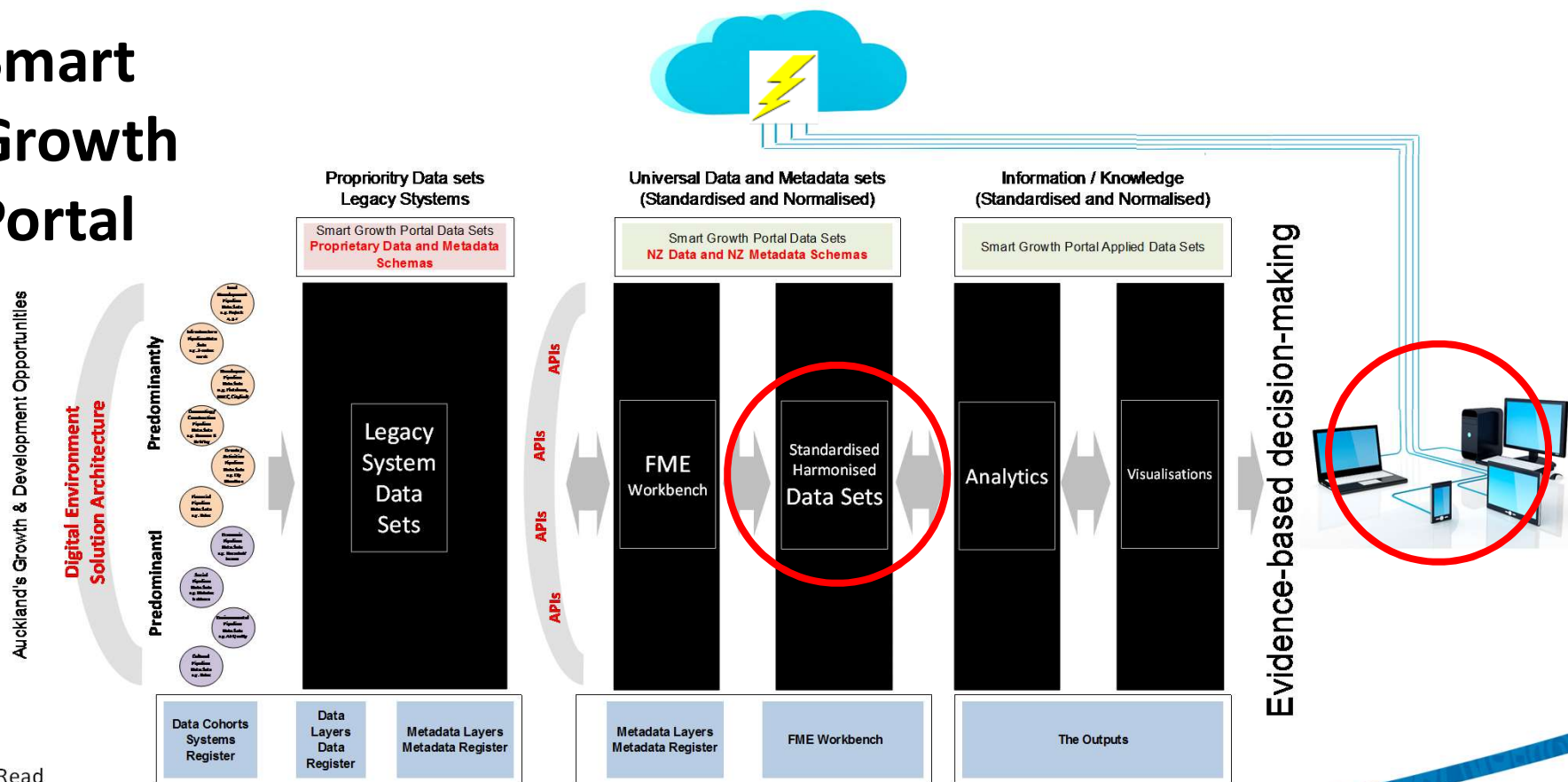
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The Analytical Platform - A Cloud Solution for Standardised Data / Analytics & Visualisations

Smart Growth Portal



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That looks like this

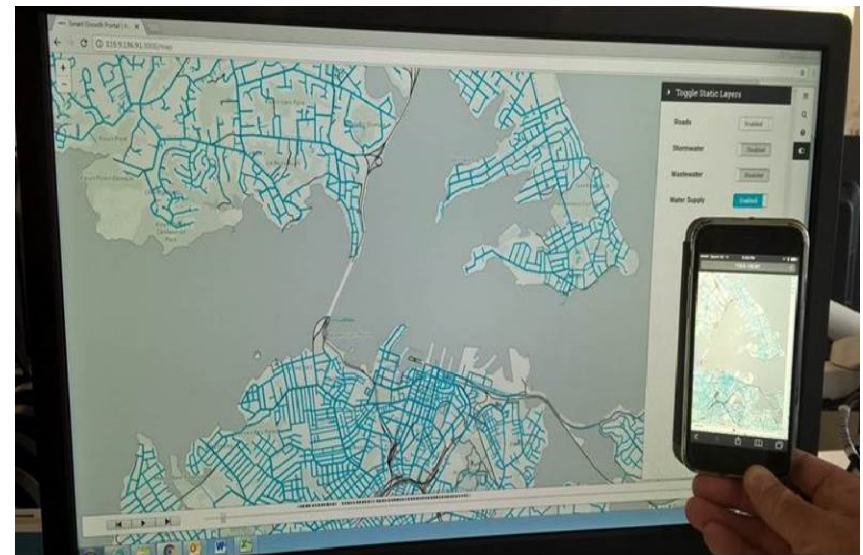
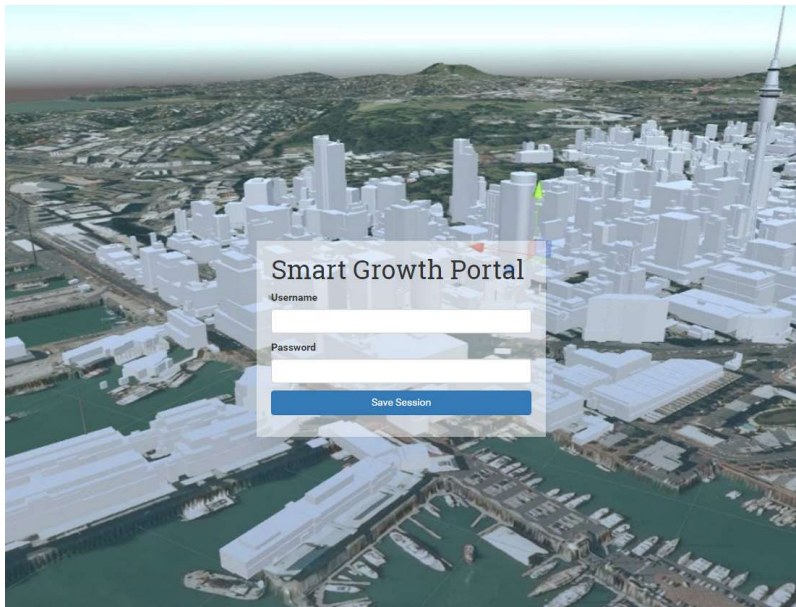
Smart Growth Portal

Username

Password

Save Session

Smart Growth Portal – Prototype included ‘mobility’



And.... does this

Smart Growth Portal

Username

Password

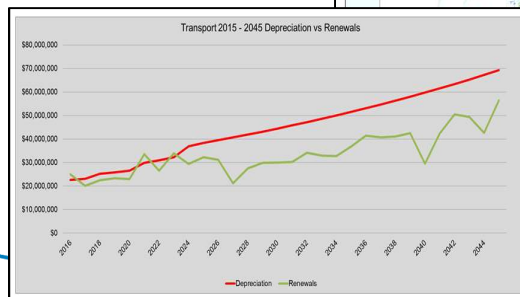
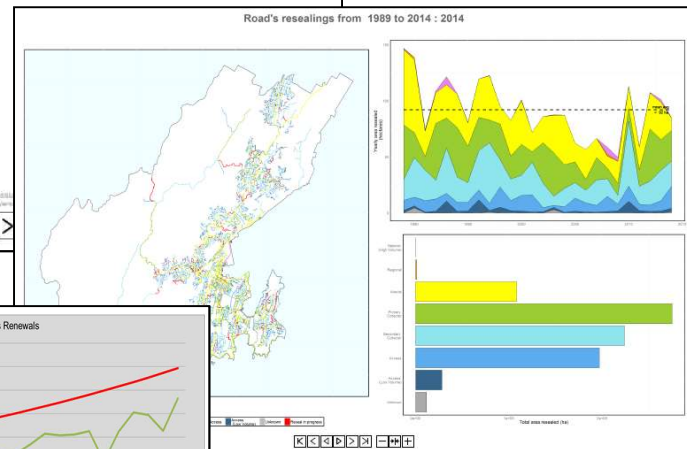
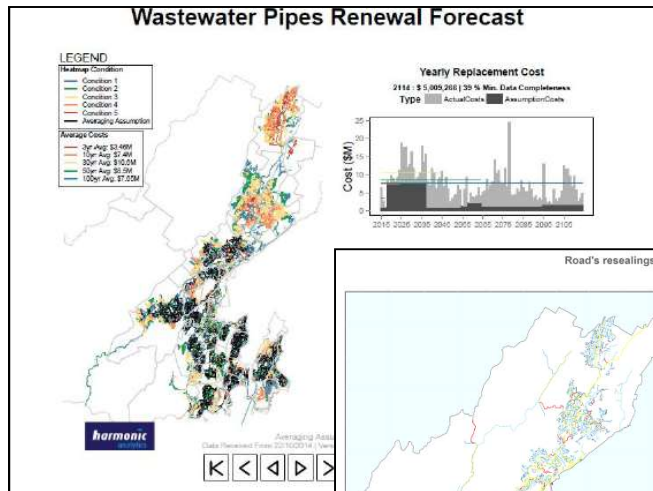
Save Session

Analyses Condition..... and

Renewal expense
algorithms

Prioritisation
algorithms

Sustainability
algorithms



Asset Lens

Work Programmes

Inspection

Testing

Capital Plans

Renewal Plans

Financial Lens

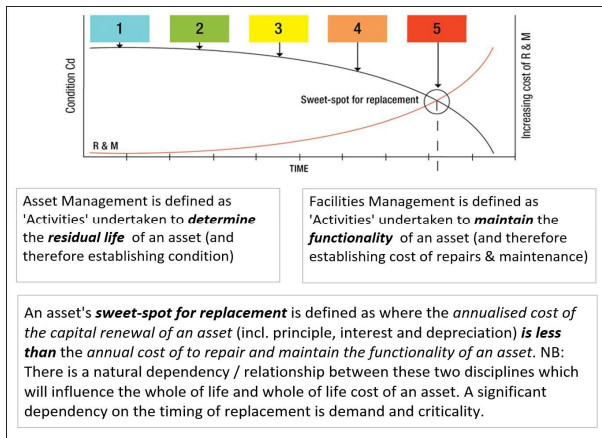
Funding Streams

Treasury Caps

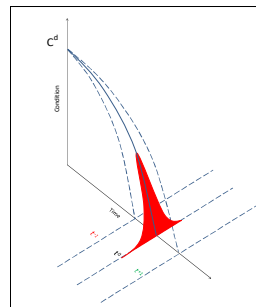
Financial Sustainability

Depreciation c.f. Capital

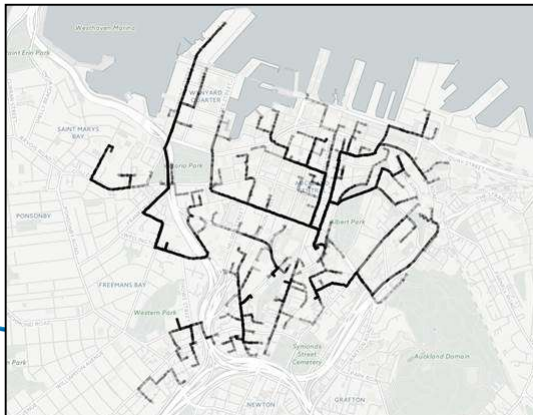
Repairs, Maintenance and Operations, and.....



Probability of Failure algorithms



Pathway algorithms



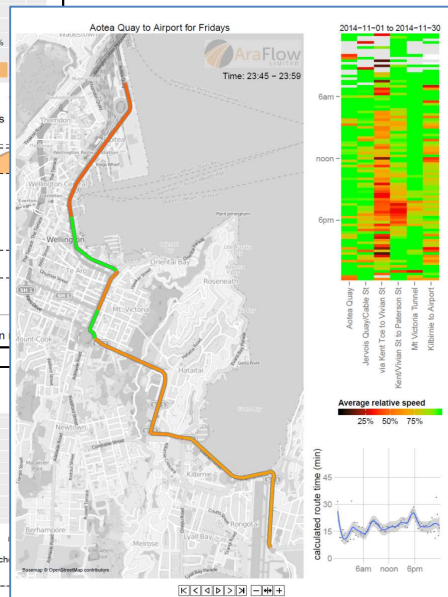
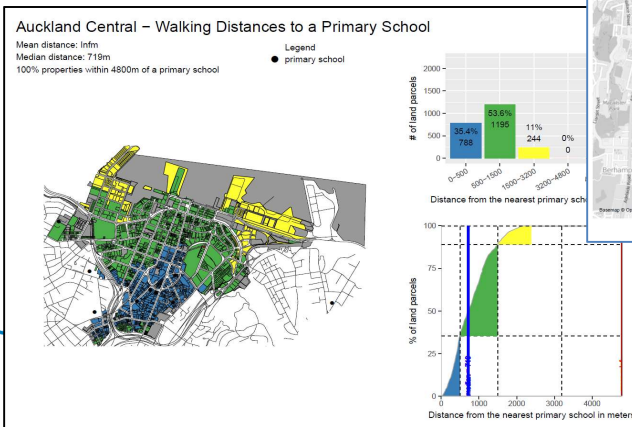
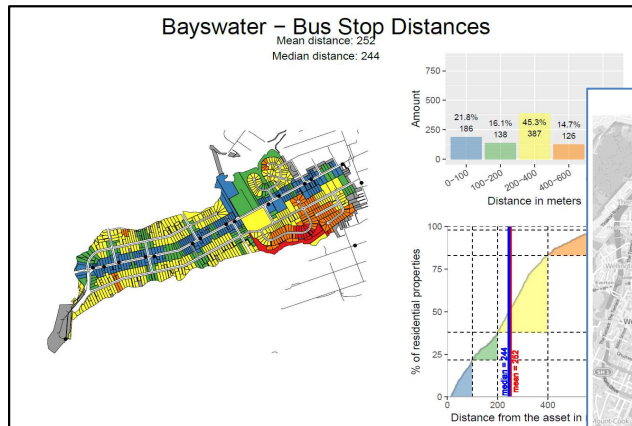
Investigation
Maintenance
Operate
Repair

Proactive
Reactive
Scheduled

Workflows
Failure Modes
Type
Cause

Utilisation, and.....

Proximity
algorithms



Congestion
algorithms

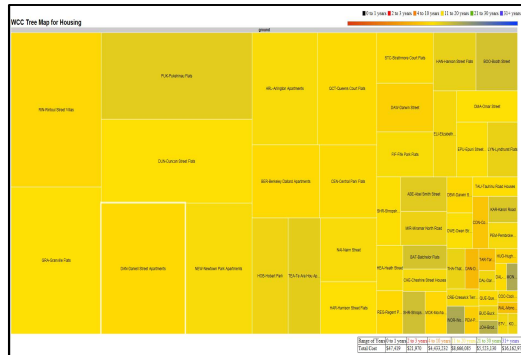
Asset Lens
Asset Type
'use'
Accessibility
Connectivity

Planning Lens
Liveable City
Policy Settings

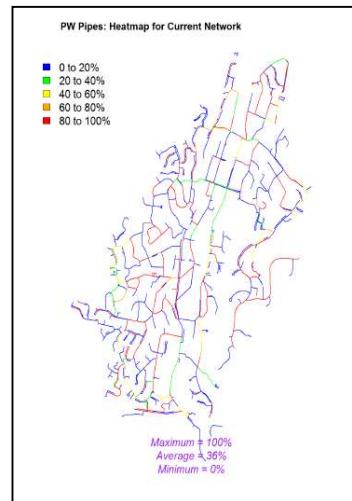
Actual Capacity / Utilisation
Forecast Capacity / Utilisation
Potential Capacity / Utilisation

People per hour / day / week / year

Demand, and.....



Floor area demand algorithms



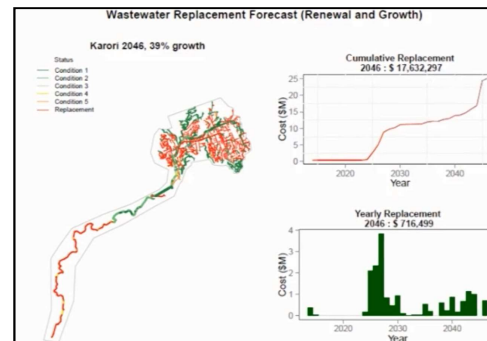
Demand algorithms - Maximum Daily

Current / Future
Number of connections to network
Number of parcels to network
litres per minute
Litres per second per 1000
connections

Actual Capacity / Demand
Forecast Capacity / Demand
Potential Capacity / Demand

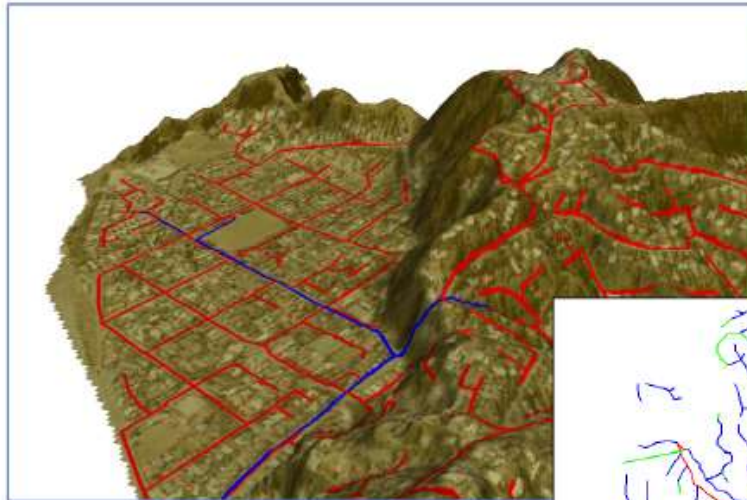
Sqm / Income / Time

Vehicles per hour / day / week /
month / year



Future Demand algorithms

Vulnerability, and.....



Physical location algorithms



Material (AC Pipe) algorithms

Vulnerability

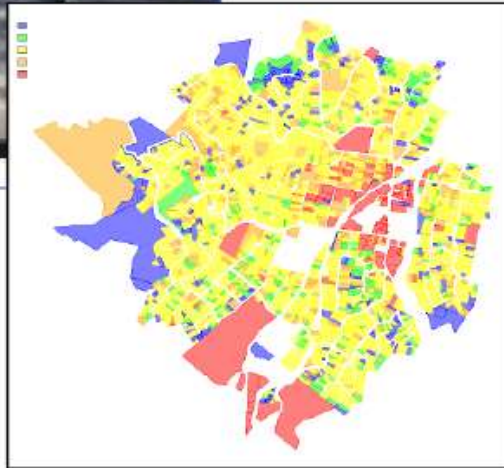
- Adaptability
- Asset Condition
- Level of Maintenance
- Material
- Physical Location
- Structural Design

Criticality, and.....



Location algorithms –
Buffer zones

Location algorithms –
Critical Sites



Ranking

Very Low

Low

Medium

High

Very High

Service

Facility Importance Rating

- hospital

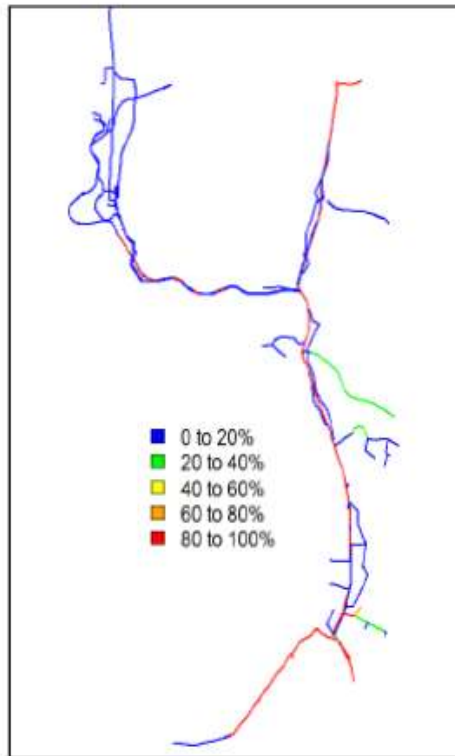
- school

- house

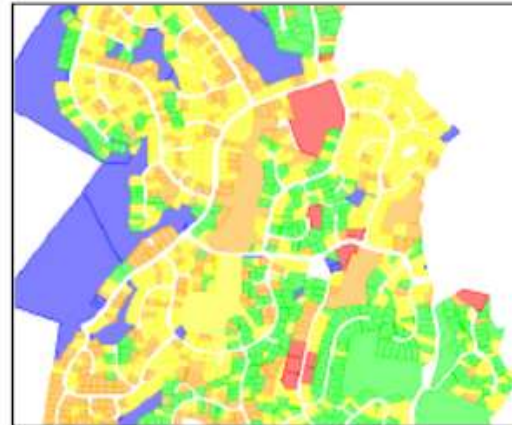
- data centre

Residential Population Rating

Risk, and.....



Risk Algorithms - Pipes



Risk Algorithms - Location

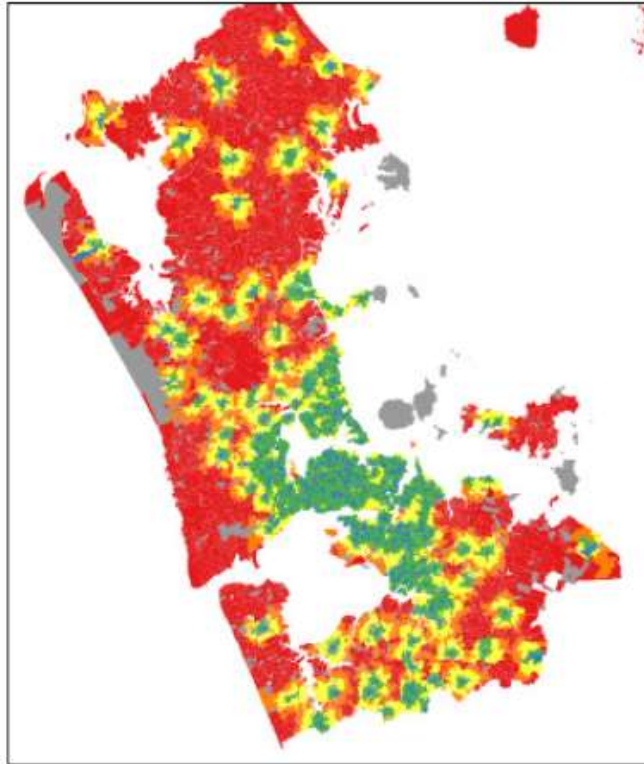
Likelihood Rating
Consequence Rating
Risk Rating

Consequence

- Governance
- Health and Safety
- Financial
- Environmental
- Social and Cultural



Resilience, and.....



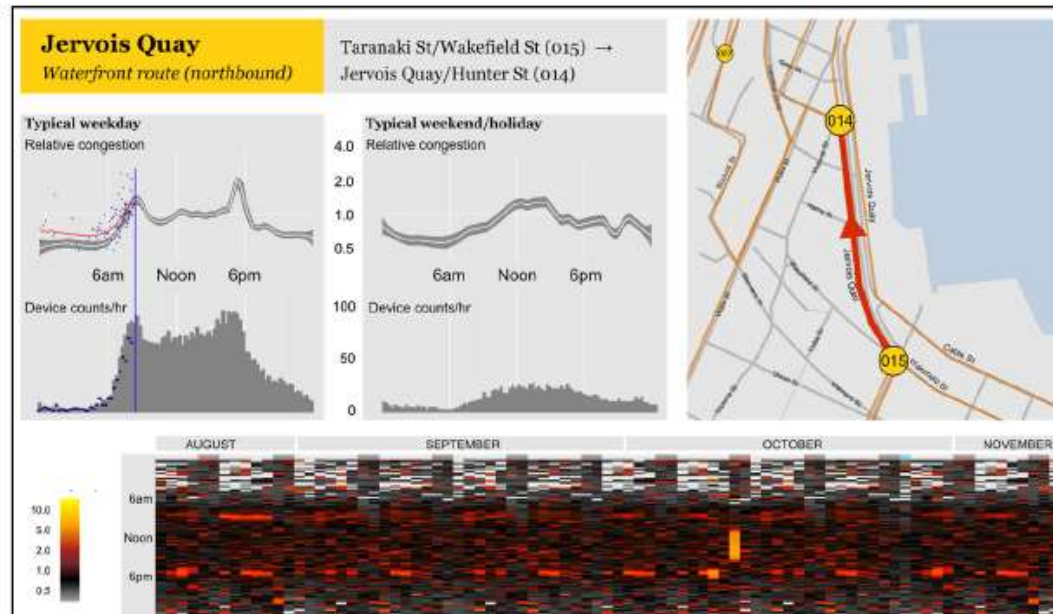
Resilience
algorithms
emergency
response

Resilience

- Event Significance
- Service Performance
- Residential Population
- Reinstatement Time

- Adaptability/Operability
- Alternative Servicing Options
- Cost to Recover
- Critical Spares Availability
- Recovery Time
- Redundancy

Design Performance, and.....



Congestion algorithms – travel time

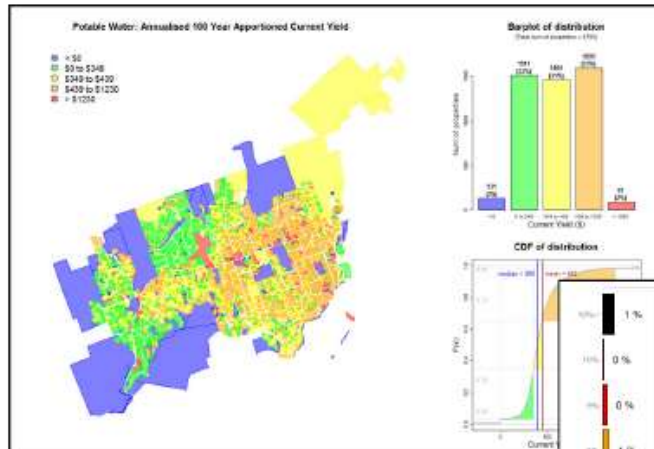
Asset Lens

- Speed
- Pressure
- Access
- Connectivity
- Cost
- Value
- Optimised

Financial Lens

- Yield
- Sustainability
- Affordability
- Equity (Intergenerational)

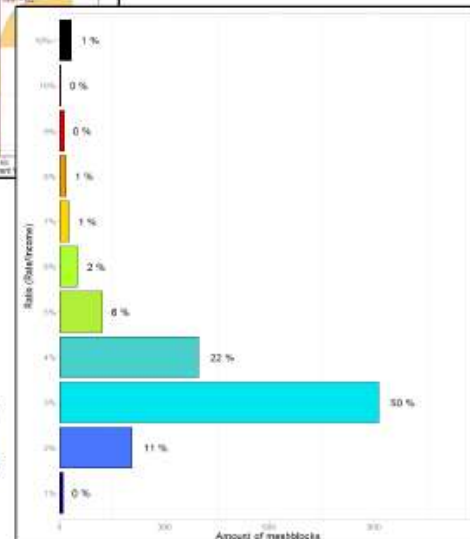
Financial Performance, and.....



Development Contribution
algorithms

Housing Affordability
algorithms

Economic Yield
algorithms



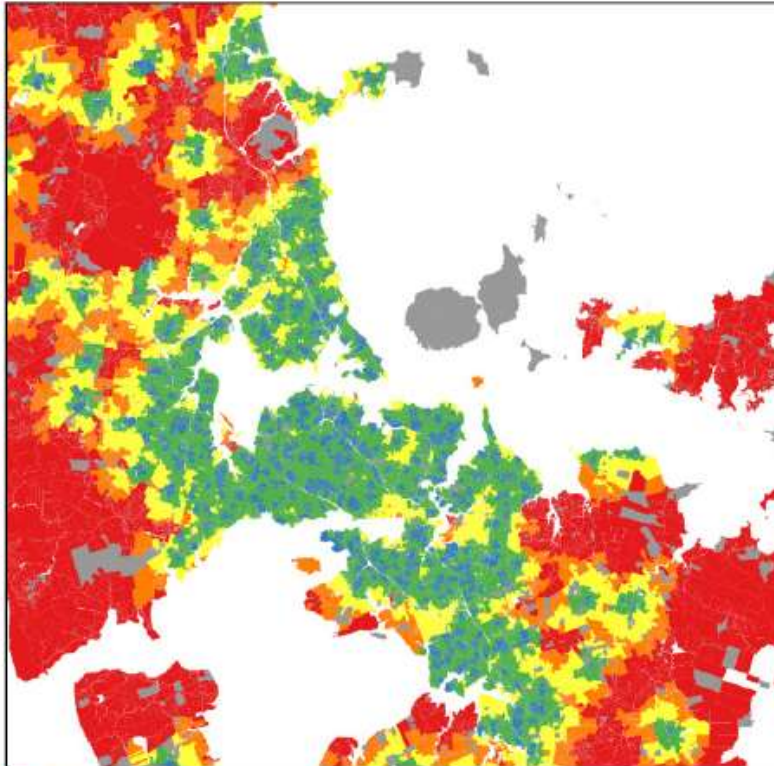
Asset Lens

- Capital Plans
- Renewal Plans
- Maintenance
- Repairs
- Operations

Financial Lens

- Funding Streams
- Treasury Caps
- Yield
- ROI
- ROE
- Gearing Ratios

Service Performance, and.....

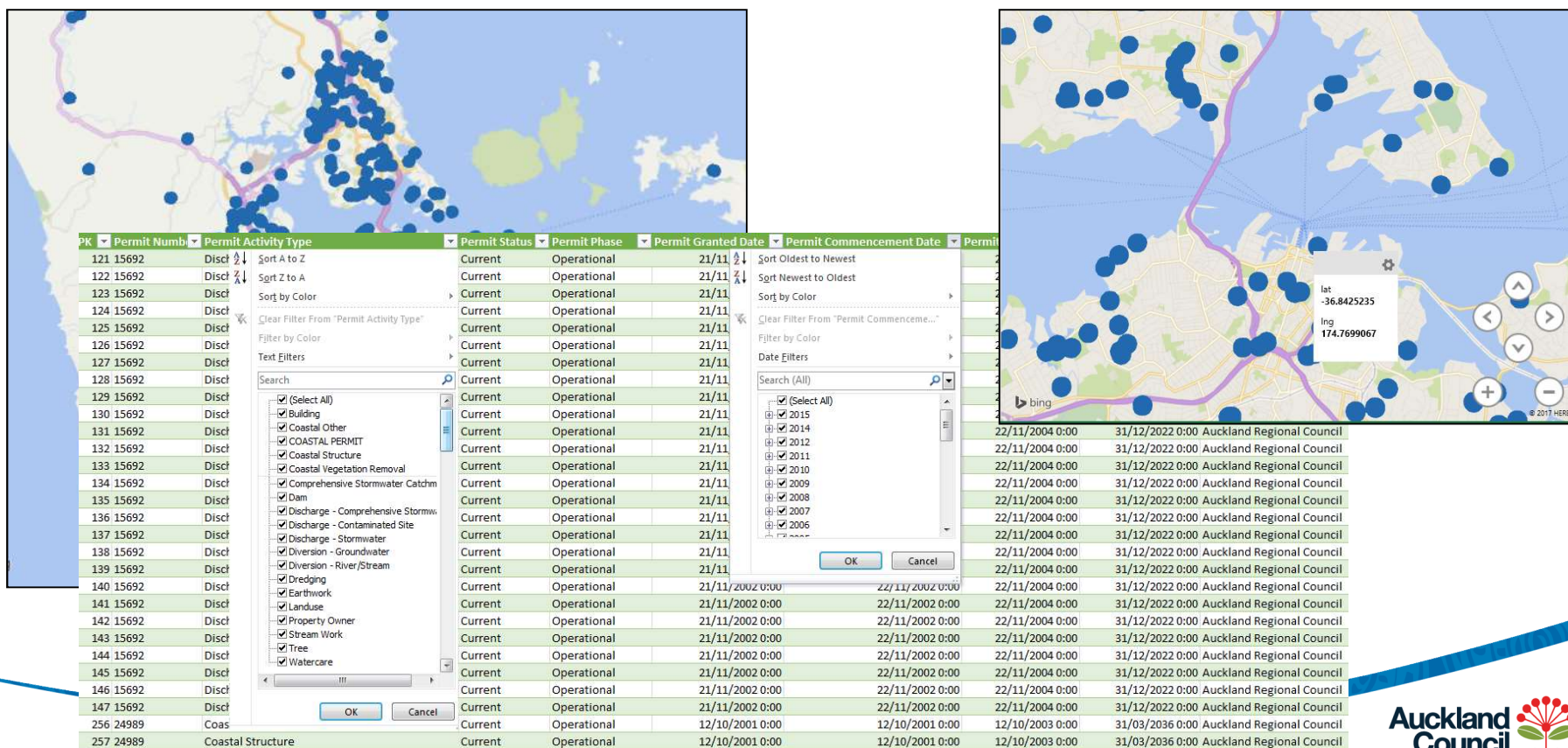


Level of
Service
algorithms

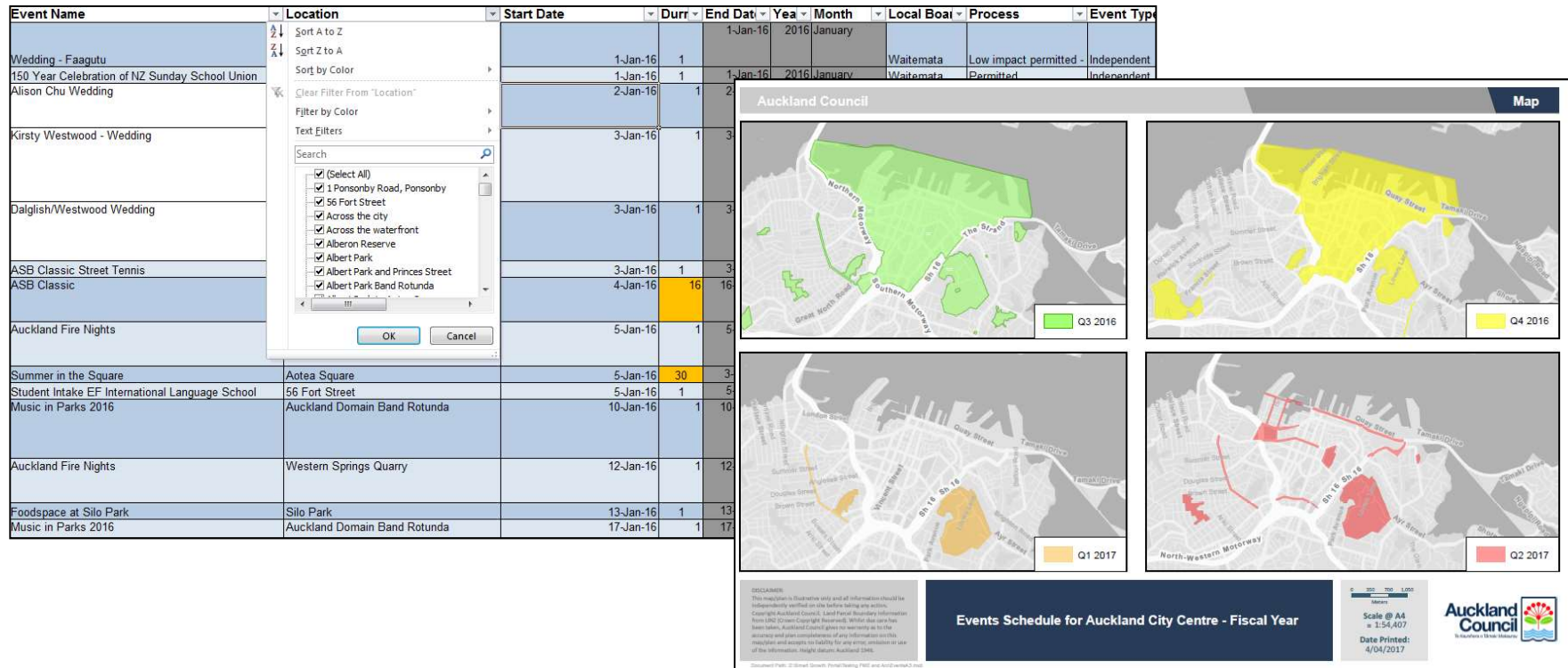
Asset Lens
Capital Plans
Renewal Plans
Work Programmes

Financial Lens
Funding Streams
Treasury Caps

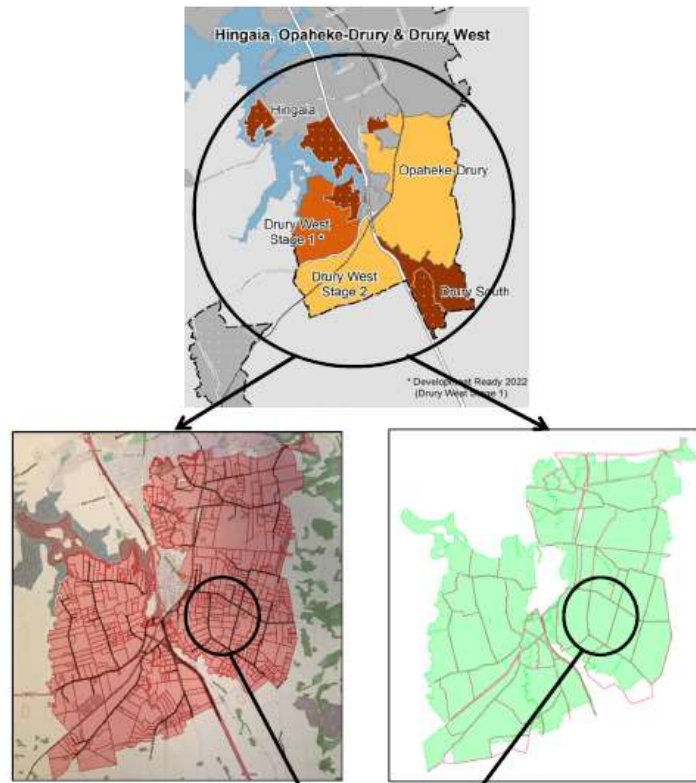
Resource Consents Monitoring Data, and....



Events Data etc. etc.....



Prototyping Analytics – Greenfields Development



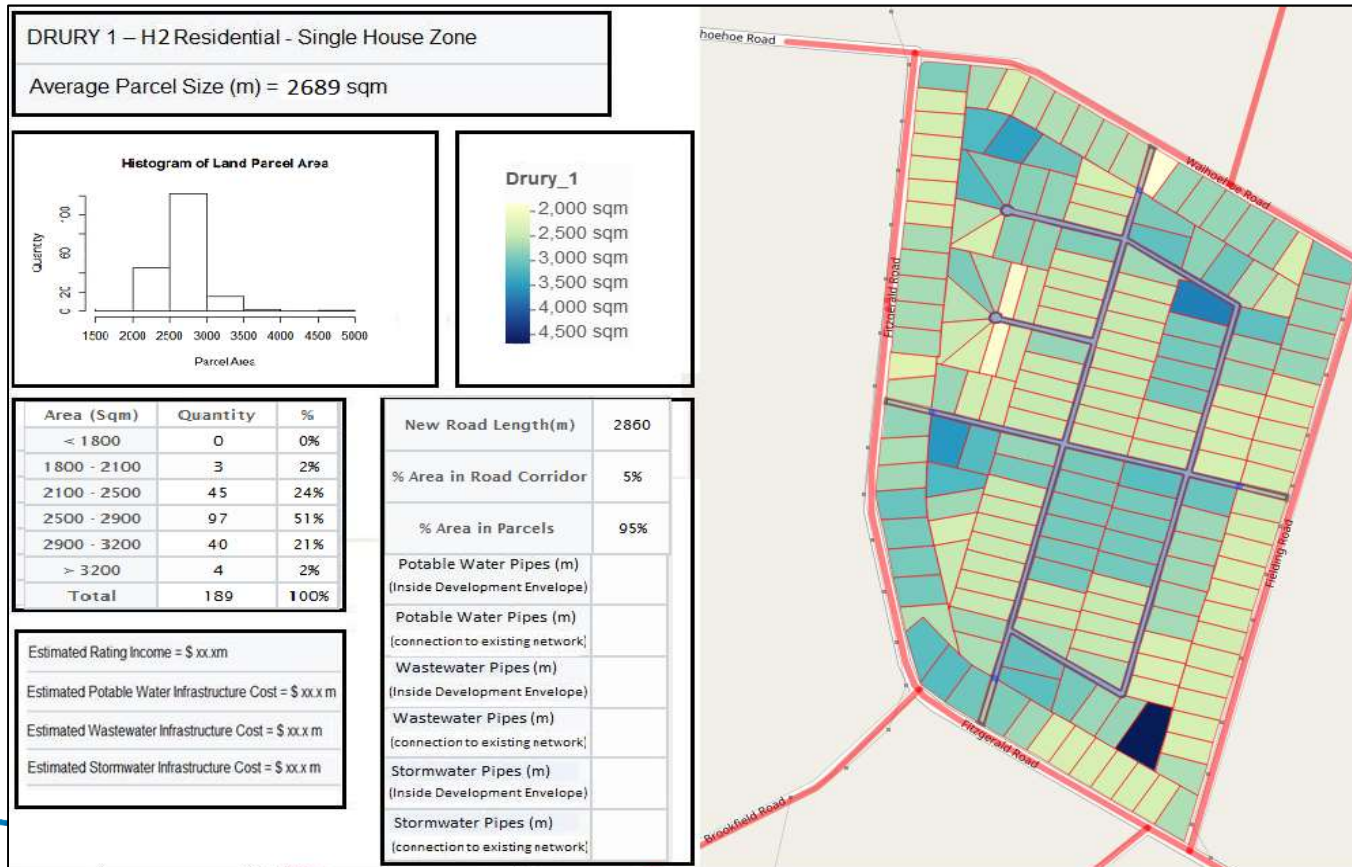
Land Use - Economic



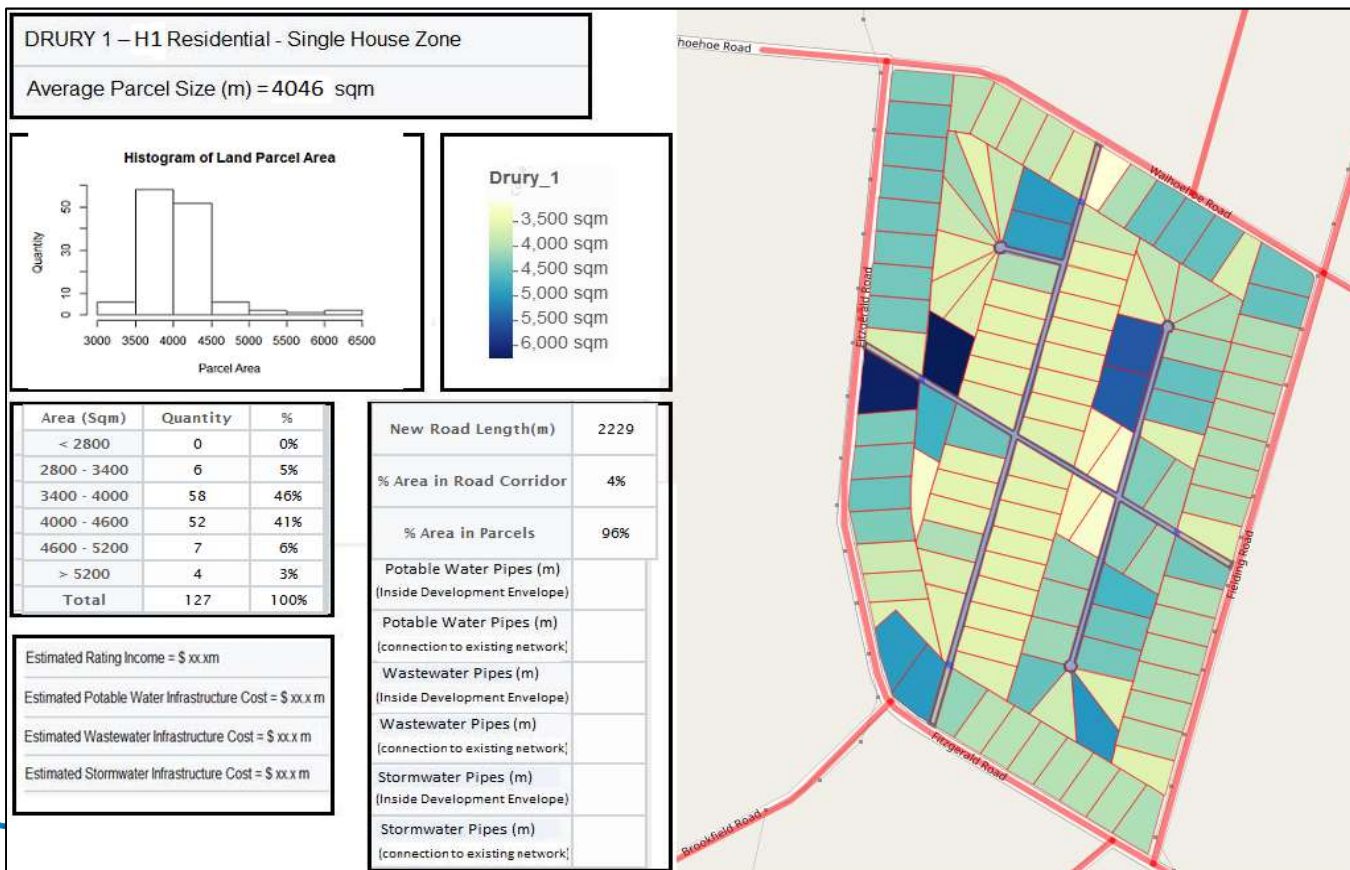
Density - Parcel Yield and Economic Yield

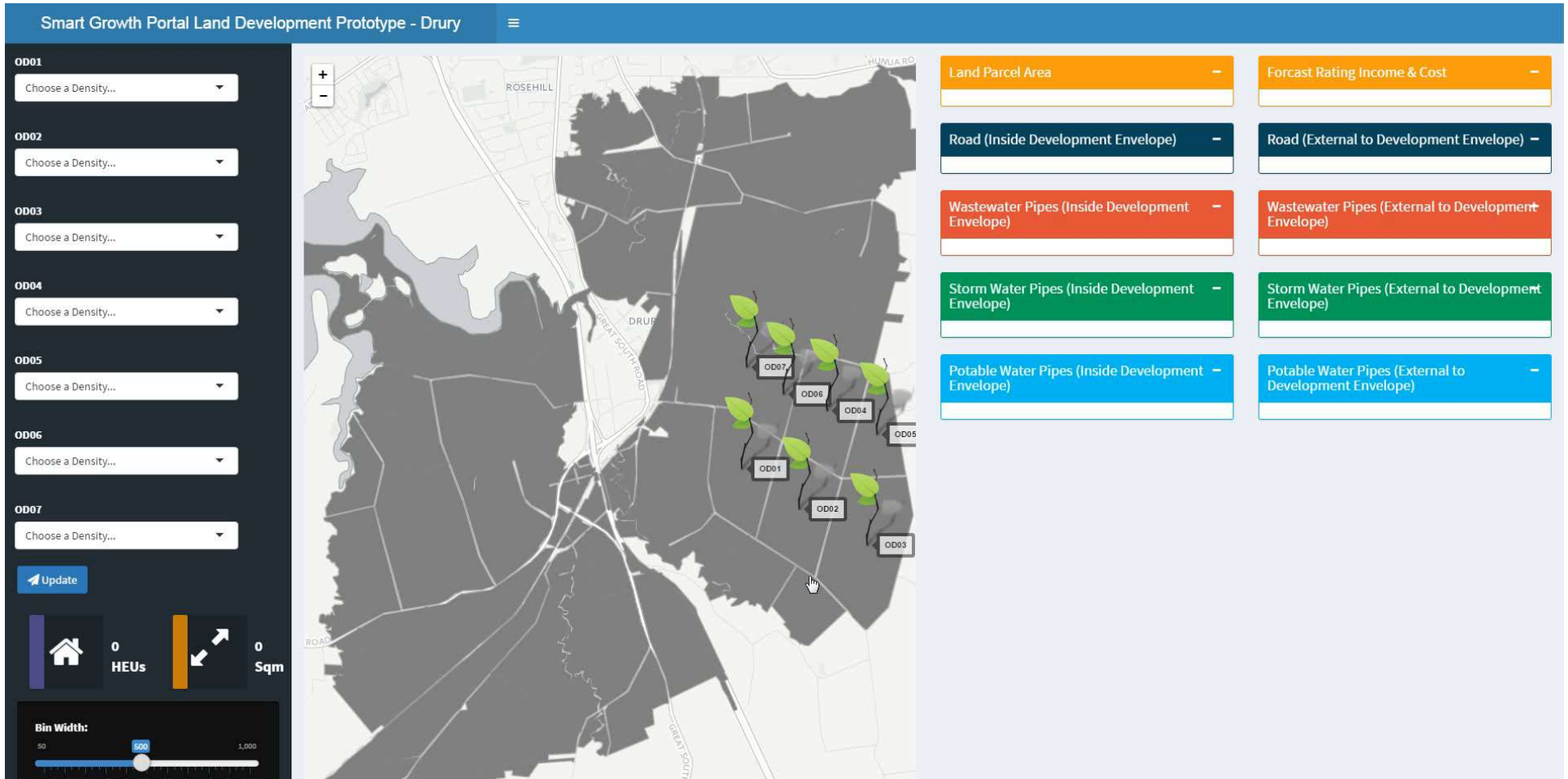


Density - Parcel Yield and Economic Yield



Density - Parcel Yield and Economic Yield





Questions?

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