Inknowvation

Making Innovation Happen

The Engineering Industry Challenge

#SHIFTHAPPENS

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In Comparison……WA Local Govt.

In 2015-16, Western Australian local governments:

- raised more than $2.1 billion in rates
- received more than $280 million in Commonwealth Government Financial Assistance Grants
- managed assets worth more than $40 billion
- In what is the 10th largest Country in the world!!

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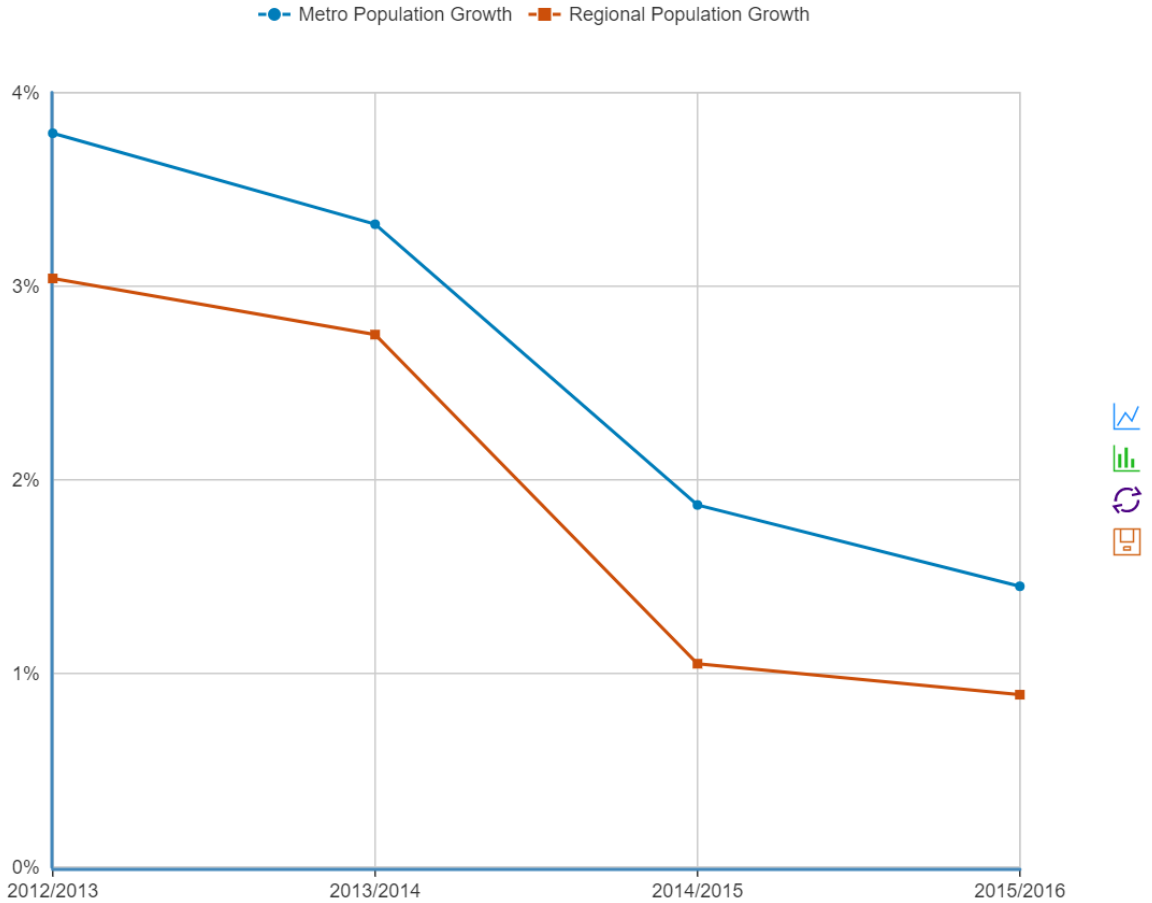
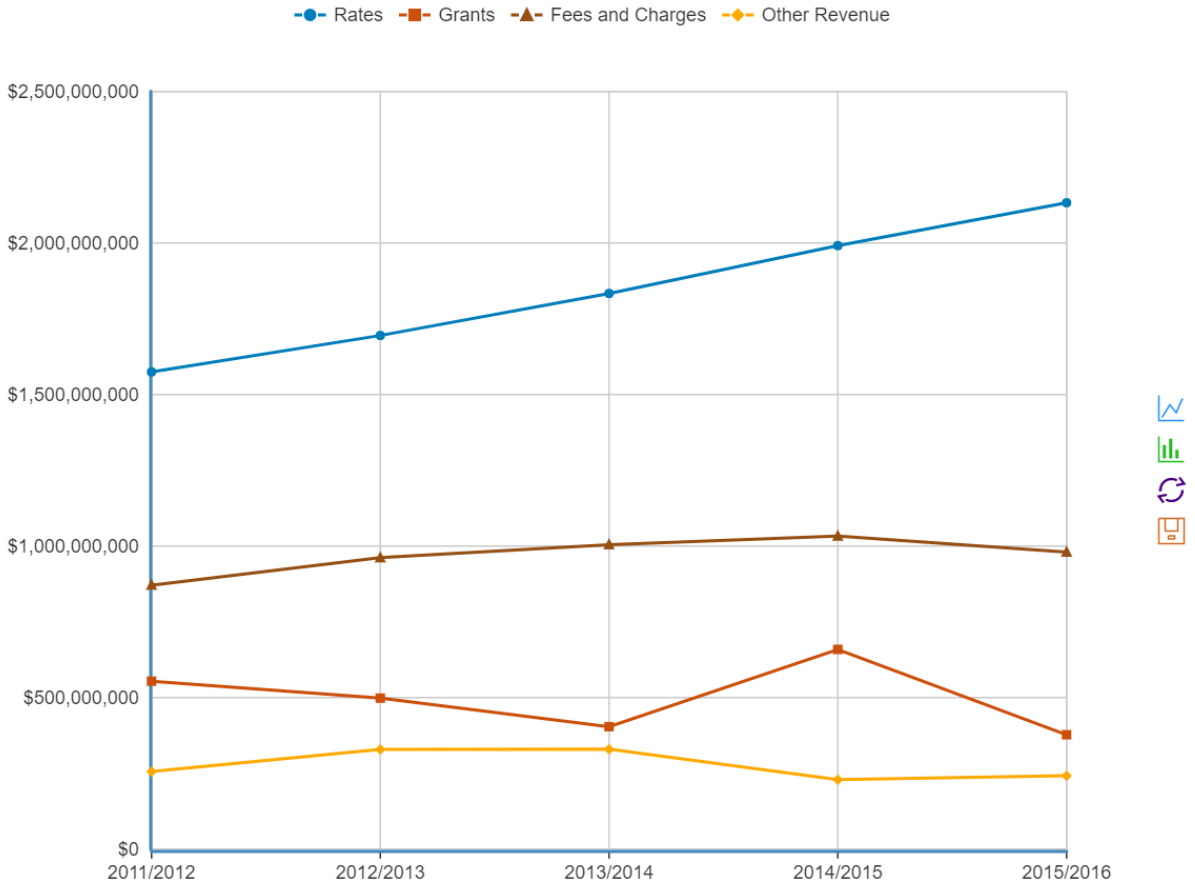
Source: https://mycouncil.wa.gov.au/Home/KeyFacts#RegionalRevenue

Current Population Growth (Metro & Regional)



Source: https://mycouncil.wa.gov.au/Home/KeyFacts

Revenue Sources



Source: https://mycouncil.wa.gov.au/Home/KeyFacts

The Financial Pressures on Business (& Councils)

Decreasing Revenue (commodity prices / population)

Burden of high historic Capital (LNG Plants / Service*)

Increased pressure on operational costs

Companies undergoing “restructure”

Further cost reductions must come from new technologies and new business models….

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*PWC National Financial Sustainability Study of Local Govt. No 2006

The Good News #SHIFTHAPPENS

Driverless Cars – LIDAR / LiPo

Mobile Phones – Micro

UAV – Data Capture

Gaming – processing / VR

Internet – Democratisation of Parts / Info

Current Asset Management Process

- Asset Management Plan (ITP)

Typical

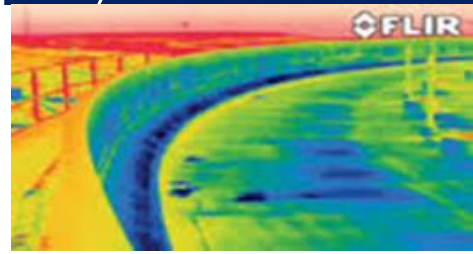
Inspection

- Predetermined
- Reactive
- Qualitative

- Repair
- Document

Repeat

Asset Management – Smarter, Faster, Cheaper, Better



Capture Asset Digitally (UAV, LIDAR, Terrestrial)

- Reduce Risks
- Improve productivity

Quality Repeatable Data

- GIS tagged
- 3D Model Integrated
- Multiple sensors
- Viewed remotely

Change Detection / Machine Learning

- Define Attributes
- Determine Risk factors
- Predicative Analytics

Fed into Integrity Management Plan (IMP)

- IMP represents quantitative Asset Data Set

IMP Drives Remote inspection intervals

- IMP determines optimised Asset Management Cycle

Innovation in Local Government

Overview and Case Studies;

- Urban Forrest
- Tree Inventory
- Remote Inspection
- Reality Modelling
- Fire Break Determination
- Development Compliance (Building envelope, Pools, Solar Panels)

Urban Forest Monitoring

The benefits urban forest are numerous and include health, amenity, biodiversity, property values, mitigating urban heat islands.

The following are routinely reported:

- Vegetation height
- Vegetation cover
- Vegetation health
- Land surface temperature (thermal imagery)
- Change in the above over time

Urban Forest Monitoring

Using remote sensing to measure and map trees in urban areas is:

- Routinely used
- Precise, replicable and fast
- Can be applied at scale
- Free and low cost data sources are available to LGA's
- Can be mined for insights such as:
  - Impact of planning policies on the urban forest
  - Focus areas for planting activities (particular suburbs or streets)
  - Stakeholder engagement
  - As a core monitoring tool to assess performance of urban forest strategies

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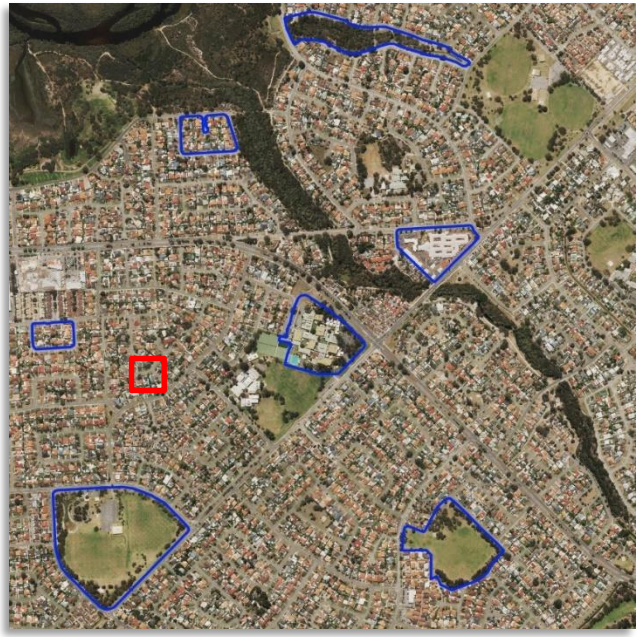
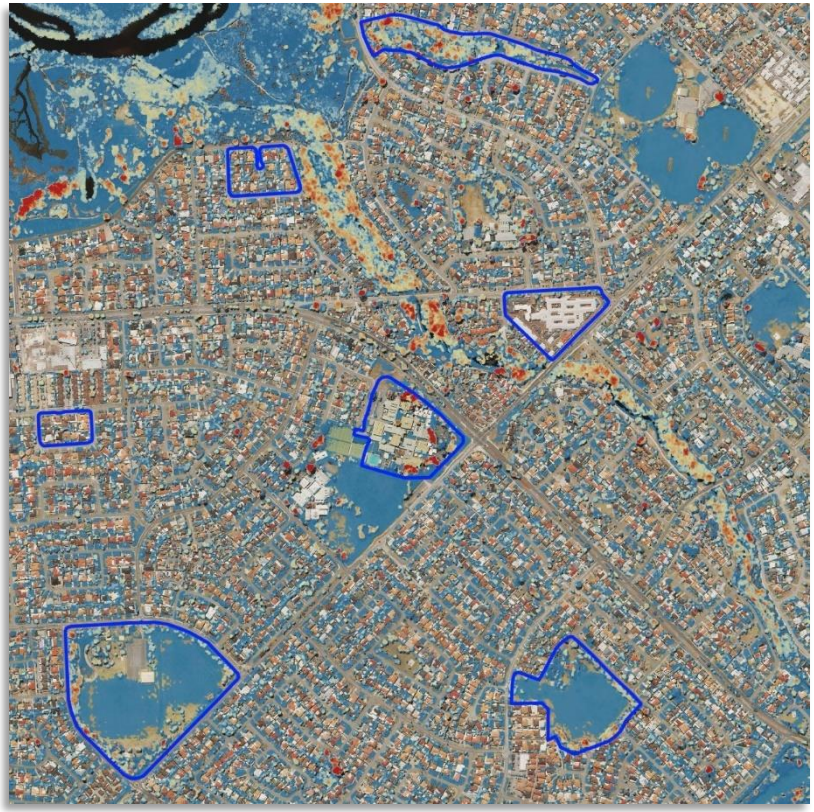
Remote Sensing



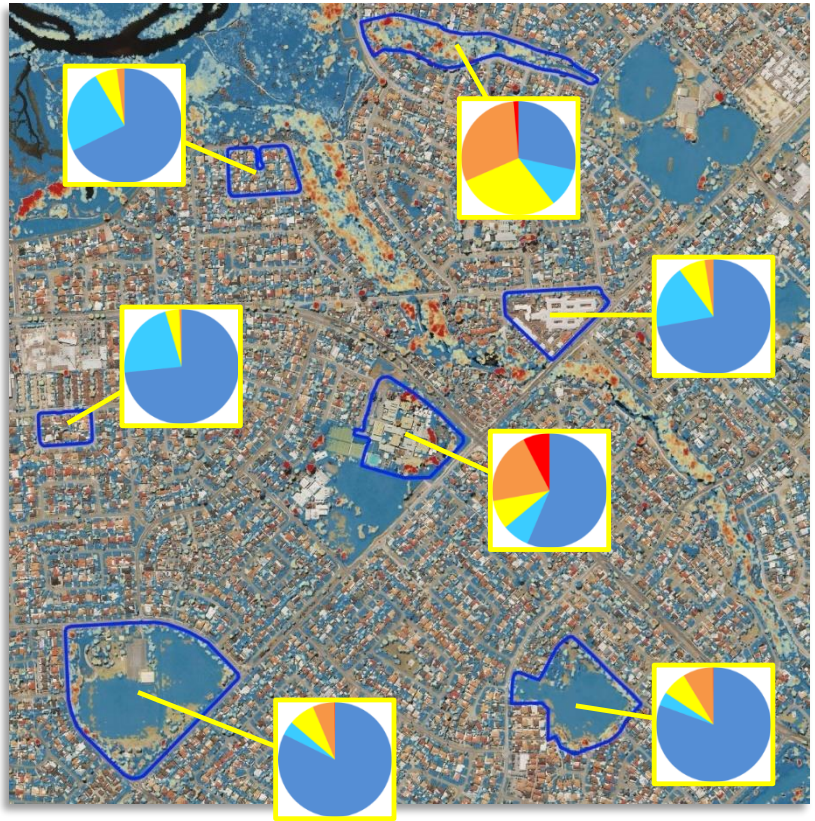
Aerial Imagery

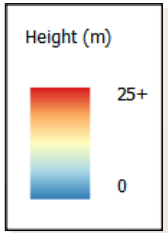
- Very High Spatial Resolution
- Discrimination of Fine Scale Features
- Very Large Datasets

Vegetation Height



Vegetation Height





Height Strata (m)

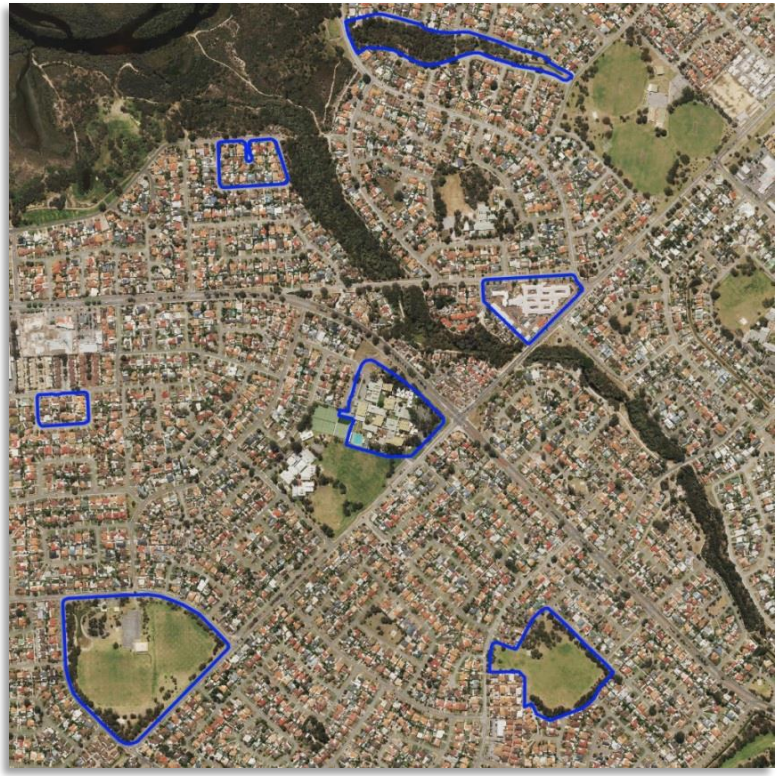
- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 +

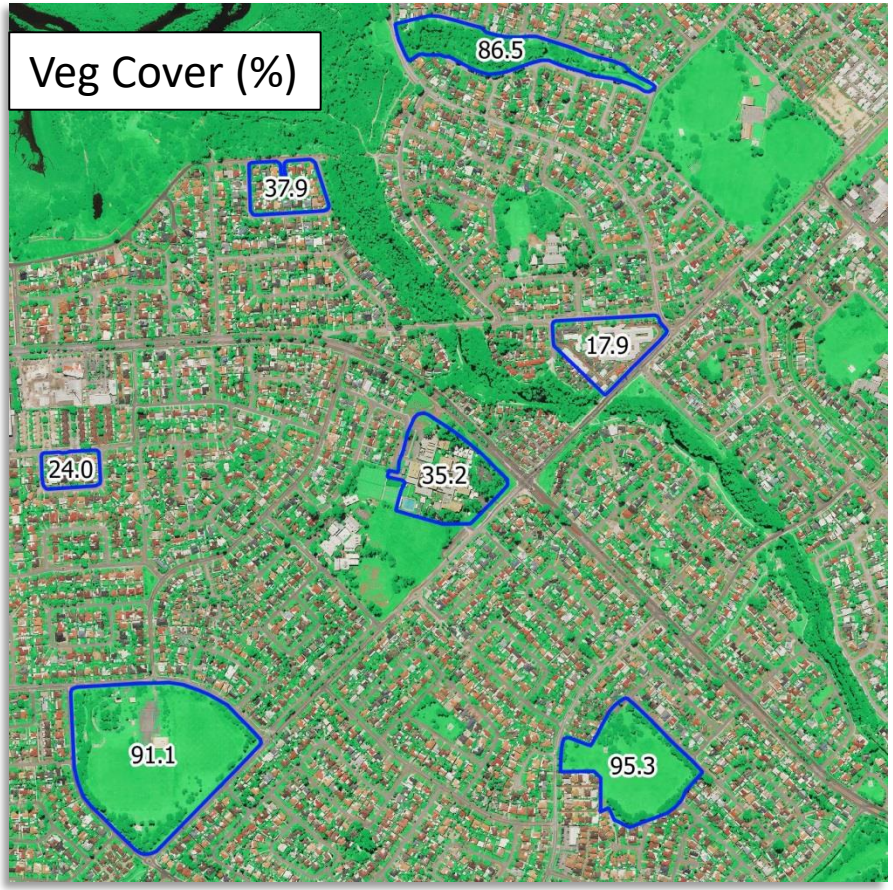
Vegetation Cover

Vegetation Estimations:

- Proportional Cover

Vegetation Cover





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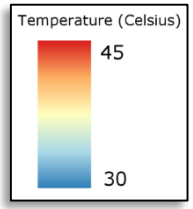
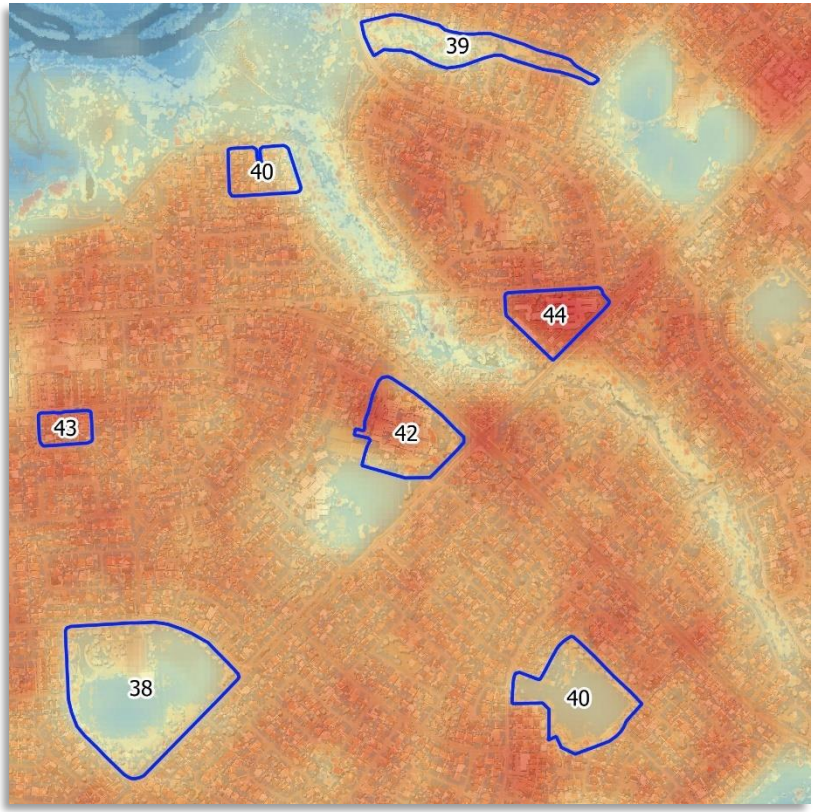
Vegetation Estimations:

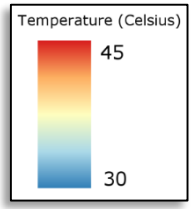
- Proportional Cover

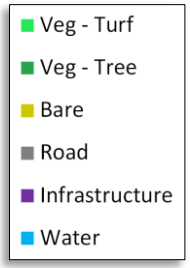
Land Surface Temperatures

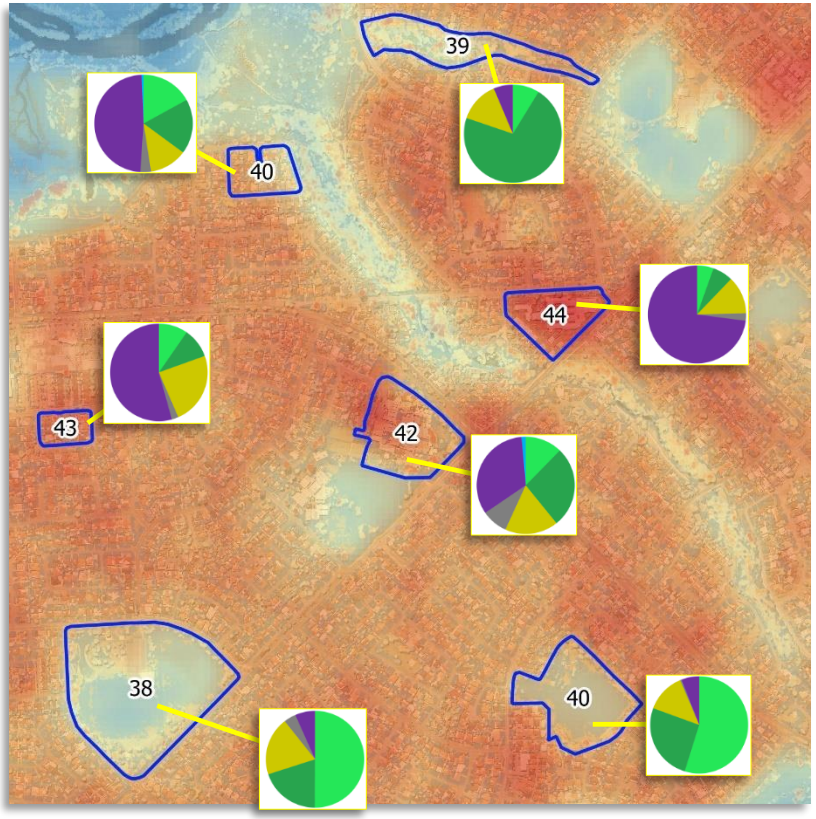




Land Surface Temperatures

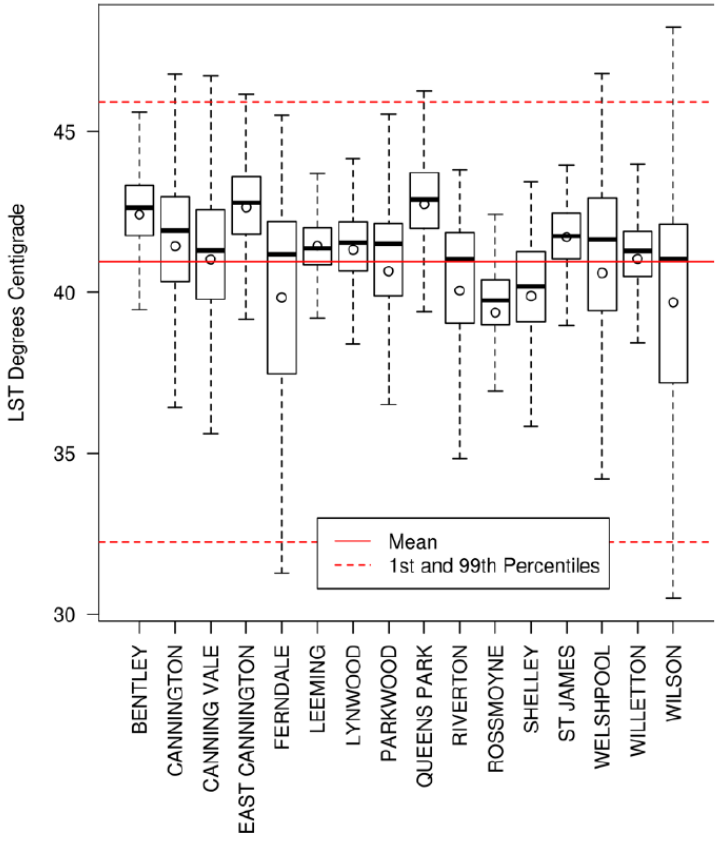






Urban Forest Monitoring

The data can be summarised by land type such as tenure, zoning,



Tree Inventory

Trees are increasingly being treated as assets by local governments, but how do you inventory assets spread across the urban landscape at around 20 per hectare?

- Collection by field technicians is slow, prone to human error and carries some safety risks (e.g. trees in road reserves). And this cannot include private property.
- Manual digitisation of imagery is also slow and prone to human error, and doesn't capture important attributes such as tree height.

Remote sensing approaches have been applied to this problem to create complete inventories with attributes such as proximity to overhead powerlines, tenure and height.

These can be directly imported into existing asset management systems.
(City of Joondalup circa 50,000trees)

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Tree Inventory

cat	asset_d	short_d	area	l_grp	l_type	l_string	suburbs	wards	reserve	road	align
558246	Private - COOLIBAH	Private Tree	31.75...	Private	Residential / Pri...	GREENWOOD\C...	GREENWOOD	South-East Ward		COOLIBAH	Property
558189	Street - WARRIGAL	Street Tree	9.625...	Street	Verge	GREENWOOD\W...	GREENWOOD	South-East Ward		WARRIGAL	Kerb
558190	Private - PARK	Private Tree	22.87...	Private	Residential / Pri...	GREENWOOD\PA...	GREENWOOD	South-East Ward		PARK	Property
558344	Private - PARK	Private Tree	68.87...	Private	Residential / Pri...	GREENWOOD\PA...	GREENWOOD	South-East Ward		PARK	Property
558247	Street - BLACKALL	Street Tree	8.625...	Street	Median	GREENWOOD\BL...	GREENWOOD	South-East Ward		BLACKALL	Median
558191	Private - BLACKALL	Private Tree	38.87...	Private	Residential / Pri...	GREENWOOD\BL...	GREENWOOD	South-East Ward		BLACKALL	Property
558143	POS - Oleaster Park	POS Tree	88.00...	POS	Park	GREENWOOD\OL...	GREENWOOD	South-East Ward	Oleaster Park	OLEASTER	Property
558337	Private - WAITARA	Private Tree	5.875...	Private							
				rivate							
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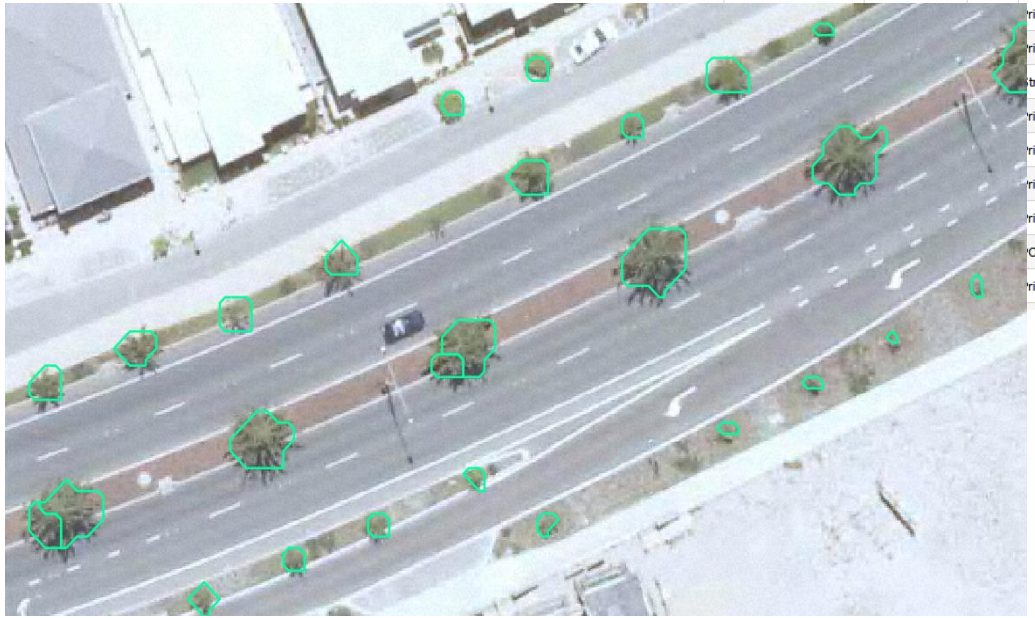

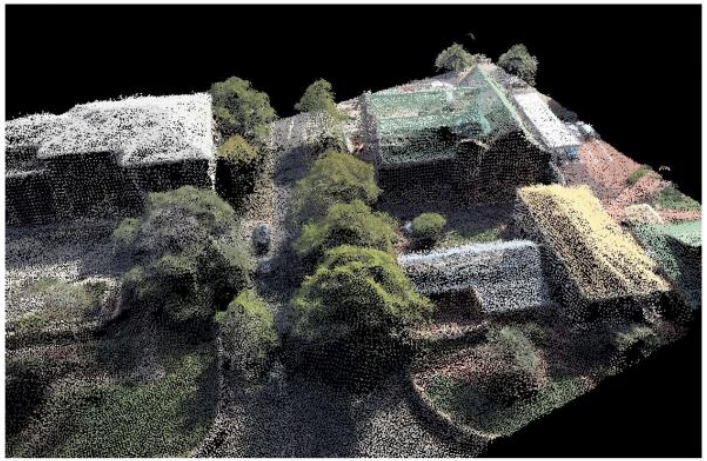

3D point cloud computed from the photogrammetry process, from which the digital canopy model is derived.

Remote Access - Cost, Time & Risk Reductions

	TIME	COST	RISK
SCAFFOLD	High	High	High
EWP	High	High	High
CONFINED SPACE	High	High	High
ROPE ACCESS	High	High	High
ELIOS	Low	Low	Low

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Elios Inspection Robot

Type	Collision Tolerant Quadcopter
Dimensions	< 400 mm Sphere
MTOW	0.7 kg
Endurance	10 minutes
Payloads	Custom RGB HD Video, Thermal

Elios is the first collision-tolerant flying robot designed for professional industrial inspections. The Elios features an integrated full HD and thermal image payload with continuous recording, on-board LED lighting, real time video feed back to the controller, dual operator capability and most importantly a collision tolerant airframe.

The Elios is allowing our clients to capture quality images from confined spaces removing the need to put workers at risk and avoiding downtime and significantly cutting inspection costs.

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ELIOS - Inspection of a Coal-Fired Boiler Superheater

CUSTOMER NEED

During an Annual plant shutdown on the Boiler, pipe support brackets were found on the floor. Determination of where the brackets had come from and determining root cause was the flight mission.

PROCEDURE

The Superheater tubes were located 70m up the furnace and were inspected over 15 flights conducted in 4 hours.

RESULTS

The location of the brackets was located and with the HD Imagery Engineering determined it was safe to start-up.

TIME	COSTS	SAFETY
Between 12 and 24 hours of downtime saved compared to a regular manned inspection.	Only 4 hours with 2 engineers needed to perform the mission.	Risks of a manned intervention avoided and HSE procedures shortened.

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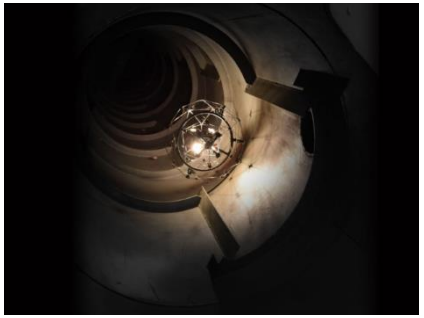
ELIOS – Pressure Vessel Inspection

Pilot Test carried out for Chevron whose objective is to prevent all human entry into confined spaces by 2020.



UAV Configuration Types

lighter than air

balloon

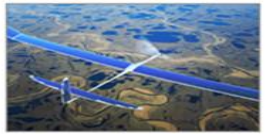
blimp

heavier than air

fixed wing

small UAV

MALE



HALE

hybrid

VTOL fixed wing

tilt wing

tilt engine

tilt platform

multi-rotor

tri-copter

quad-copter

hexa-copter

octo-copter

single-rotor

conventional

coaxial

nano

flettner

MALE: medium altitude long endurance (15.000 – 45.000 ft.), HALE: high altitude long endurance (>45.000 ft.)

Source: Droneii.com June 2016

Potential Drone Applications

- Building Inspections
- Roof Inspections
- Unauthorised Vehicular access
- Vegetation and Topographic Surveys
- Anti Social Behaviour
- Landform Stability and Erosion
- Mosquito Spraying

Reality Modelling – As Built, Progress, Training,

Application	Description
As-Built	Scan and generate a point cloud and import into Autodesk Revit™ and use it as a template to model existing conditions
Progress Tracking	Use the scanned model to both track, record and communicate project progress.
Immersive Training	A paradigm shift in Site familiarisation and high risk space exposure including utilisation of Virtual Reality [VR}
Engineering	Utilise the 3D Model to conduct dimensional and area measurements of the space.

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Infrastructure Scan

Client Synergy

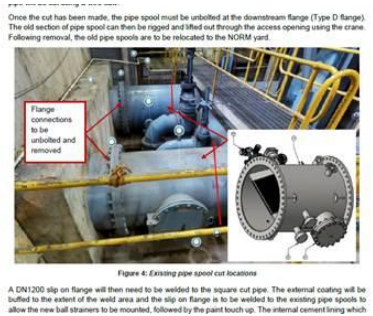
Technology Terrestrial Scanner, Photogrammetry

Description

Synergy was undertaking a plant upgrade and required Site Inspection by the Supplier for design and review.
C4D's end-to-end reality capture solution provided a full 3D interactive model for the Engineers to use to this end without having to travel from Europe to Site saving the client thousands of dollars.

It was received as highly valuable and actionable information for the Contractors that incorporated Model Shots within their proposal (Refer insert)

[Muja Condenser Cleaning System 3D Reality Model]



Infrastructure Scan

Client Western Power

Technology Terrestrial Scanner, Photogrammetry

Description

Western Power's Perenjori BESS System was required to be As-Built on completion prior to delivery to Site so the Reality Scan tech. was utilised to capture the completed Units.

It was received and reviewed by senior management whom have now also used the scans for marketing and media.

[Western Power Perenjori BESS System]

Clients and Case Studies – Reality Scan

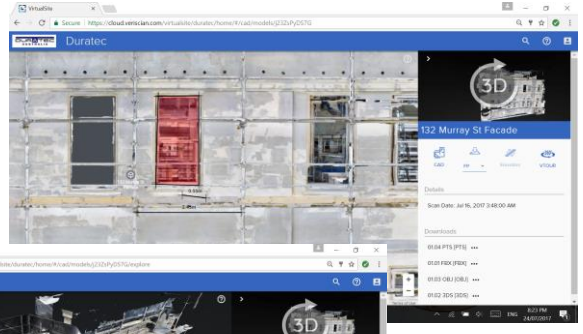
Client Duratec

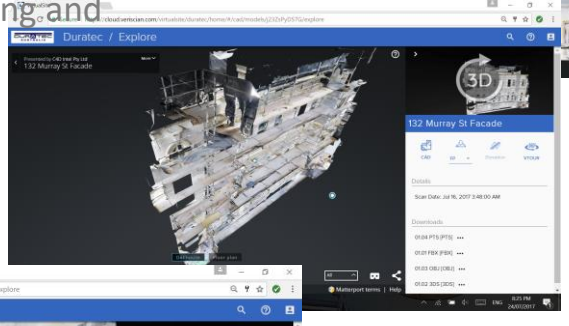
Technology Terrestrial Scanner, Photogrammetry

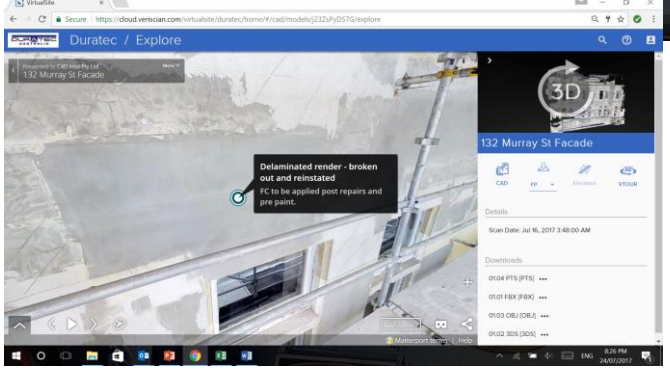
Description

Duratec are looking at utilising the Reality Scan Technology and associated Engineering Platform Veriscian to conduct both progress reporting and as-building of their works.

[Duratec 132 Murray St Facade]







Building Footprint Change Detection

Dr Ravanbakhsh

C4D INTEL

Innovative Features:

- ✓ **Automated building footprint detection using imagery in an extremely cost effective manner**
- ✓ **Automated change detection capability to ensure dataset is maintained**
- ✓ **Built upon the latest deep learning and computer vision technology**
- ✓ **Sophisticated object based comparison method**
- ✓ **Ultra-fast computational approach detecting changes in 606 buildings in less than a minute**
- ✓ **Over %95 complete and correct result**

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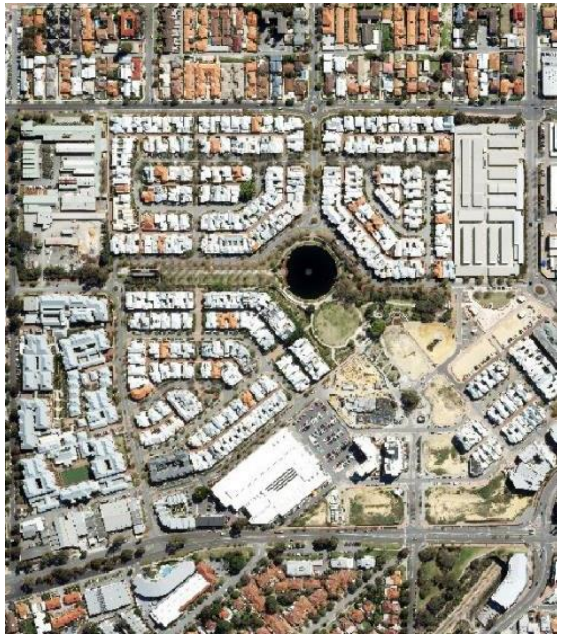

Machine Learning Approach

Change Detection Sample Result

Old database (cyan) produced by Landgate and extracted changes (red box) through Astron's approach

Size of the change within red boxes in square metre

Larger Perth Metro Test Site

Larger test site in Perth suburban areas

Outcome:

- Property address and the size of the change can be produced and reported for each suburb
- Up-to-date building footprint

Change Detection Evaluation

- Total number of parcels in study area : 662
- Number of changed parcels: 107
- %16 rate of change on parcel basis
- Total area of old building footprints: 61000 m2
- Change area : 13500 m2
- Change rate : %18.1
- Accuracy of >%95 plus 0.5 hrs QC per suburb

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Change Detection - Other Applications

- Detection of Swimming Pools
- Detection of Solar Panels
- Side Walks
- Tanks / Dams
- Air Strips
- Beach / River Bank Erosion

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The Future – Quanitative Capture of your Asset by Default

Dash Cams

The 3D “New” Near Maps

Mobile Data Capture

Autonomous UAVs

Zoo Data – Inspection Platform

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And finally…Four steps to make Innnovation Happen?

1. Engage with Academia & Industry
2. Pick some achievable Targets
3. Trial the Tech.
4. Be prepared to Fail!!

Hovermap Platform Opportunity

Free Demonstration of brand new Tech;

Thankyou and get innovating !!