

The years just fly by....A CIP Update.



John White
CIP Partner Support



Environment,
Land, Water
and Planning

Coordinated Imagery Program:

First Project: 2004-05

- Four projects
 - Photography:
 - » Analog Photography: RC30 - Kodak 2444
Leica DSW600 (Scanner)
 - » Digital: UltraCam D
 - » Resolution: 35cm – 50cm
 - Lidar:
 - » 1.6 pts/m²
 - » Two returns per pulse.
 - » No ICSM classification.



Dec 2005



Jan 2018

Current State

- **Up to 40 – 50 projects per year**
 - Photography
 - 20cm to 5cm Resolution
 - Digital Only
 - » 3 band (True Colour) or False Colour IR
 - Lidar
 - 4 – 16pts m²
 - 8 returns per pulse
 - ICSM Classification



Why Did We Change?

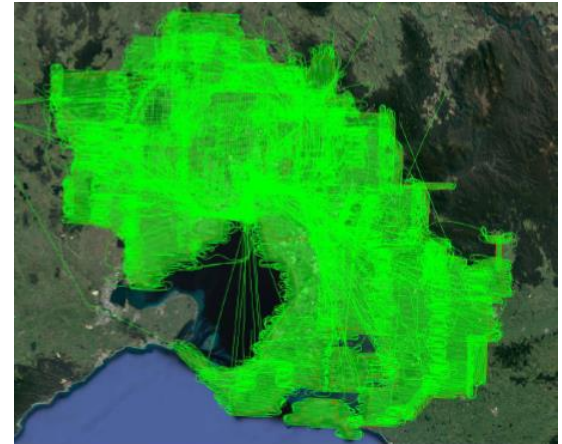
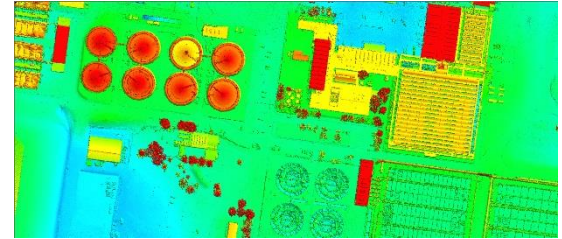


Dec 2004

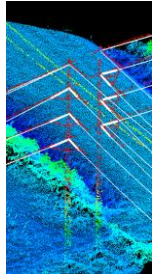
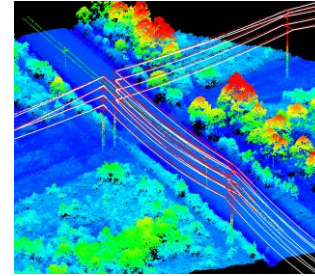


Dec 2005

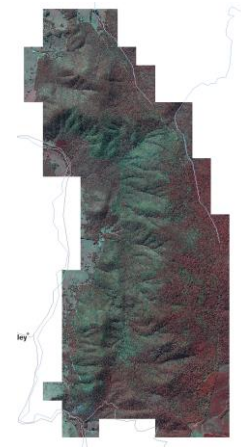
- Plan ahead
 - Increase number of partners
 - Potential better price
- Better Partner Engagement
 - Early request for EOI's
 - Contact potential partners
 - Budget Cycles vary
- Clear Statement of requirements
 - Less contract variation



- Acquisition/Processing schedule rarely goes to plan
 - ATC
 - Weather
 - Quality Issues
- Changing expectations of our partners
 - Faster delivery after capture
 - Online data delivery
 - Part delivery
- Panel of Providers



Source: Harris Corporation



Lessons Learnt: Specifications

Building Lean:



Ratio: Approx. 1:3
Forward: 100%, Side: 30%



Forward: 60% - 80%,
Side: 30% - 40%



LiDAR:

- CIP & ICSM Lidar Acquisition Specifications –
 - Enables consistent request for data
 - Greater Understanding by suppliers
 - Contractor Internal procedures
- QA4Lidar
 - Tool developed by Frontier SI supported by CIP.
 - Automatic Checks eg. Scan angles, Naming of tiles, Survey Control



Lessons Learnt: QA/QC

		QA4LiDAR Measures								
		✓ - Existing Measure met by QA4LiDAR ✗ - Existing Measure not met by QA4LiDAR								
CIP QA Measure		1. Project Scan in	2. Naming Completeness & Corruption	3. Attributes & Projection	4. Classification Statistics	5. Accuracy of Survey Control	6. Point Density & DEM Resolution	7. Flight Line Coverage	8. Absolute & Relative Vertical Accuracy	9. Visual Checks (automated processes)
1.	File Format & Naming	✓	✓	✓	-	-	-	-	-	-
2.	Tiling	-	✓	-	-	-	-	-	-	-
3.	Projection	-	-	✓	-	-	-	-	-	-
4.	Extent / Coverage	-	-	-	-	-	-	✓	-	✓
5.	Gaps / Holes / Clouds & Cloud Shadow	-	-	-	-	-	-	✓	-	✓
6.	Edge Matching and Seamlessness	-	-	-	-	-	-	-	✓	-
7.	LiDAR	8.1. Density / Point Spacing	-	-	-	-	✓	✓	-	-
		8.2. Strikes	-	-	✓	-	-	-	-	-
		8.3. Attributes	-	-	✓	-	-	✓	-	-
		8.4. Classification	-	-	-	✓	-	-	-	-
8.	DEM	9.1. Resolution / Pixel size	-	-	-	-	✓	-	-	-
		9.2. Vertical Accuracy	-	-	-	-	-	-	-	-

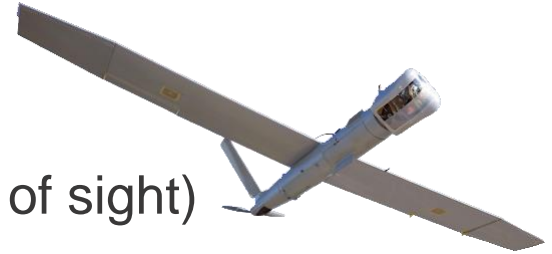
		QA4LiDAR Stages (Continued)								
	✓ - Existing Measure met by QA4LiDAR ✗ - Existing Measure not met by QA4LiDAR	1. Project Scan In	2. Naming, Completeness & Corruption	3. Attributes & Projection	4. Classification Statistics	5. Accuracy of Survey Control	6. Point Density & DEM Resolution	7. Flight Line Coverage	8. Absolute & Relative Vertical Accuracy	9. Visual Checks (automated processes)
9. Contours	9.1. Contour Interval	✗	✗	✗	✗	✗	✗	✗	✗	✗
	9.2. Topology	✗	✗	✗	✗	✗	✗	✗	✗	✗
	9.3. Attribute Accuracy	✗	✗	✗	✗	✗	✗	✗	✗	✗
10. <u>Visual Checks</u>	10.1. Aerial Photography	✗	✗	✗	✗	✗	✗	✗	✗	✗
	10.2. LiDAR	✗	✗	✗	✗	✗	✗	✗	✗	✗
	10.3. DEM	✗	✗	✗	✗	✗	✗	✗	✗	✗
	10.4. Contours	✗	✗	✗	✗	✗	✗	✗	✗	✗
11. Spatial Metadata	11.1. Flight Lines	-	✓	✓	-	-	-	-	-	-
	11.2. Frame/Swath Boundaries	-	✓	-	-	-	-	-	-	-
	11.3. Mosaic Boundary	-	✓	-	-	-	-	-	-	-
	11.4. Index File	-	✓	✓	-	-	-	-	-	-
	11.5. Control Points	-	✓	✓	-	✓	-	✓	-	-
	11.6. Check Points	-	✓	✓	-	-	-	-	-	-
	11.7. Elevation Constraints	-	✓	-	-	-	-	-	-	-
12. Textual Metadata		✗	✗	✗	✗	✗	✗	✗	✗	✗
13. Reports		-	✓	-	-	-	-	-	-	-

- Aerial Photography:
 - Increase in resolution
 - Rural Capture (eg. Shire Extent).
 - 20cm
 - Technology changes
 - Reduced Costs
 - More captures (Outside standard season)
 - Quicker Delivery (eg. Rapid Provisional Ortho)
 - Storage/Archive Increase
 - External



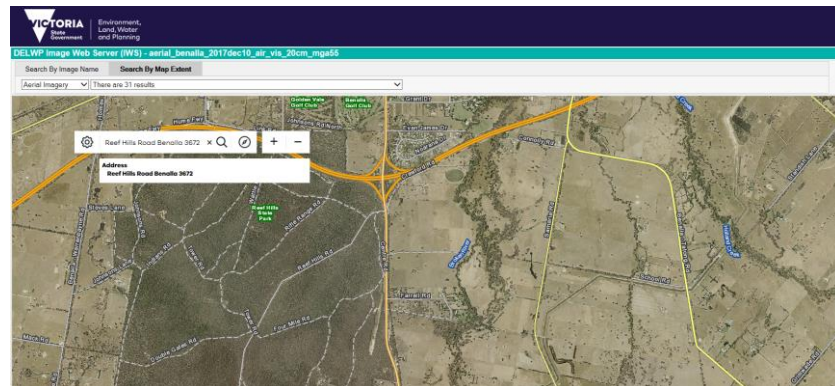
Drones/RPAS:

- Increased use
- Multiple sensors and platforms
 - Better sensors
 - Larger Platforms (Out of line of sight)
- More products
- Considerations:
 - Products
 - Flexibility
 - Extent/Area
 - Alternatives



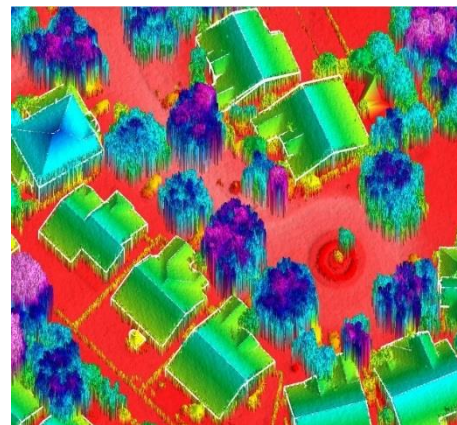
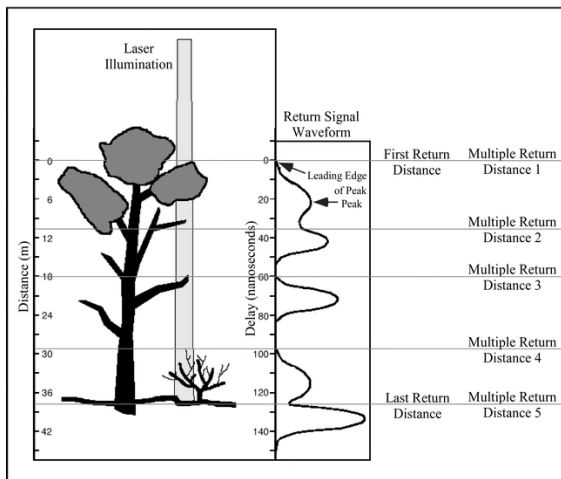
Services:

- Delivery via services (WMS, WMTS)
- Additional tools
 - Swipe
 - Measure
 - History
- API's available



Elevation:

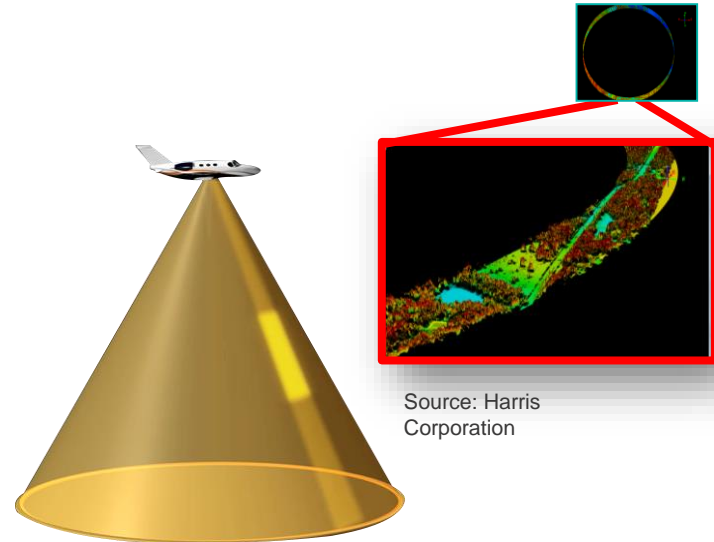
- Lidar: Increase Point Density & returns
- Feature Extraction
- Full Waveform
- Storage/Archive Increase
 - External



Source: Harris
Corporation

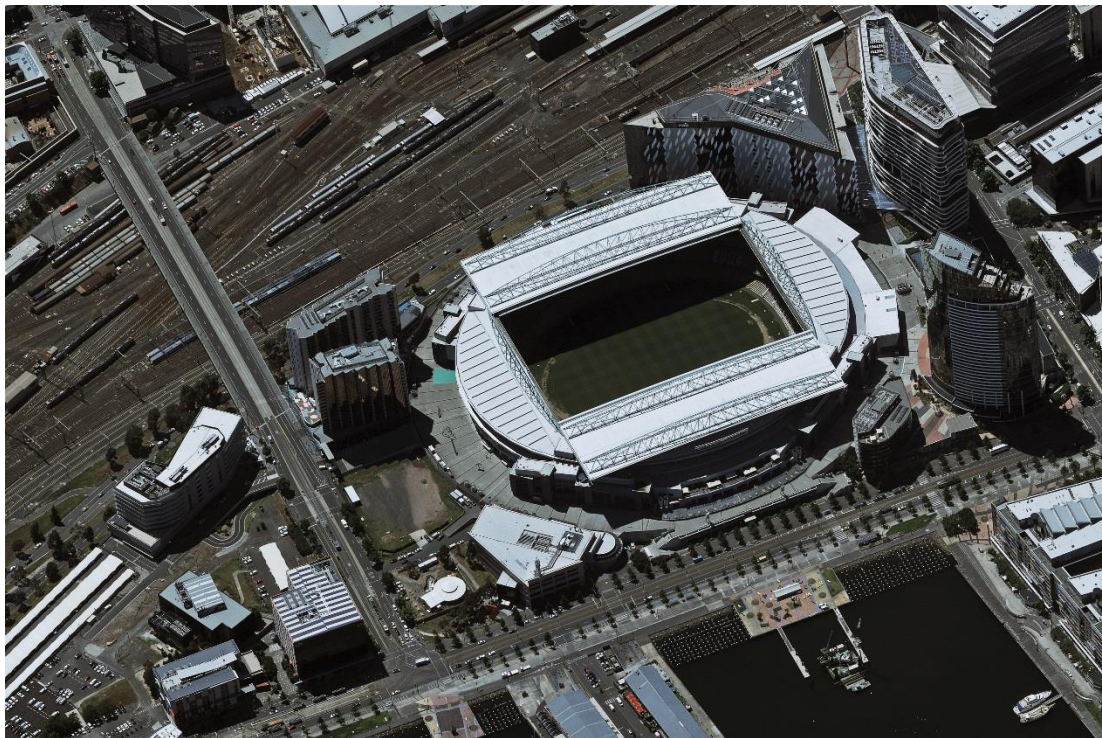
New Sensors eg. Geiger-Mode:

- Photo Diode Array
- High Point Density (200MHz)
- Single Return
- One supplier: Harris Corporation*

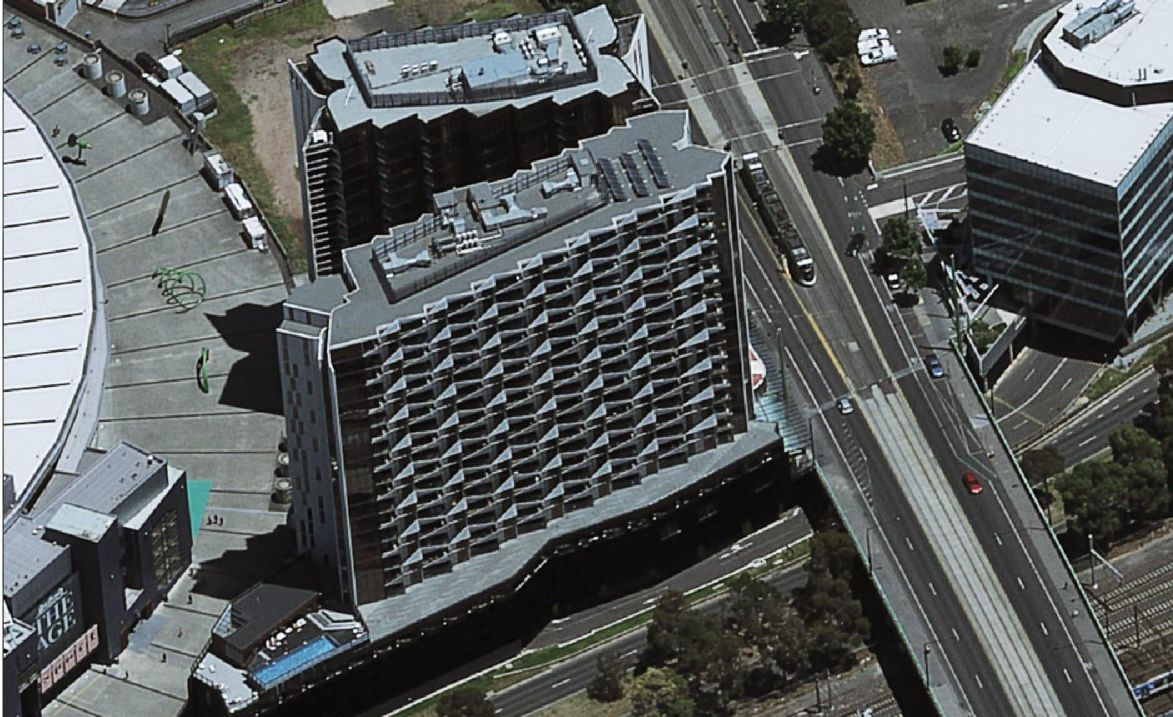


Source: Harris Corporation

Better use of the data collected:



Better use of the data collected:

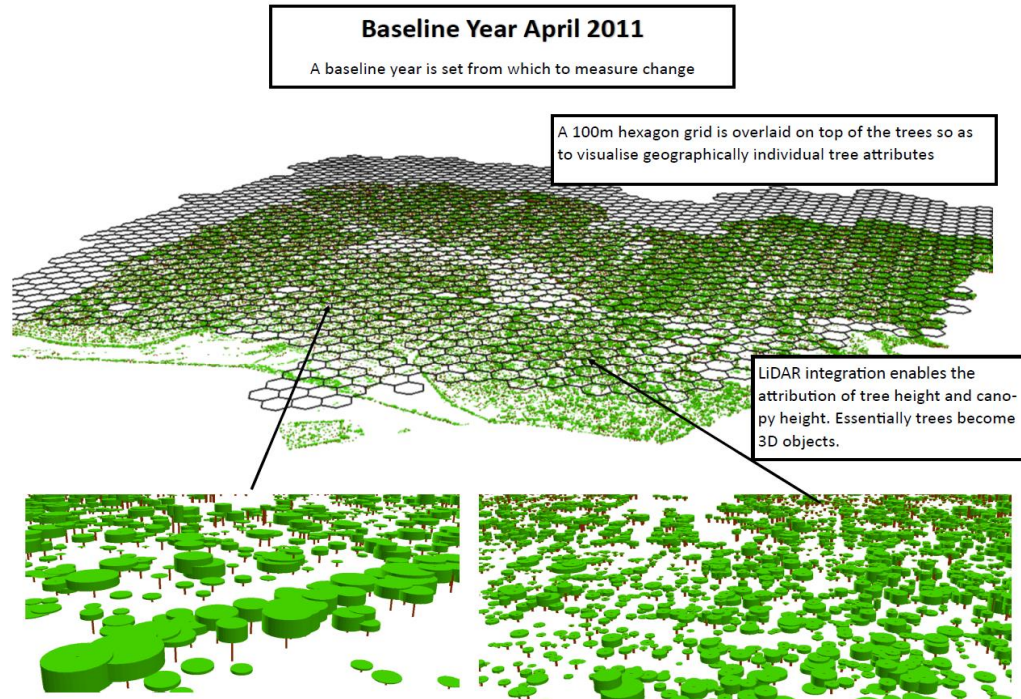


Machine Learning: Vegetation Cover – Urban Tree Ledger

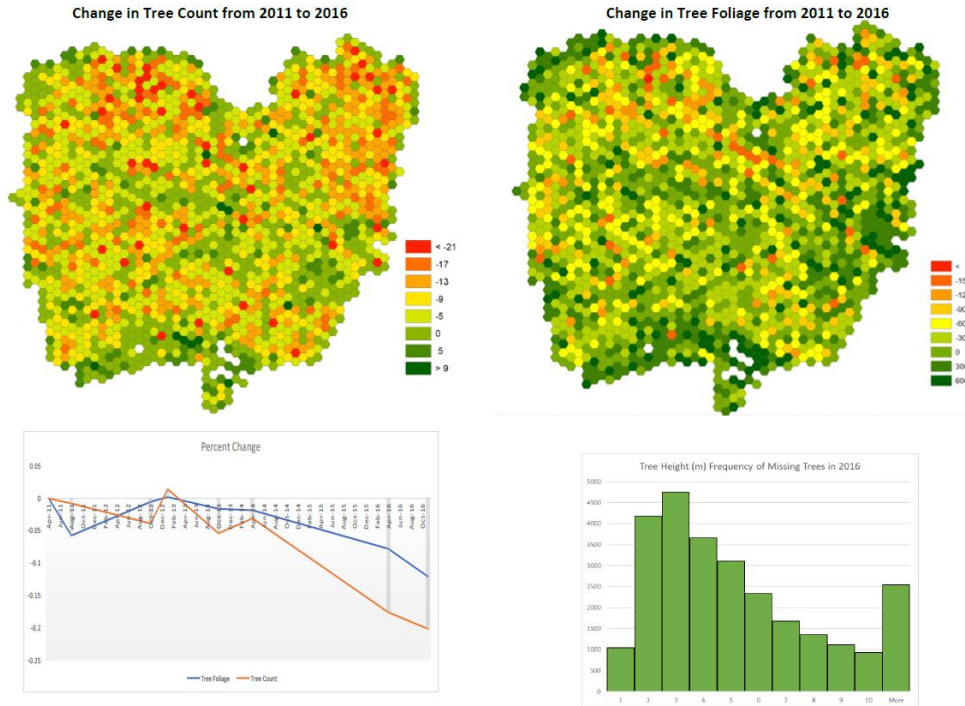


Source: Felix Lipkin Frontier SI: 2018

Machine Learning: Vegetation Cover: 2011 - 2016



Machine Learning: Vegetation Cover: 2011 - 2016

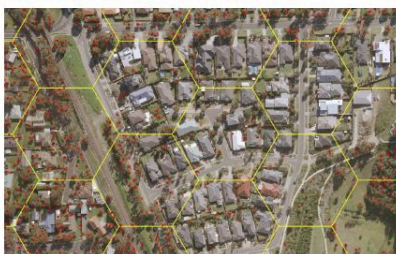
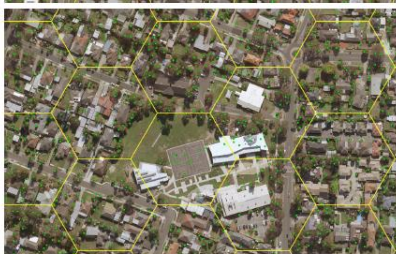


Machine Learning: Vegetation Cover: 2011 - 2016

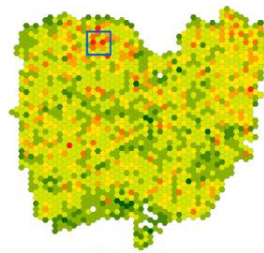
April 2011 Trees on 2011 Photography



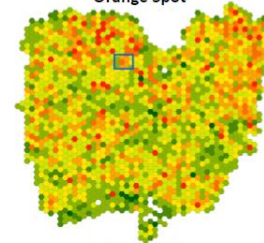
April 2011 Trees on 2016 Photography



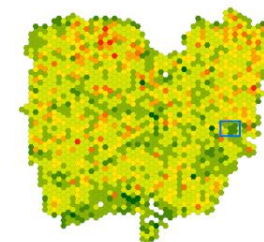
Red Spot



Orange Spot



Green Spot



Source: Felix Lipkin Frontier St: 2018

Photogrammetry: Urban Monitor System ®

“Metropolitan monitoring and analysis of vegetation cover, heat and land use”: Plan Melbourne Action 91”

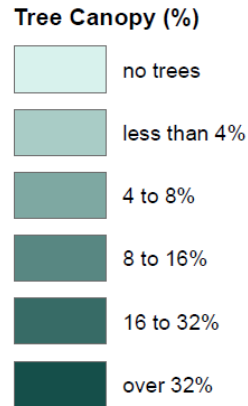
- Raw Frames (RGBI)
- Digital Frame or Push broom
 - AeroTriangulation
 - Camera Calibration
 - Ground Control Points if required
- Output
 - Radiometrically corrected true orthophotography
 - Vegetation Location & Height
 - DEM & DSM



Source: Interim Report: Urban Vegetation Cover Analysis
Northern Region 2018 (unpublished): Clean Air and Urban
Landscapes Hub, RMIT University, The University of Western
Australia, CSIRO – Data 61

Photogrammetry: Urban Monitor System ®

% Tree Canopy 2014: Mesh Block Level

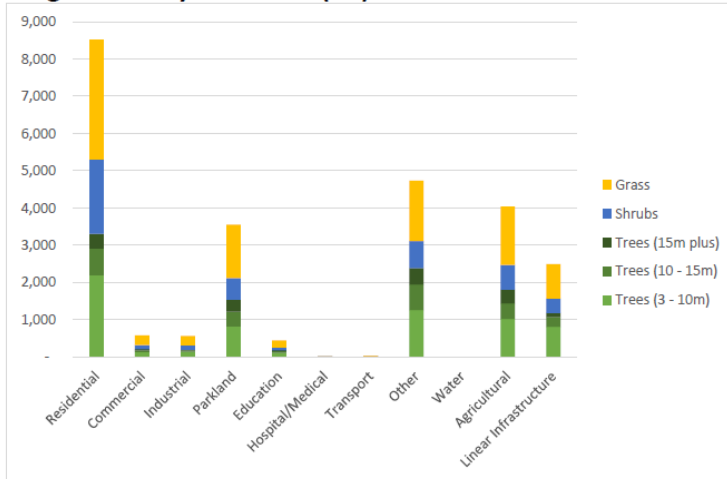


Source: Interim Report: Urban Vegetation Cover Analysis Northern Region 2018 (unpublished): Clean Air and Urban Landscapes Hub, RMIT University, The University of Western Australia, CSIRO – Data 61

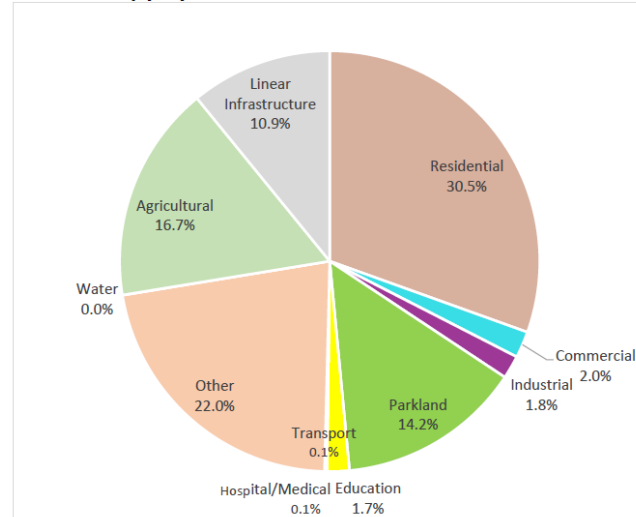
Photogrammetry: Urban Monitor System ®

Vegetation Information: 2014: Mesh Block Level

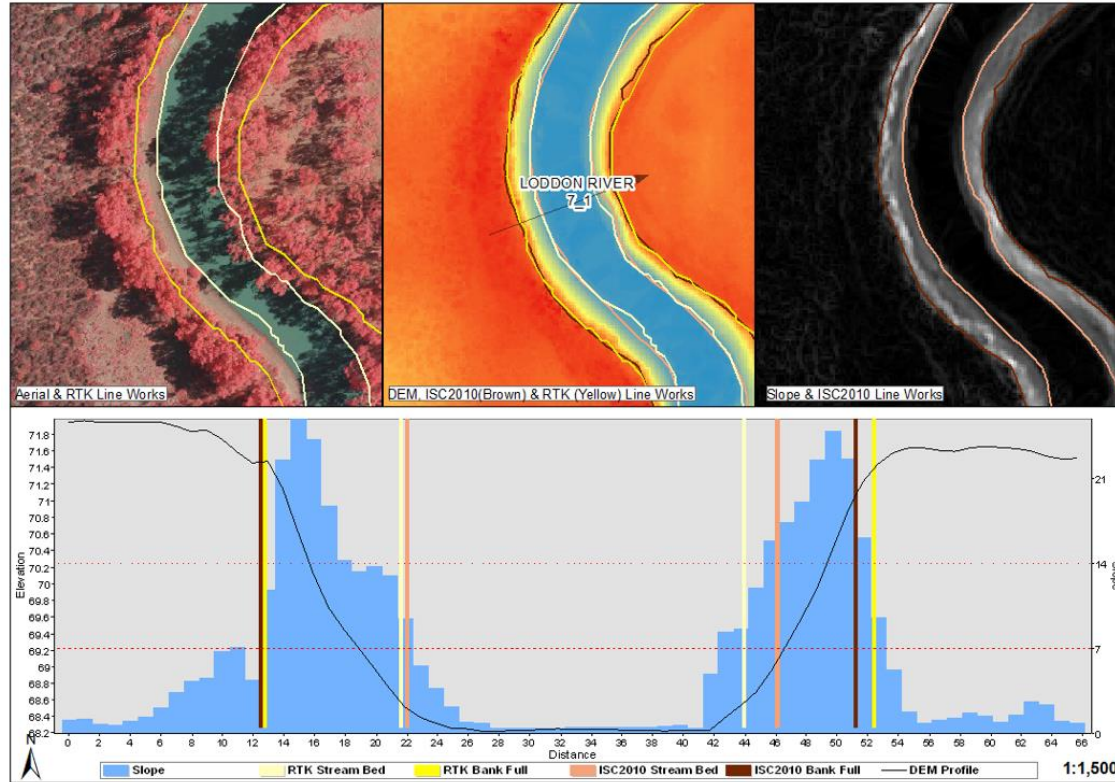
Vegetation by Land Use (ha)



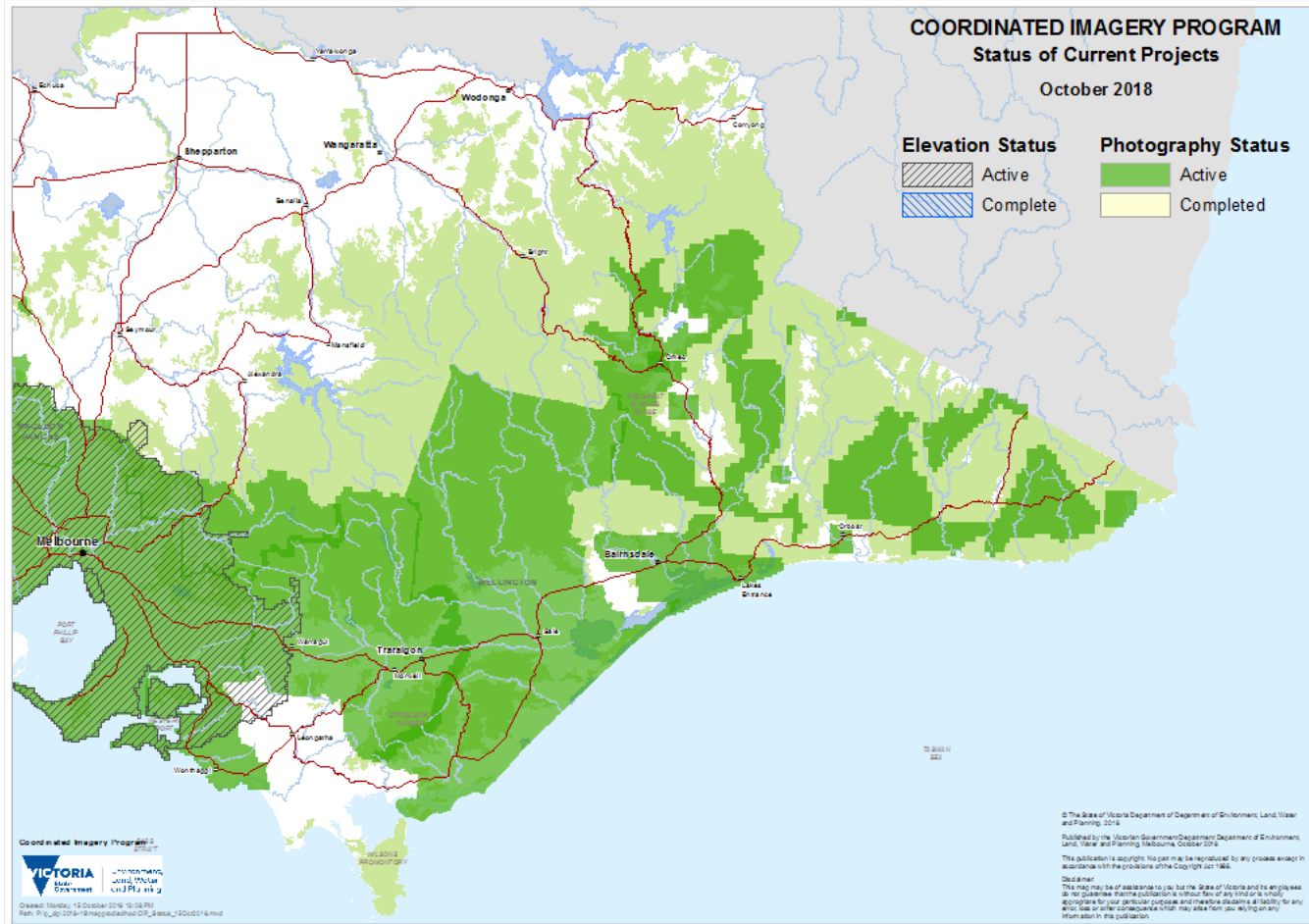
Tree Canopy by Land Use



Automated Extraction: River Lines Toolkit (RLT)



CIP 2018/19 Capture Program



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