



# AquaWatch Australia

Building a water quality monitoring and forecasting service to support better water management



# Ambition: Water Quality is a Global Challenge



Sediments & Floods



Fish-kill events



Sewage/Pollution



Harmful Algae Blooms



3 Billion people world-wide don't have access to clean water and sanitation

# AquaWatch Mission Launch March 22, 2023 (Canberra & New York)

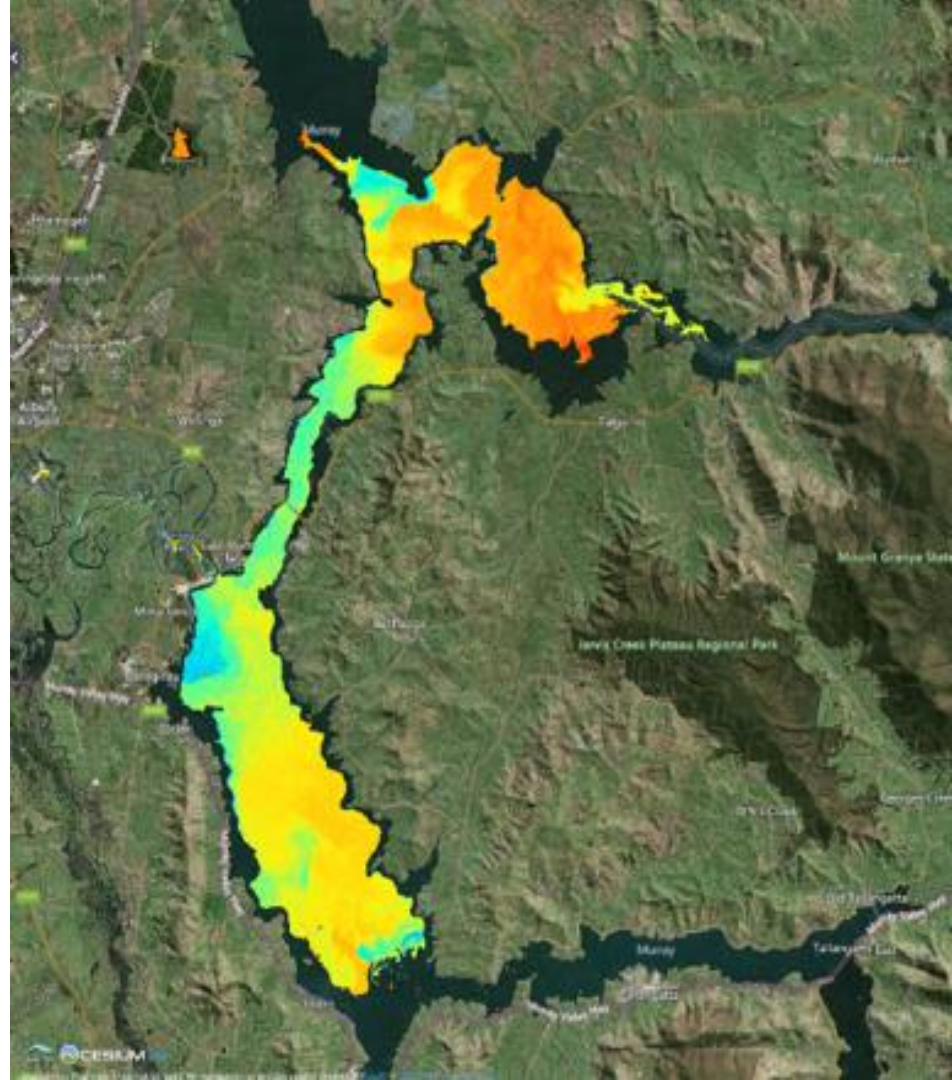




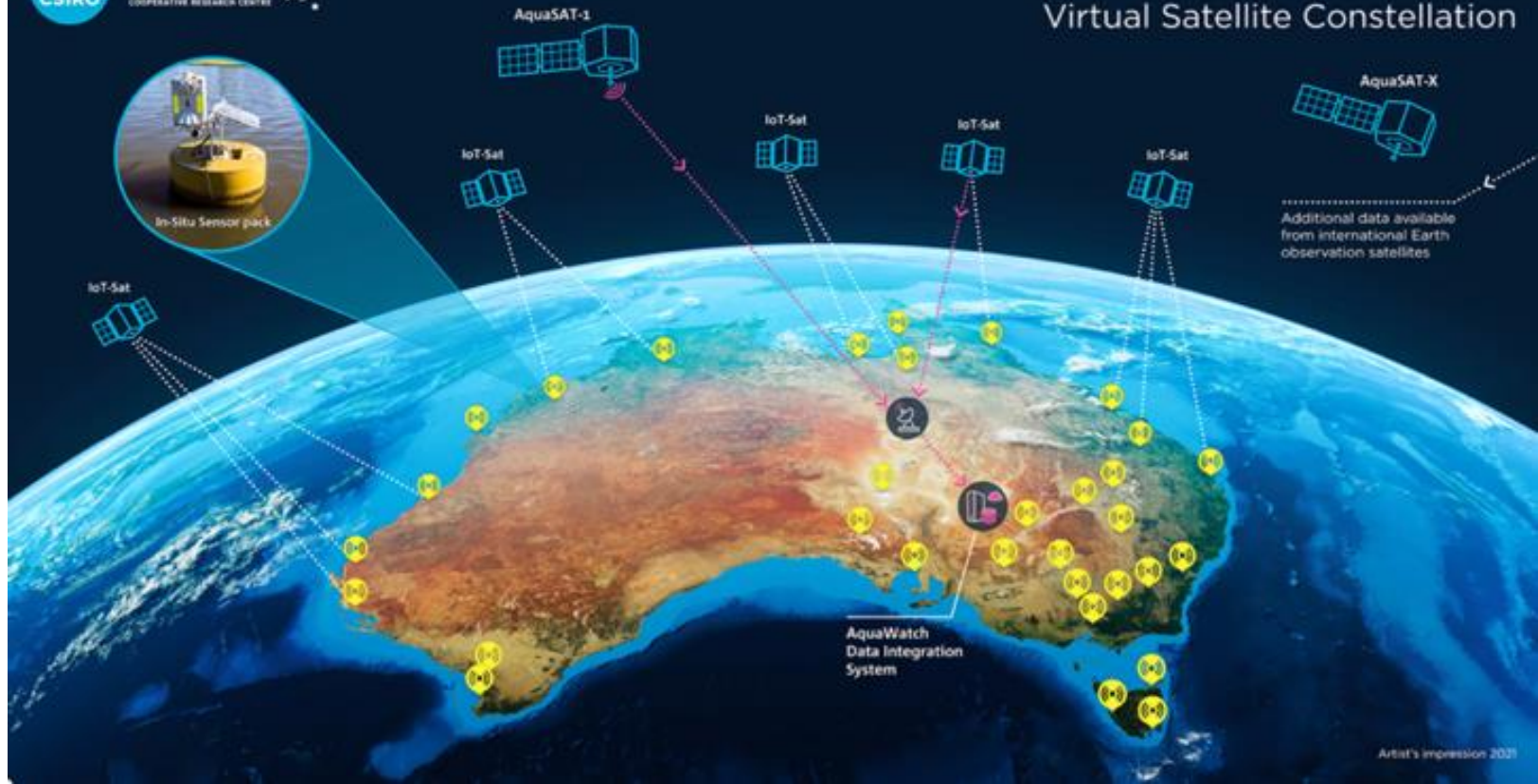


## Scope of AquaWatch

- **Technology Implementation:** space-to-ground water quality monitoring and forecasting system, with key milestones in 2026 and 2030.
- **Community Engagement and Co-Design,** strong focus on work with local users, governments and indigenous community.
- **Research program,** for continuous improvement, with aligned R&D and support for growth in the user base.



# AquaWatch Australia Mission Concept Virtual Satellite Constellation

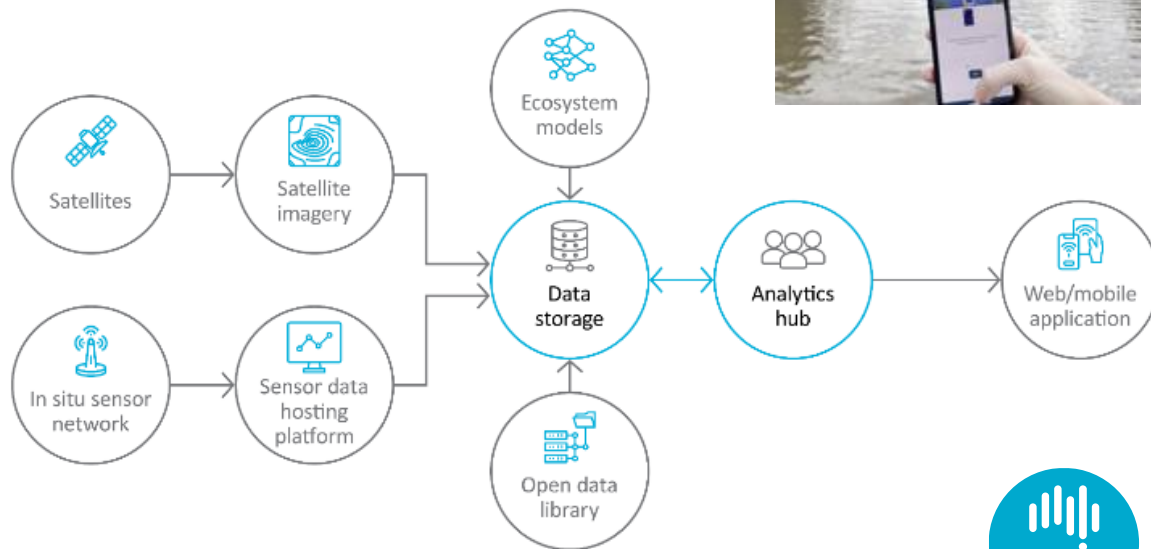


<https://www.csiro.au/en/about/challenges-missions/aquawatch>

# AquaWatch Data System

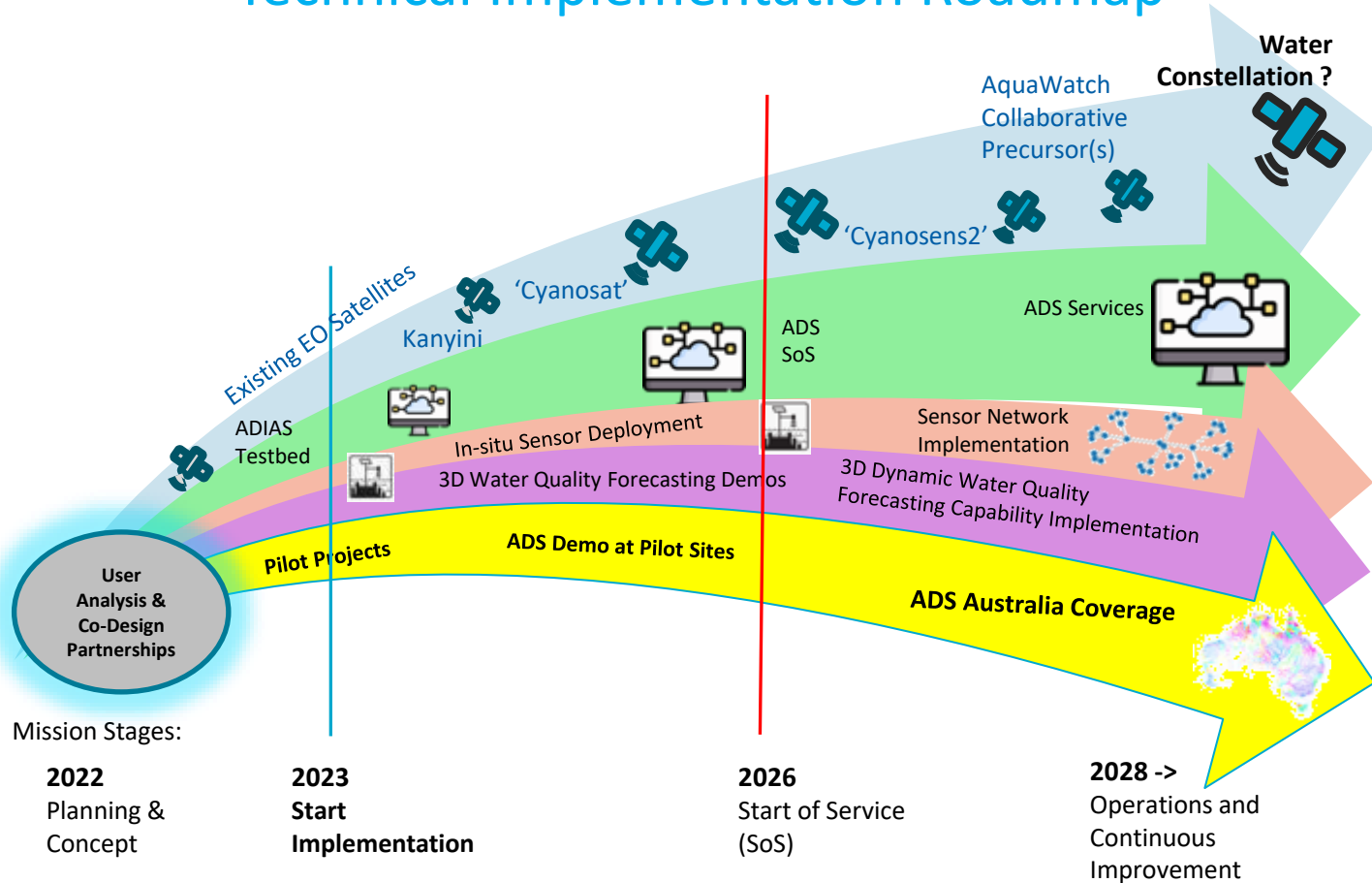


- Powered by Open DataCube Technology
- Integrates petabytes of data from both water-based sensors and Earth observation satellites.
- Advanced data analytics will transform the raw data into insights for the end user.
- Analytics tools, including AI will produce forecasts to better anticipate future conditions and provide early warning.
- The adaptability of the ADS enables AquaWatch to deliver a diverse range of data services, tailored to specific requirements and applications.

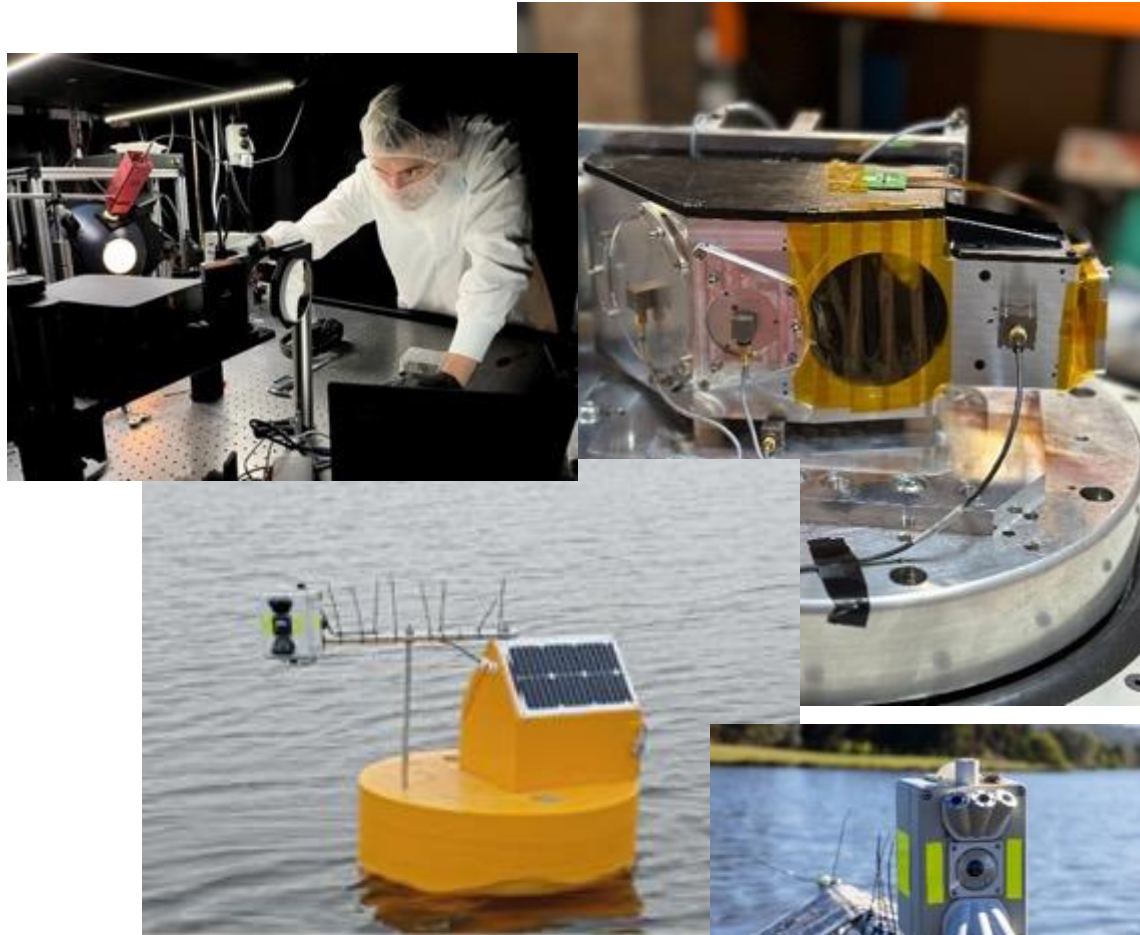




# Technical Implementation Roadmap







# Technologies

# Infrastructure Deployment

Instrumentation Stations for In-situ Water Quality Measurement and Satellite Data Validation

Instruments include:

- CSIRO Hydraspectra
- TriOS Ramses  $E_d$ ,  $L_{sky}$  and  $L_w$
- Pan/tilt unit
- Weather station
- Cameras horizontal and forward-looking
- Water temperature (below surface & 2 depths (4/8m))



HydraSpectra Mk IV



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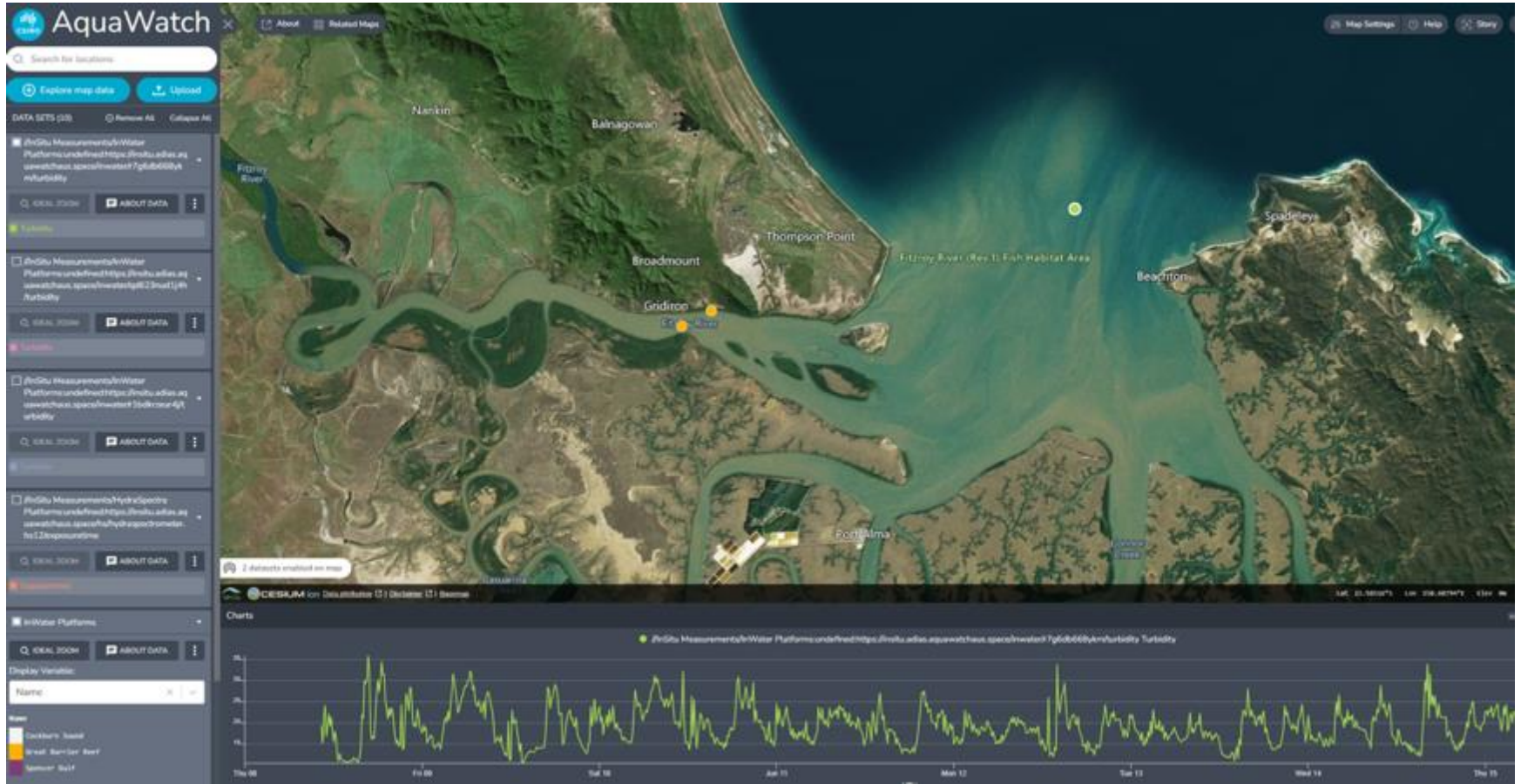
# CSIRO Deployments @ national and international pilots



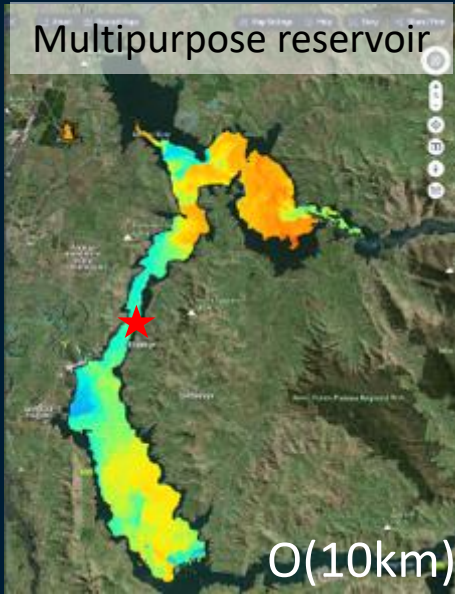
Great Barrier Reef



# Keppel Bay – Turbidity



Multipurpose reservoir



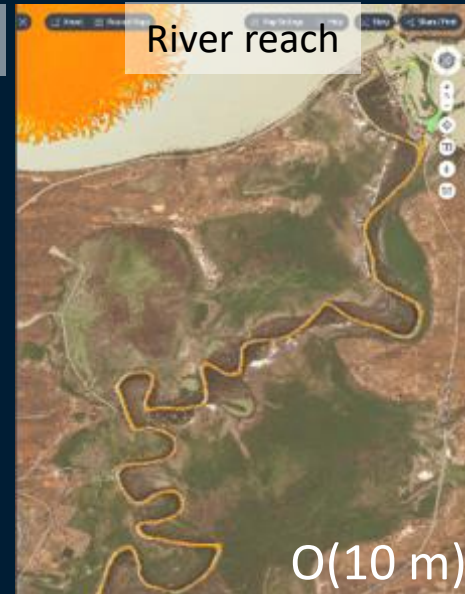
Urban lake



Water treatment lagoons



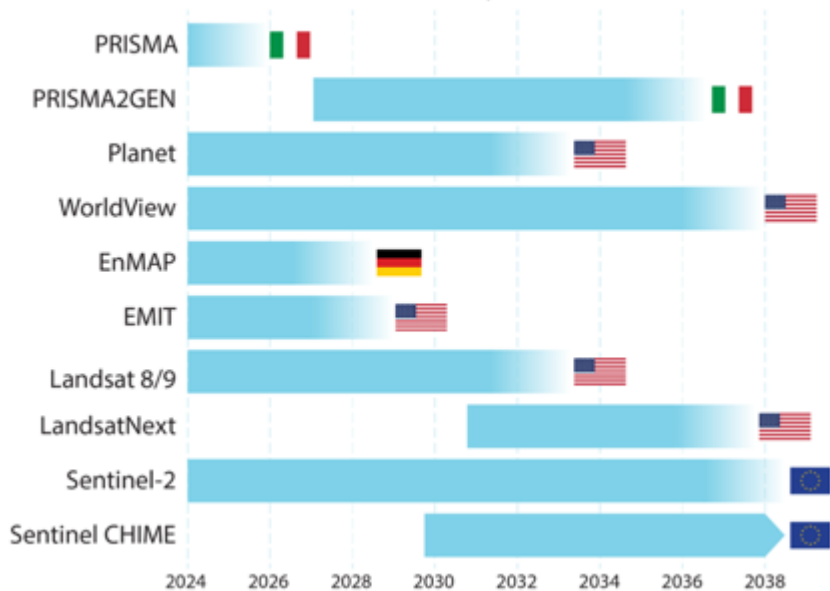
River reach



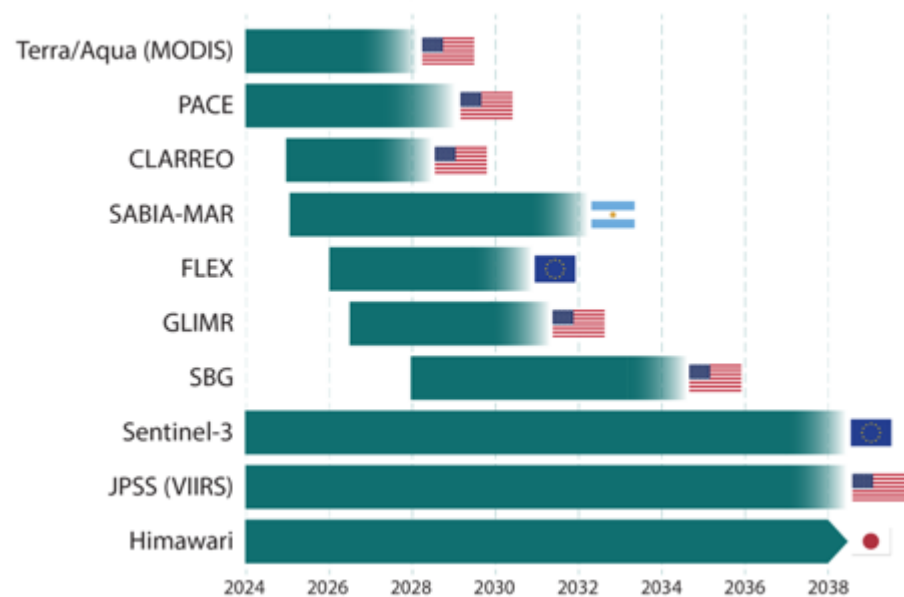
Characteristic target and feature scale  
determine necessary **spatial resolution**

# Possible Sources of EO data for AquaWatch

## Inland & Coastal Measurements (spatial resolution less than 30 m)



## Coastal Measurements (spatial resolution 30 - 1000 m)



Extra EO Data for Water Quality Modelling: SWOT, Trishna, ..

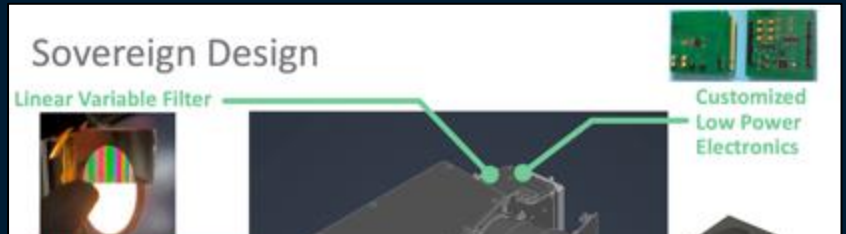
# CSIRO CyanoSens

- Aquawatch Pathfinder
- CSIRO Satellite Optics Lab, Adelaide
- Launched – June 12<sup>th</sup> on Skykraft payload
- Communication with payload, under commissioning
- CyanoSense2 in development

## Sovereign Design

Linear Variable Filter

Customized Low Power Electronics




## Sovereign Manufacturing

High Precision CNC machining

Novel Easily aligned telescope

Deployable Baffle



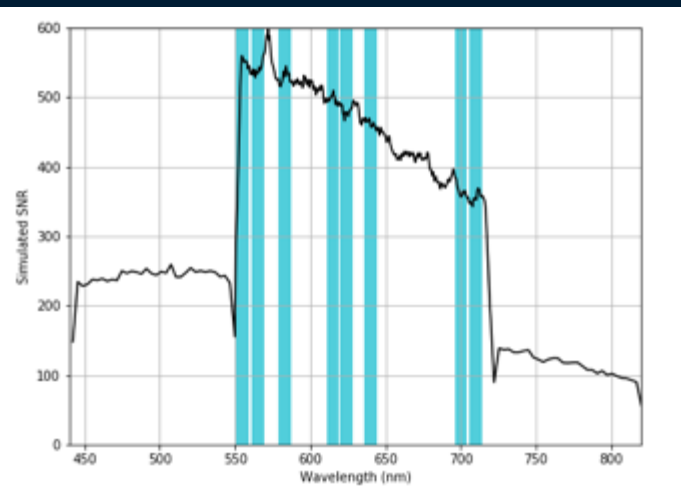
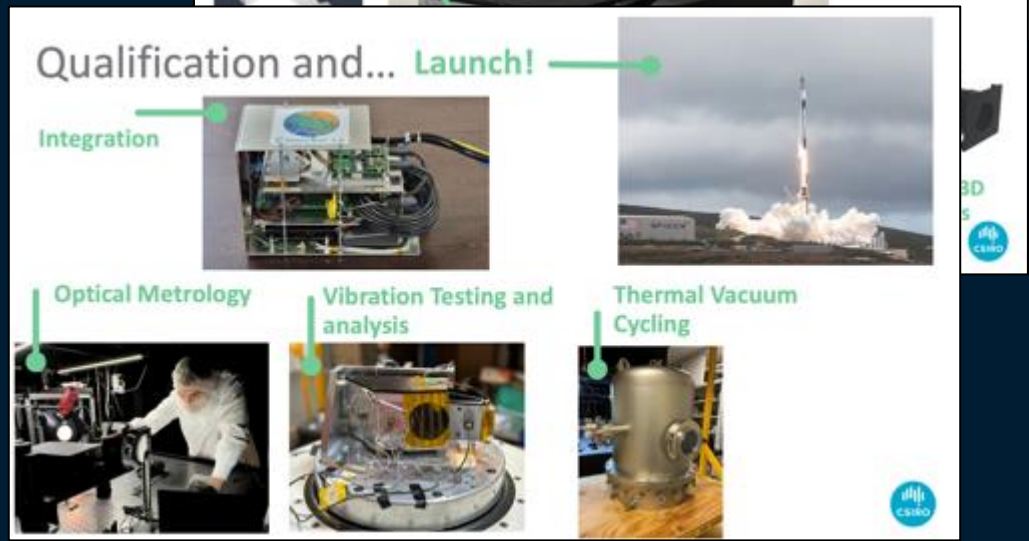
## Qualification and... Launch!

Integration

Optical Metrology

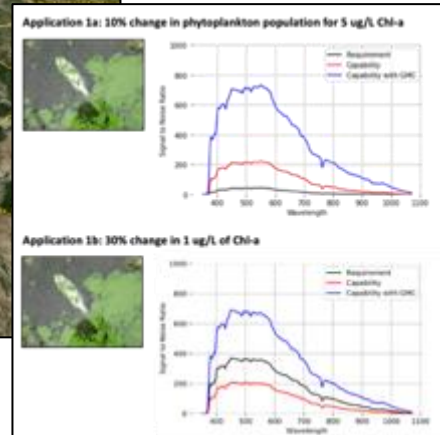
Vibration Testing and analysis

Thermal Vacuum Cycling



# CSIRO AquaSAT-1 Feasibility study, with NASA JPL

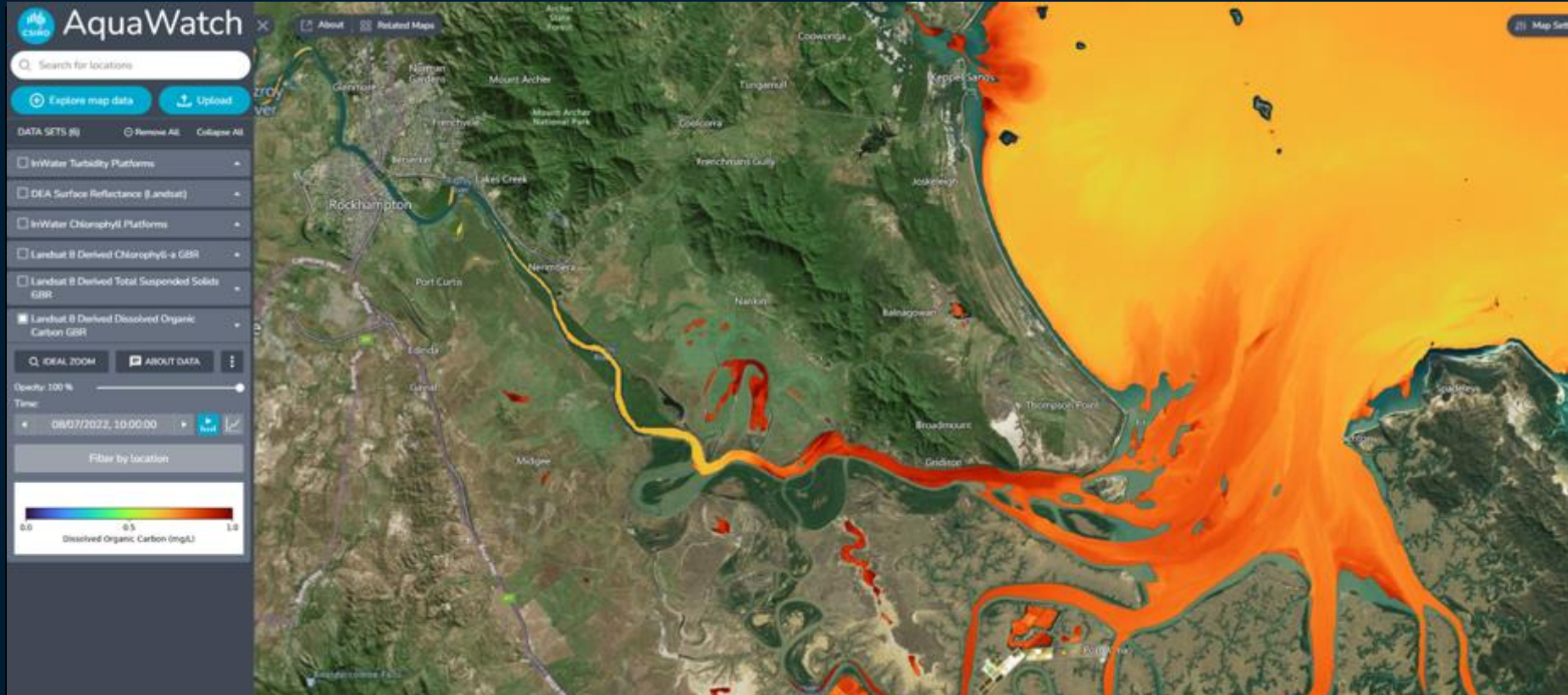
- **Orbit:** sun-synchronous, ~noon crossing time, ~400 km altitude (trade study: 600 km altitude)
- **GSD:** 18 m
- **Imaging coverage:** target sites (key lakes, rivers, estuaries, coral reefs in Australia and the US West)
- **Revisit:** 5 days with +/- 30 deg cross-track slew (not accounting for cloud cover, sunglint, target site conflicts, etc.)
- Dyson imaging spectrometer (350 to 1050 nm, 9.6 nm FWHM)



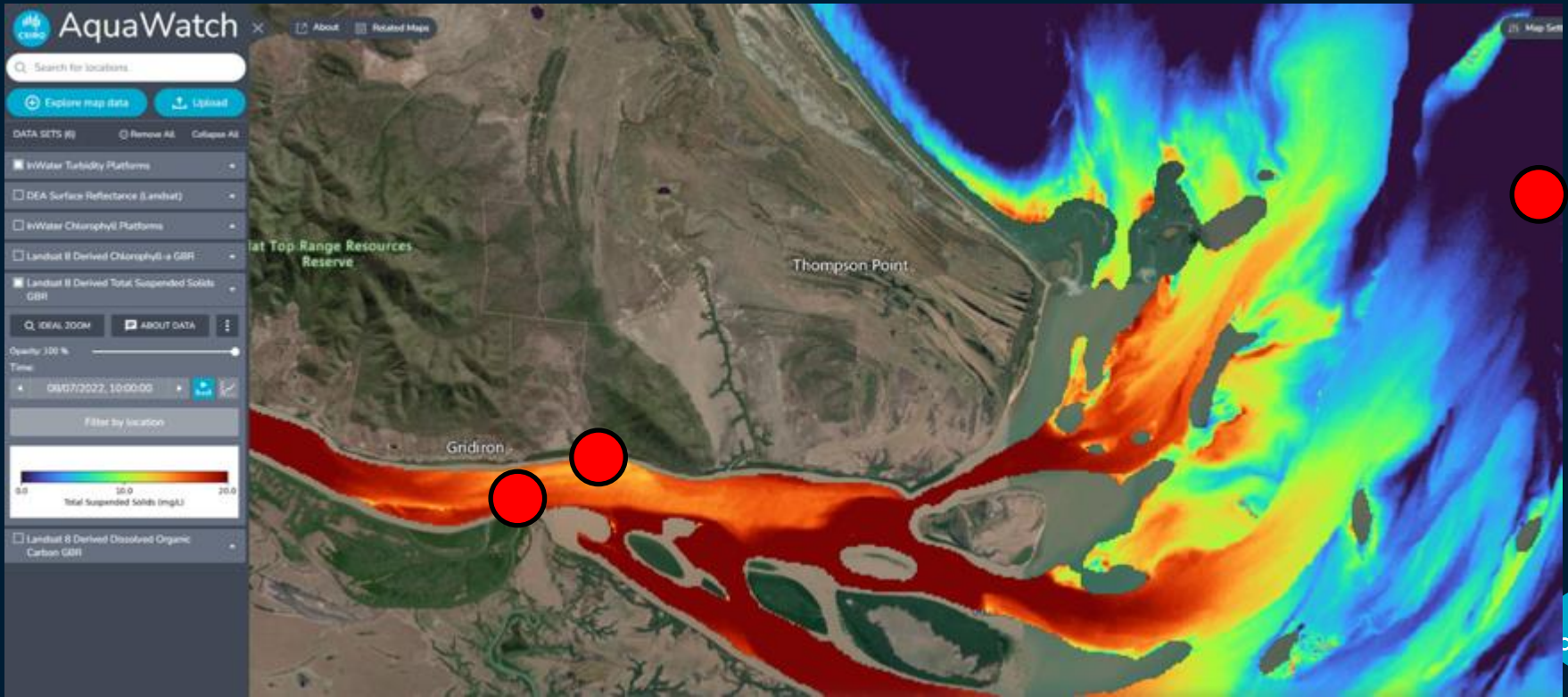




# Early Products Dissolved Organic Carbon

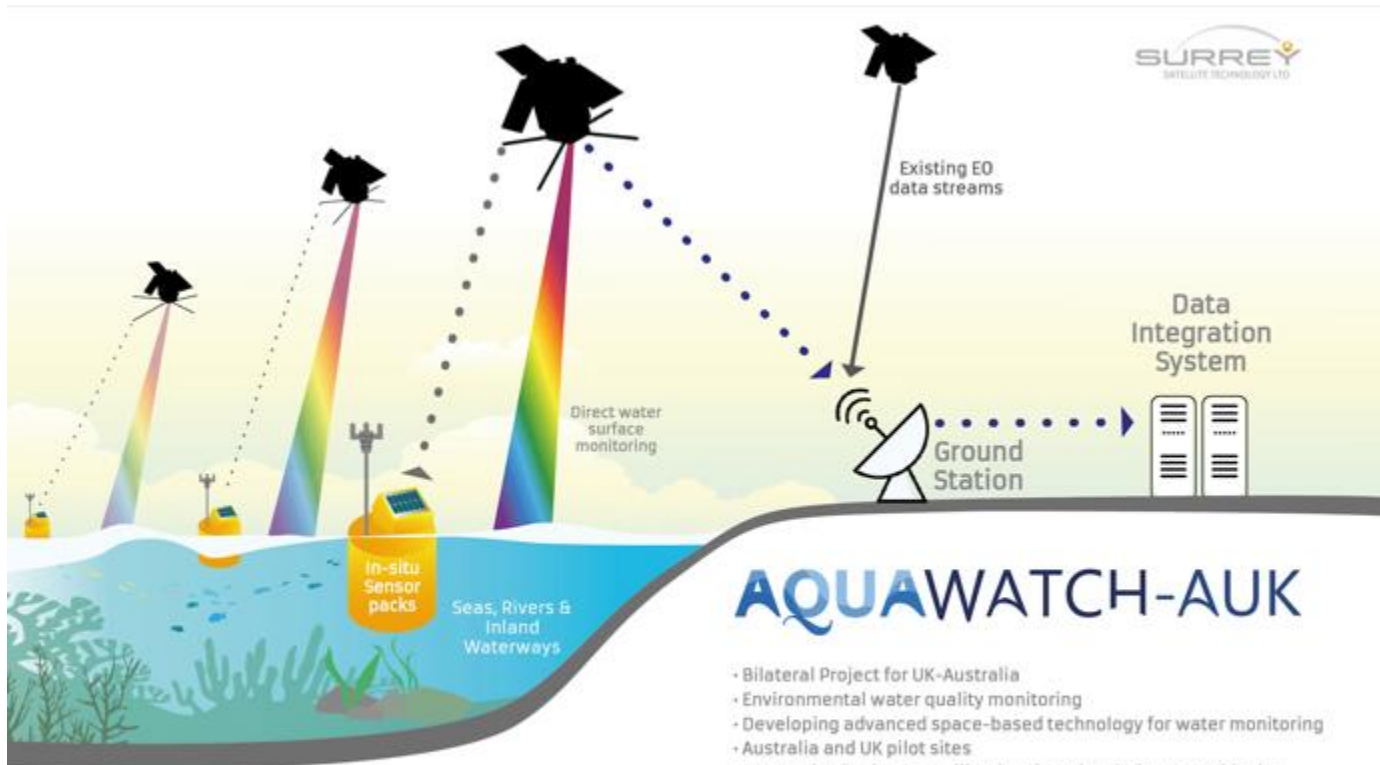


# Verification with in-water sensors



# AquaWatch Pilot Sites





## AQUAWATCH-AUK

- Bilateral Project for UK-Australia
- Environmental water quality monitoring
- Developing advanced space-based technology for water monitoring
- Australia and UK pilot sites
- Integrating in situ & satellite data into data hubs to provide the backbone for user services
- Could be expanded to integrate other nations and data supply services



## CEOS & GEO Linkages – Ideas?

- Strengthen links to GEO Aquawatch and GEO Indigenous Alliance
- Encourage CEOS agency water quality experts' participation in AquaWatch Pilot sites
- Keen to develop approaches to use additional EO missions incl. Landsat Next, SBG, CHIME, Trishna, etc.
- Collaborate on more customised EO satellite development for inland & coastal water quality monitoring
- Use of in-situ sensor network @ AquaWatch pilots for cal/val of CEOS EO sensors
- Research: Opportunities for collaboration on multi-sensor analytics and AI/ML applications.



# Thank you

**CSIRO Space & Astronomy**

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[csiro.au/en/about/challenges-missions/AquaWatch](https://csiro.au/en/about/challenges-missions/AquaWatch)