NOPSEMA | Australia's offshore energy regulator

Better Practice Forum

Environmental submissions

Collaboration and innovation

10 April 2025

nopsema.gov.au

Observations and insights on OPPs and EPs

Graham Blair
Deputy CEO - Regulatory Operations
NOPSEMA

nopsema.gov.au

Assessment Findings since January 2023

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Most common acceptance criteria not met in EP submissions *

- ALARP
- Acceptable levels
- Nature and scale
- Environmental Performance Outcomes /Standards/Measurement Criteria

Acceptance criteria not met over several EP submissions *

- ALARP
- Acceptable levels
- Environmental Performance Outcomes /Standards/Measurement Criteria

**This excludes consultation*

Observations and insights - 1

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Acceptable levels of environmental impact and risk - the case for environmental management

- Evidence must be provided to support conclusions drawn in assessments
- Allowing for flexibility and optionality is ok – but it results in assessments that must contemplate different scenarios
- Succinct explanation and demonstration is preferred – existing arguments should be revised rather than adding more "detail".

Observations and insights - 2

Uncertainty in predictions of impact

- Like all predictions of the future, acknowledging uncertainty is important
- OPPs carry greater uncertainty given the stage in the project planning cycle – but an OPP isn't a 'watered-down' version of an EP because of that uncertainty
- Uncertainty can be addressed in different ways – more upfront understanding of the environment and impacts or stronger commitments to apply measures to address impacts (i.e. managing/monitoring)

Observations and insights - 3

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Leveraging OPPs in EPs and EP submissions

- Groundwork for demonstration of acceptability of impacts in OPPs can be leveraged in subsequent EPs
- EPs following an OPP must reflect the OPP and an achieve equivalent or better levels of environmental performance
- Measures must be in place for implementing EPs including operationalising EP content, ensuring it is possible to monitor or measure success and performing assurance
- Reliance on people rather than process and systems for implementation of EPs is risky

Opportunities moving forward

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Applying learnings from NOPSEMA regulatory advice – implementing practice/systems for sharing learnings internally can reduce timeframes and improve outcomes

Promoting healthy challenge on QA/QC of documents internally

Working collaboratively to address shared issues – research to address uncertainty around shared complex issues such as cumulative impacts

Using networks and forums to share learnings and innovation to promote better practice

Reflecting on NOPSEMA assessment processes in relation to international best practice

presentation to:
NOPSEMA Better Practice Forum
Parmelia Hilton, Perth
10 April 2025

by **Angus Morrison-Saunders**

AUSTRALIA ECU EDITH COWAN UNIVERSITY
SCHOOL OF SCIENCE

Outline and context

I research and teach about environmental impact assessment (EIA) with focus on:

- best practice principles for EIA
  (e.g. IAIA – *International Association for Impact Assessment*)
- performance evaluation/outcomes (follow-up)

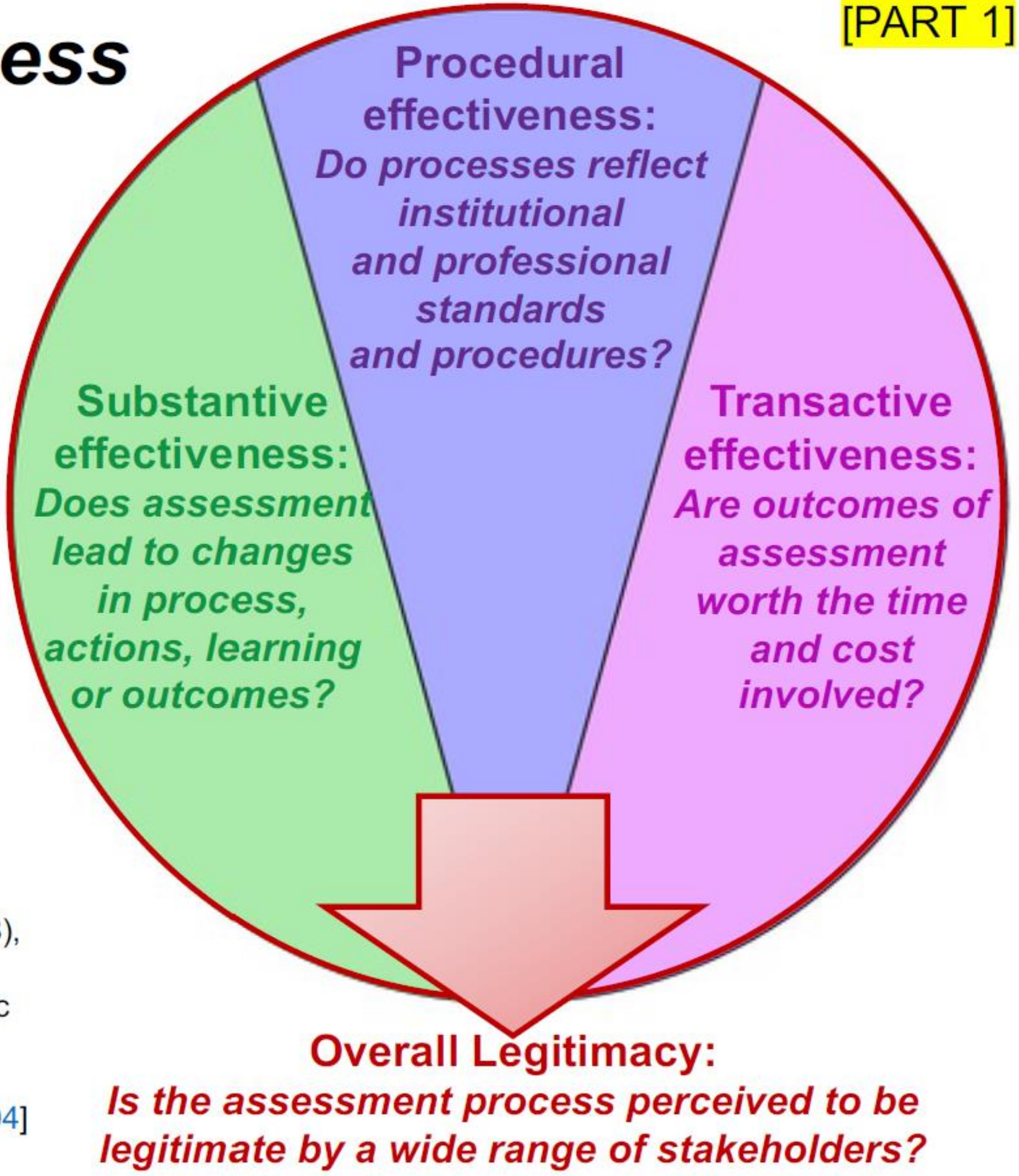
[I have never been involved with NOPSEMA before]

Presentation components

1. Broad benchmarking of NOPSEMA approaches against ***EIA effectiveness & best practice criteria***
2. International perspectives on ***levels of acceptable impacts*** relative to NOPSEMA practice
3. ***Addressing uncertainty*** in assessments

EIA *effectiveness* categories

[PART 1]



[criteria adapted from: Pope et al. (2018), Are current effectiveness criteria fit for purpose? Using a controversial strategic assessment as a test case, *EIA Review*, **70**: 34–44. https://doi.org/10.1016/j.eiar.2018.01.004]

[image: https://i.sstatic.net/vfIfN.png]

EIA *best practice principles*

INTERNATIONAL ASSOCIATION FOR IMPACT ASSESSMENT

in cooperation with

INSTITUTE OF ENVIRONMENTAL ASSESSMENT, UK

PRINCIPLES OF ENVIRONMENTAL IMPACT ASSESSMENT BEST PRACTICE

IAIA .... Pierre Senécal
Bernice Goldsmith
Shirley Conover
IAIA'97 Workshop Participants
IAIA'98 Workshop Participants

IEA .... Barry Sadler
Karen Brown

BACKGROUND

At IAIA'96 in Estoril, Portugal, a special session was held on "The Environmental Impact Assessment (EIA) Global Guidelines Project." The session discussed the need for principles of, and guidance on, impact assessment in response to an emerging interest in international standards.

Participants at the Estoril session recommended that IAIA should develop principles of "best practice" for environmental impact assessment, recognizing that a similar process had been followed successfully for social impact assessment. This initiative was undertaken in collaboration with the Institute of Environmental Assessment, UK.

2.4 Basic Principles

Environmental Impact Assessment should be:

Purposive - the process should inform decision making and result in appropriate levels of environmental protection and community well-being.

Rigorous - the process should apply "best practicable" science, employing methodologies and techniques appropriate to address the problems being investigated.

Practical - the process should result in information and outputs which assist with problem solving and are acceptable to and able to be implemented by proponents.

Relevant - the process should provide sufficient, reliable and usable information for development planning and decision making.

Cost-effective - the process should achieve the objectives of EIA within the limits of available information, time, resources and methodology.

Efficient - the process should impose the minimum cost burdens in terms of time and finance on proponents and participants consistent with meeting accepted requirements and objectives of EIA.

Focused - the process should concentrate on significant environmental effects and key issues; i.e., the matters that need to be taken into account in making decisions.

Adaptive - the process should be adjusted to the realities, issues and circumstances of the proposals under review without compromising the integrity of the process, and be iterative, incorporating lessons learned throughout the proposal's life cycle.

Participative - the process should provide appropriate opportunities to inform and involve the interested and affected publics, and their inputs and concerns should be addressed explicitly in the documentation and decision making.

Interdisciplinary - the process should ensure that the appropriate techniques and experts in the relevant bio-physical and socio-economic disciplines are employed, including use of traditional knowledge as relevant.

Credible - the process should be carried out with professionalism, rigor, fairness, objectivity, impartiality and balance, and be subject to independent checks and verification.

Integrated - the process should address the interrelationships of social, economic and biophysical aspects.

Transparent - the process should have clear, easily understood requirements for EIA content; ensure public access to information; identify the factors that are to be taken into account in decision making; and acknowledge limitations and difficulties.

Systematic - the process should result in full consideration of all relevant information on the affected environment, of proposed alternatives and their impacts, and of the
measures necessary to monitor and investigate residual effects.

IAIA and IEA – International Association for Impact Assessment and Institute for Environmental Assessment UK, (1999). *Principles of Environmental Impact Assessment Best Practice*. Fargo, USA: IAIA, www.iaia.org/uploads/pdf/principlesEA_1.pdf

EIA best practice principles for ***procedural effectiveness***

Rigorous - the process should apply "best practicable" science, employing methodologies and techniques appropriate to address the problems being investigated.

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EIA best practice principles for ***transactive effectiveness***

Cost-effective - the process should achieve the objectives of EIA within the limits of available information, time, resources and methodology.

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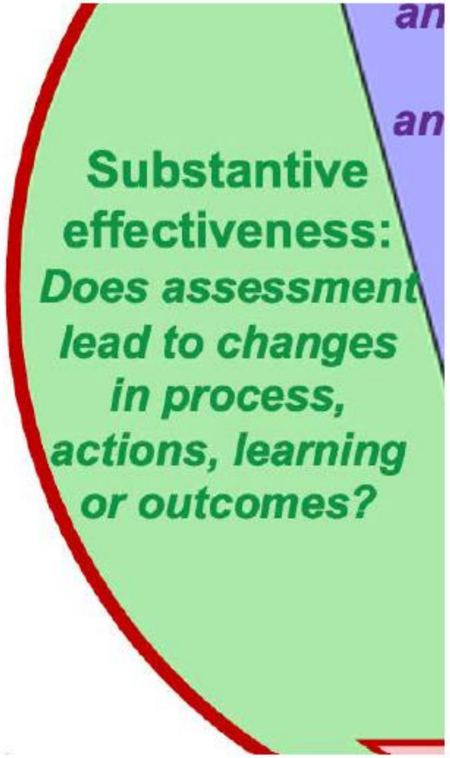
EIA best practice principles for ***substantive effectiveness***



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Systematic - the process should result in full consideration of all relevant information on the affected environment, of proposed alternatives and their impacts, and of the measures necessary to monitor and investigate residual effects.

The NOPSEMA assessment documentation suite is complex!

Offshore Petroleum and Greenhouse Gas Storage Act 2006
No. 14, 2006

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023

NOPSEMA — GUIDELINE
Offshore project proposal decision making

NOPSEMA — GUIDELINE
Consultation in the course of preparing an environment plan

NOPSEMA — GUIDELINE
End of operation of an environment plan – Regulation 46

NOPSEMA — GUIDELINE
Environment Plan decision making

NOPSEMA — POLICY
Well operations management plan assessment

NOPSEMA — POLICY
ENFORCEMENT

NOPSEMA — Environment Plan Assessment Policy

NOPSEMA — POLICY
Assessment

NOPSEMA — GUIDANCE NOTE
Environment plan content requirement

NOPSEMA — GUIDANCE NOTE
Oil Pollution Risk Management

NOPSEMA — GUIDANCE NOTE
Responding to public comment on environment plans

many guidance/policy documents (>25?) with much overlap & repetition, but also, inconsistent terminology & phrasing

EIA best practice principles for ***procedural effectiveness***

Rigorous - the process should apply "best practicable" science, employing methodologies and techniques appropriate to address the problems being investigated. ✓

Relevant - the process should provide sufficient, reliable and usable information for development planning and decision making. ✓

Focused - the process should concentrate on significant environmental effects and key issues; i.e., the matters that need to be taken into account in making decisions. ✗ [next slide]

Participative - the process should provide appropriate opportunities to inform and involve the interested and affected publics, and their inputs and concerns should be addressed explicitly in the documentation and decision making. ✓

Interdisciplinary - the process should ensure that the appropriate techniques and experts in the relevant bio-physical and socio-economic disciplines are employed, including use of traditional knowledge as relevant. ✓

Credible - the process should be carried out with professionalism, rigor, fairness, objectivity, impartiality and balance, and be subject to independent checks and verification. ✓

Transparent - the process should have clear, easily understood requirements for EIA content; ensure public access to information; identify the factors that are to be taken into account in decision making; and acknowledge limitations and difficulties. ? [more on this in Part 2]

Systematic - the process should result in full consideration of all relevant information on the affected environment, of proposed alternatives and their impacts, and of the measures necessary to monitor and investigate residual effects. ✓

https://www.istockphoto.com/photos/orange-question-mark

https://www.vecteezy.com/free-vector/green-tick-red-cross

A significance test underpins EIA activity (normally)

This is unclear/confusing in present NOPSEMA accounts

Focused - the process should concentrate on significant environmental effects and key issues; i.e., the matters that need to be taken into account in making decisions.

some examples from the NOPSEMA suite follow…

Examples: 'all' impacts versus 'significant' impacts [1/2]

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023

https://www.legislation.gov.au/F2023L00998/asmade/2023-07-10/text/original/pdf

Division 2—Contents of environment plan

21 Environmental assessment

(5) The environment plan must include:

(a) details of the environmental impacts and risks of the activity; and

(b) an evaluation of all the environmental impacts and risks, appropriate to the nature and scale of each impact or risk; and

Division 5—Revision of environment plan

39 Revision because of other change, or proposed change, of circumstances or operations

New or increased environmental impact or risk

(2) A titleholder must submit a revised environment plan under section 26 for an activity under the title before, or as soon as practicable after, the occurrence of:

(a) any significant new environmental impact or risk, or significant increase in an existing environmental impact or risk, of the activity that is not provided for in the environment plan in force for the activity; or

(b) a series of new environmental impacts or risks, or a series of increases in existing environmental impacts or risks, which, taken together, amount to the occurrence of:

(i) a significant new environmental impact or risk of the activity; or

Examples: 'all' impacts versus 'significant' impacts [2/2]

Offshore Petroleum and Greenhouse Gas Storage Act 2006 [Volume 1]

25 Significant risk of a significant adverse impact—approval of key petroleum operations

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Offshore Petroleum and Greenhouse Gas Storage Act 2006
No. 14, 2006

Offshore Petroleum and Greenhouse Gas Storage Act 2006 [Volume 4]

11A Environmental inspections—environmental prohibition notices (issue)

(2)(a)(i) an activity is occurring at the premises that involves an ***immediate and significant threat*** to the environment;

Offshore project proposal decision making Guideline

General principles - **1. Introduction**

Offshore project proposal decision making Guideline

Provide an environmental assessment process to evaluate offshore projects that have potential for ***significant impacts*** on matters protected under Part 3 of the EPBC Act

Environment plan content requirement Guidance Note

Environment plan content requirement Guidance

3.4. Details of environmental impacts and risks - 3.4.2. Core Concepts

'Details' of the environmental impacts and risks means identifying, including, describing and analysing ***all impacts*** and risks that are relevant to the activity.

Consultation in the course of preparing an environment plan Guideline

Consultation ... Guideline

3. The purpose of consultation under regulation 25

... the consultation process must ... ensure that the titleholder has ... addressed ***all the environmental impacts*** and risks that might arise from its proposed activity,

EIA best practice principles for ***transactive effectiveness***

Cost-effective - the process should achieve the objectives of EIA within the limits of available information, time, resources and methodology.

?

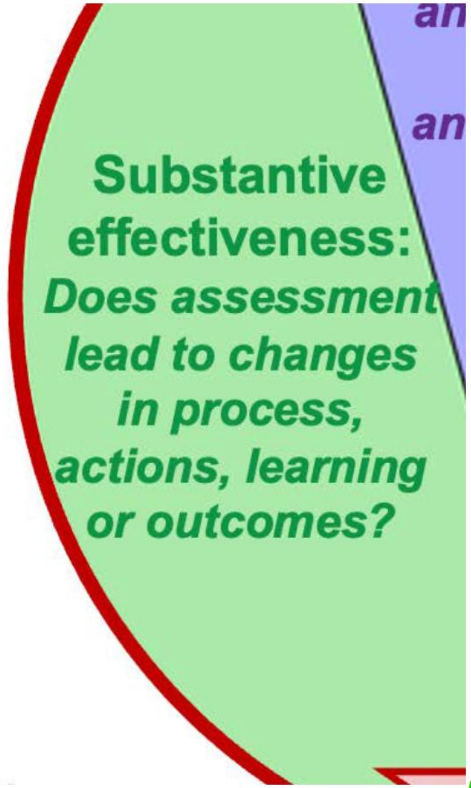
Efficient - the process should impose the minimum cost burdens in terms of time and finance on proponents and participants consistent with meeting accepted requirements and objectives of EIA.

?

[normal polluter pays philosophy applies,
time frame for NOPSEMA decision-making specified]

https://pngtree.com/so/green-question-mark

EIA best practice principles for ***substantive effectiveness***



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Systematic - the process should result in full consideration of all relevant information on the affected environment, of proposed alternatives and their impacts, and of the
measures necessary to monitor and investigate residual effects.

[procedural intent is there (true test requires audits)]

[PART 2]

On *levels of acceptable impacts*

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023

https://www.legislation.gov.au/F2023L00998/asmade/2023-07-10/text/original/pdf

34 Criteria for acceptance of environment plan

For the purposes of section 33, the criteria for acceptance of an environment plan (the ***environment plan acceptance criteria***) for an activity are that the plan:

(a) is appropriate for the nature and scale of the activity; and

(b) demonstrates that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable; and

(c) demonstrates that the environmental impacts and risks of the activity will be of an acceptable level; and

(d) provides for appropriate environmental performance outcomes, environmental performance standards and measurement criteria; and

(e) includes an appropriate implementation strategy and monitoring, recording and reporting arrangements; and

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GUIDELINE

Offshore project proposal decision making

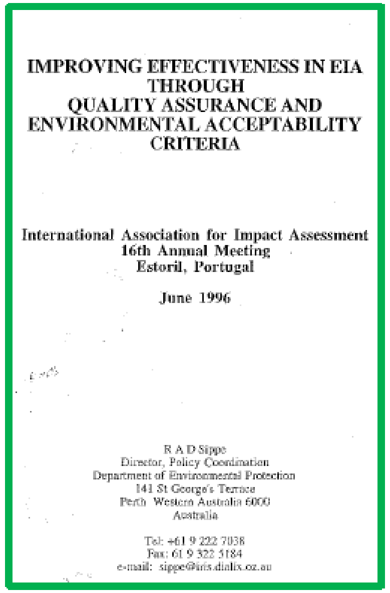
https://www.nopsema.gov.au/sites/default/files/documents/Environment plan decision making guideline.pdf

Appendix E: Summary of factors that influence decision making

SUMMARY OF FACTORS THAT INFLUENCE DECISIONS	
Acceptable levels	• Acceptable levels defined and compared to predicted levels • EP considers principles of ESD • EP is not inconsistent with key documents • Areas of uncertainty identified and addressed • All impacts and risks managed to acceptable levels • Comparison is systematic, applied thoroughly, defensible and reproducible • Relevant person consultation has been incorporated
Environmental performance	• EPOs linked to acceptable levels • EPOs address all identified impacts and risks • EPOs reflect levels of environmental performance • EPSs linked to control measures • EPSs with clear measurement criteria that can easily be monitored for compliance • EPOs, EPSs and MC that are linked and complementary

The notion of having acceptability criteria for impacts in EIA decision-making is long-established…

…***environmental acceptability is a judgement made on*** the limits to the ***degree of change to the environment*** predicted to be induced by a proposal such that it does not change the value … ascribed to it by the community.
It is clear that ***environmental acceptability criteria cannot reasonably be established for all environmental issues*** likely to come forward during BIA. However, if many of the criteria common to most proposals are published, then apart from auditing compliance with· them, most attention can be focussed on the balance. (Sippe, 1996, pp7-8)


IMPROVING EFFECTIVENESS IN EIA
THROUGH
QUALITY ASSURANCE AND
ENVIRONMENTAL ACCEPTABILITY
CRITERIA

International Association for Impact Assessment
16th Annual Meeting
Estoril, Portugal

June 1996

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Sippe, R. (1996) Improving effectiveness in EIA through quality assurance and environmental acceptability criteria, presented at: *International Association for Impact Assessment, 16th Annual Meeting, Estoril, Portugal*, June 1996, 12pp + appendices

Sippe (1997) Establishing rules for environmental acceptability for reviewing EAs, *Environmental Assessment*, **5**(1): 17-20


Establishing Rules for Environmental Acceptability for Reviewing EAs
The Western Australian Experience

THE WESTERN AUSTRALIAN EIA PROCESS HAS PUBLISHED ON ENVIRONMENTAL ACCEPTABILITY CRITERIA AS A MECHANISM FOR ENHANCING EFFECTIVENESS OF EIA. ROB SIPPE EXAMINES THEIR EXPERIENCE.

PERFORMANCE MEASURES FOR REVIEWING EAs

… and continues to be advocated

Without a deeper understanding of the actual link between predictions and decisions, the capacity of internal and external stakeholders to evaluate the effectiveness of the EIA process will remain very limited.

…the variety of ad hoc criteria and approaches… **highlights the value of further developing the logic, science and rigor of EIA decision-making**

[what is needed is] ***sound law and policy guidance on sustainability-oriented decision-making*** (Fonseca & Gibson, 2021, pp18-19)

Fonseca A & R Gibson (2021): Why are projects rarely rejected in environmental impact assessments? Narratives of justifiability in Brazilian and Canadian review reports, *Journal of Environmental Planning and Management*, **64**(1): 1940–1962, https://doi.org/10.1080/09640568.2020.1852073


Journal of Environmental Planning and Management, 2021
Vol. 64, No. 11, 1940–1962, https://doi.org/10.1080/09640568.2020.1852073
Routledge
Taylor & Francis Group
Check for updates

Why are projects rarely rejected in environmental impact assessments? Narratives of justifiability in Brazilian and Canadian review reports

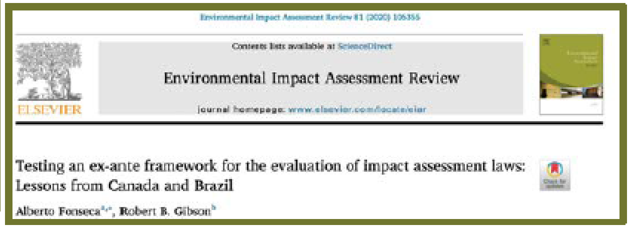
Alberto Fonseca[a*] and Robert B. Gibson[b]

Good practice elements [for impact assessment]

…

- Has ***clear rules and procedures for decision-making***
- Requires decision-making to be based on sustainability criteria

(Fonseca & Gibson, 2020, p6)


Environmental Impact Assessment Review 81 (2020) 106355
Contents lists available at ScienceDirect
Environmental Impact Assessment Review
journal homepage: www.elsevier.com/locate/eiar
ELSEVIER

Testing an ex-ante framework for the evaluation of impact assessment laws: Lessons from Canada and Brazil

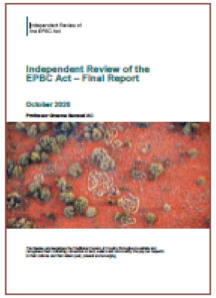
Alberto Fonseca[a,*], Robert B. Gibson[b]

Fonseca, A and R Gibson (2020) Testing an ex-ante framework for the evaluation of impact assessment laws: Lessons from Canada and Brazil, *Environmental Impact Assessment Review*, **81,** 106355, https://doi.org/10.1016/j.eiar.2019.106355

National Environmental Standards under EPBC are similar (?)

The full suite of ***National Environmental Standards should clarify the requirements of the EPBC Act and be a legally binding mechanism*** that provides confidence to support the accreditation of the arrangements of States and Territories in the immediate term. …An accredited party must be required to ***make decisions in a way that is consistent with the National Environmental Standards***. (Samuel, 2020, p12)

…The National Environmental Standards recommended by this Review provide a legally binding pathway to accredit the regulatory processes or management arrangements of other parties, while at the same time ***ensuring the aims and objectives of the EPBC Act are achieved***. (Samuel, 2020, p102)



Samuel G, (2020) *Independent Review of the EPBC Act – Final Report October 2020*, https://epbcactreview.environment.gov.au/resources/final-report

[But how easy or realistic is this approach?]

On thresholds & significance judgements in EIA (Hegmann, 2019) [1/2]

EIAs however are not a deterministic machine…

Multiple factors come into consideration, subject to both solid evidentiary basis and discretionary but rationalized interpretations, regarding the nature of an effect, its relationship with a threshold (if any), and the meaning from all this regarding what is significant.

[this is affected by]

- level of descriptive detail of baseline information…
- ability to resolve cause–effect relationship…
- level of confidence and accuracy in data and analysis…
- the concrete and discretionary interpretation of significance determinations

In short, the ***suggestion that a basic arithmetic relationship is destined to reveal a guaranteed outcome of significance is misleading and false***. (Hegmann, 2019, p130)

Hegmann, G. (2019). The insignificance of thresholds in environmental impact assessment: an illustrative case study in Canada: a critique for Environmental Management. *Environmental Management*, **64**(2), 129-132. https://doi.org/10.1007/s00267-019-01183-6

Environmental Management (2019) 64:129–132
https://doi.org/10.1007/s00267-019-01183-6

Check for updates

The Insignificance of Thresholds in Environmental Impact Assessment: an Illustrative Case Study in Canada: a Critique for *Environmental Management*

George Hegmann[1]

On thresholds & significance judgements in EIA (Hegmann, 2019) [2/2]

…***it is actually difficult to come to conclusions of significance***, unless the matter is so utterly apparent as to be inarguable by any observer, or otherwise reflects on a complex series of evidence that inexorably leads to a well-rationalized and defensible conclusion (as is the hallmark of any good EIA).

…***direct unquestioned adherence and application of thresholds is not always reasonable and appropriate***… this again speaks to one of the harder truths of EIA, being the … ***need for … professional judgement to extract interpretation from complexity in a meaningful way***.
(Hegmann, 2019, p130)

Hegmann, G. (2019). The insignificance of thresholds in environmental impact assessment: an illustrative case study in Canada: a critique for Environmental Management. *Environmental Management*, **64**(2), 129-132. https://doi.org/10.1007/s00267-019-01183-6


Environmental Management (2019) 64:129–132
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Check for updates

The Insignificance of Thresholds in Environmental Impact Assessment: an Illustrative Case Study in Canada: a Critique for *Environmental Management*

George Hegmann[1]

Determining acceptability criteria requires involvement of all stakeholders (not just proponent-led)

…balancing subjective inputs from proponents and local, affected communities can … be used to crucially improve EA processes.

Stakeholders should directly contribute to the determination of significance where their values are under threat.

Government agencies should ***require or encourage the collaborative approach*** to make it more common in the EA process.

Social and scientific thresholds can be strictly enforced to balance proponent-funded professional judgements and reasoning, allowing a better understanding of the trade-offs between economic gains and environmental, social, and cultural impacts. (Murray, et al., 2018, p1069)

Murray, C. C., Wong, J., Singh, G. G., Mach, M., Lerner, J., Ranieri, B., ... & Chan, K. M. (2018). The insignificance of thresholds in environmental impact assessment: an illustrative case study in Canada. *Environmental management*, **61**, 1062-1071, https://doi.org/10.1007/s00267-018-1025-6

Environmental Management (2018) 61:1062–1071
https://doi.org/10.1007/s00267-018-1025-6

CrossMark

The Insignificance of Thresholds in Environmental Impact Assessment: An Illustrative Case Study in Canada

Cathryn Clarke Murray[1,2,5] · Janson Wong[2,3] · Gerald G. Singh[1] · Megan Mach[4] · Jackie Lerner[1] · Bernardo Ranieri[1] · Guillaume Peterson St-Laurent[1] · Alice Guimaraes[1] · Kai M. A. Chan[1]

Fuzzy set approach for determining significance in EIA

- establish and communicate impact significance across different stakeholder groups in collaborative process
  [eg. noise & visual effects for windfarm EIA in Wood et al (2007)]
- using simulations (e.g. photomontages & sound recordings), people asked to grade impacts as “slight”, “moderate” etc.
- fuzzy sets representing these linguistic terms calibrated against relevant corresponding continuous variables (e.g. dB(A) for noise) to ‘map’ boundaries of impact significance
- facilitates agreement on acceptable levels of impact

Figure 1. Hypothetical Membership Function for the Concept “NEAR”

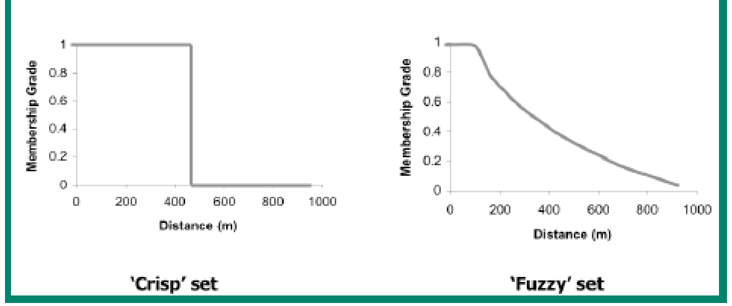
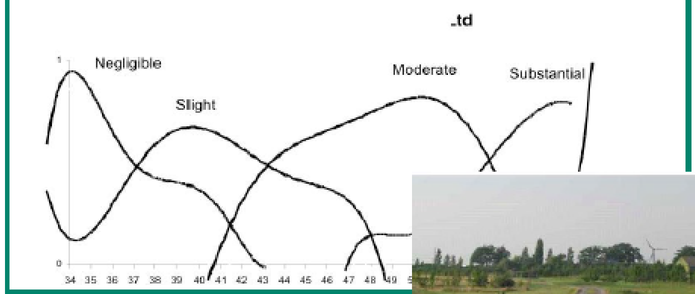


Figure 3. Significance of Noise Impact: Developer Membership Functions



Wood G, A Rodriguez-Bachiller and J Becker (2007) Fuzzy sets and simulated environmental change: evaluating and communicating impact significance in EIA, *Environment and Planning A*, **39**: 810-829

Addressing uncertainty in assessments [PART 3]

Uncertainty is an inherent part of impact assessment (IA), and can vary in type and source. [Larsen, 2021, p1]

Sources of uncertainty in EIA (Larsen, 2014).

Source	Description
Design and technology	Uncertainty about the final project design and the choice of technology
Construction	Uncertainty about timelines and methods for construction
Data	Uncertainty about data used as a basis for calculations, prediction and assessments e.g. because of questionable data collection or natural variability
Calculations and models	Uncertainty about the specific methodology, assumptions etc. for models and calculations of impacts
Causal mechanisms	Uncertainty about what the derived consequences of predicted impacts are
Values	Uncertainty about society's values e.g. expressed through attitudes, classifications or goals
Related activities	Uncertainty about the status of related projects, plans and activities etc.

Larsen S V (2021) Inclusion of uncertainty in Environmental Impact Assessment in Greenland, *Environmental Impact Assessment Review* **89**: 106583 [7pp]

Communication of uncertainty in EIA is vital

This study investigates practices of uncertainty disclosure and communication in Canadian environmental assessment (EA) in the context of the Joslyn North Oil Sands Mine project. Nineteen interviews with project stakeholders were conducted, revealing significant uncertainties about the project, attributed to multiple factors including lack of clarity in the terms of reference and requirements of the proponent; the project's predicted impacts and proponent commitments to mitigation; cumulative effects and the potential for effects interaction with other projects; Aboriginal engagement, including engagement processes and broader socio-political context; and poor uncertainty disclosure and communication practices. Some uncertainties were disclosed but at times downplayed to render the project more palatable through the EA process. Informants stated that this is not an uncommon occurrence in oil sands EA. Recommendations to improve uncertainty disclosure and communication in EA and enhance the consideration of uncertainties in decision-making are provided.

p317

Not disclosing uncertainties in a project EIS, and not providing sufficient opportunity to challenge and debate uncertainties and assumptions through information requests or public hearings, does more damage than good to the credibility of the EA process. For example, an advantage of uncertainty disclosure is that it makes the assessment and its strengths and weaknesses more transparent to decision makers and to the public.

p330

Aksamit C, J Blakley, J Jaeger, B Noble & C Westman (2020) Sources of uncertainties in environmental assessment: Lessons about uncertainty disclosure and communication from an oil sands extraction project in Northern Alberta, *Journal of Environmental Planning and Management*, **63**:2, 317-334.

Addressing uncertainty during assessment

- assess level of uncertainty
  - may be expressed quantitatively (e.g. risk)
  - or as range (best case scenario vs. worst case prediction)
- attempt to reduce & manage uncertainty
  - uncertainty in impact predictions can be addressed by technical means
    - eg. scientific methods, sensitivity analysis, Monte Carlo error analysis
  - management of value-related uncertainty requires communication eg. negotiation, mediation

Environmental Resources Limited 1985 ‘Uncertainties in Prediction’, and ‘Management of Uncertainty’. In *Handling Uncertainty in EIA*. MER Series Vo. 18 Ministry of Public Housing, Physical Plannning & Env Affairs, Leidshendam, The Netherlands, Ch 2 & 3

Risk science approach to EIA uncertainty

(from qualitative judgments to '90% prediction intervals' method)
[Bjørnsen & Aven, 2025, p5]


Environmental Impact Assessment Review 110 (2025) 107656

Contents lists available at ScienceDirect

Environmental Impact Assessment Review

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ELSEVIER

A risk science perspective on the treatment of uncertainty in EIAs: An illustrative case from Norwegian EIA regulation

Kjartan Bjørnsen *, Terje Aven

Bjørnsen, K., & Aven, T. (2025). A risk science perspective on the treatment of uncertainty in EIAs: An illustrative case from Norwegian EIA regulation. *Environmental Impact Assessment Review*, **110**, 107656.

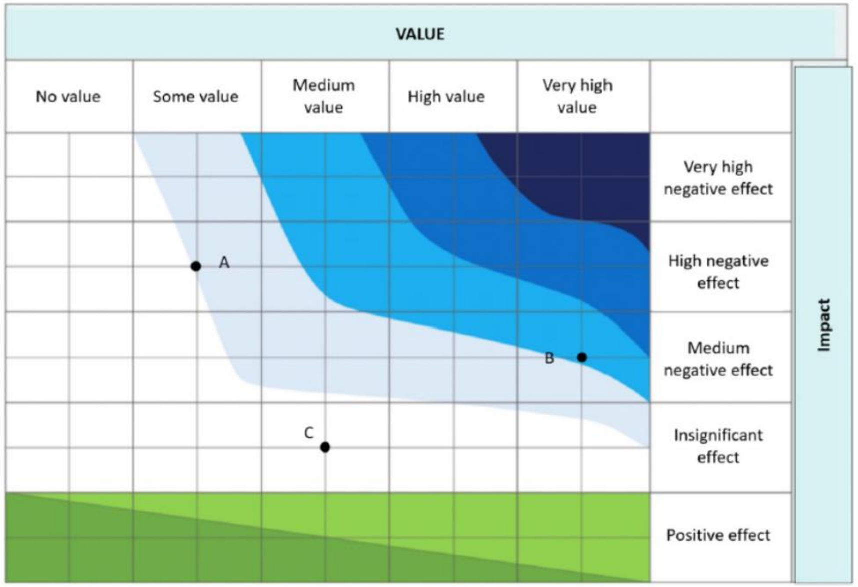


Fig. 1. Matrix for determining severity of impact based on value and impact (translated from the Norwegian Environment Agency EIA guideline (Miljødirektoratet, 2023)). Dark blue indicates a very negative impact and dark green a positive impact. The points indicate the severity for the dimensions A, B, and C. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

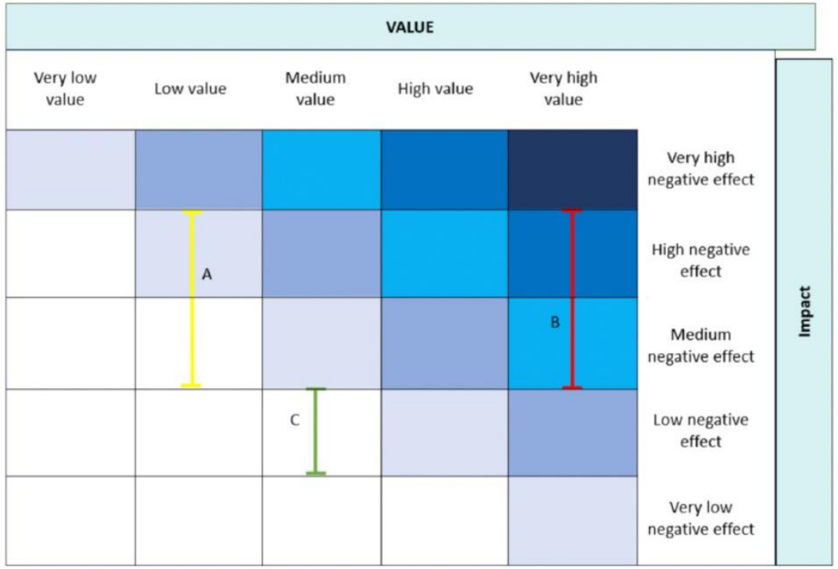


Fig. 2. Suggested new approach of characterizing impact using 90 % prediction intervals for the impact dimensions A, B and C. The colors red, yellow, and green represent that the assignment is based on weak, moderate and strong knowledge, respectively. The matrix has been adjusted from Fig. 1 to be consistent with ordinal scales. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Strategies for managing uncertainty in EIA

- seek more information before proceeding
  - e.g. baseline studies, peer review (expert opinion)
- risk assessment – e.g. consequence vs likelihood

		Consequence category					
		6	5	4	3	2	1
		Negligible	Minor	Moderate	Major	Massive	Catastrophic
Likelihood category	1 - Almost certain	Low	Medium	High	Extreme	Extreme	Extreme
	2 - Likely	Low	Low	Medium	High	Extreme	Extreme
	3 - Possible	Very Low	Low	Low	Medium	High	Extreme
	4 - Unlikely	Very Low	Very Low	Low	Low	Medium	High
	5 - Remote	Very Low	Very Low	Very Low	Low	Low	Medium

- apply the precautionary principle
  - (which leads to further uncertainties in decision-making)
- outcome-based conditions
  - (set env. requirement for proponent to meet, but leave them to determine how to accomplish this)
- adaptive management – EMPs/contingency plans

Managing uncertainty during implementation

Managers develop ways for dealing with frequently occurring uncertainties that do not commonly present extraordinary problems.

Uncertainties that occur infrequently require an adaptive learning approach to management where we must learn about the true states of nature by careful monitoring, evaluation, and experimentation.

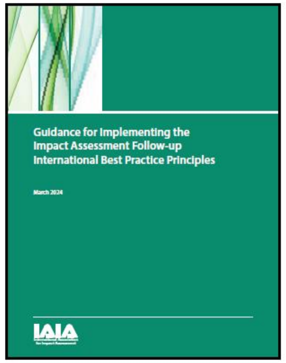
***In an undesirable situation, the ability to respond rapidly is most important*.** (Hilborn 1987, p1)

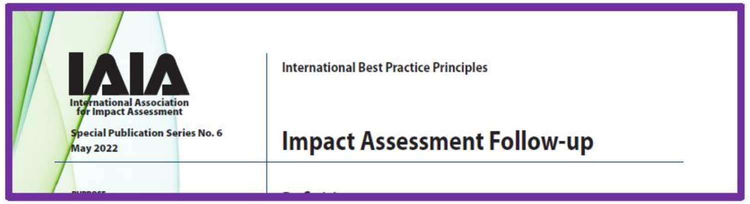
Hilborn R 1987 Living with Uncertainty in Resource Management, *North American Journal of Fisheries Management*, **7**(1): 1-5

Adaptive management – best practice EIA

Adaptive management refers to deliberate reactive, iterative, ongoing examination, based on systematic monitoring and evaluation activity with feedback (to stakeholders) and learning, rather than managing adaptively (ad hoc learning from mistakes).

Morrison-Saunders A, J Arts, C Faith-Ell, P Fitzpatrick, A Fonseca, G Geißler, J Glasson, A González, U Jha-Thakur, R Morgan, B Muir, A Nykiel, C O'Faircheallaigh, L Sánchez, W Ross & J-A Wessels (2024). *Guidance for Implementing the Impact Assessment Follow-up International Best Practice Principles*. Reference and Guidance Documents. IAIA, Fargo (USA) https://www.iaia.org/uploads/pdf/Guidance for Followup Best Practice Principles.pdf





11. Facilitate adaptive management.

Mitigation provisions for a project or plan should be adjustable as needed. Learning derived from IA follow-up should inform ongoing adaptive management of the project or plan as necessary, in order to achieve its objectives. IA follow-up would ideally also enable unexpected consequences to be revealed and addressed as appropriate, as part of an effective adaptive management approach.

Arts, J. and Morrison-Saunders, A. (2022) *Impact Assessment Follow-up: International Best Practice Principles*. Special Publication Series No. 6. Fargo, USA: International Association for Impact Assessment. https://iaia.org/uploads/pdf/SP6_22 Follow up_converted.pdf

Adaptive management and EIA approval conditions (Preston, 2020)

Science evolves, community expectations and needs evolve, and environmental problems evolve. Nature does not stand still. Yet ***project approvals remain static, involving "a once-and-for-all determination of the application*** *with* ***no opportunity to reconsider or impose new conditions*** *of consent in response to evolving information or changes in circumstances".* (Preston, 2020, p442)

Contemporary Issues in Environmental Impact Assessment

Brian J Preston*

Environmental impact assessment (EIA) developed in the latter half of the 20th century as a response to growing concern about the impacts of human development on the environment and a recognition of the inadequacy of existing approaches to environmental management. Once an uncertain and new area, it is now ubiquitous in the approval process for projects across the world. It is trite law to say that the impacts of proposed activities should be considered in the process to determine whether the proposed activities should be permitted. However, EIA is often understood broadly and leaves many issues unresolved. What is an impact of development? How far removed (how indirect) can the impacts be that an EIA can consider? What about the cumulative impacts of similar projects? When can these be taken into account? This article identifies three contemporary issues in EIA, assessed in the context of climate change: the scope of EIA, cumulative impacts and temporal problems.

Preston B (2020) Contemporary Issues in EIA, *Environmental Planning and Law Journal*, **37**: 423–442

12. Be flexible according to emerging needs.

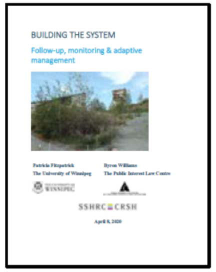
Governance arrangements for IA follow-up, and the IA follow-up program itself, should be adjusted as necessary to emerging needs (e.g., arising from environmental changes, evolving needs of stake-holders, or changes in the regulatory framework).

Arts, J. & Morrison-Saunders, A. (2022) *Impact Assessment Follow-up: International Best Practice Principles*. Special Publication Series No. 6. Fargo, USA: IAIA. https://iaia.org/uploads/pdf/SP6_22 Follow up_converted.pdf

5 elements of effective adaptive management

It is possible to identify at least five design elements of effective adaptive management strategies. Adaptive management [3, 45-47]:

- *is **iterative**: decisions must be reviewed and reassessed on a regular basis;*
- *involves **on-going examination**: purposeful, well-conceived interventions are planned and implemented to address key uncertainties, and the findings are reflected in subsequent design;*
- ***relies on systematic monitoring:** detailed and robust records are needed to evaluate changes in the environment;*
- *emphasizes **feedback and learning:** by developing clear processes for using monitoring data, and incorporating outcomes from monitoring; and,*
- ***involves the community**: design and implementation should incorporate the experience and expertise of the broader policy community.*



Fitzpatrick P and B Williams (2020) *Building the system: Follow-up, monitoring & adaptive management*, The University of Winnipeg: Winnipeg, MB. https://www.sshrc-crsh.gc.ca/society-societe/community-communite/ifca-iac/evidence_briefs-donnees_probantes/environmental_and_impact_assessments-evaluations_environnementales_et_impacts/fitzpatrick_williams-eng.aspx

EIA and adaptive management

Effective applications of adaptive management require thorough upfront EIA. Prior to the grant of a project approval, there should be, at least, a ***clear definition of the management problem*** *and baseline conditions, and an* ***effective numerical model to predict the impacts*** *of the project and* ***identify areas of uncertainty****.*

…substantive limits on project impacts should be determined as part of this pre-approval EIA process (which includes the opportunity for public comment) and set in the conditions of the project's. ***By setting substantive limits in environmental approval conditions, they will be binding on the proponent and provide clear boundaries within which adaptive management may occur.*** (Lee & Gardner, 2014, p247-8)

Lee J and A Gardner (2014) A Peek Around Kevin's Corner: Adapting Away Substantive Limits?, *Environmental Planning and Law Journal* **31**: 247-250

Adaptive management – NOPSEMA

Environment plan content requirement
Guidance Note

3.5. Evaluation of environmental impacts and risks

3.5.2. Core concepts

- The evaluation should acknowledge uncertainty in predictions of environmental impacts and where necessary consider the application of adaptive management principles to ensure that the principles of ESD[21] can be achieved.

3.6. Details of the control measures to be used

3.7.3. Considerations

- In cases where there is a low level of confidence in the ability of certain to effectively manage impacts to an acceptable level, there may be a case for impact verification studies and / or an adaptive management approach.

Offshore project proposal decision making
Guideline

5.4.3. Factors that influence decision making

- **EPOs provide clear commitment(s) to implement programs of monitoring and adaptive management** in cases where such commitments are necessary to demonstrate the project could be implemented consistent with principles of ESD and be considered in further detail during the EP assessment process.

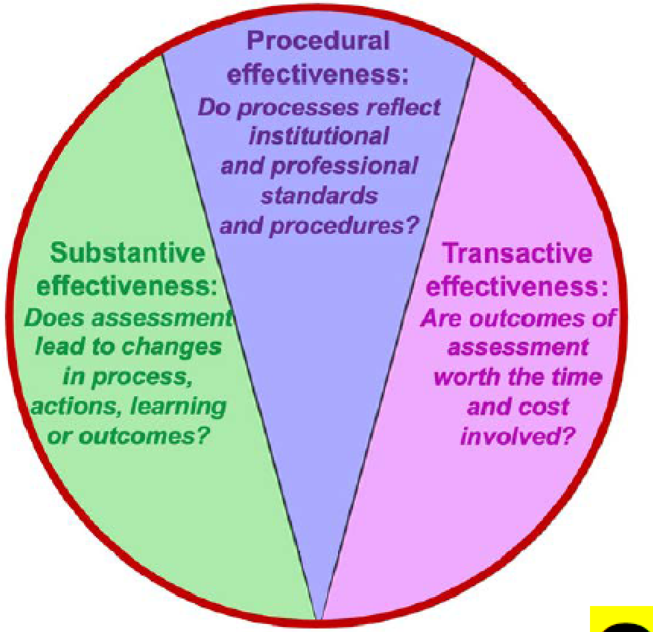
Closing thoughts

- I hope to stimulate thinking and discussion on NOPSEMA assessment processes (i.e. to seek enhancements)
- NOPSEMA processes benchmark well against international effectiveness and best practice criteria
- A question mark remains over how significance and acceptability for approval decision-making is best tackled.

Thank you

NOPSEMA
Australia's offshore energy regulator

a.morrison-saunders@ecu.edu.au



Overall Legitimacy:
Is the assessment process perceived to be legitimate by a wide range of stakeholders?

?

Translating science knowledge and data analytics into streamlined decisions

A SHARED ENVIRONMENTAL ANALYTICS FACILITY (SEAF)

Shared Environmental Analytics Facility (SEAF)

From project-based assessment towards standards-based assessment

Cumulative impact > How can data and data science assist in transitioning? Qualitative to Quantitative

SEAK> WABSI Data Sharing > IBSA > IMSA > BIO > SEAF Business Case > SEAF Feasibility Study > SEAF Pilot Projects

Data sharing vs. data accessibility,

" Imagine if we had a vision to develop basin scale information sets to support OPP / EP's "

Operationalising shared data and analytics, trust and confidence through science – SEAF is, SEAF isn't

Feasibility Study – why Pilbara and Cockburn? Hub and Spoke logic. Partners.

Current Pilot project status

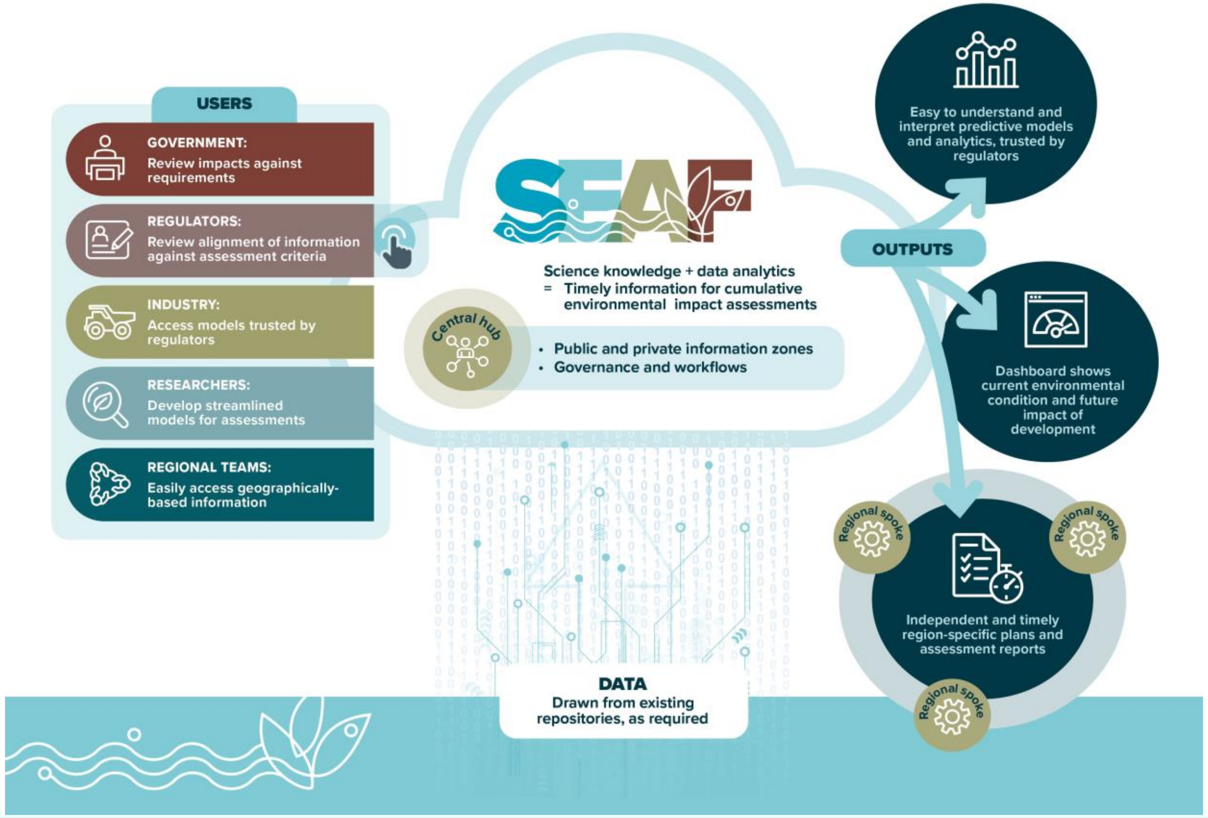
- Investors
- Pilbara & Cockburn
- Timing

Shared Environmental Analytics Facility (SEAF)

A Shared Environmental Analytics Facility (SEAF) translates science knowledge and data analytics into products such as maps, reports and forecasting tools, to enable cumulative impact assessments at regional scale.

SEAF does not duplicate existing databases. It is a cloud-based mechanism that **draws on data already available or held in multiple portals and repositories.**

- It **simplifies how environmental information is accessed, interpreted, used and managed** providing trusted, single-point access to disparate information sources, through **secure data sharing**.
- It **draws data for use in predictive models and custom-built analytics** – turning it into practical, useable information and forecasting tools.
- SEAF **helps unlock value from shared data and analytics** to enable users to make more informed decisions for **cumulative environmental impact assessments**, at a region-specific scale.
- SEAF **provides the ability to understand and interpret** dynamic information.
- It creates a shared, robust, repeatable and **sustainable environmental information value chain**



Cumulative EIA - Opportunities

- Restoration opportunities
- Ecological linkages at ecosystem scale
- Ecological functioning level rather than species focus
- Holistic approach provides more protection value for same avoidance and management activities
- Key values become clearer through significance focus
- Better planning at a regional or sub-regional scale = more efficient assessment

Cumulative EIA - Challenges

- Lack of a business case “owner”
- Data overload for decision-making
- Models can be a “black box” especially for the public
- Monitoring and contingencies in triggers are exceeded hard to enforce
- Appropriate scale depends on perspective
- Existing approved impacts preferenced, scientific uncertainty devalued

How can shared data and analytics assist in transitioning from project-based assessment towards cumulative or standards-based assessment?

Shared Environmental Analytics Facility (SEAF)

Mission/Purpose

Putting trusted and secure environmental data at the core of environmental and economic decision-making.

Vision

A robust, repeatable, trusted sustainable environmental information value chain and analytics facility to support nature positive outcomes.

Overall Value Proposition

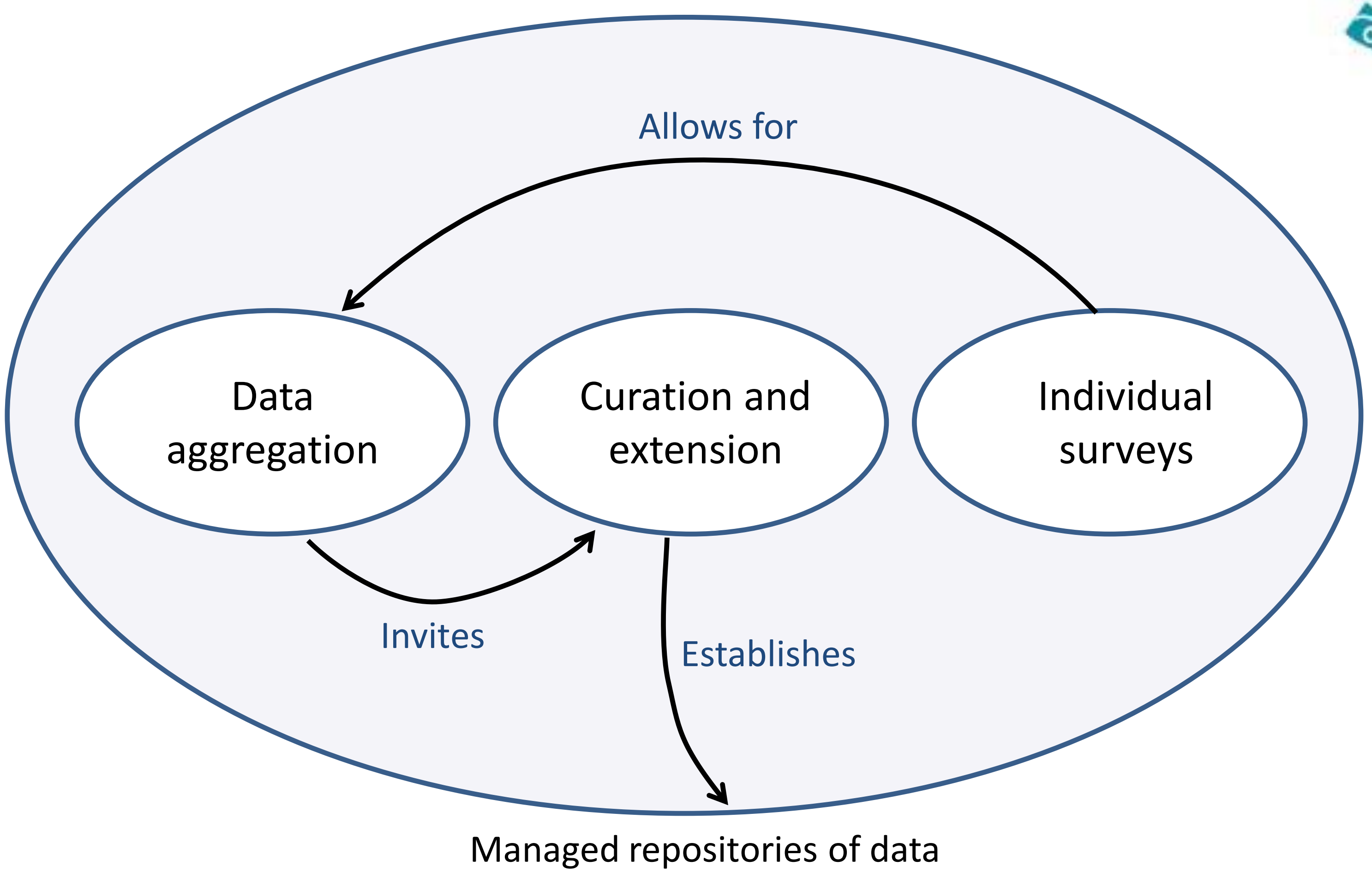
The SEAF helps its stakeholders meet their Economic, Social and Environmental needs by providing faster and more accurate decision making *through:*

Providing managed access to a trusted environmental data and analytics platform

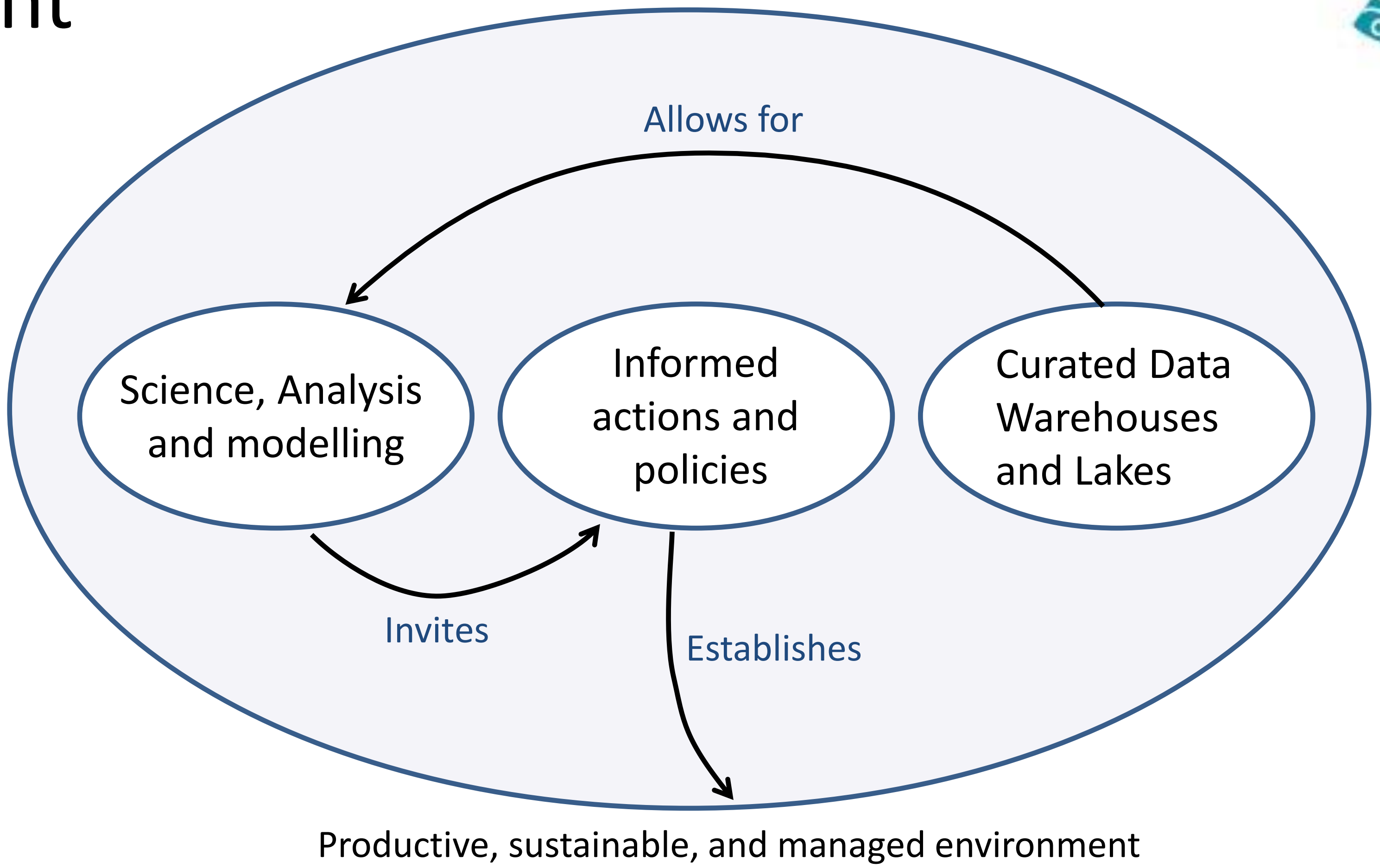
Application of leading science, analytics & models

Streamlined and dynamic environmental reporting

Data Supply Chain (e.g. IBSA/IMSA)

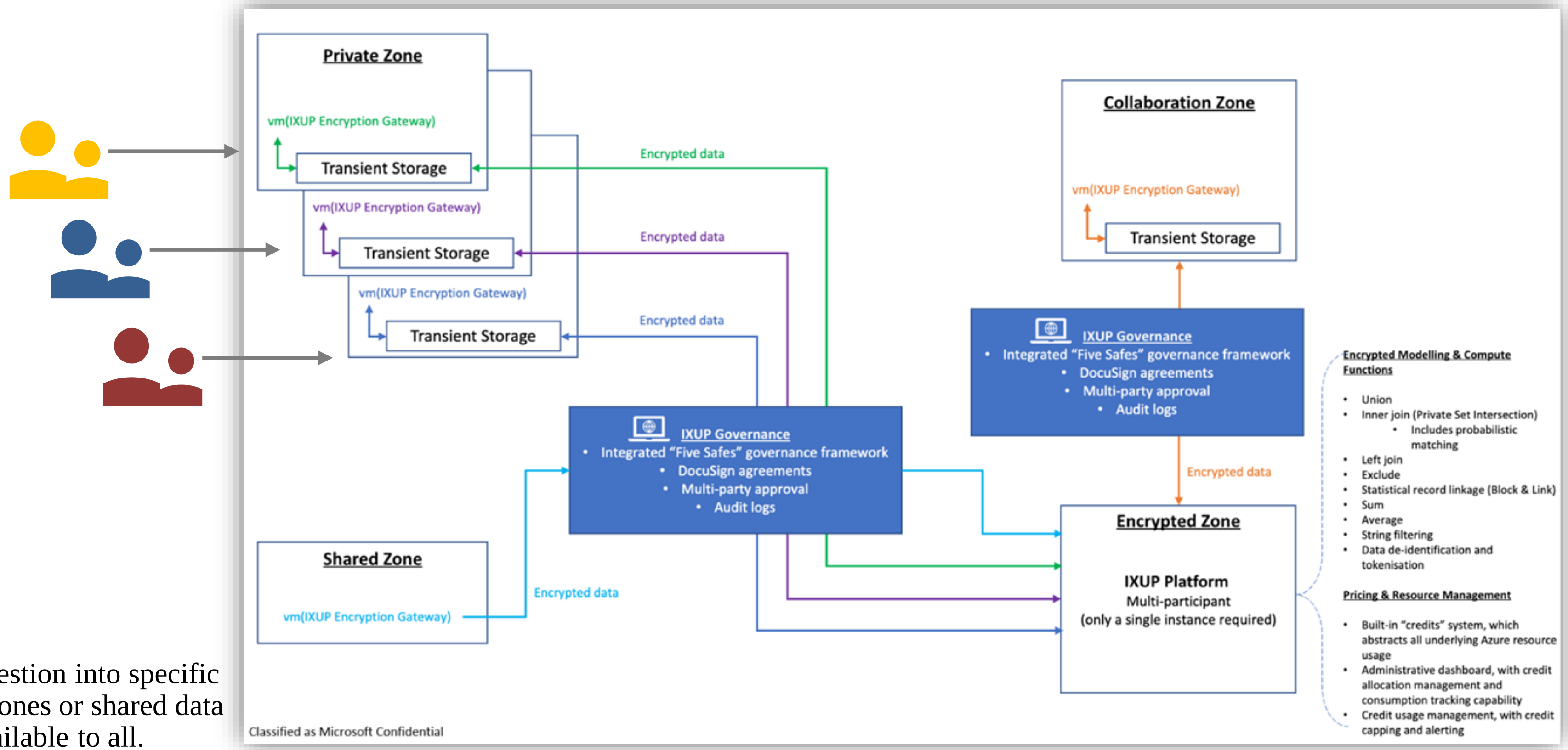


Data Supply >> Science >> Robust, Repeatable Assessment



Shared Environmental Analytics - Encrypted Data Flow

Landing zones created for
specific users or use-cases



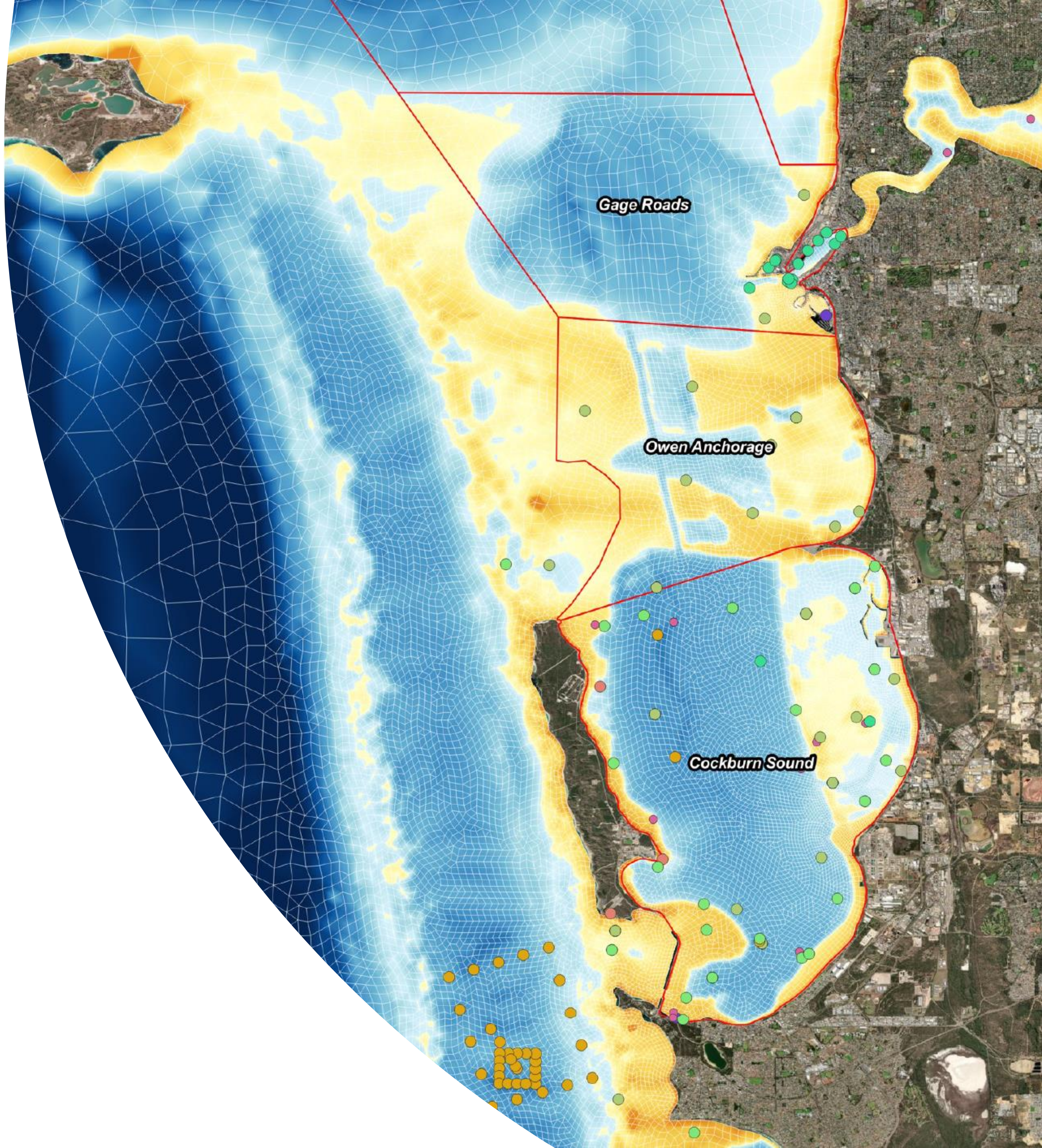
Data Ingestion into specific private zones or shared data lakes available to all.

Data Transfer zones ensure security is maintained in Private Zones

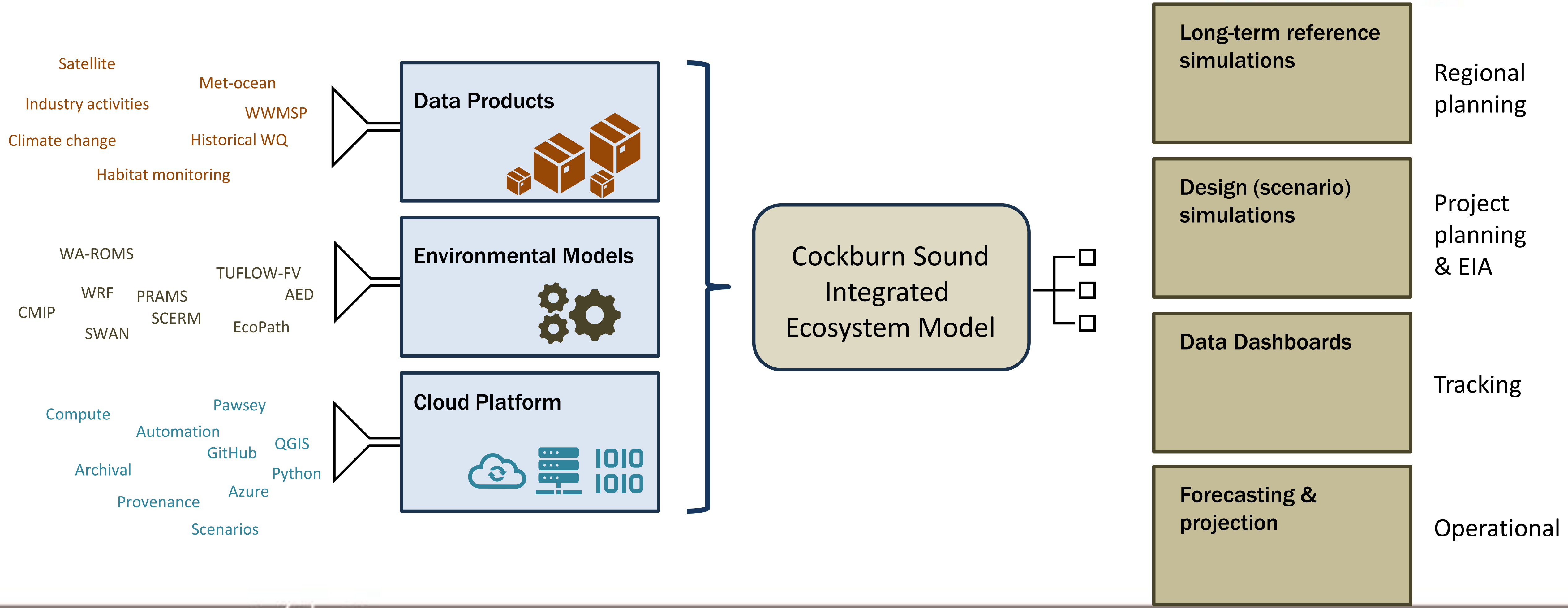
Challenge:

Cockburn Sound Cumulative Impacts

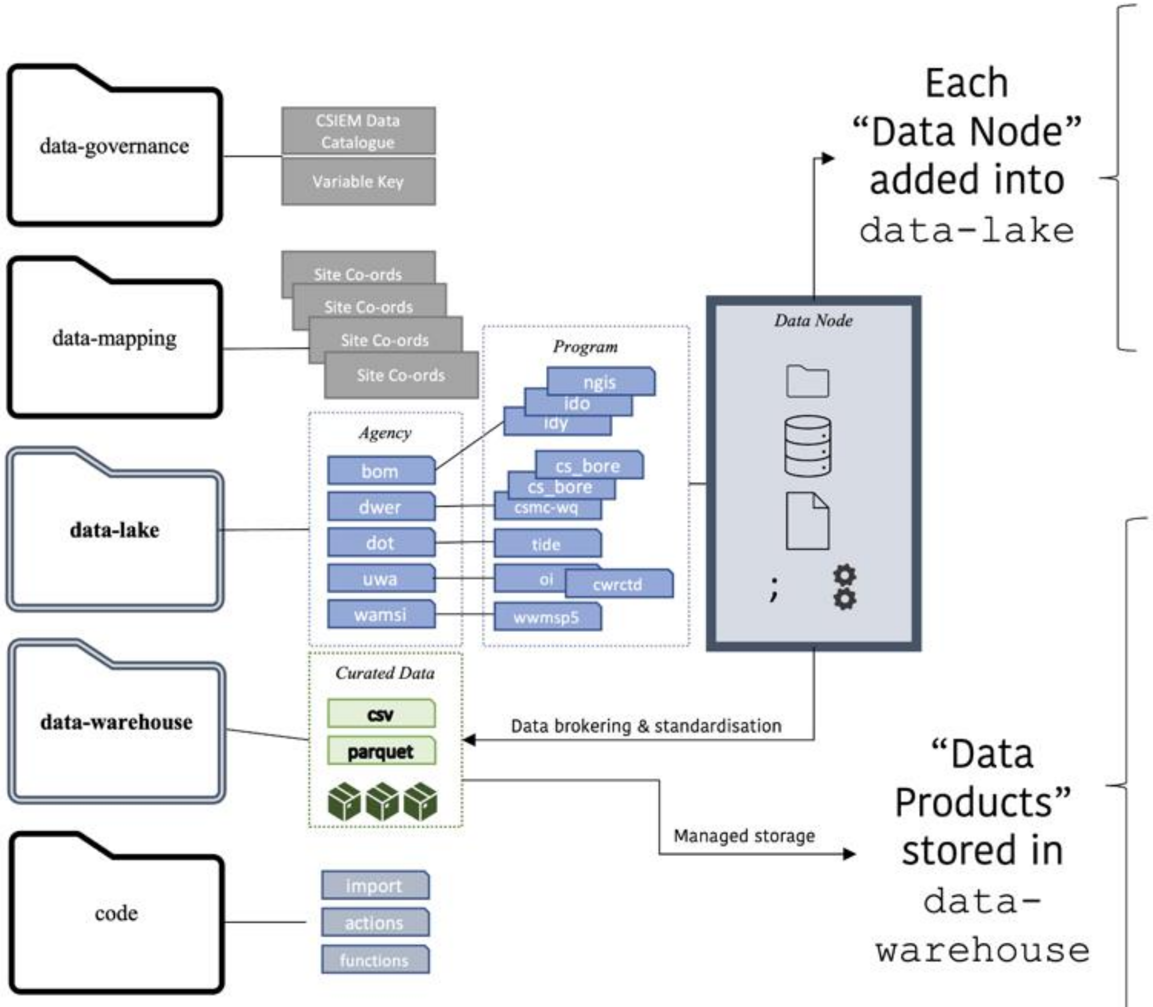
- The Cockburn Sound Regional Assessment covers a 500 km2 region off coastal WA.
- Proposed development for the region over the next 5 years is approx. **$15B**.
- The **current development proponents** are:
  - Westport
  - BP
  - ANI
  - Water Corp
  - Defence
- Additional **development proponents** with expiring permits are:
  - Fremantle Port
  - Cockburn Cement
  - Alcoa and several more

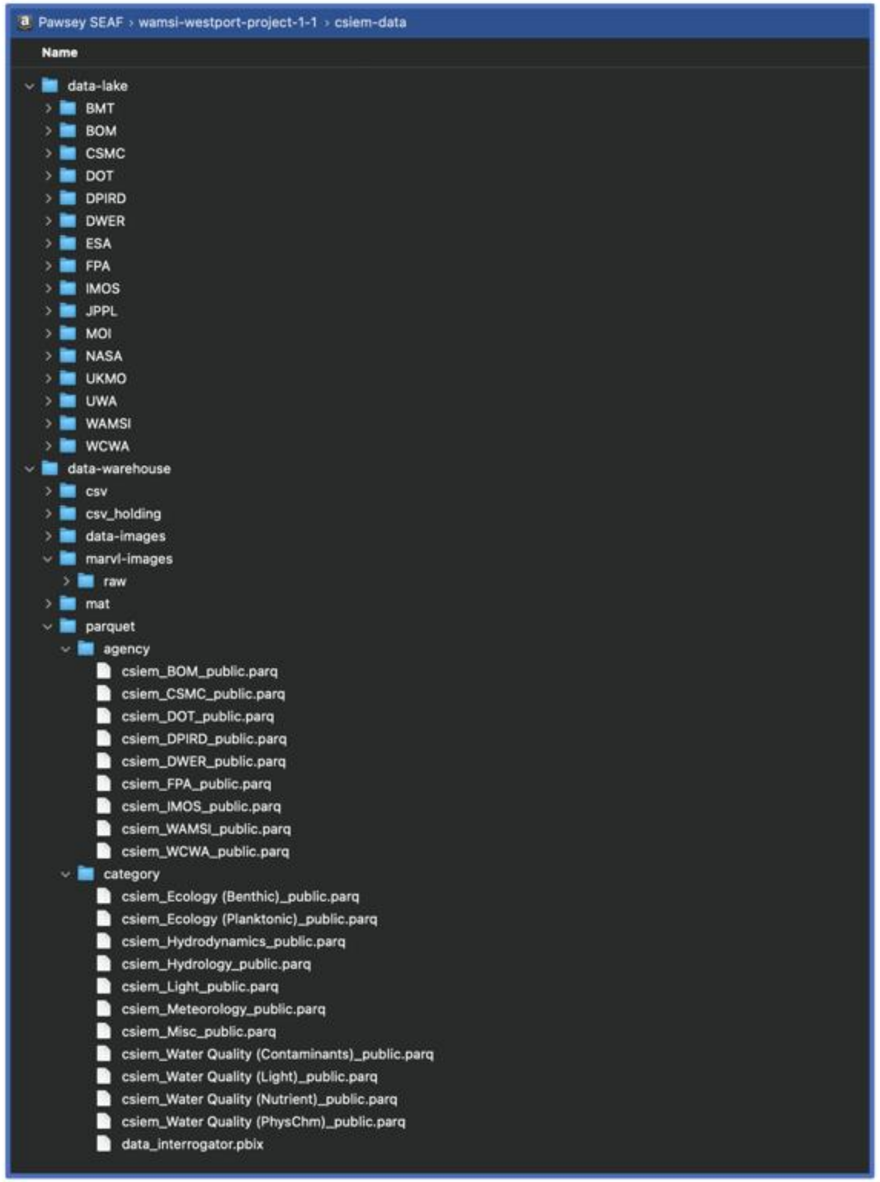


Develop a common approach to the interpretation of the environmental pressures and the impact of current and future development on the Cockburn region in the context of data shared by multiple proponents using the developed tools and products.



Trusted data products





CSIEM Data Warehouse

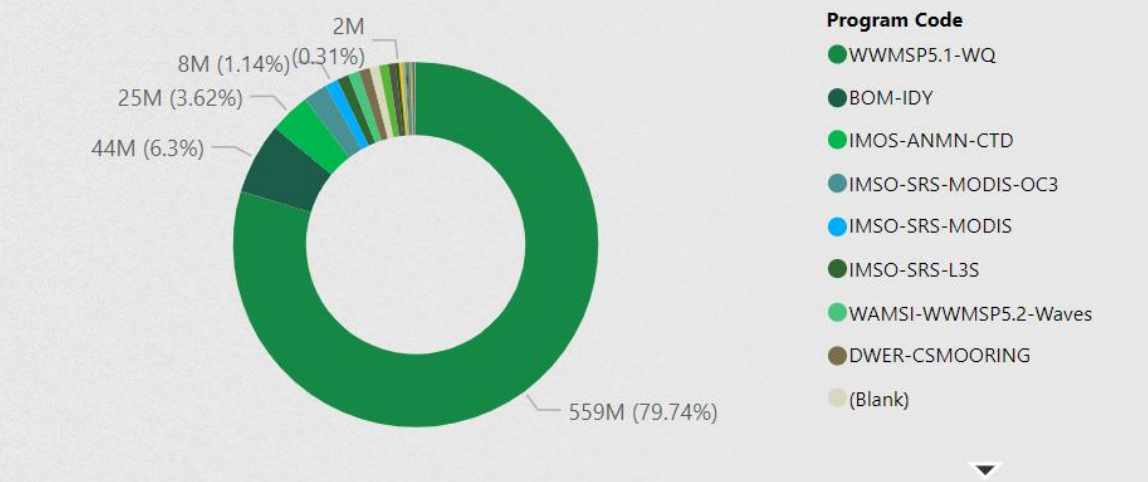
(Blank)	Ecology (Benthic)	Ecology (Planktonic)	Hydrodynamics	Hydrology	Light	Meteorology	Misc	Water Quality (Contaminants)	Water Quality (Light)	Water Quality (Nutrient)	Water Quality (PhysChm)

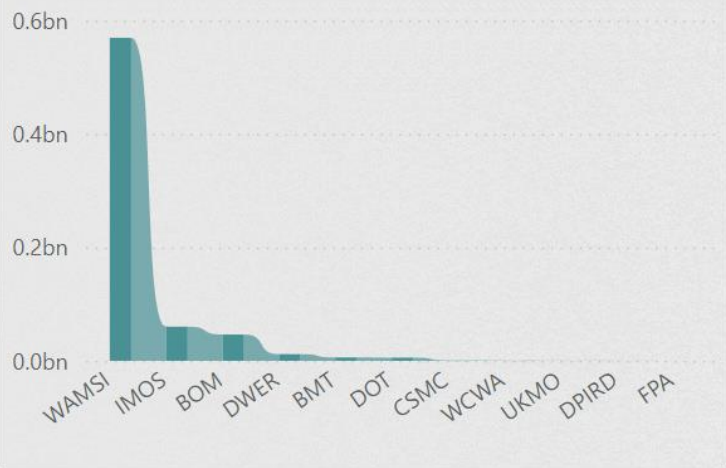
 # Data
701M

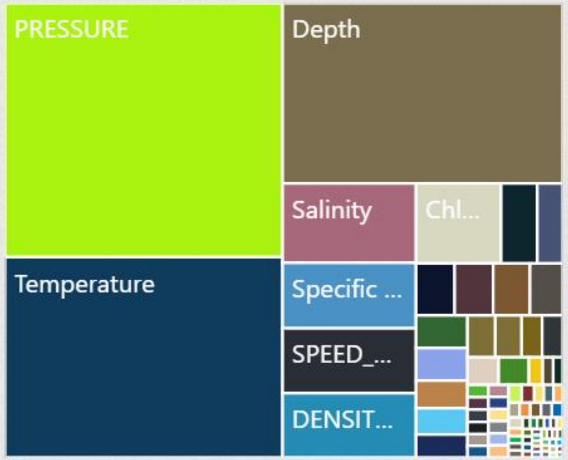
 # Variables
240

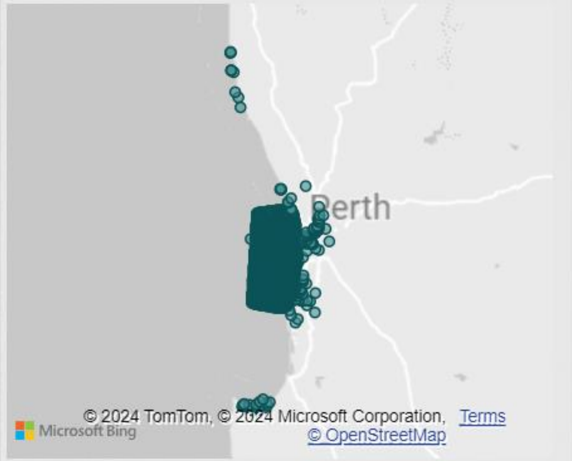
 # Agencies
13

Agency	Agency Code
Western Australian Marine Science Institution	WAMSI
Water Corporation WA	WCWA
Water Corporation	WCWA
United Kingdom Met Office	UKMO
Integrated Marine Observing System	IMOS
Fremantle Port Authorityn	FPA
Department of Water and Environmental Regulation	DWER
Department of Transport	DOT
Department of Primary Industry and Regional Development	DPIRD
Cockburn Sound Management Council	CSMC
Bureau of Meteorology	BOM
BOM	BOM
BMT	BMT









WESTERN AUSTRALIAN MARINE SCIENCE INSTITUTION

CSIEM-DATA : data-lake summary (Feb 2025)

Agency	Program / Dataset	Description	Category
AIMS	TEMP	Temperature Logger Program	PHYSCHEM
BMT	BNA	Breakwater model output	HYDRO
	SWAN	SWAN model export	HYDRO
BOM	BARRA	Gridded reanalysis export	MET
	IDO	Hillary's tide station	HYDRO
	IDY	Weather stations	MET
	NGIS	Groundwater data	HYDRO
	RAIN	Rainfall stations	MET
CSIRO	SRFME	Two Rocks transect hydro monitoring	HYDRO
	DALSENO	Cockburn bottom O_2 monitoring (2018/19)	PHYSCHEM
CSMC	WQ	CSMC data from MAFRL	PHYSCHEM, NUTRIENT
DEP	SMCWS	Digitised South Metropolitan Coastal Waters Study WQ data	PHYSCHEM, NUTRIENT
DOT	AWAC	DOT AWAC stations	HYDRO
	TIDE	DOT tide stations	HYDRO
	WAVE	DOT wave buoys	HYDRO
DPIRD	CRP	Crab Research Program	PHYSCHEM
DWER	BORE	Groundwater monitoring	HYDRO
	CSMC-phy	Phytoplankton taxonomy	PLANKTON
	CSMC-wq	CSMC data via WIR	PHYSCHEM, NUTRIENT
	CSMOORING	WQ mooring deployments, incl spectral light	LIGHT
	SCE-phytoplankton	Phytoplankton taxonomy	PLANKTON
	SCE-est	Estuary monitoring	PHYSCHEM, NUTRIENT
ESA	GC-Optics	GlobColor ocean color satellite exports	LIGHT
	GC-Plankton		PLANKTON
	GC-PP		PLANKTON
	GC-Reflectance		LIGHT
	GC-Transp		PHYSCHEM
	SEN-NC	Sentinel satellite exports	PHYSCHEM
FPA	MQMP	Marine Quality Monitoring Program	PHYSCHEM, NUTRIENT
	TIDE	Tidal stations	HYDRO
IMOS	AMNM	Rottnest IMOS mooring data	HYDRO
			PHYSCHEM
	REF	Rottnest IMOS bgc / plankton data	NUTRIENT PLANKTON
	SOOP	Ships of Opportunity (ferries and RV)	PHYSCHEM
	SRS	Selected Satellite Remote Sensing exports	PHYSCHEM
JPPL	AWAC	AWAC station	HYDRO
MOI	NEMO	Global model outputs	PHYSCHEM, NUTRIENT
	PISCES		
	SEAPODYM		
NASA	GHRSST	Synthesized daily temperature	PHYSCHEM
	MODIS	PAR/PIC/POC	NUTRIENT
NESP	NOD	National outfall database of WCWA effluent (monthly)	HYDRO, NUTRIENT
UKMO	OSTIA	Synthesized daily temperature	PHYSCHEM
UWA	AED	Gedaria phytoplankton / cytometry data	PLANKTON
	CWR	SMCWS CTD data	PHYSCHEM
	OI	Kendrick light data	LIGHT
	WAWAVES	Hillary's wave buoy data	HYDRO
WAMSI	WWMSP1	WRF model export	MET
	WWMSP2-light	Spectral light data	LIGHT
	WWMSP2-seagrass	ECU synthesis of historical seagrass biomass & epiphyte data	BENTHIC
	WWMSP2-waves	Wave data	HYDRO
	WWMSP3-ctd	MAFRL CTD cast data	PHYSCHEM
	WWMSP3-seddep	MAFRL sediment deposition expt data	SEDIMENT
	WWMSP3-sedpsd	MAFRL sediment deposition expt data	SEDIMENT
	WWMSP3-sgrest	MAFRL sediment data at restoration sites	SEDIMENT
	WWMSP4-zoop	Zooplankton survey data	PLANKTON
	WWMSP5-adcp	Cockburn ADCP deployment	HYDRO
	WWMSP5-met	Boat club met station	MET
	WWMSP5-roms	ROMS T,S model export	HYDRO
	WWMSP5-waves	Cockburn wave deployment	HYDRO
	WWMSP5-wq	Cockburn O2/PAR deployment	PHYSCHEM
	WWMSP5-wwm	WWM wave model export	HYDRO
	WWMSP8-dolphin	Dolphin occurrence data	PELAGIC
	WWMSP9-awac	Wave expt data	HYDRO
WCWA	PLOOM	Historical WWTP outfall monitoring	PHYSCHEM, NUTRIENT
	PSDP	PSDP outfall monitoring and discharge rates	PHYSCHEM, NUTRIENT
	SDOOL	Sepia Depression monitoring	PHYSCHEM, NUTRIENT
	WC-BMT	Digitised oxygen data from BMT report	PHYSCHEM

BARRA, WRF

Weather conditions

SWAN, WWM

Wave conditions

Regional ocean conditions

HD: ROMS

- *Hydrodynamics*

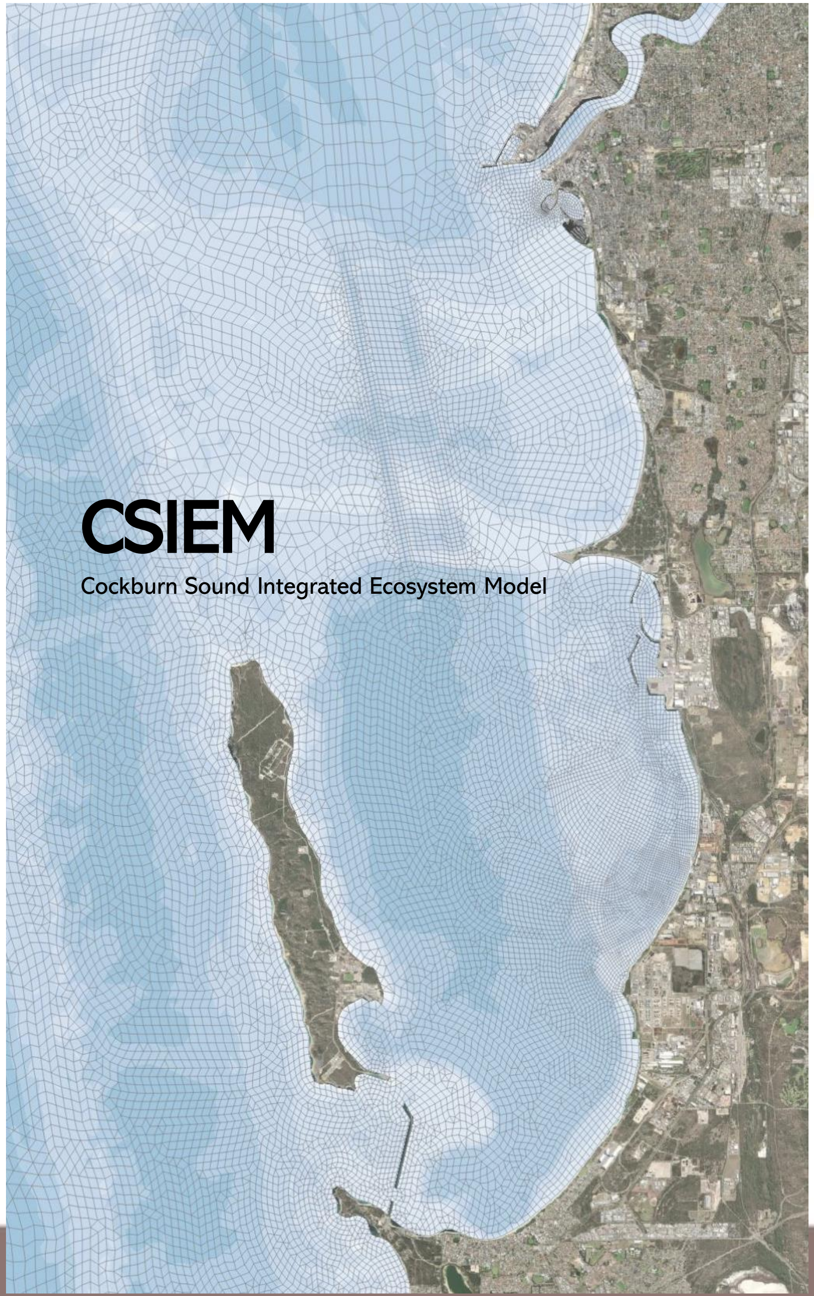
BGC: O-BGC

- *Biogeochemistry*

MARS

GIS

Benthic habitat



SEAF

Swan Estuary inputs

SCERM

Local discharges/intakes

PSDP, SDOOL,

… Industry …

Local groundwater inputs

PRAMS

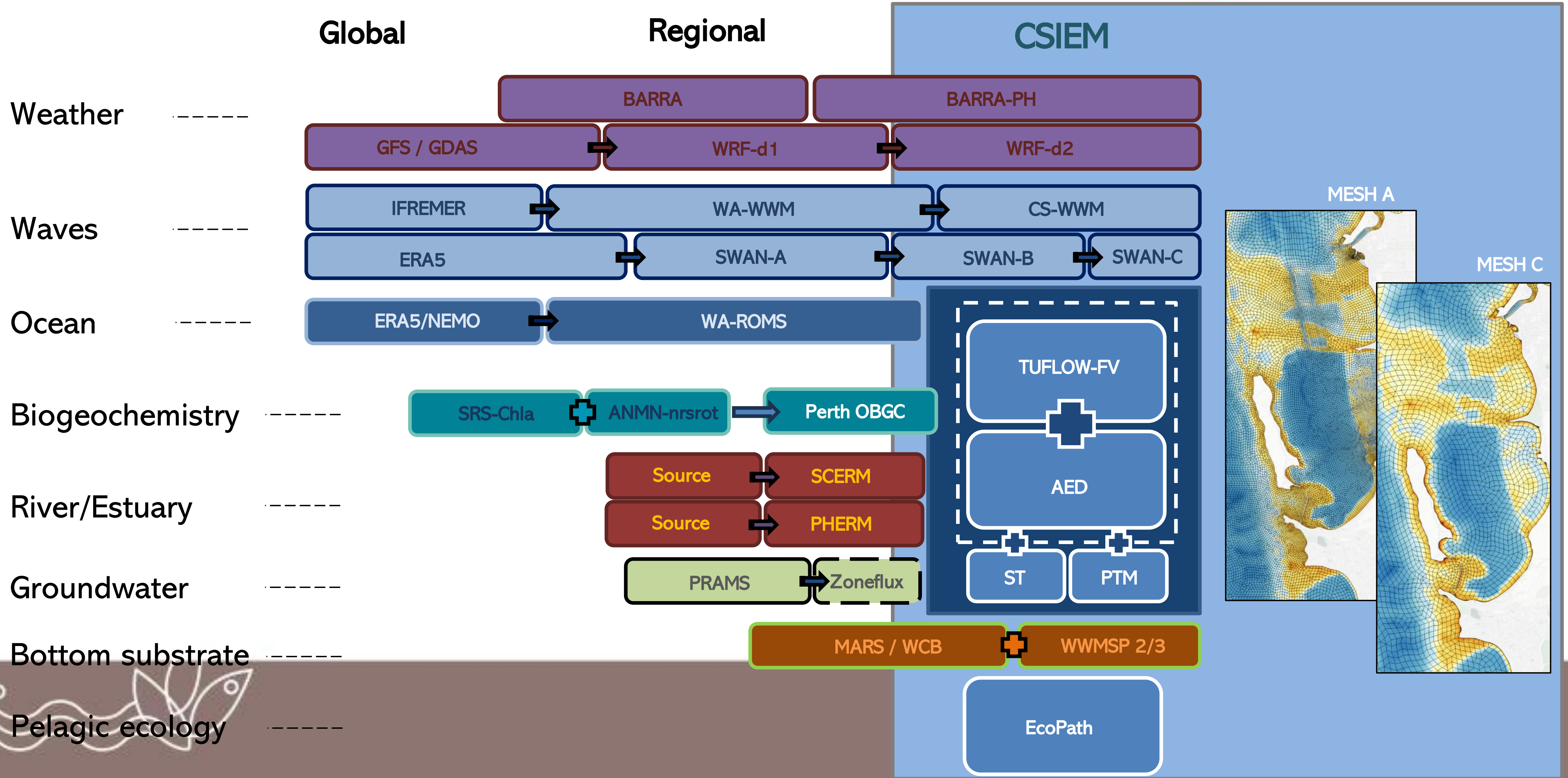
Local activities

Shipping, Berthing,

Dredging, Spoil,

Aquaculture, etc.

Knowledge synthesis through model integration



Cumulative Impacts in Cockburn

Ocean biogeochemistry conditions

Groundwater inputs

WWMSP 3

Bio-optical (light) conditions

Oxygen and sediment biogeochemistry

WWMSP 3

Benthic communities

WWMSP 2

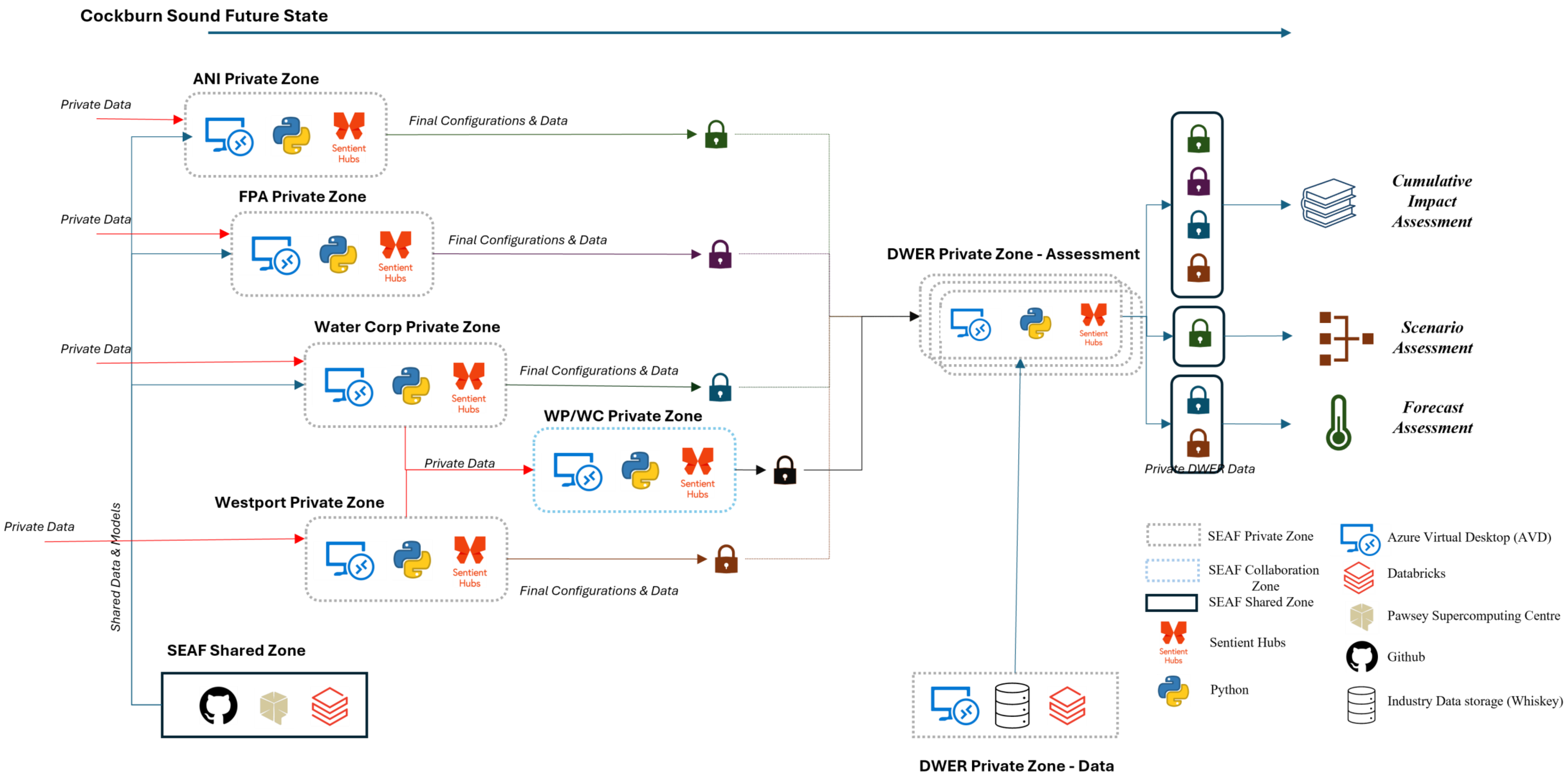
Phytoplankton
Zooplankton

WWMSP 4

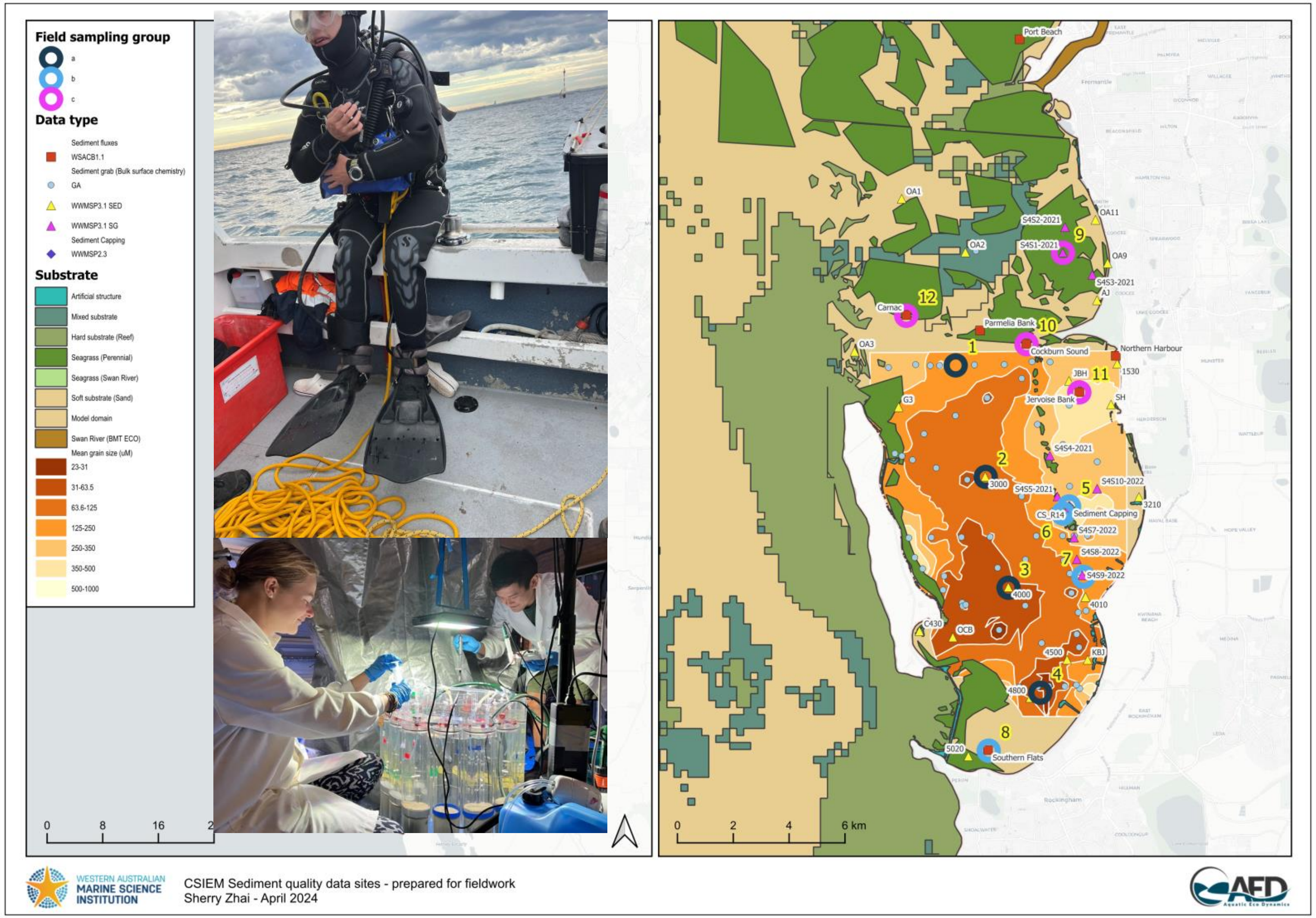
Issues of Concern:

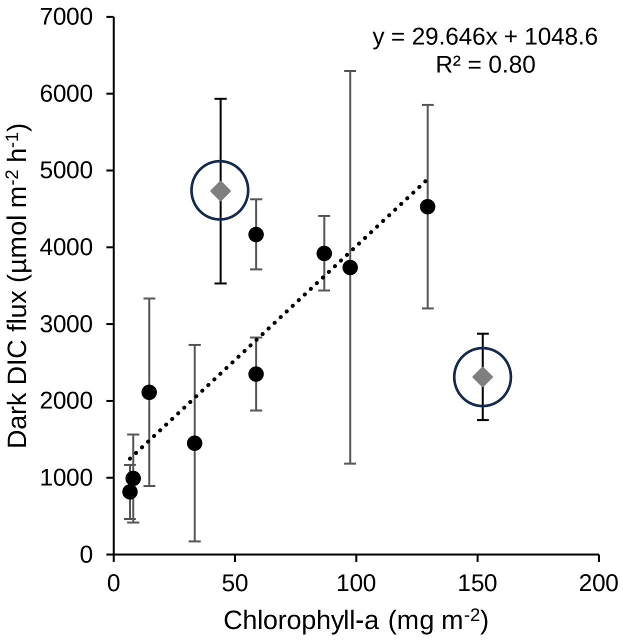
Water clarity
Hypoxia
Seagrass loss
Harmful Algal Blooms
Fishery productivity
Ecotox
…

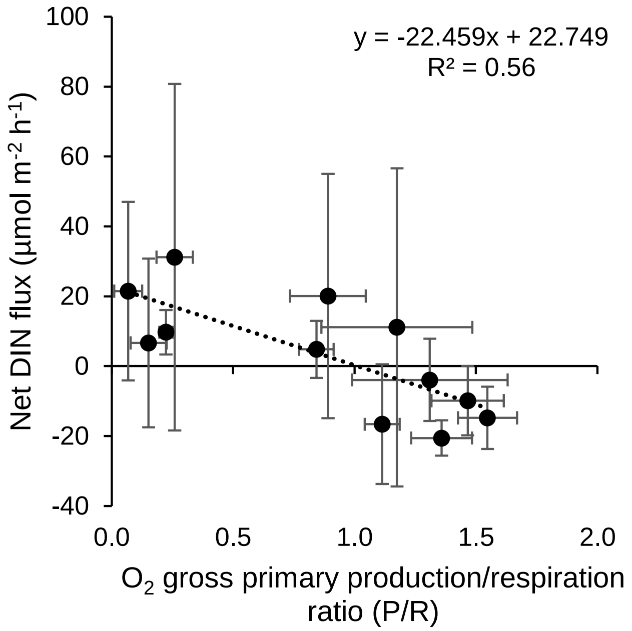
SEAF: Cockburn Sound



Benthic Nutrient Flux Dynamics

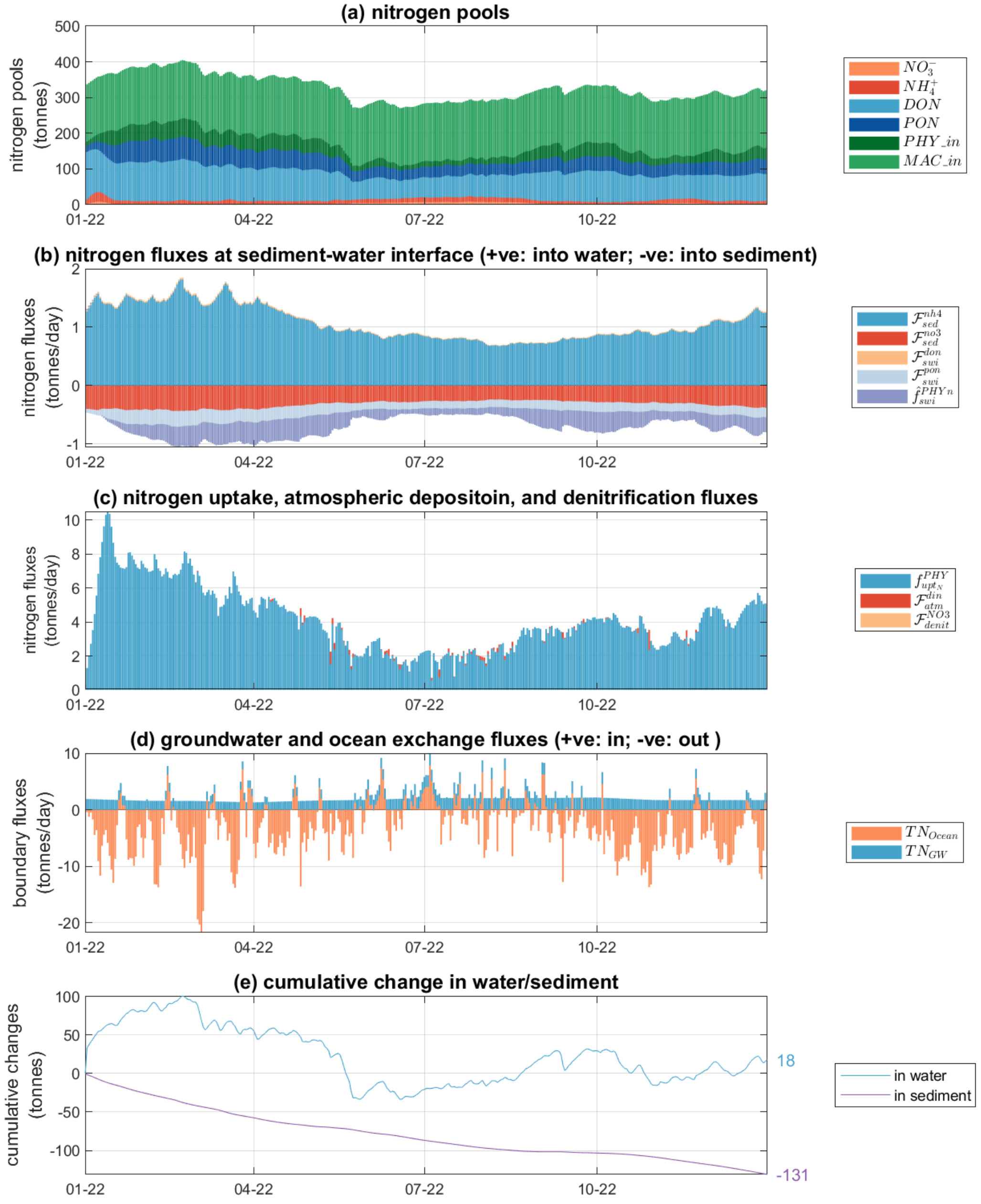


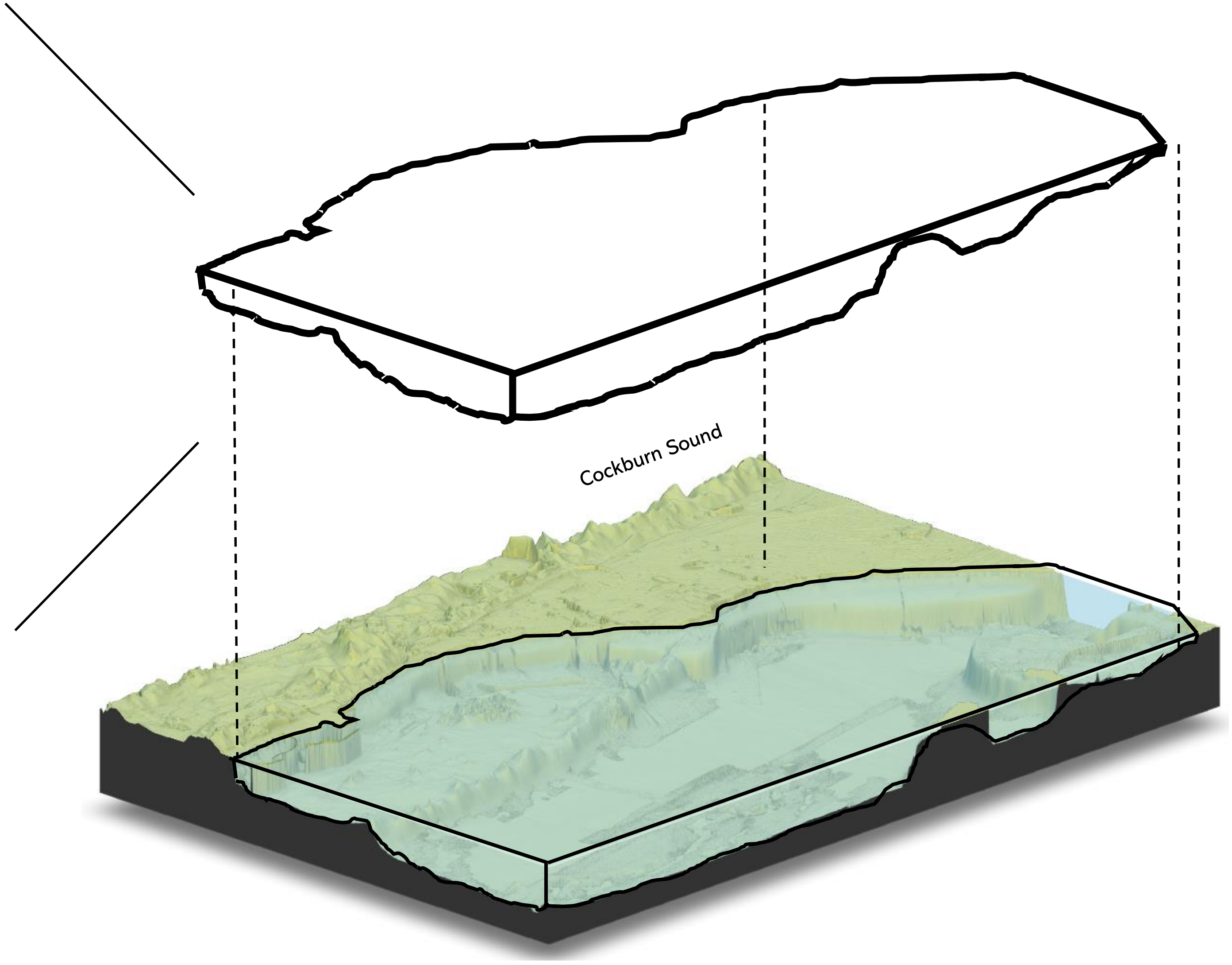


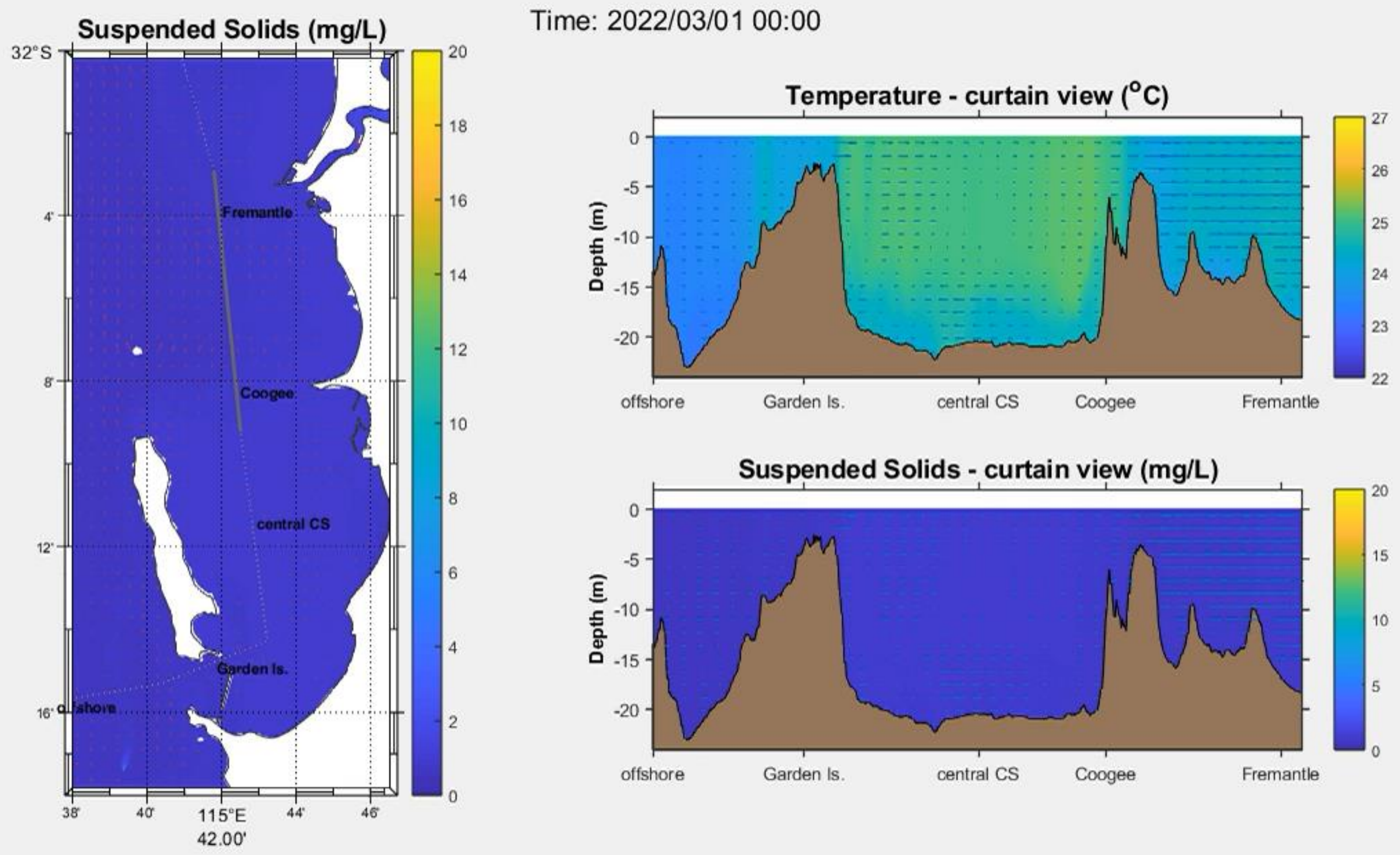


Data from WWMSP3 (Eyre)

Nitrogen budget tracking







Moving plume inputs:
Dredge plumes
Shipping/berthing inputs

Water quality response (turbidity, nutrients)

Benthic light (PAR) changes

Seagrass productivity changes

Shared Environmental Analytics Facility (SEAF)

- From project-based assessment towards standards-based assessment
- Cumulative impact > How can data and data science assist in transitioning? Qualitative to Quantitative
- Data sharing vs. data accessibility
- Operationalising shared data and analytics, trust and confidence through science – SEAF is, SEAF isn't
- Acknowledgments

Translating science knowledge and data analytics into streamlined decisions

A SHARED ENVIRONMENTAL ANALYTICS FACILITY (SEAF)

Thank you

Please scan to provide feedback

NOPSEMA | Australia's offshore energy regulator

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