NSW GOVERNMENT

DRAFT Coastal Integrated Forestry Approvals Monitoring Program 2019-2024

For public review

October 2019

This document has been prepared by the NSW Natural Resources Commission on behalf of the NSW Forest Monitoring and Improvement Steering Committee.

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List of acronyms and abbreviations

Conditions	Coastal Integrated Forestry Operations Approval Conditions of Approval
DPI	Department of Primary Industries
The Commission	Natural Resources Commission
EES	Environment, Energy and Science Group under the Department of Planning, Industry and Environment
EPA	NSW Environment Protection Authority
FCNSW	Forestry Corporation of New South Wales
NSW FMIP	NSW Forest Monitoring Improvement Program
FRAMES	Forest Resource and Management Evaluation System
IFOA	Integrated Forestry Operations Approval
LiDAR	Light Detection and Ranging
NSW	New South Wales
SEPP	State Environmental Planning Policy
Steering Committee	The Forest Monitoring and Improvement Program Steering Committee

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The Natural Resource Commission acknowledges and pays respect to all the Traditional Owners and their Nations in the area. The Commission recognises and acknowledges that the Traditional Owners have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. We value and respect their knowledge of natural resource management and their contributions of earlier generations, including the Elders.

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1 Program summary

The Coastal Integrated Forestry Operations Approval (Coastal IFOA) is an agreement between the NSW Minister for Energy and Environment and the Minister for Regional NSW, Industry and Trade.[1] It guides native timber harvesting operations on NSW state forests and Crown timber land.[2]

Coastal IFOA conditions:

The Coastal IFOA is comprised of objectives, outcomes statements, conditions and protocols. The Coastal IFOA's conditions set mandatory actions and controls for protecting threatened plants and animals, habitats, soils and water. The conditions are supported by protocols, which set out additional enforceable actions and controls to support the effective implementation of the Coastal IFOA.

Where this document refers to 'conditions' it refers to the Coastal IFOA conditions as stated above.

The Coastal IFOA requires that the effectiveness of its conditions and the extent to which its objectives and outcomes are achieved is continually monitored.[3]

The NSW Government has established a Forest Monitoring and Improvement Program (NSW FMIP). The Premier has asked the Natural Resources Commission (the Commission) under a terms of reference to independently oversee and advise on the program.

The NSW FMIP is a cross-tenure program that will lead and coordinate monitoring, evaluation and research for improved forest management on public and private land, including national parks, state forests and private native forestry areas.

As part of the NSW FMIP, the NSW Forest Monitoring and Improvement Steering Committee (the Steering Committee) was established, which is a multi-agency body chaired by the Commission.

Under the Terms of Reference, the Steering Committee was asked to propose a monitoring program for the Coastal IFOA.[4] This document proposes the Steering Committee's draft program for the Coastal IFOA. The purpose of the program is to ensure the monitoring of Coastal IFOA is delivered effectively and that its objectives and outcomes are being achieved within the available resources.

1 The Coastal IFOA commenced on 16 November 2018.

2 The Coastal IFOA applies to **native timber forests on state forests and crown timber lands** within the region shown in **Figure 1**. It does not apply to soft or hardwood plantations, or forestry activities on other tenures (for example, private native forestry).

3 NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Protocols.* Chapter 8, Protocol 38, Section 38.1(2). Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1178-coastal-ifoa-protocols.pdf.

4 The Coastal IFOA conditions specifically requires a monitoring steering committee to be established and chaired by the Natural Resources Commission (NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Conditions*. Chapter 8, Condition 122.1. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1177-coastal-ifoa-conditions.pdf.

As part of this process, the Commission worked with independent scientific experts and a technical working group, which was established by the Steering Committee to guide the development and implementation of monitoring, evaluation and research plans.

The Steering Committee is seeking feedback from community and interested stakeholders on the draft program introduced in this report. This chapter provides a high-level summary of the program and outlines how you can have your say on the program in **Section 1.7**. **Chapters 2** to **5** provide more detail on the program.

Feedback will be considered by the Steering Committee as it finalises the program. Once this has occurred, the Steering Committee must propose the program for joint approval by the Chief Environment Regulator of the Environment Protection Authority (EPA) and the Deputy Director of the Department of Primary Industries (DPI) before more detailed monitoring and research plans are developed.

1.1 Monitoring approach

The program will answer four overarching questions, related to:

- **Effectiveness monitoring –** are the Coastal IFOA conditions effectively meeting its objectives and outcomes?
- **Trend monitoring –** is the Coastal IFOA having a neutral, positive or negative impact on landscape-scale environmental values or wood supply?
- **Compliance monitoring –** are forestry operations carried out in accordance with the Coastal IFOA?
- **Adaptive management –** can Coastal IFOA conditions, forestry operations, forestry management or monitoring be improved to better meet objectives and outcomes?

Adaptively managing monitoring programs is good practice[5]. Programs need to be able to explore, evolve and develop in response to new questions, and improve monitoring approaches and protocols[6]. As such, the program will be reviewed and adapted over time.

The following sections give a high-level description of the approaches to address these questions and **Chapter 4** describes them in more detail.

1.1.1 Effectiveness monitoring

Are the Coastal IFOA conditions effectively meeting its objectives and outcomes?

This question is the primary focus of the program.

The program has nine strategies to monitor and evaluate the effectiveness of the conditions in meeting the Coastal IFOA objectives and outcomes. These strategies are considered most likely to:

5 LINDENMEYER, D.B. and LIKENS, G.E. 2010. *Effective ecological monitoring*. CSIRO Publishing, Collingwood Victoria

6 LINDENMAYER, D.B., GIBBONS,P., BOURKE, M., BURGMAN, M., DICKMAN,C.R., FERRIER,S., FITZSIMONS, J., FREUDENBERGER, D.,GARNETT,S.T.GROVES,C., HOBBS,R.J, KINGSFORD,R.T., KREBS,C., LEGGE,S., LOWE, A.J., McLEAN, R., MONTAMBAULT,J., POSSINGHAM,H., RADFORD,J., ROBINSON,D., SMALLBONE,L., THOMAS,D., VARCOE,T., VARDON,M., WARDLE,G., WOINARSKI,J. & ZERGER,A. 2012. Improving biodiversity monitoring. *Austral Ecology* 37:285-294.

- support informed decision-making and improved forest management practices
- deliver cost-effective monitoring
- meet the requirements of the Coastal IFOA under Protocol 38 and the Premier's terms of reference
- meet the aims and good practice principles of the NSW FMIP.

1.1.2 Trend monitoring

Is the Coastal IFOA having a neutral, positive or negative impact on landscape-scale environmental values or wood supply?

The Coastal IFOA requires the program to assess landscape-scale trends against baselines across a range of variables, including biodiversity, water quality, forest regeneration and wood supply.

This question is linked to the evaluation of the effectiveness of the conditions (**Section 1.1.1**). Trend monitoring will:

- provide an indication of whether the Coastal IFOA conditions are affecting environmental values or leading to changes in wood supply from native hardwood forests over time
- help evaluate what type of effect the Coastal IFOA conditions are having on environmental values or wood supply overall.

1.1.3 Monitoring program for effectiveness and trends

Table 1 summarises the Coastal IFOA monitoring program, including the specific questions the program will evaluate and how the program could be designed to answer those questions. Data collected as part of the monitoring program will be used for both the effectiveness and trend monitoring components of the program. The monitoring program will implement monitoring and research at two different scales:

- **Site-scale monitoring or research –** for example, the extent to which conditions are maintaining habitat features such as hollows for fauna.
- **Landscape-scale monitoring –** for example, using remote sensing techniques to investigate the extent to which harvesting conditions maintain of forest age classes at the landscape scale.

Table 2 summarises the environmental values and wood supply landscape trends that will be determined for this program. Trend monitoring will also form part of the state-wide cross tenure monitoring through the state-wide monitoring plot network[7].

In addition to the coastal IFOA monitoring program, the FMIP will also identify broader set of state-wide evaluation questions to inform monitoring and research on other tenures.[8] These questions could focus on broader landscape drivers such as climate change and fire regimes. Information from these other programs can also inform the evaluation of the Coastal IFOA.

These strategies will be overseen by the Commission as independent chair of the steering committee. Some of the strategies are existing programs, which have been peer reviewed. New strategies from the program may be subject to peer review by experts from an appropriate academic institution.

7 The NSW Forest Monitoring and Improvement Program's *Program Framework 2019-2024* commits to this deliverable.

8 *Ibid.*

Table 1: Overview of the draft monitoring program

Monitoring strategy	Monitoring questions	Indicative program design	Responsible party	Oversight, annual review and reporting	Indicative cost
Monitoring regenerating forests	▪ Are the conditions effective in ensuring regenerating forests meet benchmarks for: (i) floristic composition, (ii) forest structure, (iii) coarse woody debris? ▪ Are the conditions and practices effectively managing risks of invasive flora species in regenerating forests? ▪ Are the conditions affecting commitments to meet wood supply? ▪ Are the conditions likely to promote regeneration that sustains timber supply?	▪ Monitor a permanent, cross-tenure plot network across the Coastal IFOA area (including state forests) ▪ Use floristic composition,[9] forest structure and coarse woody debris benchmarks, established for each vegetation class and forest age-class ▪ Use sampling methods consistent with cross-tenure, state-wide monitoring plot network and following agreed protocols and conventions	▪ Forestry Corporation of NSW (FCNSW) ▪ Environment, Energy and Science Group (EES) ▪ DPI – Forest Science	▪ Steering Committee ▪ Commission	▪ $400k first-year establishment ▪ $ 350k annual

[9] Recognising that that floristic composition of forest will adapt to changes in climate.

Monitoring strategy	Monitoring questions	Indicative program design	Responsible party	Oversight, annual review and reporting	Indicative cost
Monitoring forest structure and health	▪ Do harvesting conditions establish an appropriate mosaic of forest age classes at the landscape scale? ▪ Are the conditions maintaining functional connectivity for focal fauna species to move within and across the forest? ▪ To what extent are the conditions effectively managing the risk of new or existing areas subject to dieback?	▪ Establish benchmarks for landscape heterogeneity (age class, structure) ▪ Analyse remote sensing data, LiDAR[10] and multispectral imagery consistent with the approach used in the state-wide monitoring program	▪ FCNSW ▪ EES ▪ DPI – Forest Science	▪ Steering Committee ▪ Commission	▪ $250k first-year establishment ▪ $200k annual ▪ Does not include spatial data purchase and storage costs
Monitoring key habitat features	▪ To what extent do retained habitat features maintain their function?[11]	▪ Monitor a representative sample of key habitat features identified and conserved through strategic and operational planning processes ▪ Monitor persistence and use of key habitat features ▪ Use hollow inspection, camera trapping and hair trapping	▪ FCNSW	▪ Steering Committee ▪ Commission	▪ $250k first-year establishment ▪ $200k annual

10 LiDAR stands for Light Detection and Ranging and is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth.
11 Habitat features can include hollows, winter flowering trees and feed trees.

Monitoring strategy	Monitoring questions	Indicative program design	Responsible party	Oversight, annual review and reporting	Indicative cost
Monitoring species occupancy	▪ To what extent do the Coastal IFOA conditions maintain species occupancy in the landscape?[12] ▪ To what extent do the conditions maintain the population status of focal species?	▪ Use passive sensors ▪ Use automated data collection and species detection methods, including for koalas, forest owls and frogs ▪ Continually update species call libraries ▪ Reanalyse historical data	▪ FCNSW ▪ DPI – Forest Science	▪ Steering Committee ▪ Commission	▪ $350k first-year establishment (including additional equipment purchases) ▪ $200k annual
Species-specific monitoring – fauna	▪ To what extent do the Coastal IFOA conditions maintain fauna species viability in the landscape? ▪ To what extent are the species-specific management plans effective in maintaining the viability of that species?	▪ Approach will be species-dependent but will be consistent with the monitoring requirements of any relevant species management plan, if applicable	▪ FCNSW ▪ DPI – Forest Science	▪ Steering Committee ▪ Commission	▪ Existing program ▪ $200k annual
Species-specific monitoring – flora	▪ To what extent do the Coastal IFOA conditions maintain flora species viability in the landscape? ▪ To what extent are the species-specific management plans effective in maintaining the viability of that species?	▪ Approach will be species-dependent but will be consistent with the monitoring requirements of any relevant species management plan, if applicable	▪ FCNSW	▪ Steering Committee ▪ Commission	▪ $100k annual

12 For the purpose of effectiveness monitoring, landscape refers to state forests within the Coastal IFOA, only

Monitoring strategy	Monitoring questions	Indicative program design	Responsible party	Oversight, annual review and reporting	Indicative cost
Catchment-based waterway health monitoring	▪ To what extent are the soil and water conditions effective in minimising the impact of harvesting and roading on waterway condition ▪ Are the exclusion zone conditions for class 1 classified drainage lines effective in minimising the impact on waterway condition? ▪ Are the exclusion zone conditions effective in reducing the impact of forestry operations on Coastal State Environmental Planning Policy (SEPP) wetlands?	▪ Evaluate the learnings from existing long-term replicated paired catchment experiments at Yambulla and Karuah ▪ Undertake macroinvertebrate or environmental DNA sampling on large river systems flowing out of state forests ▪ Establish a before-after-control-impact site on the north coast in the intensive zone ▪ Undertake flood scenario modelling	▪ FCNSW	▪ Steering Committee ▪ Commission	▪ Evaluation of existing program at Yambulla and Karuah ▪ $300k annual
Research program	▪ How are koalas responding to koala conditions, including tree retention rates and size? ▪ Can technology improve the probability of detection for a range of species in forestry operations?	▪ Commissioned research to be performed by research institutions and/or agencies ▪ Design will depend on the nature of the research ▪ Design will be peer reviewed ▪ Further research priorities will be developed and adopted throughout the monitoring program ▪ Note: the Commission is currently overseeing an independent research program on koala response to regeneration harvesting on NSW north coast state forests. The program investigates koala density and diet and the nutritional value of its habitat	▪ Commission	▪ Steering Committee ▪ Commission	▪ $200k annually for first four years

Monitoring strategy	Monitoring questions	Indicative program design	Responsible party	Oversight, annual review and reporting	Indicative cost
Independent evaluation of forestry practice	▪ Is pre- and post-harvesting burning maintaining the function of key habitat features? ▪ Are drainage feature crossings and road features effectively designed and maintained to reduce the impact of forestry operations on waterway condition? ▪ Are the species and habitat survey and modelling conditions and practices effective?	▪ Independently evaluate the effectiveness of the planning and implementation of forestry operations and forest management practices[13] **Priority evaluation themes[14]** ▪ Pre- and post-harvesting burning ▪ Roading and drainage features ▪ Species and habitat surveys and modelling, including research programs on wildlife detection	▪ Steering Committee	▪ Steering Committee ▪ Commission	▪ $200k in the first four years

13 FCNSW currently has its practices independently certified to the Sustainable Forest Management Standard (Responsible Wood).

14 Priority themes were derived from a strategic and risk-based prioritisation process, which is detailed in **Attachment 1**.

Table 2: Proposed landscape-scale trend monitoring

Baseline	Description
Environmental values	
Coastal IFOA Conditions **(2019 baseline – ongoing)**	Baseline will be from the commencement of the Coastal IFOA for variables used to assess the effectiveness of its conditions (see **Section 1.1.1**) **Attachments 1 to 5** provide further detail on how each monitoring question is used to monitor biodiversity, water quality and forest regeneration trends Data collected as part of landscape-scale monitoring strategies will be used for both the effectiveness and trend monitoring components of the program Trend monitoring will also be part of state-wide, cross-tenure monitoring through the state-wide monitoring plot network.
Historical trends **(1999 – ongoing)**	Historical trends will be based on the datasets from the Comprehensive Regional Assessment undertaken in 1999 that are comparable with current datasets[15] This will be a reference point from which the trajectory of environmental values will be tracked These will identify longer-term temporal trends in environmental values up to the commencement of the Coastal IFOA and will be used to assess how the Coastal IFOA affects these values
Wood supply	
Modelled **(2019 – ongoing)**	This assesses the modelled sustainable yield volumes[16] under the Coastal IFOA A baseline will be established as modelled wood supply under the previous IFOA conditions This allows actual wood supply under the Coastal IFOA to be compared with the wood supply that would be expected if the Coastal IFOA had not been implemented
Actual yield **(2003 – 2019 then ongoing)**	This baseline will reflect actual yields every year from 2003[17] and will continue to monitor actual yields going forward This is based on 2003 harvest volumes to identify longer-term trends in wood supply Actual yield will need to be tracked over several years to accurately assess the impact of the Coastal IFOA on actual volumes and test wood supply models, as annual wood supply can vary due to weather and market conditions, and the Coastal IFOA allows annual harvest volumes to vary by up to 25 percent from annual limits[18]

15 Note: Datasets from the Comprehensive Regional Assessment will only be used if they are comparable to current datasets. The Commission also notes that older datasets are likely to be at a coarser scale to current datasets and will be used to give a broad indication of trends. Since the Comprehensive Regional Assessment technology, data collection methods and means of recording results have improved.

16 As reported in DPI (2018) *Sustainable yield in New South Wales Regional Forest Agreement Regions*. Available at: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/842098/sustainable-yield-in-NSW-RFA-regions.pdf.

17 FCNSW reports on actual versus predicted yield as part of reporting to the Australian Government on the Regional Forest Agreements. Actual yield figures from this process will be used as part of trend monitoring.

18 Under the Coastal IFOA, FCNSW is allowed to overcut and undercut their annual limits by up to 25 percent. However, to be in line with sustainable yield, the average yield over 20 years must not exceed the annual limits.

1.1.4 Compliance monitoring

Are forestry operations carried out in accordance with the Coastal IFOA?

To assess the effectiveness of Coastal IFOA conditions, it is important to understand whether forestry operations comply with these conditions and that they are enforced in the first instance.

The EPA conducts compliance monitoring for the Coastal IFOA and FCNSW must report on compliance with the Coastal IFOA annually. Information from existing compliance programs will inform the program's overall assessment of the effectiveness of conditions. As such, an independent evaluation of compliance will be conducted every five years. This will be timed so that it is conducted prior to the five-yearly review of the Coastal IFOA. The first independent evaluation will be in 2023.

The evaluation will address three questions related to compliance monitoring:

- Which conditions have or haven't been met?
- What are the reasons for any conditions not being met?
- What are the challenges for monitoring Coastal IFOA compliance?

1.1.5 Adaptive management

Can Coastal IFOA conditions, forestry operations, forestry management or monitoring be improved to better meet objectives and outcomes?

During the detailed design of the monitoring strategies, performance benchmarks and management action triggers will be established for each of the monitoring questions. The monitoring and evaluation activities will be reviewed against these benchmarks and triggers to identify any necessary changes to the Coastal IFOA.

Table 3 outlines the adaptation management opportunities for the Coastal IFOA. Informal annual reviews linked to annual forums will be complemented by formal reviews held every five years, starting in 2024.

The Commission – on behalf of the Steering Committee – will provide progress reports at least annually to the NSW Government, EPA and DPI, along with the results of any program reviews. These reports will be made publicly available online.

Annual forums will consider the results of the monitoring program and will also identify new priority themes for independent evaluations and research.

Table 3: Key adaptive management opportunities

Timing	Opportunity	By who	To who
Annual	1 Emerging results from the program 2 Recommended changes to the Coastal IFOA (if any)	▪ Overseen by Steering Committee ▪ Open annual forums with experts, researchers and community	▪ EPA ▪ DPI ▪ Community through public reporting[19]
Five-yearly	1 Detailed results from the program, including trends 2 Recommended changes to the Coastal IFOA (if any)	▪ Overseen by Steering Committee	▪ EPA ▪ DPI ▪ Community through public reporting[20]

1.2 Proposed program schedule

Table 4 presents the proposed timeline for key elements of the program, particularly the monitoring strategies and adaptive management reviews.

For the forest structure and health and species occupancy monitoring strategies, it will be difficult to comprehensively monitor the Coastal IFOA area every year, given the available time and resources. As such, monitoring for these strategies will be staged through a five-year rotating group of plots spread throughout the Coastal IFOA, with 20 percent of all plots monitored annually.

This approach will collect data on forest structure and species occupancy for the entire Coastal IFOA area every five years, which aligns with the program's evaluation and reporting timeframes, as well as the development of new spatial datasets from updated LiDAR.

19 Available on the EPA website or other location approved by the EPA.
20 Available on the EPA website or other location approved by the EPA.

Table 4: Proposed program schedule

		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Monitoring regenerating forests	Detailed design	●															
	Plot establishment /baseline		●														
	Monitor plots (Three to five years post-harvest)		**Plot Group 1**	**Plot Group 2**	**Plot Group 3**	**Plot Group 4**	**Plot Group 5**	**Plot Group 1**	**Plot Group 2**	**Plot Group 3**	**Plot Group 4**	**Plot Group 5**	**Plot Group 1**	**Plot Group 2**	**Plot Group 3**	**Plot Group 4**	**Plot Group 5**
Monitoring forest structure and health	Review imagery					●					●					●	
	Detailed design	●															
	Monitoring (20 percent of plots rotated annually for five years)		**Plot Group 1**	**Plot Group 2**	**Plot Group 3**	**Plot Group 4**	**Plot Group 5**	**Plot Group 1**	**Plot Group 2**	**Plot Group 3**	**Plot Group 4**	**Plot Group 5**	**Plot Group 1**	**Plot Group 2**	**Plot Group 3**	**Plot Group 4**	**Plot Group 5**
Monitoring key habitat features	Detailed design	●															
	Monitoring		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Monitoring species presence	Detailed design	●															
	Monitoring (20 percent of plots rotated annually for five years)		**Plot Group 1**	**Plot Group 2**	**Plot Group 3**	**Plot Group 4**	**Plot Group 5**	**Plot Group 1**	**Plot Group 2**	**Plot Group 3**	**Plot Group 4**	**Plot Group 5**	**Plot Group 1**	**Plot Group 2**	**Plot Group 3**	**Plot Group 4**	**Plot Group 5**
Species-specific monitoring – fauna	Management Plans	●															
	Monitoring	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Species-specific monitoring – flora	Management Plans	●															
	Monitoring		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Catchment-based waterway health monitoring	Detailed design	●															
	Monitoring		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Research program	Research programs results[21]	R1		R2		R		R		R		R		R		R	
Independent evaluation of forestry practice	Roading and drainage		●								●					●	
	Species survey and modelling				●												
	Burning practices						●										
	Review priority								**Priority 1**		**Priority 2**		**Priority 3**		**Priority 4**		**Priority 5**
Landscape-scale trends	Environmental values		Baseline			●											
	Wood supply		Baseline	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Independent review of compliance monitoring	Review report					●					●					●	
Reporting and adaptive management	Annual Forum	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Program Evaluation						●					●					●

21 R1: Wildlife detection technology; R2: The Commission's koala study; R: Additional research priorities to be established.

1.3 Budget

At this stage, the program has funding committed for its first five years.

Based on the best available information at this time, it is estimated that it will cost approximately $2 million to undertake the first year of monitoring and establish the effectiveness monitoring. Following this, it is estimated that it will cost approximately $1.8 to $1.9 million annually to maintain the program's proposed monitoring strategies.

To meet these costs, FCNSW has committed $1.5 million annually for the effectiveness and trend monitoring components. This funding is from redirected staff costs that were used for pre-harvest surveys and water quality monitoring activities under the previous IFOA, which are no longer a requirement under the Coastal IFOA.

In addition, the EPA has allocated $2 million over five years from the NSW Waste and Environment Levy for the development and ongoing review and adaptive management of the program, as well as research projects and evaluation costs.

To establish trend monitoring, a cross-tenure plot network and remote sensing program will be established in the Coastal IFOA region, including in state forests, using a consistent methodology. This will be funded from two sources:

- the $7.2 million announced by DPI in the 2018/19 budget and allocated to the NSW FMIP
- FCNSW annual $1.5 million commitment for Coastal IFOA monitoring strategies will also be used as part of trend monitoring.

Wood supply baselines could also be established using existing funding to the Commission to independently verify wood supply as part of its proposed old growth reassessment methodology.

Table 5 shows the budget for each monitoring component of the evaluation framework in the first five years.

Table 5: Indicative budget to deliver the evaluation framework over five years

Component	Indicative total value	Funds sourced from
Effectiveness monitoring	$8.8 million	▪ $1.3 million – EPA ▪ $7.5 million – FCNSW[22]
Trend monitoring (environmental values and wood supply)	To be confirmed – under design as part of a cross-tenure, state-wide program	▪ NSW FMIP ▪ FCNSW ▪ Commission funds from wood supply verification
Compliance monitoring	$0.2 million	▪ EPA
Adaptive management	$0.5 million	▪ EPA

[22] Includes components from the monitoring program used in landscape-scale trend monitoring.

1.4 Roles and responsibilities

1.4.1 Steering Committee

The terms of reference for the NSW FMIP requires the Commission to establish and independently chair a cross-agency Steering Committee to oversee the design, implementation, review and continuous improvement of the NSW FMIP. In relation to the Coastal IFOA Monitoring Program, the Steering Committee must:

- ensure the program meets the requirements in Condition 38.3 of Protocol 38 of the Coastal IFOA (see **Table 9**)
- oversee the implementation of the program
- review the effectiveness of the program and inform necessary amendments to ensure it is progressing and providing scientifically robust results
- review and analyse program data and provide expert scientific advice to the EPA, DPI and FCNSW
- engage with community, environment and industry stakeholders on the program.

1.4.2 Agencies

Under the Premier's terms of reference, the Commission has a role to independently oversee the NSW FMIP, including governance, design, direction, accountability and reporting.

The Coastal IFOA protocols identify specific agency roles and responsibilities.[23] For example, following approval of the program by EPA and DPI, FCNSW must:

- implement and comply with the program as per Coastal IFOA requirements
- contribute to adaptive management of the Coastal IFOA in response to relevant program findings and Steering Committee recommendations
- participate in public consultation processes associated with the program.

Delivery of the program is a cross-agency responsibility through the Steering Committee. It is the responsibility of all agencies to report and share data to the Steering Committee so it can adequately evaluate, report and provide adaptive management recommendations.

1.5 Linking with other programs

The Coastal IFOA protocols require the monitoring program to link to other relevant NSW Government programs and reviews related to the monitoring and management of state forests and the broader NSW forest estate.[24] **Table 10** in **Section 4.2** identifies relevant programs and reviews as part of the monitoring strategies.

23 NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Protocols*. Chapter 8, Protocol 38. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1178-coastal-ifoa-protocols.pdf.

24 *Ibid*, Protocol 38.1(1)(g).

1.6 Community and stakeholder engagement

The community and environment and industry stakeholders will be engaged on the program's design and implementation, as well as during review and adaptation processes. Stakeholders will be kept informed and given opportunities to provide feedback as more detailed monitoring approaches and methodologies are developed for each of the monitoring strategies proposed for the program. The timing and details of these opportunities are outlined in **Table 6**.

Stakeholders will also be invited to annual forums – a requirement of the Coastal IFOA protocols – to jointly review the findings of the program and implications for forest management in NSW.[25]

Details of current and upcoming engagement opportunities can be found on the Commission's website: https://www.nrc.nsw.gov.au/forest-monitoring.

Table 6: Key engagement opportunities

Subject	Details	Timeframe
Annual monitoring performance reviews	Online paper and forum	Annually every September, from September 2020
Major review	Online paper, submissions and forum	2024

1.7 Next steps

Following adoption of this program, a detailed monitoring plan will be developed. The key steps and timing of this process are as follows:

- Evaluation of existing species management plans – c**ommenced and ongoing**.
- Development of new species management plans by FCNSW – **commencing late 2019**.
- Detailed design of monitoring strategies – **commencing late 2019 (subject to EPA and DPI approval)**.
- Commencement of monitoring – **mid-2020**.

[25] *Ibid*, Protocol 38.4(1).

Have your say on the draft Coastal IFOA Monitoring Program

The Commission invites submissions regarding **this program** from all interested parties. Feedback will be considered when the Steering Committee finalises the program that will be presented to the EPA and DPI for approval in **November 2019**.

Have your say

There is no standard format for submissions. Submissions may range from a short letter outlining your views on a particular aspect of the proposed Monitoring Program, to a more comprehensive document covering a range of issues. The Commission is particularly keen to understand:

- Is the proposed Monitoring Program asking the right evaluation and monitoring questions? How can they be improved?
- Are the broad monitoring strategies, and their indicative design heading in the right direction? How can they be improved?
- Are there other priority issues the Program should focus on?
- What are the priorities for the detailed design of the monitoring strategies?

Regarding privacy and publication of submissions, please note that:

- all submissions, including those marked confidential, will be shared with the Steering Committee
- all submissions will be made public on the Commission's website unless they are clearly marked as confidential or contain material that is defamatory, offensive or in breach of any law
- your name will be published along with your submission on the Commission's website unless you clearly indicate in the submission that you would like your name withheld from the published version
- the Commission's privacy policy is available in full online at: www.nrc.nsw.gov.au/privacy.

Submissions close **5 pm AEDT Friday 8 November 2019**

Submissions can be made via email or mail.

Email: nrc@nrc.nsw.gov.au

Mail: Coastal IFOA Monitoring Program
Natural Resources Commission
GPO Box 5341
Sydney NSW 2001

If you have further questions please contact the Commission on **(02) 9228 4844**.

2 Introduction

2.1 The Coastal IFOA

The Coastal IFOA is an agreement between the NSW Minister for Energy and Environment and the Minister for Regional NSW, Industry and Trade. It guides native timber harvesting operations on NSW state forests and Crown timber land.[26]

The Coastal IFOA commenced on 16 November 2018,[27] consolidating four previous approvals into a single approval covering the Eden, Southern, Upper North East and Lower North East coastal regions of NSW (see **Figure 1**).

The Coastal IFOA aims to balance the on-going protection of threatened species, water, soil and sustainable timber supply by ensuring forestry operations are carried out:

- in accordance with the principles of ecologically sustainable forest management
- in a manner that integrates the regulatory regimes for environmental planning, assessment and protection, and biodiversity and threatened species conservation.

The Coastal IFOA is comprised of objectives, outcomes statements, conditions and protocols. As an outcomes-based licence, the Coastal IFOA identifies high-level objectives and outcome statements. These are not enforceable requirements but are meant to clarify the intent of the Coastal IFOA's conditions and guide its implementation.

The Coastal IFOA's conditions set mandatory actions and controls for protecting threatened plants and animals, habitats, soils and water. The conditions are supported by protocols, which set out additional enforceable actions and controls to support the effective implementation of the Coastal IFOA.

Forestry operations that are compliant with Coastal IFOA conditions are expected to achieve its outcomes and objectives. However, it is important to test this assumption by monitoring and evaluating the effectiveness of the conditions. The Coastal IFOA requires that the effectiveness of the approval in meeting objectives and outcomes is assessed through an ongoing monitoring, evaluation, reporting and improvement framework, within available resources.[28]

Full details of the Coastal IFOA's objectives, outcomes statements, conditions and protocols can be found at: https://www.epa.nsw.gov.au/your-environment/native-forestry/integrated-forestry-operations-approvals/coastal-ifoa.

26 The Coastal IFOA applies to **native timber forests on state forests and crown timber lands** within the region indicated in **Figure 1**. It does not apply to soft or hardwood plantations or forestry activities on other tenures (for example, private native forestry).

27 When it was signed by the then Minster for the Environment and the Minister for Lands and Forestry.

28 NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Conditions.* Chapter 1, Division 3. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1177-coastal-ifoa-conditions.pdf.

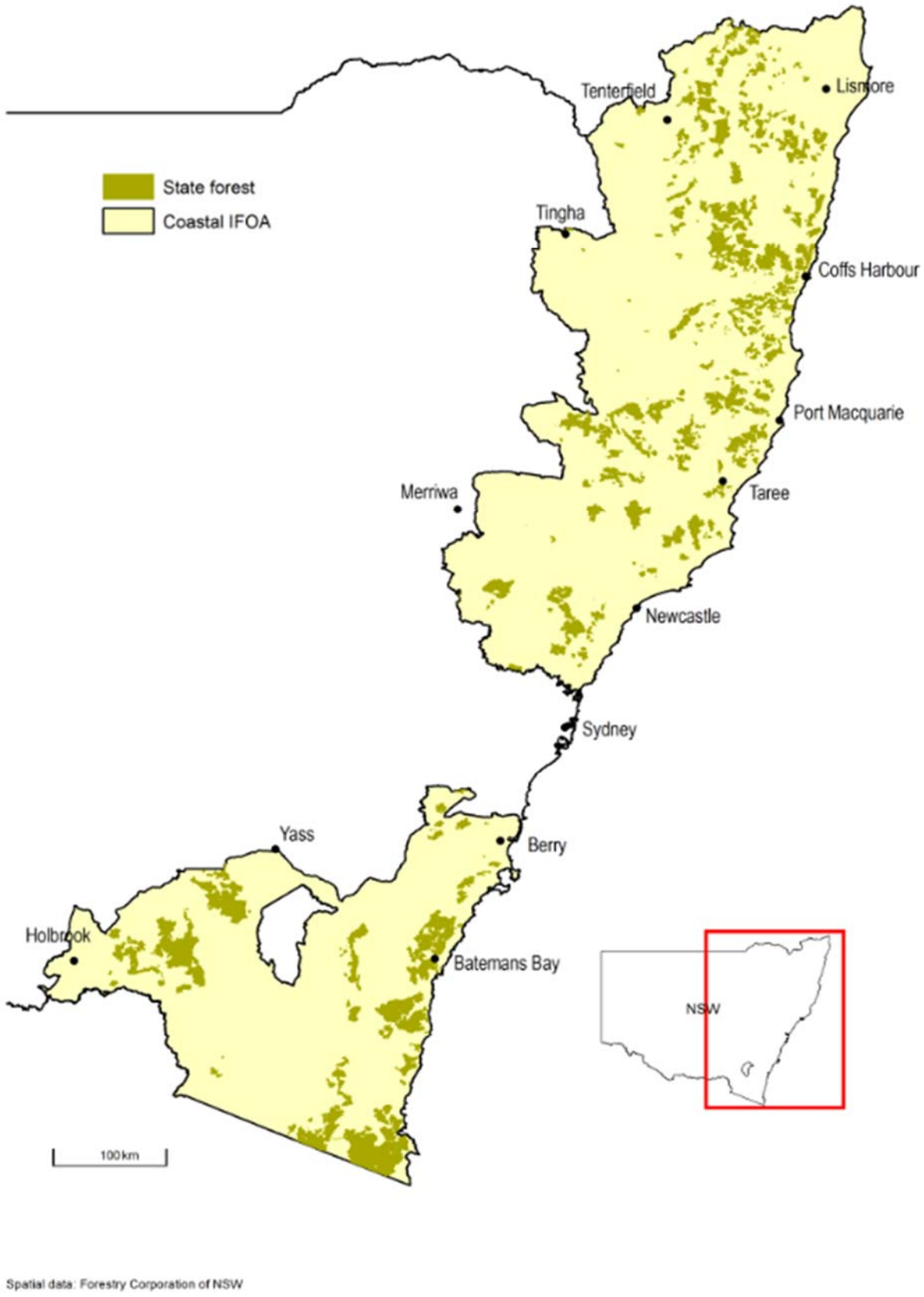

Figure 1: The Coastal IFOA region

2.2 NSW Forest Monitoring and Improvement Program

The NSW Government has established the NSW FMIP. The NSW FMIP is a cross-tenure program that will lead and coordinate monitoring, evaluation and research for improved forest management on public and private land, including national parks, state forests and private native forestry areas. The program outlined in this report will contribute to and draw on information from the NSW FMIP.

The NSW FMIP will determine whether current forest management approaches – including IFOAs – are working and support evidence-based adaptive management. It will also consider whether the NSW Government is on track to achieve its commitment to ecologically sustainable forest management under the NSW Forest Management Framework.[29]

The Premier has asked the Commission to independently oversee the design and implementation of the NSW FMIP and this process is currently underway. The Commission will work with the Steering Committee, which includes agency representatives and independent scientific experts, to guide the development and implementation of monitoring, evaluation, and research plans under the NSW FMIP.

2.3 NSW Forest Monitoring Steering Committee

The Steering Committee is independently chaired by the Commission. It consists of NSW government agencies that are responsible for natural resources and environmental policy, regulation, delivery and science, as well as agencies with a direct role in forest management. It includes:

- Department of Planning, Industry and Environment (including DPI, EES and Crown Lands)
- EPA
- Department of Premier and Cabinet (including Aboriginal Affairs and Heritage)
- Local Land Services
- FCNSW.[30]

Four independent experts will advise the Steering Committee:

- **Professor Patrick Baker –** former Australian Research Council Future Fellow and School of Ecosystem and Forest Sciences, University of Melbourne.
- **Associate Professor Phillip Gibbons –** Fenner School of Environment and Society, Australian National University.
- **Associate Professor Jacki Schirmer –** Institute for Applied Ecology & Health Research Institute, University of Canberra.

[29] Ecologically sustainable forest management seeks to maintain or increase environmental, social, economic and cultural forest values across the NSW native forest estate for present and future generations (NSW Government (2018) *Overview of the Forest Management Framework*. p. 1. Available at: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/833792/Overview-of-the-NSW-Forest-Management-Framework.pdf).

[30] The Coastal IFOA requires FCNSW to participate in the Steering Committee (NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Protocols.* Chapter 8, Protocol 38(122.1). Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1178-coastal-ifoa-protocols.pdf.

- **Dr Peter Hairsine –** Centre for Water and Landscape Dynamics at the Fenner School of Environment and Society, Australian National University.

2.4 The Coastal IFOA Monitoring Program

The Coastal IFOA requires that that the effectiveness of its conditions and the extent to which its objectives and outcomes are achieved is continually monitored.[31] As part of the NSW FMIP, the Steering Committee was asked to propose a monitoring program for the Coastal IFOA.[32]

The program must be endorsed by the Steering Committee before being jointly approved by the Chief Environment Regulator of the EPA and the Deputy Director General of DPI.

The Steering Committee will continue to engage with the community and stakeholders on the development of detailed research and monitoring plans for each priority condition and monitoring question as they come online.[33]

This rest of this report provides initial information about the program, including the:

- relevant monitoring program outcomes, requirements and design principles (**Chapter 3**)
- proposed monitoring program (**Chapter 4**)
- priorities and next steps (**Chapter 5**).

31 Protocol 38, section 38.1(2)

32 Chapter 8 of the Coastal IFOA conditions specifically requires a monitoring steering committee to be established and chaired by the Natural Resources Commission (see condition 122.1)

33 Protocol 38.2(2)(e)

3 Program requirements and design principles

This chapter outlines the:

- Coastal IFOA objectives and outcomes the program will assess
- design requirements for the program under the Coastal IFOA
- design principles and aims under the NSW FMIP.

3.1 Objectives and outcomes the program will assess

The Coastal IFOA requires that:

> *Monitoring programs are applied at multiple landscape scales to ensure the ongoing effectiveness of the approval in delivering the objectives of the approval and outcome statements*[34]

Table 7 outlines the objectives that the program will assess. **Table 8** outlines the outcome statements that will be used to assess the performance of Coastal IFOA conditions. These objectives and outcomes have been defined within the Coastal IFOA and previously approved by the NSW Government.[35]

Table 7: Summary of Coastal IFOA objectives

Coastal IFOA objectives	
Overall objective	To authorise the carrying out of forestry operations: ▪ in accordance with the principles of ecologically sustainable forest management ▪ in a manner which integrates the regulatory regimes for: - environmental planning and assessment - the protection of the environment - threatened species conservation and biodiversity ▪ in accordance with the Coastal IFOA conditions and protocols, as applicable
Specific objectives	**Threatened species conservation and biodiversity** – to set out: ▪ the minimum measures required to be implemented to protect species, communities and their habitats from the impacts of forestry operations ▪ multi-scale protection measures that ensure sufficient and adequate habitat is provided at the site, local landscape area, and management zone scales ▪ measures for species or communities that require specific measures to ensure habitat is protected around known occurrences
	Protection of the environment – ensuring that practical measures are taken to protect the aquatic environment and waters from the impacts of water pollution caused by forestry operations

34 NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Conditions.* Chapter 8, Section 121.1. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1177-coastal-ifoa-conditions.pdf.

35 NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Conditions.* Chapter 1, Division 3. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1177-coastal-ifoa-conditions.pdf.

Coastal IFOA objectives	
	Threatened species under the *Fisheries Management Act 1994* – set out the minimum measures required to protect threatened species, populations, communities and habitats (as per the *Fisheries Management Act 1994*) from the impacts of forestry operations and associated activities
	All conditions – ensuring the ongoing monitoring, evaluation, reporting and improvement of the Coastal IFOA so that it is effective in achieving the objectives of the approval and relevant outcome statements

Table 8: Summary of outcome statements from the Coastal IFOA conditions

Outcome location	Outcome statement
Chapter 2 – Administrative conditions	
Division 1 – Registers	Transparent, accurate and comprehensive information and records of a forestry operation (and matters covered by the approval) are maintained and accessible
Chapter 3 – Planning conditions	
Division 1 - Local Landscape Areas	Landscape planning units (local landscape areas) are designed and implemented to deliver both conservation and ecological sustainable forest management outcomes
Division 2 – Distribution of harvesting across the landscape	Harvesting operations are distributed across the landscape and over time, to support a mosaic of forest age-classes and maintenance of forest structure in the operational area or local landscape area
Division 3 – Environmentally Significant Areas	Habitat and environmental features are identified and retained to provide refuge, connectivity, and to support forest regeneration
Division 4 – Operational Planning	Environmental features, habitat and risks are identified and site-specific protections and management practices are developed to mitigate the impact of the forestry operation
Chapter 4 – Operational planning and implementation	
Division 1 – Planning Assessments and surveys	Environmental features, habitat and risks are identified to ensure that protections and management actions are implemented to mitigate the impact of the forestry operation
Division 2 - Habitat Protection	Environmental features, habitat, landscapes and communities are identified, and protections are permanently established, to mitigate the impact of the forestry operation Woody debris is retained across operational areas to provide shelter and foraging habitat for native species to support their persistence
Division 3 – Retained Trees	Important trees are retained and protected for shelter and food resources for native species, and to support their persistence
Division 4 – Species-specific conditions for fauna	Site-specific measures are implemented to mitigate the impact of the forestry operation on fauna species and their habitat, and to support their persistence
Division 5 – Species-specific conditions for flora	Site-specific measures are implemented to mitigate the impact of the forestry operation on flora species and their habitat, and to support their persistence
Division 6 – Species management plans	Monitoring, management and protection measures are identified, planned and implemented for specific native species to support their persistence.

Outcome location	Outcome statement
Division 7 – Burning	Environmental features, habitat, landscapes and communities are maintained through the implementation of best management practices for pre-harvest burns and post-harvest burns
Chapter 5 – Operating conditions	
Division 2 – Management of Environmentally Significant Areas	Environmentally Significant Areas are protected during forestry operations to maintain their intended, specific environmental values
Division 3 – Riparian protection	Vegetation adjacent to drainage features and wetlands is protected, and groundcover is retained, to maintain water quality, stream stability, riparian habitat and contribute to habitat connectivity
Division 4 – Roads	Water quality, aquatic habitat and native fish movement are maintained through the implementation of best management practices for roads and road crossings
Division 5 - Tracks	Water quality, aquatic habitat and native fish movement are maintained through the implementation of best management practices for tracks and track crossings
Division 6 – General soil and water operating requirements	Water quality, aquatic habitat are protected through the implementation of best management practices Dust and waste are managed to minimise pollution around operational areas
Division 7 – Burning operations	Environmentally Significant Areas and important habitat are managed during burning operations to maintain their intended, specific environmental values and provide short-term refuge habitat
Chapter 6 – Mapping	
-	Accurate data layers for forestry operations are created, maintained, used and publicly available
Chapter 7 – Regeneration	
-	Harvested areas are adequately stocked with a natural floristic composition to maintain ecological function and sustainable timber supplies
Chapter 8 – Monitoring Conditions	
-	Monitoring programs are applied at multiple landscape scales to ensure the ongoing effectiveness of the approval in delivering the objectives of the approval and outcome statements

3.2 Design requirements under the Coastal IFOA

Table 9 outlines the requirements that the program must address under Protocol 38 of the Coastal IFOA.[36]

In addressing these requirements, Protocol 38 specifies that the design and timing of the program must consider available budget and resources. The proposed budget and funding sources for the program are outlined in **Chapter 1.3**.

Protocol 38 also includes other program requirements, including around reporting and adaptive management.

Table 9: Summary of Coastal IFOA requirements under Protocol 38

Protocol 38 requirements (38.3(1))
a) Monitor and evaluate the effectiveness of Coastal IFOA conditions, including but not limited to: i. the multi-scale landscape protections ii. drainage feature crossing and road conditions iii. riparian exclusion zones and ground protection zones on class 1 classified drainage lines iv. Exclusion zones for Coastal SEPP wetlands v. Effectiveness of soil and water protection in intensive harvesting forestry operations vi. Protecting and recruiting hollow-bearing trees vii. Koala conditions viii. Effectiveness of selective harvesting limits in achieving regeneration and stocking standards as measures of longer term regeneration ix. Maintaining sufficient levels of coarse woody debris
b) Establish a scientifically valid environmental and wood supply baseline to track and evaluate the effectiveness or impacts of the Coastal IFOA on the maintenance of environmental values and woody supply
c) Provide environmental trend monitoring at the landscape scale, including but not limited to: i. water quality monitoring ii. forest regeneration iii. biodiversity trend monitoring
d) Provide species-specific monitoring, including but not limited to those management plans listed in Protocol 21: Species management plan
e) Provide species-specific monitoring for other species which require monitoring under existing programs related to the monitoring of threatened flora
f) Meet Principles of ecologically sustainable forest management under the NSW Regional Forest Agreements
g) Provide linkages to other relevant NSW Government programs and/or review related to the monitoring of State Forest management and the NSW forest estate, including but not limited to: i. NSW Report on Native Vegetation (Department of Planning, Industry and Environment) ii. Saving our Species (Department of Planning, Industry and Environment) iii. Department of Primary Industries – Fisheries Strategic Research Plan 2014-2018 (Department of Primary Industries – Fisheries) iv. NSW Regional Forest Agreements v. AdaptNSW (Department of Planning, Industry and Environment) vi. Department of Primary Industries – Forest monitoring program (Department of Primary Industries – Fisheries)

[36] NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Protocols.* Chapter 8, Protocol 38. Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1178-coastal-ifoa-protocols.pdf.

3.3 Design principles and aims

The program design principles and aims are guided by the design principles and aims of the NSW FMIP.[37]

The NSW FMIP program aims are to:

- focus on the information required to improve the adaptive management of NSW forests
- be cost-effective by employing efficient mechanisms to meet program objectives
- be adaptable to changes in both research priorities and forest monitoring methods
- satisfy the NSW Government's obligations to national and international forest management reporting
- provide the public with transparent, independent, accessible and robust evidence of forest management performance.

3.4 NSW Government Open Data Policy

To satisfy the program's aim to provide the public with transparent, independent and accessible information, the program will comply with the NSW Government Open Data Policy.[38]
The objectives of this policy are to:

- release data for use by the community, researchers, businesses and industry
- accelerate the use of data to derive new insights for better public services
- embed open data into business-as-usual
- use data to inform the design of policy, programs and procurement
- support the use of data by the NSW Data Analytics Centre for research and evidence-based decision making
- advance citizen engagement with the NSW Government and the work of government
- support the *Government Information (Public Access) Act 2009* (GIPA Act) and promote simple and efficient compliance with the requirements set out in that Act.

[37] Natural Resources Commission (2019) *NSW Forest Monitoring and Improvement Program Strategy – Draft for consultation,* prepared for the FMIP Steering Committee.

[38] NSW Government (2019) *NSW Open Data Policy.* Available at: https://www.digital.nsw.gov.au/policy/data-information/making-data-open/nsw-open-data-policy.

4 Proposed Coastal IFOA Monitoring Program

This chapter presents the overarching framework for the program and how it will assess the effectiveness of the Coastal IFOA. It includes further detail about the four components of the program introduced in **Chapter 1**, which are:

- effectiveness monitoring
- trend monitoring
- compliance monitoring
- adaptive management.

4.1 The overarching framework

This program will answer four overarching questions:

- **Effectiveness monitoring –** are the Coastal IFOA conditions effectively meeting its objectives and outcomes?
- **Trend monitoring –** is the Coastal IFOA having a neutral, positive or negative impact on landscape-scale environmental values or wood supply?
- **Compliance monitoring –** are forestry operations carried out in accordance with the Coastal IFOA?
- **Adaptive management –** can Coastal IFOA conditions, forestry operations, forestry management or monitoring be improved to better meet objectives and outcomes?

These overarching questions are interrelated and information collected to answer one question may also help answer other questions. For example, in order to assess whether a condition needs to be changed based on poor achievement of outcomes, it is important to understand whether:

- the condition is being implemented as intended or if poor compliance is affecting outcomes
- poor outcomes are due to other factors across the landscape, unrelated to the Coastal IFOA.

4.2 Effectiveness monitoring

This is the primary focus of this program. This component has nine monitoring strategies that reflect priority monitoring activities. These strategies are shown in **Table 10**. Information from these strategies will also inform the assessment of landscape-scale trends (**Section 4.3**), compliance (**Section 4.4**) and adaptive management (**Section 4.5**).

Given the high costs associated with monitoring and the limited resources available for the program, these strategies were selected through a strategic, risk-based prioritisation process in order to make the best use of available resources.[39]

[39] This aligns with the requirements of Protocol 38 in the Coastal IFOA (see **Chapter 3.2**) and the aims of the NSW FMIP related to cost-effectiveness and efficiency (see **Chapter 3.3**).

The prioritisation process was undertaken by the program's technical working group, in collaboration with the CSIRO Conservation Decisions Team. This was a structured, transparent and justifiable process that identified an optimal set of priority monitoring activities. **Attachments 1 to 5** provide details of this process. The process considered the design principles of the NSW FMIP and prioritised monitoring activities based on their ability to:

- support informed decision-making and improved forest management practices
- deliver cost-effective monitoring
- meet the requirements of the Coastal IFOA under Protocol 38 and the Premier's terms of reference
- meet the aims and good practice principles of the NSW FMIP.

Each monitoring strategy is guided by a set of monitoring questions that are considered most useful for decision-makers and forest managers.

The strategies have been designed to minimise duplication across the program and increase cost-effectiveness. In some cases, multiple risks are addressed under a single monitoring question and multiple monitoring questions are captured within one monitoring strategy.

Baselines will be established using information collected in the first year of the program and will be used to assess ongoing effectiveness and trends under the Coastal IFOA.[40] Protocol 38 of the Coastal IFOA outlines that the baselines may contain – but are not limited to – measures of:

- biodiversity
- water quality
- forest regeneration.

More detailed design of the strategies (including methods and locations of monitoring) will occur following the program's approval. As part of the detailed design, performance benchmarks will be set against which the performance of the monitoring strategies will be tracked as part of the program's adaptive management. Where benchmarks are not met, this may trigger changes to conditions or the way conditions are monitored.

Stakeholders will be given the opportunity to provide feedback on the detailed design of the strategies. Information on this process is available on the Commission's website: https://www.nrc.nsw.gov.au/forest-monitoring.

[40] Baselines may need to be adjusted if year one is found not to be representative.

Table 10: Summary of proposed monitoring strategies program design

Monitoring strategy	Monitoring questions	Program design	Proposed sampling density and frequency	Links to existing or proposed programs	Indicative cost	Responsible party	Oversight, annual review and reporting
Monitoring regenerating forests	▪ Are the conditions effective in ensuring regenerating forests meet benchmarks for: (i) floristic composition (ii) forest structure (iii) coarse woody debris? ▪ Are the conditions and practices effectively managing risks of invasive flora species in regenerating forests? ▪ Are the conditions affecting commitments to meet wood supply? ▪ Are the conditions likely to promote regeneration that sustains timber supply?	▪ Monitor a permanent, cross-tenure plot network covering the Coastal IFOA area (including state forests) ▪ Use floristic composition[41], forest structure and coarse woody debris benchmarks, established for each vegetation class and forest age-class ▪ Use sampling methods consistent with cross-tenure, state-wide monitoring plot network and following agreed protocols and conventions	▪ Approximately 50-100 plots per region ▪ Systematic spacing of 5 kilometres ▪ Plot density may be higher in intensive harvesting and alternate coupe harvesting areas	▪ State-wide forest monitoring program ▪ Passive Acoustic Monitoring Program ▪ NSW Report on Native Vegetation	▪ $400k first-year establish-ment ▪ $ 350k annual	▪ FCNSW ▪ EES ▪ DPI – Forest Science	▪ Steering Committee ▪ Commission

41 Recognising that that floristic composition of forest will adapt to changes in climate.

Monitoring strategy	Monitoring questions	Program design	Proposed sampling density and frequency	Links to existing or proposed programs	Indicative cost	Responsible party	Oversight, annual review and reporting
Monitoring forest structure and health	▪ Do harvesting conditions establish an appropriate mosaic of forest age classes at the landscape scale? ▪ Are the conditions maintaining functional connectivity for focal fauna species to move within and across the forest? ▪ To what extent are the conditions effectively managing the risk of new or existing areas subject to dieback?	▪ Establish benchmarks for landscape heterogeneity (age class, structure) ▪ Analyse remote sensing data, LiDAR and multispectral imagery consistent with the approach used in the state-wide monitoring program	▪ Five-year rotating group of plots (20 percent of plots sampled annually) ▪ Spatial data reviewed every five years	▪ State-wide forest monitoring program ▪ Wood supply monitoring	▪ $250k first-year establish-ment ▪ $200k annual ▪ Does not include spatial data purchase and storage costs	▪ FCNSW ▪ EES ▪ DPI – Forest Science	▪ Steering Committee ▪ Commission
Monitoring key habitat features	▪ To what extent do retained habitat features maintain their function?[42]	▪ Monitor a representative sample of key habitat features identified and conserved through strategic and operational planning processes ▪ Monitor persistence and use of key habitat features ▪ Use hollow inspection, camera trapping and hair trapping	▪ 50-100 habitat features per region annually ▪ Stratified – in clumps, Environmentally Significant Areas and harvest area	▪ Saving our Species	▪ $250k first-year establish-ment ▪ $200k annual	▪ FCNSW	▪ Steering Committee ▪ Commission

42 Habitat features can include hollows, winter flowering trees and feed trees.

Monitoring strategy	Monitoring questions	Program design	Proposed sampling density and frequency	Links to existing or proposed programs	Indicative cost	Responsible party	Oversight, annual review and reporting
Monitoring species occupancy	▪ To what extent do the Coastal IFOA conditions maintain species occupancy in the landscape?[43] ▪ To what extent do the conditions maintain the population status of focal species?	▪ Use passive sensors ▪ Use automated data collection and species detection methods, including for koalas, forest owls and frogs ▪ Continually update species call libraries ▪ Reanalyse historical data	▪ Uses the permanent plot network ▪ Five-year rotating group of plots (20 percent of plots sampled annually) ▪ Spatial data reviewed every five years	▪ Saving our Species	▪ $350k first-year establish-ment (including additional equipment purchases ▪ $200k annual	▪ FCNSW ▪ DPI – Forest Science	▪ Steering Committee ▪ Commission
Species-specific monitoring – fauna	▪ To what extent do the Coastal IFOA conditions maintain fauna species viability in the landscape? ▪ To what extent are the species-specific management plans effective in maintaining the viability of that species?	▪ Approach will be species-dependent but will be consistent with the monitoring requirements of any relevant species management plan, if applicable	▪ Dependant on the species ▪ Consistent with the monitoring requirements of the Species Management Plan, if applicable	▪ Saving our Species ▪ Passive Acoustic Monitoring Program ▪ Monitoring key habitat features (under this program) ▪ National programs, for example Flying Fox and Eastern Bristle Bird	▪ Existing program ▪ $200k annual	▪ FCNSW ▪ DPI – Forest Science	▪ Steering Committee ▪ Commission

43 For the purpose of effectiveness monitoring, landscape only refers to state forests within the Coastal IFOA.

Monitoring strategy	Monitoring questions	Program design	Proposed sampling density and frequency	Links to existing or proposed programs	Indicative cost	Responsible party	Oversight, annual review and reporting
Species-specific monitoring – flora	▪ To what extent do the Coastal IFOA conditions maintain flora species viability in the landscape? ▪ To what extent are the species-specific management plans effective in maintaining the viability of that species?	▪ Approach will be species-dependent but will be consistent with the monitoring requirements of any relevant species management plan, if applicable	▪ Dependant on the species ▪ Consistent with the monitoring requirements of the Species Management Plan	▪ Saving our Species	▪ $100k annual	▪ FCNSW	▪ Steering Committee ▪ Commission
Catchment-based waterway health monitoring	▪ To what extent are the soil and water conditions effective in minimising the impact of harvesting and roading on waterway condition ▪ Are the exclusion zone conditions for class 1 classified drainage lines effective in minimising the impact on waterway condition? ▪ Are the exclusion zone conditions effective in reducing the impact of forestry operations on Coastal SEPP wetlands?	▪ Evaluate learnings from the existing long-term replicated paired catchment experiments at Yambulla and Karuah ▪ Undertake macroinvertebrate or environmental DNA sampling on large river systems flowing out of state forests ▪ Establish a before-after-control-impact site on the north coast in the intensive zone ▪ Undertake flood scenario modelling	▪ Water quality, water yield ▪ Macroinvertebrate sampling twice annually for two years prior impact to create baseline and then twice annually after impact ▪ Review and update studies into exclusion zones around class 1 streams	▪ WaterNSW river health data ▪ State-wide forest monitoring program ▪ Catchment-based waterway health monitoring	▪ Evaluation of existing programs at Yambulla and Karuah ▪ $300k annual	▪ FCNSW	▪ Steering Committee ▪ Commission

Monitoring strategy	Monitoring questions	Program design	Proposed sampling density and frequency	Links to existing or proposed programs	Indicative cost	Responsible party	Oversight, annual review and reporting
Research program	▪ How are koalas responding to koala conditions, including tree retention rates and size? ▪ Can technology improve the probability of detection for a range of species in forestry operations?	▪ Commissioned research to be performed by research institutions and/or agencies ▪ Design will depend on the nature of the research ▪ Design will be peer reviewed ▪ Further research priorities will be developed and adopted throughout the monitoring program ▪ Note: the Commission is currently overseeing an independent research program on koala response to regeneration harvesting on NSW north coast state forests. The program investigates koala density and diet and the nutritional value of its habitat	▪ Dependant on the nature of the research ▪ Experimental design peer reviewed	▪ The Commission's koala research project ▪ Further research priorities will be developed and adopted through the life of the monitoring program	▪ $200k annually for first four years	▪ Commission	▪ Steering Committee ▪ Commission

Monitoring strategy	Monitoring questions	Program design	Proposed sampling density and frequency	Links to existing or proposed programs	Indicative cost	Responsible party	Oversight, annual review and reporting
Independent evaluation of forestry practice	▪ Is pre- and post-harvesting burning maintaining the function of key habitat features? ▪ Are drainage feature crossings and road features effectively designed and maintained to reduce the impact of forestry operations on waterway condition? ▪ Are the species and habitat survey and modelling conditions and practices effective?	▪ Independently evaluate the effectiveness of the planning and implementation of forestry operations and forest management practices[44] **Priority evaluation themes[45]** ▪ Pre- and post-harvesting burning ▪ Roading and drainage features ▪ Species and habitat surveys and modelling	▪ Evaluation will occur once prior to the five-year review	▪ None	$200k in the first four years	▪ Steering Committee	▪ Steering Committee ▪ Commission

44 FCNSW currently has its practices independently certified to the Sustainable Forest Management Standard (Responsible Wood).
45 Priority themes were derived from a strategic and risk-based prioritisation process, which is detailed in **Attachment 1**.

4.3 Trends

The Coastal IFOA protocols require the program to assess landscape-scale trends across a range of variables, including biodiversity, water quality and forest regeneration.[46] This will help evaluate whether the Coastal IFOA is leading to changed environmental values or wood supply.

Landscape-scale baselines for environmental values and wood supply will be established to determine trends, in addition to the effectiveness monitoring baselines established under the monitoring strategies set out in **Section 4.2**. These baselines will meet the requirements of the Coastal IFOA protocols and indicate whether the Coastal IFOA conditions are affecting environmental values or leading to changes in wood supply from native hardwood forests over time.

The assessment will use landscape-scale monitoring programs and data from the program's nine monitoring strategies. Data on areas outside the Coastal IFOA area will be collected from the cross-tenure, state-wide forest monitoring plot network to assess how forests in the Coastal IFOA region are changing in comparison to forests on other tenures.[47] Data will also be used from other programs, such as the NSW Report on Native Vegetation (**Section 4.2**).

The monitoring of state forests under this program component will use the same plot design used for forest monitoring on other tenures. This means forest management under the Coastal IFOA can be compared with forest management on the national parks estate, Crown land, private land and other state forests. This will help determine if changes to environmental values and wood supply can be attributed to the Coastal IFOA conditions or if external factors are also affecting environmental values and wood supply on other tenures.

Identification of baselines and relevant monitoring activities to support the trend monitoring component is discussed further in the following sections, **Section 4.3.1** (environmental values) and **Section 4.3.2** (wood supply).

4.3.1 Monitoring trends in environmental values

Defining landscape scales for environmental values

To assess landscape-scale trends in environmental values, the appropriate scale for analysis needs to be defined. **Figure 2** shows the scales at which environmental values can be assessed in a landscape context, including:

- Management zones
- Regional Forest Agreement/former IFOA regions
- North Coast/South Coast NSW geographic regions
- Coastal IFOA region.

46 NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Protocols*. Chapter 8, Protocol 38.3(1)(c). Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1178-coastal-ifoa-protocols.pdf.

47 This is in line with the NSW Forestry Industry Roadmap commitment to undertake 'transparent environmental and regeneration monitoring of state forests to determine the effectiveness of the IFOAs at achieving their objectives, within the framework of a broader landscape monitoring program across tenures'.

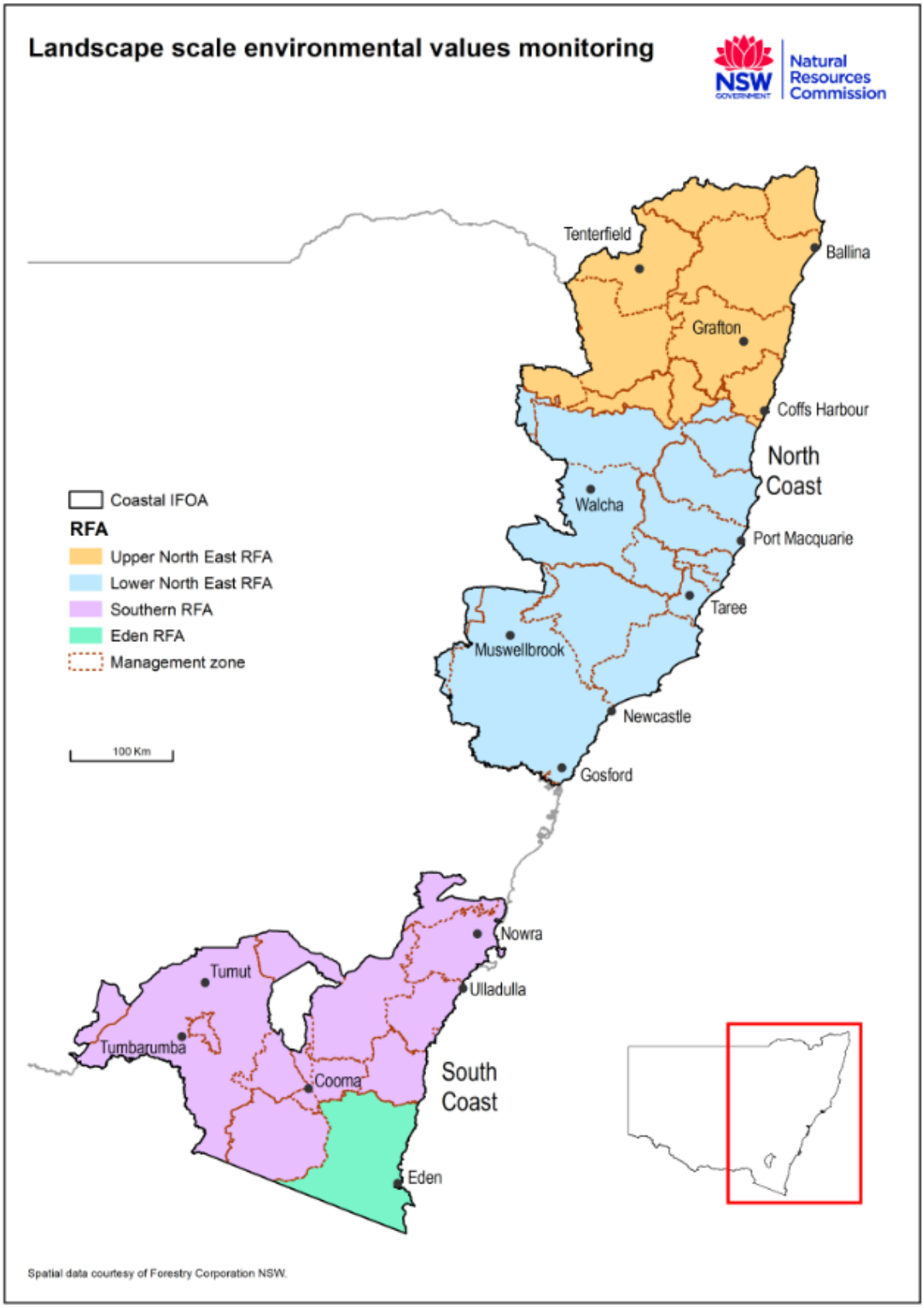

Figure 2: Types of landscape scales to assess trends in environmental values

Establishing baselines for trends in environmental values

Establishing baselines for trends in environmental values is difficult, as landscape-scale systems are dynamic and change in response to many factors, such as drought.

Baselines for environmental values will provide a starting point from which the impacts of the Coastal IFOA conditions across the landscape can be assessed. Protocol 38 of the Coastal IFOA outlines that the baselines may contain – but are not limited to – measures of:

- biodiversity[48]
- water quality
- forest regeneration.

These measures align with the four monitoring streams developed as part of the risk-based prioritisation process outlined in **Attachments 1 to 5**.[49]

Table 11 describes the baselines that will be used in this program.

Table 11: Proposed baselines for environmental values

Baseline	Description
Coastal IFOA Conditions (2019 baseline – ongoing)	Baseline will be from the commencement of the Coastal IFOA for variables used to assess the effectiveness of its conditions (see **Section 1.1.1**) **Attachments 1 to 5** provide further detail on how each monitoring question is used to monitor biodiversity, water quality and forest regeneration trends Data collected as part of landscape-scale monitoring strategies will be used for both the effectiveness and trend monitoring components of the program Trend monitoring will also be part of state-wide, cross-tenure monitoring through the state-wide monitoring plot network.
Historical trends (1999 – ongoing)	Historical trends will be based on the datasets from the Comprehensive Regional Assessment undertaken in 1999 that are comparable with current datasets[50] This will be a reference point from which the trajectory of environmental values will be tracked These will identify longer-term temporal trends in environmental values up to the commencement of the Coastal IFOA and will be used to assess how the Coastal IFOA affects these values

48 Comprised of two parts – 1) ecological function and habitat connectivity and 2) native species presence.

49 The monitoring streams are – 1) ecological function and habitat connectivity, 2) native species presence, 3) forest regeneration and forest structure and 4) aquatic habitat and water quality. Streams 1 and 2 would inform assessments of biodiversity as part of the assessment of trends in environmental values.

50 Note: Datasets from the Comprehensive Regional Assessment will only be used if they are comparable to current datasets. The Commission also notes that older datasets are likely to be at a coarser scale to current datasets and will be used to give a broad indication of trends. Since the Comprehensive Regional Assessment technology, data collection methods and means of recording results have improved.

4.3.2 Monitoring trends in wood supply

Defining landscape scales for wood supply

Figure 3 shows the different landscape-scales at which wood supply trends will be assessed, including:

- Supply zone
- Regional Forest Agreement/former IFOA regions
- North Coast/South Coast NSW geographic regions
- Coastal IFOA.

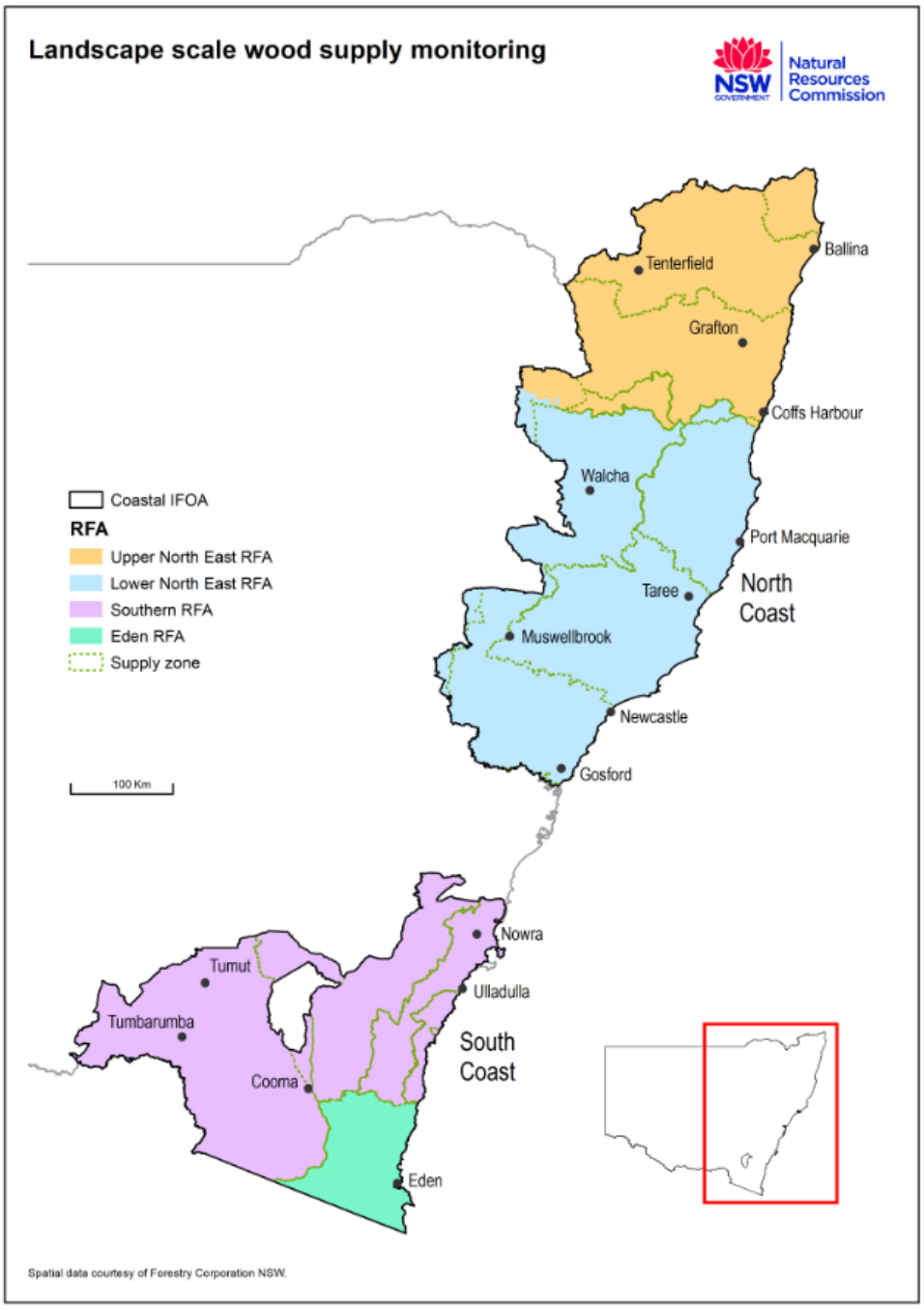

Figure 3: Types of landscape scales for wood supply trend monitoring

Establishing wood supply baselines

Like the environmental values baselines, multiple baselines are required to assess trends in wood supply. **Table 12** gives and overview of the proposed baselines.

Table 12: Proposed wood supply trend monitoring baselines

Baseline	Description
Modelled (2019 – ongoing)	This assesses the modelled sustainable yield volumes[51] under the Coastal IFOA A baseline will be established as modelled wood supply under the previous IFOA conditions This allows actual wood supply under the Coastal IFOA to be compared with the wood supply that would be expected if the Coastal IFOA had not been implemented
Actual yield (2003 – 2019 then ongoing)	This baseline will reflect actual yields every year from 2003[52] and will continue to monitor actual yields going forward This is based on 2003 harvest volumes to identify longer-term trends in wood supply Actual yield will need to be tracked over several years to accurately assess the impact of the Coastal IFOA on actual volumes and test wood supply models, as annual wood supply can vary due to weather and market conditions, and the Coastal IFOA allows annual harvest volumes to vary by up to 25 percent from annual limits[53]

Assessing wood supply against the modelled baseline

Modelled volume yields of native hardwood forest wood supply will be assessed against the baseline identified in **Table 12** using the following metrics:

- log grade and size (high quality large and high quality small)
- species or species grouping
- supply zone and price zone
- average distance between harvest and supply nodes
- period (over 100 years).

The modelled baseline requires an estimate of the volume of wood that would have been sustainably supplied to maintain wood supply agreements if the Coastal IFOA was not implemented. To do this a strategic-scale modelling assessment and a tactical-scale field assessment will be undertaken:

- **Strategic-scale modelling:** This uses FCNSW's Forest Resource and Management Evaluation System (FRAMES). It quantifies wood supply under previous IFOA settings at the regional and sub-regional scales, such as price or supply zones.

51 As reported in DPI (2018) *Sustainable yield in New South Wales Regional Forest Agreement Regions*. Available at: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/842098/sustainable-yield-in-NSW-RFA-regions.pdf.

52 FCNSW reports on actual versus predicted yield as part of reporting to the Australian Government on the Regional Forest Agreements. Actual yield figures from this process will be used as part of trend monitoring.

53 Under the Coastal IFOA, FCNSW is allowed to overcut and undercut their annual limits by up to 25 percent. However, to be in line with sustainable yield, the average yield over 20 years must not exceed the annual limits.

- **Tactical-scale field assessment:** This involves the field validation of strategic-scale modelling results under previous IFOA settings at the local landscape area and compartment scales. It identifies compartments that would have been selected under a multi-year plan of harvesting operations for previous IFOA settings and applies the first four or five years of yield data (wood volumes) from the baseline supply model.

Assessing wood supply against the actual yield baseline

The actual yield baseline will be established based on the mean average actual yields harvested over time from coastal state forests from 2003[54] until the inception of the Coastal IFOA in 2018. Volume metrics for this assessment will include:

- log grade and size
- species or species grouping.

4.4 Compliance

Compliance monitoring determines whether forestry operations are being carried out in accordance with the Coastal IFOA conditions. Understanding the extent to which conditions are complied with is an important part of assessing their effectiveness.

Compliance monitoring for the Coastal IFOA is managed by the EPA and FCNSW must report on compliance with the Coastal IFOA conditions annually. This program will use compliance monitoring data from these agencies.

Table 13 shows the types of questions that will guide the program's assessment of compliance.

Table 13: Questions to guide the compliance monitoring action

	Question	Purpose
1	**Which conditions have or haven't been met?**	▪ Understand where outcomes are likely to be adversely affected by non-compliance ▪ Identify and address high-risk conditions that are likely to be generating poor outcomes
2	**What are the reasons for non-compliance?**	▪ Understand why conditions and protocols are not being implemented ▪ Explore whether there are inherent flaws in the design of the conditions and protocols that are resulting in non-compliance and need to be addressed
3	**Are there any challenges monitoring compliance with the Coastal IFOA?**	▪ Understand if there are systemic or underlying issues that will lead to knowledge gaps around compliance and performance that will undermine evaluation of Coastal IFOA effectiveness

54 This is the first year for which harvest volumes from the whole Coastal IFOA region is available.

4.5 Adaptive management

The Coastal IFOA requires the program to review the results of monitoring and evaluation activities and recommend necessary changes to the Coastal IFOA – including to the program itself – including changes to:

- IFOA conditions or supporting protocols
- underlying management practices.

Adaptive management of the Coastal IFOA will be based on the evidence collected through the program. It will be underpinned by key performance indicators for each monitoring question based on what that question is aiming to achieve, thresholds to trigger changes to management and expected changes to management as a result of trigger thresholds being reached. These will be developed during the detailed design of the monitoring strategies and there will be opportunities for stakeholder input.

Table 14 shows the adaptive management opportunities under Protocol 38.4 of the Coastal IFOA, including the review and adaptation of this program and recommendations for changes to the Coastal IFOA itself.

Informal annual reviews linked to annual forums will be complemented by formal reviews held every five years, starting in 2024. Stakeholders will have a chance to participate in adaptive management through the annual forums (see **Section 1.6**).

Table 14: Key adaptive management opportunities

Timing	Opportunity	By who	To who
Annual	3 Emerging results from the program 4 Recommended changes to the Coastal IFOA (if any)	▪ Overseen by Steering Committee ▪ Open annual forums with experts, researchers and community	▪ EPA ▪ DPI ▪ Community through public reporting[55]
Five-yearly	5 Detailed results from the program, including trends 6 Recommended changes to the Coastal IFOA (if any)	▪ Overseen by Steering Committee	▪ EPA ▪ DPI ▪ Community through public reporting[56]

55 Available on the EPA website or other location approved by the EPA.
56 Available on the EPA website or other location approved by the EPA.

4.5.1 Reporting requirements

The Coastal IFOA protocols require the Commission – on behalf of the Steering Committee – to provide progress reports at least annually to the EPA and DPI.[57] Independent advice, recommendations and answers to priority evaluation questions will be provided by the Commission to NSW Ministers and agencies, and made publically available.

Reviews of the program must be provided to the EPA and DPI, and will be published on the EPA website, or other EPA-approved locations, as detailed in the protocols.

[57] NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Protocols.* Chapter 8, Protocol 38.4(3). Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1178-coastal-ifoa-protocols.pdf.

5 Next steps

Monitoring under the program will commence in mid-2020. This chapter outlines the next steps and priority actions to implement the program, including the:

- Development of supporting plans and documentation, including the:
  - evaluation of existing species management plans – c**ommenced and ongoing**.
  - development of new species management plans by FCNSW – **commencing late 2019**.
- Detailed design of monitoring strategies **– commencing late 2019 (subject to EPA and DPI approval)**.

5.1 Developing supporting plans and documentation

Species management plans under the Coastal IFOA are designed to manage and protect priority fauna and flora species. The Coastal IFOA protocols require the program to include any monitoring requirements outlined in species management plans.[58] The Commission is currently reviewing existing species management plans. FCNSW will be developing new plans required by the Coastal IFOA. Once complete, these programs will be reviewed and incorporated into the program.

5.1.1 Evaluating existing species management plans

There are currently five species management plans for the Coastal IFOA, which are for the:

- Southern Brown Bandicoot (*Isoodon obesulus*) (South Eastern NSW), in operation since 2008
- Giant Burrowing Frog (*Heleioporus australiacus*) (South Eastern NSW), in operation since 2008
- Yellow-bellied Glider (*Petaurus australis*) (Bago Plateau), in operation since 2013
- Eastern Bristle Bird (*Dasyornis brachypterus monoides*) (Donaldson State Forest and surrounding area), in operation since 2016.
- Smoky Mouse (*Pseudomys fumeus*) (South Eastern NSW), in operation since 2008.

These plans are currently being reviewed, with the exception of the Smoky Mouse plan.[59] The review will recommend changes to the plans, which should be made before they are incorporated into the program.

58 NSW Government (2018) *Coastal Integrated Forestry Operations Approval – Protocols.* Chapter 8, Protocol 38.3(d). Available at: https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/forestagreements/18p1178-coastal-ifoa-protocols.pdf.

59 Due to the broad range of stakeholders involved, the review of the Smoky Mouse plan will begin when the other plan reviews are complete.

5.1.2 Developing new species management plans

To meet Coastal IFOA requirements, species management plans are being developed for seven flora species, including:

- *Euphrasia arguta* - Upper North East Subregion and Lower North East Subregion
- *Corchorus cunninghamii* (Native Jute) - Upper North East Subregion and Lower North East Subregion
- *Genoplesium vernale* (East Lynne Midge Orchid) - Southern Subregion and Eden Subregion
- *Macrozamia johnsonii* (Johnson's Cycad) - Upper North East Subregion and Lower North East Subregion
- *Niemeyera whitei* (Rusty Plum) - Upper North East Subregion and Lower North East Subregion
- *Parsonsia dorrigoensis* (Milky Silkpod) - Upper North East Subregion and Lower North East Subregion
- *Typhonium sp. aff. brownii* (Stinky Lily) - Upper North East Subregion and Lower North East Subregion.

5.2 Detailed design of monitoring strategies

The proposed monitoring strategies require further development before they are implemented. The level of additional planning required varies between the strategies. Some are existing programs that only require evaluation before they can proceed, such as the fauna species management plans listed above. Other strategies need more detailed planning to ensure they provide the information required within the available resources.

The nest steps for each of the monitoring strategies are outlined below.

Monitoring strategy	Next steps
Monitoring regenerating forests	▪ This monitoring strategy establishes a permanent network of monitoring plots within the Coastal IFOA region ▪ The design of this plot network is critical as it will provide the infrastructure for many of the other monitoring strategies ▪ It needs to be consistent with the state-wide forest monitoring program and the requirements of Protocol 37 (regeneration and stocking) ▪ Benchmarks for floristic composition, structure and coarse woody debris need to be established for each harvested forest type
Monitoring forest structure and health	▪ Remotely sensed spatial data plays an important role in the monitoring of forests internationally and advances in technology are improving its cost-effectiveness ▪ The NSW Government has advanced capability in the field and the development of this strategy should proceed quickly ▪ An important next step is developing a process to measure landscape heterogeneity or age class structure and establishing appropriate benchmarks

Monitoring key habitat features	▪ An effective design of this monitoring strategy is critical, as the Coastal IFOA conserves a range of habitat features in different contexts and over a large area ▪ Developing a scientifically rigorous monitoring approach to gather information on the effectiveness of conditions within the available resources will be challenging ▪ Monitoring approaches will require regular inspections of conserved habitat features for evidence of use ▪ This will likely involve hollow inspections and employ remote sensing technologies such as ultrasonic detection and camera trapping ▪ FCNSW will work in partnership with research institutions to develop an experimental design for review by the Steering Committee
Monitoring species presence	▪ Remote sensors are an efficient and non- invasive way to study a broad range of species populations and communities to monitor species responses to the IFOA conditions ▪ Remote sensor monitoring is advancing rapidly, facilitated by emerging sensor hardware and the application of machine learning innovations to automated call identification ▪ Work is currently underway with Queensland University of Technology to develop automated detection capacity for priority forest species ▪ Detailed design of the program will involve maximising the return on investment for sensor, which require large capital expense
Catchment-based waterway health monitoring	▪ This strategy involves both existing and new elements ▪ The current program in the South East region will be evaluated, along with the establishment of a new study ▪ The new study will assess macroinvertebrates to determine the soil and water impacts from intensive harvesting ▪ An existing before-after-control-impact experiment on the Wilson River in the intensive harvesting zone has several years of pre-harvest data, which will form the basis of further monitoring ▪ Another step will be to review the feasibility of flood modelling in state forests
Research program	▪ The research program's role is to derive information for priority issues through targeted research projects rather than broader monitoring ▪ Some research into priority areas is already underway, including the thermal koala survey and koala nutrition studies ▪ The next steps will involve seeking proposals for research priorities
Independent evaluation of forestry practice	▪ The next steps are to establish a plan for the program's evaluation questions

Attachment 1 – Risk-based prioritisation process to inform program design

To satisfy the NSW FMIP's principles around transparency, risk-based decision-making and cost-effectiveness, the program's technical working group – in collaboration with the CSIRO Conservation Decisions Team – used a risk-based decision-making protocol to inform program design.

The approach seeks to reduce the risks associated with Coastal IFOA conditions not meeting its objectives and outcomes. As such, program design elements were assessed based on:

- their ability to detect that outcomes are not being met
- the consequence of not detecting that the outcome is not being met
- the cost of monitoring required to detect that the outcome is not being met
- their potential to inform change management practices to improve Coastal IFOA performance

Identifying ineffective or harmful management practices and addressing issues in a timely way reduces the likelihood of adverse outcomes from the implementation of the Coastal IFOA. An efficient, strategically prioritised monitoring strategy maximises the number of risks that can be monitored and increases the overall effectiveness of the program.

Identifying risks

A comprehensive risk register was generated by analysing the Coastal IFOA conditions and outcomes statements. Additional risks were identified from submissions to the draft Coastal IFOA. Ninety-five risks were identified, which were then ranked by an expert panel.

Initial prioritisation

The likelihood and consequence of risks being realised without monitoring were elicited from a panel of 16 experts using a Delphi method. Due to the high number of risks, an initial prioritisation process was used to develop a manageable set of risks for which monitoring questions and monitoring strategies could be developed. Forty-seven risks were selected; 42 from the initial prioritisation and five that were selected in order to align with the requirements of Protocol 38 of the Coastal IFOA. Monitoring questions and strategies were developed for the final set of risks.

Monitoring question development

Monitoring questions were developed for each monitoring strategy to focus monitoring activities on answering the key questions that are most useful for decision-makers and forest managers.

The strategies were designed to minimise duplication across the program and increase cost-effectiveness. In some cases, multiple risks are addressed under a single monitoring question and multiple monitoring questions are captured within one monitoring strategy.

Monitoring strategy development

Monitoring strategies were developed in consultation with the expert panel. Experts were asked to advise on:

1 What the monitoring strategy is trying to detect, the assumptions being made and the accuracy required from monitoring.

2 The monitoring study design, including the method, what spatial and temporal scale should be used, sampling density and frequency, replication and stratification.

3 A cost estimate for establishing and implementing the monitoring strategy.

4 The likelihood that the monitoring would be successfully implemented and detect change if it occurred.

5 The likelihood that the risk would occur if the monitoring (and associated changes in management practices) were implemented.

Through this process the expert group developed nine monitoring strategies that covered the full set of risks. These strategies are:

- Species-specific monitoring – Flora
- Species-specific monitoring – Fauna
- Research programs
- Monitoring species occupancy
- Monitoring key habitat features
- Monitoring regenerating forests
- Monitoring forest structure and health
- Independent evaluation of forestry practice
- Catchment-based waterway health monitoring

Through this process it emerged that many of the risks could be monitored collectively through a set of complementary monitoring strategies. For example, a passive acoustic monitoring array can be used to monitor koala occupancy (risk 45), the population of hollow-dependent birds (risk 35) and other risks to species that vocalise, such as bats. Similarly, remote sensing data can be used to monitor both forest health and forest structure.

Some risks can also be monitored using multiple strategies. For example, strategies to maintain adequate winter flowering trees includes conserving trees (monitored by the 'monitoring key habitat features' strategy) and ensuring they are regenerated (monitored by the 'monitoring regenerating forests' strategy).

The expert group also identified risks that would be difficult to monitor and for which information should be gathered through other means, such as targeted research or evaluation of forestry practice.

Prioritising within monitoring strategies

The effectiveness of each monitoring strategy can be increased by prioritising the risks that they address. Risks within monitoring strategies can be prioritised using the expected level of risk

reduction that could be achieved. This prioritisation process will be important in the detailed design phase for certain strategies to:

- identify how resource constraints can be addressed
- determine the order of issues to be addressed in the evaluation or research programs.

Table 15 summarises the prioritisation criteria and assessment process used to identify the priority risks and associated monitoring activities. The assessment process relied on structured expert elicitation, using methods designed to gather expert scientific knowledge while minimising expert fatigue and potential judgement biases. Members of the program's technical working group made up the initial expert group, nominating additional relevant expertise from agencies and organisations as required.

The prioritisation process identified 51 priority risks from over 90 initial risks. Priority risks include all the priority conditions for the program identified within Protocol 38.3(1)(a) of the Coastal IFOA.

The priority risks, monitoring questions and monitoring strategies were categorised into four streams, which were informed by the requirements of Protocol 38:

- ecological function and habitat connectivity
- persistence of native species

  } Biodiversity

- forest regeneration and forest structure
- aquatic habitat and water quality.

A proposed effectiveness monitoring approach was developed for each of these streams, including priority conditions, monitoring questions and monitoring strategies. These monitoring approaches are presented by monitoring theme in **Attachments 2 to 5**.

Table 15: Overview of prioritisation criteria and assessment process

Criteria	Description	Assessment process
Risk	The level of risk that the condition presents to the achievement of Coastal IFOA outcomes	▪ Identify a comprehensive set of risks, including risks that are: - associated with each condition - identified from submissions to the Coastal IFOA - based on consideration of community impacts, including the extent to which the proposed monitoring fulfils community expectations or is needed to ensure social licence to operate ▪ Assess the likelihood and consequence of each risk in relation to achieving the Coastal IFOA's objectives and outcomes

Criteria	Description	Assessment process
Monitoring effectiveness	The likelihood that each monitoring strategy will effectively detect a risk that is being realised or changes in the effectiveness of a condition	▪ Identify monitoring questions and potential monitoring strategies[60] (or a suite of alternative strategies) that address each risk ▪ Assess the likelihood of monitoring success, including factors such as: - the history of the monitoring strategy - the likelihood of funding - the social acceptability of the strategy - time required to see results - generalisability of results - uncertainty ▪ Assess the likely contribution that monitoring would make towards reducing each risk ▪ The prioritisation process is ongoing and will inform the detailed design of the monitoring strategies.
Risk mitigation	The availability of interventions or changed management practices that would reduce risks identified through monitoring and better protect the environment, species or biodiversity	▪ Identify the expected alternative management practices that could be implemented if monitoring indicates risks are occurring ▪ Estimate the likelihood that alternative management practices could be adopted and implemented successfully, including factors such as: - the history of the management practice - the likelihood of funding - the timeframe required to see results - spatial coverage - uncertainty - the likelihood of adaptive management ▪ Estimate the revised likelihood that the risk is realised, assuming that monitoring and alternative management practices are successfully implemented ▪ Compare the relative risk post- and pre-mitigation to estimate the extent of risk mitigation that monitoring may achieve

[60] The monitoring strategies for the program are outlined in **Chapter 4**.

Criteria	Description	Assessment process
Cost-effectiveness	Total cost and relative cost-effectiveness of each monitoring question, including the reduction in risk per dollar spent as a result of monitoring	▪ Estimate the cost of proposed monitoring strategies for each risk and monitoring question ▪ Categorise estimated costs using a scale from minimal to high expense ▪ Dollar-range intervals will be developed during detailed planning, based on expert advice
IFOA requirements	Whether it is a priority requirement under Protocol 38.3	▪ Review against Protocol 38 requirements (refer to **Table 9** in **Chapter 3**) ▪ Any Protocol 38 requirements not initially identified as a priority in the initial prioritisation process added to the priority risk list

Attachment 2 – Ecological function and habitat connectivity stream priorities

Four key monitoring questions were derived from the prioritisation process that focus on the effectiveness of the Coastal IFOA conditions in addressing ecological function and habitat connectivity.

Monitoring questions:

1 Are the conditions maintaining functional connectivity for focal fauna species to move within and across the forest?

2 To what extent do retained habitat features maintain their function?

3 Do harvesting conditions establish an appropriate mosaic of forest age classes at the landscape scale?

4 Is pre- and post-harvesting burning maintaining the function of key habitat features?

Monitoring strategies that will answer the monitoring questions include:

- Monitoring forest structure and health.
- Monitoring key habitat features.
- Independent evaluation of forestry practice.

Table 16 outlines the outcome statements, priority conditions, monitoring questions and monitoring strategies for the stream.

Table 16: Summary of outcome statements, priority conditions, monitoring questions and monitoring strategies for the ecological function and habitat connectivity stream

Outcome statement	Protocol 38 priority	Condition (C)	Monitoring question	Monitoring strategy
Habitat and environmental features are identified and retained to provide refuge, connectivity and to support forest regeneration	3(1)(a)(i)	C49 (Category 1 and 2 Environmentally Significant Areas) C52 (Ridge and headwater habitat)	Are the conditions maintaining functional connectivity for focal fauna species to move within and across the forest?	Monitoring forest structure and health
Habitat and environmental features are identified and retained to provide refuge, connectivity and to support forest regeneration	3(1)(a)(i) 3(1)(a)(vi)	C49 (Category 1 and 2 Environmentally Significant Areas) C50 (Wildlife habitat clumps in the Local landscape Area)	To what extent do retained habitat features maintain their function?	Monitoring key habitat features
Harvesting operations are distributed across the landscape and over time, to support a mosaic of forest age-classes and maintenance of forest structure in the operational area or local landscape area	Not listed	C45 (Intensive harvest limits) C46 (Selective harvest limits) C47 (Mixed intensity harvest limits) C48 (Alternate coup harvest limits)	Do harvesting conditions establish an appropriate mosaic of forest age classes at the landscape scale?	Monitoring forest structure and health
Environmental features, habitat, landscapes and communities are maintained through the implementation of best management practices for pre-harvest burns and post-harvest burns. C62 (Coarse woody debris protection)	Not listed	C64 (Retained trees) C85-87 (Burning conditions) C113 (Burning)	Is pre- and post-harvesting burning maintaining the function of key habitat features?	Independent evaluation of forestry practice
Environmentally Significant Areas and important habitat are managed during burning operations to maintain their intended, specific environmental values and provide short-term refuge habitat. C85-87 (Burning conditions)	Not listed	C91-92 (Category 1 and 2 Environmentally Significant Areas) C113 (Burning)		

Attachment 3 – Native species presence stream priorities

Four key monitoring questions were derived from the prioritisation process that focus on the effectiveness of the Coastal IFOA conditions in addressing native species presence.

Monitoring questions:

1 To what extent do the Coastal IFOA conditions maintain species occupancy in the landscape?

2 Are the species and habitat survey and modelling conditions and practices effective?

3 How are koalas responding to koala conditions, including tree retention rates and size?

4 Can technology improve the probability of detection for a range of species in forestry operations?

Monitoring strategies that will answer the monitoring questions include:

- Monitoring species occupancy.
- Species-specific monitoring – fauna.
- Species-specific monitoring – flora.
- Independent evaluation of forestry practice.
- Research program.

Table 17 outlines the outcome statements, priority conditions, monitoring questions and monitoring strategies for the stream.

Table 17: Summary of outcome statements, priority conditions, monitoring questions and monitoring strategies for the native species presence stream

Outcome statement	Protocol 38 priority	Condition (C)	Monitoring question	Monitoring strategy
Important trees are retained and protected for shelter and food resources for native species, and to support their persistence	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions Protocol 38.3(1) (d) – Species Specific Monitoring	C63 (Tree retention clumps) C64 (Retained trees)	To what extent do the Coastal IFOA conditions maintain species occupancy in the landscape?	Monitoring species occupancy
	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions Protocol 38.3(1) (d) – Species Specific Monitoring	C63 (Tree retention clumps) C64 (Retained trees)		
Habitat and environmental features are identified and retained to provide refuge, connectivity, and to support forest regeneration	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions Protocol 38.3(1) (d) – Species Specific Monitoring	C49 (Category 1 and 2 Environmentally Significant Areas)		
	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions Protocol 38.3(1) (d) – Species Specific Monitoring	C63 (Tree retention clumps) C64 (Retained trees) C78 (Bat roost tree protection) C79 (Flying-fox camps) C80 (Subterranean bat roosts)		
Site-specific measures are implemented to mitigate the impact of the forestry operation on fauna species and their habitat, and to support their persistence	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions Protocol 38.3(1) (d) – Species Specific Monitoring	C57 (Broad area habitat searches) C76 (Nest, roost or den)		
	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions Protocol 38.3(1) (d) – Species Specific Monitoring	C76 (Nest, roost or den)		
	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions Protocol 38.3(1) (d) – Species Specific Monitoring	C51 (large forest owl landscapes) C76 (Nest, roost or den)		
	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions Protocol 38.3(1) (d) – Species Specific Monitoring	C57 (Broad area habitat searches) C76 (Nest, roost or den)		
	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions Protocol 38.3(1) (d) – Species Specific Monitoring	C75 (Koala)		
	Protocol 38.3(1) (d) – Species Specific Monitoring	C57 (Broad area habitat searches) C76 (Nest, roost or den)		Species-specific

Outcome statement	Protocol 38 priority	Condition (C)	Monitoring question	Monitoring strategy
	Protocol 38.3(1) (d) – Species Specific Monitoring	C57 (Broad area habitat searches) C76 (Nest, roost or den) C84 (Species management plans)		monitoring – fauna
	Protocol 38.3(1) (d) – Species Specific Monitoring	C84 (Species management plans)		
	Protocol 38.3(1) (d) – Species Specific Monitoring	C71 (Northern Corroboree Frog)		
	Protocol 38.3(1) (d) – Species Specific Monitoring	C72 (Hastings River Mouse)		
	Protocol 38.3(1) (d) – Species Specific Monitoring			
	Protocol 38.3(1) (d) – Species Specific Monitoring	C84 (Species management plans)		
	Protocol 38.3(1) (d) – Species Specific Monitoring	C57 (Broad area habitat searches) C76 (Nest, roost or den)		
	Protocol 38.3(1) (d) – Species Specific Monitoring	C76 (Nest, roost or den)		
	Protocol 38.3(1) (d) – Species Specific Monitoring	C76 (Nest, roost or den)		
Site-specific measures are implemented to mitigate the impact of the forestry operation on flora species and their habitat, and to support their persistence	Protocol 38.3(1) (d) – Species Specific Monitoring Protocol 38.3(1) (e) – Threatened flora	C81 (Flora requiring protection of all individuals) C84 (Species management plans)		Species-specific monitoring – flora
	Protocol 38.3(1) (d) – Species Specific Monitoring Protocol 38.3(1) (e) – Threatened flora	C81 (Flora requiring protection of all individuals) C84 (Species management plans)		
	Protocol 38.3(1) (d) – Species Specific Monitoring Protocol 38.3(1) (e) – Threatened flora	C81 (Flora requiring protection of all individuals) C84 (Species management plans)		
	Protocol 38.3(1) (d) – Species Specific Monitoring Protocol 38.3(1) (e) – Threatened flora	C81 (Flora requiring protection of all individuals) C84 (Species management plans)		

Outcome statement	Protocol 38 priority	Condition (C)	Monitoring question	Monitoring strategy
	Protocol 38.3(1) (d) – Species Specific Monitoring Protocol 38.3(1) (e) – Threatened flora	C81 (Flora requiring protection of all individuals) C84 (Species management plans)		
	Protocol 38.3(1) (d) – Species Specific Monitoring Protocol 38.3(1) (e) – Threatened flora	C81 (Flora requiring protection of all individuals) C84 (Species management plans)		
Environmental features, habitat and risks are identified to ensure that protections and management actions are implemented to mitigate the impact of the forestry operation	Protocol 38.3(1) (d) – Species Specific Monitoring Protocol 38.3(1) (e) – Threatened flora	C56 (Targeted flora and fauna surveys) C57 (Broad area habitat searches) C58 (Records of species and habitat features)	Are the species and habitat survey and modelling conditions and practices effective?	Independent evaluation of forestry practice
Important trees are retained and protected for shelter and food resources for native species, and to support their persistence	Protocol 38.3 (1)(a)(vii) – Koala conditions	C65 (Koala browse tree retention)	How are koalas responding to koala conditions, including tree retention rates and size?	Research program
Site-specific measures are implemented to mitigate the impact of the forestry operation on fauna species and their habitat, and to support their persistence	Protocol 38.3 (1)(a)(vii) – Koala conditions	C75 (Koala)	Can technology improve the probability of detection for a range of species in forestry operations?	Research program

Attachment 4 – Forest regeneration and forest structure stream priorities

Four key monitoring questions were derived from the prioritisation process that focus on the effectiveness of the Coastal IFOA conditions in addressing persistence of native species.

Monitoring questions:

1 Are the conditions effective in ensuring regenerating forests meet benchmarks for:

   (i) floristic composition

   (ii) forest structure

   (iii) coarse woody debris.

2 Are the conditions and practices effectively managing risks of invasive plant species in regenerating forests?

3 Are the conditions likely to promote regeneration that sustains timber supply?

4 To what extent are the conditions effectively managing the risk of new or existing areas subject to dieback?

Monitoring strategies that will answer the monitoring questions include:

- Monitoring regenerating forests.
- Monitoring forest structure and health.

Table 18 outlines the outcome statements, priority conditions, monitoring questions and monitoring strategies for the stream.

Table 18: Summary of outcome statements, priority conditions, monitoring questions and monitoring strategies for the forest regeneration and forest structure stream

Outcome statement	Protocol 38 priority	Condition (C)	Monitoring question	Monitoring strategy
Harvested areas are adequately stocked with a natural floristic composition to maintain ecological function and sustainable timber supplies	Protocol 38.3(1) (a) (viii) – The effectiveness of selective harvesting limits in achieving the regeneration and stocking standards as measures of longer term regeneration	C20 (Regeneration)	Are the conditions effective in ensuring regenerating forests meet benchmarks for: (i) floristic composition (ii) forest structure (iii) coarse woody debris?	Monitoring regenerating forests
	Protocol 38.3(1)(a)(ix) The maintenance of sufficient levels of coarse woody debris	C20 (Regeneration)		
	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions	C20 (Regeneration)		
	Not listed	C20 (Regeneration)	Are the conditions and practices effective in managing risks of invasive plant species in regenerating forests?	Monitoring regenerating forests
	Not listed	C20 (Regeneration)	Are the conditions likely to promote regeneration that sustains timber supply?	Monitoring regenerating forests program
Environmental features, habitat and risks are identified and site-specific protections and management practices are developed to mitigate the impact of the forestry operation	Protocol 38.3(1) (a) (i) – Multiscale Landscape Provisions	C63 (Tree retention clumps) C64 (Retained trees)	To what extent are the conditions effectively managing the risk of new or existing areas subject to dieback?	Monitoring forest structure and health

Attachment 5 – Aquatic habitat and water quality stream priorities

Four key monitoring questions were derived from the prioritisation process that focus on the effectiveness of the Coastal IFOA conditions in addressing persistence of native species.

Monitoring questions:

1 Are the exclusion zone conditions for class 1 classified drainage lines effective in minimising the impact on waterway condition?

2 Are the soil and water controls effective in minimising the impact of harvesting and roading on waterway condition?

3 Are drainage feature crossings and road features effectively designed and maintained to reduce the impact of forestry operations on waterway condition?

4 Are the exclusion zone conditions effective in reducing the impact of forestry operations on Coastal SEPP wetlands?

Monitoring strategies that will answer the monitoring questions include:

- Catchment-based waterway health monitoring.
- Research program.
- Independent evaluation of forestry practice.

Table 19 outlines the outcome statements, priority conditions, monitoring questions and monitoring strategies for the stream.

Table 19: Summary of outcome statements, priority conditions, monitoring questions and monitoring strategies for the aquatic habitat and water quality stream

Outcome statement	Protocol 38 priority	Condition (C)	Monitoring question	Monitoring strategy
Vegetation adjacent to drainage features and wetlands is protected, and groundcover is retained, to maintain water quality, stream stability, riparian habitat and contribute to habitat connectivity	Protocol 38.3 (1)(a)(iii) – The effectiveness of the exclusion zones on class one classified drainage lines	C95 (Riparian exclusion zones for classified drainage features)	Are the exclusion zone conditions for class 1 classified drainage lines effective in minimising the impact on waterway condition?	Catchment-based waterway health monitoring
Water quality, aquatic habitat are protected through the implementation of best management practices Dust and waste are managed to minimise pollution around operational areas	Protocol 38.3 (1)(a)(v) – The effectiveness of soil and water protection in intensive harvesting operations	C45 (Intensive harvest limits) C109 (Debris and spoil management)	Are the soil and water controls effective in minimising the impact of harvesting and roading on waterway condition?	Catchment-based waterway health monitoring
Water quality, aquatic habitat and native fish movement are maintained through the implementation of best management practices for roads and road crossings	Protocol 38.3 (1)(a)(ii) – Effectiveness of drainage feature e crossing and road conditions	C101 (Drainage of roads) C104 (Drainage of tracks) C106 (Track crossings)	Are drainage feature crossings and road features effectively designed and maintained to reduce the impact of forestry operations on waterway condition?	Independent evaluation of forestry practice
Vegetation adjacent to drainage features and wetlands is protected, and groundcover is retained, to maintain water quality, stream stability, riparian habitat and contribute to habitat connectivity	Protocol 38.3 (1)(a)(iv) – the effectiveness of the exclusion zones for SEPP coastal SEPP wetlands	C99 (Wetlands)	Are the exclusion zone conditions effective in reducing the impact of forestry operations on Coastal SEPP wetlands?	Catchment-based waterway health monitoring