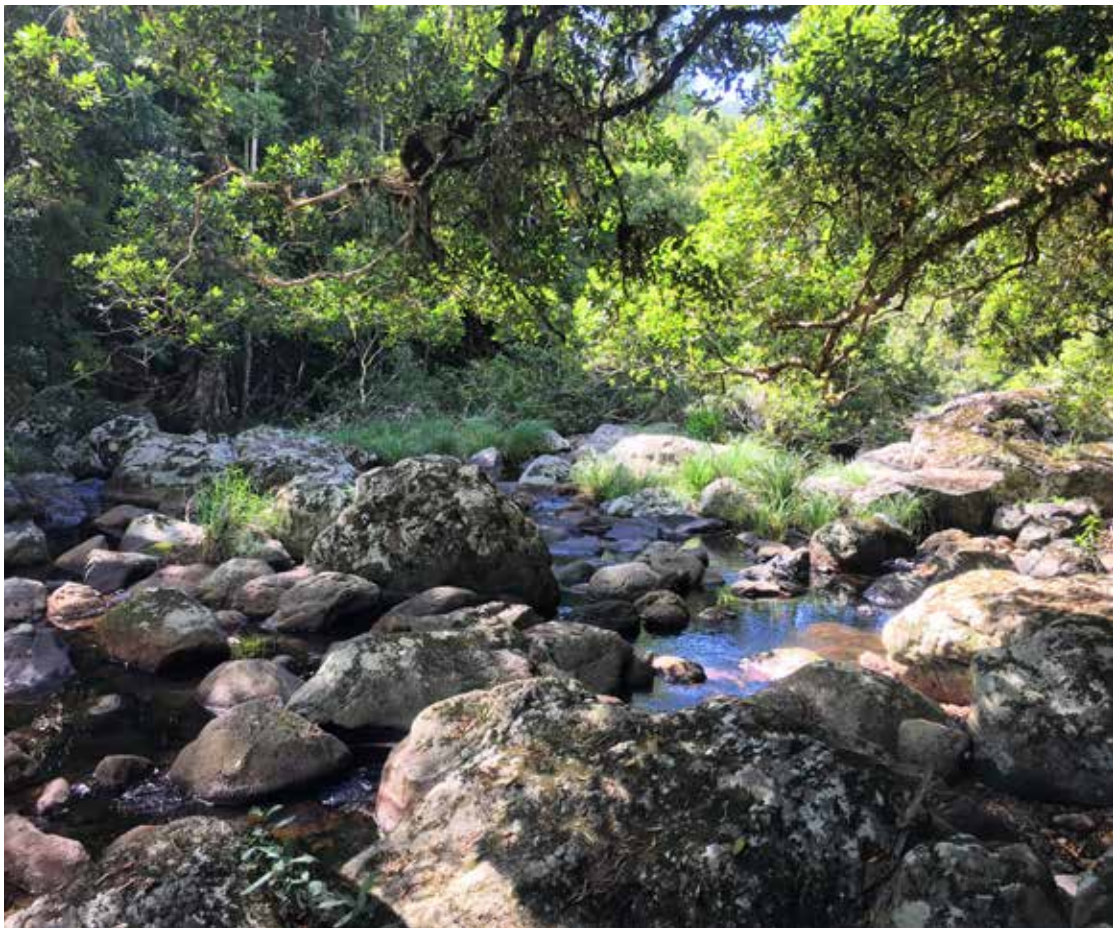
NSW GOVERNMENT

Coastal IFOA: Monitoring plan

Waterway and wetland health

October 2020



Monitoring strategy summary	
Monitoring strategy	Waterway and wetland health
Version 1.0	8 October 2020

Contents	
Part 1	Monitoring strategy details
Part 2	Monitoring implementation timeline

Part 1: Monitoring strategy details

1.1 Strategy title

Waterway and wetland health

1.2 Protocol 38

- Protocol 38.3 (1)(a)(ii) monitor and evaluate the effectiveness of drainage feature crossing and road conditions (Evaluated under the independent evaluation of forestry practice component of the monitoring program)
- Protocol 38.3 (1)(a)(iii) – The effectiveness of the exclusion zones on class one classified drainage lines
- Protocol 38.3 (1)(a)(v) – The effectiveness of soil and water protection in intensive harvesting operations
- Protocol 38.3 (1)(a)(iv) – The effectiveness of the exclusion zones for Coastal State Environmental Planning Policy (SEPP) wetlands

1.3 Coastal IFOA condition and associated outcome statements

Drainage features and road conditions (Evaluated under the independent evaluation of forestry practice component of the monitoring program)

Outcome statement: Water quality, aquatic habitat and native fish movement are maintained through the implementation of best management practices for roads and road crossings and tracks and track crossings.

Conditions

- C100: Roads
- C101 Drainage of roads
- C102 Wet weather restrictions
- C103 Road crossings of drainage lines and drainage depressions
- C106 Track crossings of drainage lines and drainage depressions

Riparian exclusion zones and ground protection zones on class 1 classified drainage lines

Outcome Statement: 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.

- C95: Riparian exclusion zones for classified drainage features
- C97: Ground protection zones

Exclusion zones for Coastal State Environmental Planning Policy (SEPP) wetlands

Outcome Statement: 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.

- C99: Wetlands

Soil and water protection in intensive harvesting forestry operations

Outcome Statement:

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.

Water quality and aquatic habitat are protected and maintained through the implementation of best management practices.

- C95: Riparian exclusion zones for classified drainage features
- C97: Ground protection zones

1.4 Monitoring questions

- To what extent are the soil and water conditions effective in minimising the impact of intensive 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?

1.5 Strategy objective

- Design a program to monitor the effectiveness of harvesting, roading and waterway road crossing conditions in protecting waterway condition
- Design a monitoring program to monitor the effectiveness of conditions in meeting their desired outcomes in protecting waterway condition in intensive harvesting zones at both the site and catchment scale
- Design a monitoring program to monitor the effectiveness of vegetation buffers around class one streams and SEPP wetlands.

1.6 Strategy summary

Current state of knowledge

- To inform the waterway and wetland health monitoring, the Commission will conduct a desktop study to review the current state of our knowledge in water quality and timber harvesting in NSW forests

Drainage feature crossings and road conditions

- As part of the evaluation of forestry practices under a joint study with the Forest Monitoring and Improvement Program, the Commission has engaged Alluvium, in collaboration with Soil Conservation Services, to conduct an evaluation of forest road network design and management to protect in-stream water quality.

- Results of this evaluation will also be used to inform the adequacy of soil and water conditions relating to the forest road network during harvest operations.
- In addition, should the desktop study into the current state of knowledge of temporary log crossings require their monitoring to evaluate their effectiveness in maintaining water quality, a methodology to monitor a set of temporary log crossings will be developed as part of broader site-based monitoring.

Riparian exclusion zones and ground protection zones on class 1 classified drainage lines

- Under the review of the current state of our knowledge in water quality and timber harvesting, current baselines of the roles of class 1 streams in maintain water quality will be determined. Existing methods to monitor class 1 streams will be determined that can be implemented in coastal state forests. Where no suitable methods exist, conduct a feasibility analysis and research into the use of sediment tracing assessment to initially be trailed through the research monitoring strategy.

Exclusion zones for Coastal State Environmental Planning Policy (SEPP) wetlands

- No harvest operations are planned to occur within state forests that contain Coastal SEPP wetlands. Should harvesting occur in future plans of operations, features within state forests subject to selective or intensive harvesting monitored using sediment and water quality monitoring approaches used for stream buffer monitoring establish whether the buffers adequately maintain water quality and aquatic habitat.

Soil and water protection in intensive harvesting forestry operations

- Resulting from the review the current state of our knowledge in water quality and timber harvesting, where gaps in knowledge exist relating to sediment distribution from an intensive harvesting operations, monitoring or research into these knowledge gaps will be incorporated into this component of the monitoring.
- In addition, the review will recommend the indicators of water quality that should be measured to monitor the performance of riparian protection zones in areas subject to intensive harvesting forestry operations.
- Where required to do so, in classified drainage lines within LLAs that are subject to intensive harvest silvicultural treatments, a statistically rigorous number of monitoring locations of instream gauges to be installed, at least two years prior to harvest, to monitor runoff from intensive harvest areas for sediment and water quality indicators.

Landscape-scale water quality monitoring

- As part of a joint request for proposal from the Forest Monitoring and Improvement program and Coastal IFOA monitoring, implement cross-tenure, catchment scale monitoring of water quality and instream ecology. Initially funded and piloted through a joint Forest Monitoring and Improvement Program and Coastal IFOA proposal then results incorporated into this monitoring.
- In line with other monitoring plans, site-based monitoring of waterway health, will be implemented as part of a rotating panel of local landscape areas. This is so to utilise data collected as part of the overall monitoring program, including LiDAR, for use in monitoring waterway health and to set benchmarks for the effectiveness of the Coastal IFOA conditions.

1.7 Outline of methods and approach

Reviewing the current state of knowledge for water and timber harvesting in NSW forests

- It is important to have a base in knowledge so the monitoring program can review waterway and wetland health monitoring results and evaluate whether the associated conditions and protocols remain consistent with findings from previous studies.
- In July 2020, the Commission engaged Alluvium to deliver a literature review, including an analysis of monitoring or research approaches in peer reviewed, scientific publications (reference list in Attachment 1) relating to forestry impacts on waterway health and water quality in active forestry areas in NSW or other relevant jurisdictions.
- The literature review will seek to answer the following questions:
  - What are the major sources of pollutants, including sediments, to streams draining from NSW coastal state forests?
  - What is the significance of wildfires for the control or mitigation of these pollutant sources? (Noting that the approved monitoring program will also undertake research into the impacts of changing fire intensity and regimes on the achievement of the Coastal IFOA's objectives and outcomes)
  - How do existing pollution mitigation measures (i.e. Coastal IFOA conditions and associated protocols) address each of these pollution sources?
  - Given the relative sources of pollution within NSW state forests and the other forms of pollution mitigation measures, are the use of buffers of class one streams effective for pollution control purposes? (Noting these buffers also provide ecological functions in a harvested landscape)
  - Where wetlands exist within NSW forests, what pollution mitigation measures are warranted?
- Given the responses to the above questions, what is the relative merit to continue or reinstate the Middle Brother, Yambulla, Kangaroo River and Karuah water quality monitoring projects?
- The review is focused on forestry operations related to the general harvesting area, log dumps, snig tracks and temporary log crossings in the Coastal IFOA regions and will:
  - conduct a desktop study to compile and review peer reviewed literature concerning forestry impacts, on waterway health and water quality in active forestry areas, including the role of headwater stream buffers in maintaining waterway health
  - focus review and advice primarily on NSW forests but also consider other jurisdictions if relevant/transferable information
  - advise on industry accepted practices and cost-effective approaches to measure waterway impacts associated with forestry operations to be used as a knowledge base for waterway and wetland health monitoring in Coastal IFOA state forests
  - advise on any other factors the commission should consider in the design and implementation of the Coastal IFOA waterway and wetland health monitoring plan

- Results of this review will provide:
  - consideration of the Coastal IFOA waterway and wetland health monitoring requirements
  - a review of studies into sediment redistribution within harvested forests and consideration of, but not limited to, the references provided later in this plan
  - an evaluation of the Middle Brother, Yambulla, Kangaroo River and Karuah water quality monitoring projects and advice on the relative merit to continue or reinstate these monitoring programs
  - an assessment of the state of knowledge for each thematic area examined – e.g. emerging, foundational, mature – with an emphasis on knowledge in the Coastal IFOA region
  - a draft and final written report of current state of knowledge for expert review, including monitoring design considerations relating to the requirements detailed in waterway and wetland health monitoring for the Coastal IFOA.
- The results of the literature review are expected in early-October 2020 after which, this monitoring plan will be refined with the monitoring strategy design team to reflect the findings.
- Where that knowledge is considered comprehensive, it will be used as a knowledge base; activities that would effectively repeat this work will not be included in this monitoring strategy.
- Where there is a lack of knowledge in a target area, this should be incorporated into the monitoring design.

Drainage feature crossings and road conditions

- As part of the evaluation of forestry practices and under the Forest Monitoring and Improvement Program, the Commission has engaged Alluvium, in collaboration with Soil Conservation Services, to conduct an evaluation of forest road network design and management to protect in-stream water quality.
- Results of this evaluation will be used to inform the adequacy of soil and water conditions relating to the forest road network during harvest operations.
- The evaluation will include:
  - Development of a method to understand the impact of forest roads on water quality
  - Review of the influence of various factors on erosion rates from forest roads, including:
    - Terrain and topographic position
    - Soil type
    - Forest type
    - Catchment hydrology and rainfall
    - Road type, age, design, use and management practices
    - Connectivity between roads and streams
    - Bushfire
    - Flood

- Drought
- Climate change (and its influence on the above)

- Visual geomorphic assessment at each survey event
- Monthly water quality monitoring including wet weather and dry weather event focussing physio-chemical sampling (ph, DO, EC, Temp, turbidity and Total Suspended Solids (TSS).

Riparian exclusion zones and ground protection zones on class 1 classified drainage lines

- Review of existing studies into role of vegetation around headwater/class one streams in maintaining waterway quality.
- Following review, conduct analysis of the feasibility of adopting existing methods to monitor class one stream buffers.
- If not feasible, research into the use of sediment stable isotope analysis to monitor effectiveness of class one stream buffers in both selective and intensive harvesting areas as well as referencing against unharvested areas.
- Incorporate findings from the research monitoring strategy, when completed, including studies into exclusion zones around class 1 streams on target class 1 stream within selective and intensive harvest areas – see Coastal IFOA research monitoring plan currently being developed by the NRC.

Coastal SEPP wetlands

- The adequacy of 40 metre vegetation buffers around wetlands in forests subject to harvesting will be reviewed as part of the current state of knowledge. Where uncertainties exist, monitoring will be implemented to determine the effectiveness of those buffers.
- This monitoring will only be implemented where Coastal SEPP wetlands occur within a State Forest subject to harvesting as part of a future plan of operations developed by FCNSW. The identified State Environmental Planning Policy (Coastal Management) 2018 wetlands (Coastal SEPP wetland) must occur within native hardwood State Forests subject to selective or intensive harvesting.
- Before-after, control-impact (BACI) monitoring program to determine the adequacy of the 40 metres vegetative exclusion zone width around Coastal SEPP wetland features to maintain water quality and riparian habitat, establish gauges to monitor water quality including:
  - temperature,
  - chlorophyll-a,
  - salinity,
  - turbidity,
  - dissolved oxygen,
  - pH and suspended
  - sediment yield.

Soil and water protection in intensive harvesting forestry operations

- The review of current state of knowledge will provide the level of certainty whether the soil and water conditions being used are best practice in minimising the impact of intensive harvesting on waterway condition.

- Resulting from the review, should any key gaps in knowledge exist in how sediment is distributed from an intensive harvesting operation, monitoring or research of these knowledge gaps will be incorporated into this component of the monitoring.
- In classified drainage lines within LLAs that are subject to intensive harvest silvicultural treatments, a statistically rigorous number of monitoring locations for instream gauges to be installed, at least two years prior to harvest, to monitor runoff, for sediment and water quality indicators.
- Sediment and water quality indicators that need to be monitored will be identified during the review of current state of knowledge.
- Sediment quality measures could include:
  - % fines grain size,
  - total organic carbon,
  - total nitrogen and
  - nutrients.
- In addition, physio-chemical water quality indicators could include:
  - temperature,
  - salinity,
  - turbidity,
  - dissolved oxygen and
  - pH.
- Impact on these indicators will be assessed by comparison to before intensive harvesting measurements.
- A panel of biostatisticians are to be engaged as part of the Forest Monitoring and Improvement program. That panel will be engaged to seek advice on the appropriate number of monitoring locations will be required to determine a suitable certainty in the results.
- As concluded by the CRC for catchment hydrology, at the site scale, it is determined that the soil and water protocols are effective when the water quality indicators return to pre-harvest levels within two years.

Landscape-scale trends in water quality

- Under the Forest Monitoring and Improvement Program, the Commission has engaged the University of Melbourne to establish baselines, drivers and trends in water quality and quantity emanating from forested catchments of the Regional Forestry Agreement regions.
- Through this project, water quality indicators for landscape-scale water quality monitoring for the Coastal IFOA will be established to inform ongoing monitoring through both the Coastal IFOA monitoring program and state-wide monitoring program.
- It is anticipated that catchment scale before-after, control-impact (BACI) monitoring program of water quality, quantity and instream ecology sampling that will include intensive harvesting catchment of the north coast or an alternate coupe harvesting catchment in Eden.

- Landscape-scale indicators in water quality will look to include sediment and physio-chemical water quality indicators collected as part of site scale monitoring. The indicators will be part of the state-wide program and will be determined through considerations such as cost-effectiveness and usability to inform land management decisions.

Monitoring local landscape areas

To ensure that the validation monitoring is cost-effective and fit-for-purpose, it is proposed that this monitoring will occur within a rotating schedule of local landscape areas.

In any given year, there will be a minimum number of local landscape areas that will be subject to validation monitoring, spread across the IFOA sub-regions. For example:

- Three LLAs in the Upper North East
- Three LLAs in the Lower North East
- Two LLAs in Eden
- Two LLAs in Southern

The local landscape areas will be rotated on a five-year cycle so that the monitoring will return to each validation area every five years.

The following monitoring strategies will be informed be the rotating panel of LLAs:

- Forest structure, health and regeneration
- Key habitat features
- Species occupancy
- Waterway and wetland health

The number of local landscape areas, as well as the intensity of field monitoring will be determined during the experimental design of the Coastal IFOA monitoring program.

1.8 Summary of approach to develop baselines and benchmarks for adaptive management

Condition effectiveness baseline:
Baselines for metrics related to water quality are being developed as part of the baselines, drivers and trends in water quality and quantity project.

Benchmarks:

A key objective for this monitoring strategy is to utilise benchmarks, where they exist, and where they do not exist, set appropriate benchmarks to trigger adaptive management.

The CRC for catchment hydrology, at the site scale, it is determined that if the riparian protections zones for soil and water protocols are effective when, the water quality indicators should return to pre-harvest levels within two years.

Where there are gaps in our knowledge that are identified in the desktop review being conducted under this strategy, benchmarks will have to be determined at a level and time period considered appropriate to identify if a condition is effective. In this case, it is likely that the program will require the several years of data to establish benchmarks for management action triggers.

The results of all Coastal IFOA monitoring strategies will be combined and analysed by a technical specialist team appointed by the FMIP Steering Committee to determine the adequacy of the monitoring, identify trends in the data and recommend benchmarks for adaptive management triggers.

Trends in the data will be analysed annually as part of the monitoring programs annual review with the benchmarks set in the first program evaluation in 2024.

Adaptive management

As part of the decision-making framework being developed under the program's adaptive management strategy, the process to establish performance benchmarks, analyse the monitoring results and the adaptive management activities that are triggered to adapt the Coastal IFOA to better meet its desired outcomes for regeneration will be described.

1.9 Existing programs and data that will inform the strategy

- NSW forest monitoring and improvement program engaged study into the forest road network, including roads, tracks, snig tracks and crossings in coastal state forests.
- NSW forest monitoring and improvement program engaged project into baselines, drivers and trends in water quality and quantity in forested catchments – including establishing landscape-scale water quality monitoring in coastal state forests as well as other tenures.
- FCNSW Wilson River pilot study.
- ABARES Preparing forest industries for the future - climate change adaptation research.

1.10 How the data will be stored, analysed and presented

Data collection and storage will need to comply with the National Industry Guideline for water quality metadata:
http://www.bom.gov.au/water/standards/niGuidelineWQmetadata.shtm

Data will be collected and stored by FCNSW to the standards set out in the Forest Monitoring and Improvement Program data management system, including analysis and presentation, then made available for integration with the state-wide forest monitoring program analysis platform.

1.11 Expected strategy outcomes

Riparian exclusion zones and ground protection zones on class 1 classified drainage lines
Evidence as to whether the riparian exclusion zone and ground protection zone on class 1 classified drainage lines adequately maintain water quality, stream stability, riparian habitat and habitat connectivity.

Exclusion zones for Coastal State Environmental Planning Policy (SEPP) wetlands
Evidence as to whether the exclusion zone on Coastal SEPP wetlands adequately maintains water quality, stream stability, riparian habitat and habitat connectivity.

Soil and water protection in intensive harvesting forestry operations
Evidence as to whether the current CIFOA soil and water protections are effective in intensive harvesting forestry operations to adequately maintain water quality and aquatic habitat.

1.12 Linkages and uses with the overall NSW Forest Monitoring and Improvement Program Framework

The state-wide program has the following evaluation questions that guide the program:

- Are forest water catchments healthy and what is the predicted trajectory for water availability and quality?
- What is the health and stability of soil in forests, and what is their predicted trajectory?

To establish the current trends in values associated with these questions the following studies are to be engaged within forests of the NSW Regional Forest Agreement regions:

- NSW forest monitoring and improvement program engaged project into baselines, drivers and trends in water quality and quantity in forested catchments – including establishing landscape-scale water quality monitoring in coastal state forests as well as other tenures.
- NSW forest monitoring and improvement program engaged project into baselines, drivers and trends in soil stability and health in forests.
- An overarching resilience framework for NSW forest. This framework aims to look how drivers including climate change, fore and drought impact forest attributes including soil and water.

Part 2: Timeline		
Milestone description	**Start date**	**End date**
1. Review of current state of knowledge	**August 2020**	**October 2020**
2. Development of landscape-scale monitoring indicators	**July 2020**	**November 2020**
3. Design team review of current state of knowledge	**October 2020**	**November 2020**
4. Design team update site-based monitoring approach	**October 2020**	**November 2020**
5. Experimental design of monitoring	**October 2020**	**February 2021**
6. Pilot of monitoring strategies	**February 2021**	**June 2021**
7. Pilot data and cost analysis	**June 2021**	**July 2021**
8. First year local landscape areas field monitoring	**September 2021**	**March 2022**
9. Data analysis	**March 2022**	**June 2022**
10. Reporting	**June 2022**	**August 2022**

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