Gunns LIMITED
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Bell Bay Pulp Mill
Environmental Impact Management Plan (EIMP)
Module M: Monitoring

Prepared for the
Commonwealth Minister for the Environment, Heritage and the Arts
in accordance with approval EPBC 2007/3385

GNS-PLN-1000-1400-0018

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Revision Status

Revision	Date	Revision Description	Prepared	Reviewed	Approved
A	24 June 2008	For submission to DEWHA for review	IW	JD/LH	CF
B	22 August 2008	Revised for submission to DEWHA following comments on revision A	IW	JD/LH	CF
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D	17 November 2008	Revised for submission to DEWHA	IW	JD	CF
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G	16 December 2008	Revised for submission to DEWHA	IW	CF	CF

1. OVERVIEW

1a. A description of the proposal and associated infrastructure

A description of the pulp mill project has been provided in EIMP Module A.

The activity to which this module relates is monitoring. For the purpose of the EIMP and more particularly this module, monitoring comprises sampling, testing and inspection monitoring relating to the potential impacts of construction and operation of the mill and associated infrastructure on matters of Commonwealth significance; monitoring does not include preconstruction surveys.

This module collates monitoring commitments made in other modules and also describes baseline monitoring of the Commonwealth marine environment required by condition 36 and operational monitoring of the Commonwealth marine environment required by condition 41 of the approval (the module also references studies described in Module L that inform these monitoring programs).

Module L describes studies and investigations required to be undertaken prior to commissioning. It also describes trigger levels and maximum limits and response strategies that will be implemented should those triggers or limits be exceeded. Module N summarises the response strategies.

Gunns has also prepared a Commonwealth Baseline and Operational Monitoring Plan (C-BOMP) document which describes in much greater technical detail the baseline and operational monitoring that will be undertaken to satisfy the approval requirements. This is provided in Appendix C. For completeness, the C-BOMP also collates the monitoring commitments made in other modules.

The C-BOMP is an adaptive document that will be refined as monitoring and hydrodynamic modelling results come to hand. It is anticipated that any such refinements will also be subject to approval by DEWHA with the advice of the IEG. The refinements to the C-BOMP may also lead to refinements to this module

1a.1 Purpose

On 4 October 2007, the Commonwealth Minister for the Environment and Water Resources approved the taking of an action under the *Environment Protection and Biodiversity Conservation Act 1999*, namely "to construct and operate a bleached Kraft pulp mill at Bell Bay, Tasmania, and associated infrastructure" (EPBC 2007/3385).

Condition 2 of the approval requires Gunns to develop and submit an Environmental Impact Management Plan (EIMP), the objective of which is to ensure that there are no adverse impacts on matters of National Environmental Significance as a result of the action.

The purpose of the EIMP, and the further investigations that are required in order to prepare some of its components, is to ensure that matters of National Environmental Significance are protected during the construction and operation of the pulp mill project.

The EIMP and those investigations are not a continuation or extension of the project's approval assessment process. The approval process concluded with the issue of approval EPBC 2007/3385 on 4 October 2007. The EIMP is designed to ensure that the conditions of the EPBC approval are satisfied.

This module of the EIMP addresses those conditions of the approval that are relevant to monitoring.

1a.2 Scope

The EIMP deals only with matters relevant to the EPBC approval. It does not deal with the much wider range of matters relevant to the State approval conditions other than those that are also relevant to the EPBC approval.

The staging of the project will be different for different elements of the project. For example, construction work on the mill site itself will commence before the construction of the ocean outfall commences.

Hence, in accordance with conditions 7 and 8, which recognise a sectional and staged approach, the EIMP development and approval necessarily has a modular structure.

This EIMP, Module M: Monitoring, should be read in conjunction with the other EIMP modules that will be prepared and submitted in accordance with the timing of the various stages of the project. This module describes the monitoring that will be undertaken for the project, including monitoring described or referred to in those other modules.

Monitoring includes both monitoring by inspection and monitoring by measurement. Laboratory testing that is relevant to monitoring is identified in this module for completeness but is more fully described in EIMP Module L: Precommissioning management.

Preconstruction surveys are not included under the term monitoring and will not be described in this module. They are described in other modules as relevant.

Further information about the environmental management measures that will be implemented for the pulp mill project is available at www.gunnspulpmill.com.au.

1a.3 EIMP Structure

Schedule 2 of the EPBC 2007/3385 approval provides an outline for the EIMP (although the Schedule does not address all the permit conditions relating to the EIMP). The EIMP must set out specific issues and specific measures at each of the key preliminary phases of the project, these being:

- Preconstruction
- Construction
- Precommissioning.

The EIMP must also describe environmental management measures that will be implemented once the mill is operational, including:

- Ongoing monitoring
- Remedial and response strategies if trigger levels are likely to be exceeded or maximum target levels reached.

The operational phase modules of the EIMP describe trigger levels, maximum limits, response measures and a monitoring program to ensure protection of matters of National Environmental Significance from the operation of the mill.

The Department of Environment, Water, Heritage and the Arts (DEWHA) has specified that the EIMP structure must reflect the structure of Schedule 2 of the EPBC 2007/3385 approval.

These structural requirements overlay the project's staging, leading to the modular breakup shown in Table 1 that Gunns will adopt for EIMP preparation. Table 1 also shows the anticipated submission dates for each module. If these dates vary, DEWHA will be advised accordingly. As a matter of course, an updated Table 1 will be presented in each module of the EIMP.

Note that the original separation of the pipelines into the four modules and the solid waste disposal facility and reservoir into two modules (shown in Table 1) was based on the projected construction timetable at that time. Subsequent project delays and consequential changes to the construction timetable mean that the separation is no longer warranted. In addition, recent advice from DEWHA is that the approval conditions treat the effluent pipeline as a single action, which means that construction of any one element of the pipeline cannot proceed until all EIMP modules relating to it have been approved.

To minimise unnecessary duplication, EIMP Modules F, G, H and K have therefore been combined into a single module that will address those elements of the EIMP that are relevant to the water supply pipeline construction, effluent pipeline construction, shore crossing and ocean outfall construction. Similarly, EIMP Modules I and J have been combined into a single module that will address those elements of the EIMP that are relevant to the solid waste disposal facility and the reservoir.

Table 1: Modular elements of the EIMP and anticipated submission dates

	Module	Estimated submission date	Gunns document number
	Overview		
A	EIMP Overview	Approved 1-Feb-08	GNS-PLN-1000-1400-0006
	Preconstruction and construction		
B	Vegetation clearing - mill site and wharf access	Approved 1-Feb-08	GNS-PLN-1000-1400-0007
C	Bulk earthworks mill site	Approved 31-March-08	GNS-PLN-1000-1400-0008
C1	Mill construction	Submitted 14-Jul-08	GNS-PLN-1000-1400-0022
D	Wharf construction	Submitted 10-Jul-08	GNS-PLN-1000-1400-0009
E	Accommodation facility construction	Approved 23-May-08	GNS-PLN-1000-1400-0010
F	Water supply pipeline construction	Submitted 11-Jul-08	GNS-PLN-1000-1400-0011
G	Shore crossing	Submitted 11-Jul-08	GNS-PLN-1000-1400-0011
H	Ocean outfall construction	Submitted 11-Jul-08	GNS-PLN-1000-1400-0011
I	Solid waste disposal construction	Submitted 21-Jul-08	GNS-PLN-1000-1400-0014
J	Local reservoir construction	Submitted 21-Jul-08	GNS-PLN-1000-1400-0014
K	Effluent pipeline construction	Submitted 11-Jul-08	GNS-PLN-1000-1400-0011
	Precommissioning		
L	Precommissioning management	Submitted 15-Aug-08	GNS-PLN-1000-1400-0017
	Ongoing monitoring		
M	Monitoring program	Submitted 2-Jul-08	GNS-PLN-1000-1400-0018
	Remedial and response strategies		
N	Remedial and response strategies	22-Aug-08	GNS-PLN-1000-1400-0019
	Habitat measures		
O	Habitat offsets & reserves	Submitted 2-Jul-08	GNS-PLN-1000-1400-0020

Note that although the modules are labelled sequentially for convenience, as shown by the anticipated submission dates they will not be submitted in strict sequential order.

The detailed EIMP requirements are described in the separate EIMP Overview module. This EIMP Monitoring module should be read together with the EIMP Overview module. This EIMP module will also reference other previously approved modules where appropriate.

The EPBC 2007/3385 conditions addressed by each EIMP module are shown in Table 2.

Table 2: Modular elements of the EIMP and the EPBC 2007/3385 conditions they address

	Module	Conditions addressed	
	Overview		
A	EIMP Overview	1, 2, 6, 7, 8, 9, 10, 11, 12, 13, 20, 44, 45, 46, 47, 48	
	Preconstruction and construction	Preconstruction	Construction
B	Vegetation clearing - mill site and wharf access	14, 15, 17, 18, 20, 23, 25, 26	14, 15, 17, 18, 20, 23, 25, 26
C	Mill site bulk earthworks	14, 17, 18, 20, 23, 25, 26	14, 17, 18, 20, 23, 25, 26
C1	Mill construction	14, 17, 20, 23, 25, 26	14, 17, 20, 23, 25, 26
D	Wharf construction	14, 20, 27, 28, 29, 30	14, 20, 27, 28, 29, 30
E	Accommodation facility construction	14, 20, 23, 25	14, 20, 23, 25
F	Water supply pipeline construction	14, 20, 21, 22, 23, 25	14, 19, 20, 21, 23, 25
G	Shore crossing	14, 20, 23, 25, 27	14, 20, 23, 24, 25, 27
H	Ocean outfall construction	14, 20, 27, 28, 30, 38, 39	14, 20, 26, 27, 28, 30
I	Solid waste disposal construction	14, 17, 20, 23, 25	14, 17, 20, 23, 25, 26
J	Local reservoir construction	14, 17, 20, 23, 25	14, 17, 20, 23, 25, 26
K	Effluent pipeline construction	14, 20, 21, 23, 24, 25	14, 19, 20, 21, 22, 23, 24, 25
	Precommissioning		
L	Precommissioning management	3, 4, 9, 31, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42	
	Ongoing monitoring		
M	Monitoring program	3, 4, 15, 31, 32, 33, 36, 37, 40, 41, 42, 43*	
	Remedial and response strategies		
N	Remedial and response strategies	3, 4, 5, 19, 26, 29, 30, 31, 32, 33, 39	
	Habitat measures		
O	Habitat offsets & reserves	15, 16, 17, 18	

* For completeness Module M also reiterates monitoring described in other modules relevant to conditions 15, 16, 17, 18, 19, 20, 22, 25, 26, 27, 29, 30, 31, 34, 35, 36 and 38

Module A Overview was the first module prepared and approved. Table 2 of that module listed the conditions which at that time were anticipated to be addressed by each of the succeeding modules. As those other modules have been developed, some changes to the allocation of conditions to modules emerged as being desirable to best reflect the scope and contents of each module and their relationship to the approval conditions. The changes from the Module A anticipated allocations are indicated in the above table. Additions are shown in dark blue and removals are shown in light grey. Module G has been renamed from dune crossing to shore crossing.

Note also that Module C1 has been added since Module A was finalised. Module C1 does not introduce any environmental issues not already addressed by Modules B and C but it is provided as an informative document to describe the pulp mill's buildings and structures.

This module follows the outline required by Schedule 2 of the conditions of approval. While the Schedule, and consequently Table 2, notionally divides activities into preconstruction and construction, many activities are common to both phases. Measures addressed in the preconstruction phase may also be relevant to the construction phase. In this module, such activities include monitoring for wedge tailed eagles. Management measures for these common activities are described in the preconstruction chapter of this module and, where appropriate, the construction chapter refers to these descriptions.

The EIMP Overview Module A provides additional detail that demonstrates relationships between approval conditions, project elements, EIMP modules and EIMP components from various perspectives.

Appendix A provides an integrated summary of all those perspectives. Note that there have been some changes to the allocation of Schedule 2 issues to modules since Module A was approved. These changes emerged during the development of the modules as being desirable to best reflect the scope and contents of each module and their relationship to the Schedule 2 issues.

Appendix B provides a tabular summary of the monitoring strategies described in this module. In the event of any inconsistency between the text in these tables and the text in the body of the EIMP, the latter prevails.

Appendix C provides the detailed C-BOMP, which provides more details of the monitoring described in this module.

The EIMP modules cover both the construction (B-K, O) and operational phases of the project (L, M, N), with module A being an overview of the EIMP.

All EIMP modules have been prepared and submitted to the Minister to achieve final approval under condition 7 of the approval by 5 January 2009. This date was extended from the original 4 October 2008 approval date by consent of the Minister in accordance with that condition.

The construction phase modules describe management measures that will be implemented to ensure that there are no significant impacts on matters of National Environmental Significance due to the construction of the pulp mill and associated infrastructure.

The operational phase modules describe trigger levels, maximum limits, response measures and a monitoring program to ensure that there are no significant impacts on matters of National Environmental Significance due to the operation of the pulp mill.

The operational phase modules also describe additional studies and investigations that will be undertaken to address residual risks and uncertainties identified by the Chief Scientist. The findings of these studies and investigations may lead to a need to amend trigger levels, maximum limits, response measures and/or the monitoring program. A program of these studies and investigations is provided in Module L.

These studies and investigations are intended to further inform understanding of effluent characteristics and the design of the monitoring program. Gunns may also use the results of some of these studies and investigations to contribute to a request to the Minister to revise the trigger levels and maximum limits as provided for under condition 32.

The findings of the completed studies will need to be approved by the Department prior to commissioning commencing.

The results of the approved studies will need to be incorporated into the monitoring program (known as the Commonwealth Baseline and Operational Monitoring Plan, C-BOMP), or other documents as required, to the satisfaction of the Department prior to commissioning commencing. The results of baseline surveys being undertaken to inform the monitoring program will also be incorporated into the monitoring program.

An example of how the results of the further studies described in this module will influence the design of the final monitoring program is through the revision to and addition of sampling sites.

The hydrodynamic and sediment transport model required by condition 38 of the approval are central to the further studies and investigations described in this module. As required by

condition 39 a range of responses are outlined in this module depending on the sediment deposition and effluent plume behaviour predicted by the hydrodynamic modelling study.

As with the other studies, the results of the hydrodynamic modelling will be used to inform the design of the monitoring program prior to commissioning commencing. In addition, if the result of the modelling study show that a more significant response than this are required, such as changing the design of the diffuser or implementing tertiary treatment, the Minister would then determine under condition 44 of the approval to request Gunns to revise the EIMP as necessary. On receipt of such a request Gunns would revise the EIMP and submit the revision to the Minister for approval.

1a.4 Relevant environmental commitments

Gunns' environmental commitments for the project as they relate to matters of Commonwealth interest are described in documents submitted to the Minister under the EPBC Act approval process:

- Preliminary documentation: Gunns Limited Bell Bay Pulp Mill Project Impact Assessment under the *Environment Protection Biodiversity Conservation Act 1999*; and
- Response to public submissions: Gunns Limited Bell Bay Pulp Mill Project Response to Submissions under the *Environment Protection Biodiversity Conservation Act 1999*.

These commitments are described in EIMP Module A. Commitments that directly or indirectly require inspection and/or measurement monitoring and that are therefore relevant to this module are:

Terrestrial construction activities

All areas

- Prevent accidental loss or damage to native vegetation, through clear indication (ie flagging) of the areas to be cleared.
- Open trenches will be constructed with trench ramps and trench plugs to enable fauna to escape. Trenches will be checked for fauna at intervals during the day and first thing in the morning. Trapped fauna will be removed from the trench by trained personnel.
- A pre-clearing check of trees with nesting hollows will be undertaken by suitably trained personnel for signs of use by species such as the masked owl. If an active nest is located the tree will be maintained and pipeline construction activities delayed until young have fledged.
- In the unlikely event that an eagle nest is located during clearing or construction activities operations within 500 m or 1 km line of sight will stop, with breeding season exclusion buffers applied, between August and January inclusive, and appropriate nest management prescriptions applied in consultation with relative authorities.

Water supply pipeline, effluent pipeline and outfall site

- To ensure no disturbance to breeding white bellied sea eagles at the recorded nest site, no construction activities on the water supply pipeline will be undertaken within 500 m or 1 km line of sight of the nest site during the breeding season (August to January inclusive), if the nest is active. [Note: As described in Module F-G-H-K this is no longer required because the nest has since been found to not be an eagle's nest.]
- A pre-construction check of the shoreline at the effluent outfall site for breeding shorebirds will be undertaken for a distance of 200 m on either side of the construction zone. In the event that a nest is located they will be clearly marked and construction activities kept on the other side of the pipeline alignment from the breeding birds.
- The beach profile will be restored to its original shape after construction.
- With the exception of access tracks and roads, the pipeline alignments and effluent outfall area will be rehabilitated and revegetated with vegetation commensurate with the existing environment. Large trees or species with invasive root systems will, however, be excluded from the pipeline easements.

Marine construction activities

- If impact pile-driving operations for the wharf construction indicate that there is acoustic damage to fish, bubble curtains may be used to reduce underwater noise.
- For construction activities in the Tamar River visual monitoring will be implemented for marine mammals near the construction area to minimise any risk from underwater noise and vessel strike. A 2 km radius alert zone for whales will be implemented, with a 1 km radius safety zone, within which noise-generating activities will be ceased if a whale approaches. A reason for not halting construction activities for whales in the alert zone is that continuing construction noise may ensure whales move out of the area rather than encroaching the safety zone. If a whale approaches within 500 m of a construction vessel, the vessel will reduce speed or stop to avoid potential for collision.
- For construction activities in the Tamar River a 1 km radius alert zone for seals and dolphins will be implemented, with a 0.5 km radius safety zone, within which noise generating activities will be ceased if a seal or dolphin approaches.
- For construction activities at the ocean outfall site visual monitoring will be implemented for marine mammals near the construction area to minimise any risk from underwater noise and vessel strike. A 1 km radius alert zone for whales will be implemented, with a 0.5 km radius safety zone, within which noise-generating activities will be ceased if a whale approaches. The 1 km radius alert zone is a reduced distance from the typical 3 km visual zone typically applied to marine seismic surveying, due to the more benign nature of the construction noise required for the project.

Operational activities

- Key constituent concentrations within the treated effluent will be measured and monitored in the effluent treatment plant prior to its disposal via the effluent pipeline and diffuser.
- Treated effluent dispersion monitoring, and monitoring of the long-term impacts of treated effluent on the marine environment will be undertaken.

Monitoring measures to ensure delivery of these commitments are described in this EIMP Module.

1a.5 Relevant approval conditions and management measures

Schedule 2 of EPBC 2007/3385 identifies key phases of the project.

The approval conditions require a number of surveys to be undertaken in the Preconstruction phase. These surveys are described in the EIMP modules to which they are relevant, and survey reports are submitted to DEWHA as they are completed. These surveys are separate to monitoring and are therefore not discussed further in this module.

Subsequent project phases – Construction and Precommissioning – both have associated monitoring requirements, which are described in this module. Schedule 2 also requires the EIMP to describe arrangements for ongoing monitoring and monitoring against trigger levels. These arrangements are also described in this module.

Summary descriptions of the EPBC 2007/3385 approval conditions that require monitoring are provided in Table 3. Depending on its purpose, the monitoring may be by inspection or by measurement, as distinguished in the table. Table 3 also identifies those conditions for which the approval requires a trigger level to be determined.

For completeness, all conditions are shown, including overarching conditions and conditions requiring preconstruction surveys, both of which are shown in grey font because they do not fall under the definition of monitoring.

Table 3: EPBC 2007/3385 approval condition summaries and monitoring obligations that arise from them (normal font). Conditions that specify trigger levels are identified. Grey font shows conditions that do not fall under the definition of monitoring.

Condition	Summary of condition	Requirement	Trigger?	Applicability to monitoring
1	Defines geographic area of action	Overarching condition		
2	Requires EIMP to be prepared	Overarching condition		
3	Requires EIMP to include trigger levels, maximum limits and response strategies	General monitoring requirement	Yes	General requirement to identify trigger levels and maximum limits, which in turn imposes a general monitoring requirement.
4	Requires response strategies to be implemented if limits exceeded and if those measures do not achieve objectives then tertiary treatment must be installed	Overarching condition		General requirement to not exceed maximum limits, which in turn imposes a general monitoring requirement.
5	Requires response strategies to be implemented if trigger levels are exceeded	Overarching condition	Yes	
6	Requires EIMP to be developed in consultation with Expert Group	Overarching condition		
7	Provides for EIMP to be submitted in sections	Overarching condition		
8	Requires approvals to be obtained prior to each stage of construction	Overarching condition		
9	Requires final and complete EIMP to be approved prior to commissioning	Overarching condition		
10	Advises that Independent Site Supervisor will be appointed	Overarching condition		
11	Requires submission of Annual Performance Report	Annual performance reporting		(Performance reporting will need to include a summary of monitoring results against trigger levels and maximum limits.)
12	Requires compliance with any rectification requirements	Overarching condition		
13	Requires all relevant persons to be aware of EIMP provisions	Overarching condition		

Condition	Summary of condition	Requirement	Trigger?	Applicability to monitoring
14	Prescribes wedge-tailed eagle impact mitigation requirements	Preconstruction survey		
15	Requires annual inspections of wedge-tailed eagle nest #130	Ongoing inspections for 5 years		Nest #130 must be inspected in the second week of September and the second week of November each year for 5 years, commencing in 2007. If the nest is found to be abandoned as a consequence of the project, this will trigger a requirement to establish a 20 ha offset area.
16	Requires habitat offsets for threatened fauna mammals, birds and frogs	Ongoing habitat condition monitoring		The approval condition does not include an explicit monitoring requirement for habitat offsets but there is an implicit requirement to demonstrate that the offset areas are continuing to achieve their objective and that the condition of the offset areas is not degrading.
17	Requires habitat reserves for threatened mammals	Ongoing habitat condition monitoring		The approval condition does not include an explicit monitoring requirement for reserves but there is an implicit requirement to demonstrate that the reserves are continuing to achieve their objective and that the condition of the reserves is not degrading.
18	Requires foraging habitat reserve for swift parrot	Ongoing habitat condition monitoring		The approval condition does not include an explicit monitoring requirement for the reserve but there is an implicit requirement to demonstrate that the reserve is continuing to achieve its objective and that the condition of reserve is not degrading.
19	Specifies measures to minimise fauna becoming trapped in pipeline trenches	Inspections during construction	Yes	A suitably qualified person, agreed to by DEWHA, must inspect pipeline trenches each morning and remove trapped fauna. Records of fauna removed must be provided to DEWHA each month.
20	Requires vegetation disturbance to be limited to approved areas	Inspections during construction		Disturbance must be confined to within the approved pipeline project area. The corridor will be delineated and marked during construction. Inspections of construction activities will be undertaken regularly to ensure that no disturbance occurs outside the marked area.
21	Requires green and gold frog habitat to be avoided through pipeline micrositing	Preconstruction survey		
22	Specifies rehabilitation requirements for pipeline rehabilitation	Inspections during rehabilitation		Following the completion of construction works, rehabilitation and revegetation of areas that will be returned to their natural condition will be undertaken. Regular inspections of rehabilitated and revegetated areas will be undertaken until disturbed ground has stabilised and revegetation has matured.
23	Requires surveys for threatened crayfish and mitigation measures if they are found	Preconstruction survey		
24	Requires surveys and mitigation measures for *Xanthorrhoea aff. bracteata*	Preconstruction survey		
25	Requires surveys for specified threatened flora	Preconstruction survey		

Condition	Summary of condition	Requirement	Trigger?	Applicability to monitoring
26	Requires baseline monitoring of roadkill	Monitoring before and during construction	Yes	Baseline monitoring has been completed and a program of ongoing monitoring has been approved (described in Module C).
27	Requires surveys for threatened and migratory birds and beach profile	Inspection during construction		Inspection monitoring for shorebirds will be undertaken during construction if it coincides with the nesting season. A confirmation survey of the restored beach profile will be required 2 months after completion of construction.
28	Requires surveys for white-bellied sea eagle nests	Preconstruction survey		
29	Requires study and management of noise impacts on Australian grayling	Monitoring during construction	Yes	A specialist study of the potential impacts of underwater pile driving noise during wharf construction is provided in Module D. Underwater noise will be monitored during the initial piling driving to validate the model predictions of the study.
30	Requires study and management of noise impacts on marine species	Monitoring during construction	Yes	A specialist study of the potential impacts of underwater noise during construction of the ocean outfall (see Module FGHK) has been commissioned. The findings of that study have been used to develop trigger levels and a monitoring regime for underwater noise.
31	Limits volume of wastewater effluent that may be discharged	Monitoring during operations		The volume of effluent that may be discharged to the marine environment can be no more than 64 megalitres per day on an average monthly basis. The volume of effluent discharged will need to be monitored against this limit.
32	Specifies trigger levels and maximum limits for effluent concentrations	Monitoring during operations	Yes	The effluent quality must be sampled at least on a daily basis and the monthly average concentrations of specified effluent parameters must not exceed prescribed limits. The concentrations of the effluent parameters will need to be monitored against these limits.
33	Requires EIMP to include effluent concentration trigger levels	Overarching condition	Yes	
34	Requires chemical analyses and toxicity testing of overseas pulp mills	Testing before commissioning		Chemical analysis and whole toxicity testing of similar overseas pulp mills must be undertaken. Although these laboratory studies are not monitoring in themselves, their results may lead to refinements to the C-BOMP.
35	Requires laboratory studies of effluent particulate settling and flocculation	Testing before commissioning		Laboratory studies of the likely settling and flocculation properties of fine particulate organic materials in equivalent effluent must be undertaken. Although these laboratory studies are not monitoring in themselves, their results may lead to refinements to the C-BOMP.
36	Requires background survey of sediment characteristics and sediment and biota contaminants	Survey before commissioning		The grain size and organic carbon content of sediments and the background contamination of sediments and biota must be determined.
37	Requires effluent monitoring requirements to be determined	Monitoring during operations		Effluent monitoring requirements for specified effluent parameters must be determined.

Condition	Summary of condition	Requirement	Trigger?	Applicability to monitoring
38	Requires additional hydrodynamic modelling to be undertaken	Model calibration		The hydrodynamic modelling that will be undertaken will be calibrated by field monitoring results.
39	Requires response strategies if required as a result of hydrodynamic modelling	Overarching condition	Yes	
40	Requires baseline ecological surveys to be undertaken	Survey before commissioning		Precommissioning ecological surveys of benthic infauna and epibenthic flora must be undertaken.
41	Requires marine monitoring strategies to be approved prior to commissioning	Monitoring during operations	Yes	Strategies for monitoring the impacts of the mill effluent on the marine environment must be developed prior to mill commissioning.
42	Specifies maximum concentration of dioxins and furans in sediments	Monitoring during operations		Trends in concentrations of dioxins and furans in benthic sediments must be collected and analysed every 6 months to ensure levels do not exceed 850 pg TEQ/kg within Commonwealth waters.
43	Requires annual report to include reporting on performance against parameters	Annual performance reporting		Performance reporting must include a summary of monitoring results against trigger levels and maximum limits.
44	Requires compliance with any Ministerial request	Overarching condition		
45	Terminates approval if project not substantially commenced within 5 years	Overarching condition		
46	Requires independent audit of performance if directed by DEWHA	Overarching condition		
47	Requires DEWHA to be notified if any breach of anticipated breach	Overarching condition		
48	Provides for liability under EPBC Act	Overarching condition		
Schedule 2	Prescribes structure of EIMP	Guidance		(Provides guidance on how trigger levels should be addressed in the EIMP)

Schedule 2 of EPBC 2007/3385 requires the EIMP to reflect commitments made by Gunns in its preliminary documentation and also in its response to public submissions. Schedule 2 also requires the EIMP to address issues and concerns raised by the (then) Department of the Environment and Water Resources in its Recommendation Report and also matters raised in the Chief Scientist's report to the Minister. The identified monitoring tasks satisfy those requirements also.

1b. Identification of clear environmental objectives

Overarching environmental objectives for the project are to ensure that no adverse impacts occur on matters of National Environmental Significance have been outlined in Module A, Section B.

Specific environmental objectives relevant to this EIMP module are to establish a monitoring program that:

- Provides early warning of effluent concentrations reaching trigger levels and maximum limits
- Provides early warning of trigger levels being reached in Commonwealth waters or sediments or in Commonwealth listed biota
- Incorporates monitoring relevant to trigger levels addressed in other EIMP modules
- Monitors for environmental changes that might be caused by the pulp mill.

Monitoring is required to enable response strategies to be implemented if those objectives are threatened and to demonstrate that those objectives are achieved.

1c. Identification of environmental indicators, and translation of objectives into agreed targets and performance measures

EIMP modules identify specific environmental objectives and associated performance measures relevant to the particular activities covered by them. Those performance measures in turn have associated monitoring obligations.

For construction activities, examples of performance measures are:

- No abandonment of the Wedge-tailed Eagle – Tasmanian (*Aquila audax fleayi*) nest #130
- Annual (second weeks of September and November) monitoring of the Wedge-tailed Eagle – Tasmanian (*Aquila audax fleayi*) nest #130)
- No disturbance of vegetation outside the disturbance footprint shown in Modules B and C
- No harmful underwater noise levels in areas where the Australian Grayling (*Prototroctes maraena*) may be present.
- No marine mammal vessel strikes by vessels associated with construction of the wharf and ocean outfall.
- No harmful underwater noise levels in areas where whales, dolphins and seals may be present.

For operational activities, performance measures are defined by trigger levels and maximum limits. Ongoing monitoring against those trigger levels and maximum limits is required, including:

- Effluent monitoring
- Continuous monitoring of the effluent plume and its dispersion
- Sediment quality monitoring
- Sentinel biota monitoring
- Ecological surveys.

The determination of the trigger levels to be applied when the pulp mill is operating will be informed by studies and monitoring undertaken during the Precommissioning phase, including:

- Chemical and ecotoxicological assessments (described in Module L)
- Baseline monitoring of contaminants in sediments, water and biota.

1d. Design and implementation of an appropriate monitoring program

The pulp mill project will be covered by a comprehensive monitoring program.

Preconstruction surveys are not considered to be monitoring and are described separately in relevant EIMP modules and their descriptions and findings are not repeated in this module.

Construction monitoring is also described in relevant EIMP modules but is summarised in this module for completeness. The spatial scope of construction monitoring is determined by the spatial extent of impacts due to construction activities and the temporal scope of construction monitoring extends from the commencement of disturbance at a given construction site to the completion of works, and thereafter through the post-construction rehabilitation period.

Precommissioning and operation monitoring includes baseline monitoring, monitoring to identify appropriate trigger levels, and operational monitoring of performance against those trigger levels and approval discharge limits. These monitoring programs are described in this module at a level of detail considered to be appropriate for the EIMP. A more comprehensive description is provided in the C-BOMP document in Appendix C.

The structure of the C-BOMP matches the structure of the equivalent State BOMP (S-BOMP). Although there are separate BOMPs for the Commonwealth and State jurisdictions, they will be implemented in tandem by Gunns and the common structure will ensure that the monitoring is closely integrated. Together, the C-BOMP and the S-BOMP cover four principal monitoring areas: atmospheric (including emissions, ambient air, odour, produce and noise), terrestrial (including flora and fauna, soil, surface water and groundwater), effluent and marine.

The full list of monitoring programs covered by the overall project BOMP (P-BOMP) is shown in Table 4. Those relevant to the C-BOMP and therefore this module are shown in bold.

By its nature and also by the explicit requirements of the Commonwealth approval as recommended by the Chief Scientists Report, baseline and operational monitoring will both inform and be informed by the hydrodynamic modelling required by the approval conditions. Hydrodynamic modelling, which is described in EIMP Module L, will require many months of investigations and the results will not be available before 5 January 2009, the date by which the EIMP must be approved. Indeed, the EIMP describes the proposed scope and approach that will be taken for the modelling and related studies, and that work cannot be commissioned until the scope and approach have been approved, through the Minister's approval of the EIMP.

Baseline and operational monitoring will also be informed by the findings of the monitoring itself as they come to hand. These findings may similarly lead to ongoing refinements to the monitoring program. The monitoring program will need to be adaptive and the C-BOMP will therefore be an evolving document.

Table 4: The hierarchy and structure of the overall Project Baseline and Operational Monitoring Plan (P-BOMP). Items in bold are relevant to this EIMP module and the C-BOMP.

1 ATMOSPHERIC MONITORING
1.1 AIR & METEOROLOGY
1.1.1 Chemical, particulate matter and odour monitoring
1.1.2 Dairy produce monitoring
1.1.3 Noise and vibration
1.2 MILL SOURCE MONITORING
1.2.1 Continuous Emission Monitoring Systems (CEMS)
1.2.2 Non-continuous air emission monitoring (periodic stack testing)
1.2.3 Live dispersion modelling
2 TERRESTRIAL MONITORING AND NES FLORA AND FAUNA
2.1 GROUNDWATER
2.2 SURFACE WATER
2.3 SOILS
2.4 FLORA AND FAUNA OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (NES)
3 EFFLUENT QUALITY, QUANTITY & MARINE RECEIVING ENVIRONMENT MONITORING
3.1 EFFLUENT QUALITY & QUANTITY
3.1.1 Effluent quantity
3.1.2 Effluent quality
3.1.2.1 Pollutants and physico-chemical properties of effluent
3.1.2.2 Wastewater Toxicological Assessment
3.2 MARINE RECEIVING ENVIRONMENT
3.2.1 Marine (Bass Strait) ecology
3.2.1.1 Near-field ecology
3.2.1.2 Sediment quality
3.2.2 Marine (Bass Strait) water quality
3.2.3 Marine (Bass Strait) sediment chemistry
3.2.4 Sentinel biota including chemical residues
3.2.4.1 Taste tainting of seafood
3.2.4.2 Mussel watch
3.2.4.3 Flathead and mid-trophic level organisms
3.2.4.4 Higher trophic level predators

1e. Identification of, and commitment to, agreed trigger or response levels for key indicators

A number of the EPBC 2007/3385 approval conditions require the development of trigger levels that will be used to invoke response and remedial strategies to avoid approval conditions being breached and ensure that unacceptable environmental harm does not occur.

The EPBC 2007/3385 approval defines trigger levels to be: "*levels of specified parameters that, when reached, require the implementation of a response strategy within a specified timeframe as agreed by the Minister. Trigger levels will be below any maximum limits that are relevant to the trigger levels in question*".

Approval conditions specifying trigger levels are shown in Table 5.

Table 5: Approval conditions specifying trigger levels

Condition	Condition wording
3	The EIMP must include trigger points and maximum limits in relation to effluent discharge from the operation of the pulp mill as well as specific remedial management responses to be undertaken by Gunns Limited if trigger points are exceeded or maximum limits are reached. It shall be an operational objective of the pulp mill, and reflected in the EIMP, that trigger points, and maximum limits, are not to be reached.
5	If at any time during the taking of the action the trigger levels for effluent discharge in this approval, or in the EIMP, are exceeded, then Gunns Limited must immediately implement the response strategies in the EIMP, in accordance with stipulated timeframes.
19(d)	To minimise impacts during pipeline construction on the Tasmanian Devil, Spot-tailed quoll and Eastern Barred Bandicoot, and as part of the EIMP, Gunns Limited must: …(d) If at any time the number of fauna found in the trenches, reaches or exceeds the trigger levels defined in the EIMP, then response strategies must be implemented within the stipulated timeframes.
26(b)	To manage the risks to listed threatened species associated with roadkill, Gunns Limited must, in accordance with the EIMP: …(b) Monitor roadkill and implement response strategies, as necessary, in accordance with the EIMP if the number of road killed mammals exceeds the trigger levels in the EIMP.
29(c)	To minimise impacts on the Australian Grayling (*Prototroctes maraena)* Gunns Limited must put in place and implement, as part of the EIMP, measures including: …(c) If necessary, bubble curtains or other agreed response strategies must be implemented if trigger levels in the EIMP are exceeded.
30(c)	To minimise impacts on listed threatened and migratory marine species during construction of the wharf and the ocean outfall, Gunns Limited must put in place and implement, as part of the EIMP, measures, including: …(c) If necessary, bubble curtains or other agreed response strategies must be implemented if trigger levels in the EIMP are exceeded.
32	…Maximum limits and trigger levels on additional effluent contaminants (for example, nitrate, resin acid and colour) will also be developed in the EIMP in accordance with Schedule 2.
33	Prior to commissioning, trigger levels for effluent discharge for all phases of development must be included in the EIMP together with agreed response strategies and timeframes if trigger levels are exceeded or maximum limits reached.
39	In accordance with the EIMP, if the results of the modelling resulting from condition 38 indicate that effluent hydrodynamics and deposition will result in chemicals reaching trigger levels, Gunns Limited must implement approved response strategies, including, if necessary, changing the design and operation of the effluent pipeline and diffuser.

Condition	Condition wording
41(a)	In accordance with the EIMP, Gunns Limited must prepare and have approved by the Minister, prior to commencement of mill commissioning, strategies for monitoring the impacts of the mill effluent on the marine environment. These strategies must include but not necessarily be limited to: (a) Appropriate early warning of reaching trigger levels in Commonwealth waters.
Schedule 2	In addition, the EIMP must detail the arrangements for environmental management once the pulp mill is operational. These include: a. Ongoing monitoring; and b. The development of remedial and response strategies if monitoring shows trigger levels are likely to be exceeded or maximum target levels are to be reached.
	The plan must include but not necessarily be limited to: …e. Identification of, and commitment to, agreed trigger or response levels for key indicators; and f. Identification of specific remedial management responses to be undertaken when trigger point levels are exceeded, so as to ensure environmental targets and objectives will be achieved.
	The EIMP must address the management of all issues associated with protection of the Commonwealth marine environment, including: …c. Establish both maximum limits and trigger levels of pollutants in effluent discharge, in the receiving environment and in sentinel biota;
	The EIMP must establish the design and measures to implement an appropriate monitoring program to ensure there are no unacceptable impacts on matters of National Environmental Significance as a result of the action. The monitoring program must also identify and measure agreed trigger or response levels for key indicators.
	The EIMP must identify specific remedial management responses to be undertaken when trigger levels are exceeded or maximum limits are reached, so as to ensure no unacceptable environmental impacts on matters of National Environmental Significance. If necessary, remedial changes could include retrofitting of new technology, for example tertiary treatment of the effluent. It must be an operational objective of the pulp mill that trigger points, and maximum limits, are not to be reached.

The trigger levels that are specified in the approval conditions described in Table 5 are shown in Table 6, together with the EIMP modules that address them.

Table 6: Trigger levels specified in the approval and the EIMP modules that deal with them

Trigger	Module
Concentration of dioxins and furans, chlorate and total chloroacetic acids in effluent	L
Additional effluent contaminants, including nitrate, resin acid and colour	L
Numbers of Tasmanian devils, quolls and eastern barred bandicoots that may become trapped in pipeline excavation trenches	F-G-H-K
Numbers of listed threatened species that may be victims of roadkill	C, C1, I-J
Underwater noise impacts on Australian grayling during pile driving for the construction of the wharf	D
Underwater noise impacts on listed threatened and migratory marine species during construction of the wharf and ocean outfall	D, F-G-H-K

1f. Identification of specific remedial management responses to be undertaken when trigger point levels are exceeded

The approach that has been and/or will be taken to developing the response strategies for each of the trigger levels is described below.

Trigger issue: Concentration of dioxins and furans, chlorate and total chloroacetic acids in effluent

The additional toxicity studies, sediment monitoring and hydrodynamic modelling required to be undertaken by the approval conditions will inform the development of appropriate response strategies to ensure that maximum permitted levels of these substances are not exceeded. Response strategies could include:

- modifications to the diffuser design and/or operation
- modifications to the effluent treatment plant design and/or operation
- modifications to the mill's processes and/or operations.

Trigger issue: Additional effluent contaminants, including nitrate, resin acid and colour
The additional effluent contaminants are nitrogen, phosphorous, total suspended solids and BOD (from the second table in condition 32) and nitrate, resin acid and colour as identified in condition 32)

As above, response strategies could include:

- modifications to the diffuser design and/or operation
- modifications to the effluent treatment plant design and/or operation
- modifications to the mill's processes and/or operations.

Trigger issue: Numbers of Tasmanian devils, quolls and Eastern barred bandicoots that may become trapped in excavation trenches

The following response strategy has been adopted:

- Trenches will include trench ramps and plugs to enable fauna to escape of their own accord.
- Trenches will be checked first thing in the morning and at regular intervals during the day.
- When an animal is noted as trapped, work in the immediate vicinity (ie. 50 m) will stop immediately.

- Fauna trapped in trenches will be removed as soon as possible. No operations will commence or continue until fauna have been removed. Surviving fauna will be relocated to a suitable habitat by an ecologist trained in fauna handling procedures. Records will be kept of all live and dead fauna, including amphibians, removed from the trench.
- No untrained personnel will approach or unduly stress fauna.
- The grade and spacing of trench ramps will be revised if an animal becomes trapped.

Trigger issue: Numbers of listed threatened species that may be victims of roadkill

The following response strategy has been adopted:

- Speed reductions from 60 km/hr to 40 km/hr will be imposed on the site access road from the East Tamar Highway and a 20 km/hr limit will be imposed on the mill construction site internal networks.
- Traffic counters will be installed on the pulp mill access road and the landfill access road.
- Pulp mill access roads will be monitored for roadkill and any roadkill carcasses will be removed to a minimum distance of 10 m from the road to minimise risks of roadkill from carcass feeding.
- Car pooling and bus transport will be implemented to minimise construction worker vehicle movements associated with construction of the mill to achieve a 36% reduction in the construction worker traffic levels proposed in the Preliminary Documentation (Draft Integrated Impact Statement – Transport and Traffic Impact Assessment), from which Commonwealth assessment of the project was conducted.
- A daily bus service from George Town or Launceston (or both) will be implemented when construction workers travelling from either of those locations exceeds 50.
- Construction related heavy vehicle (ie. non-employee movement) traffic will be scheduled to minimise traffic during crepuscular periods (dawn and dusk) to minimise fauna roadkill.
- A feasibility study into the possibility of a cross-river ferry service for transportation of workers from the West Tamar to the site will be conducted.
- Site induction for all employees will include alerting them to the impact of roadkill and the need for care.

Trigger issue: Underwater noise impacts on Australian grayling during pile driving for the construction of the wharf

A desktop study of the potential impacts of underwater noise on the Australian grayling and listed Commonwealth marine species has been undertaken and is provided in EIMP Module D. On the basis of this study, a trigger level of CSEL = 195 dB re 1 μPa^2.sec at 500 m will be adopted.

If the CSEL is greater than 195 dB re 1 μPa^2.sec at 500 m, the hammering rate will be reduced until the CSEL at that distance reduces to below the trigger level. If the necessary rate reduction is not practicably achievable, bubble curtains will be installed to reduce the CSEL to below the trigger level at the desired hammering rate.

Trigger issue: Underwater noise impacts on listed threatened and migratory marine species during construction of the wharf and ocean outfall

In addition to the pile driving noise response measures described above, a marine mammal observer will be on duty at the wharf site at all times during pile driving and any other activity that could generate significant underwater noise. Similarly, a marine mammal observer will be on duty at the outfall site at all times that a significant underwater noise could be generated. As required by condition 30(e) of the approval, approval for the marine mammal observer(s) will be obtained from the Department. Noise-generating activities will cease if a whale, dolphin or seal enters their applicable safety zone, which will be the trigger for this response.

2. PRECONSTRUCTION

2a. Management of impacts on the wedge-tailed eagle – Tasmanian

This issue is managed by preconstruction surveys for wedge-tailed eagle and also white-bellied sea eagle nests (there is no separate heading for the latter in Schedule 2) and by construction exclusion buffers around nests.

The nearest nest to the construction footprint is nest #130, a wedge-tailed eagle nest approximately 900 m from the closest construction boundary. The nest is not line-of-sight to the construction area, and is outside the applicable 500 m exclusion buffer.

The approval conditions require an offset strategy to be invoked if this nest is abandoned as a result of construction. This strategy is described in Module O.

Nest #130 will be monitored by inspection in the second week of September and November each year for 5 years and the results will be provided to DEWHA.

In addition to inspection monitoring of this known nest, monitoring inspections for unknown nests will be undertaken in the construction corridor prior to vegetation clearance.

2b. Management of risks to listed flora from plant pathogens

This issue is managed by preconstruction surveys for *Phytophthora cinnamomi* and by an equipment hygiene certification system, described in EIMP Module C.

The certification system will use guidelines outlining specific hygiene requirements for specific infested areas, a washdown register to record machinery and vehicle movements, and colour coded stickers to assist in the identification of vehicles and machinery involved.

All vehicles must be certified and registered as clean before being permitted access to construction areas. Certified vehicles utilising constructed roads that have not passed through bare soil areas will not require wash down.

Inspections will be undertaken at the same time as the initial safety inspection and clean vehicles will be issued with confirming certification.

2c. Management of risks and uncertainties associated with the non-detection of listed flora

This issue is managed by preconstruction surveys for *Prasophyllum secutum*, *Caladenia caudata*, *Epacris exserta* and *Glycine latrobeana*, reported in EIMP Modules B, E, F-G-H-K and I-J. All areas within the proposed construction corridor have been surveyed. There are no flora monitoring requirements for this issue but monitoring inspections of construction activities will be undertaken to ensure that activities are confined to delineated construction areas.

2d. Management of risks associated with the decline of difficult-to-detect listed flora

In addition to the surveys for these species (see 2c), management measures will be implemented to ensure that disturbance is confined to within the approved pipeline project area. All vehicle access will be confined to existing roads and tracks that are within the pipeline project area and that have been subject to flora and fauna surveys.

Regular monitoring inspections and audits will be undertaken to ensure that disturbance is confined to the delineated work areas. Inspection will involve daily checks and recording of any non-conformance by date.

2e. Management of risks associated with the decline of *Xanthorrhoea aff. bracteata*

This issue is managed by preconstruction surveys for *Xanthorrhoea bracteata*, reported in EIMP Module F-G-H-K.

Management measures will be implemented to ensure that disturbance is confined to within the approved pipeline project area. All vehicle access will be confined to existing roads and tracks that have been subject to flora and fauna surveys.

Regular monitoring inspections and audits will be undertaken to ensure that disturbance is confined to the delineated work areas. Inspection will involve daily checks and recording of any non-conformance by date.

2f. Management of risks associated with the amphibian chytrid fungus *Batrachochytrium dendrobatidis*

This issue is managed by preconstruction surveys (reported in EIMP Module F-G-H-K), micrositing of pipelines to avoid identified green and gold frog (*Litoria raniformis*) habitat and by an equipment hygiene certification system, described in EIMP Module C.

The certification system will use guidelines outlining specific hygiene requirements for specific areas, a washdown register to record machinery and vehicle movements, and colour coded stickers to assist in the identification of vehicles and machinery involved.

All vehicles must be certified and registered as clean before being permitted access to the easement construction zone. Certified vehicles utilising constructed roads that have not passed through bare soil areas will not require wash down.

Inspections will be undertaken at the same time as the initial safety inspection and clean vehicles will be issued with confirming certification.

2g. Management of risks associated with trenching

This issue is managed by the following response strategy:

- Trenches will include trench ramps and plugs to enable fauna to escape of their own accord.
- When an animal is noted as trapped, work in the immediate vicinity (ie. 50 m) will stop immediately.
- Fauna trapped in trenches will be removed as soon as possible. No operations will commence or continue until fauna have been removed. Surviving fauna will be relocated to a suitable habitat by an ecologist trained in fauna handling procedures. Records will be kept of all live and dead fauna, including amphibians, removed from the trench and will be provided to DEWHA within three months of commencement of trench construction and progressively each month until all trenches have been filled.
- No untrained personnel will approach or unduly stress fauna.
- The grade and spacing of trench ramps will be revised if animals become trapped.

Trenches will be monitored by inspection first thing in the morning, at regular intervals during the day, and in the evening once works have concluded for the day.

2h. Mitigation of impacts on the pipeline corridors

A monitoring program for rehabilitation of pipeline easements will be implemented. This will entail inspections every 3 months for 2 years after completion of primary rehabilitation of an area, and every 6 months for a further 2 years. In addition, in areas susceptible to erosion, inspections will occur after each significant rain event and monthly during winter for 2 years after completion of primary rehabilitation.

Establishment of photo points for monthly monitoring of the success of rehabilitation.

2i. Establishment of baseline surveys for roadkill

A consulting firm, Genames, was commissioned to undertake a 3-month baseline survey of roadkill on the East Tamar Highway. A report (Genames (February 2008) *Baseline Roadkill Monitoring Programme for Bell Bay Alliance. Report prepared for Gunns Ltd*) has been provided to DEWHA and was attached to EIMP Module C as Appendix F.

2j. Undertaking appropriate surveys and establishing mitigation measures for impacts on listed migratory birds

A survey of the beach shoreline section of the construction corridor for shore bird nests will be conducted one week before construction activities commence within the shore crossing corridor. The results of this survey will be communicated to DEWHA.

If shore bird nests are found within the construction corridor, construction will be delayed until after breeding is completed.

After construction within the corridor has commenced, the corridor will be regularly monitored for shore birds. If shore birds begin nesting within the corridor after construction commences, the nest will be signposted at a distance that will not disturb the birds and avoided by construction vehicles and personnel.

2k. Undertaking appropriate examination of likely impacts of pile-driving noise associated with the wharf construction

Wharf construction

A desktop study of the potential impacts of underwater noise on the Australian grayling and listed Commonwealth marine species has been undertaken and is provided in EIMP Module D.

Underwater noise will be monitored in the vicinity of the wharf at the start of pile driving to validate the predictions of the underwater acoustic expert's report. The validation monitoring (which addresses condition 29(b) of the approval) will involve measuring underwater noise using a hydrophone lowered to mid-water depth at maximum interval distances of 100 m from the trial pile driving out to a distance of 500 m across the river (the direction and distance modelled in the study). Validation monitoring will be undertaken at both low tide and high tide. If measured values deviate significantly from the predictions, further advice will be taken from the study authors.

The hammering rate of pile driving will be controlled to ensure that the underwater acoustic trigger level of 195 dB re 1 μPa^2.sec (a measure of the cumulative sound exposure level from repeated pile driving strikes) at a distance of 500 m from the wharf is not exceeded. If achieving the trigger level by controlling hammer rate alone is not practicable, bubble curtains or other response strategies agreed with DEWHA will be used also.

Ocean outfall construction

A desktop study of the potential impacts of underwater noise on listed and migratory marine species during construction of the ocean outfall has also been undertaken and is provided in EIMP Module F-G-H-K.

Underwater noise will be monitored during the first stages of construction to validate the model predictions of the noise modelling study. The validation monitoring will involve measuring underwater noise using a hydrophone lowered to mid-water depth at a distance of 500 m and 1000 m away from the source of noise. Validation monitoring will be undertaken at both low tide and high tide. The monitoring findings will be compared with the study predictions. If measured values deviate significantly from the predictions, further advice will be taken from the study authors.

If noise measured during validation exceeds 190 dB re 1 µPa msp at 500 m (the level at which TTS occurs in pinnipeds) or 180dB re 1 µPa msp at 1000m (the level at which TTS occurs in cetaceans) then the safety zones will immediately be extended accordingly so that construction that may cause underwater noise is suspended if a mammal is within a distance where TTS is possible.

2l. Establishing baseline levels of vessel strike in the region

As described in EIMP Module D, at the request of Gunns the Resource Management and Conservation Agency, Conservation Policy Planning Branch of the Tasmanian Department of Primary Industry and Water have accessed all known sources of vessel strike data, including non-government sources.

The Agency provided the following advice:

> *It should be noted that there have been no reported marine mammal vessel strikes within State waters and as such there is no data to provide. The only known reports of marine mammal and vessel strikes has been from yachts competing in the Sydney to Hobart Yacht Race, however this has only been hearsay and no such formal reports have been recorded.*

There are therefore no records of vessel strike within Tasmanian State waters and therefore in the vicinity of the pulp mill project.

2m. Monitoring the baseline levels of contaminants in listed species

Baseline monitoring of contaminants in biota is described in section 4d.

2n. Developing rehabilitation and offset plans for listed threatened species

This issue relates to the creation of offsets to compensate for the loss or modification of native vegetation, specifically:

1. The rehabilitation of 200 ha of potential habitat for listed threatened species as an offset for the loss or modification of potential native vegetation habitat; and
2. The establishment of a 20 ha offset surrounding an eagle nest, should nest #130 be abandoned during construction or in the first breeding season after the commencement of construction.

The proposed habitat offset is 226 ha, which provides for a buffer around the 200 ha rehabilitation area.

The proposed eagle nest offset is significantly larger than the required offset of 20ha, with the offset approximately 40 ha of native forest containing two recorded eagle nests, #107 and #572. This offset has been proposed to provide for greater conservation outcomes, particularly given the presence of two recorded nest sites. If the offset is triggered the activity status of the nests will be determined in the next breeding season, with a report detailing the condition and activity of the nests submitted to the DEWHA. This activity assessment will be conducted on a single occasion, if the area is required as an offset, to ensure that disturbance to breeding birds associated with the activity checking is kept to an absolute minimum.

As described in EIMP Module O, the offsets will be maintained and protected in perpetuity under a covenant under Part 5 of the Tasmanian *Nature Conservation Act 2002.*

The covenant process and rehabilitation measures are described in EIMP Module O, and include:

- Site specific implementation of rehabilitation management actions for the long-term protection and management of the area;
- An action plan outlining timeframes for the implementation of each phase; and
- Monitoring and reporting commitments.

The wedge-tailed eagle offset (if triggered to be established) will be monitored in a similar manner to the reserves (see section 2o), with an appropriate monitoring program submitted to the Department for approval if the requirement for this offset occurs. Any necessary monitoring or management activities within the offset area will be timed to occur outside the eagle breeding season to eliminate the risk of disturbing breeding eagles.

The 200 ha rehabilitation offset area will be intensively monitored. The objective for the rehabilitation offset is to restore habitat values for threatened fauna species, and the intensive monitoring is required to confirm that this objective is being met.

Active rehabilitation monitoring

During rehabilitation activities a 6 month monitoring schedule will be implemented. Permanent photo points will be established at suitable vantage points within the rehabilitation offset area, with photos taken on an annual basis. These photo points will enable documentation of rehabilitation over time and will be included in the annual report for review and reference for DEWHA.

Long term monitoring

Long term permanent monitoring plots will be established within the rehabilitation offset area, both in the extant plantation and native vegetation community areas. Whilst the final number and exact location of the plots will be determined during the detailed planning stage, it is estimated that a minimum of 20 plots will be established. Plots in the native vegetation area will be located to capture the range of extant vegetation communities, with plots within the plantation areas located to capture the range of the likely pre-disturbance vegetation communities. This will enable tracking of the condition and improvement of each area over time.

These plots will be assessed using a quantified vegetation condition and fauna habitat assessment. The methodology will be based on that used to assess areas for their potential as habitat offsets.

The methodology provides a condition score for the monitoring plot being assessed, and changes in the condition score over time will provide a means of tracking and assessing the improvement of vegetation and habitat condition.

The monitoring methodology will incorporate relevant criteria used in the TASVEG *Vegetation Condition Manual* (VCM)[1] and also incorporate some additional criteria (as detailed following) to more accurately reflect the vegetation types being assessed, the potential presence of threatened species and fauna habitat, a more detailed consideration of weeds and disease and a modified consideration of landscape context.

Condition scores for the monitoring plots will be determined using (but not limited to) criteria drawn from the following, as appropriate and relevant to the condition of the plots (not all criteria will necessarily be used in any particular plot but the criteria used will remain consistent in any particular plot).

[1] Michaels, K. (2006), A Manual for Assessing Vegetation Condition in Tasmania, *Version 1.0*. Resource Management and Conservation, Department of Primary Industries, Water and Environment, Hobart.

The criteria include:

- *Patch classification*: classification of vegetation according to TASVEG mapping units
- *Floristic classification*: classification of vegetation according to the floristic communities present
- *Large trees*: estimation of the number of large trees (alive and dead)
- *Stocking:* the number of eucalypts present in relation to the stocking standards for the vegetation community
- *Tree canopy cover*: estimation of the projective foliage cover of the tree canopy
- *Understorey summary*: description of the composition of the understorey based on the observed number of species in different life form categories, including potential suitability as a fauna shelter site
- *Weeds*: estimation of the total percentage weed (projected foliage) cover in the zone and the proportion of this cover due to high threat weeds
- *Weed improvement factor*: estimation of the potential to improve the condition of a patch by control and/or elimination of identified weeds
- *Recruitment*: assessment of the evidence of recruitment and its diversity
- *Organic litter*: estimation of the percentage cover of the organic litter
- *Logs*: estimation of the length of logs present
- *Threatened flora*: adjustment to the total score if priority flora is identified from within or immediately adjacent to the monitoring plot
- *Patch size*: assessment of the size and degree of disturbance of the patch of which the monitoring plot forms a part
- *Neighbourhood*: assessment of the amount and configuration of native vegetation within the proximity of the monitoring plot
- *Fauna habitat*: assessment of the habitat value within the monitoring plot, presence of suitable foraging, den or shelter sites, with particular focus on listed species
- *Fauna presence*: recording of evidence of presence or utilisation within the monitoring plot, e.g. scats, prey remains or den sites, and incidental sightings of fauna species

These plots will be established prior to the commencement of rehabilitation activities and a 'before' assessment of these plots undertaken, to enable testing of the condition assessment methodology. Review and finalisation of the vegetation condition and fauna habitat assessment will be undertaken after this assessment, in consultation with DEWHA.

It is possible that the plots located within the extant vegetation areas could form comparison sites for those same vegetation communities being rehabilitated from plantation. This will also be determined during the 'before' assessment of the plots.

The assessment of these plots will be undertaken every two years after the completion of rehabilitation activities, for a minimum of 10 years. The monitoring requirements will be reassessed at this stage in consultation with DEWHA.

Recovery trajectory toward TASVEG benchmarks

The goal of the rehabilitation is to re-establish the likely pre-disturbance vegetation communities within the offset rehabilitation area. While final attainment of this goal is expected to take decades (and for some vegetation communities probably beyond the life of the pulp mill), progress towards it will be able to be tracked using "recovery trajectory" methods.

Recovery trajectory methods are still under development worldwide (Society for Restoration Ecology 2004[2]) but they are sufficiently developed to provide a useful performance tracking measure for the rehabilitation work for this project. An example of recovery trajectory tracking is available in Kanowski and Catterall (2007)[3] for wet tropical forests. Recovery trajectory has not been applied in cool temperate forests to our knowledge.

Vegetation condition assessment scores will be determined for each of the monitoring plots and trends towards the TASVEG benchmark score of the target vegetation type will be plotted for each of the condition criteria. The TASVEG benchmark score represents the average characteristics of a mature and apparently long-undisturbed state of the same vegetation type and were created using TASVEG vegetation community descriptions, existing literature, site data and input from vegetation scientists with expert knowledge of particular communities.

Trends will not always be continuously upwards towards an ultimate objective. In some cases, such as understorey, in the early years of rehabilitation the score may exceed the final objective and then drop towards the objective as the community matures. The ultimate goal of the rehabilitation will be for all criteria to settle to a score that meets the definition of the target vegetation type.

In addition to graphical tracking of the trends of individual criteria, a single overall index of the progress of the rehabilitation towards the target vegetation type will be calculated. It is anticipated that this will be by the use of a statistical similarity index but alternative indices may be determined to be more appropriate as results come to hand and experience is gained.

The use of recovery trajectory analysis to track rehabilitation has not been undertaken in Tasmanian forests before, and it is therefore not possible to establish performance benchmarks (e.g. by nominating in advance a benchmark similarity index to be achieved in any particular year). Nevertheless, the application of trajectory analysis to this project will provide a useful measure of rehabilitation progress and it will also develop valuable experience that will be applicable to other rehabilitation projects in Tasmanian forests and also in cool temperate forests in Australia generally.

Ongoing site inspections and surveys

Site inspections by a qualified ecologist will also be conducted annually to visually inspect the offset area and identify any management or emergent issues, e.g. declared weed infestations, and ensure that the appropriate response strategy is determined and implemented.

Detailed fauna surveys across the broader offset rehabilitation area will commence at the completion of the active rehabilitation program (estimated 2013) to track and establish progress toward milestones. These surveys will include a combination of targeted searches for fauna, including searching for scats, dens, evidence of foraging, spotlighting and use of

[2] Society for Ecological Restoration International Science & Policy Working Group, (2004) *The SER International Primer on Ecological Restoration*. www.ser.org & Tucson: Society for Ecological Restoration International.

[3] Kanowski, J. and Catterall, C.P. (2007) *Monitoring revegetation projects for biodiversity in rainforest landscapes. Toolkit version 1, revision 1.* Marine and Tropical Sciences Research Facility Report Series. Reef and Rainforest Research Centre Limited, Cairns.

hair tubes. Surveys will be designed and aim to determine the level of use, including whether fauna numbers are increasing or if there is evidence of successful breeding, more den sites etc. The exact methodology will be developed prior to the completion of the active rehabilitation program in consultation with DEWHA.

If the 40 ha wedge-tailed eagle offset is established (due to nest #130 being abandoned as a result of pulp mill construction activities), visual monitoring will be undertaken on an annual basis within this offset. Permanent monitoring photo points will be established within the offset area to enable documentation of its condition over time.

2o. Establishing measures for habitat protection

This issue relates to the creation of reserves to maintain or protect potential habitat for listed threatened species, specifically:

1. The establishment of a 150 ha reserve on the pulp mill site to maintain potential habitat for listed mammal species; and

2. The establishment of a 34 ha reserve to specifically protect habitat for the swift parrot.

As described in EIMP Module O, these areas will be maintained and protected in perpetuity under a covenant under Part 5 of the Tasmanian *Nature Conservation Act 2002.*

The protection of the 150 ha reserve area during construction has previously been described in EIMP Modules B and C.

The reserves have been selected due to their good ecological condition and similarity to habitat that will be lost. Site inspections by a qualified ecologist will be conducted annually to visually inspect the reserves and identify any management or emergent issues and may include strategic site photographs of any identified issues. The visual inspection will include noting of general health and any recruitment of the reserve vegetation, e.g. *E. ovata* trees in the swift parrot reserve, and include any incidental sightings of fauna or evidence of fauna use e.g. scats, diggings etc.

The swift parrot reserve site inspection will be timed to coincide with the presence of the swift parrot in Tasmania (August to February), to provide the opportunity for incidental sightings of bird use.

There will be daily monitoring of construction activities on the pulp mill site, such as vegetation clearing and bulk earthworks, to ensure that there will be no disturbance to the reserve network.

Permanent monitoring photo points will be established at suitable vantage points within the reserve areas to enable documentation of reserve condition over time. Photos will be taken on an annual basis, in line with the visual monitoring, and included in the annual report for review and reference for DEWHA.

Any emergent issues (e.g. the appearance of an infestation of declared weed) will be identified and an appropriate response strategy will be determined and implemented, in consultation with DEWHA.

3. CONSTRUCTION

Approval conditions relating to the following issues are identified in other EIMP modules. The associated monitoring obligations are summarised here.

3a. Management of risks associated with the amphibian chytrid fungus

This issue is managed by preconstruction surveys, micrositing of pipelines to avoid identified green and gold frog (*Litoria raniformis*) habitat and by an equipment hygiene certification system, described in EIMP Module C.

The certification system will use guidelines outlining specific hygiene requirements for specific areas, a washdown register to record machinery and vehicle movements, and colour coded stickers to assist in the identification of vehicles and machinery involved.

All vehicles must be certified and registered as clean before being permitted access to the easement construction zone. Certified vehicles utilising constructed roads that have not passed through bare soil areas will not require wash down.

Inspections will be undertaken at the same time as the initial safety inspection and clean vehicles will be issued with confirming certification.

3b. Management of risks associated with roadkill

The response strategy to manage risks of roadkill has been summarised in section 1f (and described in detail in EIMP Module C).

Compliance monitoring will be undertaken as follows. This monitoring was described in the approved EIMP Module C.

Three traffic classifier/counter devices will be installed at suitable locations on the access roads at:

- The access road to the overall site including pulp mill and Gunns' existing operations; and
- The existing operations, being Gunns Forest Products - Tamar, comprising the Tamar North and South Chip Mills and the associated North East Tasmania forestry business units (note - the contribution of chip mill operations can be gauged by the difference between the pulp pill road data and the main access road counts); and
- The access road to the Solid Waste Disposal Facility and Local Reservoir

The traffic classifier counters will be configured to report vehicle movements (inward and outward) at both sites according to the AustRoads 1994 Vehicle Classification System.

Periodic (weekly to fortnightly) interrogation of the recorded data will examine:

- Speed statistics in 10 km/h bins by vehicle class for both locations for inbound and outbound vehicle movements; and
- Daily vehicle counts by hourly time bins.

Information obtained by this process will be used for:

- Monitoring adherence to speed limits (refer Commitment 1);
- Management feedback for temporal controls (e.g. diversion of traffic movements from crepuscular periods);
- Dissemination of actual performance against targets in relation to condition 26 (roadkill) will be provided on a regular basis to the construction workforce as a means of reinforcing our objectives and commitments for this issue; and

- Preparation of quarterly reports to DEWHA including:
    - Directional class/speed matrix;
    - Total number of worker days (for construction activities) for the reporting period;
    - Monitoring of construction worker vehicle entries (refer commitment 3);
    - Daily mean individuals transported by bus for the period from Launceston and George Town (refer Commitments 3 and 4) ;
    - Actual verses projected cumulative vehicle movements to the site (with passenger(s) relating to construction); and
    - Records, photographs and GPS locations of roadkill fauna.

The traffic counter selected for the project is able to deliver both speed and vehicle classification, with an expected >95% accuracy. Vehicle speeds will be calculated from actuation time of parallel pressure sensors located 1.00 (±0.01) metre apart to an accuracy of ±1 millisecond. (Resolution can be impeded in some circumstances. For example, simultaneous actuation of sensors by vehicles travelling in opposite directions can inhibit the instrument's ability to accurately classify the vehicle(s) class in all cases.)

Three key AustRoads vehicle categories (classes 1, 3 and 4) to be managed by this system relate to passenger vehicles. It may therefore be necessary to manually adjust or supplement automated totals by manual records that are able to discriminate vehicles within a class based on their load. For example, class 3 and 4 vehicles have axle/wheelbase patterns that are common to both buses and trucks. In addition, vehicles carrying passengers (eg. visitors) that are not involved in construction activities will need to be excluded from vehicle movement reports relating to movement numbers.

3c. Management of pile-driving noise

Marine mammal observers (MMOs) will be people agreed to by the Department under condition 30(e) of the approval. Requests for these approvals will be separate to the module submission process. As a minimum the MMOs will have a demonstrable familiarity with the Australian Petroleum Production and Exploration Association (APPEA) CD-based identification and reporting package.

At least one MMO will be on duty at the wharf site and solely dedicated to observing marine mammals at all times during pile driving and any other activity that could generate significant underwater noise. Similarly, at least one MMO will be on duty at the ocean outfall site and solely dedicated to observing marine mammals at all times during any activity that could generate significant underwater noise (pile driving will not be undertaken for the outfall).

At the start of each continuous pile driving period at the wharf there will be gradual build-up in the hammering rate over at least a 10 minute period so that Australian grayling and marine mammals have time to leave and/or avoid the area before the full hammering rate is reached.

MMOs will be equipped with appropriate equipment (e.g. range finder binoculars, camera and recording documents) and will be sited at strategic vantage points on the shore or on board vessels, as is most appropriate for the circumstances.

For the wharf construction, the observer height and location will be whatever is necessary on a particular day (and time of day) to observe the entrance to Long Reach (the arm of the estuary within which the wharf is located) without obstruction or glare. Potential observer sites include on patrol vessels, the wharf site itself, the nearby power station, the observation point at Bell Bay, the wharf at Bell Bay and at Rowella.

For the outfall construction, the observer height and location will be whatever is necessary on a particular day (and time of day) to observe the marine mammal safety and alert zones surrounding the particular activity being undertaken. Potential observer sites include on

patrol vessels, the construction vessels themselves site itself and for activities close to shore the shoreline itself.

MMOs will be in direct or radio contact with the person overseeing construction activities to enable communications regarding any whale, dolphin or seal observations.

When construction activities that generate underwater noise are occurring at the wharf, regular visual surveillance at 10 to 15 minute intervals within the alert zones will be conducted.

When construction activities that generate underwater noise are planned, continual visual surveillance will occur within the relevant safety zones when marine mammals are present in those zones and those activities will not commence until the animals have left the safety zones.

A trigger level of a single marine mammal entering the relevant safety zone will be adopted. A 2 km radius alert for whales will be implemented with a 1 km radius safety zone, within which underwater noise generating activities will be ceased if a whale approaches. A 1 km radius alert for seals and dolphins will be implemented with a 0.5 km radius safety zone, within which underwater noise generating activities will be ceased if a seal or dolphin approaches.

3d. Development of strategies to minimise vessel strike

As described in EIMP Module D there are no records of vessel strike within Tasmanian State waters.

Based on general sighting data (provided by the Resource Management and Conservation Agency, Conservation Policy Planning Branch of the Tasmanian Department of Primary Industry and Water), the greatest likelihood of the presence of both cetaceans and seals is in spring and summer, particularly the latter. Nevertheless, care will be required at all times of the year.

Pulp mill vessels will be speed limited – the maximum allowed vessel speed during construction manoeuvres will be 2 knots and the maximum allowed vessel speed when transiting the Tamar Estuary will be 5 knots.

Vessel skippers and deck officers will keep monitoring watch for marine mammals and take avoidance action when necessary (deviation or stopping), aiming to leave a minimum separation distance of 500 m.

Shore based marine mammal observers will also conduct surveillance monitoring (see issue 3c) and will advise vessels in the vicinity when a marine mammal is within the alert zone of the wharf of ocean outfall construction areas.

3e. Appropriate strategies to minimise impacts on listed migratory birds

As described in issue 2j, during construction work at the ocean outfall shore crossing, regular monitoring of the construction corridor for newly arrived nesting shorebirds will be undertaken. If birds begin nesting within the construction corridor after construction commences, this would indicate that they are not distressed by the construction activities. Nevertheless, the nest will be signposted at a distance that does not disturb the birds and it will be avoided by construction vehicles and personnel.

Following rehabilitation of the beach profile after construction ends, a confirmation engineering survey of the beach profile will be undertaken and the results made available to DEWHA.

3f. Strategies to ensure no increase in the levels of contaminants in listed species

The overriding strategy to ensure no increase in the levels of contaminants in any species, including listed species, is to design, construct and operate a world's best practice pulp mill.

The mill effluent's key parameter concentrations will be lower than the US EPA guidelines and EU/IPPC guidelines, and will be similar to or lower than discharges at other modern pulp mills.

Whole of effluent testing has been undertaken to evaluate acute, sub-lethal and chronic endpoints in a number of aquatic species (described in the DIIS and the Preliminary Documentation). Effluent samples were taken from two overseas mills with similar mill engineering processes. The whole of effluent testing showed no toxicity to any tested organism in effluent diluted 10 times (ie 1:10 dilution). Therefore no toxicity impacts are expected at the much greater dilutions occurring in the Commonwealth marine area. However, additional surveys of overseas pulp mill effluent will seek to confirm this.

In addition to the general effects of the effluent constituents, a specific assessment for the impacts of dioxins on key species was undertaken. The Australian fur seal was selected as the key marine mammal species, as they are at the top of the food chain, are relatively sedentary and females spend the majority of their reproductive lives in the area and therefore will be more highly exposed to the effluent constituents through their diet.

While not an EPBC Act listed threatened or migratory species, the Australian fur seal is of conservation significance, and is a species highly exposed to the treated effluent discharge by virtue of its long life and position as a high trophic level predator. The assessment first considered the level of toxicity equivalents to dioxins and furans in the fish diet of seals. The assessment found that the total toxicity equivalent in fish was less than the US EPA and Environment Canada guideline values established to protect sensitive fish, as well as birds and mammals that eat fish. The total amount of toxic equivalents ingested by the seals were below the level of intake set to protect species. Therefore, adverse effects are not anticipated on the Australian fur seal, and therefore other marine mammals with less exposure to dioxins are also expected to be unaffected.

The results of the assessment of the impact of effluent constituents, including the dioxin impact assessment, together with the results of the whole of effluent testing for chronic and sub-lethal impacts, leads to the conclusion that the treated effluent will not adversely impact the survival, breeding and migration of fish, marine mammals, birds or other organisms in Tasmanian waters. However, additional surveys of overseas pulp mill effluent will seek to confirm this.

As no adverse impacts are expected within Tasmanian waters, there are no adverse impacts expected in the Commonwealth marine area, where effluent dilutions are predicted to be significantly greater. The assessment found that the existing primary productivity of the surrounding ecosystem will be unaltered, which together with a lack of direct toxicity to organisms, indicates ecological community structures and species diversity are unlikely to be adversely changed by the effluent outside a defined mixing zone.

Additional toxicity testing and hydrodynamic modelling will be undertaken in accordance with conditions 34 and 38 (and associated conditions) of the approval to validate these conclusions.

The marine monitoring programs described in this module will evaluate and provide surveillance using multiple lines of evidence into the future of the performance of the mill against the above expectations of no significant impacts on listed species.

3g. Management of risks associated with listed crayfish

This issue is managed by preconstruction surveys and micrositing of pipelines to avoid identified central north burrowing crayfish (*Engaeus granulatus*) and Mt Arthur burrowing crayfish (*Engaeus orramakunna*) populations. As described in Module C, these species do not occur within the project area. There are no monitoring requirements for this issue.

4. PRECOMMISSIONING

The Tasmanian and Commonwealth pulp mill approvals both have comprehensive baseline and operational monitoring requirements. Extensive discussions have been held with State and Commonwealth regulatory agencies, including a two day workshop attended by representatives of those agencies, Gunns, the Independent Expert Group and specialist consultants. The purpose of this workshop was to align the State and Commonwealth monitoring as much as possible.

In subsequent discussions with DEWHA, it was agreed that Gunns will submit a specific C-BOMP to the Commonwealth for approval (a separate S-BOMP will be submitted to the State for approval)

By its nature and also by the explicit requirements of the Commonwealth approval as recommended by the Chief Scientists Report, baseline and operational monitoring will both inform and be informed by modelling. In the case of the marine environment, the modelling will be the hydrodynamic modelling required by the approval conditions. Hydrodynamic modelling, which for the Commonwealth is addressed by EIMP Module L, will require many months of investigations and the results will not be available before 5 January 2009, the date by which the full EIMP must be approved.

Baseline and operational monitoring will also be informed by the findings of the monitoring itself as they come to hand. These findings may lead to changes in the monitoring program being necessary and desirable. The monitoring program needs to be adaptive and the C-BOMP will be an evolving document.

The monitoring programs described in the C-BOMP have been designed to ensure statistical rigour, based on expert advice from monitoring specialists with extensive experience in the environmental monitoring of pulp mills. The C-BOMP includes scheduled reviews of the monitoring results to confirm the statistical and other design issues.

The following summary descriptions of monitoring are derived from the C-BOMP. Further detail is available in the C-BOMP itself, which is attached as Appendix C.

The approval variously uses the terms “background” and “baseline” in different conditions. To minimise confusion, the term “baseline” will be used in the following for consistency unless the context means that it is not appropriate.

4a. Toxicity testing of an Elemental Chlorine Free mill effluent

Effluent testing prior to commissioning has been addressed in Module L.

Condition 34 requires toxicity testing of effluent from overseas mills. This testing must be undertaken prior to the commissioning of the Bell Bay pulp mill. The testing procedures have been described in Module L. The results of this testing will be compared with the results of ongoing toxicity testing of Bell Bay pulp mill effluent following commissioning. The ongoing testing is described in section 5e.

Condition 37 requires a reassessment of risk quotients for hydrophobic substances prior to mill commissioning. The reassessment methodology is described in Module L.

4b. Studies to establish the properties affecting fate of fine particulate organic matter in effluent

This issue relates to the hydrodynamic and sediment transport modelling that will be undertaken, which is described in EIMP Module L.

4c. Establish maximum limits and trigger levels of pollutants in effluent, receiving environment and sentinel biota

Module L addresses the establishment of trigger levels and maximum limits. The effluent, receiving environment and sentinel biota will be monitored against those trigger levels and maximum limits. This monitoring is described in section 5.

4d. Measurement of background contaminants in sediments and biota (condition 36)

4.d.1 Approval requirements

Relevant to this issue, condition 36 of the approval requires:

In accordance with the EIMP, to establish the level of background contaminants in sediments and biota, Gunns Limited must:

a) Undertake a survey of sediment grain size and organic carbon content for the region containing the outfall, including adjacent coastal and offshore regions, and identified depositional zones.

b) Determine background concentrations of contaminants of potential concern for sediments along transects from the proposed diffuser site, including both inshore and offshore sites, paying particular attention to depositional zones with fine grain size and high organic content.

c) Demonstrate how these findings have both informed, and been informed by, the refined hydrodynamic and sediment transport modelling required by the EIMP.

d) Limit samples for this research to the top 2 cm of core samples, so that recent deposition can be determined in later studies.

e) Determine background concentrations of contaminants of potential concern needed to be established for sentinel biota from outside of the mixing zone and from sediments collected both inshore and at identified likely deposition zones. Species selection must be agreed to by the Department on the basis of:

i) Benthic surveys; and

*ii) Expert knowledge of the prey species of listed threatened migratory and marine species and shore birds and the wide-ranging top predators, the Australian Fur Seal (*Arctocephalus pusillus*) and the Little Penguin (*Eudyptula minor*).*

4.d.2 Sediments (conditions 36(a), 36(b), 36(c), 36(d) and 36(e)(i))

The monitoring strategy includes baseline sediment surveys to be taken annually for two years, commencing after Notice to Proceed has been issued by Gunns Limited's Board with completion before mill commissioning. The location of the sampling sites may be adjusted in response to the findings of the hydrodynamic modelling and continuous plume monitoring programs. The findings of the baseline sediment sampling will in turn inform the hydrodynamic modelling and the interpretation of the hydrodynamic modelling results.

The monitoring strategy's survey design follows a Multiple Before and After at Control and Impact Locations (MBACI) framework.

Sampling locations are shown in Figure 1. In this map, the code "P" refers to epibenthic flora and fauna sampling sites and the code "B" refers to sediment and benthic infauna sampling sites. The code prefixes I, W and E refer to Impact, West and East respectively.

Sample Locations[4] will include at least 4 "test" areas nominally referred to as Impact Locations and 10 control Locations that coincide with ecological benthic infauna Locations (section 4e).

The sampling Locations form transects running east and west from the diffuser. In addition to these inshore Locations, four further Locations will be established along a transect running north of the diffuser into Commonwealth waters. These further Locations will be selected on the basis of inspection for suitable substrate, favouring finer material with organic content if apparent.

The program design including the location of the sampling sites may be adjusted in response to the findings of the hydrodynamic modelling, which is described in Module L. Following mill commissioning, there may also be adjustments to the sampling sites in response to the findings of the continuous plume monitoring described in section 5b. However, this will be after mill commissioning and will not influence the baseline monitoring. Further details are provided in the C-BOMP and below.

Impact Locations are situated at a distance of 25 to 75 m from the edge of the mixing zone defined under the State approval. The mixing zone is set in accordance with the Tasmanian *State Policy on Water Quality Management 1994*. The edge of the mixing zone identifies the distance from the discharge point where Water Quality Objectives for the ambient environment, prescribed in accordance with the policy, are achieved.

The impact Locations are situated where discharge concentrations or deposition of matter are potentially elevated, subsequent to the initial dilution that occurs within the mixing zone.

The control Locations are situated up to approximately 6 km to the west and east of the outfall (5 each), distances where exposure to effluent are likely to be very much less.

More (or alternative) Locations may also be determined to be necessary by the hydrodynamic modelling that will be undertaken. This modelling will examine sediment transport and may suggest Locations that are more likely to receive settlement of discharged particulates, and which may therefore be more appropriate sediment sampling Locations.

Each Location covers a 50 m diameter area. For the routine baseline sampling 5 Sites will be sampled within each Location drawn from the ecological program (section 4e) six monthly for a limited range of key determinands, while a limited number of the same Locations and other Locations that are not part of the ecological program will be sampled for a broader suite of determinands. All Locations will be repetitively sampled over the baseline period for a suite of dioxin and dioxin like compounds that will either be analysed immediately or archived pending analysis if required.

All samples for chemical analysis will be restricted to the surface 2 cm, using a spade corer or similar sampling device (eg. box corer) in accordance with Condition 36(d).

Each sample will be analysed for total nitrogen and total organic carbon content. The ratio of total nitrogen to total carbon will be examined as a covariate in the benthic infauna temporal and spatial variability analyses as the ratio of carbon to nitrogen is affected by terrestrial (wood) verses aquatic plant sources of marine deposition[5].

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[4] The terminology hierarchy used is *Location* then *Site* then *Replicate*: each Location will have 5 sample Sites within it and each Site may have up to 2 Replicate samples within it.

[5] Table 5-4 Pulp and Paper EEM Guidance Document, Environment Canada, 2005

The 5 Site samples from a given Location will also be used to make a composite sample that will be analysed for particle size distribution, using the Wentworth classification. A separate particle size distribution analysis will also be undertaken on samples retrieved by the benthic infauna sampler (Section 4e.2).

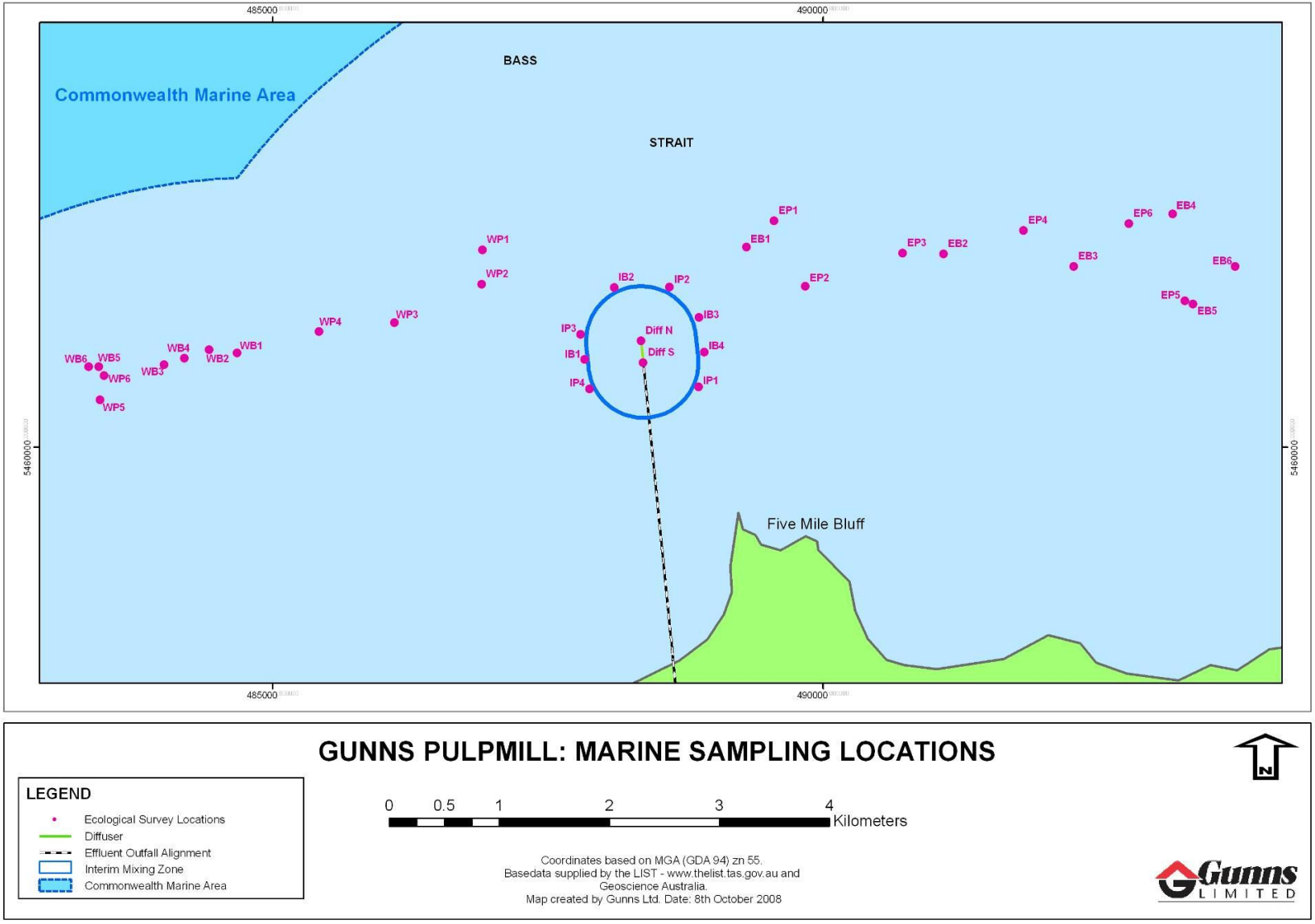

Figure 1: Marine sampling locations (these may be refined as a result of additional hydrodynamic modelling)

A detailed suite of chemical analysis will be conducted on a subset of Locations, referred to as Intensive Chemistry Locations – one Location from the western controls, one Location from the eastern controls, all four Impact Locations. The configuration of the Intensive Chemistry Locations will be approximately parallel to the prevailing tidal current along the coast, Intensive Chemistry Locations will be sampled in replicate, including limited sample archiving, while other Locations may not be sampled in replicate. The full sediment sampling regimes are described within the C-BOMP (Section 3.2).

4.d.3 Biota (condition 36(e)(ii))

The determination of baseline concentrations in benthic sediments (condition 36(e)(i)) is described in section 4.d.2.

The determination of baseline concentrations in sentinel biota (condition 36(e)(ii)) is described below.

The Tasmanian pulp mill permit also has monitoring requirements for sentinel biota. Discussions have been held with both the Tasmanian and Commonwealth regulatory agencies on this issue.

The Tasmanian regulators have clarified their permit requirements to be:

- To assess the baseline tissue burden of relevant persistent pollutants in higher predators endemic to the vicinity of the outfall, where
- Persistent pollutants comprise polychlorinated dibenzodioxins (PCDDs, 'dioxins'), polychlorinated dibenzofurans (PCDFs, 'furans'), and higher predators comprise little penguins (*Eudyptula minor*) and Australian fur seals (*Arctocephalus pusillus doriferus*).

The same strategy is proposed here in this module to satisfy the Commonwealth approval requirements. The species selected as sentinel biota, described in the following sections, have been agreed to by DEWHA in accordance with condition 36(e) of the approval.

The Marine Risk Assessment (Drew & Frangos 2007) for the pulp mill project used seals as the sentinel mammalian species and little penguins and white bellied sea eagles as the sentinel species for birds. The assessment constructed simplified food webs for the three species and estimated total TEQ intakes, noting that these organisms represent higher order predators. The three species were chosen for that detailed Risk Assessment as they have similar attributes including a likelihood for long term exposure of the organisms themselves and their food to effluent from the mill.

Of the three species chosen for the Marine Risk Assessment, two species (little penguins and Australian fur seals) have been selected for ongoing monitoring to test the conclusions made in the assessment.

The purpose of the monitoring is to establish the extent of little penguin and Australian fur seal exposure to potential bioaccumulative constituents of the pulp mill effluent. The objectives of the monitoring can therefore be summarised as:

- What is the baseline level of the pollutants in a sample of little penguins and fur seals?
- Do these variables change as a result of the pulp mill, i.e. is there evidence in little penguins or fur seals of bioaccumulation of pollutants?

Gunns is conscious of the need to minimise the impact of the required monitoring on individual penguins and seals and on the populations from which they are sampled, and the sampling program has been designed to achieve this end.

4.d.3.1 Prey species of listed threatened migratory and marine species and shore birds (condition 36(e)(ii))

Listed threatened migratory and marine species and shore birds feed on a range of species too wide to sample practically.

Sampling will therefore concentrate on representative species that can reasonably be taken to be indicative of the variety of species that may be preyed upon by threatened migratory marine species and shore birds.

The species selected as sentinel biota for the prey of migratory and marine species and shore birds in accordance with Condition 36(e) are as follows. The selection of these species has also been integrated with the monitoring requirements of the State approval conditions to ensure a coordinated monitoring program.

Blue mussel (*Mytilus edulis*) and triploid Pacific oyster (*Crassostrea gigas*).

These are filter feeding bivalves that feed on planktonic algae and detritus.

Although neither species is naturally found in the vicinity of the outfall, both have a well established and understood use as sentinels for pollution assessments. They will be sourced from an aquaculture hatchery and deployed in socks (mussels) and or cages (mussels or oysters) tethered at two levels, circa 5 m below the water surface and circa 2.5 m above the seabed. The oysters, which are an introduced species, will be triploids and therefore sterile.

The planned deployment Locations for baseline monitoring are at sites 500 m from the diffuser in the southeast and southwest quadrants and at sites 5 km to the west and east of the diffuser (sites EOP, WOP, SE500, SW500, EOP and WOP shown in Figure 2). The program design including the Location of the sampling sites may be adjusted in response to the findings of the hydrodynamic modelling and a three month pilot program to be trialled before full scale deployment.

These Locations may be refined due to the anchoring constraints imposed by the proximity of the Basslink high voltage electricity cable.

The mussels and oysters will be representative of filter feeding bivalves, such as scallops and clams, which form part of the diet of many marine mammals and shore birds. Scallops and clams are less suitable for cage culture and, more particularly, do not have the well established record of use in pollution monitoring that mussels and oysters do.

Two sub-programs are planned and both will be trialled for a period of three months before full deployment. One sub-program will focus on tissue accumulation over short periods (3 months, mussels only), while the other program assesses organism health over 24 month deployment (mussels and oysters). Due to the nature of Bass Strait, achievement of this program may be problematic due to a number of natural factors that are unable to be controlled. The success of the program will be monitored and any variations emanating from the experience gained by pilot monitoring will be discussed and agreed with DEWHA prior to full scale deployment.

Soft tissue (mussels only) will be analysed for discharge contaminants that have the potential to bioaccumulate. The analytical suite and methodology for the pilot phase program are described in the C-BOMP (Appendix C).

Deployment over a period prior to mill commissioning will establish baseline contamination levels.

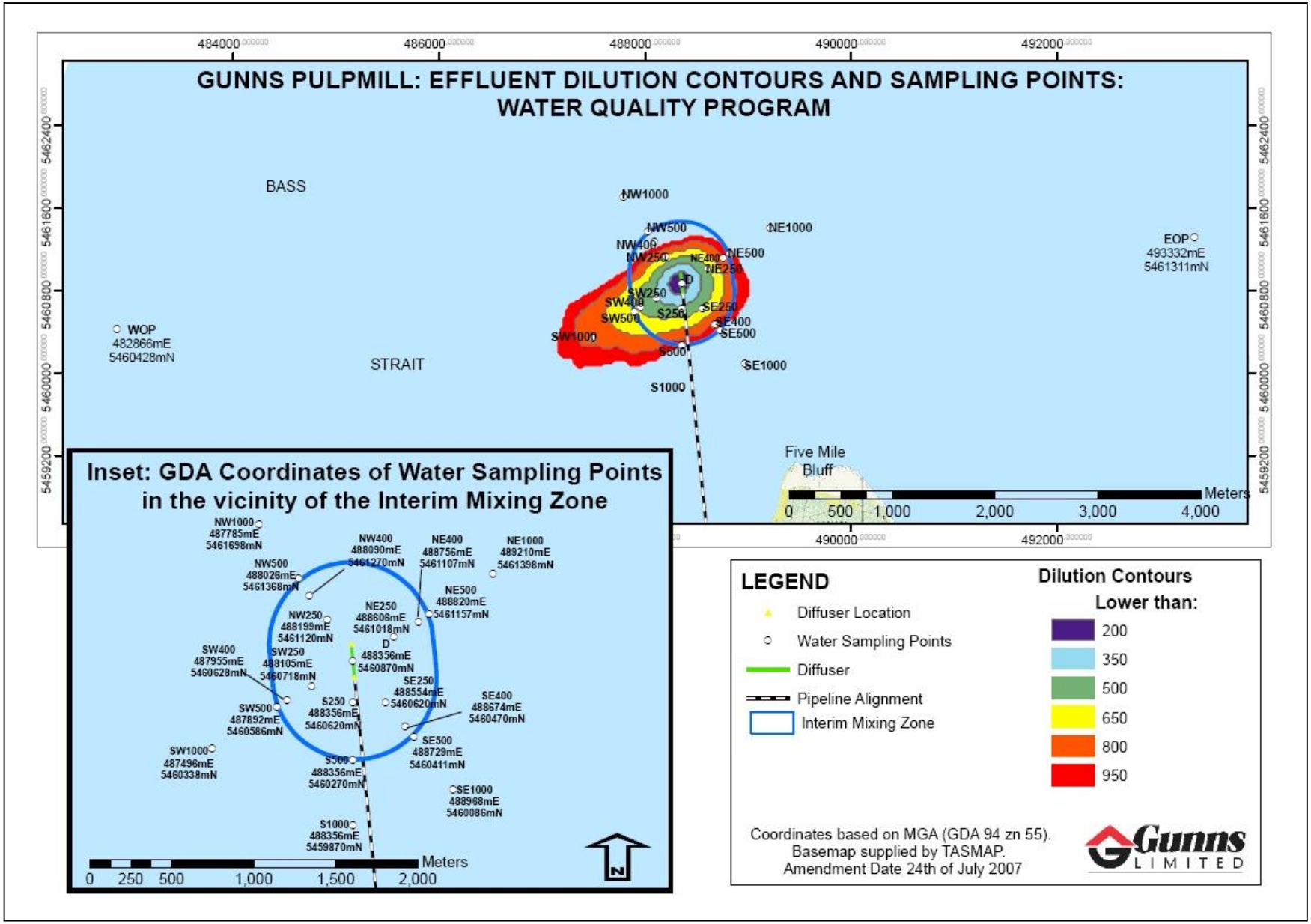

Figure 2: Interim mixing zone and associated water quality monitoring Locations (these may be refined as a result of additional hydrodynamic modelling)

Following the commencement of mill commissioning, the periodic deployments will continue for up to 3 years. These samples will allow comparison with the baseline levels to indicate whether effluent contaminants may have entered the food chain of threatened migratory and marine species and shore birds.

In addition to the chemical tissue accumulation analysis of the short term exposure program, condition assessments of mussels and oysters will be undertaken for both baseline and operational deployments. Condition indicators will include growth and survival rates, wet to dry weight ratio, wet flesh to total weight ratio and a byssal thread attachment assay.

Flathead (*Neoplatycephalus aurimaculatus* and/or *Platycephalus basensis*)

Flathead are bottom dwelling fish and are a mid trophic level opportunistic predator. Flathead share components of the food chain that lead to higher predators of Commonwealth significance and have been reported as minor components of the diet of little penguins and fur seals. Flathead are also a major recreational fishing catch and are therefore of major interest for potential contamination and tainting of human seafood.

A pilot catch program for two candidate species – toothy flathead (*Neoplatycephalus aurimaculatus*) and sand flathead (*Platycephalus basensis*) – will be undertaken to select the species to be used, based on availability and other biological and logistical factors.

Fish will be caught in a pre-spawning period each year (likely to be September to November). Catch locations will be in the vicinity of the diffuser and two reference or control Locations. Candidates for the reference Locations include but are not necessarily limited to the Bridport region and in the Musselroe Bay region (see Figure 3). These Locations reflect the expected dispersion pattern of the effluent.

Muscle tissue will be analysed for discharge contaminants that have the potential to bioaccumulate (taste testing will also be conducted). The analytical suite and methodology are described in the C-BOMP (Appendix C).

In addition to the chemical contamination analysis, condition assessments of the fish will be undertaken for both baseline and operational deployments. Condition indicators will include histological archiving of gill, kidney, liver and gonads, of a subset of fish for future reference if required and macroscopic assessments including gonadosomatic, hepatosomatic and Fulton's condition indices and inspections for skin lesions and ectoparasites. The nominated somatic and condition indices are used successfully to monitor for endocrine disruption in fish populations in Canada and other places, particularly in water bodies receiving pulp mill & or sewage effluents.

Leatherjackets (*Thamnaconus degeni* and/or *Scobinichthys granulatus*)

Degen's leatherjacket (*Thamnaconus degeni*) is a bottom dwelling species and the rough leatherjacket (*Scobinichthys granulatus*) is found in seagrass beds and on rocky reefs. Leatherjackets typically have an omnivorous diet that includes algae, epifauna, hydroids, molluscs, crustaceans and polychaetes. Leatherjackets are a common component of the diet of seabirds, such as penguins and crested terns, and also the Australian fur seal. Leatherjackets therefore occupy a mid-level position in the food chain leading to higher predators of Commonwealth significance.

Fish will be caught from the vicinity of the diffuser and from the Tenth Island area (see Figure 3), reflecting the foraging area of the Tenth Island seal colony. The sampling will be coordinated with the ecological program (section 4e) initially and may be modified to optimise interpretation of key metrics which are based on seasonal factors.

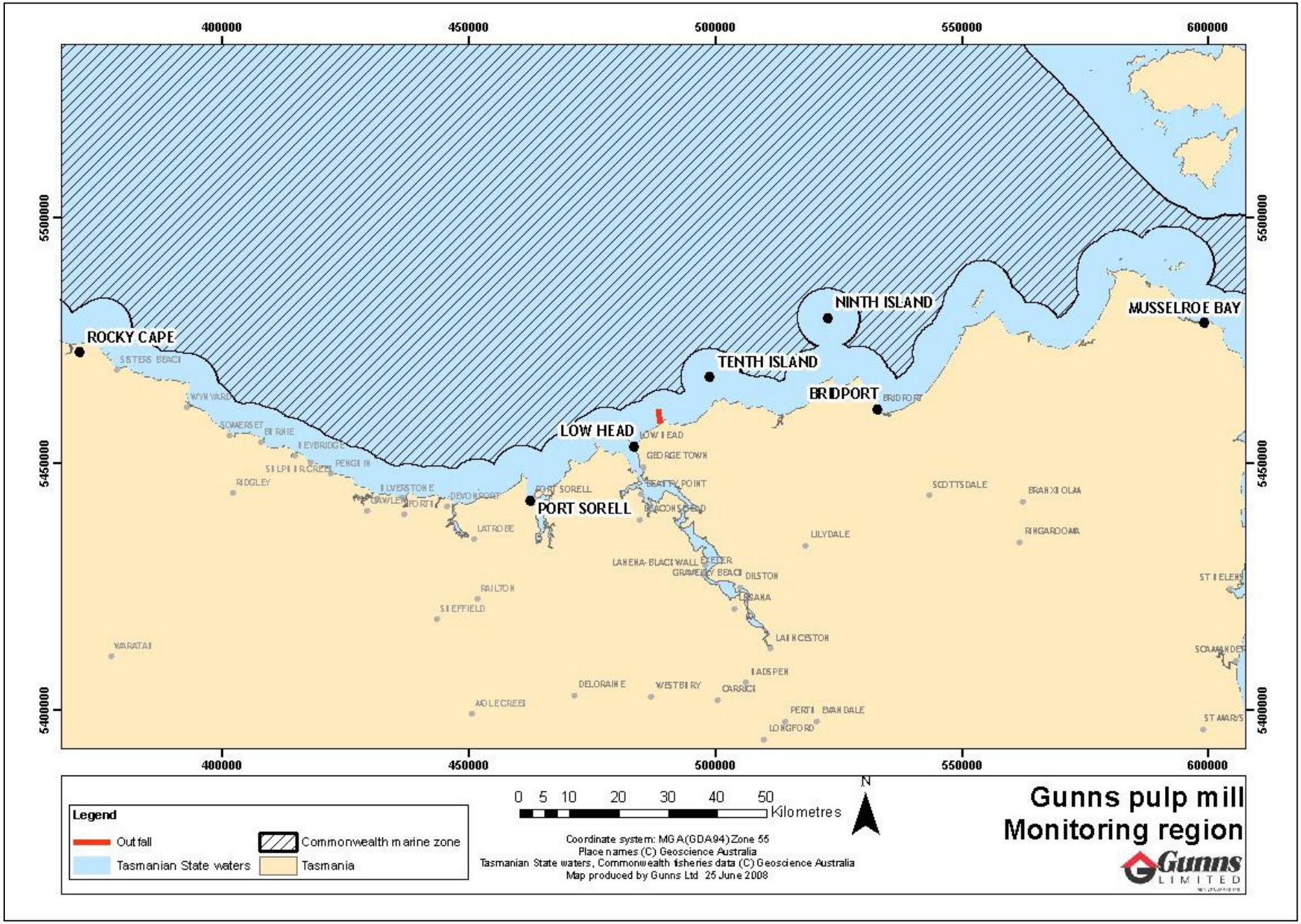

Figure 3: Monitoring localities referred to in the text

Composite samples of fish tissue will be analysed for dioxins, furans and dioxin-like PCBs, reported as WHO_{05}-TEF congeners and WHO_{05}-TEQ pg/g fresh and pg/g lipid. The full analytical description and methodology are provided in the C-BOMP (Appendix C). Somatic and condition indices, as per the flathead program will also be tracked in leatherjackets, thus adding a further line of evidence to strengthen the interpretive value of the integrated program.

Sampling over a 2 year period prior to mill commissioning will establish baseline contaminate and condition index levels.

4.d.3.2 Seals (condition 36(e)(ii))

Baseline monitoring of Australian fur seals in the vicinity of the outfall and at a control Location at Reid Rocks (20 km southeast of King Island) will be undertaken to assess the existing tissue burden of polychlorinated dibenzo-p-dioxin (PCDD or dioxins) and polychlorinated dibenzofuran (PCDF or furans) congeners that have WHO_{05} Toxic Equivalency Factors (TEFs) assigned.

Dioxins and furans are persistent organic pollutants (POPs). Uptake of the POPs is predominantly via the food web, with accumulation of POPs culminating in maximum tissue burdens being found in higher predators such as seals. Fish-eating wildlife, including marine mammals such as seals, are particularly vulnerable to contamination by POPs given their long lives, high trophic level, relative inability to metabolize many POPs, and the bioaccumulation of these contaminants in aquatic food chains. POPs are generally lipophilic and in seals will therefore be found in their highest concentrations in blubber.

The monitoring will use samples of seal blubber. Baseline data will establish the existing dioxin and furans TEQ profile in Australian fur seals.

The most appropriate seals to sample are seal pups. Mature males forage too widely to be representative of local conditions. Seals also accumulate POPs with age and it would be crucial to know the age of any sampled individuals. However, aging requires the removal of a tooth, which is both permanently damaging and dangerous to sampling personnel. Mature females forage locally but POPs are transferred to pups with lactation, resulting in fluctuating POP levels in the mothers and hence making long term interpretation problematic. Seal pups are therefore the preferred candidate for obtaining reliable results in a long term study. Before they begin foraging on their own, their POP levels will reflect the bioaccumulation of POPs in their mother, sourced from prey in the vicinity of their breeding colony over the preceding year.

The vast majority of Australian fur seals recorded in the vicinity of the outfall belong to the nearby colony on Tenth Island (see Figure 3). The seal monitoring strategy will therefore focus on this colony as the sentinel population.

Tenth Island is the closest seal colony to the outfall diffuser, and is located 12 km from it. It is highly likely that seals from this colony will forage in the effluent stream. The closest other Tasmanian breeding colonies are located at Reid Rocks and Moriarty Rocks, 265 km and 149 km distant respectively.

Sampling of seals is necessarily an invasive procedure. Blubber samples must be taken by biopsy punching. This is stressful to the seals and it also introduces a risk of later infection. Primary objectives for the design of the program are that the harm and stress on individual seals and on the seal colony must be minimised and must be acceptable.

Crucially, the risks of impacts on seals and colonies from the sampling need to be weighed against the risks of harm to seals due to the effects of the effluent discharge.

In addition to live sampling, the opportunistic sampling of seal carcasses will also be considered. If any suitable dead seal pups (for example obviously recent mortalities – determined by the on-site veterinary surgeon) are encountered during the sampling events,

the carcasses if less than three total or a representative portion of carcasses if greater than three total will be sampled with a methodology consistent with that of live pups, with the samples frozen and archived for a minimum period of ten years from collection for potential analysis if required. Any decision to analyse tissue from these carcasses will be made in consultation with DEWHA and the biota monitoring framework will be revised for approval by DEWHA if and as necessary.

As described in the DIIS and Preliminary Documentation, it is considered to be highly unlikely that the effluent discharge will lead to any measurable accumulation of contaminants in seals. Seal monitoring intensity needs to be commensurate with this low risk.

In order to minimise sampling impacts on seals, Gunns proposes to use the Reid Rocks control site for a single baseline sampling run and then only sample the site again if an increase in contaminants is observed in seals at the Tenth Island colony. If this circumstance arises, a second site may be introduced through an Investigation of Cause (IoC) process to determine whether that trend is local to the Tenth Island colony or widespread, beyond any potential impact from the pulp mill discharge.

Two years of baseline data will be obtained to establish the existing POP TEQ profile in seal pup blubber at Tenth Island and Reid Rocks. Consistent with other baseline monitoring and the scientific literature, the baseline data is expected to show a small ratio of low to high chlorinated PCDD/F congeners.

Where PCDD/Fs have been measurable in other pulp mill effluents, the ratio of low to high chlorinated PCDD/F congeners in the effluent is characteristically higher than that naturally occurring in the surrounding environment. If mill effluent contains measurable PCDD/F's, the lower chlorinated congeners (<5 Cl) could be expected to dominate whereas the dominant background congeners are highly chlorinated (>6 Cl). If seals bioaccumulate PCDD/Fs from the pulp mill effluent, the ratio of low to high chlorinated PCDD/F congeners in their blubber would be expected to gradually increase. A more sensitive exposure indicator for pulp mill effluent may be an increase in the (< 5 Cl PCDD/F congener TEQ):(PCB TEQ) ratio occurring in the face of stable (>6 Cl PCDD/F congener TEQ):(PCB TEQ) ratios, because pulp mill effluent is not expected to contain PCBs.

Confirmation of the specificity of the signature of the dioxins and furans may be gained from the effluent monitoring (section 4.g.3).

The sampling protocol will follow the international (OSPAR Convention) Joint Assessment and Monitoring Programme (JAMP) Guidelines for Monitoring Contaminants in Biota.

Pups will be sampled in the presence of a veterinary surgeon, whose discretion will determine the number of pups that can be sampled. The target number of samples will be the minimum necessary to achieve statistical reliability within bioethical and logistical constraints.

An initial test sampling run will be undertaken in February/March 2009 at Tenth Island (only). This sampling will test the sampling methodology and provide material for testing the analytical methodology.

The variability in POP levels in the test samples will be determined if possible, and the results of this will inform future sample size decisions. The appropriateness and/or need for using composite samples to satisfy laboratory analytical requirements will also be assessed.

A full description of the seal sampling methodology and analytical protocols is provided in the C-BOMP (Appendix C).

4.d.3.3 Penguins (condition 36(e)(ii))

Baseline monitoring of little penguins in the vicinity of the outfall will be undertaken to assess the existing tissue burden of polychlorinated dibenzo-p-dioxin (PCDD or dioxins) and polychlorinated dibenzofuran (PCDF or furans) congeners that have WHO_{05} Toxic Equivalency Factors (TEFs) assigned.

Dioxins and furans are persistent organic pollutants (POPs). Uptake of the POPs is predominantly via the food web, with accumulation of POPs culminating in maximum tissue burdens being found in higher predators such as penguins. Fish-eating wildlife, including seabirds such as seals, are particularly vulnerable to contamination by POPs given their long lives, high trophic level, relative inability to metabolize many POPs, and the bioaccumulation of these contaminants in aquatic food chains. POPs are generally lipophilic and in penguins will therefore be found in eggs.

The monitoring strategy is to use samples of eggs. Baseline data will establish the existing dioxin and furans TEQ profile in little penguin eggs.

Eggs will be collected from the Low Head little penguin colony, which is located to the west of the proposed outfall (see Figure 3). The Low Head colony is the closest little penguin colony to the outfall diffuser and is approximately 9 km from it. It is highly likely that penguins from this colony will forage in the effluent stream close to the mixing zone.

A control site for little penguins will also be sampled. This site will be at Cataraqui Point King Island, approximately 250 km by sea from the outfall.

Confirmation of the specificity of the signature of the dioxins and furans (section 4.d.3.2) may be gained from the effluent monitoring (section 4.g.3). Subject to this confirmation, the source of POPs is expected to be able to be determined without the use of controls.

A test sampling run will be undertaken at Low Head (only) in spring 2008 to test the sampling methodology and test the analytical methodology.

Two years of baseline data (after Notice to Proceed is issued by Gunns Limited's Board) will subsequently be taken at Low Head and King Island to determine baseline levels of POPs.

In order to minimise impacts on penguin colonies, subsequent sampling of populations other than the Low Head colony will only be taken if an increase in contaminants is observed at the Low Head population.

The proposed sampling protocol will follow the international (OSPAR Convention) Joint Assessment and Monitoring Programme (JAMP) Guidelines for Monitoring Contaminants in Biota.

In addition to live sampling, the opportunistic sampling of penguin carcasses will also be considered. If any suitable dead penguin nestlings (for example obviously recent mortalities) are encountered during the sampling events, the carcasses if less than three total or a representative portion of carcasses if greater than three total will be collected, frozen and archived for a minimum period of ten years from collection for potential analysis if required. Any decision to analyse tissue from these carcasses will be made in consultation with DEWHA and the biota monitoring framework will be revised for approval by DEWHA if and as necessary.

A full description of the penguin egg sampling methodology and analytical protocols is provided in the C-BOMP (Appendix C).

4e. Background ecological surveys (condition 40 and 41(j))

4.e.1 Approval requirements

Relevant to this issue, condition 40 of the approval requires:

> *In accordance with the EIMP and conditional of the outcomes of the hydrodynamic and sediment modelling, Gunns Limited must undertake surveys to establish baseline ecological data upon which impacts of effluent can be measured. This must include, but not necessarily be limited to:*
>
> *a) A baseline (pre-commissioning) survey of both benthic infauna and epibenthic flora including:*
>
> *i) Abundance and diversity at 'impact' locations outside the defined mixing zone; and*
>
> *ii) At control locations to the east and west of the outfall.*

Also relevant to this issue, condition 41(j) of the approval requires:

> *In accordance with the EIMP, Gunns Limited must prepare and have approved by the Minister, prior to commencement of mill commissioning, strategies for monitoring the impacts of the mill effluent on the marine environment. These strategies must include but not necessarily be limited to:*
>
> *…*
>
> *(j) Impacts of chlorate on the total area of brown algae adjacent to the marine outfall.*
>
> *…*

4.e.2 Surveys to be undertaken (condition 40(a) and 41(j))

The monitoring strategy includes baseline ecological surveys to establish the existing characteristics of marine communities in the region around the proposed outfall.

Preliminary pilot surveys commenced early 2005 and the baseline surveys (which comply with the current experimental design as described in the C-BOMP) commenced in April 2007 and are scheduled to be undertaken in April and October each year. Due to project delays, the April 2008 survey was not conducted. Baseline surveys recommenced in October 2008 and will be reviewed for statistical power and other design details immediately thereafter. Baseline sampling will again recommence at the earliest opportunity after Notice to Proceed is issued by Gunns Limited's Board as described in the C-BOMP.

The survey design follows a Multiple Before and After at Control and Impact Locations (MBACI) framework.

Sample Locations[6] comprise 4 Locations nominally referred to as Impact Locations adjacent to the outfall's defined mixing zone and 10 control Locations. These will be the same as the sediment sampling Locations (see section 4.d.2) and also at additional Locations (described in the C-BOMP in Appendix C). The Location of the sampling sites may be adjusted in response to the findings of the hydrodynamic modelling and continuous plume monitoring programs.

The Impact Locations are situated at a distance of 25 to 75 m from the edge of the mixing zone defined under the State approval. The mixing zone is set in accordance with the Tasmanian *State Policy on Water Quality Management 1994*. The edge of the mixing zone

[6] The terminology hierarchy used is *Location* then *Site* then *Replicate*: each location has a number of sample sites within it and each site has replicate samples within it.

identifies the location from the discharge point where Water Quality Objectives for the ambient environment, prescribed in accordance with the policy, are achieved.

The impact Locations are situated where discharge concentrations are likely to be high, based on hydrodynamic modelling undertaken as part of the Preliminary Documentation, subsequent to the initial dilution that occurs within the mixing zone and where suitable habitat occurs.

The control Locations are situated progressively approximately 6 km to the west and east of the outfall (5 each), where exposure to effluent will be very much less than the Impact group.

Each Location covers a 50 m diameter area.

The ecological sampling will comprise benthic infauna grab samples and epibenthic flora and fauna photo samples.

Benthic infauna samples will be taken by van Veen grabs over a 1 mm mesh size. At each Location, 5 Sites will be sampled, each with 2 Replicates (a review of the number of replicates and indicators is scheduled for December 08 and may be modified after that review to ensure that the design is optimised). Infauna will be identified to family level, except for molluscs and any introduced species, which will be identified to species level wherever possible. Sediment samples will also be taken for a limited suite of chemical analyses.

The photo sampling will involve 50 photo quadrats within each Location, from which percent cover of algae and other epibenthic species will be determined. The fish community diversity and abundance will also be recorded using baited video photography. Brown algae, to which the Commonwealth approval refers in condition 41(j), will be separately identified as a subset of algae. Brown algal cover will therefore be surveyed during autumn and spring at 14 Locations (comprising 700 photographs per survey) along an approximately 12 km transect from east to west adjacent to the outfall. Refer to Section 3.2.1.1 of the C-BOMP for details of brown algae monitoring.

The full monitoring methodology detailing how key marine ecological communities are surveyed is described in the C-BOMP section 3.2.1 Marine Ecological Monitoring (Appendix C).

4f. Improved modelling (hydrodynamic and sediment) of fate and impact of effluent

The improved hydrodynamic and sediment transport modelling is described in EIMP Module L.

4g. Design of the monitoring program for marine effluent

The monitoring program for marine effluent is described in section 5.

5. ONGOING MONITORING (conditions 3, 4, 31, 32, 33, 37 and 41)

Conditions 3 and 4 require trigger levels and maximum limits to be established and the mill to be operated so that those maximum limits are not exceeded.

> *3) The EIMP must include trigger points and maximum limits in relation to effluent discharge from the operation of the pulp mill as well as specific remedial management responses to be undertaken by Gunns Limited if trigger points are exceeded or maximum limits are reached. It shall be an operational objective of the pulp mill, and reflected in the EIMP, that trigger points, and maximum limits, are not to be reached.*
>
> *4) If at any time during the taking of the action there are reasonable grounds for any of Gunns Limited, the Minister, the Department, the Independent Expert Group or the Independent Supervisor to believe that the maximum limits for effluent discharge in this approval, or in the EIMP, are likely to be exceeded, then that party (if it is not Gunns Limited) shall immediately inform Gunns Limited. Once Gunns Limited has either been so informed or itself believes maximum limits are likely to be exceeded, it must immediately implement the response strategies in the EIMP, in accordance with the stipulated timeframes. If within the stipulated timeframe Gunns Limited is unable to demonstrate to the satisfaction of the Minister that response strategies are achieving their objective as set out in the EIMP to reverse the undesirable impacts, the mill must cease to operate until such time as a tertiary treatment solution satisfactory to the Minister is installed.*

Avoidances of such exceedances will be by implementing response measures when the trigger levels are reached. Monitoring undertaken in accordance with condition 41 during operations will give warning of trigger levels being reached (condition 41(a)) to meet conditions 3 and 4. Response strategies are detailed further in section 6 of this document.

> *41) In accordance with the EIMP, Gunns Limited must prepare and have approved by the Minister, prior to commencement of mill commissioning, strategies for monitoring the impacts of the mill effluent on the marine environment. These strategies must include but not necessarily be limited to:*
>
> *a) Appropriate early warning of reaching trigger levels in Commonwealth waters.*
> *b) Effluent quantity and quality.*
> *c) Chemical and ecotoxicological assessments including assessments of endocrine disrupting ability, and ecological assessments.*
> *d) Water and sediment quality and bioaccumulation of contaminants in the same sentinel biota as were used to determine baseline concentrations.*
> *e) Being of appropriate statistical design, including agreed power and confidence.*
> *f) Site selection will be informed by the hydrodynamic and sediment transport models.*
> *g) Effluent monitoring must be undertaken on weekly composites of the daily samples.*
> *h) Sediment and bioaccumulation monitoring must be taken six monthly.*
> *i) Dioxin and furan concentrations in the benthic sediments surrounding the marine outfall progressively towards and including Commonwealth marine waters.*
> *j) Impacts of chlorate on the total area of brown algae adjacent to the marine outfall.*
> *k) Pollutant levels in sentinel benthic and pelagic species.*
> *l) Whole-effluent toxicity testing using species relevant to Commonwealth waters in Bass Strait.*
> *m) A mechanism or mechanisms for tracing the actual movement of the effluent plume.*

A detailed description of monitoring is provided in the C-BOMP, attached as Appendix C to this module. The C-BOMP includes a detailed discussion of the statistical design (condition 41(e)) of the monitoring programs.

The approval variously uses the terms “background” and “baseline” in different conditions. To minimise confusion, the term “baseline” will be used in the following for consistency unless the context means that it is not appropriate.

5a. Effluent monitoring (conditions 31, 32, 33, 37(a) and 41)

In addition to condition 41, also relevant to this issue, condition 31 of the approval requires:

The volume of wastewater effluent discharged from the operation of the pulp mill to the marine environment must not be more than 64 megalitres per day on an average monthly basis.

In addition to condition 41, also relevant to this issue, condition 32 of the approval requires:

Gunns Limited must sample the effluent discharge from the operation of the pulp mill for the parameters in the tables below on at least a daily basis. The pulp mill must not operate if the monthly average effluent concentrations from the pulp mill exceed the maximum limits provided in the tables below. These limits may be revised in the final EIMP if agreed by the Independent Expert Group and approved by the Minister as a result of further studies. Maximum limits and trigger levels on additional effluent contaminants (for example, nitrate, resin acid and colour) will also be developed in the EIMP in accordance with Schedule 2.

Parameter	*Monthly average effluent concentration*	
	Trigger level	*Maximum limit*
Dioxins and furans	*2.0 pg TEQ/L*	*3.4 pg TEQ/L*
Chlorate (ClO_3^-)	*1.9 mg/L*	*3.7 mg/L*
Total chloroacetic acids	*237 µg/L*	*237 µg/L*

Parameter	*Monthly average effluent concentration Maximum limit*
Total nitrogen	*2.5 mg/L*
Total phosphorus	*0.8 mg/L*
Total suspended solids	*20 mg/L*
Biological oxygen demand	*11 mg/L*

Also relevant to this issue, condition 33 of the approval requires:

Prior to commissioning, trigger levels for effluent discharge for all phases of development must be included in the EIMP together with agreed response strategies and timeframes if trigger levels are exceeded or maximum limits reached.

Also relevant to this issue, conditions 37(a) and 37 (c) of the approval require:

Gunns Limited must determine, in accordance with the EIMP, effluent monitoring requirements prior to the commencement of pulp mill commissioning. This must include but not be limited to:

a) the parameters described in Condition 32;

…

c) sampling and analysis protocols and accreditation.

5.a.1 Effluent quantity (conditions 31, 32, 33 and 41(b))

In addition to conditions 32, 33 and 41, also relevant to this issue, condition 31 requires:

> *The volume of wastewater effluent discharged from the operation of the pulp mill to the marine environment must not be more than 64 megalitres per day on an average monthly basis.*

The strategy is to monitor effluent flow volumes after effluent emerges from the secondary clarifiers of the treatment plant.

The monitoring point is before the input of clean site stormwater to the effluent stream. Stormwater is not part of the effluent produced by the operation of the pulp mill, to which condition 31 relates, and effluent volume will therefore be normalised to exclude streams to which the volume effluent limit applies. Consequently, the daily flows of clean stormwater and other non-permit volume streams (discussed below) into the effluent stream will also be measured.

The measured effluent stream will include wash water and stormwater from the chip mill, which will be redirected to the pulp mill's treatment plant. This water also does not form part of the 64 megalitres per day monthly average limit, and it will therefore need to be discounted from the measured exit flow from the secondary clarifiers of treatment plant. To achieve the discounting, input flows from the chip mill will be measured prior to entering the treatment plant. Similar discounting will be done for stormwater if and when there is a stormwater flow.

The net average daily flow from the pulp mill alone will be calculated each calendar month and these values will be compared against the approval's 64 ML/day monthly average limit.

5.a.2 Effluent quality (conditions 32, 33, 37(a), 41(b) and 41(g))

The monitoring strategy is to measure effluent quality by 7 day composites of daily samples. Where possible, monitoring for compliance assessment will utilise laboratory based techniques based on traceable standard techniques. Where requirements are not articulated by the Commonwealth Approval Decision guidance on the design of the C-BOMP has been taken from *AS 5667.10:1998 Water Quality –Sampling. Part10: Guidance on sampling of wastewaters*. Wherever there is a contradiction between the relevant Australian Standard and the Approval Decision, the Approval Decision has taken priority. This is most evident in the requirement stipulated in condition 41 (g) which states "Effluent monitoring must be undertaken on weekly composites of the daily samples".

Refer to Figure 2 for sampling sites.

Analytes are classified into the following groups, based on a combination of chemical species and sample handling requirements. Condition 32 of the Commonwealth approval sets trigger levels and maximum limits for specified parameters. In accordance with condition 32 trigger levels and maximum limits for other analytes have also been developed and in accordance with condition 33 trigger levels and maximum limits for the ramp-up and commissioning phase have also been developed (in Module L). Analytes shown in bold are condition 32 and 33 trigger level and maximum limit parameters.

Group A — Instrument measurements — physical, flow
Group B — General wastewater treatment parameters — chemical oxygen demand (COD), biological oxygen demand (BOD), suspended solids, colour
Group C — Chlorate, nitrogen, phosphorus & nitrate.
Group D — resin acids
Group E — Metals and metalloids (total) – not included in C-BOMP
Group F — Metals and metalloids (dissolved) – not included in C-BOMP
Group G — chloracetic acids
Group H — Dioxins, furans and dioxin-like polychlorinated biphenyls (PCBs).

The full suite of analytes (condition 37(a) and their sampling and analysis protocols (condition 37(c) are described in the C-BOMP (Appendix C).

The analytical suite described in the C-BOMP may be supplemented with any additional hydrophobic substances for which monitoring in effluent is determined to be warranted by the reassessment of risk quotients required by condition 37.

Group D analytes will be sampled as 7 day composites leading up to, during and immediately after pine campaigns. Resin acids are not associated with eucalypt pulp production. The initial planned construction configuration of the mill will not allow for pine production. Therefore Group D monitoring (of resin acids) will be initially suspended. Should a decision be made to alter the configuration of the mill as built, DEWHA will be notified of that decision and the monitoring regime for resin acids will be implemented.

Trigger levels and response strategies required by condition 33 are described in Module L and summarised in Module N.

As with effluent quantity (section 5.a.1), effluent quality measurements will need to discount non-pulp mill sources. This will be done as follows.

The flows from non-mill sources will be variable (although maximum flows will be in the order of only 1 or 2% of the total flow through the ETP) and flows will therefore be measured at least weekly. Concentrations from non-mill sources are expected to be relatively constant and once concentrations have been characterised they will able to be assumed, with occasional validation measurements.

The discounting procedure will be as follows (Table 7), which describes discounting based on average daily flows from the chip mill, taken from Mr Hannu Jäppinen's Expert Witness Statement (available at http://www.gunnspulpmill.com.au/iis/supp/hannu_jappinen_ews.pdf). The actual values used for the calculations will vary from period to period as they are measured by the monitoring program.

Table 7: Example calculations of contaminant contributions from the chip mill

Parameter	Daily chip mill load to ETP*	Reduction coefficient in ETP	Net final chip mill effluent load from ETP	Net final chip mill concentration contribution from ETP***
TSS	0.66 t/d	97.5 %	16.5 kg/d	0.25 mg/L
BOD	0.35 t/d	98.8 %	4.2 kg/d	0.06 mg/L
COD	1.05 t/d	79.9 %	211.1 kg/d	3.23 mg/L
Colour	2.16 t/d**	0 %	2160 kg/d	33.00 mg/L
N	0.09 t/d	79.7 %	3.6 kg/d	0.06 mg/L
P	0.02 t/d	87.8 %	0.4 kg/d	0.01 mg/L

*Pulp mill effluent treatment plant
**Estimate assuming 1500 mg/L
***Assuming combined average monthly flow from chip mill of 1440 kL/day and pulp mill effluent flow of 64 ML/day

For the actual calculations, the values in the second column (daily load to ETP) will be replaced by the as-measured loads (ie. measured volumetric flow from chip mill multiplied by concentration from chip mill).

The measured volumetric flow from the chip mill in any given period will be discounted from final ETP flow to give the net flow contribution from the pulp mill alone. The calculated concentrations in the final column will be discounted each period from the concentrations measured in the final ETP effluent to give the concentration contribution from the pulp mill alone.

The resultant pulp mill flow and concentrations will then be used to calculate the weekly and monthly averages for comparison to the relevant pulp mill effluent quality against the trigger levels and maximum limits.

Similar discounting calculations will be done for stormwater if and when there is a stormwater flow.

5b. Continuous monitoring of the effluent plume and its dispersion (conditions 41(a), 41(f) and 41(m))

The monitoring strategy is to measure the dilution and dispersion of the effluent plume beyond the outfall diffuser by a combination of physicochemical, optical and water quality (chemical) parameters. The monitoring will give early warning of any contaminants reaching trigger levels in Commonwealth waters (condition 41(a)). The monitoring has a rigorous statistical design, which is described in the C-BOMP (Appendix C).

The physicochemical and optical monitoring will provide the primary description of the behaviour of the effluent plume in the near-field dispersion zone around the diffuser. The physico-chemical parameters will show how the effluent constituents are diluted.

The initial distribution of sampling sites will be based on the mixing zone prescribed under the State approval conditions, shown in Figure 2. This mixing zone was determined by hydrodynamic modelling prepared for the State DIIS and the Commonwealth Preliminary Documentation. The additional hydrodynamic modelling required by the Commonwealth approval (condition 38) will include a re-examination of near-field dispersion predictions and this may lead to the mixing zone boundaries being adjusted. Logically, any associated monitoring Location may also be adjusted as necessary to suit. This is consistent with the strategy adopted for the baseline and operational monitoring under which monitoring refinements will be made in response to findings.

The majority of the Marine Water Quality Program involves discrete monitoring events, including spatial transects. However, following commissioning a program to deploy the field instrument to assess a physico-chemical tracer (eg salinity or temperature) will be included in the Marine Water Quality Program for a period yet to be determined. The information from the field deployment ideally will produce a high frequency database (eg. 15 min logged data points) for comparison to a nominated WQO.

5.b.1 Physicochemical and optical monitoring (condition 41(m))

Interpretation of plume dispersion monitoring results will be informed by baseline monitoring of existing conditions. For most parameters, monthly monitoring has already commenced.

Field measurements of salinity, pH, dissolved oxygen, temperature and oxidation potential will be undertaken at 5 m depth intervals at the diffuser, at sites 250 and 500 m from the diffuser in each of the northeast, northwest, southeast and southwest quadrants and at sites 5 km to the west and east of the diffuser (sites NE250, NE500, NW250, NW500, SE250, SE500, SW250, SW500, WOP AND EOP on Figure 2).

Water colour is measured using a viewer apparatus and classified according to the Munsell colour chart.

Vertical light penetration will be measured using Photosynthetic Active Radiation sensors. Surface water clarity will be measured by a field instrument. This monitoring is planned to commence after Notice to Proceed is issued by Gunns Limited's Board. Simultaneous upwelling and downwelling measurement using two sensors will be undertaken to determine the upwelling to downwelling ratio and hence the reflectance coefficient. Vertical light penetration from the sea surface to seabed will also be measured at 1 m intervals.

Following mill commissioning, the above monitoring will be undertaken weekly (subject to weather conditions and other logistical constraints) for the first 6 months and thereafter monthly, before a full program review at the end of year 3. For this sampling, the optical monitoring will be extended to cover all the physicochemical monitoring sites and the physicochemical measurements will continue outward from each of the perimeter sampling sites if and as necessary until the values reach background levels.

5.b.2 Water quality (conditions 41(d) and 41(m))

Interpretation of plume dispersion monitoring results will be informed by baseline monitoring of existing conditions. Monthly monitoring commenced in December 2006 and will continue until a baseline database of relevant water quality parameters covering a period of at least 24 months has been established.

Paired water samples are taken from the top 1 m of the water column and 1 m from the seabed at sites 500 m from the diffuser in the north east and southwest quadrants and at sites approximately 5 km to the west and east of the diffuser (sites NE500, SW500, EOP and WOP on Figure 2). The Location of the sampling sites may be adjusted in response to the findings of the hydrodynamic modelling and continuous plume monitoring programs.

Laboratory analysis of the collected samples is undertaken. Analytes include both State and Commonwealth approval requirements. Analytes shown in bold are those for which the Commonwealth approval (condition 32) sets trigger levels and/or maximum limits.

Physicochemical — physical, suspended solids, bacteria, chlorophyll *a*, adsorbable organically bound halogens (AOX), nitrogen and phosphorus

Toxicants — metals and metalloids, non-metalloids inorganics including chlorate, organic alcohols, halogenated alkanes, chlorinated alkenes, anilines, hydrocarbons, aromatic hydrocarbons (excluding dioxins and furans*), phenols, organic sulphur compounds, surfacants, organic acids including chloroacetic acids, chlorinated natural phenolics and sterols.

*Dioxins and furans will be bound to organic matter and therefore will be monitored in sediment (section 5c) rather than in the water column

Following mill commissioning, the monitoring will be extended to cover sites 500 m from the diffuser in the northeast, northwest, southeast and southwest quadrants and at sites 5 km to the west and east of the diffuser (sites NE500, SW500, NW500, SE500, EOP and WOP on Figure 2). This monitoring will be undertaken weekly (subject to weather conditions and other logistical constraints) for the first 6 months and thereafter monthly, whereupon a full program review will be held at the end of year 3.

5c. Sediment quality monitoring (conditions 41(d), 41(h), 41(i) and 42)

In addition to condition 41, also relevant to this issue, condition 42 of the approval requires:

The maximum limit of concentration of dioxins and furans in the benthic sediments in any location within Commonwealth marine waters is 850pg TEQ/kg. To ensure that concentrations do not reach this level, trends in concentrations of samples collected in State and Commonwealth waters, in accordance with the EIMP, must be analysed and independently reviewed on a six-monthly basis.

Following mill commissioning, sediment surveys will be taken quarterly in the first year of operations. Thereafter they will be taken twice annually (spring and autumn) for 3 years unless the findings indicate that quarterly sampling should be continued. The sampling need and sampling frequency will be reviewed after 3 years.

The sampling regime and analytes will be as described in section 4.d.2 for the baseline surveys.

Samples will include 2 Locations situated within the mixing zone.

More (or alternative) Locations may also be determined to be necessary by the hydrodynamic modelling that will be undertaken. This modelling will examine sediment transport and may suggest Locations that are more likely to receive settlement of discharged particulates, and which may therefore be more appropriate sediment sampling Locations.

Four further Locations will be established north of the mixing zone leading into Commonwealth waters. These Locations will be selected on the basis of inspection for suitable substrate, favouring finer material with organic content if apparent. In conjunction with other sampling Locations, these Locations will create a sampling transect that runs from south of the diffuser north to Commonwealth waters.

In the quarterly sampling for the first year after commissioning samples will be taken from a subset of Locations - one Location from the western controls, one Location from the eastern controls and all four of the Impact Locations and at least the two mixing zone Locations.

In the quarterly sampling year (year 1), the analysis for dioxins and furans will be done for each quarterly sample.

Detailed chemical analysis will be conducted on a subset of Locations, referred to as Intensive Chemistry Locations – one Location from the western controls, one Location from the eastern controls, all four of the Impact Locations. The configuration of the Intensive Chemistry Locations will be approximately parallel to the prevailing tidal current along the coast.

All Intensive Chemistry Locations will be sampled and analysed in replicate for the WHO_{05}-TEF suite of dioxins and furans at least 6 monthly post operationally for 3 years and thereafter pending a technical review. Other Locations will be sampled and analysed at least on a lower replicate intensity for the same period and be subject to the same review process at the end of the third year.

The chemical analysis will include at least the key tracers being dioxins, furans and dioxin-like PCBs (reported as WHO_{05}-TEF congeners and WHO_{05}-TEQ pg/kg), organic carbon and nitrogen. In accordance with Condition 42, the three nominated determinands above will be intensively examined for any observed spatial and temporal trends. The full analytical description and methodology is provided in the C-BOMP in two areas being Section 3.2.1.2 and 3.2.2 (Appendix C). The topic of sediment monitoring is also described in 4.d.2 above.

5d. Sentinel biota monitoring (conditions 41(d), 41(h), 41(j) and 41(k))

5.d.1 Prey species of listed threatened migratory and marine species and shore birds (conditions 41(d), 41(h) and 41(k))

Following mill commissioning, the sampling described in section 4.d.3.1 for the baseline surveys will continue up to year 3 of operations. These samples will allow comparison with the baseline levels to indicate whether effluent contaminants may have entered the food chain of threatened migratory and marine species and shore birds.

The mussel and oyster monitoring will be extended to include sites D (surface only), EOP, WOP, SW250, SW500, SE250, SE500, NW250, NW500, NE250, NE500, S 250 and S500 shown on Figure 2, subject to review of a pilot monitoring yet to be undertaken and approval by DEWHA.

5.d.2 Seals (conditions 41(d) and 41(h))

Following mill commissioning, the monitoring described in section 4.d.3.2 for the baseline surveys will be repeated 2 years after the commencement of commissioning and thereafter every third year until adequate evidence regarding the extent or rate of accumulation dioxins and furans via the food chain of Australian fur seals is obtained, or until otherwise determined by DEWHA.

5.d.3 Penguins (conditions 41(d) and 41(h))

Following mill commissioning, the monitoring described in section 4.d.3.3 for the baseline surveys will be repeated 2 years after the commencement of commissioning and thereafter every third year adequate evidence regarding the extent or rate of accumulation dioxins and furans via the food chain of little penguins is obtained, or until otherwise determined by DEWHA.

5.d.4 Brown algae (conditions 41(j))

Brown algal cover will be surveyed during autumn and spring at 14 Locations (comprising 700 photographs per survey) along an approximately 12 km transect from east to west adjacent to the outfall. Refer to Section 3.2.1.1 of the C-BOMP for details of brown algae monitoring.

5e. Effluent toxicity testing (conditions 37(a), 41(c) and 41(l))

5.e.1 Whole effluent toxicity testing (condition 37(a), 41(c) and 41(l))

The toxicity testing procedures using overseas effluent (condition 34) prior to the mill commissioning have been described in Module L. As required by condition 37(a), effluent testing will include testing of effluent parameters established under condition 32.

Following mill commissioning, an operational phase toxicity testing program (conditions 41(c) and 41(l)) will be implemented. The design of this program will be similar to the Precommissioning program described in Module L but with any appropriate modifications that may arise out of the findings of that program.

Regular toxicity testing of mill effluent will be undertaken. Toxicity testing conducted on effluent from an overseas pulp mill under condition 34 will establish reference findings against which regular operational toxicity monitoring required under condition 41 can be compared. The operational toxicity testing is described in section 3.1.2.2 of the C-BOMP.

5.e.2 Endocrine Disruption Chemical (EDC) testing (condition 41(c))

The term endocrine disruption relates to the ability of certain chemicals to interfere with normal endocrine function. The endocrine system plays an important role in the maintenance of homeostasis and the regulation of key developmental processes and bodily functions. Therefore, an endocrine disrupting chemical is one that can potentially interfere with any of these processes. However, most of the concern about endocrine disruption has focused on those chemicals that interfere with the endogenous sex hormones, oestrogen and testosterone, thereby affecting normal sexual development.

Research into this area has been extensive and many methods have been developed to assess the mechanisms by which chemicals can interfere with normal sexual development. In contrast, endocrine disruption via processes not involving the endogenous sex hormones, such as thyroid disruption, has not received much attention and the methodology for investigating the potential effects of chemicals on other endocrine-mediated processes is not currently suitable for routine interpretive use.

The Global Water Research Coalition recently conducted a review on 24 assays to assess their suitability to measure estrogenic activity in water samples. Of these 24 assays, 5 were selected for further evaluation using raw sewage, treated sewage, groundwater, river water and artificial (spiked) samples. From this testing, 2 assays in particular performed well and were considered robust and reliable, with low detection limits.

These assays were the ER-mediated chemical-activated luciferase gene expression assay (ER-CALUX) and the E-screen assay. Of these two assays, only the ER-CALUX assay may be considered suitable for testing in this context, given its availability on a routine commercial basis. The difficulty with any assay however, is to interpret the results in an ecologically relevant manner. Thus, the key strategies for monitoring endocrine disrupting ability to the time of writing are included within Section 3.2.1 and 3.2.4 of the C-BOMP (Module M). Monitoring of a number of key sentinel species *in vivo* provides a highly relevant ecological marker when compared to a more ecologically detached *In vitro* assay such as ER-CALUX. The key strategies in the nominated sections of the C-BOMP therefore continue to focus on protocols drawn from the Canadian Pulp & Paper Environmental Effects Monitoring (EEM) system.

The Canadian experience relating to endocrine disruption associated with Pulp & Paper Mills effluent continues to grow and will continue to develop before this project can commence operations. A publication detailing progress and future strategy for the Investigation of Cause (IOC) project for effluent effects on fish reproduction has been recently published[7] by Environment Canada.

Therefore, the current strategy for monitoring endocrine disruptive ability of the effluent of the Bell Bay Pulp Mill Project will continue to include the focussed surveillance strategies developed for the EEM. This strategy however, will be reviewed again after construction of the mill has commenced and before commissioning commences. The intent of the review will examine if any other assay(s) potentially with greater ecological relevance than the presently known *In vitro* assays, such as ER_CALUX have developed from the Canadian project or any other robust source. If there are any such assays, they will be considered for inclusion in later versions of the C-BOMP, with the final strategy subject to approval by DEWHA.

5f. Ecological surveys (condition 41(c) and (j))

Following mill commissioning, the ecological surveys described in section 4e for the baseline surveys will continue for at least three years. These surveys will allow statistical comparison with the baseline surveys to indicate whether the effluent discharge may have altered benthic and/or epibenthic ecology.

The ecological surveys are described in detail in the C-BOMP (Section 3.2.1). As part of these surveys, algal cover (of which brown algae is an identified sub-set) will be recorded at six monthly intervals at 14 Locations (comprising 70 Sites) along a transect from east to west adjacent to the outfall.

[7] http://www.ec.gc.ca/eem/English/Publications/web_publication/IOC/default.cfm?#Publications

5g. Annual reporting (condition 43)

In addition to condition 41, relevant to this issue, condition 43 of the approval requires:

> *43) Gunns Limited must report on the results of the pulp mill's performance against the monitoring requirements and those parameters prescribed in the EIMP in the annual report required under condition 11. Performance against the monitoring requirements to be included in the annual report must be verified by an independent expert, agreed to by the Department.*

In accordance with condition 43, monitoring results and findings will be summarised in the annual performance report to the Department. This report will be audited by an independent expert approved by the Department.

5h. Adaptive Monitoring (conditions 36(c))

By its nature, baseline and operational monitoring needs to be subject to refinement and adjustment as results become available. The outcomes of the hydrodynamic modelling (described in EIMP Module L) may also suggest changes to the monitoring program.

The C-BOMP will therefore be adapted as appropriate to respond to new information.

The need for an adaptive monitoring program is reflected in a number of approval conditions, as follows. The C-BOMP will be adapted as appropriate to respond to the information that arises from the studies and investigations undertaken in accordance with these conditions.

Condition 32

This condition provides for the maximum monthly average effluent concentration limits prescribed in the condition to be revised as a result of further studies. The further studies in the first instance and then any proposal to change these limits may require associated changes to the monitoring program.

Condition 33

This condition requires response strategies to be developed for implementation if effluent discharge concentration trigger levels are exceeded or maximum limits reached. The implementation of response strategies will require monitoring to measure their effectiveness. The particular monitoring requirements will depend on the particular circumstances applying at the time, and may require changes to the monitoring program.

Condition 36

This condition requires sediment monitoring to pay particular attention to depositional zones with fine grain size and high organic content. The location and extent of these zones may become better defined as monitoring results come in, and the monitoring program may then need to be adjusted to suit.

This condition also requires a demonstration of how the baseline contamination assessments for sediments and biota have both informed and been informed by the refined hydrodynamic and sediment transport modelling required by the approval. Modelling findings may indicate monitoring refinements and *vice versa*.

Condition 37

This condition requires the effluent monitoring program to be informed by a reassessment of risk quotients for hydrophobic substances. This reassessment may suggest additional hydrophobic substances that should be monitored in the effluent as it is discharged from the mill.

Condition 38

This condition requires additional hydrodynamic and sediment transport modelling to be undertaken and the model to be calibrated by a supplementary field monitoring program. The details of the necessary calibration monitoring will only be known when the modelling study is sufficiently progressed. The calibration monitoring is likely to require a series of refinements or other redesign of the monitoring program as currently described.

This condition also anticipates the use of measured water data to capture the three-dimensional and seasonal nature of the water column. These data measurements will require a refinement to the existing monitoring program.

Condition 41

This condition requires the monitoring program's site selection to be informed by the hydrodynamic and sediment transport models. This information will only be known when the modelling study is sufficiently progressed. Any changes to site selection will require a change to the existing monitoring program.

As highlighted in the above approval conditions, the remedial and response strategy for the pulp mill monitoring program is for it to be responsive to the findings of the monitoring itself, the hydrodynamic and sediment transport modelling that will be undertaken, and the requirements of other EIMP response strategies that may be invoked.

6. REMEDIAL AND RESPONSE STRATEGIES

Remedial and response strategies will be developed for each of the matters for which the approval conditions require trigger levels to be developed and these will be described in their relevant EIMP modules, which have been identified in Table 9 of the EIMP Module A Overview module, as shown in Table 8 below.

Table 8: Trigger levels and the EIMP modules that will deal with them and their associated remedial and response strategies

Trigger	Module
Concentration of dioxins and furans, chlorate and total chloroacetic acids in effluent	L
Additional effluent contaminants, including nitrate, resin acid and colour	L
Numbers of Tasmanian devils, quolls and Eastern barred bandicoots that may become trapped in pipeline excavation trenches	F-G-H-K
Numbers of listed threatened species that may be victims of roadkill	B, C, C1, I-J
Underwater noise impacts on Australian grayling during pile driving for the construction of the wharf	D
Underwater noise impacts on listed threatened and migratory marine species during construction of the wharf and ocean outfall	D, F-G-H-K

The monitoring described in this module includes monitoring against the above trigger levels.

Appendix A
Integrated EIMP progress update

Phase		EPBC 2007/3385 Schedule 2 Component	MODULE A	B	C	C1	D	E	F	G	H	I	J	K	L	M	N	O
			EIMP Overview	Vegetation clearing - mill site and wharf access	Mill site bulk earthworks	Mill construction	Wharf construction	Accommod-ation facility construction	Water supply pipeline construction	Shore crossing construction	Ocean outfall construction	Solid waste disposal facility construction	Local reservoir construction	Effluent pipeline construction	Pre-commission management	Monitoring program	Remedial and response strategies	Habitat offsets & reserves
1. Overview	a	A description of the proposal and associated infrastructure																
	b	Identification of clear environmental objectives																
	c	Identification of environmental indicators, and translation of objectives into agreed targets and performance measures																
	d	Design and implementation of an appropriate monitoring program																
	e	Identification of, and commitment to, agreed trigger or response levels for key indicators																
	f	Identification of specific remedial management responses to be undertaken when trigger point levels are exceeded																
		EPBC approval condition(s)	1,2,6,7,8,9,10, 11,12,13,20, 44,45,46,47,48	14,15,17, 18,20,23,25,26	14,17, 18,20,23,25,26	14,17, 20,23,25,26	14,27,28,29,30	14,20,23,25	14,19,20,21, 22,23,25	14,20,23,24, 25,27	14,20,26,27, 28,30,38,39	14,17, 20,23,25,26	14,17, 20,23,25,26	14,19,20,21, 22,23,24,25	3, 4, 9, 31, 32, 33, 34, 35, 37,38,39,41,42	3,4,31,32,33, 36,37,40,41, 42,43*	3,4,5,19,26,29, 30,31,32,33,39	15,16,17,18

*For completeness Module M also reiterates monitoring described in other modules relevant to conditions 15, 16, 17, 18, 19, 20, 22, 25, 26, 27, 29, 30, 34, 35 and 38

	Not applicable		Other modules		This module

Phase		EPBC 2007/3385 Schedule 2 Component	MODULE A EIMP Overview	B Vegetation clearing - mill site and wharf access	C Mill site bulk earthworks	C1 Mill construction	D Wharf construction	E Accommod-ation facility construction	F Water supply pipeline construction	G Shore crossing construction	H Ocean outfall construction	I Solid waste disposal facility construction	J Local reservoir construction	K Effluent pipeline construction	L Pre-commission management	M Monitoring program	N Remedial and response strategies	O Habitat offsets & reserves
2. Preconstruction	a	Management of impacts on the Wedge-tailed Eagle – Tasmanian																
	b	Management of risks to listed flora from plant pathogens																
	c	Management of risks and uncertainties associated with the non-detection of listed flora																
	d	Management of risks associated with the decline of difficult-to-detect listed flora																
	e	Management of risks associated with the decline of Xanthorrhoea aff. bracteata																
	f	Management of risks associated with the amphibian chytrid fungus Batrachochytrium dendrobatidis																
	g	Management of risks associated with trenching																
	h	Mitigation of impacts on the pipeline corridors																
	i	Establishment of baseline surveys for roadkill																
	j	Undertaking appropriate surveys and establishing mitigation measures for impacts on listed migratory birds																
	k	Undertaking appropriate examination of likely impacts of pile-driving noise associated with the wharf construction [or outfall construction noise]																
	l	Establishing baseline levels of vessel strike in the region																
	m	Monitoring the baseline levels of contaminants in listed species																
	n	Developing rehabilitation and offset plans for listed threatened species																
	o	Establishing measures for habitat protection																
		EPBC approval condition(s)	1,2,6,7,8,9,10, 11,12,13,20, 44,45,46,47,48	14,15,17, 18,20,23,25,26	14,17, 18,20,23,25,26	14,17, 20,23,25,26	14,27,28,29,30	14,20,23,25	14,19,20,21, 22,23,25	14,20,23,24, 25,27	14,20,26,27,28 ,30,38,39	14,17, 20,23,25,26	14,17, 20,23,25,26	14,19,20,21, 22,23,24,25	3, 4, 9, 31, 32, 33, 34, 35, 37,38,39,41,42	3,4,31,32,33, 36,37,40,41, 42,43*	3,4,5,19,26,29, 30,31,32,33,39	15,16,17,18

*For completeness Module M also reiterates monitoring described in other modules relevant to conditions 15, 16, 17, 18, 19, 20, 22, 25, 26, 27, 29, 30, 34, 35 and 38

	Not applicable		Other modules		This module

Phase		EPBC 2007/3385 Schedule 2 Component	MODULE A EIMP Overview	B Vegetation clearing - mill site and wharf access	C Mill site bulk earthworks	C1 Mill construction	D Wharf construction	E Accommod-ation facility construction	F Water supply pipeline construction	G Shore crossing construction	H Ocean outfall construction	I Solid waste disposal facility construction	J Local reservoir construction	K Effluent pipeline construction	L Pre-commission management	M Monitoring program	N Remedial and response strategies	O Habitat offsets & reserves
3. Construction	a	Management of risks associated with the amphibian chytrid fungus																
	b	Management of risks associated with roadkill																
	c	Management of pile-driving noise[or outfall construction noise]																
	d	Development of strategies to minimise vessel strike																
	e	Appropriate strategies to minimise impacts on listed migratory birds																
	f	Strategies to ensure no increase in the levels of contaminants in listed species																
	g	Management of risks associated with listed crayfish																
4. Precommissioning	a	Toxicity testing of Elemental Chlorine Free mill effluents																
	b	Studies to establish the properties affecting fate of fine particulate organic matter in effluent																
	c	Establish maximum limits and trigger levels of pollutants in effluent, receiving environment and sentinel biota																
	d	Measurement of background contaminants in sediments and biota																
	e	Background ecological surveys																
	f	Improved modelling (hydrodynamic and sediment) of fate and impact of effluent																
	g	Design of the monitoring program for marine effluent																
		EPBC approval condition(s)	1,2,6,7,8,9,10, 11,12,13,20, 44,45,46,47,48	14,15,17, 18,20,23,25,26	14,17, 18,20,23,25,26	14,17, 20,23,25,26	14,27,28,29,30	14,20,23,25	14,19,20,21, 22,23,25	14,20,23,24, 25,27	14,20,26,27,28 ,30,38,39	14,17, 20,23,25,26	14,17, 20,23,25,26	14,19,20,21, 22,23,24,25	3, 4, 9, 31, 32, 33, 34, 35, 37,38,39,41,42	3,4,31,32,33, 36,37,40,41, 42,43*	3,4,5,19,26,29, 30,31,32,33,39	15,16,17,18

*For completeness Module M also reiterates monitoring described in other modules relevant to conditions 15, 16, 17, 18, 19, 20, 22, 25, 26, 27, 29, 30, 34, 35 and 38

	Not applicable		Other modules		This module

Phase		EPBC 2007/3385 Schedule 2 Component	MODULE A EIMP Overview	B Vegetation clearing - mill site and wharf access	C Mill site bulk earthworks	C1 Mill construction	D Wharf construction	E Accommod-ation facility construction	F Water supply pipeline construction	G Shore crossing construction	H Ocean outfall construction	I Solid waste disposal facility construction	J Local reservoir construction	K Effluent pipeline construction	L Pre-commission management	M Monitoring program	N Remedial and response strategies	O Habitat offsets & reserves
5. Ongoing monitoring	a	Effluent monitoring																
	b	Continuous monitoring of the effluent plume and its dispersion																
	c	Sediment quality monitoring																
	d	Sentinel biota monitoring																
	e	Ecological surveys																
6. Remedial response	a	Remedial management responses to be undertaken when trigger levels are exceeded or maximum limits are reached																
		EPBC approval condition(s)	1,2,6,7,8,9,10, 11,12,13,20, 44,45,46,47,48	14,15,17, 18,20,23,25,26	14,17, 18,20,23,25,26	14,17, 20,23,25,26	14,27,28,29,30	14,20,23,25	14,19,20,21, 22,23,25	14,20,23,24, 25,27	14,20,26,27,28 ,30,38,39	14,17, 20,23,25,26	14,17, 20,23,25,26	14,19,20,21, 22,23,24,25	3, 4, 9, 31, 32, 33, 34, 35, 37,38,39,41,42	3,4,31,32,33, 36,37,40,41, 42,43*	3,4,5,19,26,29, 30,31,32,33,39	15,16,17,18

*For completeness Module M also reiterates monitoring described in other modules relevant to conditions 15, 16, 17, 18, 19, 20, 22, 25, 26, 27, 29, 30, 34, 35 and 38

	Not applicable		Other modules		This module

Appendix B
Summary of monitoring

Approval condition wording		Summary of monitoring strategy
15	To ensure effective monitoring of impacts on the Wedge-tailed Eagle - Tasmanian and as part of the EIMP, Gunns Limited must: a) With an appropriately qualified person, approved by the Department conduct monitoring checks on the Wedge-tailed Eagle nest known as #130 'Tippogoree Hills' in the second week of September and in the second week of November each year for five years, in accordance with the 'Forest Practices Authority, Fauna Technical Note Series – Eagle Nest Management. b) Provide results from the monitoring to the Department and to the Tasmanian Department of Primary Industries and Water within one month of each monitoring event and provide the information in the annual performance report against the EIMP. c) Should nest #130 'Tippogoree Hills' be abandoned during construction or in the first breeding season after the commencement of construction, Gunns Limited must, within six months of becoming aware of the abandonment, submit an offset response strategy to the Department for approval. The response strategy must provide for the protection of a minimum of 20 ha surrounding an eagle nest that is not protected in a 'formal reserve'3. This response strategy and its timing must be included in the EIMP and detail a site description, connectivity with other habitats and mechanisms for long term protection, conservation and management. The Department may request that the response strategy be revised or amended before approval; any such request must be responded to within the time frame specified in the request.	Nest #130 will be monitored by inspection in the second week of September and November each year for 5 years. In addition to inspection monitoring of this known nest, monitoring inspections for unknown nests will be undertaken of vegetation prior to clearance. If nest #130 is abandoned as a result of construction activities, a 20 ha offset reserve will be established and inspection monitoring will measure the success of the protection measures in enhancing and maintaining the ecological value of this offset. Visual monitoring will be undertaken on an annual basis within this offset. Permanent monitoring photo points will be established within the offset area to enable documentation of its condition over time.
16	To offset the loss of 200ha of land at the pulp mill site and as part of the EIMP, Gunns Limited must: a) Within 12 months of the date of this approval, develop in the EIMP the management strategies to rehabilitate an area of at least 200ha of potential habitat for the listed threatened species Tasmanian Devil *(Sarcophilus harrisii)*; Spot-tailed Quoll – Tasmanian population *(Dasyurus maculatus maculates)*; Eastern Barred Bandicoot – Tasmanian *(Perameles gunnii gunni)*; Swift Parrot *(Lathamus discolour)*; and Southern Bell Frog *(Litoria raniformis)*. b) The EIMP must include details of the 200 ha offset to be rehabilitated, including a map, site description, connectivity with other habitats, appropriate buffer zones, a rehabilitation program and mechanisms for long-term protection, conservation and management. c) Implementation of the offset rehabilitation elements of the EIMP must commence within two years of the date of this approval.	<u>Active rehabilitation monitoring</u> During rehabilitation activities a 6 month monitoring schedule will be implemented. Permanent photo points will be established at suitable vantage points within the rehabilitation offset area, with photos taken on an annual basis. These photo points will enable documentation of rehabilitation over time and will be included in the annual report for review and reference for DEWHA. <u>Long term monitoring</u> Long term permanent monitoring plots will be established within the rehabilitation offset area, both in the extant plantation and native vegetation community areas. Whilst the final number and exact location of the plots will be determined during the detailed planning stage, it is estimated that a minimum of 20 plots will be established. Plots in the native vegetation area will be located to capture the range of extant vegetation communities, with plots within the plantation areas located to capture the range of the likely pre-disturbance vegetation communities. This will enable tracking of the condition and improvement of each area over time. These plots will be assessed using a quantified vegetation condition and fauna habitat assessment. The methodology will be based on that used to assess areas for their potential as habitat offsets. The methodology provides a condition score for the monitoring plot being assessed, and changes in the condition score over time will provide a means of tracking and assessing the improvement of vegetation and habitat condition. The monitoring methodology will incorporate relevant criteria used in the TASVEG *Vegetation Condition Manual* (VCM)[8] and also incorporate some additional criteria (as detailed following) to more accurately reflect the vegetation types being assessed, the potential presence of threatened species and fauna habitat, a more detailed consideration of weeds and disease and a modified consideration of landscape context. Condition scores for the monitoring plots will be determined using (but not limited to) criteria drawn from the following, as appropriate and relevant to the condition of the plots (not all criteria will necessarily be used in any particular plot but the criteria used will remain consistent in any particular plot).

[8] Michaels, K. (2006), A Manual for Assessing Vegetation Condition in Tasmania, *Version 1.0*. Resource Management and Conservation, Department of Primary Industries, Water and Environment, Hobart.

Approval condition wording		Summary of monitoring strategy
		The criteria include: • *Patch classification*: classification of vegetation according to TASVEG mapping units • *Floristic classification*: classification of vegetation according to the floristic communities present • *Large trees*: estimation of the number of large trees (alive and dead) • *Stocking:* the number of eucalypts present in relation to the stocking standards for the vegetation community • *Tree canopy cover*: estimation of the projective foliage cover of the tree canopy • *Understorey summary*: description of the composition of the understorey based on the observed number of species in different life form categories, including potential suitability as a fauna shelter site • *Weeds*: estimation of the total percentage weed (projected foliage) cover in the zone and the proportion of this cover due to high threat weeds • *Weed improvement factor*: estimation of the potential to improve the condition of a patch by control and/or elimination of identified weeds • *Recruitment*: assessment of the evidence of recruitment and its diversity • *Organic litter*: estimation of the percentage cover of the organic litter • *Logs*: estimation of the length of logs present • *Threatened flora*: adjustment to the total score if priority flora is identified from within or immediately adjacent to the monitoring plot • *Patch size*: assessment of the size and degree of disturbance of the patch of which the monitoring plot forms a part • *Neighbourhood*: assessment of the amount and configuration of native vegetation within the proximity of the monitoring plot • *Fauna habitat*: assessment of the habitat value within the monitoring plot, presence of suitable foraging, den or shelter sites, with particular focus on listed species • *Fauna presence*: recording of evidence of presence or utilisation within the monitoring plot, e.g. scats, prey remains or den sites, and incidental sightings of fauna species These plots will be established prior to the commencement of rehabilitation activities and a 'before' assessment of these plots undertaken, to enable testing of the condition assessment methodology. Review and finalisation of the vegetation condition and fauna habitat assessment will be undertaken after this assessment, in consultation with DEWHA. It is possible that the plots located within the extant vegetation areas could form comparison sites for those same vegetation communities being rehabilitated from plantation. This will also be determined during the 'before' assessment of the plots. The assessment of these plots will be undertaken every two years after the completion of rehabilitation activities, for a minimum of 10 years. The monitoring requirements will be reassessed at this stage in consultation with DEWHA. <u>Recovery trajectory toward TASVEG benchmarks</u> The goal of the rehabilitation is to re-establish the likely pre-disturbance vegetation communities within the offset rehabilitation area. While final attainment of this goal is expected to take decades (and for some vegetation communities probably beyond the life of the pulp mill), progress towards it will be able to be tracked using "recovery trajectory" methods. Vegetation condition assessment scores will be determined for each of the monitoring plots and trends towards the TASVEG benchmark score of the

Approval condition wording		Summary of monitoring strategy
		target vegetation type will be plotted for each of the condition criteria. The TASVEG benchmark score represents the average characteristics of a mature and apparently long-undisturbed state of the same vegetation type and were created using TASVEG vegetation community descriptions, existing literature, site data and input from vegetation scientists with expert knowledge of particular communities. Trends will not always be continuously upwards towards an ultimate objective. In some cases, such as understorey, in the early years of rehabilitation the score may exceed the final objective and then drop towards the objective as the community matures. The ultimate goal of the rehabilitation will be for all criteria to settle to a score that meets the definition of the target vegetation type. In addition to graphical tracking of the trends of individual criteria, a single overall index of the progress of the rehabilitation towards the target vegetation type will be calculated. It is anticipated that this will be by the use of a statistical similarity index but alternative indices may be determined to be more appropriate as results come to hand and experience is gained. The use of recovery trajectory analysis to track rehabilitation has not been undertaken in Tasmanian forests before, and it is therefore not possible to establish performance benchmarks (e.g. by nominating in advance a benchmark similarity index to be achieved in any particular year). Nevertheless, the application of trajectory analysis to this project will provide a useful measure of rehabilitation progress and it will also develop valuable experience that will be applicable to other rehabilitation projects in Tasmanian forests and also in cool temperate forests in Australia generally. <u>Ongoing site inspections and surveys</u> Site inspections by a qualified ecologist will also be conducted annually to visually inspect the offset area and identify any management or emergent issues, e.g. declared weed infestations, and ensure that the appropriate response strategy is determined and implemented. Detailed fauna surveys across the broader offset rehabilitation area will commence at the completion of the active rehabilitation program (estimated 2013) to track and establish progress toward milestones. These surveys will include a combination of targeted searches for fauna, including searching for scats, dens, evidence of foraging, spotlighting and use of hair tubes. Surveys will be designed and aim to determine the level of use, including whether fauna numbers are increasing or if there is evidence of successful breeding, more den sites etc. The exact methodology will be developed prior to the completion of the active rehabilitation program in consultation with DEWHA. If the 40 ha wedge-tailed eagle offset is established (due to nest #130 being abandoned as a result of pulp mill construction activities), visual monitoring will be undertaken on an annual basis within this offset. Permanent monitoring photo points will be established within the offset area to enable documentation of its condition over time.
17	To protect potential habitat for the listed threatened species : Tasmanian Devil: Spot-tailed Quoll – Tasmanian population; Eastern Barred Bandicoot – Tasmanian and, as part of the EIMP, Gunns Limited must: a) Within 12 months of the date of this approval, develop in the EIMP management strategies to establish a network of reserves totalling at least 150 ha within the Bell Bay pulp mill site; b) The EIMP must include details of the reserves at the site including a map, description of the flora and fauna, connectivity and mechanisms for long-term protection, conservation and management.	Site inspections by a qualified ecologist will be conducted annually to visually inspect the reserves and identify any management or emergent issues and may include strategic site photographs of any identified issues. There will be daily monitoring of construction activities on the pulp mill site, such as vegetation clearing and bulk earthworks, to ensure that there will be no disturbance to the reserve network. Permanent monitoring photo points will be established at suitable vantage points within the reserve areas to enable documentation of reserve condition over time. Photos will be taken on an annual basis, in line with the visual monitoring, and included in the annual report for review and reference for DEWHA. Any emergent issues (e.g. the appearance of an infestation of declared weed) will be identified and an appropriate response strategy will be determined and implemented, in consultation with DEWHA.
18	To protect potential habitat for the listed threatened species Swift Parrot and as part of the EIMP Gunns Limited must: a) Within 12 months of the date of this approval, confirm arrangements to establish a reserve of at least 34 ha of *Eucalyptus ovata* and/or *Eucalyptus globulus subsp. globulus* to maintain foraging habitat. b) Include details of the reserve including a map, description of the flora and fauna, appropriate buffer zones, connectivity and mechanisms for long-term production, conservation and management. c) The Department may request that the arrangements be revised or amended before approval; any such request must be responded to within the time frame specified in the request. The approved arrangements must be part of the EIMP and must be implemented.	Site inspections by a qualified ecologist will be conducted annually to visually inspect the reserves and identify any management or emergent issues and may include strategic site photographs of any identified issues. The visual inspection will include noting of general health and any recruitment of the reserve vegetation, e.g. *E. ovata* trees in the swift parrot reserve, and include any incidental sightings of fauna or evidence of fauna use e.g. scats, diggings etc. The swift parrot reserve site inspection will be timed to coincide with the presence of the swift parrot in Tasmania (August to February), to provide the opportunity for incidental sightings of bird use. Permanent monitoring photo points will be established at suitable vantage points within the reserve areas to enable documentation of reserve condition over time. Photos will be taken on an annual basis, in line with the visual monitoring, and included in the annual report for review and reference for DEWHA. Any emergent issues (e.g. the appearance of an infestation of declared weed) will be identified and an appropriate response strategy will be determined and implemented, in consultation with DEWHA.

Approval condition wording		Summary of monitoring strategy
19	To minimise impacts during pipeline construction on the Tasmanian Devil, Spot-tailed quoll and Eastern Barred Bandicoot, and as part of the EIMP, Gunns Limited must: a) Install trench ramps and trench plugs in open trenches to enable fauna to escape from the pipeline trench. b) Ensure that a suitably qualified person, agreed to by the Department, checks all open trenches for trapped fauna each morning. Surviving fauna are to be relocated to suitable habitat by an ecologist trained in fauna handling procedures. Records must be kept of all live and dead fauna, including amphibians, removed from the trench. c) These records must be provided to the Department within three months of commencement of trench construction and progressively each month until all trenches have been filled. d) If at any time the number of fauna found in the trenches, reaches or exceeds the trigger levels defined in the EIMP, then response strategies must be implemented within the stipulated timeframes.	Trenches will be checked first thing in the morning and at regular intervals during the day. Records will be kept of all live and dead fauna, including amphibians, removed from the trench and will be provided to DEWHA within three months of commencement of trench construction and progressively each month until all trenches have been filled.
20	Disturbance of vegetation at the site must be confined to the construction corridors of the pipelines and the pulp mill site and associated infrastructure and in accordance with the EIMP, including: a) No disturbance must occur until such time as the relevant pre-construction and construction requirements of the EIMP have been approved by the Minister; b) All areas to be cleared must be clearly marked to prevent damage to listed species outside the project area; c) Access to project areas must be via established roads or access tracks located on areas that have been subject to flora and fauna surveys as required in the EIMP and described in the preliminary documentation.	Regular monitoring inspections and audits will be undertaken to ensure that disturbance is confined to the delineated work areas. Inspection will involve daily checks and recording of any non-conformance by date.
22	All areas of the pipeline corridors, with the exception of access tracks and roads, are to be progressively rehabilitated as each 10 km of pipeline is constructed and revegetated with endemic species sourced from local seed stocks with the aim of providing habitat for listed threatened species in the area. a) Rehabilitation activities and timeframes must be approved as part of the EIMP. b) Rehabilitation performance must be reported in the EIMP annual report.	Following the completion of construction works, rehabilitation and revegetation of areas that will be returned to their natural condition will be undertaken. Regular inspections of rehabilitated and revegetated areas will be undertaken until disturbed ground has stabilised and revegetation has matured. Before vegetation clearing commences, points will be established where photographs will be taken before construction and monthly during construction and rehabilitation for purposes of monitoring of the success of the rehabilitation programme. A monitoring program for rehabilitation of pipeline easements. This will entail inspections every 3 months for 2 years after completion of primary rehabilitation of an area, and every 6 months for a further 2 years. In addition, in areas susceptible to erosion, inspections will occur after each significant rain event and monthly during winter for 2 years after completion of primary rehabilitation. Establishment of photo points for monthly monitoring of the success of rehabilitation.
26	To manage the risks to listed threatened species associated with roadkill, Gunns Limited must, in accordance with the EIMP: a) Immediately following the date of this approval, establish baseline monitoring of roadkill along the East Tamar highway and other major access routes for construction. b) Monitor roadkill and implement response strategies, as necessary, in accordance with the EIMP if the number of road killed mammals exceeds the trigger levels in the EIMP.	A consulting firm, Genames, was commissioned to undertake a 3-month baseline survey of roadkill on the East Tamar Highway. A report (Genames (February 2008) *Baseline Roadkill Monitoring Programme for Bell Bay Alliance. Report prepared for Gunns Ltd*) has been provided to DEWHA and was attached to EIMP Module C as Appendix F. A roadkill minimisation strategy was described and approved in Module C. Pulp mill access roads will be monitored for roadkill and any roadkill carcasses will be removed to minimise risks of roadkill from carcass feeding. The strategy also included a number of measures to reduce worker vehicle movements and speed. Compliance monitoring will be undertaken as follows. Two traffic classifier/counter devices will be installed at suitable locations on the access roads at: • The access road to the overall site including pulp mill and Gunns' existing operations; and • The existing operations, being Gunns Forest Products - Tamar, comprising the Tamar North and South Chip Mills and the associated North East Tasmania forestry business units. • Note - the contribution of chip mill operations can be gauged by the difference between the pulp pill road data and the main access road counts. A third traffic counter will be installed on the access road to the solid waste disposal facility and local reservoir. The traffic classifier counters will be configured to report vehicle movements (inward and outward) at both sites according to the AustRoads 1994

Approval condition wording		Summary of monitoring strategy

		Vehicle Classification System.
		
		Periodic (weekly to fortnightly) interrogation of the recorded data will examine:
		• Speed statistics in 10 km/h bins by vehicle class for both locations for inbound and outbound vehicle movements; and
		• Daily vehicle counts by hourly time bins.
		
		Information obtained by this process will be used for:
		• Monitoring adherence to speed limits;
		• Management feedback for temporal controls (e.g. diversion of traffic movements from crepuscular periods);
		• Dissemination of actual performance against targets will be provided on a regular basis to the construction workforce as a means of reinforcing our objectives and commitments for this issue; and
		• Preparation of quarterly reports to DEWHA including:
		  • Directional class/speed matrix;
		  • Total number of worker days (for construction activities) for the reporting period;
		  • Monitoring of construction worker vehicle entries;
		  • Daily mean individuals transported by bus for the period from Launceston and George Town;
		  • Actual verses projected cumulative vehicle movements to the site (with passenger(s) relating to construction); and
		  • Records, photographs and GPS locations of roadkill fauna.

27	To minimise impacts during onshore effluent pipeline and wharf construction on listed threatened and migratory birds, Gunns Limited must, in accordance with the EIMP: a) Carry out a pre-construction survey of the shoreline for breeding shorebirds for a distance of 200 m on either side of the onshore effluent pipeline construction corridor. b) In the event that nests are located within this area, they will be clearly marked and construction activities managed in accordance with the agreed requirements of the EIMP. c) Restore the beach profile to its original shape within two months of completion of the onshore effluent pipeline construction; d) Within two months of completion of the onshore effluent pipeline construction commence rehabilitation of vegetation in the impacted areas of the pipeline construction corridor in accordance with the requirements of the EIMP e) Report on performance of effectiveness of these mitigation measures in the EIMP annual report.	During construction work, regular monitoring of the construction corridor for newly arrived nesting shorebirds will be undertaken. If birds begin nesting within the construction corridor after construction commences, this would indicate that they are not distressed by the construction activities. Nevertheless, the nest will be signposted at a distance that does not disturb the birds and it will be avoided by construction vehicles and personnel. Following rehabilitation of the beach profile after construction ends, a confirmation engineering survey of the beach profile will be undertaken and the results made available to DEWHA.
29	To minimise impacts on the Australian Grayling (*Prototroctes maraena)* Gunns Limited must put in place and implement, as part of the EIMP, measures including: a) Prior to wharf construction, a desktop study must be conducted by a suitably qualified person, agreed to by the Department, to estimate the likely upper limits of the sound impacts at various distances from wharf construction site. b) The sound fields of the pile-driving activities should be monitored in accordance with the EIMP to re-evaluate the findings of the desktop study. c) If necessary, bubble curtains or other agreed response strategies must be implemented if trigger levels in the EIMP are exceeded. d) No night construction or under-water blasting is permitted.	Underwater noise will be monitored in the vicinity of the wharf at the start of pile driving to validate the predictions of the underwater acoustic expert's report. The validation monitoring (which addresses condition 29(b) of the approval) will involve measuring underwater noise using a hydrophone lowered to mid-water depth at maximum interval distances of 100 m from the trial pile driving out to a distance of 500 m across the river (the direction and distance modelled in the study). Validation monitoring will be undertaken at both low tide and high tide. If measured values deviate significantly from the predictions, further advice will be taken from the study authors. Before continuous pile driving commences, a small number of trial strikes will be undertaken to obtain a measure of RL, the noise level caused by a single pile strike at the trigger level distance of 500 m. This value of RL will then be used to determine the maximum number of pile strikes per 30 minute period that can be made in the absence of bubble curtains without exceeding the trigger level cumulative sound exposure level (CSEL) of 195 dB re 1 µPa2.sec at the 500 m distance.
30	To minimise impacts on listed threatened and migratory marine species during construction of the wharf and the ocean outfall, Gunns Limited must put in place and implement, as part of the EIMP, measures, including: a) Prior to wharf or ocean outfall construction, a desktop study must be conducted by a suitably qualified person, agreed to by the Department, to estimate the likely upper limits of the sound impacts at various distances from the relevant construction site. b) The sound fields of the pile-driving activities should be monitored in accordance with the EIMP to re-evaluate the findings of the desktop study.	Underwater noise at the wharf will be monitored as described for condition 29. Underwater noise will be monitored during the first stages of construction of the outfall to validate the model predictions of the noise modelling study. The validation monitoring will involve measuring underwater noise using a hydrophone lowered to mid-water depth at a distance of 500 m and 1000 m away from the source of noise. Validation monitoring will be undertaken at both low tide and high tide. The monitoring findings will be compared with the study predictions. If measured values deviate significantly from the predictions, further advice will be taken from the study authors. If noise measured during validation exceeds 190 dB re 1 µPa msp at 500 m (the level at which TTS occurs in pinnipeds) or 180 dB re 1 µPa msp at 1000 m (the level at which TTS occurs in cetaceans) then the safety zones will immediately be extended accordingly so that construction that may

Approval condition wording		Summary of monitoring strategy
	c) If necessary, bubble curtains or other agreed response strategies must be implemented if trigger levels in the EIMP are exceeded. d) No night construction or under-water blasting is permitted. e) A suitably qualified person, agreed to by the Department, must visually monitor for marine mammals within the areas defined in the EIMP; f) Radius zones as follows must be implemented: i. A 2 km radius alert zone for whales, with a 1 km radius safety zone, within which noise-generating activities will be ceased if a whale approaches; and ii. A 1 km radius alert zone for seals and dolphins with a 0.5 km radius safety zone, within which noise-generating activities will cease if a seal or dolphin approaches.	cause underwater noise is suspended if a mammal is within a distance where TTS is possible. Vessel skippers and deck officers will keep monitoring watch for marine mammals and take avoidance action when necessary (deviation or stopping), aiming to leave a minimum separation distance of 500 m. Shore based marine mammal observers will also conduct surveillance monitoring and will advise vessels in the vicinity when a marine mammal is within the alert zone of the wharf of ocean outfall construction areas.
31	The volume of wastewater effluent discharged from the operation of the pulp mill to the marine environment must not be more than 64 megalitres per day on an average monthly basis.	The strategy is to monitor effluent flow volumes after effluent emerges from the secondary clarifiers of the treatment plant. The monitoring point is before the input of clean site stormwater to the effluent stream. Stormwater is not part of the effluent produced by the operation of the pulp mill, to which condition 31 relates, and effluent volume will therefore be normalised to exclude streams to which the volume effluent limit applies. Consequently, the daily flows of clean stormwater and other non-permit volume streams (discussed below) into the effluent stream will also be measured. The measured effluent stream will include wash water and stormwater from the chip mill, which will be redirected to the pulp mill's treatment plant. This water also does not form part of the 64 megalitres per day monthly average limit, and it will therefore need to be discounted from the measured exit flow from the secondary clarifiers of treatment plant. To achieve the discounting, input flows from the chip mill will be measured prior to entering the treatment plant. Similar discounting will be done for stormwater if and when there is a stormwater flow. The net average daily flow from the pulp mill alone will be calculated each calendar month and these monthly values will compared against the approval's 64 ML/day monthly average limit.
32	Gunns Limited must sample the effluent discharge from the operation of the pulp mill for the parameters in the tables below on at least a daily basis. The pulp mill must not operate if the monthly average effluent concentrations from the pulp mill exceed the maximum limits provided in the tables below. These limits may be revised in the final EIMP if agreed by the Independent Expert Group and approved by the Minister as a result of further studies. Maximum limits and trigger levels on additional effluent contaminants (for example, nitrate, resin acid and colour) will also be developed in the EIMP in accordance with Schedule 2. [Tables of limits not shown here]	The monitoring strategy is to measure effluent quality by 7-day composite samples. Where possible, monitoring for compliance assessment will utilise laboratory based techniques based on traceable standard techniques. Where requirements are not articulated by the Commonwealth Approval Decision guidance on the design of the Plan has been taken from *AS 5667.10:1998 Water Quality –Sampling. Part10: Guidance on sampling of wastewaters*. Wherever there is a contradiction between the relevant Australian Standard and the Approval Decision, the Approval Decision has taken priority. This is most evident in the requirement stipulated in Condition 41 (g) which states "Effluent monitoring must be undertaken on weekly composites of the daily samples" Analytes are classified into the following groups, based on a combination of chemical species and sample handling requirements. Condition 32 of the Commonwealth approval sets trigger levels and maximum limits for specified parameters and in accordance with condition 33 trigger levels and maximum limits for other analytes have also been developed (in Module L). Analytes shown in bold are condition 32 and 33 trigger level and maximum limit parameters. Group A — Instrument measurements — physical, flow,, Group B — General wastewater treatment parameters — chemical oxygen demand (COD), biological oxygen demand (BOD), suspended solids, colour Group C — Chlorate, nitrogen, phosphorus & nitrate. Group D — resin acids Group E — Metals and metalloids (total) – not included in C-BOMP Group F — Metals and metalloids (dissolved) – not included in C-BOMP Group G — Chloracetic acids Group H — Dioxins, furans and dioxin-like polychlorinated biphenyls (PCBs). The full suite of analytes and their sampling and analysis protocols are described in the C-BOMP (Appendix C). The analytical suite described in the C-BOMP may be supplemented with any additional hydrophobic substances for which monitoring in effluent is determined to be warranted by the reassessment of risk quotients required by condition 37. Group D analytes will be sampled leading up to, during and immediately after pine campaigns. Resin acids are not associated with eucalypt pulp production. The initial planned construction configuration of the mill will not allow for pine production. Therefore Group D monitoring (of resin acids) will be initially suspended. Should a decision be made to alter the configuration of the mill as built, DEWHA will be notified of that decision and the monitoring regime for resin acids will be removed from this initial status of being suspended.

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33	Prior to commissioning, trigger levels for effluent discharge for all phases of development must be included in the EIMP together with agreed response strategies and timeframes if trigger levels are exceeded or maximum limits reached.	As for condition 32
34	In accordance with the EIMP, Gunns Limited must obtain (from overseas pulp mills already using technologies similar to that proposed) effluent samples, and conduct chemical analyses and whole effluent toxicity testing to identify the key contaminants and their concentrations and the effluent dilutions needed in the mixing zone for the proposed mill. Gunns Limited must report on the temporal variability in both the contaminant concentrations and toxicity in the effluents from these mills.	Toxicity testing conducted under condition 34 will help establish reference findings against which regular operational toxicity monitoring required under condition 41 can be compared. The effluent sampling at the overseas mill will be undertaken by an appropriately experienced sampling organisation consistent with relevant Australian Standards (particularly AS5667.10-1998). The individual sample(s) will be representative of effluent quality taken over a period of equal to or less than 24 hours. Samples will be transported to an Australian laboratory using handling protocols described in the SAP. Separate effluent samples collected at the same time as the toxicity test samples will be subjected to chemical analysis to describe the chemical make-up of the effluent at the commencement of the toxicity testing. Best endeavours will be made to achieve the minimum practical delivery time — 48 hours is considered to be the shortest achievable period given the significant logistical constraints. The proposed whole effluent toxicity (WET) testing will comprise: • Microtox assay using the marine bacterium *Vibrio fischeri* • 72-h micro-algal growth inhibition test using *Nitzschia closterium* • 72-h macro-algal germination assay using *Hormosira banksii* • Sea urchin fertilisation success using *Heliocidaris tuberculata* • 72-h larval development using the sea urchin *Heliocidaris tuberculata* • 48-h larval development using the doughboy scallop *Mimachlamys asperrima* • 96-h survival of the juvenile amphipod *Allorchestes compressa* • 96-h larval fish imbalance test using the striped trumpeter *Latris lineata*. Regular toxicity testing of mill effluent will be undertaken after operations commence. Toxicity testing conducted on effluent from an overseas pulp mill under condition 34 will establish reference findings against which regular operational toxicity monitoring required under condition 41 can be compared. In addition to short term ecotoxicological assessments (whole effluent testing), endocrine disrupting ability will be monitored by comparing morphological measurements of fish species. Detailed protocols are based on those developed by the Canadian Pulp and Paper Environmental Effects Monitoring Program for field testing. This program will be included in a revision of the EIMP that will be submitted to the DEWHA for approval prior to commissioning. Further details on strategies to assess endocrine disrupting ability are included in the C-BOMP (Section 3.1).
35	In accordance with the EIMP, to determine the properties affecting the fate of fine particulate organic matter in effluent, Gunns Limited must undertake laboratory studies, agreed to by the Department, to assess the likely settling and flocculation properties of fine particulate organic materials in equivalent effluent.	The laboratory study will be used to inform the hydrodynamic modelling which in turn will inform the monitoring program. The study is described in Module L Precommissioning management.
36	In accordance with the EIMP, to establish the level of background contaminants in sediments and biota, Gunns Limited must: a) Undertake a survey of sediment grain size and organic carbon content for the region containing the outfall, including adjacent coastal and offshore regions, and identified depositional zones. b) Determine background concentrations of contaminants of potential concern for sediments along transects from the proposed diffuser site, including both inshore and offshore sites, paying particular attention to depositional zones with fine grain size and high organic content. c) Demonstrate how these findings have both informed, and been informed by, the refined hydrodynamic and sediment transport modelling required by the EIMP. d) Limit samples for this research to the top 2 cm of core samples, so that recent deposition can be determined in later studies. e) Determine background concentrations of contaminants of potential concern needed to be established for sentinel biota from outside of the mixing zone and from sediments collected both inshore and at identified likely deposition zones. Species selection must be agreed to by the	[The terminology hierarchy used below is *Location* then *Site* then *Replicate*: each Location will have 5 sample Sites within it and each Site may have up to 2 Replicate samples within it.] Sediments Sample Locations will include 4 impact and 10 control Locations that coincide with ecological benthic infauna Locations. The impact Locations are situated at a distance of 25 to 75 m from the edge of the mixing zone defined under the State approval. The mixing zone is set in accordance with the Tasmanian *State Policy on Water Quality Management 1994*. The edge of the mixing zone identifies the distance from the discharge point where Water Quality Objectives for the ambient environment, prescribed in accordance with the policy, are achieved. The impact Locations are situated where discharge concentrations or deposition of matter are potentially elevated, subsequent to the initial dilution that occurs within the mixing zone. The control Locations are situated approximately 6 km to the west and east of the outfall (5 each), distances where exposure to effluent will be very much less. In addition to the impact and control Locations, 4 transect Locations will be sampled along a transect that will run from the diffuser directly north

Approval condition wording		Summary of monitoring strategy
	Department on the basis of: i) Benthic surveys; and ii) Expert knowledge of the prey species of listed threatened migratory and marine species and shore birds and the wide-ranging top predators, the Australian Fur Seal (*Arctocephalus pusillus*) and the Little Penguin (*Eudyptula minor*).	into Commonwealth waters. These Locations will indicate any trend of sediment contaminant concentrations towards Commonwealth waters. More (or alternative) Locations may also be determined to be necessary by the hydrodynamic modelling that will be undertaken. This modelling will examine sediment transport and may suggest Locations that are more likely to receive settlement of discharged particulates, and which may therefore be more appropriate sediment sampling locations. All samples for chemical analysis will be restricted to the surface 2 cm, using a spade corer or similar sampling device (eg. box corer). Each sample will be analysed for total nitrogen and total organic carbon content. The ratio of total nitrogen to total carbon will be examined as a covariate in the benthic infauna temporal and spatial variability analyses as the ratio of carbon to nitrogen is affected by terrestrial (wood) verses aquatic plant sources of marine deposition. The 5 Site samples from a given Location will also be used to make a composite sample that will be analysed for particle size distribution, using the Wentworth classification. A separate particle size distribution analysis will also be undertaken on samples retrieved by the benthic infauna sampler (Section 4.1.e). Detailed chemical analysis will be conducted on a subset of Locations, referred to as Intensive Chemistry Locations – one Location from the western controls, one Location from the eastern controls, two from the impact Locations and all four of the transect Locations. The configuration of the Intensive Chemistry Locations will be approximately parallel to the prevailing tidal current along the coast and along a transect, north from the Mixing Zone towards and into Commonwealth waters. All Intensive Chemistry Locations will be sampled and analysed for the WHO_{05}-TEF suite of dioxins and furans at least 6 monthly post operationally for 3 years and thereafter pending a technical review. Other Locations will be sampled and analysed on an annual frequency for the same period and be subject to the same review process at the end of the third year. The chemical analysis will be for dioxins, furans and dioxin-like PCBs (reported as WHO_{05}-TEF congeners and WHO_{05}-TEQ pg/kg) and metalloids (Al, Sb, As, Ba, Cd, Cr-total, CrIII, CrVI, Cu, Pb, Hg, Ni, Zn, Se, Sn, V all mg/kg). The full analytical description and methodology are provided in the C-BOMP (Appendix C). Biota – prey species Listed threatened migratory and marine species and shore birds feed on a range of species too wide to sample practically. Sampling will therefore concentrate on representative species that can reasonably be taken to be indicative of the variety of species that may be preyed upon by threatened migratory marine species and shore birds. <u>Blue mussel (*Mytilus edulis*) and triploid Pacific oyster (*Crassostrea gigas*).</u> These are filter feeding bivalves that feed on planktonic algae and detritus. The mussels and oysters will be representative of filter feeding bivalves, such as scallops and clams, which form part of the diet of many marine mammals and shore birds. Scallops and clams are less suitable for cage culture and, more particularly, do not have the well established record of use in pollution monitoring that mussels and oysters do. Two sub-programs are planned and both will be trialled for a period of three months before full deployment. One sub-program will focus on tissue accumulation over short periods (3 months, mussels only), while the other program assesses organism health over 24 month deployment (mussels and oysters). Due to the nature of Bass Strait, achievement of this program may be problematic due to a number of natural factors that are unable to be controlled. Deployment over a period prior to mill commissioning will establish baseline contamination levels. Soft tissue will be analysed for discharge contaminants that have the potential to bioaccumulate. In addition to the chemical contamination analysis of the short term exposure program, condition assessments of mussels and oysters will be undertaken for both baseline and operational deployments. Condition indicators will include growth and survival rates, wet to dry weight ratio, wet flesh to total weight ratio and a byssal thread attachment assay. <u>Flathead (*Neoplatycephalus aurimaculatus* and/or *Platycephalus basensis*)</u>

Approval condition wording		Summary of monitoring strategy
		Flathead are bottom dwelling fish and are a mid trophic level opportunistic predator. Flathead share components of the food chain that leads to higher predators of Commonwealth significance and have been reported as minor components of the diet of little penguins and fur seals. Flathead are also a major recreational fishing catch and are therefore of major interest for potential contamination and tainting of human seafood. A pilot catch program for two candidate species – toothy flathead (*Neoplatycephalus aurimaculatus*) and sand flathead (*Platycephalus basensis*) – will be undertaken to select the species to be used, based on availability. Fish will be caught in the September/October period each year. Catch locations will be in the vicinity of the diffuser, with reference sites potentially in the Bridport region and in the Musselroe Bay region (see Figure 3). These locations reflect the expected dispersion pattern of the effluent, where Musselroe Bay can be considered a control site. Muscle tissue will be analysed for discharge contaminants that have the potential to bioaccumulate (taste testing will also be conducted). The analytical suite and methodology are described in the C-BOMP (Appendix C). In addition to the chemical contamination analysis, condition assessments of the fish will be undertaken for both baseline and operational deployments. Condition indicators will include histological archiving of gill, kidney, liver and gonads, of a subset of fish for future reference if required and macroscopic assessments including gonadosomatic, hepatosomatic and Fulton's condition indices and inspections for skin lesions and ectoparasites. This scope of this program includes an examination of morphometrics that are commonly associated with endocrine disruption in fish populations. This will provide additional evidence to support the flathead program. <u>Leatherjackets (*Thamnaconus degeni* and/or *Scobinichthys granulatus*)</u> Degen's leatherjacket (*Thamnaconus degeni*) is a bottom dwelling species and the rough leatherjacket (*Scobinichthys granulatus*) is found in seagrass beds and on rocky reefs. Leatherjackets typically have an omnivorous diet that includes algae, epifauna, hydroids, molluscs, crustaceans and polychaetes. Leatherjackets are a common component of the diet of seabirds, such as penguins and crested terns, and also the Australian fur seal. Leatherjackets therefore occupy a mid-level position in the food chain leading to higher predators of Commonwealth significance. Fish will be caught from the vicinity of the diffuser and from the Tenth Island area (see Figure 3), reflecting the foraging area of the Tenth Island seal colony. The precise timing of the sampling events will be confirmed after a series of pilot runs are completed examining the annual maturation cycle of the species, with the intent that the sampling event monitoring condition indices is timed to occur immediately before spawning. Seals Baseline monitoring of Australian fur seals in the vicinity of the outfall and at a control Location at Reid Rocks (20 km southeast of King Island) will be undertaken to assess the existing tissue burden of polychlorinated dibenzo-p-dioxin (PCDD or dioxins) and polychlorinated dibenzofuran (PCDF or furans) congeners that have of the WHO_{05} Toxic Equivalency Factors (TEFs) assigned The monitoring will use samples of seal blubber. Baseline line data will establish the existing dioxin and furans TEQ profile in Australian fur seals. The vast majority of Australian fur seals recorded in the vicinity of the outfall belong to the nearby colony on Tenth Island. The seal monitoring strategy will therefore focus on this colony as the sentinel population. Tenth Island is the closest seal colony to the outfall diffuser, and is located 12 km from it. It is highly likely that seals from this colony will forage in the effluent stream. The closest other Tasmanian breeding colonies are located at Reid Rocks and Moriarty Rocks, 265 km and 149 km distant respectively. In order to minimise sampling impacts on seals, Gunns proposes to use the Reid Rocks control site for a single baseline sampling run and then only sample the site again if an increase in contaminants is observed in seals at the Tenth Island colony. If this circumstance arises, a second site may be introduced through an Investigation of Cause (IoC) process to determine whether that trend is local to the Tenth Island colony or widespread, beyond any potential impact from the pulp mill discharge.

Approval condition wording		Summary of monitoring strategy
		Baseline data will establish the existing POP TEQ profile in seal pup blubber at Tenth Island and Reid Rocks. Consistent with other baseline monitoring and the scientific literature, the baseline data is expected to show a small ratio of low to high chlorinated PCDD/F congeners. Confirmation of the specificity of the signature of the dioxins and furans will be gained from the effluent monitoring (section 4.g.3). Two years of baseline data to determine baseline levels of POPs will be obtained. An initial test sampling run will be undertaken in February/March 2009 at Tenth Island (only). This sampling will test the sampling methodology and provide material for testing the analytical methodology. The variability in POP levels in the test samples will be determined if possible, and the results of this will inform future sample size decisions. The appropriateness and/or need for using composite samples to satisfy laboratory analytical requirements will also be assessed. Penguins Baseline monitoring of little penguins in the vicinity of the outfall will be undertaken to assess the existing tissue burden of polychlorinated dibenzo-p-dioxin (PCDD or dioxins) and polychlorinated dibenzofuran (PCDF or furans) congeners that have of the WHO_{05} Toxic Equivalency Factors (TEFs) assigned. The monitoring strategy is to use samples of eggs. Baseline line data will establish the existing dioxin and furans TEQ profile in little penguin eggs. In the baseline period, eggs will be collected from the Low Head and King Island little penguin colonies. The Low Head colony is the closest little penguin colony to the outfall diffuser and is approximately 9 km from it. It is highly likely that penguins from this colony will forage in the effluent stream close to the mixing zone. The nominated control site for the little penguins program is the King Island colony on Cataraqui Point. A test sampling run will be undertaken at Low Head (only) in spring 2008 to test the sampling methodology and test the analytical methodology. Two years of baseline data will subsequently be taken at Low Head to determine baseline levels of POPs. In order to minimise impacts on penguin colonies, subsequent sampling of the King Island population beyond the baseline period will only be taken if an increase in contaminants is observed at the Low Head population.
37	Gunns Limited must determine, in accordance with the EIMP, effluent monitoring requirements prior to the commencement of pulp mill commissioning. This must include but not be limited to: a) the parameters described in Condition 32; b) a re-assessment of the Risk Quotients (RQs) for hydrophobic substances, in all media, being taken into account; and c) sampling and analysis protocols and accreditation.	Monitoring for parameters required by condition 32 is described under that condition. The analytical suite described in the C-BOMP (Appendix C) may be supplemented any additional hydrophobic substances for which monitoring in effluent is determined to be warranted by the reassessment of risk quotients required by condition 37.
40	In accordance with the EIMP and conditional of the outcomes of the hydrodynamic and sediment modelling, Gunns Limited must undertake surveys to establish baseline ecological data upon which impacts of effluent can be measured. This must include, but not necessarily be limited to: a) A baseline (pre-commissioning) survey of both benthic infauna and epibenthic flora including: i) Abundance and diversity at 'impact' locations outside the defined mixing zone; and ii) At control locations to the east and west of the outfall.	The monitoring strategy includes baseline ecological surveys to establish the existing characteristics of marine communities in the region around the proposed outfall. Pilot sampling surveys commenced in April 2007 and are undertaken in April and October each year. Due to project delays, the April 2008 survey was not conducted. Baseline surveys will recommence in October 2008 to facilitate a program review and recommence as soon as possible after Notice to Proceed is issued by Gunns Limited's Board. The survey design follows a Multiple Before and After at Control and Impact Locations (MBACI) framework. Sample Locations comprise 4 impact Locations and 10 control Locations. The impact Locations are situated at a distance of 25 to 75 m from the edge of the mixing zone defined under the State approval. The mixing zone is set in accordance with the Tasmanian *State Policy on Water Quality Management 1994*. The edge of the mixing zone identifies the location from the discharge point where Water Quality Objectives for the ambient environment, prescribed in accordance with the policy, are achieved. The impact Locations are situated where discharge concentrations are likely to be high, subsequent to the initial dilution that occurs within the mixing zone. The control Locations are situated progressively approximately 6 km to the west and east of the outfall (5 each), where exposure to effluent will be very much less than the Impact group.

Approval condition wording		Summary of monitoring strategy
		The ecological sampling will comprise benthic infauna grab samples and epibenthic flora and fauna photo samples. Benthic infauna samples will be taken by van Veen grabs over a 1 mm mesh size. At each Location, 5 Sites will be sampled, each with 2 Replicates (a review of the number of replicates and indicators is scheduled for December 08 and may be modified after that review to ensure that the design is optimised). Infauna will be identified to family level, except for molluscs and any introduced species, which will be identified to species level wherever possible. Sediment samples will also be taken for chemical analysis. The photo sampling will involve 50 photo quadrats within each Location, from which percent cover of algae and other epibenthic species will be determined. The fish community diversity and abundance will also be recorded annually using baited video photography. Brown algae, to which the Commonwealth approval refers, will be separately identified as a subset of algae.
41	In accordance with the EIMP, Gunns Limited must prepare and have approved by the Minister, prior to commencement of mill commissioning, strategies for monitoring the impacts of the mill effluent on the marine environment. These strategies must include but not necessarily be limited to: a) Appropriate early warning of reaching trigger levels in Commonwealth waters. b) Effluent quantity and quality. c) Chemical and ecotoxicological assessments including assessments of endocrine disrupting ability, and ecological assessments. d) Water and sediment quality and bioaccumulation of contaminants in the same sentinel biota as were used to determine baseline concentrations. e) Being of appropriate statistical design, including agreed power and confidence. f) Site selection will be informed by the hydrodynamic and sediment transport models. g) Effluent monitoring must be undertaken on weekly composites of the daily samples. h) Sediment and bioaccumulation monitoring must be taken six monthly. i) Dioxin and furan concentrations in the benthic sediments surrounding the marine outfall progressively towards and including Commonwealth marine waters. j) Impacts of chlorate on the total area of brown algae adjacent to the marine outfall. k) Pollutant levels in sentinel benthic and pelagic species. l) Whole-effluent toxicity testing using species relevant to Commonwealth waters in Bass Strait. m) A mechanism or mechanisms for tracing the actual movement of the effluent plume.	The monitoring strategy is to measure the dilution and dispersion of the effluent plume beyond the outfall diffuser by a combination of physicochemical, optical and water quality (chemical) parameters. The strategy will be based on a robust statistical design (41(e)). Sampling site location will be informed by the hydrodynamic and sediment transport models (41(f)). The physicochemical and optical monitoring will provide the primary description of the behaviour of the effluent plume in the near-field dispersion zone around the diffuser. The chemical parameters will show how the effluent constituents are diluted. Early warning of reaching trigger levels (41(a)) Low, medium and high level early warnings from the monitoring program are contained in Table 3.2.1 of the C-BOMP Effluent quantity (41(b)) Effluent will be monitored as described in condition 31. Effluent quality (41(b) and 41(g)) Effluent will be monitored as described in condition 32 and 33. Physicochemical and optical monitoring (41(m)) Interpretation of plume dispersion monitoring results will be informed by baseline monitoring of existing conditions. For most parameters, monthly monitoring has already commenced. Field measurements of salinity, pH, dissolved oxygen, temperature and oxidation potential will be undertaken at 5 m depth intervals at the diffuser, at sites 250 and 500 m from the diffuser in each of the northeast, northwest, southeast and southwest quadrants and at sites 5 km to the west and east of the diffuser (sites NE250, NE500, NW250, NW500, SE250, SE500, SW250, SW500, WOP AND EOP on Figure 2). Surface water clarity is measured at the diffuser and at sites 5 km to the west and east of the diffuser (sites D, EOP and WOP on Figure 2) using a field instrument. Water colour is measured using an underwater viewer and classified according to the Munsell colour chart. Vertical light penetration will be measured using Photosynthetic Active Radiation sensors. This monitoring including the water clarity referred to above is planned to commence after Notice to Proceed is issued by Gunns Limited's Board. Simultaneous upwelling and downwelling measurement using two sensors will be undertaken to determine the upwelling to downwelling ratio and hence the reflectance coefficient. Vertical light penetration from the sea surface to seabed will also be measured at 1 m intervals. Following mill commissioning, the above monitoring will be undertaken weekly (subject to weather conditions) for the first 6 months and thereafter monthly. For this sampling, the optical monitoring will be extended to cover all the physicochemical monitoring sites and the physicochemical measurements will continue outward from each of the perimeter sampling sites if and as necessary until the values return to background levels. Water quality 41(d) and 41(m)) Interpretation of plume dispersion monitoring results will be informed by baseline monitoring of existing conditions. Continuous monthly monitoring commenced in December 2006 and will continue until a suitable data set is collated (covering 24 months). Paired water samples will be taken from the top 1 m of the water column and approximately 1 m from the seabed at sites 500 m from the diffuser in the north east and southwest quadrants and at sites 5 km to the west and east of the diffuser.

Approval condition wording		Summary of monitoring strategy
		Laboratory analysis of the samples will be undertaken. The analyte groups will be as follows. The full suite of these analytes and their sampling and analysis protocols are described in the C-BOMP (Appendix C). Analytes include both State and Commonwealth approval requirements. Analytes shown in bold are those for which the Commonwealth approval (condition 32) sets effluent trigger levels and/or maximum limits. Physicochemical — physical, suspended solids, bacteria, chlorophyll *a*, adsorbable organically bound halogens (AOX), nitrogen and phosphorus Toxicants — metals and metalloids, non-metalloids inorganics including chlorate, organic alcohols, halogenated alkanes, chlorinated alkenes, anilines, hydrocarbons, aromatic hydrocarbons (excluding dioxins and furans*), phenols, organic sulphur compounds, surfacants, organic acids including chloroacetic acids, chlorinated natural phenolics and sterols. [*Dioxins and furans will be bound to organic matter and therefore will be monitored in sediment rather than in the water column] Following mill commissioning, the monitoring will be extended to cover sites 500 m from the diffuser in the northeast, northwest, southeast and southwest quadrants and at sites 5 km to the west and east of the diffuser. This monitoring will be undertaken weekly (subject to weather conditions) for the first 6 months and thereafter monthly. Sediment quality monitoring (41(d), 41(h), 41(i)) Following mill commissioning, sediment surveys will be taken quarterly (January, April, July and October) in the first year of operations. Thereafter they will be taken twice annually (April and October) for 3 years unless the findings indicate that quarterly sampling should be continued. The sampling need and sampling frequency will be reviewed after 3 years. The sampling regime and analytes will be as described for the baseline surveys (condition 36). Sampling will be undertaken at the same Locations at which baseline sediment sampling will be conducted. Samples will also be undertaken from an additional 2 sentinel Locations, situated within the mixing zone. Prey species (41(d), 41(h) and 41(k)) Following mill commissioning, the sampling for the baseline surveys will continue up to year 3 year of operations. These samples will allow comparison with the baseline levels to indicate whether effluent contaminants may have entered the food chain of threatened migratory and marine species and shore birds. Seals and penguins (41(d) and 41(h) Following mill commissioning, the seal and penguin monitoring will be repeated 2 years after the commencement of commissioning and thereafter every third year until it is confirmed that dioxins and furans are not accumulating in the food chain of Australian fur seals or little penguins. Ecological surveys (41(j)) Following mill commissioning, the ecological surveys described in section 4e for the baseline surveys will continue for at least three years. These surveys will allow statistical comparison with the baseline surveys to indicate whether the effluent discharge may have altered benthic and/or epibenthic ecology, including brown algae abundance. Toxicity testing (41(c) and 41(l)) Regular toxicity testing of mill effluent will be undertaken. Toxicity testing conducted under condition 34 will establish reference findings against which regular operational toxicity monitoring required under condition 41 can be compared. In addition to short term ecotoxicological assessments (whole effluent testing), endocrine disrupting ability will be monitored by comparing morphological measurements of fish species. Detailed protocols are based on those developed by the Canadian Pulp and Paper Environmental Effects Monitoring Program for field testing.
42	The maximum limit of concentration of dioxins and furans in the benthic sediments in any location within Commonwealth marine waters is 850pg TEQ/kg. To ensure that concentrations do not reach this level, trends in concentrations of samples collected in State and Commonwealth waters, in accordance with the EIMP, must be analysed and independently reviewed on a six-monthly basis.	Detailed chemical analysis will be conducted on a subset of Locations, referred to as Intensive Chemistry Locations – one Location from the western controls, one Location from the eastern controls, all four of the Impact Locations. The configuration of the Intensive Chemistry Locations will be approximately parallel to the prevailing tidal current along the coast. All Intensive Chemistry Locations will be sampled and analysed in replicate for the WHO_{05}-TEF suite of dioxins and furans at least 6 monthly post operationally for 3 years and thereafter pending a technical review. Other Locations will be sampled and analysed at least on a lower replicate intensity for the same period and be subject to the same review process at the end of the third year. The chemical analysis will include at least the key tracers being dioxins, furans and dioxin-like PCBs (reported as WHO_{05}-TEF congeners and WHO_{05}-

Approval condition wording		Summary of monitoring strategy
		TEQ pg/kg), organic carbon and nitrogen. In accordance with Condition 42, the three nominated determinands above will be intensively examined for any observed spatial and temporal trends. The full analytical description and methodology is provided in the C-BOMP in two areas being Section 3.2.1.2 and 3.2.2. (Appendix C). The topic of sediment monitoring is also described in 4.d.2 above.
43	Requires annual report to include reporting on performance against parameters	A summary of monitoring findings will be included in the annual report.

Appendix C
Commonwealth Baseline and Operational Monitoring Plan (C-BOMP)