

2012 - V1

ENVIRONMENTAL MANAGEMENT SYSTEM:

A VOLUNTARY, INDUSTRY DRIVEN, ENVIRONMENTAL INITIATIVE

TUROSS LAKES OYSTER FARMERS





CONTACT:

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This project is supported by:
OceanWatch Australia & Southern Rivers CMA
through funding from the Australian Government's
Caring for our Country



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COUNTRY



Catchment Management
Authority
Southern Rivers

How to use this EMS?

How to use the EMS to:

Explain oyster farming practices

An industry description is provided in the Appendix and discusses both the farming methods and land-based activities that are used to farm oysters in Tuross Lakes. The industry description also provides a summary of the species of oysters that are cultivated and the comprehensive water quality monitoring program that oyster farmers undertake to ensure a safe and premium quality product.

How to use the EMS to:

Highlight the high risk activities to the local oyster industry

High risk activities to oyster farming in Tuross Lakes have been identified through an Environmental Review. This is based on a risk analysis approach, allowing potential risks to be identified and ranked as low, moderate or high depending on the likelihood of a risk happening and the severity of the consequence.

Risks have been split into two groups:

- Internal risks: May arise as a result of oyster farming operations
- External risks: May arise from other people's activities, or from natural events such as extreme weather conditions

A summary of these risks are provided on page 22.

How to use the EMS to:

Improve environmental performance of the industry & environmental conditions in Tuross Lakes

The Environmental Improvement Plan outlines how the oyster industry and other stakeholders will work towards reducing the risks identified in the Environmental Review (see above).

The Environmental Improvement Plan provides background information on each of the risks identified, and some actions that can be taken to reduce oyster farmers exposure to those risks. It is the Environmental Improvement Plan that will be of most benefit to oyster farmers when they are applying for environmental grants to improve their farming practices.

How to use the EMS to:

Demonstrate that oysters farmers are continually improving their environmental performance

Prior to their AGM every year, it is encouraged that the oyster farmers or a suitable organisation (such as OceanWatch Australia), assess the environmental performance of the industry against the Environmental Improvement Plan outlined in this EMS. An Annual Review form has been including in this document on page 55.

Undertaking this review every year will allow the oyster farmers to assess how successfully they are working towards their Environmental Improvement Plan. A summary of the year's achievements should be added to the back of this document, and can be used as the basis of a media release promoting the actions of the local industry.

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INTRODUCTION

The Tuross Lakes Oyster Farmers recognise that they have a responsibility to cultivate oysters on behalf of the community as sustainably as current technology and techniques allow, and to improve as new methods develop.

An Environmental Management System (EMS) is a step-by-step process to identify and manage environmental impacts, risks and opportunities. The model is based on a philosophy of **continual improvement** – that is, recognising current performance against set requirements, and then working towards realistic and achievable improvements in the future.

The benefit for oyster farmers to develop an estuary-wide EMS is that it:

- **Provides an organised, documented and coordinated approach to both improving and demonstrating environmental sustainability**

Other benefits that can be gained from having an EMS include:

- Reduced operating costs;
- Higher product prices from having a clean, green image;
- Ability to portray a positive public image of the industry;
- Improve compliance levels across operators;
- Avenue to engage with stakeholders & to improve catchment conditions;

Most importantly, it helps **ensure the long term sustainability of oyster farming by reducing or preventing identified negative impacts on the environment.**

The Tuross Lakes Oyster Farmers have a vested interest in maintaining and improving the local environment, with their livelihoods dependant on the health and productivity of the estuary. The oyster growers are demonstrating their commitment by voluntarily participating in this industry-driven EMS process,

This EMS is available to download from the OceanWatch Australia website: www.oceanwatch.org.au



RELATIONSHIP WITH OTHER PLANS & REGULATIONS

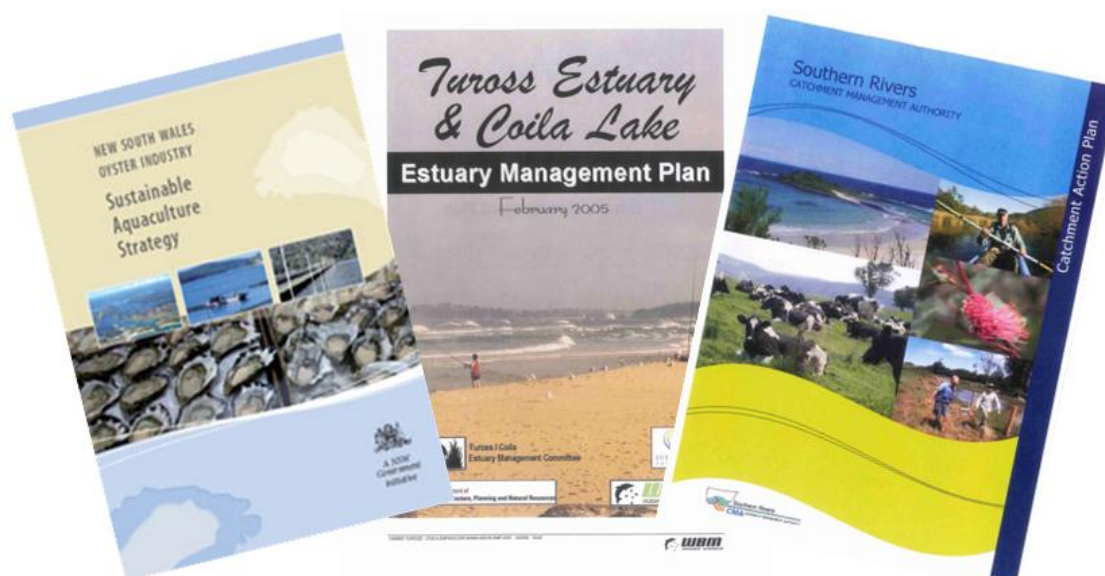
An EMS is designed to complement existing laws that control oyster farming in NSW.

This document also includes relevant information from aquaculture guidelines and strategies that have been developed to guide environmental management and best-practice marine resource use.

These include:

| | |
|---|------|
| Crown Land Act | 1989 |
| Fisheries Management Act | 1994 |
| NSW Threatened Species Conservation Act | 1995 |
| Environmental Protection & Biodiversity Conservation Act | 1999 |
| Environmental Protection & Biodiversity Conservation Regulations | 2000 |
| Fisheries Management (General) Regulation | 2002 |
| Review of Environmental Factors. Maintenance Dredging of Tuross Estuary | 2003 |
| Tuross Estuary & Coila Lake Estuary Management Study | 2004 |
| Tuross Estuary & Coila Lake Estuary management Plan | 2005 |
| South Coast Regional Strategy | 2006 |
| Batemans Bay Marine Park – Zoning Plan & User Guide | 2006 |
| New South Wales Oyster industry – Sustainable Aquaculture Strategy | 2006 |
| Southern Rivers CMA – Catchment Action Plan | 2010 |
| NSW Shellfish Industry Manual | 2011 |
| State Environmental Planning Policy (SEPP) 62 – Sustainable Aquaculture | 2011 |

The Tuross Lakes Oyster Growers have made a commitment to implement the voluntary best practice standards outlined in Section 7 of the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS).



SCOPE

The scope of this EMS is limited to:

- 1) The environmental aspects of aquaculture operations undertaken by Tuross Lakes Oyster Growers
- 2) The environmental aspects of activities within the catchment that may impact upon oyster farming in Tuross Lakes

DEVELOPMENT

As an industry driven initiative, this EMS was developed by oyster farmers in Tuross Lakes through a series of workshops, with a facilitator, Andy Myers from OceanWatch Australia. It was developed as part of a project managed by Southern Rivers Catchment Management Authority, to develop and implement oyster industry EMS. The project was funded through the Australian Government's Caring for our Country.

Whilst the EMS was compiled with regards to International Standard, ISO 14001:2004 (Environmental Management Systems), it is not fully compliant with the standard in its current form. The ISO standard describes the general requirements for documenting and implementing environmental management.

The EMS is based on a risk analysis approach to oyster farming in Tuross Lakes. Potential risks are identified and ranked as low, moderate or high depending on the likelihood of a risk happening and the consequence if the risk does occur. An Environmental Improvement Plan outlines actions to reduce or remove these risks.



REVIEW AND COMMUNICATION

An EMS is based on the philosophy of **continual improvement**. In accordance with this concept, the Tuross Lakes Oyster Farmers will undertake an annual review to measure their performance against the Environmental Improvement Plan (see '*Annual Review Form*' page 55).

This annual review will also provide the opportunity for growers to discuss incidents where the provisions of this EMS were not met. Failures may be:

- Intentional or unintentional
- An indication of inappropriate policy or actions
- Due to highly unusual circumstances
- Some combination of the above

Possible responses may include:

- No action
- A review of the EMS
- Training

In addition to the internal review, the Tuross Lakes Oyster Farmers will periodically reassess the environmental risks to oyster farming (i.e. the Environmental Review), and update the Environmental Improvement Plan to reflect the changing condition of the estuary and the catchment.

The Tuross Lakes Oyster Farmers will provide the local community and other stakeholders with regular progress reports as they work towards implementing their Environmental Improvement Plan.

EMERGENCY RESPONSE

The Tuross Lakes Oyster Farmers will respond to emergency situations and accidents, and work with the appropriate authorities to prevent or mitigate any associated negative impacts.

Growers are encouraged to work with the appropriate Authorities to develop 'Emergency Response Plans'. These plans will enable suitable preparation and planning, and a quick reaction in the event of an emergency. These actions will help to mitigating the negative impacts on the environment and the industry, increasing resilience.

Emergency response plans may include: fires, explosions, fuel & oil spills, release of hazardous chemicals, natural disasters, oyster mortality & disease, effluent spill / release.

ENVIRONMENTAL REVIEW

Tuross Lakes

Tuross Estuary is located on the south-coast of NSW, ~325km south of Sydney. Tuross River basin covers an area of 2180km² and about 85% of the region is rugged, mountainous and heavily forested to within 8km of the coast. Here, the lower catchment comprises low-lying floodplains. The main township is Tuross Head (population ~2,300) is primarily a tourist and retirement area and is located just to the north of the ocean entrance.

Forestry, dairy & beef cattle farming are major land uses in the catchment. Key threats to the river system have been identified as the disturbance of wetlands by pest animals and stock (esp. pigs & cattle) and sedimentation from roads, bank erosion and catchment activities.

Conditions in the estuary are largely influenced by the state of the ocean entrance. When the entrance is largely open (as occurs after floods, when freshwater flows push the sand plug out of the entrance), the tidal range increases, and the lake system is well flushed. When the entrance is heavily shoaled (as occurs during droughts, when wave action causes sand to accumulate in the mouth), the tidal range drops, salinity increases and flushing is reduced. This reduced flushing leaves the main lake and other backwater areas prone to catchment and pollutant inputs. In 2006, the mouth closed for the first time in about 70 years, but has since been artificially opened.



The Tuross Estuary forms a network of channels and covers a total area of ~14km² and is recognised for its ecological importance, supporting protected and endangered species (e.g. Little Tern & Hooded Plover). There are 19 SEPP 14 wetlands located within the Tuross estuary.

The township of Tuross Head is serviced by a local sewage treatment plant that discharges to sand exfiltration ponds at the rear of the dunes at Bingie Beach.

BATEMANS BAY MARINE PARK



The Batemans Bay Marine Park was established by the NSW Government in April 2006, with the zoning plan coming into effect in June 2007 following a lengthy community and stakeholder consultation process. The Marine Park covers approximately 85,000ha, extending from the north end of Murramarang Beach near Bawley Point, to Wallaga Lake in the south. It includes all of the seabed and waters from the mean high water mark on the coast to three nautical miles offshore. It includes all estuaries, creeks, rivers and lakes to the limit of tidal influence. The park is designated 'multi-use', although trawling, long lining and dredging are prohibited from the entire park.

The Tuross Lakes Oyster Farmers were considered as a key stakeholder and information resource for this process and will continue to be actively involved in any ongoing marine park development, so that it is done in an inclusive and equitable manner.

Tuross Lakes Oyster Farmers support efforts to conserve estuarine and marine biodiversity, and will assist the Marine Park Authority through their intensive water quality monitoring regime and intimate understanding of the system to maintain the high conservation value of the estuary.

Tuross Lake (including Tuross River & Borang Lake) are zoned as a Recreational Fishing Haven. These areas are free of commercial fishing, and were created to provide better angling opportunities for recreational fishers.

RISK ASSESSMENT PROCESS

Risk is the chance of something happening that will have an impact on the oyster industry and/or the environment

An EMS is based on a risk analysis approach. Potential risks are identified and ranked as low, moderate or high depending on the **likelihood** of a risk happening and the **consequence** if the risk does occur.

Potential risks that are considered may be split into:

- 1) Internal risks: Risks that arise as a direct result of oyster farming operations
- 2) External risks: Risks that arise from other people's activities, or from natural events such as extreme weather conditions

Each specific risk is ranked, based upon the tables below:

LIKELIHOOD OF A RISK HAPPENING

| | |
|-------------|---|
| 1. Rare | May occur in exceptional circumstances (e.g. once in 10 years) |
| 2. Possible | Uncommon (e.g. once in 1-3 years) |
| 3. Likely | Expected to occur in most circumstances (e.g. 2-3 times a year) |

CONSEQUENCE IF THE RISK DOES OCCUR

| | |
|-----------|---|
| 1. Minor | Minimal impact. Unlikely to be measureable from natural variability |
| 2. Severe | Maximum acceptable level of impact on the environment. Time frame for recovery more months than years |
| 3. Major | Very serious impacts with long time frame or recovery or irreversible damage |

RISK MATRIX

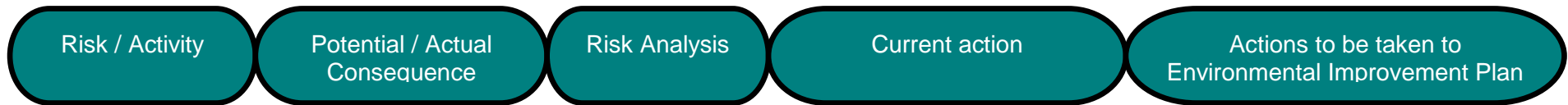
| | | Consequence | | |
|------------|--------------|-------------|------------|-----------|
| | | Minor (1) | Severe (2) | Major (3) |
| Likelihood | Rare (1) | 1 | 2 | 3 |
| | Possible (2) | 2 | 4 | 6 |
| | Likely (3) | 3 | 6 | 9 |

RISK CATEGORY & MANAGEMENT RESPONSE

| | |
|----------------|--|
| Low (1-2) | Acceptable ... no specific control measures needed, although recommended |
| Moderate (3-5) | Acceptable ... with control measures in place / continue current arrangement |
| High (6-9) | Not desirable ... strong & immediate management action required. New or further risk control measures needed |

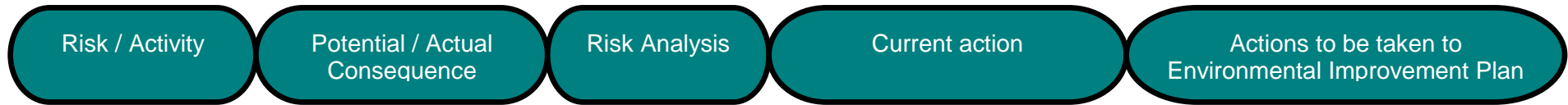


RISK ASSESSMENT: INTERNAL RISKS



TAR & TREATED TIMBER INFRASTRUCTURE

| | | | | | | | | | | |
|--|---|--|-------------|---|--------------|---|-----------------------------------|--|--|--|
| <p>Contaminants from treated / tarred timber infrastructure leaching into the estuary</p> | <ul style="list-style-type: none"> Reduced water quality Issue is high on the public agenda Accumulation in ecosystems | <table border="1"> <tr> <td>Likelihood:</td> <td>2</td> </tr> <tr> <td>Consequence:</td> <td>3</td> </tr> <tr> <td colspan="2" style="background-color: red; color: white; text-align: center;">Initial Risk Rating: High (6)</td> </tr> </table> | Likelihood: | 2 | Consequence: | 3 | Initial Risk Rating: High (6) | | <ul style="list-style-type: none"> Gradual and continual replacement program towards plastic products Infrastructure thoroughly dried before installation in estuary | <ol style="list-style-type: none"> Continue phase out of treated & tarred infrastructure |
| Likelihood: | 2 | | | | | | | | | |
| Consequence: | 3 | | | | | | | | | |
| Initial Risk Rating: High (6) | | | | | | | | | | |
| <p>Tar leaching from pit or application area into the surrounding area</p> | <ul style="list-style-type: none"> Reduced water quality Issue is high on the public agenda Accumulation in ecosystems | <table border="1"> <tr> <td>Likelihood:</td> <td>2</td> </tr> <tr> <td>Consequence:</td> <td>3</td> </tr> <tr> <td colspan="2" style="background-color: red; color: white; text-align: center;">Initial Risk Rating: High (6)</td> </tr> </table> | Likelihood: | 2 | Consequence: | 3 | Initial Risk Rating: High (6) | | <ul style="list-style-type: none"> Gradual and continual replacement program towards plastic products Pits periodically checked for leaks and cracked | <ol style="list-style-type: none"> Decommission & remove tar pits |
| Likelihood: | 2 | | | | | | | | | |
| Consequence: | 3 | | | | | | | | | |
| Initial Risk Rating: High (6) | | | | | | | | | | |
| <p>Pollutants seep into groundwater through the burial of oyster infrastructure</p> | <ul style="list-style-type: none"> Burying may lead to contamination of ground water & runoff | <table border="1"> <tr> <td>Likelihood:</td> <td>2</td> </tr> <tr> <td>Consequence:</td> <td>2</td> </tr> <tr> <td colspan="2" style="background-color: orange; color: white; text-align: center;">Initial Risk Rating: Moderate (4)</td> </tr> </table> | Likelihood: | 2 | Consequence: | 2 | Initial Risk Rating: Moderate (4) | | <ul style="list-style-type: none"> Majority of oyster cultivation infrastructure is disposed at approved landfills | <ol style="list-style-type: none"> Where no environmental harm may result, adopt principles of reuse and recycle Other material will be disposed of at licensed waste depots |
| Likelihood: | 2 | | | | | | | | | |
| Consequence: | 2 | | | | | | | | | |
| Initial Risk Rating: Moderate (4) | | | | | | | | | | |



EROSION & SEDIMENTATION

| | | | | | |
|--|---|---------------------------------|---|---|--|
| Erosion of unsealed access road & shed sites due to activity of vehicles and farm machinery | <ul style="list-style-type: none"> • Mobilises sediment • Sedimentation of the estuary • Smothers seagrass | Likelihood: | 2 | <ul style="list-style-type: none"> • Oyster shells are used to fill pot holes and contribute to road base | 5. Improve erosion control on access road & shed site to minimise impact of vehicles / machinery |
| | | Consequence: | 1 | | |
| | | Initial Risk Rating: Low (2) | | | |
| Wash from oyster punts travelling to & from leases | <ul style="list-style-type: none"> • Riverbank erosion & sedimentation • Reduced light penetration • Smothers seagrass | Likelihood: | 2 | <ul style="list-style-type: none"> • Farmers obey waterway speed limits • Punts are driven with regards to the local environment & conditions | 6. Ensure that all Tuross Lake Oyster Farmers are aware of knot limits within the Inlet |
| | | Consequence: | 1 | | |
| | | Initial Risk Rating: Low (2) | | | |
| Build up of sediment around oyster leases | <ul style="list-style-type: none"> • Disruption of natural processes • Navigational issues | Likelihood: | 2 | <ul style="list-style-type: none"> • Farmers are increasingly using long-line systems which allow greater water flow | 7. Where appropriate, move to cultivation practices with a small physical footprint |
| | | Consequence: | 1 | | |
| | | Initial Risk Rating: Low (2) | | | |



EFFLUENT

| | | | | | |
|---|--|--------------|---|---|---|
| Severe lack of adequate toilet facilities at main Tuross shed depot site to cater for farmers and visitors | <ul style="list-style-type: none"> Not optimal management of effluent Loss of productivity as must travel to use facilities | Likelihood: | 3 | <ul style="list-style-type: none"> Regular maintenance of current facilities (where they exist) Some farmers have to travel to residential properties to use facilities | <ul style="list-style-type: none"> 8. Resurrect proposal for local pump station 9. Discuss options to develop a communal toilet facility at the main Tuross depot site 10. Contact Authorities for permissions and source founding |
| | | Consequence: | 2 | | |
| Dogs in and around shed sites and on oyster punts | <ul style="list-style-type: none"> Reduced water quality Leads to questions about food safety Shellfish contamination | Likelihood: | 1 | <ul style="list-style-type: none"> Regulations prevent farmers keeping dogs in or around sheds and punts | <ul style="list-style-type: none"> 11. Pets will continue to be managed in line with industry legislation & regulations 12. Ensure visitors / contractors abide by these laws |
| | | Consequence: | 3 | | |



CHEMICALS, FUEL & OIL

| | | | | | | | | | | |
|--|---|--|-------------|---|--------------|---|-----------------------------------|--|--|---|
| Fuel / oil spills from oyster punts operating in the estuary | <ul style="list-style-type: none"> Severely impacts estuarine ecosystems Decreases water quality | <table border="1"> <tr> <td>Likelihood:</td> <td>1</td> </tr> <tr> <td>Consequence:</td> <td>3</td> </tr> <tr> <td colspan="2">Initial Risk Rating: Moderate (3)</td> </tr> </table> | Likelihood: | 1 | Consequence: | 3 | Initial Risk Rating: Moderate (3) | | <ul style="list-style-type: none"> Punts are operated with regards to the local environment & conditions Farmers alert & work with authorities to aid containment following spills | 13. Purchase fuel containment kits for storage at the central Tuross depot to enable an immediate response to spills |
| Likelihood: | 1 | | | | | | | | | |
| Consequence: | 3 | | | | | | | | | |
| Initial Risk Rating: Moderate (3) | | | | | | | | | | |
| Fuel / oil spills on land depots | <ul style="list-style-type: none"> Severely impacts ecosystems Run-off could lead to water quality issues Risk of fire | <table border="1"> <tr> <td>Likelihood:</td> <td>1</td> </tr> <tr> <td>Consequence:</td> <td>3</td> </tr> <tr> <td colspan="2">Initial Risk Rating: Moderate (3)</td> </tr> </table> | Likelihood: | 1 | Consequence: | 3 | Initial Risk Rating: Moderate (3) | | <ul style="list-style-type: none"> Machinery maintained in good working order Farmers alert & work with authorities to aid containment following spills | 14. Only small volumes of fuel & oil stored on site if no secondary containment 15. Consider secondary containment of oils and fuel (e.g. bunding) |
| Likelihood: | 1 | | | | | | | | | |
| Consequence: | 3 | | | | | | | | | |
| Initial Risk Rating: Moderate (3) | | | | | | | | | | |
| Chemicals that leak through poor storage or an adverse event | <ul style="list-style-type: none"> Toxic chemicals may severely impact ecosystems OHS risks | <table border="1"> <tr> <td>Likelihood:</td> <td>1</td> </tr> <tr> <td>Consequence:</td> <td>3</td> </tr> <tr> <td colspan="2">Initial Risk Rating: Moderate (3)</td> </tr> </table> | Likelihood: | 1 | Consequence: | 3 | Initial Risk Rating: Moderate (3) | | <ul style="list-style-type: none"> Very few chemicals stored on site, and only in small quantities Chlorine for depuration tanks are stored with a safety data sheet | 16. Store chemicals as indicated by manufacturers and stored with the appropriate safety data sheet |
| Likelihood: | 1 | | | | | | | | | |
| Consequence: | 3 | | | | | | | | | |
| Initial Risk Rating: Moderate (3) | | | | | | | | | | |



AIR QUALITY

| | | | | | |
|--|--|-----------------------------------|---|---|---|
| Release of airborne contaminants by burning oyster cultivation infrastructure | <ul style="list-style-type: none"> Burning may release airborne contaminants (e.g. hydrocarbons, toxic fumes) | Likelihood: | 2 | <ul style="list-style-type: none"> Majority of oyster cultivation infrastructure is disposed at approved landfills | 17. Where no environmental harm may result, adopt principles of re-use and recycle 18. Other material to be disposed of at licensed waste depots |
| | | Consequence: | 2 | | |
| | | Initial Risk Rating: Moderate (4) | | | |
| Inefficient motors resulting in high emissions | <ul style="list-style-type: none"> High emissions of greenhouse gasses High running costs | Likelihood: | 2 | <ul style="list-style-type: none"> Gradual move to more efficient outboards Limit unnecessary use of older motors Outboards maintained in good working order | 19. Upgrade to EPA approved motors when replacing 20. Aust. Outboard Emission Standards circulated to farmers upon release |
| | | Consequence: | 1 | | |
| | | Risk Rating: Low (2) | | | |

Risk / Activity

Potential / Actual
Consequence

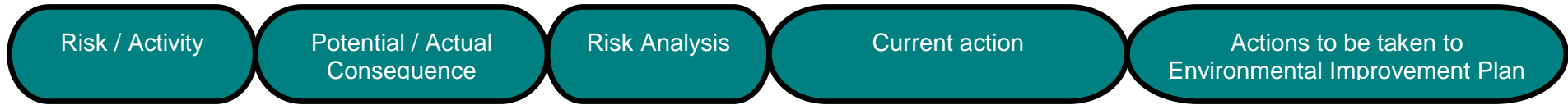
Risk Analysis

Current action

Actions to be taken to
Environmental Improvement Plan

ECOLOGICAL EFFECTS

| | | | | | | | | | | |
|---|---|--|-------------|---|--------------|---|--------------------------------------|--|--|--|
| <p>Wild Pacific oysters (declared noxious sp.) competing with native, cultivated stock</p> | <ul style="list-style-type: none"> • Competition for resources & space • Time and cost associated with management | <table border="1"> <tr> <td>Likelihood:</td> <td>2</td> </tr> <tr> <td>Consequence:</td> <td>2</td> </tr> <tr> <td colspan="2">Initial Risk Rating: Moderate (4)</td> </tr> </table> | Likelihood: | 2 | Consequence: | 2 | Initial Risk Rating: Moderate (4) | | <ul style="list-style-type: none"> • Wild Pacific oysters culled when found | <p>21. Contact NSW DPI with the option of developing a Pacific Oyster Management Plan for Tuross Lakes</p> |
| Likelihood: | 2 | | | | | | | | | |
| Consequence: | 2 | | | | | | | | | |
| Initial Risk Rating: Moderate (4) | | | | | | | | | | |
| <p>Loss of stock through disease outbreaks (e.g. winter mortality)</p> | <ul style="list-style-type: none"> • Oyster mortality • Loss of stock & income | <table border="1"> <tr> <td>Likelihood:</td> <td>2</td> </tr> <tr> <td>Consequence:</td> <td>2</td> </tr> <tr> <td colspan="2">Risk Rating: Moderate (4)</td> </tr> </table> | Likelihood: | 2 | Consequence: | 2 | Risk Rating: Moderate (4) | | <ul style="list-style-type: none"> • Mortalities above 5% reported to NSW DPI • Appropriate farming practices reduce exposure • Some farmers sourcing resistant pat | <p>22. Continue working to improve estuary and catchment health to increase oyster resilience 23. Engage with oyster monitoring programs to establish mortality & growth rates</p> |
| Likelihood: | 2 | | | | | | | | | |
| Consequence: | 2 | | | | | | | | | |
| Risk Rating: Moderate (4) | | | | | | | | | | |
| <p>Oyster stocks infected with mudworm</p> | <ul style="list-style-type: none"> • Oyster mortality • Infected stock that survive are often unsellable | <table border="1"> <tr> <td>Likelihood:</td> <td>2</td> </tr> <tr> <td>Consequence:</td> <td>2</td> </tr> <tr> <td colspan="2">Risk Rating: Moderate (4)</td> </tr> </table> | Likelihood: | 2 | Consequence: | 2 | Risk Rating: Moderate (4) | | <ul style="list-style-type: none"> • Certain farming practices are used (e.g. intertidal cultivation, periodic drying) to reduce the likelihood of infection | <p>24. Engage with researchers working on mudworm and its management</p> |
| Likelihood: | 2 | | | | | | | | | |
| Consequence: | 2 | | | | | | | | | |
| Risk Rating: Moderate (4) | | | | | | | | | | |
| <p>Marine pests harboured on derelict leases</p> | <ul style="list-style-type: none"> • Marine pests disrupt ecosystems • Derelict leases damages the industry's image | <table border="1"> <tr> <td>Likelihood:</td> <td>2</td> </tr> <tr> <td>Consequence:</td> <td>2</td> </tr> <tr> <td colspan="2">Risk Rating: Moderate (4)</td> </tr> </table> | Likelihood: | 2 | Consequence: | 2 | Risk Rating: Moderate (4) | | <ul style="list-style-type: none"> • Pacific Oyster Management Plan developed with NSW DPI • Wild Pacific oysters culled when found | <p>25. Work with NSW DPI and other organisations to identify and rehabilitate derelict leases</p> |
| Likelihood: | 2 | | | | | | | | | |
| Consequence: | 2 | | | | | | | | | |
| Risk Rating: Moderate (4) | | | | | | | | | | |



ECOLOGICAL EFFECTS (continued)

| | | | | | |
|---|--|---------------------------------|---|---|---|
| Threatened species struck by oyster punt | <ul style="list-style-type: none"> Injury or death of wildlife Bad media / image of the industry | Likelihood: | 1 | <ul style="list-style-type: none"> Report incidents Punts driven with regards to local environment and conditions | 26. Threatened species identification guides & handling manuals distributed to growers |
| | | Consequence: | 2 | | |
| | | Initial Risk Rating: Low (2) | | | |
| Damage to fauna and flora through lease building and maintenance activities | <ul style="list-style-type: none"> Disturbance of seagrass beds and ecological functions | Likelihood: | 2 | <ul style="list-style-type: none"> Every lease must have an Environmental Impact Statement prepared before it is approved Outboard use is minimised on shallow leases | 27. Where appropriate, move to low impact cultivation systems with a small physical footprint |
| | | Consequence: | 1 | | |
| | | Risk Rating: Low (2) | | | |

Risk / Activity

Potential / Actual
Consequence

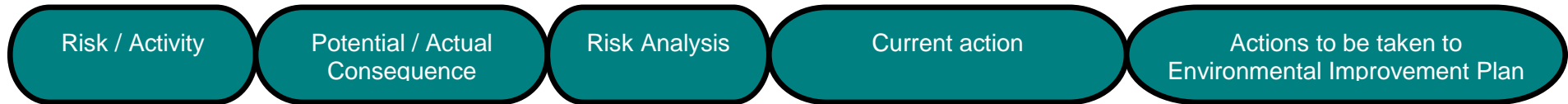
Risk Analysis

Current action

Actions to be taken to
Environmental Improvement Plan

RESOURCE USE

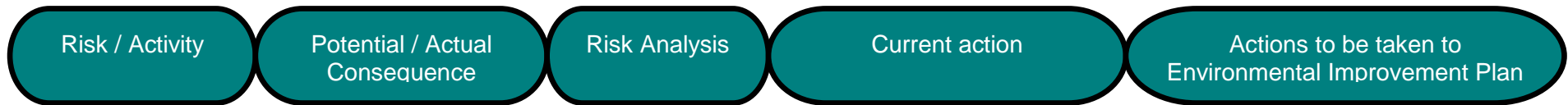
| | | | | | |
|--|---|---------------------------------|---|--|---|
| Waste shells are not utilised to their potential | <ul style="list-style-type: none"> Wasted potential resource | Likelihood: | 1 | <ul style="list-style-type: none"> Shell is often used as road-base to mitigate erosion around shed sites Excess shell taken to landfill | 28. Communicate with farmers in other estuaries to discuss alternative uses for shell 29. Investigate options to dispose or sell oyster shells (potential income from waste product) |
| | | Consequence: | 1 | | |
| | | Initial Risk Rating: Low (1) | | | |
| Potable water used to clean equipment and oysters | <ul style="list-style-type: none"> Waste of a valuable resource Water use in a cost to the business | Likelihood: | 1 | <ul style="list-style-type: none"> Water use is minimised | 30. Install rainwater tanks to minimise use of potable water 31. Reuse grey water where possible |
| | | Consequence: | 1 | | |
| | | Risk Rating: Low (1) | | | |
| Use of materials that cannot be re-used or recycled | <ul style="list-style-type: none"> Cost of waste disposal Use of limited landfill space Waste of resources | Likelihood: | 2 | <ul style="list-style-type: none"> Where possible, and when no environmental harm will result, materials are recycled or used | 32. Increase re-use and recycling of materials where appropriate, and where no environmental harm will result |
| | | Consequence: | 1 | | |
| | | Initial Risk Rating: Low (2) | | | |



NOISE & VISUAL POLLUTION

| | | | | | |
|---|---|------------------------------|---|---|--|
| Noise from oyster farming activities | <ul style="list-style-type: none"> Irritation of neighbours | Likelihood: | 1 | <ul style="list-style-type: none"> Activities are normally only conducted between 7am-6pm. | 33. Follow NSW DPI best practice guidelines for noise as outlined in the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS) |
| | | Consequence: | 1 | | |
| | | Initial Risk Rating: Low (1) | | | |
| Visual pollution of leases that have not been maintained | <ul style="list-style-type: none"> Community views industry in a bad light | Likelihood: | | <ul style="list-style-type: none"> Farmers endeavour to maintain lease areas for visual amenity, as well as environment and productivity reasons | 34. Maintain leases for visual amenity as outlined in Oyster Industry Sustainable Aquaculture Strategy 35. Launch & distribute EMS to educate community & local Authorities 36. Utilise opportunities to engage & educate community about farming practice |
| | | Consequence: | | | |
| | | Initial Risk Rating: Low (1) | | | |

RISK ASSESSMENT: EXTERNAL RISKS



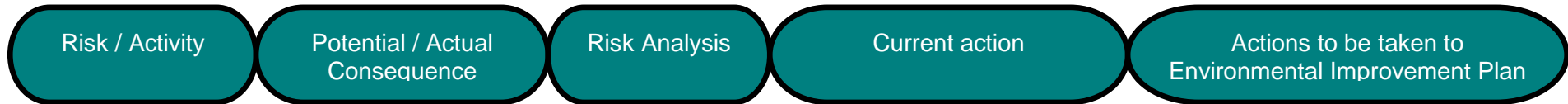
EFFLUENT

| | | | | | | | | | | |
|--|--|---|-------------|---|--------------|---|----------------------------------|--|--|---|
| <p>Animal effluent from birds and cattle accessing waterway (priority areas close to harvest zones)</p> | <ul style="list-style-type: none"> Contamination of shellfish and wider estuarine environment Closure of harvest area / loss of income | <table border="1"> <tr> <td>Likelihood:</td> <td>3</td> </tr> <tr> <td>Consequence:</td> <td>3</td> </tr> <tr> <td colspan="2" style="background-color: red; color: white; text-align: center;">Initial Risk Rating: High (9)</td> </tr> </table> | Likelihood: | 3 | Consequence: | 3 | Initial Risk Rating: High (9) | | <ul style="list-style-type: none"> Monitor water quality Farmers have previously worked with landowners on fencing projects Contacted Authorities about action to exclude stock from mangroves (high risk site) | <p>37. Identify key sites subject to effluent input & forward to key stakeholders</p> <p>38. Engage with landholders and facilitate on-ground works</p> <p>39. Promote successful projects and partnerships</p> |
| Likelihood: | 3 | | | | | | | | | |
| Consequence: | 3 | | | | | | | | | |
| Initial Risk Rating: High (9) | | | | | | | | | | |
| <p>Pump-station failure / overflow, especially when rainwater enters the sewerage system</p> | <ul style="list-style-type: none"> Contamination of shellfish and wider estuarine environment Closure of harvest area / loss of income | <table border="1"> <tr> <td>Likelihood:</td> <td>2</td> </tr> <tr> <td>Consequence:</td> <td>3</td> </tr> <tr> <td colspan="2" style="background-color: red; color: white; text-align: center;">Initial Risk Rating: High (6)</td> </tr> </table> | Likelihood: | 2 | Consequence: | 3 | Initial Risk Rating: High (6) | | <ul style="list-style-type: none"> Holding tanks are in place in the event of an overflow | <p>40. Continue working with council to increase capacity of holding tanks and to encourage more regular maintenance</p> |
| Likelihood: | 2 | | | | | | | | | |
| Consequence: | 3 | | | | | | | | | |
| Initial Risk Rating: High (6) | | | | | | | | | | |
| <p>Contamination from failing septic tanks close to the estuary foreshore</p> | <ul style="list-style-type: none"> Contamination of shellfish and wider estuarine environment | <table border="1"> <tr> <td>Likelihood:</td> <td>2</td> </tr> <tr> <td>Consequence:</td> <td>3</td> </tr> <tr> <td colspan="2" style="background-color: red; color: white; text-align: center;">Initial Risk Rating: High (6)</td> </tr> </table> | Likelihood: | 2 | Consequence: | 3 | Initial Risk Rating: High (6) | | <ul style="list-style-type: none"> Septic tanks subject to council inspections Farmers monitor water quality | <p>41. Report unexpected water test results to council</p> |
| Likelihood: | 2 | | | | | | | | | |
| Consequence: | 3 | | | | | | | | | |
| Initial Risk Rating: High (6) | | | | | | | | | | |



EROSION & SEDIMENTATION

| | | | | | |
|--|---|----------------|--|---|---|
| Sediment mobilised by earthworks carried out in the catchment without consent or appropriate control measures | <ul style="list-style-type: none"> Increased turbidity Increased chance of mudworm Deposited sediments smother seagrass & accumulate around lease infrastructure | Likelihood: 2 | | <ul style="list-style-type: none"> Farmer vigilance has identified a number of developments resulting in successful prosecutions | 42. Report all earthworks of concern to council & CMA |
| | | Consequence: 2 |  |  |  | Initial Risk Rating: Moderate (4) |
| Bank / Gully erosion through stock trampling and erosive flood waters | <ul style="list-style-type: none"> Loss of mangroves & riparian vegetation Deposited sediments smother seagrass & accumulate around lease infrastructure Higher incidence of mudworm | Likelihood: 3 | | <ul style="list-style-type: none"> Monitor water quality Farmers have previously worked with landowners on fencing projects Contacted Authorities about excluding stock from sensitive foreshore | 43. Identify key erosion sites for remediation 44. Engage with landholders & Authorities to facilitate on-ground works 45. Promote successful projects and partnerships |
| | | Consequence: 2 |  |  |  | Initial Risk Rating: High (6) |
| Sand accumulation at the lake entrance when environmental flows are reduced | <ul style="list-style-type: none"> Poor flushing of estuary Reduced tidal range Deterioration of water quality | Likelihood: 2 | | <ul style="list-style-type: none"> Working with council to improve entrance management & consideration of dredging Adapting farming methods | 46. Representation on the Tuross River / Coila Lake Estuary Management Committee |
| | | Consequence: 2 |  |  |  | Initial Risk Rating: Moderate (4) |

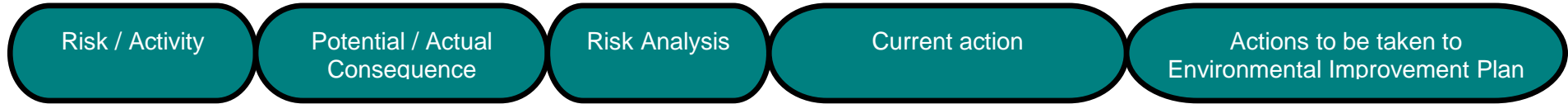


ACID SULPHATE SOILS

| | | | | | |
|---|---|--|---|---|--|
| Exposure of acid-sulphate soils through soil disturbance or drainage | <ul style="list-style-type: none"> • Estuarine fauna & flora exposed to toxic plumes • Acidic solutions dissolve / thin oyster shells | Likelihood: | 2 | <ul style="list-style-type: none"> • Farmers maintain vigilance to disturbances and unauthorised earthworks in the catchment • Water quality monitoring | 47. Report all earthworks of concern to council & CMA 48. Report unexpected water test results to council |
| | | Consequence: | 3 | | |
| | | Initial Risk Rating: High (6) | | | |

RUN-OFF

| | | | | | |
|---|---|--|---|--|---|
| High levels of nutrients in fertiliser run-off from agricultural areas & heritage grazing land | <ul style="list-style-type: none"> • Algal blooms which create low dissolved oxygen levels when bloom dies off • Potential for Harmful (toxic) Algal Blooms | Likelihood: | 2 | | 49. Liaise with local council to investigate management options 50. Work with agencies to upgrade site to best practice 51. Educate community about land-water interactions & the needs of industry |
| | | Consequence: | 3 | | |
| | | Initial Risk Rating: High (6) | | | |



CHEMICALS, FUEL & OIL

| | | | | | |
|---|--|--------------------------------------|---|---|---|
| Fuel & oil spills originating from recreational vessels | <ul style="list-style-type: none"> Severely impacts estuarine ecosystems Decreases water quality | Likelihood: | 1 | <ul style="list-style-type: none"> Farmers alert & work with authorities to aid containment following spills | 52. Purchase spill containment kits to enable an immediate response |
| | | Consequence: | 3 | | |
| | | Initial Risk Rating: Moderate (3) | | | |

SUMMARY OF ENVIRONMENTAL RISKS

Results of the risk assessment have been summarised and prioritised based on the initial risk rating. Risks have been split into two categories: Internal risks & External risks.

The Tuross Lake Oyster Farmers will work towards minimising risks that arise from oyster farming practices, whilst also engaging and working with stakeholders to address risks arising from the catchment.

Internal Risks

Risks that arise as a direct result of oyster farming practices

| | |
|---|-------------------|
| - Contaminants from treated / tarred timber leaching into estuary | High Risk (6) |
| - Severe lack of adequate toilet facilities at main depot site | High Risk (6) |
| - Tar leaking from pit / application area into surrounding area | High Risk (6) |
| - Pollutants seep into groundwater by burying old oyster gear | Moderate Risk (4) |
| - Airborne contaminants released by burning old oyster gear | Moderate Risk (4) |
| - Wild Pacific oysters competing with native, cultivated stock | Moderate Risk (4) |
| - Oyster stocks infected with mudworm | Moderate Risk (4) |
| - Marine pests harboured on derelict leases | Moderate Risk (4) |
| - Loss of stock through disease outbreaks (eg winter mortality) | Moderate Risk (4) |
| - Fuel / oil spills from oyster punts operating in the estuary | Moderate Risk (3) |
| - Fuel / oil spills on land depots | Moderate Risk (3) |
| - Chemicals that leak through poor storage or an adverse event | Moderate Risk (3) |
| - Dogs in and around shed sites and on oyster punts | Moderate Risk (3) |
| - Erosion of access road due to activity of vehicles / machinery | Low Risk (2) |
| - Threatened species struck by oyster punt | Low Risk (2) |
| - Inefficient motors resulting in high emissions | Low Risk (2) |
| - Damage to fauna & flora through lease building & maintenance | Low Risk (2) |
| - Wash from oyster punts travelling to & from leases | Low Risk (2) |
| - Build up of sediment at oyster leases as water velocities fall | Low Risk (2) |
| - Use of materials that cannot be re-used or recycled | Low Risk (2) |
| - Waste shells are not utilised to their potential | Low Risk (1) |
| - Potable water used to clean equipment & oysters | Low Risk (1) |
| - Noise from oyster farming activities | Low Risk (1) |
| - Visual pollution of leases that have not been maintained | Low Risk (1) |

External Risks

Risks that arise from other people's activities, or from natural events such as extreme weather conditions

| | |
|--|-------------------|
| - Animal effluent from birds & cattle accessing waterway | High risk (9) |
| - Pump-station failure / overflow | High risk (6) |
| - Exposure of acid-sulphate soils (disturbance/drought/drainage) | High risk (6) |
| - High levels of nutrients in fertiliser run-off from agric. areas | High risk (6) |
| - Bank / gully erosion through stock trampling & flood waters | High risk (6) |
| - Contamination from failing septic tanks close to the estuary | High risk (6) |
| - Sediment mobilised by earthworks without approp. controls | Moderate risk (4) |
| - Sand accumulation at the lake entrance when low flows | Moderate risk (4) |
| - Fuel & oil spills originating from recreational vessels | Moderate risk (3) |

ENVIRONMENTAL IMPROVEMENT PLAN

To Address Internal Risks:

Tar & Treated Timber Infrastructure:

Background:

For many years, tarred & treated timber has been used to increase the durability of cultivation infrastructure, protecting it from marine borers. There is no evidence indicating that this contaminates the oysters or neighbouring species (White, 2001), however over time the potential exists for chemicals in these wood preservatives to leach into the surrounding waters.

Oyster farmers throughout NSW are phasing out the use of tarred & treated timber by converting to polyurethane trays, plastic sleeved timber posts, or adopting alternative farming methods using hard plastic baskets and floating pillows (see Industry Description in Appendix for more details). Converting to these new products will reduce ongoing maintenance requirements and associated costs, and also eliminate potential contaminants entering the estuary. There are a few tar pits remaining in the area, however the local oyster farmers are committed to their eventual removal.

Many farmers are working towards the exclusive use of re-useable plastic products, but this is a costly, time consuming and labour intensive task. While conversion to non-degradable products will ultimately save the farmers time and money, the sheer logistics of such an operation means the change will not occur overnight.

In some circumstances, the wood removed from a lease might still be structural sound. Rather than the costly and wasteful act of disposing of this material at landfill, farmers may choose to sheath the wood in plastic to prevent any further leaching of contaminants, and then re-use on a lease.

Risks mitigated by these actions:

- Contaminants from treated / tarred timber infrastructure leaching into the water
- Tar leaching from pit or application area into the surrounding area
- Pollutants seep into groundwater through the burial of oyster infrastructure

| Actions | Who | Measured Improvement |
|---|----------------|--|
| 1. Continue phase out of treated & tarred infrastructure | Oyster farmers | Amount of treated & tarred infrastructure removed from the estuary (kg) |
| 2. Decommission & remove tar pits | Oyster farmers | Number of tar pits remaining in the local industry (target = 0) |
| 3. Where no environmental harm may result, adopt principles of re-use and recycle | Oyster farmers | Estimate of oyster infrastructure removed from estuary that has been re-used (%) |
| 4. Other material will be disposed of at licensed waste depots | Oyster farmers | Amount of oyster infrastructure that has been disposed at licensed waste depots |

Benefits of actions:

- Removal of potential contaminants from the marine environment
- Improved community perception of the industry
- OHS benefits through decreased use of hot tar

Erosion & Sedimentation:

Background:

Oyster farmers require a land-based depot that can be easily accessed from the water. It is here that farmers grade and process oysters, a practice that may involve the use of machinery to lift infrastructure, and water to wash down gear & clean oysters. In Tuross Lakes, the majority of oyster sheds are built out over the water, so the potential for these activities to cause land based erosion is limited.

One or two oyster sheds however have not been constructed above the lake, and the action of heavy machinery and washing down activities here could generate localised erosion. Similarly, road access to the main shed site is unsealed, and vehicle access has the potential to increase erosion and estuary sedimentation.

Erosion not only impacts on estuary health through smothering seagrass & inhibiting light penetration, but can also affect the feeding apparatus of oysters and lead to infestations of mudworm. This can impact on the health of oysters, and can result in mortalities. Sediment instability at shed sites can also have severe consequences on business productivity, creating OHS issues and hinder machinery operation.

To mitigate these risks, farmers are exploring options to reduce shed-site erosion by making physical improvements to depot sites, and adjusting practices to reduce mobilisation of sediment. In other estuaries, farmers have constructed sediment sumps to retain sediment on site.

Significant oyster infrastructure on the seabed can potentially disrupt local water movement. This can result in reduced water flow, promoting suspended sediment to settle out. This build up of material can create issues with navigation and can also adversely impact on the benthic environment.

Risks mitigated by these actions:

- Erosion of unsealed access road & shed sites due to activity of vehicles & farm machinery
- Wash from oyster punts travelling to & from leases
- Build up of sediment around oyster leases

| Actions | Who | Measured Improvement |
|--|----------------|---|
| 5. Improve erosion control on access road & shed site to minimise impact of vehicles / machinery | Oyster Farmers | No. of physical improvements that help manage erosion caused by vehicles / machinery No. of changes in practice that have occurred to help manage erosion caused by vehicles / machinery |
| 6. Ensure that all Tuross Lake Oyster Farmers are aware of knot limits within the estuary | OWA | Knot limits distributed (yes / no) |
| 7. Where appropriate, move to cultivation practices with a small physical footprint | Oyster Farmers | Area of lease from which rack / rail has been removed (ha) |

Benefits of actions:

- Erosion control works mitigate sediment loss & inhibit estuary sedimentation
- Shed maintenance & improvements demonstrate a professional, proactive industry
- Move to infrastructure with a small physical footprint will encourage water flow

Effluent:

Background:

Toilets: As well as spending considerable amount of time on the water tending their leases, the nature of commercial oyster cultivation also requires farmers to spend extended periods at their land based facilities, whether it be culling overcatch and fouling organisms, grading or maintaining equipment.

The main oyster shed depot site at Turlinjah houses 5-6 sheds. None of these are serviced by the main town sewer line which does not extend out to this area. Whilst some farmers maintain port-a-loos, others make arrangements to use facilities off site. This arrangement is far from adequate as time spent off site reduces productivity.

In the past, there have been discussions in council regarding the extension of the town sewer line and the construction of a nearby pumping station. This proposal appears to have stalled, however the oyster farmers of Tuross Lake are keen to see it resurrected. This would provide the farmers with the opportunity to connect to the main line and thereby improve their management of effluent. If the proposal does not proceed, there may still be an opportunity for the farmers to collectively apply for, and manage an on-site sewage management system adjacent to the main shed site.

Pets: Pets represent a risk to food safety and their presence on oyster punts and around shed sites are controlled by industry regulations. Whilst all oyster farmers know of these regulations, contractors and visitors to oyster production sites might not be aware of the potential for contamination, and the public perception issues of dogs around food products.

Risks mitigated by these actions:

- Severe lack of adequate toilet facilities at Tuross shed depot to cater for farmers & visitors
- Dogs in and around shed sites and on oyster punts

| Actions | Who | Measured Improvement |
|--|----------------|---|
| 8. Resurrect proposal for local pump station | Oyster farmers | Local authorities contacted and proposal update sought |
| | Oyster farmers | Feedback received |
| 9. Discuss options to develop a communal toilet facility at the main Tuross depot site | Oyster farmers | Options to progress communal toilet facilities discussed (yes / no) |
| 10. Contact Authorities for permissions and source funding | Oyster farmers | Authorities contacted & permissions gained (yes/ no) |
| | Oyster farmers | Communal toilet facilities constructed (yes / no) |
| 11. Pets will continue to be managed in line with industry legislation & regulations | Oyster farmers | No. of dogs in / around oyster punts and shed sites (target = 0) |
| 12. Ensure visitors / contractors abide by these laws | Oyster farmers | No. of dogs visiting oyster production sites (target = 0) |

Benefits of actions:

- Reduced risk of oyster and estuary contamination
- Increased consumer confidence in raw product

Chemicals, Fuel & Oil:

Background:

The main environmental concern in the use of chemicals, fuel and oil is the potential for stormwater and land contamination from spills. There is no bulk storage of chemicals, fuel or oil on site, and hence no bunding is currently employed to protect against spills. Only small quantities are held in sheds for everyday use, and these fluids are stored in appropriate canisters. Secondary containment is recommended to act as a back-up to contain spills in the unlikely event that the first container fails.

As oyster farming involves the use of a variety of machinery, including outboard engines, grading machines, tractors, fork-lifts, it is important for farmers to maintain this equipment in good condition to protect against leaks. Such maintenance is built into everyday farming activities, and is fundamental to maintain productivity.

Very few chemicals are used in oyster farming, with the most common probably being chlorine. Chlorine is used to disinfect depuration tanks, and should be stored as directed on the associated 'Material Safety Data Sheet'. Chlorine is corrosive & potentially hazardous to health, and all oyster farmers & employees should have access to the 'Material Safety Data Sheet' which should be stored with the chemical at all times.

Access to a spill kit will enable oyster farmers to respond quickly to an emergency situation, irrespective of the source of the spill. With oyster health linked to water quality, it is certainly in the farmer best interests to respond quickly and inhibit the spread of hazardous substances.

Risks mitigated by these actions:

- Fuel / oil spills from oyster punts operating in the estuary
- Fuel / oil spills on land depots
- Chemicals that leak through poor storage or an adverse event

| Actions | Who | Measured Improvement |
|--|----------------|--|
| 13. Purchase fuel containment kits for storage at the central Tuross depot to enable an immediate response to spills | Oyster Farmers | No. of fuel / oil spill kits available for use |
| 14. Only small volumes of fuel & oil stored on site if no secondary containment | Oyster Farmers | No. of fuel / oil containers larger than 20 litres stored at shed sites without secondary containment (target = 0) |
| 15. Consider secondary containment of oils & fuel (e.g. bunding) | Oyster Farmers | No. of secondary containment measures put in place |
| 16. Store chemicals as indicated by manufacturers and stored with the appropriate safety data sheet | Oyster Farmers | No. of chemical containers stored inappropriately or without the correct safety data sheet |

Benefits of actions:

- Appropriate storage of hazardous substances reduces the chance of spills that may cause environmental damage
- Containment kits & safety sheets enable a quick & appropriate response to spills

Air Quality:

Background:

Burning Old Infrastructure: For many years, tarred & treated timber has been used to increase the durability of cultivation infrastructure, protecting it from marine borers. This practice is now being phased out with the development of re-useable hard plastic products. Whilst lease conversion to re-useable hard-plastic products is undoubtedly beneficial to the environment, it is a time consuming and costly exercise to buy new equipment and also to dispose of old waste materials. Whilst burning of rubbish and old oyster infrastructure is not part of normal farming practice, farmers may be tempted to burn items such as treated timber and office refuse at certain times.

Moving forward, the Tuross Lakes Oyster Farmers will adopt a reuse or dispose approach to old infrastructure. In some circumstances, the wood removed from a lease might still be structural sound. Rather than the costly and wasteful act of disposing of this material at landfill, farmers may choose to sheath the wood in plastic to prevent any further leaching of contaminants, and then re-use on a lease. Material that cannot be re-used without causing environmental damage, will be dried and disposed at a suitable EPA approved landfill site.

Outboards: There are currently no Australian regulations or standards that limit air or water emissions from marine outboard engines. However, as all marine engines sold in Australia are imported mainly from the US or Japan, many do comply with emission standards applicable to the country of origin. On the other hand overseas manufactures produce high emissions marine outboard engines to sell in unregulated markets such as Australia.

There are moves for Australian emissions standards to be enacted in 2012, which are likely to be modelled on the 2010 USA standards for rating the environmental performance of outboards. Motors meeting these standards have significantly lower air and water emissions than conventional outboard motors and are also more fuel efficient.

Risks mitigated by these actions:

- Release of airborne contaminants by burning oyster cultivation infrastructure
- Inefficient motors resulting in high emissions

| Actions | Who | Measured Improvement |
|--|----------------|--|
| 17. Where no environmental harm may result, adopt principles of re-use and recycle | Oyster Farmers | % Estimate of oyster infrastructure removed from estuary that has been re-used |
| 18. Other materials to be disposed of at licensed waste depots | Oyster Farmers | Amount of oyster infrastructure that has been disposed of at licensed waste depots |
| 19. Upgrade to EPA approved motors when replacing | Oyster Farmers | Number of outboards replaced with EPA approved motors |
| 20. Australian Outboard Emission Standards circulated to farmers upon release | OWA | Australian Outboard Emission Standards Circulated |

Benefits of actions:

- Eliminates the release of airborne contaminants
- Improved community perception of the industry
- Improved efficiency of outboards, operating with lower emissions

Ecological Effects:

Background:

Pacific Oysters: The Pacific oyster is listed as a noxious species in all NSW waters except Port Stephens. This introduced pest have been noted on current & derelict oyster leases in Tuross Lakes, and the cost of managing Pacific oyster over-catch can seriously affect the commercial viability of the industry. Pacific oysters can withstand a wide range of salinities & water quality parameters, and with fast growth rates can out-compete and smother the native species. In other areas (e.g. Wagonga Inlet & Clyde River), oyster farmers have helped NSW DPI to develop & implement a Pacific Oyster Management Plan, and Clyde River farmers also participate in an annual Pacific Oyster culling day managed by Southern Rivers CMA.

Oyster disease / mudworm / marine pests: The health of oysters is largely influenced by water quality, with their capacity to tolerate disturbance and disease linked to the health of the estuary. Whilst oyster stocks in Tuross Lakes are susceptible to winter mortality (caused by the parasite *Bonamia roughleyi*), the incidence of this disease is relatively low compared to other estuaries in the region.

Where high levels of silt persist in the water column this can affect the sensitive feeding apparatus of oysters. This can lead to infestations of mudworm, a parasite that can severely impact the health of oysters, and in many cases result in mortality.

An oyster monitoring program has been underway on the south coast of NSW for a couple of year (driven by Ana Rubio from the University of Wollongong). This program has been looking at long-term trends in oyster growth and mortality in different areas. Understanding baseline rates of growth & mortality are essential in order to quickly detect when something disturbs the system. More farmers are encouraged to get involved in this project.

Derelict leases are not only a visual eyesore on the estuary, but also harbour marine pests. Oyster farmers typically pay an annual fee/bond to NSW DPI as security for lease areas. This bond system was introduced in 2001, to ensure that the industry shares the responsibility in the future for problems related to lease management & maintenance. If a lease is abandoned, NSW DPI are able to use bond money to remediate the area.

Threatened Species / Seagrass: It is highly unlikely that any oyster farming activities will interact or harm a protected or threatened species. However, to further reduce the risk, OceanWatch will distribute threatened species identification guides and handling manuals to farmers to assist them in the unlikely event of an interaction.

Seagrass in the near vicinity of oyster farms may be affected by inappropriate farming techniques. Physical shading of seagrass by aquaculture infrastructure can lead to seagrass loss by reducing light levels, while the action of boat propellers in shallow water can also impact on these sensitive ecological areas.

Risks mitigated by these actions:

- Wild Pacific oysters (declared noxious sp.) competing with native, cultivated stock
- Loss of stock through disease outbreaks (e.g. winter mortality)
- Oyster stocks infected with mudworm
- Marine pests harboured on derelict leases
- Threatened species struck by oyster punt
- Damage to fauna and flora through lease building and maintenance activities

Ecological Effects (...continued):

| Actions | | Who | Measured Improvement |
|---------|--|--------------------------|--|
| 21. | Contact NSW DPI with the option of developing a Pacific Oyster Management Plan for Tuross Lake | Oyster Farmers | NSW DPI contacted? (yes / no) |
| | | NSW DPI (if going ahead) | Pacific Oyster Management Plan developed (yes / no) |
| 22. | Continue working to improve estuary and catchment health to increase oyster resilience | Oyster Farmers | No. of catchment projects oyster farmers have engaged in to improve estuary health |
| 23. | Engage with oyster monitoring programs to establish mortality & growth rates | Oysters Farmers | No. of engagements with researchers undertaking the oyster monitoring programs |
| 24. | Engage with researchers working on mudworm and its management | Oyster Farmers | No. of engagements with researchers working on mudworm and its management |
| 25. | Work with NSW DPI and other organisations to identify and rehabilitate derelict leases | Oyster Farmers | Derelict leases identified and NSW DPI informed |
| | | Oyster Farmers | No. of derelict leases rehabilitated |
| 26. | Threatened species identification guides & handling manuals distributed to growers | OWA | Identification guides and handling manuals distributed |
| 27. | Where appropriate, move to low impact cultivation systems with a small physical footprint | Oyster Farmers | Area of lease from which rack / rail has been removed (ha) |

Benefits of actions:

- Improved management of Pacific oysters / Reduce over-catch of Pacific oysters
- Enhance oyster resilience to disease, mudworm and other disturbances
- Improve public perception of the industry
- Reduce potential risks from marine pests
- Maintain & improve ecological communities in Tuross Lakes

Resource Use:

Background:

Shell: With large volumes of stock in cultivation, some oysters will naturally die during production. There has long been discussion within the industry about how to value add to this waste product / resource. Currently, waste shell is used to fill pot-holes & reduce erosion on access roads and around shed sites. In other estuaries, shells have also been requested by local builders for use in cement. As an alternative option, research is underway into the use of crushed oyster shells as crop / lime fertiliser, with initial assessments showing some considerable benefits. Local farmers will endeavour to keep up to date on this research, so that they can take advantage of any future opportunities.

Water: Recognising that potable water is a valuable resource, farmers are committed to minimising water consumption & wastage. They will also investigate options to re-use grey water where appropriate, & any opportunities to offset the cost of rainwater tank installation. This will enable farmers to harvest run-off from shed roofs, and use this rainwater to clean equipment and machinery.

Waste: The volume of waste that oyster farms can produce is considerable. Landfill is limited by space, and comes at an increasing cost. The notion of reduce, reuse, recycle is well known and adopted by many farmers to minimise wastage.

Risks mitigated by these actions:

- Waste shells are not utilised to their potential
- Potable water used to clean equipment and oysters
- Use of materials that cannot be reused or recycled

| Actions | Who | Measured Improvement |
|---|----------------|---|
| 28. Communicate with farmers in other estuaries to discuss alternative uses for shell | Oyster Farmers | No. of communications made with farmers in other estuaries regarding alternative uses / markets for shell |
| 29. Investigate options to dispose or sell oyster shells (potential income from waste product) | Oyster Farmers | No. of different uses of shell investigated |
| | Oyster Farmers | No. of bags of shell used for purposes other than road base at shed site |
| 30. Install rainwater tanks to minimise use of potable water | Oyster Farmers | No. of rainwater tanks installed |
| 31. Reuse grey water where possible | Oyster Farmers | No. of greywater initiatives instigated |
| | Oyster Farmers | % Estimate of grey water re-used |
| 32. Increase re-use and recycling of materials where appropriate, and where no environmental harm will result | Oyster Farmers | % Estimate of waste (excluding cultivation infrastructure) that has been re-used |
| | Oyster Farmers | % Estimate of waste (excluding cultivation infrastructure) that has been recycled |

Benefits of actions:

- Minimise waste production and pressure on resources
- Utilise waste products (especially shells) and develop a market or their reuse

Noise & Visual Pollution:

Background:

In 2006, NSW Department Primary Industries developed the NSW Oyster Industry Sustainable Aquaculture Strategy (OISAS) that includes criteria for acceptable lease materials & maintenance as well as their visual amenity. Tuross Lakes Oyster Farmers take great pride in the appearance of their leases and a lot of work has recently been undertaken to upgrade infrastructure.

NSW DPI are currently reviewing the NSW OISAS. All farmers should be provided with copies of the new strategy upon release. See www.dpi.nsw.gov.au for more information.

The aesthetics of lease areas & shed sites is one of the main concerns of communities throughout coastal NSW about oyster farming. This uneasiness stems mainly from a lack of understanding & appreciation of industry needs. Communication is a key component of the EMS, and farmers will endeavour to engage with the local community to demystify the industry. The first step is the distribution of the EMS.

Noise issues are particularly relevant to shed sites which use a variety of equipment & practices that emit noise. Conveniently, the main shed site for Tuross Lake is situated some distance from neighbours and farmers take common sense steps towards minimising noise. Leases are only normally worked between 7am-6pm, depending on tides and weather conditions.

Risks mitigated by these actions:

- Noise from oyster farming activities
- Visual pollution of leases that have not been maintained

| Actions | Who | Measured Improvement |
|---|--------------------------|--|
| 33. Follow NSW DPI best practice guidelines for noise as outlined in the NSW Oyster Industry Sustainable Aquaculture Strategy | NSW DPI | 2012 version of Oyster Industry Sustainable Aquaculture Strategy circulated to growers when released |
| | Oyster Farmers | No. of noise complaints received (target = 0) |
| 34. Maintain leases for visual amenity as outlined in Oyster Industry Sustainable Aquaculture Strategy | NSW DPI | 2012 version of Oyster Industry Sustainable Aquaculture Strategy circulated to growers when released |
| | Oyster Farmers | No. of reasonable complaints received regarding the visual aspects of oyster leases |
| 35. Launch & distribute EMS to educate community & local Authorities | Oyster Farmers, OWA, CMA | EMS launched |
| | Oyster Farmers, OWA, CMA | EMS distributed to key stakeholders & Authorities |
| 36. Utilise opportunities to engage & educate community about farming practice | Oyster Farmers | No. of publicity / promotional opportunities utilised to discuss oyster farming practices |

Benefits of actions:

- Neat & tidy leases portray a professional image of the industry
- Improved community understanding of farming practices and industry needs
- Maintain good relationships with residents and other water users

ENVIRONMENTAL IMPROVEMENT PLAN

To Address External Risks:

Effluent:

Background:

Effluent contamination of waterways is the number one concern to the oyster industry. Pollution of this nature contaminates shellfish & closes harvest areas as a means to protect food safety. This can lead to loss of income for farmers, and there are cases where ongoing issues of contamination have effectively driven oyster farmers from the river (e.g. Bellinger / Kalang in northern NSW). Not only does effluent impact on the oyster industry, but it can have impacts on estuarine ecosystems and severe implications on public health.

Although ~85% of the Tuross River catchment remains forested, the lower reaches of the river pass through a low-lying floodplain. This area is subject to agricultural activities, particularly the grazing of dairy and beef cattle. Where riverbanks are unfenced, stock access to creeks can result in faecal contamination of the waterway.

Oyster farmers have a unique understanding of the estuary, and through their rigorous water quality testing program, have the ability to identify point sources of pollution. Anecdotal evidence suggests the oyster industry is often the first to detect waterway contamination. Whilst it is important that this information and local knowledge is provided to Authorities and organisations that can help, oyster farmers may have a further role to play, given their local knowledge & existing relationships with landholders. There are many examples of where a farmer's friendly and diplomatic approach has delivered excellent environmental outcomes. In 2010, eight oyster farmers joined forces with the Southern Rivers CMA and a local dairy farmer to plant over 300 trees along the foreshore at Coopers Island, the location of one of the largest dairy farms in the catchment.

The management of sewerage infrastructure is an ongoing concern to the Tuross Lakes oyster farmers. Overflows at pumping stations during heavy rain and damage to infrastructure by tree roots have severe implications for oyster farmers – contaminating the waterway and closing the harvest area. The farmers in Tuross Lake are working closely with the Wagonga Inlet oyster growers, who have held discussions with Eurobodalla Shire Council regarding the maintenance of infrastructure. The farmers will be requesting that council increase the capacity of holding tanks and increase their maintenance schedule.

Failing septic tanks within the catchment also pose a risk to the oyster industry through contamination of the estuary. Although council maintains a program to inspect on-site sewerage management systems, the Bryce Bay & Guerilla Bay backwaters are poorly flushed and the sites need to be closely monitored.

Risks mitigated by these actions:

- Animal effluent from birds and unrestricted cattle access to foreshore
- Pump-station failure / overflow, especially when rainwater enters the sewerage system
- Contamination from failing septic tanks close to the estuary foreshore

Effluent (...continued):

| Actions | Who | Measured Improvement |
|---|---------------------|---|
| 37. Identify key sites subject to effluent input & forward to key stakeholders | Oyster Farmers, CMA | Map developed indicating hotspots subject to effluent input |
| | Oyster Farmers, CMA | Map forwarded to key stakeholders (CMA, OWA, WetlandCare Australia) |
| 38. Engage with landholders and facilitate on-ground works | Oyster Farmers, CMA | No. of engagements with landholders with regards to fencing, stock exclusion projects |
| 39. Promote successful projects and partnerships | Oyster Farmers | No. of promotional opportunities utilised to publicise successful projects |
| 40. Continue working with council to increase capacity of holding tanks and to encourage more regular maintenance | Oyster Farmers | No. of engagements with council about holding tanks and maintenance of pumping stations |
| | Oyster Farmers | Were these engagements successful? |
| 41. Report unexpected water test results to council | Oyster Farmers | No. of times unexpected water tests (on basis of E.coli) reported to council |

Benefits of actions:

- Improved land management resulting in improved water quality & estuary health
- Reduced risk of shellfish & estuary contamination (improves public safety)
- Engagement promotes the need of industry

Erosion & Sedimentation:

Background:

Erosion and downstream sedimentation is a natural process in many areas, however erosion of riverbanks may be exacerbated through riparian vegetation removal, stock access to creeks and boat wash destabilising banks. Forestry in the upper catchment, & earthworks without inadequate controls, also mobilises sediment. Sediments eroded from the catchment and upland waterways are mostly deposited within the estuary as the Tuross River enters the lake system and water velocities fall. Consequently, the main depositional zones within the estuary are the areas around Reedy Island.

Suspended sediments affect water clarity & light penetration through the water column, which is an essential requirement for phytoplankton & seagrass growth. Significant erosion not only impacts on estuary health, but can also affect the feeding apparatus of oysters and lead to mudworm infestations. This can severely impact the oyster health and can result in mortalities.

Oyster farmers have a unique knowledge of the estuary, they are in a prime position to advise and work with Authorities and other organisations to identify erosion hot-spots and sources of sediment. Appropriate catchment management practices such as erosion control structures, planting programs and fencing / stock exclusions are all measures that could be used in bank stabilisation projects.

The oyster farmers maintain representation on the Estuary Management Committee, and were key stakeholders when the lake entrance was last artificially opened. The farmers will maintain a seat on the committee so that the interests and thoughts of the oyster industry are represented at that level.

Risks mitigated by these actions:

- Sediment mobilised by earthworks carried out in the catchment without consent or appropriate control measures
- Bank / Gully erosion through stock trampling and erosive flood waters
- Sand accumulation at the lake entrance when environmental flows are reduced

| Actions | Who | Measured Improvement |
|--|---------------------|---|
| 42. Report all earthworks of concern to council & CMA | Oyster Farmers | No. of earthworks of concern reported to council & the CMA |
| 43. Identify key erosion sites for remediation | Oyster Farmers, CMA | Map developed indicating hotspots subject to erosion |
| | Oyster Farmers, CMA | Map forwarded to key stakeholders |
| 44. Engage with landholders & Authorities to facilitate on-ground works | Oyster Farmers, CMA | No. of engagements with landholders with regards to bank stabilisation projects (revegetation, stock exclusion etc) |
| 45. Promote successful projects and partnerships | Oyster Farmers | No. of promotional opportunities utilised to publicise successful projects |
| 46. Representation on the Tuross River / Coila Lake Estuary Management Committee | Oyster Farmers | Representation continued on the Estuary Management Committee |

Benefits of actions:

- Improved land management resulting in reduced erosion & sedimentation
- Erosion control works mitigate sediment loss & inhibit estuary sedimentation
- Engagement promotes the needs of industry

Acid Sulphate Soils:

Background:

Acid sulphate soils (ASS) are naturally occurring soils and sediments that contain iron sulphides. Under most conditions, where the soil remains waterlogged, ASS are harmless. When iron sulphides are exposed to air – by drainage, drought or excavation of the soil, they react with oxygen in the air or water, & can produce large quantities of sulphuric acid. This acid is stored in the soil, & is usually released after rain, or after flood waters have drained away. Acidification of waterways severely degrades estuarine ecosystems; it can cause fish kills & disease, & impacts on oysters by increasing mortality, reducing growth, dissolving shells, reducing feeding activity & damaging soft tissue.

Considering the risk that earthworks may pose in the mobilisation of acid, oyster farmers need to be particularly diligent to excavations in the catchment. Any earthworks of concern should be reported to council immediately.

Risks mitigated by these actions:

- Exposure of acid-sulphate soils through soil disturbance or drainage

| Actions | Who | Measured Improvement |
|---|----------------|--|
| 47. Report all earthworks of concern to council & CMA | Oyster Farmers | No. of earthworks of concern reported to council & the CMA |
| 48. Report unexpected water test results to council | Oyster Farmers | No, of times unexpected water tests (on basis of pH) reported to council |

Benefits of actions:

- Early identification & reporting of concerning earthworks can trigger an early management response
- Engagement promotes the needs of industry

Run-Off:

Background:

Heritage Grazing Land: On the north bank of Tuross Broadwater lies Kyla Park grazing lots. This area is classified as heritage grazing land and is the subject to fertiliser application. During rain events, newly applied fertiliser may run-off from the property into the receiving waters. This peak in nutrient input has the potential to trigger algal blooms (potentially toxic) in the waterway, with severe implications for the oyster industry and public health. As algal blooms die and the organic matter decays, dissolved oxygen levels in the waterway fall and may result in local fish kills.

Urban Development: Many activities within the catchment have the potential to pollute the inlet, and most of these issues have been addressed elsewhere in this document. The issue of urban development and the risks associated with increased run-off have yet to be examined. As the township of Tuross Heads grows, the volume of runoff from this urban area is likely to increase in proportion to the percentage of hard-surfaces. As the rainwater runs through the streets it mobilises a variety of contaminants including pesticides, fertilisers, dog faeces, oil residue etc. Whilst the stormwater system may collect some of the physical littered items, many of the soluble contaminants will be discharged to the adjacent waterway. Educating the local residents is very important, raising the awareness of appropriate catchment practices. Communication is a key component of the EMS, and farmers will endeavour to engage with the local community to stress the importance of water quality to the local industry and overall estuarine health.

The health of oysters is largely influenced by water quality, with their capacity to tolerate disturbances and disease linked to the health of the estuary. Oysters growing in a healthy ecosystem are more resilient to disturbance than those growing in an unhealthy system. To improve the health of oysters during stressful periods (such as during heavy rainfall events), farmers will endeavour to engage with catchment improvement projects beforehand with the aim of improving the overall health of the estuary.

Risks mitigated by these actions:

- High levels of nutrients in fertiliser run-off from agricultural areas & heritage grazing land

| Actions | Who | Measured Improvement |
|---|----------------|--|
| 49. Liaise with local council to investigate management options | Oyster Farmers | No. of engagements with council regarding fertiliser use on heritage land |
| 50. Work with agencies to upgrade site to best practice | Oyster Farmers | Has land management practice changed as a result of discussions? (yes / no) |
| 51. Educate community about land-water interactions & the needs of industry | Oyster Farmers | No. of opportunities utilised to educate community regarding land-water interactions & needs of industry |
| | Oyster Farmers | Estimated no. of people educated |

Benefits of actions:

- Education may lead to better catchment practices = improvement in estuary health
- Improvement in estuary health will increase oyster resilience to disturbances
- Reduced nutrient input will reduce chance of algal blooms and associated issues with low dissolved oxygen

Chemicals, Fuel & Oil:

Background:

Whilst responsibility in the event of spills in the estuary falls to council and NSW Maritime, a spill containment kit may enable the Tuross Lakes oyster farmers to quickly inhibit the spread of the pollutant and provide absorbents to clean the affected area. The negative impacts from accidental spills could therefore be minimised through immediate action.

The Tuross Lakes oyster farmers maintain a regular water & meat quality monitoring regime to ensure that prompt action can be taken should pollution levels threaten the health of the inlet & oyster stocks. Anecdotal evidence suggests that oyster industry is often the first to detect local pollution events such as toxic algae, sewage, chemical & fuel spills. Such events not only threaten the oyster industry, but have severe implications on public & ecological health.

Risks mitigated by these actions:

- Fuel & oil spills originating from recreational vessels

| Actions | Who | Measured Improvement |
|---|----------------|--|
| 52. Purchase spill containment kits to enable an immediate response | Oyster Farmers | No. of fuel / oil spill kits available for use |

Benefits of actions:

- Quick response to water pollution may lessen the severity of incidents and also promotes the Tuross Lakes oyster farmers as stewards of the estuary

ENVIRONMENTAL POLICY TUROSS LAKES OYSTER FARMERS

Environmental Policy:

It is the policy of the Tuross Lakes Oyster Farmers to conduct all aquaculture activities in an environmentally responsible manner, appropriate to the nature and scale of operations.

The aim is to ensure that aquaculture activities do not cause environmental pollution, and that oyster growers operate under the principles of ecologically sustainable development.

To achieve this Tuross Lakes Oyster Farmers should:

- Comply with relevant laws and regulations and implement industry best practice (OISAS)
- Plan for environmental hazards and work towards mitigating their potential impacts
- Recognise and protect the cultural and aesthetic values of Tuross Lake and its catchment
- Cultivate oysters in a manner that minimises: resource consumption; waste production; pollution
- Communicate openly with relevant stakeholders on environmental matters
- Contribute to scientific research and innovation relevant to oyster cultivation and estuarine environments
- Strive for continual improvement



INDUSTRY DESCRIPTION

SYDNEY ROCK OYSTERS (*Saccostrea glomerata*)

The Sydney rock oyster is endemic to Australia and is found in bays, inlets and sheltered estuaries from Harvey Bay in Queensland, south to Wingan Inlet in eastern Victoria. It is capable of tolerating a wide range of salinities and occupies the intertidal zone to 3m below the low water mark. Within this range they are common on hard rocky substrates, but can survive and grow on soft substrates.

Sydney rock oysters generally spawn in summer. Peak spawning occurs at water temperatures of 21–23° C, meaning that the time of spawning varies between locations. Oysters are 'broadcast spawners', meaning that both male and female gametes are released into open water for fertilisation. Within hours of fertilisation the eggs develop into free-swimming planktonic larvae that remain in estuarine and coastal waters for up to 3 weeks. During this time the larvae develop clear shells and a retractable foot, before settling on a suitable substrate using the foot to find an appropriate site. The foot is resorbed once the larvae are attached, the shell darkens and the small animal takes on the appearance of an adult oyster. Settled, footless oyster larvae are known as 'spat'. They will remain settled in that location for the rest of their life.

Growth rates vary with local conditions, but generally Sydney rock oysters reach 40–60g in 3-4 years. They are capable of spawning after 1-year, and have the peculiar trait of changing sex from males to females as they grow older. A later sex reversal is possible, but around 75% of prime eating oysters are female.

All oysters are filter feeders, straining organic material (mainly plankton) from the surrounding water. Mortality is highest in the free swimming & early settlement phases, and at this stage oysters are subject to prey from a variety of fish species. Once the shell has hardened they are less vulnerable to fish predation, but stingrays (*Myliobatidoidei*), mud crabs (*Scylla*), whelks (*Neogastropoda*) and starfish (*Asteroidea*) all feed on adult oysters.

The Sydney rock oyster industry in New South Wales has been threatened by the introduction of wild populations of Pacific oysters (*Crassostrea gigas*). Pacific oysters were originally introduced into Tasmania from Japan in the 1940's for aquaculture purposes, and found their way into NSW waters in the 1980's. They have now spread and invaded intertidal habitats of many coastal waterways, with a 2010 survey finding populations of Pacific oysters in all NSW estuaries south of the Macleay River.

FARMING METHODS

Collectively the operations of Tuross Lakes oyster farmers utilise almost every existing method to commercially cultivate oysters. Each method has advantages and disadvantages, and the choice of a particular method depends on personal preference as well as the location and features of the lease. All oyster farmers in Tuross Lake exclusively cultivate the iconic Sydney rock oyster.

Spat for cultivation of Sydney rock oysters can either be:

1. self-sourced by harvesting naturally occurring spat (no spat are collected in Tuross Lake, most farmers have catching leases in the Moruya River).
2. brought from specialised catching farms where the catch is consistently high;
3. purchased from commercial hatcheries. These spat are often bred from family lines that grow quickly and have natural resistance to disease. These spat are available to oyster farmers through the work of NSW Department of Primary Industries in Port Stephens.

Breeding oysters for disease resistance and fast growth:

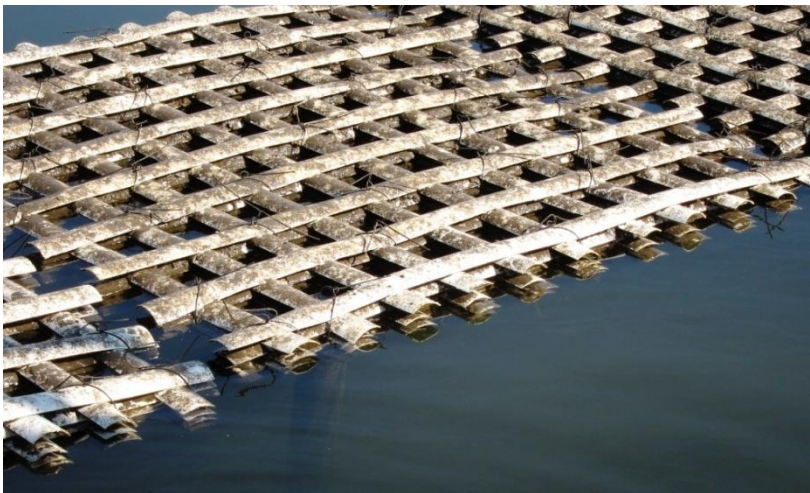
Research at the NSW DPI lab in Port Stephens initially concentrated on triploid oysters where oysters are tricked rather than genetically modified into having 3 sets of chromosomes, compared to 'normal' diploid oysters which have 2 sets of chromosomes. Triploid oysters are functionally sterile and don't spawn, allowing the energy usually used in reproduction to be diverted into growth. Although successful, research lent toward a generational breeding program whereby select individuals with a fast growth rate form the brood stock from which fast-growing spat can be derived. After 4 years trialling these oysters on the Georges River, QX disease hit the estuary and decimated local oyster populations. Whilst this was a set-back, it was discovered that some of the trial oysters survived the outbreak and subsequently these oysters formed the brood stock from which a fast growing, more disease resistant oyster could be bred.

The generational breeding program is now in its 12th year. Intellectual property of the science behind the program belongs to NSW DPI and FRDC, but the operation is managed by the Select Oyster Company (SOCo). SOCo is a non-profit company that has been set up to commercialise the Sydney rock oyster breeding program, and to help NSW oyster farmers improve productivity and viability.

At present, one commercial hatchery is producing SOCo lines of stock. Southern Cross Shellfish was established at Tomaree Point in Port Stephens and commenced production with some small runs of Sydney rocks in late 2008. Demand for SOCo stock currently exceeds supply, and getting hold of spat remains a major issue for oyster farmers throughout the state.

From the hatchery, freshly metamorphosed spat are distributed to a small group of oyster farmers in various NSW estuaries, who act as nursery operators to grow the oysters to a more distributable size.

There are a number of different techniques used for the self-harvesting of spat, but the basic principles for all methods are similar. Spat collectors must be constructed of a material that encourages the settlement of spat, whilst providing the maximum amount of surface area for settlement. They must also provide the juvenile oysters with enough protection from predators such as fish, and must allow the oysters to be easily removed without damage. Three methods of spat collection commonly used are shown below:



Plastic slats



Wooden Sticks



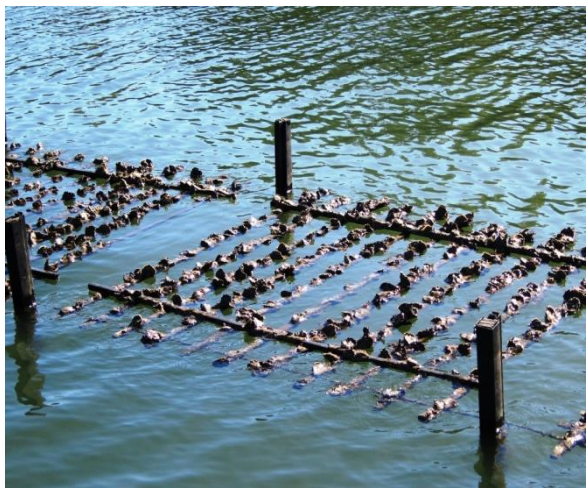
Plastic tubes
– also known as
'French sticks'

The first method utilises thin strips of arced PVC plastic or 'slats'. Numerous slats are arranged horizontally on a frame 5-10mm apart with the appearance resembling that of a Venetian blind. The frame and attached slats are then stacked on top of one another to maximise the surface area and then laid flat on racks within leases exposed to the most natural spatfall. Some slats have fine ribs to encourage settlement, and to harvest spat the slats are removed and twisted. Once removed, the spat are then transferred to other grow out methods discussed later in this section.



The second method utilises frames consisting of around five or six sticks approximately 100mm apart that are braced by two shorter sticks. The frames are stacked one up then one down (referring to the location of the brace on the sticks) to lessen the gap between the sticks and possible predation from fish. The frames are stacked on top of one another to increase the catching area and laid out on the racks. Traditionally, oyster farmers used tar and cement to prolong the life of sticks; however this practice is gradually being phased out as more farmers move towards the use of plastic slats, or plastic tubes.

Once the spat have settled in sufficient quantities, and have grown to a size where predation is not a risk, the sticks can be thinned out and moved to areas that are compatible with the next stage of growth. Oyster farmers in Tuross Lakes catch the majority of their spat in the Moruya River, but typically move juveniles to Tuross Lakes as they mature. Tuross Lake has lower spatfall, meaning that growing oysters will not be excessively fouled by setting larvae.



While oysters are attached to sticks they are repeatedly cleaned and dried. The drying process is used to cull natural oyster spatfall and other fouling organisms that settle on the maturing oysters. Although the oysters could remain on sticks until they reach a marketable size at around 3-4 years, many farmers choose to remove them and complete the final stages of growth using some other method.

Spat that is collected using the slat method, removed from catching sticks/tubes or purchased from specialised catching farms or hatcheries are required to be dealt with individually. These oysters are known as '**single seed**', and can be grown using a variety of different methods. Spat that is purchased from other producers or hatcheries can be bought at varying stages of development; the smaller the spat the cheaper they are, however mortality rates and handling requirements are increased.

Many oyster farmers use trays at some point during the oyster cultivation process. Plastic trays require very little maintenance and are being introduced to replace previously used treated timber and wire trays.



Tray divisions prevent oysters from clustering as a result of wind/waves, which would otherwise result in uneven growth. Whilst snap on lids can be brought, it is often more economical for farmers to use shade cloth to protect the oyster from predators and from the direct heat of the sun.

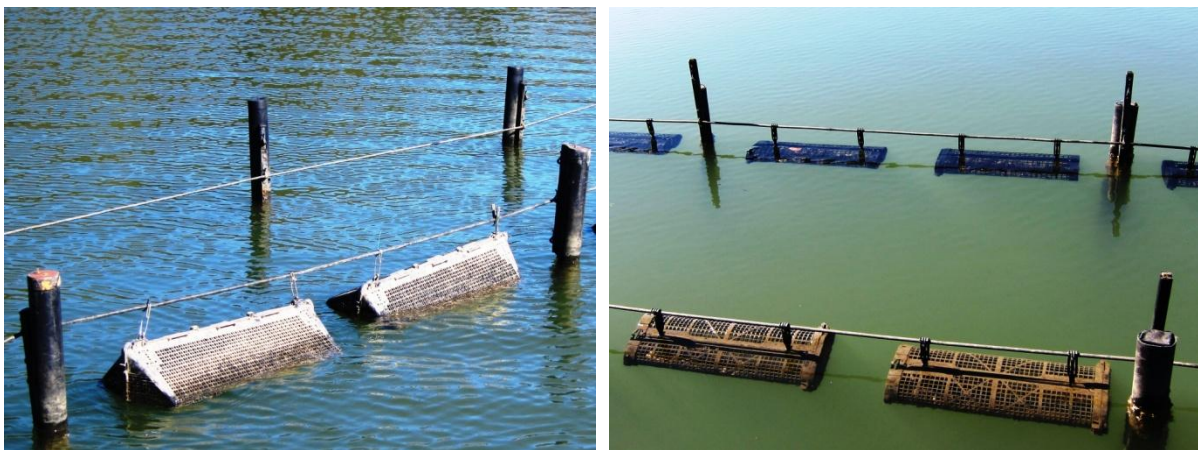
In most estuaries, these trays are placed on a rack and rail system manufactured from wooden posts (uprights) and baton (secured horizontally). In Tuross Lakes, the farmers have taken a different approach. Rather than securing horizontal wooden 'rail' to the uprights, farmers have instead attached clips to the uprights and are running cable down the line. This method is akin to running two **long-lines** parallel to one another, with oyster infrastructure spanning the two lines. This innovation saves time in construction and maintenance and allows the farmer to manipulate the height of the cable. As an alternative to trays, the rail/cable system may be used to support plastic baskets, tethered in some fashion to the structure



Traditional rack & rail (post & baton) setup vs. using cable as horizontal rails (here supporting baskets)

Farmers typically manage their oyster stocks so that they are intertidal, remaining underwater for the majority of the tide, but are fully exposed at low water. Exposing oysters for part of the tidal cycle is a technique used to manage fouling, and is also an important stage in toughening the oyster, strengthening the abductor muscle to prolong the shelf life after harvesting.

There are a number of alternatives that utilise the **long-line** set-up described on the previous page. Although farmers can suspend infrastructure between two long-lines, the usual approach is to set gear parallel to the line. '**Hard frame baskets**' are becoming increasingly popular, and can be brought in a variety of mesh sizes. The baskets are attached to long-lines with clips that allow them to rotate with the wind and tide. This movement reduces the tendency for oysters to cluster together, and promotes even growth through the stock. Oysters are frequently graded and dried, and as they grow, are progressively moved to larger mesh sizes. The larger mesh size promotes the flow of nutrients.



Suspended hard-frame baskets with different mesh sizes

'**Floating pillows or bags**' are another popular method for use with the long line system. For this method oysters are placed in hard plastic mesh bags resembling pillows that measure 500x400mm. Strips of polyurethane flotation are then attached on either side using cable ties.

The baskets or pillows are attached to long-lines via shark clips allowing them to move with the wind and tide. Attached floatation ensures that the container remains in the nutrient rich upper levels of the water column. Pillows are arranged on opposite sides of a length of polyurethane rope or heavy duty monofilament line and attached via shark clips. This allows oysters to remain in the nutrient rich upper waters for the entire tidal cycle, promoting rapid growth. Other advantages are the lack of infrastructure required and the ease of handling, as pillows on one side can be flipped over and rested on top of the neighbouring pillow with the height of combined floatation enabling the top pillow to rest clear of the water. Long-lines are arranged to best fit the lease dimensions and predominant wind and wave directions.



Line of floating bags



'Flipped' floating bags, allowing one bag the opportunity to dry out

LAND BASED ACTIVITIES

The nature of commercial oyster cultivation not only requires significant water based infrastructure but also necessitates a functional land base from which operations can be conducted. Each permit holder on Tuross Lake has a lease arrangement with the Department of Lands allowing the farmers permissive occupancy of a small section of waterfront land and storage area for cultivation infrastructure and associated equipment. The Department of Lands holds a bond that is paid by the farmers when taking over the lease, and the growers now hold 25 year tenures on land-based facilities. This long-term tenure provides more security for business investment, and represents a big improvement on previous arrangements that restricted framers to 1-year tenures.

The majority of oyster farmers operating in Tuross Lake are based on the banks of the estuary at Turlinjah. This area provides a secluded environment in which to conduct their operations. Almost all oyster farmers operating in Tuross Lakes also hold leases in Wagonga Inlet 20km to the south. These farmers operate in both estuaries and may transport stock between the waterways as a means to maximise growing conditions and mitigate exposure to risks.



The oyster sheds in Tuross Lake are currently not serviced by a sewer line. Whilst some farmers maintain port-a-loos, others make arrangements to use facilities off site. In the past, there have been discussions in council regarding the extension of the sewer line and the construction of a pumping station nearby. This proposal appears to have stalled and the oyster farmers have little option other than to maintain the status quo.

There is no bulk storage of fuel/oil on site, and hence no bunding is employed to protect against spills. Only small quantities of fuel/oil are held in sheds for everyday use, and these fluids are stored in appropriate canisters.

For many years, tarred & treated timber was used to increase the durability of cultivation infrastructure, protecting it from marine borers. Oyster farmers throughout NSW are phasing out the use of tarred & treated timber by converting to polyurethane trays, plastic sleeved timber posts, or adopting alternative farming methods using hard plastic baskets, pillows or tumblers. Converting to these new products will reduce ongoing maintenance requirements and associated costs, and also eliminate potential contaminants entering the estuary. There are a few tar pits remaining in the area, however the local oyster farmers are committed to their eventual removal.

Oyster farmers use a variety of different machinery to help them manage the land-based aspects of their operations. These include forklifts, tractors, cranes and grading machines to select similar sized oysters.



Example of a tumble grader in use

WATER QUALITY MONITORING

Due to a wide variety of activities and processes that can impact estuary health, the oyster farmers of Tuross Lakes maintain a 'Quality Assurance Program'. Through this program, water and meat quality is assessed on a regular basis to ensure that immediate action can be taken should pollution levels threaten the health of the river and the viability of oyster stocks. Tuross Lakes oyster farmers employ an accredited independent sampler to conduct testing every two weeks, with biotoxin assessments occurring on a monthly basis.

Water and meat quality samples validate each farmers licence issued by the NSW Food Authority and they are required to pay a substantial levy to fund this local Quality Assurance Program (QAP). This program greatly benefits the wider community by providing a very clear indication of catchment health. The long-term, standardised dataset also provides an invaluable record of changing environmental parameters. In this way, the oyster farmers of Tuross Lake contribute to the scientific understanding of the waterway and its management.

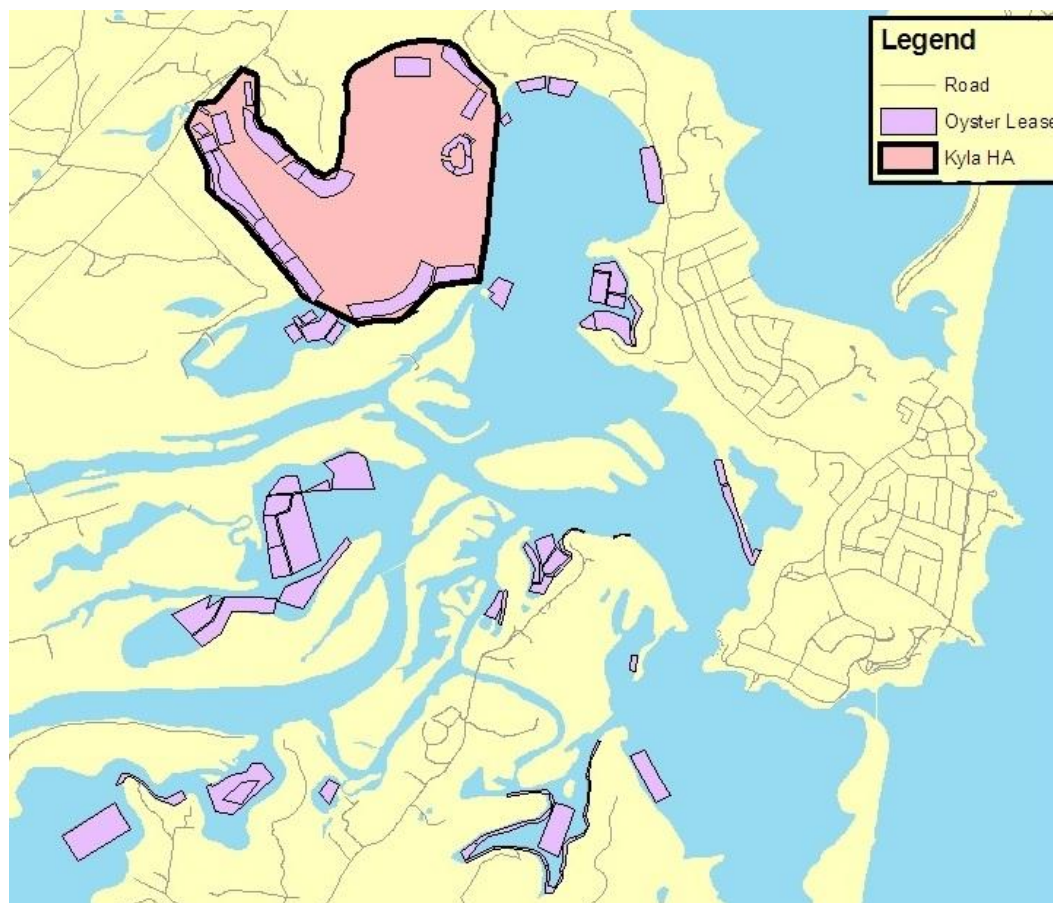
There is currently one area in the lake that is classified by the NSW Food Authority for the harvesting of oysters (see map on next page). This area has been classified in accordance with the requirements of the 'Australian Shellfish Quality Assurance Program' (ASQAP). This harvest area – Kyla - has been classified as '**Conditionally Approved**'.

The '**Conditional Approved**' status allows oyster growers to directly harvest from their leases (i.e. without the need for depuration) when water quality monitoring results fall within strict parameters (see next page). If these water quality parameters are not met then the area reverts to a 'Conditionally Restricted' status, however if environmental conditions continue to deteriorate than the harvest area will close.

The '**Conditionally Restricted**' status recognises that there may be some local issues with water quality, but at levels low enough to be removed from shellfish via depuration. Depuration is a statutory process that requires oysters to be placed in a sterilised recirculation tank for 36 hours. During this process the oysters self cleanse in recirculated water, which is sterilised using ultraviolet light.

As described above, **all harvest areas must met strict water quality criteria**. If these criteria are not met then the area closes and oyster farmers are unable to depurate or sell oysters until there is an improvement in environmental conditions.

| Harvest Area | Approved (direct harvest) | Conditional (depuration required) | Closed |
|--------------|---|---|--|
| Kyla | Rainfall < 30mm / 24 hrs AND Salinity > 25ppt | 30mm < Rainfall in 24 hrs < 40mm AND 18ppt < Salinity < 25ppt | Rainfall > 40mm in 24hrs OR Salinity < 18ppt |



REVIEW OF PERFORMANCE

ANNUAL REVIEW FORM

Review compiled by:

Date of review:

Review period:

| Actions: | | Who: | Measured Improvement: | Measure: |
|----------|---|----------------|--|----------|
| 1. | Continue phase out of treated & tarred infrastructure | Oyster Farmers | Amount of treated & tarred infrastructure removed from the estuary | kg |
| 2. | Decommission & remove tar pits | Oyster Farmers | Number of pits remaining in the local industry (target = 0) | ..... |
| 3. | Where no environmental harm may result, adopt principles of re-use and recycle | Oyster Farmers | % Estimate of oyster infrastructure removed from estuary that has been re-used | % |
| 4. | Other material will be disposed of at licensed waste depots | Oyster Farmers | Amount of oyster infrastructure that has been disposed of at licensed waste depots | kg |
| 5. | Improve erosion control on access road & shed site to minimise impact of vehicles / machinery | Oyster Farmers | No. of physical improvements that help manage erosion caused by vehicles / machinery | ..... |
| | | Oyster Farmers | No. of changes in practices that have occurred to help manage erosion caused by vehicles / machinery | ..... |
| 6. | Ensure that all Tuross Lake Oyster Farmers are aware of knot limits within the estuary | OWA | Knot limits circulated | Yes / No |
| 7. | Where appropriate, move to cultivation practices with a small physical footprint | Oyster Farmers | Area of lease from which rack / rail has been removed | ha |
| 8. | Resurrect proposal for local pump station | Oyster Farmers | Local authorities contacted and proposal update sought | Yes / No |
| | | Oyster Farmers | Feedback received | Yes / No |
| 9. | Discuss options to develop a communal toilet facility at the main Tuross depot site | Oyster Farmers | Options to progress communal toilet facilities discussed | Yes / No |

| Actions: | | Who: | Measured Improvement: | Measure: |
|----------|--|--------------------------|--|----------|
| 10. | Contact Authorities for permissions and source funding | Oyster Farmers | Authorities contacted & permissions gained | Yes / No |
| | | Oyster Farmers | Communal toilet facilities constructed | Yes / No |
| 11. | Pets will continue to be managed in line with industry legislation & regulations | Oyster Farmers | No. of dogs in / around oyster punts and shed sites (target = 0) | ..... |
| 12. | Ensure visitors / contractors abide by these laws | Oyster Farmers | No. of dogs visiting oyster production sites (target = 0) | ..... |
| 13. | Purchase fuel containment kits for storage at the central Tuross depot to enable an immediate response to spills | Oyster Farmers | No. of fuel / oil spill kits available for use | ..... |
| 14. | Only small volumes of fuel & oil stored on site if no secondary containment | Oyster Farmers | No. of fuel / oil containers larger than 20 litres stored at shed sites without secondary containment (target = 0) | ..... |
| 15. | Consider secondary containment of oils and fuel (e.g. bunding) | Oyster Farmers | No. of secondary containment measures put in place | ..... |
| 16. | Store chemicals as indicated by manufactures & stored with the appropriate safety data sheet | Oyster Farmers | No. of chemical containers stored inappropriately or without the correct safety data sheet | ..... |
| 17. | Where no environmental harm may result, adopt principles of re-use and recycle | Oyster Farmers | % Estimate of oyster infrastructure removed from estuary that has been re-used | % |
| 18. | Other materials to be disposed of at licensed waste depots | Oyster Farmers | Amount of oyster infrastructure that has been disposed of at licensed waste depots | kg |
| 19. | Upgrade to EPA approved motors when replacing | Oyster Farmers | Number of outboards replaced with EPA approved motors | ..... |
| 20. | Australian Outboard Emission Standards circulated to farmers upon release | OWA | Australian Outboard Emission Standards circulated | Yes / No |
| 21. | Contact NSW DPI with the option of developing a Pacific Oyster management Plan for Tuross Lake | Oyster Farmers | NSW DPI contacted? | Yes / No |
| | | NSW DPI (if going ahead) | Pacific Oyster Management Plan developed? | Yes / No |
| 22. | Continue working to improve estuary and catchment health to increase oyster resilience | Oyster Farmers | No. of catchment projects oyster farmers have engaged in to improve estuary health | ..... |
| 23. | Engage with oyster monitoring programs to establish mortality & growth rates | Oyster Farmers | No. of engagements with researchers undertaking the oyster monitoring programs | ..... |
| 24. | Engage with researchers working on mudworm and its management | Oyster Farmers | No. of engagements with researchers working on mudworm and its management | ..... |

| Actions: | | Who: | Measured Improvement: | Measure: |
|----------|---|----------------|---|------------|
| 25. | Work with NSW DPI and other organisations to identify and rehabilitate derelict leases | Oyster Farmers | Derelict leases identified and NSW DPI informed | Yes / No |
| | | Oyster Farmers | No. of derelict leases rehabilitated | ..... |
| 26. | Threatened species identification guides & handling manuals distributed to growers | OWA | Identification guides and handling manuals distributed | Yes / No |
| 27. | Where appropriate, move to low impact cultivation systems with a small physical footprint | Oyster Farmers | Area of lease from which rack / rail has been removed | ha |
| 28. | Communicate with farmers in other estuaries to discuss alternative uses for shell | Oyster Farmers | No. of communications made with farmers in other estuaries regarding alternative uses / markets for shell | ..... |
| 29. | Investigate options to dispose or sell oyster shells (potential income from waste product) | Oyster Farmers | No. of different uses of shell investigated | ..... |
| | | Oyster Farmers | No. of bags of shell used for purposes other than road base at shed site | bags |
| 30. | Install rainwater tanks to minimise use of potable water | Oyster Farmers | No. of rainwater tanks installed | ..... |
| 31. | Reuse grey water where possible | Oyster Farmers | No. of greywater initiatives instigated | ..... |
| | | Oyster Farmers | % Estimate of grey water re-used | % |
| 32. | Increase re-use and recycling of materials where appropriate, and where no environmental harm will result | Oyster Farmers | % Estimate of waste (excluding cultivation infrastructure) that has been re-used | % |
| | | Oyster Farmers | % Estimate of waste (excluding cultivation infrastructure) that has been recycled | % |
| 33. | Follow NSW DPI best practice guidelines for noise as outlined in the NSW Oyster Industry Sustainable Aquaculture Strategy | NSW DPI | 2012 Revised copies of Oyster Industry Sustainable Aquaculture Strategy circulated to growers when released | Yes / No |
| | | Oyster Farmers | No. of noise complaints received (target = 0) | ..... |
| 34. | Maintain leases for visual amenity as outlined in Oyster Industry Sustainable Aquaculture Strategy | NSW DPI | 2012 version of Oyster Industry Sustainable Aquaculture Strategy circulated to growers when released | Yes / No |
| | | Oyster Farmers | No. of reasonable complaints received regarding the visual aspects of oyster leases | ..... |

| Actions: | | Who: | Measured Improvement: | Measure: |
|----------|---|----------------------------|---|----------|
| 35. | Launch & distribute EMS to educate community & local Authorities | Oyster Farmers / OWA / CMA | EMS launched | Yes / No |
| | | Oyster Farmers / OWA / CMA | EMS distributed to key stakeholders & Authorities | Yes / No |
| 36. | Utilise opportunities to engage & educate community about farming practice | Oyster Farmers | No. of publicity / promotional opportunities utilised to discuss oyster farming practices | ..... |
| 37. | Identify key sites subject to effluent input & forward to key stakeholders | Oyster Farmers / CMA | Map developed indicating hotspots subject to effluent input | Yes / No |
| | | Oyster Farmers / CMA | Map forwarded to key stakeholders (CMA, OWA, WetlandCare Australia) | Yes / No |
| 38. | Engage with landholders and facilitate on-ground works | Oyster Farmers / CMA | No. of engagements with landholders with regards to fencing, stock exclusion projects | ..... |
| 39. | Promote successful projects and partnerships | Oyster Farmers | No. of promotional opportunities utilised to publicise successful projects | ..... |
| 40. | Continue working with council to increase capacity of holding tanks and to encourage more regular maintenance | Oyster Farmers | No. of engagements with council about holding tanks and maintenance of pumping stations | ..... |
| | | Oyster Farmers | Were these engagements successful? | Yes / No |
| 41. | Report unexpected water test results to council | Oyster Farmers | No. of times unexpected water tests (on basis of E.coli) reported to council | ..... |
| 42. | Report all earthworks of concern to council & CMA | Oyster Farmers | No. of earthworks of concern reported to council & the CMA | ..... |
| 43. | Identify key erosion sites for remediation | Oyster Farmers / CMA | Map developed indicating hotspots subject to erosion | Yes / No |
| | | Oyster Farmers / CMA | Map forwarded to key stakeholders (CMA, OWA, WetlandCare Australia) | Yes / No |
| 44. | Engage with landholders and facilitate on-ground works | Oyster Farmers / CMA | No. of engagements with landholders with regards to bank stabilisation projects (revegetation, stock exclusion etc) | ..... |
| 45. | Promote successful projects and partnerships | Oyster Farmers | No. of promotional opportunities utilised to publicise successful projects | ..... |
| 46. | Representation on the Tuross River / Coila Lake Estuary Management Committee | Oyster Farmers | Representation continued on the Estuary Management Committee | Yes / No |
| 47. | Report all earthworks of concern to council | Oyster Farmers | No. of earthworks of concern reported to council & the CMA | ..... |

| Actions: | | Who: | Measured Improvement: | Measure: |
|-----------------|---|----------------|--|-----------------|
| 48. | Report unexpected water test results to council | Oyster Farmers | No. of times unexpected water tests (on basis of pH) reported to council | ..... |
| 49. | Liaise with local council to investigate management options (fertiliser run-off from heritage land) | Oyster Farmers | No. of engagements with council regarding fertiliser use of heritage land | ..... |
| 50. | Work with agencies to upgrade site to best practice | Oyster Farmers | Has land management practice changed as a result of discussions? | Yes / No |
| 51. | Educate community about land-water interactions & the needs of industry | Oyster Farmers | No. of opportunities utilised to educate community regarding land-water interactions & needs of industry | ..... |
| | | Oyster Farmers | Estimated no. of people educated | ..... |
| 52. | Purchase spill containment kits to enable an immediate response | Oyster Farmers | No. of fuel / oil spill kits available for use | ..... |

SUPPORT FOR OYSTER FARMERS

RURAL SUPPORT PROGRAM



The Rural Support Program works with rural communities to improve their attributes of resilience through greater knowledge, skills and practices and the development of plans to face future adverse climatic events. Rural communities and individuals are also assisted during dry periods and to recover following other emergencies, such as Natural Disasters.

The program interfaces with existing programs within NSW DPI, such as climate adaptation and emergency management and networks with other agencies to develop human skills that contribute to the attributes of resilience. Existing programs are strengthened by integrating initiatives focused on climate variability and natural disasters, within NSW Primary Industries and the other providers of support to rural communities.

The primary audience is individuals, farm businesses and the rural communities in which they reside. Particular attention is given to disaster risk identification and reduction through planning and management at the prevention, preparation and recovery phases of natural disaster management

Contact your local Rural Support Worker for a specific projects and activities:

| Location | Rural Support Worker | Office number | Mobile | Email |
|----------|------------------------------|---------------|--------------|--|
| ORANGE | Cheryl Pope (Team Leader) | 6391 3948 | 0428 435 593 | cheryl.pope@dpi.nsw.gov.au |
| GRAFTON | Jan Bruce | 6640 1600 | 0427 257 191 | jan.bruce@pi.nsw.gov.au |
| GUNNEDAH | Jenny Croft | 6741 8336 | 0429 446 417 | jenny.croft@dpi.nsw.gov.au |
| DUBBO | Pip Brown | 6881 1266 | 0429 396 697 | pip.brown@dpi.nsw.gov.au |
| SCONE | Caroline Long | 6544 4900 | 0428 296 332 | caroline.long@dpi.nsw.gov.au |
| GOULBURN | Dick Kearins | 4828 6600 | 0427 781 514 | dick.kearins@dpi.nsw.gov.au |
| HAY | Danny Byrnes | 6993 1608 | 0428 973 141 | danny.byrnes@dpi.nsw.gov.au |
| ALBURY | Di Pritchard | 6051 7703 | 0417 231 852 | di.pritchard@dpi.nsw.gov.au |