The Living Murray
One River. One Life. Our Future.

Resnagging and Riparian Restoration Hume Dam to Yarrawonga

Risk Management Plan

May 2006

NORTH EAST CATCHMENT MANAGEMENT AUTHORITY

NSW DEPARTMENT OF PRIMARY INDUSTRIES

Victoria The Place To Be

Department of Infrastructure, Planning and Natural Resources

TABLE OF CONTENTS

1. Introduction

The *Resnagging and Riparian Restoration: Hume Dam to Yarrawonga* project (the project) aims to restore instream woody habitat in three priority areas in the River Murray main channel between Hume Dam and Yarrawonga, as detailed in Figure 1. The three priority areas are between 10-15km in length, encompassing NSW managed waters adjacent to a range of land tenures (public and private land) with somewhat restricted public access. These areas are subject to fluctuating water levels as it is released from Hume Dam according to water demand. The *Instream Habitat and Riparian Restoration Plan* and *Project Implementation Feasibility Study* provide background information and outline the methodology adopted to select these sites for resnagging.

Instream woody habitat, also referred to as snags or large woody debris, are present in most rivers in the Murray Darling Basin as a natural part of the aquatic environment. The risk associated with instream structures (natural and man made) are of concern due to the proceedings from recent public liability cases[1].

This existing (pre-resnagging) risk associated with instream logs and other waterway structures are currently managed through a variety of methods implemented by waterway managers (in particular NSW Maritime, Local Councils and NSW Department of Natural Resources).

The project will lead to an increase in the number of instream snags in the priority areas. The increase in the number of instream snags will lead to a proportional increase in risk of personal harm or capital damage to River Murray users. Due to this foreseeable risk, public authorities are vested with the statutory care, control and management of the areas proposed for resnagging and there is a Duty of Care to maintain public safety in these areas.

The Resnagging and Riparian Restoration - Hume Dam to Yarrawonga Risk Management Plan (hereafter the Plan) reviews relevant legislation, identifies the additional risks resulting from The *Resnagging and Riparian Restoration: Hume Dam to Yarrawonga* project and presents a range of risk mitigation strategies that will be employed to redress the proportional increase in risk. Through the implementation of the Plan strategies will be in place to address all potential increases in hazard risk as a result of the projects implementation.

[1] In particular the recent *Vairy v Wyong Shire Council* (HCA 62, 21 October 2005)*, Mulligan v Coffs Harbour City Council* (HCA 63, 21 October 2005) and *Berrigan Shire Council v Ballerini & Anor* (VSCA 159, 22 June 2005) lawsuit cases.

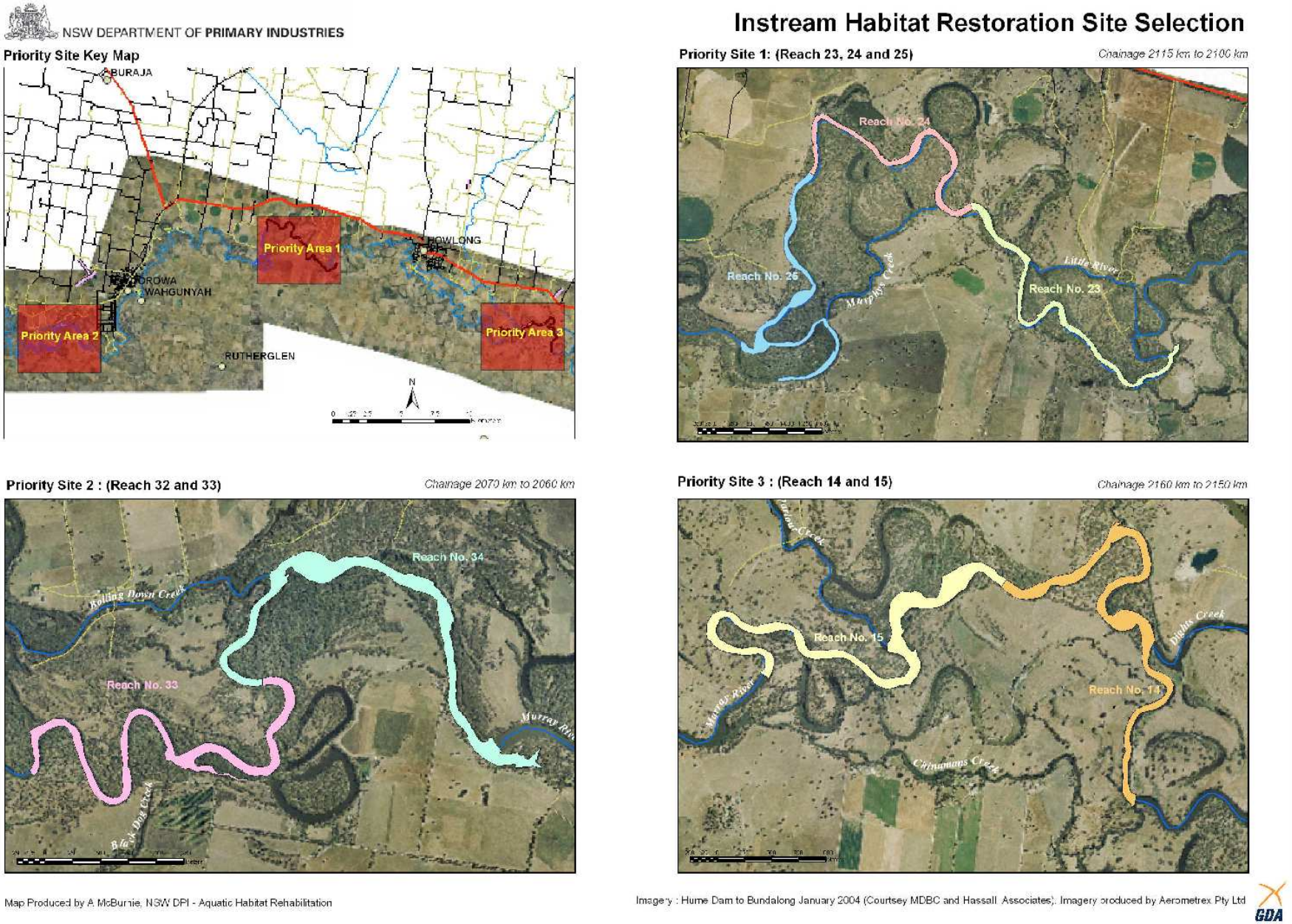


Figure 1: Priority Resnagging Areas in the Hume Dam to Yarrawonga reach.

2. Review of Existing Legislation

The Plan has been prepared following extensive consultation with the relevant agencies and stakeholder groups. Legal advice has been sought from State Agencies and the MDBC. This section includes information presented in a discussion paper that was prepared by Clarke Ballard on behalf of the Hume to Yarrawonga Waterway Management Advisory Group as it relates to the resnagging project. This discussion paper is based on advice from Blake Dawson Waldron.

The advice is advice specifically to the Commission, but does canvas issues relevant to possible liability of other stakeholders. It covers a range of issues and can be summarised as follows:

2.1 Berrigan Shire Council vs. Ballerini

The accident giving rise to that case occurred at the end of 1996. It was thus decided on the law as it existed at that time.

Subsequently, both NSW and Victoria have made important amendments to the relevant laws (*Civil Liability Act 2002* in NSW and amendments in 2003 to the *Wrongs Act 1958* in Victoria). Any new cases would be determined in the light of the new legislation.

2.2 General principles of negligence

These are now set out in the legislation in each State. The principles are:

"**(1)** a person (*which includes an agency*) is not negligent in failing to take precautions against a risk of harm unless:
(a) the risk was foreseeable (that is, it is a risk of which the person knew or ought to have known); and
(b) the risk was not insignificant; and
(c) in the circumstances, a reasonable person in the person's position would have taken those precautions.

(2) In determining whether a reasonable person would have taken precautions against a risk of harm, the Court is to consider the following (amongst other relevant things):
(d) the probability that harm would occur if care were not taken;
(e) the likely seriousness of the harm;
(f) the burden of taking precautions to avoid the risk of harm; and
(g) the social utility of the activity that causes the risk of harm"

Another useful principle, set out specifically in Victorian legislation and probably applicable an NSW as well, is that:

> "A person (the defendant) who owes a duty of care to another person (the plaintiff) to give a warning or other information to the plaintiff in respect of a risk or other matter, satisfies that duty of care if the defendant takes reasonable care in giving the warning or other information"

2.3 When a duty to warn of a risk arises

(i) Obvious risks
An obvious risk is one that would have been obvious to a reasonable person. A person who suffers harm from an obvious risk is assumed to have been aware of it (unless he convinces the Court otherwise). In NSW there is no duty of care to warn of an obvious risk, except in limited circumstances.

(ii) Recreational activities
The NSW legislation contains special rules relating to recreational activity, which is widely defined and would include all or nearly all river-based activity on the Murray and anabranches. There is no liability to a person who is injured by the materialisation of an obvious risk when engaging in a dangerous recreational activity. This applies to any activity "that involves a significant risk of physical harm" whether or not the plaintiff is aware of that risk.

Section 5M of the NSW legislation is very important. It removes (except in very limited circumstances) any duty of care when the defendant has given a risk warning about a recreational activity to the plaintiff. The section contains a lot of detail about risk warnings, and two aspects appear particularly important:

- The warning must be given in a manner that is reasonably likely to result in people being warned before they indulge in the recreational activity, and;

- The warning must be given by or behalf of the defendant, or by or on behalf of the occupier of the place where the recreational activity is indulged in.

There appear to be no comparable legislative provisions in Victoria, but a risk management strategy meeting the requirements of the NSW legislation is likely to also be appropriate in Victoria (i.e. in the anabranches in Victoria).

2.4 Liability of Public Authorities

The new legislation in both States makes it more difficult for plaintiffs to succeed in public liability claims against public authorities. "Public authorities" include constructing authorities, State departments and agencies, catchment management authorities that may construct river improvement works etc. The position of the Commission itself may be different – see Para 2.5.

(i) Negligence
It is now harder for plaintiffs to establish negligence by a public authority, because Courts must take into account the extent of funding available to an authority, the broad range of the authority's responsibilities, and its general procedures in exercising all its functions, when deciding if the authority has been negligent.

(ii) Breach of statutory duty
Apart from negligence claims, plaintiffs sometimes bring actions against authorities by claiming that the authority has breached a statutory duty by commission or omission. The new legislation in both States makes it more difficult for such actions to succeed by qualifying the circumstances in which the authority would be liable. Both States provide that:

- The act or omission must be so unreasonable that no comparable authority could consider it reasonable; and

- The mere fact that an authority exercises a function does not indicate that it has a duty to exercise the function, or to exercise it in any particular way.

2.6 Application of principles to the specific issue of river management

(i) Risk management strategy
The best risk management strategy is to devise and manage a risk warning scheme that complies as far as possible with each of the requirements of section 5M of the NSW Act. Much of the present signage and markers used by the maritime authority in NSW and by other agencies does not meet these requirements at present for some or all of the following reasons:

- They do not warn either of a specific risk or the general nature of that risk;

- They do not give a warning before a person engages in the relevant recreational activity;
- They are not given on behalf of the particular agencies that it is desired to protect.

2.8 Legal Responsibilities

A successful risk management regime needs to include:

- Noting the existing significant hazards;
- As far as possible, siting resnagging and river management works away from areas commonly used for swimming or other recreational purposes;
- Creating risk warnings identifying the significant hazards and any new ones, which comply with each of the principles in section 5M of the NSW Act.

3. Identified Hazards

It is recognised that recreational activities are regularly undertaken in the three priority areas specified for resnagging (see figure 1). There is no available data quantifying the exact level of river use in the specific priority areas. Nevertheless, it is known that the areas are subject to varying levels of recreational use dependent on the season and river flows. As the priority areas are not directly adjacent to any townships on the River Murray, it is reasonable to assume that there is a reduced level of use in these areas, in comparison to the river adjacent to townships.

A description of each of the identified uses and hazards is given below, with an assessment of the associated risk. A risk score has been calculated using the matrix provided in Appendix A.

3.1 Recreational River users

3.1.1 Boating (including aquaplaning and canoeing)

NSW Maritime are the government agency responsible for the management of commercial and recreational vessels on NSW navigable waters. The agency works with other state government agencies to achieve integrated management of NSW navigable waters. According to NSW Maritime, boating on the Hume Dam to Yarrawonga reach of the river becomes a popular activity in the summer months, when water flows within the reach are greater than 10,000ML/day. Besides the correlation of increased aquatic pursuits in warmer months, the high flows increase the depth and area of water for traffic making recreational pursuit with vessels more practical. The river channel maintains sands bars, shallow riffles and instream timber that reduce navigability particularly when water levels are below 10,000ML/day.

Whilst widespread throughout the reach, boating activity appears to be concentrated adjacent to townships and public boat ramps. There are 13 public boat ramps located at or near six towns within the Hume Dam to Lake Mulwala reach. There are also at least 27 unrecognised or private launches that are maintained by private persons in the reach. Consideration has been given to known high use boating and aquaplaning areas when selecting reaches for woody habitat restoration, however this does not mean that vessel use is considered nil within the priority areas selected in the Restoration Plan (DPI, 2005).

For the purpose of regulations that govern navigation of inland waters, vessels must travel at a safe speed. A safe speed is one at which the vessel can be stopped in time to avoid danger suddenly. Further to this, there are minimum distances that vessels must maintain from obstacles. A vessel travelling at 10 knots or more must keep 30 metres away from any thing in the water. With regard to towed persons they must also maintain this minimum distance (NSW Maritime, 2005).

There is potential for persons navigating in accordance with NSW Maritime law to hit reinstated instream structures, particularly those that are submerged and not visible from the surface. The relatively high speeds (greater than 10 knots) associated with aquaplaning create an element of risk both for participants and other river users. Fixed structures can cause significant trauma to high-speed vessels and persons engaged in aquaplaning activities.

Canoeing is also a popular activity in the Hume Dam to Yarrawonga reach throughout the year. As canoes travel at a more leisurely pace they can be manoeuvred around instream structures. However, variable river conditions and water flows could potentially lead canoeists to hit instream structures, with the risk of capsizing.

There will be two methods used to reinstate woody habitats during the construction phase of the project. “Bank-based resnagging”, whereby cables are passed across the waterway from one bank to another and back again, in order to winch large snags into place. During bank-based resnagging the cables will present a hazard to boaters attempting to pass through the resnagging area. A barge-mounted excavator will also be used to place snags directly into the desired location where bank-based resnagging is not practical. Barge resnagging on the other

hand, will present no risk to boaters as the barge will not block the channel and will operate to NSW Maritime requirements.

Likelihood: Unlikely

Severity of Consequence: Major

Risk: Medium

Summary of risks and mitigative measures:

1. Vessel strike: addressed by signage, media, woody habitat placement and securing (see sections 4.1, 4.2, 4.5, 4.6).
2. Aquaplan strike: addressed by signage, media, woody habitat placement and securing (see sections 4.1, 4.2, 4.5, 4.6).
3. Canoe strike: addressed by signage, media, woody habitat placement and securing (see sections 4.1, 4.2, 4.5, 4.6).
4. Impacts on boaters during resnagging works (bank and barge based resnagging): addressed by section 4.4).

3.1.2 Fishing

There are moderate levels of recreational fishing undertaken in priority areas, both from the banks and boat-based (P. Tilbrook, pers. comm.). The Species Impact Statement for Fishing in the Lower Murray River Catchment (NSW Fisheries, 2002) provides some estimates of fishing events within the broad region of the River Murray (Upper Murray to South Australian Border). NSW fishers engaged in a total of approximately 69 000 recreational fishing events, not including tourists and interstate fishers. It was estimated that around 10% of all Victorian fishing effort was conducted in the River Murray.

The project will provide for enhanced recreational finfish fishing opportunities due to the enhancement of native fish habitat. It is likely that there will be an increase in recreational fishing activity within the project area as a result of the resnagging works. Boat anglers would be subject to the level of risk outlined above (section 3.1.1).

The risks posed to bank-based anglers are limited within the scope of known legal fishing activities. It is likely that resnagging areas may be accessed from land when practical during periods of low flow, and hence there is opportunity for injury and harm as a result of accessing reinstated woody habitats exists.

Likelihood: Unlikely

Severity of Consequence: Major

Risk: Medium

Summary of risks and mitigative measures:

1. Vessel strike: addressed by signage, media, woody habitat placement and securing (see sections 4.1, 4.2, 4.5, 4.6).
2. Boat based access to woody habitats: addressed by woody habitat placement and securing (see sections 4.5 and 4.6).
3. Bank based access to snags: addressed by woody habitat placement and securing (see sections 4.5 and 4.6).

3.1.3 Swimming

Swimming is a popular activity, particularly in public access areas (eg State Forests, public reserves) during the summer months. There are no known designated public swimming areas in the Hume Dam – Yarrawonga reach that are managed for such purpose. Swimming may be pursued by accessing public lands in some cases, and a level of care is afforded upon the manager of that land. As a result, there is some signage present at both Parks Victoria lands and local government areas adjacent to the river that identify submerged risks to swimmers.

Consideration has been given to high use swimming areas in planning where habitat restoration is to take place. However, there are elements of risk for people swimming and diving into the waterway and hitting newly reinstated instream structures. Prevailing currents can be dangerous for swimmers when the possibility of becoming lodged on a woody habitat exists. It is also possible that that persons swimming in the water of the Murray River may utilise woody habitat for diving or jumping from. The practice of swimmers entering the water from standing trees and crude swings is widespread. Such swimming practices present a potential for injury.

Likelihood: Unlikely

Severity of Consequence: Major

Risk: Medium

Summary of risks and mitigative measures:

1. Injury by jumping/diving from introduced woody habitats: addressed by signage, media, woody habitat placement and securing (see sections 4.1, 4.2, 4.5, 4.6).
2. Injury by Impact with introduced woody habitats: addressed by signage, media, woody habitat placement and securing (see sections 4.1, 4.2, 4.5, 4.6).
3. Injury, drowning by strike with introduced woody habitats: addressed by signage, media, woody habitat placement and securing (see sections 4.1, 4.2, 4.5, 4.6).

3.2 Risks to Private Landholders

3.2.1 Bank Erosion

Geomorphic processes within the Murray River floodplain are influenced by a broad range of factors including the geologic profile, flow regime and the in-channel and riparian vegetation conditions (Earth Tech Engineering, 2006). Both the flow regime and vegetation conditions have changed significantly since European settlement. These changes have tended to increase the rate of geomorphic processes as highlighted by the increased susceptibility of some areas of river bank to erosion and the rate of development of some of the anabranch systems between Lake Hume and Lake Mulwala.

The current ongoing river management measures (overseen by the Advisory Group on Hume Dam to Yarrawonga Waterway Management) aim to reduce the rate of geomorphic processes to counteract the effect of the altered flow regime and vegetation conditions with erosion control structures and revegetation (Hume and Dartmouth Dams Operations Review Reference Panel, 1999; ID&A, 2001). To complement these works the resnagging project will aim to reduce bank erosion rates by ensuring the orientation of the introduced snag units diverts flow away from the banks and/or dissipates water energy (i.e. as is achieved through pile field alignment training works).

Likelihood: Unlikely

Severity of Consequence: Moderate

Risk: Low

Summary of risks and mitigative measures:

1. Accelerated bank erosion: addressed by woody habitat placement and securing (see sections 4.5 and 4.6).

3.2.2 Flooding

In response to concerns from some landholders that resnagging may cause flooding, a hydraulic impact study was undertaken to determine the likely impacts of resnagging (Earth Tech Engineering, 2006). Modelling was carried out for varying river flow conditions and varying resnagging loading scenarios, from between 400 and 1600 snag units in a 10km reach of the river. The modelling predicted very minor impacts, which in reality will be undetectable. In the immediate area of the habitat rehabilitation sites, the following hydraulic impacts were predicted:

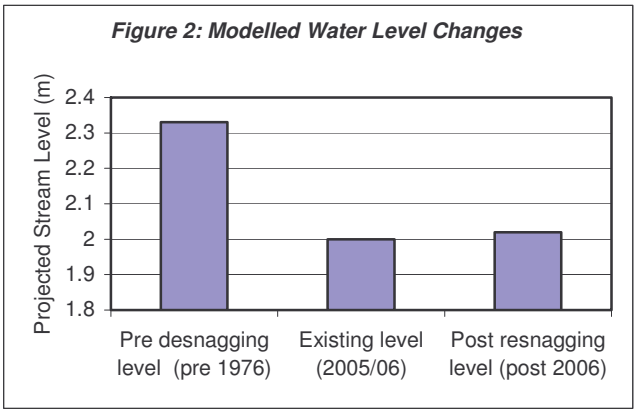
- Water level: Small average increase in river water level of 0.03m, as seen in figure 2.

- Water velocity (speed): Minor increases in the average stream velocity from 4% for the lowest woody habitat scenario, to 10% for the highest scenario.

- Anabranch flow: less than two percent change in the flows diverting into the anabranch system.

Note: The above predicted impacts are the maximum possible impacts, given that the modelling was designed to provide worst case scenario.

Figure 2: Modelled Water Level Changes



Likelihood: Possible

Severity of Consequence: Minor

Risk: Low

Summary of risks and mitigative measures:

1. Increase in water levels, velocity and flooding: addressed by woody habitat placement and securing (see sections 4.5 and 4.6).
2. Increase in anabranch flow and development: addressed by woody habitat placement and securing (see sections 4.5 and 4.6).

4. Risk Mitigation Strategy

In consultation with stakeholders and in accordance to legal advice (sought separately by MDBC, NSW DPI and NSW DNR), the following risk mitigation strategies will be adopted through the course of the project implementation to ensure public safety is maintained in the river.

4.1 Signage

4.1.1 Review of existing signage

In the Hume Dam to Yarrawonga reach of the River Murray, various responsible agencies have existing policies relating to safety and warning signs. It is the intention of this Risk Management Plan comply with existing signage policies. A formal audit of signage will be carried out in early June 2006, noting the location and photographing the existing signage, at the following locations:

- Public boat ramps from Hume to Yarrawonga, including Lake Mulwala and the Ovens River upstream to Bundalong,
- Public access areas within priority resnagging sites.

Some initial findings of this audit (to be further expanded upon in June 2006) include the following:

NSW Maritime: At public (Council managed) boat ramps Maritime has erected safety signs for the purpose of warning boaters of the risks associated with boating on the River Murray (as per figure 3).

Parks Victoria: Parks Vic is in the process of erecting new signage at the entrance to all public access State Forest land. These general warning signs cover a range of risks relevant to camping and swimming in the river (as per figure 4).

Local Councils: In public swimming areas some Local Councils have erected warning signs concerning the presence of submerged snags, cold temperatures and fast currents.

Figure 3: Maritime boat ramp warning signs

Figure 4: Parks Vic warning signs

4.1.2 Proposed Signage

(i) Interpretive signs

Interpretive signs will be erected for the information of all river users (swimmers, canoeists, fishers, boaters) entering reserves adjacent to resnagging areas. These signs will provide general information on the project, doubling as a general warning sign of river hazards and for project promotion. The signs will include the following*:

- Map(s) indicating the locations of resnagged areas
- Information on the ecological importance of snags for native fish
- Project achievements
- Hazard figures similar to figures 5 and 6
- Agency logos

It is proposed to erect interpretive signs at the entrance to public access areas (State Forest and Travelling Stock Reserves) adjacent to resnagging sites, as identified in Appendix B.

(ii) River access point signs

The positioning of signs at river access points (boat ramps) will provide a warning to river users of the risk of boating before they engage in river activities. These signs will be erected so that they are visible from the bank (ie facing away from the river). Signs at boat ramps will include the following information*:

- Map(s) indicating the locations of resnagged areas in relation to the boat ramp
- Hazard figures similar to figures 5 and 6
- Agency logos

Signs will be erected only at high use, publicly managed boat ramps as detailed in Appendix B. It is not intended to erect signs on private boat ramps or any other private river access areas.

(iii) Boating Hazard signs

Boating hazard signs targeting boat based recreational activities (general boating, boat fishing, waterskiing, canoeing) will be erected at the beginning, mid-way and end of resnagging sites (as identified in Appendix B) so that they are visible from the river (ie facing the river), similar to figure 5 below*.

Figure 5: boating hazard sign*

Figure 6: swimming hazard sign*

* The precise format and wording of the signs will be further improved upon in conjunction with a newly established Signage Committee with representatives from all relevant agencies, ie Local Councils, Maritime, DNR, DPI, DSE, Parks Vic, MDBC. Logos of each of these agencies will also appear on the signs to ensure liability cover for all those concerned. Approval from the land manager (as identified in table in Appendix B) will be required before the sign is erected. Signs are to be in place by mid August 2006.

(iv) Waterway closure signs

Resnagging works will be associated with temporary waterway closures (as detailed in section 3.1.1). To inform waterway users of these closures there will be temporary waterway closure signs erected at relevant local boat ramps while works are underway as required by NSW Maritime.

4.2 Media

The project will be advertised in the media, not only for project promotion purposes, but also to make the local community aware of the location of resnagging areas, and reinforce the dangers associated with swimming and boating in the river. The relevant components of the project communication plan are:

- Public notices in local newspaper The Border Mail (then biannually for 4 years during implementation), including advertising of temporary waterway closures prior to the commencement of instream works,
- Regular update newsletter displayed at boat shops, NSW Maritime, Fisheries and CMA offices and boat shops (biannually)
- Targeted public meetings (in Autumn 2006, prior to resnagging implementation)
- Update presentations at user group meetings (as required).

4.3 NSW Maritime

4.3.1 Public awareness strategy

NSW Maritime has the capacity under Part 2 of the *Marine Safety Act 1998* to restrict the operation of vessels in navigable waters by display of notice. NSW Maritime may, by such a notice, impose any prohibition or regulation considered appropriate for the safety of the public or for the protection of vessels or other property. Restrictions may include the speed of vessels, the creation of wash by vessels, the mooring or anchoring of vessels, the use of vessels for particular purposes.

Gazetting further regulations (speed limits, no wake zones) in resnagging areas is not considered an appropriate mechanism for managing the hazard risks of this project. An increased level of regulated zones requires an increase in compliance activity. Resourcing of such is not appropriate in view of the present risk and protection afforded by current maritime law with regard to the navigation of vessels. An educational and advisory based approach will be implemented through signage (section 4.1) and media campaign (section 4.2) to warn of the risks of boating in inland rivers due to the presence (natural or otherwise) of obstacles. The enhancement of existing techniques will ensure effective communication and awareness among stakeholders.

As a part of the Plans implementation and management inspections of the reach and a risk audit will be conducted annual. NSW Maritime will assist in the identification of navigation hazards that require marking or managing. Those that require managing, be it removal or replacement will be done so as a part of Implementation and Management (see section 4.7).

4.4 Work Site Safety

The work techniques to be used to reinstate woody habitat include bank-based resnagging and barge resnagging, as outlined in the *Project Implementation Feasibility Study* (DPI, 2005). During these works public access will be restricted to ensure public safety.

In the case of bank-based resnagging, which involves the use of cross-channel cables, temporary waterway closures will be implemented. While resnagging works are in progress the river immediately surrounding resnagging areas (at least 100 metres upstream and downstream of the site) will be closed to boating. This will include the use of warning signs and safety personnel overseeing the closure. Where necessary special marker buoys will be positioned during bank-based works to maintain a navigable channel of 30m where possible. All items (chains, machinery) within the waterway will be removed at night. Public access from land will also be controlled by on site personnel.

In the case of barge resnagging, the barge will be safely operated and marked according to NSW Maritime requirements, including the blocked channel markers (see figure 7). During operation the remaining area of channel will be navigable.

A Safe Work Method Statement (site safety plan) has been developed for use at each resnagging site (see Appendix C). It provides for the identification of site hazards, risks, mitigating strategies and safety procedures. A Safe Work Method Statement is to be completed and signed off prior to the commencement of works at each site.

Figure 7 (left): Floating Barge with Channel Blocked day shapes and night-lights.

4.5 Instream Woody Habitat Placement

4.5.1 Location

In terms of safety for swimmers, resnagging activities will be focussed away from high use public swimming areas such as those around townships and public access State Forest areas.

4.5.2 Depth

As previously mentioned, boating in the Murray River is most popular during the summer months and in times of flow greater than 10,000ML/day. For the purposes of assessing risk in this reach of the river it is assumed that low flow is up to 2000 ML/day. At 10,000ML/day, the depth of water increases by 0.6 –1.0 metre.

Woody habitat placement is to be designed in such a way that during times of flow greater than 10,000ML/day, reinstated habitats are to be within 15m of the bank and in greater than 500mm of water (see Figure 8).

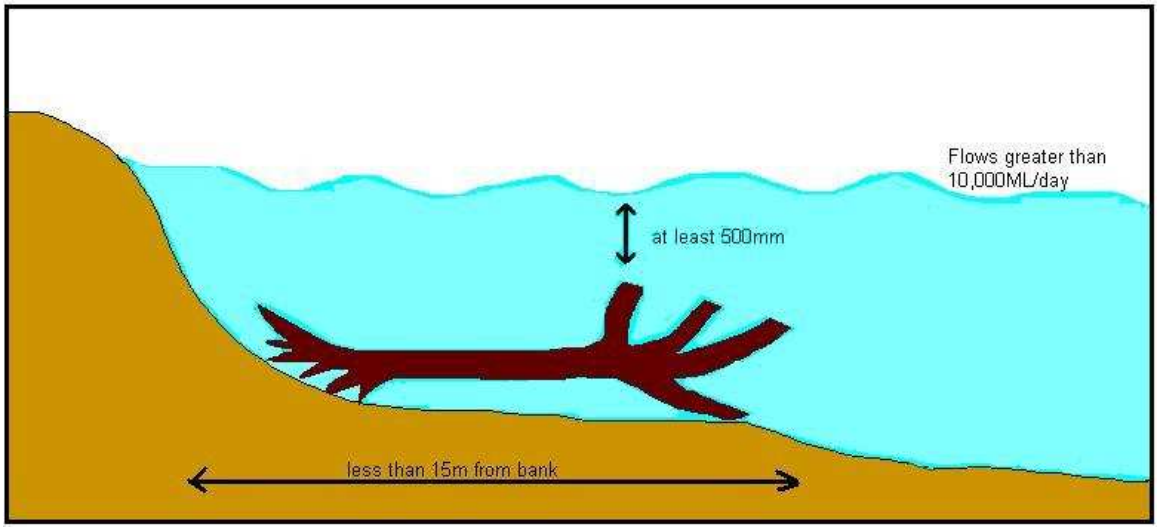


Figure 8: Woody habitat placement is to be sympathetic to boating – within 15m of bank and in at least 500mm of water during flows of greater than 10,000ML/day.

4.5.3 Hydraulic management

A hydraulic impact study (Earth Tech Engineering, 2006) also identified a number of ways that the impact on river hydrology can be further minimised, by appropriately managing where and how woody habitats are placed within the waterway. The techniques to be adopted are:

1. Place logs close to banks rather than in the center of the channel,
2. Angle the reinstated logs with the flow to reduce their impact on water flows and bank erosion.
3. Restrict resnagging activities that are located close to an anabranch offtake, as to avoid rediverting flows into the anabranch system.

To imitate the natural alignment of woody habitat in the channel each log is to be angled with the flow – between 0 and 90 degrees to the flow depending on the position within the channel (most often around 45 degrees), as shown in Figure 9. This will reduce the cross sectional area of the channel occupied by the woody habitat, while also diverting water away from the bank to mitigate the risk of erosion.

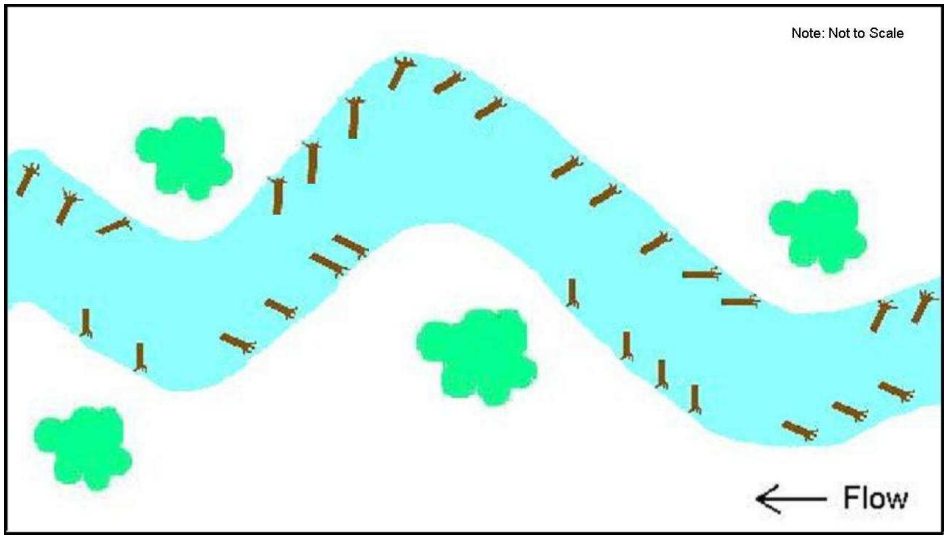


Figure 9: woody habitat placement in the water

4.6 Stability of Reinstated Woody Habitats

4.6.1 Installation

The project aims to restore habitat to specific areas of the river channel where it will be of most use to fish. Where required, reinstated woody habitats will be held in position through the use of ballast piles (as detailed in figure 10). This consists of timber piles and/or rock anchors strategically placed around an individual log and tied with cables to secure it in place.

The level at which securing is required will be assessed on site, dependent on the condition and size of each individual woody habitat and the site practicalities. For example, higher density green timber is likely to require less ballasting than lower density timber. Similarly, larger logs with intact root masses and/or branches are more likely to remain in place with minimal or no ballasting, compared with smaller, less complex timber that may tend to float without intervention.

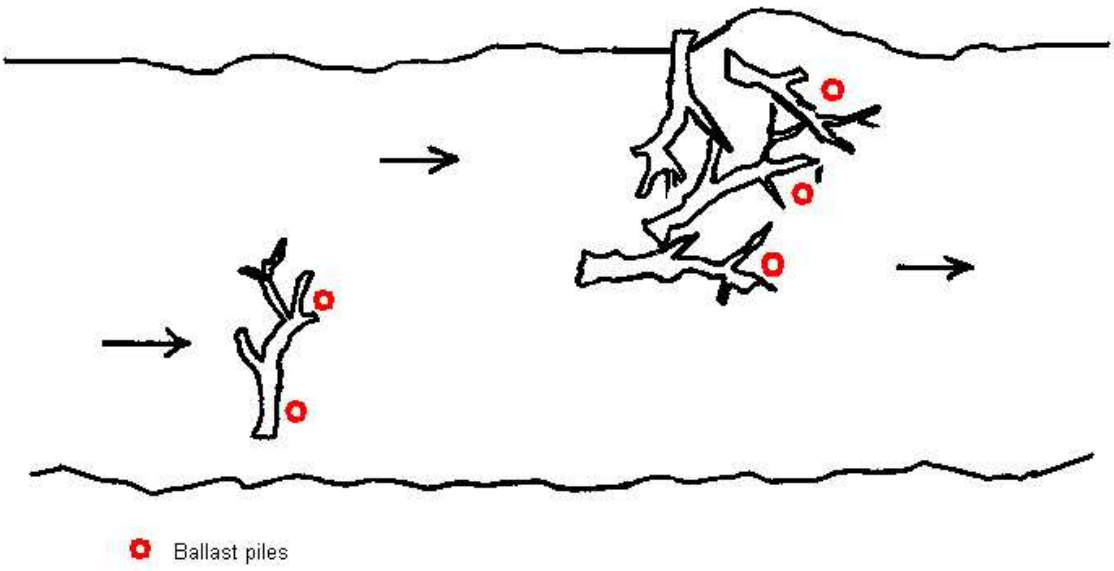


Figure 10: method of securing woody habitat in the waterway

4.7 Maintenance

The implementation of the Plan will be underpinned by a regulatory program of monitoring and management. This program will include an annual inspection and risk audit of the mitigation strategies. Reinstated woody habitats will become MDBC assets and will be mapped and recorded. In field inspections, conducted by NSW Department of Natural Resources, will audit signage, the stability of reinstated woody habitats and the identification of any new risks to be managed.

NSW Maritime will assist in the identification of navigation hazards that require marking or managing. Those that require marking in compliance with Maritime law will be done so as a part of the maintenance program.

4.8 Risk Management Responsibilities

To effectively undertake the abovementioned risk mitigation strategies it is important to identify those responsible for each task, particularly those that require longer term maintenance. Table 2 below specifies individual tasks and the responsible agency.

Table 2: Risk Mitigation Plan responsibilities

Mitigation Strategy	Detail	Responsible agency	Timeframe
4.1 Signage	Maintain existing hazard signage at boat ramps and public lands (4.1.1)	NSW Maritime Parks Vic	On going
4.1.2 Hazard signage	Erect new hazard signs at those sites where deemed necessary (4.1.2)	Project proponent	July 2006
4.1.2 Interpretive signage	Design and erect new interpretive signage (4.1.2)	Project proponent	July 2006
4.2 Media	Coordinate project media releases and public notices	Project Steering Group*	On going during implementation, 12 months following works completion
	Design, produce and distribute brochures/info sheets	Project Steering Group*	On going during implementation, 12 months following works completion
4.3 Navigation markers	Identify navigation hazards that require marking and/or managing	Project proponent NSW Maritime	On going
4.4 Work Site Safety	Safe Work Method Statements and OH&S	Project proponent	During implementation
4.5 Instream woody habitat placement	Identify areas of sufficient depth for resnagging (4.5.2)	Project proponent	During implementation
	Implement hydraulic management principles as identified by hydraulic modelling (4.5.3)	Project proponent	During implementation
4.6 Stability of reinstated woody habitat	Securely anchor reinstated woody habitat (4.6.1)	Project proponent	During implementation
4.7 Implementation and Management	Maintain signage (checks carried our during river inspections)	Project proponent	Annually
	Monitor the stability of reinstated woody habitats	Project proponent	Annually
	Monitor the need for additional navigation markers	Project proponent NSW Maritime	Annually
	Identification of any new risks to be managed	Project proponent NSW Maritime	On going

*The Project Steering Group consists of representatives from Federal and State Agencies: Murray Darling Basin Commission, NSW Department of Natural Resources, NSW Department of Primary Industries, Vic North East Catchment Management Authority and Vic Department of Sustainability and Environment. DNR will take over NECMA in the role of project management/proponents.

5. Costs of Risk Management Implementation

A number of risk management activities have previously been costed in the *Project Feasibility Study and Investment Proposal* (DPI, 2005), including woody habitat placement and securing, project media (brochures, public meetings). The additional costs of reviewing existing signage and annual asset and risk audits are costed in table 3 below.

Table 3: Additional Risk Mitigation costs.

Mitigation Strategy	**Item**	**Number required**	**Cost**	
			Previously costed*	**Additional cost**
Signage	Interpretive signs hazard signs	20	$6 000	
Review of existing signage				$2630
Media	Newsletters Public meetings Media releases	-	$58 600	
Additional media	Newspaper public notices	8	$4 000	
Woody habitat placement	Incorporated into bank- and barge-based resnagging operational works	-	$1 033 740	
Securing woody habitat	Anchors	-	$18 600	
Monitoring program	River inspections (check signs and reinstated snags)	Ongoing - annually		$5660**
			Total	$8 290

* As costed in MDBC Investment Proposal, includes total costs of item over the life of the resnagging project (3 works stages).
** Cost per annum.

6. Conclusion

Resnagging in the Hume Dam to Yarrawonga reach of the River Murray represents an opportunity to improve native fish habitat, given that this river reach has been subject to extensive habitat loss and alteration.

The conclusion of this assessment of the risk resulting from the resnagging activities indicates that works will increase the risks to a number of River Murray users, however the likelihood of any resultant harm to the public is low. Nevertheless, the project implementation will be managed in such a way as to mitigate these risks and maintain public safety in and around resnagging areas where instream habitat has been installed. The risk management measures detailed in this Risk Management Plan will be adopted through the course of the project implementation stage and will ensure the pre-existing level of public safety is maintained in the river.

7. References

DPI (2004) Hume Dam to Yarrawonga Instream and Riparian Habitat Restoration Plan.

DPI (2005) Feasibility Study - Hume Dam to Yarrawonga Resnagging and Riparian Restoration Project.

Earth Tech Engineering (2006) Hydraulic Impact Study: Resnagging of the River Murray – Hume Dam to Yarrawonga. Final Report, May 2005.

Hume and Dartmouth Dams Operations Review Reference Panel (1999) Hume and Dartmouth Dams Operations Review: Final Report. Murray Darling Basin Commission, Canberra. May 1999.

ID&A (2001) Scoping Study – Waterway Management Plan: Hume to Yarrawonga Reach of the Murray River. May 2001.

NSW Fisheries (2002) *Species impact Statement: Fishing in the Lower Murray River Catchment*. Public Consultation Document, May 2002. NSW Fisheries, Port Stephens.

NSW Maritime (2005) *Boating Handbook New South Wales*. NSW Maritime Authority Sydney.

Personal Communications

Peter Tilbrook, Supervising Fisheries Officer, NSW Department of Primary Industries. Feb 2006

Scott Kidd, Regional Manager, NSW Maritime. April 2006

8. Appendices

Appendix A – Risk Score Matrix

1. How likely is it to be bad? (LIKELIHOOD)	2. How severely could it hurt or someone of how ill could it make someone? (SEVERITY OF CONSEQUENCE)				
	I CATASTROPHIC **Death, toxic release off-site with detrimental effect, huge financial loss**	II MAJOR **Extensive injuries, loss of production capability, off-site release with no detrimental effects, major financial loss**	III MODERATE **Medical treatment required, on-site release contained with outside assistance, high financial loss**	IV MINOR **First aid treatment, on-site release immediate contained, medium financial loss**	V INSIGNIFICANT **No injures. low financial loss**
A ALMOST CERTAIN **Is expected to occur in most circumstances**			6H		15M
B LIKELY **Will probably occur in most circumstances**		5H		14M	19L
C POSSIBLE **Might Occur at some time**	4H		13M		22L
D UNLIKELY **Could occur at some time**		12M			24L
E RARE **May occur only in exceptional circumstances**	11M				25L

Adapted from NSW Treasury Managed Funds based on Australian Standard AS 4360-1999 Risk Management.

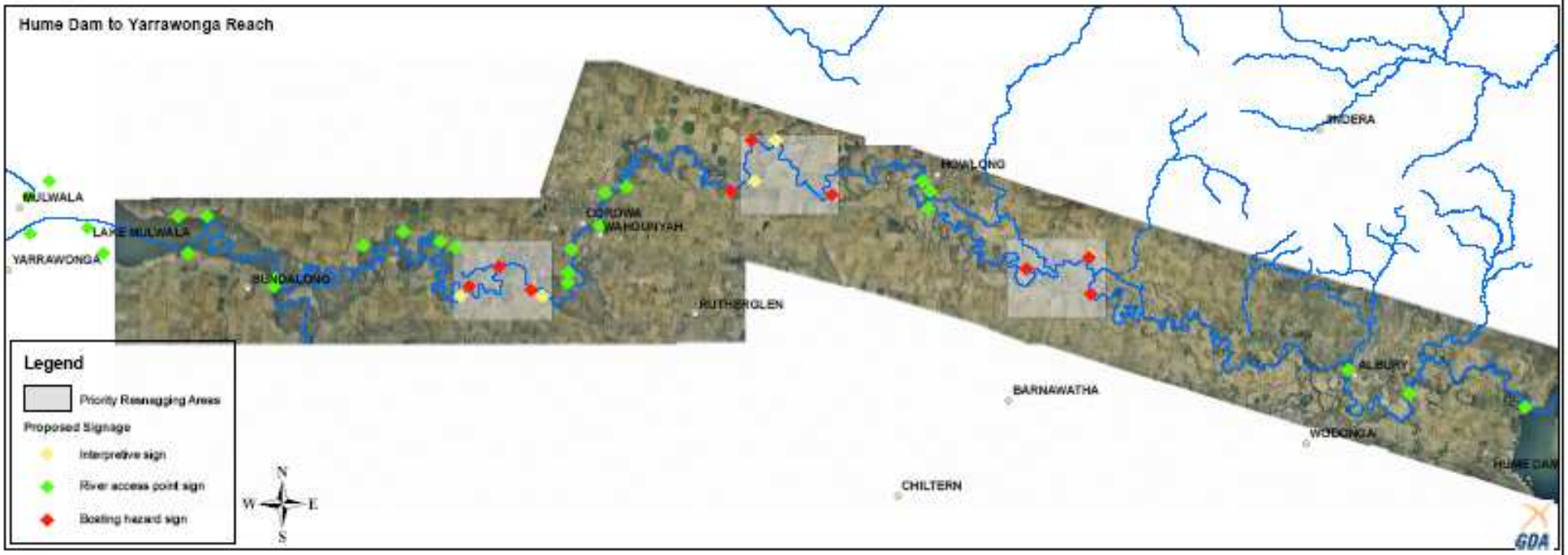
Appendix B: Proposed signage locations and land managers*

Sign Type	Site Name/Location	Land Owner/ Manager	X	Y
Interpretive sign	12 mile TSR reserve	RLPB	475814.4	6013530
Interpretive sign	Quat Quatta SF public res	NSW Forests	456539.8	6020535
Interpretive sign	Police Paddocks pub res	Parks Vic	455217.3	6018016
Interpretive sign	Stantons Bend entrance	Parks Vic	442179.3	6010962
Interpretive sign	Lumbys Bend entrance	Parks Vic	437177.7	6010989
River access point sign	Heywoods boat ramp	Wodonga Council	502524.6	6004213
River access point sign	Mungabareena boat ramp	Albury City Council	495412.6	6005034
River access point sign	Nouriel boat ramp	Albury City Council	491643.6	6006427
River access point sign	Parlour Ck boat ramp	Corowa Shire Council	465968.4	6017434
River access point sign	Boat ramp off Howlong Rd	Wodonga Council	465877.1	6016399
River access point sign	Howlong Apex res boat ram	Corowa Shire Council	465521.7	6017981
River access point sign	Granthams Bend boat ramp	Parks Vic	447376.1	6017695
River access point sign	Lone Pine boat ramp	Corowa Shire Council	446045.2	6017291
River access point sign	Corowa main boat ramp	Corowa Shire Council	445721.6	6015231
River access point sign	Cotton Street boat ramp	Corowa Shire Council	443972.8	6013875
River access point sign	Corowa Common entrance	Corowa Shire Council	443779	6012467
River access point sign	Corowa Common entrance	Corowa Shire Council	443750.2	6011830
River access point sign	Wagonwheel boat ramp	Corowa Shire Council	436844.9	6013908
River access point sign	Snake Island boat ramp	Corowa Shire Council	435906.6	6014372
River access point sign	Lagoon boat ramp	Corowa Shire Council	433627.8	6014887
River access point sign	Spring Drive boat ramp	Corowa Shire Council	431213.6	6014051
River access point sign	Bundalong boat ramp2	Moira Shire Council	425798.3	6012036
River access point sign	Bundalong boat ramp1	Moira Shire Council	425724.3	6011555
River access point sign	Drain Lane boat ramp	Corowa Shire Council	421595.8	6015836
River access point sign	Majors Lane boat ramp	Moira Shire Council	420448	6013667
River access point sign	Lake Mulwala boat ramp	Corowa Shire Council	419864.1	6015874
River access point sign	Rosemary Crct boat ramp	Moira Shire Council	415223.6	6013609
River access point sign	Mulwala Canal boat ramp	Corowa Shire Council	410624.9	6017025
River access point sign	Yarrawonga boat ramp	Moira Shire Council	410719.4	4014777
River access point sign	Mulwala Canal boat ramp2	Corowa Shire Council	411909.6	6018102
River access point sign	Yarrawonga boat ramp2	Moira Shire Council	414300.7	6015170
Boating hazard sign	Start PA3	Patterson	475838	6011044
Boating hazard sign	Mid PA3	Crown (Parks Vic)	475709.9	6013333
Boating hazard sign	End PA3	White	471916.1	6012637
Boating hazard sign	Start PA1	Morris/Frontage	459962.2	6017162
Boating hazard sign	End PA1	Parks Vic	453786.9	6017471
Boating hazard sign	Mid PA1	Parks Vic	455013.2	6020583
Boating hazard sign	Start PA2	Albert	441512.9	6011388
Boating hazard sign	Mid PA2	Chugg	439518.8	6012727
Boating hazard sign	End PA2	Chugg	437711	6011598

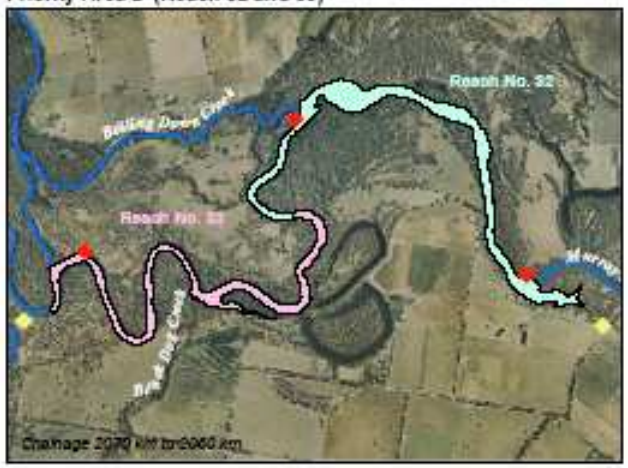
*The above listed locations are based on desktop study only and are subject to change by the Signage Committee once further field work and a review of existing signage has been conducted.

NSW DEPARTMENT OF **PRIMARY INDUSTRIES**

Proposed Signage: Resnagging Risk Mitigation



Priority Area 2 (Reach 32 and 33)



Priority Area 1 (Reach 23, 24 and 25)

Priority Area 3 (Reach 14 and 15)

Imagery : Hume Dam to Bundalong January 2004 (Courtesy MDBC and Hassall & Associates). Imagery produced by Aerometrex Pty Ltd

Appendix C

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Now incorporating NSW Fisheries
ABN 51 734 124 190-002

SAFE WORK METHOD STATEMENT [Employees & All Contractors]

WORKPLACE

Date	
Site Number	
Site Name / Location	
Property Owner / Manager	
Works to be undertaken (Timber haulage, Bank-based / Barge resnagging, access track works, site rehabilitation, etc)	_____ _____ _____
Site Description: ▪ Description (forest/ shrub/ paddock etc) ▪ Terrain ▪ Conditions ▪ Slope ▪ Other	_____ _____ _____ _____ _____

SITE WORKFORCE

Contractor 1	
Company Name	
Address	
Phone / fax / e-mail	
Work description	
Contractor's employees ▪ Site supervisor ▪ Employee / work description ▪ Employee / work description ▪ Employee / work description All employees appropriately licensed for machinery operation, chainsaw, etc.	_____ _____ _____ _____ _____ Signed: (by site supervisor)
Contractor 2	
Company Name	
Address	
Phone / fax / e-mail	
Work description	
Contractor's employees ▪ Site supervisor ▪ Employee / work description ▪ Employee / work description ▪ Employee / work description All employees appropriately licensed for machinery operation, chainsaw, etc.	_____ _____ _____ _____ _____ Signed: (by site supervisor)
Contractor 3	
Company Name	
Address	
Phone / fax / e-mail	
Work description	
Contractor's employees ▪ Site supervisor ▪ Employee / work description ▪ Employee / work description ▪ Employee / work description All employees appropriately licensed for machinery operation, chainsaw, etc.	_____ _____ _____ _____ _____ Signed: (by site supervisor)

NSW DPI	
Work description	
NSW DPI Employees ▪ Site supervisor ▪ Employee / work description ▪ Employee / work description	_____ _____ _____ _____

ON-SITE MEDICAL EMERGENCY

Location of on-site First-aid Kit	
On-site First Aider: Name / job	

ON-SITE MAJOR PLANT

Type / function / radio call sign	
Type / function / radio call sign	
Type / function / radio call sign	
Type / function / radio call sign	

ON-SITE COMMUNICATIONS

Person to person on ground	
Machine to person on ground	
Person on ground to machine	
Machine to machine	

ON-SITE WARNING SIGNS

Outer perimeter of workplace ▪ Location of entry points ▪ Sign type	_____ _____
Worksite ▪ Location of entry points ▪ Sign type	_____ _____

RIVER TRAFFIC MANAGEMENT

Waterway closures (if applicable)	
Location of security personnel and signs	
Regular checking for security of warning signs	

ROAD TRAFFIC MANAGEMENT

Location of Traffic Management Plan (If applicable)	
Road closures (if applicable)	
Regular checking for security of warning signs	

RISK MANAGEMENT OF WORKPLACE

HAZARD	CONTROL STRATEGY	BY WHOM
Timber haulage: Hazards identified in Transportation Plan: (dangerous trees / limbs / loading / unloading / chainsaw / steep river bank / power lines / underground cables or pipelines / road conditions) Hazards identified by contractor: ▪ ▪ ▪ Incidental hazards identified during the course of work: ▪ ▪ ▪ Methods used to mitigate hazards:	_____	_____

RISK MANAGEMENT OF WORKPLACE (cont.)

HAZARD	CONTROL STRATEGY	BY WHOM
Bank – Based Resnagging Identified hazards: ▪ ▪ ▪ ▪ ▪ Incidental hazards identified during course of work ▪ ▪ Methods used to mitigate hazards:		
Barge Resnagging Identified hazards: ▪ ▪ ▪ ▪ ▪ Incidental hazards identified during course of work ▪ ▪ Methods used to mitigate hazards:		
Boating Safety Identified hazards: ▪ ▪ ▪ ▪ ▪ Incidental hazards identified during course of work ▪ ▪ Methods used to mitigate hazards:		
Access Track Works Identified hazards: ▪ ▪ ▪ ▪ ▪ Incidental hazards identified during course of work ▪ ▪ Methods used to mitigate hazards:		

RISK MANAGEMENT OF WORKPLACE (cont.)

HAZARD	CONTROL STRATEGY	BY WHOM
Chainsaw Use Identified hazards: ▪ ▪ ▪ Incidental hazards identified during course of work ▪ ▪ Methods used to mitigate hazards:	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
Site Rehabilitation Identified hazards: ▪ ▪ ▪ ▪ ▪ Incidental hazards identified during course of work ▪ ▪ Methods used to mitigate hazards:	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
Supervision of "operators-in-training"	_____ _____ _____	_____ _____ _____
Visitors to Workplace (On-site Induction) ▪ Routine visitors ▪ Unexpected visitors	_____ _____ _____ _____	_____ _____ _____ _____

MEDICAL EVACUATION EMERGENCY PLAN

Mobile phone reception at work site	CDMA _____ DIGITAL	❑ Good ❑ Poor ❑ Nil_____ ❑ Good ❑ Poor ❑ Nil
Radio	Channel No. Call To: Call sign from:	_____ _____
Emergency Meeting Point For ambulance / police	Description of location: 1:100,000 grid reference: GPS Lat / Long:	_____ _____
Helicopter Landing Place	Description of location: GPS Lat / Long:	_____

PROCEDURES TO OBTAIN AMBULANCE ASSISTANCE

Telephone 000 or,
Radio_____site supervisor on channel_____and say, "This is_____, Emergency Call, Emergency Call, over"
When supervisor responds, provide brief details of situation (incident) ask for the operator to relay a "000"call.

THE INCIDENT INFORMATION IS TO BE PROVIDED TO THE "000" OPERATOR IN THE FOLLOWING SEQUENCE:

QUESTIONS FROM "000" OPERATOR	YOUR RESPONSE	INCIDENT DETAILS
1. Police, Fire, Ambulance?	NSW Ambulance	
2. Suburb?	Name of Site: Nearest town or locality: Nearest Ambulance station:	_____ _____
3. Address?		
4. Nearest road junction / cross street?		
5. Local Government Area?		
6. Nature of problem?	Brief statement of the nature of the incident and number and condition of casualties	
7. Where is the incident?	▪ Worksite grid ref: ▪ 1:000,000 sheet name ▪ Worksite lat / long: ▪ Meeting Point grid ref: ▪ Meeting Point lat / long: ▪ Directions to navigate from_____ ambulance station to Meeting Point ▪ 4WD ambulance required ▪ CB radio channel to use:	_____ _____ _____ _____ _____ _____ _____ _____ ❑ Yes ❑ No _____
8. Injuries received by victims?	Detailed information about condition of the casualty	
9. Call back number?	▪ Mobile phone ▪ Head Office number	_____
10. Name of reporter?		

SAFE WORK METHOD STATEMENT SIGN-OFF

Workers involved in the preparation of Statement:

Name:_____ Task:_____ Name:_____ Task:_____
Name:_____ Task:_____ Name:_____ Task:_____
Name:_____ Task:_____ Name:_____ Task:_____
Name:_____ Task:_____ Name:_____ Task:_____
Name:_____ Task:_____ Name:_____ Task:_____
Name:_____ Task:_____ Name:_____ Task:_____
Name:_____ Task:_____ Name:_____ Task:_____

Contractor's workplace
Worksite supervisor

Name_____
Signature_____
Date_____

Certification by workplace supervisor that all site specific hazards identified in the Works Plan have been considered and appropriate control strategies included in this Safe Work Method Statement.

Supervising Officer

Name_____
Signature_____
Date_____

SAFE WORK METHOD STATEMENT AMENDED BY:

Amendment 1: _____
Name_____ Signature_____ Date_____

Amendment 2: _____
Name_____ Signature_____ Date_____

Amendment 3: _____
Name_____ Signature_____ Date_____

Amendment 4: _____
Name_____ Signature_____ Date_____

Appendix D – Additional Correspondence

Correspondence with Maritime

From: "Kidd, Scott" <skidd@maritime.nsw.gov.au>
To: "Jenny Fredrickson" <Jenny.Fredrickson@dpi.nsw.gov.au>
Date: 4/13/06 12:50pm
Subject: RE: Resnagging in the Murray River

Jenny,

Consent given and all matters confirmed as below.

Scott Kidd
Regional Manager
Murray/Inland Region
NSW Maritime

----- Original Message-----
From: Jenny Fredrickson [mailto:Jenny.Fredrickson@dpi.nsw.gov.au]
Sent: Thursday, 13 April 2006 12:45 PM
To: Kidd, Scott
Subject: Resnagging in the Murray River

Scott,

As discussed at our meeting this morning, DPI requests NSW Maritime's consent to carry out resnagging works in certain areas of the Murray River channel, as detailed in the Review of Environmental Factors and Risk Management Plan documents previously reviewed by you.

Following our discussions I would like to confirm the following specific actions will be incorporated into our works plan to maintain waterway safety during resnagging works:
- Appropriate advertising of temporary closures prior to the commencement of instream works (ie public notices in the Border Mail),
- Temporary waterway closure signs at relevant local boat ramps,
- Appropriately marked vessels at either end of the zones during works during times when the waterway is obstructed by cables.
- Positioning of special marker buoys during bank-based works to maintain a navigable channel of 30m where possible.

As discussed, DPI will continue to consult with Maritime throughout the project to ensure safety standards are effectively implemented and maintained.

Please don't hesitate to contact me if you have any further queries.

Thanks
Jenny

Jenny Fredrickson ><>
Conservation Management Officer
Aquatic Habitat Rehabilitation
NSW Department of Primary Industries - Fisheries
Unit 3, 556 Macauley St
Albury NSW 2640

Email: Jenny.Fredrickson@dpi.nsw.gov.au
Phone: (02) 6042 4208
Mobile: 0428 227 460
Fax: (02) 6021 0113

Correspondence with Parks Victoria

From: "BARROW Geoffrey"<gbarrow@parks.vic.gov.au>
To: <jenny.Fredrickson@dpi.nsw.gov.au>
Date: 3/3/06 10:53am
Subject: Murray River Resnagging risk Management Draft Plan

Hi Jenny, Thanks for the chance to comment on this document it appears to be a thorough and well written plan I have nothing to add. I have passed it on to Martin and Chris McCormack Chief Ranger for Murray Central and will let you know if there are any issues from them.

Regards

Geoff Barrow
Ranger in Charge Wangaratta
Tara Court, Ford Street, Wangaratta 3677
Phone: 03 5723 8660
Mob: 0408 315 770
Fax: 03 5723 8692

----- Original Message-----
From: Jenny Fredrickson
To: gbarrow@parks.vic.gov.au
Date: 2/28/06 3:10pm
Subject: Murray River resnagging risk management

Hi Geoff,

As we discussed on the phone please find attached a draft version of the Resnagging Risk Management Plan for your comment. Please don't hesitate to call if you have any questions.

Thanks
Jenny

Jenny Fredrickson ><>
Conservation Management Officer
Aquatic Habitat Rehabilitation
NSW Department of Primary Industries - Fisheries
Unit 3, 556 Macauley St
Albury NSW 2640

Email: Jenny.Fredrickson@dpi.nsw.gov.au
Phone: (02) 6042 4208
Mobile: 0428 227 460
Fax: (02) 6021 0113