Rehabilitation of the mangrove community along the Parramatta River associated with the development of this site

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Mr Andrew Hanna
State Wide Planning Pty Ltd
5-7 Charles St, Parramatta
NSW 2124

Dear Mr Hanna

Re: Rehabilitation of the mangrove community along the Parramatta River associated with the development of this site

Introduction

The separate flora and fauna report undertaken by Hawkeswood (2011) has identified the Grey Mangrove (*Avicennia marina*, Avicenniaceae) to be a dominant of the estuarine habitat along the Parramatta River, The area is highly degraded and requires removal as a result of contamination with asbestos. The length of the infected area is approximately 300 metres. This will result in soil and vegetation being removed. The soil will have to be replaced with clean fill and similar to the soil occurring elsewhere along the Parramatta River.

The Grey Mangrove is a pioneer coloniser of shallow tidal waters. Its roots breathe by means of fibrous woody pneumatophores which arise from horizontal cable rots around the tree. This dense root system assists the silt to settle, protects banks from erosion and provides a living environment for a host of small marine animals. The animals and algae which form around the roots are a crucial part of the food supply for many species of young fish.

Hydrology and Sedimentation

It is necessary to study the tidal activities and consequently the frequency of inundation of the site before any rehabilitation work can proceed. The site at Parramatta is well inland and the water is brackish and does not display harsh wave action. However before any planting occurs the organization chosen for the rehabilitation work should obtain tidal details for this section of the Parramatta River. Such factors to consider are depth, duration and frequency of tidal inundation and to determine if there is any tidal flooding. It may also be useful to determine if the subject area has any dryness that may influence the growth of the plants of the rehabilitated area.

The rate of sedimentation at the site is a critical factor to consider as it has been shown that excess input of sediment to mangroves stifles growth, and can cause death of trees owing to root smothering. Incoming rivers may become overloaded with sediment if there is extensive logging or other destructive activities occurring upstream.

Licenses for removal of mangroves

The Office for Water is responsible for the Management of fish and marine vegetation, including mangroves, under the Fisheries Management Act 1994 (FM Act). Any development or activity that may harm mangroves must be referred to the Office of Water for Approval.

The FM Act sets out provisions to protect marine vegetation, including mangroves, from 'harm'. 'Harm' under the FM Act means gather, cut, pull up, destroy, poison, dig up, remove, injure, prevent light from reaching or otherwise harm the marine vegetation, or any part of it. A permit is required from NSW DPI to harm any marine vegetation, including mangroves. NSW Department of Primary Industries PO Box 97 Huskisson NSW 2540 Phone: (02) 4441 8969 Conservation Manager – South Region NSW Department of Primary Industries.

Protection of mangroves

Some simple ways to help protect mangroves are:
• fence along the intertidal zone and prevent stock access to mangrove areas,
• design riverfront structures such as jetties or boat ramps to avoid or minimise impacts to mangroves,
• avoid walking, riding or driving through mangrove areas at low tide,
• dispose of rubbish, oils and chemicals in the correct manner

Rehabilitation of mangrove communities including the one at Parramatta River

Along the coastline of New South Wales, numerous rehabilitation projects are being conducted to help restore areas where loss of mangrove habitat has occurred. Although often a slow process, the majority of these rehabilitation projects are proving to be successful. The degree of success depends on a number of environmental factors; including tidal range, soil type, and the intensity of wave energy at the rehabilitation site. It is vital that these circumstances be assessed prior to any regeneration attempt. As mangrove habitats are very fragile, and mangroves are protected in NSW waters, any mangrove rehabilitation projects should be assessed by the local New South Wales Department of Primary Industries Fisheries Conservation Manager to determine if a permit is required before being implemented.

Options for mangrove rehabilitation include:

• natural recruitment
• seeding
• transplanting
• reducing wave energy

Natural recruitment

Where site conditions are suitable for mangrove regeneration, natural recruitment is the best and most cost-effective method. In such situations, often simply fencing the mangrove area and excluding cattle and other stock can result in substantial natural recruitment and recovery of mangrove forests.

Planting with seeds

Where high wave energy or a steep slope limits natural recruitment there are two major planting techniques used in mangrove rehabilitation. The 'seeding' technique involves planting the seeds directly into the ground at the location of the rehabilitation site.

The second technique involves planting or 'transplanting' the seedlings which may be grown in special nurseries or gathered from drains or other sites. Compared to transplanting, seeding is a quick and easy method of establishing mangroves, with survival rates of up to 95% being achieved when seeds are planted correctly. Seeds and saplings used for rehabilitation work should be sourced from local populations within the same catchment and should be appropriate species for that area. Only the seeds that have dropped from mangrove trees should be collected. When collecting seeds, care should be taken not to damage the root systems of established trees.

Seeds of the Grey Mangrove are generally most abundant and readily available between October and December. Seeds are gathered from the ground within the mangrove forest. Sometimes accumulations of seeds collect in protected pockets along the foreshore, where large numbers can be collected in a short time. Strong winds can dislodge immature seeds so it is best to choose the largest seeds possible as these are more mature and close to germination.

Grey Mangrove seeds are covered by a buoyant outer husk. The collected seeds can be placed into a bucket of water (fresh or salty) and left overnight. The next day the husks will have separated and will be floating on top of the water. These seeds are then ready to be planted and roots will begin to form within a few days Seeding is appropriate for sites that have been degraded, as well as for increasing the density of existing mangrove stands. However, seeding is not suitable for all locations, as intense wave and tidal action can easily dislodge the seed. The best sites to actively seed mangrove plants are those that are sheltered from wave energy and have gently sloping foreshores with a muddy or silty substrate. Sandy foreshores tend to be too mobile and may dislodge or smother seeds.

Optimum growth and establishment success appears to occur at the Fringing to Intermediate Zones where the regeneration site has a suitable elevation, generally between 0–0.5 m above sea level, and where there is a good source of seed nearby. The seeds can be hand-sown in selected locations. Using a stick or a finger to make a hole, sprouting seeds are placed only 1–2 cm deep into the substrate. If the seed is totally covered then it may rot. To stop floating debris (such as logs and dead seagrass) from pulling out the seed, the seed is positioned so that the sloping top edge is facing the water. In exposed areas seeds are often washed out of the substrate by wave action. Wash out of seeds can be prevented to some extent by planting in short rows and pegging plastic or metal mesh (e.g. gutter guard) over the seeds until the roots have sprouted and anchored to the substrate.

Construction of a plastic mesh fence parallel to the shoreline can significantly reduce the subsequent smothering of seedlings by floating debris and significantly increase survival. Alternatively, wave energy reducing methods may be used (see Fig. 1b). Ongoing management, repair, removal and replacement of deteriorating wave barriers are critical to limit the likelihood of this material becoming unwanted debris in our estuaries.

Planting with seedlings

Transplanting seedlings

Trials have shown that the transplanting technique may not be as successful as the seeding technique. The lower survival rate is thought to be caused by damage suffered to the plant roots whilst transplanting. Transplanted seedlings often fall victim to wind, waves, boat wash and floating debris. The roots take time to re-establish and can be pulled out or knocked over before they gain hold in the foreshore.

Transplanting is a viable method provided the seedlings are between 20–40 cm high, have 6–10 leaves and no peg root development. Transplanting is better suited to exposed locations where seeds tend to wash out too easily. When transplanting a mangrove seedling, a vertical ring is cut at a radius of about one third of the height of the plant. A suitably sized PVC pipe is generally effective. Soil is removed from outside the cut to enable a space for a shovel to be run underneath the plant. The objective is to minimise damage to the roots. The plant is then lifted out and placed on polythene and balled up for transportation.

Sometimes abundant small seedlings become established in very soft mud within or adjacent to mangrove forests. These can often be gently lifted out with little damage to the root system and transplanted elsewhere. Large quantities of these 'bare-rooted' seedlings can be much more readily transported than seedlings with the root substrate still attached. However, the mud needs to be very soft to minimise root damage.

Using a shovel, seedlings can be transplanted into the foreshore. The shovel is pushed into the substrate deep enough so that the seedling root remains vertical with no bends. The shovel is levered to the side to create an opening into which the seedling is placed. The shovel is slowly removed so the silt gap closes around the seedling and its roots. Any remaining gaps in the silt are left to be closed by the next rising tide. No pressure is applied around the seedling as this can damage the delicate roots.

Growing seedlings in pots

Seeds can be propagated in pots and planted out once they reach seedling size. The pots (150 mm) are filled with mud from the river foreshore.

Seedlings grown in pots must be watered twice a day for about two hours. This is done by placing trays of pots into a tank with 30% salty water and 70% freshwater pumped in to cover the pots or by placing the nursery in the intertidal zone. Seedlings should be protected by a fence and situated out of sight to prevent vandalism.

Reducing wave energy

In areas that are subject to excessive wave action, several methods can be used to reduce wave energy, thereby allowing natural recruitment or seeding to take place. Rock fillets, timber or sediment fencing are energy dissipating methods constructed to mean high water level and placed about 3–5 m in front of an eroding bank. These structures absorb wave action and create an area of still water between the fillet or fence and the eroding bank. This still water area permits the accumulation of sediment and provides a habitat that is suitable for the natural regeneration of mangroves. Generally, energy dissipation structures are laid parallel to the riverbank,overlapping each other at the downstream end, thereby allowing tidal flushing, fish passage and natural recruitment of mangrove seedlings. Demonstration of the success of such structures is evident in the Manning and Hastings River estuaries on the mid north coast where thousands of mangroves have germinated behind completed rock fillets.

Fig. 1a. Typical mangrove rehabilitation works using Grey Mangrove seedlings on the Shoalhaven River, south coast of New South Wales. A similar method can be applied to the subject site at the Parramatta River.

Fig. 1b. Plastic mesh fencing can protect mangrove rehabilitation areas from smothering by floating debris. This technique may be useful for this project on the Parramatta River.

Fig. 1c. Grey Mangrove seedlings growing in pots within the fringing to intermediate zone to allow for tidal flushing. Note protective mesh barrier. This technique may also be useful for this project on the Parramatta River.

I am, Yours faithfully

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(Dr Trevor J. Hawkeswood)
(4 June 2012)
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