



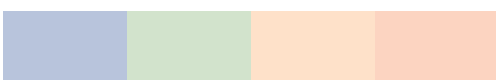
# Environmental Awareness Workbook

FOR CIVIL CONSTRUCTION, ROAD,  
RAIL AND MARINE PROJECTS



**Government of South Australia**

Department of Planning,  
Transport and Infrastructure



Environmental awareness for civil construction, road, rail and marine projects

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DPTI thanks Jodie Gates for the photograph of rare plant *Cheiranthra volubilis*, the Department of Environment and Natural Resources for their images of Phytophthora management and AECOM for their photos of erosion control, waste and noise management.



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# Contents

## SECTION 1

- 4 Introduction
- 5 Activities and Environmental Impacts
- 7 Obligations and Legislative Control
- 8 Environmental Management for the Department's Construction Projects

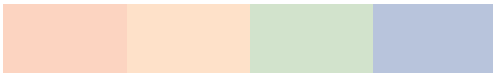
## SECTION 2

- 12 Vegetation management
- 20 Fauna
- 22 Erosion and sediment control
- 26 Watercourses and marine environments

## SECTION 3

- 28 Heritage
- 30 Noise and vibration
- 32 Air quality
- 33 Waste Management and Contaminated Material
- 36 Materials Storage

## APPENDICES

- 40 Appendix A: Contact List
  - 42 Appendix B: Environmental Terms
- 



## Introduction

This workbook has been developed by the Department of Planning, Transport and Infrastructure (The Department) for participants in the training course on Environmental awareness for civil construction, road, rail and marine projects.

The Department is committed to improving the sustainability of South Australia's transport and infrastructure network. To achieve this everyone involved with the construction, operation and maintenance of these systems has a role to play in minimising environmental impact and enhancing the environment.

This workbook and the companion Environmental Code of Practice for Construction - Road, Rail and Marine Facilities provide guidance to environmental best practice.

The course aims to:

- provide construction workers with the knowledge to identify environmental issues associated with their activities and best practice methods to minimise environmental impact
- outline environmental legal obligations relevant to construction activities.

At the completion of this course participants will be able to:

- understand common environmental terms
- state their legal obligations and responsibilities in relation to environmental management
- recognise common environmental impacts on construction sites and potential impacts resulting from the individual's work activities
- identify accepted current environmental management best practices for relevant workplace activities
- identify situations which require further advice about appropriate work practices to minimise environmental damage.





## Activities and Environmental Impacts

To minimise environmental impact it is important to understand the link between various construction activities and the potential for these activities to impact on the environment.

The environment is defined as 'living things, their physical, biological and social surroundings and the interactions between all of these'.

Environmental management measures will depend on the nature of the site activities and the sensitivity of the project area and surrounding land or water environment. For example, excavations resulting in steep slopes are likely to lead to soil erosion and water quality problems downstream and will require the installation of erosion protection measures.

The table on the following page gives examples of common construction activities and potential impacts. It is not a complete listing.



Soil erosion control measures need to be installed



## ACTIVITIES AND ENVIRONMENTAL IMPACTS

Potential Impact	Activity														
	Vegetation Clearance	Earthworks	Storage of materials (stockpiles)	Storage of fuel/oil	Disposal of waste	Grading/compacting	Road sealing	Road marking and signage	Drainage works	Concrete works	Revegetation and landscaping	Weed spraying	Dredging	Pile Driving	Rail Operations
Damage to vegetation	*	*	*		*	*			*	*	*	*			*
Spread of weeds	*	*	*		*	*			*		*				*
Interrupt or modify drainage	*	*	*	*		*	*		*	*	*				*
Soil and water contamination	*	*	*	*	*	*	*	*	*	*	*	*			*
Soil erosion	*	*	*			*	*		*	*	*				*
Soil compaction	*	*				*			*	*					
Habitat disturbance	*	*	*			*			*		*	*			*
Disturbance of sites of natural or heritage significance	*	*	*			*		*	*	*			*	*	*
Litter					*			*	*	*	*	*			*
Air emissions	*	*	*			*	*	*	*	*	*	*			*
Noise disturbance	*	*				*	*	*	*	*	*		*	*	*
Fire Risk	*			*	*										*



## Obligations and Legislative Control

It is important that construction activities are undertaken in accordance with environmental legislation. Everyone on site is responsible for complying with environmental legislation.

Under the Environment Protection Act 1993 everyone has a general duty not to harm the environment by polluting.

Pollution can include soil, water, air and noise pollution.

Penalties for offences against environmental legislation are significant.

The following legislation is relevant to aspects of construction activities:

- Aboriginal Heritage Act 1988
- Agricultural and Veterinary Products (control and use) Chemicals Act 2002
- Coast Protection Act 1972
- Dangerous Substances Act 1979
- Development Act 1993
- Environment Protection Act 1993
- Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
- Fire and Emergency Services Act 2004
- Heritage Places Act 1993
- Marine Parks Act 2007
- National Parks and Wildlife Act 1972
- Native Vegetation Act 1991
- Natural Resources Management Act 2004
- Petroleum Products Regulations Act 1995
- Protection of Marine Waters (Prevention of Pollution from Ships) Act 1987

The construction site may require a licence under the Environment Protection Act if the contractor is undertaking a Prescribed Activity under Schedule 1 of the Act (including earthworks drainage, dredging and rail operations). The contractor should contact the Environment Protection Authority (EPA) for clarification of licence requirements under the Act. The license may include specific conditions such as soil erosion controls, dust and noise monitoring.

The site may also require a Water Affecting Activities Permit from the Natural Resources Management Board, if working in a watercourse.

If you are uncertain about your obligations it is important that you seek advice from your supervisor.



## Environmental Management for the Department's Construction Projects

Environmental management relates to the control of human activity which could impact upon the environment. Construction of transport infrastructure can have significant environmental impacts if not undertaken with care.

An environmental management system has been developed by the Department to minimise the environmental impact of projects. The system is outlined in the flow chart on page 10.

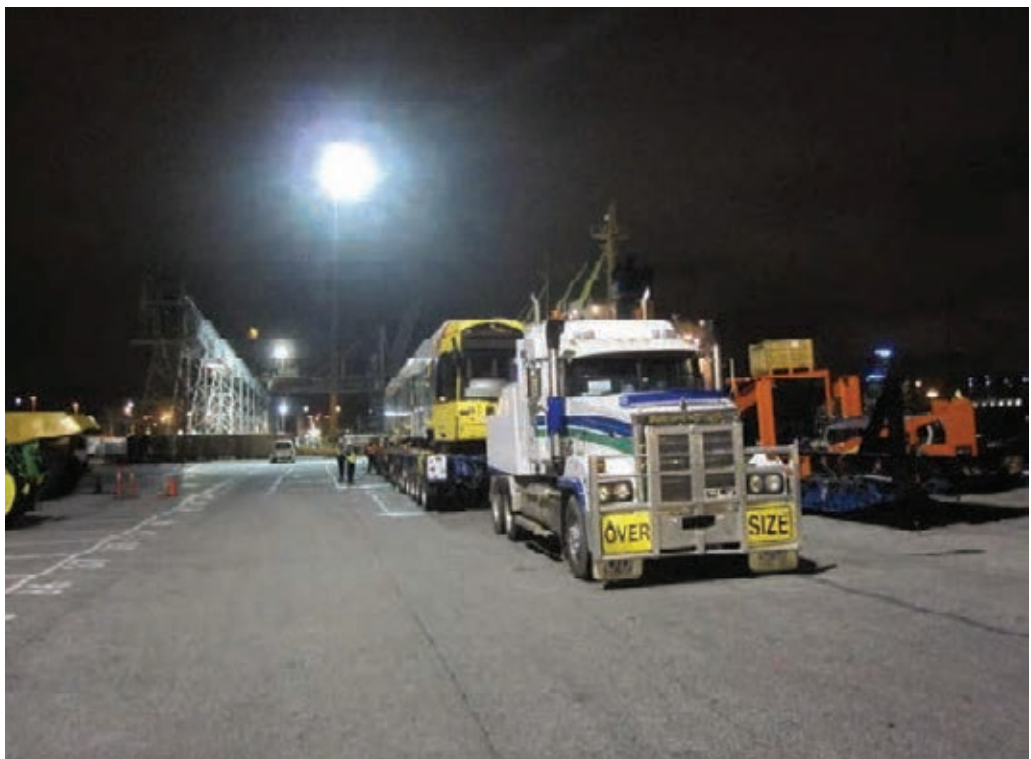
For contractors the most important elements of the system are the Contractor's Environmental Management Plan (CEMP), which describes how the environmental management requirements, identified in the Project Environmental Management Plan (PEMP) or contract documents, will be implemented and managed on site. The CEMP details how the contractor will mitigate construction impacts and documents the contractor's plans for inspecting, monitoring, auditing and correcting or improving

environmental performance on the site. This ensures potential environmental impacts are effectively managed.

Larger projects require a CEMP to address the contract specific requirements. All projects are required to comply with the contract requirements and the Department's Environmental Code of Practice for Construction - Road, Rail and Marine Facilities and legislative requirements.

It is important that you are aware of the elements within the CEMP and the Codes of Practice that are relevant to you.

An example of a CEMP schedule is included on page 9.





## EXAMPLES OF THE TYPES OF MEASURES IN A CEMP

Contract requirement	Action	Inspection/ test	Frequency	Acceptance criteria	Evidence	Responsible person
Construction of detention basin at chainage 500-1000m and operating at a minimum of 75% capacity at all times	Construct sediment detention basin prior to construction commencing and divert flow from construction site. Maintain sediment levels below 25%	Hold point prior to earthworks commencing. Physical inspection against established markers	Inspect weekly between April-August and at other times before and after rain	Basin constructed. Sediment level below 25% of basin capacity	Site inspection & entry in checklist. Site inspection & entry in checklist	Project engineer. Site supervisor.
Protect cut and fill areas from surface runoff and stabilise as soon as possible	Cut off drains to be installed. Straw bales, silt fences or erosion matting to be used to intercept flow and stabilise surfaces as required	Visual inspection	Inspect daily between April-August and at other times before and after rain	Minimal longitudinal scour marks in surface, minimal sediment in drains/pipes	Site inspection & entry in checklist. Photos may be taken.	Site supervisor.
Progressive mulching of completed areas as per construction program	Mulching of areas as approved by contract manager within 1 week of completion	Visual inspection	Inspect weekly	Nominated areas mulched	Site inspection and entry in checklist	Site supervisor.



## THE DEPARTMENT'S ENVIRONMENTAL MANAGEMENT SYSTEM

Project planning: assessment and mitigation of environmental impacts

ORGANISATIONAL RESPONSIBILITY  
THE DEPARTMENT

Environmental Code of Practice and Project Environmental Management Plan (PEMP) and Contract Documents

ORGANISATIONAL RESPONSIBILITY  
THE DEPARTMENT

Contractor's Environmental Management Plan (CEMP)

ORGANISATIONAL RESPONSIBILITY  
CONTRACTOR

Environmental inspection and monitoring

ORGANISATIONAL RESPONSIBILITY  
CONTRACTOR

Environmental auditing

ORGANISATIONAL RESPONSIBILITY  
THE DEPARTMENT and/or CONTRACTOR

## IMPORTANT STEPS TO REDUCE ENVIRONMENTAL IMPACTS

1. Walk the construction route to identify the limit of vegetation clearance, significant vegetation, 'no go' areas, locations for stockpiles, plant compounds and access roads.
2. Clearly identify the extent of the construction area and those areas to remain undisturbed.
3. Ensure machinery and equipment is clean before bringing to site.
4. Keep work and vehicles within the construction area.
5. Keep machinery and stockpiles on cleared areas.
6. Use the appropriate machinery for the task.
7. Plan vegetation removal (do not clear vegetation unnecessarily).
8. Topsoil should be stripped and stockpiled for use as soon as practicable.
9. Protect and maintain site erosion control measures, such as:
  - replacing temporary cut-off drains at the end of the day's work
  - minimise exposed soil and slopes
  - avoid damage to erosion control measures
  - replace damaged erosion control measures, including silt fences, temporary bunds and strawbales
  - ensure the works drain to the erosion/ sedimentation control structures.
10. Ensure waste is controlled and disposed of correctly.
11. Clean equipment before moving to another site.
12. If unsure about any environmental controls contact the Site Supervisor.

Outlined in points 1-12, you should walk your site to familiarise yourself with the designated stockpile site, native vegetation and other areas that are protected within your worksite. Your site's CEMP should outline your requirements onsite including 'no-go' areas.



## ENVIRONMENTAL EMERGENCY RESPONSE

Many of the recommendations in this workbook will reduce the risk of an environmental incident. However, there is always some risk that an environmental incident may occur on the project site.

Examples of environmental incidents are:

- significant spill of fuel or oil
- significant chemical spill
- severe erosion from flooding
- fire (on site or from off site)
- damage to a heritage site (Aboriginal or non-Aboriginal)
- overflow from on-site washdown areas into creeks or drainage lines
- destruction of a rare plant outside the defined construction zone.

It is important to be aware of site instruction(s) dealing with such emergencies. Prompt and effective action is likely to significantly reduce the environmental impact. Any such action should not endanger the health or safety of any of the site workers.

An emergency response plan is an essential part of the Contractor's Environmental Management Plan. If you are unaware of the emergency plan it is important to discuss it with the Site Supervisor.

Some environmental incidents such as spillages and uncovering of Aboriginal heritage sites require reporting to the appropriate authorities. The Site Supervisor should be aware of these requirements.

## OPERATOR RESPONSIBILITIES



- Ensure that you are aware of the site environmental emergency response plan.
- Locate emergency equipment that may be relevant to your responsibilities.
- Ensure that you are familiar with using emergency equipment that is relevant to your responsibilities.
- Ensure that you know whom to contact in the case of an emergency.



- Do not endanger the health and safety of yourself or others when responding to an emergency situation.



Soil contamination resulting from a washdown incident. Do not flush bitumen spray bars onto the ground.



## Vegetation management

A construction site may contain vegetation that needs to be protected. This may be urban street trees or remnant native vegetation.

Vegetation has a range of benefits including:

- biodiversity - contains a diverse range of plants and provides habitat for animals and insects
- soil stabilisation - protects soil from erosion, waterlogging and salinisation
- amenity - beautifies or enhances the character of an area, provides shade, screening or protection from wind
- heritage - may be of historical importance or protected by legislation.

Remnant native vegetation or naturally occurring local native plants includes trees, small groundcovers, native grasses, wetland plants (such as reeds and rushes) and marine plants. These plants may be located in natural scrub or may be isolated plants in a modified setting, such as urban street trees.

Native vegetation is valuable because it:

- provides habitat for native wildlife
- provides corridors to allow wildlife to move between patches of habitat
- may contain rare and endangered plants and animals
- is easier to look after than introduced vegetation (e.g. suppresses weed growth)
- has a lower fire risk than weeds
- provides a local seed source for revegetation
- maintains the depth of the water table to prevent salinity
- provides shade and shelter for adjacent farmland
- improves the appearance of the landscape
- reduces erosion
- stores carbon.

Protecting vegetation involves more than protecting trees. The smaller plants such as shrubs, grasses and herbs reduce weeds, stabilise the soil and provide habitat for animals and insects. The majority of South Australia's threatened native species are small shrubs, grasses and groundcovers. Native vegetation will require little maintenance if undisturbed, and regenerates after fire.

All vegetation plays an important role within the ecosystem. Dead trees and trees with hollows are particularly valuable as habitat for native animals and birds. Dead and decaying vegetation release plant nutrients back into the soil. Aquatic vegetation provides habitat for fish and other aquatic animals.

The re-establishment of vegetation on areas cleared or degraded during construction is important.

Relocation of tree hollows to provide shelter and nest sites for wildlife.





Examples of Native Vegetation Types (left column)  
Themeda triandra grassland,  
Acacia Shrubland, Chenopod lowland and rare species  
Cheiranthra volubilis.



Examples of Native Vegetation Types (right column) Open mallee woodland, forest and marine.





### WORKING UNDER TREES

Healthy soil contains spaces holding air and water which are essential for plant growth.

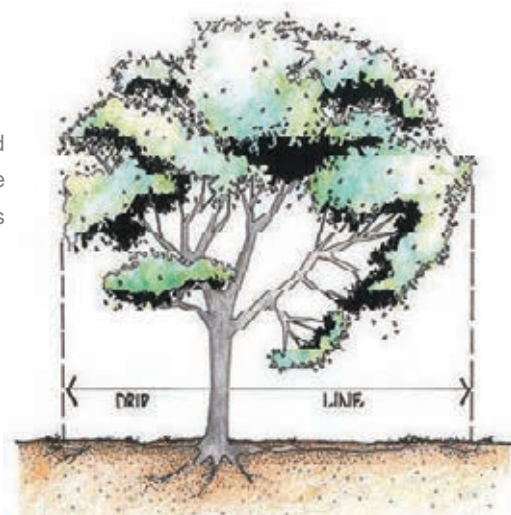
When soil is compacted, water and air can no longer travel through the soil causing oxygen starvation for plant roots, germinating seeds, and soil organisms. Soil compaction can also result in restricting the spread of plant roots and poor soil drainage.

Soil compaction can be caused by the weight of vehicles and machinery, or when materials are stockpiled on the soil surface.

To reduce the effect of soil compaction:

- keep vehicle movements to marked areas and defined access tracks
- use existing cleared land for stockpiling
- do not park machinery or vehicles under tree canopies (the 'drip-line' or 'tree protection zone').

Vehicles should not be parked under the drip line (tree protection zone) of trees



Soil compaction can be caused by the weight of vehicles and machinery, or when materials are stockpiled on the soil surface. This is an example of poor management. Stockpiles should not be located under drip lines (tree protection zone) of trees





Clean or wash down vehicles to remove weed seeds.

## WEEDS

A weed (pest plant) is a plant growing in the 'wrong' place. Declared pest plants are weeds that have been declared to be a serious threat to agriculture or biodiversity under the Natural Resources Management Act. Environmental weeds are weeds that threaten native plant communities.

Weeds cause problems such as:

- competition with agricultural plants
- poisoning of livestock
- increasing the roadside fire hazard
- blocking waterways (e.g. table drains and culverts)
- invading and displacing native vegetation.

Undisturbed native vegetation can generally resist weed invasion, but disturbance (e.g. felling trees, driving over vegetation or actions which expose the soil) will encourage weeds to become established.

### Spread of weeds

It is an offence to bring or let declared pest plants to be brought into certain control areas.

For many declared weeds, the control area extends across the whole of SA. It is also an offence to take a pest plant or any soil or vehicle carrying a pest plant (or its seeds/ bulbs) onto a public road in a control area. To make sure that no pest plants or seeds are transported in soil and vegetation caught on construction vehicles, clean vehicles before moving out of a site or into a weed free area, and cover any loads which contain weed material.

When obtaining materials from borrow pits or stockpiles, check that the material does not contain pest plants or their seeds/ bulbs. If weeds have grown on stockpiles, they should be sprayed with herbicide 10-14 days before moving the material.

All maintenance activities should be undertaken in designated hard stand areas and material disposed of at an appropriate waste facility.

### Natural Resources Management Boards

Advice on weeds in your site area can be obtained from the local Natural Resources Management Board. The local council can provide details of the relevant board for the area in which you are working.



## PLANT DISEASES

Phytophthora can easily be spread by humans, so all equipment used in an affected area must be washed, shoes should be scrubbed so that all excess soil and vegetation is removed with the phytophthora kit.



## Phytophthora

Phytophthora cinnamomi is a root rot disease that occurs in high rainfall areas. It causes the death of many of our native plants and is a threat to many agricultural crops. Since plants take up nutrients and water through their roots, root damage from this fungus will affect the growth and survival of the plants.

Spread of the disease is mainly caused by human activities including changing drainage patterns and movement of infected soil on shoes, vehicles and machinery. The fungus spreads via soil and water movement and will spread downhill along drainage lines and creeks. If plant diseases are present on your construction site, there will be detailed hygiene instructions related to earthworks and vehicle movements in the CEMP. Ensure that you are aware of any such instructions.



## KEY PRINCIPLES

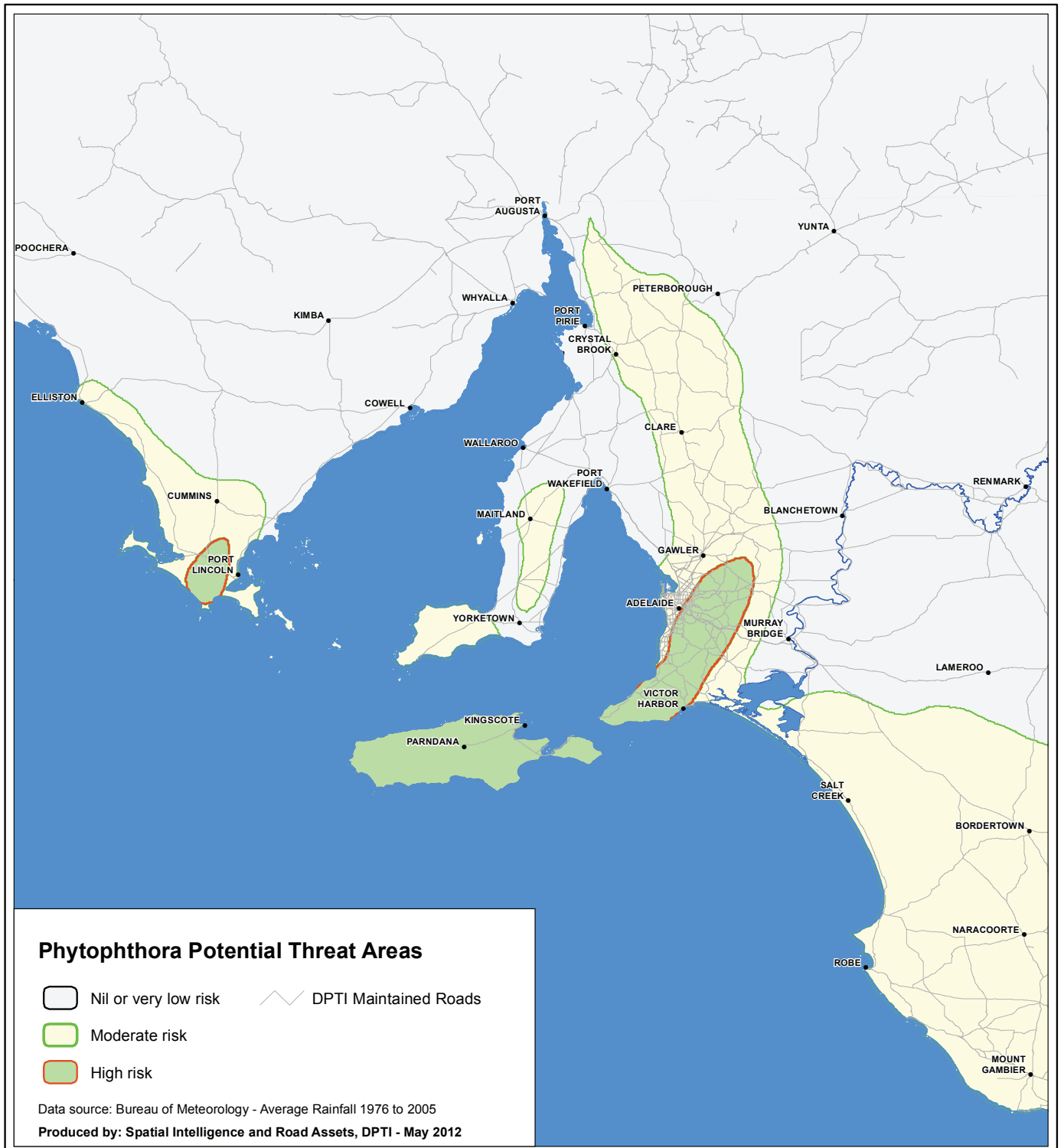
1. stay on formed areas or keep to defined access tracks
2. work in dry conditions and avoid low lying wet areas
3. always clean down before leaving known infected areas.

Phytophthora causing death of Xanthorrhoea (Grass trees) at Deep Creek Conservation Park.





## MAP OF AREAS AT RISK FROM PHYTOPHTHORA



Path: H:\environment\misc\Phytophthora.mxd



Revegetation to enhance existing vegetation



Mulch and revegetation



Hydromulching on the Adelaide – Crafers Project



Erosion matting and revegetation to control erosion and minimise weed growth



## REVEGETATION

Revegetation of disturbed areas assists in erosion control and in minimising weed growth. Topsoil is important for plant growth and, in areas of native vegetation, may be a significant seed source. Retaining and reusing topsoil will assist in landscaping the project.

When stripping topsoil maintain the soil layers in separate stockpiles and replace them in the same order as they were removed (the top 15 cm contains plant seeds, bulbs and soil microorganisms).

Wherever possible, return topsoil and mulched vegetation to approximately the same area from which it was removed.

## FIRE MANAGEMENT

Contractors should be aware of their obligations regarding fire management in their worksite. Under the Fire & Emergency Services Act, welding, gas cutting, grinding and heating bitumen are classified as a “fire”. As such they **MUST NOT** be undertaken on total fire ban days.

These activities may be undertaken at other times during the fire season (besides total fire ban days), provided that ALL FIVE conditions under Sec. 79 (2) (c) of Fire and Emergency Services Act are met:

- (i) A shield or guard of fire-resistant material is positioned around the fire to prevent the escape of sparks, hot metal or slag.
- (ii) The space immediately around and above the fire is cleared of all flammable material to a distance of at least four metres, or wetted sufficiently to prevent the spread of fire.
- (iii) A supply of water adequate to extinguish the fire is at hand.
- (iv) If any equipment is removed from the fire, the equipment is immediately placed in a fireproof receptacle.
- (v) A person who is able to control the fire is present at the site of the fire from the time it is lighted to the time it is completely extinguished

If these five conditions can not be met, the contractor must obtain a Permit from an

Authorised Officer at the local Council prior to undertaking any of these activities.

## OPERATOR RESPONSIBILITIES



### Before working

- Walk the job prior to starting any construction activities to ensure that you understand the limits of the job and to identify the location of any areas of vegetation to be protected.
- Ensure that vehicles and equipment are free from soil, weeds and seeds before coming on site.
- Take note if your site is subject to plant disease control measures. Check for areas which may have been marked by bunting to protect vegetation.
- Check with your supervisor if you are unsure about anything.



### During the work

- Minimise vegetation disturbance and protect all vegetation not identified for removal.
- Avoid the use of machinery or vehicles outside the construction zone. Use designated parking areas and plant compounds.
- Locate stockpiles and their access tracks in cleared areas away from drainage lines or good vegetation.
- Maintain bunting around protected areas.
- Store weed infested materials separately from clean materials. Clear or spray weeds before stockpiling topsoil.
- Check fill and construction materials for weeds and seeds before use.
- Control weeds from stockpiles 10-14 days before use. If material is weed infested, inform the supervisor.
- Revegetate or mulch disturbed areas, particularly batter slopes, at the earliest opportunity.



- Do not flush spray bars near vegetation or under the tree canopy.
- Do not stockpile material on vegetation, under tree canopies or against trunks.
- Do not burn vegetation prunings or removals unless there are no other options and keep fires clear of other vegetation.



### After completing the work

- Wash or brush down equipment and vehicles to remove soil and plant matter before leaving the site as this can carry weeds and soil diseases.
- Dispose of weeds and empty weed spray containers at a licensed waste depot.



## Fauna

Native vegetation provides habitat for native animals, reptiles and insects including shelter, food, protection from predators and breeding areas. The Contractor's Environmental Management Plan (CEMP) will identify any special requirements for protecting native fauna on your site.

### BACKGROUND INFORMATION

Construction sites may impact on native animal habitat and it is important to make sure that no native animals are harmed or killed during construction operations. If animals, including lizards and snakes, are found on site and are likely to be damaged by earthmoving equipment, they should be relocated to an area away from the project.

Ensure that no runoff of materials, fuels or other substances is allowed to enter stormwater drains, watercourses and the marine environment to avoid damage to aquatic and marine animals and fish.

Protect vegetation onsite as it provides habitat for fauna.

### MARINE FAUNA

Marine animals such as whales, dolphins and sea lions can become disorientated or affected by loud noise occurring underwater, from impact/vibro piling or blasting for jetties and other marine structures. If undertaking noisy activities in the marine environment, works should be programmed outside of breeding and calving seasons. Measures can be undertaken to minimise the impact of noise from pile driving activity, e.g.

- planning works outside of breeding/calving seasons
- utilising low noise piling methods, e.g. vibro piling in lieu of impact piling
- adopting a soft start procedure when commencing pile driving
- ceasing pile-driving as soon as practicable when marine mammals are observed in proximity to the works.

Piling noise can affect some marine fauna.





## OPERATOR RESPONSIBILITIES



### Before working

- Identify areas which are likely to be potential animal habitat.
- Check the CEMP or with your supervisor for any particular measures to protect fauna on your site.



### During the work

- Check for fauna before clearing vegetation. Keep out of areas of native vegetation.
- Check trenches and excavations for trapped animals.
- If native animals are found on the site, contact National Parks and Wildlife SA for removal.
- Report any injury caused to a native animal.
- Where possible, salvage hollow limbs from cleared vegetation and place in remaining trees and vegetation.
- Clear up any waste food or food containers.



- Do not disturb vegetation outside the construction zone.
- Do not disturb nests, breeding sites or young.
- Do not attempt to kill or capture snakes unless directly threatening your safety.
- Do not bring dogs or other pets to the worksite.



## Erosion and sediment control

Construction activities can contribute to erosion of soil that may impact on water quality downstream of the site and cause siltation of watercourses. Water including surface, groundwater or marine areas should not be contaminated by activities on the site.

Your site's CEMP may include a Soil Erosion and Drainage Management Plan which outlines measures to control erosion and sedimentation. In addition, compliance is required with the Stormwater Pollution Prevention Code of Practice for Local, State and Federal Government and the Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry produced by the Environment Protection Authority.

### SOIL EROSION

Soil erosion causes pollution of watercourses, loss of vegetation, impacts on aquatic fauna, decreases the aesthetic value of a watercourse and can damage the transport infrastructure. The main factors that control the rate of soil erosion are speed and the quantity of water.

The greater these factors, the greater the risk of erosion.

Your site may have both temporary and permanent measures to control erosion and manage stormwater. These measures will vary with the nature and location of the site, the seasons and the weather forecast.

### MEASURES TO REDUCE RUNOFF, EROSION & SEDIMENTATION

Where possible, measures should be established to prevent erosion and control pollution at the source.

If this is not possible, a 'treatment train' approach should be adopted which minimises the area open to erosion and uses control measures in series.

Mulch berm used to trap sediment coming from new batter. Sediment fence has caught any sediment that has passed through the mulch.



Soil embankments and pavement materials will erode if they are not protected. The best form of protection is to prevent water flowing over the site, except in designed and protected drainage lines.

#### Minimise vegetation clearance of the construction site

Staging of works and progressive mulching and seeding of exposed soils and slopes can help to reduce the area open to erosion.

#### Straw bale/sandbag barriers

Straw bale barriers and sandbags may be used across minor drainage lines to slow the movement of the water and filter runoff from areas of up to 0.5 ha. They may also be used as a temporary bank around disturbed areas preventing runoff from leaving the area without being treated. The straw bales have a short life span and therefore require regular inspection and repair or replacement. It is important to ensure that the straw bales do not contain any potential pest plants or their seeds.

#### Silt fences

Silt fences are used as temporary sediment traps and to intercept sheet flow from disturbed areas. They may also be used around the toe of stockpiles or across or at the base of embankments. It is essential that they are properly installed by burying the base in the ground, and are well maintained.

#### Silt curtains/Bubble curtains

Silt or bubble curtains are a floating barrier that can be put up around a construction site that is located by an aquatic or marine environment. They prevent sediment and silt spreading into the surrounding aquatic environment.



Straw bales can be used across minor drainage lines to slow the movement of water and sediment.



Silt fences can be used as temporary sediment traps to restrict the flow of sediment into the surrounding environment.



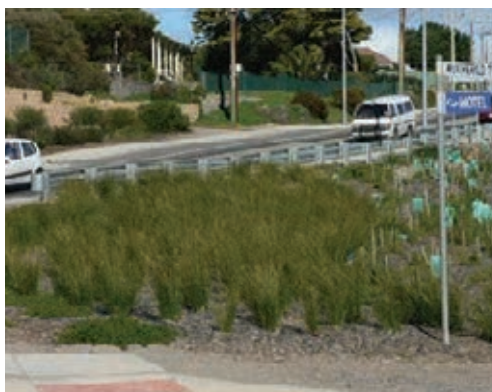
Use silt or bubble curtains to protect water bodies from silt.



Use site materials to create temporary sediment traps



Revegetation to provide a dense ground cover is a good way to reduce soil erosion from disturbed sites



Erosion matting along batter slope to prevent erosion



Install shaker ramps at site exits



### Vegetated buffers

Vegetated buffers are strips of undisturbed or established vegetation left to intercept sediment laden sheet flow of stormwater which is shallow and spread over a large area. The buffers remove silt from runoff by the filtering action of the vegetation and the slowing of runoff speed.

### Temporary bunds

Temporary bunds can be created from material on site. Ensure that temporary drains are reconstructed at the end of each working day so drainage is directed into the sediment detention basins.

### Batter roughening

Avoid smooth trimming, or vertical grooving down the slope of batters as these are highly vulnerable to erosion. The final trim should produce a roughened batter surface which will slow water runoff and trap seed.

### Revegetation

Revegetation to provide a dense ground cover is a good way to reduce soil erosion from disturbed sites, although it cannot provide protection for unstable soil because of its structure, texture or slope. Progressively revegetate the construction site where possible.

Consider erosion control matting or hydromulch on steep slopes to protect them until the vegetation cover is fully established.

Mulch with brush matting or chipped vegetation from the site.

### Temporary construction exit

Site exits should be regularly checked for sediment build-up.

This should be controlled by regular sweeping, a 'cattle grid' type shaker or washdown bay. Exit pads should drain to a sediment trap or basin.



### Collection of wastewater

Wastewater from site activities such as concrete or bitumen cutting, drilling or excavation should not be allowed to pollute stormwater. For example, use a vacuum pump to collect wastewater.

Discharging more than 100 kL of sediment-laden water is an activity of environmental significance and may require environmental authorisation under the Environmental Protection Act.

### Maintenance

All erosion and sediment control structures will require regular inspection and periodic maintenance and/or replacement. Sediment

removed from the structures during maintenance operations must not be allowed to remobilise and move from the site.



Do not allow wastewater from cement or bitumen cutting to enter stormwater drains.

## OPERATOR RESPONSIBILITIES



### Before working

- Check your project Soil Erosion and Drainage Management Plan and CEMP.



### During the work

- Use a treatment train approach to minimise soil erosion.
- Control erosion of stockpiles, batters and disturbed areas by control devices. Keep stockpiles away from drainage lines.
- Revegetate or stabilise exposed areas or batter slopes as soon as possible after final shaping.
- Settle out sediment before pumping water into drainage lines. Restrict traffic to defined access tracks and limit to construction areas.
- Always check the worksite prior to and during rain or when leaving the site for several days to ensure the erosion control measures are effective.
- Maintain erosion and sediment control structures. Clean out and replace as needed.
- Cut turn-out drains along the contour rather than directly down the slope, as cutting down the slope increases the concentration and speed of the water flow.
- Prevent wastewaters entering drainage lines
- Prevent sediment loads entering the surrounding marine environment



- Do not place drain spoil and turn-out material into vegetation.



### After completing the work

- Ensure soil erosion and drainage measures are in place.



## Watercourses and marine environments

Coastal and riverine environments are very active and constantly changing environments subject to erosion from the direct impact of wind and water.

These areas are sensitive to disturbance and pollution and are easily disturbed by human activity such as:

- vehicle movement
- pedestrian traffic
- fires
- removal of vegetation
- material placement
- wastes and pollution
- disturbance of the river or marine bed
- removal of material including dredging.

These areas are likely to contain cultural heritage sites, water resources, vegetation and important fauna habitat, including for threatened species, which should be protected. In these areas (and particularly in sand dunes), it is critical to protect

and maintain the cover of vegetation. A single vehicle movement across the top of a sand dune can break the vegetation cover enough to provide the starting point for a major 'blow-out', of the dune. This will then expose the area behind the dune to the unsheltered force of the wind. Where possible consider alternative routes or construction of elevated walk way platforms. If these areas must be disturbed, then temporary stabilisation methods must be used.

These methods include:

- sand trap fencing
- brush layering/mulching
- spray on stabilisers (e.g. hydromulch)
- walkways and boardwalks
- matting or mesh laid over traffic areas
- sand bagging/gabions.

Silt curtain reduces spread of sediment.



Access roads across watercourses should be perpendicular to the flow and stabilised to reduce the risk of erosion. Any interruption to the flow within watercourses needs careful planning and should be included in the CEMP.

Dredging of material may require licensing by the Environment Protection Authority. Such licenses often contain conditions that need to be applied during the work.

Modifying or working within a watercourse may require a water affecting activity permit from the Natural Resources Management Board.

Working above water, such as bridge work, requires special attention to reduce the risk of pollution. This includes the use of containment areas (bunds) to contain spills and tarpaulins or screens etc under the worksite to retain fallen material.

### ACID SULFATE SOILS MANAGEMENT

Acid sulfate soils are naturally occurring soil containing iron sulphides. They can occur in low-lying coastal areas and some inland aquatic

ecosystems in South Australia. Transport infrastructure works, drainage works and dredging can disturb these soils. When these soils are disturbed and exposed to air, oxidation occurs and sulfuric acid is produced. If this sulfuric acid drains into waterways it can have severe environmental impacts including killing of fish and other aquatic species and human and animal health impacts. Acid sulfate soils can corrode built structures such as bridges and culverts.

If acid sulfate soils are present on your worksite you should avoid disturbing these sites. If soil disturbance cannot be avoided additional measures may be required to prevent the release of sulfuric acid leachate. Options include minimising the amount of time that acid sulfate soils are exposed to air, covering the soil with clean fill to prevent exposure to air or neutralising the soil with lime to avoid the release of sulfuric acid leachate. Ask your supervisor if acid sulfate soil is present on your work site and the responsibilities you have to prevent damage to aquatic environments.

## OPERATOR RESPONSIBILITIES



- Keep to defined access tracks.
- Maintain stabilisation measures (e.g. silt fences, matting). Ensure no activities pollute the aquatic environment.
- If excavating, watch for Aboriginal sites such as middens, hearths and burial sites and stop work if found.
- Use containment bunds when working over water to reduce the risk of spillage causing pollution.
- Use tarpaulins or screens when working over water to contain fallen material.
- Equipment should be refuelled and replenished with hydraulic fluid on a hardstand area away from water. If this is not feasible, ensure that only the minimum quantity of fuel is kept on site, the containers are fully bunded, equipment is well-maintained, appropriate size funnels are used when transferring liquid, and there is a marine spill kit on site.
- Minimise the disturbance of acid sulfate soils on your worksite to prevent the release of acid leachate.



## Heritage

A large number of historical sites and areas have been identified throughout South Australia. These are listed in the national, State and local heritage registers.

### ABORIGINAL HERITAGE

It is important that Aboriginal cultural heritage sites are conserved wherever possible.

Examples of Aboriginal heritage sites include:

- scarred trees
- sacred sites
- burial sites
- stone artefacts
- shell middens
- rock art.

These sites show evidence of Aboriginal use of the land, their history, culture and traditions. For many Aboriginal people these sites are tangible links with their culture, confirming their relationship to the land. The Department will have arranged for an Aboriginal Survey of the project area and sites will be identified and documented in the CEMP. Sites should be protected from damage or disturbance.

### NON-ABORIGINAL HERITAGE

South Australia's heritage sites help maintain our cultural identity and document the State's development from the initial period of European settlement.

Examples of heritage sites and items include:

- heritage buildings
- stone walls
- monuments and memorials
- burial sites and cemeteries
- artefacts and objects
- industrial and mining structures
- historic bridges
- vegetation and trees
- geological features
- shipwrecks and navigation aids.

Sites of known significance within the construction zone will be identified in the CEMP and should be clearly bunted as 'no go' areas.

Canoe tree beside the  
Blanchetown Bridge



Glen Osmond Toll House built  
1841. State Heritage Register.





Blackwood railway station.  
Local heritage register.

## OPERATOR RESPONSIBILITIES



### Before working

- Check the CEMP and with the supervisor, to determine if there are any cultural and natural heritage sites in or near your work area before starting work.
- Check for areas which have been bunted off as 'no go' areas to protect identified heritage sites.
- Consider likely vibration impacts on sensitive or fragile structures and plan works to minimise impacts (see section 3)



### During the work

- If, during construction, an Aboriginal heritage or burial site is discovered, stop work IMMEDIATELY and notify the Site Supervisor. Do not recommence work near the site until the Department's Project Manager has given approval.
- Keep vehicles and plant away from 'no go' areas.
- Maintain bunting around 'no go' areas.



## Noise and vibration

Construction noise and vibration can cause nuisance and structural damage. It is important that the noise and vibration impact adjacent to sensitive land uses is minimised and meets guidelines provided in the CEMP.

### NOISE

Excessive noise can be a considerable nuisance to neighbours. It is important to minimise noise emissions, particularly outside normal operating hours and in areas adjacent to sensitive land uses such as residential areas, hospitals and schools etc.

If night works are required (i.e. works outside of normal construction hours: 7am - 7pm on Monday - Saturday; 9am - 7pm Sunday and public holidays) contractors are required to follow the Department's Operational Instruction 21.7 – Management of Noise and Vibration: Construction and Maintenance Activities.

Depending on the level of works, a night works management plan may need to be submitted for approval, and advance notification provided to affected residents/businesses. Strong justification is required to undertake night works in areas where sensitive receivers (e.g. residents, hospitals) may be affected.

### VIBRATION

Excessive vibration may cause property damage and be a nuisance to neighbours. Vibration may be due to blasting, piling, truck movements and compacting operations. Care should be taken when working close to residential and sensitive land uses.



Heritage structures are particularly sensitive to vibration impacts and care must be taken when working in close proximity to such

structures. Monitoring vibration levels or undertaking dilapidation surveys before and after construction are two possible risk management measures.

## OPERATOR RESPONSIBILITIES



- Select the quietest available equipment and maintain noise reducing equipment (e.g. mufflers).
- Use broadband reversing beepers during night works to minimise disturbance and complaints.
- Locate stationary noise sources distant from sensitive areas.
- Notify neighbours prior to operating noisy equipment outside of normal operating hours.
- Select delivery and off-site haul routes to reduce impact on sensitive receptors.
- Plan low impact blasts.
- Notify neighbours of blasting and piling operations in advance. Secure blast areas.
- Monitor noise and vibration levels in sensitive areas.
- Consider undertaking dilapidation surveys of nearby structures prior to commencing activities with high vibration levels (particularly important when working in close proximity to heritage structures).
- Comply with the Department's Operational Instruction 21.7 Management of Noise and Vibration: Construction and Maintenance Activities.
- Obtain approval to conduct night works before commencing work.



- Do not undertake blasting outside of normal operating hours.



## Air quality

Construction activities can lead to dust emissions from traffic, cleared areas, stockpiles, and blasting. Dust can cause a nuisance to neighbours and impact on the environment by contaminating plants and watercourses.

Other air emissions are related to the exhaust fumes of equipment. These emissions are

generally controlled by ensuring that equipment is well maintained.

To minimise dust emissions  
water down the site with  
water trucks



### OPERATOR RESPONSIBILITIES



- Stay on defined roads.
- Seal or water down dusty surfaces, as required. Control dust from stockpiles. Consider using polymer coating dust suppressants.
- Spray construction materials before transport or cover loads.
- Minimise disturbed areas, particularly during summer. Revegetate areas as soon as practicable.
- Clean equipment before leaving the site.
- Sweep or remove sediment from paved or sealed areas regularly.
- Maintain equipment (e.g. tuning of engines) to reduce exhaust emissions.
- Consider use of recycled water for dust control.



- Do not track sediment on vehicles off site.
- Avoid blasting or earthworks on windy days.





## Waste Management and Contaminated Material

Minimise the production of waste and stockpile wastes separately to assist the recycling and reuse.

The disposal of construction wastes should follow these principles:

- minimise the production of wastes
- maximise the reuse and recycling of wastes
- dispose of wastes in an environmentally responsible manner.

### WASTE MINIMISATION

Waste can be avoided by good planning. Waste packaging may be reduced by selecting different products or returning the packaging to the supplier.

Waste in the form of contaminated soil can be avoided by careful use of substances such as fuels, chemicals, concrete wastes on site to ensure that the soil is not contaminated by spillages and leaks caused by poor practices.

### RECYCLING

Where possible, recycle excess materials including surplus soils, concrete, steel and timber rail sleepers, etc. Higher levels of recycling will be achieved if suitable bins/ designated stockpiles can be used to enable separation of different wastes.





Wrap contaminated rail sleepers during storage, transport and disposal.



Note that surplus material can be re-used within the same project site without the need for sampling and classification, unless known to be contaminated, in which case, material should be sampled and re-used only in suitable locations identified by the contamination consultant. If transporting material that is known to be contaminated you may need to use Environment Protection Authority (EPA) Licensed waste contractor and provide EPA Waste Tracking forms.

### RECYCLING OF SURPLUS SOILS

While the re-use of surplus soil in the Department's projects is encouraged, moving soil around the network involves a risk of spreading contamination. It is an offence to deposit waste (including unclassified surplus soil) on land in a manner that may result in environmental harm (EPA Waste to Resources Policy 2010, Clause 10).

Surplus fill should not be moved offsite, or given to private landowners or local Councils unless it has first been sampled and classified. Once the material has been classified by an environmental consultant, if it meets 'Waste Fill' criteria (the safest level) it may be re-used without any restrictions. If it exceeds these criteria, a site contamination auditor will need to advise whether it may be re-used and what controls are necessary.

Ensure that soil waste is disposed of at a licensed waste facility, or the site outlined in your CEMP. If unsure consult with your site manager.



### RECYCLING OF RAIL WASTE MATERIALS

Rail ballast and sleepers can be recycled. However, material from rail corridors may be contaminated with:

- metals (predominantly arsenic);
- lead
- hydrocarbons
- asbestos (occasionally).

All material leaving rail corridors must be tested by a suitably qualified consultant for waste disposal or appropriateness for re-use.

### LISTED OR HAZARDOUS WASTES

Certain wastes, called listed wastes (Environment Protection Act) need to be disposed of by licensed waste contractors. Common listed wastes include waste oil, acids, dangerous substances, paint sludge and residues, etc.

Treat any paints, sprays or other chemicals as hazardous wastes.

All listed or hazardous wastes should be collected and disposed of by a licensed waste contractor to a licensed waste depot.

### ASBESTOS MANAGEMENT AND DISPOSAL

Asbestos removal must be performed by a licensed asbestos removal contractor, and any waste containing asbestos must be disposed of at a waste facility licensed by the EPA to accept asbestos waste.

### LEAD PAINT MANAGEMENT AND DISPOSAL

Any lead based paint removal must be undertaken in accordance with Australian

Standard 4361.1 Guide to lead paint management Part 1: industrial applications (1995). This sets out the requirements for proper collection, handling and disposal of lead waste, as well as monitoring for potential contamination. Any re-useable equipment or materials should be properly cleansed of lead dust prior to removal from the project site.



Encapsulation of the Port Adelaide rail bridge during lead paint removal

## OPERATOR RESPONSIBILITIES



- Separate waste products for recycling, where appropriate.
- Label wastes, particularly liquid waste in drums.
- Use materials carefully and sparingly to reduce consumption and costs.
- Ensure that machinery is not leaking oil.
- Flush spray equipment (bar and hand units) into containers and reuse or dispose of to a licensed waste depot.
- Reuse materials on site, if possible.
- Get the job right first time (e.g. avoid contamination of soil). Contain any spillage or leakage to minimise volume of soil contaminated.
- Clean up contaminated soil as soon as practicable.
- Follow appropriate standards and guidelines when handling hazardous materials, and use a licensed waste contractor to dispose of hazardous wastes.
- Ensure that waste soil has been sampled and classified prior to being taken off site.
- Let your supervisor know immediately if you come across soil that looks or smells like it is contaminated.



- Do not take wrappings and packaging into the field.
- Do not bury wastes on-site.



## Materials Storage

Stockpiles and depot sites, if not located carefully, can damage vegetation and heritage sites, pollute watercourses or spread weeds. The location of stockpiles, plant compounds and access roads may be specified in the CEMP for your site.

### STOCKPILES

#### Selecting a site

Before creating a stockpile or depot, check with your supervisor if the location is suitable, away from significant environmental features and is weed-free.

Stockpiling material at a site that is different to the site where material was generated or the site where it will be used may require a licence under the Environment Protection Act.

Surrounding vegetation is damaged by the 'creep' of materials, i.e. if stockpiles are gradually pushed outwards by machinery loading from one side only. Stockpiles are therefore most effectively worked if placed in the middle of the area available.

Access to surrounding vegetation should be prevented by marking or fencing of the stockpile area.

To reduce the risk of sediment movement, stockpiles should not be located in drainage lines.

Place stockpiles away from watercourses and vegetation





Poor storage of materials

### Stockpiling topsoil

The top 15 cm of topsoil is the most important for plant growth. Contained within this layer are native seeds for revegetation, essential minerals for plant growth, and soil microorganisms that break down decaying organic matter to simple minerals which can be used by plants.

When clearing topsoil it is important not to mix it with poorer quality subsoil.

Most native plant seeds will remain viable in the soil for approximately 12 months. Therefore it should be re-spread or reused within that time. The stockpiles and site should be weed-free. Spray weeds on and around stockpiles and dumpsites to prevent spread of weeds to new areas (plan to treat with herbicide 10-14 days before use).

Weedy topsoil (e.g. spoil containing pasture grasses or weeds) should be stockpiled separately from clean topsoil and away from land which has native vegetation.

### Rehabilitation of stockpiles and other areas

To rehabilitate a stockpile area:

- remove excess material
- remove or treat weeds
- restore contours to blend with surrounding land
- rip parallel to the contours to break soil compaction
- re-spread topsoil and tyne into base material
- install erosion control measures, if needed
- spread mulch to protect the soil from erosion and keep in soil moisture
- revegetate the area with native species, where appropriate.



Ensure that hazardous materials are controlled



### FUELS, OILS AND CHEMICALS

Storage and handling of fuels, oils and chemicals should be undertaken in a manner that does not contaminate soil, watercourses and groundwater. The risk of spillage and leakage can be reduced by careful handling and attention to containment. Clean-up materials such as absorbent granules and disposable absorbent fabric sheets should be available to reduce the spread of material.

Storage (including drums and bulk tanks) of fuels, oils and chemicals should have an impervious base and be bunded. Bunding of fuels should be designed in accordance with the Australian Standard AS 1944: The storage and handling of flammable and combustible liquids. The 'compound' within the bund walls should be large enough to contain at least 110% of the contents of the largest tank. Stormwater

from the compound must be removed regularly to ensure there is room to accommodate any spillage or leakage.

Any oily water mixture must be removed by a licensed waste contractor.

Large loading and dispensing areas should also be sealed and drain to a sump to retain any spillage. Any spillage should be cleaned up at the earliest opportunity to minimise the risk of further soil or water contamination. Contaminated clean-up materials (e.g. rags) should be disposed of by a licensed waste contractor.

Some storages may require licensing under the Dangerous Substances Act or the Petroleum Products Regulations Act.

## OPERATOR RESPONSIBILITIES



### Stockpiles

- Use only designated and approved stockpile sites.
- Keep stockpiles in the middle of the marked site to allow access from several directions to avoid 'creep' into the surrounding area.
- Stockpile topsoil separately to ensure the survival of seeds and wherever possible reuse within twelve months.
- Keep machinery movement areas and stockpiles on cleared land away from vegetation.
- If cleared areas are not available on the site, consider using cleared areas on adjoining land, subject to permission.
- Temporary works such as stockpiles may be sown with grasses (e.g. sterile rye) to avoid erosion. Mulches, matting, diversion swales, straw bale fences, silt fences, or other techniques can be used to protect watercourses from silt-laden runoff from stockpiles.



### Fuel and chemical storage

- Store all fuels, oils and chemicals within sealed and bunded areas.
- Ensure that bunds are regularly cleared of stormwater. Oily water mixtures must be removed by licensed waste contractor.
- Dispense fuels and oils within a sealed area, if possible.
- Clean up any spillage as soon as practicable.
- All clean-up material must be disposed of by a licensed waste contractor.



## Appendix A: Contact List

### THE MOST IMPORTANT CONTACTS

1. Site Supervisor
2. Superintendent's representative
3. Project manager

### OTHER CONTACTS

ISSUES	CONTACT
Project Environmental Management Plan	Department of Planning, Transport & Infrastructure Project Manager
Site licensing, waste disposal, reporting pollution incidents	Environment Protection Authority (EPA) Telephone (08) 8204 2004
Removal of native fauna	National Parks and Wildlife Service SA Telephone (08) 8204 9000
Injured fauna	Fauna Rescue Telephone (08) 8289 0896  RSPCA Telephone (08) 8231 6931 After hours emergency (08) 8202 8196
Advice on Aboriginal heritage sites, reporting discovery of Aboriginal heritage sites	Aboriginal Affairs and Reconciliation Division, Department of Premier and Cabinet Telephone (08) 8226 8900
Advice on non-Aboriginal heritage	Heritage Branch, Department of Environment and Natural Resources Telephone (08) 8124 4960
Storage of fuels and chemicals	SafeWork SA Telephone 1300 365 255  Regulation and Compliance Division Environment Protection Authority Telephone (08) 8204 2019  Dangerous Substances/Petroleum Products Licensing Telephone (08) 8303 0400
Advice on weed or pest plant and animal management and water affecting activities	Natural Resources Management Boards Website <a href="http://www.nrm.sa.gov.au">http://www.nrm.sa.gov.au</a>



Disposal of waste to sewer	SA Water Trade Waste Enquiries Telephone (08) 7427 1336 Emergency 0439 888 164 (24 hours)
Fire restrictions and bushfire protection	<p>Country Fire Service Emergency: 000 Telephone (08) 8463 4200 (Head Office) Telephone 1300 362 361 (bushfire information hotline)</p> <p>Metropolitan Fire Service Emergency: 000 Telephone (08) 8204 3600 (Head Office) Telephone 1300 737 637 (country callers)</p>
Marine Oil Spills	<p>State Marine Controller State Oil Spill Commander Office (08) 8 341 5025 After Hours (08) 8248 4925 Radio Channel 12</p> <p>Harbor Master (08) 8248 3505</p>



## Appendix B: Environmental Terms

### Aboriginal heritage

Land, sites or objects which are important to Aboriginal culture and history. Under the Aboriginal Heritage Act it is an offence to damage these sites.

### Batter

The face of an embankment.

### Biodiversity

The variety of biological organisms (plants, animals and microorganisms).

### Bund

Raised bank or barrier to prevent the escape of liquids (including stormwater).

### Catchment

The area of a natural drainage basin on which rainfall lands, collects and drains by means of overland or sub-soil flow into a stream system.

### Contractor's Activity Zone

Area directly impacted by construction activities, including site office, stockpiles areas and vehicle parking areas.

### Contractor's Environmental Management Plan (CEMP)

The Contractor's Environmental Management Plan, produced by the contractor, responds to the Project Environmental Management Plan (PEMP) and details how the environmental aspects of the project will be managed on the site.

### Declared plants

Plants declared a pest to agriculture under the Natural Resources Management Act.

### Drainage line

Flow path for runoff water.

### Dredging

Removal of underwater sediments (usually by excavation or suction) for a specific purpose including, for example; maintaining, enlarging, deepening or creating a navigable channel; trenching for pipes, or cables; or removal of unsuitable or unwanted materials.

### Drip line

See Tree Protection Zone.

### Ecosystem

A number of living and non-living things which occur naturally and interact with each other in ways which form a stable system.

### Emergency incident

A sudden or unexpected event which needs quick action to repair or minimise the loss or damage which might result.

### Environment

Living things, their physical, biological and social surroundings and the interactions between all of these.

### Environmental management

Managing all human activity which could impact on the environment.

### Erosion

Removal and transport of soil and rock materials from their original location by agents such as wind or water.

### Erosion control

Use of structures, materials and practices to reduce or prevent the unwanted removal and transport of soil or rock particles.

### Fauna

Animals-including reptiles, birds, insects, etc.

### Flora

Any species of plant including trees, shrubs and grasses.

**Hazardous Material**

Any solid, liquid or gaseous substance that is harmful to plant, animal or human life.

**Heritage**

Structures, features and objects which are worth protecting because they have particular natural, cultural, historic or aesthetic value.

**Native vegetation**

Vegetation that is indigenous to the area and has not been planted.

**Noise pollution**

Unwanted noise from human activity which has a negative effect on some aspect of the environment. Sound that a listener does not wish to hear. Generally, a sound level in excess of background noise.

**Pest animals**

Introduced animals that adversely affect native fauna or flora and/or agricultural produce.

**Pest plants/weeds**

Introduced plants that adversely affect native vegetation and/or agricultural crops.

**Phytophthora cinnamomi (P.cinnamomi)**

A soil fungus which affects the roots of plants and is easily transported in soil or mud on machinery. It leads to die-back and death of infected vegetation.

**Project Environmental Management Plan (PEMP)**

The Project Environmental Management Plan, prepared by the Department, is a project-specific document that details environmental issues and requirements for a particular project. (Sometimes these requirements are contained in the specification rather than a separate PEMP).

**Risk**

The likelihood that an event will cause an adverse outcome for a person, a group or the environment.

**Runoff**

Water flowing on or near the soil surface away from where it was initially deposited as rain, hail or snow.

**Sediment**

Soil and other particles which drop from the water in which they were suspended or transported.

**Sediment trap**

A structure to remove sediment from water by filtration or slowing and reducing its carrying ability.

**Spill**

The accidental or unintended release of any material that has the potential to harm the environment or human health.

**Stockpile**

Material stored for use in, or associated with a project. It may include aggregate, gravel, road base, topsoil, overburden, mulch, etc.

**Tree Protection Zone**

The ground surface around the tree within the edge of the tree canopy or "drip line" where droplets from the leaves fall to the ground.

**Waste**

Unwanted, excess or unusable materials. It can be a solid, liquid or gas. Any matter (whether of value or not) discarded or left over in the course of activities, including excavated material not classified as clean fill.

