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RAIL INDUSTRY SAFETY AND STANDARDS BOARD
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Environmental Management in Rail Construction

CODE OF PRACTICE

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Document control

Document identification

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Code Change Procedures

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Contents

1 Background

1.1 Purpose and scope

The purpose of this Code of Practice (CoP) is to assist organisations involved in rail construction to:

- meet their environmental obligations, improve environmental performance outcomes and promote consistency across the rail construction industry;
- set environmental performance expectations for their own organisations and for stakeholders and contractors that may be involved in their project; and
- minimise impacts to the local natural and built environments and restore areas to leave a positive legacy.

The scope of the CoP covers all construction activities associated with:

- new railway systems including extensions to an existing system;
- the operation of existing railway systems where replacement or upgrade of system components are required to:
  - ensure the ongoing safety and operational effectiveness of the system; and
  - enhance the functionality and performance of the system.

In the absence of a CoP for maintenance activities, this CoP may be used by railway operators as an interim CoP.

This document does not cover sustainability or sustainable design.

1.2 Application

Typical construction activities covered by this CoP are provided in Figure 1. These activities apply to both construction and operational phases.

Figure 1 – Typical Construction activities for new and operational railways

1.3 Terms and definitions

Consent authority: this will depend on the project size, impacts and location but can be the government planning authority, statutory authority, land owner or the project proponent.

Ecosystem: Aquatic or terrestrial communities made up of living organisms and nonliving components such as air, water, and land.

Site shutdown: The temporary shutdown of construction activities at the site over extended durations such as Easter, Christmas and other holiday periods.

Groundwater dependant ecosystem: An ecosystem, including aquatic, riparian and terrestrial components that is intrinsically linked to an underground aquifer.

1.4 References

References applicable to this code of practice are presented in Table 1:

Environmental Issue	Reference
Air	National Environment Protection (Ambient Air Quality) Measure (NEPM) 2003. AS/NZS 3580.10.1: Methods for sampling and analysis of ambient air: Method 10.1: Determination of particulate matter – deposited matter – gravimetric method. Product Emissions Standards Act (No. 104) 2017.
Acid sulfate soils	Refer to individual state or territory for environmental agency guidelines.
Asbestos & hazardous materials	Refer to individual state or territory for environment protection and safety legislation and guidelines.
Biodiversity	Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act) – Matters of National Environmental Significance (MNES) For reference to anything other than MNES refer to individual state or territory for environment protection and safety legislation and guidelines.
Biosecurity	Biosecurity Regulation 2016 (made under the Biosecurity Act 2015). Biosecurity (Human Health) Regulation 2016 (made under the Biosecurity Act 2015).
Blasting	AS 2187.2 Explosives – Storage, transport and use.
Construction environmental management plan (CEMP)	Refer to individual state or territory for environment protection and safety legislation and guidelines.
Chemical and fuel storage	AS 1940-2004 (Storage and handling of combustible material).
Contaminated Land	National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM) 2013. ISO 15175 Soil quality – Characterisation of soil related to groundwater protection (Australian Standards).
CPTED	Crime Prevention Through Environmental Design.
Cultural and aboriginal heritage	Refer to individual state and territory cultural heritage legislation.
Dangerous goods	Australian Code for the Transport of Dangerous Goods by Road & Rail Edition 7.6, 2018.

Environmental Issue	Reference
Hazardous waste	Hazardous Waste (Regulation of Exports and Imports) Act 1989. Hazardous Waste (Regulation of Exports and Imports) Regulations 1996.
Cultural and aboriginal heritage	Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act). Burra Charter 2013. Guidelines for the assessment of places for the National Heritage List (Australian Heritage Council based on the EPBC Act).
Noise and vibration	AS 2436 Guide to noise and vibration control on construction, demolition and maintenance sites (Australian Standards). AS 1055.1 Australian Standard Acoustics—Description and measurement of environmental noise. BS 5228.2 “Code of practice for noise and vibration control on construction and open sites. BS7385: Part 2: Evaluation and Measurement for vibration in Buildings: Guide to damage levels from ground-borne vibration. AS 2436 Guide to noise and vibration control on construction, demolition and maintenance sites (Australian Standards). AS 2670.2 “Evaluation of human exposure to whole-body vibration – Continuous and shock induced vibration in buildings (1 to 80 Hz).
Risk management	AS 4360 “Risk Management”.
Sustainability	Infrastructure Sustainability Council of Australia (ISCA) guidelines 2012.
Spoil / waste soil	Refer to individual state or territory for environment protection legislation and guidelines. If soil is proposed to be reused onsite, then refer to individual state or territory legislation and guidelines. Applicable land owner guidelines and procedures also to be sourced and implemented.
Visual impacts	The Guidelines for Landscape and Visual Impact Assessment, Third Edition (The Landscape Institute and the Institute of Environmental Management and Assessment, UK, 2013) and previous Second Edition (2002). AS 4282 Control of the Obtrusive Effects of Outdoor Lighting.
Water	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000), Australian and New Zealand Environment and Conservation Council (ANZECC). AS/NZS 5667.11 Water quality – Sampling – Guidance on sampling of groundwaters (Australian Standards). National Environment Protection (Assessment of Site Contamination) Measures (NEPM) 2013.

Table 1 – References

2 Environmental management framework

2.1 Environmental management system

Any organisation undertaking railway construction should have an environmental management system (EMS). EMS elements may include management plans, procedures and protocols, checklists, training and awareness programs. The EMS should be appropriate to the scale, nature and impacts of the construction activities. Any documents incorporated into the EMS need to be concise and practical for the intended user, (construction contractors, subcontractors and workforce).

Depending on the environmental issues, risks and client requirements, the EMS may need to be certified or consistent with to the international standard (AS/NZS ISO 14001). The EMS may also form part of a broader integrated management system, which can cover other aspects including safety and quality. Ensuring the head contractor's EMS is certified is considered best industry practice.

The head contractor may require subcontractors to have their own EMS that is consistent with head contractor's and /or client's EMS.

Key elements of the EMS are leadership, roles and responsibilities, planning, competency and training, legal compliance, incident and emergency response, environmental monitoring, operational control and performance evaluation.

A full description of the requirements of an EMS is described in the Australian/New Zealand Standard – Environmental Management Systems – AS/NZS ISO 14001:2016.

2.2 Environmental impact assessment

All railway projects are subject to some form of an environmental impact assessment (EIA). The level of assessment will depend on a range of aspects including:

- the scale and nature of likely impacts; and
- where the project is located (each state and territory has its own EIA legislation and in some instances commonwealth legislation and local planning laws can also apply).

The EIA process will vary in each state and will depend on the significance of environmental impact. For major projects this may be a comprehensive environmental impact statement or for smaller projects, this may be a review of environmental factors. Although this process will vary in timeframes depending on the state and type of EIA required additional time will be required to allow for the EIA approval process. This additional time should therefore be accounted for in the project program.

When constructing projects, the key issues that require active management are:

- compliance with the conditions of any applicable approval (provided by the consent authority);
- any commitments made by the project proponent to the regulatory authority; and

- ensuring all construction activities are consistent with the conditions of approval, applicable regulations and are in accordance with the EIA and related documentation.

Where construction activities are proposed to differ from the EIA and conditions of approval, further assessment will be required. Where construction activities are inconsistent, further environmental assessment and supplementary approvals may be required to allow the construction activity to proceed.

2.3 Environmental risk assessment

A risk management approach must be used to determine the severity and likelihood of a project's environmental risk, so its significance can be prioritised. Environmental risk assessments should consider potential regulatory and legal risks as well as taking into consideration the concerns of community and other key stakeholders.

The objectives of risk assessment are to:

- identify activities, events or outcomes that have the potential to adversely affect the local environment and/or human health/property;
- qualitatively evaluate and categorise each risk item; and
- assess whether risk issues can be managed by environmental protection measures.

The environmental risk assessment is to be completed by the Environmental Manager (or delegate) who is aware of the activities and risks associated with the project being undertaken. Similarly, they will undertake a regular review process of this document, or when triggered to do so by the introduction of new activities on site, variation in working hours and any incidents.

AS/NZS 4360:1999, the Australian standard for risk assessments provides a useful framework for undertaking risk assessments.

2.4 Design

The design of a railway system can have a substantial influence on the construction impacts and an integrated approach to the design and construction process will result in improved environmental outcomes. Areas where design can influence construction are:

- the alignment of the railway, where practicable, to avoid environmentally sensitive areas during the construction phase;
- consideration of mitigation treatments (such as noise amelioration and drainage) that may be installed as early as possible during the construction phase to minimise impacts. Early assessment of operational environmental impacts can assist the early identification of operational measures that may be installed early for improved environmental outcomes during the construction phase;
- design optimisation to minimise resource consumption during construction through reduced material usage and by minimising activities that consume large quantities of energy including; and
- specification of materials that can minimise environmental impact and promote environmental benefits.

During the construction phase, a design review process is to be established involving environmental, community relations and construction teams so that the design of specific project elements can be reviewed, challenged and refined or re-designed to minimise construction impacts and identify opportunities to improve environmental outcomes.

The design reports should include a section on environmental performance and impacts and should be compiled with the input of the Environmental Manager during the review process, if required.

2.5 Procurement

The procurement process is critical to successful outcomes and the environmental performance of contractors (both head and subcontractors) should be considered as part of the tender assessment process. Returnable tender schedules should require contractors to declare their regulatory record, including any fines or prosecutions and provide details of their environmental management systems and processes.

Tender schedules should also clearly articulate:

- the compliance obligations of the contractor (so they are contractually binding);
- sustainability performance criteria including minimum scoring requirements against any ratings schemes; and
- any other specific environmental requirement relevant to the scope of works.

2.6 Stakeholder consultation

Project stakeholders for a typical project can include:

- government agencies (commonwealth, state and local);
- the operator;
- sensitive receivers such as residential areas, hospitals, places of worship and schools;
- Aboriginal stakeholder groups (potentially including identified traditional owners);
- community and special interest groups, including environmental action groups; and
- emergency services such as fire brigade, state emergency services.

Stakeholders and community groups can be impacted by a range of environmental issues ranging from noise, vibration, property impacts, traffic, dust and community severance. When working in communities, being a good neighbour is fundamental to success and any environmental management program needs to be fully integrated with community and communications plans so that community impacts are minimised.

2.7 Inspection, monitoring and corrective action

To ensure compliance with legal and other requirements a systematic approach should be undertaken to monitor the environmental impacts, inspect the effectiveness of controls and identifying corrective actions to ensure compliance with the relevant approvals, licences and contractual requirements.

A conceptual flow diagram outlining of the environmental management process as it applies to construction works is provided in Figure 2 (below).

2.8 Handover

Upon completion of construction the asset must be handed over or back to the operator. This will include any approval requirements that carry over into the operation, and the results and documents of any operational environmental management, including contamination, heritage, vegetation and asbestos or monitoring that has been assessed.

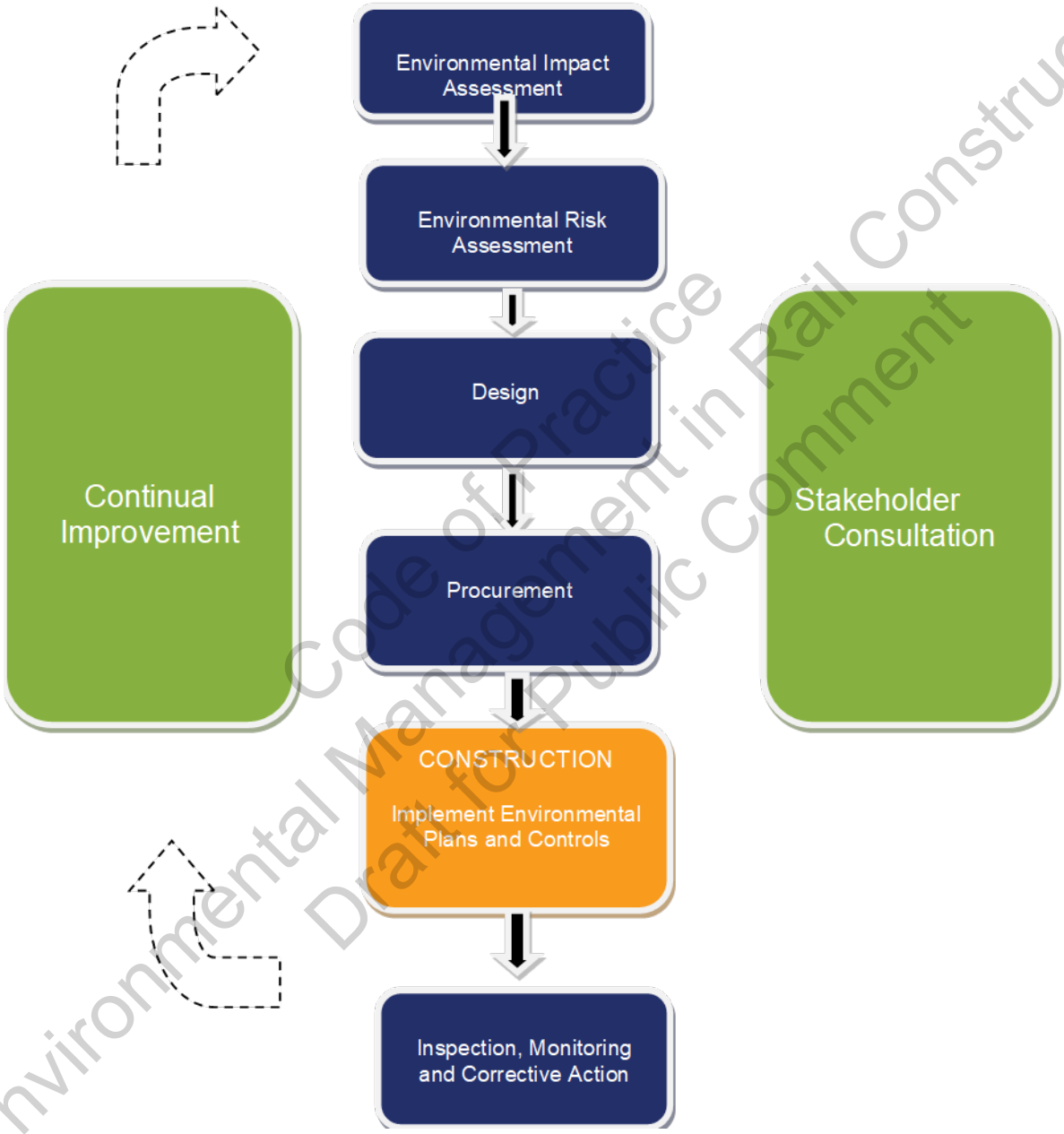

Figure 2 – Environmental management process

3 Construction environmental management

3.1 Identification of environmental issues

The identification of environmental issues that are relevant to the construction project involves reviewing:

- the environmental impact assessment and any associated specialist studies;
- stakeholder engagement and consultation feedback; and
- environmental risk assessment.

This section provides details of the key environmental issues encountered on projects in both urban and regional areas.

3.2 Air quality

3.2.1 Impacts

Air quality impacts include:

- nuisance:
  - accumulated dust on domestic washing, motor vehicles, in swimming pools and general living spaces; and
  - visual impacts of vehicle smoke and dust.
- human health:
  - respiratory effects, particularly to those with respiratory disorders;
  - carbon monoxide poisoning;
  - exposure to carcinogenic bi-products of fuel combustion;
  - exposure to asbestos and/ or building materials; and
  - exposure to dust.
- environmental harm:
  - greenhouse gas generation contributing to climate change.

3.2.2 Local environmental conditions

Local environmental conditions that can impact air quality include:

- soil profile and erodibility;
- local terrain and proximity to sensitive receivers; and
- climatic conditions including wind and rain.

3.2.3 Mitigation

Air quality impacts may be mitigated by:

- avoiding construction during high risk environmental conditions (hot, dry and windy);

- minimising ground disturbance and avoid construction methods and machinery that generate excessive dust;
- implementing effective erosion controls;
- removing accumulated dust regularly;
- restricting speed on unsealed roads and provide driver training;
- applying dust suppressants including water carts and soil binding agents;
- minimising machinery usage and turning off when not in use;
- procuring construction machinery with low vehicle emissions (e.g. Euro standard);
- ensure work areas are well ventilated;
- undertaking pre-start equipment emissions test and routine maintenance checks;
- taking equipment out of operation where excessive emissions occur;
- reviewing stakeholder complaints and correct work practices as appropriate;
- visually monitor air quality impacts and weather on a daily basis as a minimum; and
- undertaking more comprehensive air quality monitoring for high risk situations. This can include dust deposition, particulate matter and vehicle emissions.

3.3 Erosion and sedimentation

3.3.1 Impacts

Erosion and sedimentation impacts include:

- loss of sediment and fertile soil;
- changes to the hydraulic regime due to excessive sedimentation;
- vegetation smothering including of aquatic plants resulting in a loss of habitat; and
- general health impacts to aquatic and marine ecosystems due to increased turbidity in waterways.

3.3.2 Local environmental conditions

Local environmental conditions that can affect erosion and sedimentation include:

- soil profile and erodibility;
- local terrain and hydrological conditions;
- climatic conditions including wind and rain; and
- proximity to sensitive receivers (downstream of the works).

3.3.3 Mitigation

Erosion and sediment impacts may be mitigated by:

- preparing an erosion and sediment control plan in consultation with design and construction teams;

- avoiding ground disturbance where possible and ensuring vehicle movements avoid disturbed areas;
- diverting clean water (upstream) and install cross drainage as early as possible;
- covering stockpiles stabilising site access, hydro seeding or landscaping exposed areas as soon as practicable;
- channelling sediment laden water through sediment fences, swale drains, rock checks and sediment basins;
- providing specialist erosion and sediment control training to key project personnel including site supervisors, engineers;
- implementing strict protocols for testing and discharging sediment basin water;
- monitoring weather and inspecting the performance of controls weekly and immediately following rainfall;
- monitoring sediment basin discharges (particularly for suspended solids/turbidity); and
- monitoring the receiving water quality of adjacent streams and water bodies usually upstream and downstream, before, during and after construction.

3.4 Acid sulfate soils

3.4.1 Impacts

Acid sulfate soil impacts include:

- release of sulfuric acid from soil can in turn release iron, aluminium, and other heavy metals (particularly arsenic) within the soil creating a toxic environment; and
- environmental impacts include vegetation damage, acidification of ground and surface water fish and other aquatic organisms kills concrete and steel degradation.

3.4.2 Local environmental conditions

Acid sulfate soils (ASS) are naturally occurring soils, sediments or organic substrates (e.g. peat) that are formed under waterlogged conditions. They generally occur in low lying floodplain and coastal areas < 1m above sea level, the occurrence of acid sulfate soils in inland areas is unlikely. Most state environmental agencies have published acid sulfate soil risk maps which show the location and likelihood of ASS occurring in any given area.

ASS contains iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, acid sulfate soils are benign. However, if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulfides react with oxygen to form sulfuric acid.

3.4.3 Mitigation

Acid sulfate soil impacts may be mitigated by:

- preparing an acid sulfate soil management plan in consultation with design and construction teams;
- avoiding disturbance of ASS where possible and by planning the construction activities to avoid area of high-risk ASS;

- minimising deep excavations, piling and footings;
- establishing processes for managing ASS material. This may include establishment of ASS treatment areas (lined and bunded areas) with lime mixing to neutralise the PASS material; and
- installing sediment controls that may include sediment basins, sediment fences, swale drains and rock checks.
- monitoring for:
  - vegetation health and pH of local receiving waters;
  - ASS basin discharges (pH and electrical conductivity); and
  - receiving water quality of adjacent streams and waterbodies usually upstream and downstream, before, during and after construction (laboratory testing for pH, acidity, total dissolved solids, metals and metalloids).

3.5 Surface water management

3.5.1 Impacts

Surface water impacts include:

- obstruction of overland flow paths and modified hydrological regimes causing localised flooding;
- depletion of scarce water supplies and unethical sourcing of water;
- water pollution from chemical leaks and fuel spills;
- disturbance to the bed and banks or watercourses; and
- flooding resulting in loss of materials, erosion and effects to water quality such as increased turbidity, damage to project environmental controls, project disruption and worker safety.

3.5.2 Local environmental conditions

Local environmental conditions that may impact surface water include:

- soil porosity, vegetative cover and permeability;
- local terrain and hydrological conditions;
- climatic conditions including rainfall frequency, intensity and duration; and
- upstream land uses and sources of pollution.

3.5.3 Mitigation

Surface water impacts may be mitigated by:

- preparing a water management plan that assesses the likely volumes of water that are to be consumed during the project and identifies measures to reduce consumption, beneficially reuse and recycle water. The water management plan should also identify potential water sources and in remote areas this may include importing potable water from other sources;

- providing adequate temporary cross drainage and installing permanent drainage as early as practical in the construction phase;
- preparing a flood evacuation plan that should include the establishment of weather monitoring and flood warning systems, site shutdown and evacuation protocols;
- ensuring site compounds and major fuel storage areas are above an appropriate flood level (nominally 1:20 year ARI);
- ensuring all chemicals and fuels are stored in bunded and ventilated containers;
- undertaking regular checks and inspections on machinery including hydraulic testing of major items of plant that are operating near waterways;
- implementing a vehicle re-fuelling protocol to minimise the risk of fuel spillage;
- providing spill kits and spill response training to relevant personnel (superintendents, foremen etc.); and
- testing the flood evacuation and emergency management protocols on an annual basis.

3.6 Groundwater management

3.6.1 Impacts

Groundwater impacts include the following:

- generation of large volumes of contaminated / poor quality water that may have to be disposed to a licensed waste facility or require water treatment prior to re-use on site or discharge to the environment;
- infiltration of poor quality / contaminated water from site management process into groundwater;
- lowering of the water table and various un-intended adverse effects, such as:
  - impacts to groundwater dependant ecosystems;
  - exposing acid sulfate soils and increasing the groundwater loadings of acidity, sulfate salinity, metals and metalloids;
  - re-direction of pre-existing groundwater contamination towards de-watering bores and / or unsaturated soils causing additional environmental and human health impact; and
  - reduction in the quality and quantity of groundwater for nearby bore users.

3.6.2 Local environmental conditions

Local environmental conditions that may impact groundwater include:

- adjoining sensitive environments including groundwater dependent ecosystems;
- groundwater depth and chemical composition;
- aquifers and perched water tables;
- geological conditions;
- nearby groundwater users; and

- current and former land uses and environmental management practices.

3.6.3 Mitigation

Groundwater impacts may be mitigated by:

- developing a groundwater flow and water quality predictive model;
- preparing a groundwater management plan that includes:
  - identification of potential impacts to human health and the environment;
  - a set of mitigation and management measures (e.g. methods to groundwater control flow and limit dewatering volumes such as coffer dams to increase aquifer recharge and methods for water treatment of water volumes such as liming for pH adjustment and use of environmentally friendly flocculants such as gypsum); and
  - groundwater monitoring with performance criteria to validate the effectiveness of mitigation and management measures (e.g. groundwater levels and water quality parameters such as pH, alkalinity and concentrations of contaminants of concern).

3.7 Salinity

3.7.1 Impacts

Salinity impacts include:

- increase to salinity in surface water discharge to freshwater drainage lines and surface water bodies that may be detrimental to riparian vegetation and aquatic flora and fauna; and
- increase to soil salinity that may be detrimental to the re-vegetation of post-construction rehabilitation areas.

3.7.2 Local environmental conditions

Typical saline soil and brackish surface / groundwater environments include:

- low lying soils and aquifers in close proximity to current ocean shoreline and tidal water ways (e.g. such as the natural landscape of the existing Sydney Harbour and Parramatta River catchment and Botany Bay);
- inland bedrock / residual soils that are derived from former estuarine and marine environments and which brackish aquifers reside (e.g. such as various shale and residual soil units and perched aquifers in western Sydney); and
- highly evaporative environments that have highly brackish aquifers (e.g. such as the arid areas of inland Western Australia and South Australia).

3.7.3 Mitigation

Salinity impacts may be mitigated by:

- identification of saline soil and bedrock units and aquifers in the construction corridor.

- development of a salinity management plan that includes identification of potential impacts to human health and the environment and a set of mitigation and management measures such as:
  - surface water management to minimise the volumes of surface water that my come into contact with excavated saline soil and rock materials;
  - retention and re-generation of native vegetation, particularly trees with a deep root zone that prevent the rise of groundwater through saline bedrock and soils;
  - avoidance of sediment retention basins in site areas where the water table is high;
  - avoidance of re-use of highly saline soils for rehabilitation and use of salt tolerant species where required;
- monitoring groundwater against performance criteria to validate the effectiveness of mitigation and management measures (e.g. groundwater levels and water quality parameters such as electrical conductivity).

3.8 Water sensitive design

3.8.1 Impacts

Factor for consideration that could affect water sensitive design include:

- high concentrations of surface water runoff which may contribute to scouring of local creeks and localised flooding; and
- contamination of local waterways due to runoff from impermeable surfaces.

3.8.2 Local environmental conditions

Local environmental conditions that may affect water sensitive design include:

- local terrain and hydrological conditions;
- climatic conditions including rainfall frequency, intensity and duration;
- local drainage; and
- proximity of sensitive environments such as wetlands.

3.8.3 Mitigation

Water sensitive design may be achieved by:

- integrating stormwater treatment into the landscape – by using the natural drainage lines (with trees and plants to retain water and help remove pollutants);
- reducing runoff and peak flows – by using detention basins and retention areas and minimising impervious surfaces; and
- protecting water quality – by ensuring the stormwater flowing into waterways flowing offsite has a neutral or beneficial effect on water quality.

3.9 Contamination and hazardous materials

3.9.1 Impacts

Contamination and hazardous materials impacts include the following:

- Generation of large volumes of contaminated soil or groundwater that may have to be disposed to a licensed waste facility or require treatment prior to re-use on site;
- Realisation of contaminant exposure pathways (human health and environmental); and
- Disturbance of hazardous materials requiring management or disposal to a licensed waste facility by a licenced contractor (friable or bonded asbestos).

3.9.2 Source and types of contamination

Typical sources and types of contamination include:

- oils, greases, lubricants, bulk fuel and refuelling operations;
- spill capture and oil / water separator units;
- electrical and substations containing asbestos, polychlorinated biphenyls (PCB) based transformer oils and lead acid batteries);
- fire control systems containing polybrominated diphenyl ether (PBDE) flame retardants);
- paint spray and fibre-glass maintenance booths (containing volatile organic solvents and resins);
- building materials including old electrical components containing asbestos;
- surfaces painted with lead-based paint;
- numerous industrial, commercial, residential and farming type sources;
- wooden rail sleepers that have been preserved with copper-chrome-arsenate (CCA) and organo-chlorine (OC) / organo-phosphate (OP) pesticides and other contaminants;
- polychlorinated biphenyls in old light fittings;
- synthetic mineral fibres in insulation;
- ozone depleting substances in old air conditioning units;
- contaminated soil and / or groundwater form current or historical poor practices, including leaking underground or above ground tanks and related infrastructure; and
- uncontrolled use of spoil to establish site levels (e.g. use of coal ash and demolition materials that may contain asbestos, heavy metals, OC/OP pesticides and petroleum hydrocarbons).

Poor or incorrect management of hazardous materials can result in significant risk to human health and or the environment. Typical construction activities where this is the case are the demolition and dismantling of older rail infrastructure that contains hazardous materials and ground works that intersect contaminated soils or groundwater. The magnitude of risk can

increase significantly when these construction activities are in close proximity to residential areas and or sensitive terrestrial or aquatic ecosystems.

3.9.3 Local environmental conditions

Local environmental conditions that may affect contamination and hazardous substances include:

- groundwater depth and chemical composition;
- geological and hydrogeological conditions;
- climatic and hydrologic conditions;
- current and former land uses and environmental management practices; and
- proximity to sensitive receptors including ecological environments, residential areas, schools etc.

3.9.4 Mitigation

Contaminated land impacts may be mitigated by:

- determining of the nature and extent of known and potential site contamination and hazardous materials;
- identify areas of likely contamination in spoil including asbestos and other chemicals;
- assess construction specific environmental aspects and impacts and all complete pathways from source to receptor;
- undertake further environmental site assessment (if required) which covers specific areas requiring further investigation, remediation and waste classification completed in accordance with National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended in 2013) as well as stated based contaminated land regulation and guidelines. Recommendations and methodologies for the subsequent waste disposal, soil reinstatement and validation, as well as any ongoing management / monitoring requirements should also be provided;
- developing an environmental management plan that provides detail around roles and responsibilities, legislative requirements, nature and extent of known impacts, contaminant exposure pathways, general environmental management measures (e.g. for new buildings, structures of services, below ground intrusive worker requirements, handling of contaminated soil or groundwater), unidentified contamination and contingency requirements, environmental monitoring, groundwater use, waste management, emergency response and incident reporting;
- an unexpected discovery of contaminated land procedure that provides a set of remedial measures and contingencies for the unexpected intersection of soil / groundwater contamination as well as actions such as stopping and holding off on construction activities and lines of internal / external communication; and
- developing a hazardous materials management plan that stipulates aspects such as:

- subcontractor plans and registers that need to be implemented by licensed hazardous material removalists (removal control plan in compliance with relevant codes of practice, safe work method statements, hazardous material registers);
- specific protocols for hazardous materials removal and excavation of asbestos contaminated soils (i.e. overview of work flow tasks associated with removal as well as notifications to the relevant state-based health and safety regulator, licensing requirements for the removalist contractor and record keeping and waste tracking requirements);
- requirements for security, signage isolation of hazardous material work areas, air monitoring, clearance certificates and site hygiene (e.g. PPE, decontamination bins) and methods for packaging and disposal of hazardous materials; and
- spill management procedure that provides specific mitigation measures for minimising health and environmental risk (e.g. bunding), emergency response procedures (e.g. use of absorbent spill kit materials).

3.10 Ecology

3.10.1 Impacts

Ecological impacts may include:

- loss of threatened flora and fauna and communities;
- destruction of fauna habitat;
- impacts to threatened ecological communities;
- degradation of groundwater dependent ecosystems (refer Section 3.6.1);
- degradation of terrestrial and aquatic ecosystems;
- loss of access to food and water sources for grazing mammals due to severance;
- increased noise and light impacts, particularly for breeding activities;
- mortality due to vehicle/equipment strikes;
- introduction of disease and pathogenic materials; and
- injury or death of aquatic fauna due to water pollution and acid sulfate soil impacts.

3.10.2 Local environment conditions

Local environmental conditions that may affect flora, fauna and ecosystems include:

- climatic conditions;
- soil type and groundwater;
- habitat availability and type;
- connectivity; and
- proximity to threatened species and ecological communities.

3.10.3 Mitigation

Ecological impacts may be mitigated by:

- engaging a suitably qualified and experienced ecologist to identify threatened species, ecologically sensitive areas and “No Go” areas;
- identifying the location of ecological features for protection through published mapping including online resources;
- engaging a surveyor to work with the ecologist to identify clearing limits and “No Go” zone areas. Install clearing limit boundary fencing and “No Go” signage;
- implementing a “vegetation clearing permit” process so that any clearing activity has the appropriate authorisations in place prior to commencement;
- translocating threatened species under the supervision of the ecologist, if required;
- monitoring the effectiveness of the flora management plan through;
  - weekly inspections of “No Go” signage and boundary fencing;
- implement construction controls that may include but not be limited to:
  - nest boxes to offset loss of hollow bearing trees where necessary;
  - fauna fencing and crossings (such as bridges and culverts) where necessary;
  - monitor impacts including animal strikes and mortality as well as monitoring for other impacts such as noise, water quality and acid sulfate release that may impact aquatic ecology;
  - population monitoring for threatened species and communities; and
- landscaping and restoration works should be completed as soon as practicable during the construction program as their installation greatly assists with other environmental aspects including erosion control and visual amenity. Design of permanent landscaping features should be undertaken in consultation with soil scientist or rehabilitation specialist.

3.11 Bio-security

3.11.1 Impacts

Bio security impacts include:

- importation of weeds seeds, pathogens and diseases from other sites from vehicles, equipment and muddy boots;
- increase spread of pathogens, weeds and diseases on site from improper handling; and
- pest animals creating a nuisance, safety hazard and an additional source of disease.

3.11.2 Local environmental conditions

Local environment conditions that can influence biosecurity issues for the project can include:

- the location of the project. Pests in rural areas may include feral pigs, wild dogs and horses. Projects in urban areas may attract rats, mice possums and cats;
- the presence of existing weeds and pathogens on site;
- proximity to sensitive receivers including ecologically sensitive areas and agricultural properties; and
- climatic conditions including wind, rain and temperature.

3.11.3 Mitigation

Biosecurity impacts may be mitigated by:

- vehicles, equipment, materials and footwear must be kept clean on entry to prevent importing weed propagules;
- work in dry soil if practicable;
- if vehicles, equipment, materials and footwear are not clean on entry clean down by the most appropriate and effective means including wash down or compressed air in dry soil conditions if effective;
- cleaning vehicles, equipment, materials and footwear prior to site entry to prevent the importation of weeds, pathogens and disease;
- washing down plant / equipment in areas with noxious weeds are before moving to a non-noxious weed area;
- delineate “No Go” areas for areas where weeds have been identified;
- treatment of weed infestations;
- delineate “No Go” areas for areas where pathogens / diseases have been identified;
- establish hygiene decontamination protocols for working in infected areas;
- no material, plant and equipment is to be placed or stored outside of delineated “No Go” zones;
- ensuring all rubbish (particularly food scraps) are removed from site, keeping the project sites clean and free of rubbish and materials that may provide habitat for feral animals;
- install boundary fencing surrounding construction areas to prevent larger animals from entering construction zones, if required;
- in any case the presence of feral animals should be noted by the construction teams and where there is a substantial issue with feral animals, the local authorities should be advised so that appropriate action may be taken as part of broader eradication programs; and
- monitor the effectiveness of the weed, pathogen and / or disease management through ongoing inspections of to ensure that the measures are working effectively, and that pathogens and / or disease are not present at the site.

3.12 Noise and vibration

3.12.1 Impacts

Noise and vibration impacts include:

- nuisance, aggravation and annoyance;
- health effects including hearing impairment sleep disturbance, mental functioning, stress and learning impairment in children;
- superficial damage to structures, buildings and infrastructure due to excessive vibration; and
- structural damage to structures, buildings, foundations and infrastructure.

3.12.2 Local environmental conditions

Local environmental conditions that may influence noise and vibration include:

- the ambient acoustic environment. Regional areas are likely to have lower background noise levels when compared to urban environments which are busier and noisier;
- the proximity of the construction activities to those that are highly sensitive to noise and vibration including:
  - the elderly and those with pre-existing diseases and medical conditions;
  - children and pregnant women;
  - those suffering stress, anxiety, depression and mental illnesses;
  - workers in high risk industries such as construction (e.g. crane drivers, bus drivers, pilots) who need to concentrate for extended periods; and
  - schools, hospitals, retirement villages, nursing homes, pre-schools and residential areas.

3.12.3 Mitigation

Noise and vibration impacts may be mitigated by:

- preparing noise and vibration management plan, communications strategy and out of hours works protocol;
- identifying sensitive land uses and vulnerable groupings of people;
- planning construction activities so that methodologies that result in low noise and vibration emissions are deployed;
- implementing noise controls recommended during completion of noise and vibration assessment studies as soon as practicable in the construction program. Undertaking operational noise modelling prior to the commencement of construction will assist the identification of these measures;
- Implementing temporary noise controls if there is works being undertaken in close proximity to sensitive receivers;
- noise curtains placed on temporary fencing if the works are moving along the rail corridor and are close to sensitive receivers;

- provide respite to sensitive receivers during activities that result in substantial noise and vibration impacts such as piling and the use of rock breakers;
- provide alternative accommodation to noise receivers that are particularly vulnerable to the effects of noise;
- undertake regular noise and vibration monitoring during the construction works to ensure noise levels are within predicted noise levels outlined in relevant documentation provided by acoustic specialists;
- monitor and respond to community complaints promptly and undertake action to address the complaint;
- a vibration assessment should be undertaken by acoustic specialists if there is any potential for vibration to occur during rail construction; and
- condition surveys of buildings and infrastructure should be undertaken in a defined area prior to commencement of construction activities.

3.13 Aboriginal heritage

3.13.1 Impacts

Impacts to Aboriginal heritage items including the following:

- impacts to any known place of importance or significance to persons of Aboriginal descent including natural or artificial objects used for or adapted for any purpose connected with the traditional cultural life of Aboriginal people or any sacred, ritual or ceremonial site which is of importance and of special significance to persons of Aboriginal descent; and
- similar impacts to places or objects of importance or significance to persons of aboriginal descent that were unknown prior to construction (commonly known as chance finds).

3.13.2 Local environmental conditions

Local environmental conditions that will influence the presence of aboriginal heritage items include proximity to:

- natural resources that historically have supported the livelihood of aboriginal communities (e.g. drinking water, billabongs, caves, and food sources); and
- places currently or previously associated with aboriginal people which are considered to have anthropological, archaeological or ethnographic significance.

3.13.3 Mitigation

Impacts to aboriginal heritage may be mitigated by:

- preparing a heritage management plan in consultation with the relevant regulator, councils, relevant landowners and stakeholders (potentially including identified traditional owners); and
- conducting heritage inductions and tool box talks for all site personnel relating to aboriginal heritage issues;

- establishing and maintaining an exclusion zone around identified Aboriginal heritage sites or artefacts;
- where required by approval conditions employ Aboriginal monitors to monitor construction activities;
- implementing a chance finds protocol if heritage items of Aboriginal significance are discovered:
  - all work is to immediately cease, and the appropriate people contacted;
  - set up an exclusion zone around the heritage item;
  - consult the appropriate parties and stakeholders;
  - developing an action plan for the management of the aboriginal heritage item (including recording of the location, significance and appropriate mitigation measures); and
  - work will commence once further investigations have been completed.
- Monitoring the effectiveness of the following key issues:
  - maintenance of exclusion zones around identified Aboriginal heritage items;
  - implementation of chance finds protocol; and
  - adhering to approved construction boundaries with regards to heritage.

3.14 Non-aboriginal heritage

3.14.1 Impacts

Impacts to heritage items including the following:

- damage to heritage buildings and other heritage structures due to direct impact or vibration;
- removal or demolition of an item of heritage significance; and
- disturbance to unexpected buried items impact.

3.14.2 Local environmental conditions

Local environmental conditions that will influence the presence of heritage items include proximity to:

- heritage buildings and infrastructure; and
- proximity to historic sites and other heritage features.

3.14.3 Mitigation

Impacts to heritage items may be mitigated by:

- identifying the location of heritage features for protection through published mapping including online resources;
- preparing a heritage management plan in consultation with the relevant regulator, councils, relevant landowners and stakeholders (if applicable) that includes a set of mitigation and management measures such as:

  - set up and maintain an exclusion zone around identified non-Aboriginal heritage items. No access is allowed for all fenced heritage sites;
  - conducting heritage inductions and tool box talks for all site personnel relating to non-Aboriginal heritage issues; and
  - implementing appropriate buffer zones around heritage items.
- implementing an unexpected finds protocol if heritage items of non-Aboriginal significance (including skeletal material) are discovered. Unexpected finds protocol to include the following:
  - all work is to immediately cease, and the appropriate people contacted; and
  - set up an exclusion zone around the non-heritage item.
- monitoring the effectiveness of the following key issues:
  - maintenance of exclusion zones around identified non-Aboriginal items;
  - implementation of unexpected finds protocol;
  - adhering to approved site boundaries with regards to heritage; and
  - vibration monitoring for works that result in high levels of vibration.
  - If any suspected human remains are discovered during construction, all works must cease. Notify the Police, regulator and relevant stakeholders immediately. Follow the unexpected finds protocol (for skeletal materials).

3.15 Landscaping, urban design and visual

3.15.1 Impacts

Landscaping, urban design and visual impacts include:

- visual impacts during construction;
- light spillage (due to night works);
- obstructed and/or loss of views;
- graffiti;
- weed proliferation;
- increased opportunities for crime due to poor design;
- visual impacts due to poorly designed or implemented landscape and urban design plans; and
- lost connectivity and access to facilities.

3.15.2 Local environmental conditions

Local environmental conditions that will influence landscaping and urban design include:

- visual aspects of the surrounding environment;
- local land use and demographics;
- local ecology, soils and climatic conditions; and

- the existing urban realm.

3.15.3 Mitigation

Landscaping, urban design and visual impacts may be mitigated by preparing a landscape and urban design plan in consultation with local stakeholders that:

- integrates design with the adjacent land use, open space and amenity;
- incorporates public amenities (including pedestrian and cycle paths) into the development for public use and safety;
- incorporates vegetative screening for residences, structures and other built elements;
- integrates of associated built structures and landscape with the surrounding areas;
- integrates crime prevention through environmental design (CPTED) principles in the plan;
- enhances the natural environment and ecological systems of / near the construction project;
- provides vegetative screening or appropriate hoarding of construction activities;
- introduces site suitable plants and mixture of landscaped vegetation to create and enhance habitat opportunities; and
- minimises light spillage through directing lights away from sensitive receivers and providing shielding where appropriate.

Landscaping and urban design works are generally undertaken towards the end of the construction phase, however, should be completed as soon as practicable during the construction program as their installation greatly assists with other environmental aspects including erosion control and visual amenity.

3.16 Waste management

3.16.1 Impacts

The following waste management practices have the potential to impact the area around the project:

- incorrect segregation of waste and illegal disposal;
- illegal dumping of construction wastes;
- incorrect storage of waste containers on site (such as chemicals and fuel containers) resulting in contamination of soils and groundwater; and
- ineffective waste management practices leading to excessive resource consumption with associated environmental impacts.

The above practices have the potential to result in the following impacts:

- localised contamination;
- contamination of waterways; and
- visual impacts such as debris littered and oil sheens on waterways.

3.16.2 Local environmental conditions

Local environmental conditions that impact waste management include:

- the proximity of the site to waste management and recycling facilities that are appropriately licenced to accept the types of waste generated by the project; and
- the availability of adequate areas on site to provide adequate storage areas.

3.16.3 Mitigation

Waste management impacts may be mitigated by:

- identifying construction waste streams that may include:
  - demolition waste where houses, buildings and other infrastructure such as roads and bridges are required to be demolished to allow the railway to be constructed. Typical demolition wastes may include concrete, masonry glass, steel and aluminium;
  - construction waste including steel off cuts, excess concrete, waste oils and chemical containers;
  - waste cardboard and plastic used for packaging;
  - domestic waste including food scraps;
- avoiding the generation of the waste by considering alternatives to the activity;
- reducing the amount of waste generated through correct sizing of materials;
- reusing the material for other purposes;
- recycling – provide segregation facilities including bins and laydown areas that are appropriately signposted and arrange with scrap materials recyclers; and
- disposing the waste as a last resort. Ensure the correct classification and disposal of the waste to relevant facility that is approved to accept the waste.

3.17 Spoil

3.17.1 Impacts

Spoil management impacts include:

- traffic, noise and associated environmental impacts when transporting the spoil to its placement site;
- environmental impacts at both the construction site and the spoil placement site including dust, erosion and sedimentation;
- leaching of spoil contaminants into the surrounding environments; and
- depletion of available landfill when spoil is disposed at waste management facilities (i.e. cannot be reused).

3.17.2 Local environmental conditions

Local environmental conditions that may affect spoil management include:

- the availability of appropriate re-use sites in close proximity to the construction project;
- contamination status of the spoil;
- environmental aspects of re-use sites including geological conditions;
- ecology and proximity to sensitive receivers; and
- accessibility to local transport networks.

3.17.3 Mitigation

Spoil management impacts may be mitigated by:

- identifying potential reuse sites within the project, examples include noise mounds and architectural mounds;
- in-situ testing to determine spoil characteristics before removing;
- placing contaminated material in cells on site where environmental risks are acceptable;
- avoiding road transportation as far as practicable and using methods with lower impacts such as rail and barges for marine based projects;
- ensuring a rigorous testing program is implemented with chain of custody protocols for tracking and disposing spoil off site; and
- ensuring external stakeholder approvals are obtained for offsite placement at nearby properties.

3.18 Fire

3.18.1 Impacts

Impacts of fire include:

- potential safety risks to workers;
- impacts to local ecological values;
- loss of property, personal assets and people's livelihood;
- changes in local climatic conditions including temperature, humidity, wind and rain; and
- project disruption, cut off access, damage to site buildings, loss of materials and production, loss of communications.

3.18.2 Local environmental conditions

Local environment conditions that affect fire include:

- climatic conditions including wind and rain;
- proximity to fire hazards including bush, fuel and flammable hazards; and
- proximity to properties, residential areas and occupied buildings that may be impacted by fire.

3.18.3 Mitigation

Fire impacts may be mitigated by:

- conducting bushfire risk assessments to identify hazards and risk controls and reinforce these at daily pre start meetings;
- ensuring hot works are undertaken only by personnel who have the relevant certificates to perform those works;
- maintaining appropriate buffer distances between hot works and flammable materials such as fuel storage areas;
- ensuring adequate firefighting equipment is available in close proximity to the activity being undertaken and ensuring that operators are trained in firefighting protocols;
- ensuring a burn plan or other bushfire management documentation is prepared and implemented in consultation with the local fire authority which may include the Rural Fire Service (or equivalent) or the local fire brigade;
- ensuring burning off is undertaken in a previously cleared location with (no vegetation) a substantial buffer distance should also be enforced between the burn site and the nearest flammable object;
- materials and equipment should be readily available to control the fire. This may include but not be limited to water, soil, excavators, shovels, hoses and fire extinguishers;
- flammable substances should not be located in the vicinity of the fire;
- providing the local fire authority with adequate notice (1-2 weeks) of the intended burning off activity;
- burning off must not be undertaken during high risk periods over summer and during high or extreme fire danger periods;
- ensure a hazard reduction or buffer zone between the project boundary; and
- ensuring all chemicals and fuels are approved substances and stored correctly.

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RAIL INDUSTRY SAFETY AND STANDARDS BOARD

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