

# Constructed Wetlands

Capability Sheet CS5



## WHY CONSTRUCTED WETLANDS ?

*Constructed wetlands are one of a suite of new science technologies used in Water Sensitive Urban Design (WSUD) to mitigate water flow, velocities and pollutant loads to receiving waters . Developments can utilise constructed wetlands in the water treatment train to aid in stormwater or wastewater processing and reclamation, thus protecting and enhancing water quality in downstream creeks, rivers and bays. Well maintained, aesthetically constructed wetlands provide multi-factor benefits and generate premium prices for adjacent allotments.*

## WHAT IS A CONSTRUCTED WETLAND ?

Constructed wetlands are either built as surface or sub-surface flow systems, depending on application and site specific needs. Surface flow wetlands are typically used for stormwater management and are generally shallow (< 2 m deep), acting as an interface between permanent water bodies and the terrestrial environment. Sub-surface flow systems, where inflows are more uniform than in surface flow systems, are frequently used for wastewater treatment, precluding access to open water and improve the quality of treatment. Wetlands are characterised by the presence of emergent macrophytes (large aquatic plants protruding above the waterline) and epiphytes (algae growing on the surface of macrophytes).

## INVESTIGATION, DESIGN & CONSTRUCTION SERVICES

Martens provide comprehensive industry services including concept and detailed designs, water balance, development approvals, construction certificate plans, and construction.

- ▶ Preliminary planning and feasibility, concept design and approvals
- ▶ Multi-purpose designs -stormwater treatment, flood mitigation, WSUD, stormwater re-use
- ▶ Wastewater treatment wetlands and effluent polishing
- ▶ Detailed civil, structural and hydraulic design
- ▶ Complete construction services including site preparation, earthworks, engineering 'fit-out' and planting and establishment
- ▶ On-going management, environmental monitoring, weed control, watering systems, risk management and mosquito control

## RECENT PROJECTS

Some recent major constructed wetlands projects that we have worked on include:

- ▶ Twin Creeks Golf Course Residential Estate, Luddenham, NSW - Investigation, design and construction documentation for 17 constructed wetlands for stormwater quality control, runoff capture and re-use, flood mitigation and irrigation water storage.
- ▶ South Bowenfels Seniors Living Estate, Lithgow, NSW - Design of stormwater treatment wetland for water quality control and integration with a range of site WSUD management practices.
- ▶ Cessnock Airport and Visitor Centre, Cessnock, NSW - Design and construction of wetland for tertiary effluent polishing of secondary effluent for irrigation reclamation.
- ▶ Buttondery Waste Depot, Wyong, NSW - Design and construction of wetland for treatment of primary wastewater prior to effluent re-use.

### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au

# Contaminated Land Studies & Remediation

Capability Sheet CS6



## OVERVIEW

Contaminated lands may occur in any number of urban residential, commercial, industrial and rural environments. More commonly, it is not possible to identify the occurrence and / or extent of contamination without some evaluation of former land-use and soil / groundwater testing.

In many situations, Local Council's now require a contaminated land assessment to be provided with a development application in order that a 'clean bill of health' can be provided for the development site. In situations where a site is contaminated, the contaminated land assessment provides the applicant with an indication of the likely costs and measures required for remediation.

## OUR EXPERIENCE

For some 10 years, our environmental engineers have conducted contaminated land assessments for a range of developments and project scales. Martens & Associates have provided land contamination investigations and remediation advice for all stages of development and are frequently called upon to provide expert witness evidence on matters relating to soil sampling, analysis, contamination levels and site remediation.

## WORKING ENVIRONMENTS

Martens & Associates scientists and engineers have undertaken works in a wide range of environments:

- ▶ Residential lands
- ▶ Commercial and industrial estates
- ▶ Rural and agricultural industries

## KEY PROJECT TYPES

Key project areas include:

- ▶ Site history and risk evaluations
- ▶ Preliminary site assessments (Stage 1 investigations)
- ▶ Detailed site assessments (Stage 2 investigations)
- ▶ Preparation of site remediation plans
- ▶ Remediation plan implementation and site works
- ▶ Monitoring and environmental reporting
- ▶ Review and auditing of other investigations
- ▶ Monitoring bore-fields and groundwater sampling

### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au



# Effluent Re-use Schemes

Capability Sheet CS7



## 'WASTE' WATER OR A VALUABLE RESOURCE ?

*In the past decade, environmental planning and management at local, state and national government levels has shifted towards the recognition that wastewater in a treated form presents a valuable resource not a costly waste. In particular, effluent or 'reclaimed water' re-use schemes provide a means of beneficially re-using wastewater for a range of commercial uses.*

## OUR EXPERIENCE

Martens & Associates Pty Ltd have 15 years experience with the siting, design, installation, operation and management of numerous effluent re-use schemes throughout Australia. Our team of environmental engineers will ensure that practical, cost effective, low impact and sustainable solutions to your project are delivered.

## RE-USE APPLICATIONS

Our firm is actively involved in the concept design, documentation, development and implementation of re-use schemes for a wide range of applications including for example:

- ▶ Agricultural re-use such as vineyards, turf farms and pasture
- ▶ Golf course irrigation
- ▶ Groundwater injection
- ▶ Industrial re-use opportunities
- ▶ Landfill irrigation and injection
- ▶ Non-potable residential re-use ie. third pipe solutions
- ▶ Stream flow rehabilitation

## TECHNICAL DESIGN SERVICES

In all of the activity types, our engineering services encompass the full suite of technical design services including:

- ▶ Site soil and geotechnical assessment
- ▶ Land capability assessment for re-use scheme
- ▶ Approvals and licensing
- ▶ Financial modelling
- ▶ Water budgeting and water balance modelling
- ▶ Nutrient and contaminant accumulation, transport & impact modelling
- ▶ Irrigation scheme design, construction and management
- ▶ Reclaimed water detention facilities
- ▶ Land application schemes
- ▶ Crop selection and crop management
- ▶ Salinity modelling, monitoring and control

**MARTENS & ASSOCIATES**  
A Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
P + 61-2-9476-9999  
F + 61-2-9476-8767  
E mail@martens.com.au  
W www.martens.com.au

# Flood Studies

Capability Sheet CS9



*Martens provides expertise in numerical flood modelling, conceptualising physical processes and communicating the outcomes of detailed flooding analyses to a range of audiences. We are accustomed to working with problems that require integrated solutions satisfying the requirements of clients, environment and the community and are dedicated to ensuring that the outcomes of all investigations are practical and sustainable.*

## CAPABILITIES

Martens engineers have extensive experience in urban and river hydrodynamics, estuaries, water resource management, geomorphology and community consultation. Our flood management plans are aimed at containing existing and future flood risk in both urban and rural environments and can include a detailed analysis of current flooding conditions, economic and social impacts, and recommended mitigation measures to reduce flood risk. Key services that we provide in relation to flood assessments include:

- ▶ Catchment management studies
- ▶ Dam failure impact assessment
- ▶ Flood impact assessment and development feasibility
- ▶ Flood mitigation option investigations
- ▶ Flood warning systems
- ▶ Floodplain risk management studies – damage and safety analysis
- ▶ Historical flood analysis and stream gauging
- ▶ Hydrographic survey
- ▶ Sizing major hydraulic structures such as bridges and culverts
- ▶ Stormwater analysis for urban infrastructure
- ▶ Urban and rural catchment flood investigations

## MODELLING TOOLS

Martens maintain a range of sophisticated numerical modelling tools that allow for detailed investigation, prediction and representation of flood behaviour:

- ▶ Hydraulic modelling software eg. HEC RAS
- ▶ Catchment hydrologic modelling eg. DRAINS, RAFTS
- ▶ Geographical Information Systems (GIS) for regional mapping
- ▶ CAD – various packages such as AutoCAD and TurboCAD

## RECENT PROJECTS

Some of our recent investigations include:

- ▶ South Creek and Cosgroves Creek – Inundation risk assessment–rural-residential sub-division and 18 hole golf course
- ▶ Kemps Creek – Undertake mapping floodplain risk categories
- ▶ Narrabeen Lagoon – Quantification of flow velocity hazard and detailed tributary flow assessment
- ▶ Brunswick River – 100 year and PMF flood modelling for village of Main Arm
- ▶ Stony Creek – Inundation risk assessment for 282 ha 152 lot rural-residential land release

### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au

## OVERVIEW

The terrestrial water cycle is closely linked to groundwater and in many areas of Australia, groundwater forms a fundamental water resource for agriculture, sensitive ecosystems, potable water supply and environmental amenity.

Hydrogeology represents the discipline of understanding groundwater dynamics. Martens & Associates have 10 years experience with a wide range of hydrogeological investigations including resource assessment, resource maintenance, water quality assessment, impact assessment and groundwater modelling. Martens maintain all the necessary in-house geotechnical skills to undertake the complete range of hydrogeological investigations.

## RESOURCE INVESTIGATION

We provide the full range of resource investigation services including initial resource feasibility assessment through to on-going resource monitoring and maintenance. Typical investigations that we undertake include:

- ▶ Groundwater contamination assessment
- ▶ Long-term instrumented monitoring bores (level and quality)
- ▶ Single and multi-bore (ie. bore-field) pump tests
- ▶ Water quality (short and long term monitoring)
- ▶ Yield determination and recharge assessment

## IMPACT ASSESSMENT

In many areas of Australia, groundwater is under varying degrees of threat or risk. Risks come about by way of resource depletion or water quality impacts and may be the result of industry, agriculture, extraction and land-use change.

Martens & Associates have undertaken groundwater impact assessments for a range of development types including:

- ▶ Dip sites
- ▶ Industrial parks
- ▶ Intensive agricultural activities
- ▶ Landfill sites
- ▶ Mining and groundwater dewatering
- ▶ Petrol stations
- ▶ Sewage treatment and re-use facilities
- ▶ Stormwater recharge systems

## GROUNDWATER MODELLING

Martens & Associates are capable of undertaking a full range of groundwater modelling investigations. These are often required where environmental impact and potential fate of contaminants need to be investigated

- ▶ Flow nets
- ▶ 1D, 2D and 3D modelling
- ▶ Pollutant plume analysis
- ▶ Risk analysis and assessment

### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au



# On-site Wastewater Management

Capability Sheet CS11



## OVERVIEW OF ON-SITE WASTEWATER MANAGEMENT

For the past 15 years, Martens & Associates Pty Ltd have provided comprehensive national and international investigation, design and construction services in the field of on-site wastewater management (OSWM).

Martens are familiar with relevant management issues, understand current best practice and can provide innovative technological solutions to OSWM. Our in-depth knowledge of OSWM means that we will provide your project with the most efficient and cost effective treatment and disposal / beneficial re-use solution.

## MANAGEMENT CAPABILITIES

We have extensive expertise in on-site domestic wastewater management:

- ▶ Site assessment for single allotments
- ▶ Sub-division planning
- ▶ Land capability mapping
- ▶ Minimum sustainable allotment size
- ▶ Re-use of resources
- ▶ Monitoring and evaluation
- ▶ Site feasibility assessment
- ▶ Geotechnical inspection
- ▶ Treatment and disposal options studies
- ▶ Impact assessment
- ▶ Common effluent schemes

### Treatment Options

- ▶ Septic tanks
- ▶ Anaerobic reactors
- ▶ Aerobic sand filtration
- ▶ Recirculating filtration
- ▶ Aerated treatment plants
- ▶ Composting toilets
- ▶ Constructed wetlands
- ▶ Grey-water treatment
- ▶ Communal systems

### Disposal / Re-use Options

- ▶ Absorption trenches
- ▶ Surface irrigation
- ▶ Sub-surface irrigation
- ▶ Evapotranspiration beds
- ▶ Mound application
- ▶ Groundwater recharge
- ▶ Stream flow rehabilitation

## TREATMENT AND RE-USE OPTIONS

Domestic wastewater commonly contains elevated concentrations of nutrients, organic matter and pathogens, particularly bacteria. Martens & Associates can provide extensive investigation, design and construction services for the full range of on-site sewage treatment options.

Following treatment, many options are available for effluent disposal or beneficial re-use. These depend on site and legislative constraints. Martens & Associates provide comprehensive investigation, design and installation services for most effluent disposal and re-use systems.



### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au

# River Management

Capability Sheet CS13



*Martens & Associates Pty Ltd are recognised as national river management experts. Our in-house river engineers, geomorphologists and environmental scientist have provided specialist services to government bodies, and other consulting firms on all aspects of watercourse management.*

## CAPABILITIES

Our capabilities cover a broad range of river management aspects including river protection, impact assessment, modification, characterisation and remediation. Specific areas of expertise where we have provided services in the past 15 years include the following:

- ▶ Bed and bank stabilisation and rehabilitation
- ▶ Bedload characterisation and load assessment
- ▶ Channel change and risk assessment
- ▶ Historical aerial photograph interpretation (API)
- ▶ Hydraulic geometry and flood behaviour
- ▶ Impact assessment and mitigation
- ▶ Riparian management plans
- ▶ River health assessment and stream classification
- ▶ River regulation and flow regime analysis
- ▶ River restoration and remediation strategies
- ▶ Watercourse crossing risk assessment and designs

## PROJECTS ACROSS THE COUNTRY

Some recent major river projects that we have worked on:

- ▶ Gwydir River, Moree - Assessment of the impacts of river regulation on bank stability and channel migration and bed sedimentation.
- ▶ Clarence River, NSW North Coast - Documentation of historical channel changes in response to anthropogenically induced catchment changes.
- ▶ Hawkesbury-Nepean River System, NSW - Review of the Hawkesbury-Nepean River basin geomorphology, channel changes, geological controls and bio-geomorphology.
- ▶ Shannon Creek, Grafton - Impact assessment and channel protection strategy downstream of the Grafton – Coffs Harbour water supply reservoir
- ▶ South Creek, Sydney - Right bank tributary realignment and channel reconstruction to modified hydraulic regime.



### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au

# Sediment & Erosion Control

Capability Sheet CS15



## WHAT IS THE ISSUE ?

*Sediment control practices are used on building sites to prevent sand, soil and other building materials from reaching waterways. Even small amounts of site pollution can cause significant environmental damage by killing aquatic life, silting up streams and blocking stormwater pipes. Sediment control or soil and water management plans are typically submitted to Council for approval prior to work commencing. These address the location, design, scheduling and maintenance of sediment control measures and details of site rehabilitation.*

## THE NEED

The need for and design of sediment control structures is influenced by a range of factors including:

- ▶ Catchment characteristics
- ▶ Climate and season when works are undertaken
- ▶ Extent, nature and duration of soil disturbance
- ▶ Size and location of the site
- ▶ Slope and runoff characteristics
- ▶ Soil type and potential for erosion

## CONTROL STRUCTURES

Martens provides strategic advice, detailed design and documentation, and implementation services for a range of control structures such as:

- ▶ Diversion drainage and kerbside drain protection
- ▶ Revegetation and rehabilitation
- ▶ Sediment detention basins and stockpile management
- ▶ Sediment filter fences and vegetated buffers
- ▶ Stabilisation drains and banks
- ▶ Stabilised site access and washdown bays

## MARTENS SERVICES

Martens provides comprehensive services in relation to site soil and water management so that erosion and sedimentation are controlled to relevant local, state and national standards. Our services include:

- ▶ Design of structures and detailed documentation
- ▶ Preparation of erosion and sediment control plans
- ▶ Preparation of soil and water management plans
- ▶ Site inspections and geotechnical investigations
- ▶ Soil survey and testing

### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au



# Sewage Treatment Plants

Capability Sheet CS16



## THE CONCEPT

*Through our use of in-house designs and engineering skills, the best available treatment technologies are combined to produce a highly efficient sewage treatment system built to suit the full range of field applications. Treated effluent from our sewage treatment plants can be readily used for water recycling projects in any areas where treated sewage waters are required or can be re-used.*

## THE PROCESS

Martens design flexibility allows natural processes to be specifically tailored to the clients requirements of space, water quality and budget. We utilise a variety of processes to optimise each installation:

- ▶ Inlet screens and structures
- ▶ Anaerobic sludge lagoons
- ▶ Outlet structures
- ▶ PS Primary Sedimentation
- ▶ ATF Aerobic Trickling Filtration
- ▶ CFAS Continuous Flow Activated Sludge
- ▶ IDEA Intermittent Decant Extended Aeration
- ▶ IDEAL Intermittent Decant Extended Aeration Lagoon
- ▶ TTS Tertiary Treatment Systems
- ▶ MF Micro and Membrane Filtration

## TREATMENT SOLUTIONS

Martens sewage treatment plant solutions have been installed in many development situations.

- ▶ Airports
- ▶ Camping grounds & caravan parks
- ▶ Commercial developments
- ▶ Hospitals
- ▶ Industrial estates
- ▶ Motels & hotel complexes
- ▶ Residential subdivisions
- ▶ Resorts and golf courses
- ▶ Rest stops & comfort stations
- ▶ Schools and universities
- ▶ Shopping centres
- ▶ Swimming centres

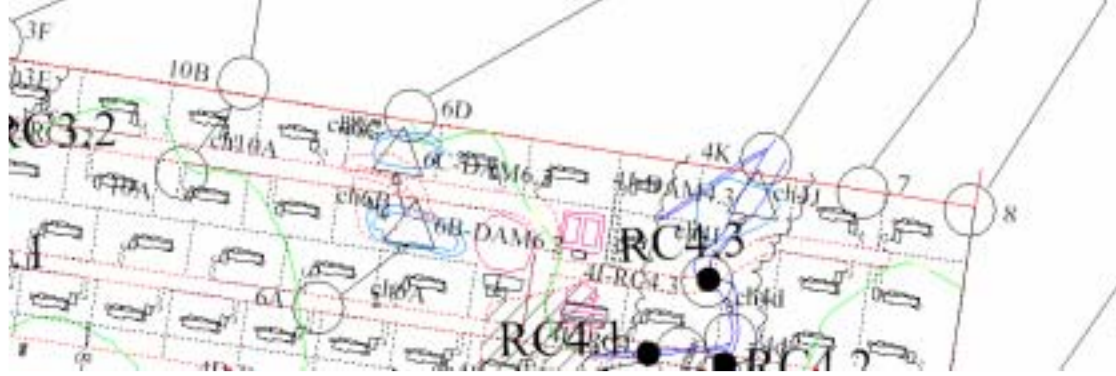
▶ Concept development
▶ Research & development
▶ Planning
▶ Conceptual design
▶ Detailed design
▶ Design & build
▶ Operate & maintain
▶ Asset management
▶ Monitoring & reporting

### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au

# Stormwater Drainage

Capability Sheet CS17



## KEY AREAS OF EXPERTISE

Our urban stormwater and drainage engineering expertise is wide ranging and encompasses natural systems, urban systems and construction activities. What ever your design requirements, we will be able to provide you with tailor-made environmentally beneficial solutions and designs meeting your site and project specific constraints.

Our engineering services in stormwater and drainage design are as diverse as:

- ▶ Residential sub-divisions
- ▶ Road and pavement drainage
- ▶ Industrial estates and commercial centres
- ▶ Creek and river works
- ▶ Wetland and lake systems

## HOLISTIC INTEGRATED DESIGNS

Martens & Associates engineers and scientists ensure that our stormwater and drainage designs are well integrated into your project. Our designs are holistic and consider the drainage network as a key part of the entire development project.

We ensure minimum visual impact, sustainable development practice, integration between constructed and natural systems, and cost effective solutions.

## CORE CAPABILITIES

Our services cover a range of core technical disciplines:

- ▶ Stormwater drainage and reticulation
- ▶ Stormwater detention
- ▶ Stormwater treatment systems
- ▶ Stormwater re-use and irrigation
- ▶ Constructed wetlands for water quality control
- ▶ Open channel hydraulics
- ▶ Flooding and risk assessment
- ▶ Floodplain flood dynamics
- ▶ Floodway mapping



### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au

# Telecommunications Towers & Monopoles

Capability Sheet CS18



## EXPERIENCE

Martens & Associates has undertaken several hundred investigations for the approval, design and construction of telecommunications infrastructure for a range of private and public organisations. Structures for which services have been provided include:

- ▶ Lattice towers
- ▶ Monopoles
- ▶ Power supply facilities
- ▶ Service buildings
- ▶ Service trenching



## PROBLEM SOLVING AND INNOVATION

Our design and field engineers are capable of delivering a range of investigations and services in order that local environmental conditions and constraints can be managed in a practical and cost-effective way. Examples of specific services include:

- ▶ Contaminated soil investigations
- ▶ Foundations investigation
- ▶ Groundwater monitoring
- ▶ Hazardous gas management
- ▶ Rock engineering
- ▶ Site supervision
- ▶ Slope stability assessment and management
- ▶ Soil reinforcement
- ▶ Stormwater control
- ▶ Water quality and groundwater chemistry

## DIFFICULT ENVIRONMENTS

Martens have delivered practical design information for numerous difficult footing environments. Examples include:

- ▶ Acid sulphate soils
- ▶ Contaminated soil
- ▶ High and corrosive groundwater conditions
- ▶ Landfill and uncontrolled fill sites
- ▶ Low bearing pressure soils
- ▶ Soft deep alluvial sediments
- ▶ Steep unstable sites

### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au

# Traffic, Transport & Parking

Capability Sheet CS19



## STRATEGIC ADVICE

Martens provide specialist independent and high quality traffic and transport planning, engineering and management services to clients across all industries including residential, commercial and industrial.

We offer a complete service to private developers and government from strategic transport planning and policy advice through to traffic impact assessments, traffic management plans, detailed analysis and road and intersection design.

## SERVICES

Martens offer a full range of services in relation to traffic, transport and parking management:

- ▶ Community consultation – public meetings, workshops, circulars
- ▶ Construction traffic management plans
- ▶ Internal access, vehicle turning paths – cars, rigid & articulated vehicles
- ▶ Local area traffic management
- ▶ Parking – occupation and stay duration survey
- ▶ Parking - car park layout design and certification
- ▶ Pedestrian and bicycle planning
- ▶ Road design - sight distance, alignments, construction drawings
- ▶ Road safety audits, black spot analysis
- ▶ Traffic and parking modelling
- ▶ Traffic data collection - manned and automatic tube counts
  - intersection turning movement counts
  - vehicle classification counts
  - vehicle origin counts
  - bicycle, public transport and pedestrian
  - interview surveys and questionnaires
- ▶ Traffic impact assessments and appraisals
- ▶ Transport economics and financial analysis
- ▶ Transport modelling and simulation
- ▶ Transport planning



### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au

# Water Supply

Capability Sheet CS22



*Our world relies upon clean and reliable water supply. Water represents a vital resource for community and industry. Its supply, treatment, storage and delivery are key engineering services that Martens & Associates provide.*

## RESOURCE INVESTIGATION

Knowing and understanding the type, availability and limits of your water resources provides key decision making information for your development and costs of delivering a sustainable water supply. Martens & Associates undertake a range of resource investigations at all stages of the development process:

- ▶ Catchment and supply dam feasibility and design
- ▶ Groundwater abstraction and supply investigation
- ▶ Reclaimed water resource assessment
- ▶ Resource evaluation and supply optimisation
- ▶ Stream flow harvesting and abstraction
- ▶ Water balance calculation

## WATER TREATMENT

Most water resources require some form of treatment prior to distribution and delivery. Martens has experience in a range of key water treatment areas:

- ▶ Economic feasibility assessment
- ▶ Existing utility improvements eg. enhanced filtration & disinfection
- ▶ Risk management and quality control
- ▶ Selection and design of water treatment facilities

## DELIVERY AND STORAGE

Our Civil and Hydraulic engineers will ensure that your project will be delivered in compliance with the most current Standards and industry best practice methods. Martens provide a comprehensive range of services in relation to water delivery and storage systems including:

- ▶ Embankment and concrete dam design
- ▶ Logistical and economic feasibility assessment
- ▶ Materials specification and construction methods
- ▶ Quantity surveying
- ▶ Reticulated delivery infrastructure
- ▶ Storage structure sizing and design
- ▶ Supply pipelines



### MARTENS & ASSOCIATES

**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au

# Water Sensitive Urban Design (WSUD)

Capability Sheet CS24



## WHY WSUD ?

Past urban water management has focused on hard engineering solutions, such as underground piping of waterways and concrete drainage systems. Whilst this approach has been beneficial in flood control and disease prevention, it has caused detrimental impacts to the ecology of our waterways, contributed to water pollution, bank erosion and salinity and has also resulted in the wastage of valuable water resources. Water Sensitive Urban Design (WSUD) is an urban water cycle method that mimics the natural water cycle, delivering short and long-term cost savings benefits to both the environment and public amenity.

## OBJECTIVES OF WSUD

The core objectives of WSUD are straightforward and make 'good sense' in terms of urban planning and environmental management. Key goals include:

- ▶ Consideration of the complete water cycle
- ▶ Mimics natural processes in the control of stormwater
- ▶ Minimise impacts of development on the natural water cycle
- ▶ Sustainable stormwater management
- ▶ Treat stormwater as a resource

## OUR EXPERIENCE

Martens have an extensive record of WSUD projects. Company founder Dr Martens was one of a handful of pioneering Australian stormwater pollution control scientists during the early 1990's while at the University of Sydney. His research efforts led to the establishment of much baseline stormwater quality information throughout the Greater Sydney Basin. Martens have since developed this base-line knowledge to deliver leading WSUD advice to government and industry for more than 10 years.

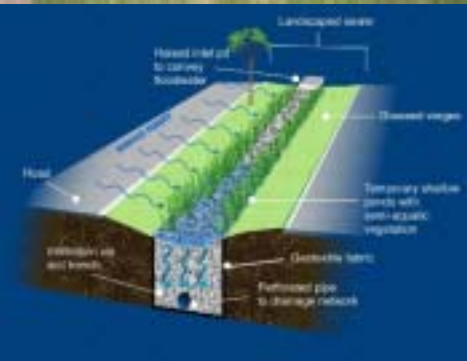
## CORE SERVICES

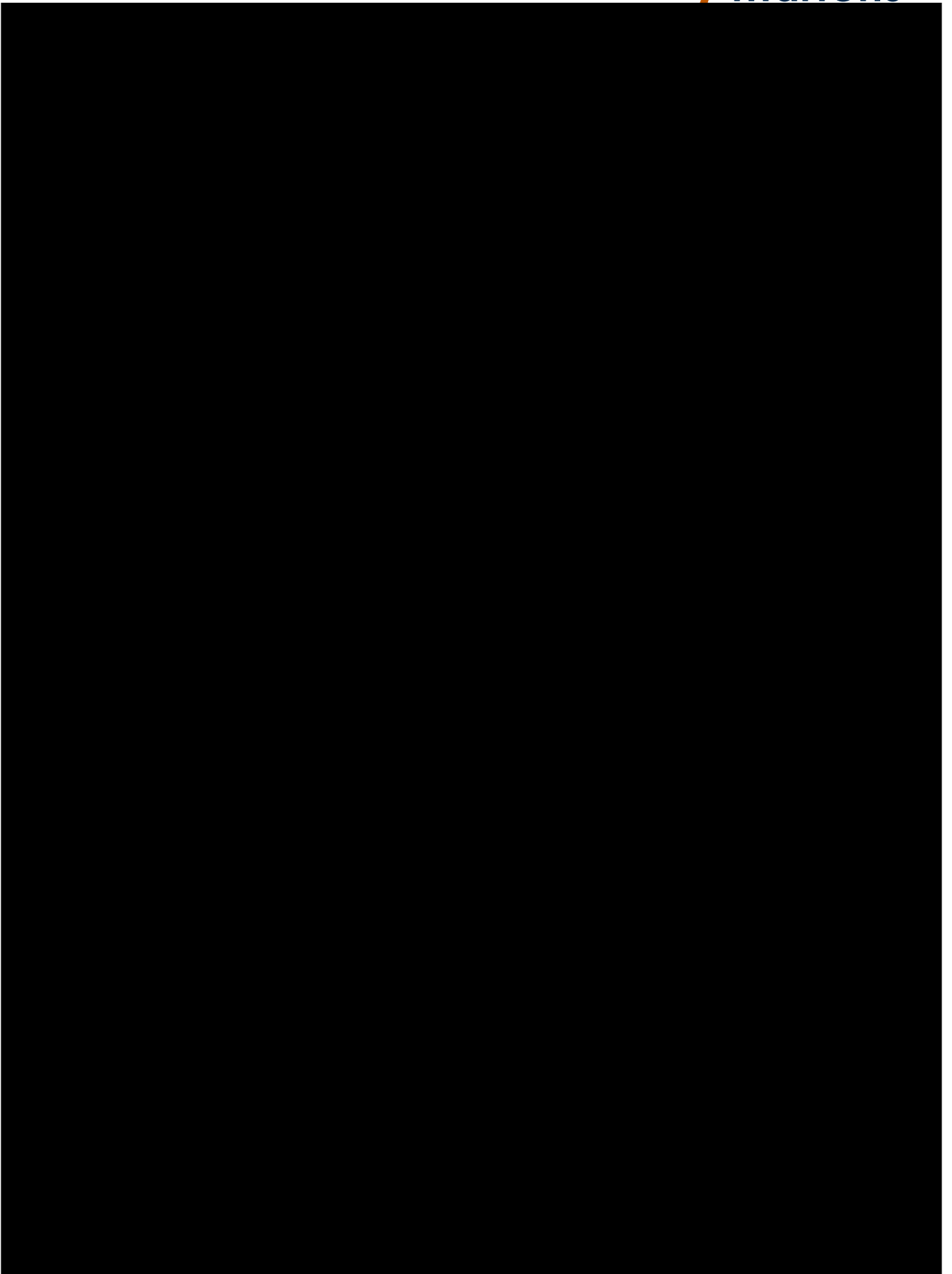
Martens provide a full range of environmental and engineering services for WSUD. We provide advice to industry and government for the entire project timeline from project inception and concept planning, through to development application documentation, detailed designs and construction certificate approvals, and construction management. Our key services include:

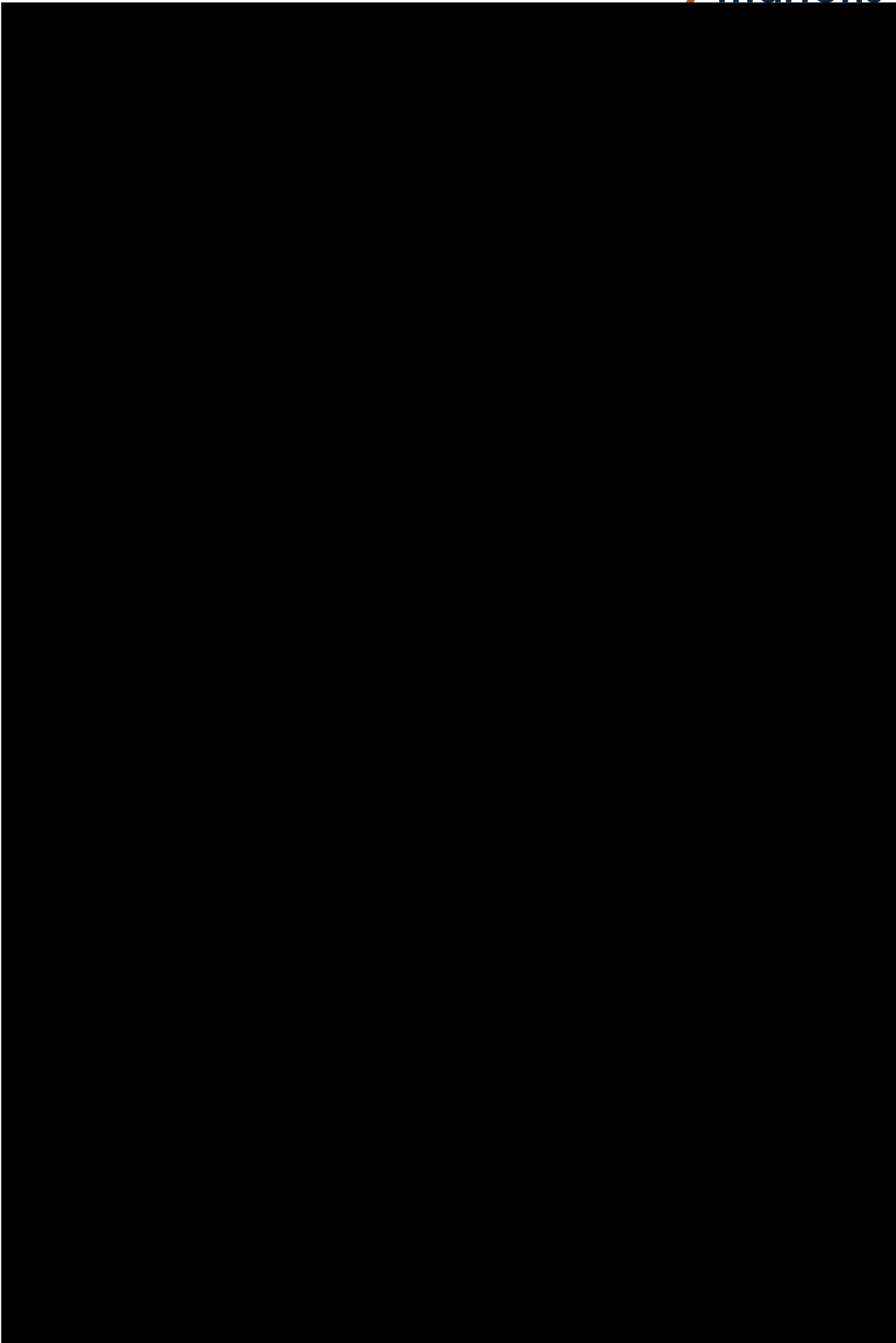
- ▶ Aquatic and riparian habitat restoration
- ▶ Design of structures – swales, infiltration systems, filters, basins, wetlands
- ▶ Detailed design and tender documentation
- ▶ Environmental buffers and set-backs – determination and assessment
- ▶ Establish stormwater quality targets for discharge and infiltration
- ▶ Groundwater injection systems – design, construction, monitoring
- ▶ Infrastructure life-cycle cost analysis – financial modelling
- ▶ Local Government– Section 94 contribution plans, DCPs, rezonings
- ▶ Stormwater re-use investigation, design and construction
- ▶ Water balance modelling- long-term supply-demand simulation
- ▶ Water cycle management plans and quantity control
- ▶ Water quality modelling (eg. MUSIC, RAFTS, DRAINS)

### MARTENS & ASSOCIATES

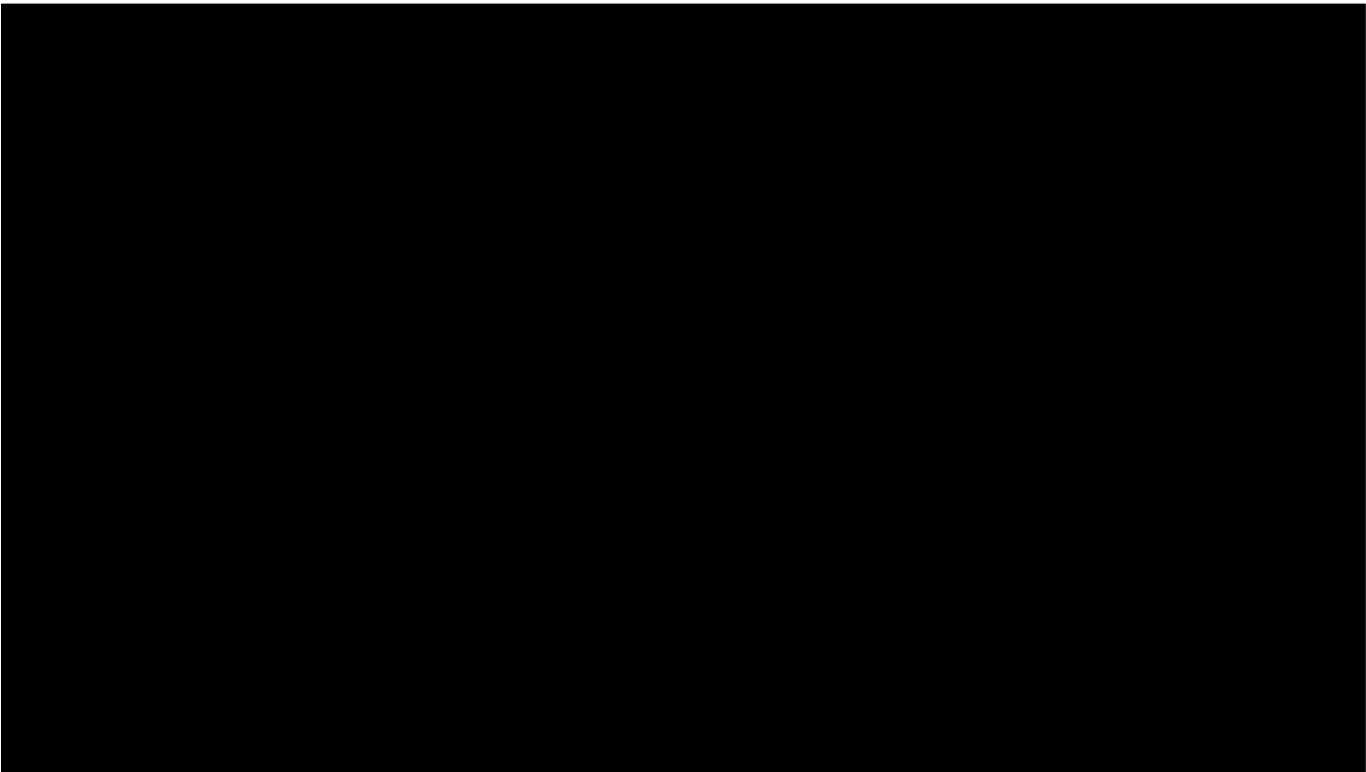
**A** Suite 201/20 George St  
Hornsby, NSW 2077  
Australia  
**P** + 61-2-9476-9999  
**F** + 61-2-9476-8767  
**E** mail@martens.com.au  
**W** www.martens.com.au

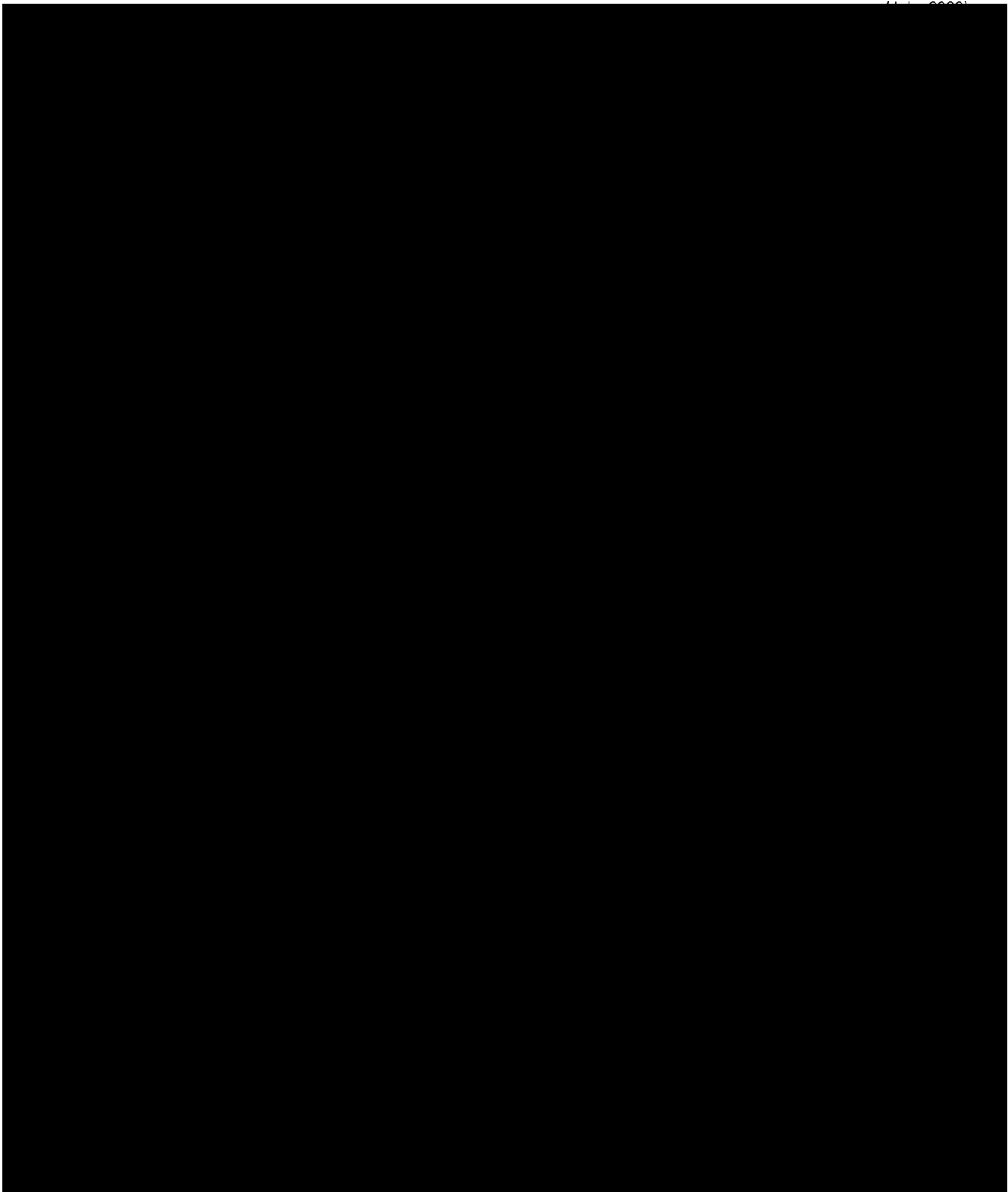


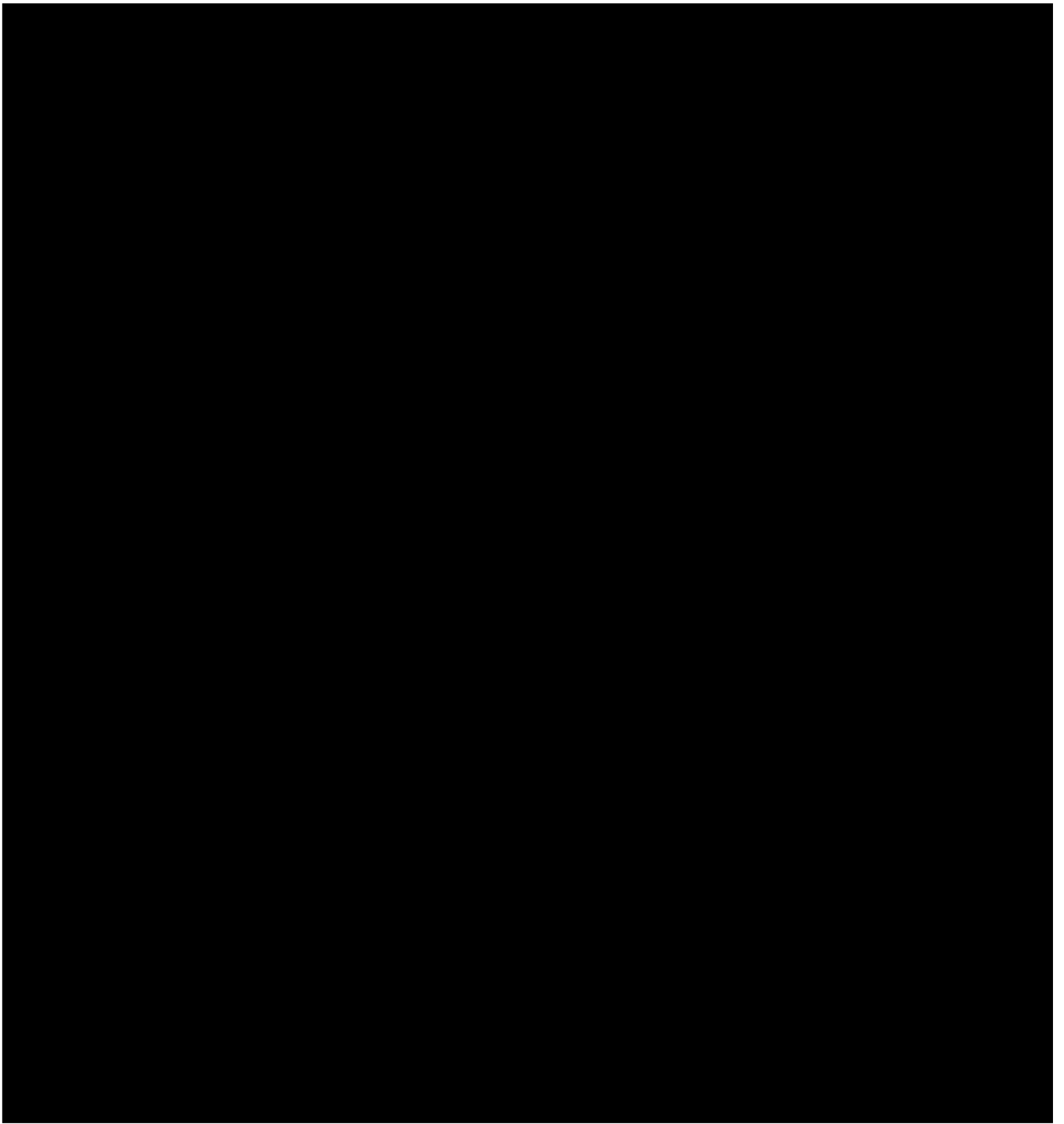












	(iv)	the swept path of the longest construction vehicle entering and exiting the site in association with the new work, as well as manoeuvrability through the site, in accordance with the latest version of AS 2890.2; and	Section 2.7, page 10-13
	(v)	arrangements to ensure that construction vehicles enter and leave the site in a forward direction unless in specific exceptional circumstances under the supervision of accredited traffic controller(s).	Section 2.7, page 10 point 3

## APPENDIX F – Flood Emergency Response

See attached full sub-plan prepared by Martens.

Condition	Document / Sub-Plan Reference	Document / Sub-Plan Reference
B18	The Construction Flood Emergency Management Sub-Plan must address, but not be limited to, the following:	-
	(a) be prepared by a suitably qualified and experienced person(s);	Page 3 Document authors
	(b) address the provisions of the Floodplain Risk Management Guidelines (EHG);	Section 1.1 Page 6
	(c) include details of:	
	(i) the flood emergency responses for the construction phase of the development;	Section 3.4 – 3.7 Page 13 - 16
	(ii) predicted flood levels;	Flood mapset page 28

	(iii)	flood warning time and flood notification;	Section 3.2 page 11 Section 3.7 page 16
	(iv)	assembly points and evacuation routes;	Section 6 Page 21
	(v)	evacuation and refuge protocols; and	Section 3.5 Page 15
	(vi)	awareness training for employees and contractors, and users/visitors.	Section 3.8 Page 17

- HCA induction for contractors includes an introduction to the emergency procedures specific to the Jerrabomberra High School site. This includes the location of the emergency muster point located in the newly constructed cul-de-sac near the gate 1 entry. This location as shown on the below diagram taken from the full appendixes report is free from flooding risk and was chosen with this in mind. Any flood or emergency evacuation requirements will be conveyed through the onsite nurse call system.
- Monitoring of weather is undertaken daily by the HCA site team to identify upcoming severe events and this information is communicated to subcontractors on site via the daily pre start and high risk construction notice board.

Extract from Appendix F – page 28



0 20 40 60 80 100 m

1:2500 @ A4

Viewport Results

Aerial Image from Nearmap (2021).  
Cadastral sourced from SIX Maps Clip & Ship (2021).

1% AEP - Existing Conditions Water Level (mAHD) & Water Depth (m)

Map Title / Figure:

FL04	Map
Lot 1, DP1263364	Site
New High School in Jerrabomberra	Project
Flooding Assessment	Sub-Project
Department of Education	Client
22/09/2021	Date



# APPENDIX G – Construction Waste Management

Attached document - JHS - Waste Management Sub-plan - Final NV 14.7.22

Appendix G - JHS Construction Waste Management Plan Rev E FINAL 8.9.22

Condition	Condition Requirement	Document / SubPlan Reference
B16	<p>The Construction Waste Management Sub-Plan (CWMSP) must address, but not be limited to, the procedures for the management of waste including the following:</p> <p>(a) the recording of quantities, classification (for materials to be removed) and validation (for materials to remain) of each type of waste generated during construction and proposed use for materials to remain;</p> <p>(b) information regarding the recycling and disposal locations; and</p> <p>(c) confirmation of the contamination status of the development areas of the site based on the validation results.</p>	<p>-</p> <p>Appendix G Section C.3 Page 17</p> <p>CEMP Section 16.11 Page 32</p> <p>Appendix G Section 8 Page 10 (Page 22 - findings / conclusion of Douglas Partners 'DETAILED SITE INVESTIGATION (CONTAMINATION)' report March 2022.  Any suspected contamination discovered during civil works on the site will be dealt with as highlighted below in 16.6.</p>



# New High School in Jerrabomberra Construction Waste Management Plan

JERRABOMBERRA HIGH SCHOOL - REVISION D

THIS DOCUMENT REFLECTS THE INTENT OF THE NATIONAL AND VARIOUS STATE LEGISLATIVE AND REGULATORY COMPLIANCE (OFSC, AS4801 & ISO9001) REQUIREMENTS

Construction  
Development  
Retirement  
Capital



**HINDMARSH**

Leadership at work



# Table of Contents

<b>1. Document Control</b>	
1.1 Revision Status .....	2
1.2 Project Specifics.....	2
1.3 Approval for Implementation .....	2
1.4 Induction.....	2
1.5 Precedence .....	3
1.6 Abbreviation Used.....	3
1.7 Purpose .....	3
<b>2. Introduction .....</b>	<b>4</b>
<b>3. Proposal.....</b>	<b>4</b>
<b>4. Site Description.....</b>	<b>6</b>
<b>5. NSW Legislative Requirements &amp; Guidelines.....</b>	<b>8</b>
<b>6. Servicing Arrangements .....</b>	<b>8</b>
6.1 Waste Management Equipment, Bin Sizes & Collection Frequency .....	8
6.2 Roles And Responsibilities .....	8
<b>7. On Site Waste Management Requirements.....</b>	<b>9</b>
<b>8. Waste Management Plan Application .....</b>	<b>10</b>
<b>9. Construction.....</b>	<b>11</b>
<b>Appendix A – JHS Site Access Diagram .....</b>	<b>13</b>
<b>Appendix B – Standard EPA Signage .....</b>	<b>14</b>
<b>Appendix C – Project Phase Waste Estimates.....</b>	<b>15</b>
C.1 DEMOLITION PHASE .....	15
C.2 EXCAVATION PHASE .....	16
C.3 CONSTRUCTION PHASE .....	17

# 1. Document Control

## 1.1 REVISION STATUS

Approved revisions to this document may be independently issued. On receipt of a revision notice, insert the issue number, revision number and date of issue in table below. Alphabetical Revisions to be utilised prior to Draft Submission.

Date Issued	Revision	Details	Section	Page
13/05/21	A	Preliminary CWMP	ALL	ALL
22/06/21	B	Combined Plan Separated for each School	ALL	ALL
26/08/22	C	Content Revisions	ALL	ALL
20/09/22	D	FINAL	ALL	Multiple

## 1.2 PROJECT SPECIFICS

<b>Company Name:</b>	Hindmarsh Construction Australia
<b>ABN</b>	15 126 578 176
<b>Project:</b>	Jerrabomberra High School (Monaro Schools Cluster)
<b>Project No:</b>	2045
<b>Location:</b>	Jerrabomberra High School 101 Environa Dr, Jerrabomberra NSW 2619
<b>Client:</b>	SINSW
<b>Contract:</b>	SINSW VEI (Very Early Contractor Involvement) leading to GC21 [D&C]
<b>Work Description:</b>	New Construction

## 1.3 APPROVAL FOR IMPLEMENTATION

This revision of the Waste Management Plan has been reviewed with due regard to compliance with the Hindmarsh Construction Business Management Systems and contractual obligations of the contract and is authorised for use. Induction information is captured electronically within Aconex, please refer to the system for approval confirmation.

## 1.4 INDUCTION

Where required Hindmarsh Employees have been inducted into this Waste Management Plan (WMP), as well as acknowledging that they have read and understood their roles and responsibilities of this Plan and the knowledge management elements.

Induction information is captured electronically within Aconex, please refer to the system for Induction confirmation.

## 1.5 PRECEDENCE

This Construction Waste Management Plan (CWMP) does not in any way override any provisions of the Project Brief or brief issued by the Client. Where there is found to be a conflict in this CWMP with any requirements of the Project Brief, the Consultant is to refer the conflict to the Project Manager for direction.

## 1.6 ABBREVIATION USED

AFC	Approved for Construction	AS	Australian Standard
BCA	Building Code of Australia	CC	Construction Certificate
CCD	Competition Concept Design	CD	Contract Documentation
CWMP	Construction Waste Management Plan	D&C	Design and Construction
DA	Development Application / Approval	DD	Detailed Design
DM	Design Manager	DMP	Design Management Plan
DOS	Design Options Study	DR	Documentation Readiness (for tender)
ESD	Environmentally Sustainable Design	FDB	Functional Design Brief
FRD	Functional Relationship Diagram	PCA	Principle Certifying Authority
HCA	Hindmarsh Construction Australia	PM	Project Manager
PCG	Project Control Group	PSA	Professional Services Agreement
PDC	Principal Design Consultant	QS	Quantity Surveyor / Cost Planner
PMP	Project Management Plan	RL	Reduced Level
QA	Quality Assurance	SQE	Safety Quality and Environmental
R&O	Risk and Opportunity (Financial focus)	WOL	Whole of Life
SD	Schematic Design	Compass	Hindmarsh Management System
SoA	Schedule of Accommodation		
VM	Value Management		
ACONEX	Web-based Information Management System		

## 1.7 PURPOSE

This plan addresses the relevant Secretary's Environmental Assessment Requirements (SEARs), namely:

- SEARs 18

The purpose of this CWMP is to:

1. Identify, quantity and classify waste streams to be generated during construction.
2. Identify appropriate servicing arrangements (including but not limited to, waste management, loading zones, mechanical plant) for the site.
3. To ensure storage and collection of waste is designed and managed having appropriate regard to space, location, amenity and ongoing management of waste management facilities.
4. Describe measures to be implemented to manage, reuse, and recycle and safely dispose of the waste.
5. To maximise reuse and recycling of demolition and construction materials and materials from development.
6. To encourage building design techniques in general which minimise waste generation.

7. To minimise the amount of waste being deposited to landfill with targets to reuse or recycle at least 90% of construction and demolition waste as per the EFSG DG02 2.7.1 Construction and demolition waste requirements.

## 2.Introduction

This CWMP accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) in support of an application for a State Significant Development (SSD No 24461956). The SSDA is for a new high school located at Jerrabomberra.

This report addresses the Secretary's Environmental Assessment Requirements (SEARs), notably:

Table 1 – SEARs Requirement	Response
18. Waste Identify, quantify and classify the likely waste streams to be generated during construction and operation. Provide the measures to be implemented to manage, reuse, recycle and safely dispose of this waste. Identify appropriate servicing arrangements (including but not limited to, waste management, loading zones, mechanical plant) for the site.	
Classification of the waste.	Refer to Appendix C
Estimates / details of the quantity of each classification of waste to be generated during the construction of the project, including bulk earthworks and spoil balance.	Refer to Appendix C
Handling of waste including measures to facilitate segregation and prevent cross contamination.	Refer Section 6.2 Roles & Responsibilities
Management of waste including estimated location and volume of stockpiles.	Refer to Appendix C
Waste minimisation and reuse.	Refer Section 6.2 Roles & Responsibilities
Lawful disposal or recycling locations for each type of waste.	Refer Section 6 Servicing Arrangements
Contingencies for the above, including managing unexpected waste volumes.	Refer Section 6 Servicing Arrangements

## 3.Proposal

The proposed development is for the construction of a new high school in Jerrabomberra. The proposal will meet community demand and to ensure new learning facilities are co-located near existing open space infrastructure. The proposal generally includes the following works:

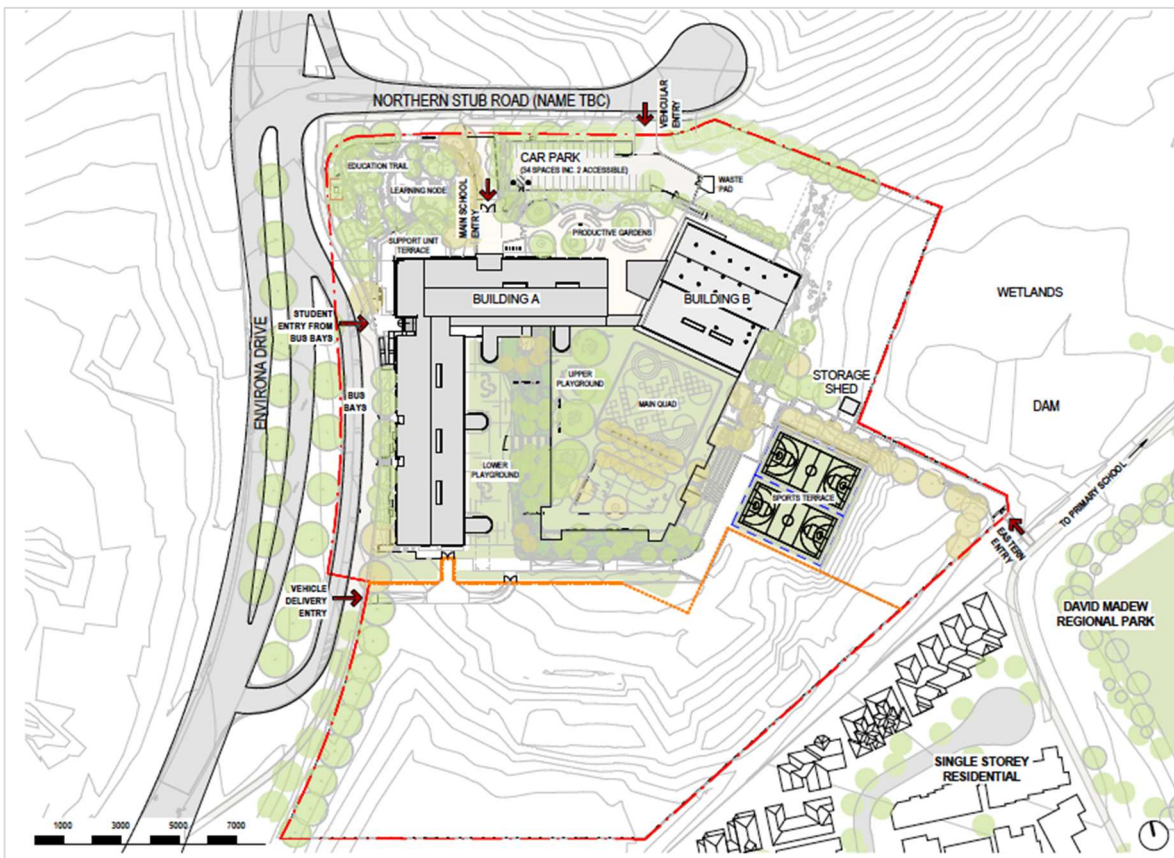
- Site preparation;

- Construction of a series of buildings up to three storeys including administration/staff areas, library, hall and general learning spaces;
- Construction of new walkways, central plaza and outdoor games courts;
- Construction of a new at-grade car park;
- Associated site landscaping and open space.

The proposal has been designed to accommodate approximately 500 students with Stream 3 teaching spaces, however the core facilities will be future proofed to a Stream 5 to enable possible future expansion to meet projected demand.

The proposal will include site preparation works, such as clearing and levelling to accommodate the proposed buildings and play areas. The proposal will involve the construction of a series of buildings housing general learning spaces, administration and staff wings, outdoor learning areas, a library and assembly hall.

The proposal will include construction of a new driveway and hardstand with access proposed off the northern stub road east of Environa Drive. Pedestrian access is proposed off Environa Drive and the northern stub road.



**Figure 1:** Proposed site plan  
Source: TKD Architects

## 4.Site Description

The proposed development is located within the South Jerrabomberra Innovation Precinct, also referred as the Poplars Innovation Hub, in the local government area of Queanbeyan-Palerang Regional Council.

The school site- is part of an existing lot (Lot 1 in DP 1263364), which is approximately 65.49ha in area and will be characterised by a mix of business park and open space uses and a new north-south connector road named Environa Drive.

Delivery of the Precinct is underway with Environa Drive currently under construction. Most of the-lot, however, remains undeveloped.

The school site is subject to a proposed lot (Lot 2 in DP 1263364), which was approved by Council under DA332-2015 on 10 March 2021 but is not yet registered. The approved lot is irregular in shape, is largely cleared and is approximately 4.5ha in area. A small dam is located adjacent to the south eastern boundary of the site, which forms part of a broader wetland.

The site is located in excellent proximity to existing open space facilities. It adjoins David Madew Regional Park to the south east and is located 100m east of an existing recreational field associated with Jerrabomberra Public School.

A description of the site is provided in the table below.

Table 1 – New High School in Jerrabomberra Site Description

Item	Description
Site address	School address yet to be determined however, it is located within the Jerrabomberra Innovation Precinct at 101 Environa Dr, Jerrabomberra.
Legal description	Lot 1 in DP 1263364 (existing) Lot 2 in DP 1263364 (proposed, but not registered)
Total area	Lot 1 – 65.49ha Lot 2 – 4.5ha
Frontages	The site provides frontage to Environa Drive and the northern stub road, both currently under construction.
Existing use	The site is undeveloped and contains a series of small vegetation clusters scattered across the site.
Existing access	Existing access is via an informal unsealed driveway off Tompsitt Drive along the northern boundary of the existing lot.  The site will be accessed via Environa Drive and a secondary access road (North Road), which is currently under construction.

Table 1 – New High School in Jerrabomberra Site Description

Item	Description
Context	<p>Land to the south is primarily residential in nature.</p> <p>Jerrabomberra Public School and David Madew Regional Park are located to the east/south-east, while land to the west is undeveloped and features Jerrabomberra Creek.</p> <p>The site is located within the South Jerrabomberra Innovation Precinct, which is currently under construction.</p> <p>The areas north and west of the site are currently undeveloped but the site is currently undergoing a transition from rural to business park uses.</p> <p>Development further north on the opposite side of Tomsitt Drive and along Edwin Land Parkway includes retail and commercial uses.</p> <p>Development immediately to the south includes existing low density residential development. Land in the south west has been identified for future low density residential, light industrial and business park uses.</p>



**Figure 2:** Site aerial depicting the land subject to the proposed High School.  
 Source: TKD Architects

# 5.NSW Legislative Requirements & Guidelines

Relevant key legislation and guidelines applicable to the project include:

- Protection of the Environment Operations Act 1997
- Protection of the Environment (General) Operations Act 1998
- Waste Avoidance and Resource Recovery Act 2014
- Protection of the Environment Operations (Waste) Regulation 2014
- Waste Classification Guidelines (EPA, 2014)
- NSW Department of Planning and Environment, Secretary's Environmental Assessment Requirements (SEARs)

## 6.Servicing Arrangements

The current legislation determines that the generator of waste is the owner of the waste until the waste crosses a calibrated weighbridge into a licensed facility. Waste contractors to demolition and construction contractors are the primary transporters of waste off-site, accordingly, waste contractors are required to provide verifiable monthly reports on waste reused, reprocessed or recycled (diverted from landfill) or waste sent to landfill. These reports have a direct bearing on the generator's compliance with the relevant regulations.

This CWMP will be implemented onsite throughout including singularly or collectively the demolition, excavation, construction and fit out phases.

A Waste Data File must be maintained on-site and all entries are to include:

- The classification of the waste
- The time and date of material removed
- A description of and the volume of waste collected
- The location and name of the waste facility that the waste is transferred to
- The vehicle registration and the name of the waste contractor's company

The Waste Data File will be made available for inspection to any authorized officer at any time during the life of the site works. At the conclusion of site works, the designated person will retain all waste documentation and make this validating documentation available for inspection.

Arrangement's will be made with the Waste Contractor to increase bin supply if there is an unexpected increase in waste generation.

### 6.1 WASTE MANAGEMENT EQUIPMENT, BIN SIZES & COLLECTION FREQUENCY

All waste will be removed by a licensed waste contractor using 15-meter bins on site. The construction and demolition waste will be removed when bins are full and within construction site hours to reduce disturbance of the neighbours.

### 6.2 ROLES AND RESPONSIBILITIES

The waste management strategy for the project will operate over the design, procurement, and construction including fit out of the project, and is detailed in the following Table 3.



**Table 3 – Breakdown of Tasks and responsibilities**

Management Strategies	Responsibilities
<p><u>Design:</u></p> <p>Design for materials to standard sizes</p> <p>Design for operational waste minimisation</p> <p>Consider ways to avoid, reuse and recycle construction wastes</p>	<p>Architect, Subcontractors</p> <p>Architect &amp; Builder</p> <p>Subcontractors.</p>
<p><u>Procurement:</u></p> <p>Select recycled and reprocesses materials</p> <p>Select components that can be reused after deconstruction</p> <p>Prioritise suppliers that take back offcuts and unused product.</p> <p>Encourage contractors and subcontractors that use unneeded offcuts and unused product for use on other jobs</p> <p>Ordering the right quantities of materials (Purchasing Policy);</p> <p>Include prefabrication of materials</p>	<p>Architect, Engineer, Builder &amp; Sub Contractors</p> <p>Architect, Engineer &amp; Builder Sub-Contractors</p> <p>Sub-Contractors</p>
<p><u>Pre-construction:</u></p> <p>Waste management plan to be reviewed &amp; approved prior to construction.</p> <p>Contract a Waste Contractor</p>	<p>Builder</p> <p>Waste Contractor</p>
<p><u>Construction on-site:</u></p> <p>Use the avoid, reuse, reduce, recycle principles Minimisation of recurring packaging materials Returning packaging to the supplier</p> <p>Separation of recycling of materials off site Audit &amp; monitor the correct usage of bins</p> <p>Audit and monitor the Waste Contractor</p>	<p>Builder &amp; Waste Contractor Sub-contractors</p> <p>Builder &amp; Sub-contractor Waste Contractor</p> <p>Builder &amp; Waste Contractor</p>
<p><u>Avoiding construction waste</u></p> <p>Reduce extraneous packaging use reusable padding and careful packing.</p> <p>All packaging generated on site should be captured for reuse or recycling wherever possible.</p> <p>Reuse formwork;</p> <p>Use reuse non-returnable containers on the job site to the maximum extent possible</p>	<p>Builder</p>

## 7. On Site Waste Management Requirements

There will be a designated waste storage area for the disposal and storage of construction waste prior to collection. This area will be located conveniently for demolition and construction work team to use the bins as well as for waste contractors to collect. An indicative location has been provided in Appendix A. Other requirements include:

- The routes for movement of waste between work site and waste storage area are to be kept obstruction-free.
- The routes for movement of bins and waste between storage and collection points are marked in the site drawing, and will be kept obstruction-free (if waste is moved between the waste storage area(s)).
- The waste bin collection point provided will be accessible for waste collection vehicles. There are no obstructions to turning or reversing, pulling up vehicles and lifting bins.
- Access for waste collection vehicles will not be compromised by construction-related activities vehicles or other consequences of construction staging.
- All waste not being reused on site will be removed during, or at the completion of, the construction stage.
- No waste will be left on site unless it is part of valid reuse on site, which is integral to and in place in the design.
- In order to manage noise levels, collection of waste from the construction site will only occur during hours approved for construction work.
- All vehicles entering or leaving the site must have their loads covered.
- All vehicles, before leaving the site, to be cleaned of dirt, sand and other materials, to avoid tracking these materials onto public roads.
- At the completion of the works, the work site is left clear of waste and debris.

## 8. Waste Management Plan Application

PROJECT: New High School in Jerrabomberra

ADDRESS: Refer Table 2 above

OWNERS: Schools Infrastructure NSW (SINSW)

DETAILS OF APPLICANT: Department of Education

DESCRIPTION OF BUILDINGS AND OTHER STRUCTURES CURRENTLY ON THE SITE:


This school is generally planned to be built on a brownfield site and will be a completely new school. Some reuse of existing Council buildings is proposed.

BRIEF DESCRIPTION OF PROPOSAL:

The proposed development is for construction and operation of a new high school in Jerrabomberra that will accommodate 500 students.

IF MATERIALS / WASTE IS REUSED ON SITE OR OFF SITE, HOW WILL IT BE RE-USED:

Generally excavation of ENM will be used onsite for fill and landscaping wherever possible. This material may be covered or drenched to reduce soil displacement and prevent air pollution.

	Name	Signed	Contact Number	Date
Prepared by:	Stefan Szczyzew		0427 429 244	20/08/2021

# 9. Construction

Prior to commencement of construction, Hindmarsh will undertake a full site investigation by an appropriately qualified person and any existing hazardous materials within the site will be removed in accordance with all relevant regulatory requirements.

Other waste building materials generated from demolition or construction activities will be recycled as far as practicable.

Hindmarsh will comply with the requirements of all relevant Authorities in relation to the disposal of all waste material.

The following measures will be adopted to encourage the management and reduction of waste to minimise the loss of natural resources and landfill space:

- Emphasise the importance of recycling and waste reduction;
- Encourage the use of recycled materials where it is reasonably practical;
- Minimise the use of packaging materials and recycle packaging materials where possible;
- Waste concrete to be sent to a concrete recycling plant where possible;
- Separate removed native vegetation from general construction waste, mulch and stockpile for re-use; and
- Dispose of any non-recyclable general waste at approved waste disposal facilities.

Reference will be made to Local Council's and Department of Education (DoE) Waste Management Guidelines to comply with any specific requirements.

Dangerous goods (such as petrol, diesel, oxy-acetylene, oils, glues etc) will be stored in a lockable compound with sufficient ventilation in accordance with relevant Codes of Practice and Standards.

Copies of all relevant Material Safety Data Sheets is retained on site as required.

A project-specific resource recovery and waste management plan will be developed, detailing the following:

- Efforts to minimise waste on site by avoiding over-estimation of purchasing requirements, minimising packaging materials and buying environmentally approved and recycled content products;
- Procedures for the collection and sorting of recyclable construction materials;
- The type and quantity of materials that are to be re-used or recycled;
- Provision of containers for recyclable materials, including cardboard, glass, metal, plastic and green waste;
- The re-use of timber, glass and other materials;
- The recycling of asphalt, metal, bricks, tiles, masonry, concrete, plasterboard, plastic, batteries, cardboard, carpet and other materials;
- Provision for collection of daily rubbish from workers;
- Procedures for removal of waste (materials that cannot be re-used or recycled) from the site;
- Procedures for removal of hazardous or dangerous materials from the site; and
- Buying environmentally approved and recycled content products.

Removal of hazardous and dangerous materials from the site shall be in accordance with State and Federal legislation, including WorkSafe requirements. Asbestos / soil waste will be removed (if applicable) according to WorkSafe Guidelines and placed in double-lined bins before being disposed of at a licensed landfill by a licensed transporter.

Waste material shall be stored on site neatly, in appropriate bins or stockpiles, in such a manner that stormwater run-off does not come into contact with waste.

Waste segregation areas and temporary storage locations for skips / waste for recycling / re-use / disposal shall be selected so as to minimise safety risks to site workers and to minimise adverse impact on the visual amenity of the site. For external bins, self-closing lids shall be installed to ensure waste does not become airborne.

Waste collection shall only occur during permitted hours.

Litter and debris trapped against the site fence shall be regularly cleaned away. Burning off on site will be prohibited.

All waste disposed of (whether it be for recycling / re-use or landfill disposal) will be recorded on forms which will be part of the project records. Recycler and landfill disposal dockets will be used for confirmation of tonnages and proof of lawful disposal.

Hindmarsh shall be responsible for reporting any incident which causes, or threatens to cause, material environmental harm or breaches approval requirements to relevant project stakeholders as soon as possible.



# Appendix B – Standard EPA Signage

## General recycling



## Instructional



## Construction and demolitions



## Public place



## Recycling



## Garden organics and food waste



## Garbage



<sup>2</sup> *Better Practice Guidelines For Waste Management And Recycling In Commercial And Industrial Facilities 2012*. Sydney: NSW Environment Protection Authority, Accessed on 05/01/2017.

# Appendix C – Project Phase Waste Estimates

## C.1 DEMOLITION PHASE

Material Type on Site	Estimated Volume (m <sup>3</sup> ) or Weight (t) (Most Favourable to Least)		ON-SITE TREATMENT	OFF-SITE TREATMENT	
	Recycling	Disposal	Proposed reuse and/or recycling collection methods	Disposal / Transport Contractor	Licensed Waste Depot, Licensed Recycling Outlet or Licensed Landfill site
Concrete Brick Block-work & Tile					Tiger Waste's waste transfer station is located in Fyshwick. The facility is EPA approved and licenced by the ACT Government Transport Canberra and City Services. Licence number L0023.
Asphalt					As above
Metals					As above
Timber off-cuts					As above
Cardboard					As above
Plasterboard					As above
General Waste					As above
Subtotal					As above
Total					

Narrative: There are no structures onsite requiring demolition

## C.2 EXCAVATION PHASE

Material Type on Site	Estimated Volume (m <sup>3</sup> ) or Weight (t) (Most Favourable to Least)			ON-SITE TREATMENT	OFF-SITE TREATMENT	
	Reuse	Recycling	Disposal	Proposed reuse and/or recycling collection methods	Disposal / Transport Contractor	Waste Depot, Recycling Outlet or Landfill site
Excavated Natural Material (ENM) Greenfield site	19,600m <sup>3</sup>	800m <sup>3</sup>	Nil	Reuse for fill and landscaping	Tiger Waste	Tiger Waste's waste transfer station is located in Fyshwick. The facility is EPA approved and licenced by the ACT Government Transport Canberra and City Services. Licence number L0023.
Sub Total	19,600m <sup>3</sup>	800m <sup>3</sup>	Nil			
TOTAL	3,190m <sup>3</sup>					

Narrative: There is minimal excavation of ENM, which will be used back on the site for landscaping. This material will be covered to reduce soil displacement and prevent air pollution.

There may be potential contaminated soils, refer to the contamination reports prior to excavation and re-use of materials on site



### C.3 CONSTRUCTION PHASE

Material Type on Site	Estimated Volume (m <sup>3</sup> ) or Weight (t) (Most Favourable → Least)			ON-SITE TREATMENT	OFF-SITE TREATMENT	
	Reuse	Recycling	Disposal	Proposed reuse and/or recycling collection methods	Disposal / Transport Contractor	Waste Depot, Recycling Outlet or Landfill site
Concrete Brick Block-work & Tile		165m <sup>3</sup>		Co-mingled Bins	Tiger Waste	Crushed for road base
Metals		85m <sup>3</sup>		Co-mingled Bins	Tiger Waste	Scrap Metal Dealer for smelting
Timber off-cuts		175m <sup>3</sup>		Co-mingled Bins	Tiger Waste	Recycled for chips and mulch
Cardboard		142m <sup>3</sup>		Co-mingled Bins	Tiger Waste	Recycled into cardboard
Plasterboard		165m <sup>3</sup>		Co-mingled Bins	Tiger Waste	Recycled as soil conditioner
Plastics, plastic packaging, paint drums*, containers		75m <sup>3</sup>	30m <sup>3</sup>	Co-mingled Bins	Tiger Waste	- Styrene and plastic to landfill - Paint drums nested and recycled
Pallets and Reels	65 units			Separated onsite	Tiger Waste	Returned to the supplier
Liquid Waste			20m <sup>3</sup>	Separated onsite	Tiger Waste	Transferred to licensed landfill
General Waste			151m <sup>3</sup>	Co-mingled Bins	Tiger Waste	Transferred to licensed landfill
Sub Total	65 units	807 m <sup>3</sup>	201m <sup>3</sup>			
TOTAL		1008m <sup>3</sup>				

**Narrative:**

As the contracts for all contractors have not been let there are still those including the waste contractor To Be Advised (TBA).

All waste will be co-mingled and taken for off-site separation and reuse or recycling except Pallets and Reels.

# APPENDIX H – Construction Noise and Vibration Management

Attached document - JHS - Construction\_Noise\_and\_Vibration\_Management\_Sub-Plan\_

Condition	Condition Requirement	Document / Sub-Plan Reference
B15	The Construction Noise and Vibration Management Sub-Plan must address, but not be limited to, the following:	-
	(a) be prepared by a suitably qualified and experienced noise expert;	Appendix 1 Page 28
	(b) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009);	Section 10-13 Page 20-25
	(c) describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers;	Section 10.4 Page 20
	(d) include strategies that have been developed with the community for managing high noise generating works;	Section 2 (a) Page 20
	(e) describe the community consultation undertaken to develop the strategies in condition B15(d);	Section 10.1 Page 20
	(f) include a complaints management system that would be implemented for the duration of the construction; and	Section 10.6 Page 21
	(g) include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the implemented management measures in accordance with the requirements of condition B12.	Section 10.3, 10.4 Page 20



## New Jerrabomberra High School

### Construction Noise and Vibration Management Sub-Plan

Project ID	20210459.8
Document Title	Construction Noise and Vibration Management
Attention To	Hindmarsh Construction Australia Pty Ltd

<b>Revision</b>	<b>Date</b>	<b>Document Reference</b>	<b>Prepared By</b>	<b>Checked By</b>	<b>Approved By</b>
0	4/07/2022	20210459.8/0407A/R0/GC	GC		GC

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION</b> .....	<b>4</b>
<b>2</b>	<b>CONDITION SATISFACTION</b> .....	<b>5</b>
<b>3</b>	<b>SITE DESCRIPTION</b> .....	<b>6</b>
<b>4</b>	<b>NOISE DESCRIPTORS</b> .....	<b>9</b>
<b>5</b>	<b>ENVIRONMENTAL NOISE SURVEY</b> .....	<b>10</b>
<b>6</b>	<b>CONSTRUCTION HOURS</b> .....	<b>10</b>
<b>7</b>	<b>CONSTRUCTION NOISE AND VIBRATION OBJECTIVES</b> .....	<b>11</b>
<b>7.1</b>	<b>NOISE OBJECTIVES</b> .....	<b>11</b>
<b>7.2</b>	<b>DECC INTERIM CONSTRUCTION NOISE GUIDELINE</b> .....	<b>11</b>
7.2.1	Australian Standard AS2436:2010 " <i>Guide to Noise Control on Construction, Maintenance and Demolition Sites</i> " .....	12
<b>7.3</b>	<b>VIBRATION OBJECTIVES</b> .....	<b>13</b>
7.3.1	Structure Borne Vibrations.....	13
7.3.2	Assessing Amenity .....	14
<b>8</b>	<b>PROPOSED CONSTRUCTION ACTIVITIES</b> .....	<b>15</b>
<b>9</b>	<b>NOISE AND VIBRATION ASSESSMENT</b> .....	<b>16</b>
<b>9.1</b>	<b>NOISE IMPACT ASSESMENT</b> .....	<b>16</b>
<b>9.2</b>	<b>GENERAL DISCUSSION</b> .....	<b>19</b>
<b>10</b>	<b>RECOMMENDATIONS</b> .....	<b>20</b>
<b>11</b>	<b>CONTROL OF CONSTRUCTION NOISE AND VIBRATION – PROCEDURAL STEPS</b> .....	<b>22</b>
<b>12</b>	<b>ADDITIONAL NOISE AND VIBRATION CONTROL METHODS</b> .....	<b>23</b>
<b>12.1</b>	<b>SELECTION OF ALTERNATE APPLIANCE OR PROCESS</b> .....	<b>23</b>
<b>12.2</b>	<b>ACOUSTIC BARRIER</b> .....	<b>23</b>
<b>12.3</b>	<b>MATERIAL HANDLING</b> .....	<b>23</b>
<b>12.4</b>	<b>ESTABLISHMENT OF SITE PRACTICES</b> .....	<b>23</b>
<b>12.5</b>	<b>COMBINATION OF METHODS</b> .....	<b>23</b>
<b>13</b>	<b>COMMUNITY INTERACTION AND COMPLAINTS HANDLING</b> .....	<b>24</b>
<b>13.1</b>	<b>ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES</b> .....	<b>24</b>
<b>13.2</b>	<b>DEALING WITH COMPLAINTS</b> .....	<b>24</b>
<b>13.3</b>	<b>REPORTING REQUIREMENTS</b> .....	<b>25</b>
<b>13.4</b>	<b>CONTINGENCY PLANS</b> .....	<b>25</b>
<b>14</b>	<b>CONCLUSION</b> .....	<b>26</b>

# 1 INTRODUCTION

Acoustic Logic has been engaged to prepare a construction noise and vibration management plan for the proposed new high school development in Jerrabomberra.

The principal objective of this study is to undertake an evaluation of works/activities to be performed during the excavation and construction of the project and forecast the potential impacts of noise and vibration. This assessment will be used to formulate and streamline effective regulation and mitigation measures.

The principal issues which will be addressed in this report are:

Identification of the noise and vibration standards which will be applicable to this project

Identification of potentially impacted nearby development

Identify likely sources of noise and vibration generation and predicted noise levels at nearby development; and

Formulation of a strategy to comply with the standards identified and mitigation treatments in the event that compliance is not achievable.

Provided all measures outlined in this report are fully implemented, noise and vibration impacts associated with the construction of the development site will be strictly controlled, and the impact on the surrounding environment minimised.

## 2 CONDITION SATISFACTION

This Construction Noise and Vibration Management Sub-Plan (CNVMSP) accompanies an Construction Environmental Management Plan (CEMP)

This report addresses the CEMP Condition of Consent B15 requirements, notably:

**Table 2-1- Condition Satisfaction Table**

<b>CEMP Condition Satisfaction Table</b>		
<b>Condition</b>	<b>Condition Requirements</b>	<b>Document/Sub Plan Reference</b>
Condition B15	The Construction Noise and Vibration Management Sub-Plan must address, but not be limited to, the following:	
	a) be prepared by a suitably qualified and experienced noise expert;	Refer to Appendix 1: Author Curriculum Vitae (CV) – Page 28
	b) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009);	Section 10 to 13 – page 20-25
	c) describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers	Note:High noise activities such as piling are not required  Refer Section 10 to 13 – page 20-25 for managing noise activities during construction
	d) include strategies that have been developed with the community for managing high noise generating works;	Section 10 to 13 – page 20-25
	e) describe the community consultation undertaken to develop the strategies in conditionB16(d);	Section 10 to 13 – page 20-25
	f) include a complaints management system that would be implemented for the duration of the construction; and	Section 10 to 13 – page 20-25
	g) include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the implemented management measures in accordance with the requirements of condition B13.	Section 10 to 13 – page 20-25
• Relevant Policies and Guidelines: •Interim Construction Noise Guideline (DECC) •Assessing Vibration: A Technical Guideline 2006		

### 3 SITE DESCRIPTION

Excavation and construction works anticipated are as follows over a construction program as estimated below:

Bulk excavation and earth works – 37 Days

Use of tower cranes, and

Erection of up to 3 building structures, new walkways, central plaza and outdoor games courts and at-grade car park; (powered hand tools for formwork, concrete pump, vibrators etc ).

Internal fit out.

Landscaping (front end loaders etc);

Investigation has been carried out by this office in regards to the existing properties and noise impacts surrounding the proposed development, which is detailed below:

Existing residential blocks to the east and south of the site, and

Existing public school to the north east of the site.

Existing active recreation area to the east of the site

The nearest noise receivers around the site include:

**R1:** Residential Receiver 1 – Residential receivers to the south along Bayside Ct and Palm Ct

**R2:** Residential Receiver 2 – Residential receivers to the east along Coachwood Avenue

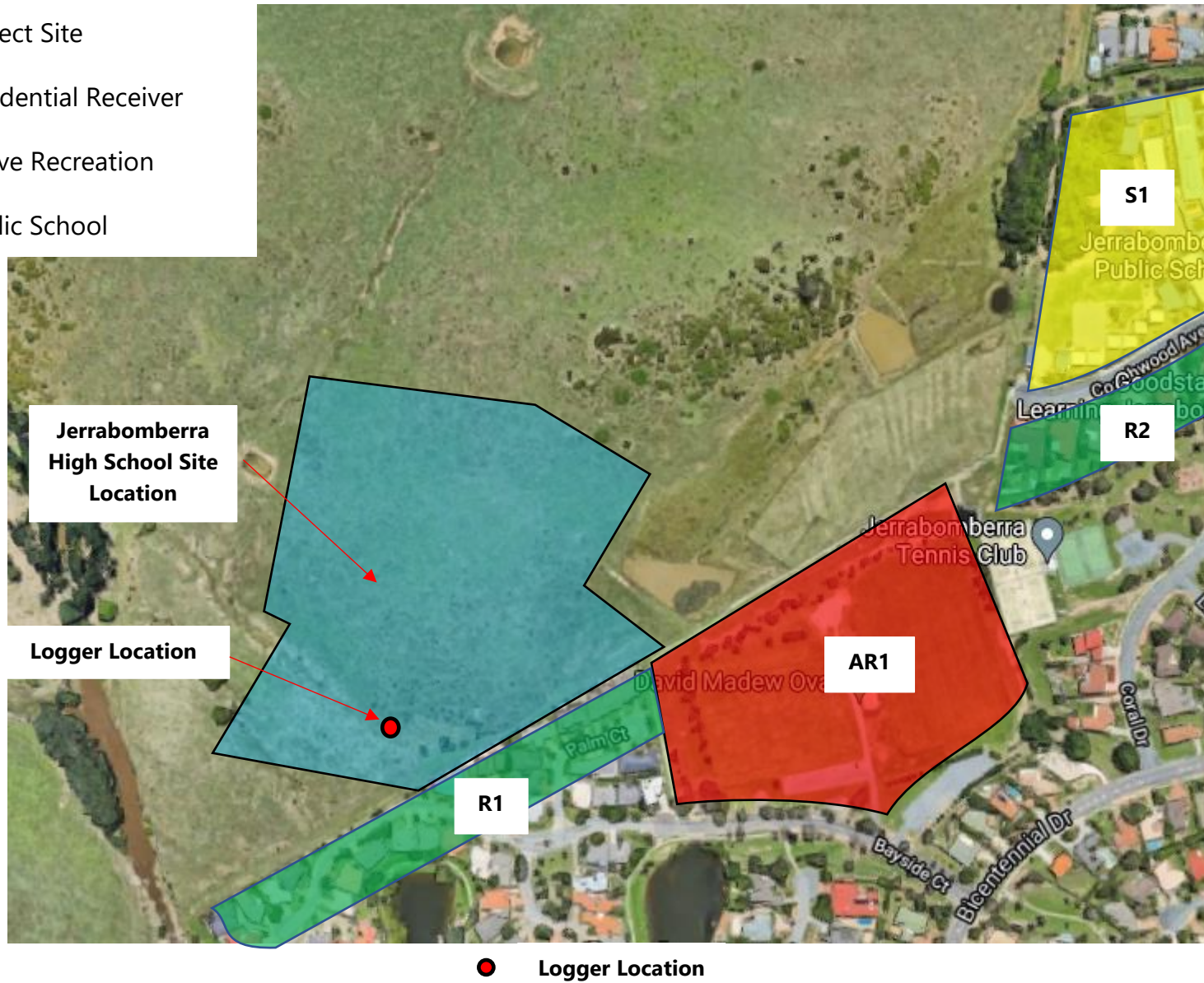
**AR1:** Active Recreation Receiver 1 – David Madew Regional Park to the east, and

**S1:** School Receiver 1 – Existing Public School to the north east along Coachwood Avenue.

A site map, measurement description and surrounding receivers are presented in Figure 1 below



- Project Site
- Residential Receiver
- Active Recreation
- Public School



**Figure 1 – Site Location and Noise Measurement Location**

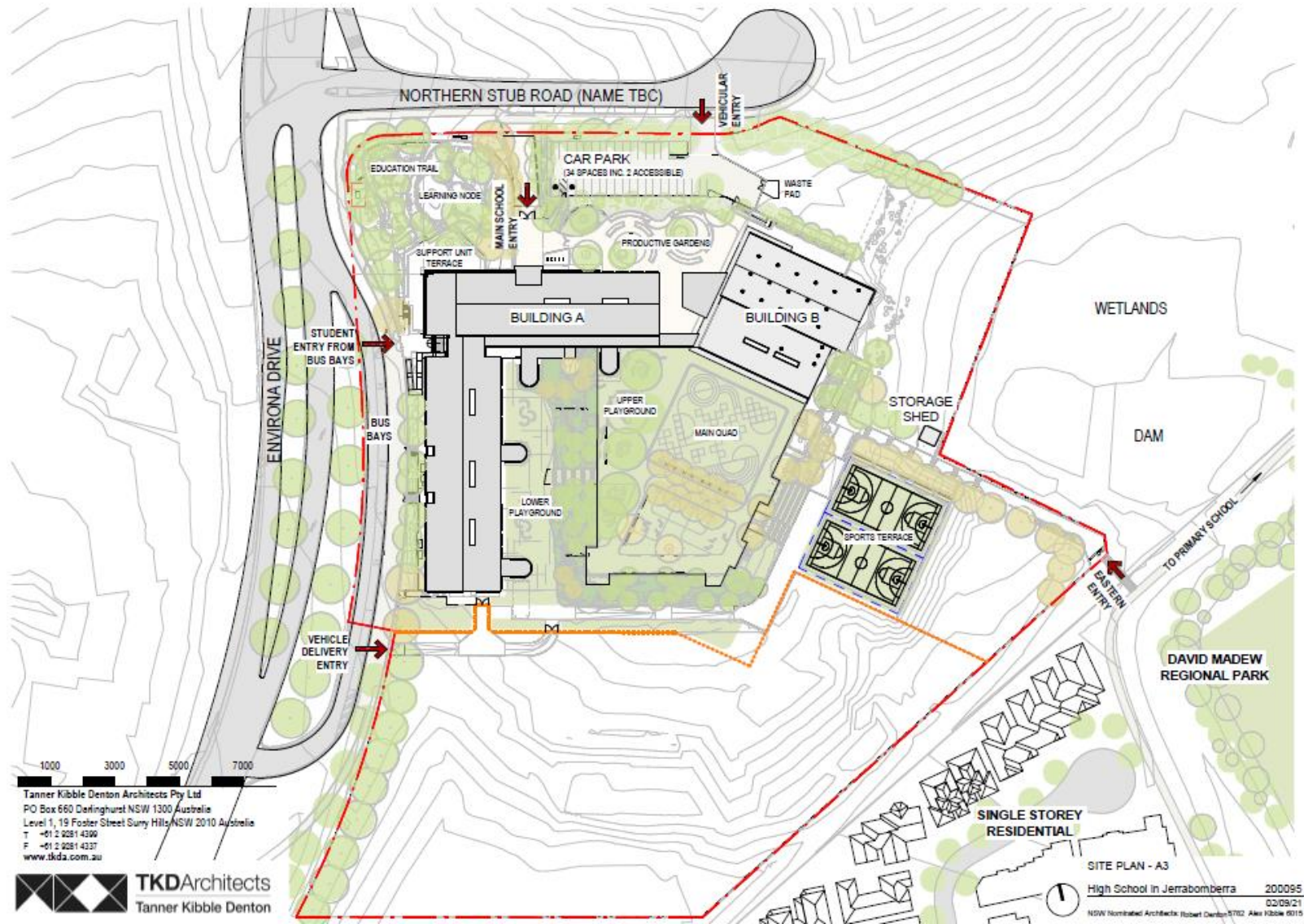


Figure 2 –Proposed Site Plan

## 4 NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three principal measurement parameters are used, namely  $L_{10}$ ,  $L_{90}$  and  $L_{eq}$ . The  $L_{10}$  and  $L_{90}$  measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The  $L_{10}$  parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the  $L_{90}$  level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The  $L_{90}$  parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the  $L_{90}$  level.

The  $L_{eq}$  parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15-minute period.  $L_{eq}$  is important in the assessment of environmental noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

## 5 ENVIRONMENTAL NOISE SURVEY

Noise monitoring was previously conducted in the approved Acoustic Logic *Noise and Vibration Assessment* prepared for DA (Ref: 20210459.2/0311A/R4/GC, dated 3/11/2021).

Summarised background noise levels are as presented below.

**Table 5-1 – Measured Rating Background Noise Levels**

<b>Location</b>	<b>Time of Day</b>	<b>Rating Background Noise Level – dB(A)<sub>L90</sub></b>
Southern Side of Site - Logger Location in Figure 1	Day (7am-6pm)	35*
	Evening (6pm-10pm)	33
	Night (10pm to 7am)	30*

\*Note: As per the EPA Noise Policy for Industry "Where the rating background noise level is found to be less than 35 dB(A) for the day periods, then it is set to 35 dB(A). Where the rating background noise level is found to be less than 30 dB(A) for the night periods, then it is set to 30 dB(A)"

## 6 CONSTRUCTION HOURS

In accordance with Standard Constructions Hours from DECC Interim Construction Noise Guideline (ICNG), work hours are as follows:

**Table 6-1 – Standard Construction Hours**

<b>Day</b>	<b>Standard Construction Hours</b>
Monday – Friday	7am – 6pm
Saturday	8am – 1pm
Sunday & Public Holidays	No Work Permitted

## 7 CONSTRUCTION NOISE AND VIBRATION OBJECTIVES

### 7.1 NOISE OBJECTIVES

Noise associated with construction activities on the site will be assessed in conjunction with the following documents and guidelines:

- NSW DECC Interim Construction Noise Guideline (2009); and
- Australian Standard 2436-2010 "Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites".

### 7.2 DECC INTERIM CONSTRUCTION NOISE GUIDELINE

The DECC Interim Construction Noise Guideline (ICNG) assessment requires:

- Determination of noise management levels (based on ambient noise monitoring).
- Review of operational noise levels at nearby development.
- If necessary, recommendation of noise controls strategies in the event that compliance with noise emission management levels is not possible.

DECC ICNG adopts differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected" level.* Where construction noise is predicted to exceed the "noise effected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise effected level". For residential properties, the "noise effected" level occurs when construction noise exceeds ambient levels by more than 10dB(A) $L_{eq(15min)}$ .
- *"Highly noise affected level".* Where noise emissions are such that nearby properties are "highly noise effected", noise controls such as respite periods should be considered. For residential properties, the "highly noise effected" level occurs when construction noise exceeds 75dB(A) $L_{eq(15min)}$  at nearby residences.

In addition to the above management levels for residential receivers, the ICNG nominates a Management Level of RBL + 5 dB(A) for any work done outside of standard hours.

**Table 7-1 – Noise Management Levels at Residential Property Boundaries**

<b>"Noise Affected" Level - dB(A)<math>L_{eq(15min)}</math> Standard Hours</b>	<b>"Highly Noise Affected" Level - dB(A)<math>L_{eq(15min)}</math></b>
45 externally at façade	75

Where noise from the construction works is above the “noise affected” level, the proponent should apply any feasible and reasonable work practices to minimise noise. The “noise affected level is representative of a level where there may be some community reaction to noise.

If noise emissions are likely to exceed 75 dB(A)<sub>Leq(15min)</sub> “highly noise affected” at the boundary of surrounding affected residential receivers, the receiver is deemed to be “highly noise affected”. The “highly noise affected” level is representative of a level where strong community reaction to noise is expected. Introduction of management controls such as scheduling of noisy periods, or respite periods is then recommended. Refer to Section 9 for specific recommendations.

Section 4.1.2 and 4.1.3 of the EPA Interim Construction Noise Guideline also nominates management levels for other sensitive land uses (other than residences). Criteria relevant to this assessment is detailed below.

**Table 7-2 – Noise Management Levels at Commercial/Sensitive Property Boundaries**

<b>Location</b>	<b>“Noise Affected” Level – dB(A)<sub>Leq(15min)</sub> Standard Hours</b>
Active Recreation Area	65 externally
Classrooms at Schools and other educational institutions	45 internally

**7.2.1 Australian Standard AS2436:2010 “Guide to Noise Control on Construction, Maintenance and Demolition Sites”**

The Australian Standard AS2436 states that where all reasonable and available measures have been taken to reduce construction noise, mitigation strategies may be put in place to reduce levels noise levels to within a reasonable and acceptable level.

For the control and regulation of noise from construction sites, AS2436:1981 nominates the following:

- a. *That reasonable suitable noise criterion is established,*
- b. *That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours, and*
- c. *The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the construction site.*

The guideline reflects on feasible and reasonable mitigation strategies, management controls and public liaising in the effort to reach realistic compromises between construction sites and potential noise affected receivers.

Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.
- Adopt management conditions as per AS2436 in the event of a non-compliance.

### 7.3 VIBRATION OBJECTIVES

Vibration caused by construction at any residence or structure outside the subject site will be assessed with reference to:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*; and
- For human exposure to vibration, Department of Environment and Conservation NSW "Assessing Vibration: A Technical Guideline" (Feb 2006) is based on the guidelines contained in BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment.

The criteria and the application of this standard are discussed in separate sections below.

#### 7.3.1 Structure Borne Vibrations

German Standard DIN 4150-3 (1999-02) provides a guideline for acceptable levels of vibration velocity in building foundations, to assess the effects of vibration on structures. The table give guidance on the maximum accepted values of velocity at the foundation and in the plane of the highest floor of various types of buildings, to prevent any structural damage.

The table below lists the peak particle velocity, which is the maximum absolute value of the velocity signals for the three orthogonal components. This is measured as a maximum value of any of the three orthogonal component particle velocities when measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

**Table 7-3 – DIN 4150-3 (1999-02) Safe Limits for Building Vibration**

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms <sup>-1</sup> )			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g., buildings that are under a preservation order)	3	3 to 8	8 to 10	8

### 7.3.2 Assessing Amenity

The NSW EPA's *Assessing Vibration – a technical guideline* is based on the guidelines contained in British Standard BS 6472-1992 'Guide to Evaluate Human Exposure to Vibration Buildings (1Hz to 80Hz)'. This guideline provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings.

The recommendations of this guideline should be adopted to assess and manage vibration from the site. Where vibration exceeds, or is likely to exceed, the recommended levels then an assessment of reasonable and feasible methods for the management of vibration should be undertaken.

**Table 7-4 – BS 6472 Vibration Criteria**

		RMS acceleration (m/s <sup>2</sup> )		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	Time	Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
<b>Continuous Vibration</b>							
Residences	Daytime	0.01	0.02	0.2	0.4	0.28	0.56
Offices	Day or night-time	0.02	0.04	0.4	0.8	0.56	1.1
Workshops		0.04	0.08	0.8	1.6	1.1	2.2
<b>Impulsive Vibration</b>							
Residences	Daytime	0.3	0.6	6.0	12.0	8.6	17.0
Offices	Day or night-time	0.64	1.28	13	26	18	36
Workshops		0.64	1.23	13	26	18	36

**Note 1: Continuous vibration relates to vibration that continues uninterrupted for a defined period (usually throughout the daytime or night-time), e.g., continuous construction or maintenance activity. (DECC, 2006).**

**Note 2: Impulsive vibration relate to vibration that builds up rapidly to a peak followed by a damped decay and that may or may not involve several cycles of vibration (depending on frequency and damping), with up to three occurrences in an assessment period, e.g., occasional loading and unloading, or dropping of heavy equipment. (DECC, 2006).**



## 8 PROPOSED CONSTRUCTION ACTIVITIES

We have been advised of the typical equipment/processes anticipated to be used for the construction of the subject development. Noise impacts from these activities on the amenity of the surrounding identified sensitive receivers, will be predicted in this section. Typically, the most significant sources of noise or vibration generated during a construction project will be demolition, excavation, civil works (compaction, asphaltting) and piling.

The A-weighted sound power levels for the expected loudest equipment/processes for each stage of development are outlined in the table below.

**Table 8-1 – Proposed Construction Activities and Associated Typical Sound Power Levels**

<b>Construction Stage</b>	<b>Equipment /Process</b>	<b>Typical Sound Power Level dB(A)</b>
Excavation	Dozer/Excavator	112
	Trucks	100
	Crane (Electric)	85
	Powered Hand Tools (Electric)	100
	Bobcat	105
Construction	Concrete Pump Truck	110
	Trucks	100
	Crane (Electric)	85
	Powered Hand Tools (Electric)	100
	Bobcat	105

The noise levels presented in the above table are derived from the following sources:

1. On-site measurements
2. Table A1 of Australian Standard 2436-2010, and
3. \*Data held by this office from other similar studies.

Noise levels take into account correction factors (for tonality, intermittency where necessary).

## 9 NOISE AND VIBRATION ASSESSMENT

### 9.1 NOISE IMPACT ASSESMENT

The predicted noise levels during excavation and construction will depend on:

- The activity undertaken.
- The distance between the work site and the receiver. For many of the work areas, the distance between the noise source and the receiver will vary depending on which end of the site the work is undertaken. For this reason, the predicted noise levels will be presented as a range.

Predicted noise levels are presented below. Predictions take into account the following:

- Noise reduction as a result of distance.
- Barrier effects resulting from shielding of the surrounding buildings (where applicable).

**The following predictions represent a worst-case scenario for each respective item. The highest predicted noise levels assume direct line of sight with no barrier effects (such as second storey receivers with direct line of sight to the operating construction machinery). It is also noted that due to the steep elevation of the site, barrier effects have not been modelled for, however is likely to have a noise mitigating effect. See Section 0.**

**Table 9-1 – Predicted Noise Generation to R1 Residential Receiver**

<b>Activity</b>	<b>Predicted Level – dB(A)</b> <b><math>L_{eq(15min)}</math></b> <b>(External Areas)</b>	<b>Comment</b>
Dozer/Excavator (Excavation only)	49-61	Will generally exceed NML
Concrete Pump (Construction)	47-59	Will generally exceed NML
Trucks	37-49	Will generally exceed NML when at southern boundary of site
Bobcat	42.54	Will generally exceed NML when at southern boundary of site
Crane (electric)	22.34	Generally Within NML
Powered Hand Tools (Electric)	37-49 – external 17-29 - assumes loss from building shell when constructed	Will generally exceed NML when at southern boundary of site Complies when building shell is constructed and works are generally internal.

**Table 9-2 – Predicted Noise Generation to R2 Residential Receiver**

<b>Activity</b>	<b>Predicted Level – dB(A)</b> <b>L<sub>eq</sub>(15min)</b> <b>(External Areas)</b>	<b>Comment</b>
Dozer/Excavator (Excavation only)	44-49	Will generally exceed NML when at north-eastern boundary of site
Concrete Pump (Construction)	42-47	Will marginally exceed NML when at north-eastern boundary of site
Trucks	32-37	Generally Within NML
Bobcat	37-42	Generally Within NML
Crane (electric)	17-22	Generally Within NML
Powered Hand Tools (Electric)	32-37 – external 12-17 - assumes loss from building shell when constructed	Generally Within NML

**Table 9-3 – Predicted Noise Generation to AR1 David Madew Regional Park Receiver**

<b>Activity</b>	<b>Predicted Level – dB(A)</b> <b>L<sub>eq</sub>(15min)</b> <b>(External Areas)</b>	<b>Comment</b>
Dozer/Excavator (Excavation only)	49-61	Generally Within NML
Concrete Pump (Construction)	47-59	
Trucks	37-49	
Bobcat	42.54	
Crane (electric)	22-34	
Powered Hand Tools (Electric)	37-49 – external 17-29 - assumes loss from building shell when constructed	

**Table 9-4 – Predicted Noise Generation to S1 School Classroom Receiver**

<b>Activity</b>	<b>Predicted Level – dB(A)</b> <b>L<sub>eq</sub>(15min)</b> <b>(Internal Areas)</b>	<b>Comment</b>
Dozer/Excavator (Excavation only)	32-36	Generally Within NML
Concrete Pump (Construction)	30-34	
Trucks	20-24	
Bobcat	25-29	
Crane (electric)	5-9	
Powered Hand Tools (Electric)	20-24	

Note: Internally in Classroom with windows and assumes full view of the construction site of western facing buildings. Assuming 10 dB(A) external to internal reduction with windows open. Further noise attenuation will occur to classrooms with partial view, barrier effects from other buildings as well as distance noise attenuation.

## 9.2 GENERAL DISCUSSION

### **Noise**

The greatest noise impact will be at the residences immediately to the south of the site and some to the north east of the site. Noise levels will generally exceed the NML but will be less than the HNAL. Therefore, "reasonable and feasible" mitigation should be applied in accordance with the "Control of Construction Noise and Vibration – Procedural Steps" outlined below.

Primarily, the use of excavators and dozers during excavation are predicted to be the highest noise generating equipment. All noise predictions have been presented as external noise levels for all receivers. Internal noise levels at all locations are expected to be 10-20 dB(A) lower dependant on the façade of each receiver.

It is also noted that all high noise generation equipment are only expected to be used during specific portions of the excavation stage and will not be continuous throughout the entire excavation stage. Notifications shall be provided to surrounding residents when excavation is planned to occur.

External noise level predictions to all receivers are presented as worst-case scenarios where the closest receiver has direct line of sight to construction plant operating at the closest point of the site with respect to each individual receiver. It is noted that many residents are shielded by other residential development which would lead to much lower noise levels than those predicted in the previous section. The predicted noise levels are to the worst-affected residential receiver in the residential blocks.

It is also noted that hoarding is unlikely to reduce the construction noise level except when working close to the hoarding due to the elevation surrounding the site. However, the development will be built with a staged approach, with any building structures that are built first providing a barrier effect to residents behind the building. With this barrier effect, it is likely that all construction stage noise levels will fall under the noise affected level if the building structure is erected between the receiver and ongoing construction works. Excavation stage activities will still approach the highly noise affected management level.

Truck access routes have also been assessed to operate and provide the easiest access routes whilst also taking full advantage of barrier effects of surrounding buildings once the structure is erected.

It is noted that noise management levels to school classroom and the David Madew Regional Park do not exceed the NML.

Treatment processes are recommended as per Section 10 for concerns with noise levels that are predicted to be over the respective noise management level. Further recommendations in Sections 11, 12 & 13. With the implementation of the aforementioned sections, the Client demonstrates that all reasonable and feasible vibration and noise mitigation measures have been taken.

### **Vibration**

There are no significant sources of vibration envisaged. Given the distance from nearby receivers, vibration impacts on all receivers is expected to be within the recommended levels detailed in Section 7.3.

## 10 RECOMMENDATIONS

1. **Community Consultation/Notification:** Notification (leaflet or similar) of all residents, and any local receivers surrounding the site as identified in the site map of Figure 1 shall be undertaken prior to commencement of works. Notification should advise of anticipate date and duration of excavation.
2. **Respite Periods:** To protect the amenity of nearby residential receivers to the south, operation of large earthmoving equipment (bulldozers and excavators) within 30m of the southern, eastern site boundary. In the event that respite periods are to be imposed  
It is also recommended to consider respite hours as follows:
  - a. In respect of pneumatic/hydraulic hammering (if required) noise impacts should be addressed via the imposition of respite periods, typically limiting operation to:
    - o 8am – 6pm, Monday to Friday
    - o 8am to 5pm, Saturday
    - o In any case maximum 3 hours operation with 1 hour uninterrupted respite.
    - o It is noted that respite periods will extend the length of works and may provide heavier loss of amenity compared to non-imposed works.
3. **Vibration monitoring:** No vibration monitoring is required for standard excavation and construction works. In the event of any continuous complaint, vibration monitoring is to be implemented along the property boundary closest to the vibration receiver who issued the complaint. This localised vibration monitoring is to be conducted for a period of 2 weeks to ensure the appropriate criteria is achieved.
4. **Noise monitoring:** No noise monitoring is required for standard excavation and construction works. In the event of continuous complaint, noise monitoring is to be implemented along the property boundary closest to the noise receiver who issued the complaint. This localised noise monitoring is to be conducted for a period of 2 weeks for documentation.
5. **Quiet Work Methods/Technologies:**
  - a. The primary noise generating activity at the site will be the ground work period. As much as practicable, use of quieter demolition methods is to be adopted
    - i. Excavation is conducted initially using excavator with bucket (quietest excavation method). Use of the loudest excavation equipment is used only when other options are not available.
    - ii. Rubber tracks for excavators and associated equipment shall be used provided the equipment manufacturer has such options.
  - b. Concrete pump trucks should be located within the bounds of the site (rather than on nearby roads at the perimeter of the site) where possible.
  - c. Materials handling/vehicles:
    - i. Trucks and bobcats to use a non-tonal reversing beacon (subject to OH&S requirements) to minimise potential disturbance of neighbours.
    - ii. Avoid careless dropping of construction materials into empty trucks.
    - iii. Trucks, trailers and concrete trucks (if feasible) should turn off their engines during idling to reduce noise impacts (unless truck ignition needs to remain on during concrete pumping).
  - d. Noisy activities (exceeding the RBL by more than 5 dB(A)) should not be carried out after 1pm Saturdays. This would generally limit the activities to "quiet" trades such as internal fitout and maintenance activities.

6. **Complaints Handling:** In the event of complaint, the procedures outlined in Section 13 should be adopted.

A detailed noise management plan will be developed by the main contractor that describes in detail the construction phases, programme, processes and equipment used, noise impact assessment and proposed mitigation and management.

7. **Site Induction:**

- a. A copy of the Construction Noise and Vibration Management Sub Plan is to be available to contractors. The location of the CNVMSP should be advised in any site induction.

Site induction should also detail the site contact in the event of noise complaint