ACOUSTICS AND AIR

COCKLE BAY MARINE STRUCTURES RENEWAL PROJECT

AIR QUALITY IMPACT ASSESSMENT

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PREPARED FOR

SYDNEY HARBOUR FORESHORE AUTHORITY
LEVEL 6, 66 HARRINGTON STREET
THE ROCKS NSW 2000

WILKINSON MURRAY

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GLOSSARY OF AIR QUALITY TERMS

Air Pollution – The presence of contaminants or pollutant substances in the air that interfere with human health or welfare, or produce other harmful environmental effects.

Air Quality Standards – The level of pollutants prescribed by regulations that are not to be exceeded during a given time in a defined area.

Air Toxics – Any air pollutant for which a national ambient air quality standard (NAAQS) does not exist (i.e. excluding ozone, carbon monoxide, PM-10, sulphur dioxide, nitrogen oxide) that may reasonably be anticipated to cause cancer; respiratory, cardiovascular, or developmental effects; reproductive dysfunctions, neurological disorders, heritable gene mutations, or other serious or irreversible chronic or acute health effects in humans.

Airborne Particulates – Total suspended particulate matter found in the atmosphere as solid particles or liquid droplets. Chemical composition of particulates varies widely, depending on location and time of year. Sources of airborne particulates include dust, emissions from industrial processes, combustion products from the burning of wood and coal, combustion products associated with motor vehicle or non-road engine exhausts, and reactions to gases in the atmosphere.

Area Source – Any source of air pollution that is released over a relatively small area, but which cannot be classified as a point source. Such sources may include vehicles and other small engines, small businesses and household activities, or biogenic sources, such as a forest that releases hydrocarbons, may be referred to as nonpoint source.

Concentration – The relative amount of a substance mixed with another substance. Examples are 5 ppm of carbon monoxide in air and 1 mg/l of iron in water.

Emission – Release of pollutants into the air from a source. We say sources emit pollutants.

Emission Factor – The relationship between the amount of pollution produced and the amount of raw material processed. For example, an emission factor for a blast furnace making iron would be the number of pounds of particulates per ton of raw materials.

Emission Inventory – A listing, by source, of the amount of air pollutants discharged into the atmosphere of a community; used to establish emission standards.

Flow Rate – The rate, expressed in gallons -or litres-per-hour, at which a fluid escapes from a hole or fissure in a tank. Such measurements are also made of liquid waste, effluent, and surface water movement.

Fugitive Emissions – Emissions not caught by a capture system.

Hydrocarbons (HC) – Chemical compounds that consist entirely of carbon and hydrogen.

Hydrogen Sulphide (H_2S) – Gas emitted during organic decomposition. Also, a by-product of oil refining and burning. Smells like rotten eggs and, in heavy concentration, can kill or cause illness.

Inhalable Particles – All dust capable of entering the human respiratory tract.

Nitric Oxide (NO) – A gas formed by combustion under high temperature and high pressure in an internal combustion engine. NO is converted by sunlight and photochemical processes in ambient air to nitrogen oxide. NO is a precursor of ground-level ozone pollution, or smog.

Nitrogen Dioxide (NO_2) – The result of nitric oxide combining with oxygen in the atmosphere; major component of photochemical smog.

Nitrogen Oxides (NO_x) – A criteria air polluant. Nitrogen oxides are produced from burning fuels, including gasoline and coal. Nitrogen oxides are smog formers, which react with volatile organic compounds to form smog. Nitrogen oxides are also major components of acid rain.

Mobile Sources – Moving objects that release pollution; mobile sources include cars, trucks, buses, planes, trains, motorcycles and gasoline-powered lawn mowers.

Particulates; Particulate Matter (PM-10) – A criteria air pollutant. Particulate matter includes dust, soot and other tiny bits of solid materials that are released into and move around in the air. Particulates are produced by many sources, including burning of diesel fuels by trucks and buses, incineration of garbage, mixing and application of fertilizers and pesticides, road construction, industrial processes such as steel making, mining operations, agricultural burning (field and slash burning), and operation of fireplaces and woodstoves. Particulate pollution can cause eye, nose and throat irritation and other health problems.

Parts Per Billion (ppb)/Parts Per Million (ppm) – Units commonly used to express contamination ratios, as in establishing the maximum permissible amount of a contaminant in water, land, or air.

PM10/PM2.5 – PM10 is measure of particles in the atmosphere with a diameter of less than 10 or equal to a nominal 10 micrometers. PM2.5 is a measure of smaller particles in the air.

Point Source – A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g. a pipe, ditch, ship, ore pit, factory smokestack.

Scrubber – An air pollution device that uses a spray of water or reactant or a dry process to trap pollutants in emissions.

Source – Any place or object from which pollutants are released.

Stack – A chimney, smokestack, or vertical pipe that discharges used air.

Stationary Source – A place or object from which pollutants are released and which does not move around. Stationary sources include power plants, gas stations, incinerators, houses etc.

Temperature Inversion – One of the weather conditions that are often associated with serious smog episodes in some portions of the country. In a temperature inversion, air does not rise because it is trapped near the ground by a layer of warmer air above it. Pollutants, especially smog and smog-forming chemicals, including volatile organic compounds, are trapped close to the ground. As people continue driving and sources other than motor vehicles continue to release smog-forming pollutants into the air, the smog level keeps getting worse.

1 INTRODUCTION

The Sydney Harbour Foreshore Authority (the Authority) is planning to renew the waterside structures surrounding Cockle Bay at Darling Harbour. This is required because many of the existing structures are at the end of their working life and there is also a need to improve their functionality within the waterway. The intention of the works is to provide for more usable and more appropriately designed structures, which allow for better access for both pedestrians and users of the bay.

Wilkinson Murray (WM) has been engaged by the Authority to undertake a qualitative construction air quality impact assessment (AQIA) for the proposed works, based on staging of the construction works provided by the Authority.

2 SITE DESCRIPTION & CONSTRUCTION STAGING

The site consists of part of the bed of Sydney Harbour known as Cockle Bay and immediate adjoining foreshore land. The site extends from Pyrmont Bridge in the north to Darling Harbour in the South as is shown in Figure 2-1.

The area surrounding the site is predominantly commercial (including retail stores, restaurants, cafes and hotels). To the north-east and north-west of the site are museum/exhibition spaces.

The waterway and the surrounding foreshore area is owned and managed by the Authority.

Cockle Bay is currently developed with various waterway structures for which the uses have changed and evolved over time. The current uses of the existing marine structures include a mix of public and private uses ranging from berthing of private yachts and vessels to drop-off and pick up by marine leisure vessels. In addition, the bay is used for many Darling Harbour events that are hosted or managed by the Authority.

Many of the existing structures are inappropriately located or designed. The intention of the renewal Project is to allow the waterway to work more effectively and efficiently as well as to create a more open and usable space for the Authority water based events.

The key components of the proposed works are:

- Demolition of existing Harbourside Steps, Harbourside Jetty, Harbourside Promenade, Convention Wharf and Cockle Bay Marina;
- New east-side commercial marina which is publicly accessible for short stay berthing of vessels; and
- New west-side floating public landing facilities which can also be used as event spaces and for foreshore public access (including the Heritage Foreshore Boardwalk).

2.1 Construction Stages

In order to evaluate the potential air quality impacts for this project the construction processes and equipment below have been assumed since the Project is at design concept stage and full details are not yet available:

- (1) Site Establishment – Includes installation of fencing and hoarding on immediately adjacent land. All amenities and equipment will be delivered via the waterway;
- (2) Dismantling and removal of the existing structures – The existing timber structures and concrete pontoon will be dismantled and removed. All piles will be removed, where possible. Piles will be cut off at seabed level if they cannot be removed or if removal may disturb a heritage relic, heritage will take precedence. Material will be recycled where possible;
- (3) Removal of the existing Harbourside steps – The existing concrete steps will be sawn and removed using water based crane. Material will be recycled where possible;
- (4) Installation of piles – The timber and steel piles supporting the new wharf structures will be installed using water based crane and piling rig;

- (5) Installation of the structures – All pontoon systems will be proprietary concrete floats manufactured off-site and will be timber decked. These fixed structures will be delivered to the site by a service barge. The deck planks will be lifted onto the piles by water based crane; and
- (6) Fit out of the wharf – Installation of lights and services will occur in stages through the project. Final fit out of the wharf will be conducted towards the end of the project.

All access and works will be from the water with the exception of the construction of hoardings.

Note that construction will take place over a 10 week period from March to May in 2016 and two 15 week windows from August to November in 2015 and 2016. Noise generating work will be restricted to the following periods:

- 8am to 12pm (Monday to Saturday);
- 2pm to 5pm (Monday to Friday);
- No works on Sundays and public holidays; and
- No noisy work during lunchtimes (12pm-2pm).

2.2 Sensitive Receptors

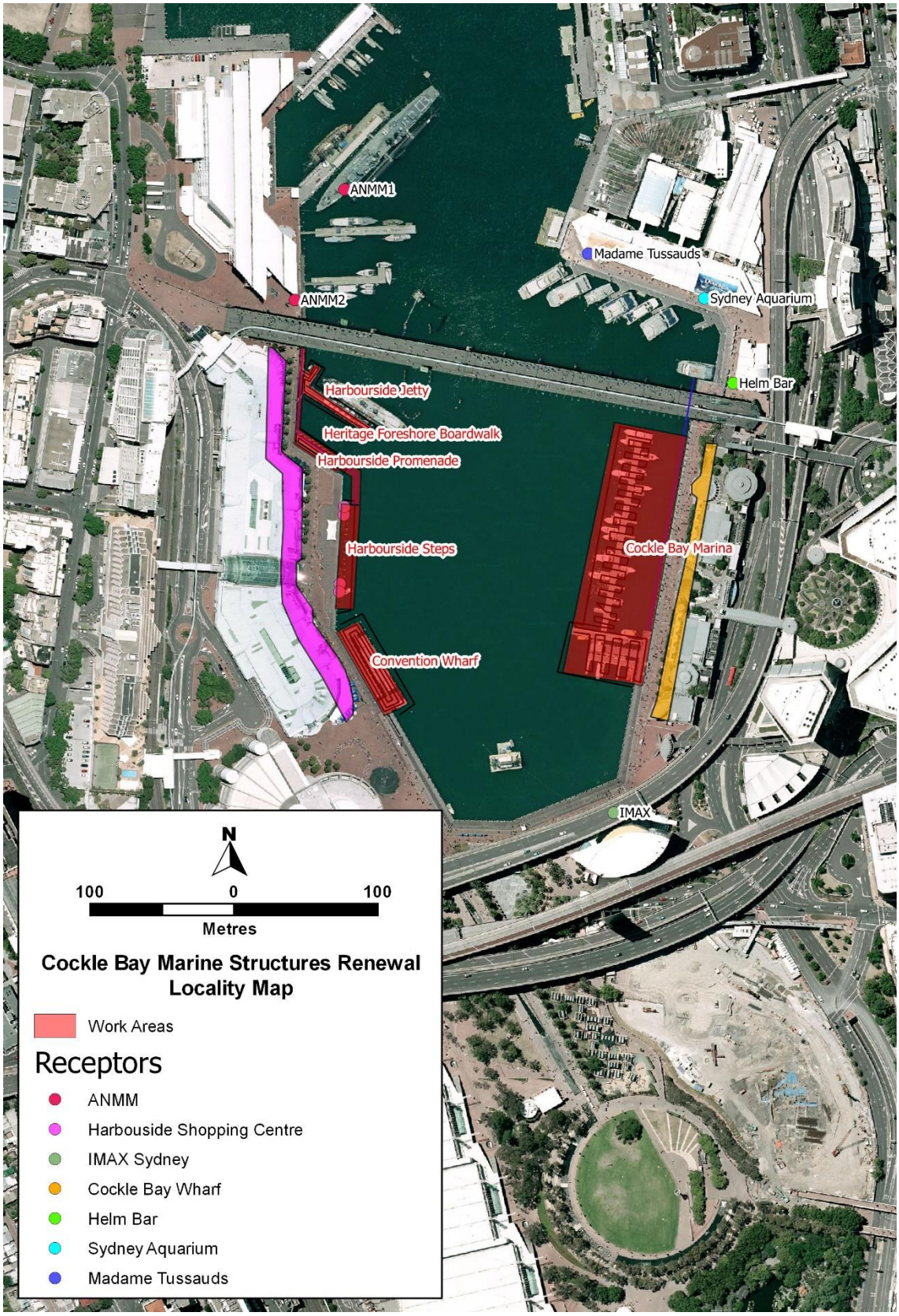
There are a number of commercial receptors sensitive to noise and vibration located in the vicinity of the work sites, including businesses within Harbourside Shopping Centre and Cockle Bay Wharf, Helm Bar, Sydney Aquarium, Madame Tussauds and the Australian National Maritime Museum (ANMM).

The potentially most affected receptors are identified in Figure 2-1.

The nearest receptors to the proposed works are businesses along the eastern façade of the Harbourside Shopping Centre and the western façade of Cockle Bay Wharf. There is potential for proposed construction works to occur within approximately 20 metres of the nearest receptors.

There are no residential receptors within 200m of the proposed works.

Figure 2-1 Locality Map



3 EXISTING ENVIRONMENT

3.1 Local Climate

Long-term meteorological data for the surrounding area is available from the Bureau of Meteorology (BoM) operated Automatic Weather Stations (AWS) at Observatory Hill and Fort Denison. The Observatory Hill AWS is located approximately 1,300 metres north of the site and records observations of a number of meteorological data including temperature, humidity and rainfall. There is no anemometer at Observatory Hill, and therefore; observations of wind speed and direction are taken from the Fort Denison AWS, located approximately 3 kilometres north east of the site.

Long-term climate statistics are presented in Table 3-1. Temperature data recorded at the Observatory Hill AWS indicates that January is the hottest month of the year, with a mean daily maximum temperature of 25.9°C. July is the coolest month with a mean daily minimum temperature of 8.1°C. June is the wettest month with an average rainfall of 132 mm falling over almost 9 days. There are on average 100 rain days per year, yielding 1213 mm of rain.

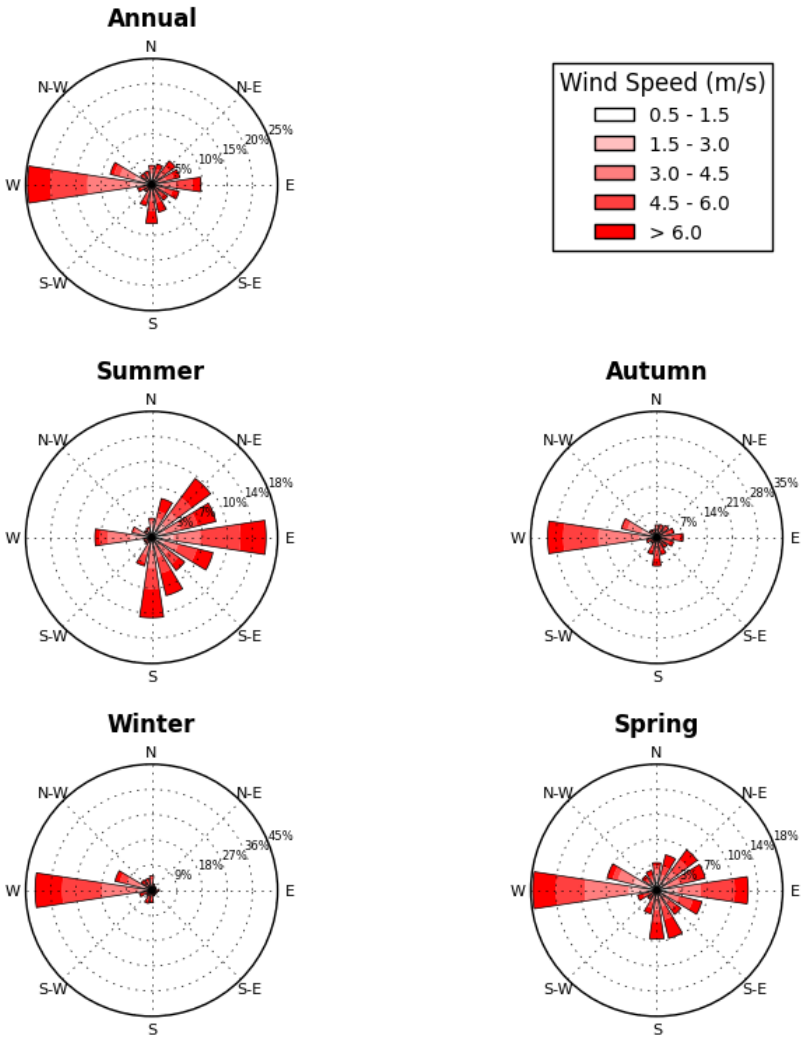
Table 3-1 Long-term Climate Averages for Observatory Hill

Observation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
9am Mean Observations													
Temperature (°C)	22.5	22.3	21.1	18.2	14.6	11.9	10.9	12.5	15.7	18.5	19.9	21.6	17.5
Humidity (%)	71	74	74	72	74	74	71	66	62	61	66	67	69
3pm Mean Observations													
Temperature (°C)	24.8	24.9	24.0	22.0	19.4	16.9	16.4	17.5	19.2	20.7	22.1	23.8	21.0
Humidity (%)	62	64	62	59	57	57	51	49	51	56	58	59	57
Daily Minimum and Maximum Temperatures													
Minimum (°C)	18.7	18.8	17.6	14.7	11.6	9.3	8.1	9.0	11.1	13.6	15.6	17.5	13.8
Maximum (°C)	25.9	25.8	24.8	22.4	19.5	17.0	16.3	17.8	20.0	22.1	23.6	25.2	21.7
Rainfall													
Rainfall (mm)	101.1	118.0	129.7	127.1	119.9	132.0	97.4	80.7	68.4	76.9	84.3	77.3	1212.6
Rain days	8.6	9.0	9.8	9.0	8.7	8.7	7.5	7.2	7.2	7.9	8.4	8.0	100.0

Windrose plots showing the distribution of wind direction and wind speed at the Fort Denison BoM AWS between 2008 and 2013 and presented in Figure 3-1.

It should be noted that the area surrounding Cockle Bay is well sheltered by nearby developments, and the prevailing winds will be of significantly lower speeds than those presented in Figure 3-1.

Figure 3-1 Windrose Plots – Fort Denison Bom AWS, 2008 – 2013



3.2 Local Air Quality

The NSW Office of Environment and Heritage (OEH) operates a network of air quality monitoring sites across the state. The nearest OEH air quality monitoring station to the Project site is located at Rozelle, approximately 3 kilometres to the west.

Ambient pollution concentrations recorded at the Rozelle site between 1 July 2013 and 30 June 2014 have been used to establish the existing local air quality for this assessment and are summarised in Table 3-2.

TSP concentrations are no longer measured at the Rozelle site and therefore, the annual average background TSP concentration has been estimated using the measured PM_{10} concentrations and based on the assumption that PM_{10} typically accounts for approximately 50% of TSP.

Table 3-2 Existing Ambient Pollutant Concentrations – Rozelle Monitoring Station

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)
PM_{10}	24 hour Maximum	59
	Annual Average	19
TSP [1]	Annual Average	39

1 Scaled from PM_{10} concentrations

4 AIR QUALITY CRITERIA

Due to the physical nature of the proposed construction activities, there is the potential for air pollution due to suspended dust particles. The dust emissions from the site are usually caused by the following:

- Sawing or breaking of concrete;
- Wind erosion of exposed soil or material stockpiles; and,
- Wheel generated dust from construction traffic.

The AQIA presented herein is qualitative, however it is prudent to establish relevant quantitative air quality goals such that they would be used in the event that air quality monitoring was deemed necessary during the construction works.

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the applicable air quality criteria for the potential air emissions that would be generated by the proposed modification.

The air quality goals that are relevant to this study are sourced from the NSW EPA document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW DEC, 2005).

4.1 Particulate matter

The air quality goals for the relevant particulate matter pollutants relate to the total pollutant burden in the air and not just the pollutants from the Project, as such, consideration of background pollutant levels is required when using these goals to assess potential impacts.

Table 4-1 shows the criteria for each of the relevant dust metric considered in this assessment.

Table 4-1 NSW EPA Air Quality Impact Assessment Criteria

Pollutant	Averaging Period	Impact	Criterion
Total suspended particulates (TSP)	Annual	Total	90 µg/m³
Particulate matter ≤10 µg/m³ (PM_{10})	Annual	Total	30 µg/m³
	24-hour	Incremental	50 µg/m³
Deposited dust (DD)	Annual	Total	2 g/m²/month
	Annual	Incremental	4 g/m²/month

Source: NSW DEC, 2005

5 ASSESSMENT OF IMPACTS

This section of the report presents a qualitative assessment of potential dust impacts from the proposed works. The likelihood of dust impacts from each major stage will be discussed.

5.1 Harbourside Steps

The existing concrete steps would be sawn and removed by floating crane and barge. The concrete sawing of the steps is considered the most likely activity to generate nuisance dust emissions.

To control dust emissions during the removal of the existing concrete steps, water sprays should be used. Both the area undergoing sawing and any stockpiles should be kept wet to control dust emissions.

It is proposed to replace the steps with a floating pontoon public wharf, much of which is expected to be constructed off-site and floated in by barge. No significant potential sources of dust emissions have been identified in association with the establishment of the new pontoon wharf.

5.2 Harbourside Jetty, Cockle Bay Marina, Convention Wharf, Harbourside Promenade & Heritage Foreshore Boardwalk

The existing Harbourside Jetty, Cockle Bay Marina, Convention Wharf, Harbourside Promenade and Heritage Foreshore Boardwalk are primarily timber structures that are proposed to be demolished. The structures will be dismantled and material removed by barge. It is not expected that any sawing of the timber structures would be required during the dismantling. The timber piles will be cut off at sea bed level to the greatest extent possible, while not disturbing any heritage relics.

Sawing of dry timber has the potential to generate dust. However, since the existing above water structures are expected to be dismantled without any sawing, no significant emissions are identified. The timber piles will be sawn under the water and therefore, any sawdust will be suppressed.

Any above water sawing of the timber structures should be accompanied by water sprays to suppress fugitive dust emissions.

The Harbourside Jetty, Cockle Bay Marina, Convention Wharf, Harbourside Promenade and Heritage Foreshore Boardwalk are proposed to be replaced by timber deck floating pontoon structures. This structure is expected to be constructed off-site and floated in by barge.

Any above water sawing of the timber structure should be accompanied by water sprays to suppress fugitive dust emissions.

6 DUST MANAGEMENT

During construction works it is recommended that best practice management strategies are implemented to minimise any potential dust impacts.

6.1 Dust Mitigation

Detailed mitigation measures should be set out in the Construction Environmental Management Plan (CEMP) prepared by the contractor, once more certainty surrounding the construction methods and programme exists.

WM recommends that the following matters are addressed within the CEMP:

- Water sprays should be used as required to dampen haul routes and work areas to prevent excessive dust emissions from the site;
- Water sprays should be used on all above water sawing of timber and concrete structures;
- Civil works should be programmed with a view to minimising the time that stockpiles are left exposed;
- All construction equipment should be maintained to ensure exhaust emissions comply with relevant State Legislation; and,
- No cutting or breaking or on-site mixing of concrete should occur during high winds.

6.2 Performance Monitoring

During the construction works, the adequacy of dust mitigation measures should be continuously assessed, with the focus of achieving:

- No visible dust for more than 15 continuous minutes during construction activities; and,
- No dust complaints received from nearby businesses or statutory authorities.

The Site Manager should be responsible for visually monitoring dust levels.

All complaints should be recorded in a register and if complaints are received on a regular basis, air quality monitoring should be conducted.

7 CONCLUSION

Sydney Harbour Foreshore Authority is planning to upgrade the water structures surrounding the Cockle Bay at Darling Harbour in order to allow for better access for the pedestrian and for the waterway to work more effectively and efficiently and create a more open and usable space.

Wilkinson Murray has undertaken a qualitative construction air quality impact assessment for the Project based on likely works staging.

A number of mitigation measures have been identified that, if employed, would be expected to effectively reduce the level of impacts to the most practicable extent. It is recommended that these measures are incorporated within a Construction Environmental Management Plan (CEMP) prepared by the contractor, once more certainty surrounding the construction methods and programme exists.