



Government of **Western Australia**  
Department of **State Development**

# **PORT HEDLAND DUST MANAGEMENT TASKFORCE REPORT TO GOVERNMENT**

**August 2016**

## **ADDENDUM**

### **Machinery of Government Changes, 2017**

In 2017, the Government initiated changes to State Government Departments as part of its Machinery of Government process. The process created a number of new amalgamated departments, affecting some of the departments participating in the Port Hedland Dust Management Taskforce and referenced in this report. The changes to the participating departments, effective from 1 July 2017, are as below.

#### **Department of Environment Regulation (DER)**

##### **Office of the Environmental Protection Authority (OEPA)**

The Department of Environment Regulation (DER) and the Office of the Environmental Protection Authority (OEPA) were amalgamated with the Department of Water to form the **Department of Water and Environmental Regulation (DWER)**.

#### **Department of State Development (DSD)**

The Department of State Development (DSD) was amalgamated with the Industry Development division of the former Department of Commerce; the Western Australian Tourism Commission; and the former Office of Science to form the **Department of Jobs, Tourism, Science and Innovation (JTSI)**.

#### **Department of Planning (DoP)**

The Department of Planning (DoP) was amalgamated with the Department of Lands and the State Heritage Office to form the **Department of Planning, Lands and Heritage (DPLH)**.

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# 1. INTRODUCTION

## 1.1 OVERVIEW

Port Hedland is the largest bulk handling port in the world, and makes a major contribution to the Western Australian and Australian economies. In 2014-15, the value of exports through the port was almost \$30 billion, accounting for 27% of Western Australia's merchandise exports and 12% of Australia's. Its users generate about half of the Western Australian Government's royalty income - \$2.4 billion in 2014-15.

Export volumes through the port have risen rapidly in recent years, in response to strong demand in China for iron ore. Iron ore exports rose from 167 million tonnes in 2010 to 424 million tonnes in 2015.

Rising exports have helped to support broader growth in the Port Hedland. The estimated residential population increased from 12,800 to 16,400 between 2001 and 2015. Social and economic infrastructure have improved, including the upgrade of recreational facilities (such as the South Hedland Aquatic Centre), the South Hedland Town Centre Revitalisation Project and major road upgrades linking Port Hedland and South Hedland. The Port Hedland Council and residents aspire to further population growth and development of economic infrastructure and social amenity.

The town and port developed in an era before modern planning principles on buffers and the separation of industrial, residential and commercial activity, and the health risks of exposure to dust were not well known. The port's industrial facilities are close to homes and businesses in Port Hedland's West End. Areas close to the port sometimes record elevated dust levels due to port activity.

In 2009, the Environmental Protection Authority raised concerns about the possible effects of dust on the health of Port Hedland residents, prompted by reports of high dust levels, mounting scientific evidence that high levels of dust concentrations can harm human health, and concerns that projected growth in throughput at the port could result in dust emissions rising.

In 2009, the Premier established the Port Hedland Dust Management Taskforce to co-ordinate and plan for dust management in Port Hedland. The Taskforce produced the *Port Hedland Air Quality and Noise Management Plan*, which included interim measures to limit exposure to dust by groups considered most at risk of health effects.

The Taskforce concluded that it needed three sets of data to make final recommendations on how to address dust issues – information on dust

levels and sources across Port Hedland; projections of how dust levels might change as the port developed; and information on the health effects of the types of dust found in Port Hedland. In response, the Port Hedland Industries Council established, and now maintains, a network of dust monitors in and around Port Hedland to collect data on dust types and levels. The Port Hedland Industries Council and the Department of Environment Regulation commissioned modelling to improve understanding of dust impacts arising from port developments. The Department of Health commissioned a Health Risk Assessment to evaluate the effects on human health of the types of dust found in Port Hedland.

All of these studies are now complete, and the Taskforce is in a position to make final recommendations to Government.

The Health Risk Assessment concluded that there is sufficient evidence of possible negative effects on human health from dust to warrant dust management controls and land-use planning measures to reduce community exposure to dust. Air quality monitoring data indicates that dust levels regularly exceed the Taskforce's interim guideline levels in the far West End (Richardson Street). Annual exceedances of the interim guideline at both Taplin Street and Neptune Street are around the recommended level of ten a year.

Dust levels have remained relatively stable in recent years, despite much higher export tonnages through the port. While port users have made substantial progress in reducing the intensity of dust emissions, these measures have not been enough to reduce dust levels to acceptable levels in the West End. If dust levels increase further, they will affect areas further east.

In reaching its recommendations, the Taskforce considered the conflicting and pressing priorities of different groups and interests. Residents are concerned that exposure to dust may affect their health. Property owners are concerned that planning measures to limit population levels and sensitive uses in dust-affected areas could reduce their properties' values and restrict their ability to improve and develop their properties in future.

The port and its users are major contributors to exports, taxes, royalties and employment. The port's continued operation and growth are important to the Western Australian and national economies.

The community aspires to live in a growing and vibrant town with good economic and social infrastructure and services, and improved amenity. The West End is an important part of that aspiration. The Town of Port Hedland needs certainty and predictability to manage its own planning and approvals processes and implement its Local Planning Strategy.

The Taskforce has framed its recommendations to meet the Health Risk Assessment objective of limiting the population exposed to relatively high dust levels in a way that takes all of these interests into consideration. Its main recommendations are:

- Exporters should continue to be required to reduce the dust emissions arising from port activities, and should be subject to more stringent risk-based regulation aimed at reducing the number of days when standards are exceeded.
- A Special Control Area should apply over the West End of Port Hedland, aimed at preventing further residential population growth west of Taplin Street, and limiting sensitive uses between Taplin and McGregor Streets.
- The State Government and the Town of Port Hedland will work with the community to improve Port Hedland's amenity, including identifying and addressing dust sources other than the port.

The following section details all of the Taskforce's recommendations.

## **1.2 RECOMMENDATIONS**

The Taskforce recommends:

### **Health Risk Assessment - Interim Guideline**

#### **Recommendation 1:**

The Taskforce recommends that the current interim guideline of 24-hour PM<sub>10</sub> of 70 µg/m<sup>3</sup> (+ 10 exceedances to accommodate natural events) continues to apply to residential areas of Port Hedland and that measures should be introduced to cap (and if possible, reduce) the number of permanent residents in dust-affected areas of Port Hedland.

### **Industry Dust and Noise Management Regulation**

#### *Air Quality Monitoring*

#### **Recommendation 2:**

The Taskforce recommends that:

- The Port Hedland Industries Council continue operating and maintaining its air quality network, with responsibility for oversight of the network, including data verification, storage and publication, transferred to the Department of Environment Regulation. The Taskforce notes that the Department of Environment Regulation will consider a number of options, including regulations, to implement this recommendation.

## *Industry Regulation*

### **Recommendation 3:**

The Taskforce recommends that:

- 3.1** The Department of Environment Regulation implements a coordinated risk-based review and assessment approach to managing dust and noise in Port Hedland through a review of all port premises licences under Part V, Division 3 of the *Environmental Protection Act 1986*.
- 3.2** Where premises are subject to Ministerial Statements, the Department of Environment Regulation will provide the findings and recommendations of its risk-based review and assessment to the Environmental Protection Authority and the Office of the Environmental Protection Authority.
- 3.3** The Environmental Protection Authority and the Office of the Environmental Protection Authority will consider the Department of Environment Regulation's assessments, and the appropriateness of conditions in Ministerial Statements.
- 3.4** Where the Environmental Protection Authority inquires under section 46 of the Environmental Protection Act 1986 into the conditions within Ministerial Statements, the Environmental Protection Authority will provide the Minister for Environment with a report on whether the conditions in the Statement/s should be changed.
- 3.5** The Department of Environment Regulation finalises and implements dust management guidelines for bulk handling port premises, outlining its expectations in relation to the assessment of dust impacts, dust control and monitoring requirements from these premises.

## *Noise*

### **Recommendation 4:**

The Taskforce recommends that:

- 4.1** The Department of Environment Regulation assesses unacceptable noise levels and assesses whether additional controls can be introduced as part of its review of all port premises licences under Part V, Division 3 of the *Environmental Protection Act 1986*.
- 4.2** The Town of Port Hedland uses the Port Hedland Cumulative Noise Study to inform its land use planning for the West End of Port Hedland.

## **Land-use planning**

### **Recommendation 5:**

The Taskforce recommends that:

- 5.1** The Minister for Planning asks the Town of Port Hedland to implement a Special Control Area westwards from McGregor Street as part of its Town Planning Scheme No. 5.

- 5.2** The Special Control Area prohibits new permanent residential development and other sensitive land uses, including aged care and child care premises, west of Taplin Street.
- 5.3** Low-density (R20) residential development be permitted in the predominantly residential area between Taplin and McGregor Streets, but higher-density residential development and other sensitive land uses be prohibited.
- 5.4** The zoning in the Special Control Area aligns with the Town of Port Hedland Local Planning Strategy's Precinct 1, taking into consideration the findings of the Health Risk Assessment.

## **Local Government and Community**

### **Recommendation 6:**

The Taskforce recommends that:

- The Town of Port Hedland works with key stakeholders to identify and mitigate dust from non-industry sources, with a focus on:
  - Identifying and implementing dust mitigation options for the spoil bank;
  - Sealing unsealed roads and undertaking regular and effective street sweeping operations;
  - Considering greening options, including coastal dune revegetation and the establishment of a green belt around the port; and
  - Reviewing and improving the efficacy of municipal services associated with dust control.

## **Governance**

### **Recommendation 7:**

The Taskforce recommends that:

- 7.1** The Taskforce continues to operate, with a focus on sharing information and co-ordinating agency activities when needed.
- 7.2** The Taskforce reports annually to the Minister for State Development on progress in implementing the recommendations in this report and on the overall status of dust and noise management in Port Hedland.



## 2. BACKGROUND

Port Hedland<sup>1</sup> is 1,300 kilometres north of Perth and falls within the Town of Port Hedland local government area, which also includes South Hedland, Wedgefield and some Aboriginal communities (See Figure 1). The environment is naturally dusty, with high levels of background dust from fires and other natural sources.

Port Hedland has grown rapidly in recent years, and exports through the port have risen substantially. This has contributed to high dust levels in the western areas, even though industry and the Pilbara Ports Authority have significantly improved the monitoring and management of dust levels.

In 2012-13, Port Hedland had 4,590 residents, of which 529 were in the West End<sup>2</sup>. The West End population represented about 4% of the total local government population of 13,772. The Town of Port Hedland's Local Planning Strategy (the Pilbara's Port City Growth Plan) identifies the West End as a major tourism precinct.

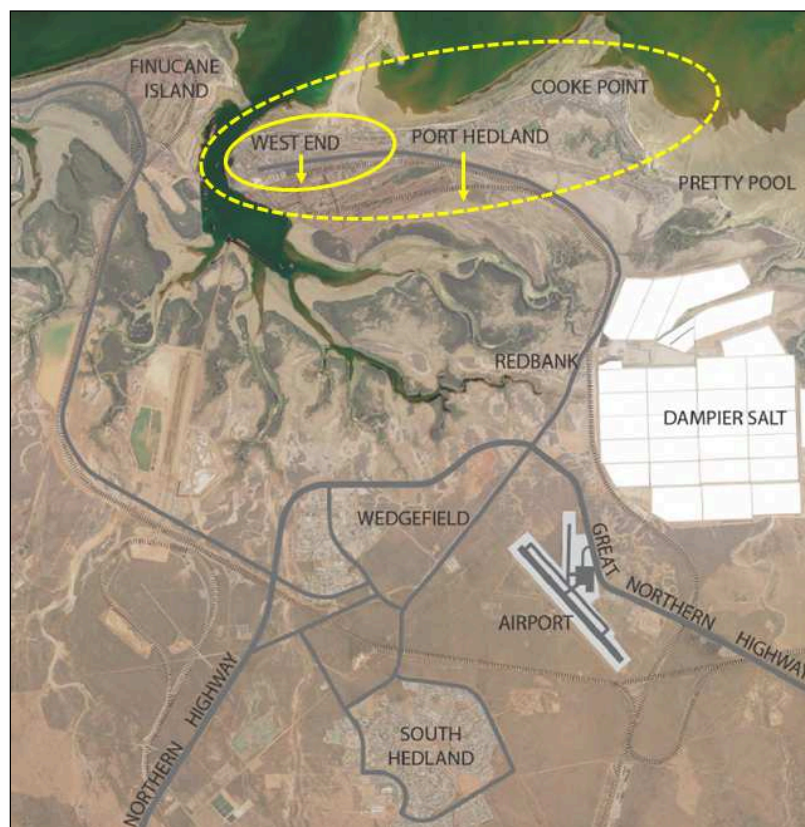


Figure 1: The West End in Port Hedland (Source: Town of Port Hedland, 2012: 15)

The Port of Port Hedland, adjacent to the West End, is the largest bulk minerals port in the world. Between 2010 and 2015, iron ore exports from

<sup>1</sup> The term 'Port Hedland' refers to the peninsula west of Pretty Pool and the term 'West End' refers to the area west of Taplin Street.

<sup>2</sup> Toxikos, 2015 - <http://ww2.health.wa.gov.au/Reports-and-publications/Port-Hedland-Health-Risk-Assessment>

the port increased from 167 million tonnes to 424 million tonnes. Other exports include salt, manganese, chrome and copper concentrates, and cattle.

The value of exports from the port was \$29.7 billion in 2014-15, accounting for 27% of Western Australia's merchandise exports and 12% of Australia's merchandise exports. Iron ore accounted for 95% (\$28.3 billion) of Port Hedland's merchandise exports in 2014-15, followed by copper (3% or \$996 million). In 2014-15, 57% of Western Australia's iron ore exports were exported from Port Hedland.

Port Hedland's exports of iron ore, copper and other base metals contributed an estimated \$2.4 billion of royalties to Western Australia in 2014-15, accounting for 48% of Western Australia's total royalty receipts (excluding North West Shelf Grants). The Pilbara Ports Authority recorded before-tax profit of \$283.8 million in 2014-15, and returned a dividend to the State of \$164.5 million.

The rapid development of this major industrial port in close proximity to an established residential area has created challenges that require careful management. In 2009, the Environmental Protection Authority expressed concerns about dust levels in Port Hedland, and the adequacy of planning controls to limit exposure to dust. At the time there was growing scientific evidence suggesting that dust can affect human health. The Authority proposed an integrated government and industry strategy to reduce and manage emissions. In response to these concerns, in 2009 the Premier established the Port Hedland Dust Management Taskforce (the Taskforce) to co-ordinate and plan for dust management in Port Hedland.

The Taskforce includes representatives of the Town of Port Hedland; the Pilbara Ports Authority; the Departments of Health, Planning, State Development and Environmental Regulation; the Environmental Protection Authority; and major port users (including BHP Billiton Iron Ore, Fortescue Metals Group and Roy Hill). The Port Hedland Industries Council is also a member of the Taskforce.

The Taskforce released the *Port Hedland Air Quality and Noise Management Plan* (the 2010 Management Plan) which the Government and Taskforce members endorsed. The 2010 Management Plan established an interim guideline measure for air quality in Port Hedland of 70 micrograms of PM<sub>10</sub> particles<sup>3</sup> per cubic metre, with no more than 10 annual exceedances. The interim guideline applied pending the completion of a Health Risk Assessment and a new air quality model.

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<sup>3</sup> Dust, or particulate matter (PM), is material suspended in the air in the form of small solid particles, or liquid droplets. Particulate matter can be categorised as PM<sub>10</sub> or PM<sub>2.5</sub>. PM<sub>10</sub> particles are 10 micrometres in diameter and smaller, while PM<sub>2.5</sub> particles are 2.5 micrometres in diameter and smaller. The concentration of an air pollutant is given in micrograms (one-millionth of a gram) per cubic meter of air, or µg/m<sup>3</sup>.

The 2010 Management Plan also recommended measures for managing dust emissions and exposure in Port Hedland. These included a planning scheme amendment for the West End (Amendment 22, gazetted 27 April 2012), the development of an air quality monitoring regime and a Health Risk Assessment.

The Department of Health managed the Health Risk Assessment, which it released in February 2016. With the completion of this work, and the availability of other noise and air quality research, including several years of air quality monitoring data, the Taskforce has the information necessary to make recommendations for managing dust in Port Hedland.

This report outlines progress in implementing the 2010 Management Plan, the Taskforce's response to the Health Risk Assessment and its recommendations concerning the future management of dust and noise emissions in Port Hedland.

## 3. HEALTH RISK ASSESSMENT

### 3.1 OVERVIEW

The 2010 Management Plan recommended a Health Risk Assessment to assess the risk posed to the health of Port Hedland residents from exposure to high dust levels.

Human health risk assessments assist regulatory agencies, industry managers and the public to formulate strategies to protect human health from substances of concern, but they are not the only source of information for making decisions. A human health risk assessment estimates the risk to a population arising from exposure to a substance of concern. The process considers the uncertainties in determining the risk, the characteristics of the substance of concern and the affected population. It identifies the ways people are exposed to a substance, and includes an assessment of acute (immediate or short-term) and chronic (delayed or long-term) health risks that might arise from the exposure. Incomplete information limits risk assessments because it is not possible to know everything about the substance of concern, or the population exposed. To counteract this, risk assessments use safety margins that overestimate the risk.

The steps of a human health risk assessment generally include issue identification, hazard assessment, exposure assessment, risk characterisation and risk management.

The Department of Health released its Health Risk Assessment report, including a detailed technical report prepared by consultants Toxikos, in February 2016. The summary report (Port Hedland Air Quality Health Risk Assessment for Particulate Matter), together with the Toxikos report (Health Risk Assessment Port Hedland) constitutes the Health Risk Assessment<sup>4</sup>.

The Health Risk Assessment determined that PM<sub>10</sub> particles (coarse particulate matter) could affect human health in Port Hedland. Port Hedland dust mainly consists of rock and mineral particles, such as iron oxide. Other particles include salt, manganese, copper and other minerals. Port Hedland dust is both naturally derived (crustal) and anthropogenic (the result of human activity, such as mining and transporting activities).

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<sup>4</sup> <http://ww2.health.wa.gov.au/Reports-and-publications/Port-Hedland-Health-Risk-Assessment>

### 3.2 FINDINGS

The Health Risk Assessment concluded:

- There is sufficient evidence of potential impacts on human health from dust, specifically PM<sub>10</sub>, in the Toxikos Report to warrant dust management controls and strategic and land-use planning to reduce community exposure to dust.
- Most of the public health concerns about dust in Port Hedland arise from PM<sub>10</sub> concentrations over 70 µg/m<sup>3</sup>. Research suggests coarse particles (PM<sub>2.5-10</sub>) are associated with an increase in all-cause mortality and hospitalisation for respiratory conditions. The areas affected are close to the Port.
- The number of affected individuals is very low because the population is small. With a larger population, the impact on health would be more visible and would necessitate more immediate regulatory control.
- A legacy of the rapid growth of Port Hedland is the close proximity of residential areas to commercial operations at Nelson Point and the port. This means that fugitive dust from port and commercial operations at Nelson Point and Finucane Island disperses over residential areas under certain meteorological conditions, despite good dust management control.

### 3.3 HEALTH RISK ASSESSMENT RECOMMENDATIONS

The Health Risk Assessment made the following recommendations:

#### a) Guideline and Exposure Reduction

- Introduce exposure reduction measures that include capping the number of permanent residents to current numbers in areas most impacted by dust currently to the west of Taplin Street. Because acceptable risk is based on population size, a strategy must be introduced now to manage and restrict future population growth in Port Hedland. The closer to the port and Nelson Point operations the tighter the restrictions. A long-term land-use planning strategy may offer a tool for gradually moving the residential areas away from the operations area. Since the aim of government is not to disadvantage anyone currently living in the area planning tools such as Amendment 22 may offer a means to manage exposure while also managing population growth.
- Current regulatory controls for managing dust from operations at Nelson Point and Finucane Island may be aided by declaring a buffer between the port and residential areas further to the east. Air

quality modelling can help define this area but should not be the sole decision making tool used for determining the buffer boundary.

- Apply the current interim guideline of 24-hour PM<sub>10</sub> of 70 µg/m<sup>3</sup> (+ 10 exceedances to accommodate natural events) in residential areas of Port Hedland within a reasonable time frame that allows for local dust sources to be identified and managed (i.e. the spoil bank). A period of five years is suggested.
- The interim guideline can be applied to South Hedland and Wedgefield but it may also be possible to achieve the National Environment Protection Measure for Ambient Air Quality in South Hedland if the source of local exceedances can be identified and managed.
- A coordinated approach to reduce dust from all sources, not just industry, is required. Various government sectors (planning, transport, energy) may need to develop and implement long-term policies and strategies that reduce exposure.

b) Air quality monitoring

- An ongoing air quality monitoring program is vital to monitor exposure risk. This program should include the criteria National Environment Protection Measure pollutants (minus lead) and manganese. The program should have the capacity to include additional pollutants as indicated by the development of new industries or changes to existing industries.
  - Exceedances of the interim guideline should be investigated and reported to the Department of Environment Regulation.
- c) Impact assessments for new developments and future expansion of existing industry should include baseline air quality data and consider additional impacts on air quality on the Port Hedland air-shed.
- d) Promote and encourage existing efforts at continuous improvement among stakeholders. Even small reductions in overall particulate matter can have incremental benefits, which, at least theoretically, contribute to improved amenity, reduced potential health risks and improved health status on a population basis.
- e) Assist local government to promote a community awareness of the benefits of reducing exposure to particulate matter overall. This may include ways to reduce personal exposure during extreme events.

- f) Promote an all of government support for further research on the health effects of crustal dust and the importance of exposure reduction.

**RECOMMENDATION 1**

**The Taskforce endorses the Department of Health's recommendation that the current interim guideline of 24-hour PM<sub>10</sub> of 70 µg/m<sup>3</sup> (+ 10 exceedances to accommodate natural events) should apply to residential areas of Port Hedland and that measures should be introduced to cap the number of permanent residents in dust affected areas of Port Hedland.**

The Taskforce's responses to the other recommendations in the Health Risk Assessment are included in the following sections.



## **4. INDUSTRY DUST AND NOISE MANAGEMENT AND REGULATION**

### **4.1 OVERVIEW**

The 2010 Management Plan recognised the need for a local air quality management plan in the West End, where dust emissions regularly exceeded the National Environment Protection Measure for Ambient Air Quality. The 2010 Management Plan also proposed environmental management controls, including air quality monitoring and regulation and noise management.

### **4.2 AIR QUALITY MONITORING**

The Port Hedland Industries Council established an air quality monitoring regime to count exceedances of the interim air quality target set out in the 2010 Management Plan. The Port Hedland Industries Council developed an ambient air quality monitoring network with monitoring points throughout Port Hedland, Wedgefield, South Hedland, and background/reference monitoring sites at Port Hedland Airport (Bureau of Meteorology) and Yule River. The Port Hedland Industries Council has monitored particulate matter across its network since 2012 and has released three annual monitoring reports, which are publicly available<sup>5</sup>. The real-time data is also available to the public on their website<sup>6</sup>.

Iron ore exports have grown substantially since the release of the Taskforce's 2010 Management Plan (from 167 million tonnes in 2010 to 424 million tonnes in 2015), but there has not been a proportionate increase in dust emissions. Air quality in the eastern parts of Port Hedland has largely remained within the interim guideline set by the Taskforce, while dust emissions in the West End of Port Hedland remain high. Figures 2 and 3 summarise data for the past three years from the Port Hedland Industries Council's monitoring stations around Port Hedland.

Due to the naturally dusty environment, the monitoring network includes background monitoring locations at Yule River and the Bureau of Meteorology site. The 2014-15 monitoring report indicated that the Taskforce's air quality criteria were exceeded on 10 days at the Taplin Street monitor, and that three of the events were due to elevated background dust levels.

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<sup>5</sup> [http://www.phic-hedland.com.au/phic/Annual\\_Report.htm](http://www.phic-hedland.com.au/phic/Annual_Report.htm)

<sup>6</sup> <http://phicmonitoring.com.au/esys/rt/realtime.jsp?siteId=371>



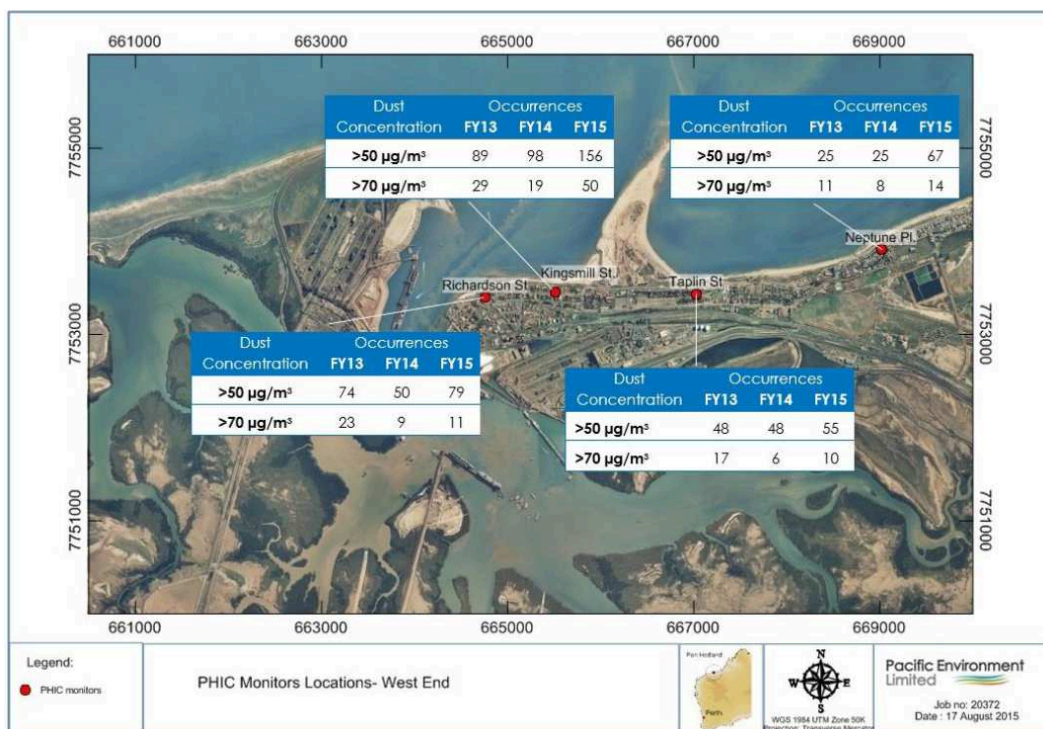


Figure 2: Port Hedland Industries Council Monitoring Station data around the West End in Port Hedland (Source: Port Hedland Industries Council, 2015: vii)

Wind direction information obtained from the monitoring network, and additional data from temporary monitors installed on the Port Hedland spoil bank, suggest that a number of sources contribute to elevated dust levels in the West End. Sources in addition to regional background dust and port-related activities may include the spoil bank itself, the Wedgefield industrial area (which has recorded significantly higher readings than the other monitoring locations), residential and commercial construction work in the West End, and traffic disturbance of dust build-up on roads. All of these sources should be addressed as part of a comprehensive response to managing dust in Port Hedland.

The Health Risk Assessment noted the importance of an ongoing air quality monitoring program to monitor dust exposure.

Some community members do not have confidence in the credibility of the air monitoring network data, given that industry funds, maintains and provides the data from the network. While the Taskforce has confidence in the accuracy of the data obtained from the network, it is important that the community shares this confidence. For this reason, the Taskforce recommends that oversight of the monitoring network, including the verification and publication of monitoring data, is transferred to the Department of Environment Regulation. The Department of Environment Regulation will consult with industry regarding options for implementing this recommendation.

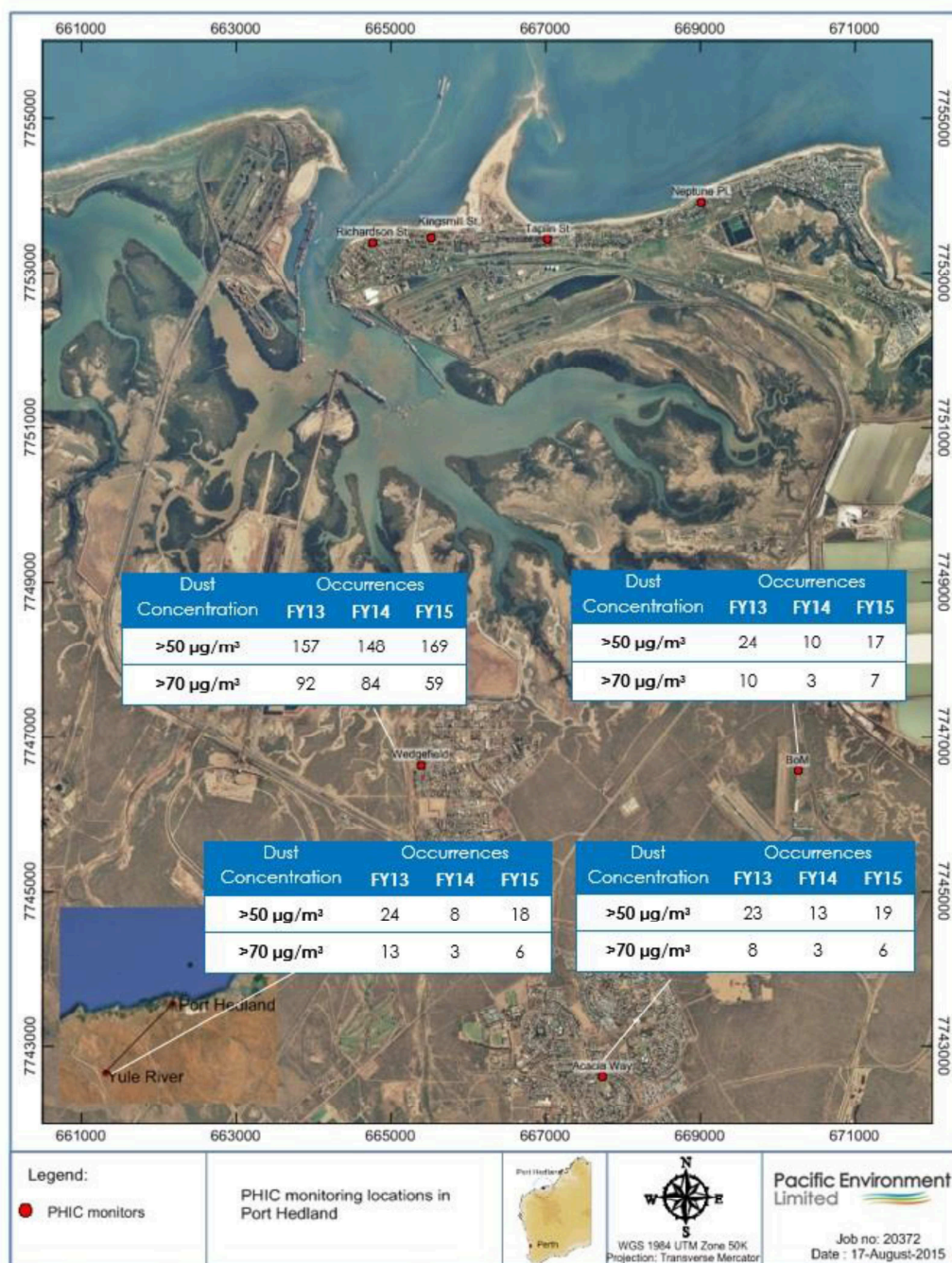


Figure 3: Additional Port Hedland Industries Council Monitoring Stations in Port Hedland (Source: Port Hedland Industries Council, 2015: viii)

## RECOMMENDATION 2

The Taskforce recommends that:

- The Port Hedland Industries Council continue operating and maintaining its air quality network, with responsibility for oversight of the network, including data verification, storage and publication, transferred to the Department of Environment Regulation. The Taskforce notes that the Department of Environment Regulation will consider a number of options, including regulations, to implement this recommendation.

### 4.3 INDUSTRY REGULATION

Two agencies administer regulatory functions under the *Environmental Protection Act 1986* for major port premises within Port Hedland.

The Environmental Protection Authority undertakes environmental impact assessments of significant proposals and provides recommendations to the Minister for Environment on whether proposals may be implemented and, if so, any conditions which should be applied under Part IV, Division 1 of the *Environmental Protection Act 1986*.

The Minister for Environment determines whether proposals can be implemented and the conditions that apply, if any, through a Ministerial Statement issued under Part IV, Division 2 of the *Environmental Protection Act 1986*. The Office of the Environmental Protection Authority monitors compliance with Ministerial Statements. Most major port premises in Port Hedland hold a Ministerial Statement.

The Department of Environment Regulation regulates prescribed premises listed in Schedule 1 of the *Environmental Protection Regulations 1987*, including port premises under Part V, Division 3 of the *Environmental Protection Act 1986*. The Department of Environment Regulation licences and applies conditions on prescribed premises with regard to, and consistent with, issued Ministerial Statements, and seeks to avoid regulatory duplication. The Department also carries out compliance and enforcement actions in relation to pollution offences, noise, and the clearing of native vegetation.

Licences issued under Part V of the *Environmental Protection Act 1986* in the Port Hedland area include monitoring requirements. Some premises are required to undertake boundary monitoring and compare results with ambient air quality data from the Taplin Street monitoring station. In other cases, monitoring and reporting requirements are applied directly to exceedances at Taplin Street or, in the case of Fortescue Metal Group's Anderson Point operation, the Wedgefield monitoring station. Where exceedances of the air quality target are identified, these are reported to the Department of Environment Regulation and compared to ambient monitoring data. The Port Hedland Industries Council also publishes annual reports, which summarise the ambient air quality monitoring data from the monitoring network.

Similar dust management and monitoring requirements have been applied through Ministerial Statements issued under Part IV of the *Environmental Protection Act 1986* to major port premises within Port Hedland.

With the release of the Health Risk Assessment, the Department of Environment Regulation can now implement a coordinated risk-based review and assessment for the port premises based on the most



up-to-date information available. Its regulatory response will be informed by an analysis of data from boundary and ambient air quality monitoring networks, as well as an understanding of the responses by premises, based on meteorological forecasting.

Additionally, the Department of Environment Regulation's review of prescribed premises' licences (issued under Part V of the *Environmental Protection Act 1986*) will involve:

- an assessment of the effectiveness of dust controls applied by premises occupiers; and
- implementation or recommendation of suitable regulatory controls through outcome-based conditions where possible or specified infrastructure and/or monitoring programs.

The Department of Environment Regulation's regulatory response will also assess other impacts, including noise, and determine the most suitable controls if the Department concludes that these impacts have a moderate or higher risk to public health or the environment. The Department aims to review the licences of all licensed port premises by the end of 2016, and will apply its Regulatory Principles<sup>7</sup> to ensure a risk-based regulatory approach.

Where a premise is also subject to a Ministerial Statement, the Department of Environment Regulation will provide a report outlining the findings and recommendation of their review and assessment to the Environmental Protection Authority and Office of the Environmental Protection Authority.

Any amendment to a Ministerial Statement will require an inquiry under section 46 of the *Environmental Protection Act 1986*. If the Minister for Environment considers that the implementation conditions relating to a proposal should be changed, section 46 enables the Minister to request the Environmental Protection Authority to inquire into the matter. On completing its inquiry, the Environmental Protection Authority will provide the Minister for Environment with a report on whether or not the implementation conditions should be changed.

The Minister for Environment, following consultation with other relevant Ministers, will then determine whether the conditions should be changed and, if so, issue a Ministerial Statement with the new conditions. The proponent of the proposal for which the implementation conditions are changed has a right of appeal. The Office of the Environmental Protection Authority manages this process.

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<sup>7</sup> Department of Environment Regulation, 2015. Guidance Statement – regulatory principles [https://www.der.wa.gov.au/images/documents/our-work/regulatory-principles/Guidance\\_Statement\\_Regulatory\\_Principles.pdf](https://www.der.wa.gov.au/images/documents/our-work/regulatory-principles/Guidance_Statement_Regulatory_Principles.pdf)

For port premises regulated by the Department of Environment Regulation and not holding a Ministerial Statement, all controls will be set out in the licences issued to port premises. The Department of Environmental Regulation will publish decision reports on its website explaining the risk assessment process and justification for the controls imposed on the licence.

The Department of Environment Regulation is also developing dust management guidelines specifically for bulk-handling port premises. These guidelines will outline its expectations in relation to the assessment of dust impacts from these premises and dust control and monitoring requirements. The guidelines will inform the establishment of appropriate and enforceable dust conditions for port premises licences. It is expected that port users will improve dust management practices in accordance with the Department of Environment Regulation's risk-based regulatory approach.

### **RECOMMENDATION 3**

**The Taskforce recommends that:**

- 3.1 The Department of Environment Regulation implements a coordinated risk-based review and assessment approach to managing dust and noise in Port Hedland through a review of all port premises licences under Part V, Division 3 of the *Environmental Protection Act 1986*.**
- 3.2 Where premises are subject to Ministerial Statements, the Department of Environment Regulation will provide the findings and recommendations of its risk-based review and assessment to the Environmental Protection Authority and the Office of the Environmental Protection Authority.**
- 3.3 The Environmental Protection Authority and the Office of the Environmental Protection Authority will consider the Department of Environment Regulation's assessments, and the appropriateness of conditions in Ministerial Statements.**
- 3.4 Where the Environmental Protection Authority inquires under section 46 of the Environmental Protection Act 1986 into the conditions within Ministerial Statements, the Environmental Protection Authority will provide the Minister for Environment with a report on whether the conditions in the Statement/s should be changed.**
- 3.5 The Department of Environment Regulation finalises and implements dust management guidelines for bulk handling port premises, outlining its expectations in relation to the assessment of dust impacts, dust control and monitoring requirements from these premises.**

#### 4.4 INDUSTRY INITIATIVES

Major port users have taken significant measures to manage their dust emissions since the release of the 2010 Management Plan, with overall dust levels remaining relatively unchanged despite substantial increases in tonnages through the port.

The Pilbara Ports Authority developed its Dust Management Leading Practice Guidelines<sup>8</sup> to support the objectives of the 2010 Management plan. The Guidelines promoted a best-practice approach for the coordinated management of dust emissions from Port Hedland port operations, and focus on bulk material handling activities. The Taskforce notes that the Department of Environment Regulation is preparing guidance on bulk material handling at premises regulated by the Department under Part V of the *Environmental Protection Act 1986*.

Since 2010, the Pilbara Ports Authority has relocated all external stockpiles from the eastern side of the harbour to the Utah Point facility. All bulk material handling on the eastern side under the management of the Pilbara Ports Authority is now undertaken within closed sheds or by using containers. The Pilbara Ports Authority monitors dust at Utah Point and its eastern operations using what it considers are best practice technologies and processes.

Dust control measures include the use of water cannons and mister sprays, and requiring all product delivered to the site to be at the correct moisture levels to limit dust generation. Conveyor systems and transfer stations are all sealed to limit dust emissions on site. The condition and quality of product delivered to the Pilbara Ports Authority's Utah Point and eastern operations is the responsibility of the shippers using these facilities. However, if this is not done properly, the Pilbara Ports Authority takes action to limit, and in some cases refuses, the delivery of product until the correct quality objectives can be met.

Major port users have implemented dust mitigation measures for their operations. In 2010, BHP Billiton Iron Ore relocated its crushing and screening facilities, which historically were some of the larger dust contributors, to its mines. It has also increased the use of direct-to-ship loading, reducing the need to double-handle product at the port. Fortescue Metals Group's dust management plan covers a range of construction and operational stage dust mitigation measures. Dust mitigation for construction activities includes measures affecting vegetation clearing (for example, use of water carts and staged clearing) and earthworks (for example, minimising areas to be cleared). Operational dust mitigation measures cover railcars (enclosing key components of rail car dumpers), conveyors and transfer points (moisture control and enclosing transfer

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<sup>8</sup> [https://www.pilbaraports.com.au/PilbaraPortsAuthority/media/Documents/PORT%20HEDLAND/ENVIRONMENT%20AND%20HERITAGE/Dust-Management-Leading-Practice-Guidelines-\(A232535\).pdf](https://www.pilbaraports.com.au/PilbaraPortsAuthority/media/Documents/PORT%20HEDLAND/ENVIRONMENT%20AND%20HERITAGE/Dust-Management-Leading-Practice-Guidelines-(A232535).pdf)

points), stackers (spray heads), reclaimers (water sprayers), stockpiles (using coarse stockpiles to protect fines stockpiles) and ship loading (water sprayers).

While industry has achieved significant improvements in dust management in recent years, further improvements are required to ensure dust emissions are not increased, and where practicable reduced, if increases in port throughput occur.

#### **4.5 CUMULATIVE AIR DISPERSION MODELLING**

As part of the recommendation in the 2010 Management Plan for establishment of a best practice air quality management regime in Port Hedland, the Taskforce, through the Port Hedland Industries Council and the Department of Environment Regulation, commissioned a cumulative air model for Port Hedland. The intention was for the model to assist Taskforce decision-making by producing contours of exceedances of the interim air quality standard under port growth scenarios. Despite considerable progress, the Taskforce notes that the model developed has significant limitations affecting its usability for decision-making.

A peer review of the model in 2016 confirmed that the model, in its current form, is not suitable for informing land-use decisions. The model only uses emission estimates from port industries and accounts simplistically for other sources such as bushfires, dust storms and localised sources (such as town vehicle dust, construction dust and windblown dust from beaches, roads and spoil banks), through the use of a single factor called “background dust”. In addition, the uncertainties associated with the model outputs are large owing to uncertainties in emission estimates, meteorology and in the background variation.

The Taskforce notes that the preferred model is better suited for assessing relative changes in dust concentrations, rather than the total dust concentration. The Department of Environment Regulation has advised that models are comparative assessment tools and that monitoring data provides a better estimate of the actual impact currently occurring in Port Hedland. The model will therefore serve as a useful tool for addressing the Health Risk Assessment recommendation that “Impact assessments for new developments and future expansion of existing industry should include baseline air quality data and consider additional impacts on air quality on the Port Hedland air-shed”.

#### **4.6 NOISE**

The 2010 Management Plan also addressed concerns around noise caused by industrial activity in Port Hedland. High noise levels may affect

the amenity of adjacent residential areas. Noise emitters in Port Hedland include port facilities and a number of rail and road operators.

Cumulative noise emissions from industries in Port Hedland exceed the assigned noise levels in the *Environmental Protection (Noise) Regulations 1997*. The 2010 Management Plan recommended a noise regulatory strategy based on the:

- development of a cumulative noise model;
- definition of noise sensitive zones;
- clarification of planning measures; and
- clarification of building standards.

In 2014, SVT Engineering Consultants completed the Port Hedland Cumulative Environment Noise Study (Noise Study), commissioned by the Port Hedland Industries Council and the Department of Environment Regulation. The study produced noise models for emissions from port facilities and rail and road usage. The models covered 'current', 'near future', 'intermediate future' and 'ultimate capacity' scenarios for Port Hedland. The noise predictions provided by the study account for a worst-case scenario for operations, that is all equipment operating simultaneously, and weather conditions.

The study predicted exceedances of noise levels for port and industrial facilities (as assigned through the *Environmental Protection (Noise) Regulations 1997*) across Port Hedland's residential areas. Noise levels in South Hedland under the 'current' scenario were modelled to be below assigned levels, but exceedances were predicted under the 'near future', 'intermediate future' and 'ultimate capacity' scenarios.

Some exceedances of the noise targets set in State Planning Policy 5.4 from road usage were predicted in the West End of Port Hedland under all scenarios. The rail noise model did not predict any exceedances at the noise sensitive receivers used in the modelling.

The Department of Environment Regulation is considering a number of regulatory strategies, including:

- Individual approvals under Regulation 17 of the *Environmental Protection (Noise) Regulation 1997*, where approval to exceed or vary from the Regulations can be granted where noise emissions cannot reasonably and practicably comply with the prescribed noise standard.
- A precinct-based Regulation 17 approval, whereby Regulation 17 approvals could be granted to specific entities – for example, to the Pilbara Ports Authority and other port operators, to cover all the emitters within the port precinct.
- Precinct noise regulations, involving the development of a new noise regulation within, or alongside, the *Environmental Protection (Noise) Regulations 1997* that would set different allowable noise levels for a defined 'Port Hedland precinct'.



- A Ministerial exemption order exempting activities from the prescribed standards specified in the *Environmental Protection (Noise) Regulations 1997* (under section 6 of the *Environmental Protection Act 1986*).

The Town of Port Hedland can also use the Noise Study when reviewing land-use planning measures in the West End.

#### **RECOMMENDATION 4**

**The Taskforce recommends that:**

- 4.1 The Department of Environment Regulation assesses unacceptable noise levels and assesses whether additional controls can be introduced as part of its review of all port premises licences under Part V, Division 3 of the *Environmental Protection Act 1986*.**
- 4.2 The Town of Port Hedland uses the Port Hedland Cumulative Noise study to inform its land-use planning for the West End of Port Hedland.**

## 5. LAND-USE PLANNING

### 5.1 OVERVIEW

The 2010 Management Plan recommended progression of an amendment to the Town of Port Hedland Town Planning Scheme No.5 to address residential and sensitive land uses in dust-affected areas of Port Hedland. The subsequent Amendment 22, gazetted in April 2012, established the West End Residential zone in the most dust-affected areas around the port. The objectives of the West End Residential zone are to:

- restrict the form of residential development so that long-term residency by families with children or elderly persons is discouraged;
- add vibrancy to both the subject land and the nearby commercial area;
- maximise opportunities for workers in nearby employment nodes to reside close to work; and
- provide opportunities for commercial, entertainment facilities and short stay accommodation.

Building design and performance standards to address exposure to dust were included in Amendment 22, as recommended in the 2010 Management Plan. These included the use of deflection screens, building orientation requirements and the location of operable windows on the western and southern facades only.

The 2010 Management Plan also recommended the preparation of a development plan for the Port Hedland area. The Western Australian Planning Commission endorsed the *Pilbara's Port City Growth Plan* (Growth Plan) in 2012. The Growth Plan functions as the Town of Port Hedland's Local Planning Strategy and was formulated through an inclusive planning process, which included a comprehensive stakeholder consultation process.

Consistent with the precautionary approach recommended in the 2010 Management Plan, the Growth Plan recommends the progressive transition from permanent residential uses under the current West End Residential zone towards a longer term land use scenario with no permanent residential (short-stay accommodation only) west of Acton Street.

## 5.2 PROPOSED LAND USE PLANNING CHANGES

The Health Risk Assessment recommends the introduction of measures to cap the number of permanent residents in dust-affected areas of Port Hedland. The Taskforce supports this recommendation. Port operations are expected to expand in the future (the Pilbara Ports Authority estimates total exports to increase to 481 million tonnes in 2016-17, up from 433 million tonnes in 2015-16<sup>9</sup>), and the port has an important role in the economic growth of the Pilbara and Western Australia. With increasing throughput, it will be difficult to reduce dust emissions even with continued improvements in dust generated per tonne of exports.

Dust levels in the West End of Port Hedland are expected to remain high. Because acceptable risk is based on population size, a strategy must be introduced to manage and restrict future population growth in Port Hedland to reduce the overall population exposed to high levels of dust. The Health Risk Assessment recommends that “the closer to the port and Nelson Point operations, the tighter the required restrictions” and notes that “current regulatory controls for managing dust from operations at Nelson Point and Finucane Island may be aided by declaring a buffer between the port and residential areas further to the east”.

Dust monitoring data indicate that Taplin Street, the current eastern boundary of the West End precinct, remains the most appropriate boundary for limiting residential land use in proximity of the port. However, dust levels at the Neptune Street monitoring station east of Taplin Street and McGregor Street are also around the recommended threshold levels.

There is now sufficient evidence for the State and Local Governments to consider additional planning measures to further limit residential land use. The Taskforce recommends that the Town of Port Hedland and the Department of Planning collaborate to implement measures limiting permanent residential developments and other sensitive land uses in dust-affected areas of Port Hedland.

The Taskforce recommends the establishment of a Special Control Area over land west of Lukis and McGregor Streets, to the port (see Figure 4). The Special Control Area should prohibit new permanent residential development and other dust sensitive land uses, including aged care and childcare premises, in the area west of Taplin Street. New low-density (R20) residential developments would be permitted in the area between Taplin Street and Lukis/McGregor Streets, but higher density residential development and other dust sensitive land uses would be prohibited. The extension of planning controls to Lukis and McGregor Streets is a precautionary measure that allows for the possibility of increases in dust levels resulting from future port expansion.

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<sup>9</sup> Port Hedland Port Authority Port Development Plan 2012-2016

The proposed land-use measures will not affect the ability of property owners to carry out, or continue to enjoy, already approved developments on their property.



Figure 4: Proposed amendment area.

The Taskforce proposes that the Special Control Area align current zonings with the Growth Plan, taking into consideration the Health Risk Assessment. The Growth Plan defines the West End (Precinct 1) as the commercial and cultural core of Port Hedland with predominantly mixed land uses, including short stay accommodation (see Figure 5).

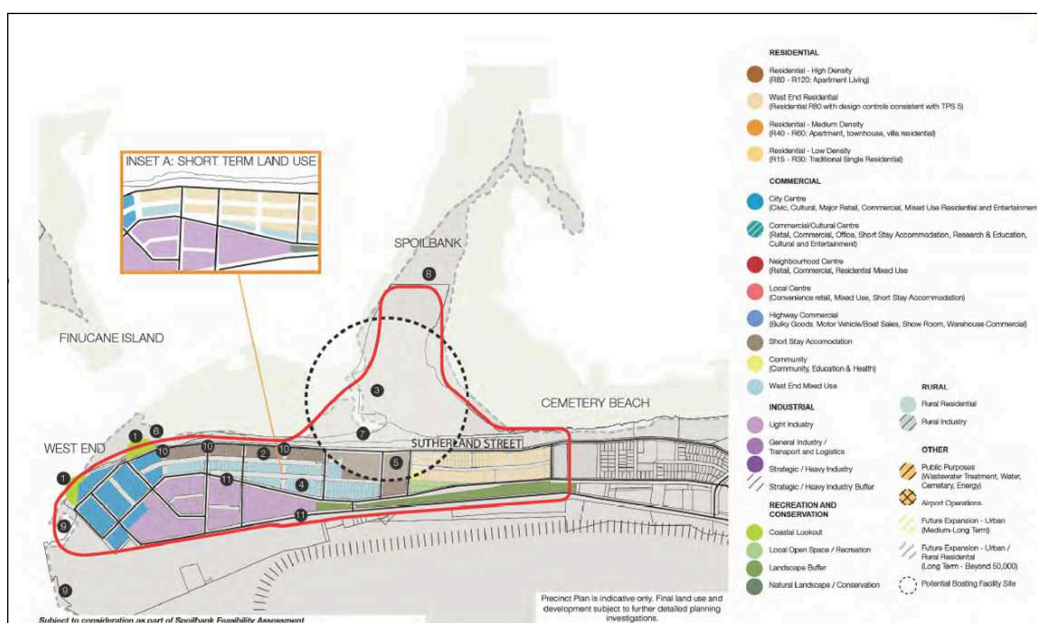


Figure 5: Pilbara's Port City Growth Plan: Precinct 1 – West End (Source: Town of Port Hedland, 2012:87)

The land-use planning measures recommended by the Taskforce can be incorporated into the Town of Port Hedland's Local Planning Scheme through a scheme amendment process prescribed under the *Planning and Development Act 2005*, and the associated *Planning and Development (Local Planning Schemes) Regulations 2015*.

#### **RECOMMENDATION 5**

**The Taskforce recommends that:**

- 5.1 The Minister for Planning asks the Town of Port Hedland to implement a Special Control Area westwards from McGregor Street as part of its Planning Scheme No. 5;**
- 5.2 The Special Control Area prohibits new permanent residential development and other sensitive land uses, including aged care and child care premises, west of Taplin Street;**
- 5.3 Low-density (R20) residential development be permitted in the predominantly residential area between Taplin and McGregor Streets, but higher-density residential development and other sensitive land uses be prohibited; and**
- 5.4 The zoning in the Special Control Area aligns with the Town of Port Hedland Local Planning Strategy's Precinct 1, taking into consideration the findings of the Health Risk Assessment.**

### **5.3 BUILDING DESIGN AND PERFORMANCE STANDARDS**

The Taskforce is not convinced of the efficacy or enforceability of the building design and performance standards implemented as part of Amendment 22. These standards, included in the 2010 Management Plan's Appendix 4, include aspects like window and door orientation and filtered air conditioning. The Local Planning Scheme's building design and performance standards can be reviewed as part of a scheme review or amendment.

## **6. LOCAL GOVERNMENT AND COMMUNITY**

### **6.1 OVERVIEW**

Dust monitoring data suggest that there are sources of dust in Port Hedland other than the port that require investigation and management. These sources include the spoil bank and the Wedgefield industrial area. The recent growth of Port Hedland, which saw a significant increase in construction activity and infrastructure development, such as roads, has also contributed to dust emissions in the town.

The Town of Port Hedland is committed to working with the State Government, industry and the community to improve Port Hedland's amenity and reduce ambient dust levels in the West End.

### **6.2 SPOIL BANK**

The Taskforce notes that the Town of Port Hedland and the State Government are committed to developing a waterfront precinct in Port Hedland, and that the Town of Port Hedland favours the development of a marina at the spoil bank site.

In 2013, the Town of Port Hedland proposed Scheme Amendment 56, which sought to establish a Marina Development zone within the Town of Port Hedland Town Planning Scheme 5 provisions and zone land on the spoil bank generally north of Sutherland Street from its current reservation as Parks and Recreation to Marina Development zone. Broadly, the Marina Development zone would provide for public marina uses as well as tourist, commercial and residential development.

In 2014, the Environmental Protection Authority determined that Amendment 56 was incapable of being made environmentally acceptable and could not be implemented due to its residential component. The Minister for Environment subsequently advised the Town of Port Hedland that it could review its amendment proposal for the spoil bank in view of the findings of the Health Risk Assessment, once complete.

Current planning for the first stage of the proposed spoil bank marina does not include any permanent residential development. The proposed Special Control Area for the West End will therefore not prevent this project from proceeding, although it would prohibit any permanent residential development for future stages of the project.

As the spoil bank contributes to dust emissions in the West End, the development of the marina may reduce emissions from this source. If the marina project does not proceed in the near future, the Town of Port

Hedland should identify and implement other options for mitigating dust from the spoil bank.

### **6.3 GREENING AND OTHER DUST MANAGEMENT INITIATIVES**

The Taskforce notes that the Town of Port Hedland recently resolved to identify a range of dust mitigation measures in response to the Health Risk Assessment, including sealing unsealed roads and collaborating with the Pilbara Ports Authority, port users, industry and key stakeholders to investigate and implement green belts of vegetation around the port and town<sup>10</sup>. The Taskforce supports this initiative.

Other areas that appear to warrant further examination include reviewing current practice around site dust management plans, especially compliance and enforcement, and the effectiveness of the Town's street sweeping program.

#### **RECOMMENDATION 6**

**The Taskforce recommends that:**

- **The Town of Port Hedland works with key stakeholders to identify and mitigate dust from non-industry sources, with a focus on:**
  - **Identifying and implementing dust mitigation options for the spoil bank;**
  - **Sealing unsealed roads and undertaking regular and effective street sweeping operations;**
  - **Considering greening options, including coastal dune revegetation and the establishment of a green belt around the port; and**
  - **Reviewing and improving the efficacy of municipal services associated with dust control.**

<sup>10</sup> <http://www.porthedland.wa.gov.au/Profiles/porthedland/Assets/ClientData/Document-Centre/Minutes/2016/OCM25May/20160525Minutes.pdf>

## 7. GOVERNANCE

The 2010 Management Plan envisaged that the Department of Planning and the (then) Department of Environment and Conservation would report separately to the Premier on implementation of the Plan. However, the Premier subsequently agreed that the Taskforce would report to him through the Department of State Development, as chair of the Taskforce. Following a change in Ministerial portfolios in early 2016, the Taskforce now reports to the Hon. Bill Marmion MLA, Minister for State Development.

The main responsibility for implementing the recommendations in this report lies with planning and regulatory agencies.

### **RECOMMENDATION 7**

**The Taskforce recommends that:**

- 7.1 The Taskforce continues to operate, with a focus on sharing information and co-ordinating agency activities when needed; and**
- 7.2 The Taskforce reports annually to the Minister for State Development on progress in implementing the recommendations in the report and on the overall status of dust and noise management in Port Hedland.**



## GLOSSARY OF TERMS

Amendment 22	Town of Port Hedland Local Planning Scheme No. 5, Scheme Amendment 22
EP Act	Environmental Protection Act 1986
DER	Department of Environment Regulation
DSD	Department of State Development
DoP	Department of Planning
HRA	Health Risk Assessment
OEPA	Office of the Environmental Protection Authority
µg	Microgram
NEPM	National Environmental Protection Measure
Particulate Matter (dust)	Particulate Matter suspended in the air in the form of minute solid particles or liquid droplets, especially when considered an atmospheric pollutant
PM <sub>10</sub>	Particulate matter classified as having an aerodynamic diameter of 10 µm/m <sup>3</sup>
PM <sub>2.5</sub>	Particulate matter classified as having an aerodynamic diameter of 2.5 µm/m <sup>3</sup>
2010 Management Plan	Port Hedland Air Quality and Noise Management Plan
ToPH	Town Of Port Hedland Council
West End	The Western of Port Hedland – the area generally west of Taplin Street

## LIST OF REFERENCES

Department of Environment Regulation, 2015. Guidance Statement Regulatory principles – Environmental Protection Act 2986, Part V; Effective and efficient regulation.

Department of Health, 2016. Port Hedland Air Quality Health Risk Assessment for Particulate Matter.

Department of State Development, 2010. Port Hedland Air Quality and Noise Management Plan, March 2010.

Port Hedland Industries Council, 2015. Ambient Air Quality Monitoring Report to the Port Hedland Dust Management Taskforce (2014-2015).

Port Hedland Industries Council, 2014. Ambient Air Quality Monitoring Report to the Port Hedland Dust Management Taskforce (2013-2014)

Port Hedland Port Authority, Port Development Plan 2012-2016.

Town of Port Hedland, 2012. Pilbara's Port City Growth Plan.

Town of Port Hedland, Town Planning Scheme No. 5.

Toxikos, 2015. Health Risk Assessment Port Hedland.