



# Technical Appendices N1 and N2

Draft Environmental Impact  
Statement/Environmental Review  
and Management Programme for the  
Proposed Wheatstone Project

**July 2010**



**Disclaimer**

In preparing this Draft Environmental Impact Statement/Environmental Review and Management Programme (Draft EIS/ERMP), Chevron Australia Pty Ltd (Chevron) has relied on material provided by specialist consultants, government agencies and other third parties who are identified in the Draft EIS/ERMP. Chevron has not verified the accuracy or completeness of the material provided by these consultants, government agencies and other third parties, except where expressly acknowledged in the Draft EIS/ERMP. Should there be any difference or inconsistency between the material presented in this Draft EIS/ERMP and that in any third-party document referred to herein (including assessments, findings, opinions, project descriptions, proposed management measures and commitments), the material presented in the Draft EIS/ERMP alone shall be taken to represent Chevron's position.

**Copyright Note**

© 2010 Chevron Australia Pty Ltd. The information contained in this document is the property of Chevron Australia Pty Ltd and may not be used or copied in whole or part without its prior written consent.

Title: Draft Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Wheatstone Project: Technical Appendices N1 and N2

## Appendix N1 to N2

N1	Wheatstone Project Benthic Primary Producer Habitat Loss Assessment	2
N2	Dredge Plume Impact Assessment	148

# Appendix N1

Wheatstone Project Benthic Primary Producer  
Habitat Loss Assessment

1	Introduction	11
1.1	Document Purpose	11
1.2	BPPH Loss Assessment Framework	11
1.3	Scope of work	14
1.4	Report Structure	15
2	BPPH Distribution & Justification of LAU Boundaries	17
2.1	BPPH Distribution	17
2.2	Justification of LAU Boundaries	24
2.3	Historical Loss of BPPH	31
3	BPPH Loss Assessment - Onshore Infrastructure	33
3.1	Introduction	33
3.2	Hooley Creek BPPH Loss Assessment	35
3.3	Borrow Pit Access Road Loss Assessment	37
3.4	Ashburton River Delta BPPH Loss Assessment	38
4	Direct BPPH Loss arising from nearshore infrastructure footprint	41
4.1	Nearshore infrastructure	41
4.2	BPPH loss assessment	41
5	BPPH Loss Assessment - Dredging & Material Placement	47
5.1	Introduction	47
5.2	Alternatives Considered	47
5.3	Proposed dredging works	48
5.3.1	Dredging works program	48
5.3.2	Selection of Nearshore Placement Sites	53
5.3.3	Stability of dredged material	53
5.3.4	Contaminant status of dredged material	55
5.3.5	Acid Sulfate Soils status of dredged material	55
5.4	Effects of dredging program on nearshore water quality	55
5.4.1	Background	55
5.4.2	Overview of modelling approach	57
5.4.3	Model set-up, calibration and validation	58
5.4.4	Selection of climate and dredging scenarios	59
5.4.5	Short-term scenario modelling results	72
5.4.6	Representation of the Full Dredge Log Program	76
5.5	Dredging induced impacts on BPPH	81
5.5.1	Scope of works undertaken	81
5.5.2	Definition of Impact Zones	81
5.5.3	Definition of tolerance limits	82
5.5.4	Scenarios modelled	86
5.5.5	Combined scenario impact zones	87
5.6	BPPH Loss Assessment	92
5.7	Management of Impacts during Construction Dredging	102
5.8	Maintenance Dredging Effects on BPPH	104

6	Indirect Effects Arising from Construction of Nearshore Infrastructure	105
7	BPPH Loss Assessment Summary	115
8	References	118
9	Limitations	123

## Tables

Table 1-1	CLGs for BPPH within defined LAUs for six categories of marine ecological protection	13
Table 2-1	Area (ha) of principal BPPH found within designated LAUs for the Project nearshore area and applicable EPA CLG category	26
Table 3-1	Mapped intertidal BPPH with predicted clearing areas	35
Table 3-2	Cumulative loss assessment summary for the Hooley Creek - Four Mile Creek LAU	36
Table 4-1	Area of Soft substrate Habitat Modified by Port Infrastructure Components	45
Table 5-1	Dredged area volumes	50
Table 5-2	Proposed dredging program schedule	52
Table 5-3	Characteristics of proposed dredge material placement sites	53
Table 5-4	Selected climatic scenarios	60
Table 5-5	Summary of dredging scenarios modelled by DHI	63
Table 5-6	Impact classification categories	82
Table 5-7	Matrix of Impact Zones for suspended sediment impact on corals, for assessment of short term scenario modelling - applicable for Nearshore Waters < 5 m deep in ECU1 during summer and winter only	83
Table 5-8	Matrix of Impact Zones for suspended sediment impact on corals, for assessment of short term scenario modelling - applicable for offshore waters (beyond 5 m isobath) for all seasons, and for nearshore waters (within 5 m isobath) during Transitional periods only	84
Table 5-9	Matrix of Impact Zones for sedimentation impact on Corals for assessment of 14-day scenario model results - For nearshore waters (within 5 m isobath) during Summer and winter only	84
Table 5-10	Matrix of Impact Zones for sedimentation impact on Corals for assessment of 14-day scenario model results - For offshore waters (beyond 5 m isobath) during all seasons, and for nearshore waters (within 5 m isobath) during Transitional periods only	84
Table 5-11	Summary of overall Estimated Zones of Impact (EZI) for 34 key sensitive receptors for each of the ninety six "Realistic Spill" scenarios (combined MesoLAPS and Onslow wind results)	94
Table 5-12	Sub-tidal BPPH loss/damage assessment resulting from exceedance of SSC tolerance limits by non-optimised dredging scenarios 1-7	97
Table 5-13	Sub-tidal BPPH Loss/Damage Assessment resulting from exceedance of SSC Tolerance Limits by the optimised dredging scenarios 1-6+7A	102
Table 6-1	Filter Feeder Loss Assessment Resulting from Exceedance of SSC (Partial Mortality) and Sedimentation (Total Mortality)	113
Table 7-1	Summary of anticipated irreversible BPPH loss as a result of Project activities	117

## Figures

Figure 1-1	EPA GS 1 Guideline mangrove management areas	14
Figure 2-1	Nearshore Project area and location of major marine components	17
Figure 2-2	Indicative distribution of subtidal marine habitats (excluding macroalgae) and substrates in the nearshore Project area	20
Figure 2-3	Indicative distribution of coral and dense macroalgae habitats and substrates in the nearshore Project area	21
Figure 2-4	Indicative distribution of intertidal marine habitats in the nearshore Project area	22
Figure 2-5	Distribution of principal BPPH within the Project area	23
Figure 2-6	Proposed ECU boundaries for BPPH loss assessment	28
Figure 2-7	Proposed ecosystem boundaries and LAUs for BPPH loss assessment	29
Figure 2-8	Onshore infrastructure and access road in a regional context with the boundaries of the three onshore LAUs	30
Figure 2-9	Existing and proposed areas of seafloor disturbance in the Project area	32
Figure 3-1	Areas of predicted intertidal BPPH loss as a result of construction of onshore infrastructure	34
Figure 3-2	Proposed borrow pit access roads	38
Figure 4-1	Optimised layout for the MOF and PLF for the foundation project	42
Figure 4-2	Nearshore port components overlaid on BPPH distribution	43
Figure 5-1	Proposed navigation channel and proposed dredge material placement sites	49
Figure 5-2	DHI definition of PLF navigation channel dredge sections (1 - 4) and PLF section (5)	62
Figure 5-3	Sketch of locations for Dredging Scenario 1 - dredge locations and placement sites are highlighted in red and yellow, respectively	64
Figure 5-4	Sketch of locations for Dredging Scenario 2: CSD dredging at red dot with loading of barges at green dot. Placement to site C at yellow dot	65
Figure 5-5	Sketch of locations for Dredging Scenario 3: CSD dredging at MOF (red dot) with pumping to barges at -3m LAT contour with overflow (green dot) and transport to placement site C (yellow dot); 5,000 m <sup>3</sup> TSHD dredging Section 4 (red line)	66
Figure 5-6	Sketch of locations for Dredging Scenario 4: 10,000m <sup>3</sup> TSHD dredging weak rock in PLF Sections 4 and 5 (green line) and 10,000m <sup>3</sup> TSHD dredging sand at PLF navigation channel Section 1 (red line); placement at site C (yellow dot)	67
Figure 5-7	Sketch of locations for Dredging Scenario 5: 10,000m <sup>3</sup> TSHD dredging weak rock in PLF Sections 1 and 2 (green line) and 10,000m <sup>3</sup> TSHD dredging sand at PLF navigation channel Section 3 (red line); placement at site C (yellow dot)	68
Figure 5-8	Sketch of locations for Dredging Scenario 6: 10,000m <sup>3</sup> TSHD dredging weak rock in PLF Sections 3 and 4 (green line) and 10,000m <sup>3</sup> TSHD dredging sand at PLF approach Section 4 (red line); placement at site C (yellow dot)	69
Figure 5-9	Sketch of locations for Dredging Scenario 7: 10,000m <sup>3</sup> TSHD dredging sand at PLF approach Section 2 (red line); placement at site C (yellow dot)	70
Figure 5-10	Sketch of locations for Dredging Scenario 7A: TSHD starting in centre of red area, dredging towards or away from shore on alternate trips with initial 1.5 km section with no overflow followed by 3 km with overflow; placement at site C (yellow dot)	71
Figure 5-11	Mean SSC for Dredge Scenario 3 with realistic (low) release rates	73
Figure 5-12	Mean SSC for Dredge Scenario 7 with realistic release rates	74
Figure 5-13	Mean SSC for Dredge Scenario 7A with realistic release rates	75



Figure 5-14	Composite of the Mean SSC for Dredge Scenario 3 with realistic release rates (all climate scenarios combined)	77
Figure 5-15	Composite of the Mean SSC for Dredge Scenario 7 with realistic release rates (all climate scenarios combined)	78
Figure 5-16	Composite of the Mean SSC for Dredge Scenario 7A with realistic release rates (all climate scenarios combined)	79
Figure 5-17	Mean excess concentration for the FDLP based on Dredge Scenario 7 (top) and Dredge Scenario 7A (bottom) with realistic release rates	80
Figure 5-18	Locations of sensitive coral and seagrass receptors in Project area (URS 2010c)	85
Figure 5-19	All seasons IZI for SSC tolerance limits on Coral (top) and Seagrass (bottom) habitats	88
Figure 5-20	All seasons IZI for Sedimentation tolerance limits on Coral (top) and Seagrass (bottom) habitats	89
Figure 5-21	Optimized dredging scenarios: All seasons IZI for SSC tolerance limits on Coral (top) and Seagrass (bottom)	91
Figure 5-22	IZI arising from exceedance of seagrass SSC tolerance limits overlaid on the Map of BPPH LAU boundaries and distribution of seagrasses and macroalgae	92
Figure 5-23	Scenario 1-7: IZI arising from exceedance of coral SSC (top) and sedimentation (bottom) tolerance limits overlain on distribution of coral and filter feeder habitats	95
Figure 5-24	Scenario 1-7: IZI arising from exceedance of seagrass SSC (top) and sedimentation (bottom) tolerance limits overlain on distribution of seagrass and macroalgae habitats	96
Figure 5-25	Restricted overflow zones 1 and 2 recommended by DHI	100
Figure 5-26	Optimised Scenario (1-6+7A): IZI arising from exceedance of coral SSC (top) and sedimentation (bottom) tolerance limits overlain on distribution of coral and filter feeder habitats	101
Figure 6-1	Location of Ashburton Island in relation to one of the two detailed short-term trunkline dredge plume modelling scenarios	107
Figure 6-2	Location of Bessieres and Thevenard Islands in relation to one of the two detailed short-term trunkline dredge plume modelling scenarios	108
Figure 6-3	Trunkline dredging IZI arising from exceedance of SSC tolerance limits for coral, with location of coral and filter feeder habitats	109
Figure 6-4	Trunkline dredging IZI arising from exceedance of sedimentation tolerance limits for coral, with location of coral and filter feeder habitats	110
Figure 6-5	Trunkline dredging IZI arising from exceedance of SSC tolerance limits for seagrass, with location of seagrass and macroalgae habitats	111
Figure 6-6	Trunkline dredging IZI arising from exceedance of sedimentation tolerance limits for seagrass, with location of seagrass and macroalgae habitats	112

## Appendices

Appendix A	Peer review by Dr Charles Sheppard on the selection of receptor tolerance limits by DHI.
Appendix B	Intertidal BPPH Tables for the Wheatstone Project.
Appendix C	Peer review by Dr Eric Paling on the BPPH in the Project Area.



# Report

## Wheatstone Project

### Benthic Primary Producer Habitat Loss Assessment

29 JUNE 2010

Prepared for  
Chevron Australia Pty Ltd  
QV1, 250 St Georges Terrace  
Perth WA 6000

42907466



This page is intentionally blank

BPPH Loss Assessment

Project Manager:



Damian Ogburn  
Principal Environmental  
Scientist

URS Australia Pty Ltd

Level 3, 20 Terrace Road  
East Perth WA 6004  
Australia

T: 61 8 9326 0100  
F: 61 8 9326 0296

Principal-In-Charge:



Bob Anderson  
Senior Principal  
Environmental Engineer

Author:



Ian Le Provost  
Marine Environmental  
Consultant

Reviewer:



Damian Ogburn  
Principal Environmental  
Scientist

Date:

29 June 2010

Reference:

42907466/WHST-

Status:

STU-EM-RPT-

0137/Rev 1

Final

© Document copyright of URS Australia Pty Limited.

This report is submitted on the basis that it remains commercial-in-confidence. The contents of this report are and remain the intellectual property of URS and are not to be provided or disclosed to third parties without the prior written consent of URS. No use of the contents, concepts, designs, drawings, specifications, plans etc. included in this report is permitted unless and until they are the subject of a written contract between URS Australia and the addressee of this report. URS Australia accepts no liability of any kind for any unauthorised use of the contents of this report and URS reserves the right to seek compensation for any such unauthorised use.

Document delivery

URS Australia provides this document in either printed format, electronic format or both. URS considers the printed version to be binding. The electronic format is provided for the client's convenience and URS requests that the client ensures the integrity of this electronic information is maintained. Storage of this electronic information should at a minimum comply with the requirements of the Commonwealth Electronic Transactions Act (ETA) 2000.

Where an electronic only version is provided to the client, a signed hard copy of this document is held on file by URS and a copy will be provided if requested.



## Introduction

Chevron Australia Pty Ltd (Chevron) proposes to construct and operate a multi-train liquefied natural gas (LNG) and domestic gas (Domgas) plant 12 km south west of Onslow on the Pilbara coast. The LNG and Domgas plant will initially process gas from fields located approximately 200 km offshore of Onslow, in the West Carnarvon Basin and other yet-to-be determined gas fields. The Wheatstone Project is referred to as the Project and the Ashburton North Strategic Industrial Area (SIA) is the proposed site for the LNG and Domgas plant. The Project will require the installation of gas gathering, export and processing facilities in Commonwealth and State Waters, and on land. The LNG plant will have a maximum capacity of 25 million tonnes per annum (MTPA) of LNG.

The Project has been referred to the State Environmental Protection Authority (EPA) and the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA). The investigations outlined in this report have been conducted to support the environmental impact assessment (EIA) process.

### 1.1 Document Purpose

An Environmental Scoping Document (Chevron 2009) for the Project identified that direct and indirect impact to marine benthic primary producer habitat (BPPH) in Western Australian coastal waters may occur as a result of the following Project activities:

- construction of onshore infrastructure at the Ashburton North Strategic Industrial Area (Ashburton North SIA);
- construction of nearshore infrastructure (a materials offloading facility (MOF) and product loading facility (PLF));
- installation of a natural gas condensate (condensate) trunkline and shore crossing;
- capital dredging of the MOF and PLF navigation and access channels and basin;
- offshore placement of dredged material; and
- maintenance dredging.

In addition, the mangrove ecosystems of the Ashburton River Delta and Hooley Creek tidal system, which occur immediately adjacent to the Ashburton North SIA, were identified as potentially being at risk from a range of indirect impacts from onshore infrastructure including:

- atmospheric and dust emissions;
- leaks and spills of hydrocarbons; and
- altered drainage.

This document summarises a number of baseline and impact assessments completed for the Project, and aims to demonstrate compliance with the EPAs Environmental Assessment Guidelines No. 3: *Protection of Benthic Primary Producer Habitats in Western Australia's Marine Environment* (EAG 3) (EPA 2009) and the EPAs *Guidance for the Assessment of Environmental Factors. Guidance Statement for the protection of tropical arid zone mangroves along the Pilbara coastline. No. 1* (GS 1) (EPA 2001). BPPH loss assessment was undertaken in accordance with EAG 3 (EPA 2009).

### 1.2 BPPH Loss Assessment Framework

BPPH are defined in EAG 3 (EPA 2009) as being seabed communities within which algae, seagrass, mangroves, corals or mixtures of these groups of organisms are prominent components (EPA 2009). The EPA developed EAG 3 (EPA 2009) in recognition of the fundamental ecological importance of BPPH and the potential consequences of their loss on marine ecosystem integrity. EAG 3 (EPA 2009)



## 1 Introduction

presents a set of overarching environmental protection principles as well as a spatial framework for assessment of the significance of cumulative losses of BPPH within defined Loss Assessment Units (LAU). LAUs take into account key physical and biological ecosystem attributes and are generally geomorphologically determined and defined. The area of an LAU is usually of the order of 50 km<sup>2</sup>. An LAU summarises the cumulative loss values made up of the sum of the proposed and historic loss/damage for each BPPH type, within a defined sub-ecosystem scale.

EAG 3 was developed to provide a framework for the assessment of development proposals that have the potential to result in irreversible loss of, or serious damage to, BPPH in Western Australia. Loss is defined as direct removal or destruction of BPPH. It is considered to be irreversible and the term is intended to apply to BPPH that have been modified to a degree that they are not likely to recover to pre-impact condition. Damage is defined as significant alteration to the structure or function of a community or habitat. Damage is considered serious if the timeframe for recovery back to pre-impact condition is expected to be longer than five years (EPA 2009).

Importantly, the EPA also recognises that (EPA 2009):

*“Some habitats exhibit natural resilience to certain stressors such that recovery can be expected to occur if the stressor is removed and environmental conditions return to, and are maintained in, the pre-impact state. In such cases, it may be reasonable for proponents to examine (using technically sound methods) the predicted serious damage to assess the recoverability of those impacts. If recovery is predicted within a timeframe of five years or less and the EPA is sufficiently confident in the predictions, those ‘recoverable’ impacts do not need to be accounted for in the context of this EAG.”*

EAG 3 also defines a set of principles, to which the proponent needs to demonstrate compliance in advance of any assessments of cumulative BPPH loss. The principles are:

1. All proponents should demonstrate consideration of options to avoid damage/loss of BPPH by providing, for example, the rationale for selection of the preferred site and broad Project design.
2. Where avoidance of BPPH is not possible, then design should aim to manage damage/loss of BPPH (e.g. through iterative design and demonstrable application of Principle 3 below). Proponents will be required to justify that design in terms of operational needs and environmental constraints of the site.
3. Proponents will need to demonstrate ‘best practicable’ design, construction methods and environmental management aimed at managing further damage/loss of BPPH through indirect impacts and maximising potential for recovery.
4. The EPA’s judgement on environmental acceptability with respect to damage/loss of BPPH and the risk to ecological integrity will be based primarily on its consideration of the proponent’s application of Principles 1 to 3 and calculations of cumulative loss of each BPPH type within a defined Local Assessment Unit (LAU; the most ‘realistic’ scenario), together with supporting ecological information and expert advice as required.

Application of the spatial framework is based around six categories of marine ecological protection and quantitative Cumulative Loss Guidelines (CLGs) for BPPH that apply to each category (Table 1-1). The calculated cumulative loss for each different BPPH is evaluated against the CLGs. CLGs are not definitive criteria and it should be noted that the acceptability of BPPH damage or loss will be definitively determined by the EPA. The EPA’s decision is generally based on consideration of the

## 1 Introduction

proponents application of the overarching assessment principles and the overall risk to ecological integrity of the LAU if the development was approved.

The six categories of marine ecosystem protection and their corresponding CLGs are summarised below (Table 1-1).

**Table 1-1 CLGs for BPPH within defined LAUs for six categories of marine ecological protection.**

Category	Description	Cumulative Loss Threshold (% of original BPPH within a defined LAU)
A	Extremely special areas	0 %
B	High protection areas other than above	1 %
C	Other designated areas	2 %
D	Non-designated areas	5 %
E	Development areas	10 %
F	Areas where cumulative loss thresholds have been significantly exceeded	0 net damage/loss (+Offsets)

With respect to loss assessment involving mangroves and their associated intertidal habitats, EAG 3 provides a significant clarification of the relationship between EAG 3 and GS 1:

*GS 1 sets out the EPA's guidance on the protection of mangroves along the Pilbara coast, having particular regard for the conservation significance of the mangrove systems in the region. For a proposal with the potential to cause impacts in an area where there is overlap of the two Guidance Statements, the EPA will assess environmental acceptability in the context of guidance provided in both documents. Through its review of this Guidance Statement [i.e. then GS No. 29], the EPA has provided more clear and explicit guidance on linkages with GS 1.*

GS 1 identifies four mangrove management areas (Guideline 1 – Guideline 4, EPA 2001; Figure 1-1). These four areas are listed below, together with the link made in EAG 3 to the categories for marine ecosystem protection.

- Guideline 1 Regionally significant mangroves – Outside designated industrial areas and associated port areas (linked to EAG 3 Category A: Extremely Special Areas).
- Guideline 2 Other mangrove areas – Outside designated industrial areas and associated port areas (linked to EAG 3 Category B: High Protection Areas other than above i.e. Category A).
- Guideline 3 Regionally significant mangroves – Inside designated industrial areas and associated port areas (linked to EAG 3 Category C: Other Designated Areas).
- Guideline 4 Other mangrove areas – Inside designated industrial areas and associated port areas (linked to EAG 3 Category E: Development Areas).

Mangroves of the Ashburton River Delta are classified in GS 1 as existing in a Guideline 1 management area, while the Hooley-Four Mile Creek mangroves are classified as existing in a Guideline 4 management area (Figure 1-1).

## 1 Introduction

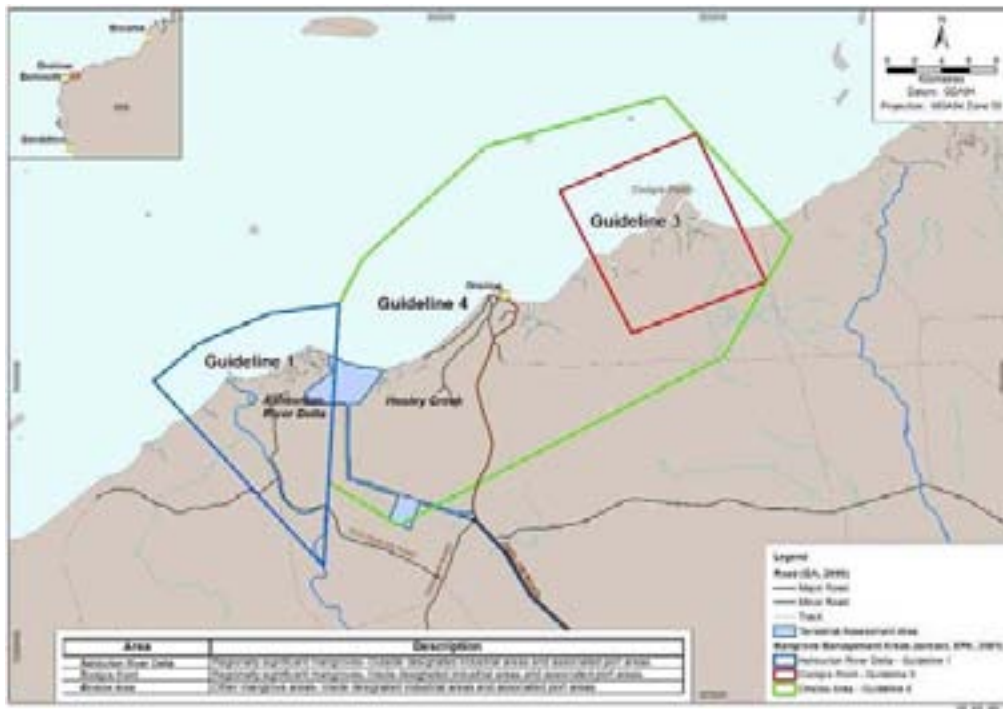


Figure 1-1 EPA GS 1 Guideline mangrove management areas.

### 1.3 Scope of work

Several baseline assessments were undertaken to document the BPPH of the Project area. These studies include:

- Field surveys to map the distribution BPPH in the Project area and characterise their biotic components, and field surveys to determine in detail, the ecosystem value of sensitive BPPH considered likely to be disturbed by the Project (URS 2010a, URS 2010b, URS 2010c, URS 2010d, URS 2010e, URS 2010f, URS 2010g, URS 2010h, URS 2010i, URS 2010m, UWA 2009,).

Several impact modelling and impact assessments were undertaken to determine the likely impact of the Project on BPPH. These studies include:

- Preparation of a report to select and justify the proposed LAU boundaries and to determine historical losses of BPPH within various LAUs to date (URS 2010j).
- A detailed assessment of potential direct and indirect impacts to the mangroves of the Ashburton River Delta (URS 2010i).
- Development and validation of a mathematical model to simulate the suspended sediments likely to be released by dredging and dredge material placement activities (Danish Hydraulics Institute (DHI) 2010a).
- Review of literature and development of tolerance limits for corals and seagrasses to suspended sediments in water and sedimentation (DHI 2010b; DHI 2010c).



## 1 Introduction

- Modelling of a wide range of both realistic and conservative “worst case” dredging and dredge material placement scenarios to develop indicative zones of impact (IZI), effect and influence (DHI 2010d).
- Calculation of cumulative losses of BPPH based on an assessment of the most realistic, conservative scenarios applicable to each activity. This involved overlaying the impact zones onto maps of BPPH distribution and the LAU boundaries (this report).

### 1.4 Report Structure

Section 1 Introduction: outlines the document purpose, provides the BPPH Loss Assessment Framework and the baseline BPPH assessments that have been undertaken.

Section 2 BPPH Distribution and Justification of LAU Boundaries: outlines Project BPPH distribution, provides justification of LAU boundaries and gives an indication of historical BPPH loss in the Project area.

Section 3 BPPH Loss Assessment - Onshore Infrastructure: assesses direct and indirect impacts to BPPH as a result of onshore infrastructure construction and operation.

Section 4 BPPH Loss Assessment – Nearshore Infrastructure: summarises direct impacts to BPPH as a result of nearshore infrastructure footprint.

Section 5 BPPH Loss Assessment – Dredging & Material Placement: assesses indirect impacts to BPPH as a result of dredging activities and the placement of the dredge material.

Section 6 BPPH Loss Assessment – Nearshore Infrastructure construction: Assesses indirect impacts to BPPH arising from construction of nearshore infrastructures and trunkline

Section 7 BPPH Loss Assessment Summary: A synthesis of the total BPPH loss anticipated as a result of construction and operation of the Project..

Section 8: presents the reference material used throughout the report.

This page is intentionally blank

## BPPH Distribution & Justification of LAU Boundaries

### 2.1 BPPH Distribution

The location of the major nearshore and offshore components of the Project are illustrated below (Figure 2-1). This figure shows the location of the Ashburton North SIA, the MOF and PLF, the navigation channel, the proposed dredge material placement sites and the proposed trunkline route. It also shows the major (in terms of marine area affected) industrial development that has occurred in the region to date; that is the location of the Onslow salt ponds onshore and the Onslow salt export jetty and shipping channel and spoil grounds. The nearshore waters between the mainland and the offshore islands have also been extensively trawled since the 1960's.

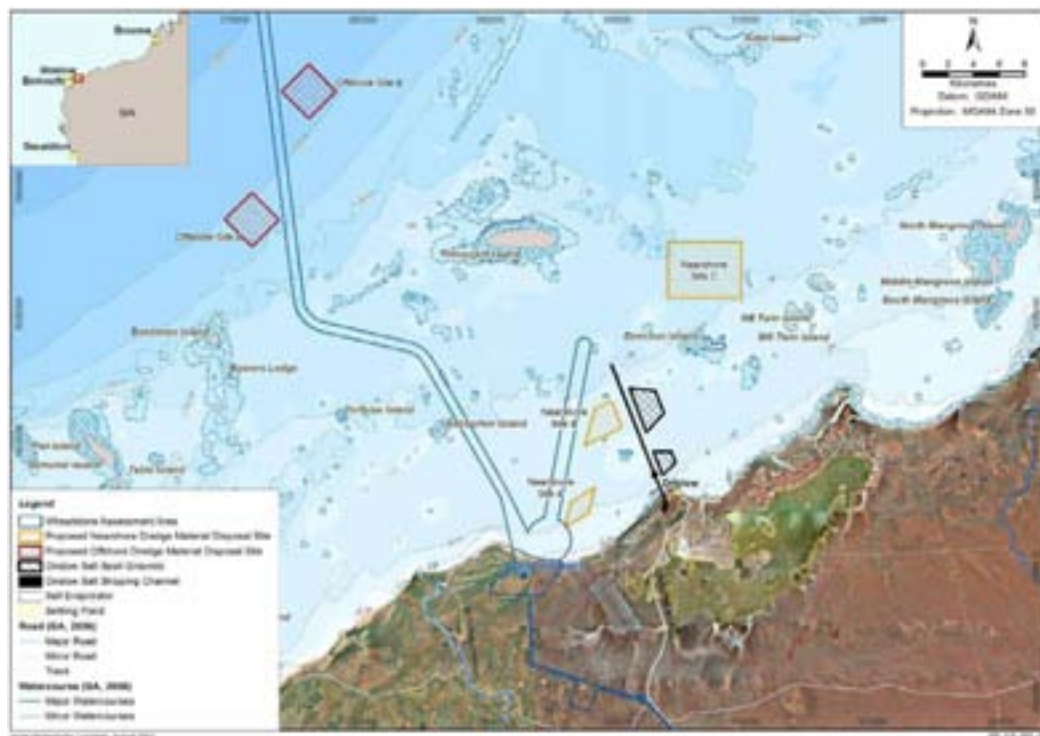


Figure 2-1 Nearshore Project area and location of major marine components.

The key physical characteristics of the marine environment of the Project area are summarised below.

- The coastline between Tubridgi Point and Coolgra Point consists primarily of a series of sandy barrier islands that protect the tidal flats behind them. Tidal creeks drain these flats at intervals along the coast and discrete mangrove assemblages are located within these creeks.
- The Ashburton River Delta occurs in the middle of this coastline and supports a large and significant mangrove community.
- Chains of islands and shoals form lines approximately parallel to the shore between the mouth of the Exmouth Gulf and Barrow Island. One line occurs in shallow water, close to the 5 m isobath. The other is located close to the 20 m isobath and includes more substantial islands including the Muiron, Serrurier, Bessieres and Thevenard islands.

## 2 BPPH Distribution & Justification of LAU Boundaries

- Nearshore waters of the Project area experience a semi-diurnal tide, with a spring tide range of 1.9 m and a Highest Astronomical Tide (HAT) water level of 2.9 m.
- Cyclones and storm surges are a relatively frequent occurrence (once every two to three years).
- Nearshore waters are relatively shallow (<20 m) and are generally clear for most of the year. The nearshore area occasionally becomes turbid as a result of sediment re-suspension generated by wind, waves and rainfall runoff after cyclones.
- Nearshore currents flow parallel to shore and are predominantly driven by tide movement, whereas offshore currents are predominantly wind driven.

BPPH is generally restricted in distribution to the photic zone which, in the Project area, occurs between the shoreline and offshore to approximately 40 m Chart Datum (CD). The following BPPH has been recorded in the Project area and are distributed from between the mean high water spring (MHWS) level and approximately 70 m in depth. Zonation is as follows:

- upper intertidal mud flats supporting cyanobacterial algal mats;
- upper intertidal saltmarsh communities;
- mixed-species low density mangrove communities;
- mixed-species dense mangrove communities;
- mixed-species macroalgal communities on lower intertidal and shallow subtidal pavements;
- subtidal coral communities on limestone pavement fringing islands or on shoals;
- scattered ephemeral seagrass (*Halodule* and *Halophila* sp) patches generally at low cover on most of the soft substrates of the study area, but with some more wave protected areas exhibiting denser cover (~10-50 %);
- scattered foliose brown algae on most of the soft substrates of the region, but in greater density on areas of sand veneered pavement further offshore;
- sessile benthic filter feeder communities (sponge/whip gardens) primarily located in deeper offshore waters (10-40 m CD) on sand veneered limestone pavement (such communities also found in generally low abundance on some of the nearshore shoals where corals are dominant); and
- a red micro-phyto benthos (MPB) algal mat on sandy substrate in deeper waters (40-70 m CD).

Figure 2-2 shows the indicative distribution of the major subtidal substrates and coral, seagrass and filter feeder habitats (URS 2010f). Figure 2-3 shows the indicative distribution of the major subtidal substrates and coral and dense macroalgae habitats (URS 2010f). Macroalgae distribution has been presented separately as it occurs over a wide range of substrate types. The data used to complete the subtidal habitat mapping was obtained using a remotely operated vehicle (ROV) to survey 350 sites. A large subtidal area of approximately 3 500 km<sup>2</sup> was covered. The ROV also employed sampling devices and towed video cameras for the purpose of quantifying the biotic component of the benthic substrate.

Figure 2-4 presents the distribution of BPPH of the Ashburton River Delta and the Hooley Creek tidal system (URS 2010e), which occur adjacent to the Ashburton North SIA. The intertidal habitats exist over a much smaller area (approximately 300 km<sup>2</sup>) of coastal shoreline. The data was obtained by “ground-truthing” high quality aerial photography during low tide conditions and therefore presents an accurate map of the distribution of nearshore intertidal habitats. Figure 2-5 shows the distribution of principal BPPH within the Project area. It is an interpretation based on the subtidal (Figure 2-2) and intertidal (Figure 2-4) habitat map, as well as information from the University of Western Australia (UWA) survey of the inner shelf (UWA 2009).

## 2 BPPH Distribution & Justification of LAU Boundaries

The methodology used in the development of the habitat maps is described in URS (2009).

BPPH that is most widespread in the region, and cover the greatest area, are the ephemeral low cover foliose algae which occur on soft substrates and denser macroalgae beds of the shallow pavement areas around offshore islands (Figure 2-3). Seagrasses occur in low abundance and cover on soft substrates between the islands and the mainland except in two locations, where they occur in greater density. The next largest single BPPH unit is the sessile filter feeders that occur on sand veneered pavement located offshore (Figure 2-2). All other BPPH types are restricted in distribution to either intertidal flats or hard bottom reefs and shoals, both intertidal and subtidal. They also occupy relatively small areas in comparison to that occupied by the soft substrates.

Coral communities are not abundant in the immediate vicinity of the Project area, and are restricted to a small number of individual shoals that occur along the 10 m isobath. They also occur along the edges of intertidal pavements which fringe many of the islands in the region (Figure 2-2; Figure 2-3). Onshore communities of mangroves, samphires and algal mat are relatively widespread, but occur within discrete creek or river systems (Figure 2-4). Most of the shoreline in the study area is comprised of sandy beach.

Detailed descriptions of the above BPPH types are provided in URS (2010f; 2010e).

BPPH Loss Assessment

2 BPPH Distribution & Justification of LAU Boundaries

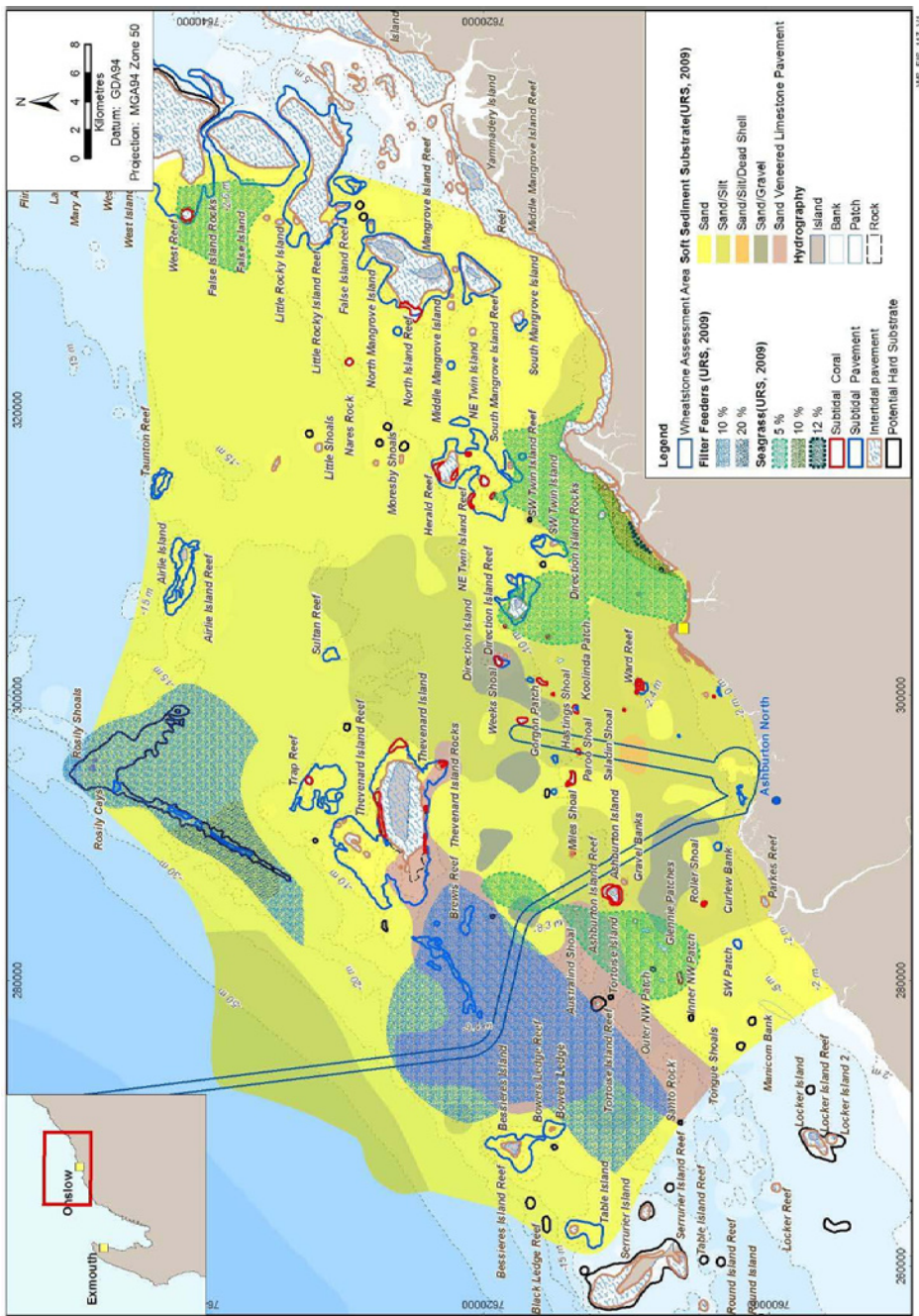
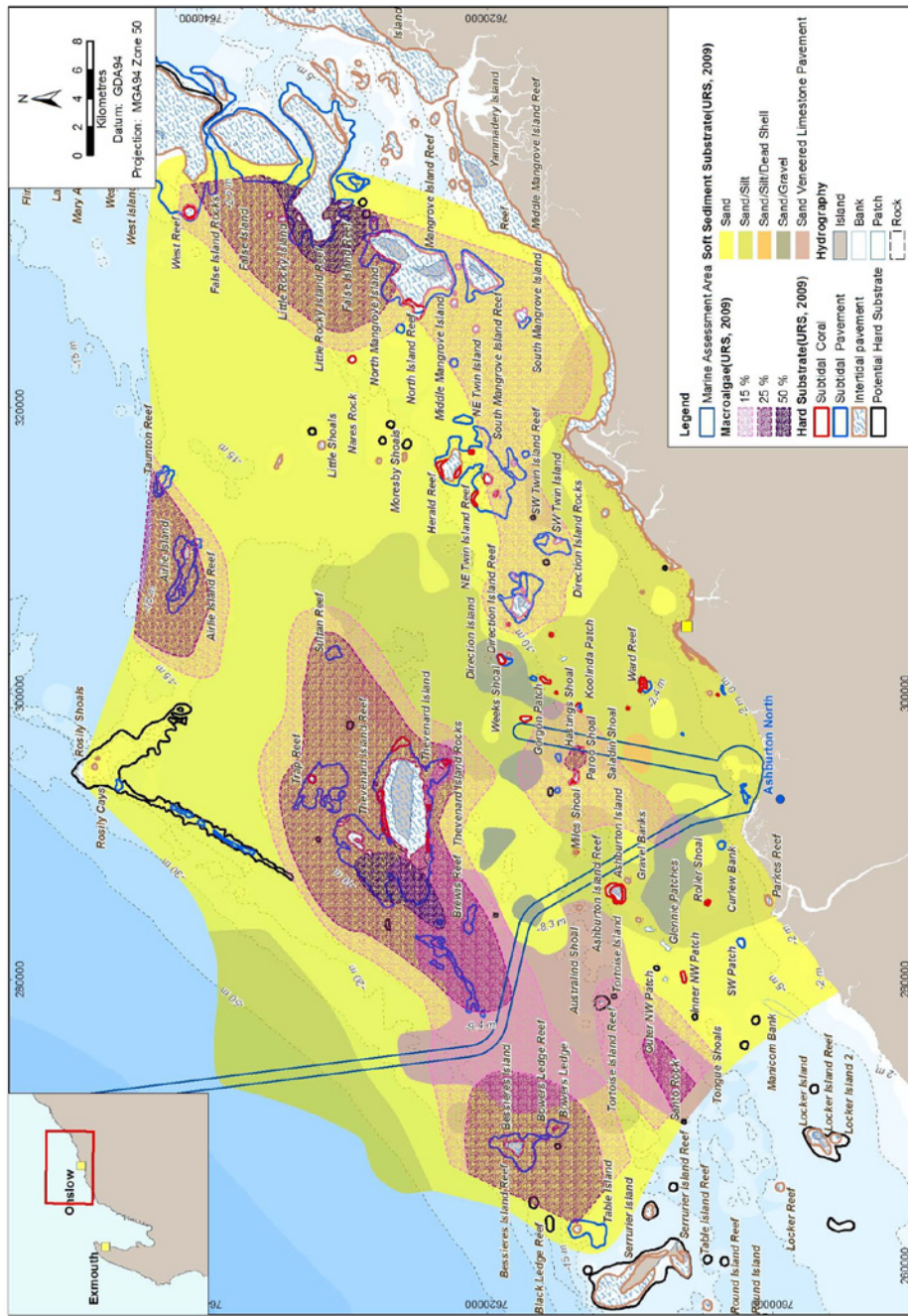


Figure 2-2 Indicative distribution of subtidal marine habitats (excluding macroalgae) and substrates in the nearshore project area.

BPPH Loss Assessment

2 BPPH Distribution & Justification of LAU Boundaries



WS\_EB\_064\_V4

Figure 2-3 Indicative distribution of coral and dense macroalgae habitats and substrates in the nearshore project area.

4207486/WS/EFTU-EMRPT-0137/Rev.1

BPPH Loss Assessment

2 BPPH Distribution & Justification of LAU Boundaries

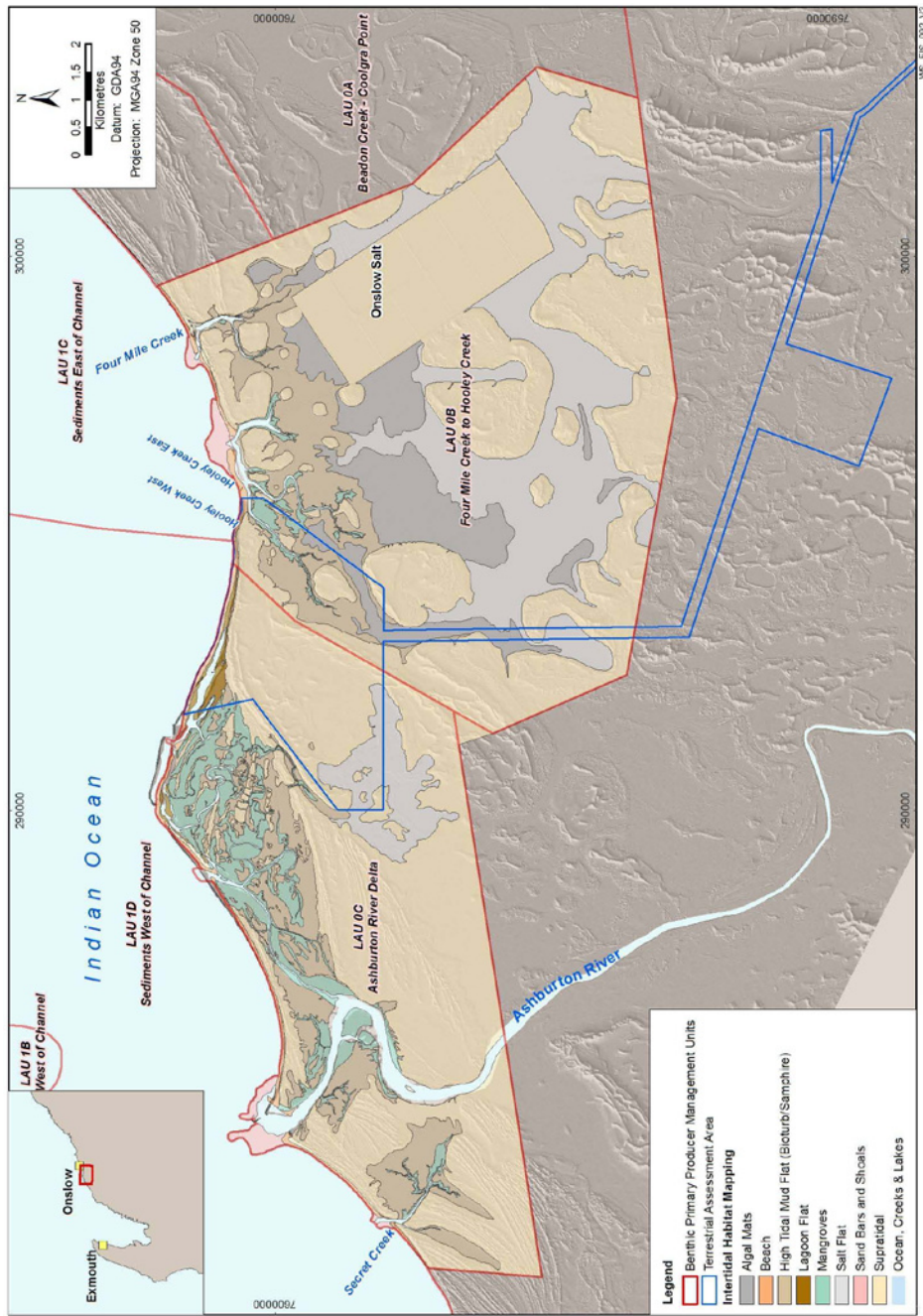


Figure 2-4 Indicative distribution of intertidal marine habitats in the nearshore Project area.



BPPH Loss Assessment

2 BPPH Distribution & Justification of LAU Boundaries

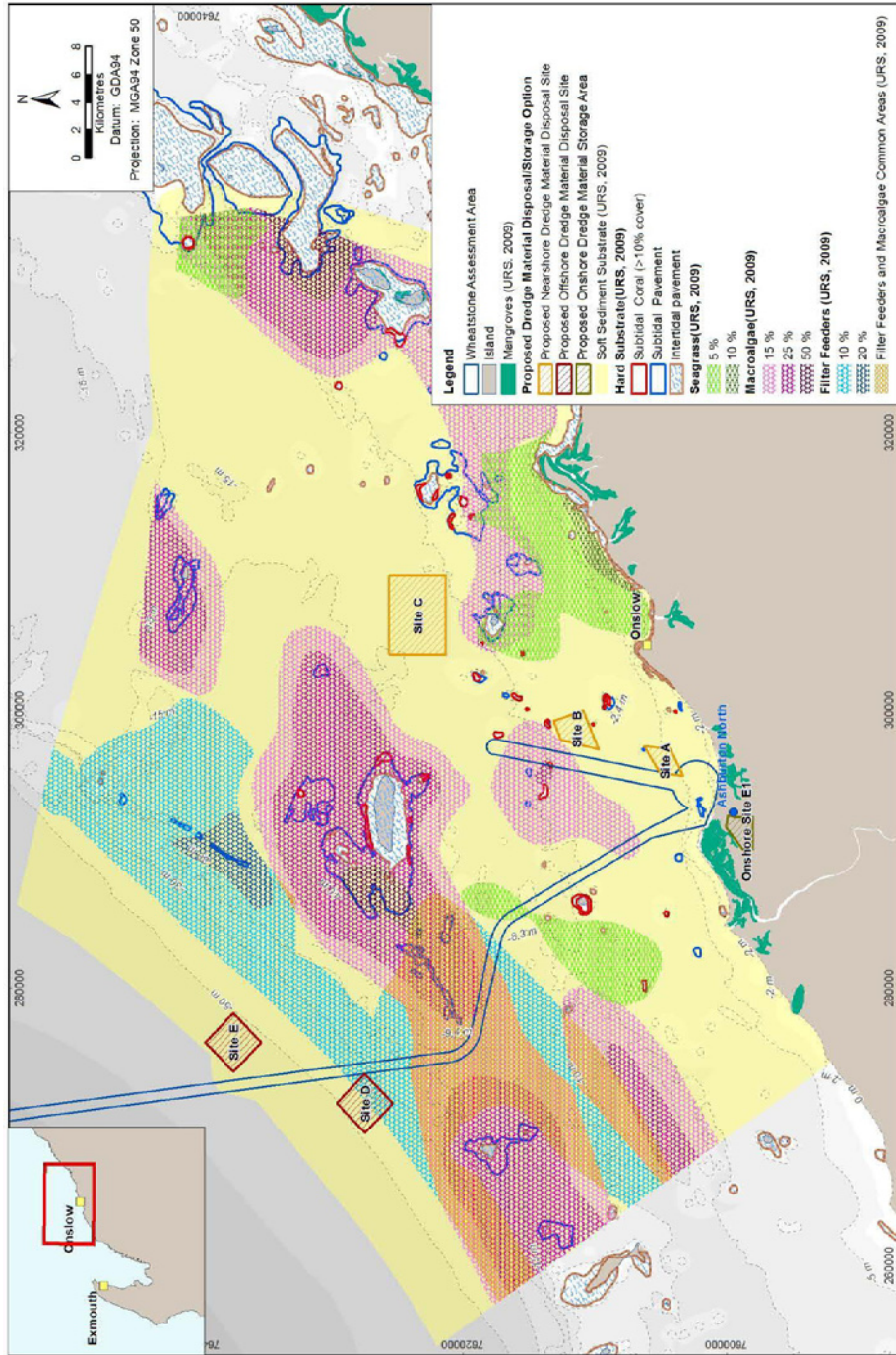


Figure 25 Distribution of principal BPPH within the Project area.

42507466/WHSE/STU-EM/PPH-G/137/Rev.1

## 2 BPPH Distribution & Justification of LAU Boundaries

### 2.2 Justification of LAU Boundaries

URS (2010j) defines and justifies the boundaries of the LAUs, proposed for the Project, as a first step toward seeking EPA agreement on the appropriateness of the scales and boundaries proposed for the potential impact area (URS 2010j). The document also presents an estimate of the historical cumulative losses of BPPH that have already occurred within the Project area. Professor Charles Sheppard (Warwick University, England) has provided a peer review of the methodology and framework used to develop the justification of the BPPH LAUs. This review is presented in Appendix A. A summary of URS (2010j) is provided below.

Aspects of the Project with the greatest potential for causing loss or structural change of BPPH are the areas where:

- capital dredging and dredge material placement activities (associated with construction of the MOF, the PLF, the navigation channel and the dredge material placement sites) will occur; and
- installation and stabilisation of the trunkline will occur.

Five dredge material placement sites have been proposed for use (Figure 2-5). Two occur in deep waters (site D and site E, 40-70 m CD) approximately 20 km to the northwest of Thevenard Island, and the remain three sites occur to the east of the proposed navigation channel in waters ranging between six and 15 m CD (site A, site B, site C). ; and an onshore dredge material storage area adjacent to the plant site. The preferred base case scenario is to place all dredged material offshore, bringing no dredged material onshore due to its high proportion of fines (approximately 40 %).

Conservative modelling of potential dredging impact zones (DHI 2010a) indicated that visible plumes may extend between approximately 25 and 35 km to the east and west, dependant on the season (west in winter and east in summer). Therefore, the area of potential impact in the nearshore environment may be an area of approximately 3 500 km<sup>2</sup>, extending for up to 70 km along the coast and 50 km offshore.

The Integrated Marine and Coastal Regionalisation of Australia (IMCRA) hierarchical ecosystem classification framework (CSIRO 2006) and further developments by Lyne *et al.* (2006) for the North West Shelf, were applied to the Project area to subdivide it into a number of distinct large ecosystem units (ECU). The ECUs share common characteristics of water quality, depth and distance offshore. Four mesoscale ECUs were derived in accordance with CSIRO (2006) and Lynne *et al.* (2006) and are as follows:

- ECU0 – Onslow onshore encompassing intertidal habitats between HAT and Lowest Astronomical Tide (LAT) (Figure 2-6).
- ECU1 – Onslow nearshore encompassing waters between LAT and 10 m CD in relatively complex bathymetry covering mainly soft substrates but including a ridge of scattered patch shoals which support corals and sponges (Figure 2-6).
- ECU2 – Onslow offshore encompassing waters between 10-20 m CD including most offshore islands, coral reefs and algal dominated shoals (Figure 2-6).
- ECU3 – Onslow inner shelf incorporating the relatively steep gradient shelf break from 20 m to 70 m CD (Figure 2-6).

Subsequently, a number of smaller LAUs based on definable bio-geomorphic attributes and the distribution of various types of BPPH have been defined for, and nested within, each of the

## 2 BPPH Distribution & Justification of LAU Boundaries

larger ECUs (Figure 2-7). Each LAU occurring within the mesoscale ECUs, as shown below (Figure 2-7), is defined in terms of the principal BPPH they contain and the boundary area for assessment.

The areas of BPPH found within the designated LAUs for the Project nearshore area is presented below, along with the applicable EPA CLG category (Table 2-1, URS 2010j).

### *Onslow onshore (ECU0)*

- LAU 0A – Onslow Salt: the mangroves and associated samphire flats and algal mats which occur between Coolgra Point and Beadon Creek (the intertidal region modified by the Onslow solar salt field).
- LAU 0B – Hooley Creek: the mangroves and associated samphire flats and algal mats which occur between Four Mile Creek and Hooley Creek (adjacent area to the east of the Project area).
- LAU 0C – Ashburton River: the mangroves and associated samphire flats of the Ashburton River Delta (adjacent area to the west of the Project area).

The intertidal units (LAU 0A – LAU 0C) have been addressed as three separate subunits (mangroves, samphires, algal mats).

### *Onslow nearshore (ECU1)*

- LAU 1A – Corals east of channel: all coral communities occurring within ECU1 (and just over the boundary of ECU1) to the east of the channel.
- LAU 1B – Corals west of channel: all coral communities occurring within ECU1 to the west of the channel. The envelope of LAU 1A and LAU 1B was designed to indicate the coral areas (shown in red) which were included in the coral area calculation. All other seafloor within these LAUs which were not coral was included as soft substrate in either LAU 1C or LAU 1D below.
- LAU 1C – Sediments east of channel: all soft sandy substrates supporting low abundance ephemeral seagrasses and/or ephemeral foliose brown algae which occur east of the channel within the ECU1 boundary.
- LAU 1D – Sediments west of channel: all soft sandy substrates supporting low abundance ephemeral seagrasses and/or ephemeral foliose brown algae which occur west of the channel within the ECU1 boundary.

### *Onslow offshore (ECU2)*

- LAU 2A – Thevenard Island: the hard substrate shoals surrounding Thevenard Island and the coral, sponge and macroalgal communities that they support.
- LAU 2B – Bessieres Island: the hard substrate shoals surrounding Bessieres Island and the coral, sponge and macroalgal communities that they support.
- LAU 2C – Airlie island: the hard substrate shoals surrounding Airlie Island and the coral, sponge and macroalgal communities that they support.
- LAU 2D – Filter feeders west of channel: the sand veneered limestone pavement that supports sponge/ascidian filter feeders and occurs to the west of Thevenard Island.
- LAU 2E – Filter feeders east of channel: the sand veneered limestone pavement that supports sponge/ascidian filter feeders and occurs to the east of the proposed navigation channel in the vicinity of Rosily Shoals.

## 2 BPPH Distribution & Justification of LAU Boundaries

- LAU 2F – Sediments east of channel: all sand/gravel substrates supporting low abundance ephemeral seagrasses and/or ephemeral foliose brown algae which occur east of the proposed navigation channel within the ECU2 boundary.
- LAU 2G – Sediments west of channel: all sand/gravel substrates supporting low abundance ephemeral seagrasses and/or ephemeral foliose brown algae which occur west of the proposed navigation channel within the ECU2 boundary.

### Onslow inner continental shelf (ECU3)

- LAU 3A – Filter feeders in ECU3: the variable filter feeding communities (sponge, sea whips, hydroids and sea fans) that inhabit the pavement and sand veneered pavement which occur between 20 and 40 m CD.
- LAU 3B – Sediments in ECU3: the soft substrates that occur below 40 m CD and support burrowing infauna and a red microalgal mat.

**Table 2-1 Area (ha) of principal BPPH found within designated LAUs for the Project nearshore area and applicable EPA CLG category.**

ID	Local Assessment Unit Code	BPPH/BSPH type	Area (ha)	EPA CLG Category
1	LAU 0A Beadon Ck – Coolgra Pt	Mangrove	837	C
2		Samphire mudflat	1,120	C
3		Algal mats	817	C
4	LAU 0B Four Mile Ck – Hooley Ck	Mangrove	83	E
5		Samphire mudflat	637	E
6		Algal mats	815	F
7	LAU 0C Ashburton River delta	Mangrove	527	A
8		Samphire mudflat	683	A
9		Algal mats	Not Present	
10	LAU 1A Corals – east	Coral communities	205	E
11	LAU 1B Corals – west	Coral communities	132	E
12	LAU 1C Sediments – east	Ephemeral seagrass and algae	43,973	E
13	LAU 1D sediments – west	Ephemeral seagrass and algae	39,056	E
14	LAU 2A Thevenard Island	Coral reef	196	E
15		Macroalgal communities	9,453	E
16	LAU 2B Bessieres Island	Coral on rocky substrate	9 (estimate)	D
17		Macroalgal communities	7,770	D
18	LAU 2C Airlie island	Coral on rocky substrate	39 (estimate)	E
19		Macroalgal communities	3,435	E
20	LAU 2D Filter feeders – west	Sponge/ascidian filter feeders	18,409	E
21	LAU 2E Filter feeders – east	Sponge/ascidian filter feeders	12,124	E
22	LAU 2F Sediments - east	Ephemeral seagrass and algae	62,757	E
23	LAU 2G Sediments - west	Ephemeral seagrass and algae	23852	E
24	LAU 3A Filter feeders in ECU3	Sponge/ascidian filter feeders	19,908	D
25	LAU 3B Sediments in ECU3	Sediments and burrowing infauna	29,143	D

*BPPH Loss Assessment*

---

## **2 BPPH Distribution & Justification of LAU Boundaries**

Further detail on the location of the onshore LAU boundaries in relation to the location of existing and proposed infrastructure is shown on Figure 2-8.

Note: The Project site straddles the boundary between two of the LAUs (LAU 0B-Hooley Four Mile Creek and LAU 0C-Ashburton River Delta).



BPPH Loss Assessment

## 2 BPPH Distribution & Justification of LAU Boundaries

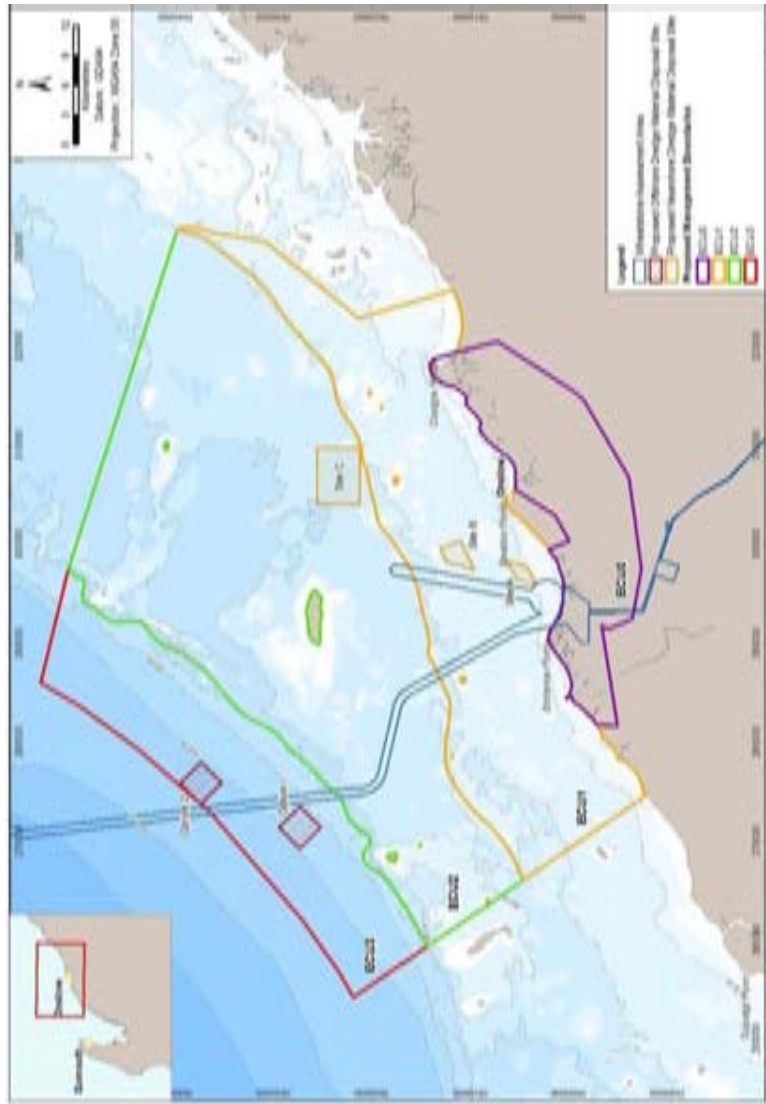


Figure 2-6 Proposed ECU boundaries for BPPH loss assessment.

BPPH Loss Assessment

2 BPPH Distribution & Justification of LAU Boundaries

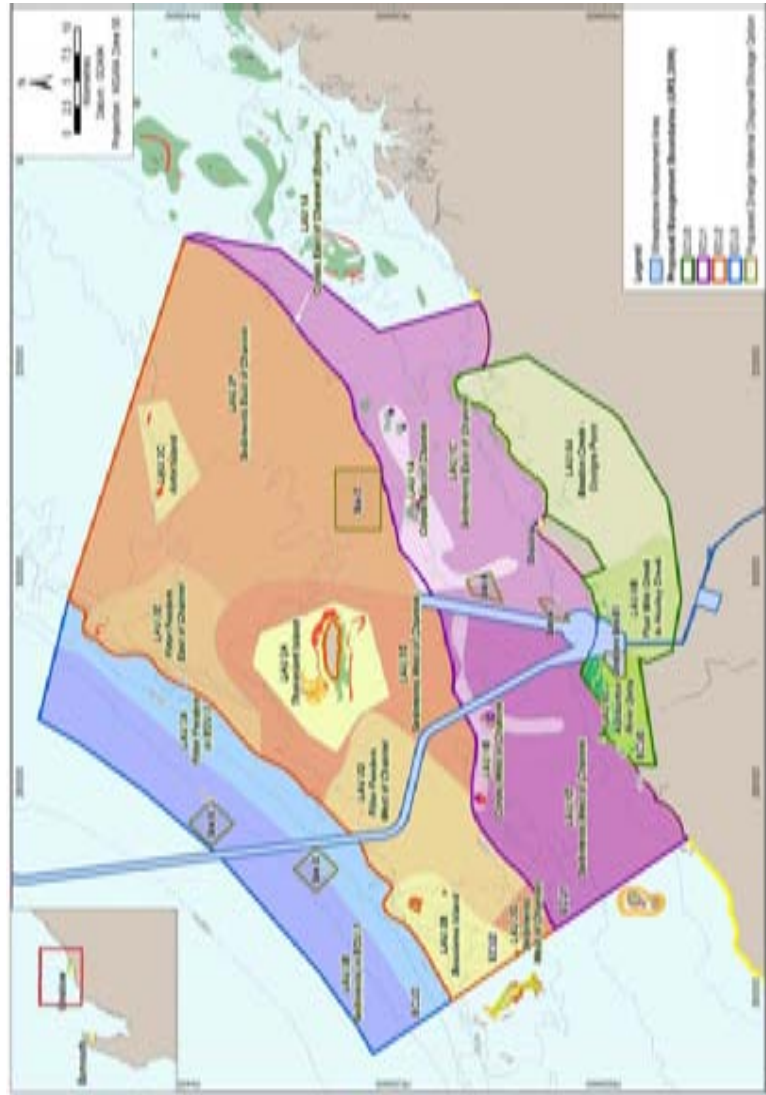


Figure 2-7 Proposed ecosystem boundaries and LAUs for BPPH loss assessment.

42907468/WHST-STU-EM-RPT-0137/Rev 1

BPPH Loss Assessment

2 BPPH Distribution & Justification of LAU Boundaries



Figure 2-8 Onshore infrastructure and access road in a regional context with the boundaries of the three onshore LAUs.



## 2 BPPH Distribution & Justification of LAU Boundaries

### 2.3 Historical Loss of BPPH

The figure below shows the location of historical and proposed areas of seafloor disturbance in the Project area (Figure 2-9).

The greatest area of historical disturbance are those that have been regularly trawled by the fleet of the Onslow Managed Prawn Fishery (Department of Fisheries (DoF) 2009). No historical loss of seagrass or ephemeral foliose algae from historical trawling activities has been assumed as the condition of the habitat prior to trawling is unknown. Information from DoF suggests that little habitat modification has resulted from historical trawling activities (DoF 2009).

The next largest area of historical disturbance of BPPH is the development of the Onslow Salt evaporation ponds, export jetty and shipping channel. The shipping channel and offshore dredge material placement sites were developed in the early 1990s and are located in soft substrate habitat which has since been recolonised by organisms typically found in similar adjacent habitat. Therefore, no historical losses of seagrasses or ephemeral foliose algae have been calculated for this activity. The evaporation ponds, however, have removed approximately 190 ha of algal mats from the high tidal flats of both the Beadon Creek and the Hooley Creek LAU. This represents approximately 20 per cent of the available algal mat habitat in both LAUs.

There has been very little loss of mangrove habitat within the region. Losses that have occurred are restricted to Beadon Creek and include the loss of approximately 1 ha in the vicinity of the evaporation pond intake area and another 1-2 ha on the south side of Beadon Creek where the wharf and boat ramp have been constructed.

There has been minimal loss of corals as a result of anthropogenic activity to date. Approximately 0.1 ha of coral habitat from the eastern side of Thevenard Island was removed to construct a trunkline trench to the island through the intertidal pavement. Numerous submarine pipelines have been installed in the region. These include the Saladin field fluids gathering system, the Roller-Skate pipeline and the Tubridgi gas pipeline. These pipelines have all been buried by sediments or rock armour which has since been recolonised. Hence no historical losses of BPPH have been calculated for trunkline development.

2 BPPH Distribution & Justification of LAU Boundaries

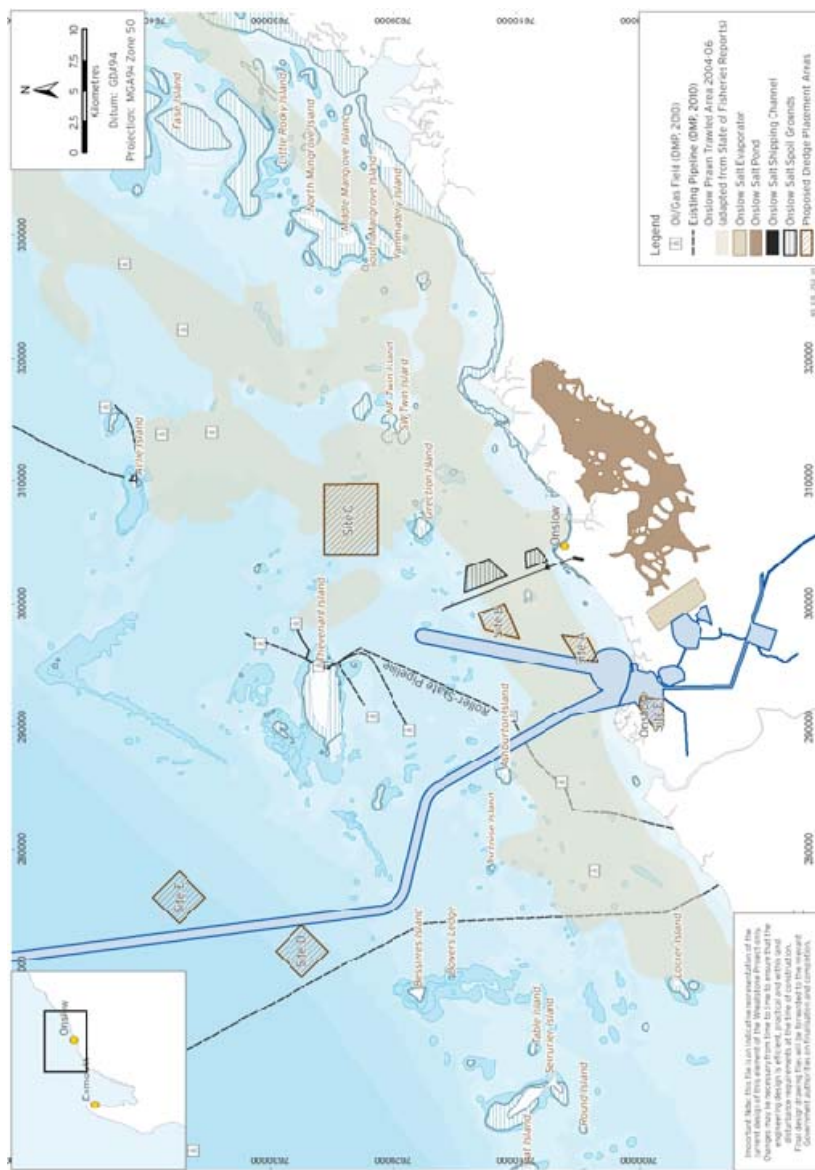


Figure 2-9 Existing and proposed areas of seafloor disturbance in the Project area.

## BPPH Loss Assessment - Onshore Infrastructure

### 3.1 Introduction

This section assesses the loss of intertidal BPPH arising from the construction of onshore infrastructure. It also presents a summary of the potential indirect impacts to mangrove habitats, adjacent to the Project, particularly those which occur in the Ashburton River Delta (URS 2010i).

Figure 3-1 depicts the onshore Project area overlain on intertidal habitat mapping. The eastern area of the Project overlaps the upper reaches of the western arm of Hooley Creek (Figure 2-4 and Figure 3-1). This creek is tidal and supports mangrove habitat, high tidal mud flats (bioturbated mud flat and samphire habitat) and, towards the hinterland, algal mat habitat. The north western "horn" of the Project area overlaps the eastern lagoon of the Ashburton River Delta (Figure 3-1). This lagoon has recently re-formed (1999) and consists of a subtidal portion and a fringing intertidal sand flat (lagoon flat; Figure 3-1). BPPH is relatively sparse within the lagoon however the western area has shown evidence of colonisation by mangrove species (URS 2010n). The beach spit that protects the lagoon is considered to be an ephemeral feature (on a decadal scale) as it is dynamic and has been subject to considerable change between the past 20 to 40 years (Damara WA 2010).

Avoidance of mangroves and their associated high tidal mudflat habitats has been a key design constraint for the Project. The current design avoids any direct impact to intertidal BPPH within the Ashburton River Delta, however, due to the orientation of coastal landforms, there are areas of BPPH (mangroves, bioturbated mud flats, algal mats) that may be impacted upon in the upper reaches of the west arm of Hooley Creek. Construction of onshore infrastructure will occur over a small area of the lower reaches of the west arm of Hooley Creek, adjacent to the MOF.

During the design phase, significant modifications to the Project area were made to manage impacts to mangroves and other intertidal BPPH in the Hooley Creek area. These modifications included:

- a reduction in mangrove loss from 36 ha to 4 ha, resulting in a reduction in cumulative loss from 43 % to 6 %; and
- management of impacts to the mid to lower reaches of Hooley Creek, containing productive closed canopy mangroves. Impacts to mangroves are confined to the upper reaches of Hooley Creek (west arm) that support an open shrubland mangrove habitat.

The extent of BPPH loss anticipated in the Hooley Creek system is illustrated in Figure 3-1. Note that no loss of BPPH is anticipated in the Ashburton Delta system located in the north west section of the terrestrial assessment area. (refer to section 3.3).

BPPH Loss Assessment

3 BPPH Loss Assessment - Onshore Infrastructure

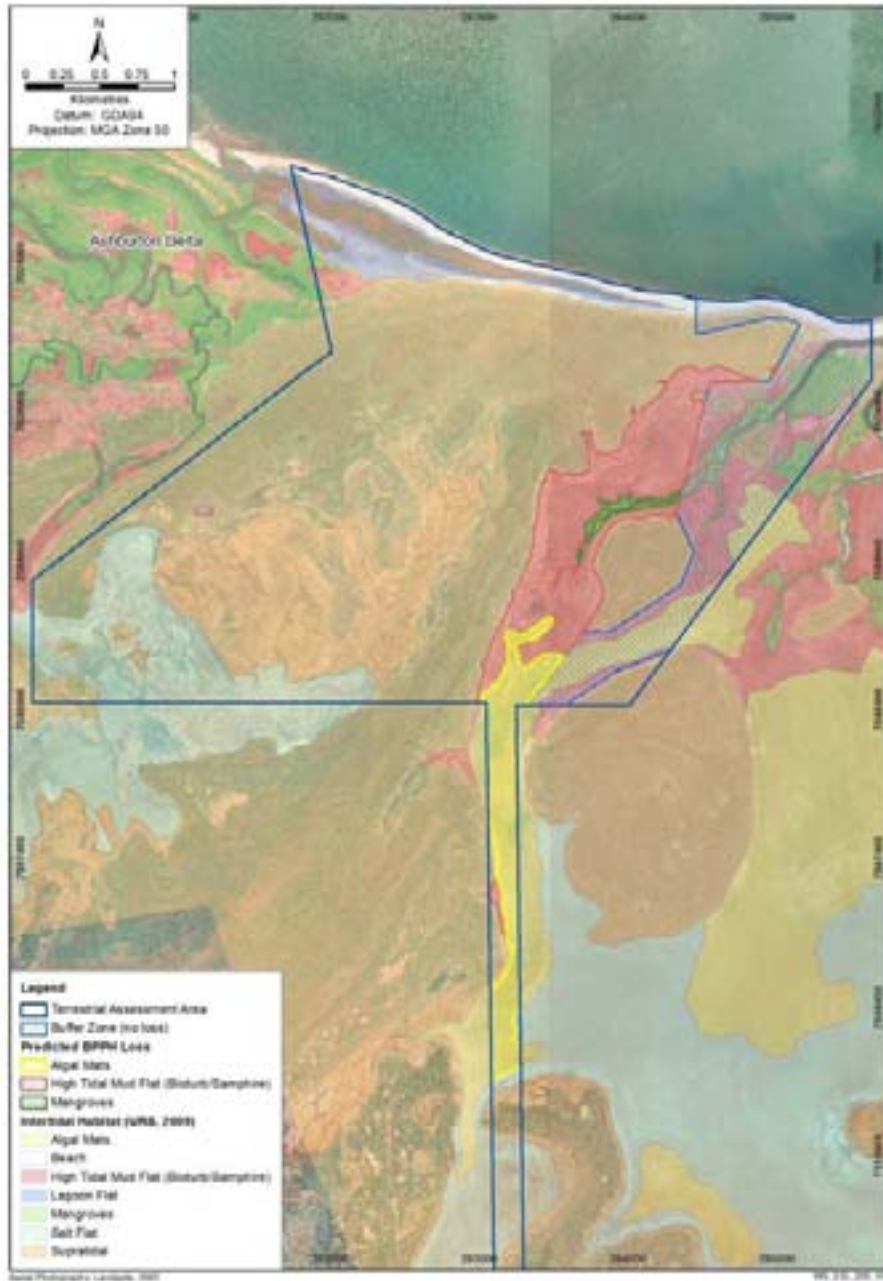


Figure 3-1 Areas of predicted intertidal BPPH loss as a result of construction of onshore infrastructure.

### 3 BPPH Loss Assessment - Onshore Infrastructure

The areas of each intertidal BPPH type that will be impacted, together with the areas of each habitat mapped in the study area, are provided below (Table 3-1). These values represent maximum loss estimates based on the assumption that the total area within the outer disturbance boundary from the revised layout (Figure 3-1) is impacted. To calculate the direct loss estimates, the Project area has been overlaid onto the intertidal habitat map (Figure 2-4) and the area of BPPH occurring within the Hooley Creek LAU calculated by GIS analysis using ARCView software.

**Table 3-1 Mapped intertidal BPPH with predicted clearing areas.**

BPPH	Ashburton Delta		Hooley Creek	
	Mapped Area (ha)	Impact Area (ha) or (%) of area mapped	Mapped Area (ha)	Impact Area (ha) or (%) of area mapped
Mangroves	526	0	83	4 ha or 5%
High Tidal Mud Flat	683	0	637	108 ha or 17%
Algal Mats	0	0	815	52 ha or 6%

#### 3.2 Hooley Creek BPPH Loss Assessment

Within GS 1, the Hooley Creek – Four Mile Creek system is identified as being a Guideline 4 management area (Figure 1-1). The EPA’s operational objective for Guideline 4 management areas is that the impacts of development on mangrove habitat and ecological function of the mangroves in these areas should be managed to as low as practicable (EPA 2001). EAG3 links Guideline 4 areas of GS1 to category E areas (Section 1.2). However, EAG 3 also implements a Category F for areas where CLGs have already been significantly exceeded. For such areas, the CLG is zero net loss/damage of BPPH and, where possible, the creation of a net increase in BPPH via an offset is required (EPA 2009). Category F applies to the algal mat habitats of Hooley Creek LAU.

EAG 3 also requires the following information to be provided in order for the EPA to evaluate a proposal:

- Definition of an appropriate LAU boundary;
- Determine the current areal extent of each BPPH type;
- Establish estimates of the areal extent of each BPPH type, prior to European habitation;
- Determine the remaining percentage;
- Determining how much more BPPH will be lost as a result of the proposal; and
- Determining how much BPPH will be lost in total if the Project is approved (i.e. potential cumulative loss).

The above information has been compiled for the three onshore LAUs (Figure 2-8) and also for the broader ECU0 area of which the three LAUs are subsets. Historical losses of BPPH, resulting from the development of the Onslow Salt, have also been included. This information is provided in Appendix B.

A summary of existing and potential cumulative loss estimates for the Hooley Creek – Four Mile Creek system, based on the revised Project area, is shown below (Table 3-2).



### 3 BPPH Loss Assessment - Onshore Infrastructure

**Table 3-2 Cumulative loss assessment summary for the Hooley Creek – Four Mile Creek LAU.**

BPPH	CLG Category and Percent Loss	Historical Cumulative Loss (%)	Proposed Cumulative Loss (%)
Mangroves	E (10%)	1%	6%
High Tidal Mud Flat	E (10%)	0.3%	17%
Algal Mats	F (0%)	19%	25%

For the Hooley Creek – Four Mile Creek LAU, the proposed total loss of mangrove is less than the CLG, while the loss of high tidal mud flat and algal mat exceeds the 10% CLG threshold for Category E development. In the case of algal mats, an historical (existing) loss of 19 % (189 ha) from construction of the Onslow Salt evaporation ponds means that Category F applies to the algal mats in the Project area. EAG3 indicates that the CLG’s should not be considered to be rigid limits, but notes that the acceptability of such losses will be a judgement of the EPA based on its consideration of the overall risk to the ecological integrity of the remainder of the ecosystem within the defined LAU. Dr Eric Paling of Murdoch University was engaged by URS to advise on the issue of cumulative loss of BPPH within the Project area (Appendix C). Based on this advice, it is considered unlikely that the proposed direct losses of algal mat and samphire habitat will threaten the integrity of the remaining BPPH within the Hooley Creek – Four Mile Creek LAU.

Impacts upon the mangroves from the Project will be confined to 4 ha of low open shrubland habitat, occurring in the upper reaches of the west arm of Hooley Creek. Although this 4 ha area forms 5 % of the 83 ha present, it should be noted that this area is not functionally equivalent to the closed canopy mangrove habitat which occurs further downstream in the mid to lower reaches of Hooley Creek.

Changes to tidal inundation regimes have the potential to result in more gradual, indirect impacts to mangroves over a longer timeframe. Tidal flow and tidal exchange are the dominant processes that maintain the mangroves in the Project area as they regulate many of the physical, chemical and biological functions (URS 2010i). An assessment of the impacts to these coastal processes from the location of nearshore infrastructure indicates that the MOF breakwaters will disrupt alongshore sediment transport, resulting in changes to morphology of the sand spit located at the mouth of Hooley Creek and hence the creek entrance itself (Damara WA 2010). Historical aerial photography indicates that the sand spit at the entrance to Hooley Creek is highly dynamic and has been deflated and rebuilt a number of times during the last 40 years (Damara WA 2010). Mangrove habitat surveys of the area (URS 2010i) did not find any evidence of historical mangrove mortality in Hooley Creek that may be attributed to changes in tidal inundation patterns, resulting from the natural modification to the alignment of the sand spit or creek entrance. A Coastal Processes Management Plan (CPMP) will be implemented to management Project-attributable changes to coastal processes. Based on the information presented above, it is not expected that indirect loss/damage to mangroves will occur from Project-attributable changes to coastal shoreline morphology and tidal inundation patterns.

In summary, the construction of onshore infrastructure will result in the (irreversible) loss and damage of some algal mat and samphire BPPH within the Hooley Creek LAU. The anticipated cumulative percentage loss within this LAU is well in excess of the applicable EPA CLG. This loss is unavoidable given the physical and planning constraints imposed on the Project. However the loss of these habitats is considered unlikely to threaten the integrity of the remaining tidal flat ecosystem..

### 3 BPPH Loss Assessment - Onshore Infrastructure

#### 3.3 Borrow Pit Access Road Loss Assessment

In addition to the irreversible BPPH losses discussed above, temporary (reversible) losses of algal mat habitat are anticipated to occur during a short term period (approximately six months) as a result of the construction of a temporary access road between two sand islands in the middle of the Hooley Creek – Four Mile Creek system. Figure 3-2 shows the location of these temporary access roads overlain on the intertidal habitat mapping. The roads are required to provide access to the sand islands for earthmoving equipment. Generally, the excavation of borrow pits is done so that a small buffer remains around the perimeter of the island, so as to manage impacts to the adjacent tidal flat and thus managing potential disturbance (i.e. so sediment run-off is contained within the borrow pit area and sediment deposition does not occur in adjacent BPPH).

The access roads will be designed and engineered such that they can be removed and the ground surface can be re-instated to a tidal flat level.

As indicated below (Figure 3-2), main east-west access road between the horseshoe shaped island and the island located near the LNG plant will cross approximately 1 km of algal mat habitat. This will result in temporary loss of 1 ha of algal mat (1 km by 10m). Minimal temporary loss of algal mat habitat is anticipated to the south of the access road given the coarse road construction material. Algal mats occurring in such high tidal flat settings on the Pilbara coast typically experience very harsh conditions and are dehydrated for long periods (i.e. no wetting from either tidal inundation or freshwater floods for long periods). Once the roads are removed and the ground surface at tidal flat level re-instated, no long-term irreversible losses are expected.

### 3 BPPH Loss Assessment - Onshore Infrastructure

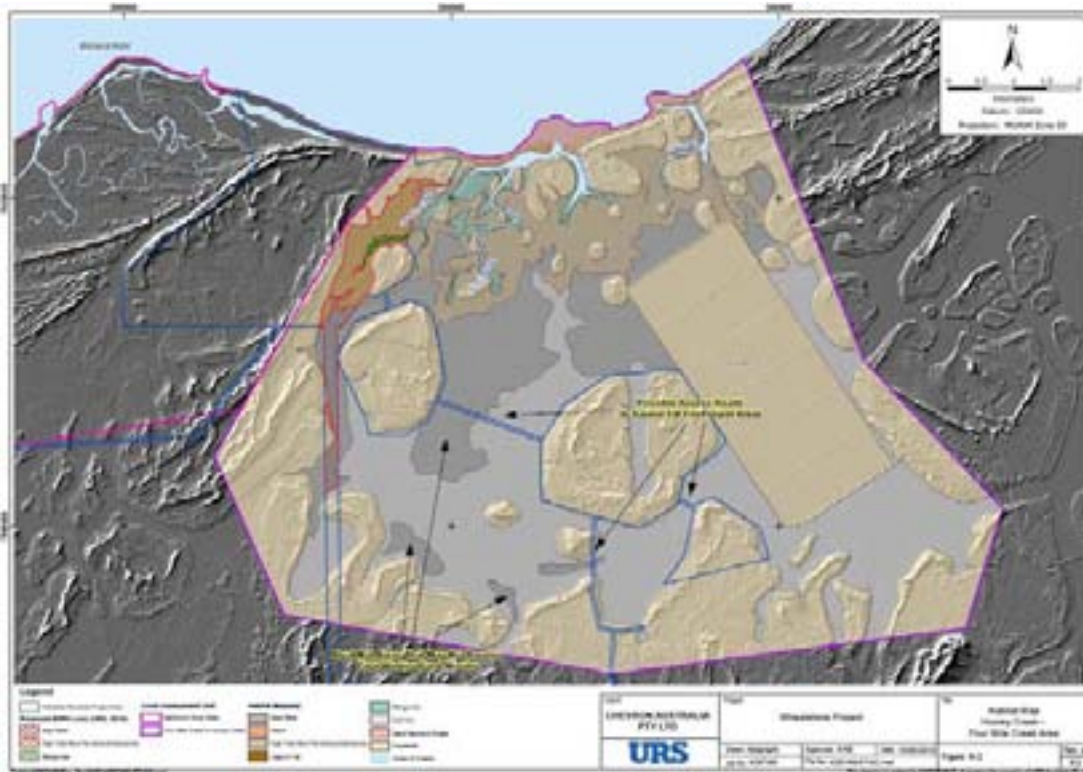


Figure 3-2 Proposed borrow pit access roads.

#### 3.4 Ashburton River Delta BPPH Loss Assessment

Within GS 1, the Ashburton River Delta is identified as being a Guideline 1 management area (Figure 1-1). The EPA's operational objective for Guideline 1 management areas is that no development should take place that would adversely affect the mangrove habitat, the ecological function of these areas and the maintenance of ecological processes which sustain the mangrove habitats (EPA 2001). In addition, the EPA will give these mangrove formations the highest degree of protection with respect to geographical distribution, biodiversity, productivity and ecological function. Proponents should be aware that where developments are proposed in these areas the EPA will adopt a presumption against finding the proposals environmentally acceptable.

The Ashburton North SIA, is located immediately adjacent the Ashburton River Delta. Protection of the mangroves in this area was raised as a concern by the EPA due to the potential for impact to the delta, arising from construction and long term operation at the site. The EPA indicated that a need existed to demonstrate that there would be no long-term Project-attributable irreversible loss of mangrove habitat from the Guideline 1 management area (C. Morgan, Chevron. *pers. comm.* February 2010). In addition, there should be no Project-attributable impact on the geomorphic formation processes of the delta, no changes to nutrient budgets to the associated lagoon, and no



### 3 BPPH Loss Assessment - Onshore Infrastructure

adverse indirect impacts on the delta. The EPA requested the development of a conceptual model to guide the assessment of potential cumulative impacts to the Ashburton River Delta through Project-attributable causes.

To address EPA's concerns, workshops were held with specialists with an understanding of processes occurring in the Ashburton River Delta to identify a range of potential direct and indirect impacts and to confirm what baseline survey work that would need to be undertaken to address the potential impacts. In addition, Dr Eric Paling was engaged to develop a conceptual model with advice from other specialists within the team, including Dr Ian Eliot who characterised the geomorphic processes considered critical to the maintenance and ongoing evolution of the delta system. The following works were undertaken:

- development of a conceptual model to guide the assessment of potential cumulative impacts to the Ashburton River Delta;
- assessment of the key processes responsible for maintenance of the ecosystem and the potential for the Project to affect these key processes; and
- assessment of the potential for indirect and/or cumulative impacts to the mangrove system from the operation of the Project.

These studies are presented in an Ashburton River Delta Impact Assessment Report (URS 2010i), which addresses the following potential impacts:

- Construction Phase:
  - potential direct impacts from the installation of a shore crossing for the trunkline. It should be noted that this method of shore crossing has since been rejected in favour of the preferred microtunneling approach..
  - potential direct loss of salt flat beneath a potential onshore dredged material placement site.
  - potential indirect impacts on mangroves of the Ashburton River Delta through water logging and seepage from the onshore dredged material placement site.
- Operation Phase:
  - potential indirect impacts to the Ashburton River Delta arising from operation-attributable aspects of the Project including:
    - atmospheric emissions (i.e. nitrogen and dust);
    - noise impacts on mangrove fauna (particularly bats);
    - light impacts on mangrove fauna (particularly birds);
    - altered flood drainage (impact to stability and growth of the delta in the long term);
    - contaminated surface water runoff; and
    - accidental release of condensate or diesel at the MOF or PLF.

The full document with findings and conclusions can be found in URS (2010i). A summary of conclusions from that report is presented below.

URS (2010i) identifies key processes that maintain the Ashburton River Delta mangroves, assesses the impacts of the Project on those processes, and undertakes an assessment of potential Project-attributable direct and indirect impacts. A summary of these assessments are that:

- none of the key processes identified as being responsible for maintaining the delta will be modified to the extent that resultant indirect impacts will occur. Therefore no adverse impacts to the delta mangrove ecosystem are anticipated to arise from the Project.



### 3 BPPH Loss Assessment - Onshore Infrastructure

- no direct impacts or longer term indirect impacts to mangrove habitats are expected to occur under normal operating conditions from the Project.
- the placement of dredge material onshore in the southwest section of the Project area is unlikely to cause localised loss of mangroves, due to seepage or water logging effects, and unlikely to cause changes to water and salt budgets.
- The potential for accidental release of condensate or diesel from the MOF and the PLF exists, however it is recognised that these are rare events. In the event that a release does occur, dependant on climatic conditions, it is possible that hydrocarbons would reach the Ashburton River Delta, causing mangrove mortality. A mangrove health monitoring program may be required to confirm the above assessments and provide warning of the need for management measures to mitigate impacts. Mitigation and management measures are being developed to manage this risk.

Based on this assessment (URS 2010i), no loss of mangrove BPPH is anticipated and it is considered that overall, the Project-attributable impacts constitute a low to negligible risk of adversely impacting the ecological integrity of the Ashburton River Delta mangrove system.

## Direct BPPH Loss arising from nearshore infrastructure footprint

### 4.1 Nearshore infrastructure

This section assesses the potential loss of BPPH arising from the direct impacts of the footprint of nearshore port infrastructure and the trunkline.

The nearshore infrastructure footprint includes:

- ◆ The dredged basins for the MOF and PLF and their associated approach channels
- ◆ The offshore dredged material placement sites
- ◆ The MOF breakwaters and wharves
- ◆ The PLF
- ◆ The submarine trunkline.

The final optimised layout for the MOF and PLF for the foundation project is shown on Figure 4-1, which also shows the four main components of the dredged area footprint. The MOF layout comprises two combined breakwater and sediment infill protection walls which enclose a small boat harbour and cyclone shelter on the western side, plus three large vessel berths that can all be operated concurrently. These berths will accommodate Roll-on/Roll-off and Lift-on/lift-off vessels and dumb barges. The berths and wharves will be backed by a substantial clear hardstand area for the storage and handling of goods.

The breakwaters will be constructed from the shore using earthmoving equipment to place engineered core material from a local quarry into the nearshore waters. The breakwater will be armoured by heavy rock and concrete armour units. Wharves, pens and berths will be piled, and wharves will be constructed of pre-cast concrete structures.

The PLF will consist of an access trestle (sub structure), including passing lanes & turn-out platforms, loading platform structures (including concrete 'table-top'), mooring and berthing dolphins and a Marine Operations Platform (MOP).

The access trestle will be constructed by driving piles from a crane located on a temporary work platform alongside the trestle, installing the pilecaps, placing a roadway and then moving forward to drive the next set of piles (i.e. all plant will be located above the water and the workfront will be fed from the shore along the completed trestle). Alternatively, the access trestle could be completed in part (where there is sufficient water depth) using floating plant.

### 4.2 BPPH loss assessment

Figure 4-2 presents the optimised layout for the MOF, PLF and channels and trunkline overlaid on a finer scale version of the BPPH distribution map presented in figure 2-5. Figure 2-5 shows the location of the offshore trunkline and offshore dredge material placement sites in relation to BPPH distribution.

#### 4 Direct BPPH Loss arising from nearshore infrastructure footprint

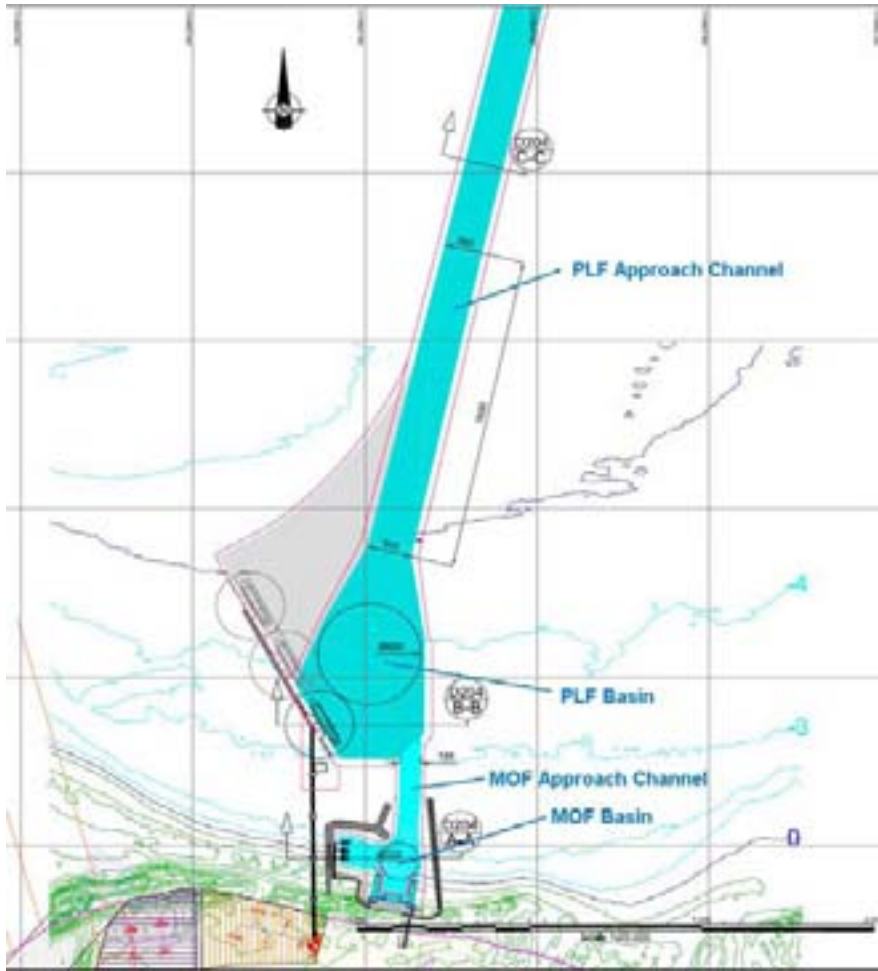
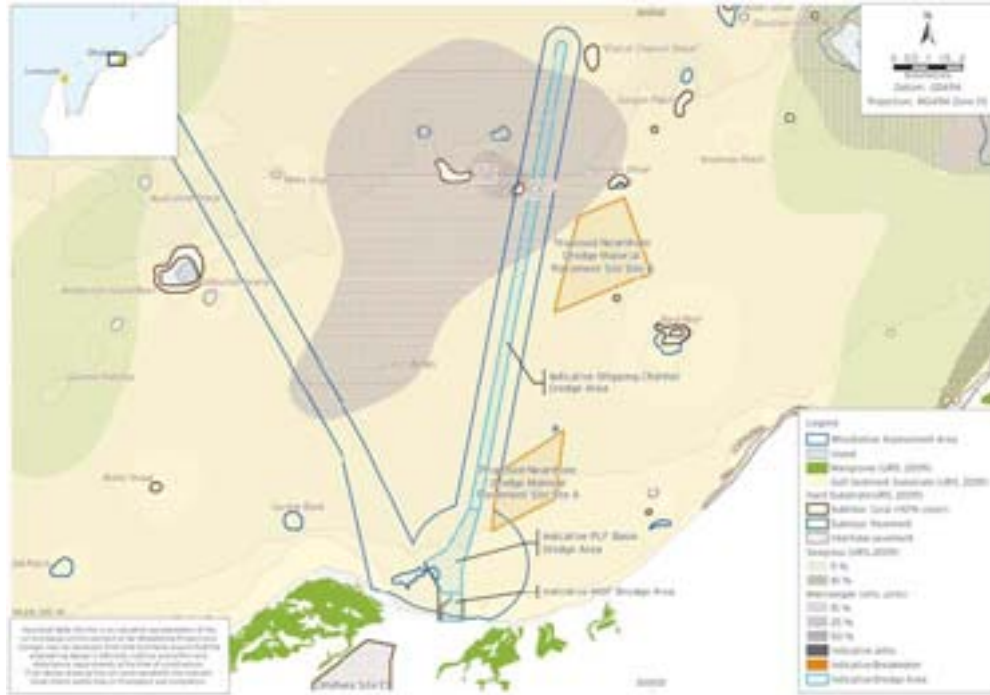


Figure 4-1 Optimised layout for the MOF and PLF for the foundation project

#### 4 Direct BPPH Loss arising from nearshore infrastructure footprint



**Figure 4-2** Nearshore port components overlaid on BPPH distribution

The **nearshore port components** (MOF, PLF and channels) are located in soft sediment substrates. This is a habitat that predominates throughout the region. An area of subtidal pavement occurs to the immediate west of the PLF. This structure appears to be a relict shoreline. It has been inspected at five locations and found to be largely sand veneered pavement with a low cover (<10 per cent) of scattered sea whips and fans (URS 2009e). Given its low cover of macrobiota and predominantly sand substrate, it has been classified as soft substrate.

Saladin shoal occurs approximately 5 km from the end of the PLF approach channel. It is a small coral habitat supporting a moderate to high cover of corals, sponges and macroalgae. The approach channel alignment has been selected to avoid this shoal and will pass within 500 m of it. Another small shoal ("End-of-channel" shoal) occurs just outside the northern end of the channel which also supports a moderate to high cover of corals. The outer end of the channel also passes through an area of approximately 250 ha of soft substrate which supports a low cover of the green algae *Enteromorpha* sp. and brown foliose macroalgae.

The nearshore **dredge material placement sites** have all been located over relatively barren soft substrate seabed which does not support significant BPPH. The preferred offshore placement site D is located partly over soft sediments which support a red microalgal mat, and partly over filter feeder habitat (Figure 2-5). The contingency offshore placement site E is located over soft sediments which

#### 4 Direct BPPH Loss arising from nearshore infrastructure footprint

support a red microalgal mat. Both placement sites are 900 ha in area, however the volume of material proposed for disposal at Site D is relatively small and will consist of pipeline trenching material and fine sediments from channel clean-up activities. Hence the actual area of habitat loss that will occur is difficult to estimate, but likely to be small.

The **trunkline route alignment** has been selected to avoid hard substrate as much as possible and avoid coral communities. The nearest coral community to the pipeline route is that at Ashburton Island located approximately 1 km to the west. It is currently anticipated that the pipeline will require mechanical trenching or excavation and backfill with engineered fill between water depths of approx 10 m to 40 m – a distance of some 35 km which extends from the Roller- Skate trunkline (Figure 2-9) to the start of the shelf break offshore. Installation of the trunkline between shore and 40 m depth will disturb a 50 m wide belt of seabed, of which the actual trench and side slopes will constitute 25 m. However engineered backfill will be confined to the trench area only which will be approximately 5 m wide at the base. In sandy areas which have historically been trawled, it is proposed to bury the pipeline flush with the seafloor with a covering of sand.

Figure 2-5 shows that most of buried section of the trunkline passes through macroalgae and filter feeder habitat (sponges, fans and whips), but a small section will traverse through an area where denser seagrass patches have been recorded. The area of BPPH habitat disturbance has been calculated to be:

- Macroalgae / Filter feeder habitat      100 ha (20 km x 50 m)
- Seagrass habitat                              10 ha (2 km x 50 m).

The seagrass habitat loss is considered to be temporary and reversible within five years because this section of the pipeline will be covered by sand. While it is expected that rock armoured parts of the pipeline will eventually be colonised by a wide range of encrusting organisms including soft and hard corals, sponges and ascidians as well as a wide variety of reef fish species, for the purposes of this assessment it has been assumed that recovery of filter feeder habitat will not occur within five years. However macroalgae are expected to recover well within five years.

The remainder of the trunkline (between the Roller-Skate pipeline and shore) mostly traverses barren sands and silts which do not support significant BPPH. A small area (approximately 80 ha) of low density macroalgae is traversed about halfway between Ashburton Island and the mainland shore. This macroalgal habitat is expected to recover rapidly after disturbance and as such is not considered to be loss as defined by EAG3.

Table 4-1 presents the area of substrate modified by each port component footprint calculated by GIS software. In interpreting this table it should be understood that installation of the infrastructure components will permanently modify existing habitats by the addition of new structures and modifying the depth of water locally.

BPPH Loss Assessment

#### 4 Direct BPPH Loss arising from nearshore infrastructure footprint

**Table 4-1 Area of Soft substrate Habitat Modified by Port Infrastructure Components**

Port component	Area of footprint (ha)
MOF breakwaters and basin	42
PLF jetty and basin	173
MOF approach channel	12
PLF access channel	421
Placement site A	337
Placement site B	533
Placement site C	2473
Placement site D	900
Placement site E	900
<b>TOTAL</b>	<b>5,791</b>

Only the MOF breakwaters, basin and the navigation channel are considered to be permanent “loss” of habitat to the marine environment. The dredge material placement sites are expected to recolonise over time with low density macroalgae and seagrass as evidenced by a survey of the spoil placement site for the nearby Onslow salt channel (URS 2009e, Appendix N). The outer walls of the MOF breakwaters will be colonised by rock encrusting organisms and crabs suited to the new cryptic habitat and the piles of the trestle structure piles will be colonised by fouling organisms which will eventually develop into an artificial reef community.

Therefore direct losses (as defined in EAG 3) of subtidal BPPH arising from the nearshore infrastructure footprint are estimated to be:

- 250 ha of macroalgae habitat within the outer end of the channel; and
- 100 ha of filter feeder habitat within the outer part of the trunkline footprint.



This page is intentionally blank



## BPPH Loss Assessment – Dredging & Material Placement

### 5.1 Introduction

This section assesses the impacts to BPPH as a result of capital dredging, and dredge material placement offshore. These activities have the potential to create extensive plumes of turbid water which gradually disperse from the dredging and dredge material placement sites. Turbid water may impact upon BPPH by smothering, due to sedimentation, and the attenuation of light. The potential effect of maintenance dredging is assessed at the end of this section.

These activities were identified in the Scoping Document (Chevron, 2009) as being a “high risk” of causing adverse impacts to the marine environment as a result of the large dredge volume proposed. Due to the high risk of these activities, DHI (formerly Danish Hydraulic Institute) were engaged to develop the modelling tools required to provide a reliable assessment of potential impacts. In addition, Dr Des Mills of Des Mills Marine Environmental Review (MER), Western Australia, was also engaged to review the adequacy and reliability of the modelling outputs which were used to simulate the dispersion of sediments arising from proposed dredging and dredge material placement activities. Dr Charles Sheppard of Warwick University, United Kingdom, was engaged to review the adequacy and reliability of the receptor tolerance limits developed by DHI (2010b). The receptor tolerance limits, when applied to the sediment transport model output, provide the basis for defining the scale and boundary of the zones of impact, effect and influence on sensitive receptors, as required by the EPA's dredging assessment framework. The advice received from both reviewers has been provided to the EPA, and the advice received from Dr Charles Sheppard is provided in Appendix A.

DHI completed the following works to enable dredge plume impact assessment:

- establishment and validation of a mathematical model for the waters of the region;
- simulation of sediment dispersion caused by dredging and placement works for a range of climatic and sediment release scenarios;
- development of sedimentation and suspended sediment tolerance limits for corals, seagrass and mangroves; and
- application of the tolerance limits to modelled sediment dispersion scenarios to derive a range of indicative impact, effect and influence zones for the Project.

Full reports of the methodology, validation, impact assessment and conclusions of the modelling work for dredging and placement activities can be found in DHI (2010a; 2010b; 2010d).

### 5.2 Alternatives Considered

The original design concept described in Chevron (2009) considered development of an onshore MOF. Since the original design concept, the channel alignment and location of the MOF and PLF basins have been optimised to minimize the volume of dredging required, while avoiding areas of hard rock detected by geophysical surveys. The current design has moved the proposed navigation channel alignment between 1 and 2 km to the west, and the MOF has moved to the shoreline of the Project area. This has increased the distance between the proposed navigation channel and the Ward Reef coral community and Onslow Salt shipping channel, while locating the proposed navigation channel midway between the two largest shoals (Paroo and Hastings). To improve dredging efficiency and reduce cost, it has been proposed that three dredge material placement sites will be located in nearshore waters and another two placement sites will be located offshore (Figure 5-1).

The Dredging and Disposal Plan (DDP, Lanier Wallingford International (LWI) 2010) originally assumed that the rock was stronger than it subsequently actually appeared to be and was therefore



## 5 BPPH Loss Assessment – Dredging & Material Placement

based on the use of two large cutter suction dredges (CSDs) and associated hopper barges to construct the navigation channel. Subsequent revisions of the DDP (LWI 2010) included preliminary analysis of the geotechnical information that was available for the channel alignment (Coffey Geotechnics 2009). This information indicated that the rock that needed to be removed was much weaker than originally assumed and could be removed using large trailing suction hopper dredges (TSHD) rather than the previously proposed CSDs and hopper barges. The geotechnical information also indicated that there were more fines in the nearshore sediments than previously assumed (~ 40 %). This resulted in a revision upwards of the anticipated release rates of nearshore sediments and has prompted a re-assessment of the advisability of bringing onshore large volumes of material.

A later revision of the DDP (LWI 2010) assumes that no dredged material would be placed onshore and that all dredged material would be placed offshore. However, the impacts of onshore placement of dredged material has been assessed in case ongoing geotechnical investigations indicate that it is feasible to bring dredged material onshore.

### 5.3 Proposed dredging works

#### 5.3.1 Dredging works program

The development of a marine terminal at the Ashburton North SIA requires the dredging and disposal of up to 45 Mm<sup>3</sup> of material to construct approach channels and basins for both a nearshore MOF and a PLF. Table 5-1 presents a breakdown of the dredge volume by work package. The material to be dredged comprises of either sands intermixed with variable fractions of clays, silts and / or gravels; or rock (siltstone, claystone and sandstone) that is generally weathered and weak (Coffey Geotechnics 2009). Until recently it was anticipated that up to 10 Mm<sup>3</sup> of this material may be placed within the onshore infrastructure area (Figure 5-1). However it is now anticipated that, owing to the high proportion of fines contained in nearshore sediments, no dredged material will be brought onshore. As indicated above, both options for placement of nearshore sediments was to be assessed, however the preferred option is for all material to be placed offshore and this is the base case assessed in this section. Note the the effect on BPPH of the onshore dredged material area has been assessed in the Ashburton Delta River Impact Assessment Report (URS 2010i) and has indicated in section 3.3 of this report, no loss of BPPH is anticipated from this action..

The majority of the dredged material will be placed offshore at placement site C. A small volume of dredged material (~1Mm<sup>3</sup>) will be placed at nearshore site A. Site B is a contingency site for the placement of dredged material excavated by backhoe if this activity becomes required. Finally, a small volume of fine material will be relocated to one of two deep water offshore placement sites in waters exceeding 30 m depth (site D is currently preferred) during the final clean up campaign of the dredging program.

BPPH Loss Assessment

### 5 BPPH Loss Assessment – Dredging & Material Placement

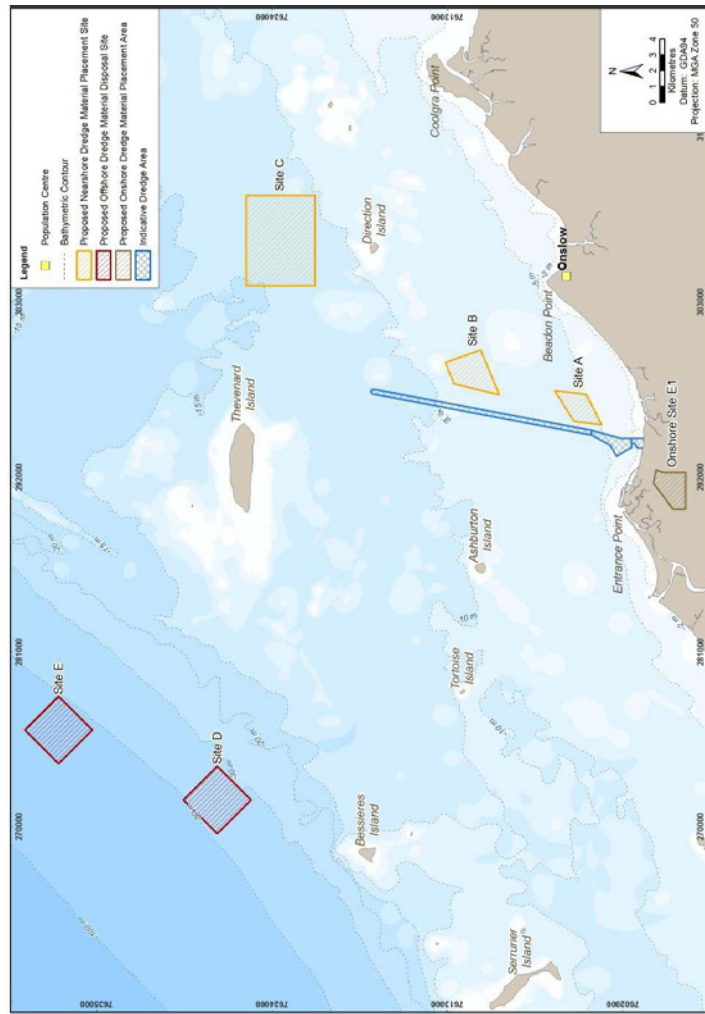


Figure 5-1 Proposed navigation channel and proposed dredge material placement sites.

42907468/WHST-STU-EM-RPT-0137/Rev 1

## 5 BPPH Loss Assessment – Dredging & Material Placement

**Table 5-1 Dredged area volumes.**

Dredge Area	Total for Area (m <sup>3</sup> )
Temporary navigation channel	935 000
MOF basin & channel	1 580 000
PLF basin	16 445 000
PLF Approach channel	20 160 000
Total Capital Dredge volume	39 120 000
Design uncertainties	5 880 000
Estimated total Capital Dredge volume	45 000 000

The specific dimensions of the approach channels after completion of dredging will be:

- the MOF approach channel: 1 km long, 120 m wide and approximately 7 m deep.
- the PLF approach channel: 16 km long, 260 m wide and approximately 13.5 m deep.

The proposed dredge execution plan is presented in Table 5-2 (LWI 2010) which shows that the duration of the dredging program will be approximately three and a half years. Dredging works may include the use of:

- a 4 000 kW CSD;
- a 10 000 m<sup>3</sup> TSHD;
- a 5 000 m<sup>3</sup> TSHD;
- up to two self-propelled barges;
- a backhoe excavator; and
- a range of ancillary small craft to service the dredgers, transport crew and survey the channels.

The choice of dredging plant will be specified by the selected dredging contractor and will be based on plant availability, schedule and environmental requirements. Therefore it is possible that other dredging plants may be selected for this task at the time of contract execution. Depending on the selected contractor, this could come from a wide range of plants available internationally. For example, dredges of the following sizes are known to exist and could conceivably be selected for this Project:

- 6,000 KW (at cutter head) CSD
- 20,000 m3 size TSHD

The dredging program has been broken up into a number of discrete work packages as follows:

- Temporary access channel (which is subsequently incorporated into the MOF channel);
- MOF basin and approach channel;
- PLF basin (expansion to 25 MTPA); and
- PLF navigation channel.

The proposed dredge execution plan (Lanier Wallington International (LWI) 2010) indicates that a CSD may operate in the nearshore area for a period of up to 6 months to fully establish the MOF and approach channel, and to dredge the PLF to -9.4 m Australian Height Datum (AHD). It is anticipated that a TSHD will reduce the PLF approach channel to -10.4 m AHD over a three month period. These

*BPPH Loss Assessment*

---

## 5 BPPH Loss Assessment – Dredging & Material Placement

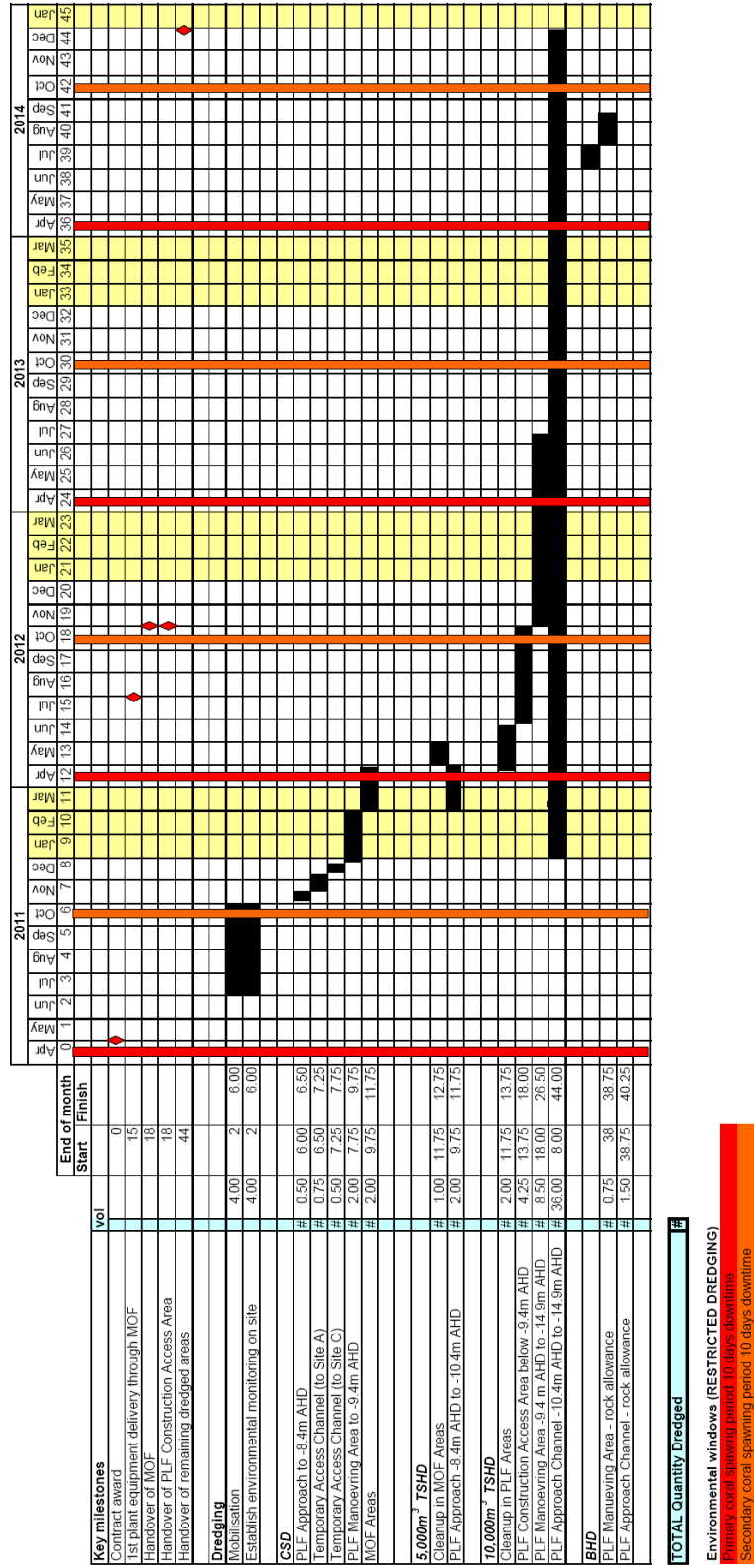
dredgers will then be replaced by two larger TSHDs, one of which will deepen the PLF to -14.9 m AHD over a period of approximately 15 months and the second one will deepen the PLF approach channel to the same depth over a period of approximately 3 yrs. All TSHD will transport dredged material to placement site C.

A large backhoe may be brought to site towards the end of the dredging program to remove any remaining hard spots. The backhoe will place excavated rocky material into two small barges which will then place the material in placement site B. One of the large TSHD's will then undertake cleanup dredging to complete the dredging program. The fines removed by this activity will be taken to placement site D.



5 BPPH Loss Assessment – Dredging & Material Placement

Table 5-2 Proposed dredging program schedule.



**5 BPPH Loss Assessment – Dredging & Material Placement**

**5.3.2 Selection of Nearshore Placement Sites**

A number of factors determined the location of the proposed dredge material placement sites, including existing navigation routes, proximity to dredging areas, similarity in composition to dredged material, potential for resuspension once placed, location of existing prawn trawling grounds, and the presence or absence of BPPH. In addition placement sites have been selected in order to manage potential negative effects on the hydrodynamics or the shoreline processes of the area, and avoid damage of coral communities which occur in the proximity of the sites. A summary of the key assumptions applicable to each of the proposed dredge material placement sites is presented below (Table 5-3).

**Table 5-3 Characteristics of proposed dredge material placement sites.**

Site	Assumptions	Mean seafloor level change (m)	Capacity (Mm <sup>3</sup> )
<b>Nearshore Placement Sites</b>			
A	For use to establish temporary access channel. Approximately 1 Mm <sup>3</sup> of dredged material will be placed by CSD using a diffuser just above the seabed. The naturally deep water areas are the primary target for placement within site A. Depth <7 m.	0.375	1.5
B	Contingency site B may be used for placing weak rock removed from the PLF navigation channel and turning basin by the backhoe dredge.	0.6	3
C	The primary placement site capable of receiving the full (Phase 1 and 2) dredge volume. Material placed either by TSHD or split hopper barges. Depth 12–15 m.	1.7	40
<b>Offshore Placement Sites</b>			
D	Primary placement site for approximately 300 000 m <sup>3</sup> fine material from cleanup operations. Also capable of receiving the full Phase I dredge volume. Material placed by either TSHD or split hopper barges but lower preference than nearshore site C. Depth 38–48 m.	4.45	40
E	Same as offshore site D, but lowest preference due to higher sailing distances. Depth >60 m. Unlikely to be used.	4.45	40

**5.3.3 Stability of dredged material**

During the placement process some of the fines in the dredged material will be released to the wider environment. The effects of this have been assessed through sediment plume modelling by DHI (2010a) (see Sec 5.4). Some of the fines however, along with coarser particles and clasts will be placed at the site. This finest fraction of the placed material will, at times, be mobile at the placement sites under the prevailing flow and wave conditions. The sediment plume modelling has established that after placement of the material at the sites the rates at which any fine sediment (< 75 microns) might be released from the sites is likely to be insignificant compared to the fines released during the placement operation, except under cyclonic conditions.

The stability of the sand fractions of placed material has been examined through modeling by DHI. This modelling indicates that the smallest grain at rest for 95% of the time is estimated to be 200-300



## 5 BPPH Loss Assessment – Dredging & Material Placement

microns at Sites A and B and between 200-450 microns at Site C. During cyclone conditions the mobility will be enhanced.

Given the predicted mobility of the finer material placed on the seabed at any of the disposal sites there will be a degree of natural sorting of that material after placement. This will commence at the time of placement, and may be influenced by subsequent placements at the site. This will result in some degree of loss of the finer fractions of material that are not well buried within the placed material. On completion of the placement activities in one area of a placement site the surface of the placed material is likely to have an overlying veneer of fine material in patches. This fine material will, over time, be reworked by the action of waves and currents such that the fine material is winnowed out and on average the surface of the placed material will coarsen. The nature of material buried within the placement is not likely to change over time. The mixed nature of the material on the surface of the placement will act to stabilize the placed material compared to the situation if the placed material were a homogenous fine sand. The coarsening of the placed material will also act to armour the bed over time. Where the placed material contains fines arising from the dredging of the very weak rock the coarser clasts will further help to stabilize the bed. Where the placed material has high fines content then consolidation processes will take place over time further reducing the erodibility of the bed material.

During extreme cyclones (e.g., Cyclone Vance in March 1999), fines remaining in the spoil grounds will be re-suspended, along with fines elsewhere on the seafloor, and will be dispersed with the currents. Once such an extreme event occurs, most fines will have been removed from the grounds and they will resemble the parent material on the adjacent seafloor. Observations by URS (2009c) confirm this has happened to the Onslow Salt dredged material placement grounds, which now resemble the adjacent seafloor and have been recolonised by a similar biota than found in adjacent non-disturbed sediments.

In essence over time the initial irregular form of the placed material will be smoothed. There will inevitably be some migration of placed material away from the placement site in the directions of dominant transport mixing into the natural transport pathways that already exist. For Site A, small amounts of fine sand placed at the sites would, at times, be transported towards the Onslow Channel to the east and towards the Wheatstone Channel to the west. Rates of such transport are unlikely to be significantly greater than that presently occurring because of the distances involved and the presence of fine sand fractions on the seabed in these areas.

The placement at Site A is scheduled to occur in the early stages of the dredging programme. The main stabilization and winnowing out of fines from Site A will gradually reduce with time after placement, and by the end of the 3 year dredging period, the rate of reworking and change is expected to be low. The risk of significantly enhanced inflow in the Onslow Salt Channel following completion of the works as a result of migration from proposed disposal at Sites A and B is considered small.

Subsequent sections of this report (refer section 5.6) show that there is little risk to BPPH arising from the dredged material placement operations. Hence little risk is anticipated from the minor release of fines that will occur for a while after cessation of the capital dredging program. Site C in particular is well situated away from sensitive BPPH and there is little BPPH in the prevailing downstream flow directions. Hence the placement sites are not anticipated to pose a long term risk to BPPH resources which occur in their general vicinity.



## 5 BPPH Loss Assessment – Dredging & Material Placement

### 5.3.4 Contaminant status of dredged material

The sampling and analysis of sediments in the proposed dredge areas was completed to identify any contaminants of potential concern (COPC), existing in the Project area that may have the potential to impact BPPH (URS 2010). Analysis of sediment samples obtained from the proposed navigation channel and proposed dredge material placement sites determined that concentrations of total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylenes compounds (BTEX group) and tributyltin (TBT) were below the detectable limit of reporting or below the relevant National Assessment Guidelines for Dredging (NAGD; Commonwealth of Australia 2009) screening levels. Generally, the analysis of sediments for the presence of metal or metalloid COPC were found to be below the NAGD screening levels (Commonwealth of Australia 2009), with the exception of arsenic and nickel which exceeded the screening levels at several sites. However, natural enrichments of arsenic and nickel above NAGD sediment quality guideline values (Commonwealth of Australia 2009) have been shown to occur regionally (URS 2010). A study undertaken by the Department of Environment and Conservation (DEC) estimated natural background concentrations of trace metals in marine sediments on the Pilbara coast (DEC 2006). The study found that natural background concentrations of arsenic were above the Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ; 2000) guideline value. All other mean trace metal concentrations in sediments around the Ashburton River mouth and Onslow were below their relevant ANZECC/ARMCANZ (2000) guideline values.

The contaminant status of the sediments to be dredged and relocated to the placement sites was assessed, in alignment with the NAGD (Commonwealth of Australia 2009), and determined to be “acceptable for unconfined disposal” at one or more of the proposed dredge material placement sites (URS 2010).

### 5.3.5 Acid Sulfate Soils status of dredged material

URS (2010m) completed an investigation into the presence of potential acid sulphate soils (PASS) of the proposed navigation channel and turning basin. The results of chromium suite testing (Scr) indicate that the sediment and rock profiles are generally non acid generating. However, concentrations slightly above or at the action criteria trigger value were detected in the shallow unconsolidated surface sediments at a small proportion of the core locations sampled. Results of acid neutralisation capacity (ANC) testing indicate that the sampled sediments were alkaline (chiefly reactive carbonates). This indicates that rates of alkalinity available for circum-neutral buffering are “chemically non-limiting”. In summary the dredge material contains sufficient buffering capacity in the associated carbonates to neutralise any acid that may be generated as a result of oxidation if placement of dredge material occurs onshore.

## 5.4 Effects of dredging program on nearshore water quality

### 5.4.1 Background

The dredging and dredge material placement operations described above will release a wide range of sediment particles to the adjacent water body during the cutting and barge/TSHD loading operations. Large and coarse sediments (>63 µm) will settle quickly to the seafloor adjacent to the channel. Small fine sediments (<63 µm) will take some time to settle and will create a visible plume of suspended



## 5 BPPH Loss Assessment – Dredging & Material Placement

sediment from both the dredging location and the dredge material placement sites, carried by the currents across the Project area (Figure 2-1). The extent of the plume will depend on a range of factors including: season; wind strength; status of tide; location and type of dredge; dredge working methods and productivity; and the particle size distribution (PSD) of the sediments generated and suspended in the water column during the dredging and dredge material placement operations. A critical factor affecting the scale of effects is the “release rate”. This is defined as the rate of release into the marine environment of fine seabed material generated from dredging activities, including re-suspended materials and those settling on the seabed outside the dredging area. The release rate is usually expressed as kg/s or t/day.

The specific activities with potential to locally increase suspended sediments in the local marine waters include:

- overflow from TSHD dredging and barge loading;
- disturbance of seabed by CSD, TSHD drag head and propeller wash;
- seafloor placement of material at nearshore or offshore placement sites;
- discharge to sea bed at site A by CSD; and
- return of decanted seawater discharge from onshore placement.

Based on experience from other dredging programs in the north western region of Western Australia, dredging will increase total suspended solids (TSS) and turbidity to above baseline levels. Dredging is likely to have little impact on salinity, pH or dissolved oxygen concentrations in receiving waters (Stoddart and Anstee 2005).

To determine the scale of sedimentation and turbidity impacts arising from the above activities, DHI simulated the dispersal of sediments released by the proposed dredging program via their range of MIKE 21 mathematical models. DHI have developed an approach for impact assessment and management of dredging and reclamation projects in Europe and Singapore which is considered international best practice by both the World Association for Waterborne Transport Infrastructure (PIANC) and the World Dredging Congress (Doorn-Groen and Foster 2007). Their approach has been documented in a publication that is planned to be jointly released by PIANC and the United Nations Environment Program (UNEP) in 2010.

The following sub-sections summarise the work that has been completed by DHI to:

- develop a modelling approach which is appropriate for the Project area and the simulation task;
- set up a mathematical hydrodynamic model for the Project area;
- establish the boundary conditions for that model based on a review of all available high quality metocean and bathymetric data;
- calibrate and validate the model;
- develop source terms for the release of particles from each dredging operation (with the marine infrastructure designers LWI);
- develop a range of dredging and climatic scenarios to be modelled; and
- simulate the selected scenarios and report their findings.

Details on the above works are provided in DHI (2010a).

## 5 BPPH Loss Assessment – Dredging & Material Placement

### 5.4.2 Overview of modelling approach

The key role of the modelling of the transport and fate of the dredge sediment plume is to ensure that any and all significant impact areas/zones are identified and that sufficient and appropriate mitigation measures are incorporated into the Dredging and Spoil Disposal Management Plan (DSDMP, SKM 2010). For the purposes of this report DHI have defined total suspended solids (TSS) as the mass of suspended particulate matter in the water column at a given time. Conversely, suspended sediment concentration (SSC) is defined as the value generated by modelling and does not take into account background levels.

The modelling methodology that has been adopted for this Project has been motivated by the need to ensure that the results of the modelling adequately provide a conservative upper bound on the potential impacts from dredge plume sediment based on the degree of uncertainty that is inherent in the Project description. The key uncertainties associated with the proposed dredging program that have been identified are:

- A. The actual sediment release rates and release characteristics that will occur. This is highly dependent upon the type of dredging equipment used and the local sediment characteristics;
- B. The final details of the dredging program which will ultimately be defined by the dredging contractor;
- C. The precise nature of the climatic conditions that will be experienced across the entire dredge area during the three year dredging program as well as the impact.

The uncertainty in the release rate (A) that will occur at the time of dredging has been addressed by the assessment of 'high' (i.e. worst-case) and 'low' (i.e. realistic) rates of sediment release associated with the dredging activities. Estimates of 'High' release rates are associated with the 90th percentile release rate per travel cycle of a dredger and is based on information presented in DHI (2010a). Thus, model results for high spill rates are indicative of short-term events (i.e. less than one day) and results presented for the climate scenarios (14-day time scale) are considered highly conservative. Due to the episodic nature of the high spill events, representation of results for either the seasonal or annual timescale is not considered appropriate.

In order to address the limitations of the study associated with uncertainties in the implemented dredge program (B), a scenario approach has been adopted that identifies key stages within the dredging program and assesses impacts from each component in isolation. Uncertainty associated with the climatic conditions that will be experienced at the time of dredging (C) has been accommodated by the use of a climate scenario approach which includes a range of worst-case climatic conditions. It is important to note that the concept of 'worst-case' with respect to the areal extent of the plume occurs under different climatic conditions rather than 'worst-case' impacts associated with (for example) sediment deposition or increased turbidity. By investigating the transport and fate of sediment for each dredge scenario under a range of worst-case climatic conditions, the sequencing of dredging activities becomes unimportant thereby reducing the influence of uncertainties associated with the dredge program (B).

Thus, the scenario approach adopted for this assessment (and as recommended by PIANC) involves the modelling of the dredging program using combinations of short-term (i.e. 14 day tidal cycles) climate scenarios, dredge scenarios, and release rates thereby ensuring that the bounds of the range of plausible conditions are adequately assessed. Importantly, the short-term scenario approach also facilitates the quantification of the effectiveness of potential dredging-related mitigation measures designed to manage the potential for adverse environmental impacts due to their reduced



## 5 BPPH Loss Assessment – Dredging & Material Placement

computational requirements. Motivated by the results of the analysis of available observational metocean data, and the configuration of the dredge program, the hydrodynamics used to drive the sediment model have been developed using a two-dimensional (2D) depth-averaged approach.

For this assessment, a (semi)-three dimensional (3D) sediment transport model has been used in which the vertical shear-structure within the water column was assumed to be associated with a logarithmic velocity profile. This approach to the modelling of the transport and fate of the dredge sediment incorporates key 3D sediment dynamics which result in variations in sediment concentration through the water column. The need to explicitly resolve the vertical shear structure (i.e. the use of fully 3D hydrodynamics) must be guided by the observational data balanced against the increased computational requirements. Consideration must also be given to the loss of horizontal resolution typically associated with fully 3D modelling, as good horizontal resolution is important when considering potential impacts to highly demarcated habitats such as island coral reefs. For the purposes of this assessment it was concluded (DHI 2010a) that the semi-3D approach based on 2D depth averaged hydrodynamics would provide conservative results when compared with an approach based on a fully 3D approach.

A number of studies have been undertaken in support of the study methodology. These studies include a comparison of the spatial extent of the impact zones on sediment transport modelling driven by 2D and 3D hydrodynamics. Results of these studies confirm that the applied methodology is sufficiently conservative for this application. Details of the studies can be found in DHI (2010a).

Details of the results of the data analysis and discussions associated with modelling methodology options, such as the advantages and disadvantages of 2D compared with 3D models, can be found in DHI (2010a).

The modelling approach undertaken by DHI is different to that used before in Western Australia. Previous modelling investigations in Western Australia have focussed on modelling the entire dredging program using a 3D mathematical model to simulate the dispersal of turbid waters. Such an approach enables determination of the maximum SSC that occurs within any vertical profile and analysis of the effects of the total dredge program. One disadvantage of this approach is that it is time consuming to model different dredging and climate scenarios. Elsewhere in the world, and as recommended by PIANC, dredging programs are modelled in 2D or 3D (depending on absence or presence respectively of stratification), using short term scenarios (14 day tidal cycles) to determine the impact fields under various climate and release scenarios. Such an approach allows simulation of many scenarios thereby testing of the sensitivity of the model outputs to variation in climatic and source term parameters. It also facilitates identification of options in undertaking the dredging program to manage potential environmental impacts.

### 5.4.3 Model set-up, calibration and validation

To ensure that the models (hydrodynamic, wave and sediment transport) produce reliable results it is important that the models are calibrated and that the validity of the model predictions are verified as far as practicable based on the availability of observational data. Calibration is the process by which model parameters are adjusted within reasonable limits so that model predictions match observational data at specified location(s).

In general, the quality of model results is determined by the quality of the model inputs. The key inputs into the hydrodynamic model for this Project include bathymetry, tides, and wind fields. The key inputs

## 5 BPPH Loss Assessment – Dredging & Material Placement

into the sediment transport model include the hydrodynamics, waves (developed using a wave model) and which are particularly critical in the nearshore, and winds. All available data at the time of the model setup and calibration phases of the assessment were reviewed by DHI and assessed for suitability for the purposes of calibrating model parameters and the validation of model output.

The calibration of the hydrodynamic model primarily focused on the refinement of the extensive bathymetric data set and bottom roughness. Bathymetry plays an important role in steering the wind and tidally driven circulations. Refinements on the model bathymetry were assessed against available current data at critical locations within the study region.

DHI has applied the internationally recognised United Kingdom Foundation for Water Research (UKFWR) Guidelines for quantitative assessment of the adequacy of the hydrodynamic model setup, calibration and validation. These guidelines are a series of quantitative measures of the accuracy of numerical hydrodynamic models and have been previously used in International Court cases to establish the validity of model outputs. DHI's model for the Project has met all of the quantitative criteria specified by the UKFWR.

Output from the wave model was validated against data from the offshore placement site D, the proposed site for the PLF and in the vicinity of Ward Reef, east of the proposed approach channel.

The validation of the output of the sediment transport model may be undertaken (if warranted) during the actual dredging phase of the Project.

Details of the setup, calibration and validation of the hydrodynamic, wave and sediment transport model may be found in DHI (2010a).

### 5.4.4 Selection of climate and dredging scenarios

As discussed in section 5.4.2, a conservative approach has been adopted that includes the use of short-term climate and dredge scenarios.

The climatic and dredge scenario selection process has been based on numerous iterative testing runs in the model and included modelling of an evolving dredging program. This has enabled extensive evaluation of plume behaviour and ensures that the chosen scenarios adequately cover the full range of dredge program activities. Only the final selection applied for the impact assessment is documented in the report DHI (2010a). This subsection presents a summary.

The **climatic scenarios** were selected after DHI reviewed the available wind data record. The most complete wind records available to the study are from 2006 and 2007. Comparison to previous years indicate that these two years follow fairly typical patterns, although 2006 encompassed cyclonic events in March and April, and 2007 had higher than average winds in January. In addition to the tides, the main climatic conditions governing the sediment plume dispersion are related to winds and waves. The waves are well correlated to the local winds, and the scenario selection can thus be based primarily on the winds and the resulting net currents.

The Onslow area has dominant summer and winter conditions for wind driven net currents that cause the sediment plumes to travel in a predominant direction according to season. A number of scenarios with best estimates of "representative (A)" and "strong (B)" wind conditions are required to develop an envelope of potential plume impact scale. There is also significant variability throughout the "calm" seasonal period occurring in April and May. Consequently, there are two representative calm periods to capture the variability during this time; one for April, the other for May.

### 5 BPPH Loss Assessment – Dredging & Material Placement

Based on a review of model simulated currents, the periods listed in Table 5-4 below have been selected to define six climatic scenarios using real wind data for the month of the period shown in the table.

**Table 5-4 Selected climatic scenarios**

Season condition	Period
Summer A	January 2007
Summer B	February 2007
Winter A	June 2007
Winter B	July 2007
Transition A	April 2007
Transition B	May 2007

The other important parameters governing the model outputs for the plume dispersion and impact assessment are the release volume and sediment characteristics introduced from the dredging. As indicated earlier, the dredge and release scenarios will remain uncertain until actual dredging has commenced. However, estimations of the potential sediment release rates for the Project have been provided by LWI/DHI based on their review of local geotechnical data and their extensive experience in alteration of sediment characteristics by dredges. Justification of the sediment spill rates used in the modelling is presented in DHI (2010a).

The characteristics of the material to be dredged in terms of fines content and settling velocities are critical for the sediment release and potential impacts. This has been assessed from soil investigations for granular (non-cohesive) material, but is not well defined for the weak rock types present at the Project site. The disintegration of the material and the release of sediments will be highly dependent upon the equipment type and the strength of the material to be dredged. In addition, the soil properties vary along the channel and for different depths. Correspondingly significant variations in release rates will therefore be experienced during the dredging program. The highest production and associated release rates from the dredging activities are expected from the loose, granular material (denoted “sand” in the DDP (LWI 2010)). To maintain conservatism and capture the highest sediment release rates for the EIA, the simulated scenarios have concentrated on the release rates corresponding to granular material (sand) along the entire dredge corridor.

For this assessment, two release rates have been selected. One (termed LOW) is considered by LWI to be a realistic estimate of “most probable” sediment release from the proposed program. The other (termed HIGH) is considered to be a conservative “worst case” over-estimate of likely sediment release rate by DHI.

The “realistic” release rates, combined with the high production rates (assuming “sand”) throughout a month of dredging, represent the best estimate of the sediment source that will leave the immediate dredge area in suspension. This estimate leads to conservative but realistic impacts over extended periods of time. The “worst case” release rates, combined with the high production rates, represent sediments leaving the work area in suspension that can occur during shorter periods of time with non-favourable combinations of climatic, dredge and soil conditions. Maintaining these rates for a full month as included in the simulations is considered highly conservative. The “worst case” release rates

## 5 BPPH Loss Assessment – Dredging & Material Placement

are thus used to derive impact zones that show the limits for impacts in a worst case scenario with no mitigation.

All selected climate scenarios have been modelled twice; once using the LOW release rate, the other using the HIGH release rate.

In accordance with advice presented in EAG 3 that proponents should present the most realistic case for assessment, it is proposed to base this impact assessment on the findings of the simulations arising from the conservative realistic (low) release rates (i.e. strong winds in summer and winter, and calms during the transition season). Justification of this approach is provided in the DHI (2010d).

The **dredging scenarios** are derived from the DDP (LWI 2010) referred to in Section 5.2 which is summarised earlier in this section, and information on sediment characteristics at the site from the geotechnical study (Coffey Geotechnics 2009). The dredge plan has been evolving as the Project design progresses and more geotechnical information is becoming available from the site. As a result several rounds of interim modelling have been carried out for development of the modelling and impact matrix presented later in this impact assessment.

For the purposes of providing discreet spatial scenarios, DHI have divided the PLF and navigation channel into five sections. These sections take into consideration the bathymetry, adjoining BPPH and likely dredging operations. Four sections each 4.5 km long have been defined for the PLF navigation channel (with some overlap between the sections). Figure 5-2 presents the location of the channel sections. For the PLF navigation channel, the TSHD operation in sand leads to the highest release rates and is likely to determine the impact zones. The dredge distance per cycle for this activity is assumed to be 4.5 km based on the cycle information from the DDP (LWI 2010) and a dredging speed of 1 m/s. The PLF is defined as Section 5, half the distance based on a turn-around approach.

As indicated previously, there will be a range of dredging plant operating concurrently during some parts of the dredging program. It is therefore important to simulate the results of all concurrent sets of activities on SSC in local waters.

5 BPPH Loss Assessment – Dredging & Material Placement

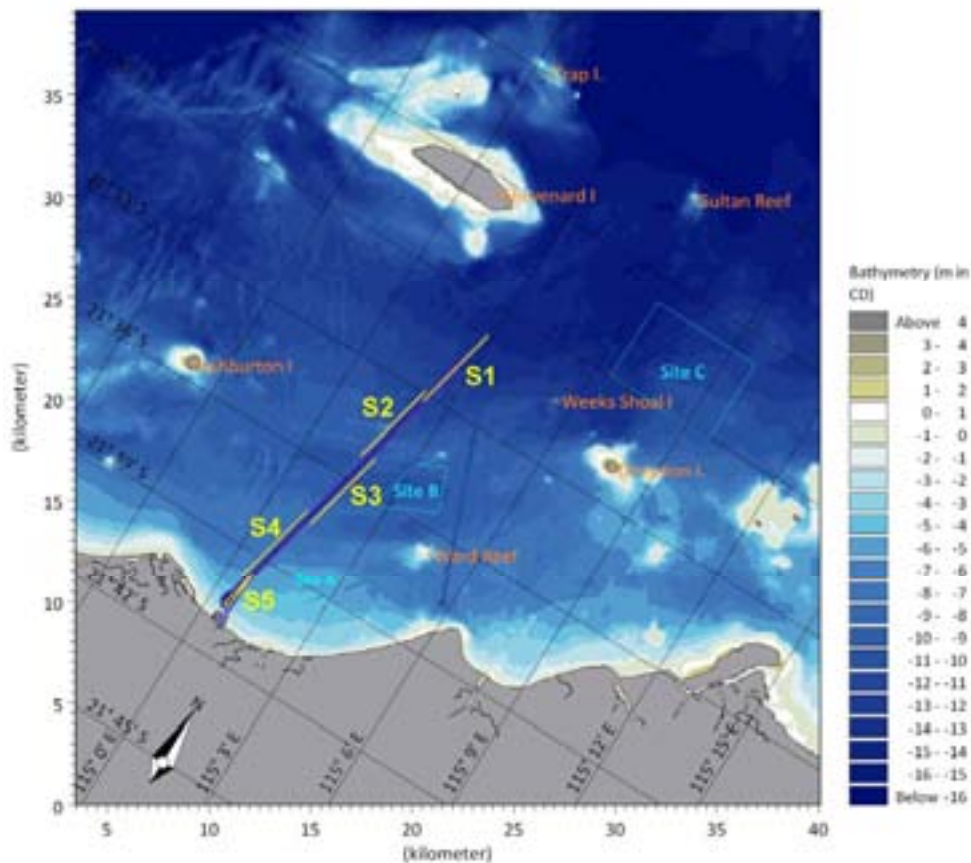


Figure 5-2 DHI definition of PLF navigation channel dredge sections (1 – 4) and PLF section (5).

Based on the DDP (LWI 2010), seven base dredge scenarios were established to cover the main planned dredging activities in the nearshore and offshore areas (Table 5-5). An additional scenario, 7A, was also developed to illustrate operational mitigation of plumes developed in the critical Section 2 adjacent to the coral shoals of the PLF navigation channel. This scenario has been “optimised” to manage the scale of impact on the adjacent shoals by establishing a “restricted-overflow” zone in this section of the channel. The seven base and one “optimised” mitigation scenarios are outlined in Table 5-5, with further details for each scenario in the following subsections.

The dredge plan has therefore been separated into seven major pieces of work, each representing the proposed activity at a particular stage of the dredge plan and at different locations along the channel alignment. Each scenario has been modelled for the six climatic scenarios described earlier, for both low and high release rates, which corresponds to 84 simulations (i.e., 2 release rates x 6 climate scenarios x 7 dredging scenarios). A detailed description of the release rates used and all assumptions adopted for modelling is provided in the DHI (2010a).



BPPH Loss Assessment

5 BPPH Loss Assessment – Dredging & Material Placement

Table 5-5 Summary of dredging scenarios modelled by DHI.

Dredge Scenario No.	Dredging Activity Description	
	Nearshore Dredging	Offshore Dredging
1	#1: CSD dredging of barge access channel with placement at site A through bottom diffuser.	
2	#2: CSD dredging in PLF berth pocket loading barges at -3m LAT contour on western side of MOF channel in the PLF basin.	
3	#3: CSD dredging in MOF area loading barges at -3m LAT contour on western side of MOF channel in the PLF basin.	#4: 5,000 m <sup>3</sup> TSHD dredging in inner part of PLF approach channel Section 4 with placement at site C
4	#5: 10,000 m <sup>3</sup> TSHD dredging weak rock in PLF (Section 5) with placement at site C	#6: 10,000 m <sup>3</sup> TSHD dredging sand along PLF approach channel Section 1 with placement at site C
5		#6: 10,000 m <sup>3</sup> TSHD dredging sand along PLF approach channel Section 3 with placement at site C #6: 10,000 m <sup>3</sup> TSHD dredging weak rock in approach channel Sections 1 and 2 with placement at site C
6		#6: 10,000 m <sup>3</sup> TSHD dredging sand along PLF approach channel Section 4 with placement at site C #6: 10,000 m <sup>3</sup> TSHD dredging weak rock in along approach channel Sections 3 and 4
7		#6: 10,000 m <sup>3</sup> TSHD dredging sand along PLF approach channel Section 2 with placement at site C
7A Optimised		#6: 10,000 m <sup>3</sup> TSHD dredging sand along defined "no overflow" zone at PLF approach channel Section 2 with placement at site C. Dredger starts each dredge cycle at centre of "no overflow" zone and dredges along the channel towards shore and offshore on alternate cycles.

Figure 5-3 to Figure 5-10 show the location of dredge and dredged material placement activity simulated for each of the eight scenarios described in Table 5-5.



### 5 BPPH Loss Assessment – Dredging & Material Placement

#### Dredging Scenario 1

- Nearshore dredging in the temporary access channel by CSD pumping to placement at site A.

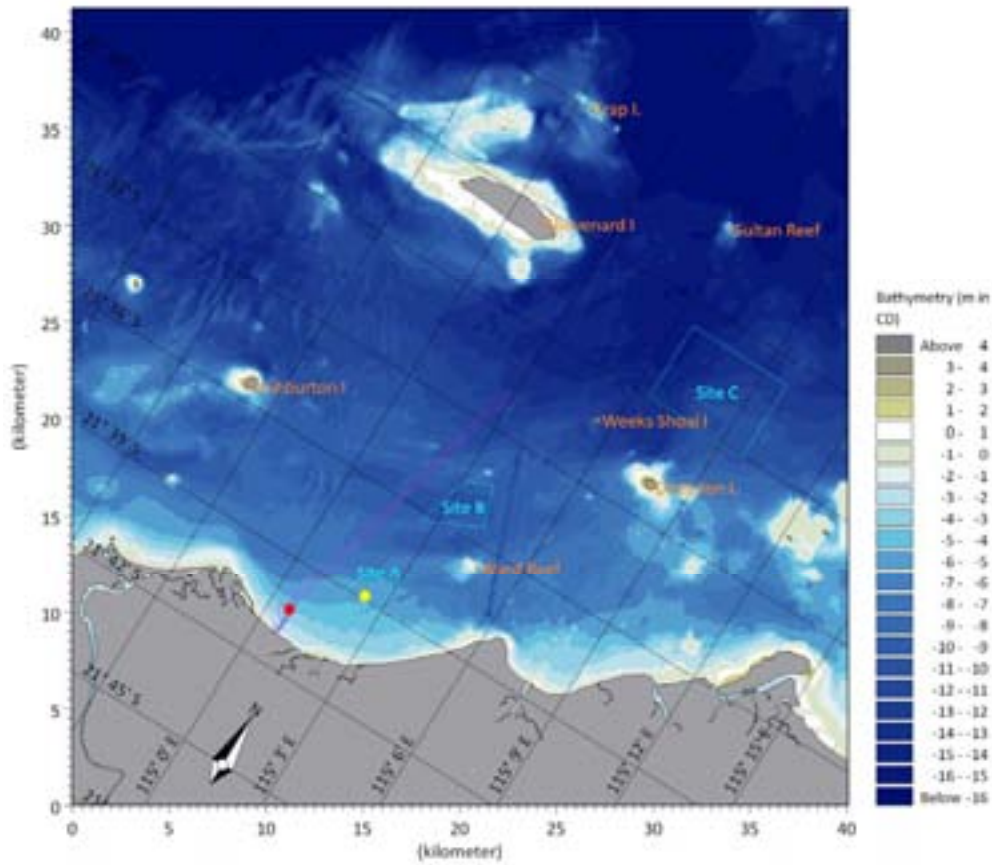


Figure 5-3 Sketch of locations for Dredging Scenario 1 - dredge locations and placement sites are highlighted in red and yellow, respectively.

BPPH Loss Assessment

## 5 BPPH Loss Assessment – Dredging & Material Placement

### Dredging Scenario 2

- Nearshore dredging in the PLF turning basin by CSD pumping to the hopper barges located at -3m LAT for transport and placement of dredged material to site C.

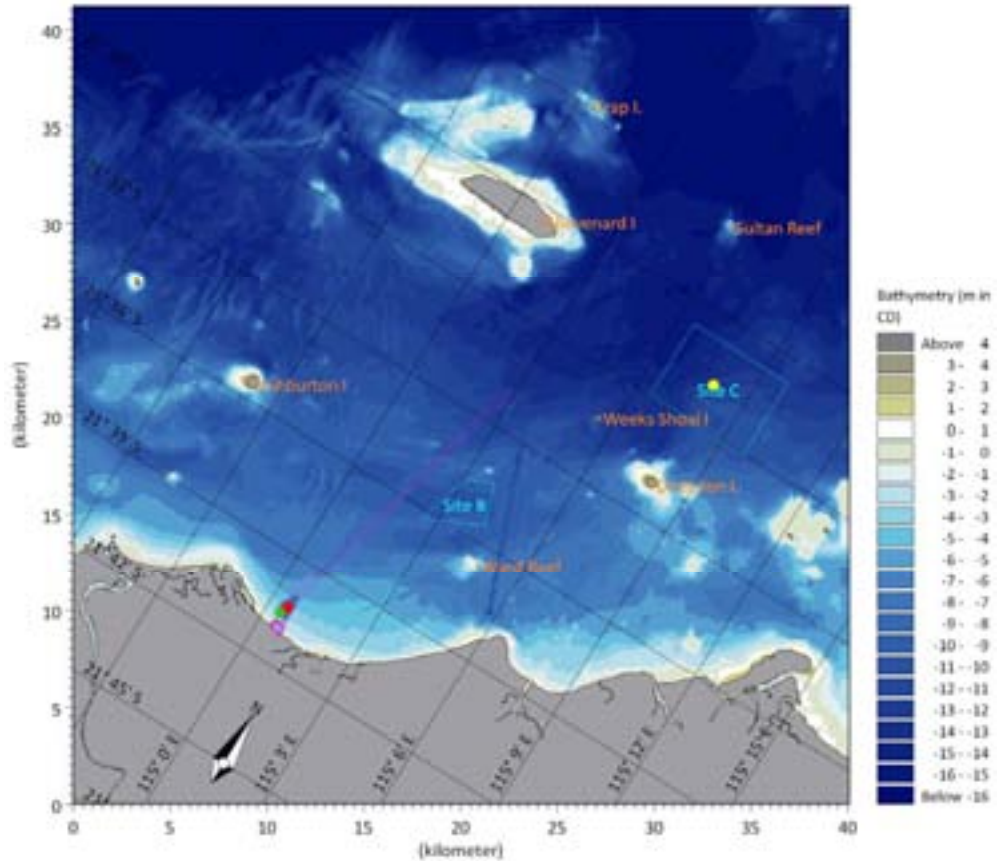


Figure 5-4 Sketch of locations for Dredging Scenario 2: CSD dredging at red dot with loading of barges at green dot. Placement to site C at yellow dot.

### 5 BPPH Loss Assessment – Dredging & Material Placement

#### Dredging Scenario 3

- Nearshore dredging in the MOF basin by CSD pumping to the hopper barges located at -3m LAT for transport and placement of dredged material to site C; plus
- Offshore dredging by the 5,000m<sup>3</sup> TSHD in Section 4 of the PLF navigation channel and placement of dredged material to site C.

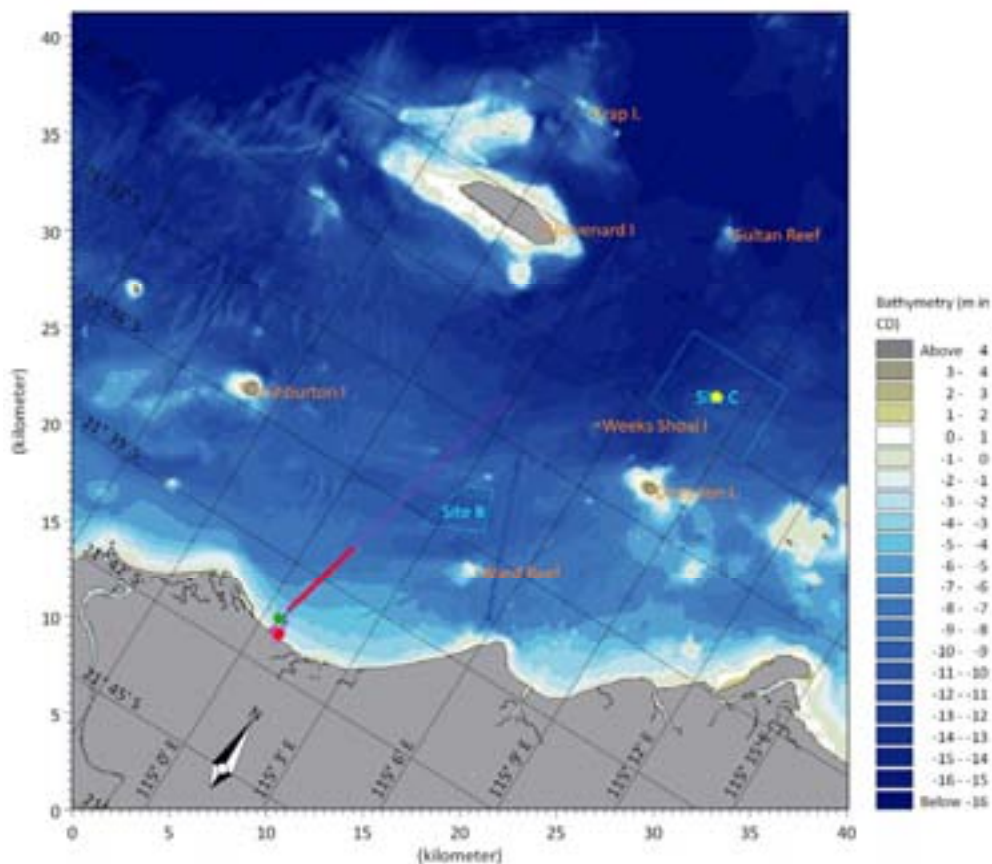


Figure 5-5 Sketch of locations for Dredging Scenario 3: CSD dredging at MOF (red dot) with pumping to barges at -3m LAT contour with overflow (green dot) and transport to placement site C (yellow dot); 5,000 m<sup>3</sup> TSHD dredging Section 4 (red line).

BPPH Loss Assessment

### 5 BPPH Loss Assessment – Dredging & Material Placement

#### Dredging Scenario 4

- Nearshore dredging of weak rock in the PLF basin by 10,000 m<sup>3</sup> TSHD and placement of dredged material to site C; plus
- Offshore dredging of sand in the PLF navigation channel by 10,000 m<sup>3</sup> capacity TSHD with placement of dredged material to site C.

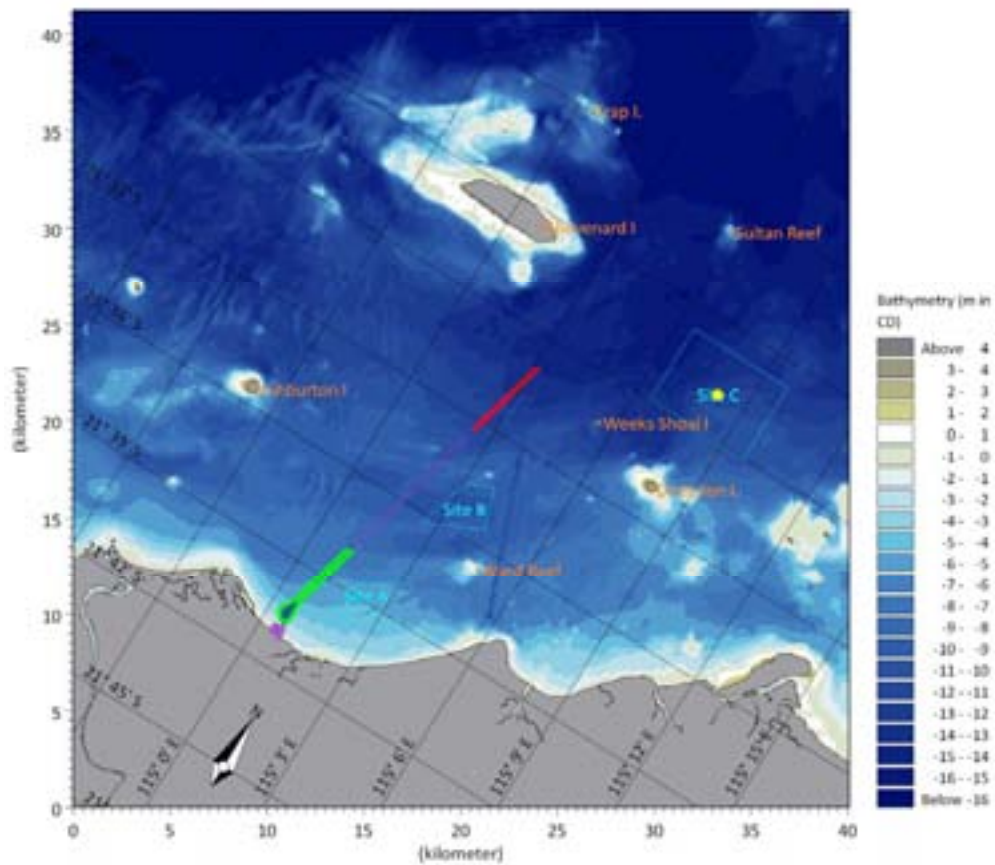


Figure 5-6 Sketch of locations for Dredging Scenario 4: 10,000m<sup>3</sup> TSHD dredging weak rock in PLF Sections 4 and 5 (green line) and 10,000m<sup>3</sup> TSHD dredging sand at PLF navigation channel Section 1 (red line); placement at site C (yellow dot).



### 5 BPPH Loss Assessment – Dredging & Material Placement

#### Dredging Scenario 5

- Nearshore dredging of sand in the PLF navigation channel by 10,000 m<sup>3</sup> TSHD with placement of dredged material to site C; plus
- Offshore dredging of weak rock in the PLF navigation channel by 10,000 m<sup>3</sup> TSHD with placement of dredged material to site C.

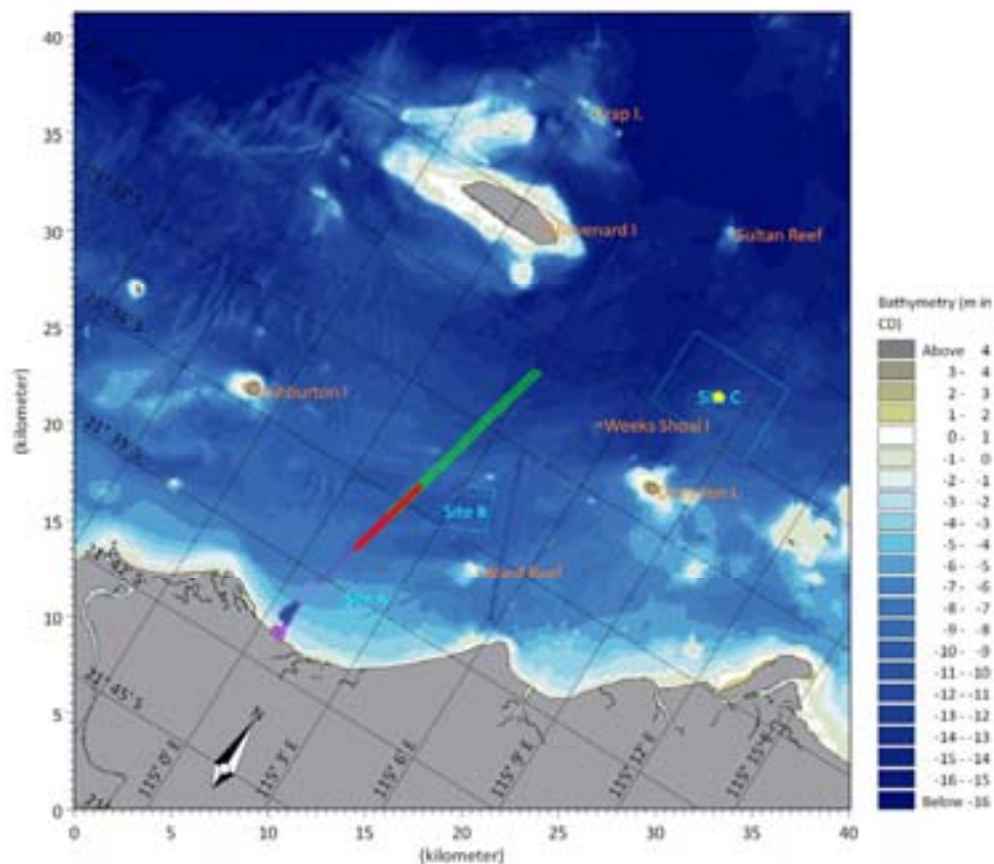


Figure 5-7 Sketch of locations for Dredging Scenario 5: 10,000m<sup>3</sup> TSHD dredging weak rock in PLF Sections 1 and 2 (green line) and 10,000m<sup>3</sup> TSHD dredging sand at PLF navigation Channel Section 3 (red line); placement at site C (yellow dot).

BPPH Loss Assessment

### 5 BPPH Loss Assessment – Dredging & Material Placement

#### Dredging Scenario 6

- Offshore dredging of sand in the PLF navigation channel by 10 000 m<sup>3</sup> TSHD; placement at site C; plus
- Offshore dredging of weak rock in the PLF navigation channel by 10 000 m<sup>3</sup> TSHD; placement at site C.

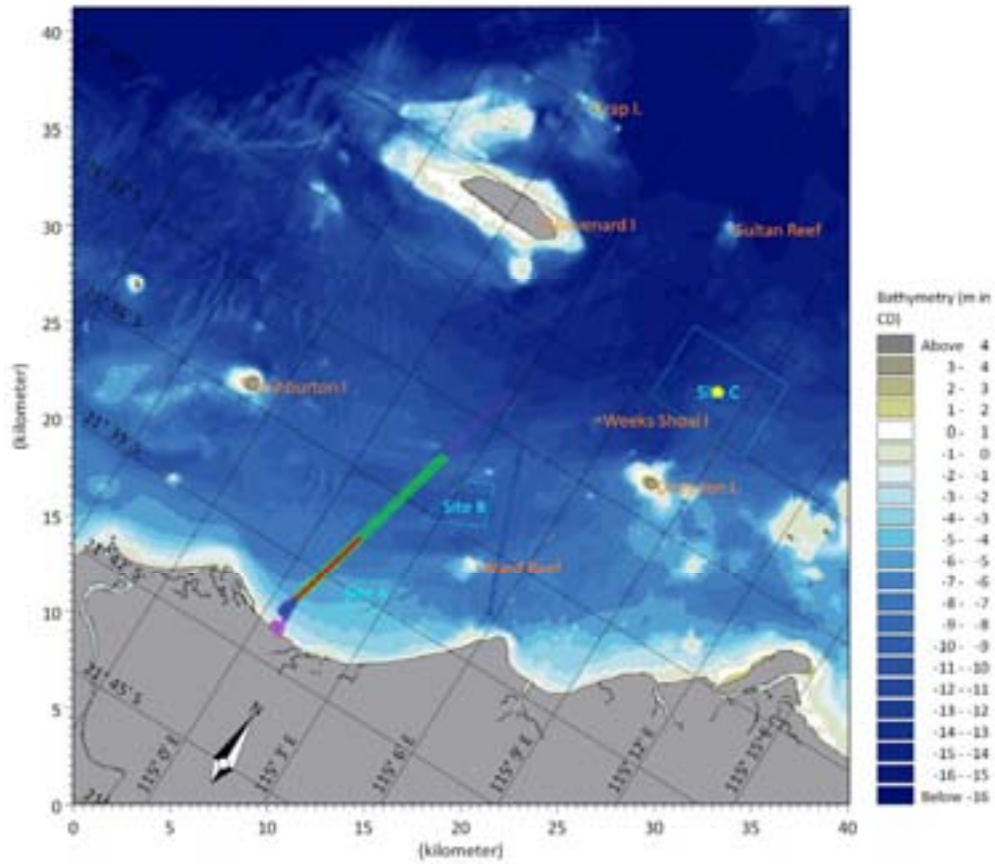


Figure 5-8 Sketch of locations for Dredging Scenario 6: 10,000m<sup>3</sup> TSHD dredging weak rock in PLF Sections 3 and 4 (green line) and 10,000m<sup>3</sup> TSHD dredging sand at PLF approach Section 4 (red line); placement at site C (yellow dot).



BPPH Loss Assessment

### 5 BPPH Loss Assessment – Dredging & Material Placement

#### Dredging Scenario 7

- Offshore dredging of sand in the PLF approach channel by 10,000 m<sup>3</sup> TSHD; placement at site C.

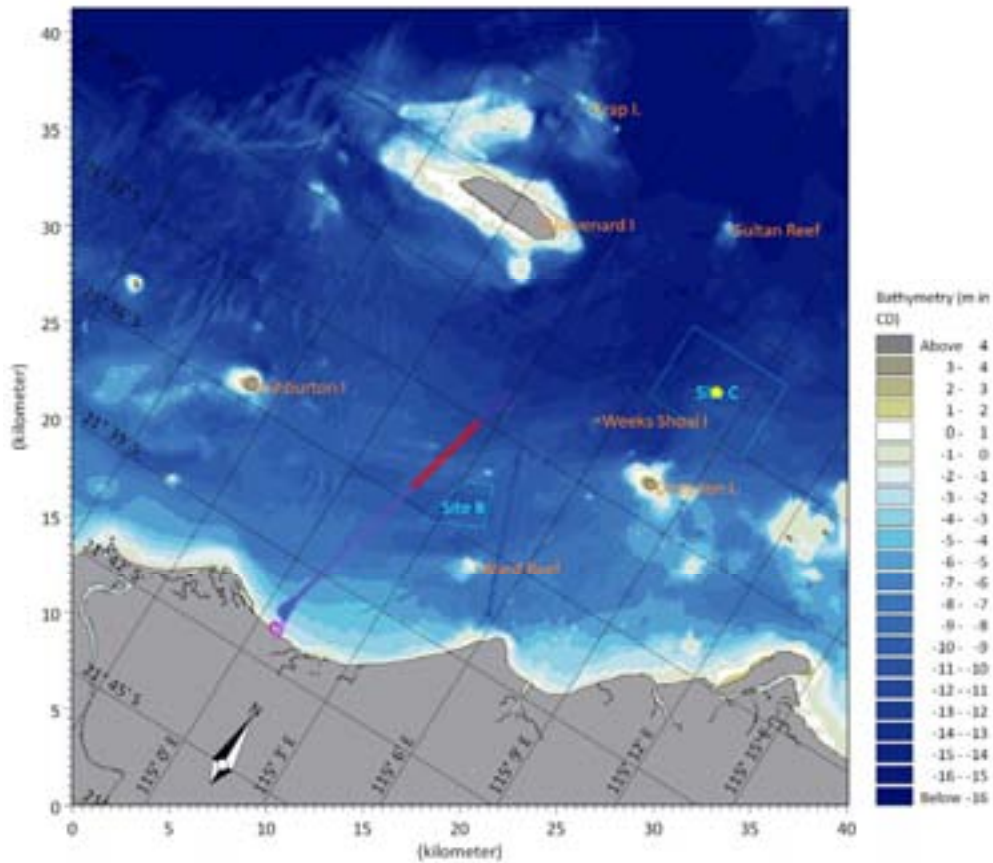


Figure 5-9 Sketch of locations for Dredging Scenario 7: 10,000m<sup>3</sup> TSHD dredging sand at PLF approach Section 2 (red line); placement at site C (yellow dot).



BPPH Loss Assessment

## 5 BPPH Loss Assessment – Dredging & Material Placement

### “Optimised” Dredging Scenario 7A

- 10 000 m<sup>3</sup> TSHD dredging sand with placement of dredged material at site C; plus
- Dredging along Section 2 and parts of Sections 1 and 3 with operational mitigation to manage overflow in “no overflow” zone.

For each dredge cycle, the TSHD starts dredging at the centre of the “no overflow” zone within Section 2. It takes 25 minutes, corresponding to a sailing distance of 1.5 km for a speed of 1 m/s (approximately 2 knots), before overflow starts. The dredger keeps dredging for another 3 km with overflow. The dredger dredges towards south and north on alternate trips. This leads to a 3 km section with no overflow with 3 km with overflow on each side, i.e. the total channel section being dredged is 9 km.

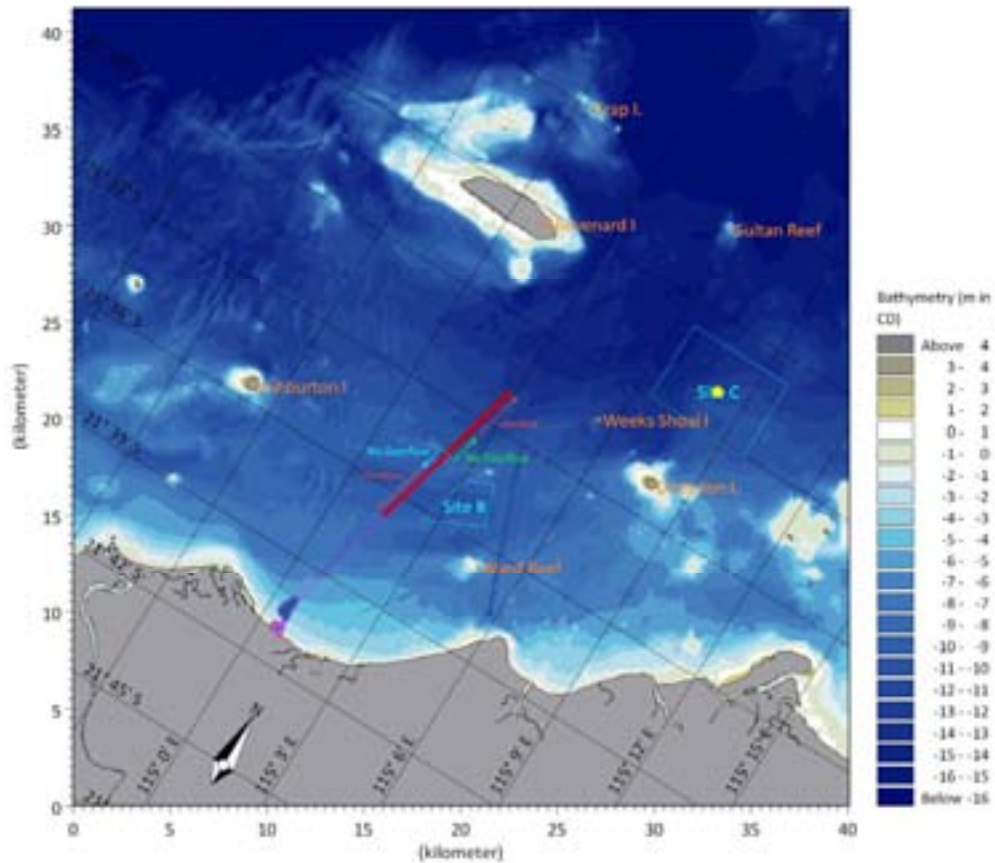


Figure 5-10 Sketch of locations for Dredging Scenario 7A: TSHD starting in centre of red area, dredging towards or away from shore on alternate trips with initial 1.5 km section with no overflow followed by 3 km with overflow; placement at site C (yellow dot).



## 5 BPPH Loss Assessment – Dredging & Material Placement

### 5.4.5 Short-term scenario modelling results

Plume modelling results for the 96 short term scenarios which have been simulated are presented in DHI (2010a). This report presents a selection of some of the scenarios which have the largest and most concentrated plumes, or plumes which impact on sensitive receptors. These scenarios include Dredge Scenario 3 and Dredge Scenario 7 as well as the optimised Dredge Scenario 7A.

Recall that Dredge Scenario 3 is associated with the offshore placement base case, with two dredges (a CSD and small TSHD) working in close proximity to each other in the nearshore. Dredge Scenario 7 is associated with a large TSHD working in sand adjacent the coral shoals which occur along the 10 m isobath. These two scenarios are responsible for most of the dredging related BPPH impacts presented later in Section 5.5. Results from Dredge Scenario 7A have been presented to highlight the potential environmental benefit that can be achieved by incorporating 'no-release' zones into the dredge program. For each of the three dredging scenarios (3, 7 and 7A), the mean SSC for each of the six climate scenarios associated with 'realistic' release rates is presented.

Presented in Figure 5-11 are the results for Dredge Scenario 3. Included in the figure is a depiction of the corresponding dredge scenario (top figure). The results for the mean SSC for the six climate scenarios for Dredge Scenario 3 based on realistic release rates are presented in the lower figures. Results highlight the extension of the sediment plume along the nearshore and to the east of the dredging activities during summer and westward during winter periods. Periods in which localised impacts are maximised (i.e. during the transitional climatic periods) are associated with the highest mean SSC. Elevated levels of SSC in the vicinity of dredge material placement site C are anticipated.

Presented in Figure 5-12 are the results for the six climate scenarios for Dredge Scenario 7 based on realistic release rates. Included in the figure is a depiction of the corresponding dredge scenario (top figure). Results highlight the influence of the prevailing winds during the winter and summer periods. Transitional periods are associated with the highest mean SSC values in close proximity to the channel. Sediment plumes associated with dredging activities in this region are predicted to extend westward to Ashburton Island during the winter period and eastward towards Weeks Shoal during the summer period.

In order to manage the potential for impacts from sediment plumes associated with dredging activities in this region, 'restricted-release' zones have been proposed and modelling undertaken (Dredge Scenario 7A). Presented in Figure 5-13 are the results for the six climate scenarios for Dredge Scenario 7A based on realistic release rates. The effectiveness of the 'no-release' zones is clearly identifiable with reductions in the mean SSC during the winter and summer periods in the vicinity of sensitive receptors.

BPPH Loss Assessment

5 BPPH Loss Assessment – Dredging & Material Placement

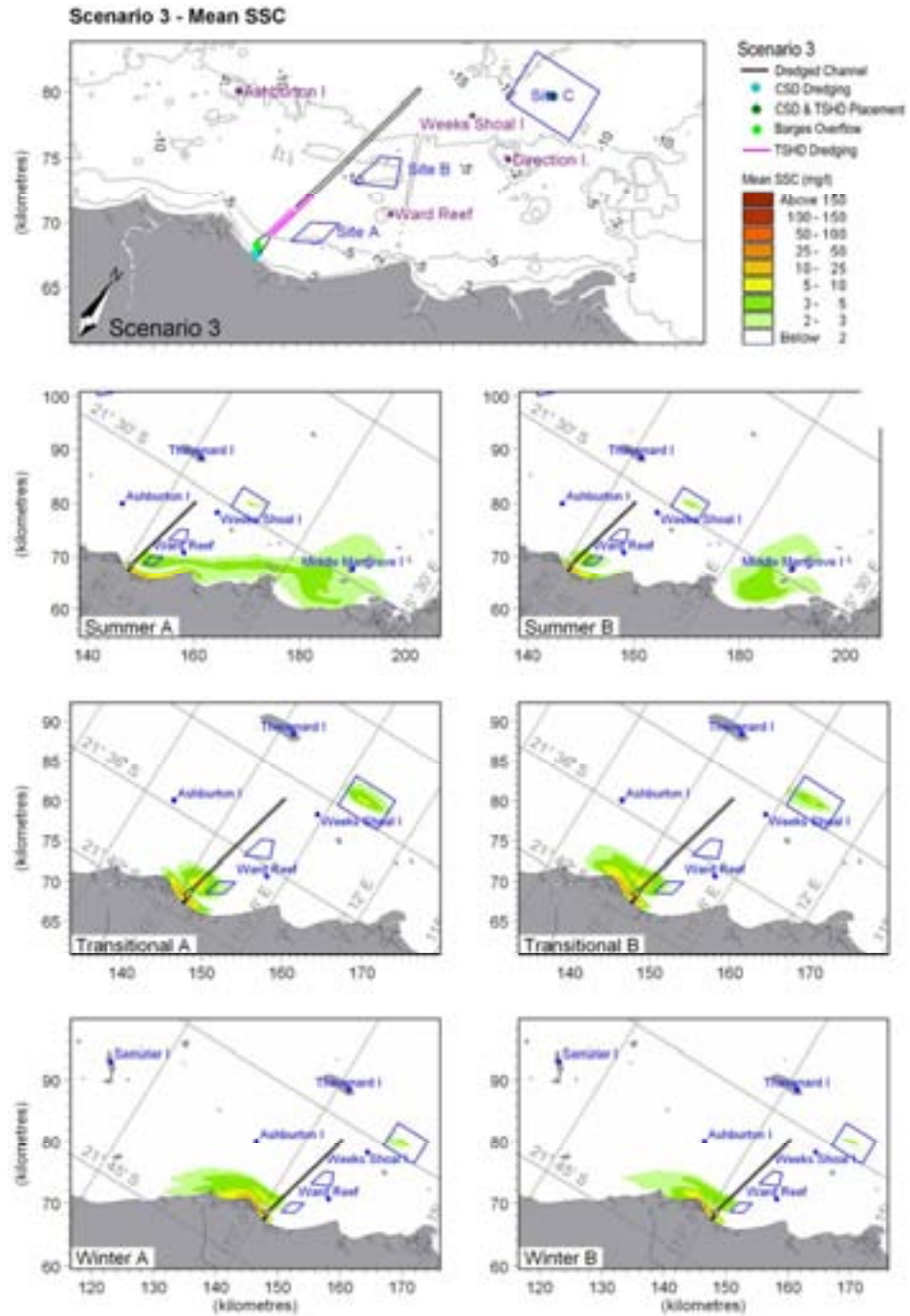


Figure 5-11 Mean SSC for Dredge Scenario 3 with realistic (low) release rates.



BPPH Loss Assessment

5 BPPH Loss Assessment – Dredging & Material Placement

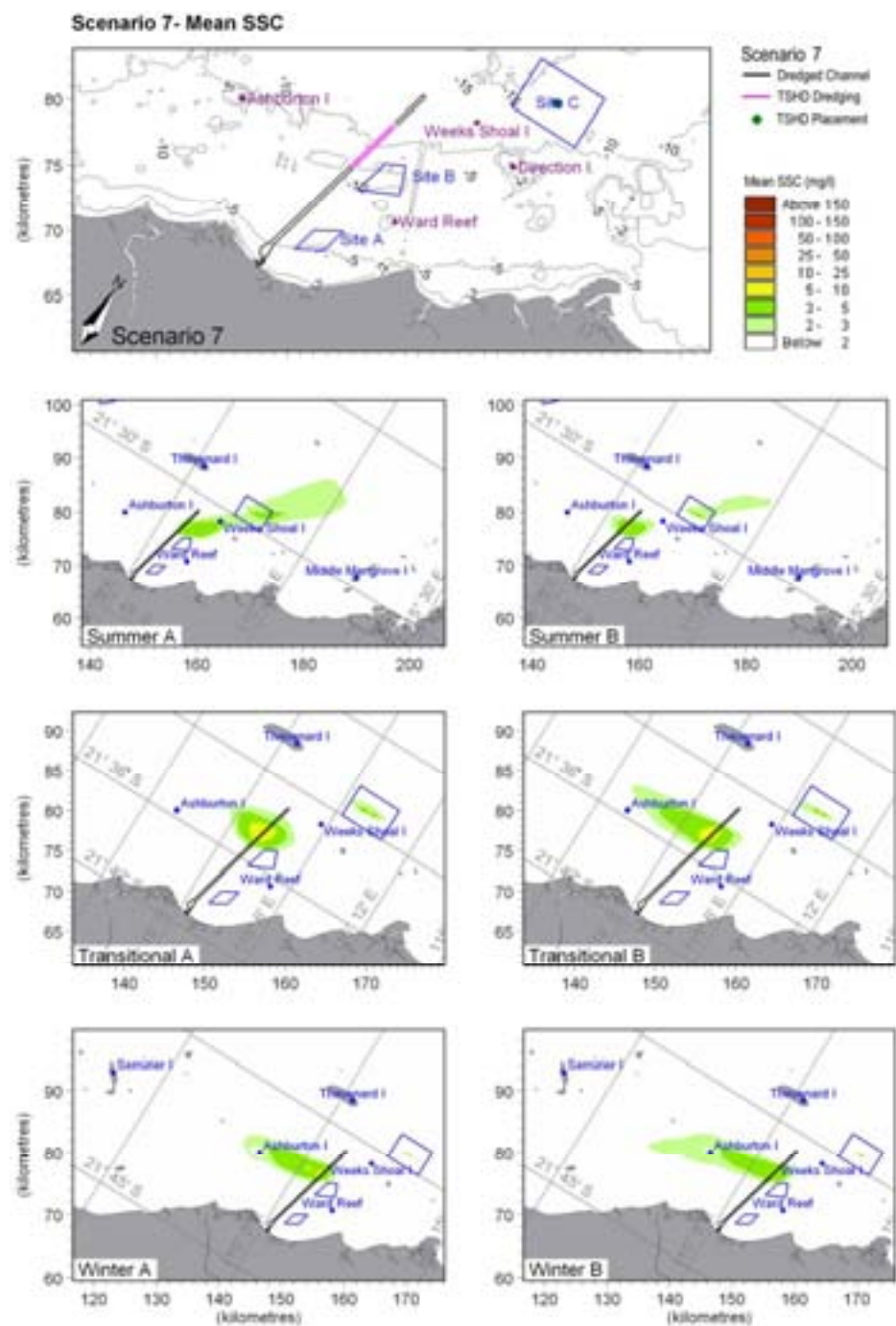


Figure 5-12 Mean SSC for Dredge Scenario 7 with realistic release rates.

BPPH Loss Assessment

5 BPPH Loss Assessment – Dredging & Material Placement

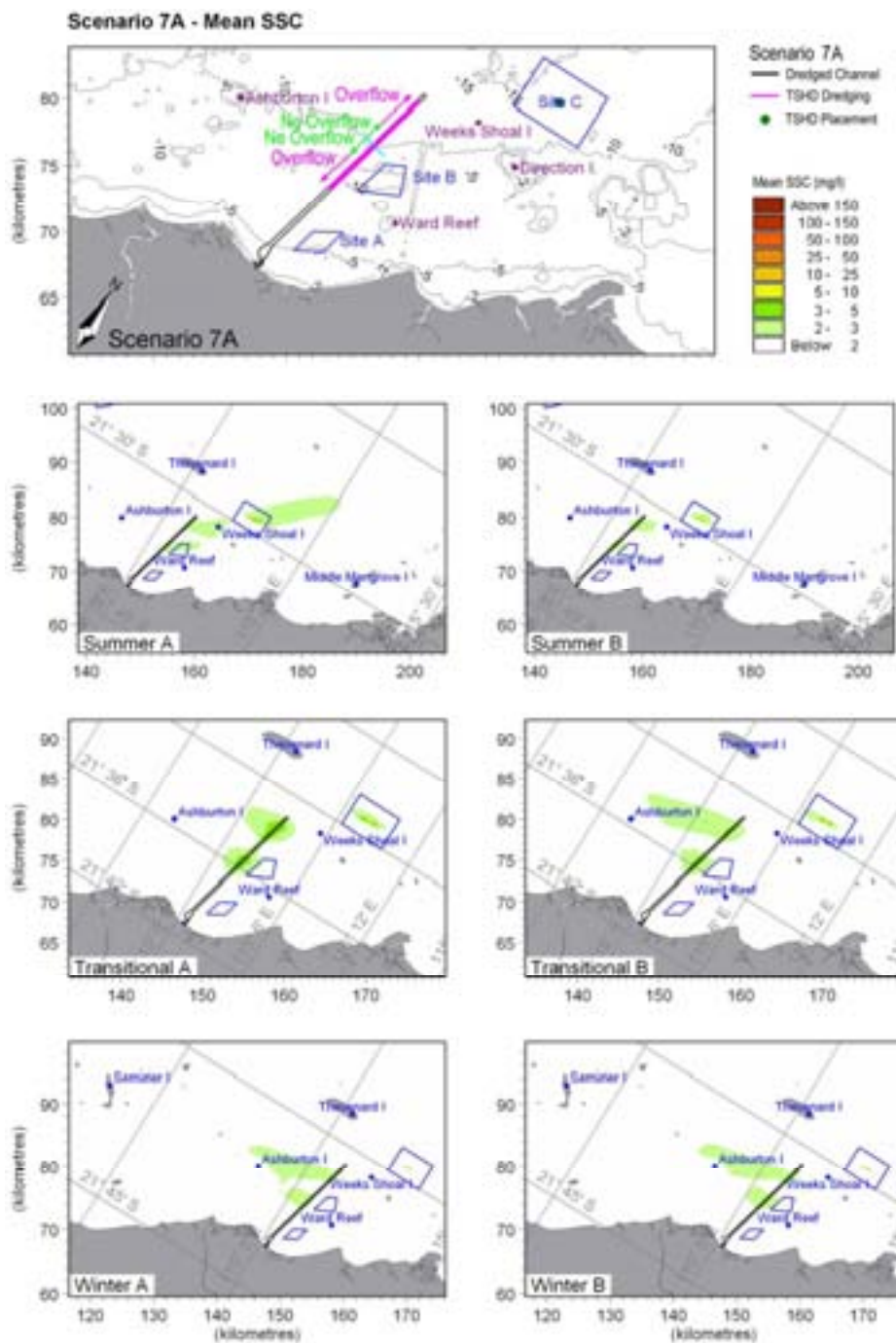


Figure 5-13 Mean SSC for Dredge Scenario 7A with realistic release rates.



## 5 BPPH Loss Assessment – Dredging & Material Placement

### 5.4.6 Representation of the Full Dredge Log Program

As discussed in section 5.4.2, one of the advantages of the scenario approach is the ability to assess the impact of dredging without the need to know in advance the order that the dredge components will be implemented nor the time of year during which these activities are undertaken. Estimates of 'worst-case' impacts associated with the full dredge log program (FDLP) can be inferred from results obtained for each of the individual dredge components.

The first step in developing a representation of the FDLP is to determine the worst-case impacts for each dredge scenario based on a composite of all of the climatic scenarios. With reference to Figure 5-11 for Dredge Scenario 3, a composite of worst-case impacts results from overlaying the results of all six climate scenarios and taking the maximum value at each point within the domain. The result of this analysis is depicted in Figure 5-14 (cf with results presented in Figure 5-11). When interpreting the results presented in the following figures (scenario 7 Figure 5-15, scenario 7A Figure 5-16), it is important to recall that these are not snapshots in time and do therefore not represent the areal extent of the dredge sediment plume at any given time. Instead, these plots are a composite of a number of simulated 14-day periods that have been superimposed to give an estimate of the maximum plume associated with each of the dredge scenarios.

BPPH Loss Assessment

5 BPPH Loss Assessment – Dredging & Material Placement

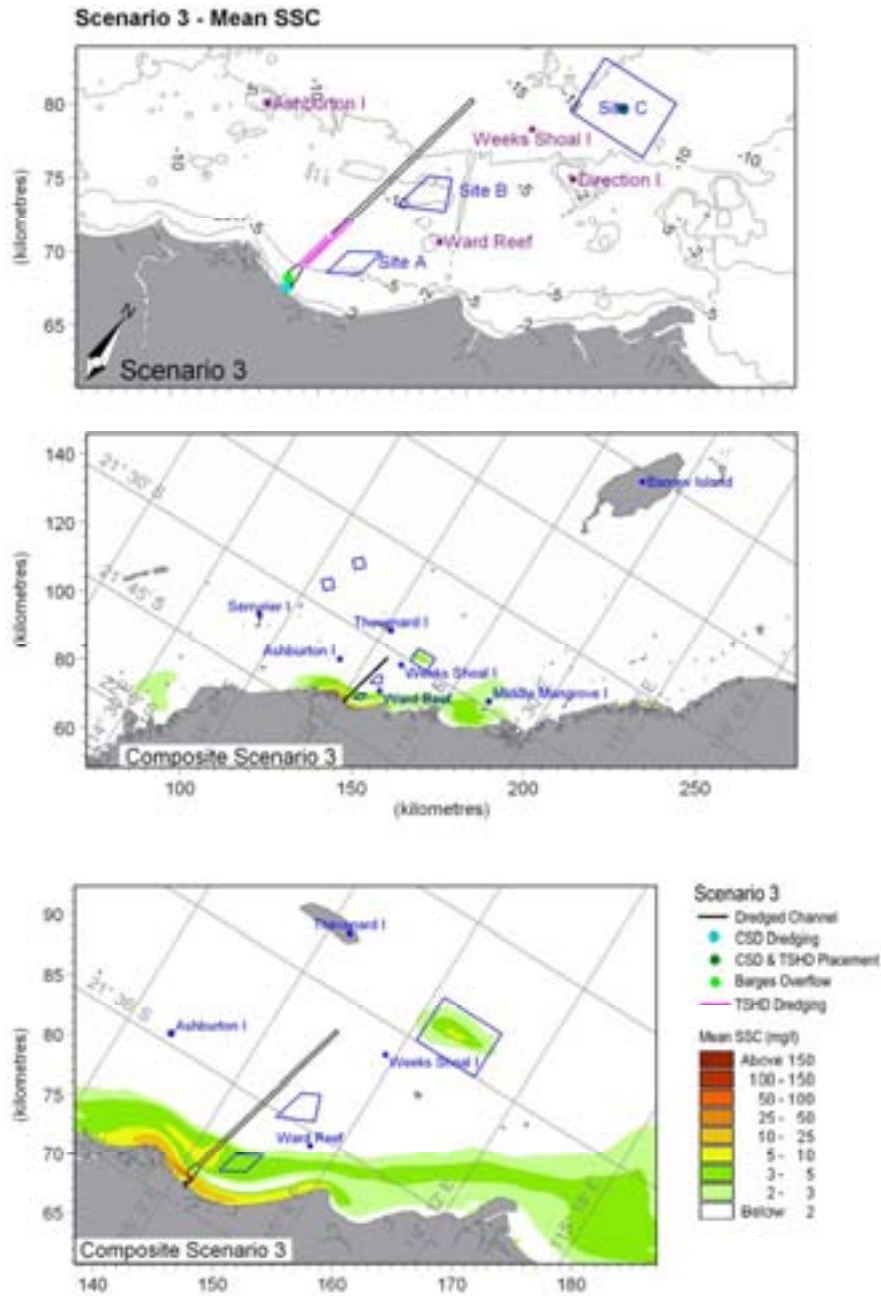


Figure 5-14 Composite of the Mean SSC for Dredge Scenario 3 with realistic release rates (all climate scenarios combined).

5 BPPH Loss Assessment – Dredging & Material Placement

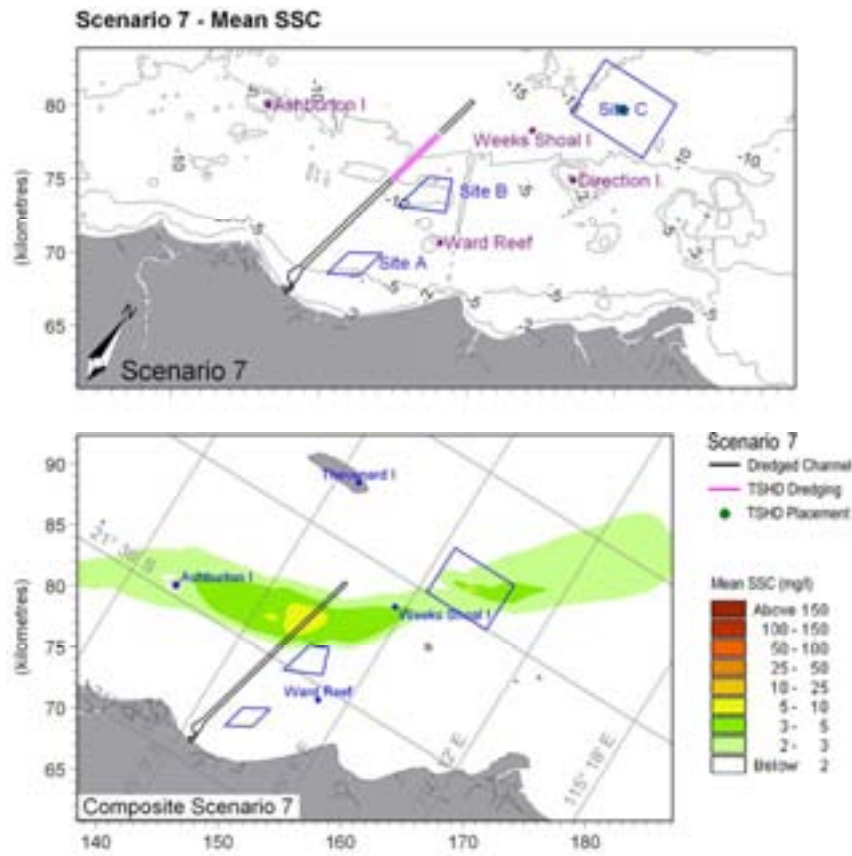


Figure 5-15 Composite of the Mean SSC for Dredge Scenario 7 with realistic release rates (all climate scenarios combined).



5 BPPH Loss Assessment – Dredging & Material Placement

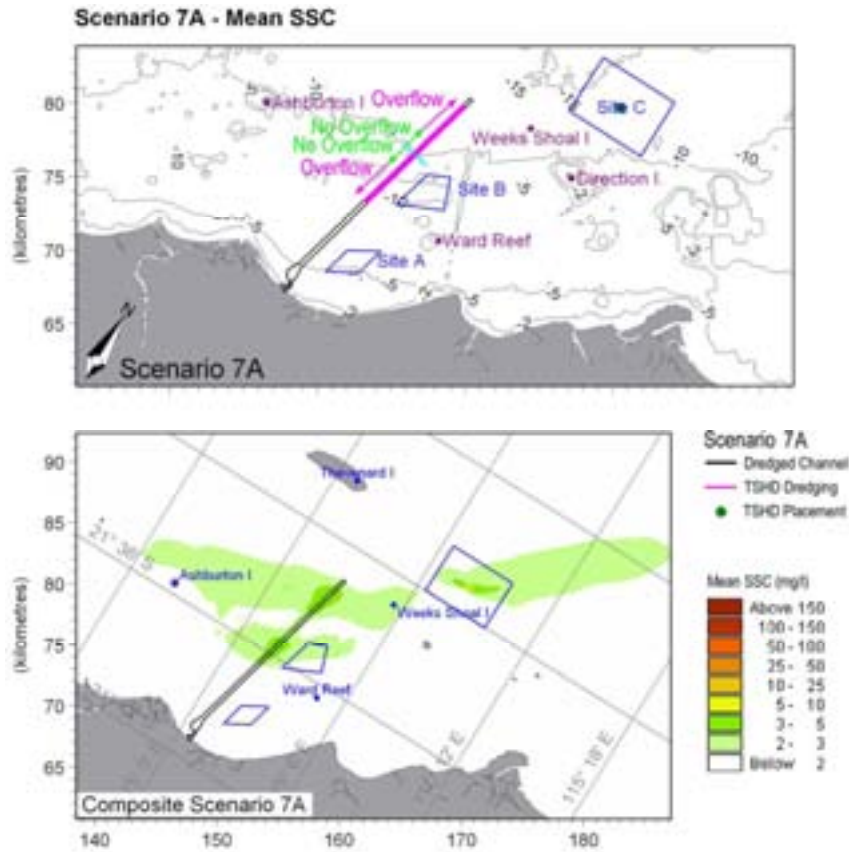


Figure 5-16 Composite of the Mean SSC for Dredge Scenario 7A with realistic release rates (all climate scenarios combined).

Presented in Figure 5-15 and Figure 5-16 are the climate composites for Dredge Scenario 7 (unmitigated) and Dredge Scenario 7A (mitigated option) respectively. The effectiveness of the proposed no-release zones is clearly evident with the reduction in the mean SSC in the vicinity of Ashburton Island and Weeks Shoal.

The final step in developing a representation of worst-case impacts on water quality associated with the FDLP is to combine each of the composites from step 1, for each of the seven dredge scenarios. The resultant plot of worst-case impacts for the mean of the SSC is presented in the top figure of Figure 5-17 for the FDLP based on Dredge Scenario 7 and in the bottom figure for the FDLP based on Dredge Scenario 7A which incorporates no-release zones in areas that may impact on sensitive receptor locations.

5 BPPH Loss Assessment – Dredging & Material Placement

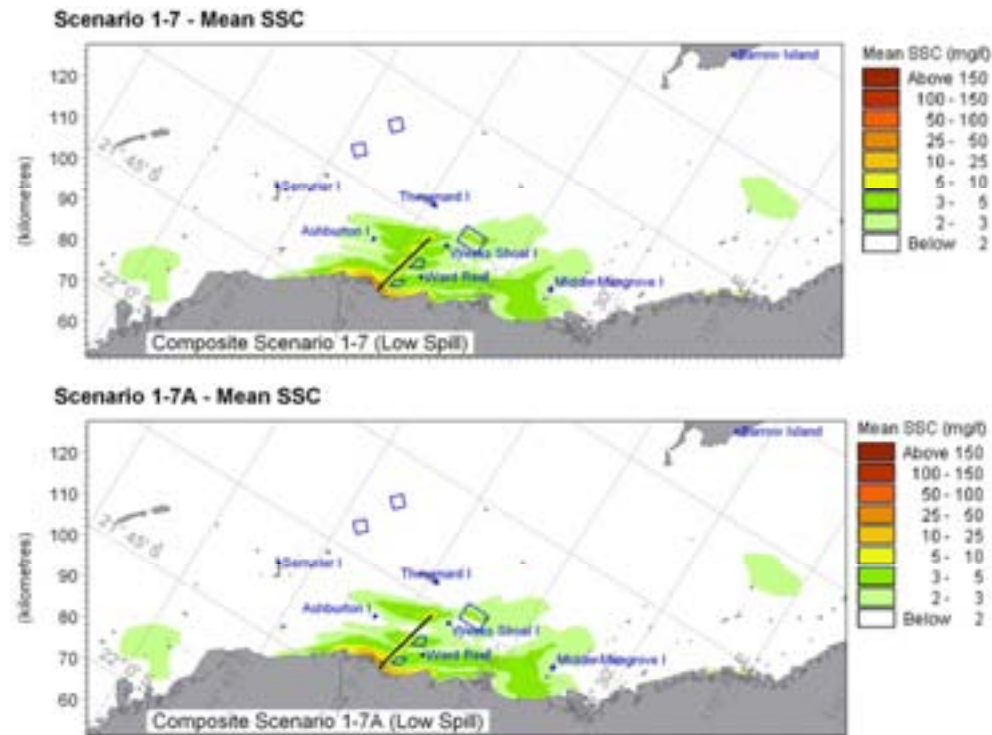


Figure 5-17 Mean excess concentration for the FDLP based on Dredge Scenario 7 (top) and Dredge Scenario 7A (bottom) with realistic release rates.

The composite scenarios provide an overall predicted extent of SSC elevations in marine waters under all scenarios in the Project area due to dredging and dredge material placement. The modelling predicts the most extensive and more intense plumes (5 mg/L SSC) are anticipated in very nearshore waters between Ashburton River and Onslow depending on the season and dredging operations.

Modelling results indicate that:

- There is a strong seasonal plume dispersion pattern in response to seasonal wind strength and direction (towards the west in winter and towards the east in summer). There are fewer sensitive receptors located to the west and there should be scope for managing the dredging program to avoid dredging adjacent to sensitive receptors to the east of the channel during summer. Similarly if all dredged material is placed offshore then impacts could be managed by undertaking this work during winter rather than summer.
- The most intense plumes (and hence most potentially damaging) occur during calm transition periods when dispersion remains very localised. There is a high risk of sedimentation to two coral shoals immediately adjacent to the approach channel during such periods.
- Suspended sediment plumes will travel furthest in nearshore waters, in response to the higher wind driven nearshore currents and resuspension by waves in the shallower waters. During summer, nearshore turbidity plume excursions to the east are likely to extend upwards of 50 km from the

## 5 BPPH Loss Assessment – Dredging & Material Placement

dredging area, whilst excursions at the placement site C are closer to 35 – 40 km. Similarly plumes during winter are expected to travel up to 70 km to the west of the dredging operation.

- Waters in the vicinity of Onslow will undergo seasonal increases in turbidity over a period of at least three years as a result of the proposed dredging program.

### 5.5 Dredging induced impacts on BPPH

#### 5.5.1 Scope of works undertaken

A substantial amount of work has been undertaken by DHI to deliver the zones of various impact levels arising from the dredging program required to enable assessment of impacts to subtidal BPPH in the Project area. This work includes:

- An extensive review of literature to summarise the current understanding of the tolerances of relevant receptors to the impacts of suspended sediments, reduced light and sedimentation. Receptors investigated were corals, filter feeders (sponges and seafans), seagrasses, macroalgae and mangroves.
- The findings of the general literature review were then combined with DHI's extensive experience of monitoring major dredging and reclamation projects in SE Asia, in order to develop end receptor tolerance limits for BPPH in the Project area (DHI 2010b). Different Tolerance limits were derived for corals, seagrass and mangroves. The coral limits were then used as a proxy for filter feeders, and seagrass limits were used as a proxy for macroalgae as corals and seagrasses were considered to be the more sensitive organisms. These tolerance limits were also compared to those established by previous projects in Western Australia (based primarily on literature review) to confirm that the DHI limits were of similar magnitude (DHI 2010b).
- Application of these tolerance limits to the latest iteration of sediment plume model results summarized in Section 5.4.5 above and presented in DHI (2010a) to derive impact zones. The results of this work are presented in the DHI (2010d). The impact zones have been derived from the 14 day scenario modelling described earlier in Section 5.4.5.

The impact zones derived by DHI were subsequently overlaid onto both the BPPH distribution map and the LAU boundary chart by GIS and the area of BPPH loss within each affected LAU calculated for each principal BPPH using ARCVIEW GIS Software.

The remainder of this section summarises the key assumptions and findings of DHI (2010d).

#### 5.5.2 Definition of Impact Zones

The scale of impacts anticipated in each impact zone is defined in Table 5-6. These definitions are based on advice provided by the Office of the EPA (OEPA) (R. Tregonning, OEPA. *pers. comm.* 2009).

## 5 BPPH Loss Assessment – Dredging & Material Placement

Table 5-6 Impact classification categories.

Zone	Definitions
Zone of Total Mortality	An area within which key receptors (BPPH) are predicted to suffer total or almost total mortality, and where loss of structural function is predicted to occur.
Zone of Partial Mortality	An area within which key receptors (BPPH) are predicted to suffer partial mortality (up to 50 % loss close to the channel and <1% loss at the extremes). Mortality will occur within the area, but will not include all individuals. The outer border will be drawn so that no mortality will be predicted to occur immediately outside of this zone.
Zone of Influence	Outside the outer boundary of the Zone of Partial Mortality there may be influence from the dredge plume at low levels (for example sub-lethal impacts on key receptors, turbidity may be visible or very light sedimentation may occur) but this is predicted to be unlikely to have any material and/or measurable impact on the key receptors.
No Impact	Beyond the outer boundary of the Zone of Influence, there will be an unbounded area where there is no detectable influence from the dredging. This area would be suitable for locating a reference site.

### 5.5.3 Definition of tolerance limits

To develop the tolerance limits an extensive review of literature was conducted to summarise the current understanding of the tolerances of relevant receptors to the impacts of suspended sediments, reduced light and sedimentation. Receptors investigated were corals, filter feeders (sponges and seafans), seagrasses, macroalgae, and mangroves.

There is a growing body of evidence from field studies showing that turbidity and sedimentation can degrade BPPH (coral reefs and seagrass meadows in particular) at local scales (e.g. Cabaco *et al.* 2008, Cooper *et al.* 2007, Erfteimeijer and Lewis 2006, Fabricius 2005, Fabricius *et al.* 2007, Gilmour *et al.* 2006). The main potential impact pathways are light reduction and/or scouring due to elevated suspended sediments concentrations in the water column, and smothering due to increased sedimentation rates.

Based on the findings of the literature review and DHI's previous monitoring experience, mangroves can be classified as highly tolerant to the magnitude of sedimentation and suspended sediments typically generated from dredging activities, while seagrass and macroalgae can be considered as moderately tolerant, with a relatively short recovery time. However, coral reefs and benthic filter feeder communities are quite sensitive to suspended sediment and sedimentation loading, and their recovery from impacts is not rapid. Therefore, coral reefs and benthic filter feeder communities were assessed as the most sensitive habitats in the Project area with respect to indirect impacts from the proposed dredging activities.

The findings of the general literature review were compared with limits set for previous dredging projects in WA, as well as limits previously developed by DHI for major dredging and reclamation projects in South East Asia, in order to develop end receptor tolerance limits for the Project (DHI 2010b; 2010c). The limits were specifically developed to capture the complex relationship between the intensity, duration and frequency of exposure. In line with good EIA practice, a conservative approach was taken in setting the tolerance limits, basing the limits on the most sensitive BPPH recorded in the Project area, and ensuring that the limits were comparable to or lower than limits that have been used

## 5 BPPH Loss Assessment – Dredging & Material Placement

for previous WA dredging projects. However, the McArthur *et al.* (2002) approach (which has previously been used to develop tolerance limits for other WA dredging projects) was not used, as it is DHI's view that this approach is not well suited for developing limits for the full range of impact categories defined in Table 8.23. DHI's critique of the McArthur *et al.* (2002) approach is provided in DHI (2010d).

Separate tolerance limits were derived for corals and seagrass. The coral limits were also used as a proxy indicator for filter feeders, as there were less literature values available for filter feeders. Overall, the literature indicates the tolerance limits of filter feeders would be equivalent to or not less than the most sensitive coral species. A similar approach was taken for macroalgae, using the seagrass limits as a proxy indicator for macroalgae.

### *Coral tolerance to suspended sediment*

DHI's proposed suspended sediment tolerance limits for corals in ECU 1 and ECU 2 are shown in Table 5-7 and Table 5-8 respectively. Note that less conservative tolerance limits were established for corals and seagrasses in nearshore shallow (<5 m) more turbid waters of ECU 1 during summer and winter. Water quality information from the area indicates that these shallow nearshore waters are naturally more turbid than the waters deeper than approximately 5 m further offshore during summer and winter primarily as a result of wave re-suspension of fine seafloor sediments and also occasional runoff from land (DHI 2010d). The TSS concentrations which occur at this time of year are close to those experienced in Singapore, for which validated tolerance limits are available.

**Table 5-7 Matrix of Impact Zones for suspended sediment impact on corals, for assessment of short term scenario modelling – applicable for Nearshore Waters < 5 m deep in ECU1 during summer and winter only.**

Zone*	Definitions
Zone of Total Mortality	Excess SSC > 25 mg/l for more than 20% of the time
Zone of Partial Mortality	Excess SSC > 25 mg/l for 5–20% of the time; OR Excess SSC > 10mg/l for more than 20% of the time; OR Excess SSC > 5 mg/l for more than 50% of the time
Zone of Influence	Excess SSC > 25 mg/l for 1-5% of the time; OR Excess SSC > 10mg/l for 1-20% of the time; OR Excess SSC > 5 mg/l for 5-50% of the time
No Impact	Excess SSC > 25 mg/l for less than 1% of the time; OR Excess SSC > 10mg/l for less than 1% of the time; OR Excess SSC > 5 mg/l for less than 5% of the time

\*Where location meets criteria for multiple zones, highest zone applies



5 BPPH Loss Assessment – Dredging & Material Placement

**Table 5-8 Matrix of Impact Zones for suspended sediment impact on corals, for assessment of short term scenario modelling – applicable for offshore waters (beyond 5 m isobath) for all seasons, and for nearshore waters (within 5 m isobath) during Transitional periods only.**

Zone*	Definitions
Zone of Total Mortality	Excess SSC > 25 mg/l for more than 10% of the time; OR Excess SSC > 10mg/l for more than 25% of the time
Zone of Partial Mortality	Excess SSC > 25 mg/l for 2.5–10% of the time; OR Excess SSC > 10mg/l for 10–25% of the time; OR Excess SSC > 5 mg/l for more than 25% of the time
Zone of Influence	Excess SSC > 25 mg/l for 0.5-2.5% of the time; OR Excess SSC > 10mg/l for 0.5-10% of the time; OR Excess SSC > 5 mg/l for 2.5–25% of the time
No Impact	Excess SSC > 25 mg/l for less than 0.5% of the time; OR Excess SSC > 10mg/l for less than 0.5% of the time; OR Excess SSC > 5 mg/l for less than 2.5% of the time

\*Where location meets criteria for multiple zones, highest zone applies

**Coral tolerance to sedimentation**

DHI’s proposed sedimentation tolerance limits for corals are shown in Table 5-9 and Table 5-10.

**Table 5-9 Matrix of Impact Zones for sedimentation impact on Corals for assessment of 14-day scenario model results - For nearshore waters (within 5 m isobath) during Summer and winter only.**

Zones	Definitions
Zone of Total Mortality	Sedimentation > 50mg/cm2/day (> 17.5 mm/14day*)
Zone of Partial Mortality	Sedimentation 10–50mg/cm2/day (3.5 – 17.5 mm/14day*)
Zone of Influence	Sedimentation 2.5–10mg/cm2/day (0.9 – 3.5 mm/14day*)
No Impact	Sedimentation < 2.5 mg/cm2/day (< 0.9mm/14day*)

\* assuming an initial deposition dry density of 400kg/m<sup>3</sup>

**Table 5-10 Matrix of Impact Zones for sedimentation impact on Corals for assessment of 14-day scenario model results - For offshore waters (beyond 5 m isobath) during all seasons, and for nearshore waters (within 5 m isobath) during Transitional periods only.**

Zones	Definitions
Zone of Total Mortality	Sedimentation > 0.2kg/m2/day (> 7.0mm/14day*)
Zone of Partial Mortality	Sedimentation 0.05 – 0.2kg/m2/day (1.7 – 7.0mm/14day*)
Zone of Influence	Sedimentation 0.01–0.05kg/m2/day (0.3 – 1.7mm/14day*)
No Impact	Sedimentation < 0.01kg/m2/day (< 0.3mm/14day*)

\* assuming an initial deposition dry density of 400kg/m<sup>3</sup>

### 5 BPPH Loss Assessment – Dredging & Material Placement

Tolerance limits for seagrasses are similar but slightly less stringent than those for coral (DHI 2010b).

The values in the tables are for excess (i.e. above background) SSC, or rates of sedimentation generated by the dredging activities, and are based on 30 day scenario modelling periods comprising a “warm-up” period of 16 days and a simulation period of 14 days. Note that this does not mean that impacts would be realised within a 30 day period. Rather, if the impact continued at the same level for an extended duration (several months), these are the predicted levels of impact anticipated.

The relevant tolerance limits have been applied to the plume modelling results to give an indication of the size and distribution of each impact zone arising from each scenario modelled. In addition, DHI established some 34 individual receptors within their model and calculated the level of impact applicable for each receptor arising from each scenario modelled.

Figure 5-18 (DHI 2010b) shows the location of all the individual receptors that have been placed into the model. It presents a description of their habitat biotype which indicates which tolerance limits have been applied at that location.

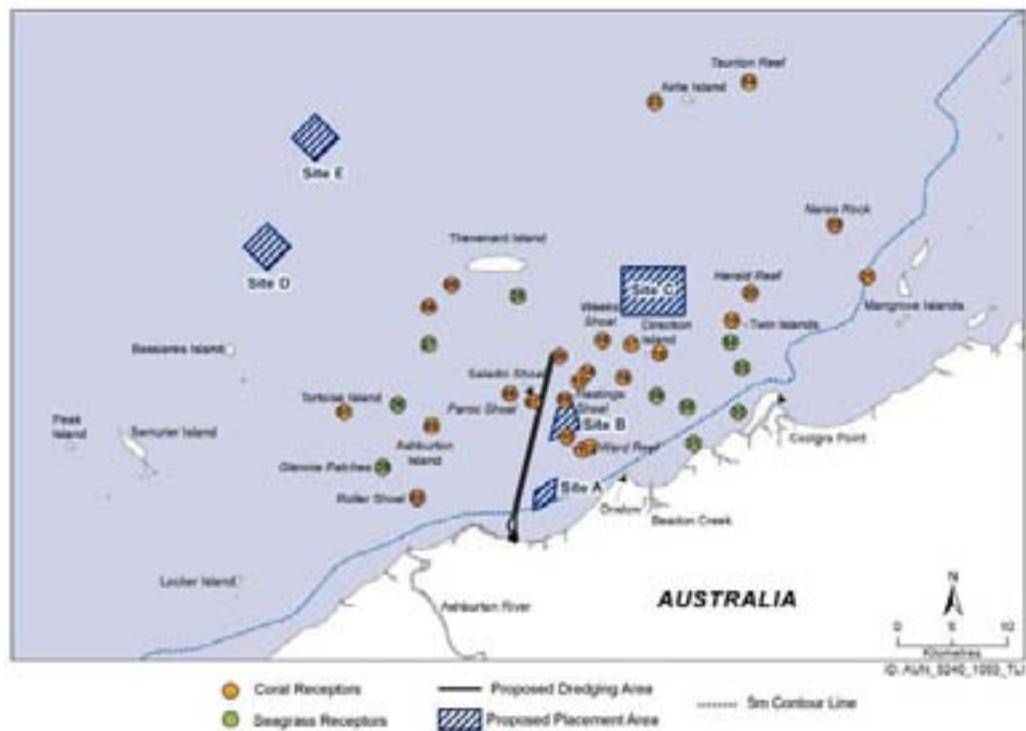


Figure 5-18 Locations of sensitive coral and seagrass receptors in Project area (URS 2010c).

## 5 BPPH Loss Assessment – Dredging & Material Placement

### 5.5.4 Scenarios modelled

As described in Section 5.4.4, the latest iteration of sediment plume modelling (DHI 2010a) has considered two climatic conditions (strong and representative wind and currents), three seasons (summer, winter and transitional periods) and two (low and high) release estimates for each of eight different stages of the dredging program (including optimised Scenario 7A), covering the full range of dredging, and dredged material placement areas and equipment. This gives a total of 96 different scenarios (2x3x2x8) that have been modelled, which are expected to cover the full spectrum of variability in terms of potential sediment plume impacts to sensitive receptors. DHI (2010a) presents all scenario modelling results.

The sediment plume model results produced by DHI (2010a) have been processed in DHI (2010d) to determine the Estimated Zones of Impact (EZI), based on the tolerance limits derived for coral and seagrass receptors. The results have been grouped into scenarios according to the eight main dredging stages described in Section 5.4.4. and Table 5-5.

The results for each scenario are summarised in a table format at the end of each section in DHI (2010d), based on extractions from the model results at the 34 key receptors shown in Figure 5-18. An overall Impact classification is assigned in the table for each receptor, based on the highest level of Impact experienced by that receptor as a result of either excess SSC or excess sedimentation (Table 5-11).



## 5 BPPH Loss Assessment – Dredging & Material Placement

### 5.5.5 Combined scenario impact zones

In order to provide a surrogate for the “full dredge log” simulations (simulating the entire 3 year dredging program) that the regulator is accustomed to seeing for dredging projects in Western Australia, the processed model results for Scenarios 1–7 for all seasons have been combined to present four levels of impact zone as defined in Table 5-6.

The impact assessment has been based on the 42 realistic (low spill rate) scenarios. The results from all 42 realistic scenarios were combined to produce the Estimated Zones of Impact (EZI), which show the highest level of impact across the 42 scenarios for each given location in the Project area. This represents an envelope of the maximum predicted extent for each of the zones during all seasons for the modelled short-term scenarios. Using the 42 combined realistic scenarios in this way provides a comprehensive and conservative assessment of the potential impacts to the sensitive habitats, from which key receptors at risk from the dredging program have been identified.

The short-term scenario modelling approach adopted by DHI for this assessment provides a good coverage of the range of dredging activities, and has allowed assessment of a large number of climatic and dredging scenarios at a suitably high spatial resolution while still maintaining realistic computational times. While the short-term scenarios do not provide continuous coverage along the entire extent of the dredging area, it is possible to manually interpolate across the small gaps between scenarios, in order to determine IZIs for the full dredging period, DHI has used this approach to develop IZIs for seagrass and corals, based on exceedance of the SSC and sedimentation tolerance limits for corals and seagrasses. These IZIs are presented in Figure 5-19 (SSC impacts) and Figure 5-20 (Sedimentation impacts) respectively for both corals and seagrasses and represent the maximum areas of impact arising from the use of conservative but realistic assumptions.

5 BPPH Loss Assessment – Dredging & Material Placement

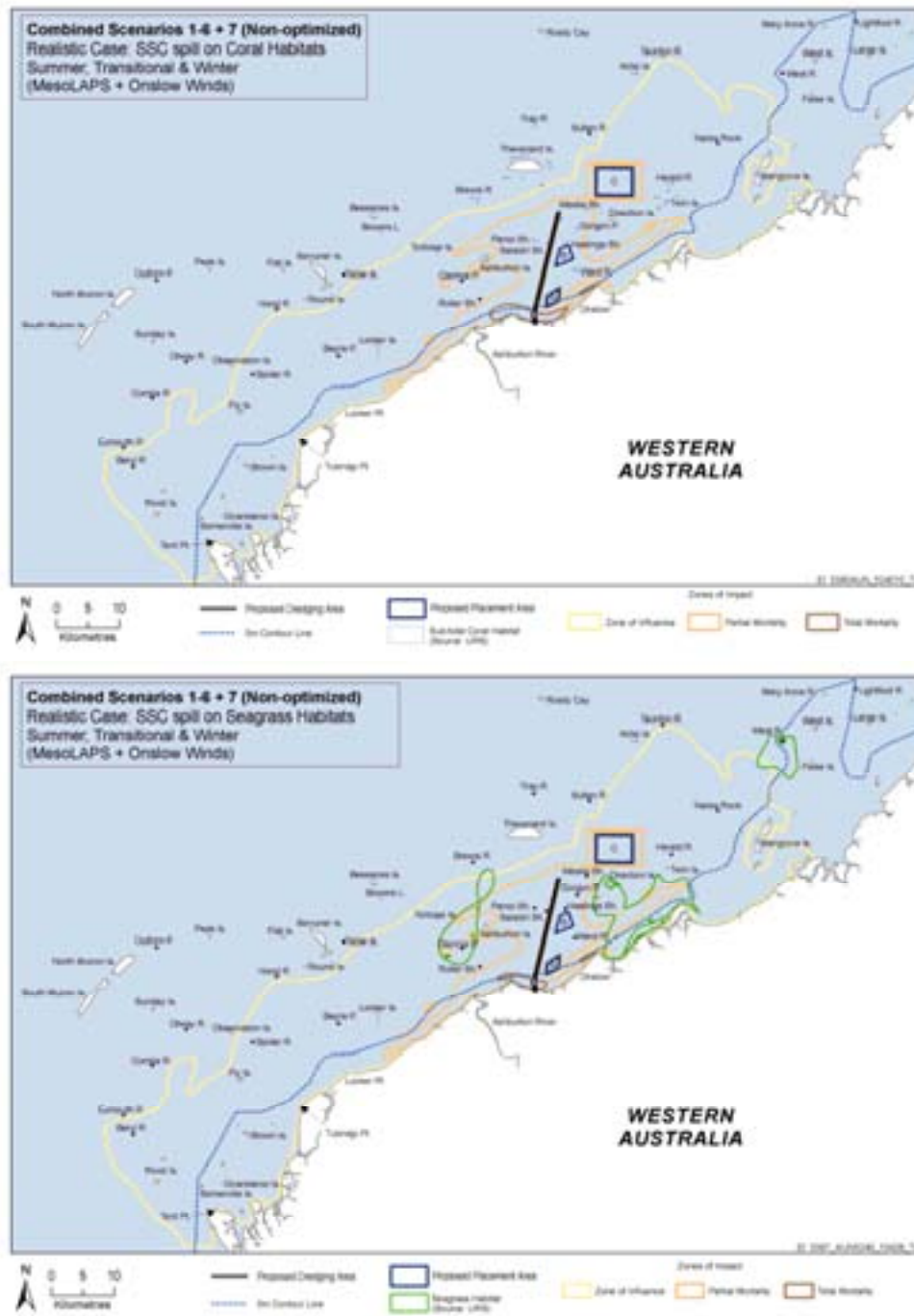


Figure 5-19 All seasons IZI for SSC tolerance limits on Coral (top) and Seagrass (bottom) habitats.

BPPH Loss Assessment

5 BPPH Loss Assessment – Dredging & Material Placement

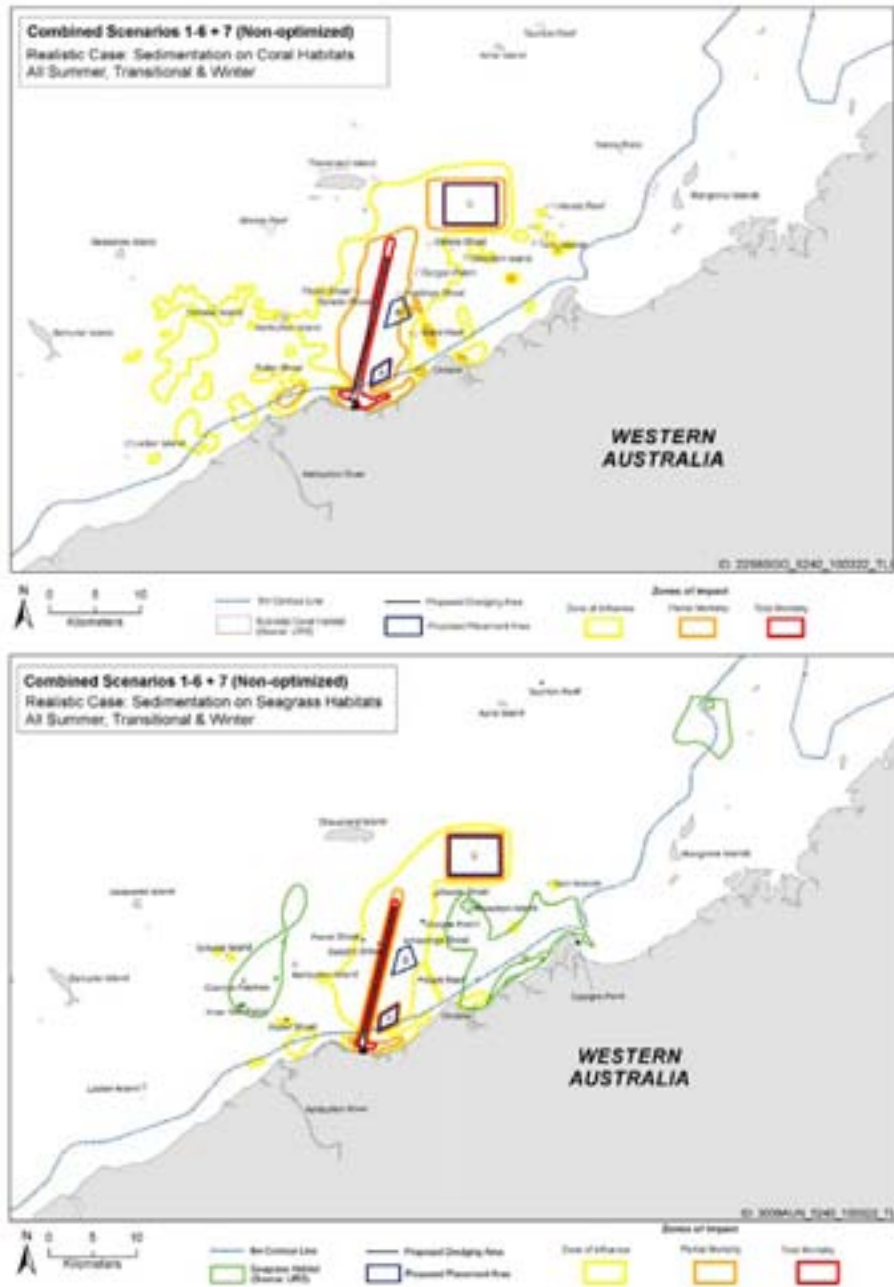


Figure 5-20 All seasons IZI for Sedimentation tolerance limits on Coral (top) and Seagrass (bottom) habitats.



## 5 BPPH Loss Assessment – Dredging & Material Placement

The IZIs presented in Figure 5-19 and Figure 5-20 show that:

- SSC IZI are similar in magnitude and location for corals and seagrass
- SSC Partial and Total Mortality IZI are slightly larger for corals, reflecting their greater sensitivity to SSC impacts compared to seagrass
- Sedimentation IZI for coral and seagrass are more localised than those for SSC

Sedimentation Impact zones for seagrass are particularly localised to the immediate vicinity of the channel and placement sites and do not impact on areas of more abundant seagrass.

It is apparent from the IZIs that most of the sensitive coral and seagrass receptors are not located in the near vicinity of the dredging area, and are generally outside of the IZI of Partial or Total Mortality. For corals, only Saladin Shoal falls within the Zone of Total Mortality, and only Paroo Shoal, Hastings Shoal and the End-of-Channel shoal fall within the Zone of Partial Mortality. For seagrass, only the seagrass area northwest of Ashburton Island and small areas immediately east of Onslow and west of Coolgra Point fall within the Partial Mortality Zone, with no seagrass areas falling within the Total Mortality Zone. These results are consistent with findings from previous Pilbara dredging campaigns, in which ecologically important impacts are largely restricted to areas within 500 m of the dredged channel or dredge material placement sites (Stoddart and Anstee 2005).

Figure 5-21 shows IZI developed for the Optimized dredging scenarios (1-6+7A) for SSC tolerance limits on Coral (top) and Seagrass (bottom). These have been developed by replacing the EZI for Scenario 7 with EZI from Scenario 7A which incorporates the “restricted-overflow” zones (Table 5-5, Figure 5-11). The figure shows that the number of coral communities affected by the partial mortality IZI has substantially reduced.

The combined Zones presented in Figure 5-19, Figure 5-20 and Figure 5-21 cover a very wide area, but it is important to note that they do not represent the full spatial extent of the Zone of Impact as a result of the proposed dredging program, as only a representative selection of the main stages of the dredging program were modelled, rather than the full three year dredging program.

BPPH Loss Assessment

5 BPPH Loss Assessment – Dredging & Material Placement

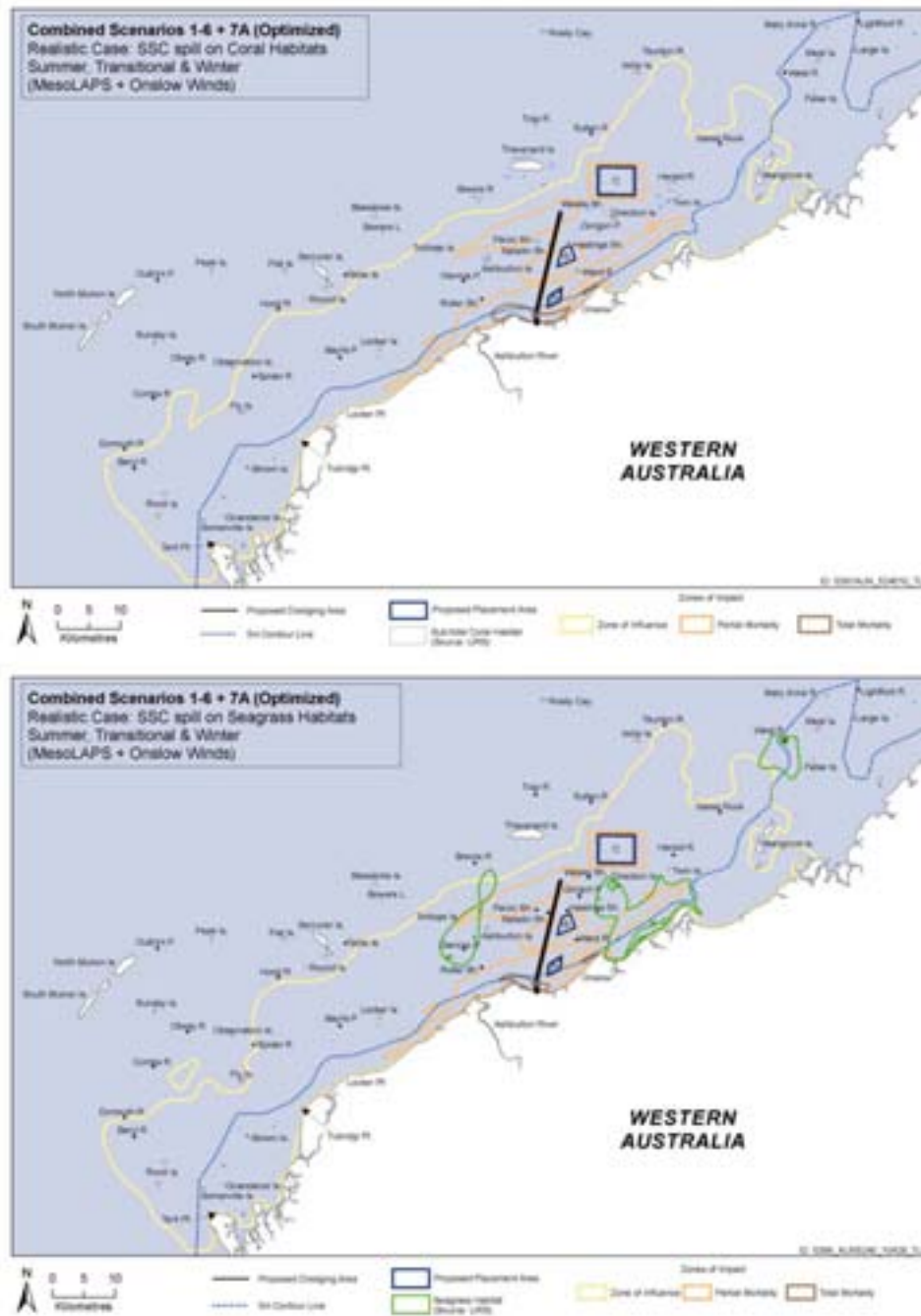


Figure 5-21 Optimized dredging scenarios: All seasons IZI for SSC tolerance limits on Coral (top) and Seagrass (bottom).



42907466/WHST-STU-EM-RPT-0137/Rev 1

## 5 BPPH Loss Assessment – Dredging & Material Placement

### 5.6 BPPH Loss Assessment

Calculation of the percentage BPPH loss within agreed LAUs involves the overlay of various figures and area calculations using ARCVIEW GIS software. Figure 5-22 presents the impact zones (Table 5-6) arising from exceedance of the SSC seagrass tolerance limits superimposed on the map of BPPH LAU boundaries and the distribution of seagrasses and macroalgae. It is too confusing to present the impact zones overlaid on both the LAU boundaries and BPPH distribution for all impact zones. Therefore the impact zones presented in Figure 5-23 and Figure 5-24 have been superimposed on maps showing just the distribution of the principal BPPH to which they refer (i.e. corals and filter feeders; or seagrass and macroalgae).

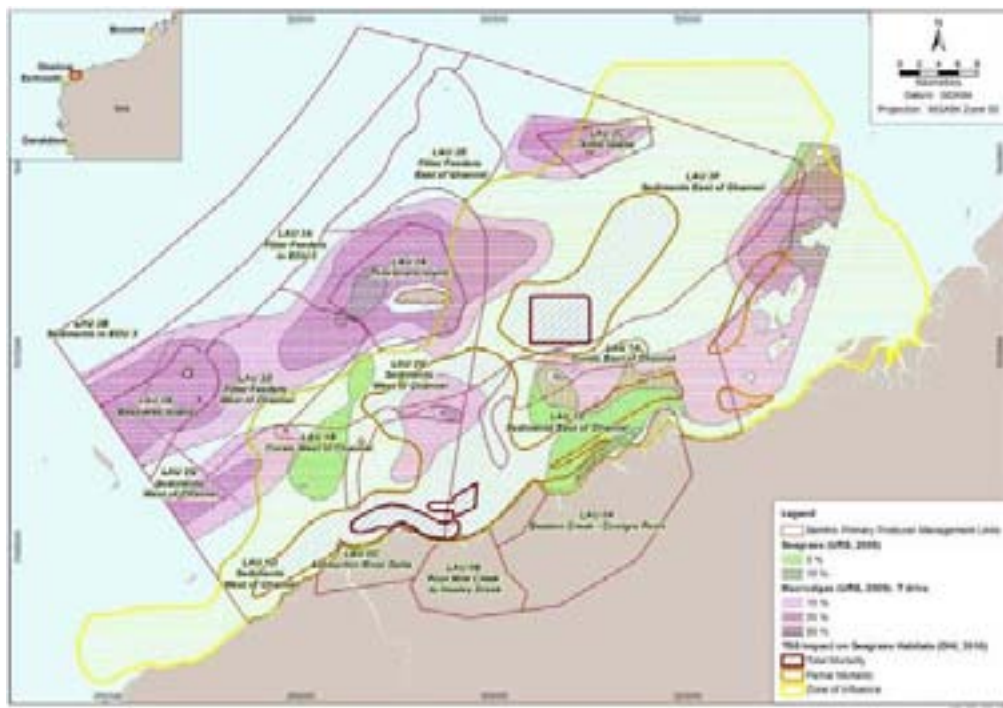


Figure 5-22 IZI arising from exceedance of seagrass SSC tolerance limits overlaid on the Map of BPPH LAU boundaries and distribution of seagrasses and macroalgae.

Figure 5-23 shows the **non-optimised dredging (scenario 1-7)** IZIs arising from exceedance of coral SSC (top) and sedimentation (bottom) tolerance limits overlaid on the distribution of corals and filter feeders in the Project area. This figure shows that:

- The IZI arising from exceedance of SSC tolerance limits are generally larger than those arising from exceedance of sedimentation tolerance limits. In particular, the partial impact zone for SSC covers more coral shoals than does the partial impact zone for sedimentation impacts.
- The total mortality zone arising from sedimentation is wider than that arising from excess SSC.
- The zone of influence (yellow contour) extends some 50 km to the east and slightly further to the west of the channel.
- Filter feeder habitats are not at risk from exposure to either excess SSC or sedimentation;

## 5 BPPH Loss Assessment – Dredging & Material Placement

- None of the regionally significant coral communities which occur around the offshore islands (i.e. Thevenard, Ashburton, Direction, Mangrove Islands) are impacted by the partial impact zone (although the zone boundary does come close to Ashburton Island)
- No coral communities occur within the total mortality impact zone – although Saladin Shoal and End-of-Channel shoals occur just outside the total mortality zone arising from sedimentation.
- A high number of coral shoals occur within the partial mortality zones including Ward Reef, Weeks Shoal, Gorgon Patch and the shoal to the SW, Paroo Shoals and Hastings Shoal, and a small shoal west of Beadon Point.

Figure 5-24 shows the non-optimised dredging (scenario 1-7) impact zones arising from exceedance of seagrass SSC (top) and sedimentation (bottom) tolerance limits overlaid on the distribution of seagrasses and macroalgae in the Project area. This figure shows that:

- No dense seagrass areas occur within the total mortality zone but that a large portion of the dense seagrass areas which occur to the east of Onslow fall within the partial mortality zone arising from exceedance of SSC tolerance limits. This zone also impacts some of the seagrass areas located to the west of Ashburton Island;
- The area of dense macroalgae which occurs adjacent the outer end of the channel falls largely within the partial impact zone arising from exceedance of SSC tolerance limits;
- None of the large areas of macroalgae which occur adjacent the offshore islands and the Mangrove Island chain are at risk.

These figures were placed into a GIS file over which the LAU boundaries were superimposed in the GIS to enable calculation of BPPH loss within each LAU arising from either exposure to excess SSC or sedimentation.

Table 5-11 presents a summary of maximum impact level experienced by all receptors (Figure 5-18) as result of both exposure to excess SSC and sedimentation arising from simulation of all dredging scenarios (1-7+7A) over all seasons under both representative (A) and strong (B) wind conditions using realistic release rates. Comparison of impacts between Scenario 7 and Scenario 7A clearly indicates the value of implementing “restricted overflow” zones.





BPPH Loss Assessment

5 BPPH Loss Assessment – Dredging & Material Placement

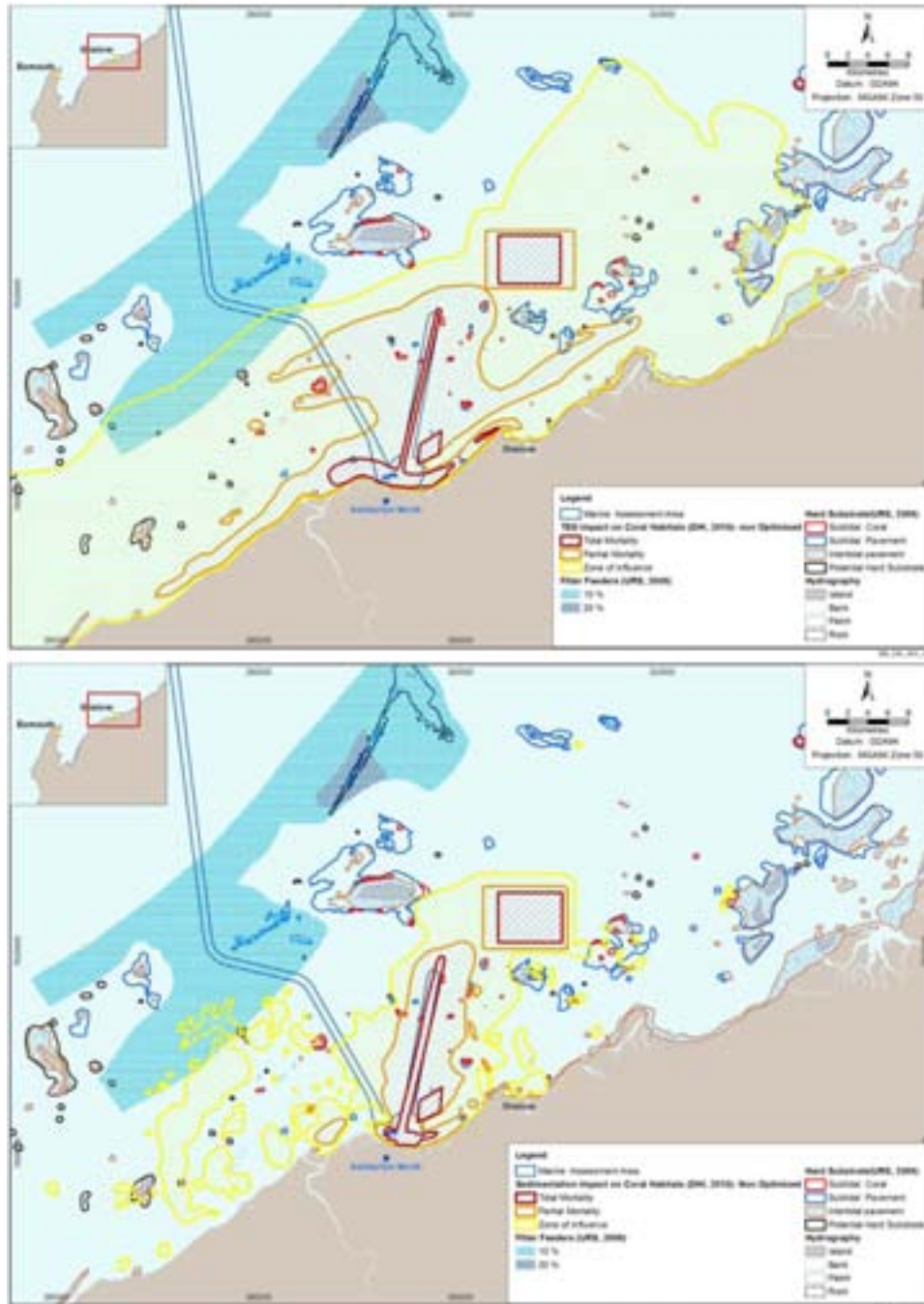


Figure 5-23 Scenario 1-7: IZI arising from exceedance of coral SSC (top) and sedimentation (bottom) tolerance limits overlain on distribution of coral and filter feeder habitats.



BPPH Loss Assessment

5 BPPH Loss Assessment – Dredging & Material Placement

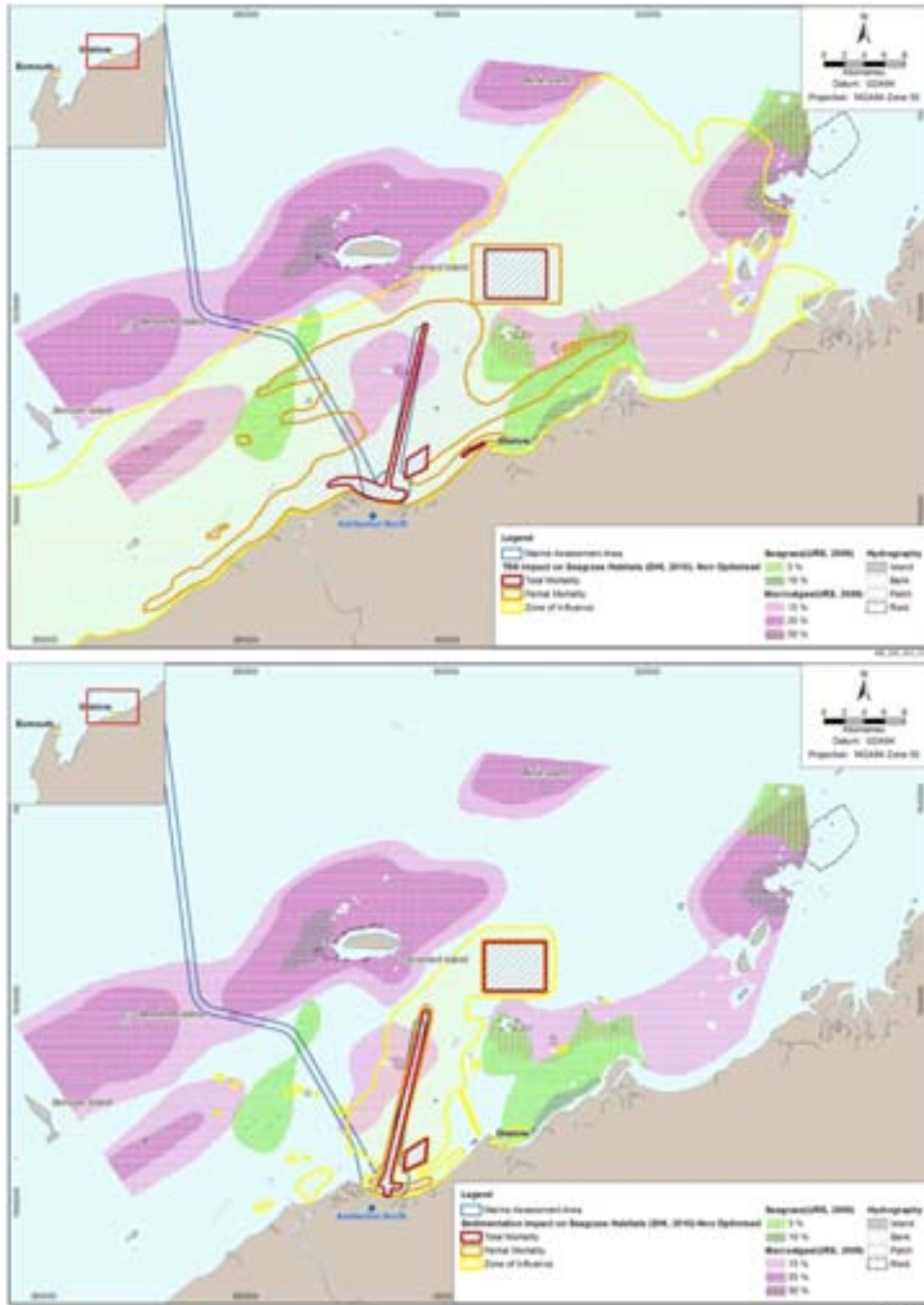


Figure 5-24 Scenario 1-7: IZI arising from exceedance of seagrass SSC (top) and sedimentation (bottom) tolerance limits overlain on distribution of seagrass and macroalgae habitats.

**5 BPPH Loss Assessment – Dredging & Material Placement**

Table 5-12 presents LAUs that fall within the IZIs of total and partial mortality, their total habitat area, the predicted area of habitat loss/damage, and the percentage it represents of the total habitat area within the LAU. Only the LAU's within ECU 1 and those at risk in ECU 2 are included. Most of the ECU 2 and ECU 3 LAUs are not considered at risk under this dredge program. It is predicted that sedimentation impacts will be restricted to the immediate vicinity of the channel and placement sites and do not encroach over significant BPPH habitat. Almost all impacts in Table 5-12 have arisen from exceedance of partial mortality SSC limits. To reflect the < 50% mortality anticipated in this zone, the area of partial mortality has been subsequently divided by two to determine the percentage loss/damage within that LAU. Only the macroalgae within the channel in LAU 1D will be totally removed and has been added to half of the area of partial mortality to calculate the percentage loss/damage. No historical losses of significant subtidal BPPH have been recorded and the EPA CLGs applicable to the impacted LAUs presented Table 5-12 is 10%.

**Table 5-12 Sub-tidal BPPH loss/damage assessment resulting from exceedance of SSC tolerance limits by non-optimised dredging scenarios 1-7.**

LAU Code	Biotype	Total Area (ha)	Partial Mortality (ha)	Total Mortality (ha)	Per cent Loss
LAU 1A Corals east of channel	Corals	205	121 Ward, NW Ward, Gorgon, Weeks, Hastings, SW of Gorgon, West of Beadon Pt, End-of-Channel Shoal.	0	30%
LAU 1B Corals west of channel	Corals	132	46 Saladin, Paroo	0	17.5%
LAU 1C Sediments east of channel	Seagrass	10151	2570	0	12.6%
	Macroalgae	11425	730	0	3 %
LAU 1D Sediments west of channel	Seagrass	3430	260	0	3.8%
	Macroalgae	11239	3915	250	19.2%
LAU2G Sediments west of channel	Seagrass	1451	356	0	12.3%
	Macroalgae	2585	1291	0	25%

The results presented in Table 5-12 show that the base case non-optimised dredging plan is predicted to result in loss/damage of 30% of coral communities which occur to the east of the navigation channel and 17.5% of those which occur to the west. These predicted losses are likely to be reversible in the long term, but are considered irreversible for this impact assessment based on the five year time frame specified for recovery in EAG 3.

Approximately 25% of seagrass habitats to the east of the navigation channel in LAU 1C may suffer up to 50% reduction in abundance/biomass nearshore, resulting in damage of up to 12.5 % of available seagrass habitat in that area. The same scale of seagrass damage occurs to the west of the



## 5 BPPH Loss Assessment – Dredging & Material Placement

channel in LAU 2G. However, seagrass coverage in the affected area is generally sparse (Photograph 5-1, obtained during ROV field survey for URS 2010h). The common species of seagrass in the Project area is *Halophila* sp. which is known to be an important coloniser in shallow waters due to its high seed output and its ability to recover rapidly after disturbance (Birch and Birch 1984; Rasheed 2004). In addition, previous work has demonstrated that a *Halophila* species is capable of complete recovery from a natural storm event within six to eight months (Williams 1988). Therefore, the damage predicted from Project dredging is considered temporary and reversible.



**Photograph 5-1 Typical seagrass coverage in area potentially impacted by sediment plume, based on ROV survey.**

Macroalgae loss is high to the west of the channel (between 19 and 25 % of LAUs 1D and 2G respectively). The large area of macroalgae that occurs over soft substrates in the vicinity and to the west of the offshore end of the shipping channel in LAU 1D and 2G will suffer a substantial loss, probably over the full three year period of construction. However, it is likely that algal biomass in this area will rapidly recover once the dredging program ceases. Evidence from natural disturbance (storm events) suggests that macroalgae are capable of recovering to pre-disturbance abundance within six to eight months after the cessation of disturbance (Williams 1988). In addition, an underwater ROV survey conducted adjacent to the Onslow salt shipping ground and material placement sites found seagrass and macroalgae species present in the area that were similar to those found in adjoining areas, indicating that the species have the ability to recolonise after a disturbance (URS 2010f). This information, in conjunction with the recruitment processes for the dominate seagrass and macroalgae species, suggests that any potential loss as a result of the Project is likely to be temporary and regeneration may occur within five years.

It is recognised that highly turbid waters will prevail close to shore during the nearshore dredging campaign. Mangroves within Hooley Creek and Ashburton River Delta will be subjected to these turbid waters. Mangroves are considered to be highly tolerant to the magnitude of sedimentation and suspended sediments typically generated from dredging activities. However, mangroves have adapted to inundated intertidal mudflats via use of aerial root systems called pneumatophores which rise above the mud and provide oxygen to the plant through small pores. Burial of these aerial root systems by fine marine sediments has the potential to manage mangrove tree health, or even cause tree deaths. Proposed dredging operations will generate turbid plumes that have the potential to increase sedimentation in some adjacent subtidal habitats.

## 5 BPPH Loss Assessment – Dredging & Material Placement

Assessment of the potential for indirect impacts to mangroves from dredging related sediment deposition indicates that such impacts are unlikely given consideration of the following factors:

- Background turbidity concentrations along the Onslow coastline are high under existing conditions and the relative increase in concentrations due to dredging is limited. Mangroves in the area already cope with periods of very high turbidity during Ashburton River flood events.
- The dredge plumes are not expected to give rise to additional sedimentation at a scale that could threaten mangrove communities. A review of sediment burial of mangroves in Australia (Ellison 1998) describes the mortality of *Avicennia marina* (the dominant mangrove in the Project area) being caused by sedimentation depths of 12–50 cm.
- Dredging activities will occur in nearshore/offshore areas and not within the mangrove fringed tidal creek systems and hence the majority of dredging related sediment mobilisation and deposition will occur in nearshore/offshore areas and not within the intertidal zone where mangroves occur. In areas of the Pilbara coast where dredging has actually occurred within mangrove fringed tidal creek systems (e.g. Port Hedland harbour) there has not been any evidence of significant indirect impacts to mangroves from dredging related sediment deposition

Algal mats occur very close to the upper limit of the intertidal zone and receive a very low frequency of tidal inundation (i.e. 1-3% of the time). Therefore the potential for dredging related sediment deposition to occur in algal mat areas is even less than that for mangroves and the risk to algal mats from this factor is negligible.

Table 5-12 indicates that the major long term impact of the non-optimised dredging plan will be to coral shoals which occur along the 10m isobath. The scale of potential impact is substantially in excess of the EPA CLG of 10%. To manage the scale of impacts on the coral shoals which occur within the partial impact zone, some form of mitigation will be required particularly during summer and transitional periods, which is when most of the impacts occur. DHI has recommended that two “restricted-overflow” zones be established for the dredging program to protect the coral shoals on the 10m isobath, and to protect Ward Reef. Figure 5-25 (DHI 2010c) shows the location of the recommended zones. However, restricted overflow in these zones should only be required during specific periods when potential impacts are likely (based on monitoring results and current forecasts), as there are extended periods when impacts are not predicted to occur due to dredging in these areas.

5 BPPH Loss Assessment – Dredging & Material Placement

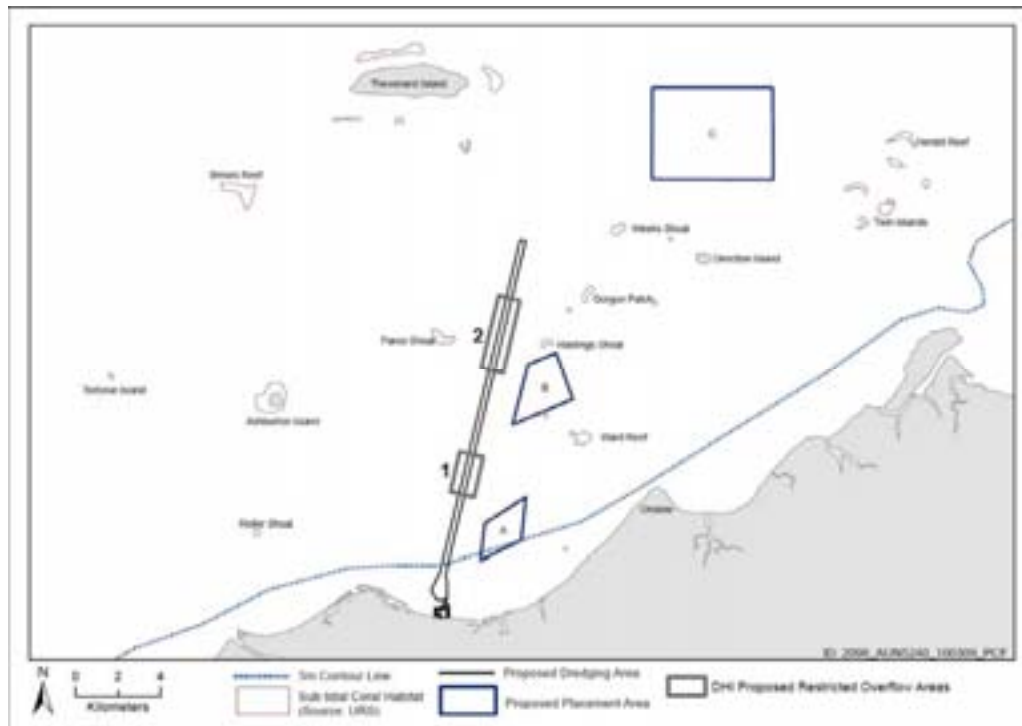


Figure 5-25 Restricted overflow zones 1 and 2 recommended by DHI.

Figure 5-26 shows the optimised dredging (scenario 1-6+7A) impact zones arising from exceedance of coral SSC (top) and sedimentation (bottom) tolerance limits overlaid on the distribution of corals and filter feeders in the Project area. The IZI shown in this figure are the result of including the two “restricted-overflow” zones shown in Figure 5-25. Optimisation results in substantial reduction in the zone of partial mortality for corals and a minor reduction of impact on seagrasses and macroalgae. The relevant IZI for partial mortality in the optimized scenario encompasses only “End-of-Channel” shoals, Saladin Shoal, the small shoal to NW of Ward Reef, and a very small nearshore shoal halfway between the Project site and Onslow. More substantial coral communities which occur around the offshore islands (i.e. Thevenard, Ashburton, Direction, Mangrove Islands) are not at risk under this optimised dredging plan.

As a result of optimisation, the scale of coral habitat loss/damage may be decreased to the following:

- LAU 1A Corals east of channel: Small nearshore reef west of Beadon Point (2.5 ha/2) plus End-of-Channel Shoal (23 ha/2), plus NW of Ward reef (2.5ha/2) = 14 ha of coral habitat will be seriously damaged, out of a total of 205 ha within the LAU = 6.8% of LAU
- LAU 1B Corals west of channel: Saladin Shoal (8 ha/2) = 4 ha of coral habitat will be seriously damaged, out of a total of 132 ha within the LAU = 3% of LAU

BPPH Loss Assessment

5 BPPH Loss Assessment – Dredging & Material Placement

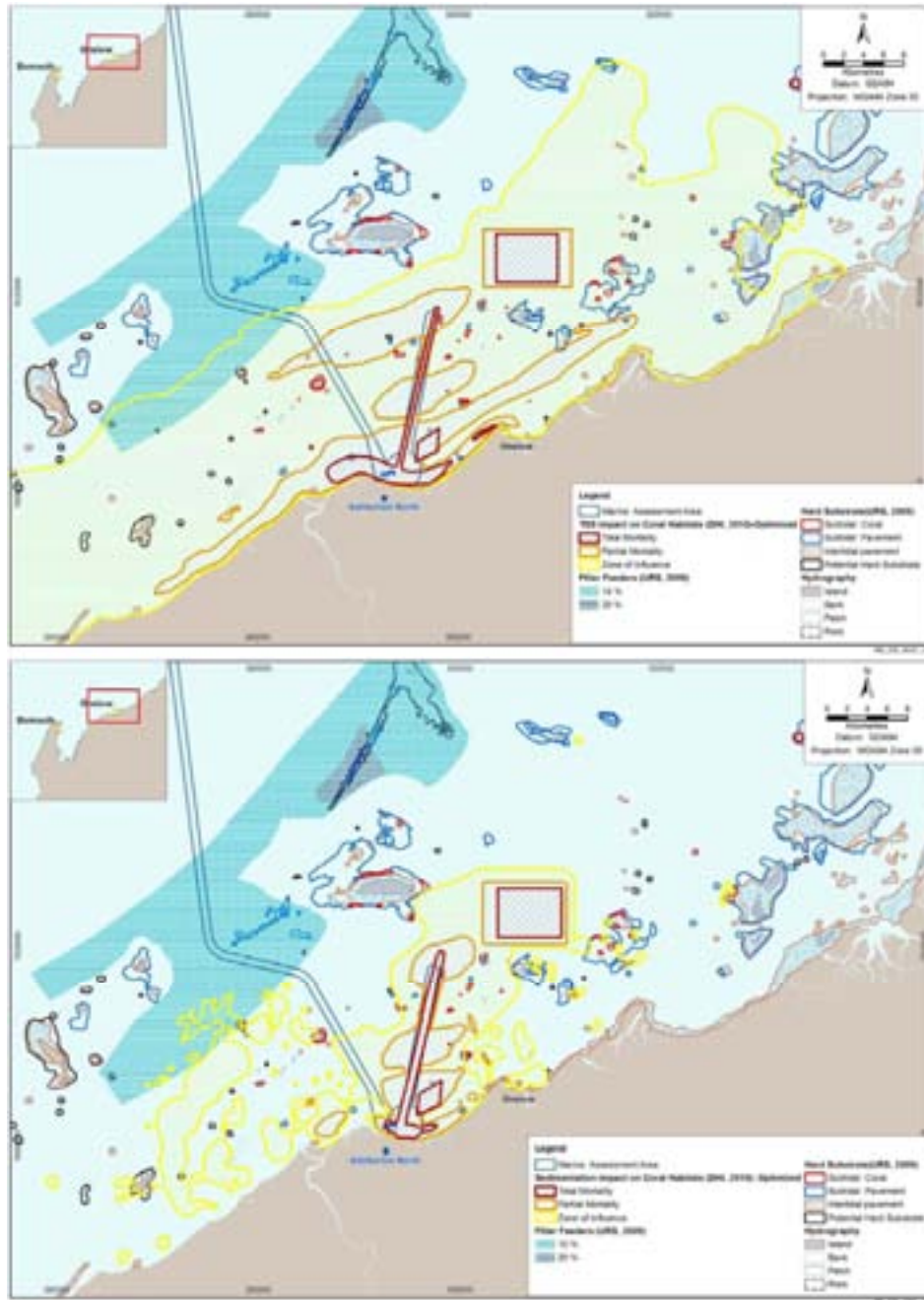


Figure 5-26 Optimised Scenario (1-6+7A): IZI arising from exceedance of coral SSC (top) and sedimentation (bottom) tolerance limits overlain on distribution of coral and filter feeder habitats.



### 5 BPPH Loss Assessment – Dredging & Material Placement

It is clear that implementation of an optimised dredging plan is necessary to manage the scale of coral mortality on the shoals adjacent the navigation channel to levels that are well within the EPA CLG of 10%. Chevron has therefore committed to adopting the recommended “restricted overflow” zones during specific periods when current forecast indicates that impacts to adjacent coral reefs are likely to occur. Given this commitment by Chevron, the BPPH loss assessment presented in Table 5-12 has been modified in Table 5-13 to reflect the predicted impacts of the optimised dredging plan. This table now forms the basis of the BPPH loss/damage assessment for the capital dredging program proposed for the Project.

**Table 5-13 Sub-tidal BPPH Loss/Damage Assessment resulting from exceedance of SSC Tolerance Limits by the optimised dredging scenarios 1-6+7A.**

LAU Code	Biotype	Total Area (ha)	Partial Mortality (ha)	Total Mortality (ha)	Per cent Loss
LAU 1A Corals east of channel	Corals	205	28 NW Ward, West of Beadon Pt, “End-of-channel Shoal.	0	6.8
LAU 1B Corals west of channel	Corals	132	8 Saladin	0	3
LAU 1C Sediments east of channel	Seagrass	10151	2570	0	12.6
	Macroalgae	11425	730	0	3
LAU 1D Sediments west of channel	Seagrass	3430	102	0	1.5
	Macroalgae	11239	1234	250	7.7
LAU2G Sediments west of channel	Seagrass	1451	291	0	10
	Macroalgae	2585	1291	0	25

Apart from the major reduction in coral habitat damage arising from implementation of an optimised dredge plan, there is also a reduction in the scale of impacts to seagrass and macroalgae habitats to the west of the channel (LAU 1D and 2G). The scale of impacts to seagrass and macroalgae habitats to the east of the channel remains unchanged.

As indicated earlier, the mangroves and filter feeder habitats are not considered at risk from the optimised dredging program and seagrasses and macroalgae will suffer temporary damage, possibly on a seasonal basis, but are expected to recover soon after dredging ceases.

Therefore in conclusion, only coral communities located close to the channel are considered at risk of irreversible loss over the long term.

### 5.7 Management of Impacts during Construction Dredging



## 5 BPPH Loss Assessment – Dredging & Material Placement

Based on the results of the modelling to date and the BPPH loss/damage assessment presented in Table 5-12 for the non-optimised dredging plan, it is clear that a number of large coral communities are predicted to fall within the Partial Mortality Zones. However, impacts to these sensitive receptors can and will be managed by the implementation of the optimised dredging plan and additional management measures.

The DSDMP identifies the receptors that need to be protected from adverse effects of the dredging and dredge material placement activities, and describe the monitoring and management measures which may be undertaken to ensure that the receptors are protected.

Monitoring programs proposed in the DSDMP include:

- Baseline characterization of potential impact and reference sites
- Sediment release characterisation
- Accumulation of fines at impact sites
- Water Quality and sedimentation at potential impact and reference sites
- Coral health at potential impact and reference sites
- Invasive marine species.

Management measures are provided which specify the appropriate response to be implemented if and when an agreed trigger for that response is exceeded. Management measures will be provided for the following receptors:

- Coral assemblages
- Dense areas of seagrass
- Mangroves
- Protected Marine Fauna
- Water quality
- Dredged material placement sites
- Invasive Marine Species
- Waste disposal
- Hydrocarbon spillages.

The overall objective of the DSDMP is to ensure that the scale of impacts to BPPH in the Project area is no greater than indicated in Table 5-13 for the optimised dredging plan. Particular attention is paid to protecting the coral shoals and significant reefs which occur east of 'End-of-Channel' Shoal and west of Saladin Shoal. The DSDMP details the location of coral health and water quality monitoring sites that may be established to provide early warning of impact to these shoals to enable their protection and subsequently to verify the impact predictions. Suitable reference sites will also be established to enable detection of natural change.

Early warning management response triggers based on the best available science will be included in the DSDMP to provide response mechanisms before mortality beyond the limits of acceptable change is reached. Early warning triggers may include sub-lethal stress criteria or water quality criteria or a combination of both.

Monitoring of mangrove health will be undertaken to ensure that the scale of impacts to intertidal habitats is no greater than indicated in Section 3.0. Pre- and post- dredge monitoring of macroalgae and seagrass may be completed to confirm impact predictions regarding their recovery.

## 5 BPPH Loss Assessment – Dredging & Material Placement

### 5.8 Maintenance Dredging Effects on BPPH

There will be a requirement for ongoing maintenance dredging of the approach channel to the MOF and also perhaps the PLF during the lifetime of the Project as a result of anticipated sedimentation resulting from both prevailing coastal processes and cyclonic events.

The Coastal Geomorphology Study (Damara 2009; Appendix P) and the DHI Coastal Processes Modelling Study (DHI 2010; Appendix P) has shown that under average conditions which prevail during summer, the eastward littoral drift is likely to generate sediment infill of the MOF channel at a rate of between 50 000 to 100 000 m<sup>3</sup> per annum. Therefore, there may be a requirement for ongoing maintenance dredging of the approach channel to the MOF and also perhaps the PLF during the lifetime of the Project as a result of anticipated sedimentation resulting from both prevailing coastal processes and cyclonic events.

Modelled simulations of a direct hit from a Cyclone Vance (1999) scale event resulted in approximately 1 Mm<sup>3</sup> of infill into the dredged areas from the single event. The infill material is likely to consist of soft sediments, as observed in the nearby Onslow Salt shipping channel. Characterisation of infill material in the nearby Onslow Salt shipping channel indicates the material is reddish brown silt to sandy silt and similar to surface sediments sampled during the field study for the proposed Project dredging program (URS 2009c).

Therefore, annual dredging of the MOF channel may be required. This may result in the removal of approximately 50 000 to 100 000 m<sup>3</sup>/year. Less frequent dredging may be required every three to five years for other dredged areas. This may be equivalent to approximately 300 000 m<sup>3</sup>/year. Estimate of total planned maintenance for 25 years of operation could be in the region of about 10-15 Mm<sup>3</sup>.

The location where most infill is anticipated to occur is the MOF channel adjacent the end of the breakwaters. If a TSHD is used for maintenance dredging, dredged material will be disposed either at placement site C (if sandy) or at placement site D (if high in fines content). If a CSD is required to clear the MOF channel, dredged material will be pumped to placement site A. Neither placement site A nor site C presently support significant amounts of BPPH, and hence no BPPH damage is anticipated from regular re-use of these sites. Site D does support filter feeder habitat, but the small volumes of fine material to be disposed at this location are considered most unlikely to cause any irreversible loss of BPPH at this location.

Given that the habitats which occur in the project area routinely experience elevated turbidity on a seasonal basis, the short time scale of this activity and the periodic nature of the turbidity generated by it poses little risk to the limited BPP habitats which occur adjacent the nearshore parts of the channel. Hence the scale of turbidity impacts arising from this activity has not been modelled.

It is therefore considered that regular maintenance dredging will not pose additional or greater risks to BPPH in the project area than those posed by the capital dredging program. The spatial and temporal scale of the turbidity generated by such activities will be small by comparison to the capital dredging. No adverse impacts to BPPH resources adjacent the channel are anticipated from this activity.

## Indirect Effects Arising from Construction of Nearshore Infrastructure

The nearshore construction activities addressed in this section include:

- the PLF
- the MOF
- trunkline installation and stabilisation.

The indirect impacts anticipated from these construction activities relate to the generation of water turbidity arising from:

- rock placement to construct the MOF and to stabilise the trunkline; and
- trenching and ploughing, or backhoe excavation for installation of the trunkline.

The construction activities proposed for the MOF and the PLF are described in Section 4 of this report. No rock dumping is proposed for the PLF and as such no indirect impacts on BPPH are anticipated from construction of the PLF.

Rock placement for the MOF breakwaters may generate localised and intermittent turbidity in the immediate vicinity and further afield of the activity. However, the amount of turbidity created is anticipated to be low as rock material to be dumped will be engineered to required size and weight grades. Most of the rock dumped will be coarse material of cobble size and above. As shown in Figure 4-2, there is no BPPH in the vicinity of the MOF which is sensitive to intermittent water turbidity. The nearest BPPH to the MOF are the mangroves of Hooley Creek and the Ashburton River. As indicated earlier in Section 5.5, mangroves are tolerant of high water turbidity which they experience periodically when the Ashburton floods and they have been assessed as not being at risk of adverse impact from the capital dredging works.

Hence given that indirect losses/damage of BPPH from construction of the MOF are most unlikely, the turbidity impacts of MOF construction have not been modelled. No attempt has been made to quantify the potential scale of turbidity created during the rock placement process for the MOF breakwaters. The core material and armour rock is not anticipated to contain significant fines and the scale of turbidity is anticipated to be very small, short term and localised in comparison to that created by the nearshore dredging works.

The construction activities proposed for the trunkline installation and stabilisation are summarised below. The direct losses of BPPH arising from the installation and stabilisation of trunkline have been assessed earlier in this report (Section 4). The location of the trunkline in relation to distribution of BPPH is shown in Figure 2-1.

The trunkline will be up to 1.2 m (48") in diameter and weight coated. It will be installed using either a conventional third generation moored lay barge or fourth generation dynamically positioned lay barge in deep waters, and a second generation flat bottomed lay barge in shallow nearshore waters. The second and third generation lay barges will be stabilised using an eight or 12 point anchor mooring system. The anchors will be continually moved by dedicated anchor handling vessels, as the barge winches itself along the trunkline alignment. Anchor placement can cause disturbance to the seabed over an area of approximately 50 m<sup>2</sup>.

In waters deeper than 40 m CD, the trunkline will be laid directly onto the seafloor and stabilised using a continuous concrete weight coating. In waters shallower than 40 m CD, the trunkline will be stabilised by burial and/or rock armouring.

## 6 Indirect Effects Arising from Construction of Nearshore Infrastructure

It is currently anticipated that the trunkline trench will be excavated by mechanical trenching, with the trench being backfilled with engineered coarse sand and/or rock. In water depths less than approximately 10 m CD, between the Roller-Skate trunkline crossing and the Project shore crossing interface point (a distance of approximately 8 km), it is anticipated that trench excavation will be undertaken using a backhoe dredge over a period of approximately three months. Up to 700 000 m<sup>3</sup> of dredged material will be transported in small hopper barges and be placed at proposed dredge material placement site C.

In water depths of between approximately 10 and 40 m CD, a distance of approximately 26 km, a mechanical trencher may be used for excavation works. The mechanical trencher deposits removed material directly onto the adjacent seabed, thus removing the need for transport and placement of dredged material. In areas of harder substrate, the trunkline will be laid directly onto the seafloor and stabilised using rock armouring. Turbidity generated by trunkline trenching and stabilisation will be transient since it will continually move along the 33 km route. Therefore, adjacent habitats will be exposed to localised water turbidity for only a short period (anticipated three to four days). The rate of progress along the trunkline route is anticipated to be at between 150 and 200 m per day.

Smothering impacts arising from the trenching and ploughing activity have been addressed in the 50 m wide corridor assumed in the direct loss/damage assessment presented earlier in Section 4.

Installation of the trunkline may need to be performed using larger dredging equipment, particularly if the geotechnical conditions do not favour the mechanical trenching methodology. In this case it is possible that a combination of CSD and TSHD dredging may be used to create a trench for the trunkline. This may be undertaken in water depths of between approximately 5 m CD and 40 m CD, covering a distance of approximately 33 km. The dredge material volume may be up to 2.4Mm<sup>3</sup> and would be removed over a period of approximately six months. Material dredged from the nearshore area out to approximately 10 m CD would be placed at proposed dredge material placement site C, while material from water depths of approximately 10 m CD to 40 m CD would be placed at site D.

In order to be conservative, dredge plume modelling has been undertaken based on the abovementioned contingency case. It should be noted, however, that indirect impacts are expected to be much lower if the preferred methodology of trunkline installation is used.

The trunkline dredging plume modelling utilised the same methodology discussed earlier that applied to the modelling of the navigation channel dredging. Recall this involved the defining of short-term dredge scenarios and the use of the six climatic scenarios outlined in Section 5.4.4. The short-term trunkline dredge scenarios focused on a 14 day segment of the trunkline dredge log, and were associated with sediment loading of 1029 t per day.

Two critical receptor locations were identified for detailed short-term scenario modelling (Figure 6-1 and Figure 6-2):

- Ashburton Island – the proposed trunkline route passes approximately 1 km east of the reef around Ashburton Island, which has high cover and diversity of hard corals. There is also a large area of denser seagrass to the west of Ashburton Island.
- Bessieres Island – the proposed trunkline route also passes within 7 km of Bessieres Island, which has moderate cover and diversity of hard corals. This location is also on a direct flow path to Brewis Reef and Thevenard Island.

6 Indirect Effects Arising from Construction of Nearshore Infrastructure

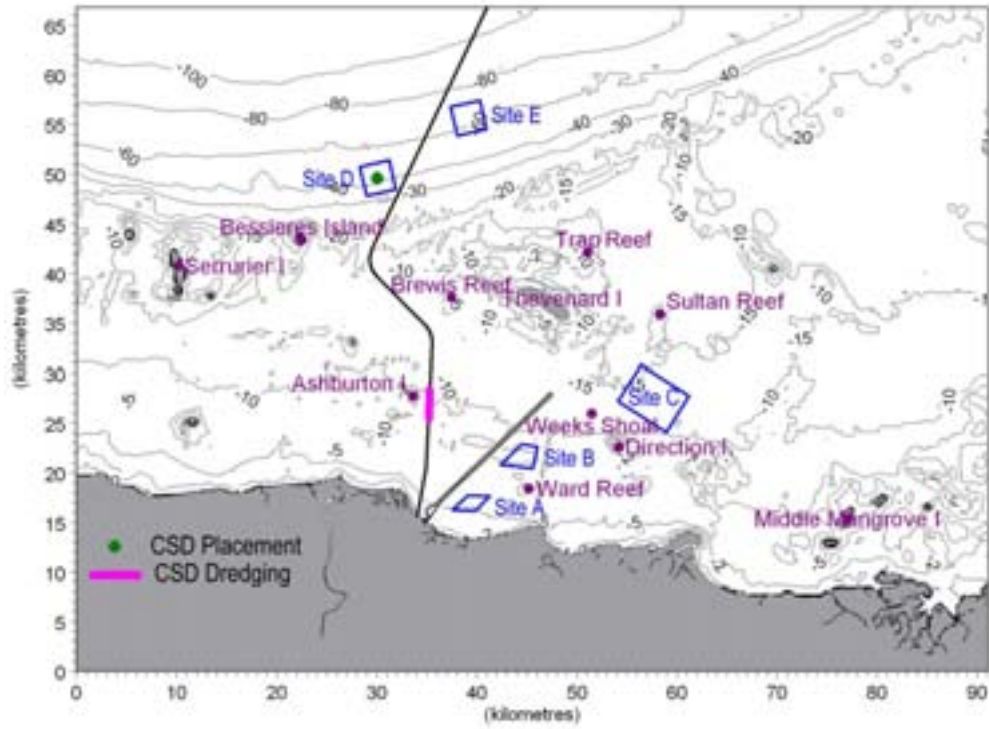


Figure 6-1 Location of Ashburton Island in relation to one of the two detailed short-term trunkline dredge plume modelling scenarios.

6 Indirect Effects Arising from Construction of Nearshore Infrastructure

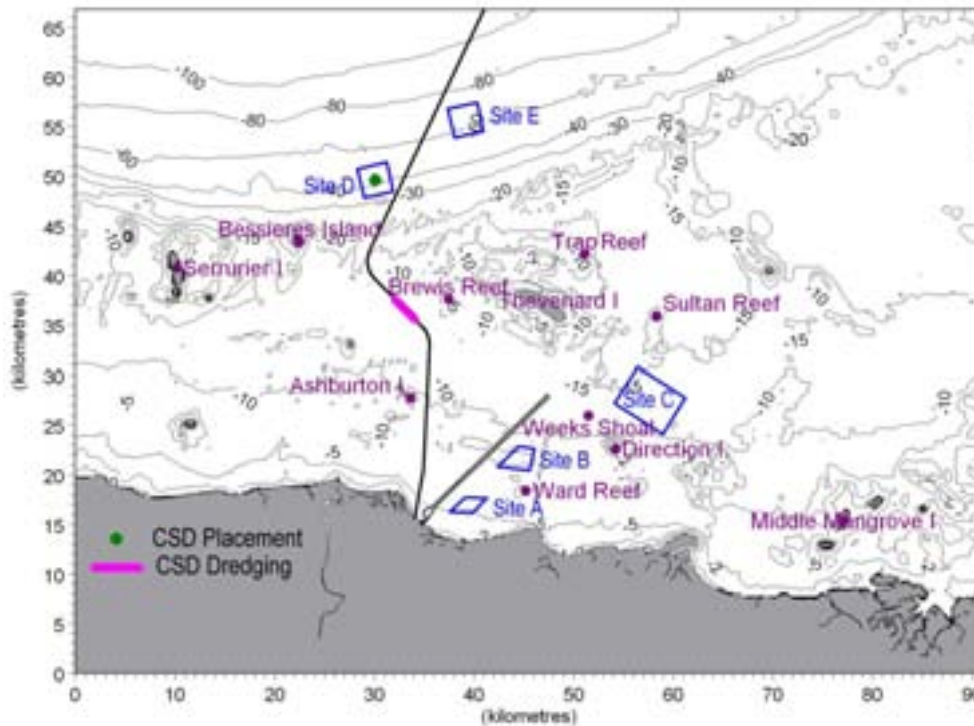


Figure 6-2 Location of Bessieres and Thevenard Islands in relation to one of the two detailed short-term trunkline dredge plume modelling scenarios.

Dredge plume IZIs, arising from the exceedance of SSC (Figure 6-3) and sedimentation (Figure 6-4) tolerance limits for coral have been overlain on distribution mapping of coral and filter feeder habitat.

BPPH Loss Assessment

### 6 Indirect Effects Arising from Construction of Nearshore Infrastructure

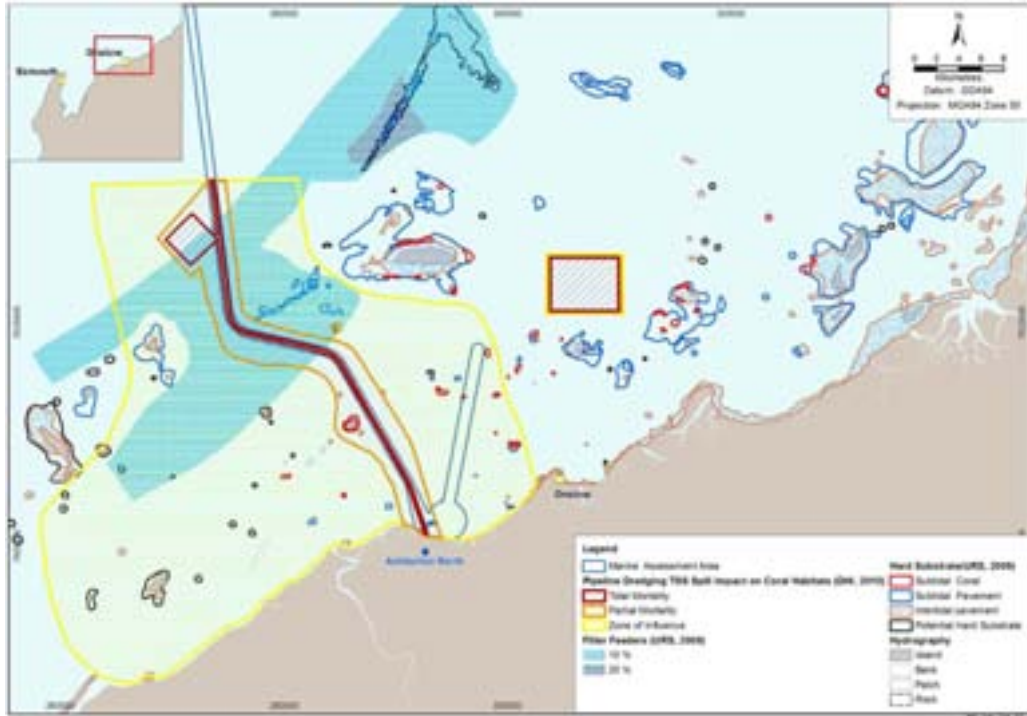


Figure 6-3 Trunkline dredging IZI arising from exceedance of SSC tolerance limits for coral, with location of coral and filter feeder habitats.



6 Indirect Effects Arising from Construction of Nearshore Infrastructure

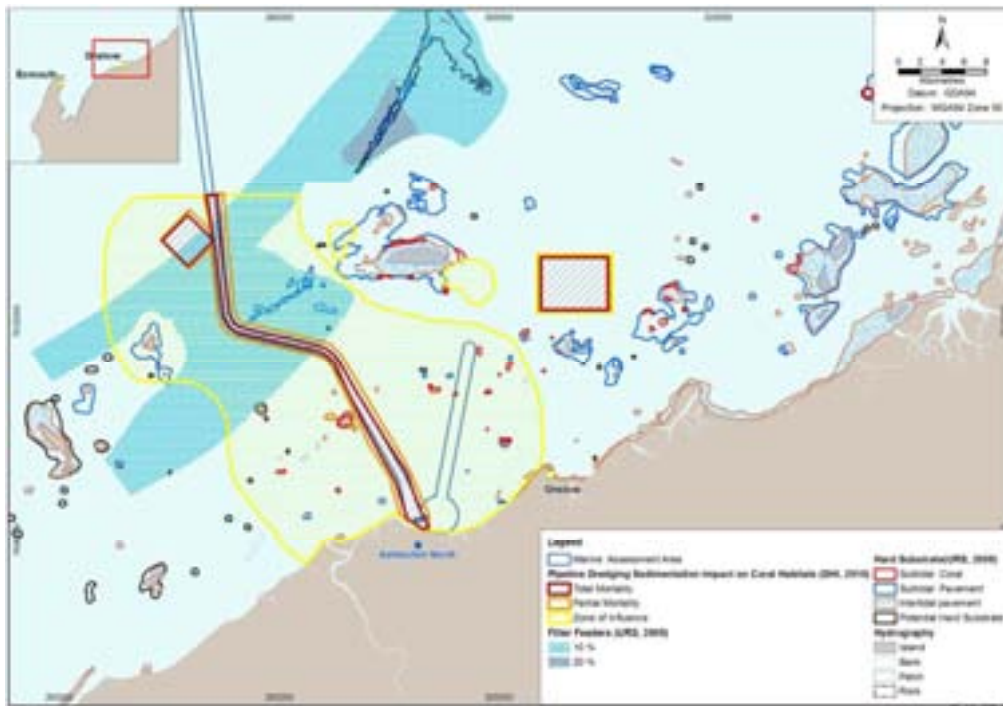


Figure 6-4 Trunkline dredging IZI arising from exceedance of sedimentation tolerance limits for coral, with location of coral and filter feeder habitats.

Dredge plume IZIs, arising from the exceedance of SSC (Figure 6-5) and sedimentation (Figure 6-6) tolerance limits for seagrass have been overlain on distribution mapping of seagrass and macroalgae habitat.



BPPH Loss Assessment

### 6 Indirect Effects Arising from Construction of Nearshore Infrastructure

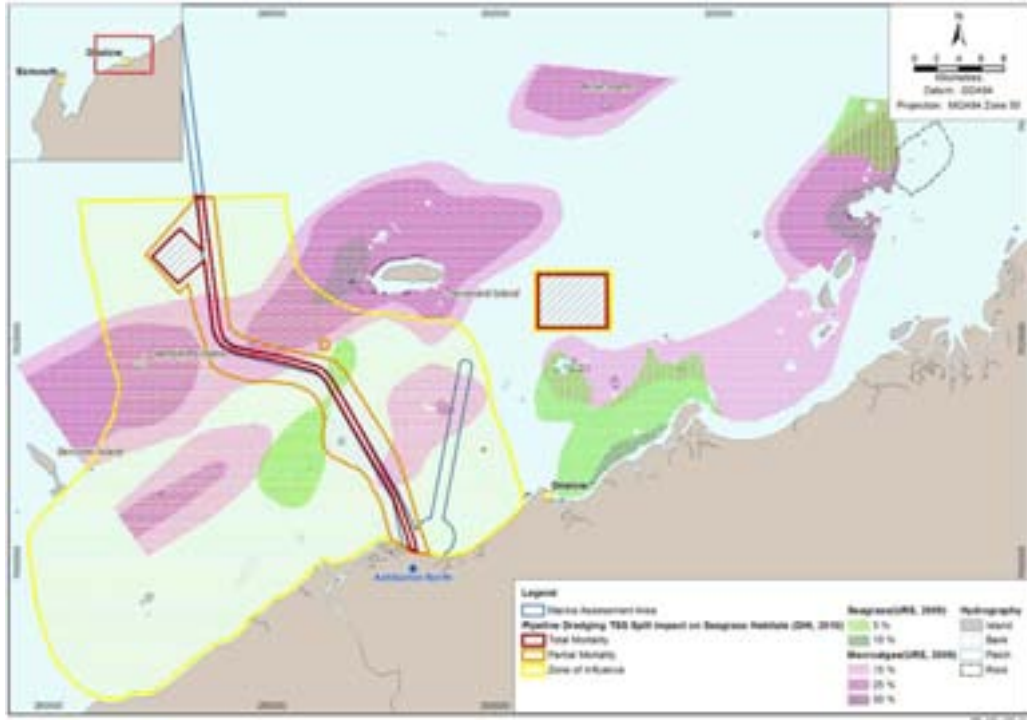
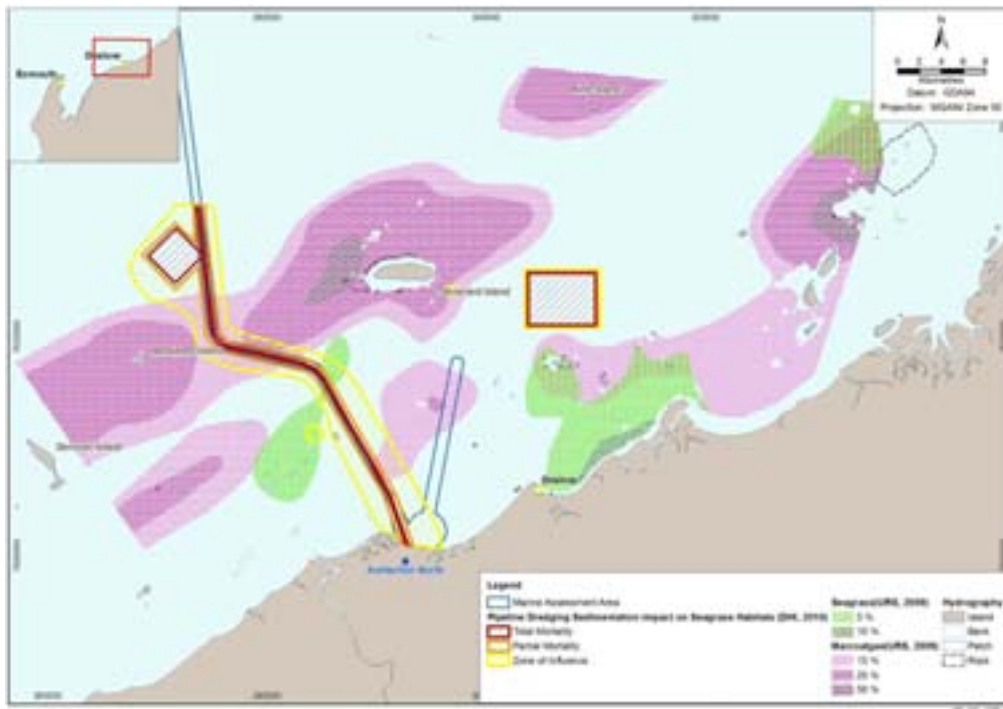


Figure 6-5 Trunkline dredging IZI arising from exceedance of SSC tolerance limits for seagrass, with location of seagrass and macroalgae habitats.



### 6 Indirect Effects Arising from Construction of Nearshore Infrastructure



**Figure 6-6 Trunkline dredging IZI arising from exceedance of sedimentation tolerance limits for seagrass, with location of seagrass and macroalgae habitats.**

It should be noted that the IZIs illustrated above (Figure 6-3, Figure 6-4, Figure 6-5, Figure 6-6) are based on modelling at the two most sensitive locations along the trunkline route. A conservative approach has therefore been used in determining the IZI boundaries, and the actual zones of impact are expected to be significantly smaller.

It is anticipated that CSD dredging along the trunkline route will release a relatively narrow plume of suspended sediments that may extend a considerable distance from the dredging location (in the order of between 5 and 10 km). However, unlike the CSD dredging for construction of the MOF and PLF, which requires the CSD to remain relatively stationary for extended periods, the CSD dredging for the trunkline route will move relatively quickly along the route (in the order of between 150 and 200 m per day). therefore, the plume would affect a different area for each day of the 14 day modelling duration, and after day 14 the CSD would have moved approximately 2 km along the length of the trunkline route.

The SSC zone for Partial Mortality of corals and seagrass (Figure 6-3, Figure 6-5) is anticipated to extend from between 1 and 2 km to the east and to the west of the trunkline route, potentially impacting coral reef areas around Ashburton Island. The SSC zone for Total Mortality of corals and seagrass (Figure 6-3, Figure 6-5) is only anticipated to extend 500 m to the east and to the west, depending on the season.

Predicted sedimentation zones are more localised, with the zone of Partial Mortality anticipated to extend from between 1 and 2 km to the east and to the west of the trunkline route for corals (Figure

## 6 Indirect Effects Arising from Construction of Nearshore Infrastructure

6-4), and less than 1 km to the east and to the west for seagrasses (Figure 6-6), depending on the season. Some remote sedimentation is also predicted to occur to the east during summer and to the west during winter and during transitional periods. The zone of Total Mortality is extremely localised, and is only predicted to extend from between 100 and 200 m to the east and to the west of the trunkline route. The largest zones of Partial Mortality are predicted to occur during calm transitional periods, when currents are low, resulting in elevated SSC and sedimentation rates. This may potentially impact Ashburton Island.

Ashburton Island is the only coral receptor predicted to fall within the zone of Partial Mortality, due to the proximity of the proposed trunkline route to the island and based on using a CSD to undertake the trenching. Impacts to Ashburton Island could be managed by re-routing the trunkline to be located further to the east, by timing the trenching works near Ashburton Island to avoid the more sensitive periods (i.e. the calm transitional periods), or by utilising alternative equipment (such as a mechanical trencher) or backhoe excavator. Chevron has committed to protecting the Ashburton Island coral communities in the trunkline DSDMP and will therefore employ whichever integration technique is considered appropriate at the time of construction. Therefore no loss of coral habitat is anticipated to result from this activity.

Filter feeder habitat in LAUs 2D and 3A may also be impacted by sedimentation as the plume may extend from the route by 200 m to either side of the trunkline. SSC-derived Partial Mortality has the potential to extend for up to 2 km to either side of the trunkline. Damage to similar areas of macroalgae habitat in LAU 2D is also anticipated, however macroalgae are anticipated to recover rapidly with no permanent loss of habitat resulting.

Seagrass habitat to the north of Ashburton Island may also fall within the zone of Partial Mortality and the zone of Total Mortality, as the trunkline route passes through this area. However, the seagrass coverage is relatively sparse (approximately five per cent) and consists mostly of *Halophila ovalis* or *H.minor*, which is able to regenerate and re-colonise habitat following disturbance. It is not anticipated that permanent loss of seagrass will result. Based on the modelling results, only filter feeder habitat is anticipated to be lost for a period exceeding five years.

Table 6-1 presents the filter feeder loss assessment resulting from exceedence of both the Partial Mortality Threshold for SSC and the Total Mortality Threshold for sedimentation.

**Table 6-1 Filter Feeder Loss Assessment Resulting from Exceedence of SSC (Partial Mortality) and Sedimentation (Total Mortality)**

Local Assessment Unit Code	Biotype	Total Area (ha)	Partial Mortality (ha)	Total Mortality (ha)	Per cent loss/damage
LAU 2D	Filter feeders	18 409	3 558	358	10.6
LAU 3A	Filter feeders	19 908	1 486	669	5.4

The maximum area of filter feeder habitat loss is anticipated to be:

- LAU 2D: 1958 ha which represents 10.6 % of LAU (total area 18 409 ha); and
- LAU 3A: 1077 ha which represents 5.4 % of LAU (total area 19 908 ha)



*BPPH Loss Assessment*

---

## **6 Indirect Effects Arising from Construction of Nearshore Infrastructure**

The above loss estimates are considered “worst case” estimates. A DSDMP, specific to trunkline installation and stabilisation activities (SKM 2010) will be developed and will be aimed at protecting the coral communities of Ashburton Island, and reducing the scale of impact on the filter feeder habitat to as low as practicable.

## BPPH Loss Assessment Summary

A range of temporary direct and indirect impacts to seagrass and macroalgae BPPH are likely to occur during the construction and operation phases of the Project. However, rapid recovery of these BPPH is anticipated. Irreversible loss of BPPH will be restricted to localized areas in the vicinity of the Project. The predicted scale of irreversible loss of BPPH arising from Project activities is as follows:

- ECU 0 – Onslow Onshore
  - Hooley Creek: Moderate loss of mangrove habitat (six per cent). Substantial cumulative loss of samphire/bioturbated mud habitat and algal mats arising from the placement of onshore infrastructure within the Project area (17 and 24 per cent respectively). The loss of samphire and algal mat habitat exceeds the EPA CLG (EPA 2009) of 10 per cent.
  - Ashburton River Delta: No adverse long term habitat loss is anticipated for the Ashburton River Delta mangrove ecosystem as a result of installation of the trunkline shore crossing. No adverse indirect impacts to the Ashburton River Delta mangroves are anticipated as a result of the operation of the Project in the long term.
- ECU 1 – Onslow Nearshore
  - Loss of coral habitat to the east and the west of the navigation channel, as a result of dredging, is not anticipated to exceed the EPA CLG (EPA 2009) of 10 per cent. However, coral habitat are that may be impacted upon includes Saladin Shoal, an area northwest of Ward Reef, a small nearshore shoal west of Beadon Point, and an area at the end of the navigation channel. Paroo and Hastings shoals may potentially be effected if appropriate management measures are not implemented. Coral habitat surrounding Direction, Tortoise and Ashburton Islands are not at risk.
  - Temporary and seasonal damage of seagrasses is anticipated during the dredging program, however no long term loss is anticipated from the Project area. Similarly there will be a temporary reduction in abundance (and therefore biomass) of foliose macroalgae in the vicinity of the navigation channel, however no permanent long-term reduction is anticipated, outside of the navigation channel route (approximately 250 ha).
  - Permanent modification of generally uncolonised soft substrate habitat beneath the nearshore infrastructure area (i.e. the MOF, the PLF, navigation channel) (approximately 1378 ha). This is a very minor irreversible loss of substrate given its wide-spread occurrence throughout the Project area and the Pilbara region in general, and given the substrate type contains no significant BPPH.
- ECU 2 – Onslow Offshore
  - No short or long term impacts to the coral habitats of Thevenard, Airlie or Direction Islands are anticipated.
  - Trunkline installation and stabilisation will result in loss of approximately 100 ha of filter feeder habitat, occurring between Thevenard and Bessieres Islands.
  - Plume modelling of the contingency trunkline installation and stabilisation method indicates that only filter feeder habitat is likely to be lost, potentially for a period exceeding five years. The area of filter feeder loss is conservatively anticipated to be 2000 ha which represents 10.6% of LAU 2D.
- ECU 3 – Inner Shelf
  - The contingency trunkline installation and stabilisation method, if implemented, will result in the loss approximately 1077 ha of filter feeder habitat which represents approximately 5.4 % of LAU 3A.
  - No long term irreversible loss of BPPH is anticipated from LAU 3B.

*BPPH Loss Assessment*

---

## **7 BPPH Loss Assessment Summary**

A summary of anticipated irreversible BPPH loss, as a result of Project-attributable activities is presented below (Table 7-1). Reversible loss of seagrass and macroalgae habitat has not been included in the table.

7 BPPH Loss Assessment Summary

Table 7-1 Summary of anticipated irreversible BPPH loss as a result of Project activities.

ECU	LAU	Activity	Samphire zone		Algal mats		Mangroves		Seagrass		Macroalgae		Corals		Filter feeders		
			%	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%	Ha	
0	0A	Onshore Infrastructure	0.0%	0.0	0.0%	0.0	0.0%	0.0	-	-	-	-	-	-	-	-	
	0B		17.0%	110.0	24.0%	241.0	6.0%	5.0	-	-	-	-	-	-	-	-	-
	0C		0.0%	0.0	0.0%	0.0	0.0%	0.0	-	-	-	-	-	-	-	-	-
1	1A	Dredging	-	-	-	-	-	-	-	-	-	-	-	6.8%	14.0	-	-
	1B		-	-	-	-	-	-	-	-	-	-	-	3.0%	4.0	-	-
	1C		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1D		-	-	-	-	-	-	-	2.0%	250 ha	-	-	-	-	-	-
2	2A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2D	Preferred trunkline Installation method	-	-	-	-	-	-	-	-	-	-	-	-	0.4%	70.0	-
	2D	Contingency trunkline Installation method	-	-	-	-	-	-	-	-	-	-	-	-	10.6%	1958.0	-
	2E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	3A	Preferred trunkline Installation method	-	-	-	-	-	-	-	-	-	-	-	-	0.1%	30.0	-
	3A	Contingency trunkline Installation method	-	-	-	-	-	-	-	-	-	-	-	-	5.4%	1077.0	-
	3B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



## References

- Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ). 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT.
- Birch, W. R., Birch, M. 1984. Succession and pattern of tropical intertidal seagrasses in Cockle Bay, Queensland. Australia: a decade of observations. *Aquatic Botany* 19: 343-367
- Cabaco, S., Santos, R. and Duarte, C.M. 2008. The Impact of Sediment Burial and Erosion on Seagrasses: A review. *Estuarine, Coastal and Shelf Science* 79: 354–366.
- Chevron Australia Pty Ltd. 2009. Wheatstone Project: Environmental Scoping Document. WS0-0000-HES-RPT-CVX-000-00003-00. 2<sup>nd</sup> June 2009.
- Coffey Geotechnics. 2009. Draft Interpretive Report - Chevron Wheatstone Development Project, Contract Number C611541, *Nearshore Geotechnical Investigation – Downstream*. Unpublished report for Chevron Australia Pty Ltd, November 2009.
- Commonwealth of Australia. 2009, *National Assessment Guidelines for Dredging*, Canberra.
- Cooper T.F., Uthicke, S., Humphrey, C. and Fabricius, K.E. 2007. Gradients in water column nutrients, sediment parameters, irradiance and coral reef development in the Whitsunday Region, central Great Barrier Reef. *Estuarine, Coastal and Shelf Science* 74: 458 – 470.
- Commonwealth Scientific and Industrial Research Organisation (CSIRO). 2006. Interim Marine and Coastal Regionalisation for Australia Technical Group (IMCRA) 2006, *Interim Marine and Coastal Regionalisation for Australia: An Ecosystem Based Classification for Marine and Coastal Environments*. Version 3.3. IMCRA Technical Group, Environment Australia, Canberra, ACT
- Damara WA. 2010. *Coastal Geomorphology of the Ashburton River Delta and Adjacent Areas*, February 2010. Unpublished Report to URS.
- Department of Environment and Conservation (DEC). 2006. *Background Quality of the Marine Sediments of the Pilbara Coast*. Department of Environment and Conservation, Perth, Western Australia, MTR11
- Department of Fisheries (DoF) 2009, *State of the Fisheries Report 2008 – 2009*. Available online: <http://www.fish.wa.gov.au/docs/sof/index.php>
- DHI. 2010a. *Wheatstone Project: Dredge Spoil Modelling Report*. Final Report Prepared for Chevron Australia Pty Ltd, May 2010.
- DHI. 2010b. *Wheatstone Project: Tolerance Limits Report*, Final Prepared for Chevron Australia Pty Ltd, May 2010.
- DHI. 2010c. *Wheatstone Project: Tolerance Limits Literature Review*. Draft prepared for Chevron Australia Pty Ltd. January 2010.
- DHI. 2010d. *Wheatstone Project: Dredge Plume Impact Assessment Report*. Final Report Prepared for Chevron Australia Pty Ltd, May 2010.
- DHI. 2010e. *Wheatstone Project: Coastal Impacts Modelling Report*. Final Report Prepared for Chevron Australia Pty Ltd, May 2010.



## 8 References

- Doorn-Groen, SM., and Foster TM. 2007. *Environmental monitoring and management of reclamation works close to sensitive habitats*, Proceedings of the World Dredging Congress XVIII, 27 May to 01 June 2007, Lake Buena Vista, Florida, USA.
- Ellison, JC (1998) Impacts of Sediment Burial on Mangroves. *Marine Pollution Bulletin*, 37: 420-426
- Environmental Protection Authority (EPA). 2001. *Guidance for the Assessment of Environmental Factors Western Australia (in accordance with the Environmental Protection Act 1986) Guidance Statement for protection of tropical arid zone mangroves along the Pilbara coastline*, No. 1 April 2001, Western Australia.
- Environmental Protection Authority (EPA). 2009. *Environmental Assessment Guidelines, No 3: Protection of Benthic Primary Producer Habitats in Western Australia's Marine Environment* GS 3. December 2009.
- Erfteemeijer, PLA and Lewis, RRR. 2006. Environmental impacts of dredging on seagrasses: A review. *Marine Pollution Bulletin* 52: 1553-1572
- Fabricius, K.E. 2005. Effects of terrestrial runoff on the ecology of corals and coral reefs: review and synthesis. *Marine Pollution Bulletin* 50: 125 – 146.
- Fabricius, K.E, Golbuo, Y., Victor, S. 2007. Selective mortality in coastal reef organisms from an acute sedimentation event. *Coral Reefs*, 26, 69.
- Gilmour J.P., Cooper T.F., Fabricius K.E. and Smith L.D. 2006. *Early warning indicators of change in the condition of corals and coral communities in response to key anthropogenic stressors in the Pilbara, Western Australia: Executive Summary and Future Recommendations*. Environmental Protection Authority, Western Australia.
- Gordon, D, Bougher, A, LeProvost, I, and Bradley, S. 1995. Use of Models for Detecting and Monitoring Change in a Mangrove Ecosystem in North Western Australia. *Environment International*, 21, No. 5, pp. 605-618.
- LeProvost, Dames and Moore. 1998. *Cargill Salt: Environmental Management Program Annual Report 1997*. Report to Cargill Salt by LeProvost Dames and Moore, Perth, Western Australia, This included the following component reports: Progress and Compliance Report (Report No. R694); Mangrove Monitoring Program and Rehabilitation Plan 1992-1997 Report (Report No. R678); Bitterns Discharge Monitoring Program 1992-1997 Report (Report No. R691); Monitoring of Rehabilitation Sites (Report No. R695) and Shorebird Monitoring 1993-1997, Final Report.
- LWI 2010, *Wheatstone Project Marine facilities, CUCA 3.2c Dredging and Disposal Plan*. Report prepared for Bechtel/Chevron Corporation March 2010. Doc No: EBR4454/0330/001
- Lyne, V Fuller, M Last, P Butler, A Martin, M and Scott, A. 2006. *Ecosystem Characterisation of Australia's North West Shelf*. North West Shelf Joint Environmental Management Study Technical Report No. 12. CSIRO Marine Research, Floreat, Western Australia.
- McArthur C., Ferry R., and Proni J. 2002. Development of Guidelines for Dredged Material Disposal Based on Abiotic Determinants of Coral Reef Community Structure. In "*Dredging 2002 – Key Technologies for Global Prosperity*", 3<sup>rd</sup> Speciality Conference on Dredging and Dredged Material Disposal. Editor Stephen Garbaciak Jr., May 5-8, 2002 Orlando Florida, USA. Publ. *American Society of Civil Engineers*

## 8 References

- Rasheed MA. 2004. Recovery and succession in a multi-species tropical seagrass meadow following experimental disturbance: the role of sexual and asexual reproduction. *Journal of Experimental Marine Biology and Ecology*. 310:13 - 45.
- Sinclair Knight Merz (SKM) 2010. *Wheatstone Project Draft Dredging and Spoil Disposal Management Plan*. Report for Chevron Australia Pty Ltd.
- Stoddard, JA and Anstee, S 2005. *Water quality plume modelling and tracking before and during dredging in Mermaid Sound, Dampier, Western Australia*. In: J.A Stoddard and S.E. Stoddard (eds.) *Corals of the Dampier Harbour, their Survival and Reproduction During the Dredging Programs of 2004*. Unpublished report for DPA and Pilbara Iron.
- URS Australia Pty Ltd 2009. *Methods Statement Wheatstone Benthic Habitat Mapping*, Draft Unpublished Report, September 2009.
- URS 2010a. 20-70m Contour Habitat Survey Field Report. Prepared for Chevron Australia Pty Ltd, May 2010.
- URS 2010b. Baseline Coral Community Description. Prepared for Chevron Australia Pty Ltd, May 2010.
- URS 2010c. Survey of Benthic Habitats near Onslow, Western Australia (15-70 metres). Prepared for Chevron Australia Pty Ltd, May 2010.
- URS 2010d. Deepwater Habitat Survey. Prepared for Chevron Australia Pty Ltd, May 2010.
- URS Australia Pty Ltd 2010e. Intertidal Habitats of Onslow coastline, Western Australia. Prepared for Chevron Australia Pty Ltd, May 2010.
- URS Australia Pty Ltd 2010f. Wheatstone Project: Survey of Subtidal Habitats off Onslow, Western Australia. Prepared for Chevron Australia Pty Ltd, May 2010.
- URS 2010g. Biota of Subtidal Habitats in Pilbara Mangroves, with Particular Reference to the Ashburton Delta and Hooley Creek. Prepared for Chevron Australia Pty Ltd, May 2010.
- URS 2010h. Benthic Primary Producer (Seagrass and Macroalgae) Habitats of the Wheatstone Project Area. Prepared for Chevron Australia Pty Ltd, May 2010.
- URS 2010i. Wheatstone Project: Ashburton River Delta Mangrove System: Impacts Assessment Report, Prepared for Chevron Australia Pty Ltd, May 2010.
- URS Australia Pty Ltd 2010j. Wheatstone Project: Justification of BPPH Loss Assessment Unit Boundaries. Report Prepared for Chevron Australia Pty Ltd, May 2010.
- URS 2010k. Wheatstone Project Groundwater Studies. Prepared for Chevron Australia Pty Ltd, May 2010.
- URS Australia Pty Ltd 2010l. Draft Sediment Quality Assessment – Wheatstone Dredging Program. Prepared for Chevron Australia Pty Ltd, May 2010.
- URS 2010m. Nearshore Acid Sulfate Soils Investigation (Turning Basin and Dredge Channel). Prepared for Chevron Australia Pty Ltd, May 2010.
- URS 2010n. Assessment of Potential Impacts of the Proposed Pipeline Route Through the Northern-Eastern Lagoon of the Ashburton Delta. Prepared for Chevron Australia Pty Ltd, May 2010.

*BPPH Loss Assessment*

---

## 8 References

University of Western Australia, 2009, *Wheatstone – Survey of benthic habitats near Onslow, Western Australia*. Report to URS Australia Pty Ltd by the Centre for Marine Futures, The University of Western Australia.

Williams SL. 1988 Disturbance and recovery of a deep-water Caribbean seagrass bed. *Marine Ecology Progress Series* 42: 63-71



---

42907466/WHST-STU-EM-RPT-0137/Rev 1

This page is intentionally blank

## Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Chevron Australia Pty Ltd and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between April and May 2010 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

## Appendix A Peer review by Dr Charles Sheppard on the selection of receptor tolerance limits by DHI.

The comments from Charles Sheppard's and DHI's responses to them presented in the following table relate to an earlier version of this DHI Tolerance Limits Report and not the version submitted with the Draft EIS/ERMP. These comments from Charles Sheppard were taken onboard in the latest version of this Tolerance Limits Report which is included as **Technical Appendix N3 with the EIS/ERMP.**

Professor Charles Sheppard  
Department of Biological Sciences  
University of Warwick, UK  
Chief Editor: *Marine Pollution Bulletin*

### A.1 Final comments: Revised DHI Tolerance Limits Report

Received 29 March 2010

This is a good report on tolerances of several tropical marine habitats to differing sediment loads. It presents an assessment and synthesis of a large amount of data along with some thorough quantities estimations of sediments that naturally exist or which might be added as a consequence of dredging and related activities. As a document which needs to be of practical use for engineers it will be useful. It is also clear that if the engineers applied the recommendations made, then certainly impacts from the dredging can be minimized.

The amount of literature surveyed seems comprehensive. The conclusions reached in their recommendations are perhaps the best that can be done in today's circumstances.

I have one of two concerns noted below, mostly concerning omissions (though the omissions may well be outside the scope of work here).

Most important perhaps is the comment made:

P 4. The location of the disposal areas are yet to be confirmed.

This location is of course going to be very important. It is stated elsewhere that the excavated material will not be suitable for landfill for shoreline construction, presumably meaning that all of it will be dumped somewhere further out to sea. It was said in earlier reports, and I commented on this before, that indications were such that it appears that a lot of the deepwater region is fairly rich in what is often called deepwater reefs. These are not photosynthetic, and indeed there is probably almost no light reaching most of them, but they are probably very important in secondary production, as feeding areas for fish including commercial species, and for biodiversity. Their importance should not be underestimated. Probably, the amount of sedimentation generated in the dumping grounds will exceed that done by the excavation. It might consist mostly of coarse grain material if fines are spilled at the excavation site, but the tonnage might be greater.

It is understood that the report being reviewed here is about tolerance levels, not about where each habitat is located and so on, but the dumping location surely is a central element of the whole story, because most of the sedimentation produced in the total project will come from it. I would like to take this opportunity to repeat that really, regardless of all the analysis that has been done, the primary objective must be to avoid making much sedimentation in the first place. A comment on page 37 illustrates the point with regard to seagrass in Western Australia, although the same point applies to corals and other habitats too:



## Appendix A

P 37. ... in a literature review compiled by Erftemeijer and Lewis (2006) which reports widespread loss of seagrass meadows in Australia ranging from a few hundred to a few thousand hectares as a result of dredging and associated turbidity and burial effects. Habitats of all types are lost continuously, not much by any one project possibly, but the total accumulates.

Reference was often made to Southeast Asia, sometimes to Singapore, where the cumulative damage done over many years has been enormous. I do not know what proportion of Singapore's corals, mangroves or Seagrasses are left, because the data does not exist, but it will not be great. Each single project might have been responsible for only a very small portion of the reduction, but the summation is nothing to be pleased with. I suspect the same is a danger in Western Australia.

We also know that:

P 8. the project area routinely experiences relatively low turbidity, with median turbidity at both nearshore and offshore survey locations ranging from 1–3 NTU and TSS ranging from 2–5mg/l.

This suggests that the habitats in this region are probably not very well adapted to raised or high turbidity. In the case of corals this means that they will be more sensitive to sedimentation; it does not mean that there is a longer way to go before they reach dangerous levels. I know this was not specifically claimed in the report although I did pick up that this might have been implied.

The second issue which seems to have been ignored (in this report at least) is that of how and where monitoring should take place. I would have thought some recommendations would be made.

What I think does matter now is something written, instructions if you like, on how measurements of turbidity will be done during operational work, the numbers and stations where the instrumentation will be deployed, frequency of measurement, and of course procedures on what to do if thresholds are exceeded. This goes alongside the issue of where the dumping will take place and, in conjunction with that what sedimentation monitoring will take place in the dumping grounds, not just where excavation takes place. The former is every bit as important as monitoring in areas where the dredging takes place. Presumably this will be developed and proposed when it is decided where the dumping grounds will be; it is not sufficient just to say that it will be offshore where currents will take it away.

In summary, the report, assessing as it does the literature on the effects of sedimentation, is good. It's structure may be rather repetitive with too much in the appendices being put in the main body of the report too, but maybe that doesn't matter much. I presume that this report is one of a suite of reports on managing the sediment loads.

### A.2 Comments on DHI (2010b), with particular reference to Sediment Tolerance tables.

Date: 22 October 2009

There is a considerable amount of literature on sedimentation and turbidity effects on corals; a lot of literature is listed in my interim report on this. The present report absorbs the latter report.

It is obvious that much of this literature is already known to DHI. Much of the published work is derived from work carried out in the Arabian/Persian Gulf and Caribbean, with some important work done on the Great Barrier Reef, which is highly relevant.

## Appendix A

Two key points are very important and which appear to have been omitted in the document tabling coral tolerance limits. These are the nature of the species concerned and the nature of the sediment.

### A.2.1 Sedimentation impacts

#### *Nature of species*

The tables treat corals as though "coral" can be viewed as either one kind of organism or perhaps as a kind of median or mean form of coral. But, as can be seen from some of the references below, different species vary in their susceptibility to sediment by one or even two orders of magnitude. Corals try to shed sediment after sediment has settled, so the shape of the colony form is one key feature which affects its susceptibility. On a leafy form, for example, sediment needs to be transported for a much greater distance than it would be on, for example, a lattice shaped table. The former would require much more energy expenditure than the latter. This is complicated by the greatly different abilities of corals to secrete mucus, which is one means by which shedding is done. There quite simply can be no kind of average coral for this.

#### *Nature of sediment*

Basically, fine sediments may have a quite different impact to coarse sediments on any one coral, even where the weight of each (in  $\text{g cm}^{-2}$  say) might be the same. Fine sediments of the sorts which are commonly found just sub-surface away from a coral reef can be the most harmful, and relatively small quantities of such fine sediment may have the same adverse effect as a much greater weight of coarse grained sediments.

I am not clear what the footnotes "assuming an initial deposition dry density of 400 etc." actually means. Should the tabulated values which indicate a certain amount be added to the initial density?

### A.2.2 Suspended sediment impacts tables

#### *Nature of species*

Again, the importance of the amount of light reduction depends not only on the weight of sediments and the time, but on the species concerned. Some species are dependent to at least 90% on photosynthesis for their nutrition; others less than 50% because they are more actively carnivorous. Indeed, the deepest kinds found, namely those that are not strictly reef corals but those on the deep shelf area where sediments may be finally placed, are entirely carnivorous and do not photosynthesize at all. There can be no 'average coral' in this respect.

#### *Nature of sediments*

As you know, coarse sediment settles out within a very short distance and in a short time. The finest sediments may remain in suspension almost indefinitely and will disperse over a greater area. There really can be no 'average sediment' as needs to be implied with tables such as these.

#### *General comments:*

What kills corals is probably a complex function between energy obtained and energy expended. The first is affected both by reduced light when turbidity rises, and also by 'feeding' on particles which turn





## Appendix A

out to be inert sand rather than a zooplankter. Energy expenditure is affected by the cost of shedding sediments (affected by colony shape, mucus production, depth etc.). With 200 species of corals there will be many widely varying responses.

The model appears at first sight to be an ingenious and, I believe, novel scheme incorporating, for example, alternative scenarios. These alternatives include zone of partial loss, temporary loss etc., made up from scenarios using 25 mg for 5 – 20 % of the time vs. 5 mg for more than 50 % of the time, and so on. But a weakness I think is that there is inadequate use of literature to justify the model used (it is called scenario modelling). Several time 'experience' with various other projects is used as justification, in which cases it is simply not possible to make a proper judgment.

It is very likely, of course, that some aspects of the tables will match some species of corals under some conditions. But we can easily see from the above that, while it is very likely in any one place that some corals will be killed to be replaced by other more sediment-tolerant species, this would change the nature of the reef or coral community, rather than simply kill it. Many examples exist whereby total coral cover in sediment areas is very high, but not by the same species that occur in clearer water.

Another concern is the apparent linear nature used in the model (as far as I can deduce). In most tables there seems to be a straightforward reciprocity between the two variables used (e.g. 10 mg for 25 % of the time being the same things as 25 mg for 10 % of the time). Biologically I don't think there is justification for this. Given the generally nonlinear responses of living organisms to various impacts, this would need to be very strongly justified. It may be the case, but I just don't know, and I find it unlikely.

To make the problem worse, it is also the case that the same species can respond differently to sedimentation depending upon its own 'history' of being subjected to this stress. These differences in responses may be an order of magnitude or greater. In other words, colonies of many species simply get "used to it" given several generations but, more than that, may even be able to utilize the sediment for feeding (or try to) more than would be the case for a colony of the same species in clear water. For this reason too, there is a nonlinearity in responses, and these also do not appear, as far as I can see, to be accounted for in these 14 day exposure scenario models.

There is no indication either of whether these values that are tabulated apply to coral larvae and their settlement and reproduction generally (i.e. to the next generation of corals), or whether they look at just the adult standing stock of corals.

It is also unclear whether the mixed effects of sediment and nutrients has been taken into account either. Sediment particles very commonly have substantial nutrient adsorbed on to their surfaces such that, when sediment is disturbed and put into suspension, pulses of raised nutrients become desorbed from particles into the water. This can have consequent, sometimes rapid effects on algal growth. In such cases, size of sediment particles is very important foot of the very nonlinear relationship between the total surface area of particles and their consequent adsorbed nutrients, with simple weight of sediment; smaller particle sizes have exponentially greater surface area for the same weight compared to coarser grained sediments.

The tables provide a very conservative permitted amount compared to some values (perhaps not most) in the literature. But literature values vary widely and in any case are commonly derived from experiments of short duration and not field events. Rather more persistent levels as might be found in field conditions would require lesser values for the same amount of damage. However, information on long-term exposures to sediment seems to be inadequate at present.

## Appendix A

These tables might look very suitable for engineering purposes, for some species in some places. But given that responses vary by 1 to 2 orders of magnitude depending on species and type of settlement, and given that some species might also adapt to some degree, I suspect that they apply to only a minority of situations. But I think it is an ingenious approach, which may well have valid application.

### *Practical issues*

I understand completely that straightforward, simple, adaptable thresholds and limits are needed in a practical sense for this Project. It may well be that biological meaningfulness may need to be subordinated, in the form of 'average corals' to the straightforward needs of the engineering operation. It is not entirely clear to me, however, that these tables can be robustly or adequately supported yet. This approach may be on the right track, however, and certainly something along these lines is badly needed, not only in this area of the world but in many others too.

### **A.2.3 Some specifics in the report which need strengthening**

A caution is needed in Section 2.1. The report says that "due to the lack of information and assumed lack of sensitive receptors for zone 3, no tolerance limits have been proposed for this offshore management area". Yet this is the area where the placement of millions of tons of sediment may take place and where a possibly significant amount of deep water ahermatypic and sponge reef occurs, i.e. experiencing exactly the problem that the next statement points out, namely that sediment interferes with filter feeding mechanisms.

DHI suggest that there are 'step changes' between turbid environments, which contain species that more tolerant to elevated sedimentation, and the clear water environments whose species that are less tolerant. The indicator for the difference appears to be whether the background sedimentation routinely exceeds the very approximate number 10 mg per liter. But in section Page 3.2, DHI states that tolerance limits are complex and cannot be described by a single threshold criterion. Yet that is exactly what DHI then suggest, by smoothing out all differences between different corals and different natures of sediment, particularly the all-important particle size. I honestly do not think that the simple linear combination of duration of impact and amount of sedimentation is anything like sufficient in any real-world case. Furthermore the tolerance limits recommended appear to have been developed for a 14 day time span with apparently some sort of consistent and uniform sedimentation throughout that period.

I agree completely with the statement: "the key to the process is to focus on the monitoring and management on the source of the impact, which is the dredger, rather than on receptors". In a Project of this scale it is only reduction of sediment plumes that can have any realistic possibility of success.

Another point made is that traditional biological monitoring usually only detects impacts once they have already occurred, which of course can be too late. The report points out that it is monitoring of the actual suspended sediment load, or release, which counts, and that probably only this has the potential to estimate damage which will be done or prevented.

The section on marine habitat status in Singapore is included, presumably, to use as the model or parallel condition for Western Australia. (But still any workings for the derivation of the thresholds in Singapore are missing, though an earlier report is referenced.) This section is, in any event, rather misleading. It states that coral is relatively rich in Singapore because about half of the genera worldwide exist there. Yet Singapore is just beside the coral triangle and it should have, and probably



## Appendix A

once did have, almost all of them. (Its higher diversity compared to the Caribbean is a red herring: this is a biogeographical aspect and nothing to do with Singapore being somehow better than the Caribbean.) Reports suggest that the reefs seem to be in a sorry state! Singapore may not be a very good example of conserving its once rich reef habitat! I think the authors recognize this in some of their following statements. And some of the coral relocation exercises there have been, as I'm sure the authors know, not entirely adequate compensation for what has been lost in several projects. Some of the reefs discussed, such as Pulau Hantu, may well be some of Singapore's best diving areas today but I suspect this is rather a case of the "shifting baselines syndrome". After all the report says that Acroporids are generally absent, and of course this genus likely was the most abundant, was it not? The trouble with this section is that it attempts to draw a parallel with Western Australia, when it probably should not.

This leads again to the tables of proposed thresholds which are proposed for the Project. What is determined as suitable thresholds (a combination of quantity x time) appear to be based on what they experienced in Singapore; rather more than on literature cited, perhaps). But given that Singapore may be a long way from any natural baseline while Northwest Australia is in a different condition, I think some justification is needed to apply the observations in the former area to the latter. In other words, corals in Singapore are those which are presumably highly tolerant to sediment.

The trouble is we have no very good information on whether this would make the Australian corals more or less resistant to sedimentation. It is entirely possible that several will disappear but that eventually total cover provision by those that survive will climb post-Project.

This all sounds rather negative, but I think that it is probably not possible to devise any other kind of table, if threshold tables are going to be used.

Taking minor to moderate impact, the proposal is (Table 3.3) that about 0.2 to 0.5 kg meter<sup>-2</sup> day<sup>-1</sup> is a threshold value. An equivalent amount derived for Persian Gulf water is sometimes 1 to 10 kg meter<sup>-2</sup> day<sup>-1</sup>. (Values obtained from consultancy reports which are not in the public domain). The Gulf values probably imply therefore a rough agreement, and even that the proposed Australia values are conservative. I conclude that the tables provided for the Australia case are probably fairly near the mark, though I make the important caveat that duration is key, sediment size is key, and species composition is key because of differential susceptibilities. If, for example, the Australian coral communities have been less subjected historically to elevated sediment then they will be more susceptible than those surviving in Singapore. I am not sure that anybody can sensibly tell.

In the absence of anything better being simple and possible, I would support these proposed tables of thresholds. For engineering purposes these, or something like these, need to be developed, but I imagine some stronger justification is needed for values chosen.

Feedback monitoring is problematic in that when (or if) coral communities are seen to be dying it is likely to be too late. Early indications of problems will be mortality of the more sensitive species, for example the *Acropora* group, which have apparently mostly disappeared from Singapore and which are also much less abundant now in the Persian Gulf than used to be the case. As noted, the only solution likely to produce an improved outcome would be reduction of the sediment plume generated by the dredging.

For suspended sediments similarly, the same kinds of caveats apply as they do to settled sediment, where again any biologist must be unhappy with the gross simplification needed to produce these tables. One point overlooked is the change in the kind of coral community that may occur. We know

*BPPH Loss Assessment*

---

## Appendix A

from the Persian Gulf for example that elimination of the dominant group (in this case the acroporids), for whatever reason, has led to substantial change in the reef type. In that Gulf, this has led to a loss of 3D structure and diversity.

### A.2.4 Conclusions

It is very difficult to see what alternative is possible to using simplistic tables like this (once the values are justified from the literature). Engineers and monitors will understand them. The quantities discussed seem to be reasonable. What cannot be forecast with these is any change in the type of coral community that will take place and which is acceptable; reduction of 3-D structure and diversity is bad even if total coral cover remains unchanged. In some senses, therefore, the levels may offer a false security; ignoring as it does the duration of sedimentation, the desorption of nutrients from the sediments when they are disturbed, and the history of sedimentation at the site, and so on.

But, as a guide during construction I think it is about the best that can be done (provided some more justification of the values from the cited report is added).



---

42907466/WHST-STU-EM-RPT-0137/Rev 3

BPPH Loss Assessment

Appendix A

A.3 DHI response to Dr Charles Sheppard's comments

Reviewer Comment (Charles Shepherd, dated 22 October 2009)	DHI Response
<p>The tables treat corals as though "coral" can be viewed as either one kind of organism or perhaps as a kind of median or mean form of coral. But, as can be seen from some of the references below, different species vary in their susceptibility to sediment by one or even two orders of magnitude. Corals try to shed sediment after sediment has settled, so the shape of the colony form is one key feature which affects its susceptibility. On a leafy form, for example, sediment needs to be transported for a much greater distance than it would be on, for example, a lattice shaped table. The former would require much more energy expenditure than the latter. This is complicated by the greatly different abilities of corals to secrete mucus, which is one means by which shedding is done. There quite simply can be no kind of average coral for this.</p>	<p>Tables are based on the most sensitive coral species, not an "average" coral species. The tables have been developed with a very conservative approach, based on available literature plus DHI's extensive monitoring experience, such that they should provide adequate protection for even the most sensitive coral. This is because the targets for managing dredging related impacts to corals in Singapore has been "no impact", which has generally been interpreted as "no mortality". Because site-specific and species-specific data are inevitably lacking when working in a new location (as in this case), DHI's approach has been to set the limits conservatively, with the view that they can be reviewed based on monitoring data during the Project, and optimized according to the monitoring results. This is the classic feedback monitoring approach that DHI has successfully applied in Europe and throughout SE Asia.</p>
<p>Basically, fine sediments may have a quite different impact to coarse sediments on any one coral, even where the weight of each (in g cm<sup>-3</sup> say) might be the same. Fine sediments of the sorts which are commonly found just sub-surface away from a coral reef can be the most harmful, and relatively small quantities of such fine sediment may have the same adverse effect as a much greater weight of coarse grained sediments.</p>	<p>Agreed. The tables are based on the fine sediments typically generated by dredging activities. Once again, as described above, due to the lack of site specific and species-specific data from the Project area, a conservative (but realistic) approach has been taken in setting the tolerance limits for sedimentation.</p>
<p>I am not clear what the footnotes "assuming an initial deposition dry density of 400 etc." actually means. Should the tabulated values which indicate a certain amount be added to the initial density?</p>	<p>The footnote indicates the density of sediment that has been assumed in converting the sedimentation tolerance limits from kg/m<sup>2</sup>/day to mm/14 days. DHI's sediment plume model presents sedimentation in terms of a layer thickness (i.e. mm/14 days), which is easy to observe in the field. However, much of the literature reports sedimentation in terms of a mass per unit area (since historically it has been measured using sediment traps). DHI therefore presents both measures in the tolerance limits table, and the value of 400kg/m<sup>3</sup> is used to convert between the two. The choice of 400kg/m<sup>3</sup> is based on DHI's extensive monitoring experience of sedimentation, and is a conservative value.</p>

42907466/WHST-STU-EM-RPT-0137/Rev.3

BPPH Loss Assessment

Appendix A

Reviewer Comment (Charles Shepherd, dated 22 October 2009)	DHI Response
<p>Again, the importance of the amount of light reduction depends not only on the weight of sediments and the time (as noted), but on the species concerned. Some species are dependent to at least 90% on photosynthesis for their nutrition; others less than 50% because they are more actively carnivorous. Indeed, the deepest kinds found, namely those that are not strictly reef corals but those on the deep shelf area where sediments may be finally placed, are entirely carnivorous and do not photosynthesize at all. There can be no 'average coral' in this respect.</p> <p>As you know, coarse sediment settles out within a very short distance and in a short time. The finest sediments may remain in suspension almost indefinitely and will disperse over a greater area. There really can be no 'average sediment' as needs to be implied with tables such as these</p>	<p>See response to comment #1. Limits are based on most sensitive species, not "average" species</p> <p>See response to comment #2. Agreed, sediment properties may vary considerably, with smaller grain sizes remaining in suspension while coarser grain sizes settle out within a relatively short distance from source. However, the level of variability (and uncertainty) in terms of suspended sediment impacts due to sediment properties (which are essentially light reduction impacts and potentially scouring impacts) is relatively small within the wider set of uncertainties associated with attempting to assess the impacts of dredging at this stage of a project. Other factors, such as flocculation and colloidal potential, colour, etc are also important. While it would be ideal to be able to address all of these variables, it would make the tables too unwieldy to be operationally useful, and the detailed sediment property information required is not available to be included until after dredging has actually started. At the end of the day, it must be recognized that the tables are based on a number of assumptions, and one of them is that the fine sediments have relatively uniform properties, and that the main factor controlling impact is the amount of fine sediment deposited on the corals. As the tables are based on extensive field monitoring and a conservative use of available literature, DHI feels that this assumption is relatively valid, but that it should of course be tested as part of the monitoring during the dredging works, and optimized via the feedback loop.</p>
<p>What kills corals is probably a complex function between energy obtained and energy expended. The first is affected both by reduced light when turbidity rises, and also by 'feeding' on particles which turn out to be inert sand rather than a zooplankton. Energy expenditure is affected by the cost of shedding sediments (affected by colony shape, mucus production, depth etc.). With 200 species of corals there will be many widely varying responses</p>	<p>Agreed, but as discussed above, a conservative approach has been taken, setting limits based on the most sensitive corals.</p>



42907465/WHST-STU-EM-RPT-0137/Rev 3

BPPH Loss Assessment

Appendix A

Reviewer Comment (Charles Shepherd, dated 22 October 2009)	DHI Response
<p>The model appears at first sight to be an ingenious and, I believe, novel scheme incorporating, for example, alternative scenarios. These alternatives include zone of partial loss, temporary loss etc., made up from scenarios using 25 mg for 5 - 20% of the time vs. 5 mg for more than 50% of the time, and so on. But a weakness I think is that there is inadequate use of literature to justify the model used (it is called scenario modelling). Several time 'experience' with various other projects is used as justification, in which cases it is simply not possible to make a proper judgment.</p>	<p>Unfortunately, while DHI has continuous monitoring data from more than 5 years of dredging and reclamation activities in SE Asia (in Singapore particularly), the majority of the projects are confidential, and DHI has not been able to convince the clients to allow DHI to publish the data. The only exception to this so far has been Doorne-Groen (2007), a copy of which can be provided upon request. What has been published extensively though is the feedback monitoring and management approach (e.g. Grey and Jensen 1993, Bach <i>et al.</i> 1997, Driscoll <i>et al.</i> 1997). The critical thing to recognize with the feedback approach is the acknowledgement that it is not possible to have all the information at the EIA stage, or even at the start of dredging. There are significant uncertainties in terms of dredging equipment and methodologies, timing, sediment characteristics, and receptor characteristics. The only way to address these uncertainties is to take a conservative approach at the EIA stage, and then to fine-tune or optimize the tolerance limits, release budgets, etc during the course of the project, based on the feedback loop from the monitoring data.</p>
<p>It is very likely, of course, that some aspects of the tables will match some species of corals under some conditions. But we can easily see from the above that, while it is very likely in any one place that some corals will be killed to be replaced by other more sediment-tolerant species, this would change the nature of the reef or coral community, rather than simply kill it. Many examples exist whereby total coral cover in sedimented areas is very high, but not by the same species that occur in clearer water.</p>	<p>The process of changing the coral reef community would not occur in the same timeframe as the monitoring for the project. If suspended sediments or sedimentation are too high, sensitive species will die, and over the long term be replaced by more tolerant species. But it takes many years for coral planulae to settle, grow and develop into new mature coral colonies. Monitoring during the dredging project will most likely be undertaken on a fortnightly or monthly interval, and would definitely identify the loss of any sensitive individuals. It is this loss of sensitive individuals that the tolerance tables are related to (and which the regulator is concerned about... they define a loss that takes greater than 5yrs to recover as a permanent loss).</p>

42907466\WHST-STU-EM-RPT-0137\Rev.3

BPPH Loss Assessment

Appendix A

Reviewer Comment (Charles Shepherd, dated 22 October 2009)	DHI Response
<p>Another concern is the apparent linear nature used in the model (as far as I can deduce). In most tables there seems to be a straightforward reciprocity between the two variables used (e.g. 10 mg for 25% of the time being the same things as 25 mg for 10% of the time). Biologically I don't think there is justification for this. Given the generally nonlinear responses of living organisms to various impacts, this would need to be very strongly justified. It may be the case, but I just don't know, and I find it unlikely.</p>	<p>The apparent reciprocity referred to by the reviewer is coincidental. The limits are actually based on an exponential dose/duration relationship for each zone of impact, similar to the curves proposed by Gilmour <i>et al</i> (2006) shown in Figure 4-1. DHI is very confident of the right-hand side of these curves, related to low levels of impact and long periods of time, as we have extensive monitoring data for this part of the curve. Data on the higher concentrations, which would be sufficient to kill corals in a short period of time, is lacking, as the projects have (generally) been managed to avoid these levels of impacts. DHI has therefore taken a conservative approach in estimating the values for the left hand side of the curves, potentially under-estimating the tolerance limits for the high concentrations (i.e. corals may be able to tolerate 25mg/l or 10mg/l for a longer period than shown in the tables before mortality actually occurs, but because of insufficient data on mortality, shorter durations are assumed at this stage)</p>
<p>To make the problem worse, it is also the case that the same species can respond differently to sedimentation depending upon its own 'history' of being subjected to this stress. These differences in responses may be an order of magnitude or greater. In other words, colonies of many species simply get "used to it" given several generations but, more than that, may even be able to utilize the sediment for feeding (or try to) more than would be the case for a colony of the same species in clear water. For this reason too, there is a nonlinearity in responses, and these also do not appear, as far as I can see, to be accounted for in these 14 day exposure scenario models.</p>	<p>DHI agrees that there is definitely a difference in response from the same species, depending on their own history of stress, and what type of background conditions they are accustomed to. Differences between corals in normally clear water vs normally turbid water has been accounted for by the use of the two separate tables, one for the nearshore area (which is typically turbid) and the shallow offshore areas, which are clearer. Once again, these are based on the most sensitive corals in these areas.</p>
<p>There is no indication either of whether these values that are tabulated apply to coral larvae and their settlement and reproduction generally (i.e. to the next generation of corals), or whether they look at just the adult standing stock of corals.</p>	<p>Impacts to larval settlement and coral reproduction are not currently covered, the focus of the tables is the adult standing stock. DHI is continuing to research the impacts of suspended sediments and sedimentation on both of these issues, but does not have sufficient data at this stage to set meaningful limits.</p>



42907466/WHST-STU-EM-RPT-0137/Rev 3



BPPH Loss Assessment

Appendix A

Reviewer Comment (Charles Shepherd, dated 22 October 2009)	DHI Response
<p>It is also unclear whether the mixed effects of sediment and nutrients has been taken into account either. Sediment particles very commonly have substantial nutrient adsorbed on to their surfaces such that, when sediment is disturbed and put into suspension, pulses of raised nutrients become desorbed from particles into the water. This can have consequent, sometimes rapid effects on algal growth. In such cases, size of sediment particles is very important because of the very nonlinear relationship between the total surface area of particles and their consequent adsorbed nutrients, with simple weight of sediment; smaller particle sizes have exponentially greater surface area for the same weight compared to coarser grained sediments.</p> <p>The tables provide a very conservative permitted amount compared to some values (perhaps not most) in the literature. But literature values vary widely and in any case are commonly derived from experiments of short duration and not field events. Rather more persistent levels as might be found in field conditions would require lesser values for the same amount of damage. However, information on long-term exposures to sediment seems to be inadequate at present.</p>	<p>The mixed effects of nutrients and sediment have been implicitly included in the tables, as they are based on extensive field monitoring data which document coral response to these two linked sources of impact. However, this is based on the assumption that the nutrient levels in the Project area are similar to those in SE Asia, which may not be valid. It is noted though that previous observations from the Onslow Salt dredging which was carried out adjacent to the project site did not record any issues of algal blooms, indicating that this may not be a significant concern.</p>
<p>These tables might look very suitable for engineering purposes, for some species in some places. But given that responses vary by 1 to 2 orders of magnitude depending on species and type of settlement, and given that some species might also adapt to some degree, I suspect that they apply to only a minority of situations. But I think it is an ingenious approach, which may well have valid application.</p> <p>I understand completely that straightforward, simple, adaptable thresholds and limits are needed in a practical sense for this project. It may well be that biological meaningfulness may need to be subordinated, in the form of 'average corals' to the straightforward needs of the engineering operation. It is not entirely clear to me, however, that these tables can be robustly or adequately supported yet. This approach may be on the right track, however, and certainly something along these lines is badly needed, not only in this area of the world but in many others too.</p>	<p>As discussed above (see response # 1, 5 and 7 in particular), DHI has taken a conservative (but realistic) approach in setting the tolerance limits. While information on long-term exposure to sediments is inadequate in published literature, DHI has access to more than 5 years of continuous monitoring data which has been used to help determine the values in the tolerance tables taking long-term exposure into account.</p>
<p>I understand completely that straightforward, simple, adaptable thresholds and limits are needed in a practical sense for this project. It may well be that biological meaningfulness may need to be subordinated, in the form of 'average corals' to the straightforward needs of the engineering operation. It is not entirely clear to me, however, that these tables can be robustly or adequately supported yet. This approach may be on the right track, however, and certainly something along these lines is badly needed, not only in this area of the world but in many others too.</p>	<p>As discussed above (see response #1), the tolerance limits tables have been developed using a conservative approach in order to protect the most sensitive coral species. They have been successfully adapted and applied throughout SE Asia, and can also be successfully adapted to this project. However, as discussed above, they must be seen as a starting point, rather than an end point, due to the lack of available site-specific data at this stage of the project.</p>

42907466\WHST-STU-EM-RPT-0137\Rev.3

BPPH Loss Assessment

Appendix A

Reviewer Comment (Charles Shepherd, dated 22 October 2009)	DHI Response
<p>A caution is needed in Section 2.1. The report says that "due to the lack of information and assumed lack of sensitive receptors for zone 3, no tolerance limits have been proposed for this offshore management area". Yet this is the area where the dumping of millions of tons of sediment may take place and where a possibly significant amount of deep water ahermatypic and sponge reef occurs, i.e. experiencing exactly the problem that the next statement points out, namely that sediment interferes with filter feeding mechanisms.</p>	<p>Zone 3 was initially where all of the offshore dredged material was proposed to be dumped. However, DHI's understanding is that now only a relatively small volume of very fine material (mostly from cleanup dredging) will be dumped in Zone 3. This combined with the significant water and depth and current speeds means that the bulk of the material is likely to be dispersed over a relatively wide area, effectively "diluting" the impacts. Significant impacts to the seabed communities outside of the "dump site" would not be expected, and it is actually seen as the most desirable dumping site from a strictly environmental view point (though not from an economic view point given the significant sailing distances). However, for completeness, DHI will expand the tolerance limits report to include this third sector. Tolerance limits will have to be based very much on conservative assumptions, as literature is particularly scarce in terms of scouring and filter feeding impacts on deeper water soft tissue invertebrates, and DHI does not have previous monitoring data for these communities.</p>
<p>DHI suggest that there are 'step changes' between turbid environments, which contain species that more tolerant to elevated sedimentation, and the clear water environments whose species that are less tolerant. The indicator for the difference appears to be whether the background sedimentation routinely exceeds the very approximate number 10 mg per litter. But in section Page 3.2, DHI states that tolerance limits are complex and cannot be described by a single threshold criterion. Yet that is exactly what DHI then suggest, by smoothing out all differences between different corals and different natures of sediment, particularly the all-important particle size. I honestly do not think that the simple linear combination of duration of impact and amount of sedimentation is anything like sufficient in any real-world case.</p>	<p>The statement in Section 3.2 refers to the traditional approach of some impact assessments and monitoring programs to use a single trigger or threshold criterion (e.g. TSS = 100mg/l) to determine impact or trigger a management response.</p> <p>The other main issues raised have (hopefully) been addressed in previous response above. As emphasized already, this approach has been extensively tested and developed through more than 5 years of continuous monitoring and management of dredging and reclamation works near coral reefs.</p>
<p>Furthermore the tolerance limits recommended appear to have been developed for a 14 day time span with apparently some sort of consistent and uniform sedimentation throughout that period.</p>	<p>The tolerance limits are based on a 14 day period as this matches the spring neap cycle. Current speeds are typically higher during spring tides, and lower during neap tide periods. Higher currents result in higher suspended sediments and lower sedimentation (due to lower deposition and higher resuspension), and vice-versa during low current periods. By running the sediment plume model over the 14 day period, and comparing the results of the model against the tolerance limits for the 14 day period, this variability is incorporated, and "net" sedimentation can be determined.</p>



42907465/WHST-STU-EM-RPT-0137/Rev 3

BPPH Loss Assessment

Appendix A

Reviewer Comment (Charles Shepherd, dated 22 October 2009)	DHI Response
<p>I agree completely with the statement: "the key to the process is to focus on the monitoring and management on the source of the impact, which is the dredger, rather than on receptors". In a project of this scale it is only reduction of sediment plumes that can have any realistic possibility of success.</p> <p>Another point made is that traditional biological monitoring usually only detects impacts once they have already occurred, which of course can be too late. The report points out that it is monitoring of the actual suspended sediment load, or release, which counts, and that probably only this has the potential to estimate damage which will be done or prevented.</p>	<p>Agreed, and thanks for the support. For far too long dredge monitoring and management has focused almost exclusively on the receptors (which are of course important), but by the time you are measuring a response of the receptor, it's too late, the impact has been realized. And you have no understanding of why the impact has been realized, unless you have also been monitoring both the dredger and the background conditions both locally and at reference locations.</p>
<p>The section on marine habitat status in Singapore is included, presumably, to use as the model or parallel condition for Western Australia. (But still any workings for the derivation of the thresholds in Singapore are missing, though an earlier report is referenced.) This section is, in any event, rather misleading. It states that coral is relatively rich in Singapore because about half of the genera worldwide exist there. Yet Singapore is just beside the coral triangle and it should have, and probably once did have, almost all of them. (Its higher diversity compared to the Caribbean is a red herring; this is a biogeographical aspect and nothing to do with Singapore being somehow better than the Caribbean.) Reports suggest that the reefs seem to be in a sorry state! Singapore may not be a very good example of conserving its once rich reef habitat! I think the authors recognize this in some of their following statements. And some of the coral relocation exercises there have been, as I'm sure the authors know, not entirely adequate compensation for what has been lost in several projects. Some of the reefs discussed, such as Pulau Hantu, may well be some of Singapore's best diving areas today but I suspect this is rather a case of the "shifting baselines syndrome". After all the report says that Acroporids are generally absent, and of course this genus likely was the most abundant, was it not? The trouble with this section is that it attempts to draw a parallel with Western Australia, when it probably should not.</p>	<p>The main purpose of the section was to demonstrate the variety of projects where the release budget and scenario modelling approaches had been successfully applied. It was not the intent to place the corals of Singapore, which occur adjacent to the world's busiest port, in the same league in terms of overall habitat quality with the corals in the Pilbara, which is a relatively undeveloped and un-impacted landscape. To avoid this impression, this section has been moved to an appendix.</p>

42907466\WHST-STU-EM-RPT-01317\Rev 3

BPPH Loss Assessment

Appendix A

Reviewer Comment (Charles Shepherd, dated 22 October 2009)	DHI Response
<p>This leads again to the tables of proposed thresholds which are proposed for the Project. What is determined as suitable thresholds (a combination of quantity x time) appear to be based on what they experienced in Singapore; rather more than on literature cited, perhaps). But given that Singapore may be a long way from any natural baseline while Northwest Australia is in a different condition, I think some justification is needed to apply the observations in the former area to the latter. In other words, corals in Singapore are those which are presumably highly tolerant to sediment. The trouble is we have no very good information on whether this would make the Australian corals more or less resistant to sedimentation. It is entirely possible that several will disappear but that eventually total cover provision by those that survive will climb post-project.</p> <p>This all sounds rather negative, but I think that it is probably not possible to devise any other kind of table, if threshold tables are going to be used.</p>	<p>The approach has been to use the Singapore-derived tolerance limits as a starting point, but in recognition of the different baseline conditions, and based on the available literature of tolerances for the most sensitive coral species in the Project area, to reduce the tolerance limits for the Project area to a more conservative level for this initial EIA assessment. As discussed above, the tolerance limits tables should be seen as a conservative starting point, and they should be refined and optimized through on-site monitoring leading up to and during the dredging works.</p>
<p>Taking minor to moderate impact, the proposal is (table 3.3) that about 0.2 to 0.5 kg meter<sup>2</sup> day<sup>-1</sup> is a threshold value. An equivalent amount derived for Persian Gulf water is sometimes 1 to 10 kg meter<sup>2</sup> day<sup>-1</sup>. (Values obtained from consultancy reports which are not in the public domain). The Gulf values probably imply therefore a rough agreement, and even that the proposed Australia values are conservative. I conclude that the tables provided for the Australia case are probably fairly near the mark, though I make the important caveat that duration is key, sediment size is key, and species composition is key because of differential susceptibilities. If, for example, the Australian coral communities have been less subjected historically to elevated sediment then they will be more susceptible than those surviving in Singapore. I am not sure that anybody can sensibly tell.</p> <p>In the absence of anything better being simple and possible, I would support these proposed tables of thresholds. For engineering purposes these, or something like these, need to be developed, but I imagine some stronger justification is needed for values chosen.</p>	<p>Correct, at this stage, in a new area, the only approach is to make conservative assumptions and then test them and refine them through field measurements.</p> <p>This comparison is very useful, and DHI is reassured that the sedimentation values are broadly similar (and perhaps lower, which was the intention) than Prof Shepherd's experience in other parts of the world. DHI fully concurs that duration, grain size and species mix are critical, and has attempted to cover these variables in the development of the tables. DHI's understanding (supported by a review of 3 years of MODIS satellite imagery) is that the corals in the area are periodically exposed to elevated suspended sediment levels and subsequent elevated sedimentation rates due to the strong discharges of terrigenous sediment from the Ashburton, and resuspension of fine seabed material in the shallow coastal waters due to strong spring tides and strong winds during certain periods. But as Prof Shepherd points out, it is not possible to tell if this would make them more or less susceptible to impacts from the dredging works than Singapore corals, so the tolerance limits have been reduced in order to be conservative until field measurements can validate the limits.</p> <p>DHI appreciates Prof Shepherd's support, and re-iterates that the limits will need to be tested and optimised during the course of the dredging.</p>



42907466/WHST-STU-EM-RPT-0137Rev.3

BPPH Loss Assessment

Appendix A

Reviewer Comment (Charles Shepherd, dated 22 October 2009)	DHI Response
<p>The trouble with feedback monitoring is that when (or if) coral communities are seen to be dying it is of course likely to be too late. Early indications of problems will be mortality of the more sensitive species, for example the <i>Acropora</i> group, which have apparently mostly disappeared from Singapore and which are also much less abundant now in the Persian Gulf than used to be the case. As noted, the only solution likely to guarantee good results will be severe reduction of the sediment plume generated by the dredging</p>	<p>What is described is (unfortunately) the usual outcome from more traditional monitoring programs, which are reactive and require a response from the coral in order to trigger a response. The essence of true feedback monitoring is to proactively manage the dredging works, so that impacts are predicted and then prevented, rather than observed. There are a variety of management tools at hand, and while control of production is one, spatial and temporal controls are also effective, if applied with a good understanding of the hydrodynamics and the eventual fate of the sediments.</p>
<p>For suspended sediments similarly, the same kinds of caveats apply as they do to settled sediment, where again any biologist must be unhappy with the gross simplification needed to produce these tables. One point overlooked is the change in the kind of coral community that may occur. We know from the Persian Gulf for example that elimination of the dominant group (in this case the acroporids), for whatever reason, has led to substantial change in the reef type. In that Gulf, this has led to a loss of 3D structure and diversity.</p>	<p>DHI concurs that loss of keystone species (such as <i>Acropora</i>) from the reefs leads to a significant change in the reef structure, even though the percent cover may be the same (or sometimes even higher). As highlighted previously, the tables have been developed based on the most sensitive corals, in order to prevent the loss of these sensitive keystone species. The monitoring data that they have been based upon has measured species diversity and size class distribution as, and monitoring of individual colonies of keystone species, as well as the more usual percent cover measurements. Based on this, the tables have been developed to prevent changes in the assemblage and structure of the reef, not just its percent cover.</p>
<p>It is very difficult to see what alternative is possible to using simplistic tables like this (once the values are justified from the literature). Engineers and monitors will understand them. The quantities discussed seem to be reasonable. What cannot be forecast with these is any change in the type of coral community that will take place and which is acceptable; reduction of 3-D structure and diversity is bad even if total coral cover remains unchanged. In some senses, therefore, the levels may offer a false security, ignoring as it does the duration of sedimentation, the desorption of nutrients from the sediments when they are disturbed, and the history of sedimentation at the site, and so on.</p> <p>But, as a guide during construction I think it is about the best that can be done (provided some more justification of the values from the cited report is added).</p>	<p>DHI is grateful for Prof Shepherd's qualified support of the approach and the limits proposed. While it is a simplistic approach, DHI is continually working to strengthen and improve it. As discussed above, the limits do actually address the issues of loss of 3D structure and diversity, duration of sedimentation, nutrients, etc., as they have been based on a long-term monitoring that has linked the overall integrated biological response to all of these issues in correlation with the levels of suspended sediment and sedimentation received by the corals. As requested, some additional justification of the limits has been provided in subsequent revisions of the report, though unfortunately due to confidentiality restrictions DHI has not been able to provide details of the monitoring data used to help to derive the limits. But as stated previously, the limits have been set to a conservative level, and should be viewed as a starting point that can be refined and optimized during the course of the monitoring.</p>

42907466\WHST-STU-EM-RPT-0137\Rev.3

## Appendix B Intertidal BPPH Tables for the Wheatstone Project.

The following tables have been prepared on the basis of both historical and recent mapping data to address items 2 to 6 above, and to determine the total cumulative loss estimates for comparison with the CLG. Several sources have been used to determine the original area of each of the three intertidal BPPH types including the extent of historical loss (i.e. from the Onslow Salt development), the current area of each BPPH type, and the proposed loss occurring as a result of the Project. These sources include:

- Onslow Salt Project Environmental Review and Management Program: Volume 1 (Gulf Holdings Pty Ltd 1990) – This document provides areal extent data for mangrove and algal mats from Hooley Creek to Coolgra Point, prior to the construction of the Onslow Salt pond system. This data provides the most reliable indication of baseline or pre-European BPPH areas as the construction of the salt pond system has been the only significant historical loss of BPPH in the Onslow area.
- Changes to Project, Onslow Solar Salt Pty. Ltd., Onslow Salt Solar Project, Section 46 (Halpern Glick Maunsell Pty Ltd 1997) – this source together with EPA (1997) (below) confirms the extent of mangrove and algal mat loss from the Onslow Salt pond project, including areas in both the Hooley Creek – Four Mile Creek area (for construction of crystalliser ponds) and the Beadon Creek – Coolgra Point area (for construction of concentration ponds and seawater intake infrastructure).
- Onslow Solar Salt Project. Onslow Salt Pty. Ltd. Proposed Change to Environmental Conditions: Report and Recommendations of the Environmental Protection Authority. EPA, Perth, Western Australia. Bulletin 857 June 1997.
- Intertidal Habitats of Onslow Coastline, Western Australia (URS 2010e) – Mapping of intertidal habitats in the both the Ashburton River Delta and the Hooley Creek – Four Mile Creek LAUs undertaken for the Project.

The extent of BPPH loss from the Project was calculated by overlaying the revised terrestrial assessment area (10 February 2010 alignment) on the intertidal habitat map as shown in Figure 3-2.

Tables 1 to 3 provide the data for each of the intertidal BPPH types of mangroves, high tidal mud flat (bioturbated mud flat and samphire zone) and algal mats. In each table the data is provided for each of the three defined LAUs and also for the broader ECU0 (the ECU which is composed of the three LAUs) to provide a more regional context of BPPH extent and loss

Tables 4 and 5 provide a comparison of existing and total cumulative loss percentages against the CLG for both the Ashburton Delta (LAU0C) and Hooley Creek to Four Mile Creek (LAU0B) areas. Total cumulative loss percentages are provide for both the original and revised terrestrial assessment area alignments as shown in Figure 3-2

BPPH Loss Assessment

Appendix B

Table B-1 BPPH Assessment: Mangroves

BPPH LAU	Original Mangrove Extent (ha)	Historical Loss of Mangroves (ha and %)	Current Mangrove Extent (ha)	Proposed Project Loss (ha)	Cumulative Loss (ha and %)	Remaining Area (ha)
Ashburton Delta (LAU0C)	526 ha <sup>4</sup>	0 ha or 0%	526 ha <sup>4</sup>	0 ha	0 ha or 0%	526 ha
Hooley's Creek to Four Mile Creek (LAU0B)	84 ha <sup>1,4</sup>	1 ha or 1% <sup>1</sup>	83 ha <sup>4</sup>	4 ha <sup>4</sup>	5 ha or 6%	79 ha
Beadon Creek to Coolgra Pt (LAU0A)	839 ha <sup>1</sup>	1 ha or 0.1% <sup>1</sup>	838 ha	0 ha	1 ha or 0.1%	838 ha
Total ECU0 area	1450 ha	2 ha or 0.1%	1448 ha	4 ha	6 ha or 0.4%	1444 ha

42907466/WHST-STU-EM-RPT-0137/Rev.3

BPPH Loss Assessment

Appendix B

Table B-2 BPPH Assessment: High Tidal Mud Flat – Bioturbated Mud flat and Samphire Zone

BPPH LAU	Original Habitat Extent (ha)	Historical Loss of Habitat (ha and %)	Current Habitat Extent (ha)	Proposed Project Loss (ha)	Cumulative Loss (ha and %)	Remaining Area (ha)
Ashburton Delta (LAU0C)	683 ha <sup>4</sup>	0 ha or 0%	683 ha <sup>4</sup>	0 ha	0 ha or 0%	683 ha
Hooley's Creek to Four Mile Creek (LAU0B)	639 ha <sup>1,4</sup>	2 ha or 0.3 % <sup>1 and 4</sup>	637 ha <sup>4</sup>	108 ha <sup>4</sup>	110 ha or 17%	529 ha
Beadon Creek to Coolgra Pt (LAU0A)	1160 ha <sup>4</sup>	40 ha or 3% <sup>4</sup>	1120 ha	0 ha	0 ha or 0%	1120 ha
Total ECU0 area	2482 ha	42 ha or 2%	2440 ha	108 ha	150 ha or 6%	2332 ha

42907466/WHST-STU-EM-RPT-0137/Rev 3



BPPH Loss Assessment

Appendix B

Table B-3 BPPH Assessment: Algal Mats

BPPH LAU	Original Algal Mat Extent (ha)	Historical Loss of Algal Mats (ha and %)	Current Algal Mat Extent (ha)	Proposed Project Loss (ha)	Cumulative Loss (ha and %)	Remaining Area (ha)
Ashburton Delta (LAU0C)	0 ha	0 ha or 0%	0 ha	0 ha	0 ha or 0%	0 ha
Hooley's Creek to Four Mile Creek (LAU0B)	1004 ha <sup>1,4</sup>	189 ha or 19% <sup>1, 2, and 3</sup>	815 ha <sup>4</sup>	52 ha <sup>4</sup>	241 ha or 24%	763 ha
Beadon Creek to Coolgra Pt (LAU0A)	1008 ha <sup>1</sup>	191 ha or 19% <sup>1, 2, and 3</sup>	817 ha	0 ha	191 ha or 19%	817 ha
Total ECU0 area	2012 ha	380 ha or 19%	1632 ha	52 ha	432 ha or 21%	1580 ha

42907466\WHST-STU-EM-RPT-0137\Rev.3

BPPH Loss Assessment

Appendix B

Table B-4 Cumulative Loss Summary: Ashburton Delta (LAU0C)

BPPH type	EAG 3 CLG (Category and % Loss)	Existing Cumulative Loss (%)	Cumulative Loss (original terrestrial assessment area alignment)	Cumulative Loss (revised terrestrial assessment area alignment)
Mangroves	Category A 0%	0%	0%	0%
High Tidal Mud Flat (Sarnphire/Bioturbated Zone)	Category A 0%	0%	0%	0%
Algal Mats	Category A 0%	0%	0%	0%

42907468/WHST-STU-EM-RPT-0137/Rev 3

Appendix B

Table B-5 Cumulative Loss Summary: Hooley Creek – Four Mile Creek (LAU0B)

BPPH type	EAG 3 CLG (Category and % Loss)	Existing Cumulative Loss (%)	Cumulative Loss (original terrestrial assessment area alignment)	Cumulative Loss (revised terrestrial assessment area alignment)
Mangroves	Category E 10%	1%	44%	6%
High Tidal Mud Flat (Sarnphire/Bioturbated Zone)	Category E 10%	0.3%	28%	17%
Algal Mats	Category F (0% increase from existing loss)	19%	27%	24%

## Appendix C Peer review by Dr Eric Paling on the BPPH in the Project Area.

**Dr Eric Paling**

**Department of Marine Sciences**

**Murdoch University, Perth, Western Australia**

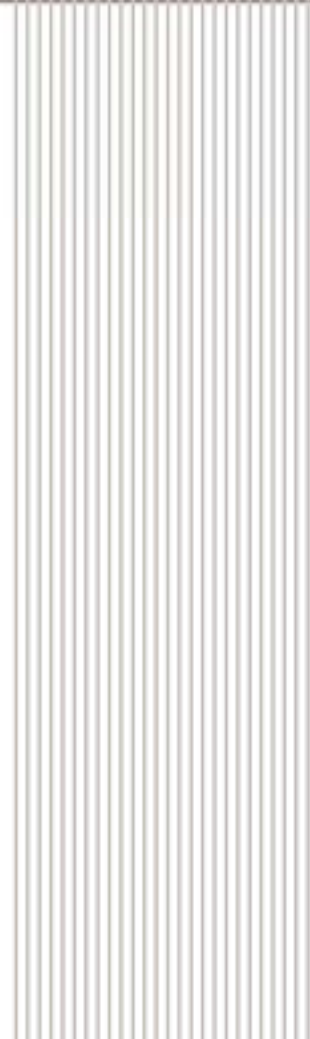
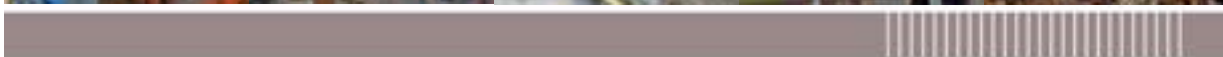
Algal mats have been shown to be able to fix atmospheric nitrogen (Paling *et al.* 1989) and potentially provide a source of nutrients for seaward ecosystems (Paling and McComb 1994). This is the reason for their inclusion as a potentially significant intertidal habitat and BPPH unit in EAG 3. In terms of ecological value, algal mats, in addition to the above, provide a habitat for microbes, a form of fixed carbon and a food source for grazing crustaceans, particularly on high spring tides (Paling 1986).

However the contribution that algal mats make to seaward ecosystems has not yet been verified as several factors have not been studied. For example, although algal mats leach nutrients into retreating seawater on an outgoing tide, much of this material will not be able to be absorbed by mangrove root systems due to the speed of seawater flow and its channelling towards tidal creeks. Additionally, algal mats only leach nutrients on the first few spring tides to inundate them or after sporadic rainfall events. They do so because their cells walls, when dried, lose integrity and allow the leaching of material after rewetting (Paling and McComb 1994). Once their cell walls reinstate their integrity, they provide much more protection for the cell contents and less leaching occurs. The only definitive method to trace nutrients (e.g. nitrogen) between algal mats and mangrove systems would be by isotope labelling.

In addition several pieces of evidence suggest that mangroves do not receive a great degree of assistance from algal mats. This is derived from the observation that where algal mat loss has occurred there appear to be no adverse affects on adjacent mangroves or the integrity of the system in which they occur. The most relevant example is the adjacent solar salt development around Onslow where 380 ha of algal mat were removed. Long term pre and post monitoring of mangroves associated with the operation have shown no observable impact on mangroves, either around the crystallisers or the evaporative ponds east of the Onslow town site (Biota Pty Ltd 2003). Examples are also provided in Dampier (solar salt development, Paling 1986) and Port Hedland (harbour development, Paling *et al.* 2003), although these had much less extensive pre-monitoring than Onslow.

Thus, based upon the evidence described above, it is unlikely that the ecological integrity of the Hooley/Four Mile Creek system will be compromised by the removal of the algal mat from this development.

It is more difficult to assess the significance of any loss of the high tidal mud flat (samphires and bioturbated mud flat) as there is less information available on their production ecology (both primary and secondary) and these are not generally well-studied worldwide. There are also no data available on the ecological connectivity, if any, between mangroves and samphires. Generally, apart from their own intrinsic ecological value, it can be inferred that the loss of high tidal mud flat does not influence the ecological integrity of adjacent mangrove systems. This conclusion is based upon the lack of ecological effects on mangroves noted from the observed loss of 42 ha of this habitat in the Onslow Salt development and substantial losses around the Dampier and Port Hedland areas.



URS Australia Pty Ltd  
Level 4, 407 Pacific Highway  
Artarmon NSW 2064  
Australia  
T: 61 2 8925 5500  
F: 61 2 8925 5555

[www.ap.urscorp.com](http://www.ap.urscorp.com)

---

# Appendix N2

Dredge Plume Impact Assessment

1	Introduction	158
2	Key Receptors and Tolerance Limits	160
2.1	Key Receptors	160
2.2	Types of Impacts	163
2.2.1	Dredging, Onshore and Offshore Disposal Related Impacts	163
2.2.2	Classification of Impacts	165
2.3	Tolerance Limits	166
2.3.1	Coral Tolerance to Suspended Sediments	167
2.3.2	Coral Tolerance to Sedimentation	168
2.3.3	Seagrass Tolerance to Suspended Sediments	169
2.3.4	Seagrass Tolerance to Sedimentation	169
3	Dredging Scenarios	171
3.1	Dredging Activities	172
3.1.1	Dredging Scenario 1	174
3.1.2	Dredging Scenario 2	175
3.1.3	Dredging Scenario 3	176
3.1.4	Dredging Scenario 4	177
3.1.5	Dredging Scenario 5	178
3.1.6	Dredging Scenario 6	179
3.1.7	Dredging Scenario 7	180
3.1.8	Dredging Scenario 7A (Optimised)	181
3.2	Pipeline Trenching Activities	182
3.2.1	Pipeline Trenching Scenario 1	183
3.2.2	Pipeline Trenching Scenario 2	184
3.3	Climatic Scenarios	184
3.3.1	Seasonal Variability	184
3.3.2	Wind Conditions	185
3.4	Spill Scenarios	185
4	Assessment Methodology	186
4.1	Determining Impact Zones for Individual Scenario Results	186
4.2	Producing Estimated Zones of Impact (EZI)	186
4.3	Producing Indicative Zones of Impact (IZI)	187
5	Impact Assessment	188
5.1	Realistic vs Worst Case Spill Rates	188
5.2	Seasonal Effects	188
5.3	Climatic Variability	197
5.4	Dredging Activities	197
5.4.1	Cutter Suction Dredger (CSD)	197
5.4.2	Trailer Suction Hopper Dredger (TSHD)	206
5.4.3	Offshore Placement	220

5.5	Pipeline Trenching	228
5.5.1	Trenching near Ashburton Island	228
5.5.2	Trenching near Bessieres Island and Brewis Reef	234
5.6	Summary of Zones of Impact for Sensitive Receptors	240
5.6.1	Summary of Impacts from Dredging Activities	240
5.6.2	Summary of Impacts from Pipeline Trenching Activities	248
5.7	Overall Zones of Impact	249
5.7.1	Dredging Indicative Impact Zones	250
5.7.2	Pipeline Trenching Indicative Impact Zones	255
6	Mitigation, Monitoring and Management Measures	258
6.1	Monitoring and Management Programme	258
6.2	Mitigation Measures	258
7	Conclusions and Recommendations	259
8	References	261
Appendix A	Processed Model Results Based on MesoLAPS Winds	
Appendix B	Processed Model Results Based on Onslow Winds	



## Figures

Figure 1.1	General location of the study area (Source: URS)	158
Figure 2.1	Habitat map showing locations of corals and seagrass in the Project area. Source: URS	160
Figure 2.2	Locations of sensitive receptors in the vicinity of the navigation channel. Source: URS	161
Figure 2.3	Locations of sensitive receptors in the vicinity of the pipeline. Source: URS	162
Figure 2.4	Sediment trap design	164
Figure 3.1	Overview of Dredging and Disposal Areas (left) and Detailed Locations of Dredging Areas (right). Source: LWI	172
Figure 3.2	Division of the Approach Channel into Sections for Scenario Modelling	173
Figure 3.3	Scenario 1: CSD dredging location and offshore placement site (highlighted with blue and dark green circles respectively) simulated for the plume assessment	174
Figure 3.4	Scenario 2: CSD dredging location (blue circle), nearshore barge loading location (light green circle) and offshore placement site (dark green circle) simulated for the plume assessment	175
Figure 3.5	Scenario 3: CSD dredging location (blue circle), nearshore barge loading location (light green circle), 5,000 m <sup>3</sup> TSHD dredging route (pink line) and offshore placement site (dark green circle) simulated for the plume assessment	176
Figure 3.6	Scenario 4: Dredging routes for 10,000 m <sup>3</sup> TSHD dredging weak rock in PLF (Sections 4 & 5, shown as a light green line) and 10,000 m <sup>3</sup> TSHD dredging sand in approach channel (Section 1, shown as a pink line) and offshore placement site (dark green circle) simulated for the plume assessment	177
Figure 3.7	Scenario 5: Dredging routes for 10,000 m <sup>3</sup> TSHD dredging weak rock in PLF (Sections 1 & 2, shown as a light green line) and 10,000 m <sup>3</sup> TSHD dredging sand in approach channel (Section 3, shown as a pink line) and offshore placement site (dark green circle) simulated for the plume assessment	178
Figure 3.8	Scenario 6: Dredging routes for 10,000 m <sup>3</sup> TSHD dredging weak rock in PLF (Sections 3 & 4, shown as a light green line) and 10,000 m <sup>3</sup> TSHD dredging sand in approach channel (Section 4, shown as a pink line) and offshore placement site (dark green circle) simulated for the plume assessment	179
Figure 3.9	Scenario 7: Dredging route for 10,000 m <sup>3</sup> TSHD dredging sand in approach channel (Section 2, shown as a pink line) and offshore placement site (dark green circle) simulated for the plume assessment	180
Figure 3.10	Scenario 7A: 10,000 m <sup>3</sup> TSHD starting in centre of pink area, dredging towards or away from shore on alternate trips with initial 1.5 km section with no overflow followed by 3 km with overflow. Placement at Site C (dark green circle)	181
Figure 3.11	Pipeline Scenario 1: CSD dredging adjacent to Ashburton Island (pink line), pumping into a barge with overflow adjacent to the CSD. Placement at Site D (dark green circle)	183
Figure 3.12	Pipeline Scenario 2: CSD dredging adjacent to Bessieres Island and Brewis Reef (pink line), pumping into a barge with overflow adjacent to the CSD. Placement at Site D (green circle)	184
Figure 5.1	Comparison of Realistic (top) and Worst Case (bottom) Spill Rate results for SSC Zones of Impact for corals, for the combined Summer, Transitional and Winter conditions, based on both MesoLAPS and Onslow winds	189
Figure 5.2	Comparison of Realistic (top) and Worst Case (bottom) Spill Rate results for sedimentation Zones of Impact for corals, for the combined Summer, Transitional and Winter conditions, based on both MesoLAPS and Onslow winds	190
Figure 5.3	Comparison of Realistic (top) and Worst Case (bottom) Spill Rate results for SSC Zones of Impact for seagrass, for the combined Summer, Transitional and Winter conditions, based on both MesoLAPS and Onslow winds	191
Figure 5.4	Comparison of Realistic (top) and Worst Case (bottom) Spill Rate results for sedimentation Zones of Impact for seagrass, for the combined Summer, Transitional and Winter conditions, based on both MesoLAPS and Onslow winds	192

Figures (cont'd)

Figure 5.5	Comparison of Summer (top) Transitional (middle) and Winter (bottom) conditions for SSC Zones of Impact for corals, based on combined Realistic spill rate results for both MesoLAPS and Onslow winds	193
Figure 5.6	Comparison of Summer (top) Transitional (middle) and Winter (bottom) conditions for sedimentation Zones of Impact for corals, based on combined Realistic spill rate results for both MesoLAPS and Onslow winds	194
Figure 5.7	Comparison of Summer (top) Transitional (middle) and Winter (bottom) conditions for SSC Zones of Impact for seagrass, based on combined Realistic spill rate results for both MesoLAPS and Onslow winds	195
Figure 5.8	Comparison of Summer (top) Transitional (middle) and Winter (bottom) conditions for sedimentation Zones of Impact for seagrass, based on combined Realistic spill rate results for both MesoLAPS and Onslow winds	196
Figure 5.9	Example of climatic variability for SSC Zones of Impact for corals, based on MesoLAPS winds	198
Figure 5.10	Example of climatic variability for sedimentation Zones of Impact for corals, based on MesoLAPS winds	199
Figure 5.11	MODIS images processed to show TSS (mg/l), illustrating periodic elevated nearshore turbidity caused by wind re-suspension of fine seabed material during summer	200
Figure 5.12	MODIS images processed to show TSS (mg/l), illustrating periodic elevated nearshore turbidity caused by wind re-suspension of fine seabed material during winter	201
Figure 5.13	Example of suspended sediment plume and sedimentation extent due to nearshore CSD dredging, based on Scenario 2 with a Realistic spill rate	202
Figure 5.14	Example of Summer SSC Zones of Impact extent due to nearshore CSD dredging, based on Scenario 2 with a Realistic spill rate	203
Figure 5.15	Example of Winter SSC Zones of Impact extent due to nearshore CSD dredging, based on Scenario 2 with a Realistic spill rate	204
Figure 5.16	Example of sedimentation Zones of Impact extent during the calm transitional period due to nearshore CSD dredging, based on Scenario 2 with a Realistic spill rate	205
Figure 5.17	Example of suspended sediment plume extent due to CSD and 5,000m <sup>3</sup> TSHD dredging, based on Scenario 3, Strong conditions and a Realistic spill rate	207
Figure 5.18	Example of Summer SSC Zones of Impact extent due to CSD and 5,000 m <sup>3</sup> TSHD dredging, based on Scenario 3 with a Realistic spill rate	209
Figure 5.19	Example of Winter SSC Zones of Impact extent due to CSD and 5,000 m <sup>3</sup> TSHD dredging, based on Scenario 3 with a Realistic spill rate	210
Figure 5.20	Example of sedimentation Zones of Impact extent during the calm transitional period due to CSD and 5,000 m <sup>3</sup> TSHD dredging, based on Scenario 3 with a Realistic spill rate	211
Figure 5.21	Example of suspended sediment plume extent due to two 10,000 m <sup>3</sup> TSHDs dredging, based on Scenario 6, Strong conditions and a Realistic spill rate	212
Figure 5.22	Example of Summer SSC Zones of Impact extent due to two 10,000 m <sup>3</sup> TSHDs dredging, based on Scenario 6 with a Realistic spill rate	213
Figure 5.23	Example of Winter SSC Zones of Impact extent due to two 10,000 m <sup>3</sup> TSHDs dredging, based on Scenario 6 with a Realistic spill rate	214
Figure 5.24	Example of sedimentation Zones of Impact extent during the calm transitional period due to two 10,000 m <sup>3</sup> TSHDs dredging, based on Scenario 6 with a Realistic spill rate	215
Figure 5.25	Example of Summer SSC Zones of Impact extent due to a 10,000 m <sup>3</sup> TSHD dredging offshore, based on Scenario 7 with a Realistic spill rate	217

Figure 5.26	Example of Winter SSC Zones of Impact extent due to a 10,000 m <sup>3</sup> TSHD dredging offshore, based on Scenario 7 with a Realistic spill rate	218
Figure 5.27	Example of sedimentation Zones of Impact extent during the calm transitional period due to a 10,000 m <sup>3</sup> TSHD dredging offshore, based on Scenario 7 with a Realistic spill rate	219
Figure 5.28	Comparison of SSC Zones of Impact generated from dredging during strong summer conditions adjacent to sensitive corals with and without the use of a "restricted overflow" zone	221
Figure 5.29	Comparison of SSC Zones of Impact generated from dredging adjacent to sensitive corals during the strong winter period with and without the use of a "restricted overflow" zone	222
Figure 5.30	Comparison of sedimentation Zones of Impact generated from dredging adjacent to sensitive corals during the calm transitional period with and without the use of a "restricted overflow" zone	223
Figure 5.31	Example of suspended sediment plume and sedimentation extent due to nearshore CSD dredging with placement at Site A, based on Scenario 1 with a Realistic spill rate	224
Figure 5.32	Example of Summer SSC Zones of Impact extent due to nearshore CSD dredging with placement at Site A, based on Scenario 1 with a Realistic spill rate	225
Figure 5.33	Example of Winter SSC Zones of Impact extent due to nearshore CSD dredging with placement at Site A, based on Scenario 1 with a Realistic spill rate	226
Figure 5.34	Example of sedimentation Zones of Impact extent during the calm transitional period due to nearshore CSD dredging with placement at Site A, based on Scenario 1 with a Realistic spill rate	227
Figure 5.35	Example of suspended sediment plume extent due to pipeline trenching near Ashburton Island using a CSD	229
Figure 5.36	Example of Summer SSC Zones of Impact extent due to pipeline trenching near Ashburton Island using a CSD	230
Figure 5.37	Example of SSC Zones of Impact extent during calm transitional periods due to pipeline trenching near Ashburton Island using a CSD	231
Figure 5.38	Example of Winter SSC Zones of Impact extent due to pipeline trenching near Ashburton Island using a CSD	232
Figure 5.39	Example of sedimentation Zones of Impact extent during the calm transitional period due to pipeline trenching near Ashburton Island using a CSD	233
Figure 5.40	Example of suspended sediment plume extent due to pipeline trenching near Ashburton Island using a CSD	235
Figure 5.41	Example of Summer SSC Zones of Impact extent due to pipeline trenching near Bessieres Island and Brewis Reef using a CSD	236
Figure 5.42	Example of SSC Zones of Impact extent during calm transitional periods due to pipeline trenching near Bessieres Island and Brewis Reef using a CSD	237
Figure 5.43	Example of Winter SSC Zones of Impact extent due to pipeline trenching near Bessieres Island and Brewis Reef using a CSD	238
Figure 5.44	Example of sedimentation Zones of Impact extent during the calm transitional period due to pipeline trenching near Bessieres Island and Brewis Reef using a CSD	239
Figure 5.45	Comparison of SSC EZI at Coral habitats for Realistic Spill Scenarios 1-7 combined (top: without optimization) and for Scenarios 1-7A combined (bottom: with optimization)	243
Figure 5.46	Comparison of SSC EZI at Seagrass habitats for Realistic Spill Scenarios 1-7 combined (top: without optimization) and for Scenarios 1-7A combined (bottom: with optimization)	244
Figure 5.47	Comparison of Sedimentation EZI at Coral habitats for Realistic Spill Scenarios 1-7 combined (top: without optimization) and for Scenarios 1-7A combined (bottom: with optimization)	245
Figure 5.48	Comparison of Sedimentation EZI at Seagrass habitats for Realistic Spill Scenarios 1-7 combined (top: without optimization) and for Scenarios 1-7A combined (bottom: with optimization)	246

Figures (cont'd)

Figure 5.49	SSC IZI for Coral habitats for "Realistic Spill" Scenarios 1-7 combined (top: without optimization) and for Scenarios 1-7A combined (bottom: with optimization)	251
Figure 5.50	SSC IZI for Seagrass habitats for "Realistic Spill" Scenarios 1-7 combined (top: without optimization) and for Scenarios 1-7A combined (bottom: with optimization)	252
Figure 5.51	Sedimentation IZI for Coral habitats for "Realistic Spill" Scenarios 1-7 combined (top: without optimization) and for Scenarios 1-7A combined (bottom: with optimization)	253
Figure 5.52	Sedimentation IZI for Seagrass habitats for "Realistic Spill" Scenarios 1-7 combined (top: without optimization) and for Scenarios 1-7A combined (bottom: with optimization)	254
Figure 5.53	SSC IZI for coral (top) and seagrass (bottom)	256
Figure 5.54	Sedimentation IZI for coral (top) and seagrass (bottom)	257

Tables

Table 2.1	List of Sensitive Receptors in the vicinity of the navigation channel. Source: URS	161
Table 2.2	List of Sensitive Receptors in the vicinity of the pipeline route. Source: URS	162
Table 2.3	DHI's recommended impact classification categories	166
Table 2.4	Matrix of Impact Zones for suspended sediment impact on corals for assessment of short-term scenario model results - For offshore waters (beyond 5 m isobath), and for nearshore waters (within 5m isobath) during Transitional periods only	167
Table 2.5	Matrix of Impact Zones for suspended sediment impact on corals for assessment of short-term scenario model results - For nearshore waters (within 5 m isobath) during Summer and Winter only	168
Table 2.6	Matrix of Impact Zones for sedimentation impact on corals for assessment of short-term scenario model results - For offshore waters (beyond 5 m isobath), and for nearshore waters (within 5 m isobath) during Transitional periods only	168
Table 2.7	Matrix of Impact Zones for sedimentation impact on corals for assessment of short-term scenario model results - For nearshore waters (within 5 m isobath) during Summer and Winter only	168
Table 2.8	Matrix of Impact Zones for suspended sediment impact on seagrass for assessment of short-term scenario model results - For offshore waters (beyond 5 m isobath), and for nearshore waters (within 5m isobath) during Transitional periods only	169
Table 2.9	Matrix of Impact Zones for suspended sediment impact on seagrass for assessment of short-term scenario model results - For nearshore waters (within 5 m isobath) during Summer and Winter only	169
Table 2.10	Preliminary Matrix of Impact Zones for sedimentation impact on seagrass for assessment of short-term scenario model results - For offshore waters (beyond 5 m isobath), and for nearshore waters (within 5 m isobath) during Transitional periods only	169
Table 2.11	Preliminary Matrix of Impact Zones for sedimentation impact on seagrass for assessment of short-term scenario model results - For nearshore waters (within 5 m isobath) during Summer and Winter only	170
Table 3.1	Key components of the proposed dredging programme	172
Table 3.2	Climatic Scenarios	185
Table 5.1	Summary of overall Estimated Zones of Impact (EZI) for 34 key sensitive receptors for each of the ninety six "Realistic Spill" scenarios (combined MesoLAPS and Onslow wind results)	241
Table 5.2	Summary of overall Estimated Zones of Impact (EZI) for 34 key sensitive receptors for each of the ninety six "Worst Case Spill" scenarios (combined MesoLAPS and Onslow wind results)	242
Table 5.3	Summary of overall Estimated Zones of Impact (EZI) for 25 key sensitive receptors for each of the 12 pipeline scenarios	248

## Abbreviations

<b>Abbreviation</b>	<b>Description</b>
ADCP	Acoustic Doppler Current Profiler
BPP	Benthic Primary Producers
BPPH	Benthic Primary Producer Habitat
CSD	Cutter Suction Dredger
DDP	Dredging and Disposal Plan
DEC	Department of Environment and Conservation (WA)
DEWHA	Department of Environment, Water, Heritage and the Arts
DRL	Dredging Research Limited
DSDMP	Dredging and Spoil Disposal Management Plan
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	Western Australia Environmental Protection Authority
ERMP	Environmental Review Management Program
EZI	Estimated Zones of Impact
IZI	Indicative Zones of Impact
LNG	Liquefied Natural Gas
LWI	Lanier-Wallingford International
m AHD	Australian Height Datum (metres)
m LAT	Lowest Astronomical Tide (metres)
MEB	Marine Ecosystems Branch, DEC
MOF	Materials Offloading Facility
MTPA	Million Tonnes Per Annum
NTU	Nephelometric Turbidity Units
PAR	Photosynthetically Active Radiation
PLF	Product Loading Facility
SKM	Sinclair Knight Merz
SSC	Suspended Sediment Concentration
T	Tonne
TSHD	Trailing Suction Hopper Dredgers
TSS	Total Suspended Solids
WA	Western Australia

This page is intentionally blank

**The Wheatstone Project**



**Dredge Plume Impact Assessment**

**Final Report**

**May 2010**

DHI Water & Environment (S) Pte. Ltd.  
 200 Pandan Loop  
 #08-03 Pantech 21  
 Singapore 128388  
 Tel: +65 6777 6330  
 Fax: +65 6777 3537  
 Email: dhi@dhi.com.sg  
 URL: www.dhi.com.sg  
 Co Reg No: 200301802D  
 GST Reg No: 20-0301802-D

Client		Client's representative			
Chevron Australia Pty Ltd		Mr. Ceri Morgan			
Project		Project No			
Chevron Wheatstone LNG Development		SG 5240			
Authors		Date			
Matt Jury Tom Foster Claus Pedersen Amy Ling		Pui Cuifen Tove Lindfors Veradej Phipatanasuphorn Bambang Irawan		Approved by Matt Jury	
6	Final Report	MJJ	TMF	MJJ	18.05.10
5	Final Draft Report	MJJ	TMF	MJJ	10.05.10
4	Updated Draft Report	MJJ	TMF	MJJ	31.03.10
3	Updated Draft Report	MJJ	TMF	MJJ	26.02.10
2	Updated Draft Report	PCF	TMF	MJJ	23.12.09
1	Draft Report	MJJ	TMF	MJJ	04.12.09
Revision	Description	By	Checked	Approved	Date
Key words		Classification			
Pilbara Dredging Sediment Plume Impact Sedimentation LNG		<input type="checkbox"/> Open <input type="checkbox"/> Internal <input checked="" type="checkbox"/> Proprietary			
Distribution				Number of copies	
Chevron		Digital		1	
URS		Digital		1	
DHI		Digital		1	

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10







relevant receptors to the impacts of suspended sediments, reduced light and sedimentation. The findings of the general literature review were then combined with DHI's extensive experience of monitoring major dredging and reclamation projects in south east Asia, in order to develop end receptor tolerance limits for the Wheatstone Project (DHI 2010a).

In this report, these tolerance limits are applied to the latest round of sediment plume model results (DHI 2010b) in order to assess the potential impacts of the proposed dredging programme on the benthic primary producers in the vicinity of the dredging works, for use in the Environmental Impact Assessment / Environmental Review Management Programme (EIA/ERMP).

Recommendations in terms of mitigation measures to address any identified impacts have not been included in this report, as they are addressed in detail in the draft Dredging and Spoil Disposal Management Plan (DSDMP) prepared by Sinclair Knight Merz (SKM 2010).



## 2 KEY RECEPTORS AND TOLERANCE LIMITS

### 2.1 Key Receptors

URS has provided a habitat map showing the distribution of corals and seagrass across the Project area (Figure 2.1).

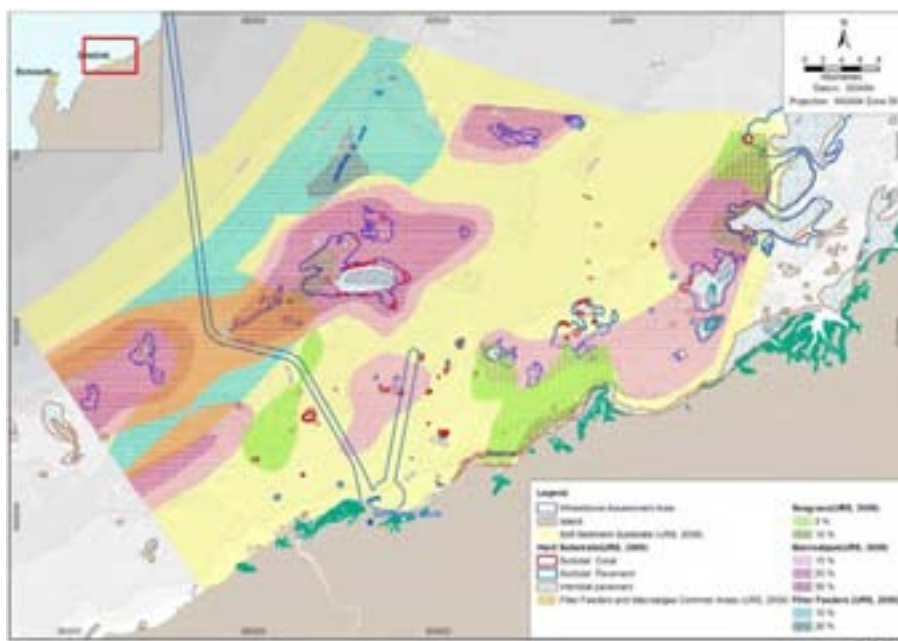


Figure 2.1 Habitat map showing locations of corals and seagrass in the Project area. Source: URS

The locations of the sensitive receptors in relation to the proposed navigation channel are shown in Figure 2.2 and listed in Table 2.1, while the sensitive receptors in the vicinity of proposed pipeline route are shown in Figure 2.3 and listed in Table 2.2. The locations of the proposed offshore placement sites are also shown on these figures.

Note that Site A and Site C are the base case placement sites for the bulk of the material dredged from the navigation channel, while Site C and Site D are the base case placement sites for the pipeline trenching. Site B is a reserve site, and Site D and E are also intended for disposal of small volumes of fine material from cleanup dredging. The focus of the sediment plume modelling has therefore been on offshore placement at Sites A and C for the navigation channel dredging, and Site D for the pipeline trenching.



Figure 2.2 Locations of sensitive receptors in the vicinity of the navigation channel. Source: URS

Table 2.1 List of Sensitive Receptors in the vicinity of the navigation channel. Source: URS

No.	Habitat*	Geographic Name	No.	Habitat*	Geographic Name
1	CR & MA	Tortoise Island	18	CR	Direction Island
2	CR & MA	Roller Shoal	19	CR & MA	NE Twin Island
3	CR & SG	Ashburton Island	20	CR	North Herald Reef
4	FF	Brewis Reef East	21	FF & CR	West Middle Mangrove Is
5	MA & CR	Thevenard Island West	22	CR	Nares Rock
6	CR	Paroo Shoals	23	CR & MA	Airlie Island
7	CR, MA & FF	Saladin Shoal	24	CR & MA	Taunton Reef
8	CR	End of Channel	25	SG	West Glennie Patches
9	CR	Hastings Shoal	26	SG	NW of Ashburton Island
10	CR	North West Ward Reef	27	SG	S of Brewis Reef
11	CR	Ward Reef	28	MA	Thevenard Island South
12	CR	Ward Reef	29	SG	S of Direction Island
13	CR	SW of Gorgon Patch	30	SG	SE of Direction Island
14	CR	Gorgon Patch	31	SG	Nearshore NE of Onslow
15	CR, MA & FF	Weeks Shoal	32	SG	SW of Coolgra Point
16	CR	Unnamed shoal to NE of Koolinda Patch	33	SG	S of Twin Islands
17	CR & MA	NW of Direction Island	34	SG & MA	SW Twin Island

\* Note: CR = Subtidal coral communities      MA = Subtidal macroalgal communities  
 SG = Subtidal seagrass communities      FF = Subtidal benthic filter feeder communities

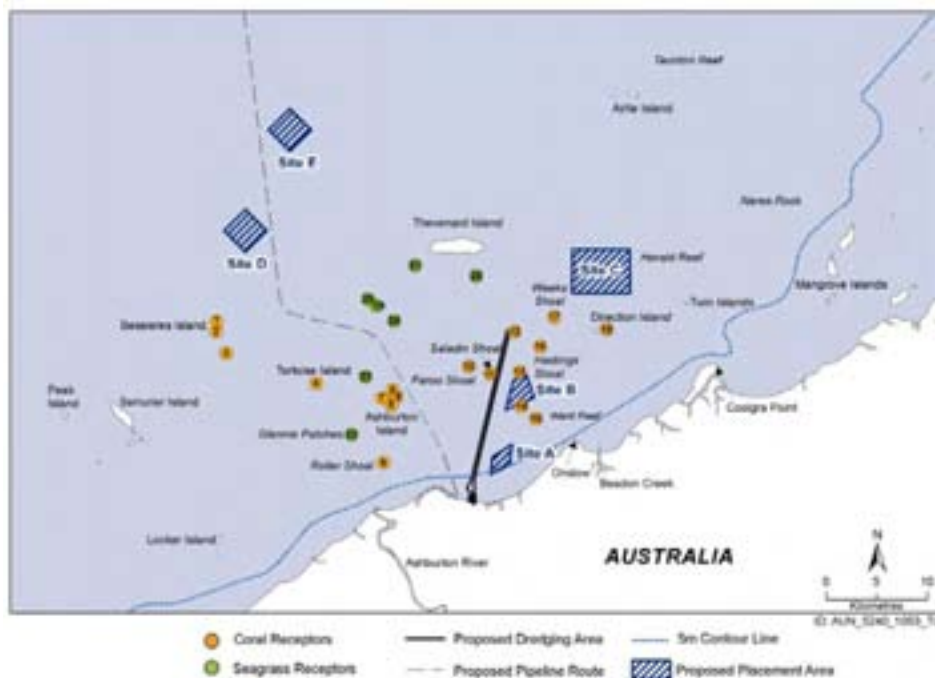


Figure 2.3 Locations of sensitive receptors in the vicinity of the pipeline. Source: URS

Table 2.2 List of Sensitive Receptors in the vicinity of the pipeline route. Source: URS

No.	Habitat*	Geographic Name	No.	Habitat*	Geographic Name
1	CR & MA	Bessieres Island - North	14	CR	North West Ward Reef
2	CR & MA	Bessieres Island - South	15	CR	Ward Reef
3	CR & MA	Bowers Ledge	16	CR	Gorgon Patch
4	CR & MA	Tortoise Island	17	CR, MA & FF	Weeks Shoal
5	CR & MA	Roller Shoal	18	CR	Direction Island
6	CR & SG	Ashburton Island - South	19	MA	Brewis Reef- South
7	CR & SG	Ashburton Island - West	20	MA	Brewis Reef- North
8	CR & SG	Ashburton Island - North	21	MA & CR	Thevenard Island West
9	CR & SG	Ashburton Island - East (?)	22	SG	West Glennie Patches
10	CR	Paroo Shoals	23	SG	NW of Ashburton Island
11	CR, MA & FF	Saladin Shoal	24	SG	S of Brewis Reef
12	CR	End Shipping Channel	25	MA	Thevenard Island South
13	CR	Hastings Shoal			

\* Note: CR = Subtidal coral communities      MA = Subtidal macroalgal communities  
 SG = Subtidal seagrass communities      FF = Subtidal benthic filter feeder communities



## 2.2 Types of Impacts

### 2.2.1 Dredging, Onshore and Offshore Disposal Related Impacts

The main sources of impact to the receptors mentioned above in relation to dredging, onshore and offshore disposal are suspended sediments and sedimentation.

Suspended sediments result in increased turbidity (which is a decrease in water transparency due to the presence of suspended and some dissolved substances, which causes incident light to be scattered, reflected and attenuated rather than transmitted), reduced light penetration and may also cause physical abrasion to soft tissue and interference with filter-feeding mechanisms (Philipp and Fabricius 2003, Erfteimeijer and Lewis 2006, Erfteimeijer and Riegl 2009). Sedimentation results in reduced light via direct shading, increased energy expenditure for those species that actively shed sediment (e.g. through mucous production, ciliary action, etc.) and can interfere with prey capture and/or filter feeding mechanisms, smother benthic fauna, create anoxic conditions near the seabed, and reduce larval recruitment (Fabricius and Wolanski 2000, Erfteimeijer and Lewis 2006, Erfteimeijer and Riegl 2009).

Turbidity and light availability (the amount of photosynthetically active radiation (PAR) reaching marine photosynthetic organisms) in the marine environment are measured and expressed in a number of different ways. Common measures include: nephelometric turbidity units (NTU), Secchi disc readings (m) and water column light attenuation coefficients ( $K_d$  or  $E$ ). Light availability is generally measured directly as PAR (in  $\mu\text{mol photons/m}^2/\text{day}$ ) or expressed as relative measure, for example, minimum light requirement (in % of surface irradiance). Sedimentation is typically measured either as a mass per unit area per time (e.g.  $\text{kg/m}^2/\text{day}$  or  $\text{mg/cm}^2/\text{day}$ ) or as a layer thickness per unit time (e.g.  $\text{mm}/14 \text{ days}$ ), which is an easier unit to visualise.

Traditionally, suspended sediment concentrations (SSC) are based on measurements of total suspended solids (TSS) via collection of water samples, which are then filtered in the lab or in the field, to determine the total mass of suspended particulate matter in a given volume of sample. However, it is important to note that SSC is a sub-set of TSS, which also comprises a variable amount of suspended organic matter (e.g. plankton, detritus, etc.).

Turbidity is measured using a nephelometer, which uses an optical backscatter sensor to measure light reflection from the suspended particles. Nephelometers allow results to be obtained *in situ* over a long period of time, and if they are linked via a modem to an online data acquisition programme, then near real time results can be obtained. However, there are considerable limitations to the reliability of results, with frequent calibration required using suspended sediment samples from the area being measured. Fouling is also a common problem with nephelometers, and they require regular maintenance (typically once every two weeks in tropical environments) to minimise the impact of fouling on the data.

Due to recent technological advances, long term *in situ* monitoring of suspended sediments using either laser (e.g. a LISST) or acoustic backscatter (i.e. using an acoustic doppler current profiler (ADCP)) measurements is also possible. While still



in their early stages, indications are promising that with further development these approaches may gain widespread acceptance. DHI has used acoustic backscatter measurements extensively in Singapore to monitor SSC, and found very reliable results, providing sufficient calibration samples covering an adequate range of depths are collected.

Turbidity is commonly used as a proxy for either TSS (and/or SSC) or light attenuation, although such comparisons are subject to uncertainty relating to, amongst other factors, particle size distribution and colour, and water depth. Turbidity measurements therefore require calibration against site specific samples collected and analysed for TSS or site specific light attenuation measurements. Light attenuation can also be measured directly. Light measurements are required both at the surface and at varying depths down to the seabed for effective data capture, which makes such monitoring more complex than measurements of turbidity.

Sedimentation is traditionally measured using sediment traps, which are vertical tubes installed near the seabed that capture particles depositing on the seabed. Due to the enclosed nature of the tubes, they provide a conservative maximum measurement of sedimentation, as they do not take account of the re-suspension of settled particles that generally occurs during stronger current or wave conditions. There are various designs for sediment traps, but the most commonly used design comprises a cluster of three tubes, based on the recommended design by English *et al.* (1997), as shown in Figure 2.4. A plastic mesh is used to cover the entrance of the traps, in order to reduce the incidence of marine fauna taking up residence in the tubes, and anti-fouling paint is used to reduce fouling, as both of these issues can interfere with the effectiveness of the traps at measuring sedimentation.

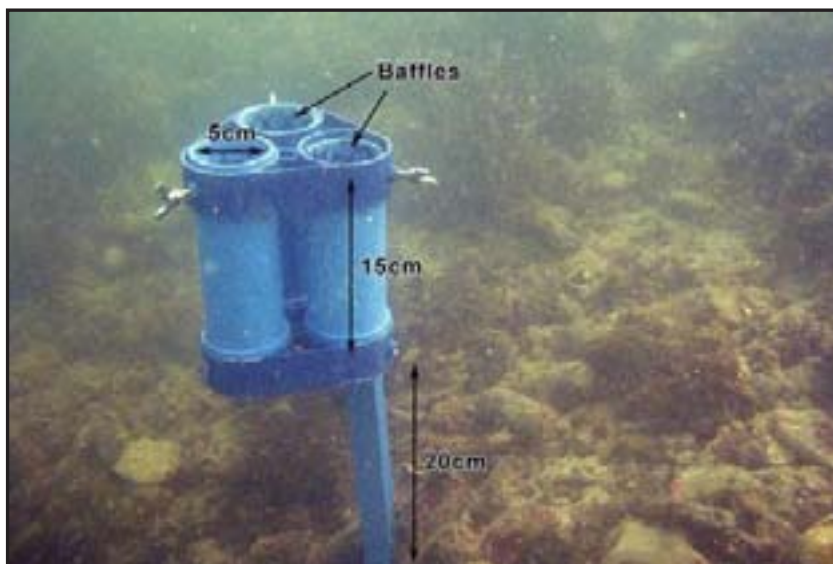


Figure 2.4 Sediment trap design



### 2.2.2 Classification of Impacts

The classification of impacts will broadly follow the recommended approach of the Western Australia Department of Environment and Conservation's Marine Ecosystems Branch (MEB), which uses four categories of classification (Rob Tregonning, pers. comm. 24/08/09):

1. **Zone of Permanent Loss (or Significant Impact)** – an area within which key receptors (i.e. benthic Primary Producer or some other species of concern) are predicted to suffer mortality. This is the area in which mortality and loss of structural function is predicted to occur. This zone should encapsulate the area where “lethal” impacts are predicted. Mortality may occur within the area – but it does not necessarily indicate that the entire area will experience mortality. The border needs to be drawn so that no mortality should be predicted to occur immediately outside of this zone. (Note that MEB's definition of “permanent loss” comprises both “loss” and “serious damage” as defined in EPA Guidance Statement 3 (EPA, 2009). “Loss” is defined as direct removal or destruction of BPPH, which is considered to be irreversible, with BPPH not predicted to recover to the pre-impact state. “Serious damage” is defined as damage to BPPH that is effectively irreversible or where recovery, if that can be reasonably predicted at all, would not occur for at least 5 years).
2. **Zone of Temporary Loss/Damage** – This area, outside the Zone of Permanent Loss, is the area within which sub-lethal impacts on key receptors are predicted (e.g. for seagrass, this may be a reduction in shoot density or some other metric that describes a decline in seagrass health).
3. **Zone of Influence** – Outside the outer boundary of the zone of temporary loss/damage, there may be influence from the dredge plume at low levels (e.g. turbidity may be visible or very light sedimentation may occur), but this is predicted to be unlikely to have any material/or measurable impact on the key receptors.
4. Finally beyond the outer boundary of the zone of influence, there will be an unbounded area where there is no detectable influence on turbidity and sedimentation rates from the dredging. This area would be suitable for locating a reference site.

Based on the information provided by MEB, DHI has adopted the following four impact categories shown in Table 2.3. The categories are similar to the MEB categories, except that MEB's “Zone of Permanent Loss” has been subdivided into two zones, reflecting an area of total (or almost total) mortality, which will be confined to a relatively small area within and close to the work area, and a zone of partial mortality, which is a larger zone where partial mortalities are expected to occur. Beyond the zone of partial mortality, no mortalities are expected. The zones of temporary loss/damage and zone of influence have been combined, due to the difficulty in monitoring and detecting “temporary” loss in terms of sub-lethal impacts. This combined zone is referred to as the zone of influence, which is consistent with previous dredging EIAs in WA.



Table 2.3 DHI's recommended impact classification categories

Zone	Definitions
<b>Zone of Total Mortality</b>	An area within which key receptors (– Benthic Primary Producer (BPP) or some other species of concern) are predicted to suffer total or substantial mortality (more than 50%), and where loss of structural function is predicted to occur.
<b>Zone of Partial Mortality</b>	An area within which key receptors (– BPP or some other species of concern) are predicted to suffer partial mortality (up to 50% loss). Mortality will occur within the area, but will not include all individuals. The outer border will be drawn so that no mortality will be predicted to occur immediately outside of this zone.
<b>Zone of Influence</b>	Outside the outer boundary of the Zone of Partial Mortality there may be influence from the dredge plume at low levels (for example sub-lethal impacts on key receptors, turbidity may be visible or very light sedimentation may occur) but this is predicted to be unlikely to have any material and/or measurable impact on the key receptors.
<b>No Impact</b>	Beyond the outer boundary of the Zone of Influence, there will be an unbounded area where there is no detectable influence on turbidity and sedimentation rates from the dredging. This area would be suitable for locating a reference site.

However, it is important to note that the zones represent a gradation of impact, which decreases quickly with increasing distance from the impact source. So while a relatively large area may be covered by the Zone of Partial Mortality (for example), this does not mean that 50% mortality is predicted throughout this Zone. Rather, up to 50% mortality is predicted at the edge of the Zone closest to the source of impact, with the impact decreasing to almost zero mortality at the outer edge of the Zone. MEB's requirement that there should be no mortality in the Zone of Influence means that a conservative "buffer" has been included in the Zone of Partial Mortality to meet this requirement.

### 2.3 Tolerance Limits

The proposed tolerance limits for the impact assessment are based on a detailed literature review, combined with extensive monitoring experience throughout Southeast Asia. DHI has also taken the background conditions into account in developing the tolerance limits to be used for this impact assessment. MScience (2009) has undertaken a review of the background water quality conditions of the project area, using a combined approach of field measurements and remote sensing using four years of MODIS optical satellite images provided by DHI.

The conclusions of the review were that the Project area generally experiences relatively low turbidity (2–5 mg/l) and sedimentation rates (1–2 mg/cm<sup>2</sup>/day) during most of the year. However, the area experiences occasional cyclones and heavy rainfall events during the summer period, as well as strong spring tide currents and strong wind and wave activity during both the summer and winter periods. These result in elevated and variable turbidity (more than 100 mg/l for several days following a cyclone) and subsequent elevated sedimentation rates. Even discounting the periodic effects of cyclones, the turbidity and sedimentation in the nearshore area





(within the 5 m isobath) is generally elevated and more variable during summer and winter (typically 10–12 mg/l and 10 mg/cm<sup>2</sup>/day), due to strong winds and wave action causing re-suspension in these shallow nearshore areas.

So, overall the area can be categorised as a generally “clear water” environment, but during summer and winter the corals and seagrass present across the entire Project area, but particularly in the nearshore area (within the 5 m isobath), may be exposed to periodic elevated turbidity levels, sometimes lasting for several weeks, due to occasional cyclones and storm events, and strong spring tides and wind events. A conservative set of tolerance limits, suitable for “clear water” conditions, has therefore been recommended for most of the Project area. However, a less conservative set of tolerance limits has been recommended for the nearshore area (within the 5 m isobath) during summer and winter, in keeping with the elevated and variable background turbidity and sedimentation experienced in the shallow nearshore areas during these periods.

It should be noted that the tolerance limits in the following sections are for excess (i.e. above background) suspended sediment concentrations (referred to throughout this report as SSC) or rates of sedimentation generated by the dredging, onshore or offshore disposal activities, for assessment of impacts from short-term (typically 2–4 week) scenario modelling. Note that this does not mean that impacts would necessarily be realised within a 2–4 week period. Rather, if the level of stress/loading continued at the same level for an extended period of time (several months), these are the predicted levels of impact. The limits have been developed based on the most sensitive species, in order to ensure that the levels of impact predicted are conservative.

A detailed description of the tolerance limits and their development is provided in DHI (2010a), and summarised below.

**2.3.1 Coral Tolerance to Suspended Sediments**

DHI’s proposed suspended sediment tolerance limits for corals are shown in Table 2.4 and Table 2.5.

*Table 2.4 Matrix of Impact Zones for suspended sediment impact on corals for assessment of short-term scenario model results - For offshore waters (beyond 5 m isobath), and for nearshore waters (within 5 m isobath) during Transitional periods only*

Zone*	Definitions
<b>Zone of Total Mortality</b>	<ul style="list-style-type: none"> <li>• Excess SSC &gt; 25 mg/l for more than 10% of the time; OR</li> <li>• Excess SSC &gt; 10 mg/l for more than 25% of the time</li> </ul>
<b>Zone of Partial Mortality</b>	<ul style="list-style-type: none"> <li>• Excess SSC &gt; 25 mg/l for 2.5–10% of the time; OR</li> <li>• Excess SSC &gt; 10 mg/l for 10–25% of the time; OR</li> <li>• Excess SSC &gt; 5 mg/l for more than 25% of the time</li> </ul>
<b>Zone of Influence</b>	<ul style="list-style-type: none"> <li>• Excess SSC &gt; 25 mg/l for 0.5-2.5% of the time; OR</li> <li>• Excess SSC &gt; 10 mg/l for 0.5-10% of the time; OR</li> <li>• Excess SSC &gt; 5 mg/l for 2.5–25% of the time</li> </ul>
<b>No Impact</b>	<ul style="list-style-type: none"> <li>• Excess SSC &gt; 25 mg/l for less than 0.5% of the time; OR</li> <li>• Excess SSC &gt; 10 mg/l for less than 0.5% of the time; OR</li> <li>• Excess SSC &gt; 5 mg/l for less than 2.5% of the time</li> </ul>

*\*Where location meets criteria for multiple zones, highest zone applies*



Table 2.5 Matrix of Impact Zones for suspended sediment impact on corals for assessment of short-term scenario model results - For nearshore waters (within 5 m isobath) during Summer and Winter only

Zone*	Definitions
<b>Zone of Total Mortality</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for more than 20% of the time</li> </ul>
<b>Zone of Partial Mortality</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for 5–20% of the time; OR</li> <li>Excess SSC &gt; 10 mg/l for more than 20% of the time; OR</li> <li>Excess SSC &gt; 5 mg/l for more than 50% of the time</li> </ul>
<b>Zone of Influence</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for 1-5% of the time; OR</li> <li>Excess SSC &gt; 10 mg/l for 1-20% of the time; OR</li> <li>Excess SSC &gt; 5 mg/l for 5-50% of the time</li> </ul>
<b>No Impact</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for less than 1% of the time; OR</li> <li>Excess SSC &gt; 10 mg/l for less than 1% of the time; OR</li> <li>Excess SSC &gt; 5 mg/l for less than 5% of the time</li> </ul>

\*Where location meets criteria for multiple zones, highest zone applies

### 2.3.2 Coral Tolerance to Sedimentation

DHI’s proposed sedimentation tolerance limits for corals are shown in Table 2.6 and Table 2.7.

Table 2.6 Matrix of Impact Zones for sedimentation impact on corals for assessment of short-term scenario model results - For offshore waters (beyond 5 m isobath), and for nearshore waters (within 5 m isobath) during Transitional periods only

Zones	Definitions
<b>Zone of Total Mortality</b>	<ul style="list-style-type: none"> <li>Sedimentation &gt; 0.2 kg/m<sup>2</sup>/day (&gt; 7.0 mm/14day*)</li> </ul>
<b>Zone of Partial Mortality</b>	<ul style="list-style-type: none"> <li>Sedimentation 0.05 – 0.2 kg/m<sup>2</sup>/day (1.7 – 7.0 mm/14day*)</li> </ul>
<b>Zone of Influence</b>	<ul style="list-style-type: none"> <li>Sedimentation 0.01–0.05 kg/m<sup>2</sup>/day (0.3 – 1.7 mm/14day*)</li> </ul>
<b>No Impact</b>	<ul style="list-style-type: none"> <li>Sedimentation &lt; 0.01 kg/m<sup>2</sup>/day (&lt; 0.3 mm/14day*)</li> </ul>

\* conversion from kg/m<sup>2</sup>/day to mm/14 days assumes an initial deposition dry density of 400 kg/m<sup>3</sup>

Table 2.7 Matrix of Impact Zones for sedimentation impact on corals for assessment of short-term scenario model results - For nearshore waters (within 5 m isobath) during Summer and Winter only

Zones	Definitions
<b>Zone of Total Mortality</b>	<ul style="list-style-type: none"> <li>Sedimentation &gt; 0.5 kg/m<sup>2</sup>/day (&gt; 17.5 mm/14day*)</li> </ul>
<b>Zone of Partial Mortality</b>	<ul style="list-style-type: none"> <li>Sedimentation 0.1–0.5 kg/m<sup>2</sup>/day (3.5 – 17.5 mm/14day*)</li> </ul>
<b>Zone of Influence</b>	<ul style="list-style-type: none"> <li>Sedimentation 0.025–0.1 kg/m<sup>2</sup>/day (0.9 – 3.5 mm/14day*)</li> </ul>
<b>No Impact</b>	<ul style="list-style-type: none"> <li>Sedimentation &lt; 0.025 kg/m<sup>2</sup>/day (&lt; 0.9 mm/14day*)</li> </ul>

\* conversion from kg/m<sup>2</sup>/day to mm/14 days assumes an initial deposition dry density of 400 kg/m<sup>3</sup>



**2.3.3 Seagrass Tolerance to Suspended Sediments**

DHI’s proposed suspended sediment tolerance limits for seagrass are shown in Table 2.8 and Table 2.9.

Table 2.8 Matrix of Impact Zones for suspended sediment impact on seagrass for assessment of short-term scenario model results - For offshore waters (beyond 5 m isobath), and for nearshore waters (within 5 m isobath) during Transitional periods only

Zone*	Definitions
<b>Zone of Total Mortality</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for more than 25% of the time; OR</li> <li>Excess SSC &gt; 10 mg/l for more than 50% of the time</li> </ul>
<b>Zone of Partial Mortality</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for 2.5–25% of the time; OR</li> <li>Excess SSC &gt; 10 mg/l for 10–50% of the time; OR</li> <li>Excess SSC &gt; 5 mg/l for more than 25% of the time</li> </ul>
<b>Zone of Influence</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for 0.5–2.5% of the time; OR</li> <li>Excess SSC &gt; 10 mg/l for 0.5–10% of the time OR</li> <li>Excess SSC &gt; 5 mg/l for 2.5–25% of the time</li> </ul>
<b>No Impact</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for less than 0.5% of the time; OR</li> <li>Excess SSC &gt; 10 mg/l for less than 0.5% of the time; OR</li> <li>Excess SSC &gt; 5 mg/l for less than 2.5% of the time</li> </ul>

\*Where location meets criteria for multiple zones, highest zone applies

Table 2.9 Matrix of Impact Zones for suspended sediment impact on seagrass for assessment of short-term scenario model results - For nearshore waters (within 5 m isobath) during Summer and Winter only

Zone*	Definitions
<b>Zone of Total Mortality</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for more than 50% of the time</li> </ul>
<b>Zone of Partial Mortality</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for 5–50% of the time; OR</li> <li>Excess SSC &gt; 10 mg/l for more than 20% of the time</li> </ul>
<b>Zone of Influence</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for 1–5% of the time; OR</li> <li>Excess SSC &gt; 10 mg/l for 1–20% of the time; OR</li> <li>Excess SSC &gt; 5 mg/l for more than 5% of the time</li> </ul>
<b>No Impact</b>	<ul style="list-style-type: none"> <li>Excess SSC &gt; 25 mg/l for less than 1% of the time; OR</li> <li>Excess SSC &gt; 10 mg/l for less than 1% of the time; OR</li> <li>Excess SSC &gt; 5 mg/l for less than 5% of the time</li> </ul>

\*Where location meets criteria for multiple zones, highest zone applies

**2.3.4 Seagrass Tolerance to Sedimentation**

DHI’s proposed sedimentation tolerance limits for seagrass are presented in Table 2.10 and Table 2.11.

Table 2.10 Preliminary Matrix of Impact Zones for sedimentation impact on seagrass for assessment of short-term scenario model results - For offshore waters (beyond 5 m isobath), and for nearshore waters (within 5 m isobath) during Transitional periods only

Zones	Definitions
<b>Zone of Total Mortality</b>	<ul style="list-style-type: none"> <li>Sedimentation &gt; 0.7 kg/m<sup>2</sup>/day (&gt;25 mm/14day*)</li> </ul>
<b>Zone of Partial Mortality</b>	<ul style="list-style-type: none"> <li>Sedimentation 0.2–0.7 kg/m<sup>2</sup>/day (7 – 25 mm/14day*)</li> </ul>
<b>Zone of Influence</b>	<ul style="list-style-type: none"> <li>Sedimentation 0.03–0.2 kg/m<sup>2</sup>/day (1 – 7 mm/14day*)</li> </ul>
<b>No Impact</b>	<ul style="list-style-type: none"> <li>Sedimentation &lt; 0.03 kg/m<sup>2</sup>/day (&lt;1 mm/14day*)</li> </ul>

\* conversion from kg/m<sup>2</sup>/day to mm/14 days assumes an initial deposition dry density of 400 kg/m<sup>3</sup>



Table 2.11 Preliminary Matrix of Impact Zones for sedimentation impact on seagrass for assessment of short-term scenario model results - For nearshore waters (within 5 m isobath) during Summer and Winter only

Zones	Definitions
<b>Zone of Total Mortality</b>	• Sedimentation > 1 kg/m <sup>2</sup> /day (>35 mm/14day*)
<b>Zone of Partial Mortality</b>	• Sedimentation 0.3–1 kg/m <sup>2</sup> /day (10 – 35 mm/14day*)
<b>Zone of Influence</b>	• Sedimentation 0.04–0.3 kg/m <sup>2</sup> /day (1.5 – 10 mm/14day*)
<b>No Impact</b>	• Sedimentation < 0.04 kg/m <sup>2</sup> /day (<1.5 mm/14day*)

\* conversion from kg/m<sup>2</sup>/day to mm/14 days assumes an initial deposition dry density of 400 kg/m<sup>3</sup>



### 3 **DREDGING SCENARIOS**

The DHI approach to modelling dredging programmes for impact assessment is to use a scenario-based methodology, simulating a number of different scenarios over a relatively short period of time (usually 2–4 weeks in order to capture the spring-neap tidal cycle). This is computationally very efficient, as multiple scenarios can be run simultaneously on a large number of computers, allowing great flexibility in terms of testing different variables and assumptions.

Scenarios that are selected are representative of the main activities (in terms of locations, equipment, production rates, etc.) that will be undertaken during the dredging programme, and run for a range of seasonal and climatic situations that are representative of calm, typical and strong conditions at the Project site. Assumptions regarding the spill rate (rate that fine dredged material is released into the marine environment during dredging) from different equipment during different activities (sometimes referred to as “source terms”) can also be tested.

The flexibility of the scenario-based approach is critical for impact assessment of dredging programmes, because at the impact assessment stage final decisions have not been made regarding the actual equipment, methodologies and phasing that will be used. The impact assessment is usually carried out 12 months or more before the dredging contractor is appointed, and the dredging programme is usually not finalised until 1–2 months before the start of dredging, and is often subject to change during the dredging works, depending on conditions encountered during the dredging. In addition, unless the area has been previously dredged and carefully monitored during that dredging, the sediment characteristics and the behaviour of the fine sediments after they have been through the dredger can only be estimated, based on previous experience. So there are a large number of uncertainties and assumptions associated with simulating a dredging programme at the impact assessment stage, but the scenario-based approach allows those various uncertainties and assumptions to be tested, and the potential impacts assessed in a conservative manner consistent with internationally recognized principles of EIA.

The latest round of sediment plume modelling (DHI 2010b) has considered seven dredging scenarios (as well as one additional “optimisation” scenario), three seasons (summer, winter and transitional periods), with two climatic conditions (covering strong and representative wind and wave conditions) for each season, and realistic and worst case spill estimates covering all of the main stages of the dredging programme, and the full range of dredging and offshore disposal areas and equipment. This gives a total of ninety six different scenarios that have been modelled, which are expected to cover the full spectrum of variability in terms of potential sediment plume impacts to sensitive receptors.

In addition, two sensitive locations along the proposed pipeline route were also assessed, adjacent to Ashburton Island, and between Bessieres Island and Brewis Reef. Each of these sensitive locations was simulated for the same range of seasonal and climatic situations as the main dredging scenarios.

Details of all of the scenarios are provided in the following sections.



### 3.1 Dredging Activities

A detailed description of the proposed dredging activities has been provided by Chevron (LWI 2009). The key elements of the dredging programme, which have been covered by DHI’s short-term scenario modelling simulations (DHI 2010b) are described in Table 3.1. A detailed location plan for the dredging programme is shown in Figure 3.1.

It is clear from Table 3.1 that the main dredging activity will be the Trailer Suction Hopper Dredger (TSHD) dredging in mainly sandy material, which will take in the order of 3 years. However, the initial dredging (in the order of 6 months) will need to be undertaken by a Cutter Suction Dredger (CSD) due to the shallow water depths at the Project site, and the confined area of the Materials Offloading facility (MOF). The TSHD will also be used to remove weak rock present in sections of the approach channel and the Product Loading Facility (PLF) basin.

Table 3.1 Key components of the proposed dredging programme

#	Activity	Plant	Disposal Site	Time (months)
	Description			
1	Temporary Access Channel to MOF and barge access to -3 m LAT contour in PLF	CSD	Site A/C	1.75
2	Dredging PLF Maneuvering Area to -9.4 m AHD follow on from Temp Access channel dredging	CSD	Site C	2.0
3	MOF and MOF approach channel. Follow-on from PLF Maneuvering Area dredging.	CSD	Site C	2.0
4	Dredging PLF approach channel to -10.4 m AHD	5,000 m <sup>3</sup> TSHD	Site C	2.0
5	Dredging PLF Basin from -9.4 to -14.9 m AHD (installed depth + siltation allowance)	10,000 m <sup>3</sup> TSHD	Site C	12.75
6	Dredging PLF approach channel to -14.9 m AHD (installed depth + siltation allowance)	10,000 m <sup>3</sup> TSHD	Site C	36

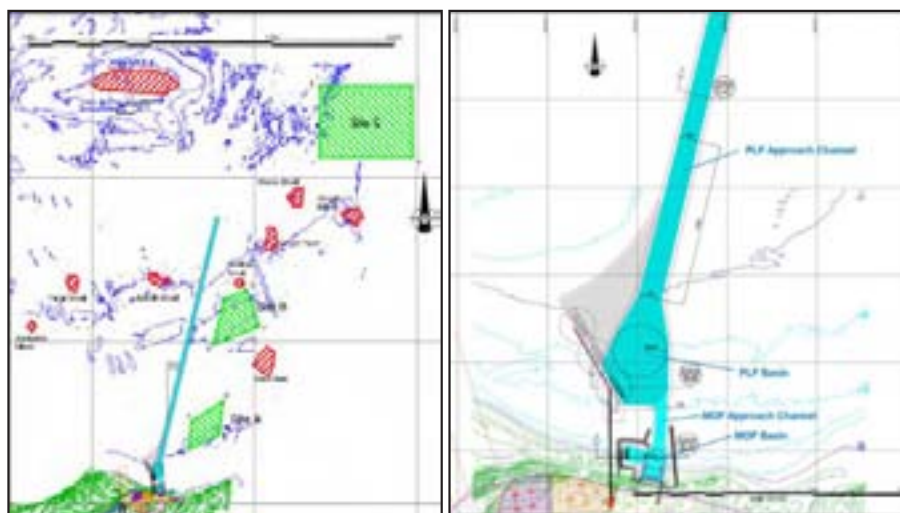


Figure 3.1 Overview of Dredging and Disposal Areas (left) and Detailed Locations of Dredging Areas (right). Source: LWI



For modelling purposes, the approach channel has been divided into four sections, each representing the typical length of the channel covered during a single trip, with the PLF basin shown as a fifth section. The five sections are shown in Figure 3.2.

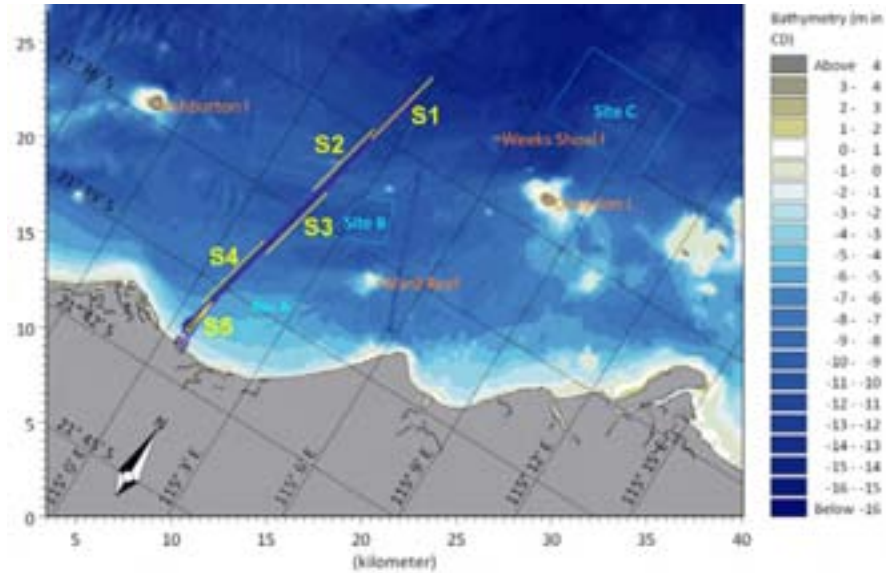


Figure 3.2 Division of the Approach Channel into Sections for Scenario Modelling

Based on the proposed schedule, the dredging programme has been divided into seven dredging scenarios. Details on the scenario selection process and the spill rates that have been used for each scenario are provided in DHI’s Dredge Plume Modelling Report (DHI 2010b). The main focus has been on the dredge activities anticipated to lead to the highest spill rates and highest potential for impacts at a given section along the dredge corridor. An “optimization” scenario has also been run (Scenario 7A), in order to test whether use of a proposed “restricted overflow area” would be an effective mitigation measure for a particularly sensitive location. This gives a total of eight scenarios.

Descriptions of each of the eight dredging scenarios that have been modelled are presented in the following sections.



### 3.1.1 Dredging Scenario 1

#### Nearshore Dredging: CSD in Barge Access Channel

- CSD dredging barge access channel, with pumping to placement Site A, using a near bed diffuser
- Bathymetry with partly dredged access channel to -3 m LAT
- Material available for suspension in dredged channel portion

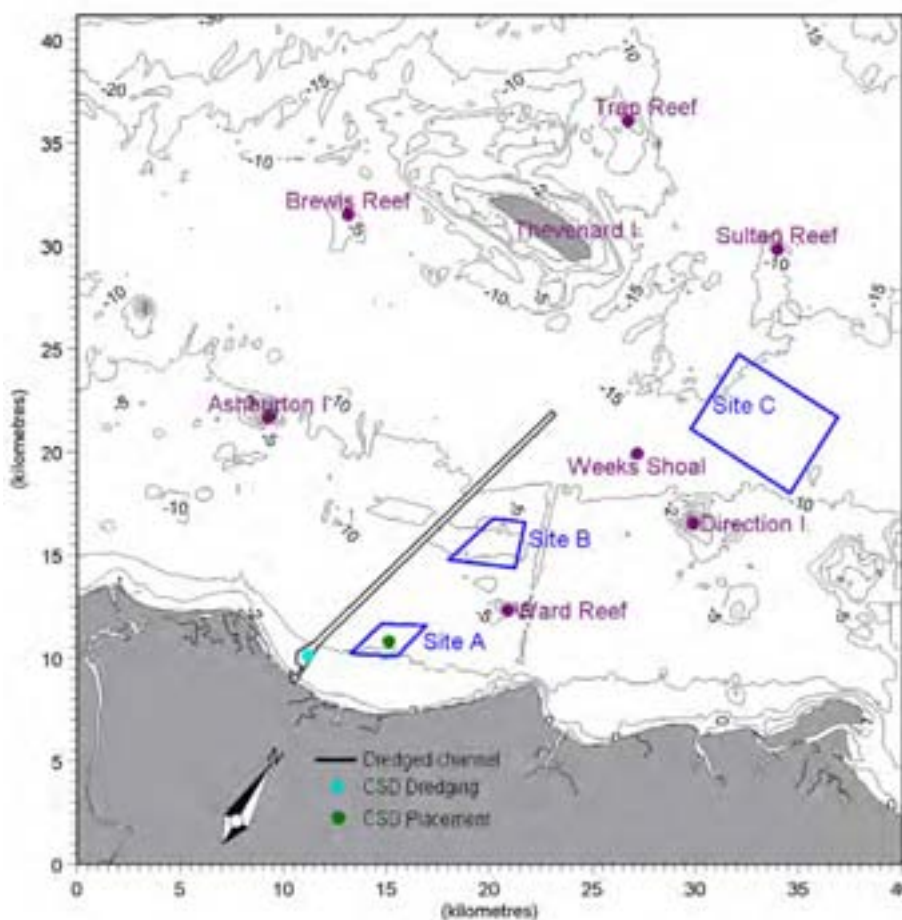


Figure 3.3 Scenario 1: CSD dredging location and offshore placement site (highlighted with blue and dark green circles respectively) simulated for the plume assessment





### 3.1.2 Dredging Scenario 2

#### Nearshore Dredging: CSD in PLF Basin

- CSD dredging in PLF Basin with pumping to barges at -3 m LAT for transport to Site C
- Bathymetry with fully dredged access channel to -3 m LAT, partly dredged 150 m wide channel to -8.3 m LAT
- Material available for suspension in dredged channel, Site A and Site C
- Include MOF breakwaters

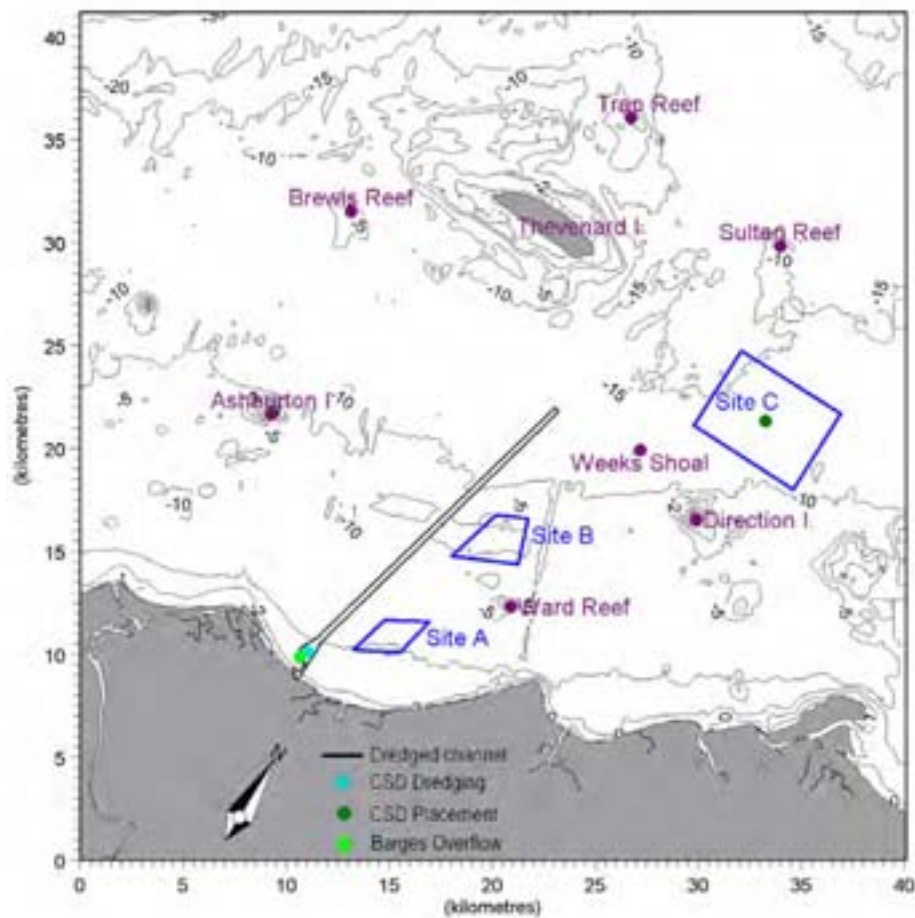


Figure 3.4 Scenario 2: CSD dredging location (blue circle), nearshore barge loading location (light green circle) and offshore placement site (dark green circle) simulated for the plume assessment



### 3.1.3 Dredging Scenario 3

#### Nearshore Dredging: CSD in MOF

- CSD dredging in MOF with pumping to barges at -3 m LAT for transport to Site C
- Bathymetry with fully dredged, 75 m wide channel to -6 m LAT and barge access channel
- Material available for suspension in dredged channel, Site A and Site C
- Include MOF breakwaters.

#### Offshore Dredging 1: Approach Channel – Section 4 Sand

- 5,000 m<sup>3</sup> TSHD with offshore placement at Site C
- Dredging along Section 4 to bring PLF approach channel down to -8 m LAT

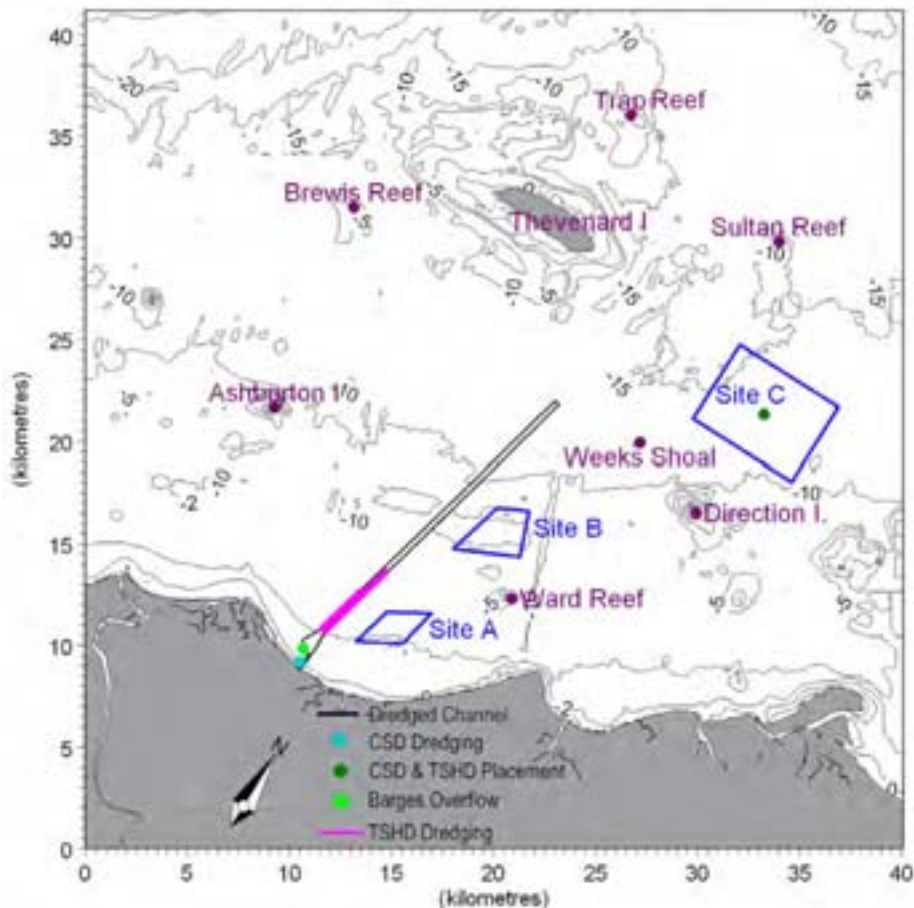


Figure 3.5 Scenario 3: CSD dredging location (blue circle), nearshore barge loading location (light green circle), 5,000 m<sup>3</sup> TSHD dredging route (pink line) and offshore placement site (dark green circle) simulated for the plume assessment



### 3.1.4 Dredging Scenario 4

#### Nearshore Dredging: TSHD in PLF basin – weak rock

- 10,000 m<sup>3</sup> TSHD dredging in PLF basin, with offshore placement at Site C
- Bathymetry with fully dredged MOF and MOF channel, partly dredged PLF to -12 m LAT
- Material available for suspension in dredged channel
- Include MOF dredged basin and MOF breakwaters.

#### Offshore Dredging: TSHD in Approach Channel Section 1 - Sand

- 10,000 m<sup>3</sup> TSHD dredging with offshore placement at Site C
- Dredging along Section 1
- Partly dredged approach channel along entire length
- Material available for re-suspension along channel and in placement Sites A and C

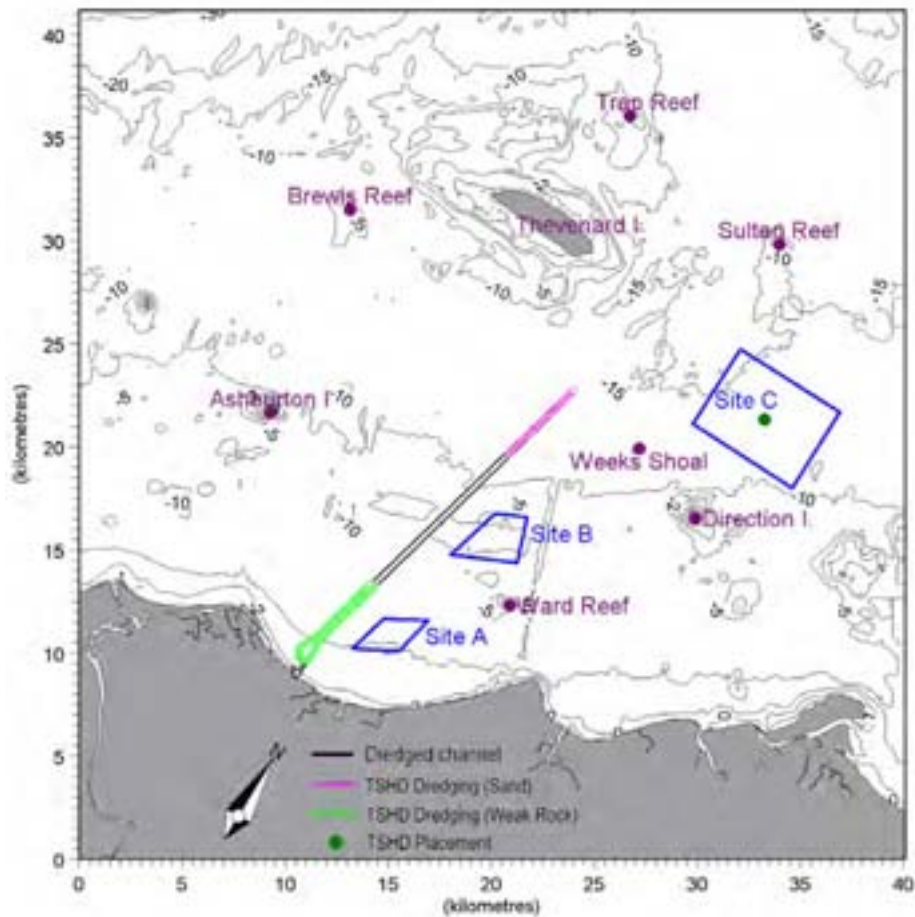


Figure 3.6 Scenario 4: Dredging routes for 10,000 m<sup>3</sup> TSHD dredging weak rock in PLF (Sections 4 & 5, shown as a light green line) and 10,000 m<sup>3</sup> TSHD dredging sand in approach channel (Section 1, shown as a pink line) and offshore placement site (dark green circle) simulated for the plume assessment



### 3.1.5 Dredging Scenario 5

#### General

- Bathymetry with fully dredged MOF, MOF channel and PLF basin. Partly dredged approach channel along entire length
- Material available for re-suspension along all dredged areas and in placement Sites A and C
- Include MOF dredged basin and MOF breakwaters.

#### Offshore Dredging 1: Approach Channel – Section 3 Sand

- 10,000 m<sup>3</sup> TSHD with offshore placement at Site C
- Dredging along Section 3

#### Offshore Dredging 2: Approach Channel – Weak Rock

- 10,000 m<sup>3</sup> TSHD with offshore placement at Site C
- Dredging along Sections 1 & 2

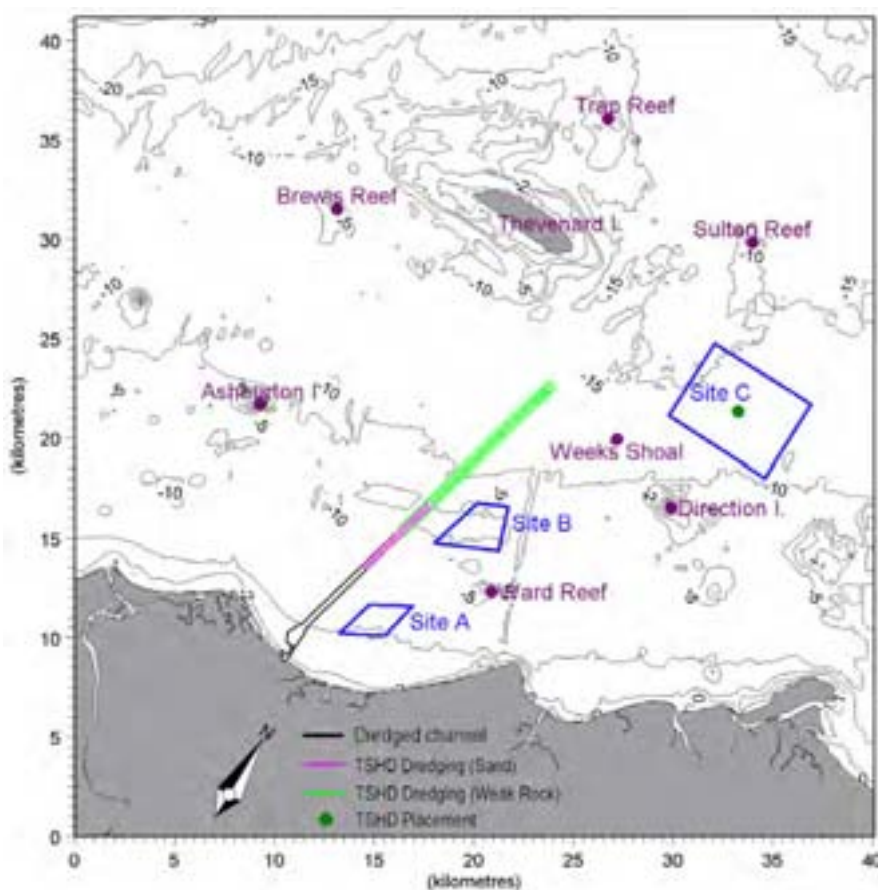


Figure 3.7 Scenario 5: Dredging routes for 10,000 m<sup>3</sup> TSHD dredging weak rock in PLF (Sections 1 & 2, shown as a light green line) and 10,000 m<sup>3</sup> TSHD dredging sand in approach channel (Section 3, shown as a pink line) and offshore placement site (dark green circle) simulated for the plume assessment



### 3.1.6 Dredging Scenario 6

#### General

- Bathymetry with fully dredged MOF, MOF channel and PLF basin. Partly dredged approach channel along entire length
- Material available for re-suspension along all dredged areas and in placement Sites A and C
- Include MOF dredged basin and MOF breakwaters.

#### Offshore Dredging 1: Approach Channel – Section 4 Sand

- 10,000 m<sup>3</sup> TSHD with offshore placement at Site C
- Dredging along Section 4

#### Offshore Dredging: Approach Channel – Weak Rock

- 10,000 m<sup>3</sup> TSHD with offshore placement at Site C
- Dredging along Sections 3 & 4

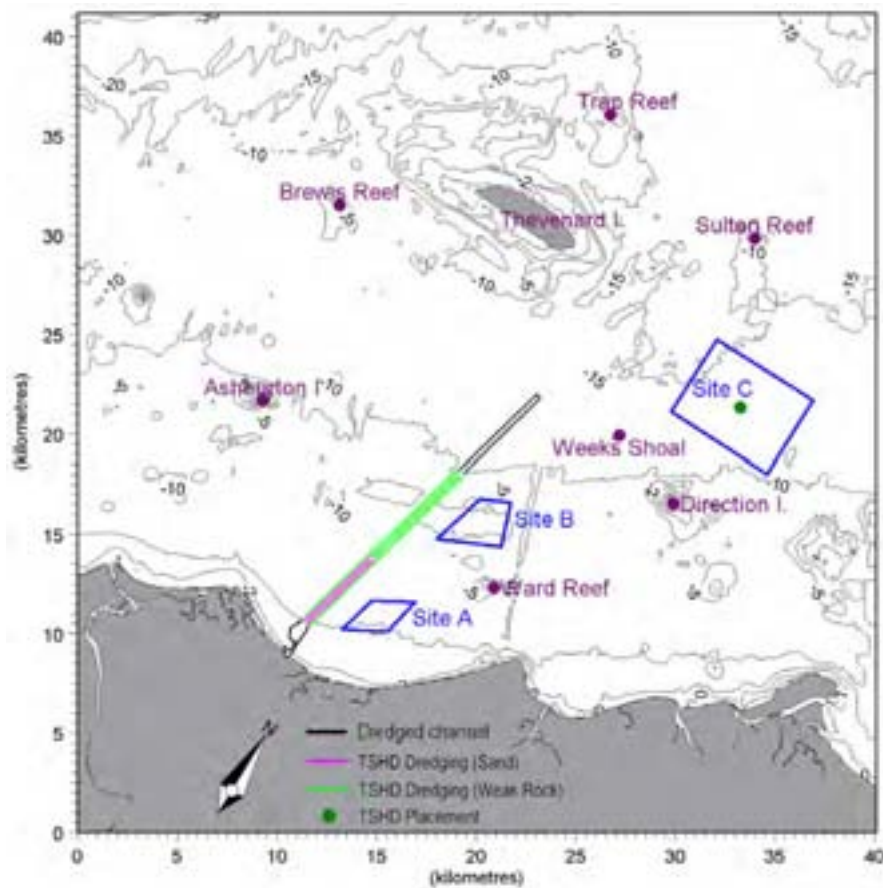


Figure 3.8 Scenario 6: Dredging routes for 10,000 m<sup>3</sup> TSHD dredging weak rock in PLF (Sections 3 & 4, shown as a light green line) and 10,000 m<sup>3</sup> TSHD dredging sand in approach channel (Section 4, shown as a pink line) and offshore placement site (dark green circle) simulated for the plume assessment



### 3.1.7 Dredging Scenario 7

#### General

- Bathymetry with fully dredged MOF, MOF channel and PLF basin. Partly dredged approach channel along entire length
- Material available for re-suspension along all dredged areas and in placement Sites A and C
- Include MOF dredged basin and MOF breakwaters.

#### Offshore Dredging: Approach Channel – Section 2 Sand

- 10,000 m<sup>3</sup> TSHD with offshore placement at Site C
- Dredging along Section 2

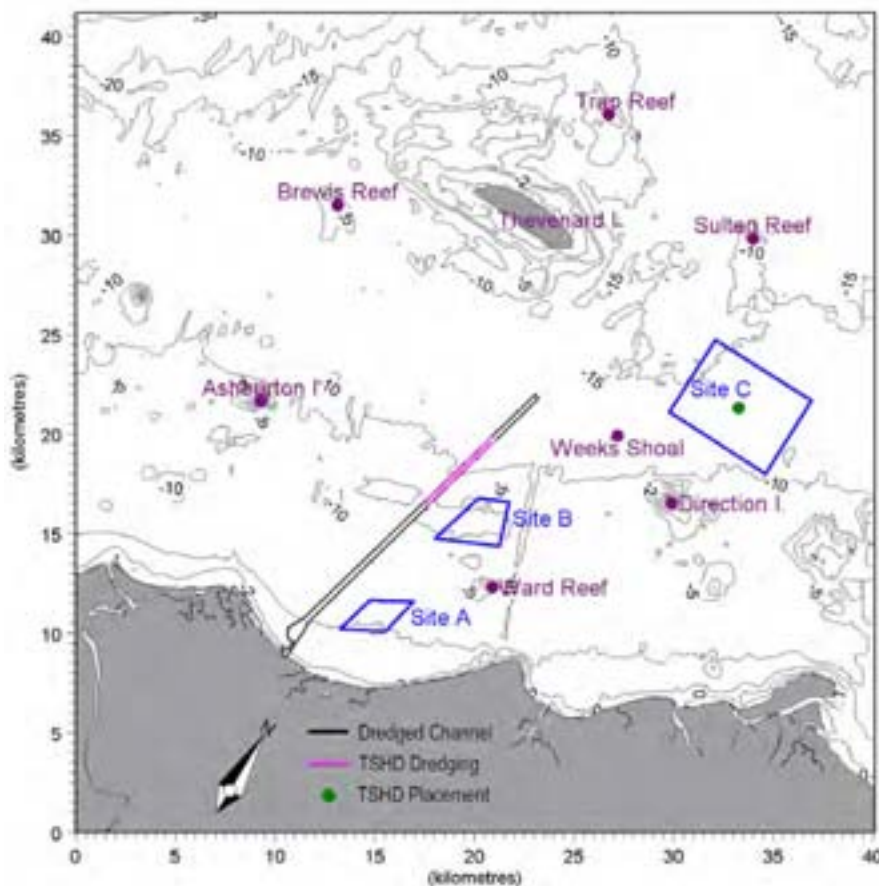


Figure 3.9 Scenario 7: Dredging route for 10,000 m<sup>3</sup> TSHD dredging sand in approach channel (Section 2, shown as a pink line) and offshore placement site (dark green circle) simulated for the plume assessment



### 3.1.8 Dredging Scenario 7A (Optimised)

#### General

- Scenario 7A is a mitigated version of Scenario 7 to avoid overflow in the critical zone adjacent to Paroo Shoal and Hastings Shoal.

#### Offshore Dredging: Approach Channel – Section 2 Sand

- 10,000 m<sup>3</sup> TSHD with offshore placement at Site C
- Dredging along Section 2 and parts of Sections 1 and 3, with operational mitigation to avoid overflow in “restricted overflow” zone

For each dredge cycle, the TSHD starts dredging at the centre of the “restricted overflow” zone within Section 2. It takes 25 minutes, corresponding to a sailing distance of 1.5 km for a speed of 1 m/s (app. 2 knots) before overflow starts. The dredger keeps dredging for another 3 km with overflow. The dredger dredges towards south and north, respectively, on alternate trips. This leads to a 3 km section with no overflow with 3 km with overflow on each side, i.e. the total channel section being dredged is 9 km.

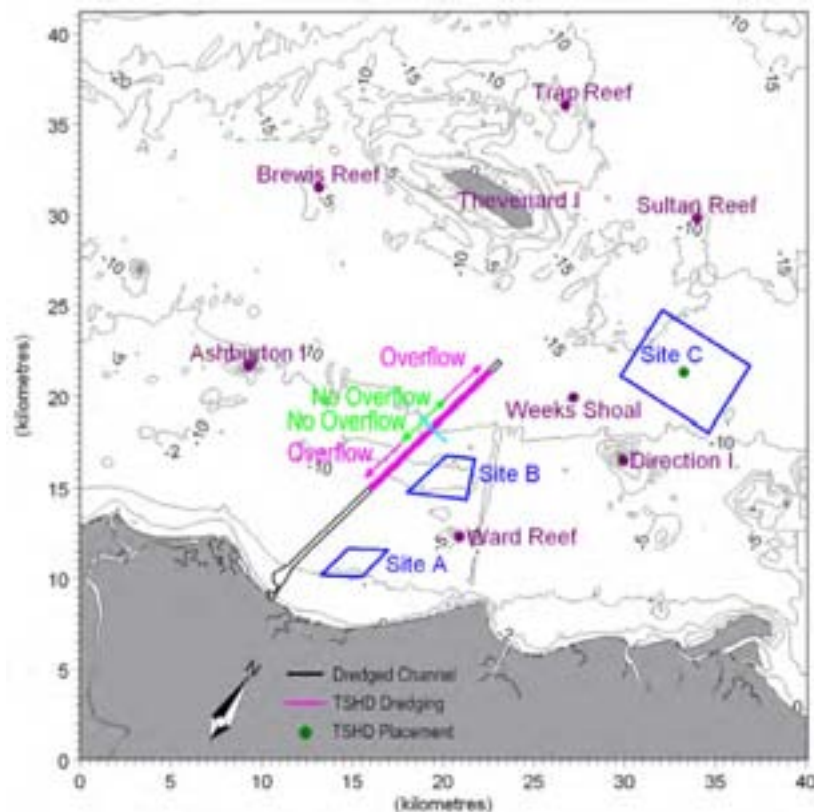


Figure 3.10 Scenario 7A: 10,000 m<sup>3</sup> TSHD starting in centre of pink area, dredging towards or away from shore on alternate trips with initial 1.5 km section with no overflow followed by 3 km with overflow. Placement at Site C (dark green circle)



### 3.2 Pipeline Trenching Activities

A pipeline is required to transfer gas and liquids from the offshore platform to the onshore processing facilities. The final route and installation methodology for the pipeline is not yet confirmed, so the assessment has been based on currently available information and conservative assumptions. The proposed pipeline route is shown in Figure 1.1, extending northwest from the onshore plant site, passing just to the east of Ashburton Island, and in between Bessieres Island and Brewis Reef, before heading northwards to the offshore platform location.

In water depths less than approximately 10 m CD between the Roller-Skate pipeline crossing and shore crossing interface point (in 2 m water depth) – a distance of approximately 8 km – it is anticipated that trench excavation will be undertaken using a back hoe dredge over a period of approximately three months. Up to 700,000 m<sup>3</sup> of dredged sediments will be transported in small hopper barges and placed at Site C from this operation. Once the pipeline is laid the trench will be backfilled using engineered fill to achieve a relatively flush reinstated seafloor such that prawn trawling is still possible above the pipeline.

In water depths greater than approximately 10 m CD out to approximately 40 m CD between the Roller-Skate pipeline and the shelf break – a distance of approximately 26 km – a mechanical trencher will be used for most of the length. The mechanical trencher deposits removed material directly to the adjacent seabed, so there is no transport and placement of dredged material at a remote site. Once the pipeline is laid the trench will be backfilled using engineered fill to achieve a relatively flush reinstated seafloor. In areas too hard to be trenched, the pipeline will be laid on the seabed and stabilised (e.g. by rock dumping), which will create a profile 1–2 m above the existing seabed in these areas. Based on available geotechnical data, it is expected that up 4–8 km of the 26 km section of the route may be too hard to trench.

However, there is also a contingency case, where the pipeline trenching may need to be performed using larger dredging equipment, particularly if the geotechnical conditions do not favour the mechanical trenching methodology. In this case it is possible that a combination of CSD and TSHD dredging may be used to create a trench for the pipeline. This may be undertaken from a water depth of approximately 5 m CD, out to approximately 40 m CD – a distance of approximately 33 km. The dredging volume could be up to 2.4 million m<sup>3</sup>, over a period of approximately six months. Dredged material out to approximately -10 m CD would be placed at Site C, while material from approximately -10 m CD to -40 m CD would be placed at Site D.

In order to be conservative, dredge plume modelling has been undertaken based on this contingency case, though it is noted that the actual impacts are expected to be much lower if the preferred methodology is used.

The dredge plume modelling utilised the same methodology applied to the modelling of the channel dredging, which involved defining short-term dredge scenarios and the use of the six climatic scenarios outlined in Section 3.3.





Two sensitive receptor locations along the proposed pipeline route were identified for detailed short-term scenario modelling:

- Ashburton Island – the proposed pipeline route passes approximately 1 km east of Ashburton Island, which has high cover and diversity of hard corals. This location is also on a direct flow path to sensitive coral areas at Paroo Shoal and Saladin Shoal. There is also a large seagrass meadow to the west of Ashburton Island.
- Bessieres Island/Brewis Reef – the proposed pipeline route also passes within 7 km of Bessieres Island, which has moderate cover and diversity of hard corals and within 5 km of Brewis Reef, which has moderate macroalgal cover. This location is also on a direct flow path to Thevenard Island.

The two modelling scenarios associated with these sensitive receptor locations are shown in Figure 3.11 and Figure 3.12.

### 3.2.1 Pipeline Trenching Scenario 1

#### Pipeline Trenching: CSD Adjacent to Ashburton Island

- CSD dredging pipeline trench adjacent to Ashburton Island, with pumping to adjacent hopper barge overflow, for transport to Site D

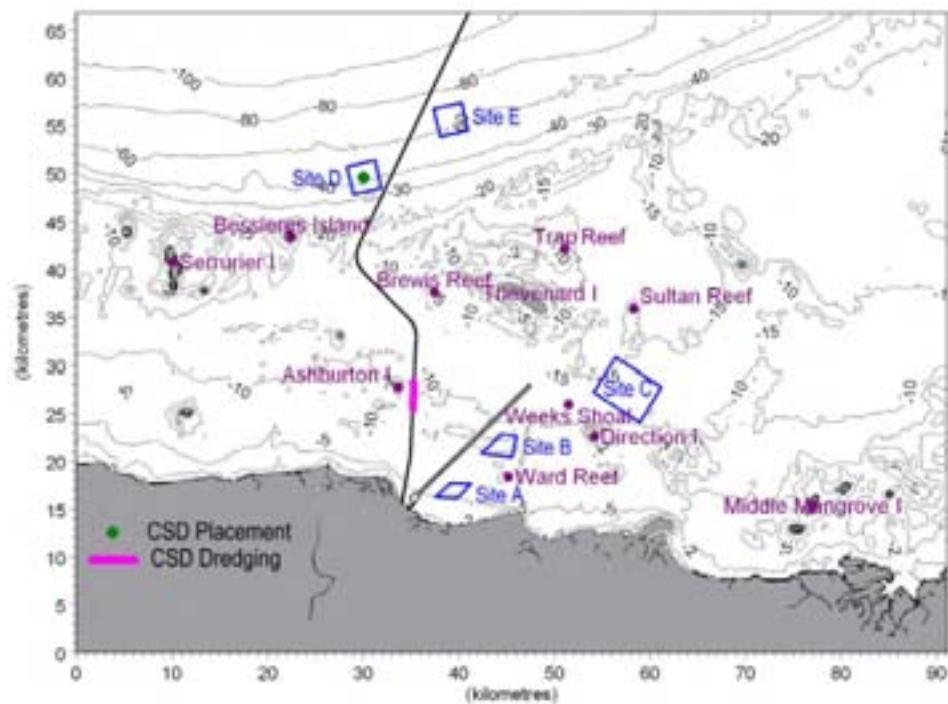


Figure 3.11 Pipeline Scenario 1: CSD dredging adjacent to Ashburton Island (pink line), pumping into a barge with overflow adjacent to the CSD. Placement at Site D (dark green circle)



### 3.2.2 Pipeline Trenching Scenario 2

#### Pipeline Trenching: CSD Adjacent to Bessieres Island and Brewis Reef

- CSD dredging pipeline trench adjacent to Bessieres Island and Brewis Reef, with pumping to adjacent hopper barge overflow, for transport to Site D

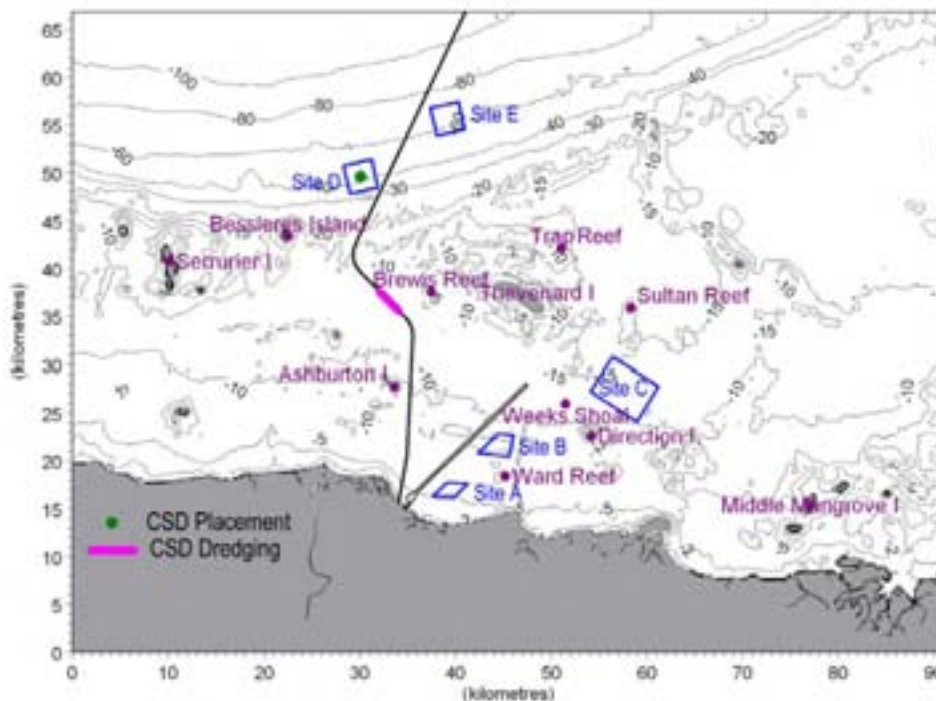


Figure 3.12 Pipeline Scenario 2: CSD dredging adjacent to Bessieres Island and Brewis Reef (pink line), pumping into a barge with overflow adjacent to the CSD. Placement at Site D (green circle)

### 3.3 Climatic Scenarios

#### 3.3.1 Seasonal Variability

The Wheatstone area has dominant summer and winter conditions with wind-driven net currents that cause the sediment plumes to travel in a pre-dominant direction. Due to the variable climatic component, a number of scenarios covering both representative and strong conditions are required to develop an envelope of possible impacts.

Based on simulated regional net current patterns, the periods listed in Table 3.2 have been simulated to cover the variable climatic conditions. More details on the climate scenario selections are provided in DHI’s Dredge Plume Modelling Report (DHI 2010b).



Table 3.2 Climatic Scenarios

Condition Period	Period
Summer-A period	January 2007
Summer-B period	February 2007
Winter-A period	June 2007
Winter-B period	July 2007
Calm Transitional-A period	April 2007
Calm Transitional-B period	May 2007

### 3.3.2 Wind Conditions

The modelling has mainly been undertaken using wind fields based on measured data from Onslow. However, in order to address comments made during an external independent review of the model methodology, the latest versions of the scenarios have been run using wind fields based on simulated data from the Bureau of Meteorology's MesoLAPS model.

DHI has reviewed both the Onslow wind data and the MesoLAPS wind data in some detail (DHI 2010b), and it has become apparent that the Onslow wind data under-predict the wind speed (particularly in the nearshore area) during the winter months, while the MesoLAPS wind data under-predict the wind speed (particularly in the nearshore area) during the summer months. The decision has therefore been made to use both sets of model results in order to ensure a suitably conservative approach in determining the impact zones for this assessment.

### 3.4 Spill Scenarios

DHI's extensive dredge monitoring experience has shown that seabed geotechnical conditions in any given dredging area will vary markedly on a local scale, resulting in different and variable spill rates from trip to trip even when dredging in the same location. Therefore, in order to be conservative, two sets of spill rates have been simulated: a "realistic" set of spill rates, representing typical spill rates from similar equipment used in similar sediment types, and a "worst case" set of spill rates, representing the 90<sup>th</sup> percentile of measured spill rates from similar equipment used in similar sediment types. These two sets of spill rates have been agreed between LWI and DHI for each spill source simulated in the model, and are provided in both LWI's Dredging and Disposal Plan (LWI 2009) and DHI's Dredge Plume Modelling Report (DHI 2010b).

However, DHI notes that applying the "worst case" spill rate constantly for the full 14 day simulation period is extremely (and perhaps overly) conservative, and therefore the main impact assessment has been based on the "realistic" spill rate scenarios.



## **4 ASSESSMENT METHODOLOGY**

### **4.1 Determining Impact Zones for Individual Scenario Results**

The sediment plume model results produced by DHI (2010b) have been processed to determine the Zones of Impact, based on the tolerance limits presented in Section 2.3.

Each grid cell in the model area is assessed using an algorithm developed from the tolerance limits tables presented in Section 2.3, in order to determine the impact score for that grid cell. Where a grid cell satisfies the criteria for multiple levels of impact, the highest level of impact is used (e.g. if for a given cell, the impact would be assessed as “Zone of Partial Mortality” based on the exceedence of 5 mg/l, but “Zone of Total Mortality” based on the exceedence of 10 mg/l, then the cell is scored as “Zone of Total Mortality”).

Separate assessments are done based on the tolerance limits for corals and for seagrass, and for impacts from SSC and from sedimentation, so that four separate impact zone plots are generated from each modelled scenario.

The processed impact zone results for each of the ninety- six modelled scenarios are presented in Appendix A based on the MesoLAPS wind data, and in Appendix B based on the Onslow wind data.

The results have been grouped according to the eight dredging scenarios and two pipeline trenching scenarios described in Section 3. The results for each scenario are summarised in a table format at the end of each section, based on extractions from the model results at the key receptor locations discussed in Section 2.1. An overall Zone of Impact is assigned in the table for each receptor, based on the highest Zone of Impact experienced by that receptor as a result of either excess SSC or excess sedimentation.

### **4.2 Producing Estimated Zones of Impact (EZI)**

In order to provide a surrogate for the “full dredge log” simulations (simulating the entire 3.5 year dredging programme) that the regulator is accustomed to seeing for dredging projects in Western Australia, Estimated Zones of Impact (EZI) have been prepared by overlaying the results from all of the dredging and seasonal scenarios together, and using the highest impact zone out of each of the individual scenarios for each given location. Separate EZI plots have been produced for the base case (comprising Scenarios 1–6 + 7) and for the “optimised” version of Scenario 7 (comprising Scenarios 1–6 + 7A).

These EZI plots allow an easy comparison between the realistic versus worst case spill rates, as well as between different seasons. However, they can be regarded as extremely worst case in terms of the spatial extent of the Zones of Impact, as for each given location they show the highest zone of impact experienced at that location out of all of the 96 different modelled scenarios. They can, therefore, be thought of as the maximum spatial extent for each of the Zones.



### **4.3 Producing Indicative Zones of Impact (IZI)**

While the EZI plots provide a good overview of the maximum predicted extent of the impact zones, it should be noted that even the combination of Scenarios 1–7 (or 1–7A) may not provide an even coverage along the length of the navigation channel, due to the no overflow period at the start of each dredging trip (when the hopper is still filling up, and so no overflow occurs), and some visual interpolation is required to estimate the full extent of the Impact Zones. Due to this visual interpolation, these plots have been referred to as Indicative Zones of Impact (IZI).

Based on the processed model results, the predicted impacts associated with the proposed dredging programme are assessed in Section 5.



## **5 IMPACT ASSESSMENT**

The scenario modelling approach allowed DHI to isolate and test the variables of seasonal and climatic conditions and assumptions regarding the spill rates from each of the different dredging activities, and to test the impacts associated with the different stages of the dredging programme, as well as testing a potential mitigation measure to reduce impacts. These are discussed in more detail in the following sections.

### **5.1 Realistic vs Worst Case Spill Rates**

There is a distinct difference between the realistic and worst case spill rates for each of the scenarios modelled. The difference between the Zones of Impact for realistic and worst case spill rates for all of the combined scenarios is presented in Figure 5.1 to Figure 5.4 for corals and seagrass. While both the realistic and worst case spill rates represent measured rates provided by LWI and DHI from similar previous projects in other parts of the world; the worst case approximates the 90<sup>th</sup> percentile of measured rates. It is therefore extremely (perhaps overly) conservative to apply the worst case rate constantly for the entire 14-day simulation period. DHI therefore recommends that the realistic spill rates (which approximate the 50<sup>th</sup> percentile or “typical” spill rate) be used for the main impact assessment, while still making reference to the potential “worst case” impacts.

### **5.2 Seasonal Effects**

There are clear seasonal differences identified by the modelling. There is a net easterly drift during summer and a net westward drift during winter that result in the impact Zones extending predominantly in these directions during the respective seasons. During the transitional periods, dispersion is lower, and there is no clear net drift in either direction, so the Zones are more centralised around the dredging areas. A comparison of the summer, transitional and winter SSC Impact Zones is presented in Figure 5.5 to Figure 5.8 for corals and seagrass. In order to ensure a suitably conservative assessment in terms of the Impact Zones, it is recommended that the results of Summer, Winter and Transitional scenarios be combined for the impact assessment, and that all three seasons are included in the future modelling runs of the dredging programme.



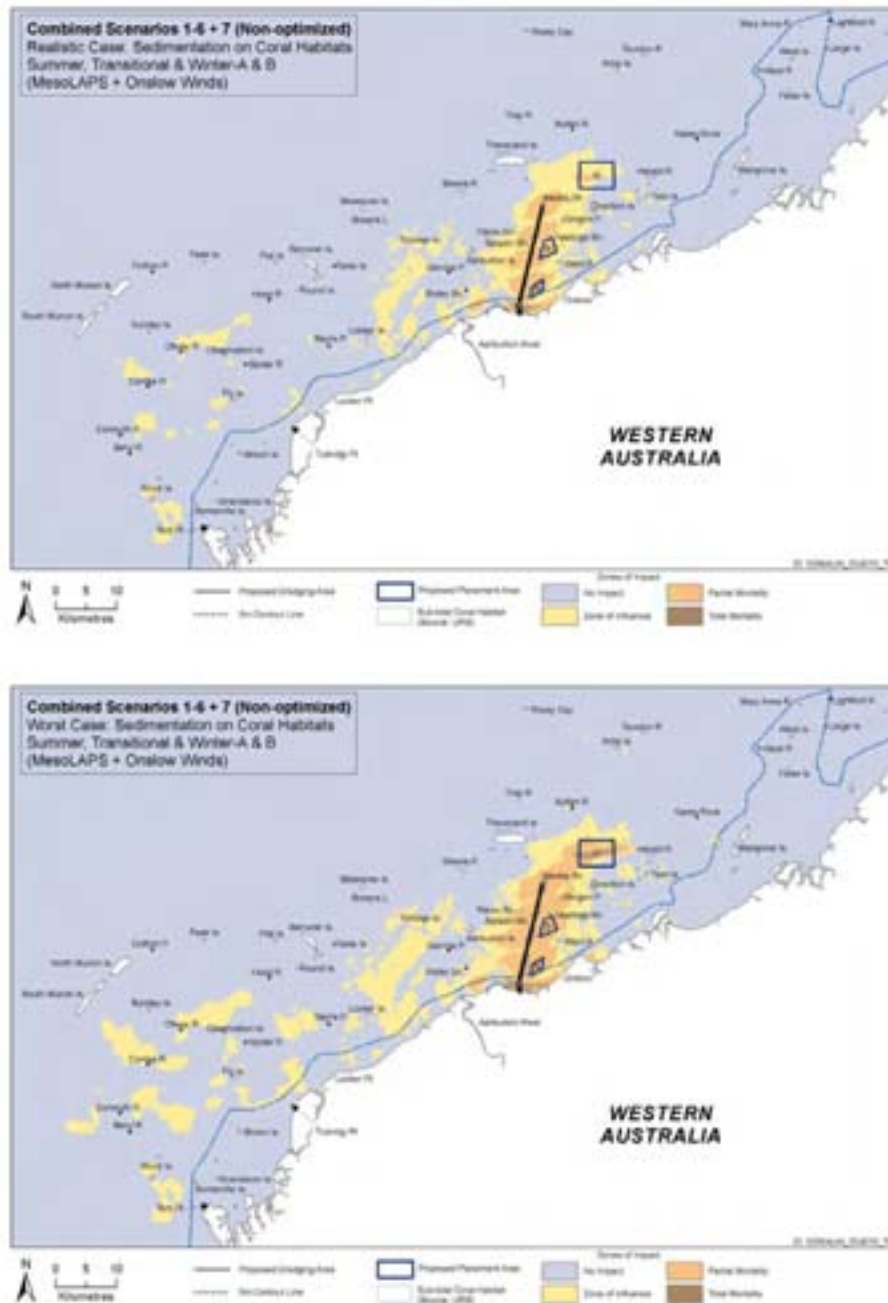


Figure 5.2 Comparison of Realistic (top) and Worst Case (bottom) Spill Rate results for sedimentation Zones of Impact for corals, for the combined Summer, Transitional and Winter conditions, based on both MesoLAPS and Onslow winds



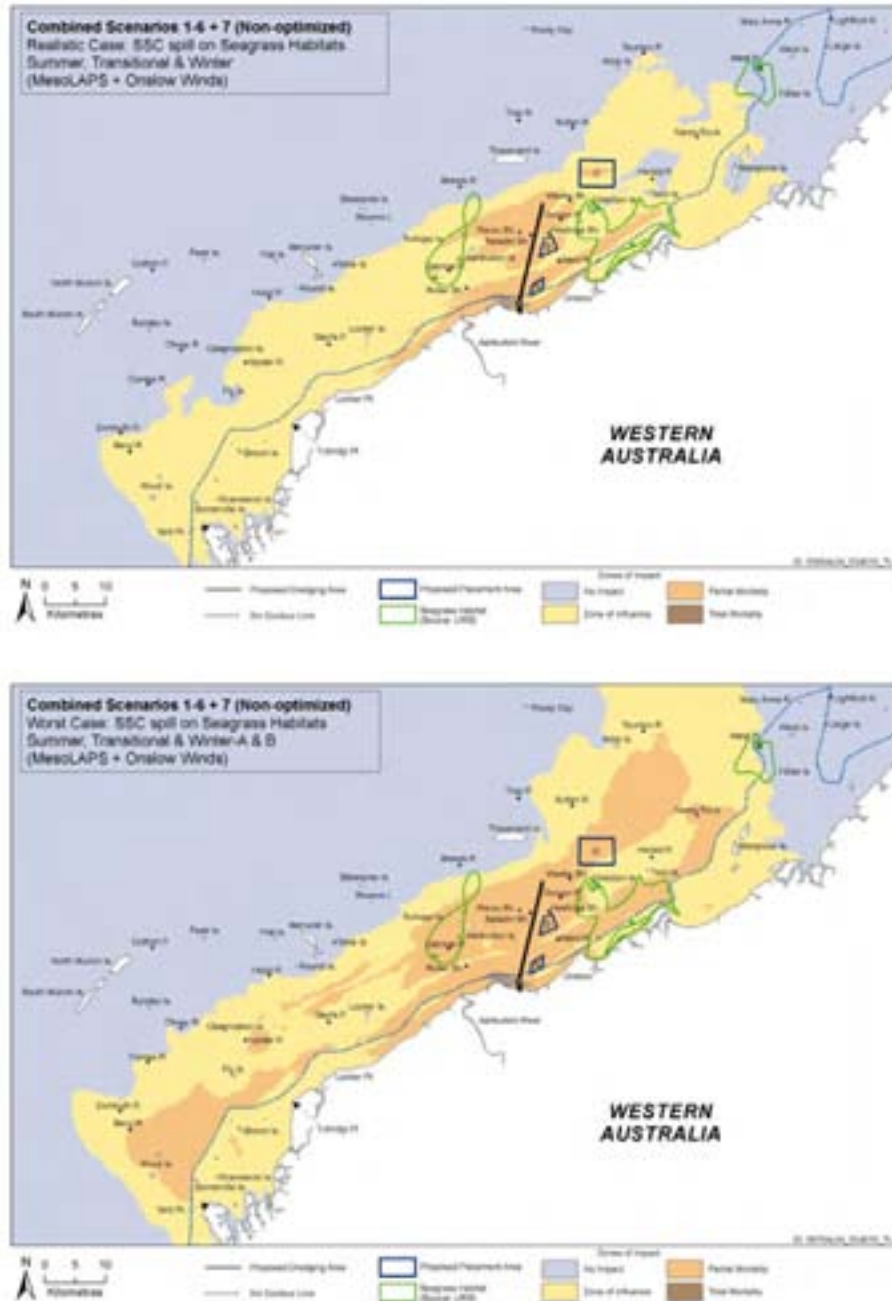


Figure 5.3 Comparison of Realistic (top) and Worst Case (bottom) Spill Rate results for SSC Zones of Impact for seagrass, for the combined Summer, Transitional and Winter conditions, based on both MesoLAPS and Onslow winds

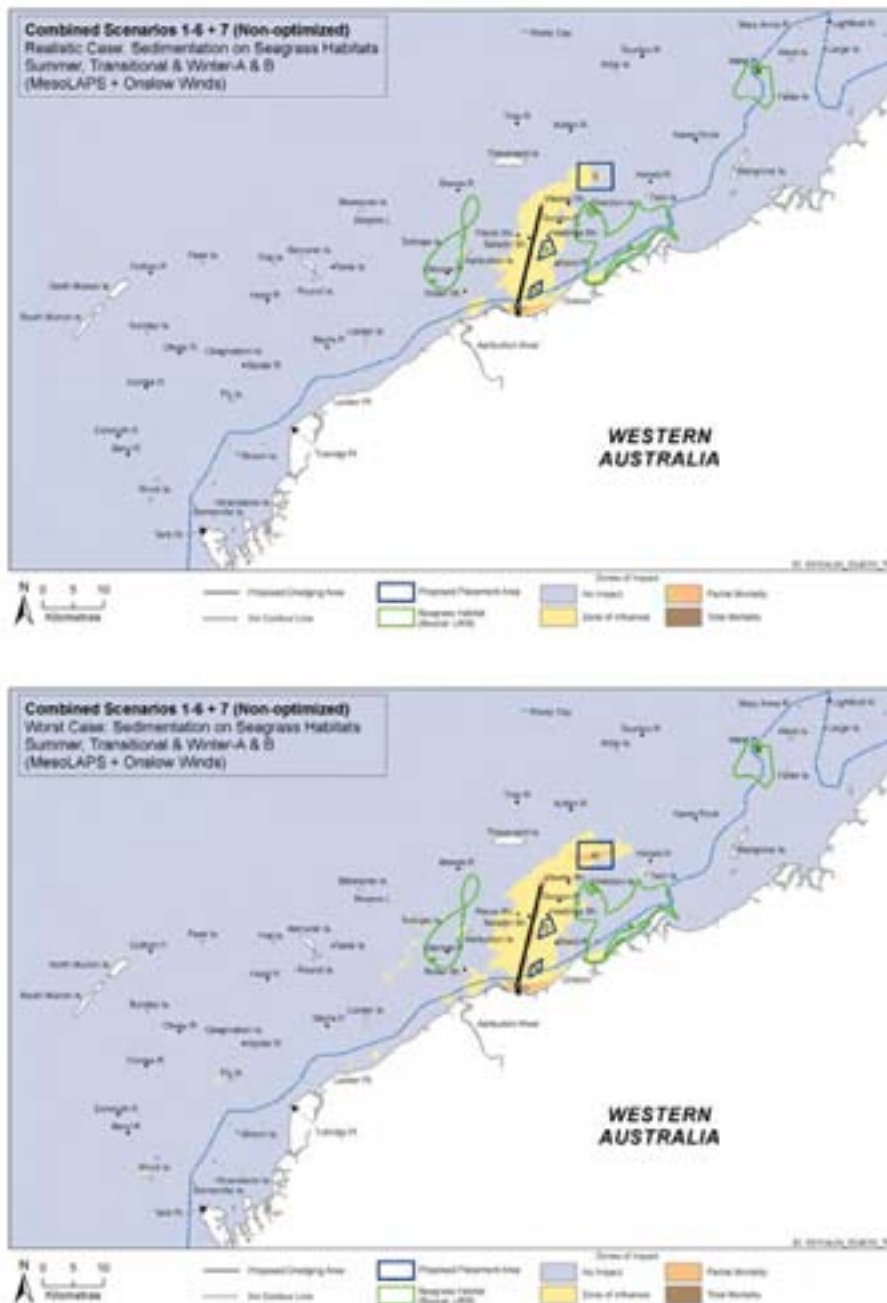


Figure 5.4 Comparison of Realistic (top) and Worst Case (bottom) Spill Rate results for sedimentation Zones of Impact for seagrass, for the combined Summer, Transitional and Winter conditions, based on both MesoLAPS and Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

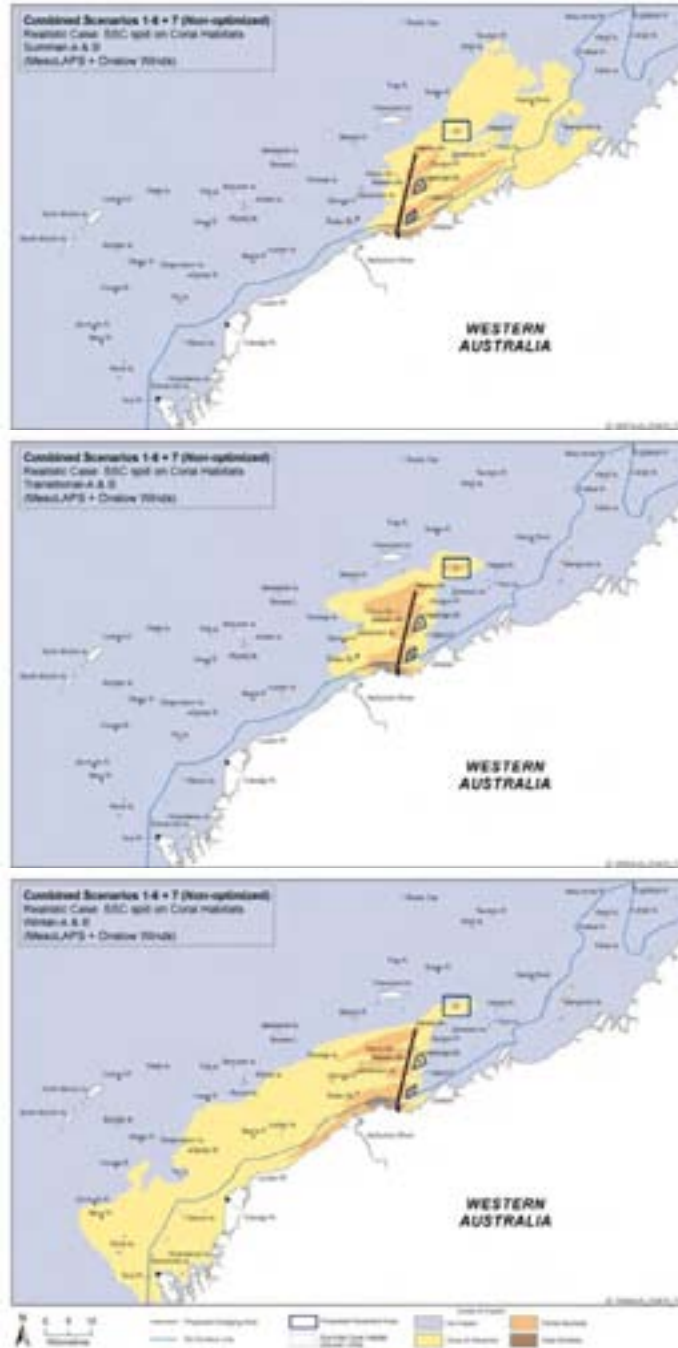


Figure 5.5 Comparison of Summer (top) Transitional (middle) and Winter (bottom) conditions for SSC Zones of Impact for corals, based on combined Realistic spill rate results for both MesLAPS and Onslow winds

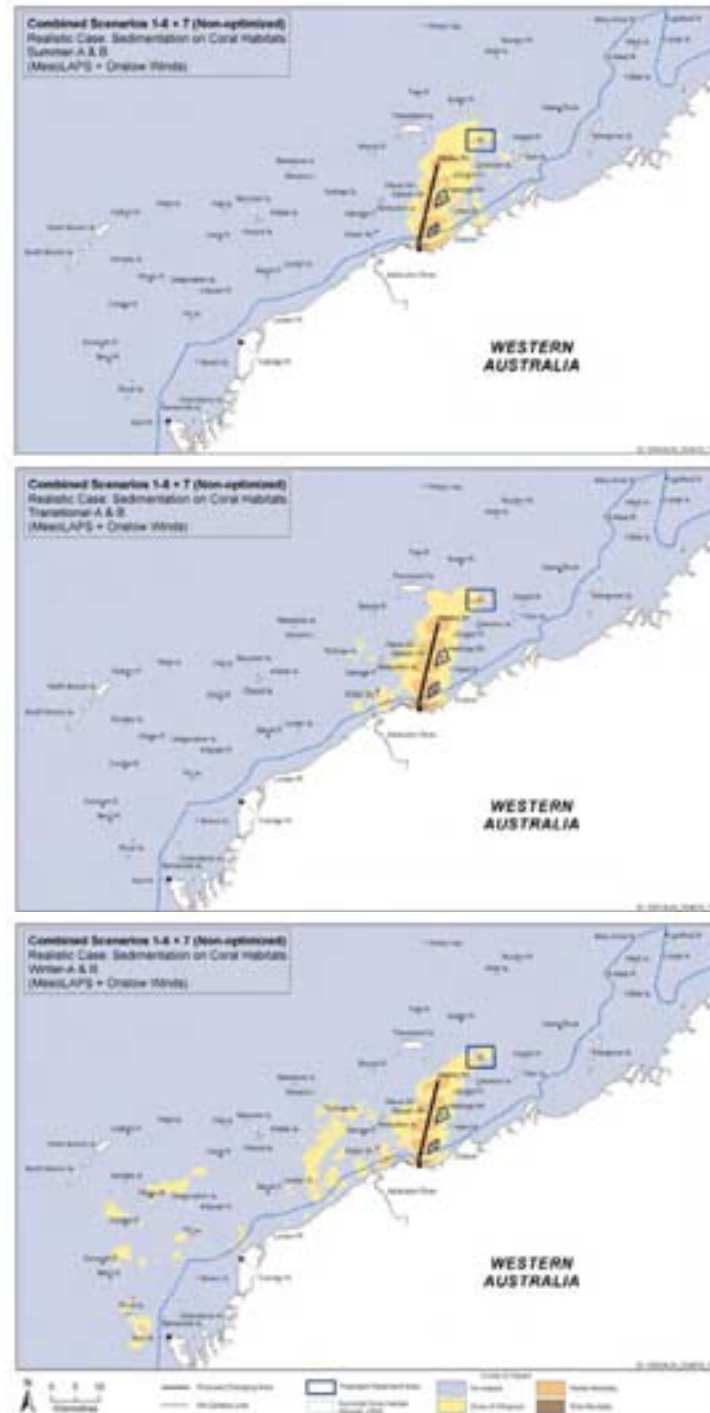


Figure 5.6 Comparison of Summer (top) Transitional (middle) and Winter (bottom) conditions for sedimentation Zones of Impact for corals, based on combined Realistic spill rate results for both MesoLAPS and Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

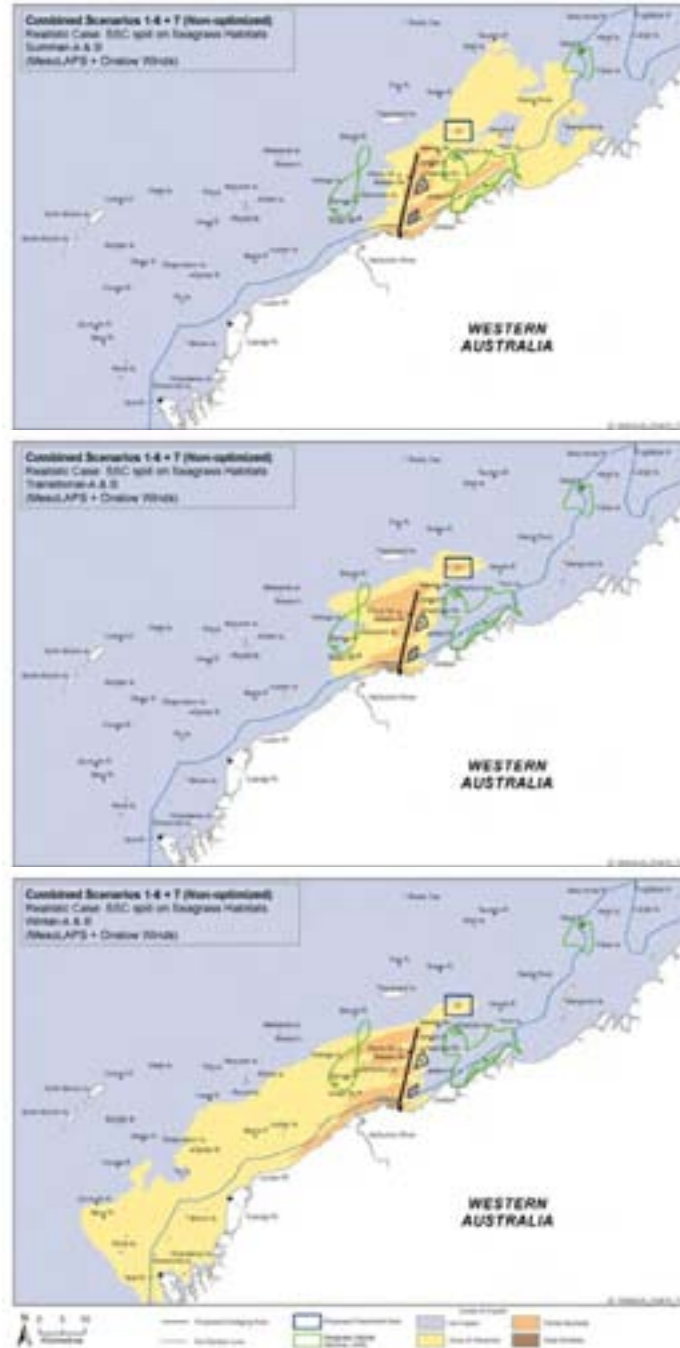


Figure 5.7 Comparison of Summer (top) Transitional (middle) and Winter (bottom) conditions for SSC Zones of Impact for seagrass, based on combined Realistic spill rate results for both MesoLAPS and Onslow winds

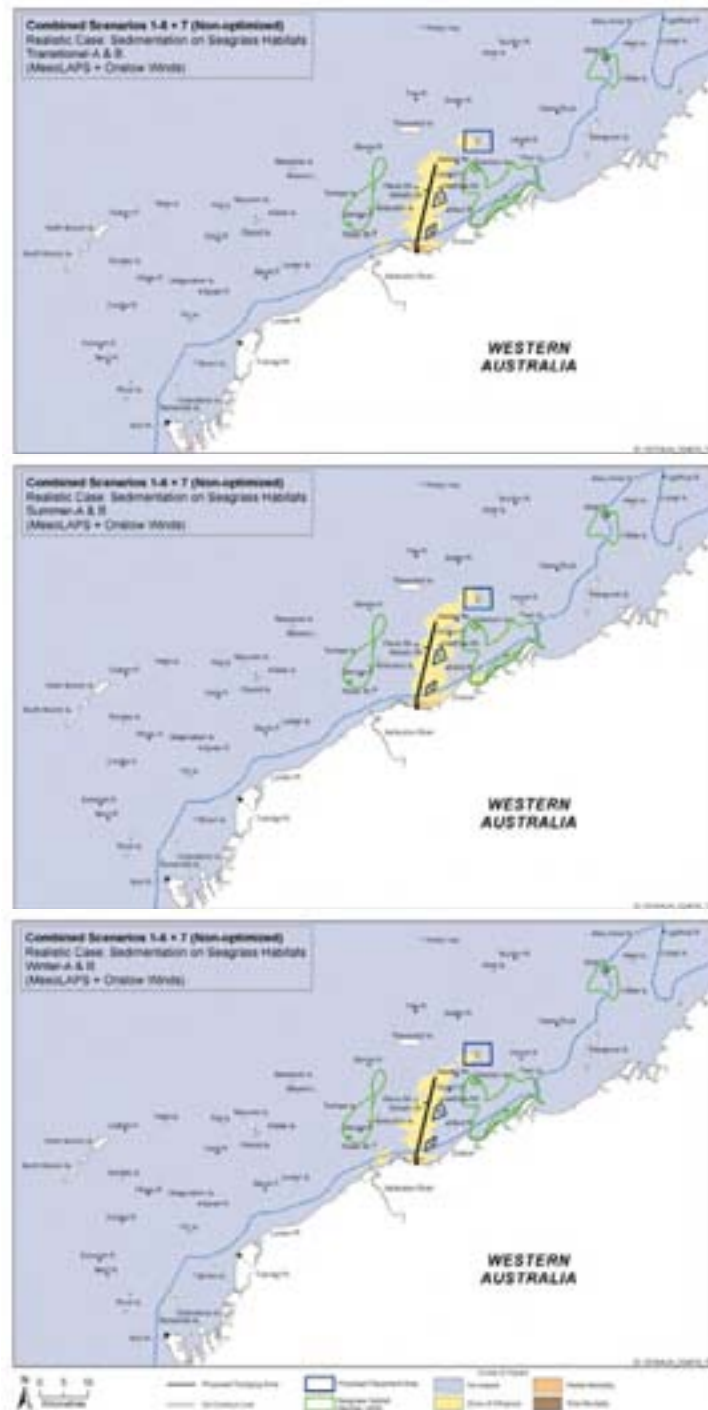


Figure 5.8 Comparison of Summer (top) Transitional (middle) and Winter (bottom) conditions for sedimentation Zones of Impact for seagrass, based on combined Realistic spill rate results for both MesoLAPS and Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



### 5.3 Climatic Variability

The climatic periods were selected to cover a range of both “strong” and “representative” climatic conditions for each season. It is important to cover a range of climatic conditions to ensure a conservative envelope is developed for the impact zones. Periods with strong currents and/or wind and wave activity result in a greater dispersion of the suspended sediment plume, which means that the spatial extent of the impact zones (particularly for SSC) tend to be larger. But during periods of more representative or lower current speeds and/or wind and wave activity, the plumes will be less well dispersed, and concentrations can build up near the dredging area. This results in smaller but more concentrated plumes, so that the Zone of Influence tends to be smaller, but the Zones of Partial and Total Mortality (particularly for sedimentation) may be larger near the dredging area.

An example of the difference between stronger and more representative conditions is presented in Figure 5.9 for SSC and Figure 5.10 for sedimentation impacts on corals. These figures illustrate that while the Winter-B scenario, which included a period of strong winds, produces a larger Zone of Influence, the Zone of Partial Mortality is actually smaller compared to the Winter-A scenario, due to the greater dispersion during Winter-B. Using both strong and representative climatic periods therefore ensures that the worst-case scenario in terms of the Zone of Influence as well as the Zones of Partial and Total Mortality is captured by the impact assessment.

### 5.4 Dredging Activities

#### 5.4.1 Cutter Suction Dredger (CSD)

The CSD dredging releases a relatively narrow plume of suspended sediments over an extended period of time (resulting in relatively high impacts within the narrow zone of the plume) that extends a considerable distance from the dredging location (tens of kilometres). The CSD will be used for the nearshore dredging of the temporary approach channel, MOF and PLF basin areas, with an expected duration in the order of six months at the start of the dredging programme.

Scenarios 1–3 show the impacts associated with the CSD dredging in the nearshore area. Scenario 2 represents the “worst case” stage for the CSD dredging, as it incorporates a relatively high spill from offshore loading of hopper barges at the 3 m isobath in addition to the spill from the CSD itself, with the hopper barges disposing of the dredged material at offshore Site C. The proximity of the two spill sources in the nearshore area leads to an overlap of the plumes which leads to longer and wider plumes being generated. This is particularly evident during summer and winter.

However, it should be noted that similar episodes of elevated concentrations are known to occur naturally in these nearshore area, due to strong spring tide currents in combination strong and persistent winds leading to re-suspension of fine material in the shallow coastal waters east of the Project area during summer (Figure 5.11) and west of the Project area during winter (Figure 5.12).

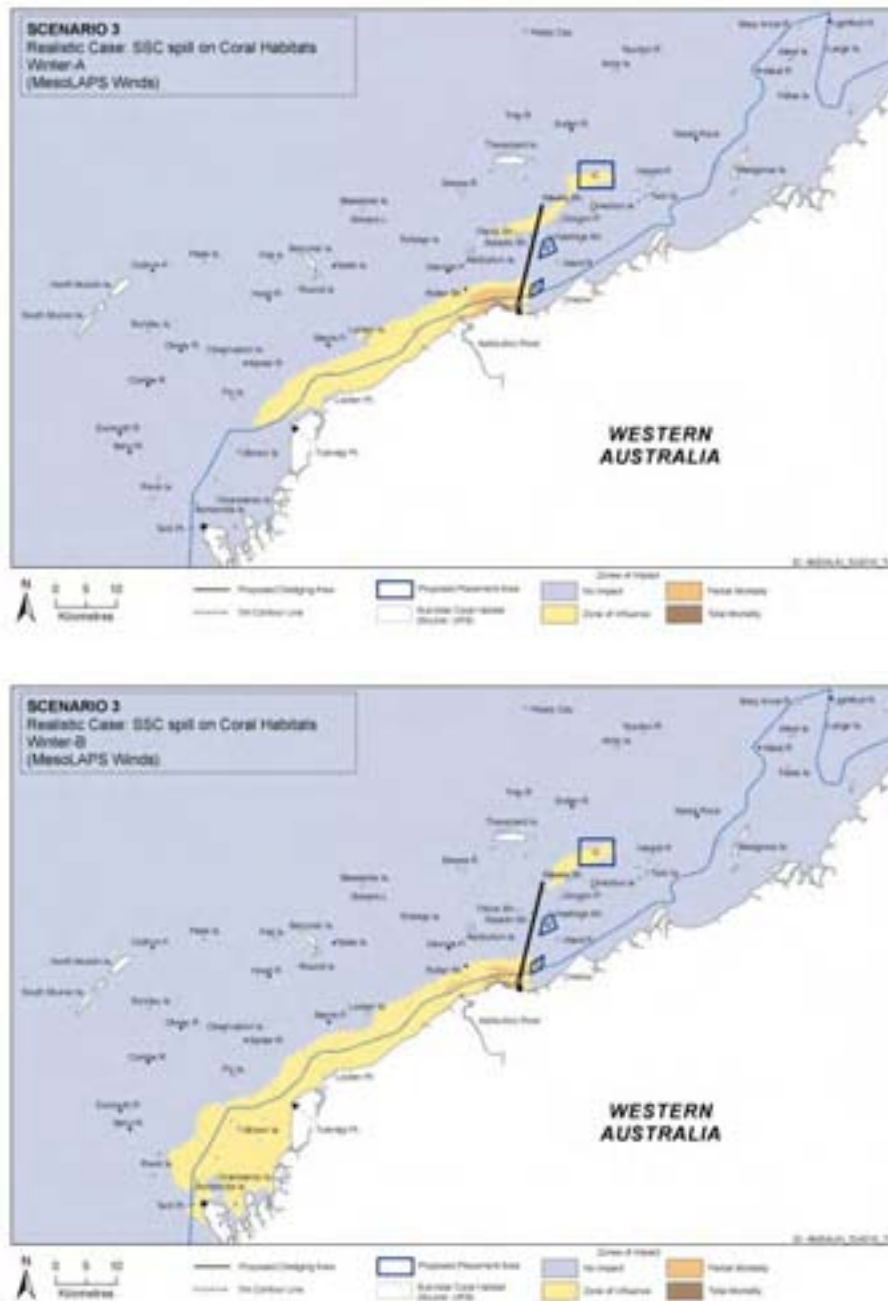


Figure 5.9 Example of climatic variability for SSC Zones of Impact for corals, based on MesoLAPS winds



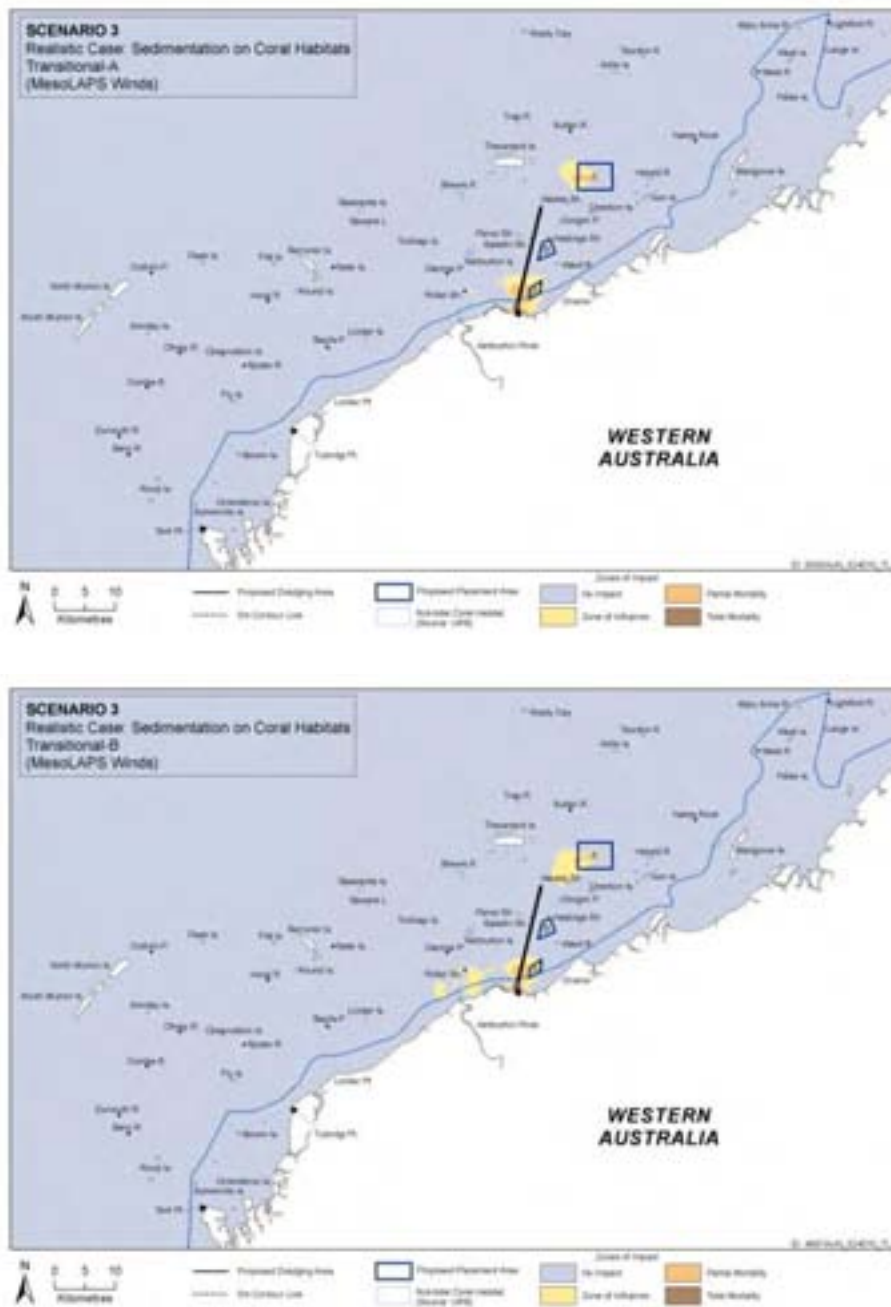


Figure 5.10 Example of climatic variability for sedimentation Zones of Impact for corals, based on MesoLAPS winds

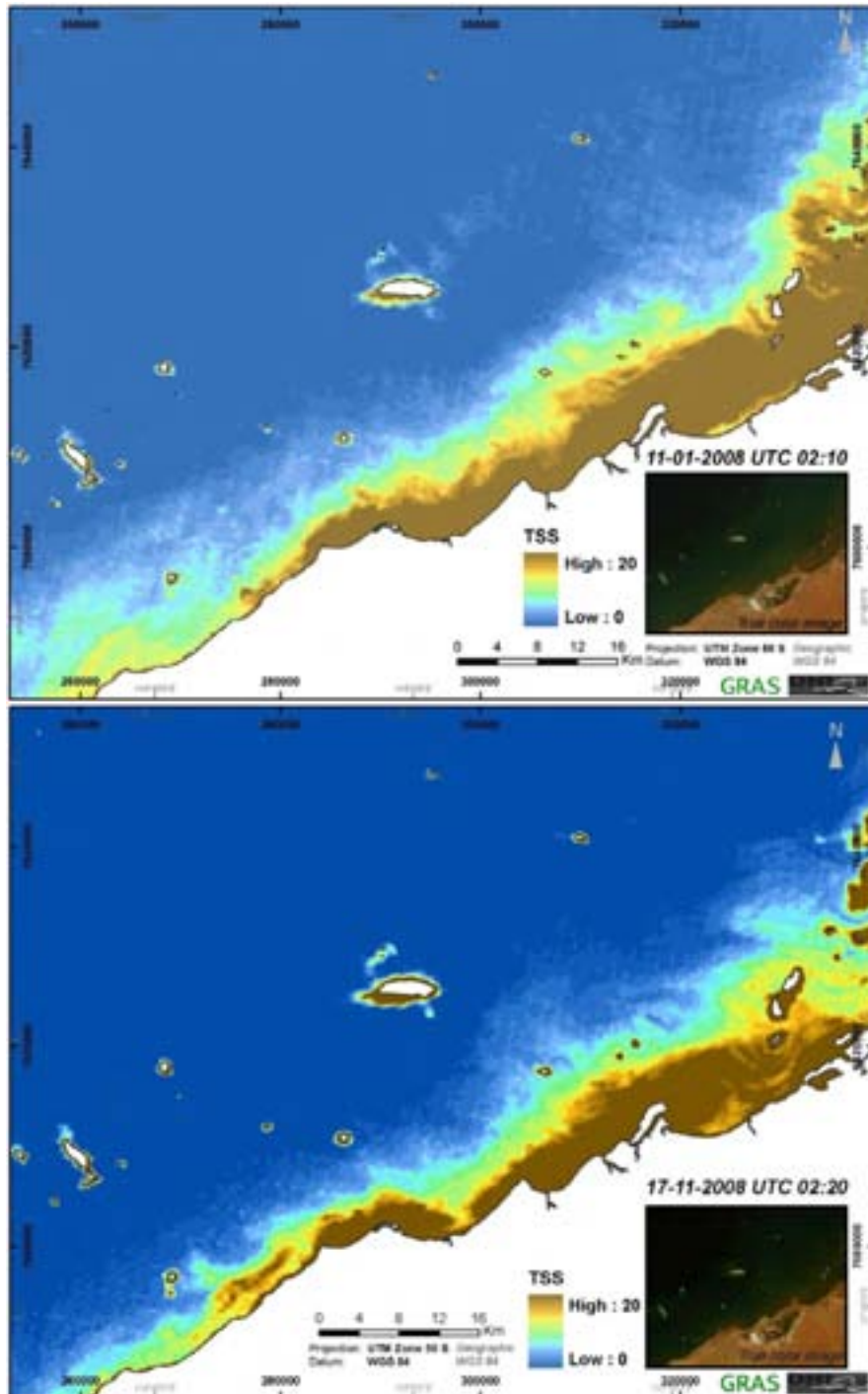


Figure 5.11 MODIS images processed to show TSS (mg/l), illustrating periodic elevated nearshore turbidity caused by wind re-suspension of fine seabed material during summer

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

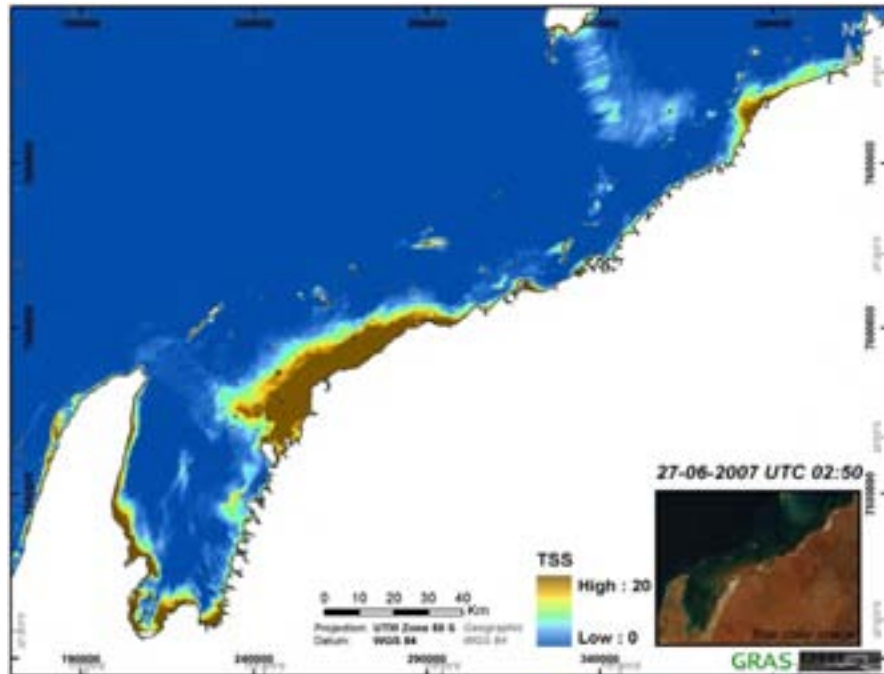


Figure 5.12 MODIS images processed to show TSS (mg/l), illustrating periodic elevated nearshore turbidity caused by wind re-suspension of fine seabed material during winter

During summer, the plumes extend eastwards to the Mangrove Islands, almost 40 km from the dredging area, though at low concentrations (average concentration in order of 3–5 mg/l above background, Figure 5.13). During winter, the overlap of the plumes also leads to a relatively longer and wider plume extending in the order of 10–15 km westwards, past the Ashburton River, with concentrations in the order of 2–5 mg/l above background (Figure 5.13). Sedimentation is generally confined to within 1–5 km of the dredging area, and is highest during the transitional period, when current speeds are low (Figure 5.13).

For CSD dredging with loading of hopper barges at the 3 m isobath, the SSC Zone of Partial Mortality is predicted to extend in the order of 10–15 km east and up to 10–25 km west along the shoreline from the dredging area, and the SSC Zone of Total Mortality is predicted to extend in the order of 4–5 km east and 6–7 km west, depending on the season and distance offshore (e.g. Figure 5.14 and Figure 5.15).

The sedimentation Zones are more localised, with the Zone of Partial Mortality extending 5–7 km east and 1–2 km west of the dredging location (depending on season) for corals, and 1–4 km east and up to 1 km west (depending on season) for seagrass (e.g. Figure 5.16), with some remote sedimentation also predicted to the east during summer and west during winter. This is because the overflow from the hopper barges contains very fine material, which is dispersed over a wide area (hence the large SSC plumes, particularly during summer), rather than settling locally to cause sedimentation impacts.

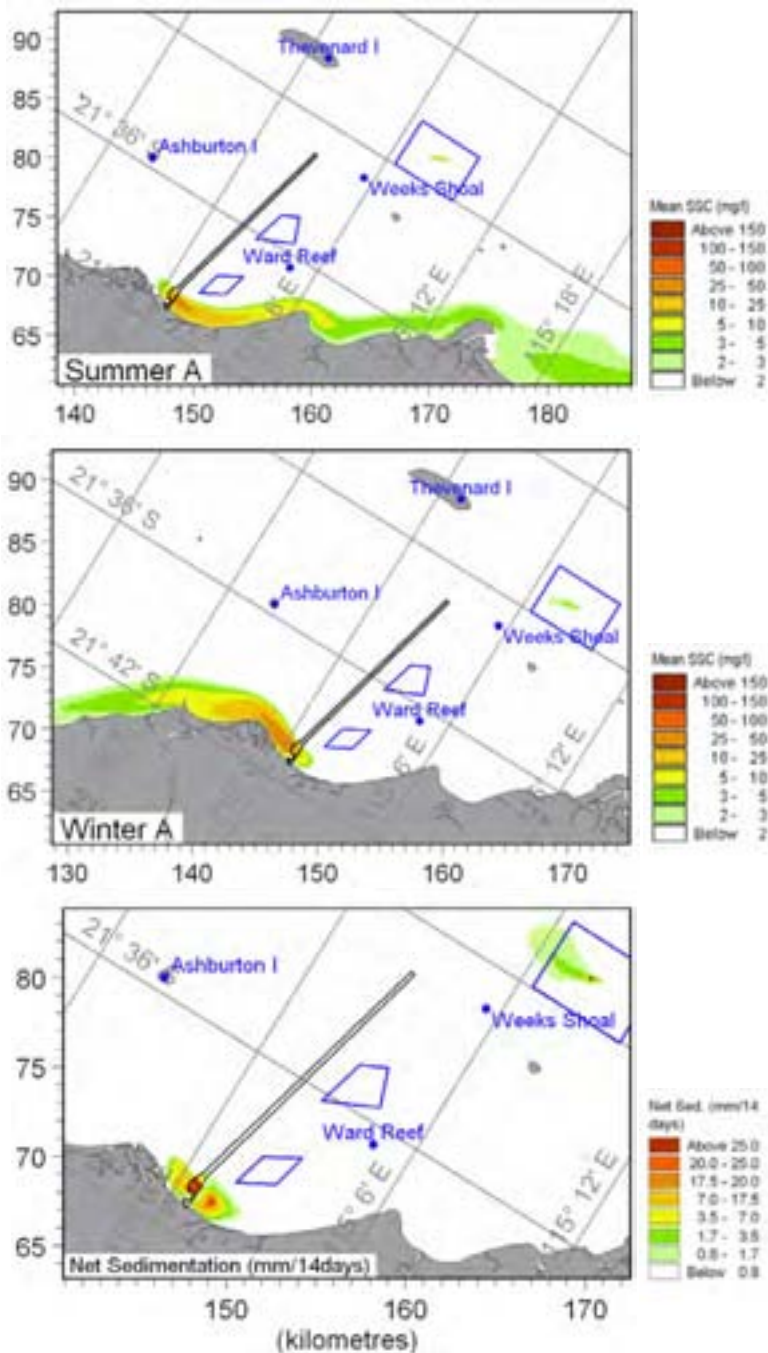


Figure 5.13 Example of suspended sediment plume and sedimentation extent due to nearshore CSD dredging, based on Scenario 2 with a Realistic spill rate

Top: Mean Suspended Sediment Concentration for Summer  
 Middle: Mean Suspended Sediment Concentration for Winter  
 Bottom: Net Sedimentation Rate for the Transitional Period

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

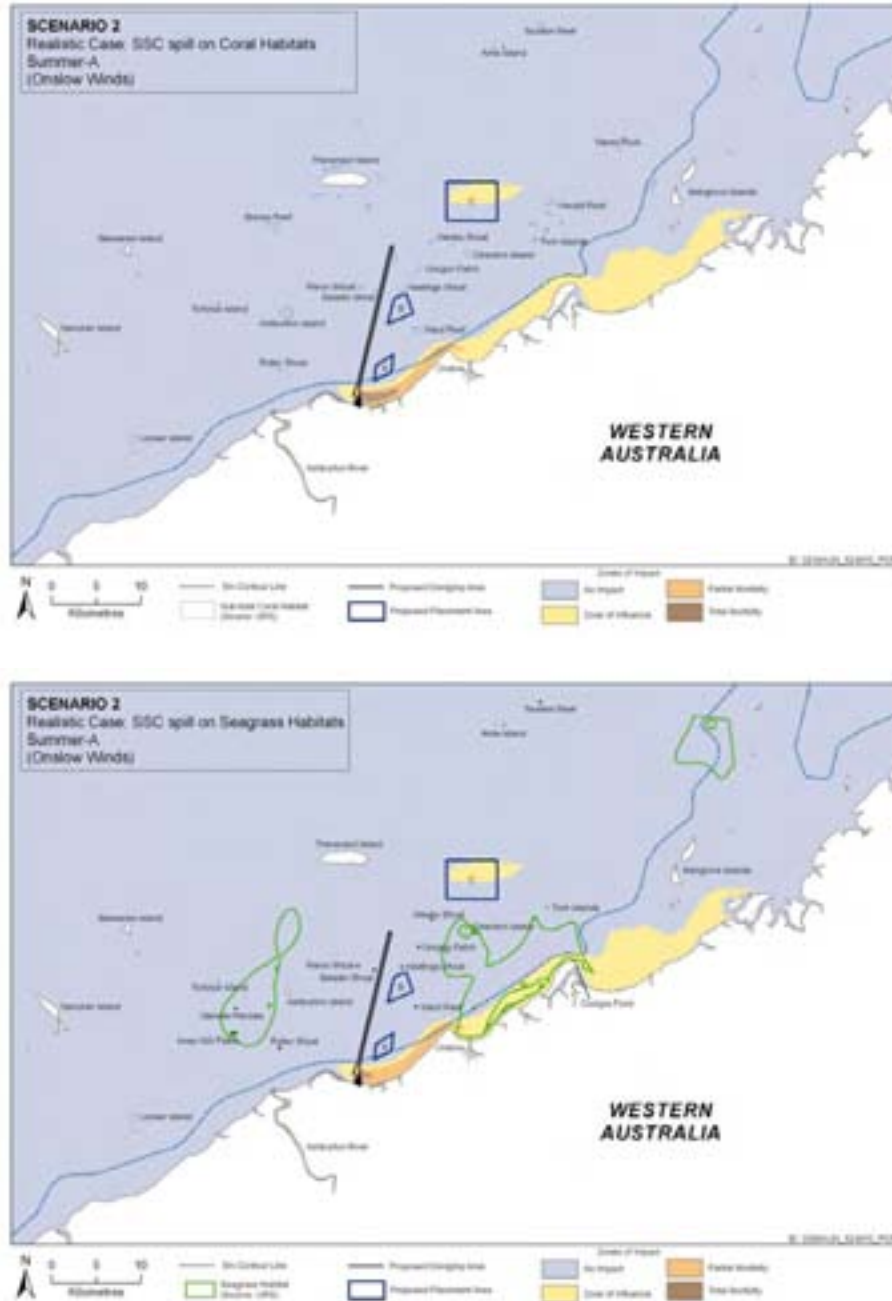


Figure 5.14 Example of Summer SSC Zones of Impact extent due to nearshore CSD dredging, based on Scenario 2 with a Realistic spill rate

Top: Coral impact zones, based on Onslow winds

Bottom: Seagrass impact zones, based on Onslow winds



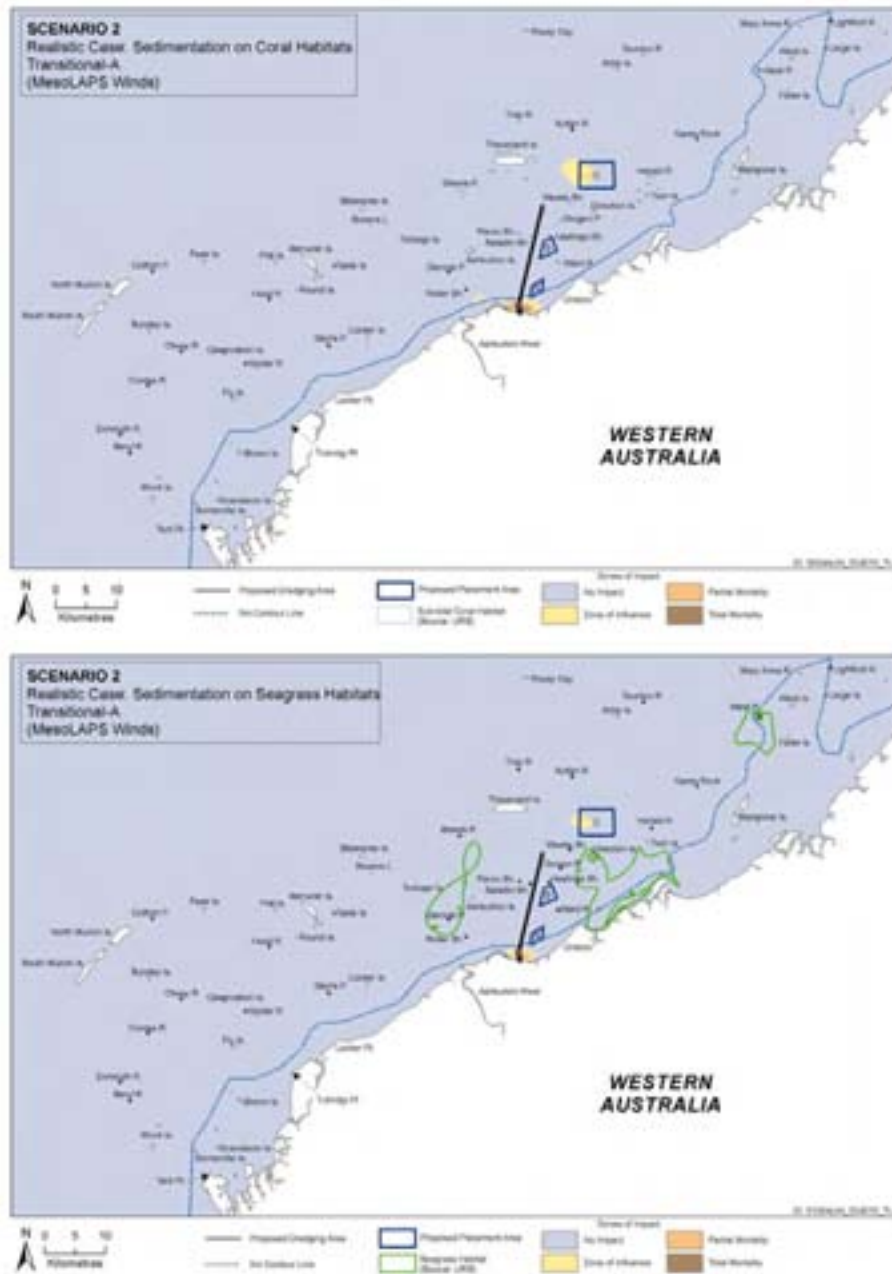


Figure 5.16 Example of sedimentation Zones of Impact extent during the calm transitional period due to nearshore CSD dredging, based on Scenario 2 with a Realistic spill rate  
 Top: Coral impact zones, based on MesoLAPS winds  
 Bottom: Seagrass impact zones, based on MesoLAPS winds



However, it should be noted that there are no coral habitats located within the potential Zones of Partial or Total Mortality for this nearshore CSD dredging, and only a very small area of the seagrass meadow offshore from Onslow falls within the Zone of Partial Mortality (Figure 5.14), and only during strong summer conditions. The planned duration of the CSD dredging is in the order of 6 months.

#### **5.4.2 Trailer Suction Hopper Dredger (TSHD)**

Dredging using TSHDs forms the main component of the proposed dredging programme, comprising in the order of 80% of both the programme duration and total volume of material to be dredged. The dredging programme from LWI (2009) has specified a relatively small TSHD (5,000 m<sup>3</sup>) to carry out the initial dredging of the nearshore sections of the navigation channel (down to a depth of -8 m), as well as two larger TSHDs (10,000 m<sup>3</sup> each) to dredge the main navigation channel and the PLF basin from -8 m down to the full dredge depth (approximately -14 m). The suspended sediment plume from the TSHD dredging is spread over a wider area but at lower concentrations compared to the CSD, as it is a moving source, covering approximately 4–7 km along the navigation channel over a period of approximately 1–2 hours. It then leaves the site to dispose of the dredged material at an offshore placement site, returning 1–2 hours later to start dredging again.

This intermittent spill is much easier for corals and seagrass to cope with than a constant spill such as that from a CSD, as it allows frequent periods of clearer water for photosynthesis. Sedimentation from the TSHD is also generally lower, as it is spread over a much wider area. The high sedimentation shown in the PLF basin and dredging channel in Figure 5.17 is due to the coarse fines, which settle almost immediately, and will be removed subsequently by the cleanup dredging.

There will be a period near the start of dredging when the 5,000 m<sup>3</sup> TSHDs will be working in the nearshore area in parallel with the CSD dredging and loading into the hopper barges. This is covered under Scenario 3, which has the 5,000 m<sup>3</sup> TSHD dredging in the nearshore section of the approach channel while the CSD dredges in the MOF basin and loads into hopper barges at the 3 m isobath, for disposal at placement Site C.

As would be expected, the spill (and therefore the plume) from the 5,000 m<sup>3</sup> TSHD is lower in concentration and smaller in size than the plumes from either the CSD or the 10,000 m<sup>3</sup> TSHDs. However, due to the close proximity of the 5,000 m<sup>3</sup> TSHD and the CSD and hopper barge loading in the nearshore area, the plumes overlap and result in a single larger plume (mainly from the CSD) with mean concentrations in the order of 5–10mg/l above background, extending east well past Onslow during summer, and west well past the Ashburton River mouth during winter (Figure 5.17). Sedimentation is generally confined to within 1–5km of the dredging area, and is highest during the transitional period, when current speeds are low (Figure 5.17).



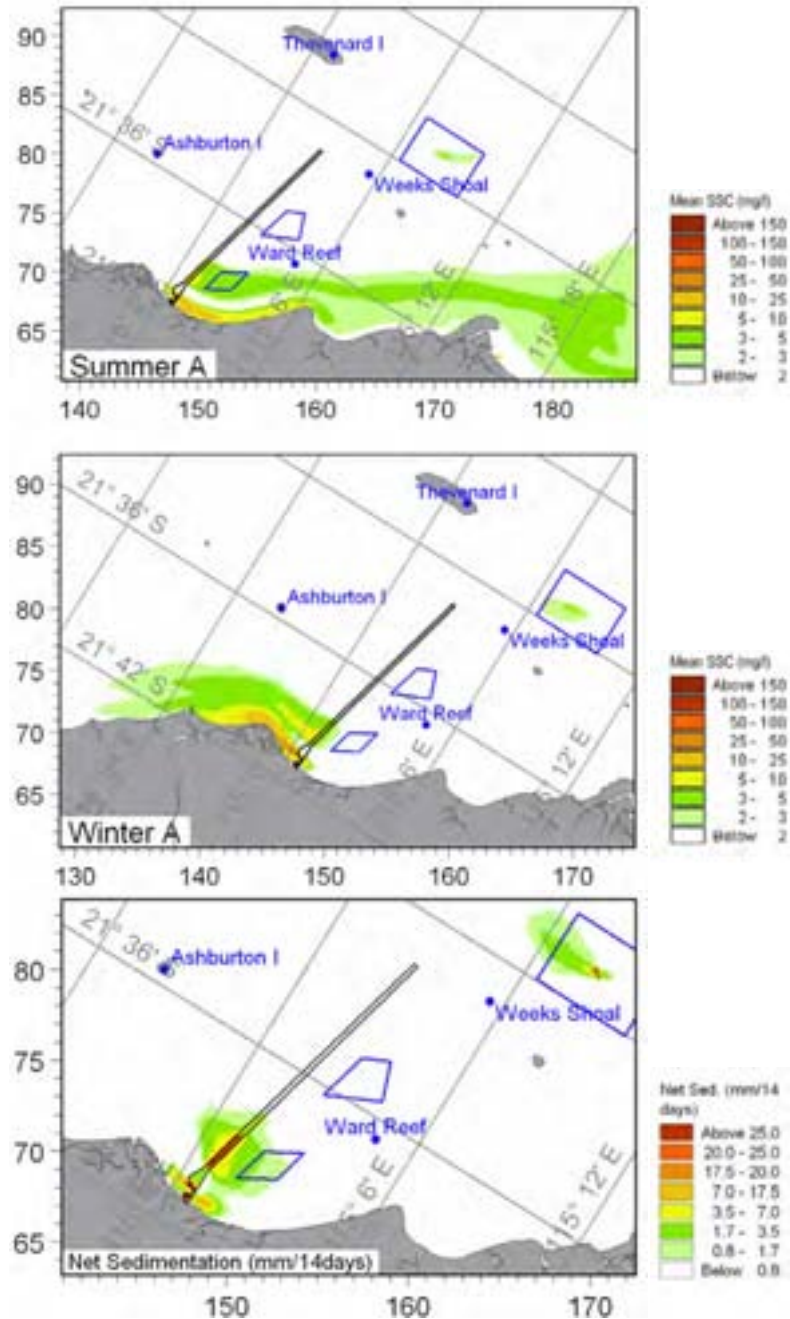


Figure 5.17 Example of suspended sediment plume extent due to CSD and 5,000m<sup>3</sup> TSHD dredging, based on Scenario 3, Strong conditions and a Realistic spill rate

- Top: Mean Suspended Sediment Concentration for Summer
- Middle: Mean Suspended Sediment Concentration for Winter
- Bottom: Net Sedimentation Rate for the Transitional Period



The SSC Zone of Partial Mortality for the 5,000 m<sup>3</sup> TSHD dredging is difficult to segregate, due to the overlap with the plume from the CSD, but it appears to be confined to the dredging area, while the Zone of Total Mortality is definitely confined to the dredging area (e.g. Figure 5.18 and Figure 5.19). The sedimentation Zone of Partial Mortality for the 5,000 m<sup>3</sup> TSHD dredging appears to extend approximately 1 km east and west of the dredging area, depending on season, while the Zone of Total Mortality is again confined to the dredging area (e.g. Figure 5.20). There are no coral or seagrass receptors that fall within the Zones of Partial or Total Mortality for the 5,000 m<sup>3</sup> TSHD dredging in the nearshore section of the approach channel.

Scenarios 4–7 cover the two 10,000 m<sup>3</sup> TSHDs dredging in sand and weak rock along the offshore sections of the navigation channel, in order to achieve the final navigation depth. The spill (and therefore the plume) from a 10,000 m<sup>3</sup> TSHD is higher in concentration and larger in size than the plume from a 5,000 m<sup>3</sup> TSHD, particularly when dredging in the nearshore area. Scenario 6 shows the potential impacts from two 10,000 m<sup>3</sup> TSHD dredging in the nearshore areas of the approach channel. The overlap of the plumes from the two large TSHDs results in a large plume with mean concentrations in the order of 3–5 mg/l above background, extending 35–40 km east towards the Mangrove Islands during summer, and more than 10 km west, past the Ashburton River mouth during winter (Figure 5.21). Sedimentation is generally confined to within 1–5 km of the dredging area, and is highest during the transitional period, when current speeds are low (Figure 5.21).

The SSC Zone of Partial Mortality for corals and for seagrass for the two 10,000 m<sup>3</sup> TSHD dredging in the nearshore area (Scenario 6) is predicted to extend in the order of 5–25 km east and up to 10 km west of the dredging area, depending on season, while the SSC Zone of Total Mortality is not predicted to extend more than 500 m east or west of the dredging area (e.g. Figure 5.22 and Figure 5.23).

The sedimentation Zones are more localised, with the Zone of Partial Mortality for corals extending 3–4 km east and 2–3 km west of the dredging location, while the Zone of Total Mortality extends in the order of 500 m – 1 km east and west of the dredging area, depending on season (e.g. Figure 5.24). The Zone of Partial Mortality for seagrass is even more localised, only extending in the order of 500 m – 1 km east and 500 m west of the dredging area, while the Zone of Total Mortality is confined to the dredging area (e.g. Figure 5.24).

Due to the spatial extent of the Zones during strong summer conditions, when the plume is carried many kilometres to the east by the prevailing wind and current conditions, the southern side of Ward Reef falls within the Zone of Partial Mortality for corals (Figure 5.22). Proposed mitigation measures to avoid or minimise these impacts are discussed in more detail in the DSDMP (SKM 2010).

A relatively large area of seagrass offshore from Onslow and across to Coolgra Point also falls within the Zone of Partial Mortality for seagrass during the strong summer conditions (Figure 5.22). However, since the impact is only predicted during strong summer conditions, and the impact areas are more than 10 km from the dredging area, the potential impact may not be fully realised. But even if it does result in some localised seagrass mortality, the dominant seagrass species (*Halophila ovalis*) is known to rapidly recover from disturbance (Longstaff and Dennison 1999).

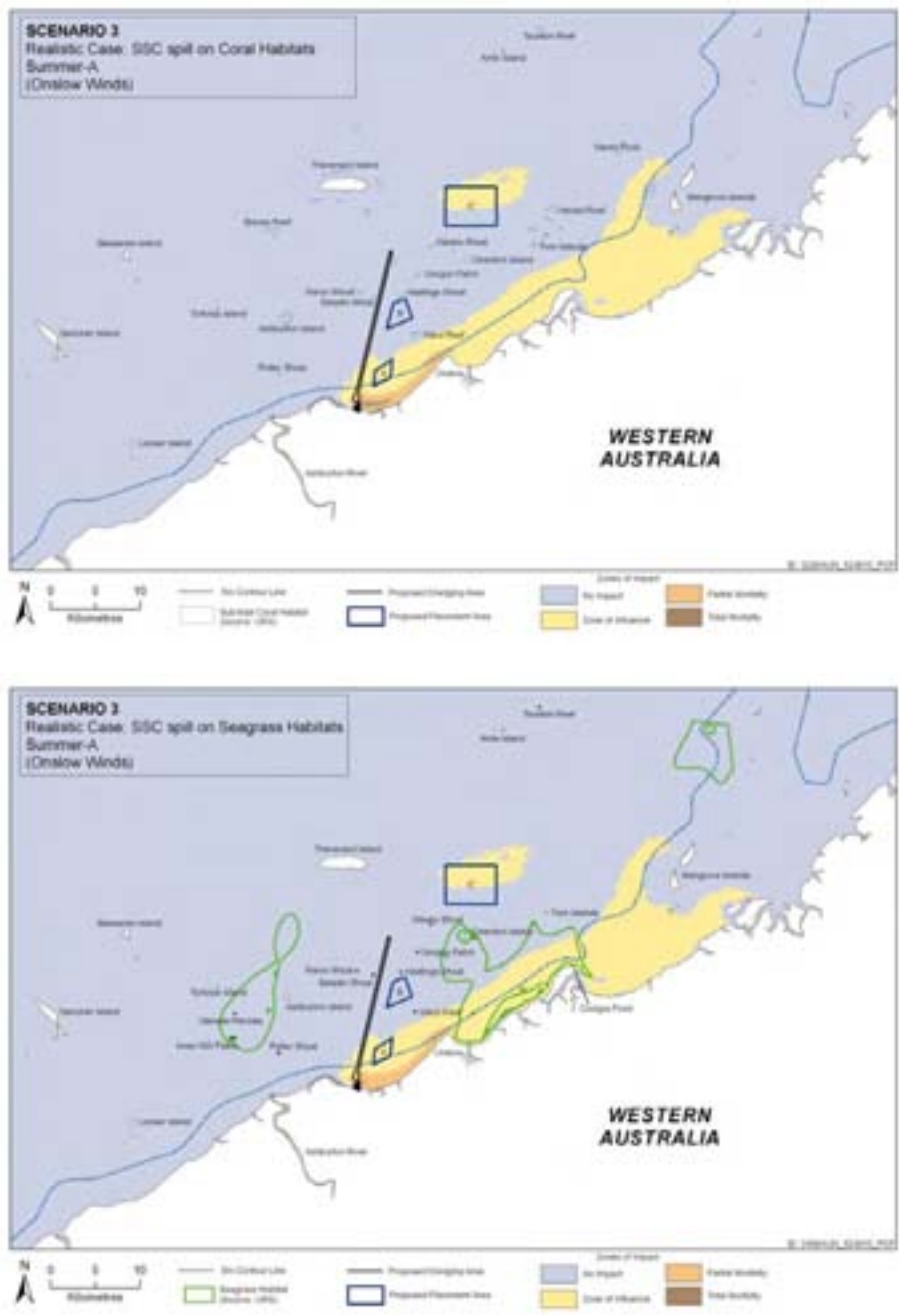


Figure 5.18 Example of Summer SSC Zones of Impact extent due to CSD and 5,000 m<sup>3</sup> TSHD dredging, based on Scenario 3 with a Realistic spill rate  
 Top: Coral impact zones, based on Onslow winds  
 Bottom: Seagrass impact zones, based on Onslow winds

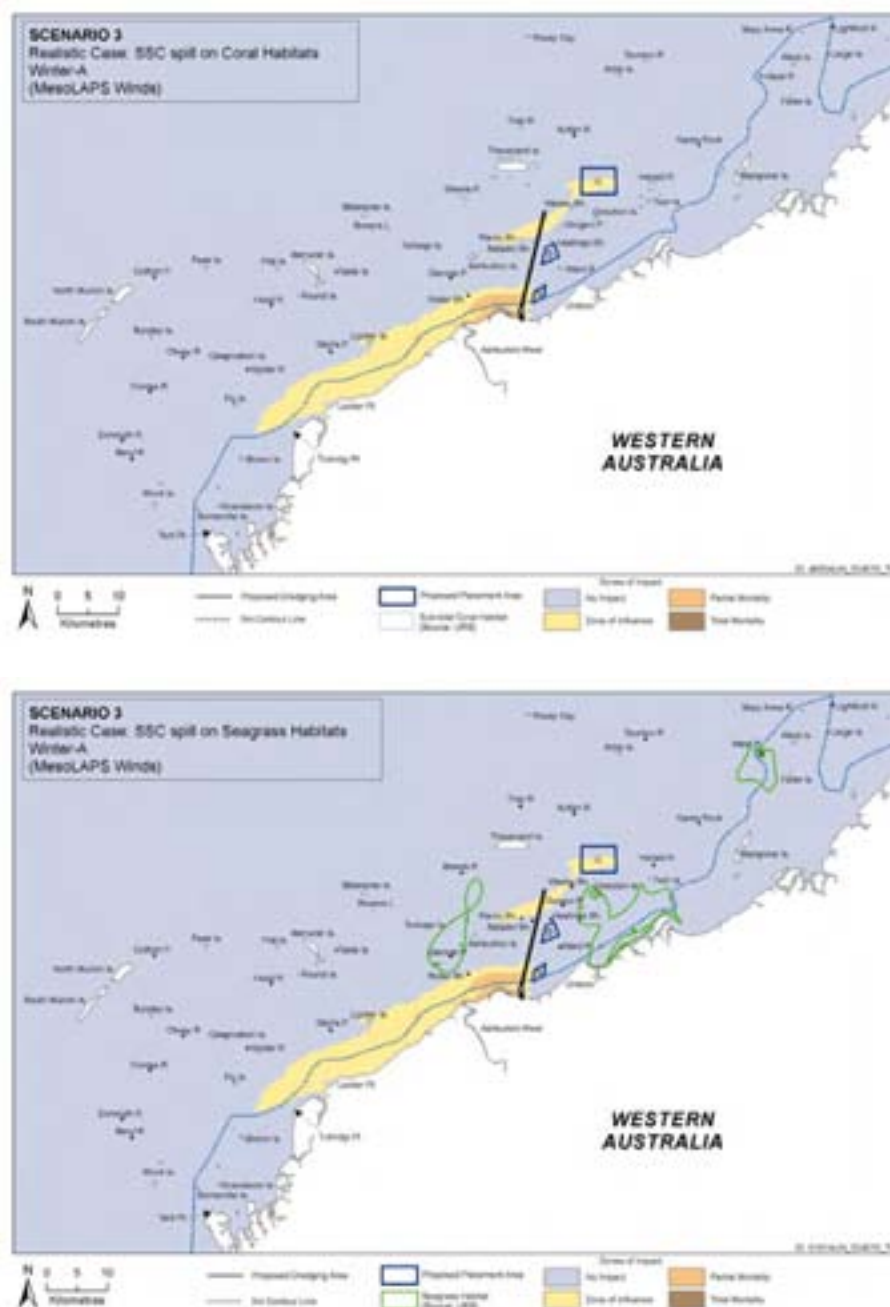


Figure 5.19 Example of Winter SSC Zones of Impact extent due to CSD and 5,000 m<sup>3</sup> TSHD dredging, based on Scenario 3 with a Realistic spill rate  
 Top: Coral impact zones, based on MesoLAPS winds  
 Bottom: Seagrass impact zones, based on MesoLAPS winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

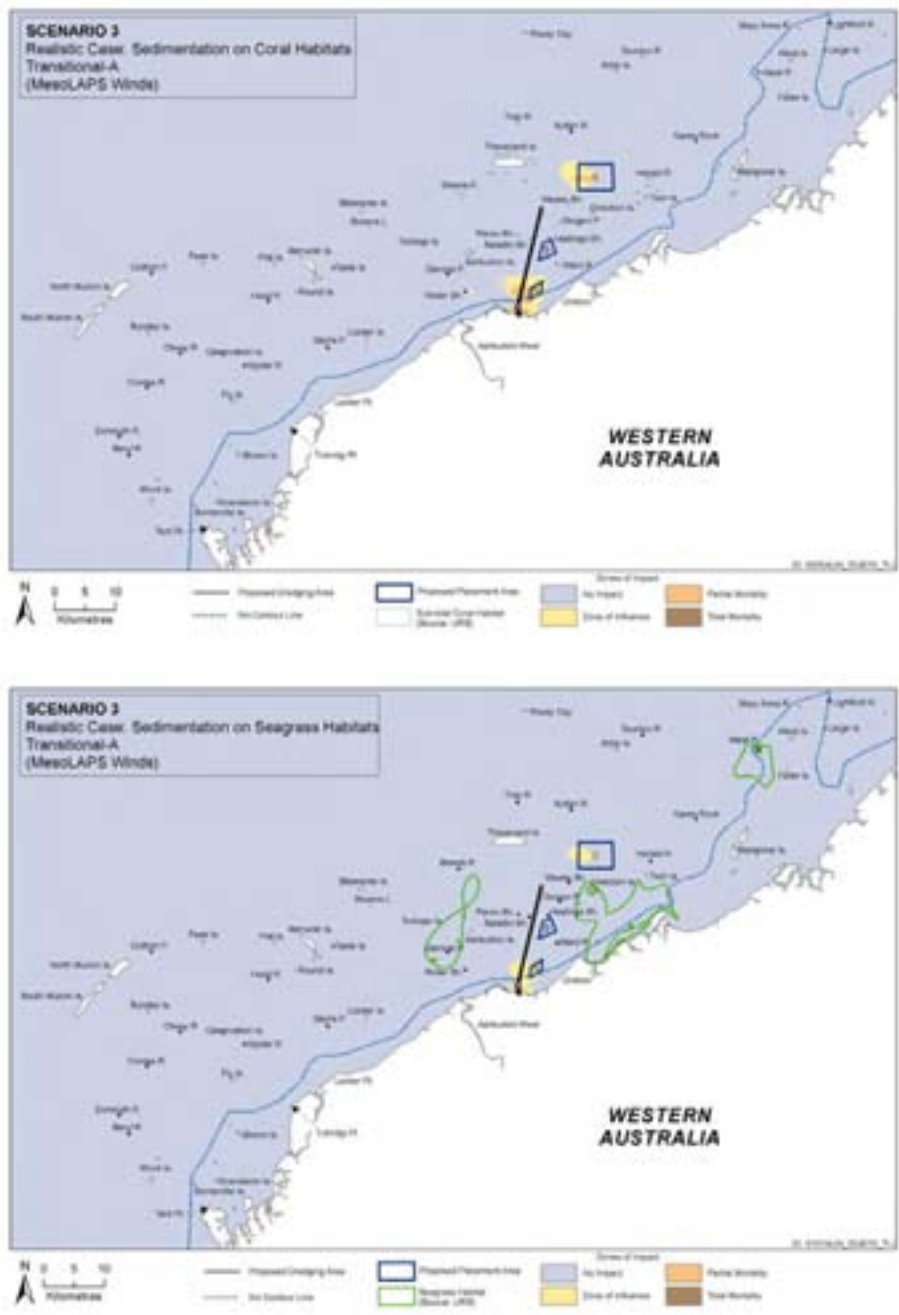


Figure 5.20 Example of sedimentation Zones of Impact extent during the calm transitional period due to CSD and 5,000 m<sup>3</sup> TSHD dredging, based on Scenario 3 with a Realistic spill rate

Top: Coral impact zones, based on MesoLAPS winds

Bottom: Seagrass impact zones, based on MesoLAPS winds

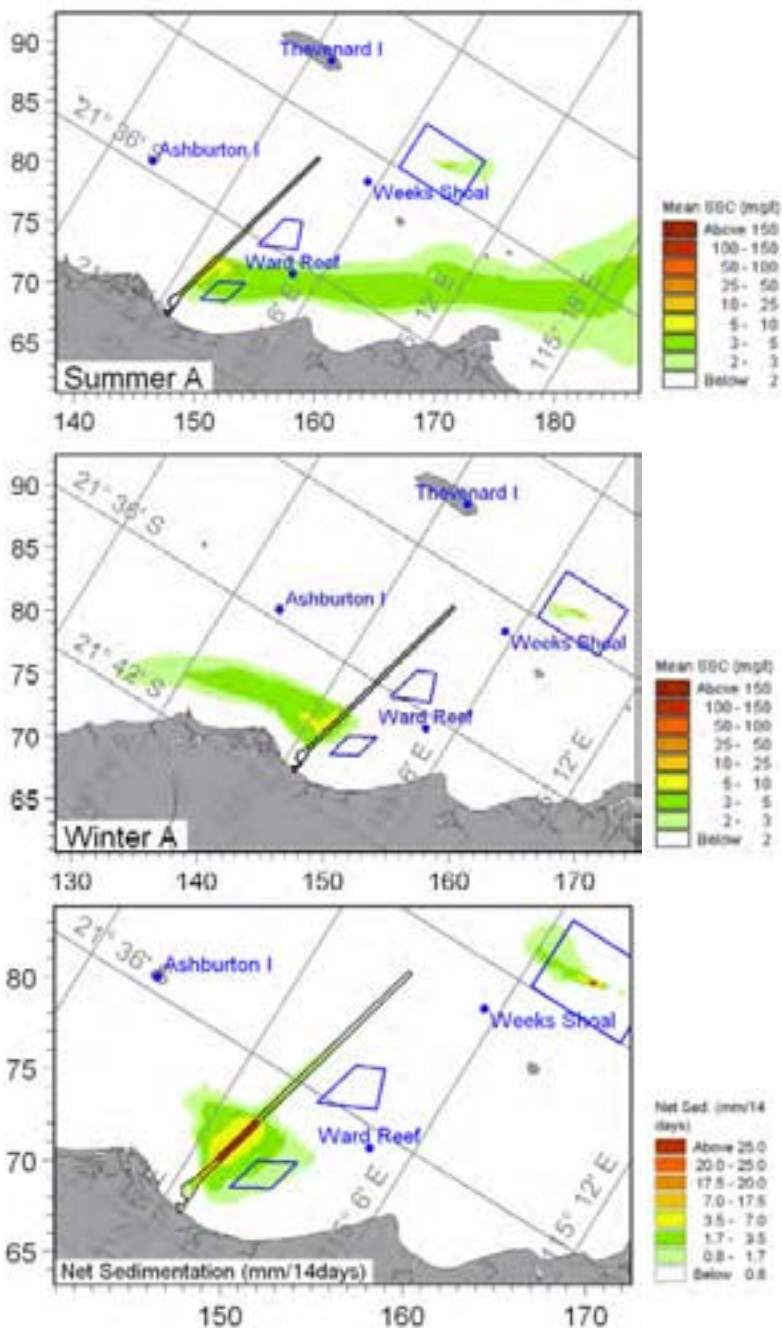


Figure 5.21 Example of suspended sediment plume extent due to two 10,000 m<sup>3</sup> TSHDs dredging, based on Scenario 6, Strong conditions and a Realistic spill rate  
 Top: Mean Suspended Sediment Concentration for Summer  
 Middle: Mean Suspended Sediment Concentration for Winter  
 Bottom: Net Sedimentation Rate for the Transitional Period

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

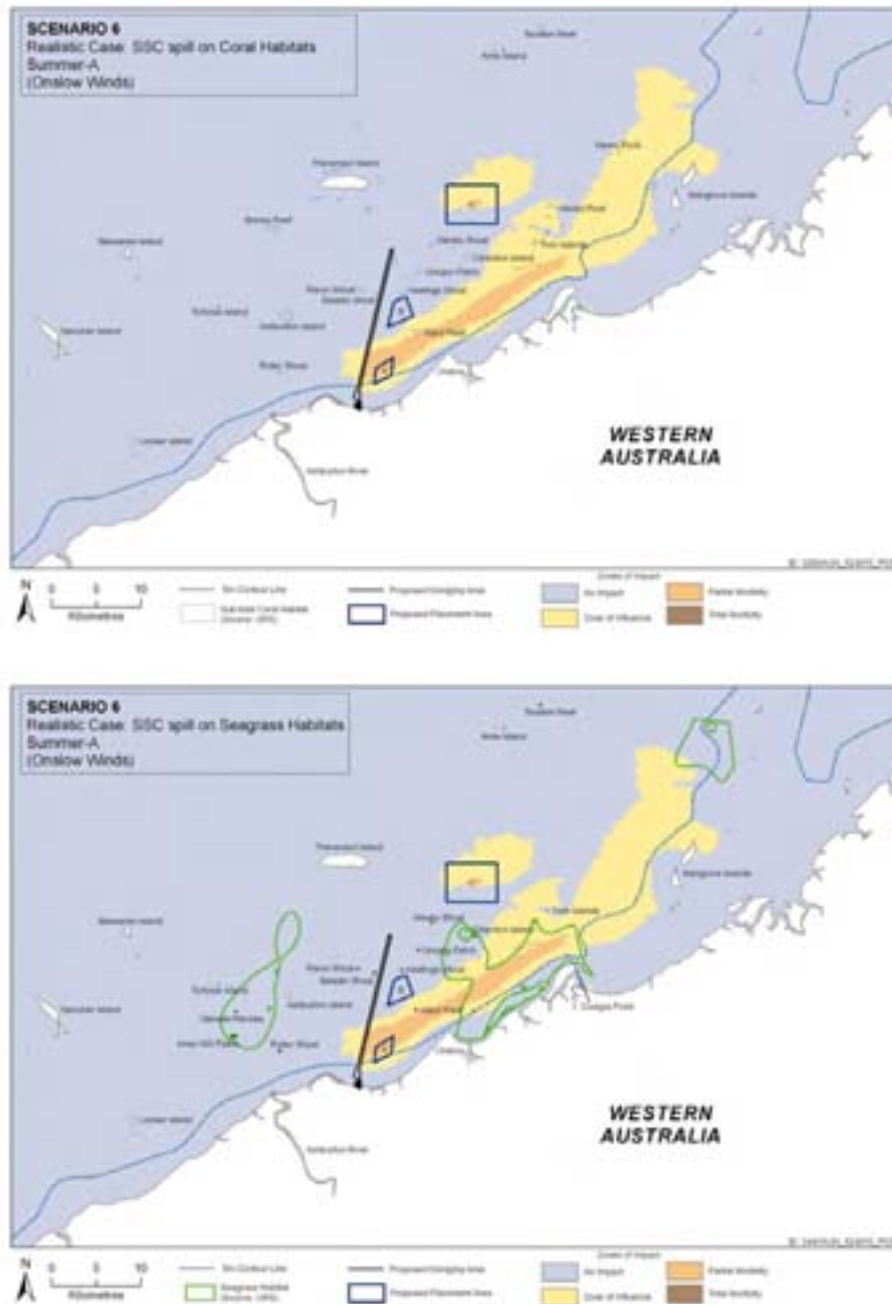


Figure 5.22 Example of Summer SSC Zones of Impact extent due to two 10,000 m<sup>3</sup> TSHDs dredging, based on Scenario 6 with a Realistic spill rate  
 Top: Coral impact zones, based on Onslow winds  
 Bottom: Seagrass impact zones, based on Onslow winds





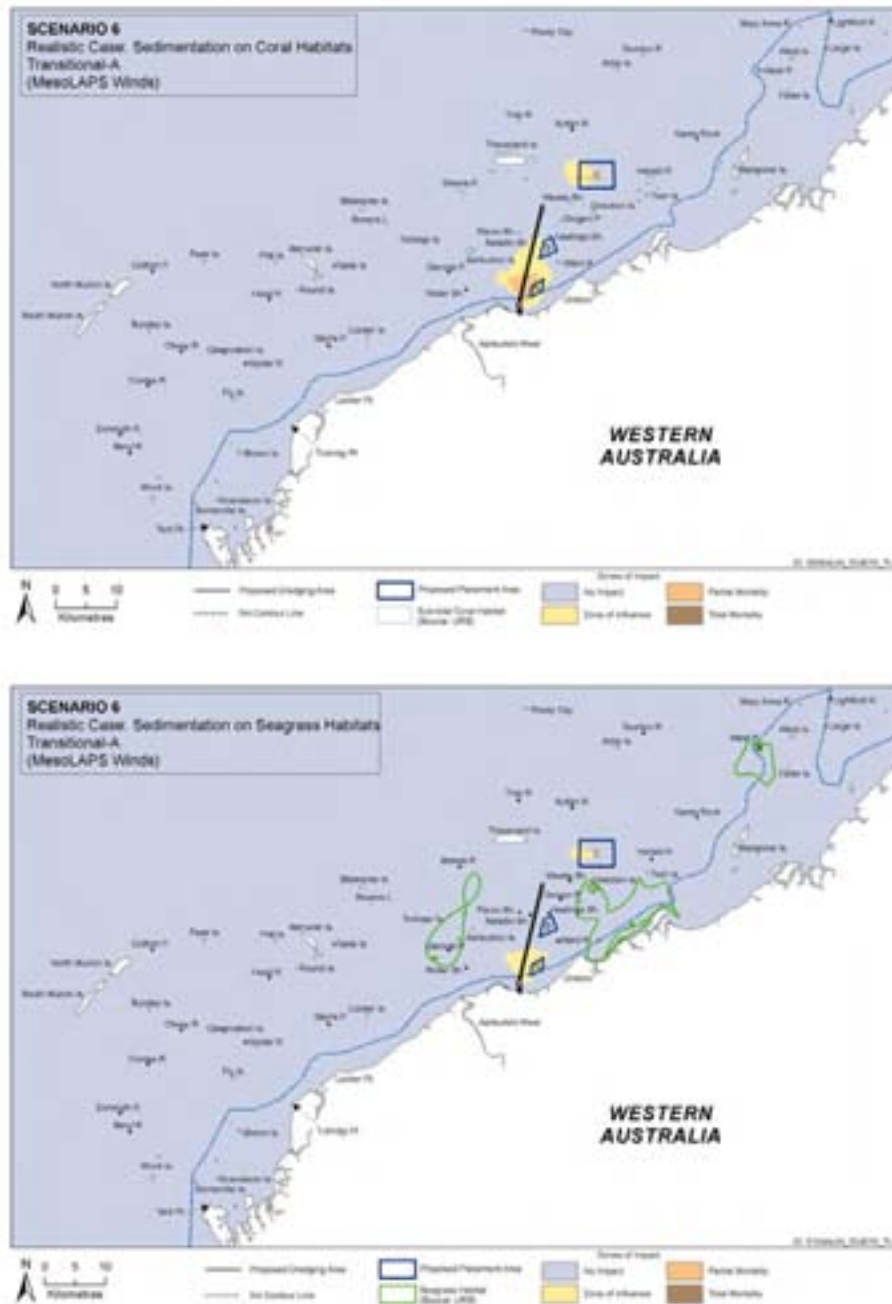


Figure 5.24 Example of sedimentation Zones of Impact extent during the calm transitional period due to two 10,000 m<sup>3</sup> TSHDs dredging, based on Scenario 6 with a Realistic spill rate  
 Top: Coral impact zones, based on MesoLAPS winds  
 Bottom: Seagrass impact zones, based on MesoLAPS winds



It should be noted that the extended transport of the fine material (particularly eastwards during summer) is exaggerated somewhat in the model, as a conservative approach was taken by not including any consolidation of the dredged material for these short-term scenarios. This has resulted in fine dredged material repeatedly settling and then being re-suspended and carried further and further from the dredging area in the model due to the strong spring tide currents and strong and persistent wind conditions, particularly during summer and winter. In reality, initial consolidation (which is perhaps better described as establishment of cohesive forces) is relatively rapid, and can take place between the spring tides which tend to re-suspend the material. This consolidation would reduce the amount of re-suspension that would actually occur, compared to what is predicted in the model, and would therefore be expected to reduce the spatial extent of the Zones of Impact, particularly during summer and winter.

It should also be noted that while the definition of “partial mortality” for this assessment is up to 50% mortality, this level of mortality is only likely to occur relatively close to the dredging area. The seagrass area is located more than 10 km from the dredging area. Based on the modelling, the dredging during summer is predicted to lead to a mean increase in SSC in the order of 5 mg/l across the seagrass area (Figure 5.21). However based on MODIS imagery from 2006 to 2009, the nearshore areas offshore from Onslow and Coolgra Point experience periodic elevated turbidity (in the order of 5–10 mg/l) throughout the year, but particularly during summer, due to strong spring tides and strong and persistent winds causing re-suspension of fine seabed material in the nearshore area (Figure 5.11).

While the duration of the elevated turbidity caused by the dredging will be longer than what is normally experienced in the area, the magnitude of the increase will generally be within the range that is normally experienced by the seagrass. Substantial mortality is therefore not predicted, though some individuals, particularly those either already affected by epiphytes or grazing, or those species at or near their depth/light limit, may be lost.

For the 10,000 m<sup>3</sup> TSHD dredging in the offshore area of the navigation channel, the SSC Zone of Partial Mortality is predicted to extend in the order of 10 km east and west of the dredging area, depending on the season (e.g. Figure 5.25 and Figure 5.26). The sedimentation Zones are more localised, extending 2–3km east and west of the dredging location (depending on season) for corals, and in the order of 500 m east and west (depending on season) for seagrass (e.g. Figure 5.27). The Zone of Total Mortality is not predicted to extend outside of the dredging area for either SSC or sedimentation.

Due to their proximity to the dredging area, Paroo Shoal, Saladin Shoal, Hastings Shoal, Gorgon Patch and the small patch reef south-west of Gorgon Patch fall within the Zone of Partial Mortality due to the large 10,000 m<sup>3</sup> TSHD dredging in the channel section adjacent to these reefs (covered under Scenario 7). Similarly, the small patch reef at the end of the shipping channel falls into the Zone of Partial Mortality due to the large 10,000 m<sup>3</sup> TSHD dredging in the outer-most section of the channel (covered under Scenario 4).

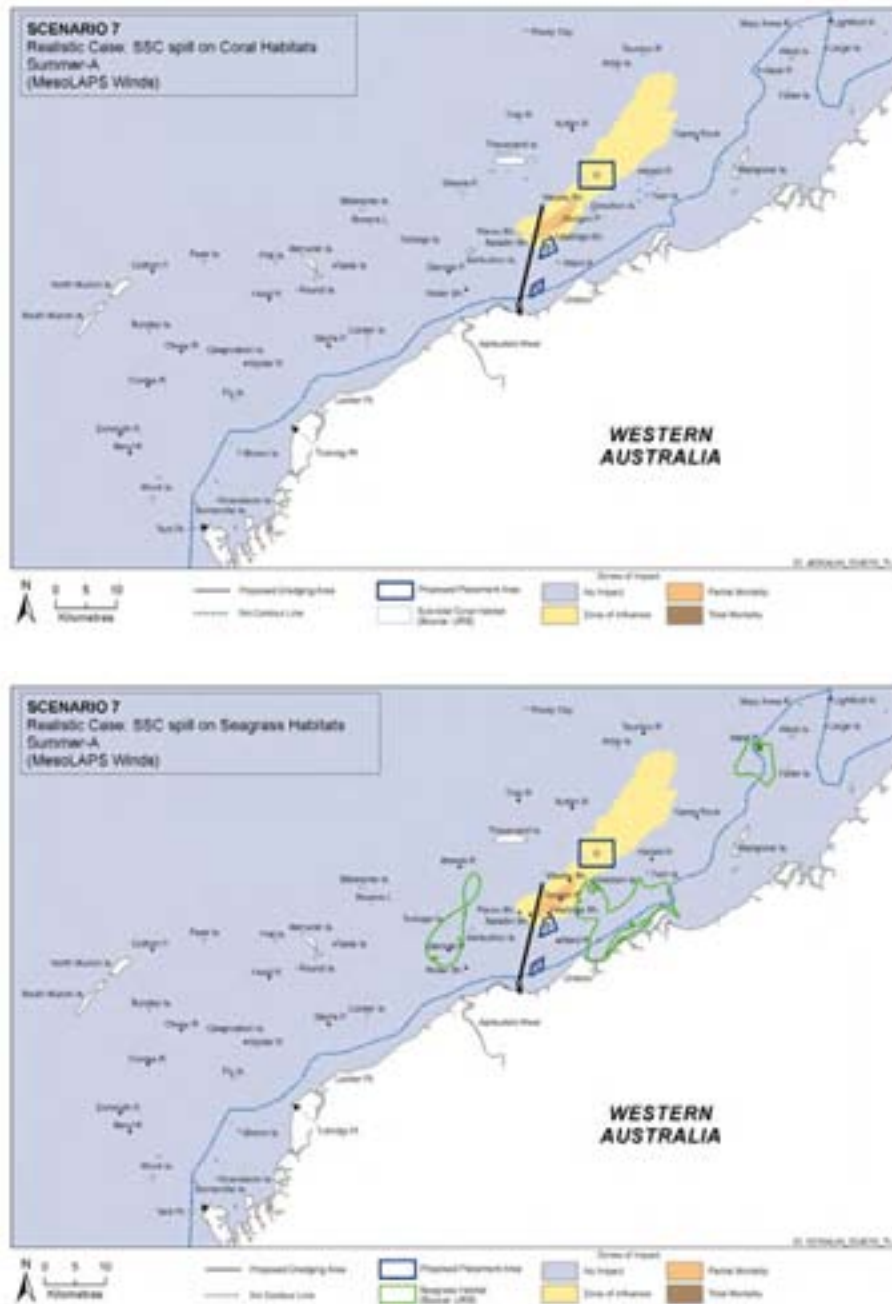


Figure 5.25 Example of Summer SSC Zones of Impact extent due to a 10,000 m<sup>3</sup> TSHD dredging offshore, based on Scenario 7 with a Realistic spill rate

Top: Coral impact zones, based on MesoLAPS winds

Bottom: Seagrass impact zones, based on MesoLAPS winds

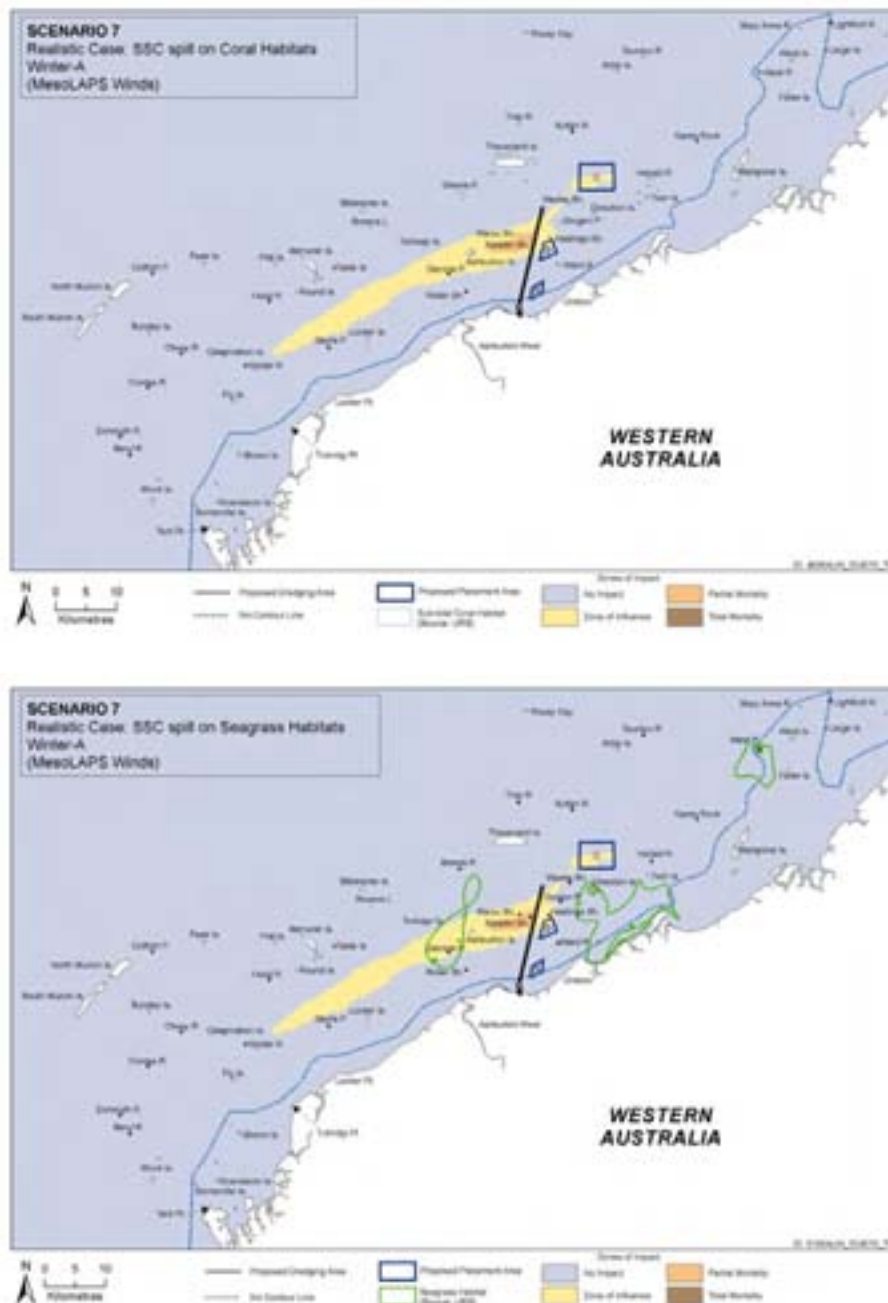


Figure 5.26 Example of Winter SSC Zones of Impact extent due to a 10,000 m<sup>3</sup> TSHD dredging offshore, based on Scenario 7 with a Realistic spill rate

Top: Coral impact zones, based on MesoLAPS winds

Bottom: Seagrass impact zones, based on MesoLAPS winds

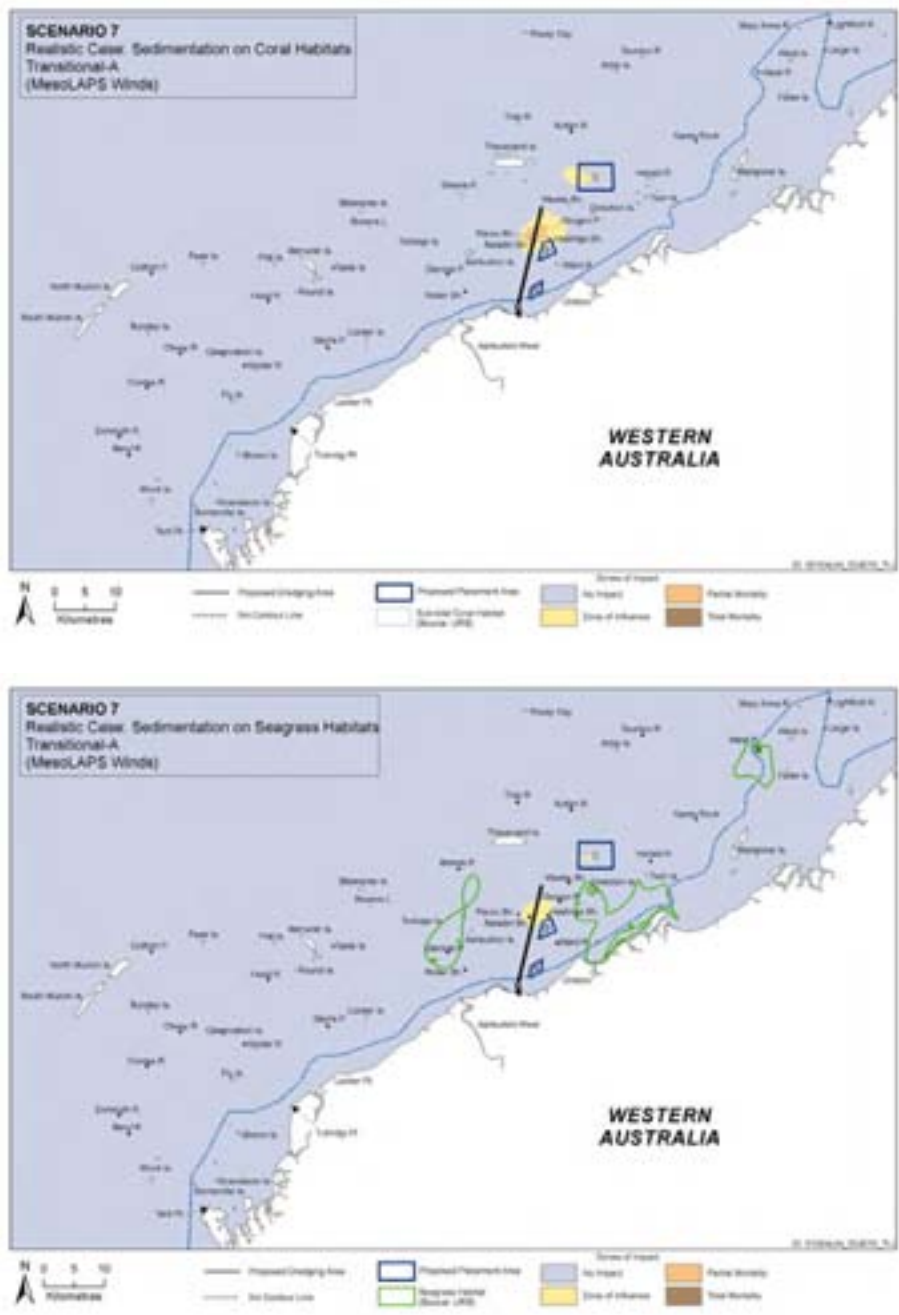


Figure 5.27 Example of sedimentation Zones of Impact extent during the calm transitional period due to a 10,000 m<sup>3</sup> TSHD dredging offshore, based on Scenario 7 with a Realistic spill rate

Top: Coral impact zones, based on MesoLAPS winds  
Bottom: Seagrass impact zones, based on MesoLAPS winds



As Saladin Shoal and the unnamed shoal at the end of the shipping channel are within 1 km of the dredging area, it would be difficult to avoid impacts to these reefs without adding prohibitive restrictions and costs to the dredging programme. However, mitigation measures can be used to avoid or minimise the potential impacts to the other reefs (e.g. Paroo Shoal, Hastings Shoal, Gorgon Patch, etc.). Details of proposed mitigation measures are provided in the DSDMP (SKM, 2010).

Scenario 7A shows the effectiveness of “restricted overflow” areas in mitigating impacts to the coral areas adjacent to the dredging area (Paroo Shoal, Hastings Shoal, Gorgon Patch, etc.). By establishing a “restricted overflow” zone immediately updrift of the coral areas, the suspended sediment concentrations (e.g. Figure 5.28 and Figure 5.29) and sedimentation (Figure 5.30) experienced at those coral areas is substantially reduced, so that the corals fall within the Zone of Influence, rather than the Zone of Partial Mortality. However, it is noted that restricted overflow zones would only be required during specific periods when impacts are likely to occur (based on monitoring and/or current predictions).

#### **5.4.3 Offshore Placement**

Site A and Site C are the base case placement sites for the bulk of the capital dredging material. Site B is a reserve site, while Site D and E are intended for disposal of small volumes of fine material from cleanup dredging. The focus of the sediment plume modelling has therefore been offshore placement at Sites A and C.

Offshore placement at Site A is proposed via pumping from a CSD dredging the temporary approach channel nearby, which is simulated in Scenario 1. The spill rate at Site A is constant but relatively low (5 kg/s, LWI 2009), as a near-bed diffuser will be used to minimise the generation of a turbid plume at the dump site. As a result the mean concentrations predicted outside the boundary of the placement area are generally less than 5 mg/l, though sedimentation may extend for several kilometres east and west of the placement site with the prevailing currents (Figure 5.31).

The Zone of Partial Mortality for SSC and sedimentation is only predicted to extend in the order of 1 km east and less than 1 km west of Site A, depending on the season, while the Zone of Total Mortality is not predicted to extend outside of the placement site (e.g. Figure 5.32, Figure 5.33 and Figure 5.34).

Offshore placement at Site C is proposed via hopper barges disposing of dredged material loaded from the CSD dredging the PLF Basin, MOF and MOF Basin (Scenarios 2 and 3), and by the 5,000 m<sup>3</sup> TSHD and two 10,000 m<sup>3</sup> TSHDs disposing of sand and weak rock dredged from the navigation channel (Scenarios 4–7). The individual events of offshore placement at Site C are short in duration and only intermittent in nature (in the order of five minutes duration, once every 1–2 hours). So although the spill rate is relatively high, the resulting plume only extends up to 1–2 km outside the placement site, with average concentrations of 2–3 mg/l above background levels (e.g. Figure 5.21).

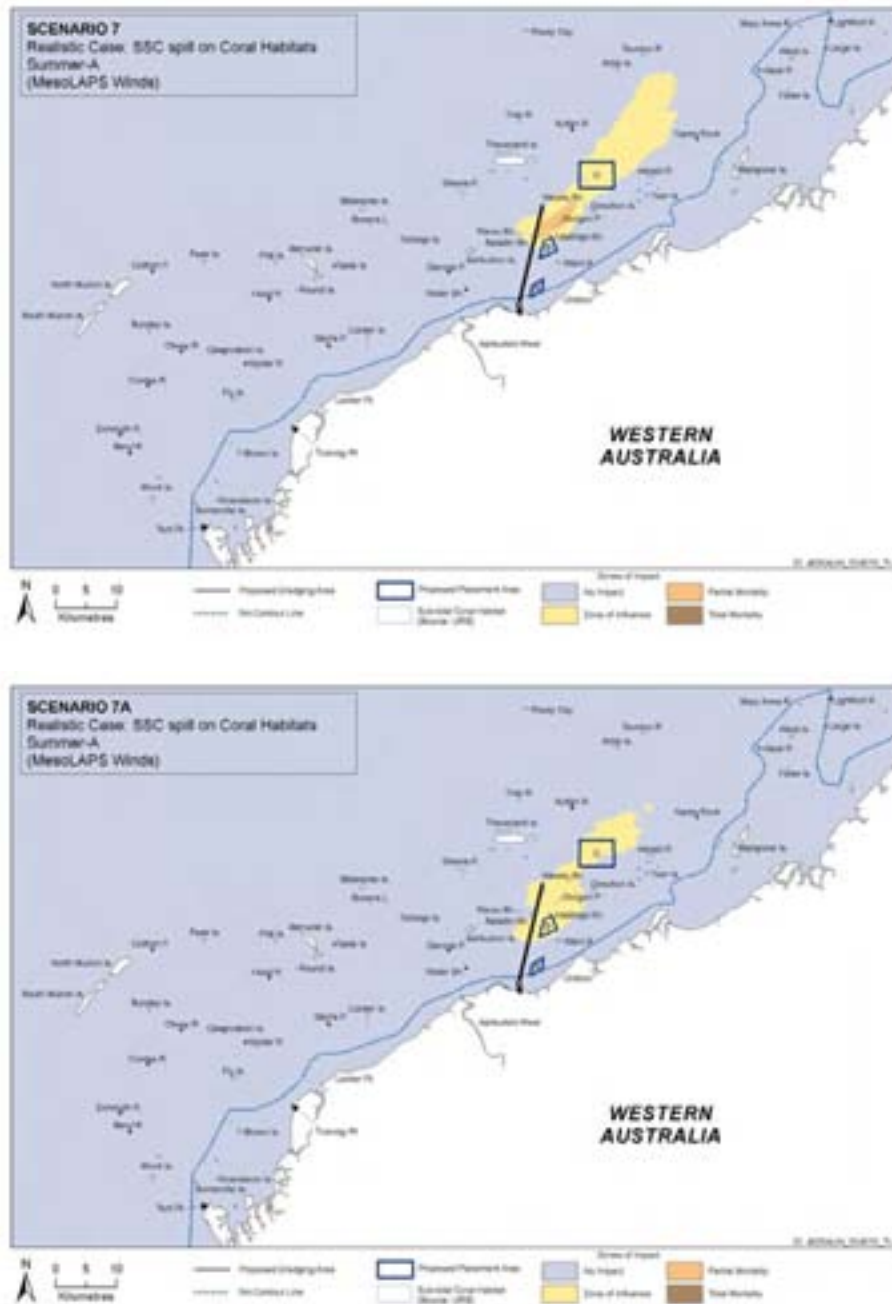


Figure 5.28 Comparison of SSC Zones of Impact generated from dredging during strong summer conditions adjacent to sensitive corals with and without the use of a “restricted overflow” zone

Top: no “restricted overflow” zone (Scenario 7)

Bottom: with “restricted overflow” zone (Scenario 7A)

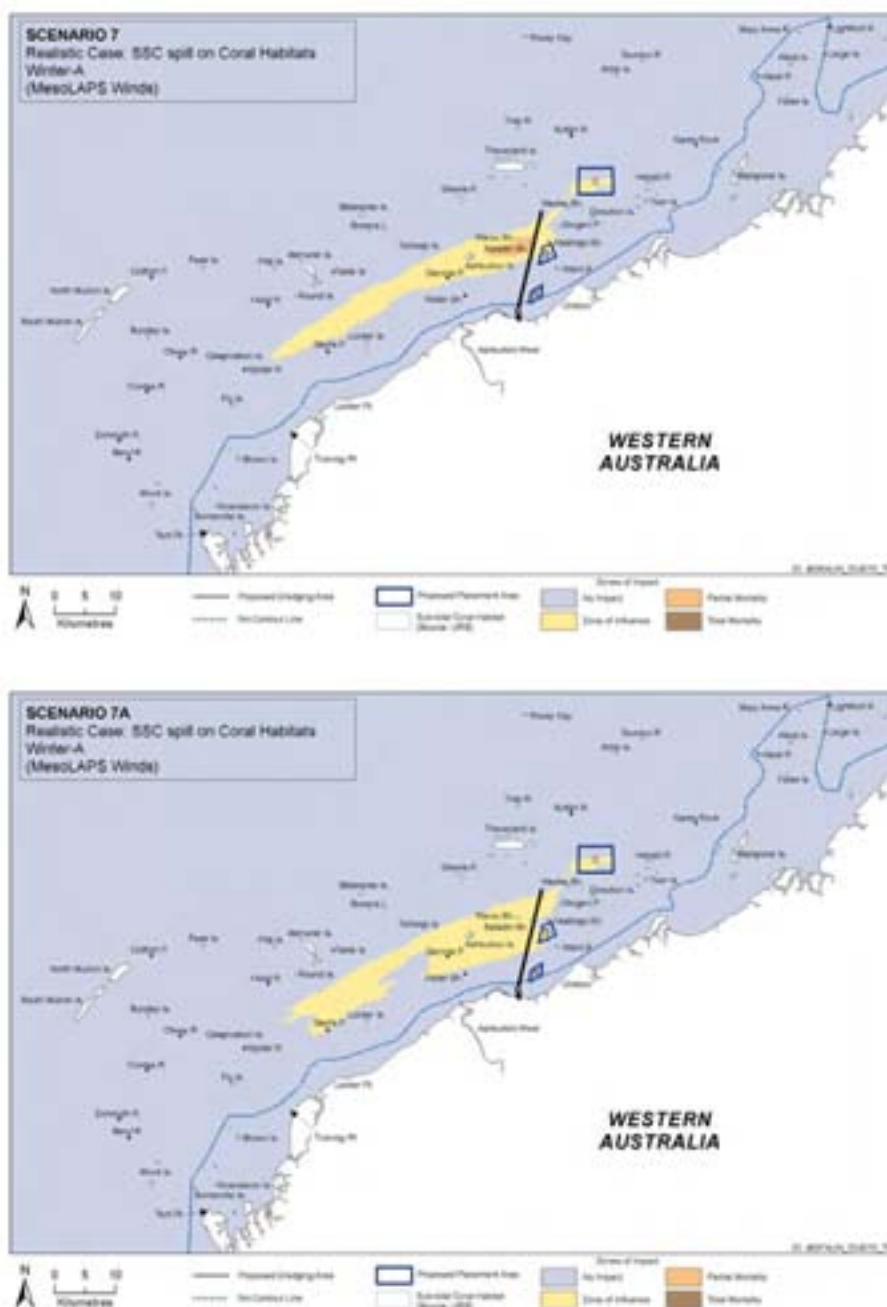


Figure 5.29 Comparison of SSC Zones of Impact generated from dredging adjacent to sensitive corals during the strong winter period with and without the use of a “restricted overflow” zone  
 Top: no “restricted overflow” zone (Scenario 7)  
 Bottom: with “restricted overflow” zone (Scenario 7A)

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



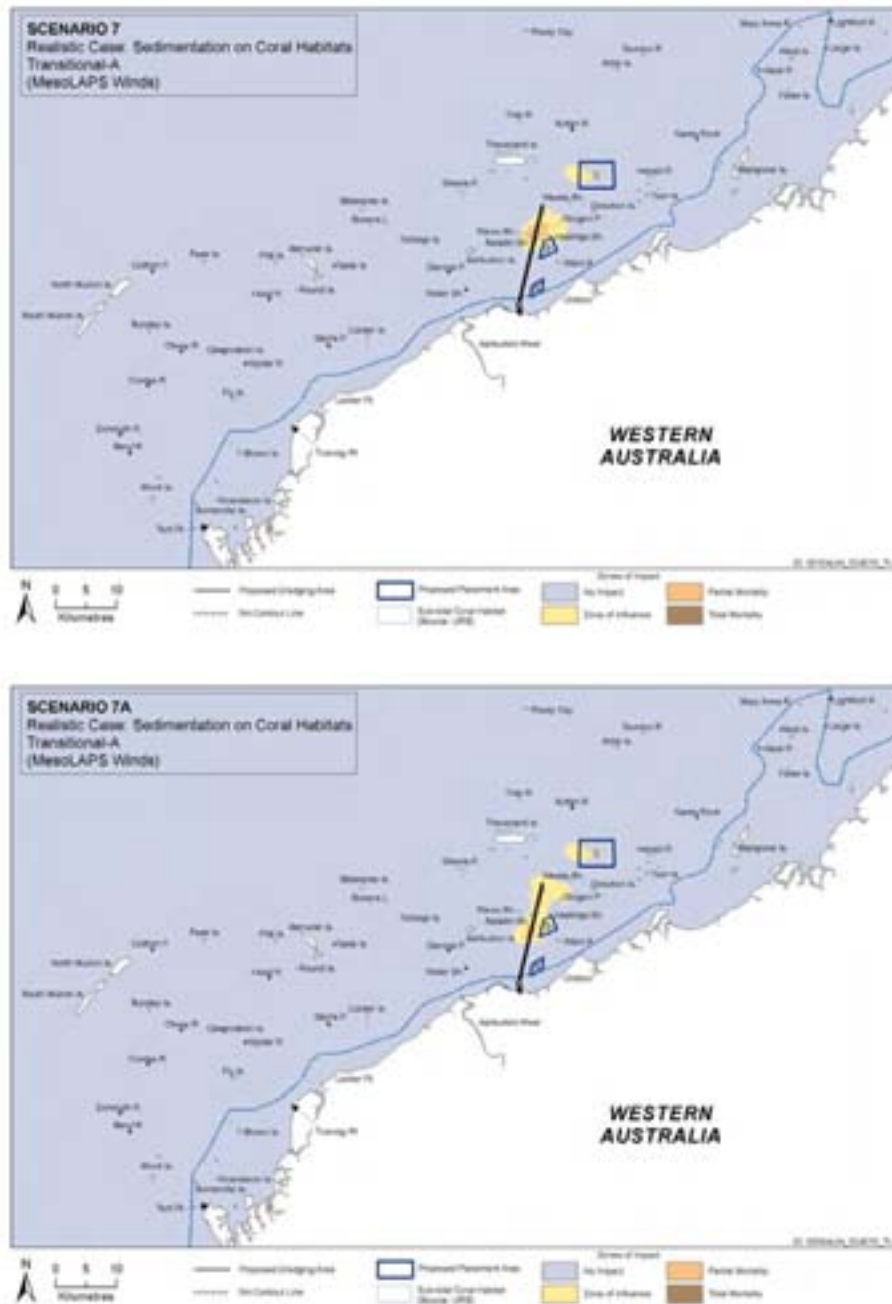


Figure 5.30 Comparison of sedimentation Zones of Impact generated from dredging adjacent to sensitive corals during the calm transitional period with and without the use of a “restricted overflow” zone

Top: no “restricted overflow” zone (Scenario 7)

Bottom: with “restricted overflow” zone (Scenario 7A)

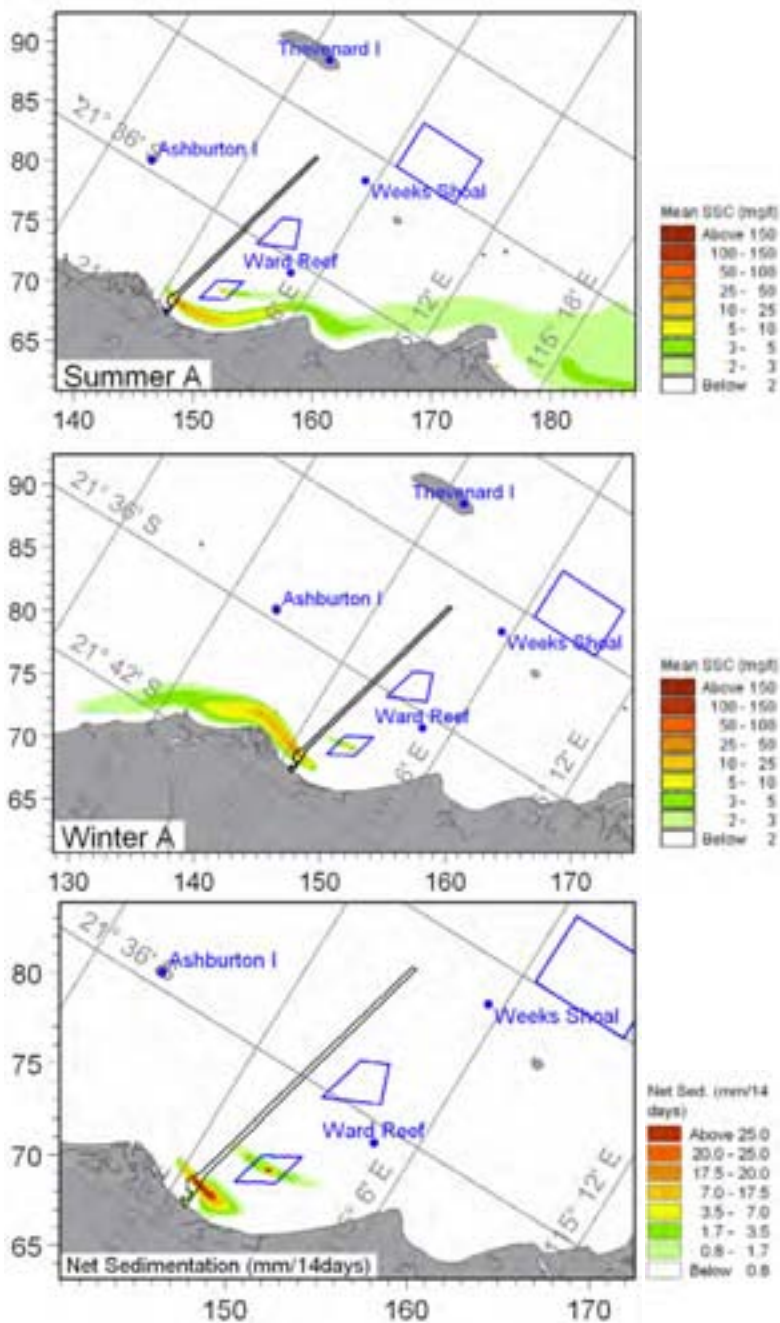


Figure 5.31 Example of suspended sediment plume and sedimentation extent due to nearshore CSD dredging with placement at Site A, based on Scenario 1 with a Realistic spill rate  
 Top: Mean Suspended Sediment Concentration for Summer  
 Middle: Mean Suspended Sediment Concentration for Winter  
 Bottom: Net Sedimentation Rate for the Transitional Period

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

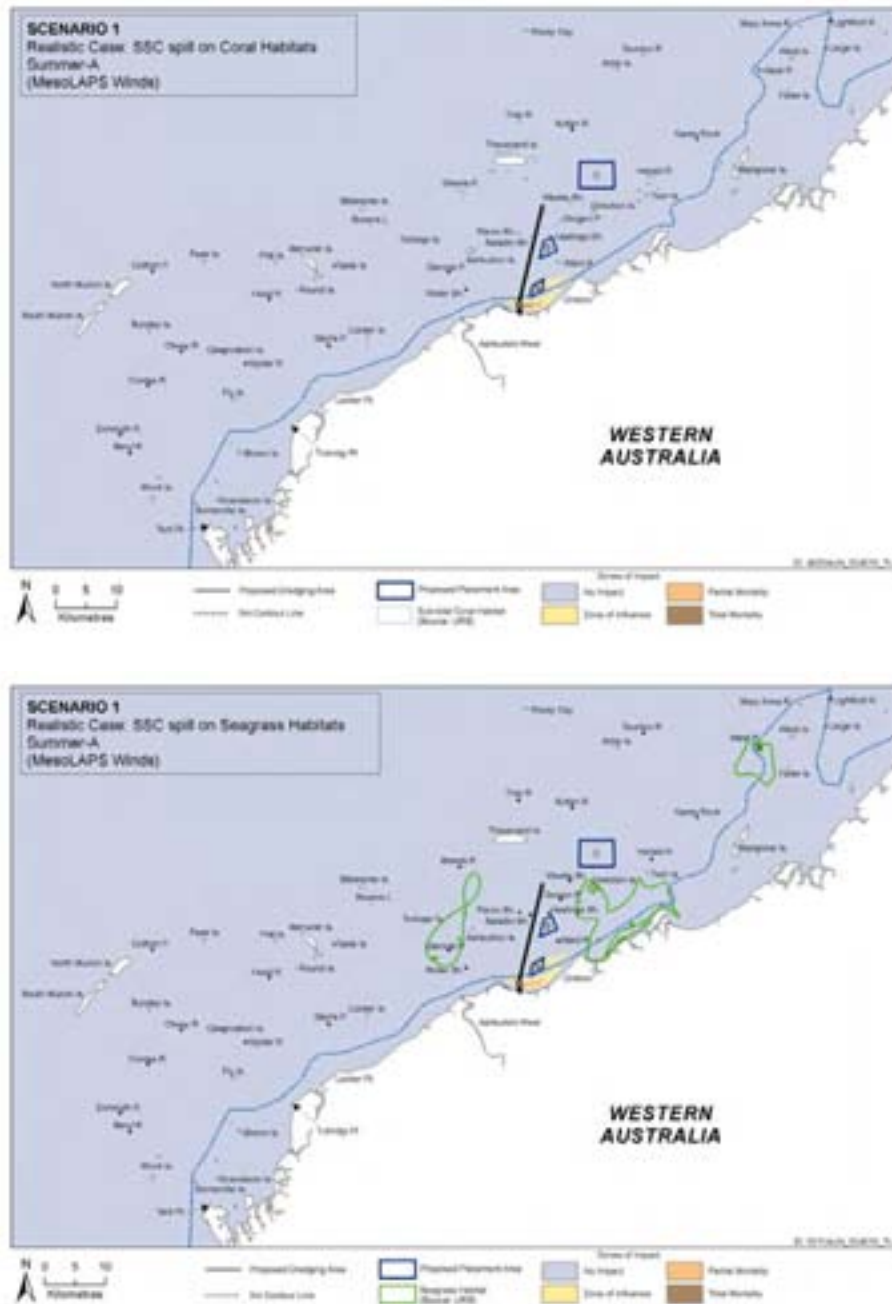


Figure 5.32 Example of Summer SSC Zones of Impact extent due to nearshore CSD dredging with placement at Site A, based on Scenario 1 with a Realistic spill rate  
 Top: Coral impact zones, based on Onslow winds  
 Bottom: Seagrass impact zones, based on Onslow winds

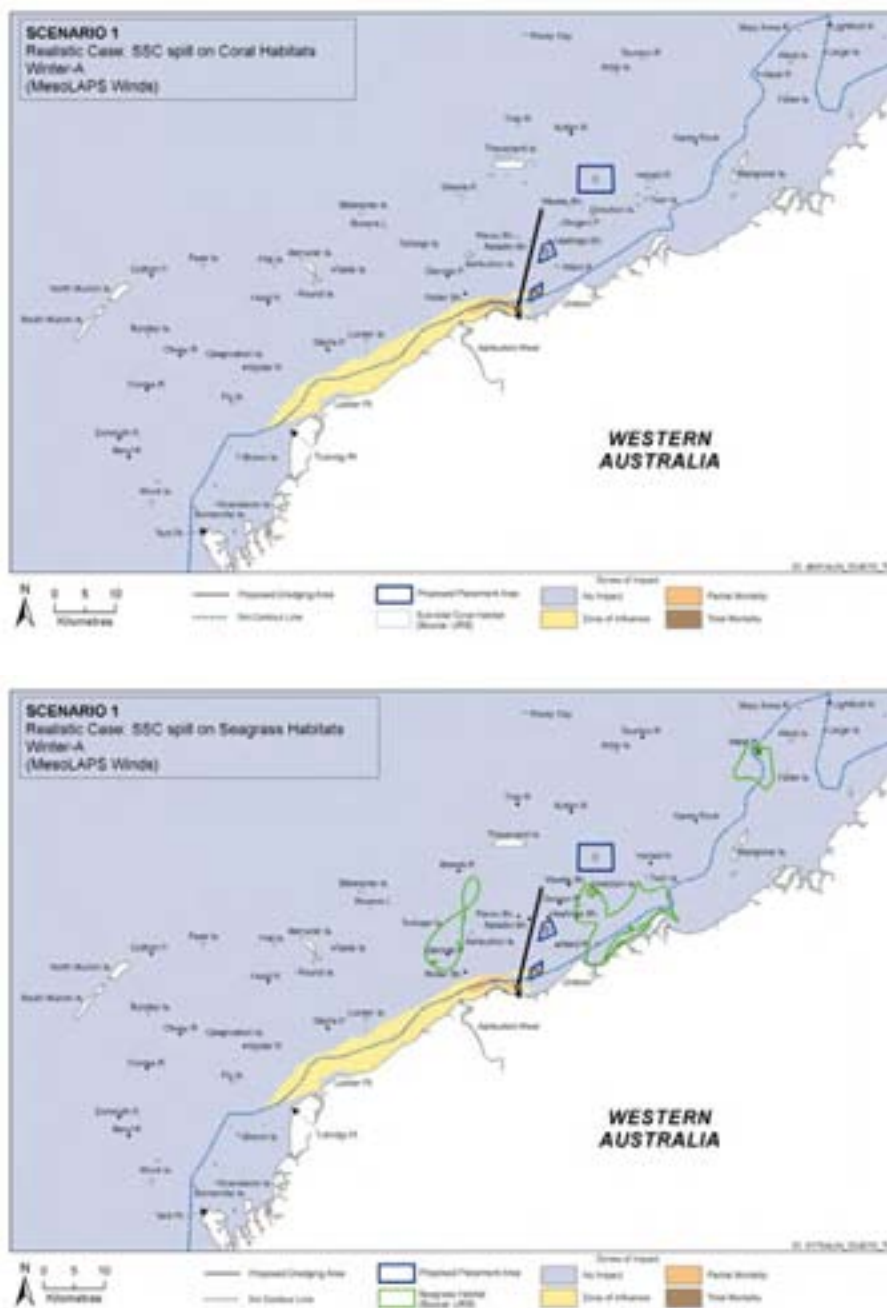


Figure 5.33 Example of Winter SSC Zones of Impact extent due to nearshore CSD dredging with placement at Site A, based on Scenario 1 with a Realistic spill rate  
 Top: Coral impact zones, based on Onslow winds  
 Bottom: Seagrass impact zones, based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

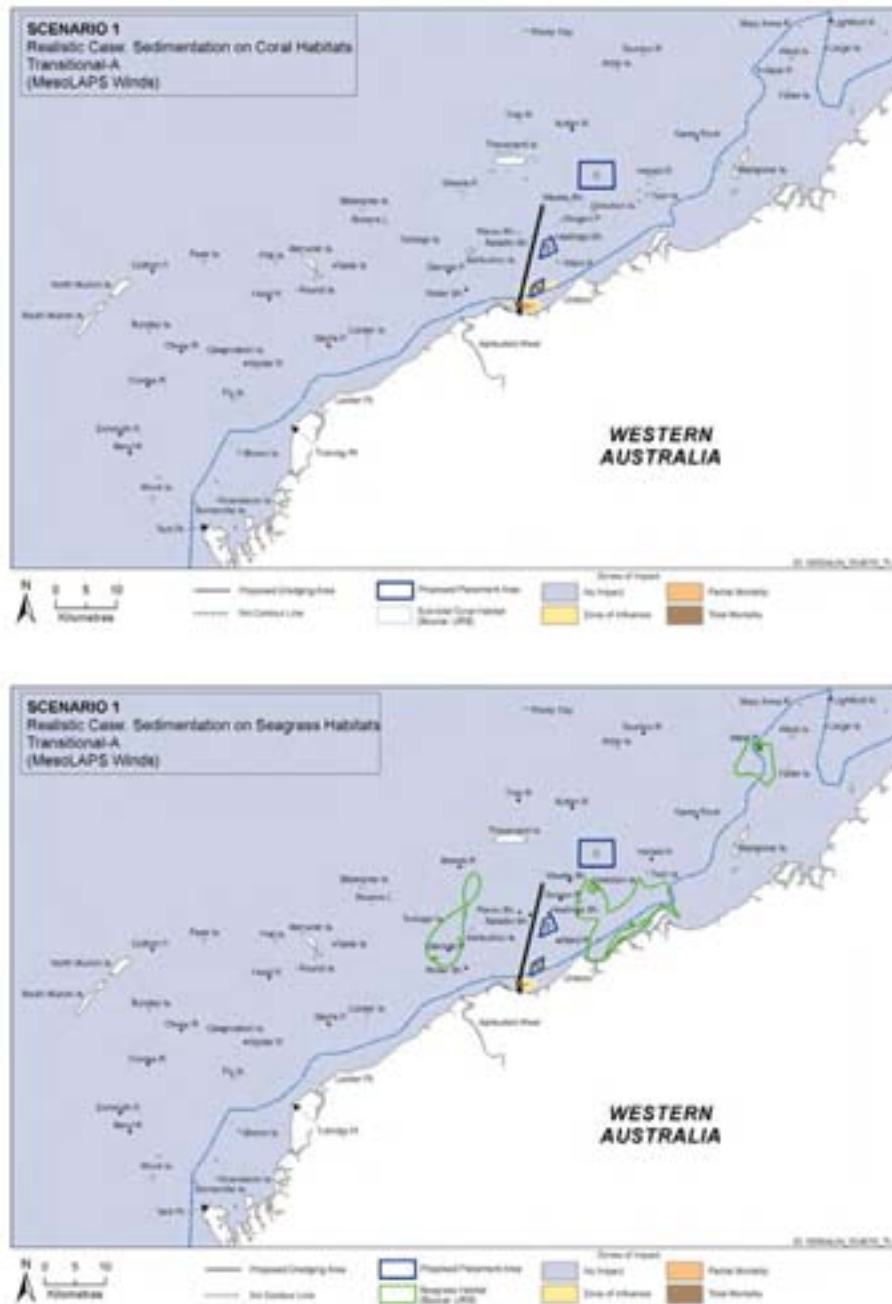


Figure 5.34 Example of sedimentation Zones of Impact extent during the calm transitional period due to nearshore CSD dredging with placement at Site A, based on Scenario 1 with a Realistic spill rate

Top: Coral impact zones, based on MesoLAPS winds

Bottom: Seagrass impact zones, based on MesoLAPS winds



The SSC Zones of Partial or Total Mortality for both seagrass and corals for offshore placement in Site C are not predicted to extend outside of the placement area (e.g. Figure 5.22 and Figure 5.23). For corals, the sedimentation Zone of Partial Mortality may extend at most 1 km west of the placement site, while the sedimentation Zone of Total Mortality is not predicted to extend beyond the boundary of the placement site (e.g. Figure 5.24). For seagrass, both the Zones of Partial and Total Mortality are not predicted to extend beyond the boundary of the placement site (e.g. Figure 5.24). None of the coral or seagrass areas fall within the Zones of Impact due to offshore placement at Site C.

## **5.5 Pipeline Trenching**

The CSD dredging along the pipeline route releases a relatively narrow plume of suspended sediments that extends a considerable distance (in the order of 5–10 km) from the dredging location. However, unlike the CSD dredging for the MOF and PLF basins, which requires the CSD to remain relatively stationary for extended periods, the CSD dredging the pipeline route would move relatively quickly along the route (in the order of 150–200 m per day). So each day the plume would be affecting a slightly different area, and over the 14-day modelling duration, the CSD would have moved approximately 2 km along the pipeline route.

### **5.5.1 Trenching near Ashburton Island**

During summer, the plumes are rapidly dispersed, predominantly to the east, extending 5–10 km towards Paroo Shoal and Saladin Shoal, though at low concentrations (average concentration in order of 2–3 mg/l above background, Figure 5.35). During winter, a similarly high dispersion is noted, this time predominantly to the west, past Ashburton Island and towards Glennie Patches, with concentrations in the order of 2–3 mg/l above background (Figure 5.35). However, during the calmer transitional periods, the plume is not as well dispersed, leading to elevated concentrations in the vicinity of the trenching location. Mean concentrations along the eastern side of Ashburton Island, which is immediately adjacent to the trenching area, are predicted to range from 3–10 mg/l, with lower concentrations on the southern and western side of Ashburton Island (Figure 5.35).

The SSC Zone of Partial Mortality for corals and seagrass is predicted to extend in the order of 1–2 km east and west from the pipeline route, potentially impacting some of the coral reef areas around Ashburton Island (e.g. Figure 5.36, Figure 5.37 and Figure 5.38). The SSC Zone of Total Mortality is only predicted to extend in the order of 500 m east and west, depending on the season.

The sedimentation Zones are more localised, with the Zone of Partial Mortality extending 1–2 km east and west of the dredging location (depending on season) for corals, and less than 1 km east and west (depending on season) for seagrass (e.g. Figure 5.39), with some remote sedimentation also predicted to the east during summer and west during winter and transitional periods. The Zone of Total Mortality is extremely localised, and is only predicted to extend in the order of 100–200 m east and west of the pipeline route (e.g. Figure 5.39).

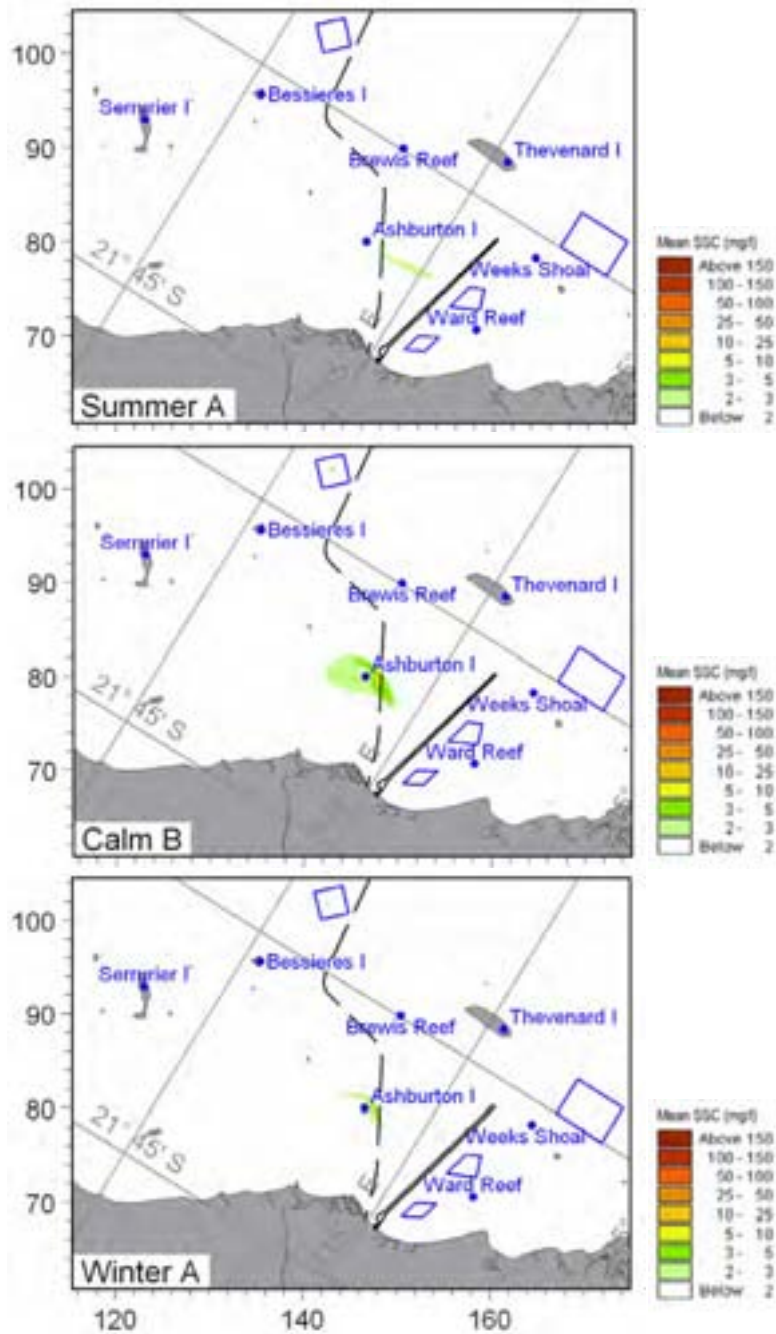


Figure 5.35 Example of suspended sediment plume extent due to pipeline trenching near Ashburton Island using a CSD

Top: Mean Suspended Sediment Concentration for Summer

Middle: Mean Suspended Sediment Concentration for the calm Transitional Period

Bottom: Mean Suspended Sediment Concentration for Winter

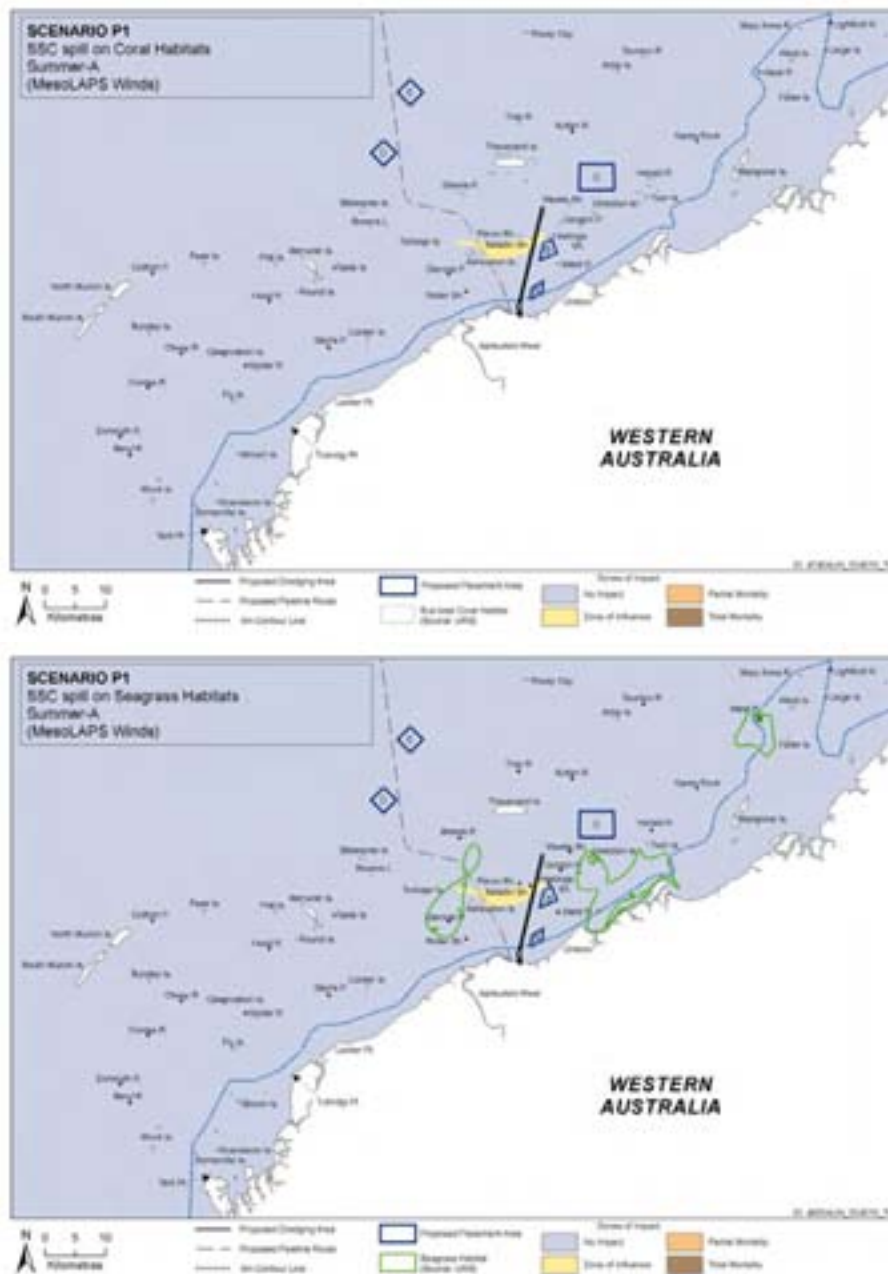


Figure 5.36 Example of Summer SSC Zones of Impact extent due to pipeline trenching near Ashburton Island using a CSD

Top: Coral impact zones

Bottom: Seagrass impact zones



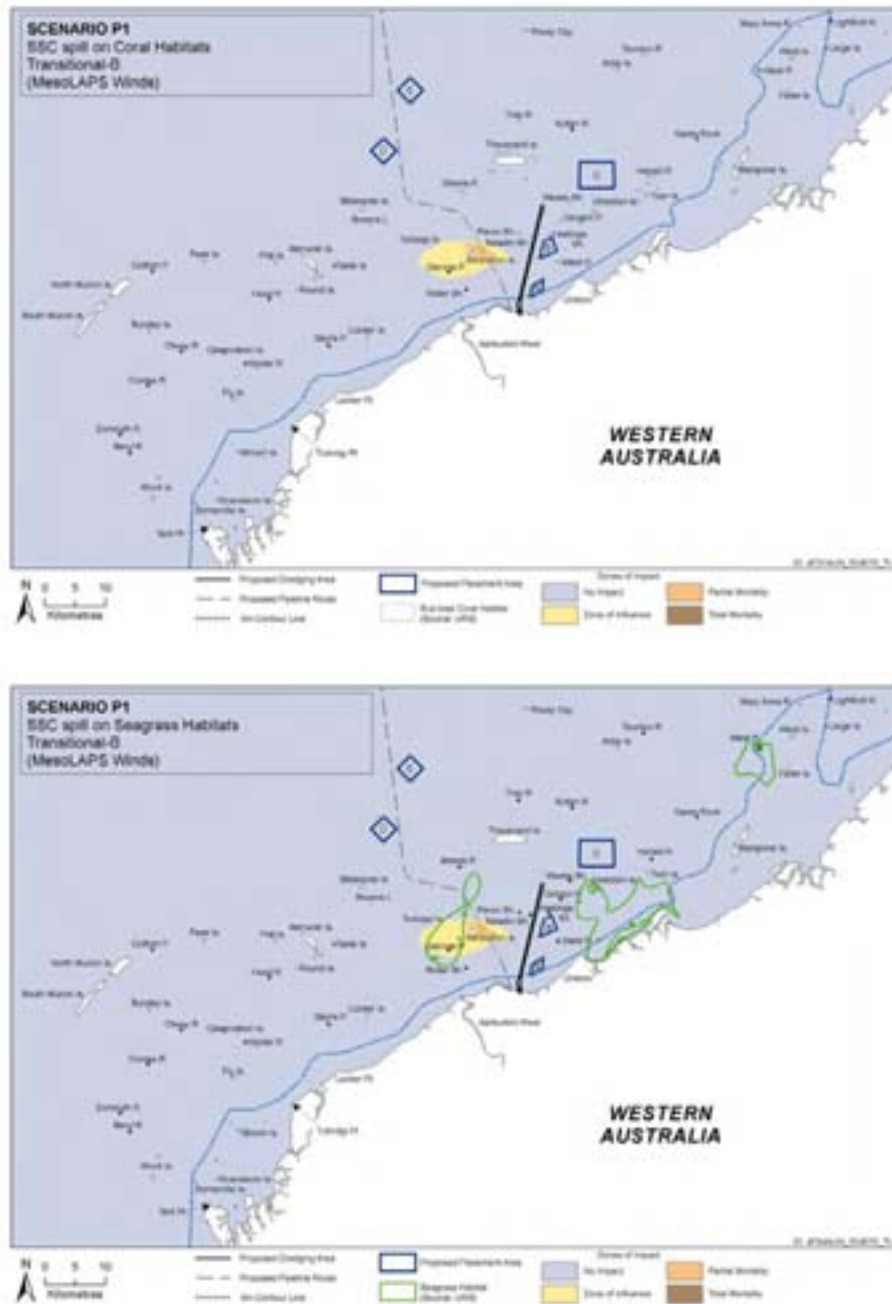


Figure 5.37 Example of SSC Zones of Impact extent during calm transitional periods due to pipeline trenching near Ashburton Island using a CSD

Top: Coral impact zones  
Bottom: Seagrass impact zones

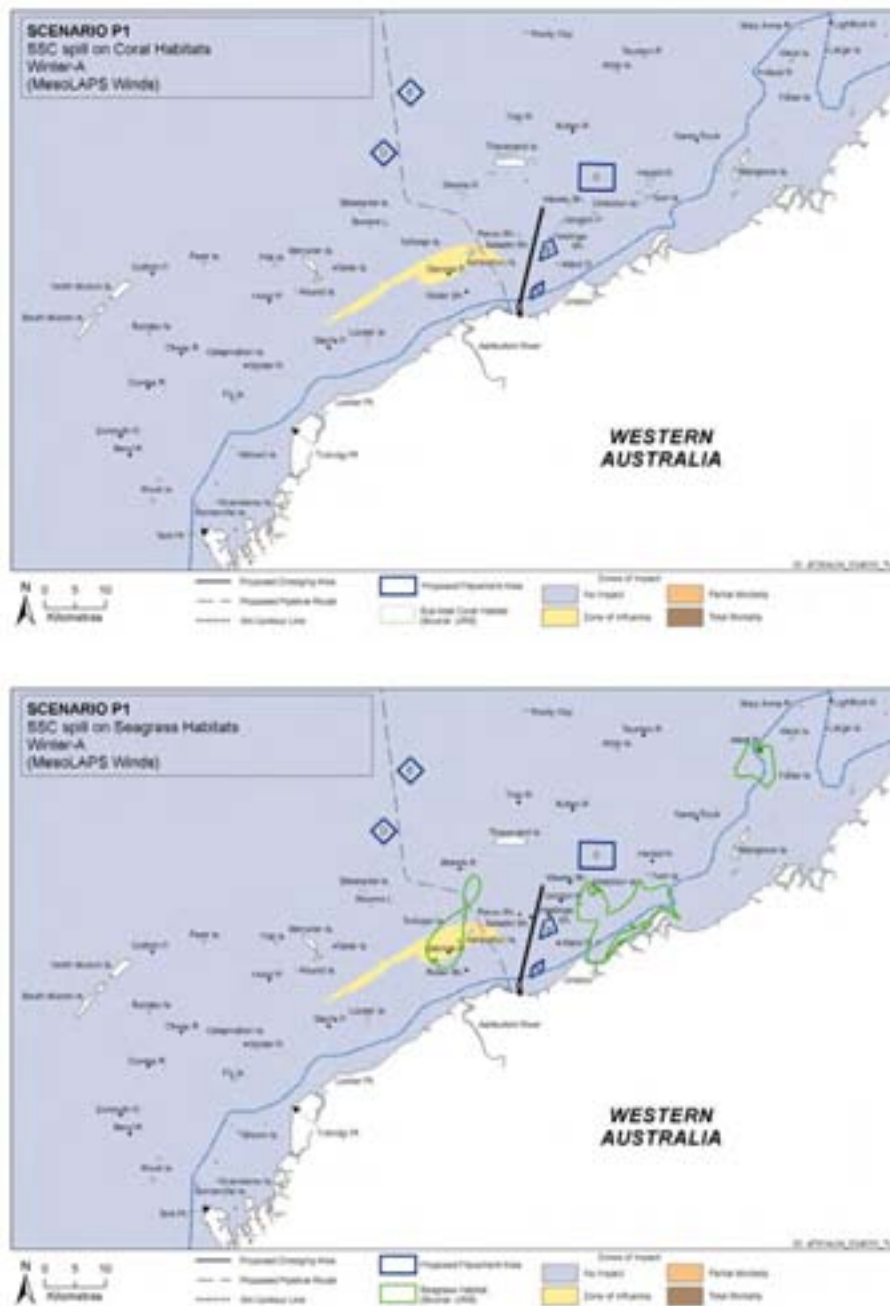


Figure 5.38 Example of Winter SSC Zones of Impact extent due to pipeline trenching near Ashburton Island using a CSD

Top: Coral impact zones

Bottom: Seagrass impact zones

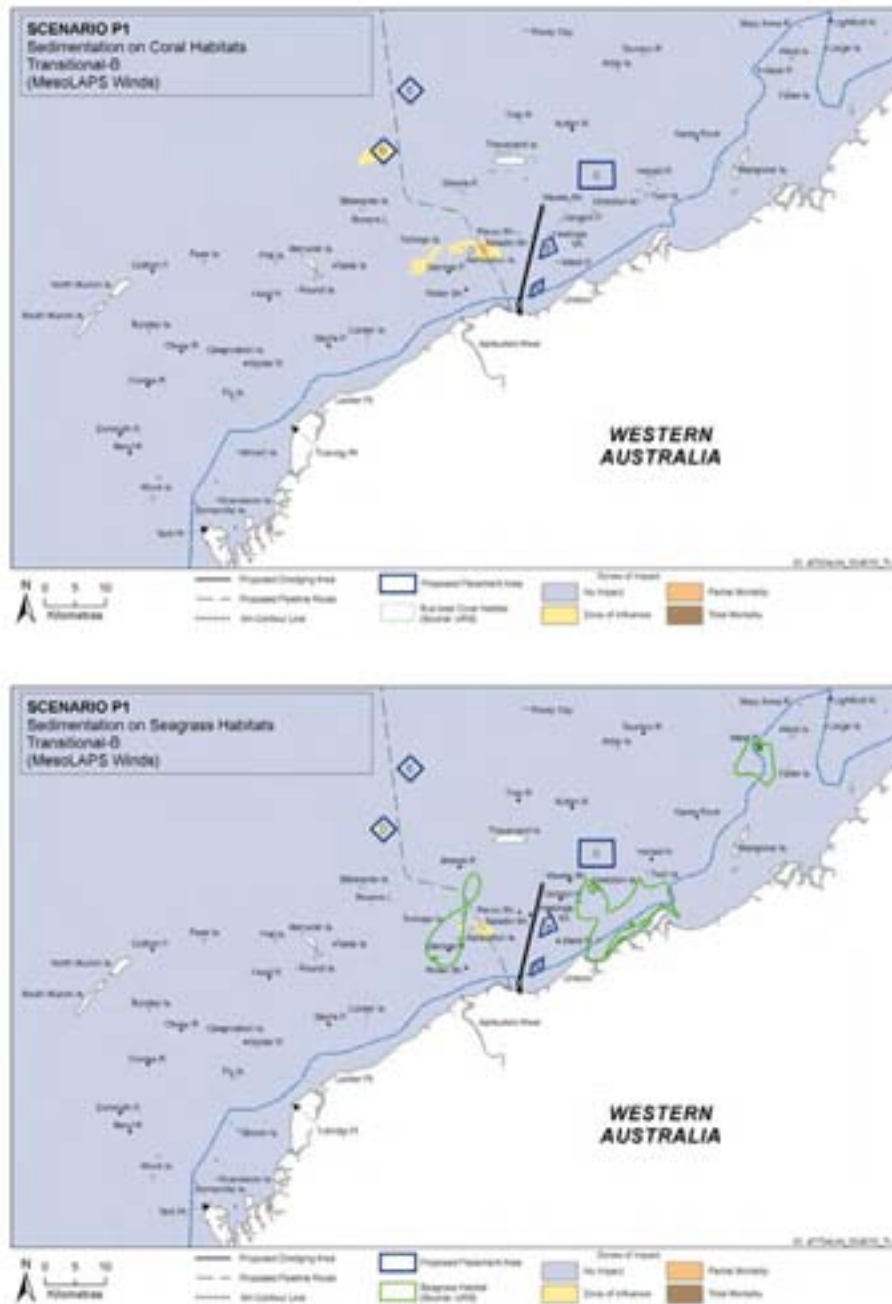


Figure 5.39 Example of sedimentation Zones of Impact extent during the calm transitional period due to pipeline trenching near Ashburton Island using a CSD

Top: Coral impact zones

Bottom: Seagrass impact zones



### 5.5.2 Trenching near Bessieres Island and Brewis Reef

During summer, the plumes are rapidly dispersed, predominantly to the east, extending 2–5 km towards Brewis Reef, though at low concentrations (average concentration in order of 2–3 mg/l above background, Figure 5.40). During winter, a similarly high dispersion is noted, this time predominantly to the west, towards Bessieres Island, although again at very low concentrations (in the order of 2–3 mg/l above background, Figure 5.40). However, during the calmer transitional periods, the plume is not as well dispersed, leading to elevated concentrations in the vicinity of the trenching location. Mean concentrations immediately adjacent to the trenching area are predicted to range from 3–10 mg/l, with lower concentrations (average concentration of 2–3 mg/l) extending more than 8 km to reach Brewis Reef (Figure 5.40).

The SSC Zone of Partial Mortality for corals and seagrass is predicted to extend in the order of 2–3 km east and west from the pipeline route, although remote re-suspension is also predicted up to 5 km east and west of the pipeline route, potentially impacting some of the macroalgal areas around Brewis Reef (e.g. Figure 5.41, Figure 5.42 and Figure 5.43). The SSC Zone of Total Mortality is only predicted to extend in the order of 500 m east and west of the pipeline route, depending on the season.

The sedimentation Zones are more localised, with the Zone of Partial Mortality extending up to 1 km east and west of the dredging location (depending on season) for corals, and less than 500 m east and west (depending on season) for seagrass (e.g. Figure 5.44), with some remote sedimentation also predicted to the east during summer and west during winter and transitional periods. The Zone of Total Mortality is extremely localised, and is only predicted to extend in the order of 100–200 m east and west of the pipeline route (e.g. Figure 5.44).

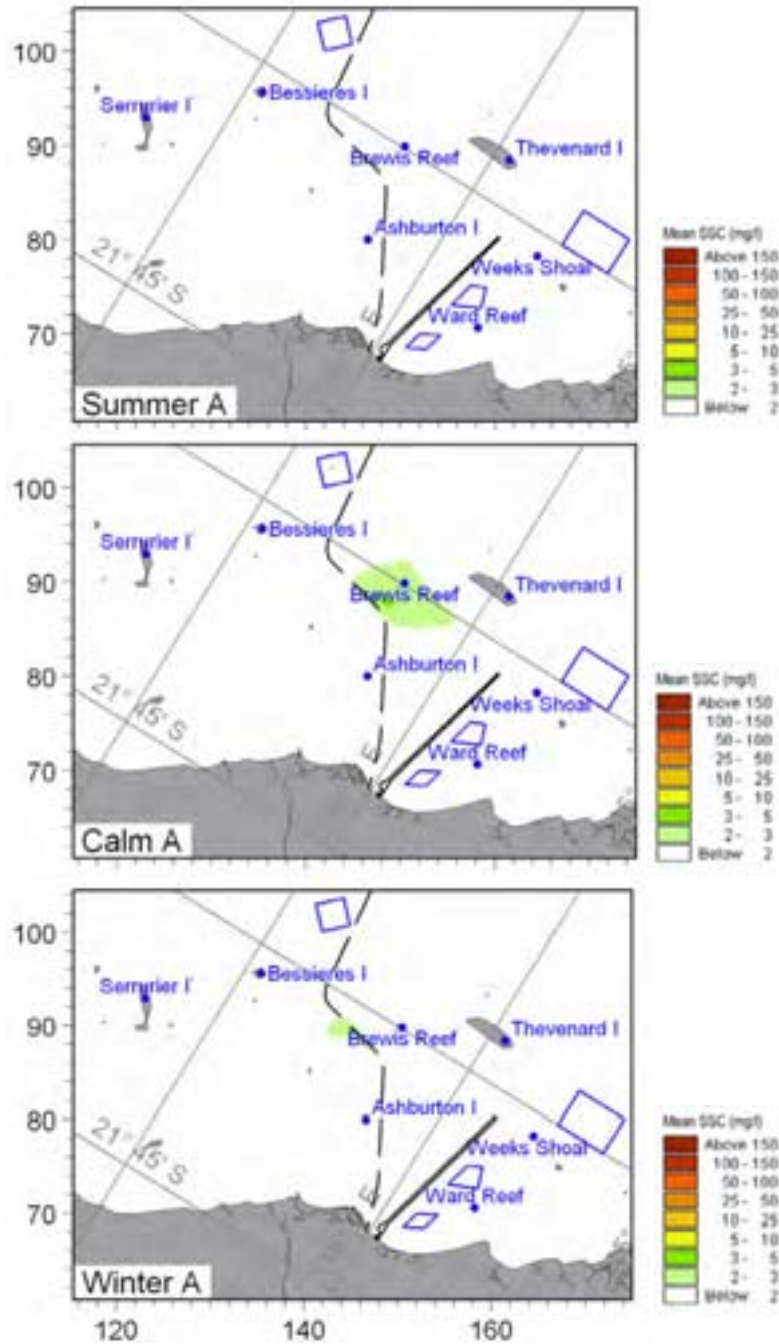


Figure 5.40 Example of suspended sediment plume extent due to pipeline trenching near Ashburton Island using a CSD  
 Top: Mean Suspended Sediment Concentration for Summer  
 Middle: Mean Suspended Sediment Concentration for the calm Transitional Period  
 Bottom: Mean Suspended Sediment Concentration for Winter



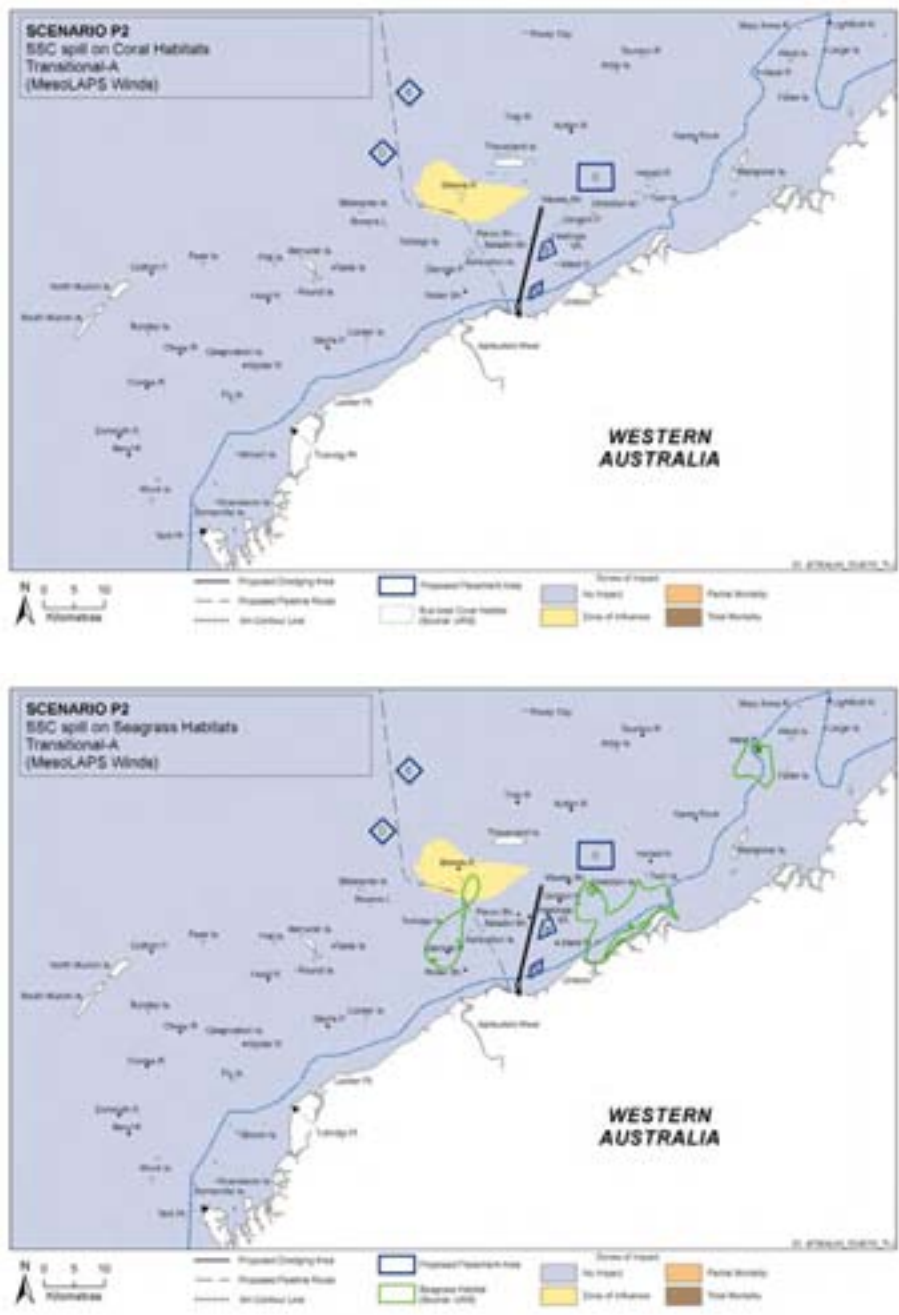


Figure 5.42 Example of SSC Zones of Impact extent during calm transitional periods due to pipeline trenching near Bessieres Island and Brewis Reef using a CSD  
 Top: Coral impact zones  
 Bottom: Seagrass impact zones

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

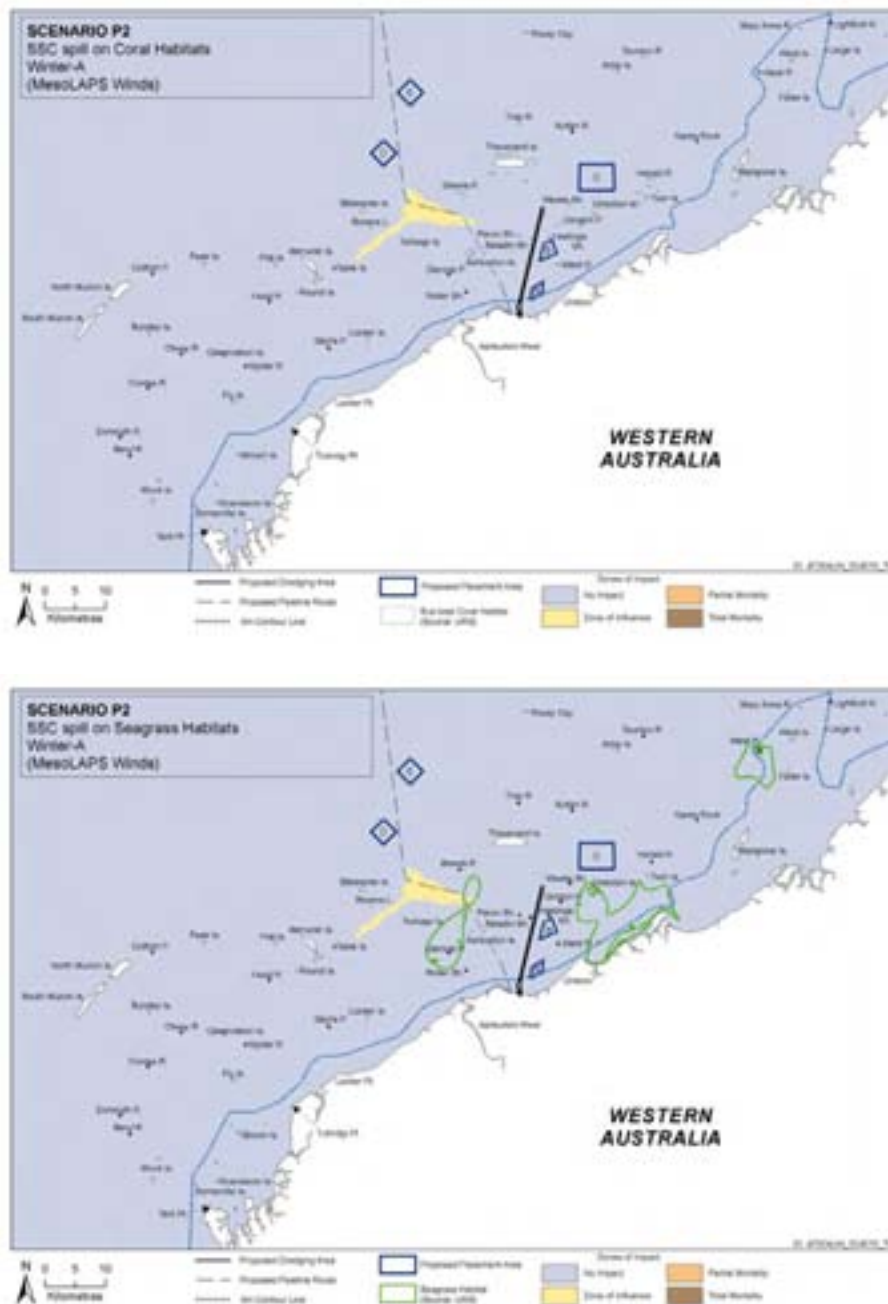


Figure 5.43 Example of Winter SSC Zones of Impact extent due to pipeline trenching near Bessieres Island and Brewis Reef using a CSD

Top: Coral impact zones

Bottom: Seagrass impact zones



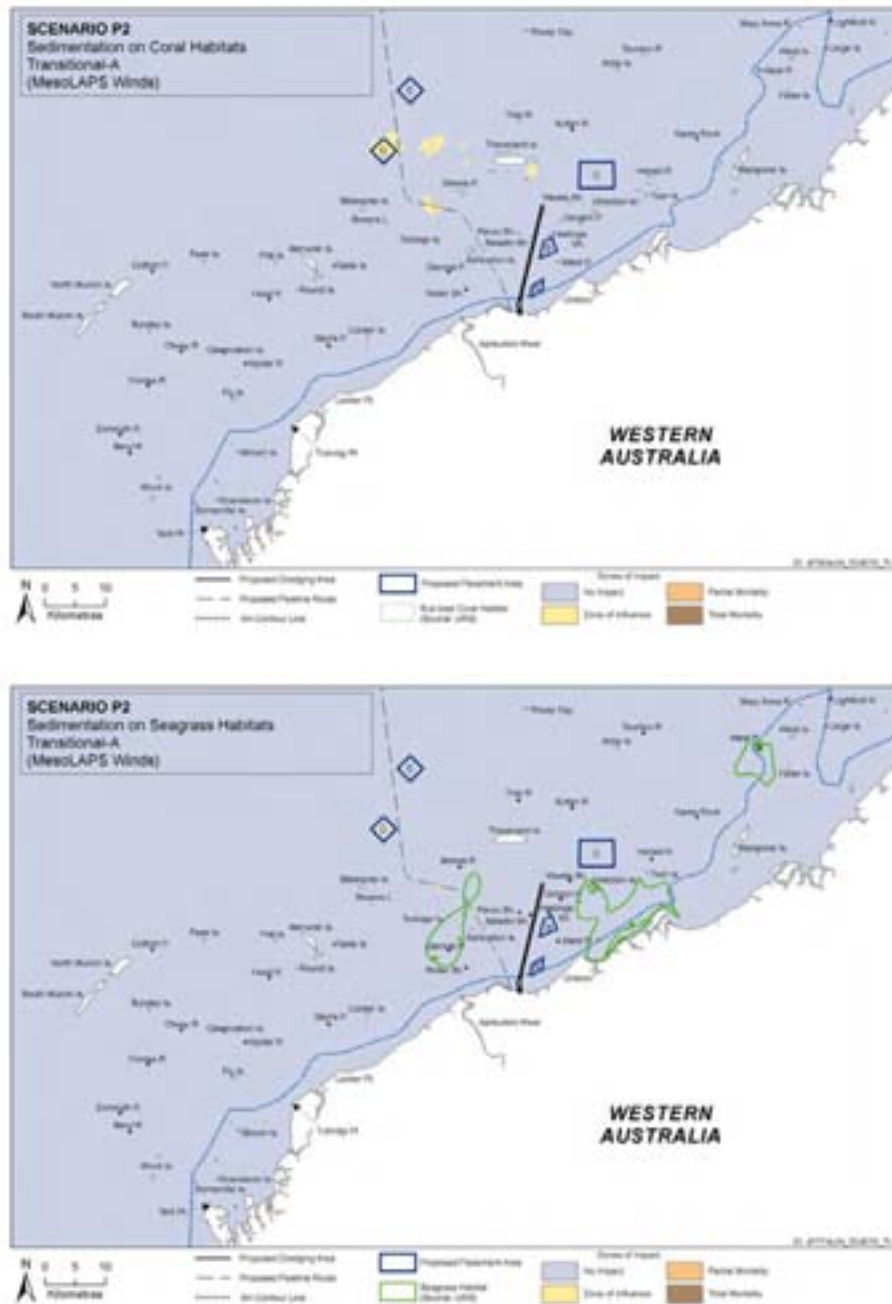


Figure 5.44 Example of sedimentation Zones of Impact extent during the calm transitional period due to pipeline trenching near Bessieres Island and Brewis Reef using a CSD

Top: Coral impact zones

Bottom: Seagrass impact zones



## 5.6 Summary of Zones of Impact for Sensitive Receptors

### 5.6.1 Summary of Impacts from Dredging Activities

An overall summary of the Estimated Zones of Impact (EZI) at the 34 key sensitive receptors in the vicinity of the dredging area (Section 2.1), based on the processed model results summarised in Section 5.4 and included in full in Appendix A and B, is presented in Table 5.1 for the “realistic” spill rates, and in Table 5.2 for the “worst case” spill rates, for comparison purposes. However, as noted previously, the main impact assessment has been based on the “realistic spill” scenarios, as the “worst case” spill rates represent the 90<sup>th</sup> percentile rates, and applying them consistently across the 14-day simulation period is overly conservative.

The main stages of the dredging programme that are predicted to have the most substantial impact on nearby coral and seagrass receptors are Scenarios 4–7 (Table 5.1, please refer to Section 3.1 for description of these scenarios). Impacts (in terms of partial or total mortality) are predicted to be generally confined to the small number of shoals located immediately adjacent to the dredging areas (i.e. Saladin Shoal, Paroo Shoal, and several un-named shoals, see Section 2.1), although Ward Reef and sections of the large seagrass area between Onslow and Coolgra Point do fall within the Zone of Partial Mortality under Scenario 6 during summer.

Figure 5.45 to Figure 5.48 show the Estimated Zones of Impact (EZI), based on combining the Zones from “realistic spill” for Scenarios 1–7 (non-optimized) and Scenarios 1–7A (optimized), and taking the maximum impact zone at each point from all of these scenarios. This is an inherently conservative approach, as while the dredging programme will extend for more than three years, it is not likely that dredging during all three seasons will occur along the entire length of the approach channel (though it may well occur for some sections). While this approach results in Estimated Zones of Impact with quite a large spatial extent, it is important to keep in mind that an impact will only be realised when the Zones overlap with coral or seagrass habitats. The locations of the main coral and seagrass habitats are indicated on Figure 5.45 to Figure 5.48.

These figures illustrate that for all stages of the dredging programme and for the broad range of climatic and seasonal scenarios modelled, the SSC Zone of Total Mortality does not overlap with any coral or seagrass habitats. The SSC Zone of Partial Mortality overlaps corals within about 5 km of the dredging zone (including Ward Reef, Saladin Shoal, Paroo Shoal, Gorgon Patch and several small un-named shoals). A portion of the large seagrass area to the east of the dredging area (offshore between Onslow and Coolgra Point) falls inside the Zone of Partial Mortality during the summer months, while a smaller portion of the seagrass area west of the dredging area falls inside the Zone of Partial Mortality during winter (Figure 5.46).





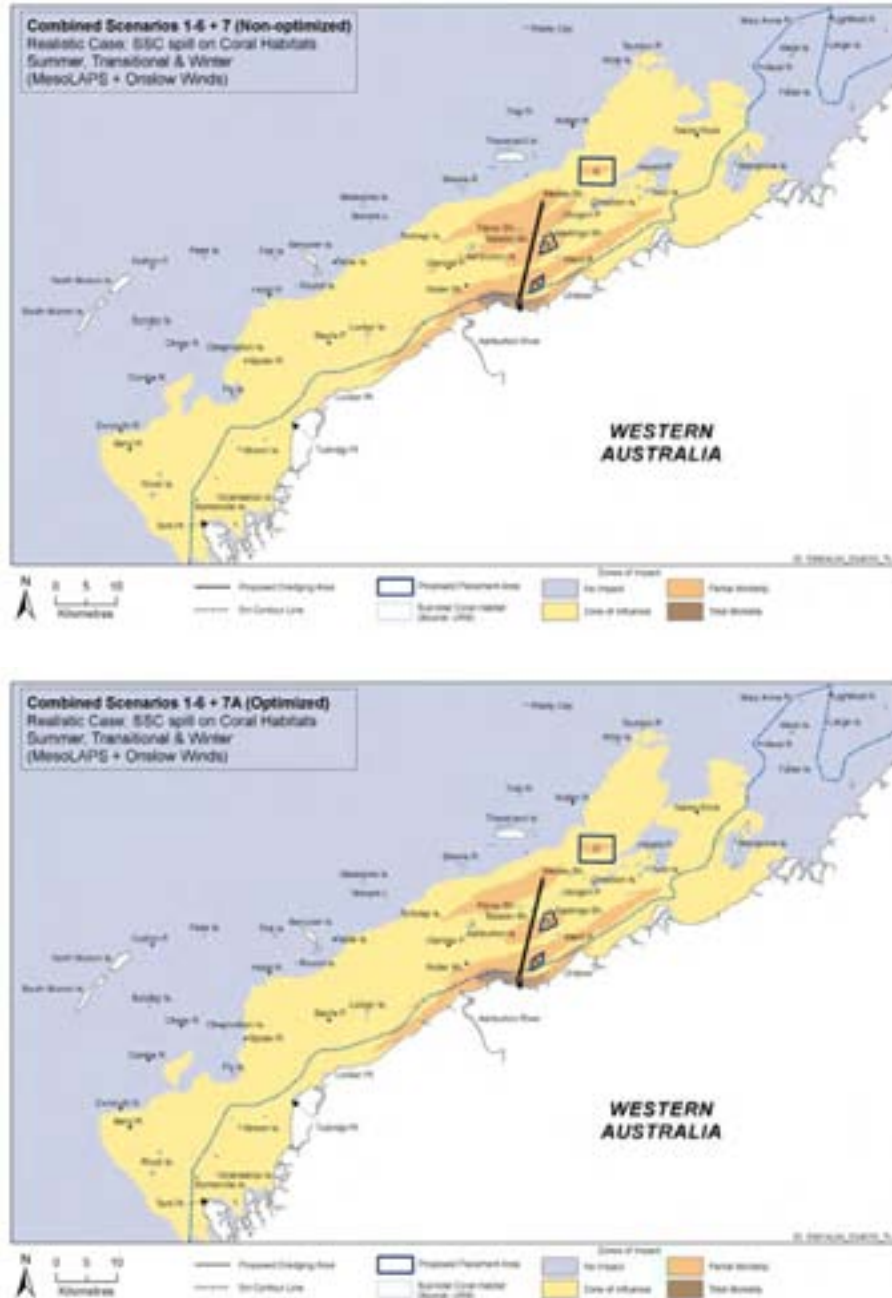


Figure 5.45 Comparison of SSC EZI at Coral habitats for Realistic Spill Scenarios 1–7 combined (top: without optimization) and for Scenarios 1–7A combined (bottom: with optimization)

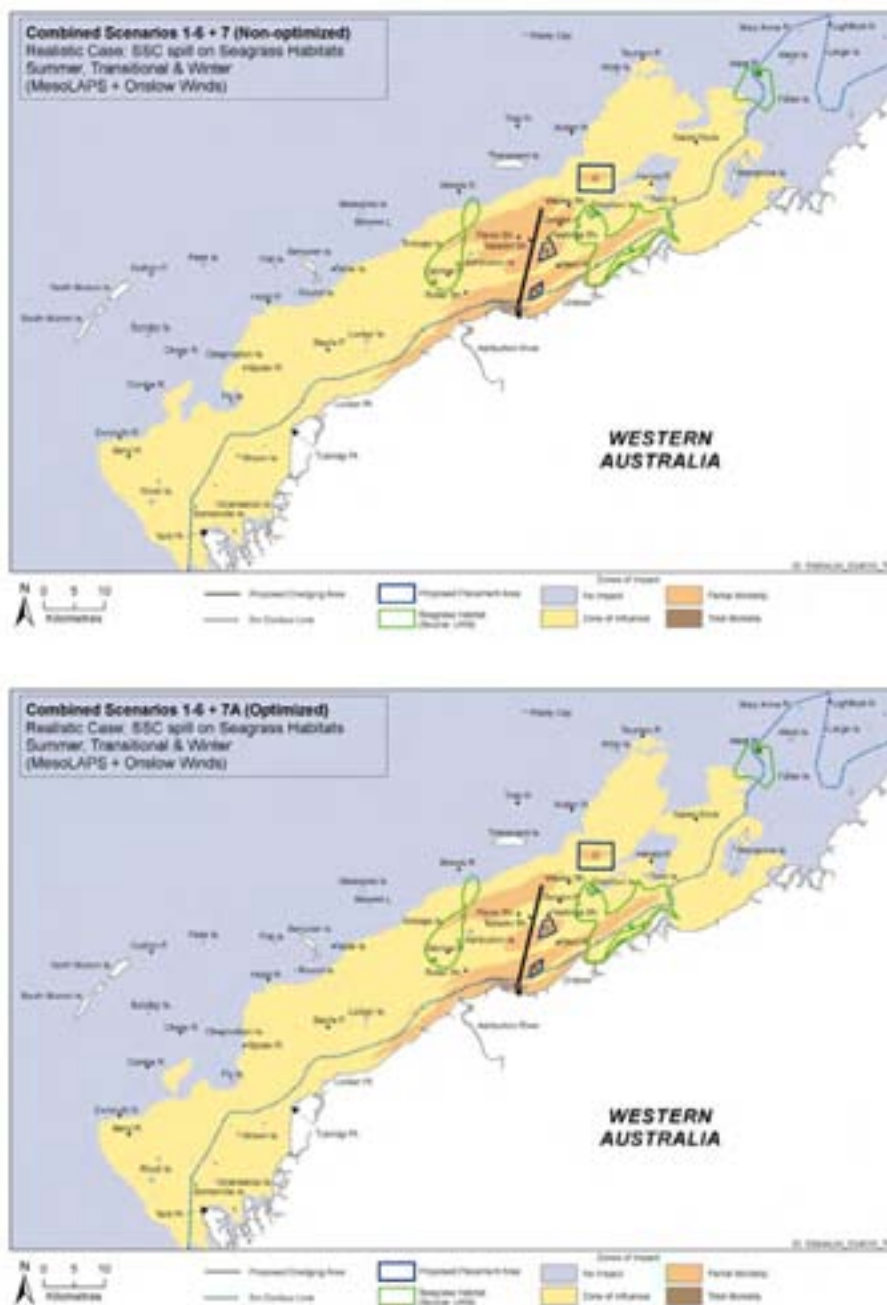


Figure 5.46 Comparison of SSC EZI at Seagrass habitats for Realistic Spill Scenarios 1–7 combined (top: without optimization) and for Scenarios 1–7A combined (bottom: with optimization)

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

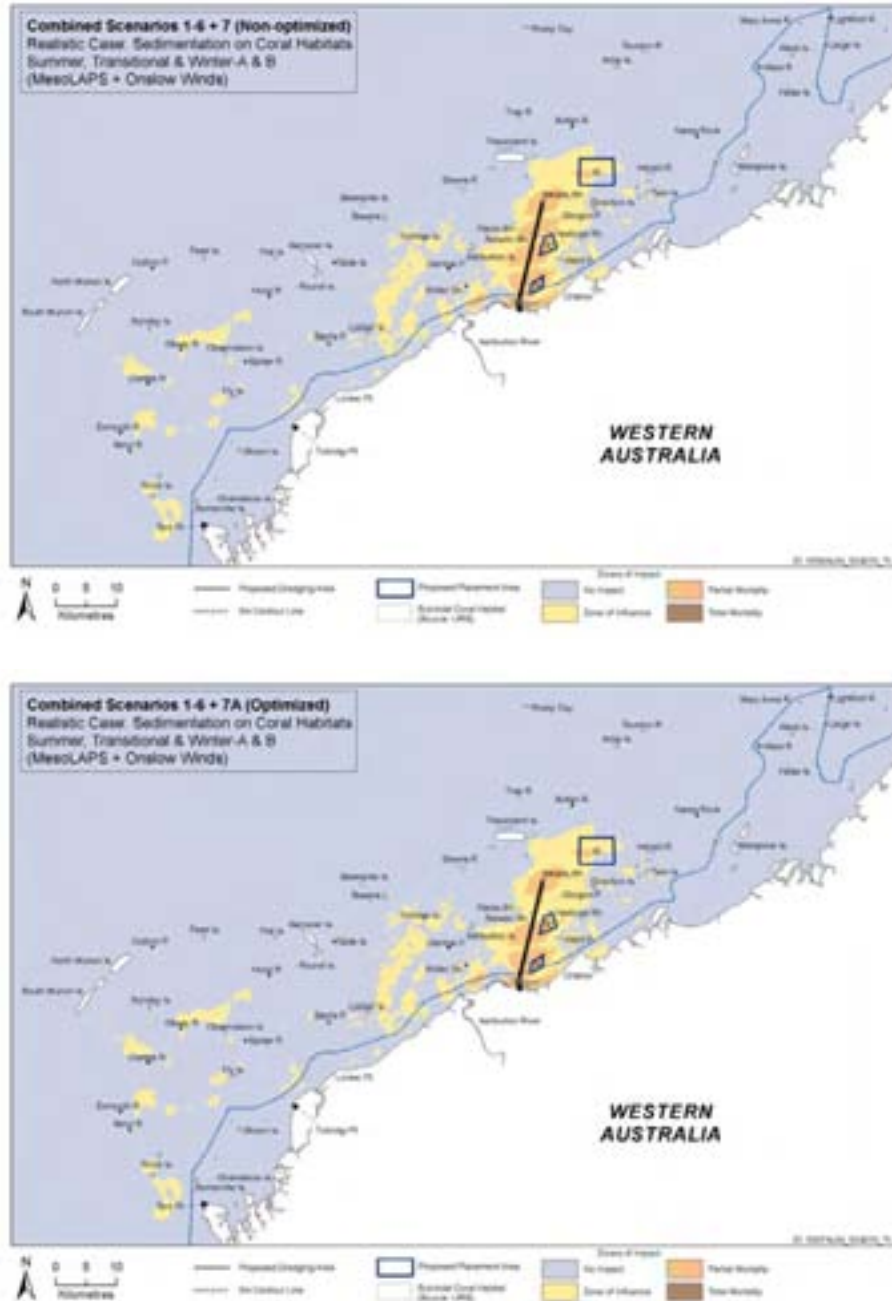


Figure 5.47 Comparison of Sedimentation EZI at Coral habitats for Realistic Spill Scenarios 1-7 combined (top: without optimization) and for Scenarios 1-7A combined (bottom: with optimization)

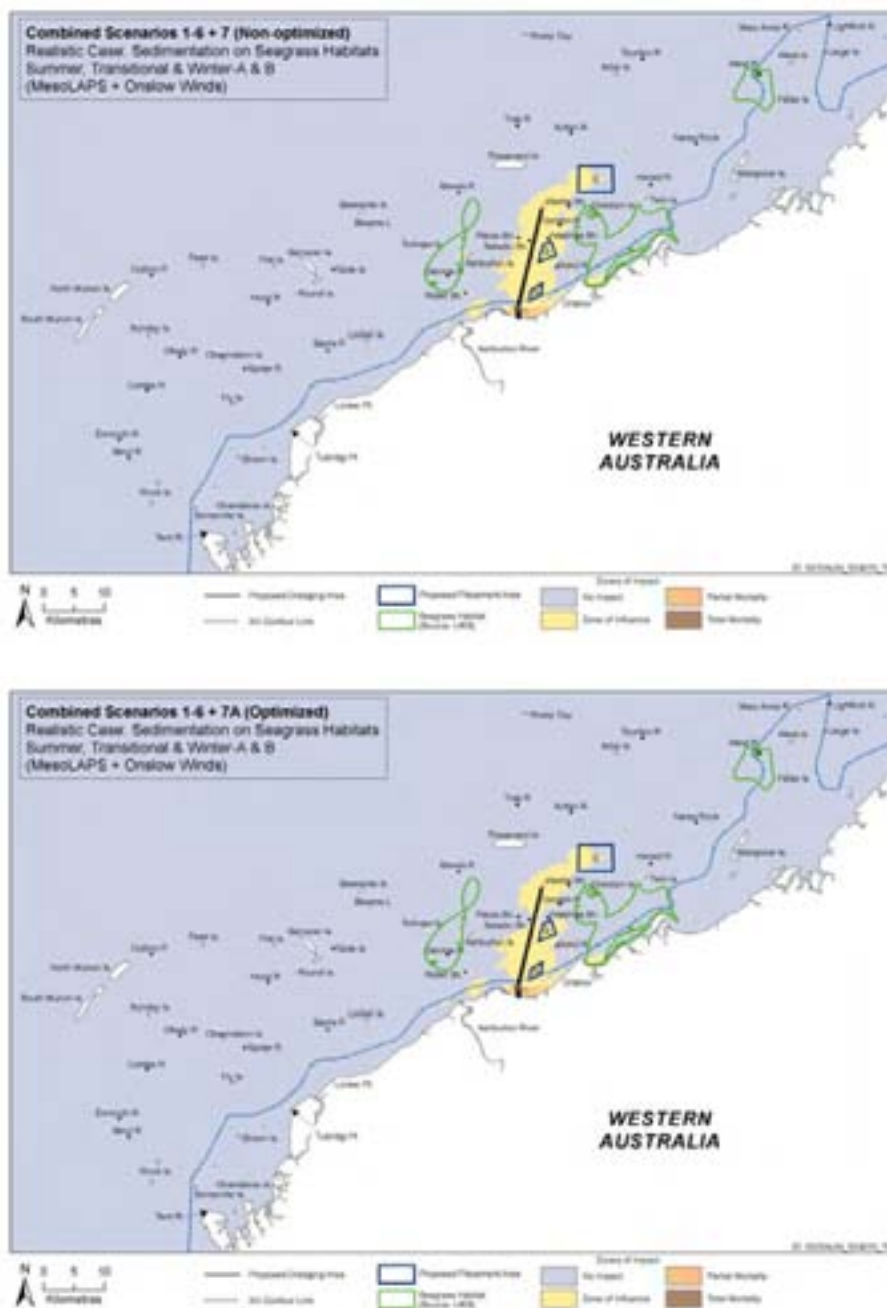


Figure 5.48 Comparison of Sedimentation EZI at Seagrass habitats for Realistic Spill Scenarios 1–7 combined (top: without optimization) and for Scenarios 1–7A combined (bottom: with optimization)





For sedimentation, the EZI for corals (Figure 5.47) and particularly for seagrass (Figure 5.48) are even more localised than for SSC. The Zone of Partial Mortality is predicted to extend approximately 3–4 km east and west of the dredging area for corals, and less than 1 km east and west for seagrass (apart from some localised sedimentation immediately east of the MOF, which is most likely due to localised reduced current conditions following construction of the MOF and PLF Basin). Saladin Shoal, Hastings Shoal, the eastern part of Paroo Shoal and several small unnamed shoals are therefore predicted to fall in the sedimentation Partial Mortality Zone.

While the Zone of Influence overlaps many of the coral and seagrass areas (particularly for SSC) it should be noted that the definition of this Zone is that it is not predicted to result in any material and/or measureable effect.

As discussed previously, the extended SSC Zone of Partial Mortality to the east of the Project area during summer and to the west of the Project area during winter is due to the repeated re-suspension and transport of fine dredged material due to strong spring tides and strong and persistent winds during the summer and winter periods. It should be noted that this extended transport of the fine material is exaggerated somewhat in the model, as a conservative approach was taken by not including any consolidation of the dredged material for these short-term scenarios.

This has resulted in fine dredged material repeatedly settling and then being re-suspended and carried further and further from the dredging area in the model due to the strong spring tide currents and strong and persistent wind conditions, particularly during summer and winter. In reality, initial consolidation (which is perhaps better described as establishment of cohesive forces) is relatively rapid, and can take place between the spring tides which tend to re-suspend the material. This consolidation would reduce the amount of re-suspension that would actually occur, compared to what is predicted in the model, and would therefore be expected to reduce the spatial extent of the EZI, particularly during summer.

It should also be noted that while the definition of “partial mortality” for this assessment is “up to 50% mortality”, this level of mortality is only likely relatively close to the dredging area. The seagrass area offshore from Onslow and Coolgra Point is located more than 10 km from the dredging area. Based on the modelling, the dredging is predicted to lead to a mean increase in SSC in the order of 5 mg/l across the seagrass area. However based on MODIS satellite imagery from 2006 to 2009, the seagrass area offshore between Onslow and Coolgra Point (and the Mangrove Islands) commonly experience periodic elevated turbidity (in the order of 5–10 mg/l) throughout the year, but particularly during summer, due to strong spring tide currents and strong and persistent winds causing re-suspension and transport of fine seabed material in the nearshore area (Figure 5.11).



**5.6.2 Summary of Impacts from Pipeline Trenching Activities**

An overall summary of the Estimated Zones of Impact (EZI) at the 25 key sensitive receptors in the vicinity of the pipeline route (Section 2.1), based on the processed model results summarised in Section 5.5 and included in full in Appendix A, is presented in Table 5.3 for the “realistic” spill rates.

Table 5.3 Summary of overall Estimated Zones of Impact (EZI) for 25 key sensitive receptors for each of the 12 pipeline scenarios

Sensitive Receptor	Geographic Name	Habitat	Scenario P1			Scenario P2		
			S	W	T	S	W	T
1	Bessieres Island - North	CR & MA						
2	Bessieres Island - South	CR & MA						
3	Bowers Ledge	CR & SG						
4	Tortoise Island	FF						
5	Roller Shoal	MA & CR						
6	Ashburton Island - South	CR						
7	Ashburton Island - West	CR, MA & FF						
8	Ashburton Island - North	CR						
9	Ashburton Island - East	CR						
10	Paroo Shoals	CR						
11	Saladin Shoal	CR						
12	End of Wheatstone Shipping Channel	CR						
13	Hastings Shoal	CR						
14	North West Ward Reef	CR						
15	Ward Reef	CR, MA & FF						
16	Gorgon Patch	CR						
17	Weeks Shoal	CR & MA						
18	Direction Island	CR						
19	Brevis Reef- South	CR & MA						
20	Brevis Reef- North	CR						
21	Theravard Island West	FF & CR						
22	West Glennie Patches	CR						
23	NW of Ashburton Island	CR & MA						
24	S of Brevis Reef	CR & MA						
25	Theravard Island South	SG						

\*See Figure 2.3 for locations of Sensitive Receptors

**Legend**

- CR – Coral
- FF – Filter Feeders
- SG – Seagrass
- MA – Macroalgae
- S – Summer (A or B)
- W – Winter (A or B)
- T – Transitional (A or B)

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



The main concern is the trenching works in the vicinity of Ashburton Island, which may result in partial mortality to the corals at this sensitive receptor (particularly along the eastern side closest to the pipeline route). However, it should be noted that this assessment is based on the contingency case of using a large CSD to create the pipeline trench. The base case, which is to use a mechanical trencher, would generate much smaller EZI, and would not be likely to result in partial mortality impacts at Ashburton Island.

## 5.7 Overall Zones of Impact

The short-term scenarios that have been described in the previous sections provide a comprehensive and conservative assessment of the potential impacts to the sensitive habitats, from which key receptors at risk from the dredging programme have been identified. It is DHI's view that this short-term scenario approach is the most robust and conservative approach for assessing complex dredging programmes such as the capital dredging works for the Wheatstone Project. At the EIA stage of a project, the timing, methodology and equipment that may be used to carry out the dredging works are usually not confirmed, as the dredging contractor is usually not yet appointed. Using the short-term scenario modelling approach addresses some of this uncertainty by breaking the dredging works down into the key activities, and simulating those activities across a wide range of climatic situations. However, because this is a different approach from the "full dredge log scenario" approach that has commonly been used previously to assess dredging impacts in WA, it is important to highlight the differences in the approach.

The benefit of the short-term scenario approach is that it allows for detailed assessment of potential impacts at particular sensitive receptors (e.g. Ward Reef). Because simulation run times are relatively short (14 days as opposed to more than three years for a full dredge log simulation), this allows the flexibility to test a wide range of climatic and production scenarios, and to test mitigation measures (if required). For example, a total of 12 different scenarios were used to assess the potential impacts at Ward Reef (six seasonal/climatic conditions, two wind fields), in order to draw a conservative envelope around the potential impacts to this sensitive receptor. If a full dredge log scenario approach was taken, even if specific efforts were made to ensure that dredging in areas updrift of Ward Reef occurred during periods of strong flow towards the reef, at most three or four of these full dredge log scenarios are usually used for impact assessment. The challenge of ensuring that dredging was simulated updrift of all of the sensitive receptors during the most critical climatic periods would simply be too difficult to meet. So only three or four versions of the potential dredging works near sensitive receptors would be used for the impact assessment, creating a relatively high possibility of the full dredge log simulation not identifying potential impacts to sensitive receptors.

Combining all of the "realistic spill" scenarios discussed above and presented in Appendix A and B to produce the EZI plots provides a conservative overview of the Zones of Impact for the proposed dredging programme. The combined EZIs cover a wide area, but it is important to note that they may not represent the full spatial extent of the Zones of Impact along the channel as a result of the proposed dredging



programme. The EZIs are based on a representative selection of the main stages of the dredging programme, rather than the full dredging programme, which is expected to extend for more than three years. In order to overcome this, DHI has interpolated the combined EZI model results to develop Indicative Zones of Impact (IZI) for seagrass and corals, based on SSC and sedimentation impacts.

### **5.7.1 Dredging Indicative Impact Zones**

The IZIs for the main capital dredging works are presented in Figure 5.49 to Figure 5.52. For SSC, the IZIs are quite similar for corals and seagrass (Figure 5.49 and Figure 5.50), though the Zones of Partial and Total Mortality are slightly larger for corals, reflecting their greater sensitivity to SSC impacts compared to seagrass. For sedimentation, the coral Zones of Impact are much more localised than for SSC (Figure 5.51), and the Zones for seagrass are even more localised (Figure 5.52), reflecting the greater tolerance of seagrass for sedimentation compared to corals. However, as emphasised in previous sections, most of the sensitive coral and seagrass receptors are not located in the near vicinity of the dredging area, and are generally outside of the Zone of Partial or Total Mortality.

For corals, Saladin Shoal and the un-named shoal at the end of the shipping channel may fall at least partially within the Zone of Total Mortality, while Ward Reef, Saladin Shoal, Paroo Shoal, Hastings Shoal, Weeks Shoal, Gorgon Patch and several small un-named shoals near the navigation channel fall within the Zone of Partial Mortality. The effectiveness of a restricted overflow zone adjacent near the 10 m isobath, adjacent to Paroo Shoal, Hastings Shoal etc. is clearly evident in reducing both SSC and sedimentation impacts at these areas (compare top and bottom plots in Figure 5.49 to Figure 5.52). The potential effectiveness of such a restricted overflow zone adjacent to Ward Reef is also illustrated, though the zone would need to be positioned slightly further to the south in order to provide full protection to Ward Reef.

For seagrass, none of the receptors fall within the Zone of Total Mortality, but the seagrass areas northwest and southwest of Ashburton Island, and offshore between Onslow and Coolgra Point, fall within the SSC Partial Mortality Zone (Figure 5.50), while no seagrass areas fall within the sedimentation Partial Mortality Zone (Figure 5.52). However, as discussed previously, these seagrass areas are more than 10 km from the dredging area, and given the frequent natural episodes of turbidity across this area (see Figure 5.11 and Figure 5.12), this level of impact may not be realised.

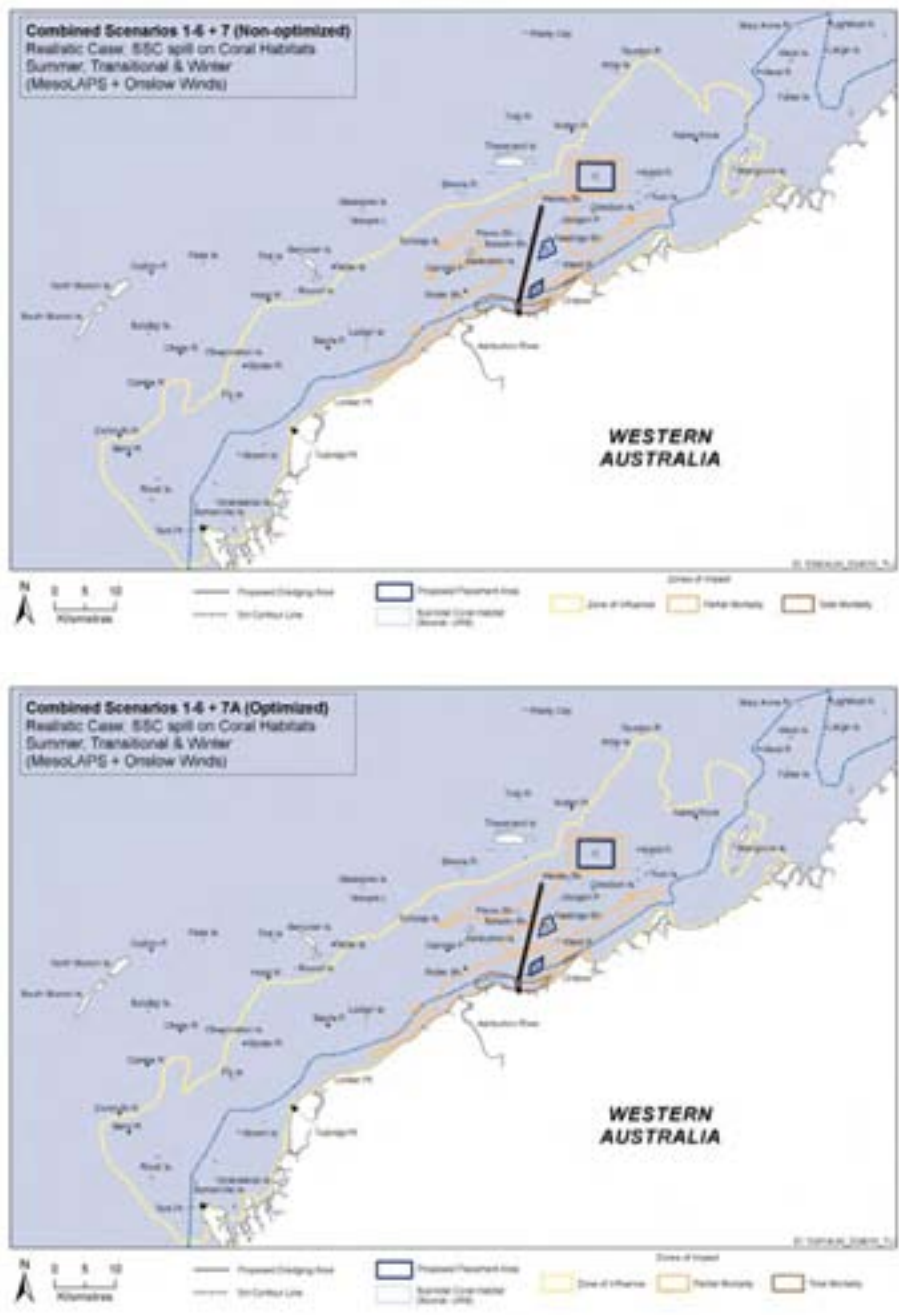


Figure 5.49 SSC IZI for Coral habitats for “Realistic Spill” Scenarios 1–7 combined (top: without optimization) and for Scenarios 1–7A combined (bottom: with optimization)

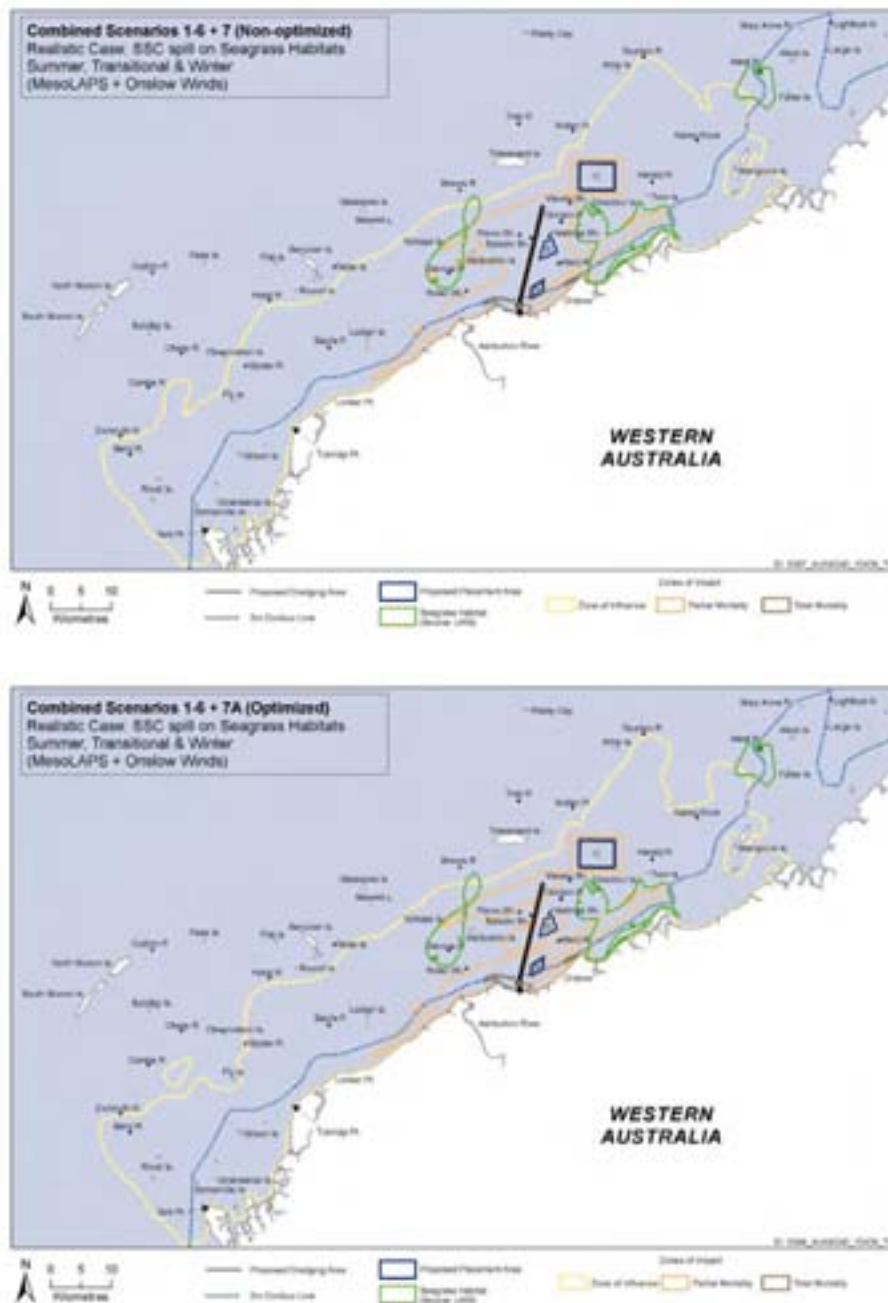


Figure 5.50 SSC IZI for Seagrass habitats for “Realistic Spill” Scenarios 1–7 combined (top: without optimization) and for Scenarios 1–7A combined (bottom: with optimization)

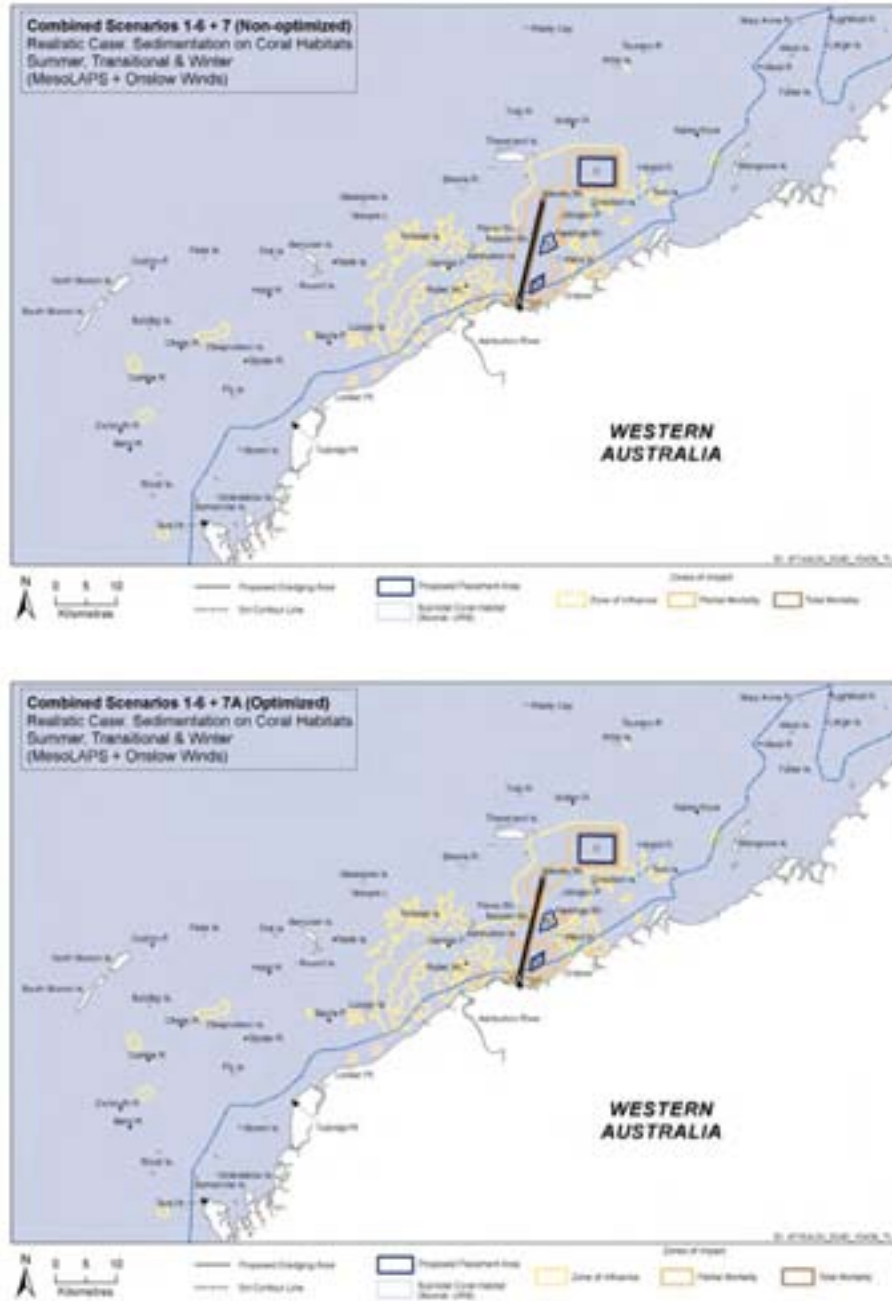


Figure 5.51 Sedimentation IZI for Coral habitats for “Realistic Spill” Scenarios 1–7 combined (top: without optimization) and for Scenarios 1–7A combined (bottom: with optimization)

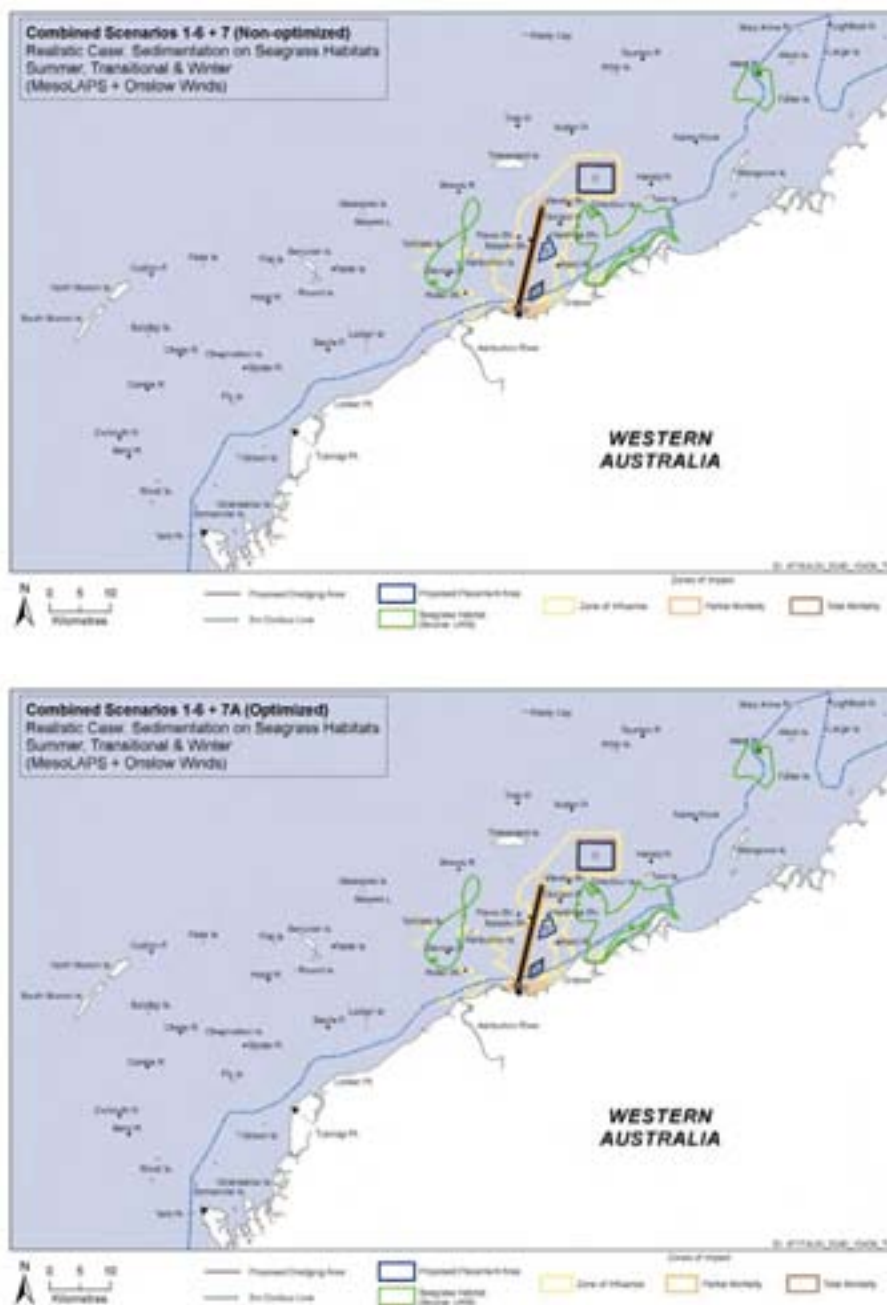


Figure 5.52 Sedimentation IZI for Seagrass habitats for “Realistic Spill” Scenarios 1–7 combined (top: without optimization) and for Scenarios 1–7A combined (bottom: with optimization)





### 5.7.2 Pipeline Trenching Indicative Impact Zones

The IZIs for the pipeline trenching are shown in Figure 5.53 and Figure 5.54. It should be noted that these IZIs are much less certain than the IZIs for the main capital dredging, as they are only based on modelling at the two most sensitive locations along the pipeline route. A conservative approach has therefore been used in determining the IZI boundaries, and the actual zones of impact are expected to be significantly smaller.

Ashburton Island is the only coral receptor predicted to fall within the Zone of Partial Mortality. This is mainly due to the proximity of the proposed pipeline route, and the very conservative assessment based on using a CSD to undertake the trenching.

Portions of the seagrass area north of Ashburton Island also fall within the Zone of Partial Mortality and the Zone of Total Mortality as the pipeline route passes through some of this seagrass area. However, the seagrass coverage is relatively sparse (in the order of 5%) and consists mostly of *Halophila ovalis/minor*, which is able to quickly regenerate and re-colonise an area following disturbance.

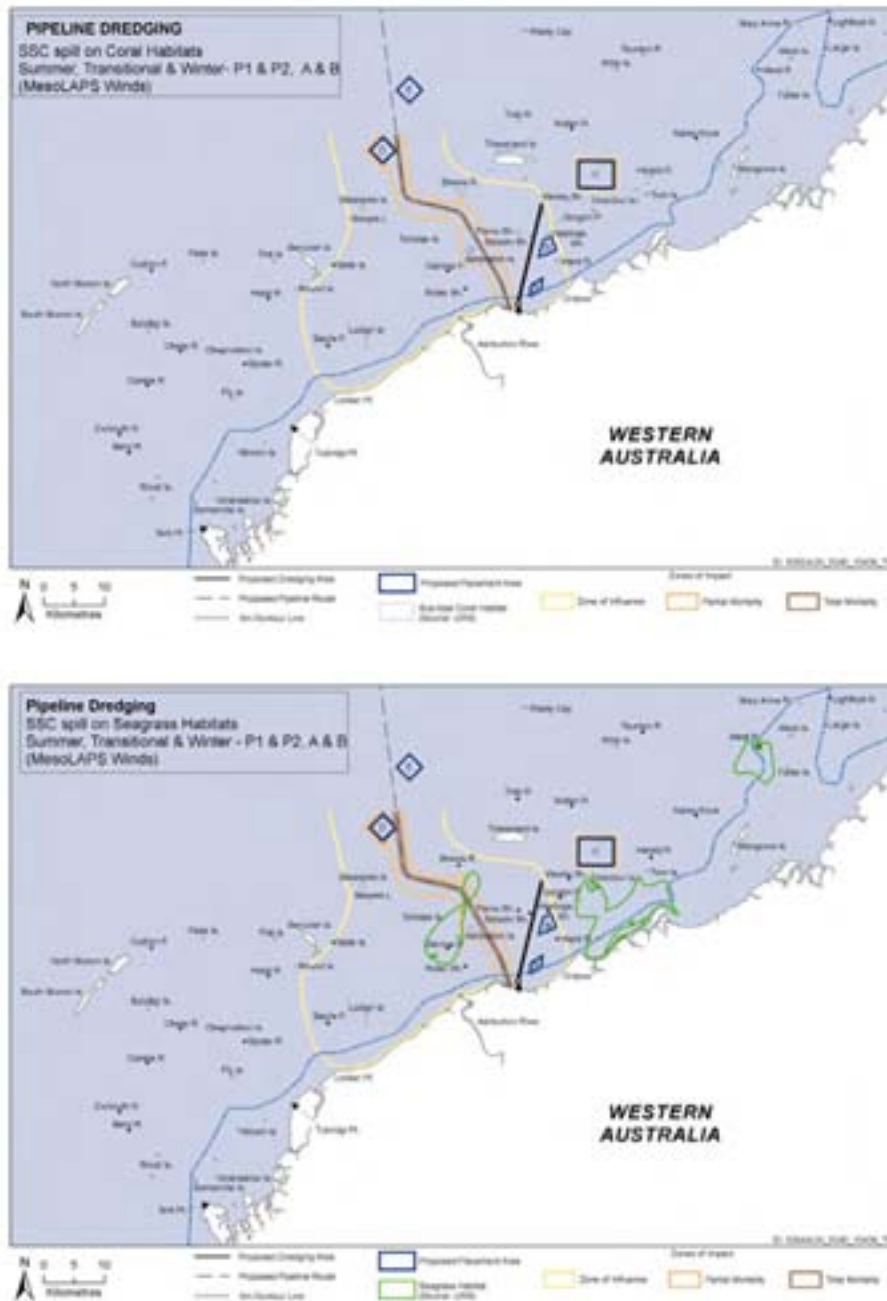


Figure 5.53 SSC IZI for coral (top) and seagrass (bottom)

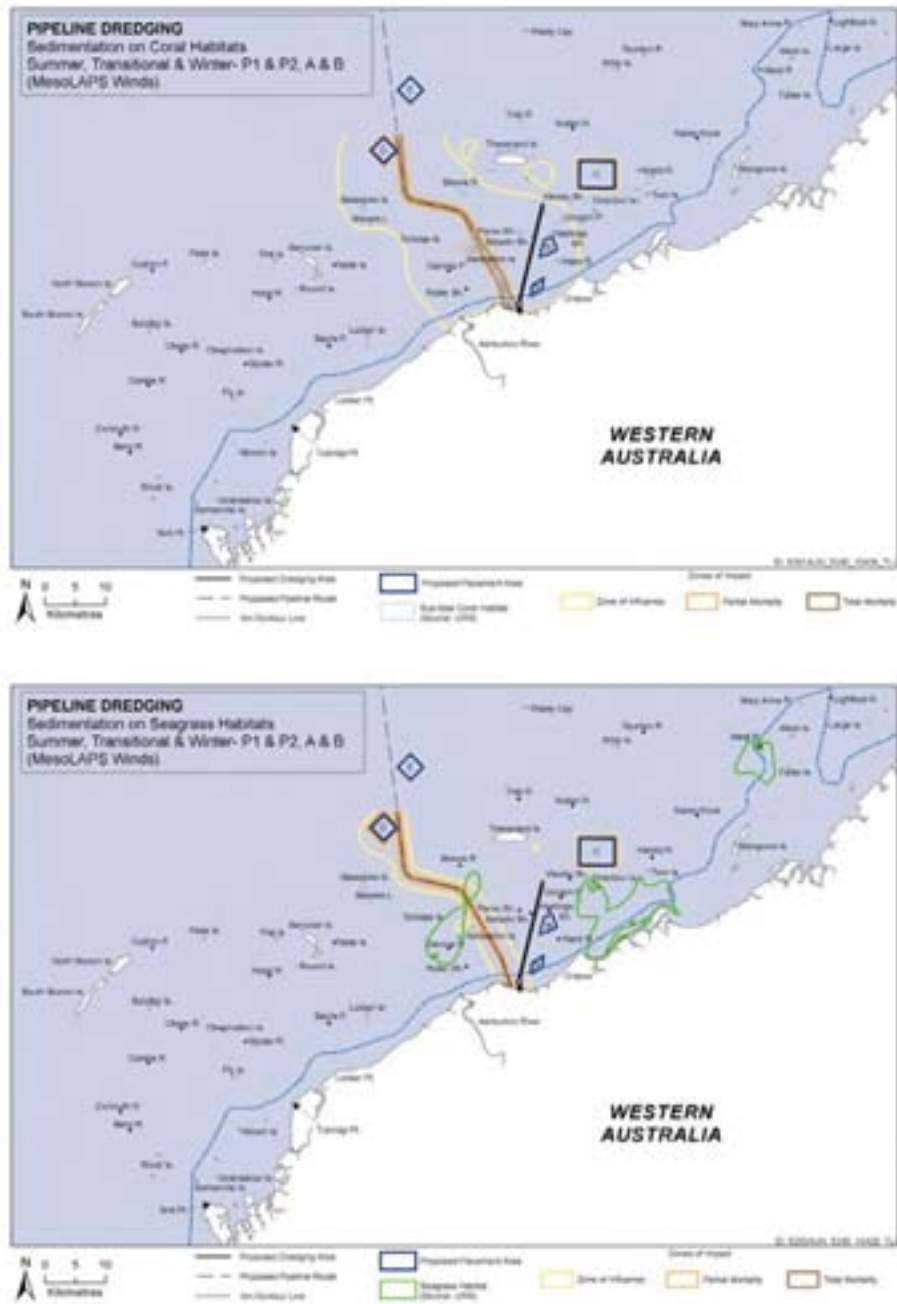


Figure 5.54 Sedimentation IZI for coral (top) and seagrass (bottom)



## **6 MITIGATION, MONITORING AND MANAGEMENT MEASURES**

### **6.1 Monitoring and Management Programme**

The draft DSDMP (SKM 2010) contains the detailed monitoring programme proposed by Chevron in order to monitor and detect any impacts to the key sensitive environmental receptors in the vicinity of the dredging area. This monitoring programme has been developed based on the established norms for previous dredge monitoring programmes in WA, but tailored for the site specific conditions in the Project area. It comprises both biological monitoring and water quality monitoring (both *in situ* sensors and discreet sampling locations) targeting both key receptors (e.g. Ward Reef, Paroo Shoal, etc.) and locations closer to the dredging area but in the general flow path towards key receptors. Trigger levels for both coral health and water quality will be established as part of the DSDMP, based on baseline monitoring data from the Project site.

### **6.2 Mitigation Measures**

The DSDMP also details the proposed mitigation measures, including the proposed response measures if trigger levels are exceeded.

DHI notes that while silt screens are often seen by the public and sometimes by regulators as a viable mitigation measure, the use of silt screens is generally not possible in high current and high tidal range conditions such as those experienced in the Project area. If currents exceed 0.5 m/s, there is a distinct danger of moorings shifting, and DHI is aware of numerous cases where silt screens have been installed near coral reefs in order to prevent impacts from dredging, and have instead caused substantial physical damage to the reefs due to dragging moorings. DHI therefore does not recommend the use of silt screens in the Project location, due to the high current conditions and tidal range.



## 7 CONCLUSIONS AND RECOMMENDATIONS

Overall, the model results show that while the Zones of Impact during the different stages of dredging may extend for many kilometres west and east of the dredging area, depending on the season, the lack of sensitive habitats in the vicinity of many sections of the dredging area mean that the area of sensitive habitat potentially impacted by the dredging is still relatively low. However, because the overall area of some types of BPPH in the Project area (corals in particular) is also relatively low, this has the effect of increasing the relative importance of those habitats, as even a small area of habitat loss will represent a relatively large proportion or percentage of the total habitat type in the Project area.

From the main capital dredging activities, Saladin Shoal and the un-named shoal at the end of the navigation channel will most likely fall at least partially within the Zone of Total Mortality, as they are located less than 1 km away from the dredging area. However, even these reefs are not predicted to be irreversibly lost. While substantial or total mortality due to sedimentation and reduced light is predicted, the habitat will remain, and over the long-term re-colonisation of the habitat can reasonably be expected to occur.

Paroo Shoal, Hastings Shoal, Weeks Shoal, Gorgon Patch, Ward Reef and several small un-named shoals in their vicinity fall within the Zone of Partial Mortality. Partial Mortality has been defined as “up to 50% mortality” for this assessment. However, due to their distance from the dredging area and the conservative approaches taken for setting the tolerance limits, undertaking the modelling, and creating the IZIs the actual mortality at these sites is expected to be substantially lower than 50%.

In addition, due to extensive re-suspension and transport of the dredged material eastwards during summer and westward during winter, portions of the seagrass areas east and west of the navigation channel also fall within the Zone of Partial Mortality due to dredging by the TSHD. However, it should be noted that review of MODIS satellite imagery shows that the shallow nearshore areas west and east of Onslow (from Tent Point to the Mangrove Islands) are routinely subjected to periods of elevated turbidity due to strong spring tides and strong and persistent winds (particularly during summer and winter) re-suspending fine seabed material. It should also be noted that the modelling approach has been conservative in that no consolidation of the dredged material depositing on the seabed was included in the short-term model scenarios. However, based on available literature, initial consolidation (which is perhaps better described as establishment of cohesive forces) is relatively rapid, and can take place between the spring tide periods which tend to re-suspend the material. This consolidation would reduce the amount of re-suspension that would actually occur, compared to what is predicted in the model, and would be therefore be expected to reduce the spatial extent of the Zones of Impact, particularly during summer and winter.



It should be noted that Scenarios 1–7 simulated for this round of assessment have not incorporated any mitigation measures, in order to provide a conservative overview of the potential impacts and identify which of the sensitive habitats may be at risk from the dredging. Various mitigation measures are available in order to reduce the level of impact at the sensitive receptors identified to be at risk (particularly Paroo Shoal, Hastings Shoal, Weeks Shoal, Gorgon Patch, Ward Reef and several small un-named shoals in their vicinity). Details of these measures are presented in the DSDMP (SKM 2010). If these measures are effectively implemented, then impacts at these sensitive receptors can be expected to be avoided or minimised.

For trenching along the proposed pipeline route, there is a potential for partial mortality impacts to the corals around Ashburton Island. Some of the seagrass area north of Ashburton Island, which falls within the proposed pipeline route, will also be impacted. These impacts are mainly due to the proximity of the proposed pipeline route, and the very conservative assessment based on using a CSD to undertake the trenching.



## 8 REFERENCES

DHI (2010a). Chevron Wheatstone LNG Development - *Tolerance Limits Report*. Draft Report prepared for Chevron Australia Pty. Ltd. by DHI Water and Environment (S) Pte. Ltd. May 2010.

DHI (2010b). Chevron Wheatstone LNG Development – *Dredge Plume Modelling Report*. Draft Report prepared for Chevron Australia Pty. Ltd. by DHI Water and Environment (M) Sdn. Bhd. May 2010.

English, S., Wilkinson, C., Baker, V. (1997). *Survey Manual for Tropical Marine Resources*. Second Edition, Australian Institute of Marine Science, Townsville. 1997.

EPA (2009). Environmental Assessment Guidelines for Protection of Benthic Primary Producer Habitat in Western Australia's Marine Environment (No. 3). Environmental Assessment Guideline prepared by the Western Australian Environmental Protection Authority (EPA), Perth, Western Australia. 41pp.

Erfteimeijer, P.L.A. and Lewis, R.R.R. (2006). "Environmental impacts of dredging on seagrasses: A review". *Marine Pollution Bulletin* 52: 1553-1572.

Erfteimeijer, P.L.A. and Riegl, B.M. (2009). "Environmental Impacts of Dredging on Corals – A Review". *Marine Pollution Bulletin* (submitted).

Fabricius, K.E. and Wolanski, E. (2000). "Rapid smothering of coral reef organisms by muddy marine snow". *Estuarine Coastal and Shelf Science* 50(1): 115-120.

Longstaff, B.J. and Dennison, W.C. (1999). "Seagrass survival during pulsed turbidity events: the effects of light deprivation on the seagrasses *Halodule pinifolia* and *Halophila ovalis*". *Aquatic Botany* 65: 105 – 121.

LWI (2009). Dredging and Disposal Plan. Report # EBR4454/0330/001. Prepared for Chevron by Lanier Wallingford International (LWI). December 2009.

MScience (2009). *Wheatstone LNG Development - Baseline Water Quality Assessment Report*. Report: MSA134R3. November 2009.

Philipp, E., and Fabricius, K. (2003). "Photophysiological stress in scleractinian corals in response to short-term sedimentation". *Journal of Experimental Marine Biology and Ecology* 287, 57–78.

SKM (2010). Wheatstone Dredging and Spoil Disposal Management Plan (DSDMP). Draft report prepared for Chevron by Sinclair Knight Merz.

A-1



***APPENDIX A***  
***Processed Model Results Based On MesoLAPS Winds***

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



A-2



## A.1 Dredging Scenario 1

### A.1.1 Summer-A, Realistic Spill Scenario

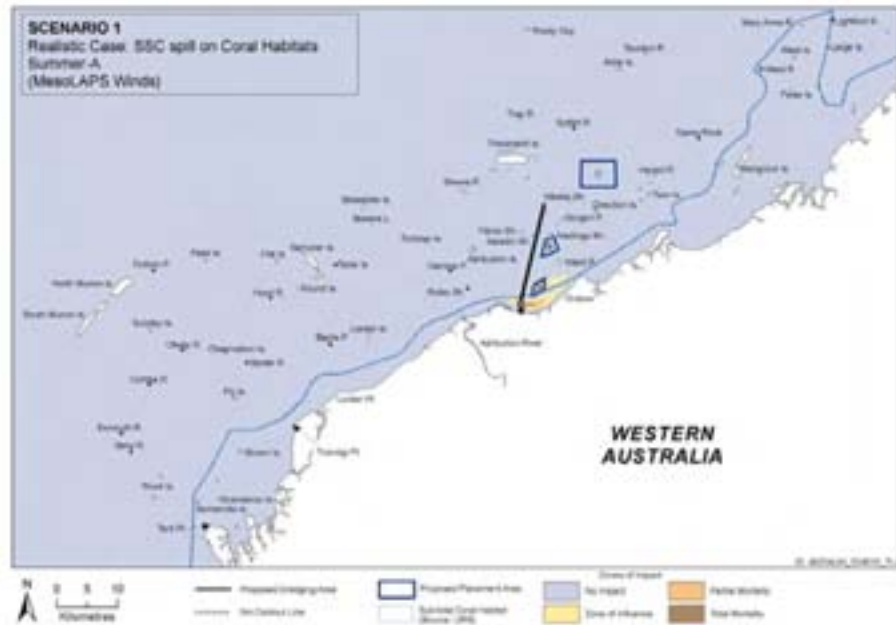


Figure A.1 Scenario 1, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

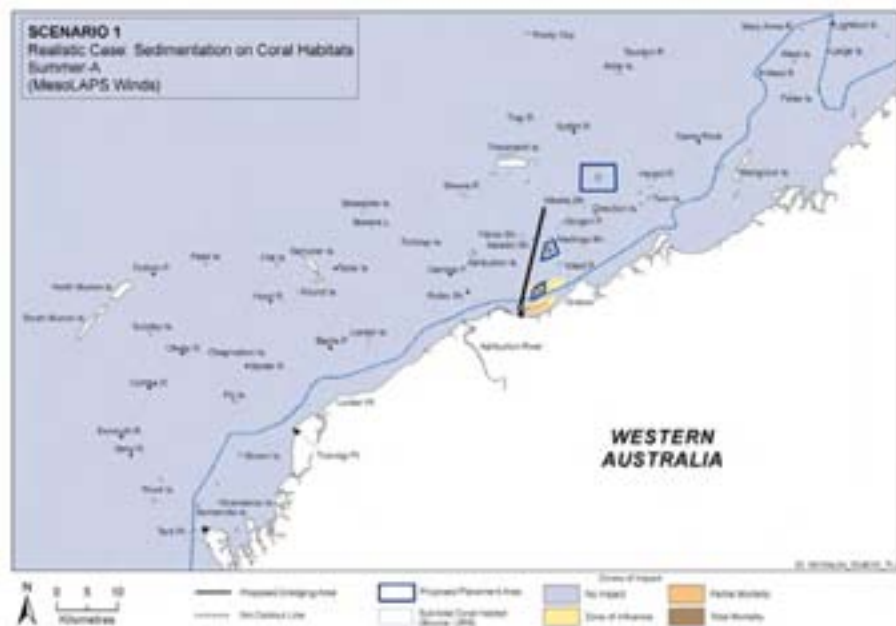


Figure A.2 Scenario 1, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

A-3

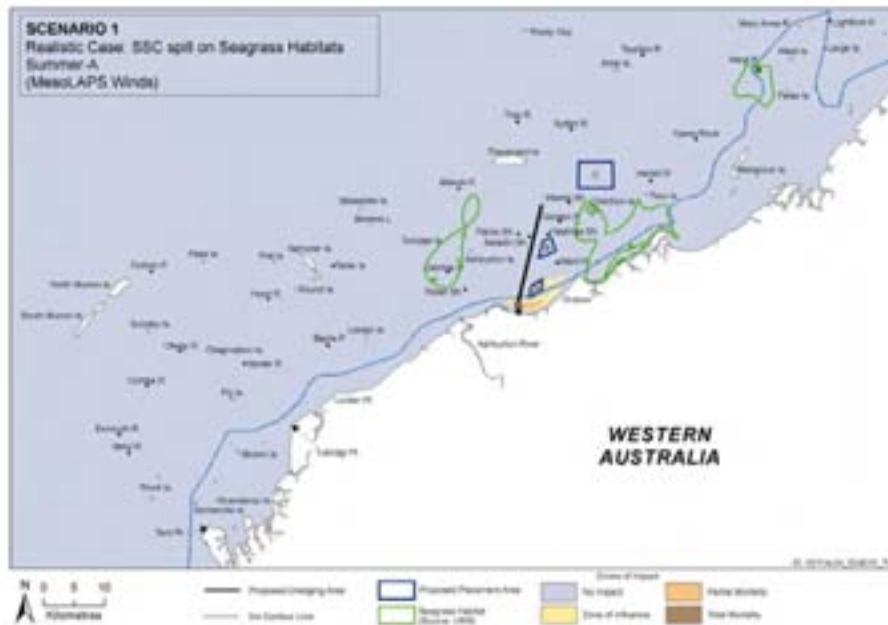


Figure A.3 Scenario 1, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.4 Scenario 1, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-4



Table A.1 Summary of Impacts at Sensitive Receptors for Scenario 1, Summer-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brewis Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.4	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.1	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.4	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.5	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.4	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.3	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.1.2 Summer-B, Realistic Spill Scenario**



Figure A.5 Scenario 1, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.6 Scenario 1, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-6

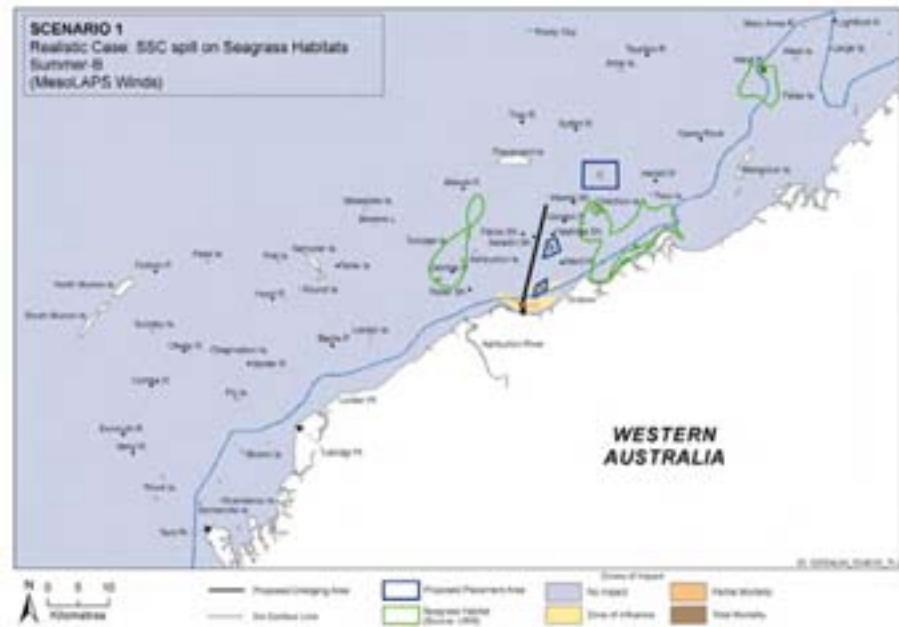


Figure A.7 Scenario 1, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

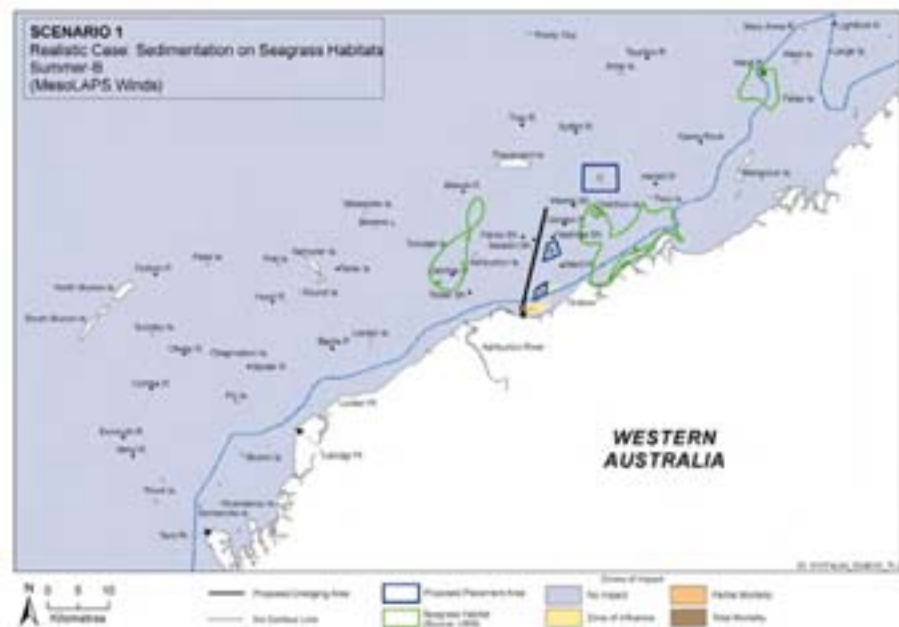


Figure A.8 Scenario 1, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Table A.2 Summary of Impacts at Sensitive Receptors for Scenario 1, Summer-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.2	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.6	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.3	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.4	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.3	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.4	0.3	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.3	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.1.3 Winter-A, Realistic Spill Scenario**



Figure A.9 Scenario 1, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

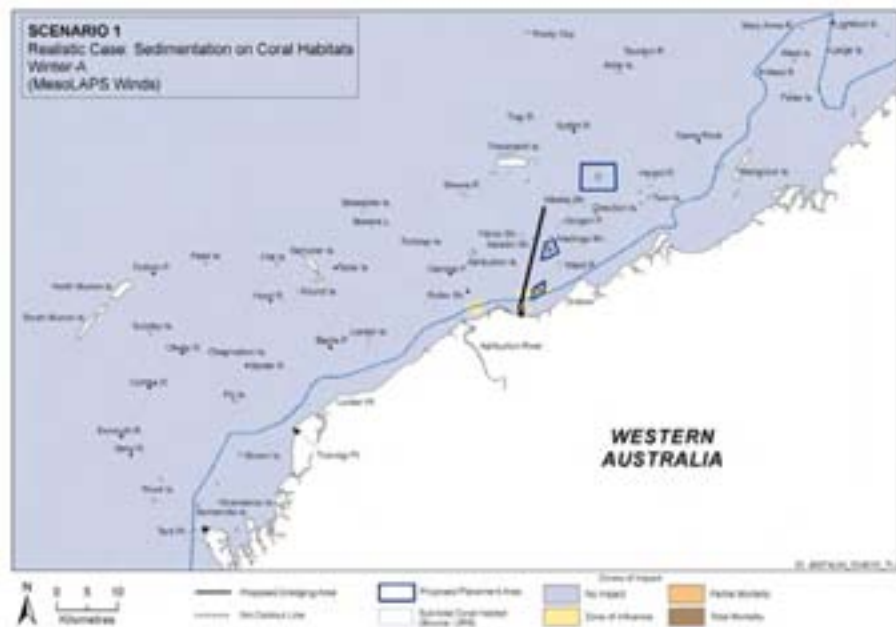


Figure A.10 Scenario 1, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

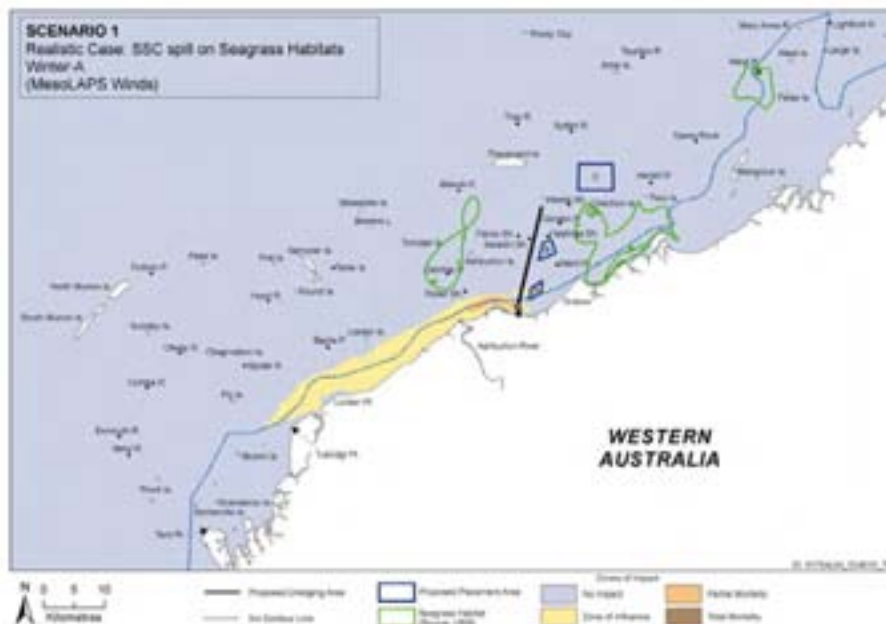


Figure A.11 Scenario 1, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.12 Scenario 1, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



A-10



Table A.3 Summary of Impacts at Sensitive Receptors for Scenario 1, Winter-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.1.4 Winter-B, Realistic Spill Scenario**



Figure A.13 Scenario 1, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

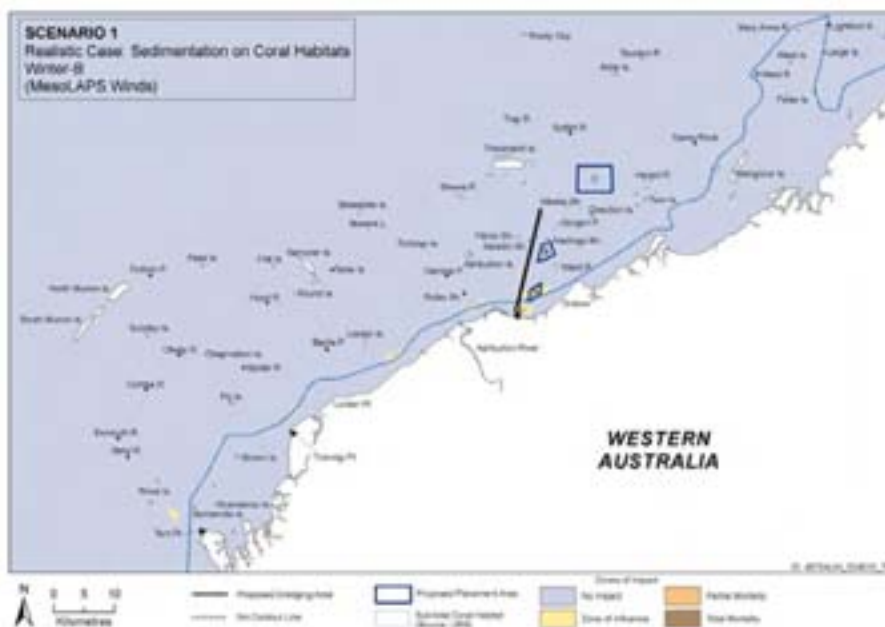


Figure A.14 Scenario 1, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-12

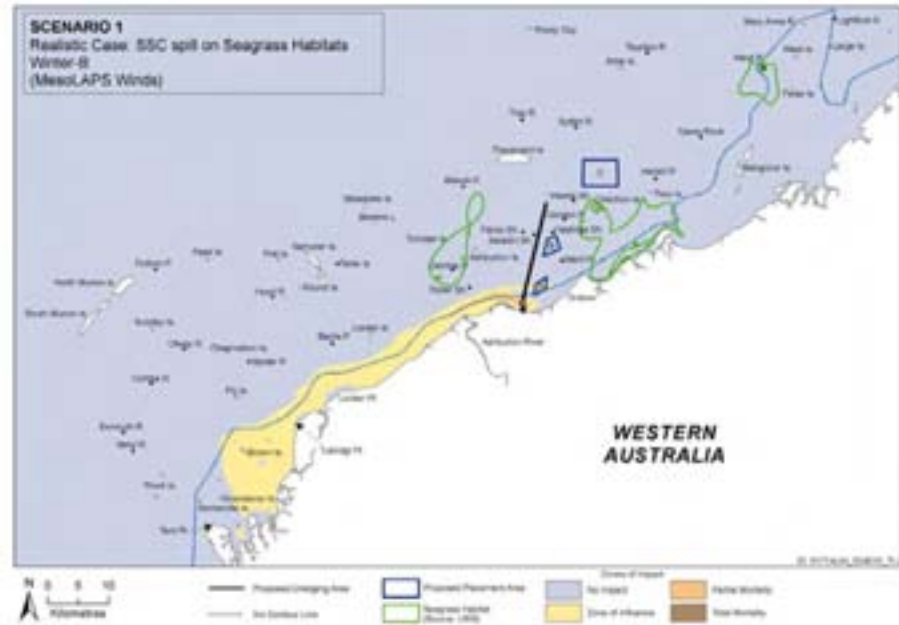


Figure A.15 Scenario 1, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.16 Scenario 1, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Table A.4 Summary of Impacts at Sensitive Receptors for Scenario 1, Winter-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608668	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.1.5 Transitional-A, Realistic Spill Scenario**

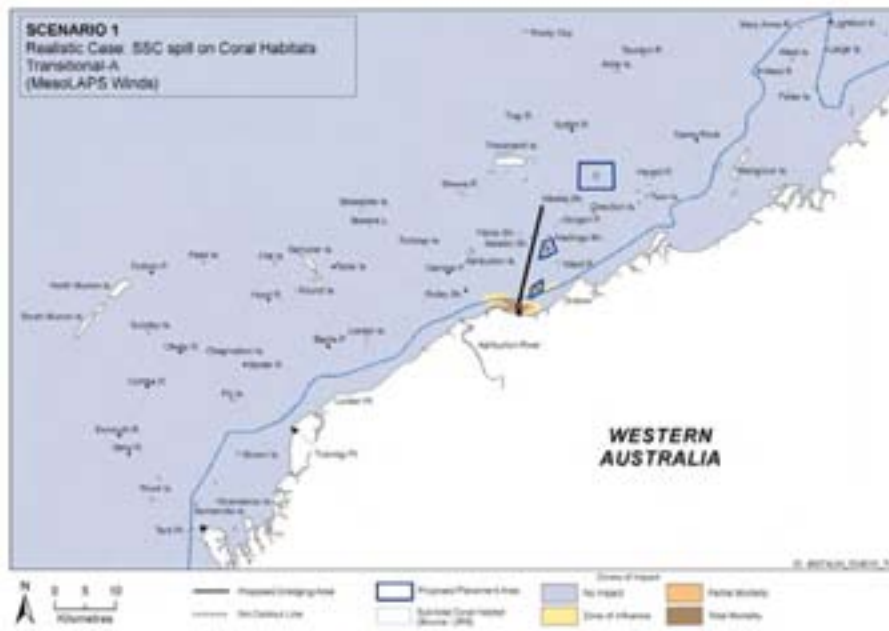


Figure A.17 Scenario 1, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

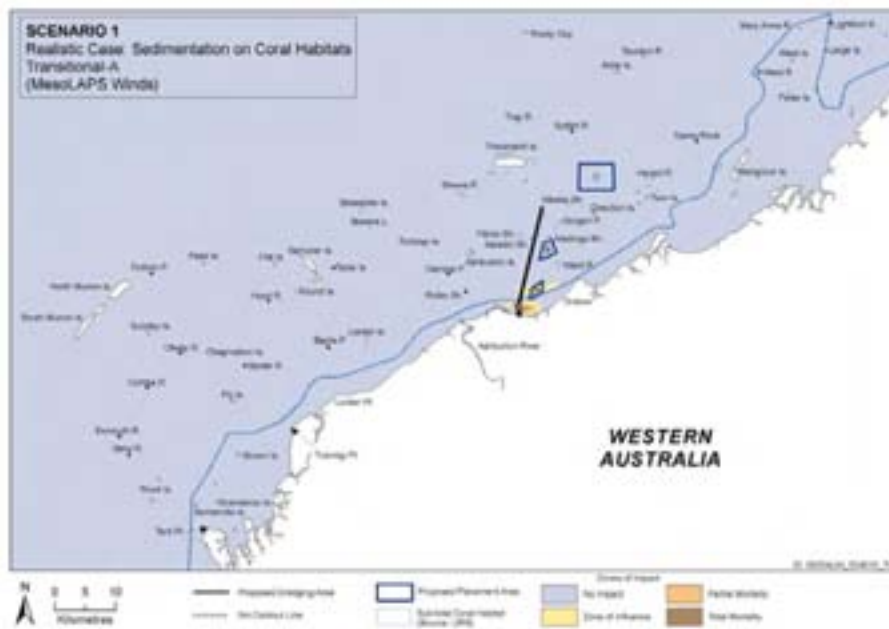


Figure A.18 Scenario 1, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-15

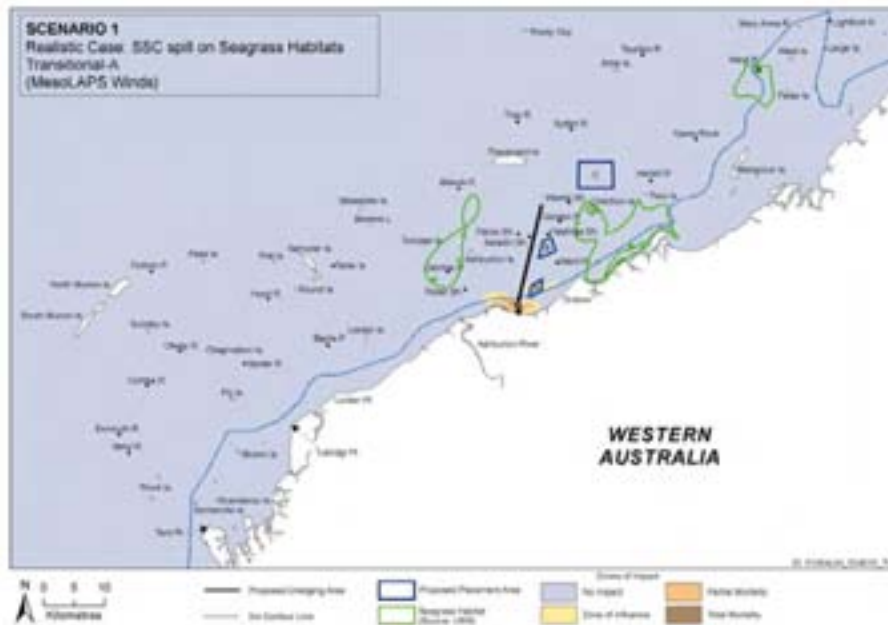


Figure A.19 Scenario 1, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.20 Scenario 1, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-16



Table A.5 Summary of Impacts at Sensitive Receptors for Scenario 1, Transitional-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.2	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.1.6 Transitional-B, Realistic Spill Scenario**



Figure A.21 Scenario 1, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.22 Scenario 1, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds



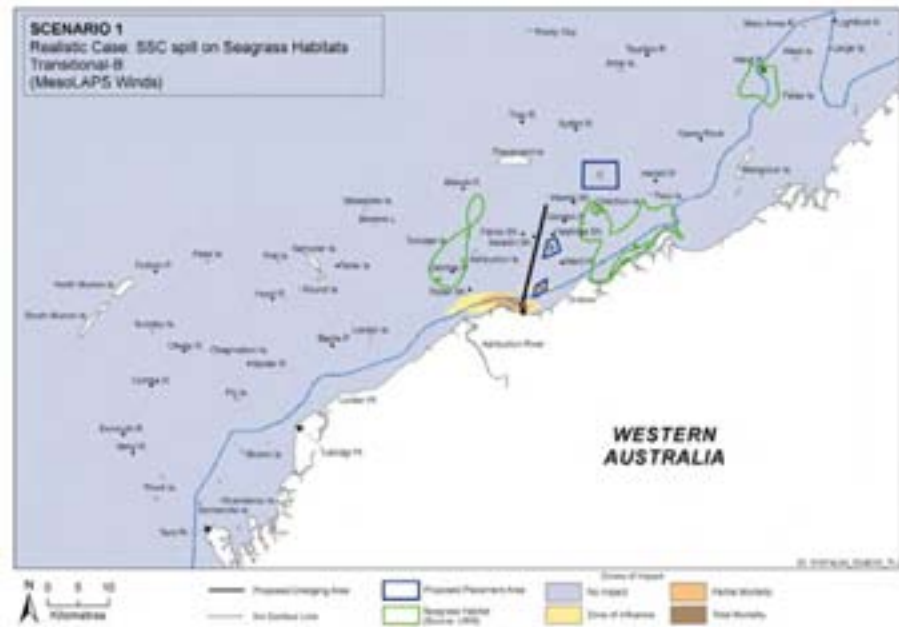


Figure A.23 Scenario 1, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.24 Scenario 1, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Table A.6 Summary of Impacts at Sensitive Receptors for Scenario 1, Transitional-B, Realistic Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.4	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.1.7 Summer-A, Worst Case Spill Scenario**

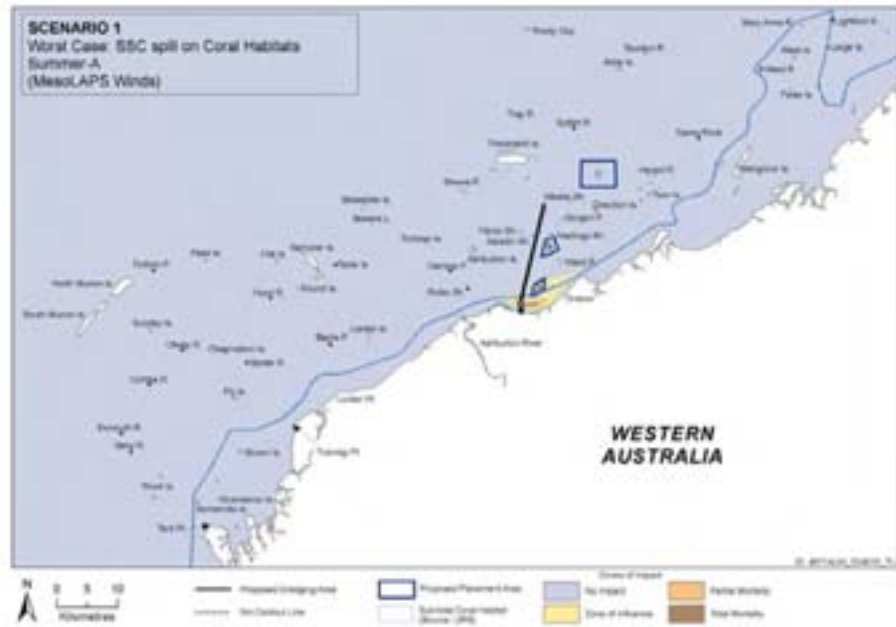


Figure A.25 Scenario 1, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

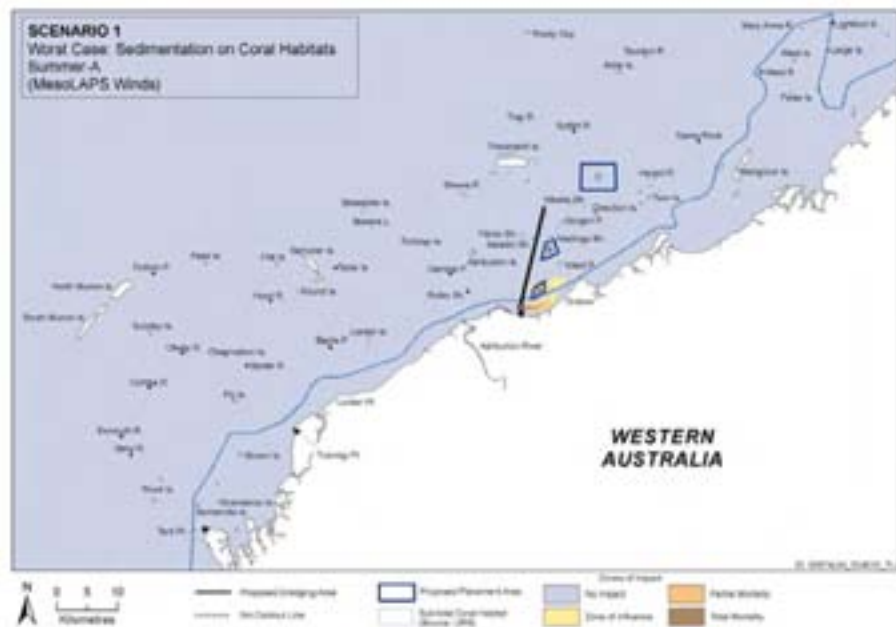


Figure A.26 Scenario 1, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

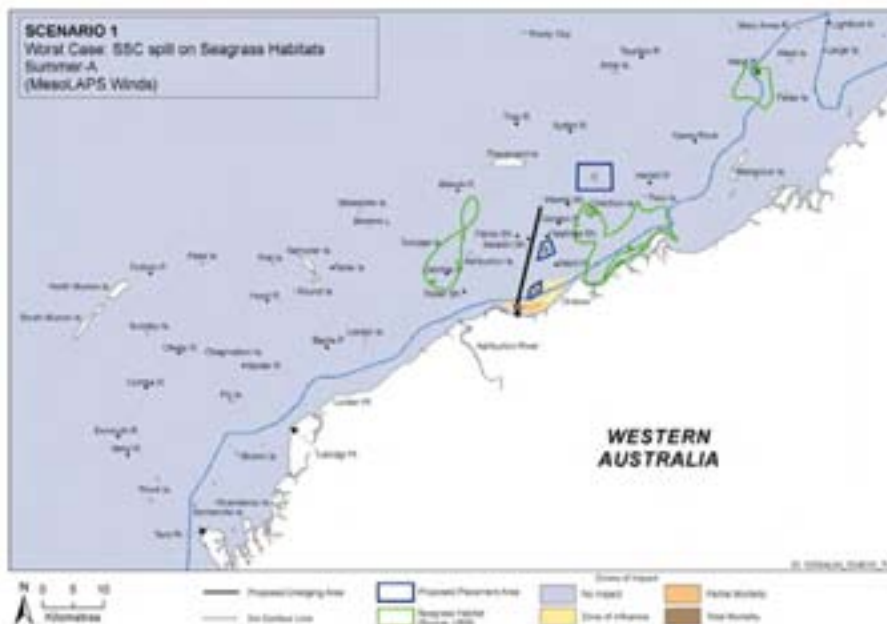


Figure A.27 Scenario 1, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

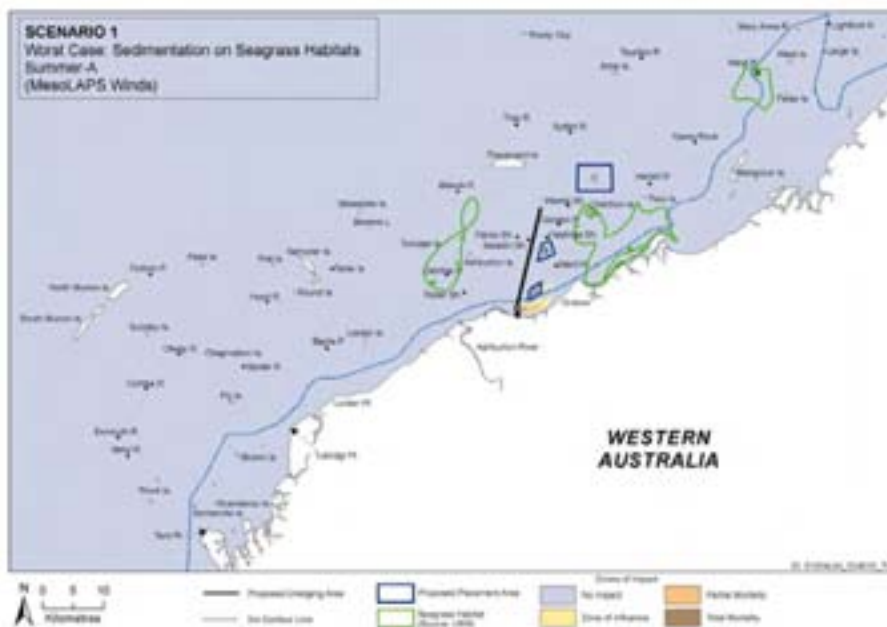


Figure A.28 Scenario 1, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-22



Table A.7 Summary of Impacts at Sensitive Receptors for Scenario 1, Summer-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brewis Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.4	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.1	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.4	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.5	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.4	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.3	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.1.8 Summer-B, Worst Case Spill Scenario**



Figure A.29 Scenario 1, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

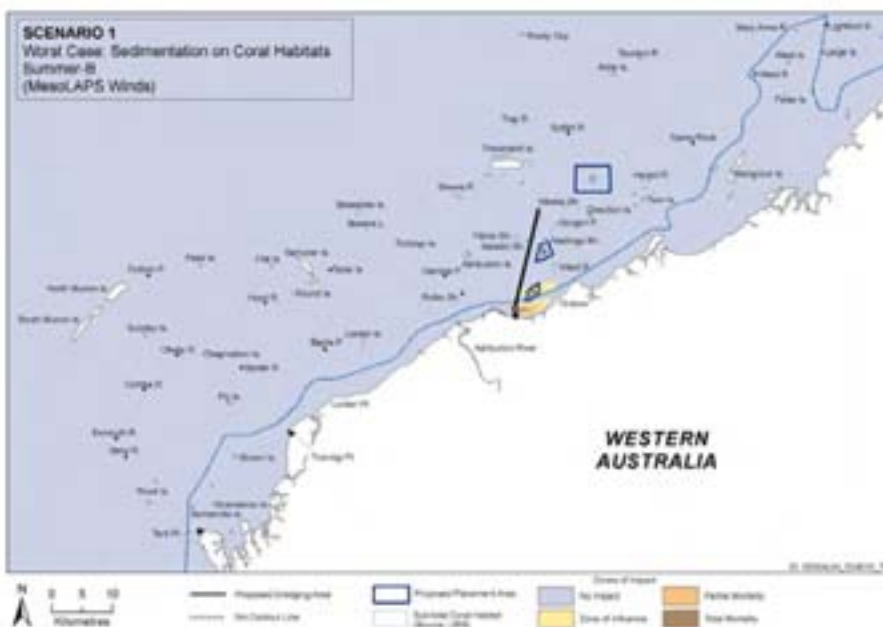


Figure A.30 Scenario 1, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

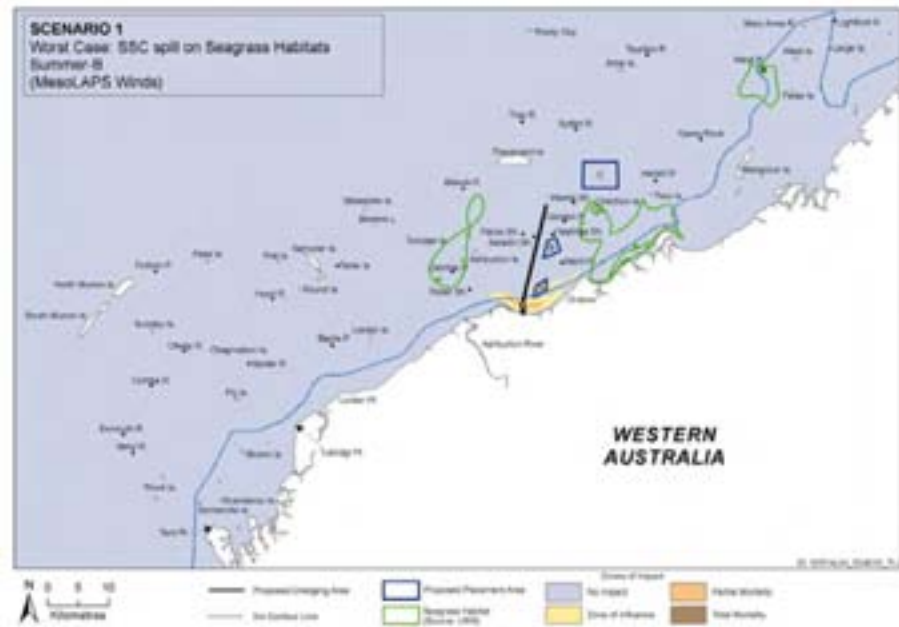


Figure A.31 Scenario 1, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

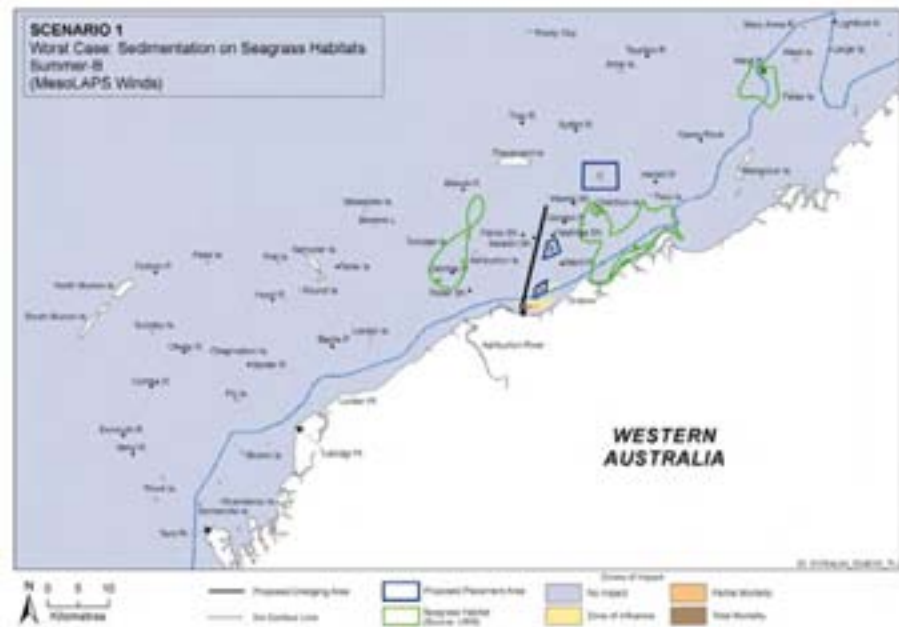


Figure A.32 Scenario 1, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



Table A.8 Summary of Impacts at Sensitive Receptors for Scenario 1, Summer-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.2	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.8	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.4	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.4	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.4	0.7	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.6	0.9	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.4	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**A.1.9 Winter-A, Worst Case Spill Scenario**

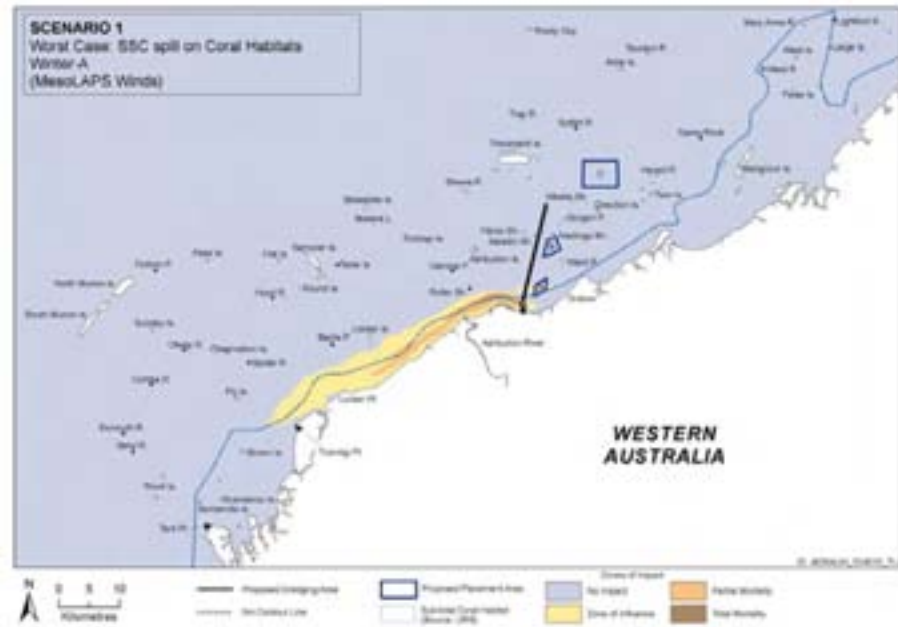


Figure A.33 Scenario 1, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

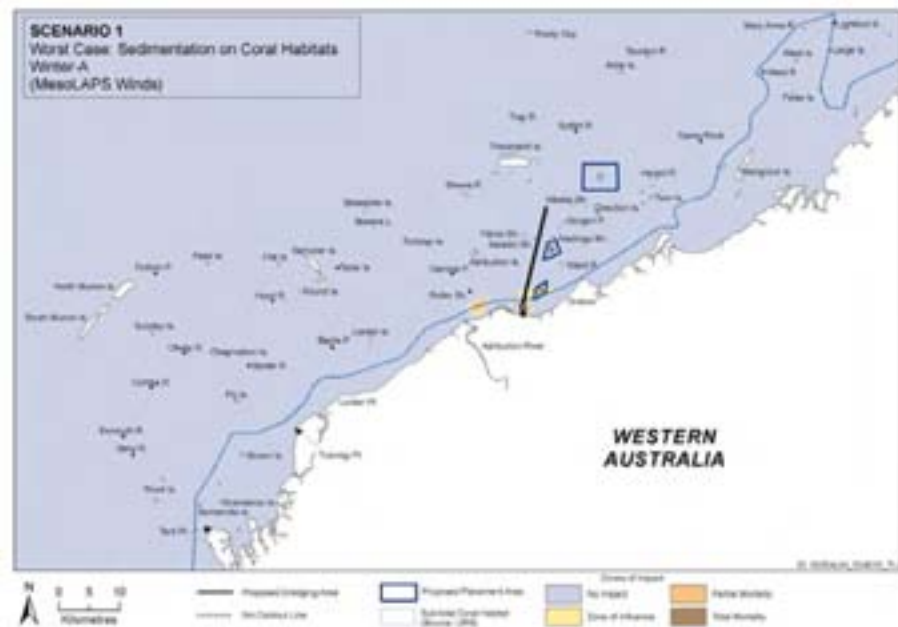


Figure A.34 Scenario 1, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

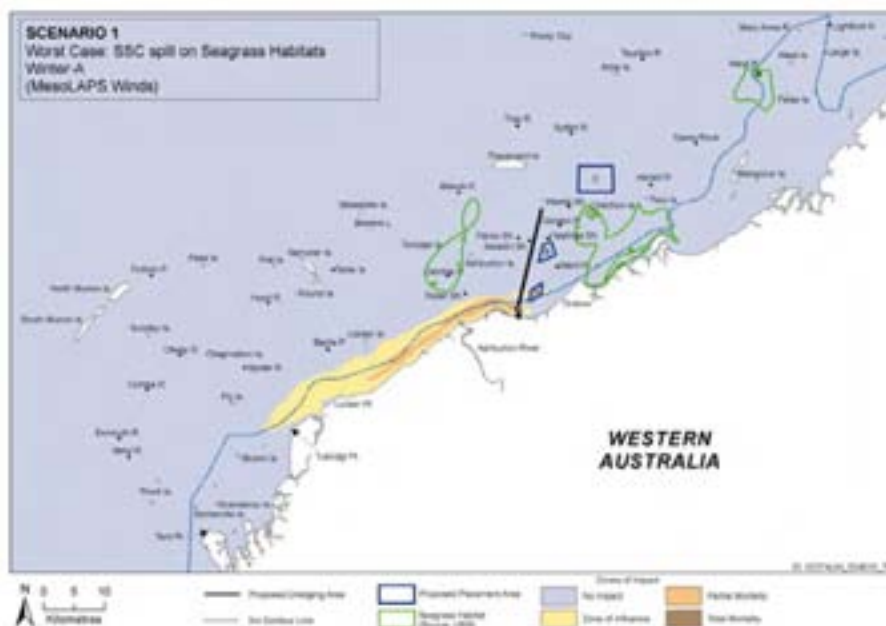


Figure A.35 Scenario 1, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

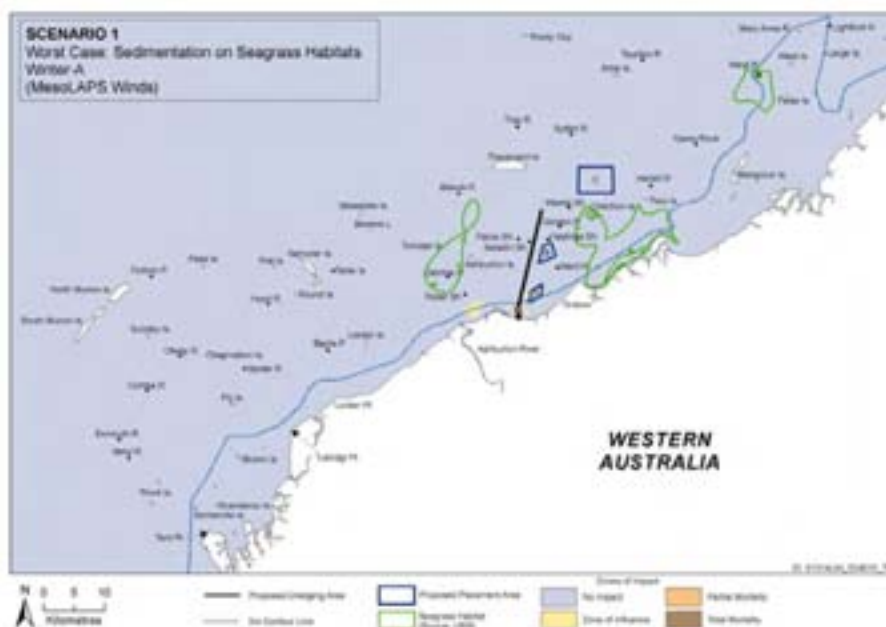


Figure A.36 Scenario 1, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Table A.9 Summary of Impacts at Sensitive Receptors for Scenario 1, Winter-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.1.10 Winter-B, Worst Case Spill Scenario**

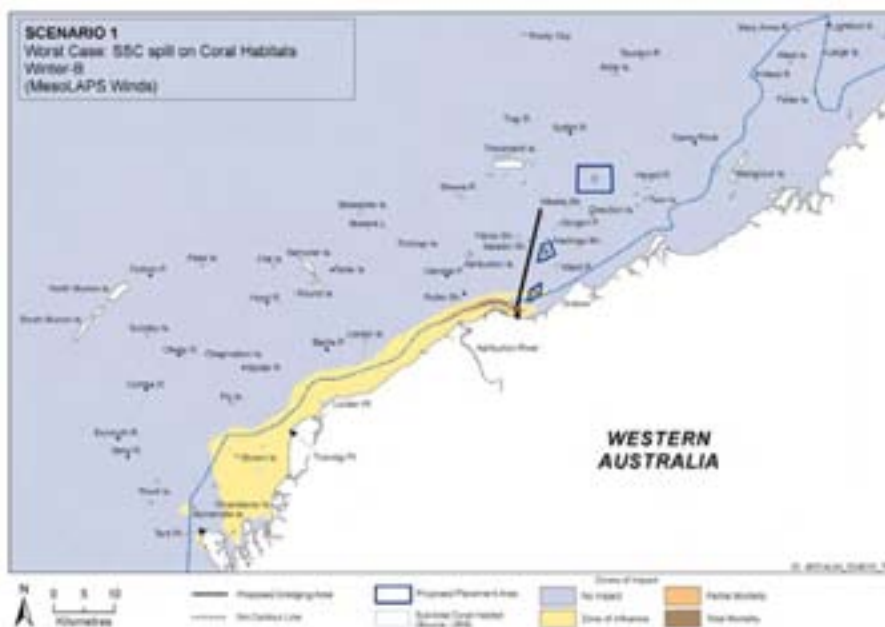


Figure A.37 Scenario 1, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

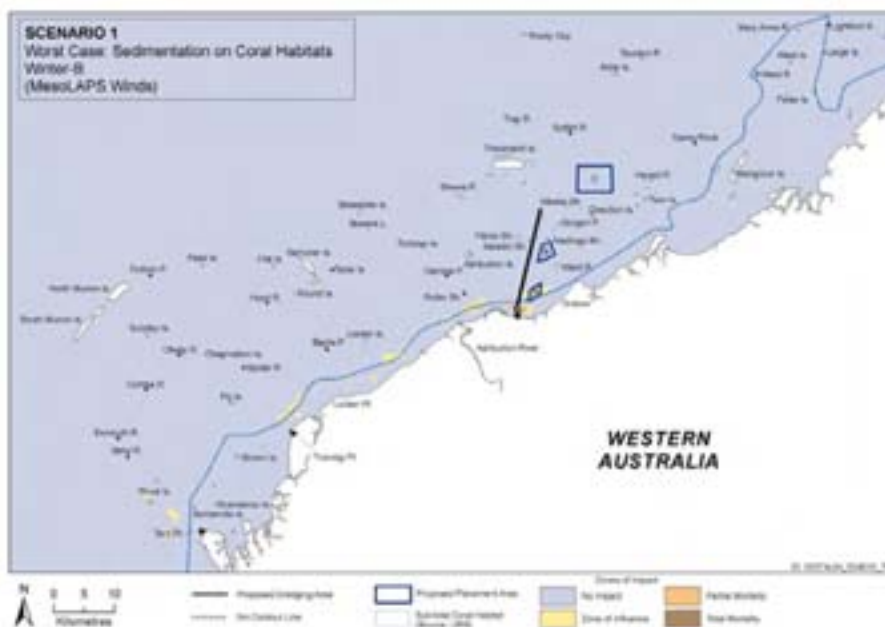


Figure A.38 Scenario 1, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-30

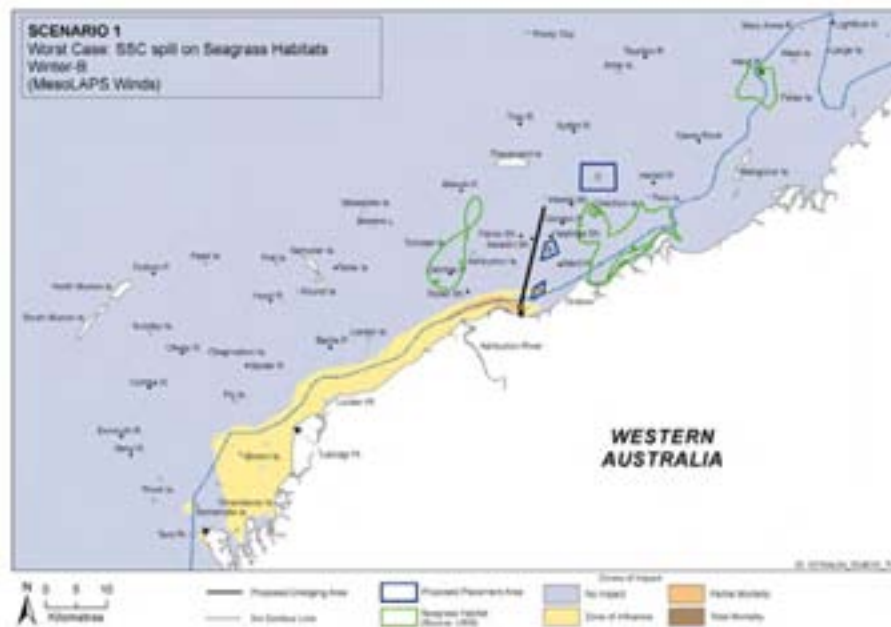


Figure A.39 Scenario 1, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.40 Scenario 1, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Table A.10 Summary of Impacts at Sensitive Receptors for Scenario 1, Winter-B, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.1.11 Transitional-A, Worst Case Spill Scenario**

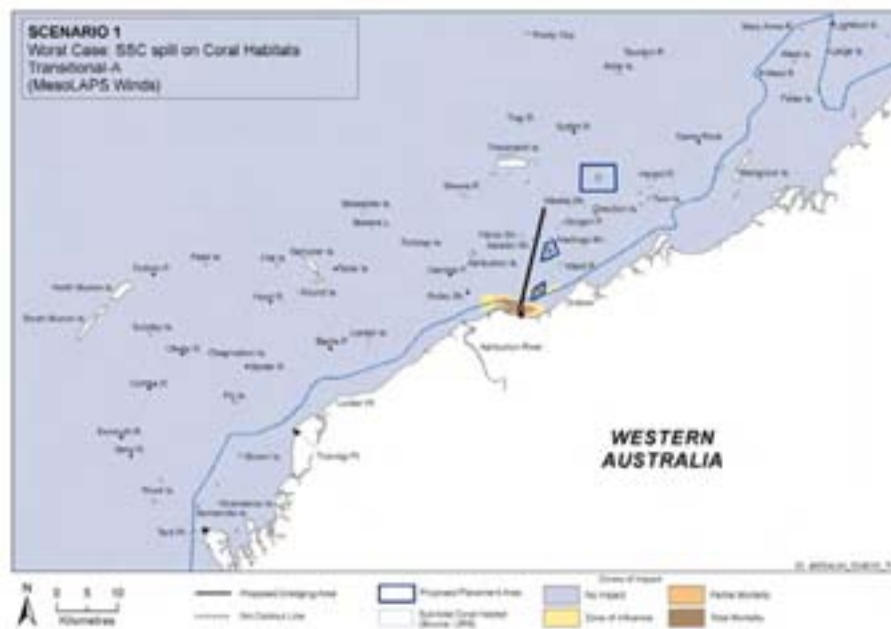


Figure A.41 Scenario 1, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

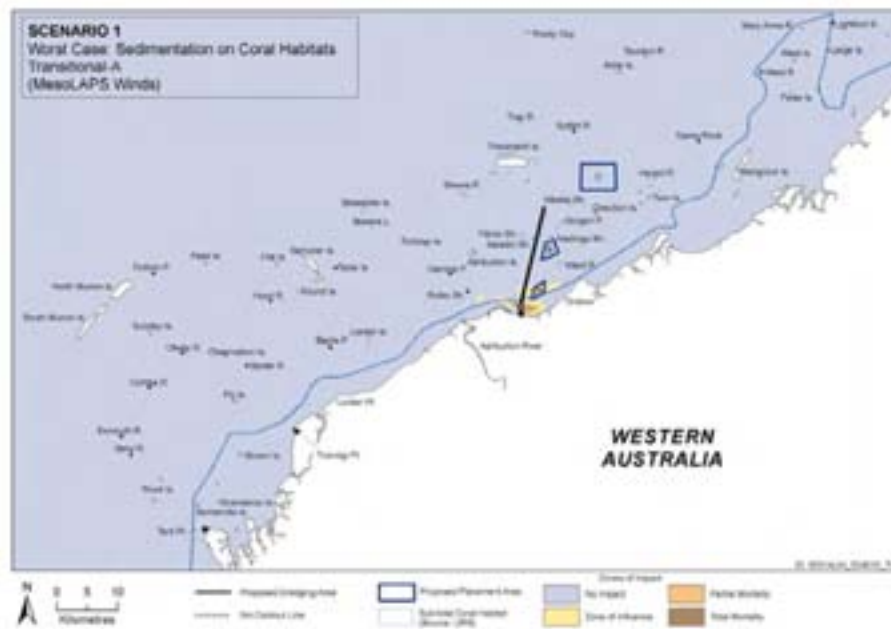


Figure A.42 Scenario 1, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

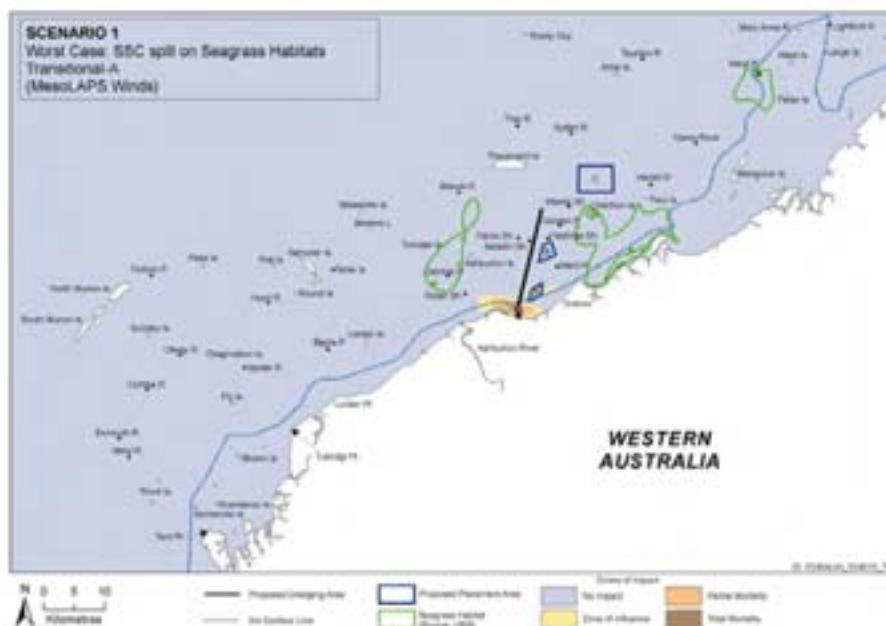


Figure A.43 Scenario 1, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

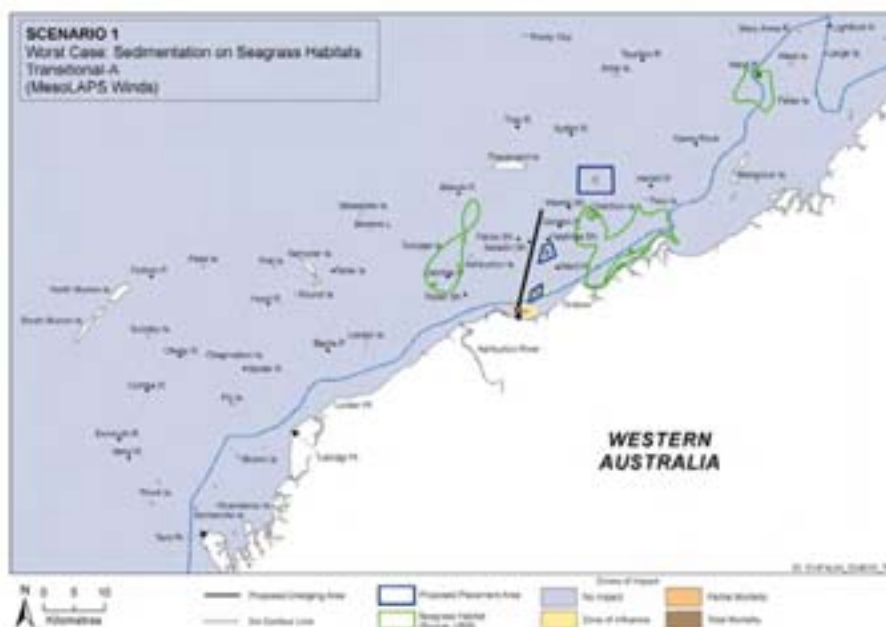


Figure A.44 Scenario 1, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



A-34



Table A.11 Summary of Impacts at Sensitive Receptors for Scenario 1, Transitional-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.1.12 Transitional-B, Worst Case Spill Scenario**



Figure A.45 Scenario 1, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

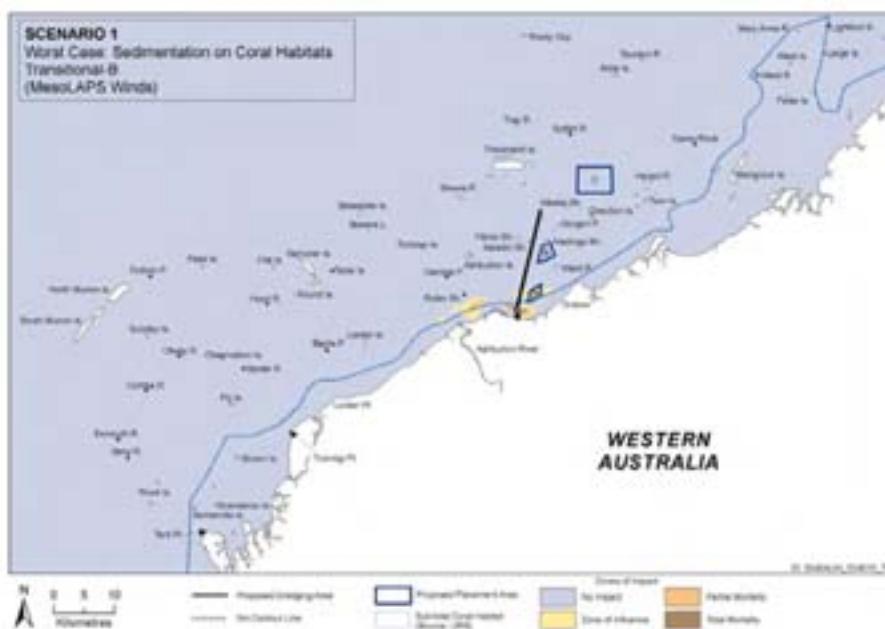


Figure A.46 Scenario 1, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-36

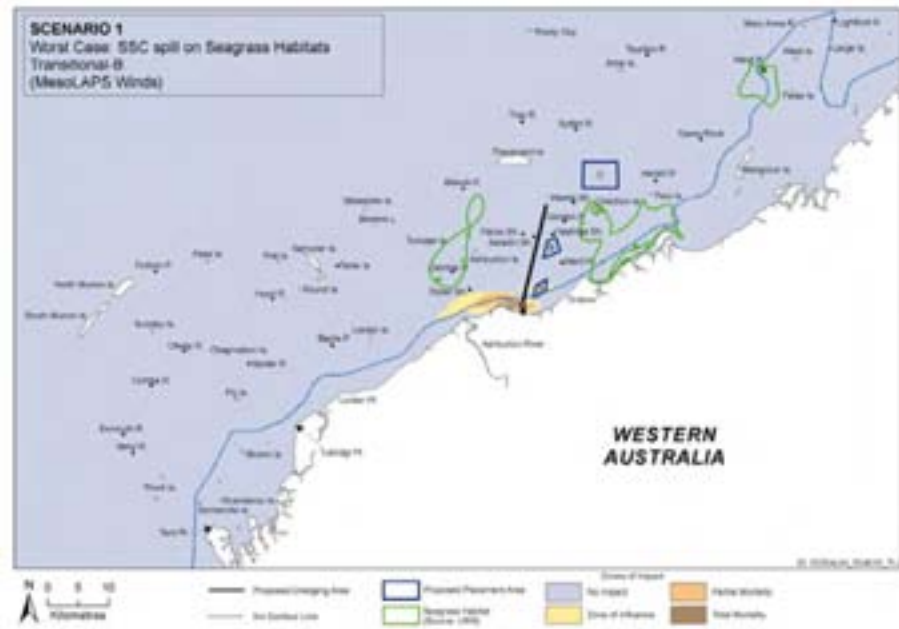


Figure A.47 Scenario 1, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

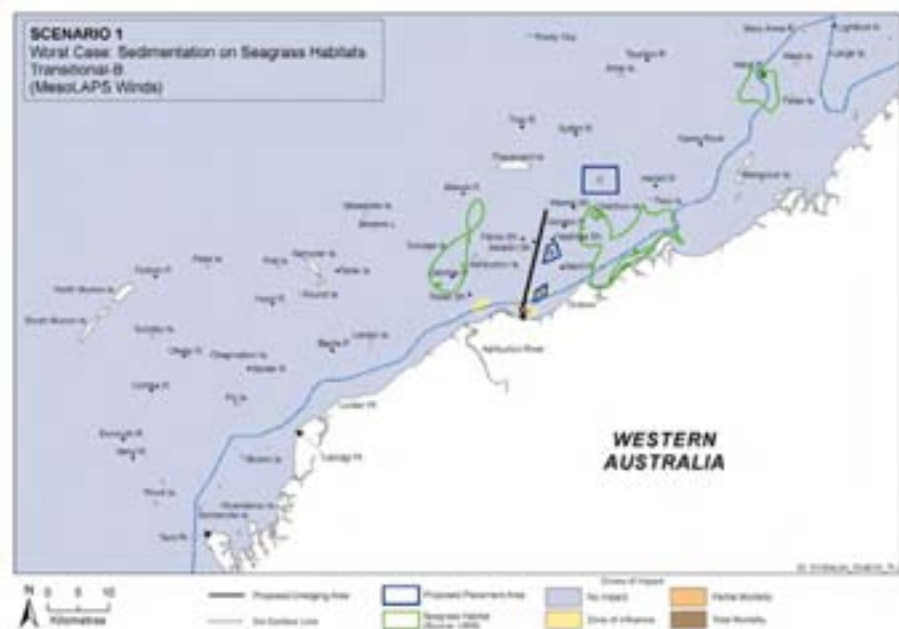


Figure A.48 Scenario 1, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



Table A.12 Summary of Impacts at Sensitive Receptors for Scenario 1, Transitional-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.5	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2 Dredging Scenario 2**

**A.2.1 Summer-A, Realistic Spill Scenario**

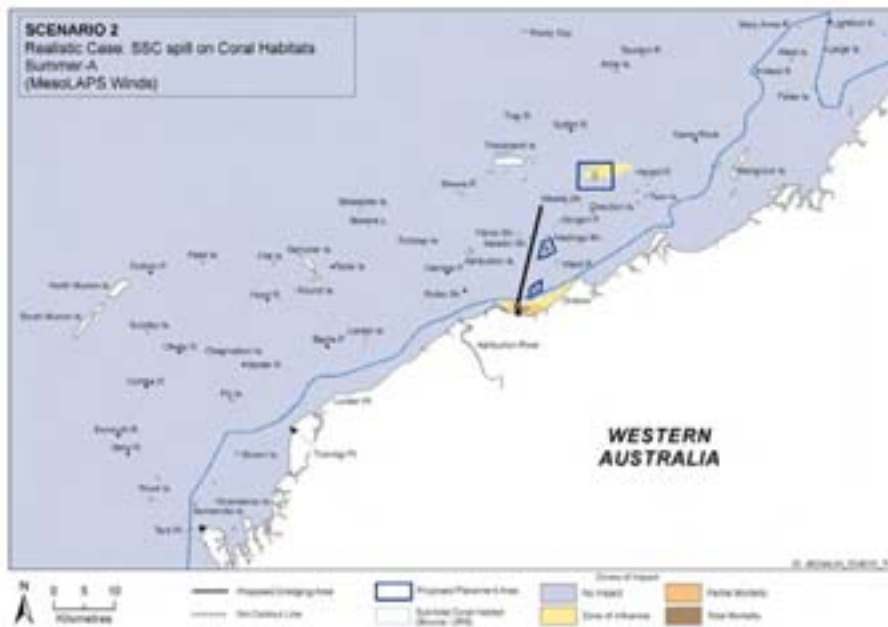


Figure A.49 Scenario 2, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

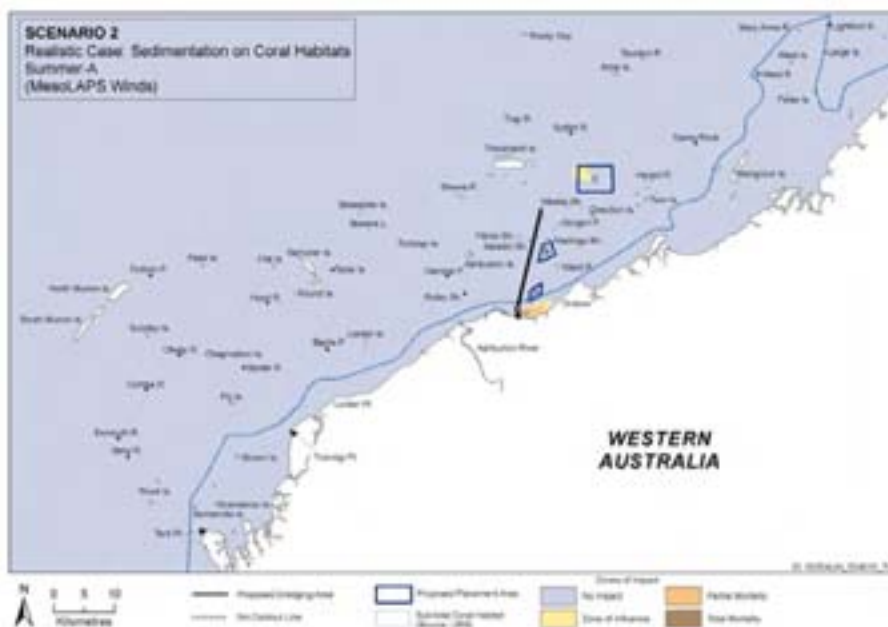


Figure A.50 Scenario 2, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

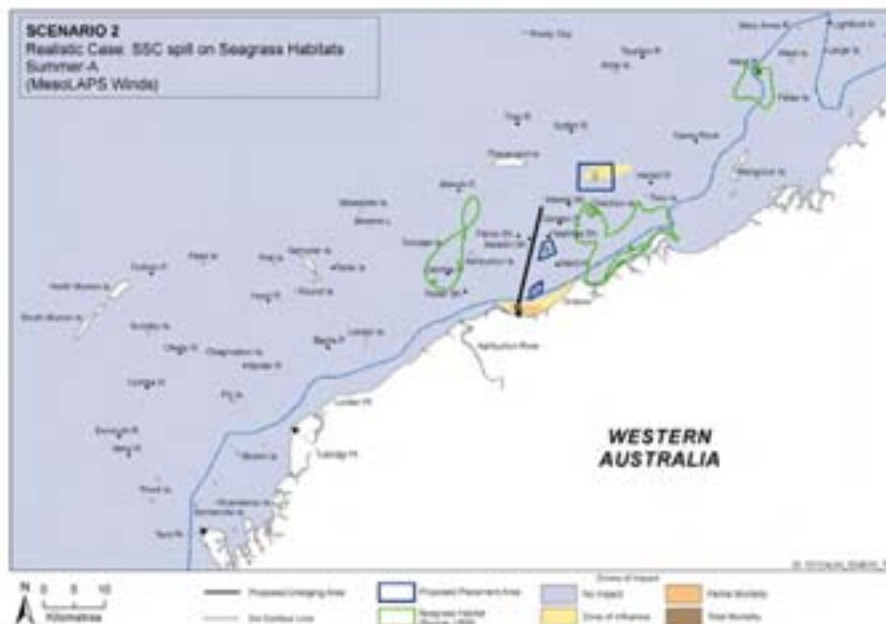


Figure A.51 Scenario 2, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

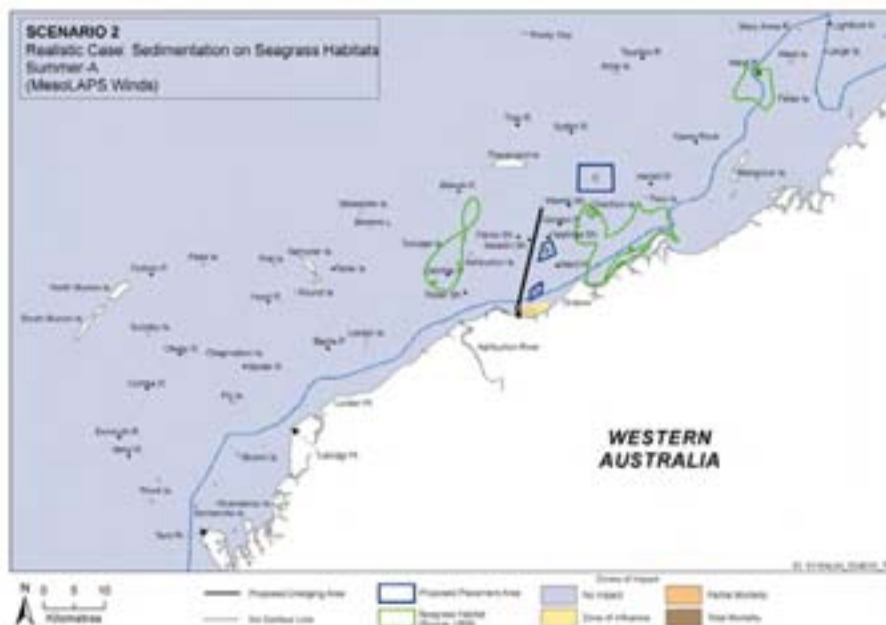


Figure A.52 Scenario 2, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Table A.13 Summary of Impacts at Sensitive Receptors for Scenario 2, Summer-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.1	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.5	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.7	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.6	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2.2 Summer-B, Realistic Spill Scenario**

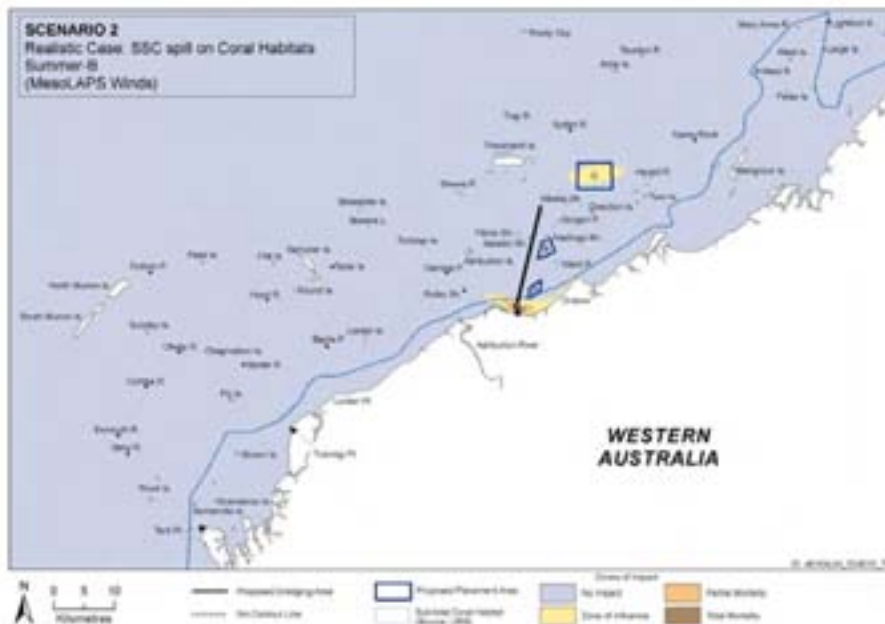


Figure A.53 Scenario 2, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.54 Scenario 2, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds



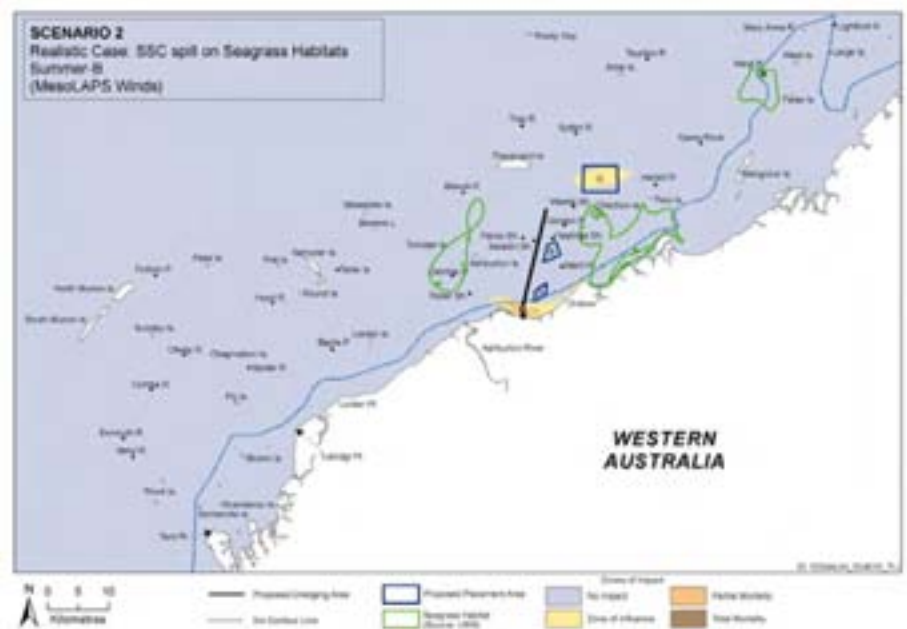


Figure A.55 Scenario 2, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

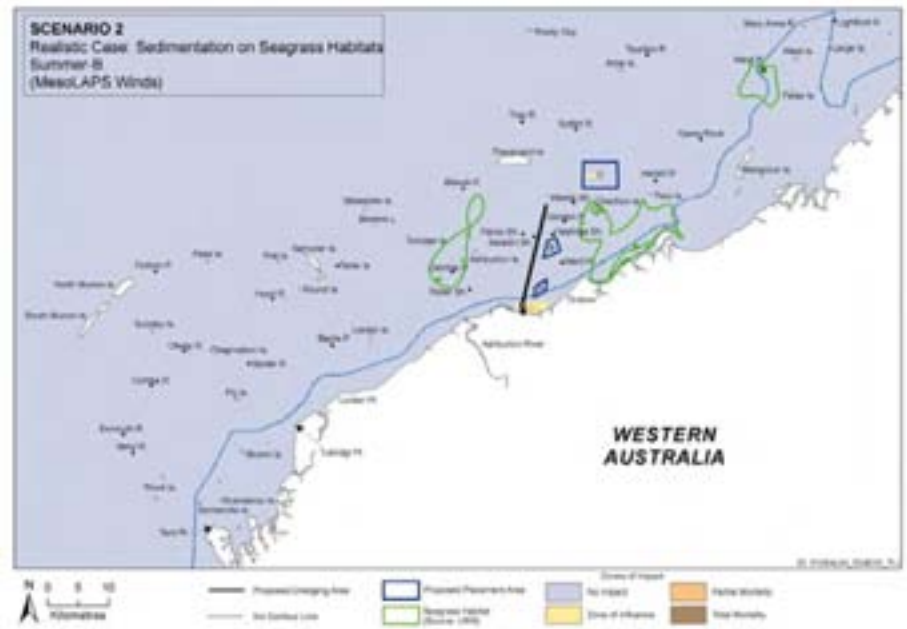


Figure A.56 Scenario 2, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Table A.14 Summary of Impacts at Sensitive Receptors for Scenario 2, Summer-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.4	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.1	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.3	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.5	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.5	0.1	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2.3 Winter-A, Realistic Spill Scenario**

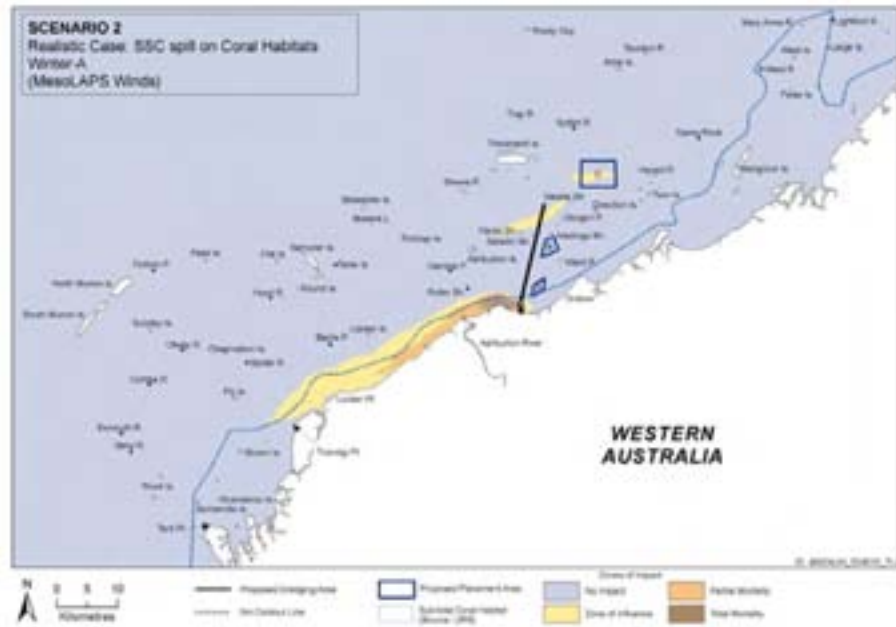


Figure A.57 Scenario 2, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

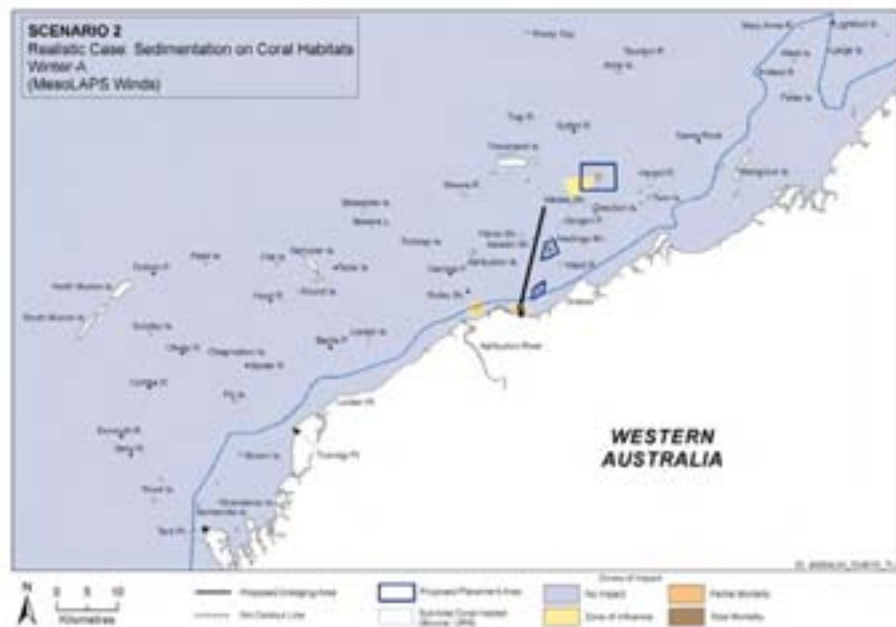


Figure A.58 Scenario 2, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

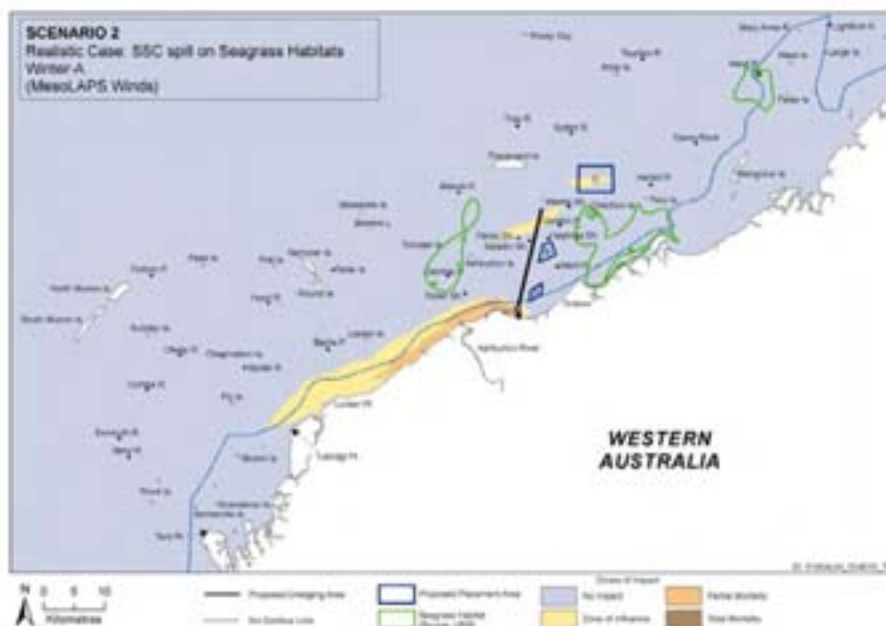


Figure A.59 Scenario 2, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

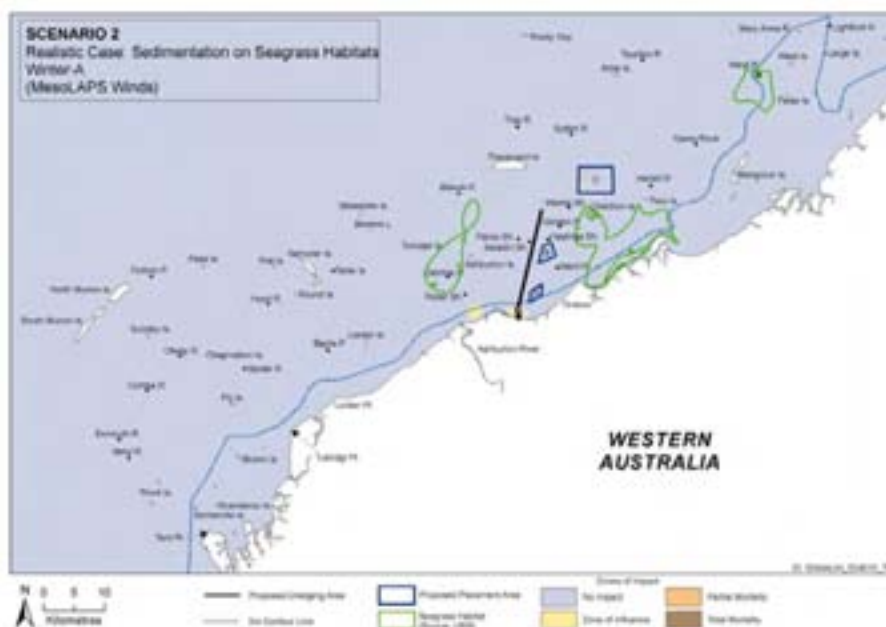


Figure A.60 Scenario 2, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Table A.15 Summary of Impacts at Sensitive Receptors for Scenario 2, Winter-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.5	2.2	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.2	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.7	3.6	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.6	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.3	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2.4 Winter-B, Realistic Spill Scenario**



Figure A.61 Scenario 2, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

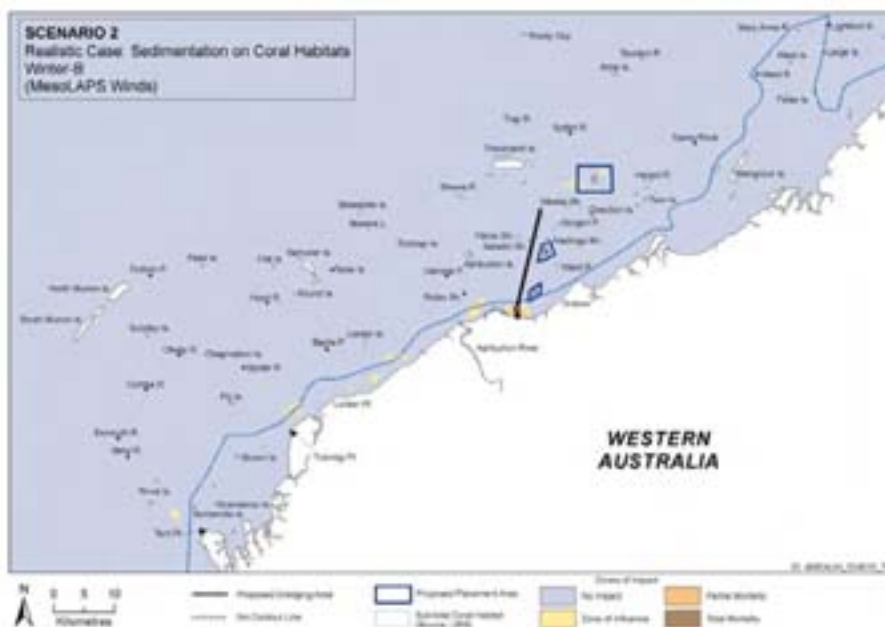


Figure A.62 Scenario 2, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

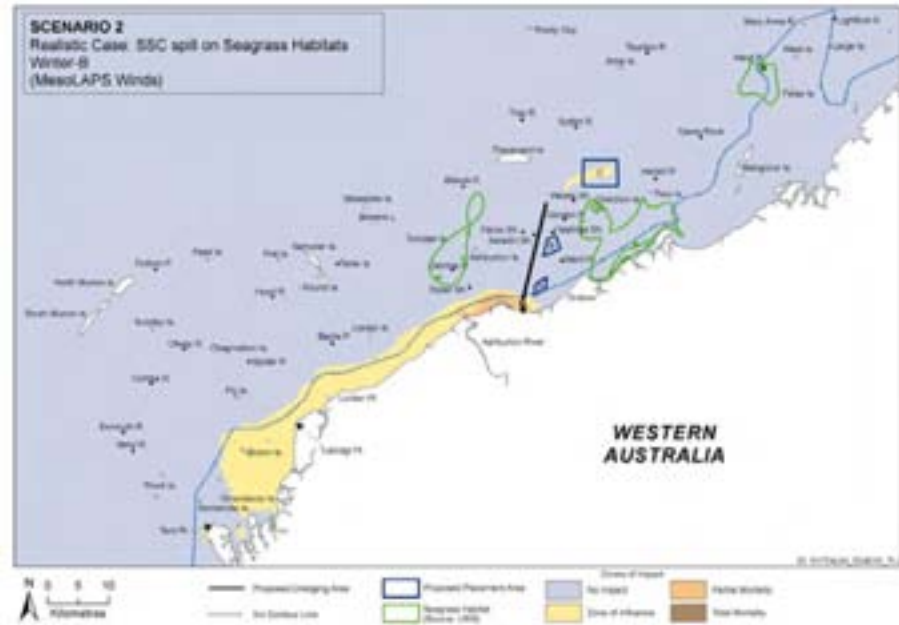


Figure A.63 Scenario 2, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.64 Scenario 2, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Table A.16 Summary of Impacts at Sensitive Receptors for Scenario 2, Winter-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.6	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.3	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.9	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.4	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.8	0.1	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.7	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**A.2.5 Transitional-A, Realistic Spill Scenario**

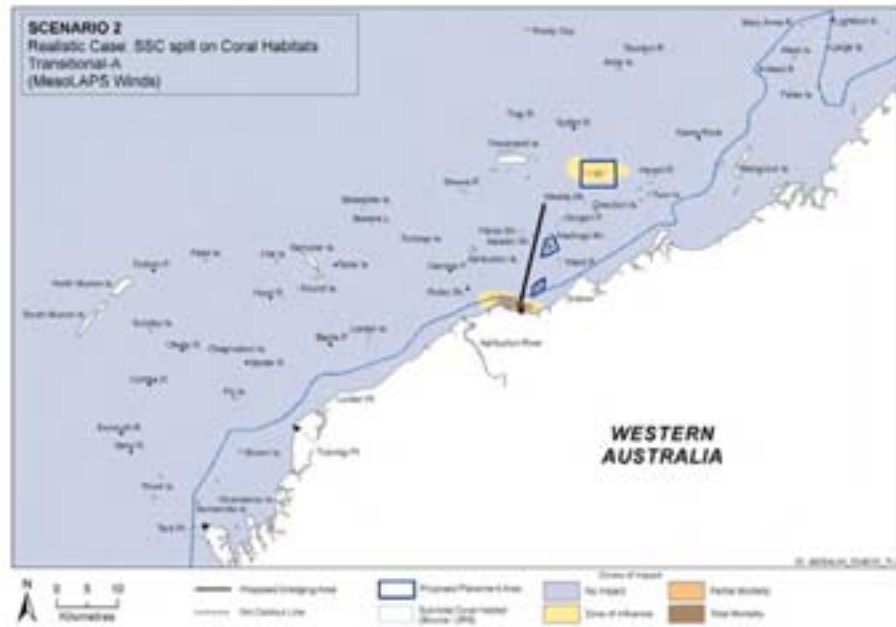


Figure A.65 Scenario 2, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

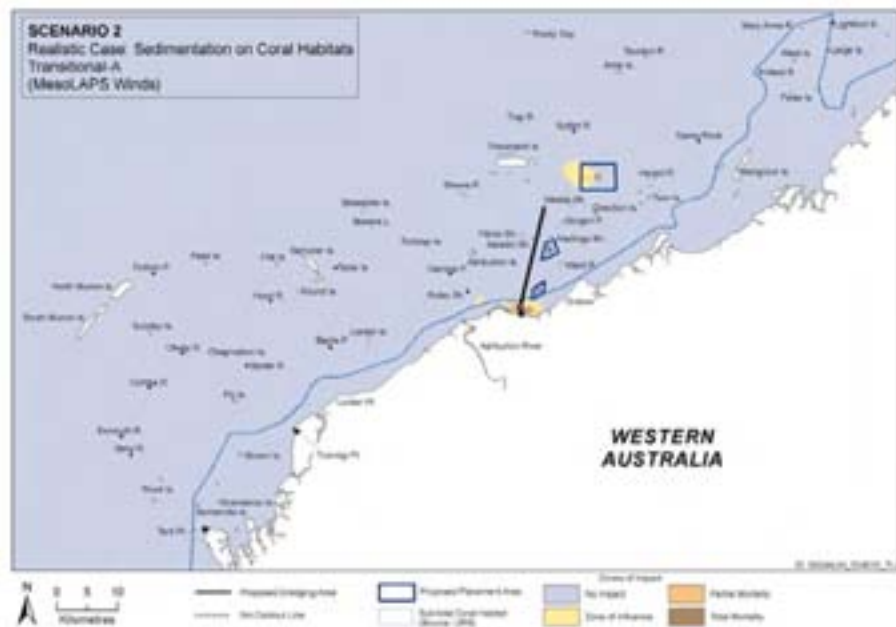


Figure A.66 Scenario 2, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

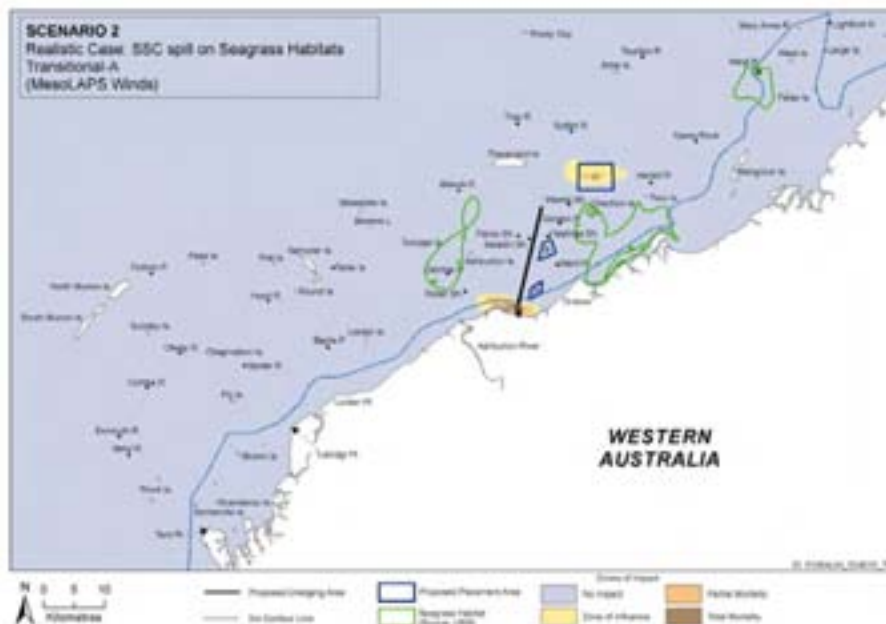


Figure A.67 Scenario 2, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.68 Scenario 2, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Table A.17 Summary of Impacts at Sensitive Receptors for Scenario 2, Transitional-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.1	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2.6 Transitional-B, Realistic Spill Scenario**



Figure A.69 Scenario 2, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.70 Scenario 2, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

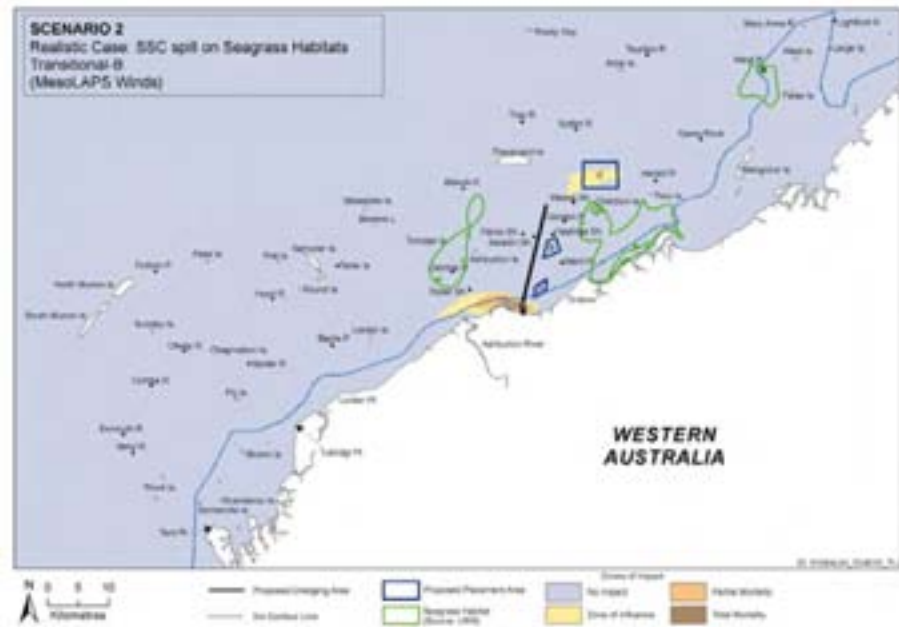


Figure A.71 Scenario 2, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.72 Scenario 2, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Table A.18 Summary of Impacts at Sensitive Receptors for Scenario 2, Transitional-B, Realistic Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.1	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.3	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.1	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.5	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.5	0.3	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.2	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2.7 Summer-A, Worst Case Spill Scenario**

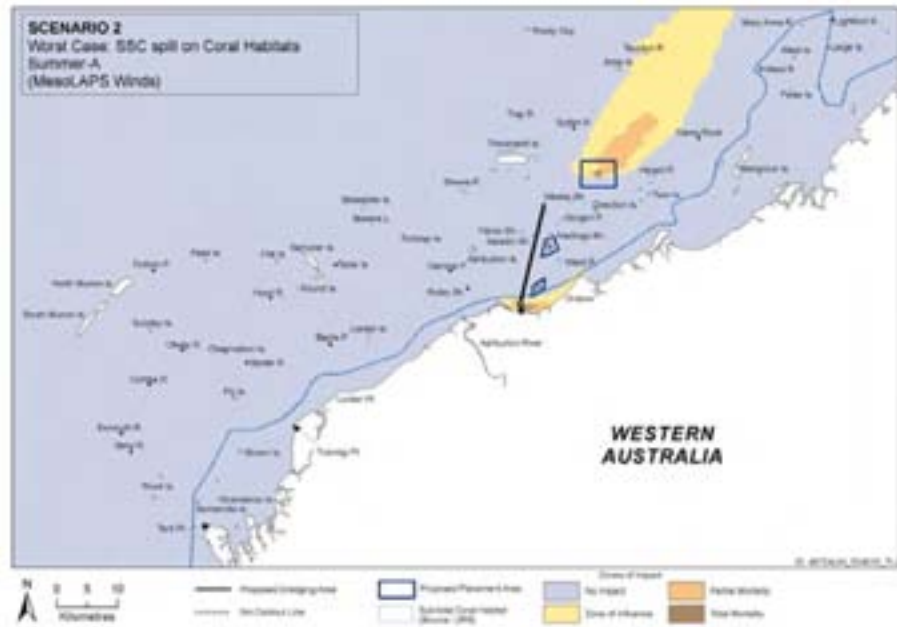


Figure A.73 Scenario 2, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

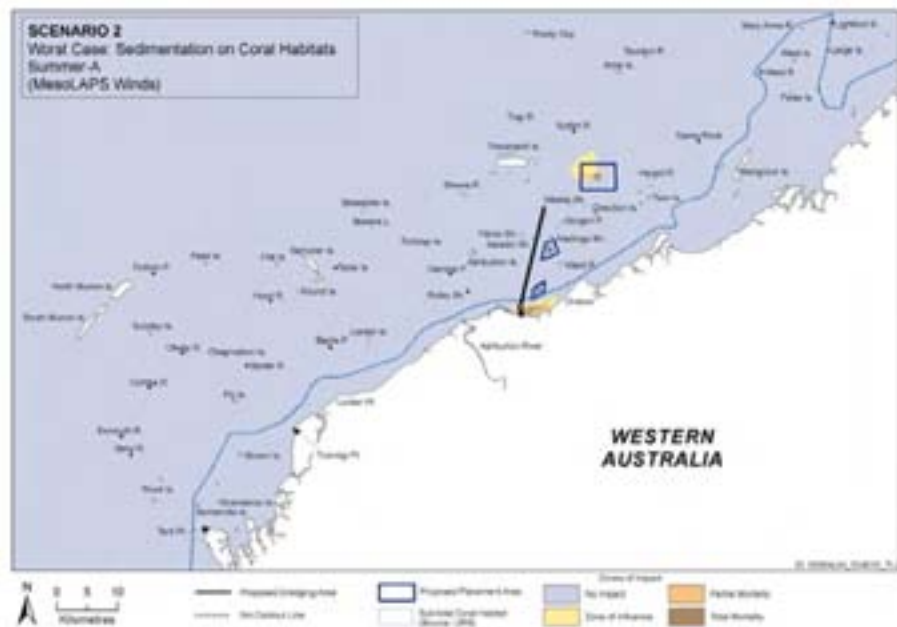


Figure A.74 Scenario 2, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

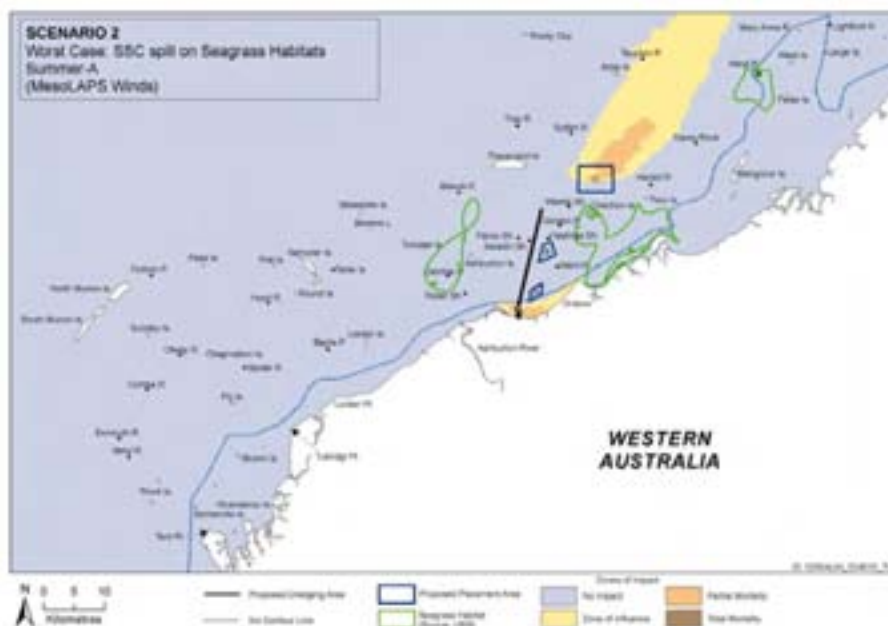


Figure A.75 Scenario 2, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.76 Scenario 2, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds





Table A.19 Summary of Impacts at Sensitive Receptors for Scenario 2, Summer-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.2	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.1	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.5	8.3	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	1.1	0.6	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.9	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2.8 Summer-B, Worst Case Spill Scenario**

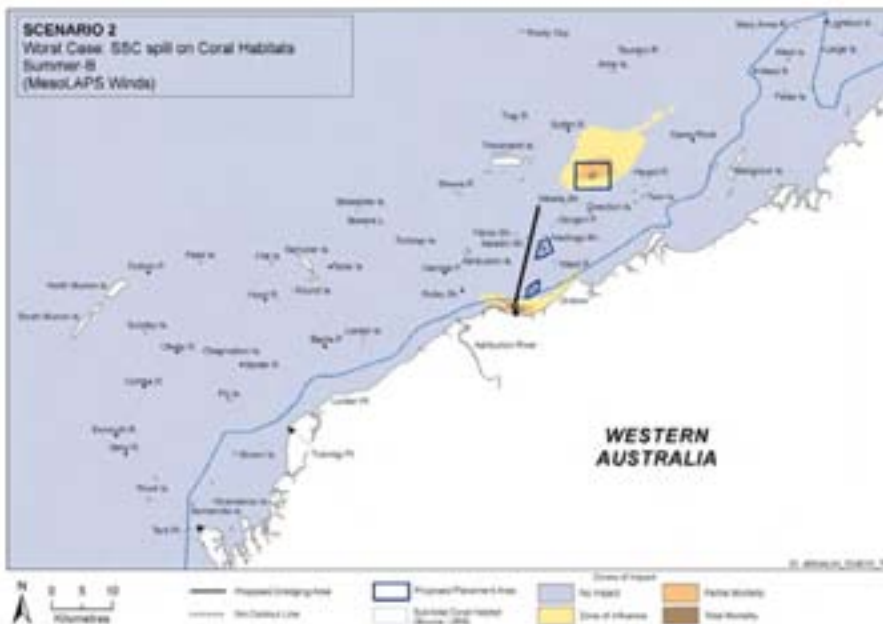


Figure A.77 Scenario 2, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

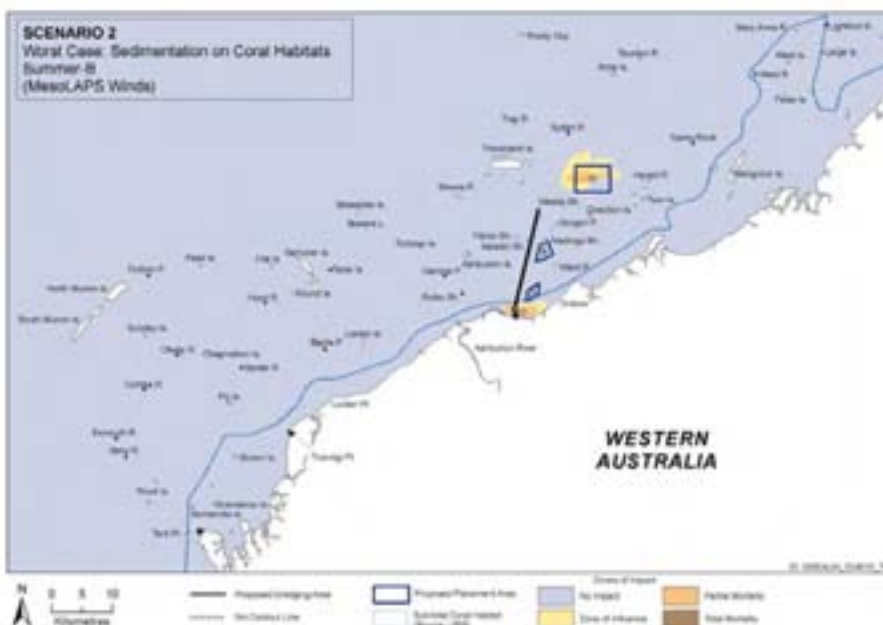


Figure A.78 Scenario 2, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

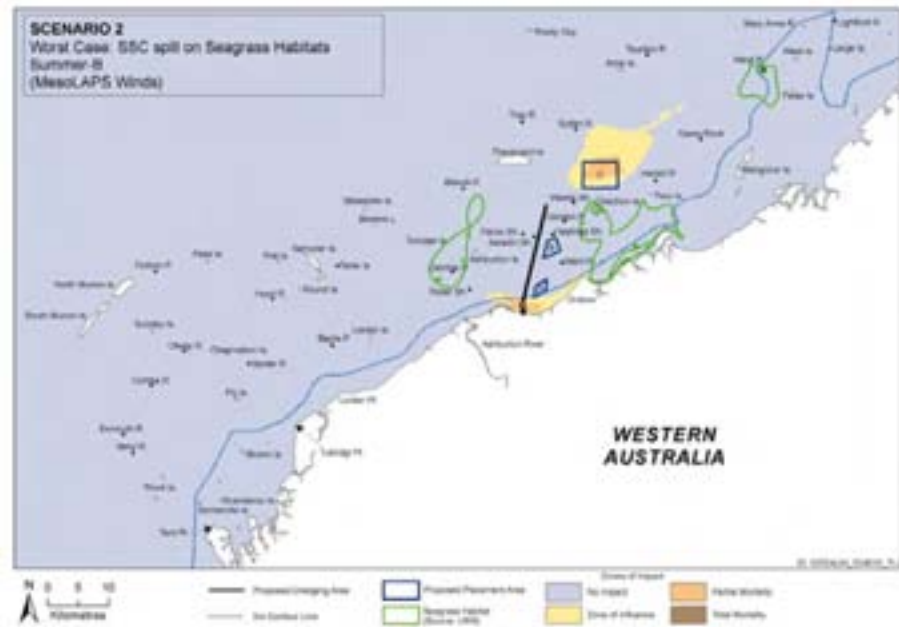


Figure A.79 Scenario 2, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.80 Scenario 2, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



Table A.20 Summary of Impacts at Sensitive Receptors for Scenario 2, Summer-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.5	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.2	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.5	0.0	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	0.9	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.7	1.3	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.7	1.5	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.2	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2.9 Winter-A, Worst Case Spill Scenario**

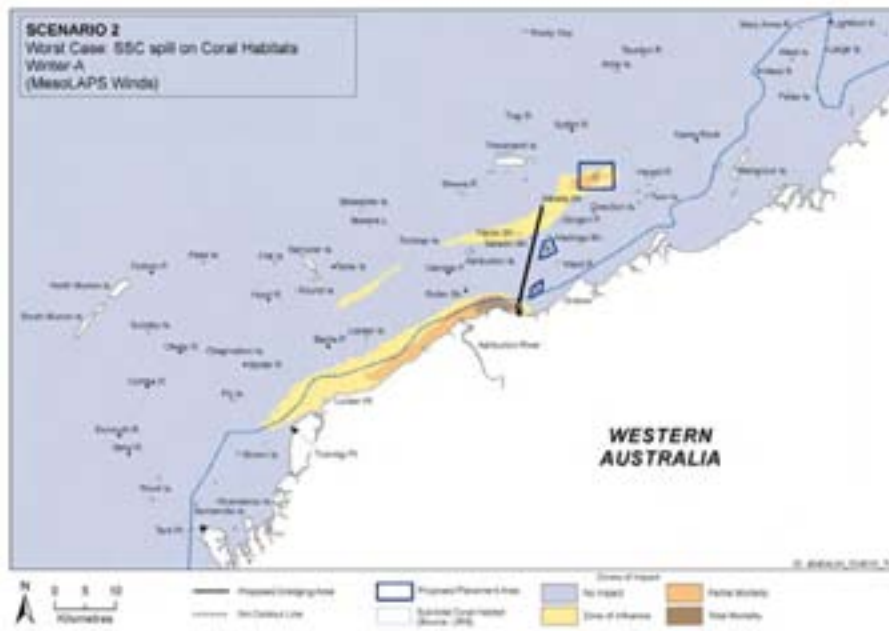


Figure A.81 Scenario 2, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

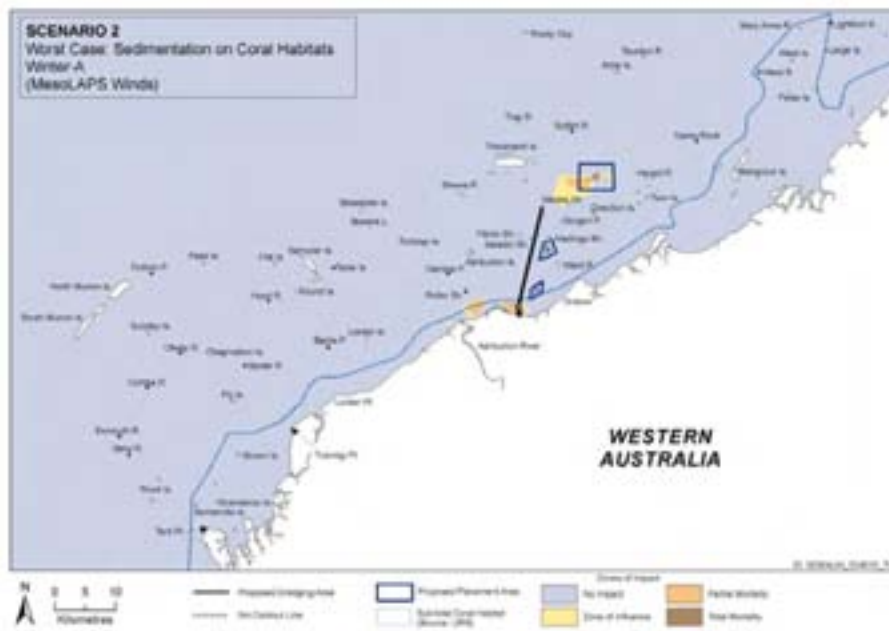


Figure A.82 Scenario 2, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

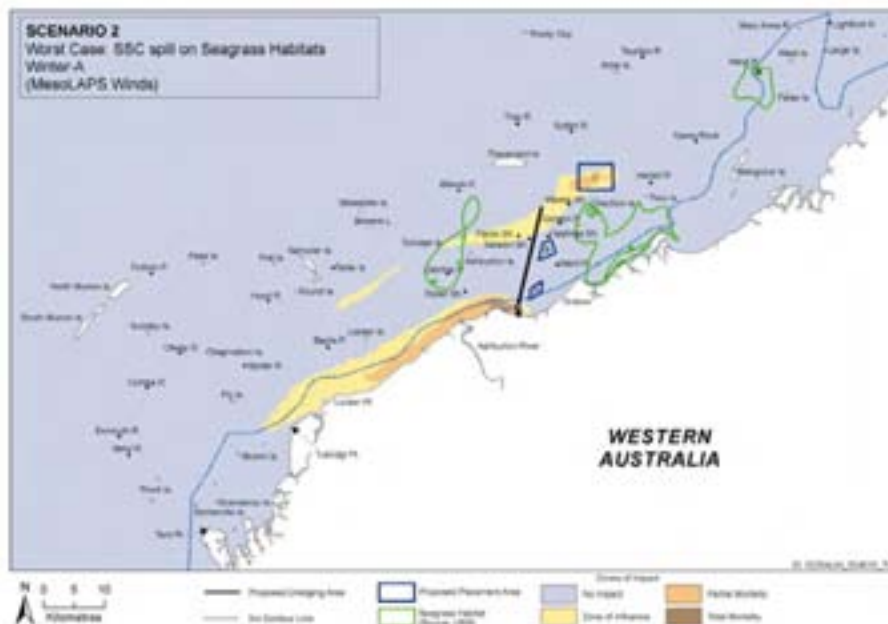


Figure A.83 Scenario 2, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.84 Scenario 2, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-64



Table A.21 Summary of Impacts at Sensitive Receptors for Scenario 2, Winter-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.5	1.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.4	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.2	4.8	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	1.8	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.8	6.8	1.6	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.3	0.1	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.6	4.5	0.4	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.9	4.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2.10 Winter-B, Worst Case Spill Scenario**

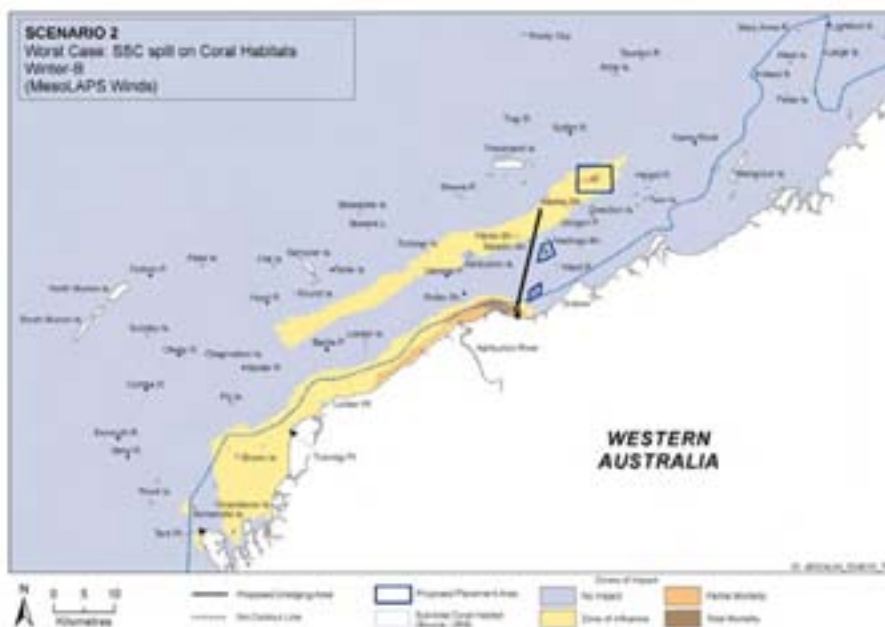


Figure A.85 Scenario 2, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

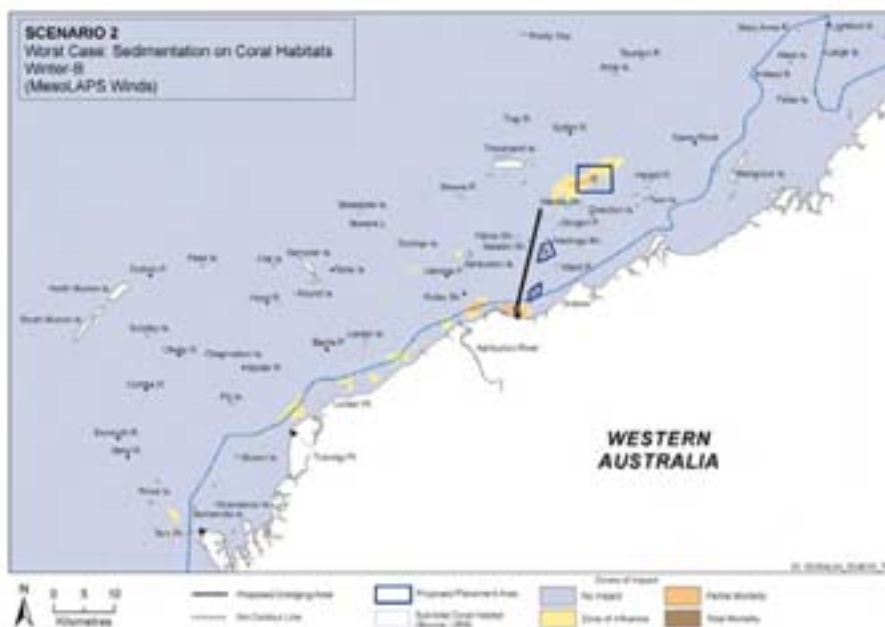


Figure A.86 Scenario 2, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds



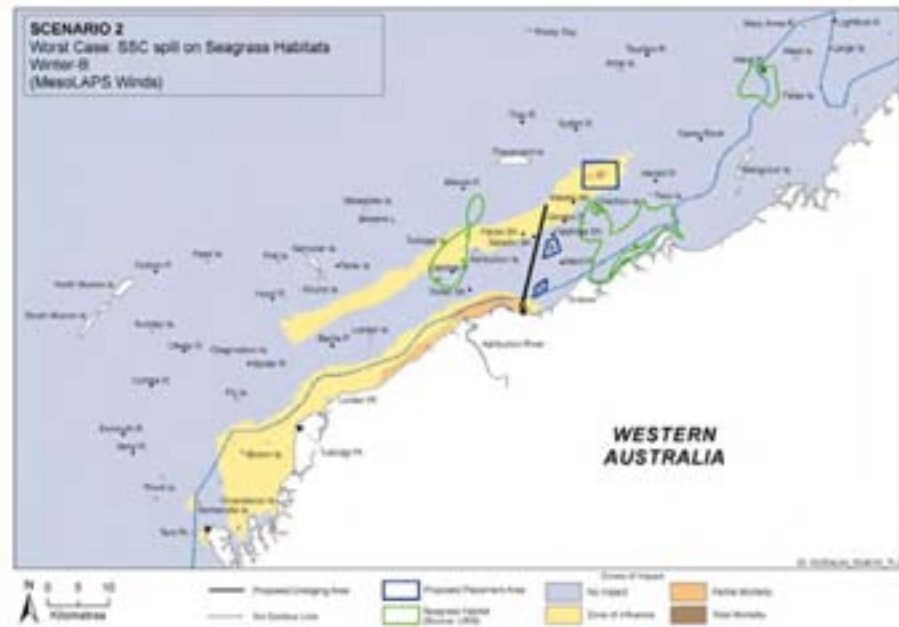


Figure A.87 Scenario 2, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

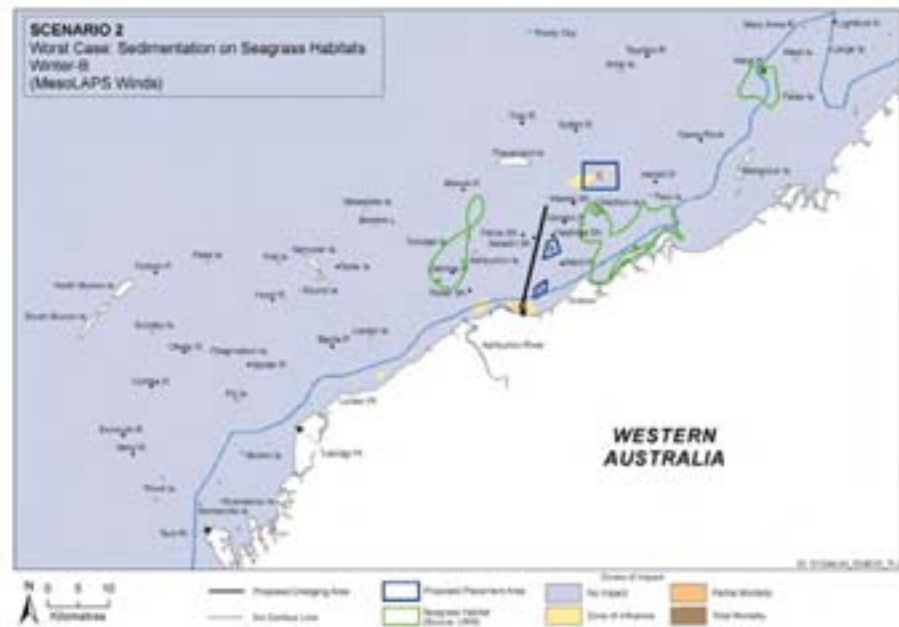


Figure A.88 Scenario 2, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Table A.22 Summary of Impacts at Sensitive Receptors for Scenario 2, Winter-B, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.1	1.6	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.9	1.2	0.0	0.0	0.3	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.9	11.3	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.9	1.6	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.7	10.4	0.7	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.2	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	1.3	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.7	2.8	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.6	9.5	0.6	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.6	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.9	8.3	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2.11 Transitional-A, Worst Case Spill Scenario**

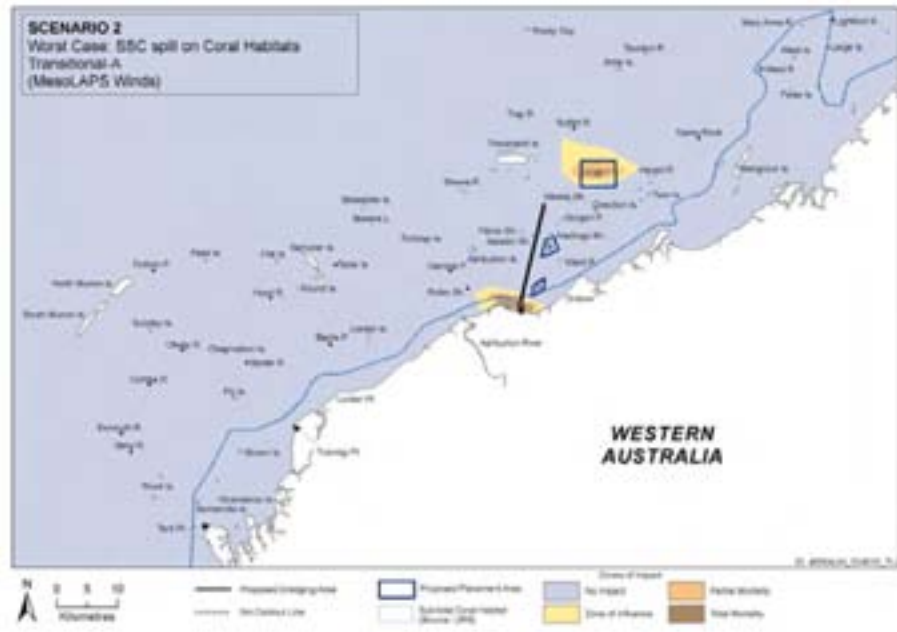


Figure A.89 Scenario 2, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

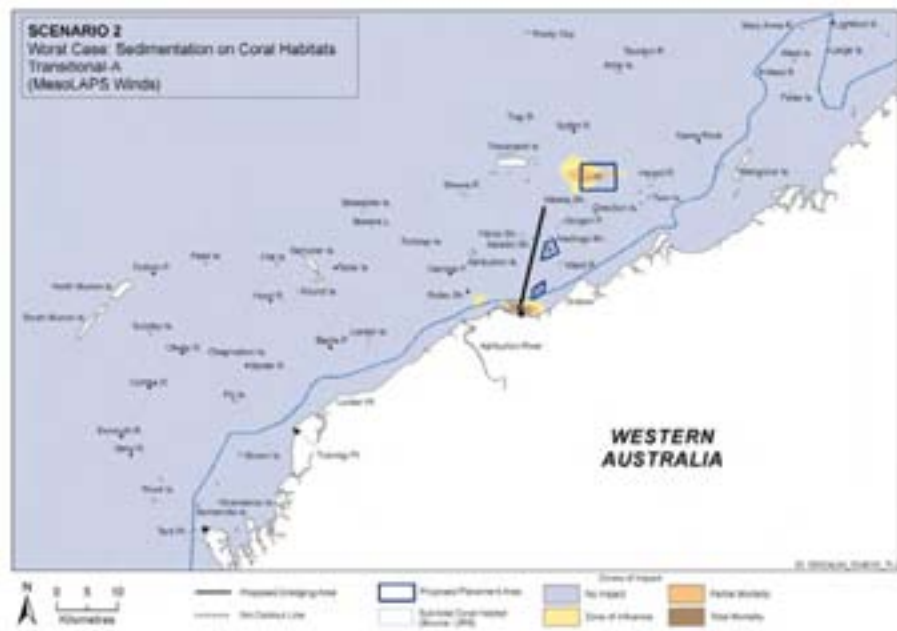


Figure A.90 Scenario 2, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

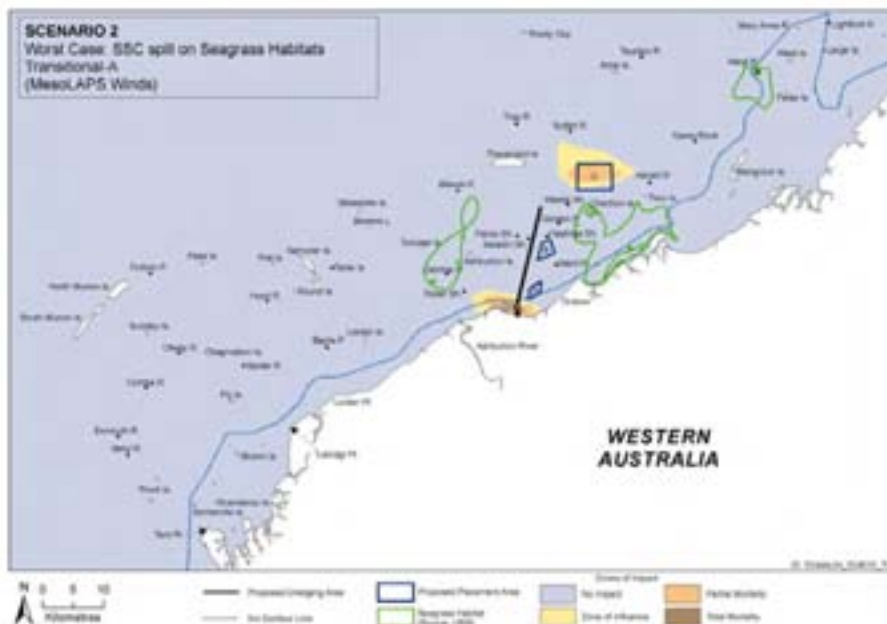


Figure A.91 Scenario 2, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.92 Scenario 2, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-70



Table A.23 Summary of Impacts at Sensitive Receptors for Scenario 2, Transitional-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.1	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.1	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.2.12 Transitional-B, Worst Case Spill Scenario**



Figure A.93 Scenario 2, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

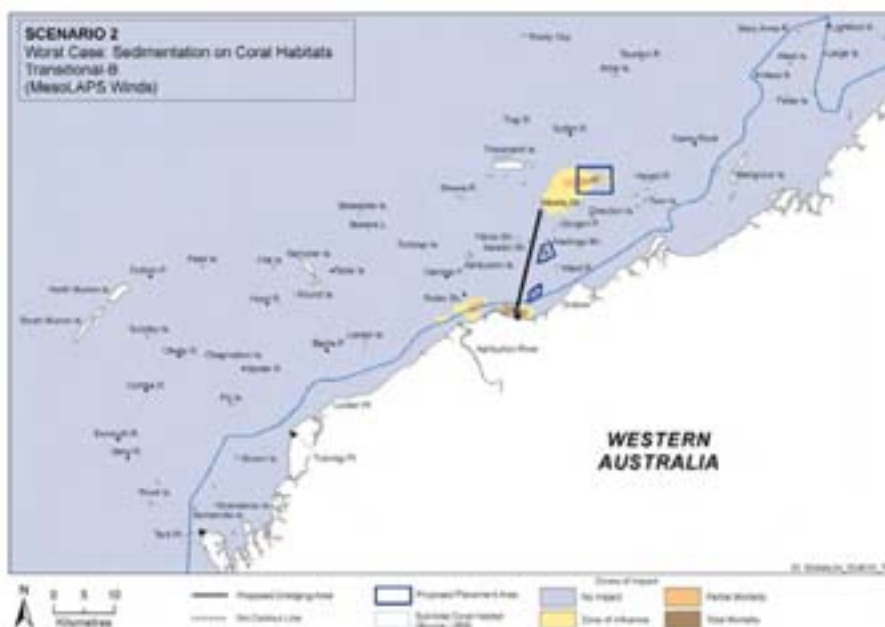


Figure A.94 Scenario 2, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-72

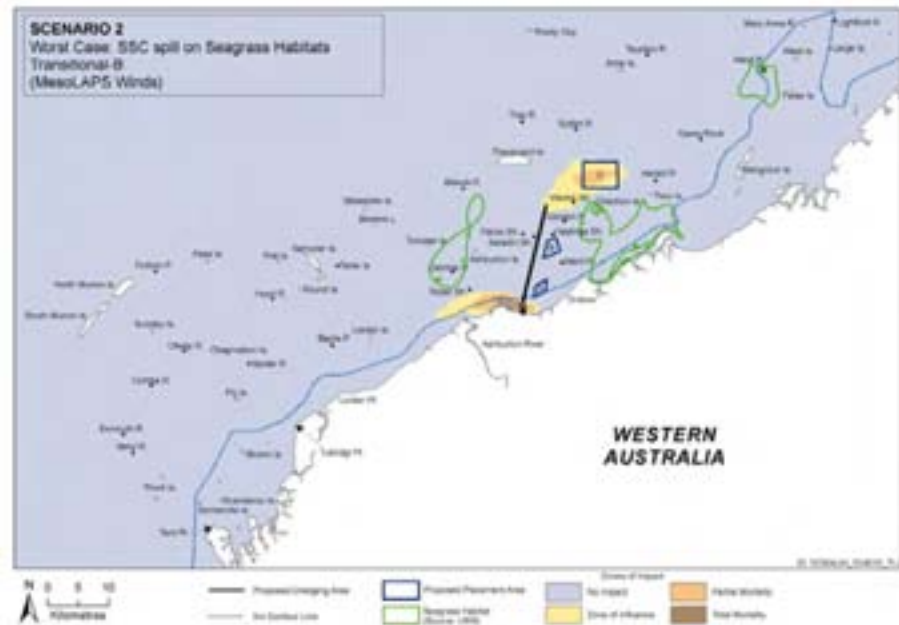


Figure A.95 Scenario 2, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.96 Scenario 2, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



Table A.24 Summary of Impacts at Sensitive Receptors for Scenario 2, Transitional-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.3	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.5	0.3	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.7	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.1	2.2	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.1	4.6	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.5	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





### A.3 Dredging Scenario 3

#### A.3.1 Summer-A, Realistic Spill Scenario

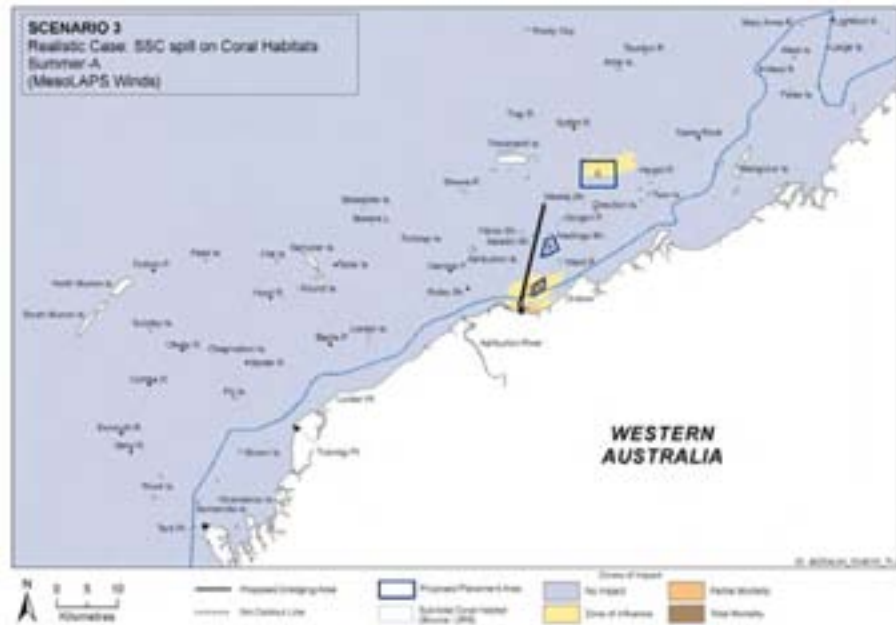


Figure A.97 Scenario 3, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

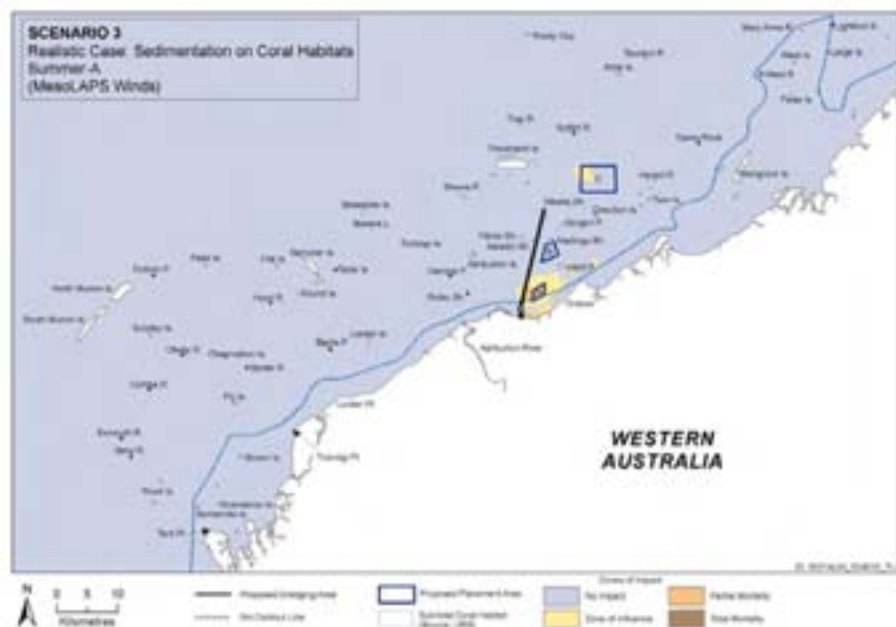


Figure A.98 Scenario 3, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

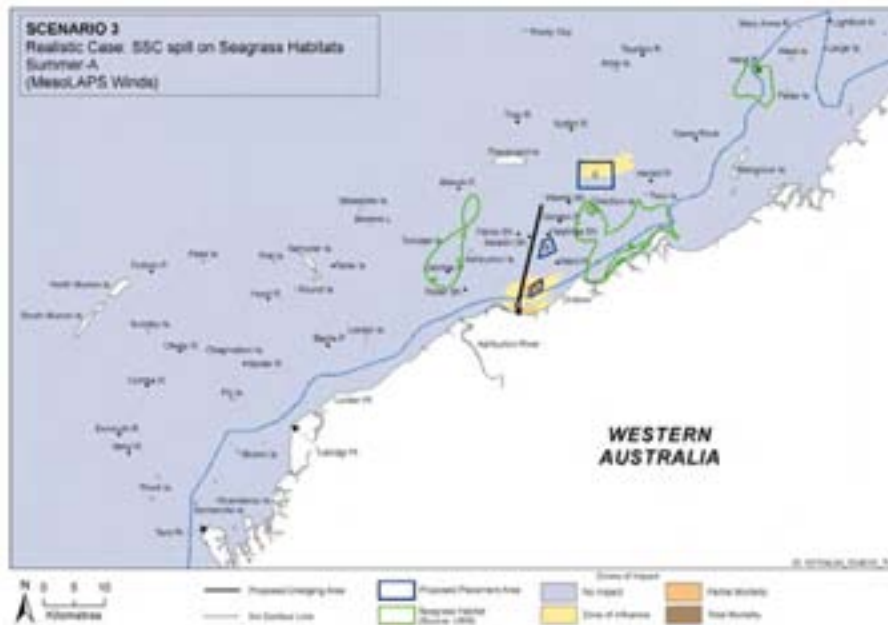


Figure A.99 Scenario 3, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.100 Scenario 3, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-76



Table A.25 Summary of Impacts at Sensitive Receptors for Scenario 3, Summer-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.7	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.8	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.3	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.2	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.4	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.6	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.4	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	1.3	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.4	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.4	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	1.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.3	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.3.2 Summer-B, Realistic Spill Scenario**



Figure A.101 Scenario 3, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.102 Scenario 3, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

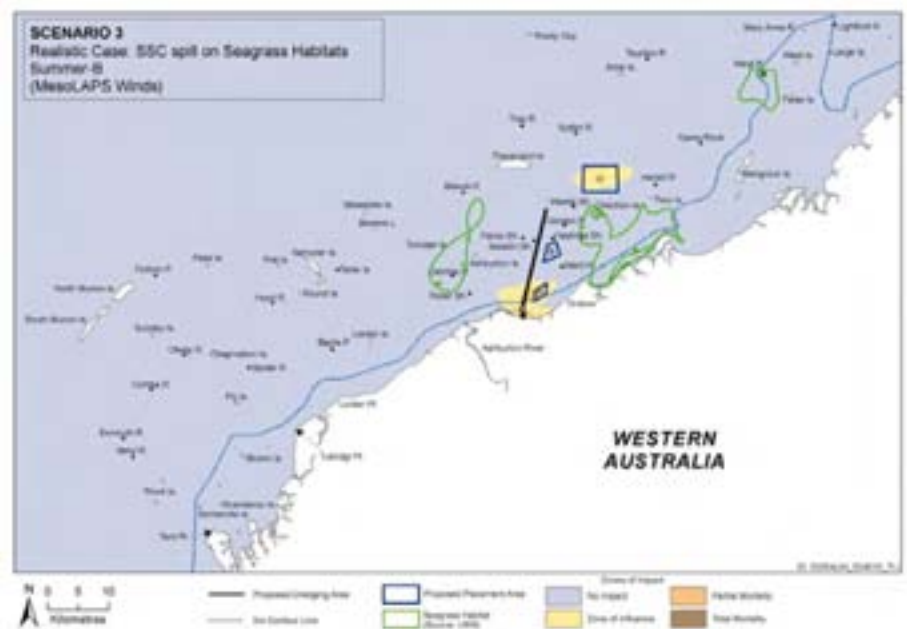


Figure A.103 Scenario 3, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

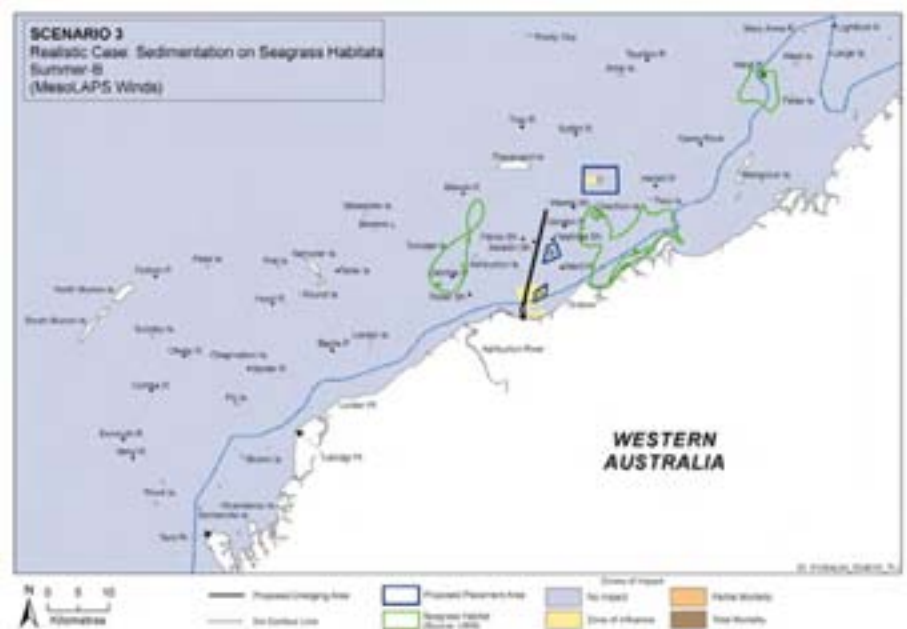


Figure A.104 Scenario 3, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Table A.26 Summary of Impacts at Sensitive Receptors for Scenario 3, Summer-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.2	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.6	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.6	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.8	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.4	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.3	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.9	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.3	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.3	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.7	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.3.3 Winter-A, Realistic Spill Scenario**

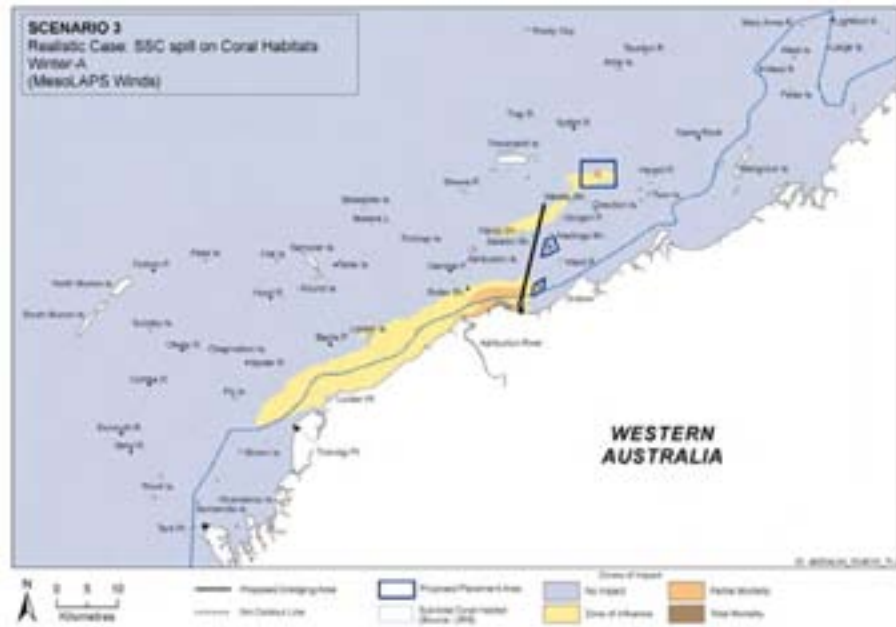


Figure A.105 Scenario 3, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

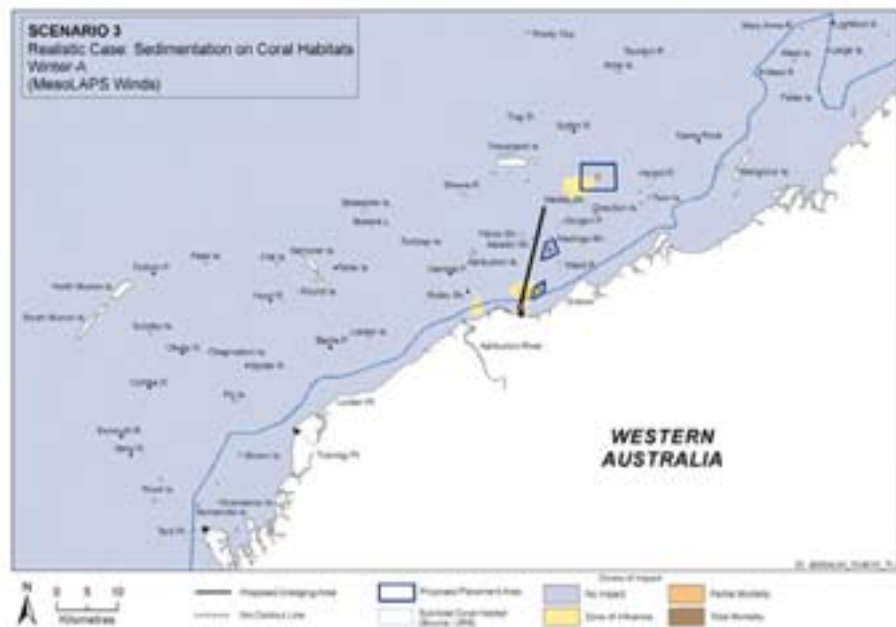


Figure A.106 Scenario 3, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

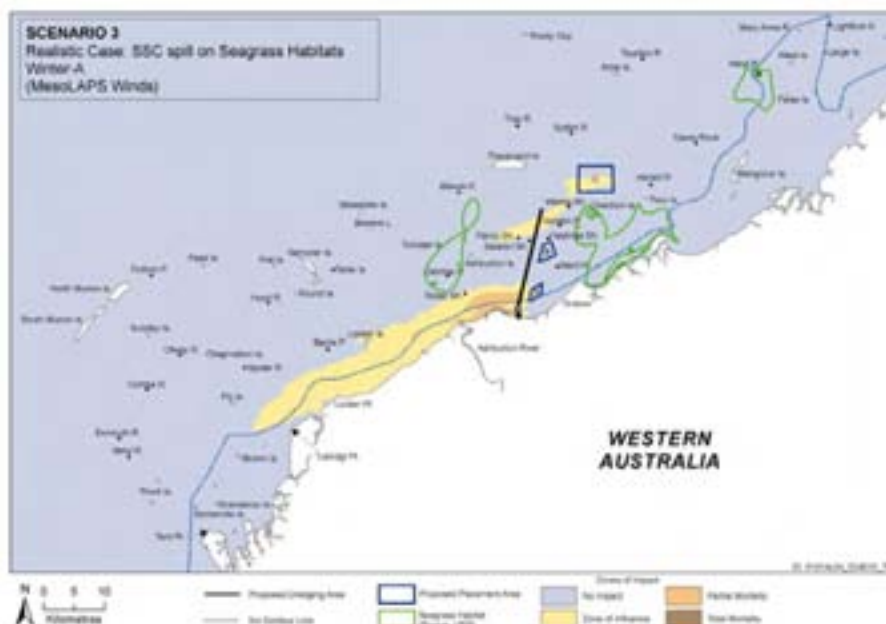


Figure A.107 Scenario 3, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

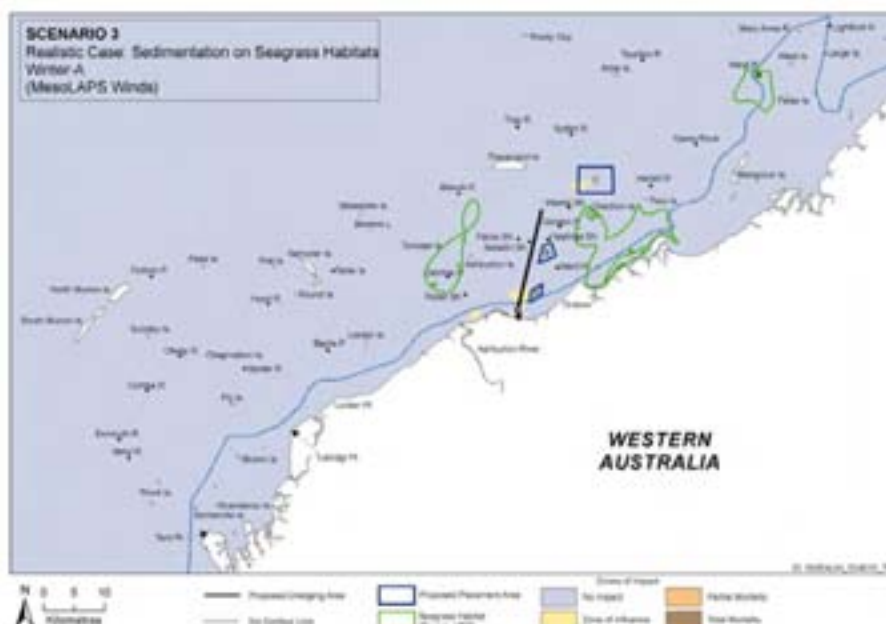


Figure A.108 Scenario 3, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds





Table A.27 Summary of Impacts at Sensitive Receptors for Scenario 3, Winter-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.5	7.4	0.7	0.0	0.0	
3	Ashburton Island	286705	7611075	0.2	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.6	3.1	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.7	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.8	3.6	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.8	1.2	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.4	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.3.4 Winter-B, Realistic Spill Scenario**

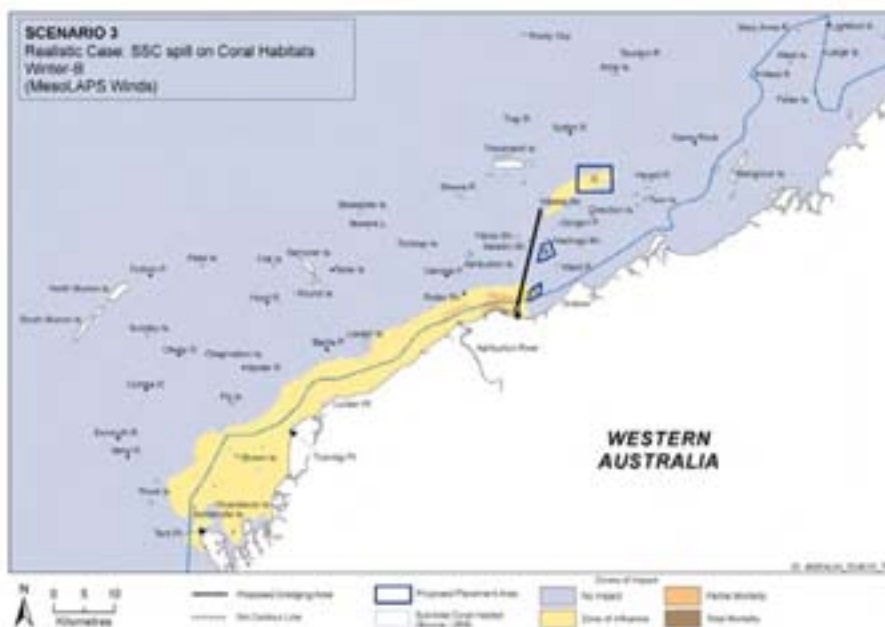


Figure A.109 Scenario 3, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

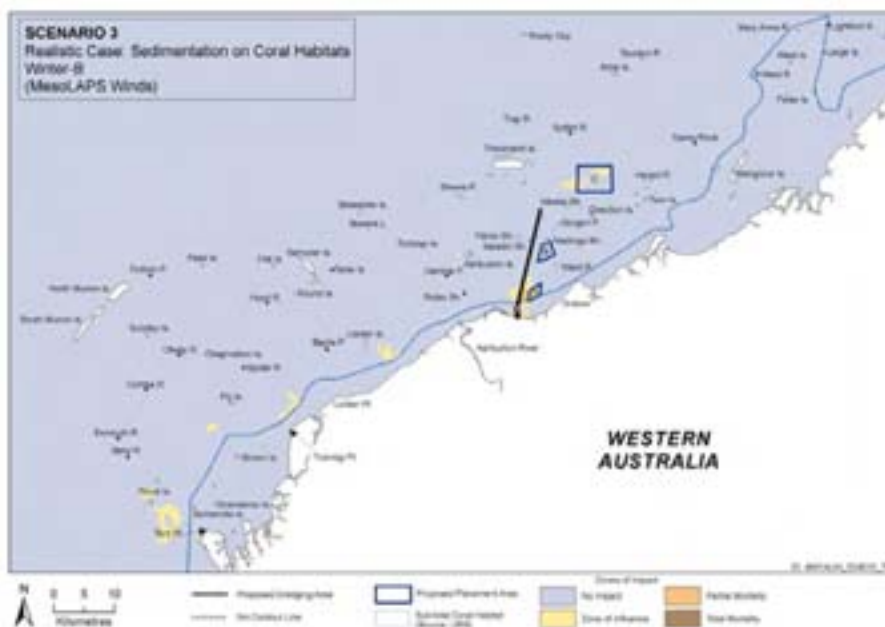


Figure A.110 Scenario 3, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

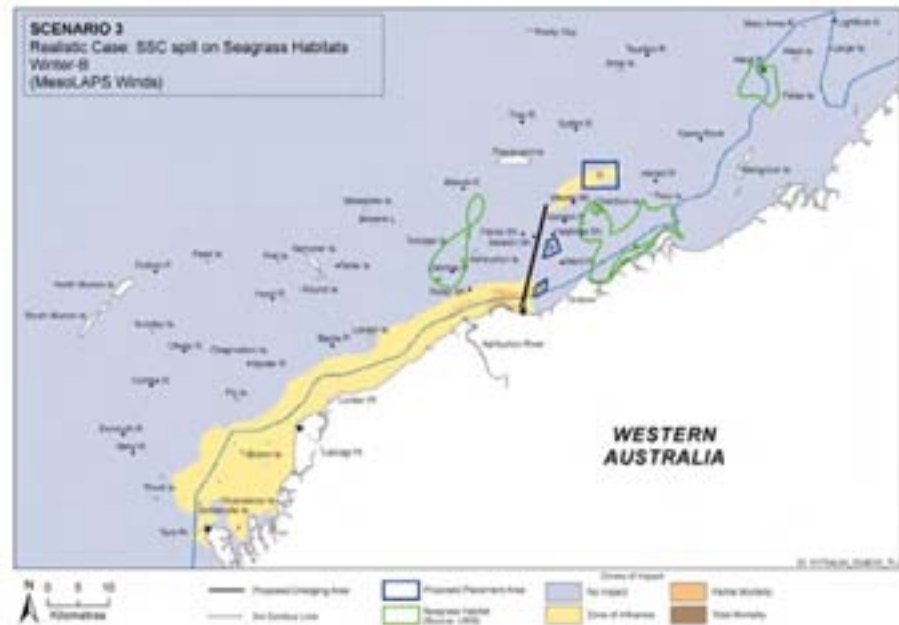


Figure A.111 Scenario 3, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.112 Scenario 3, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Table A.28 Summary of Impacts at Sensitive Receptors for Scenario 3, Winter-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.7	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.1	4.6	0.3	0.0	0.0	
3	Ashburton Island	286705	7611075	0.4	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.4	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.0	2.4	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.9	0.6	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.3.5 Transitional-A, Realistic Spill Scenario**

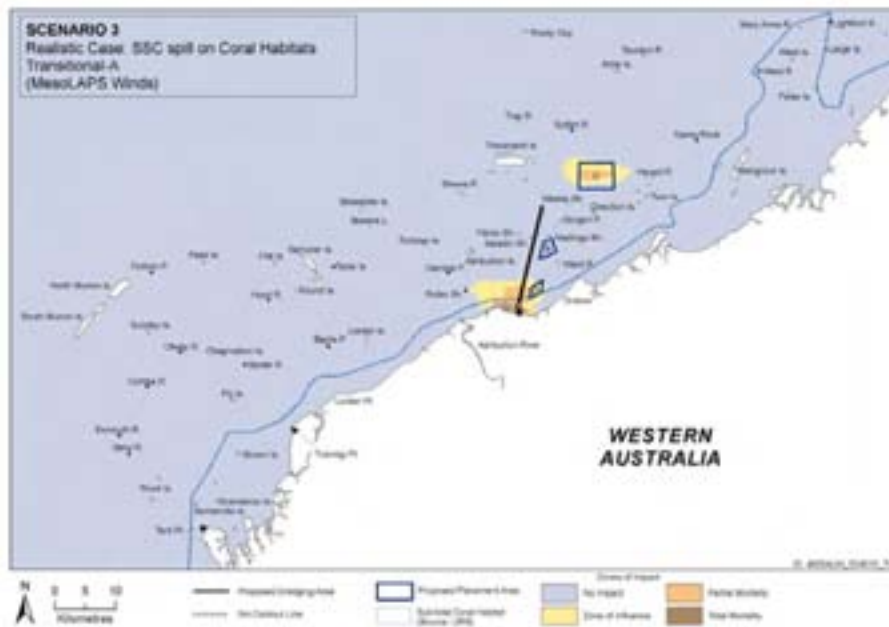


Figure A.113 Scenario 3, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

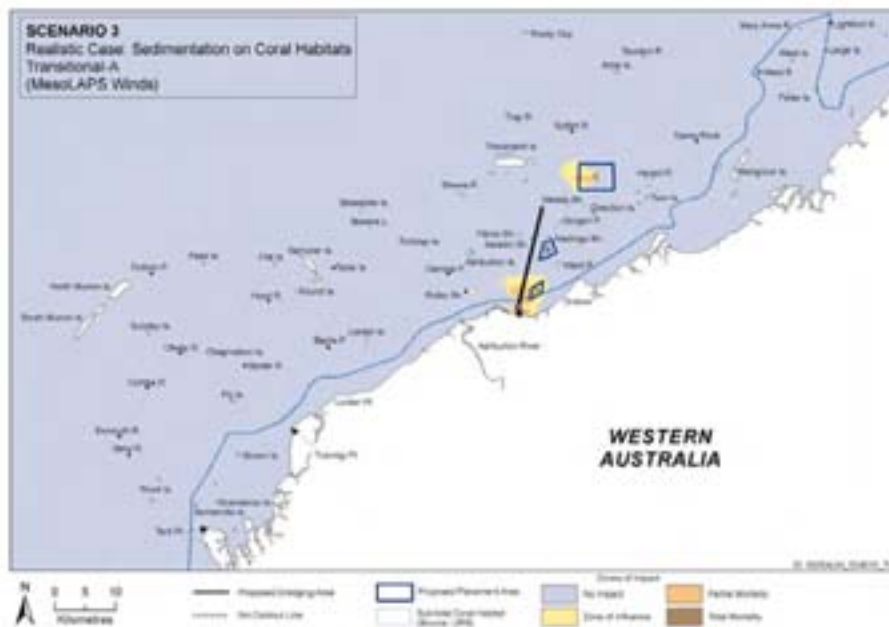


Figure A.114 Scenario 3, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-87

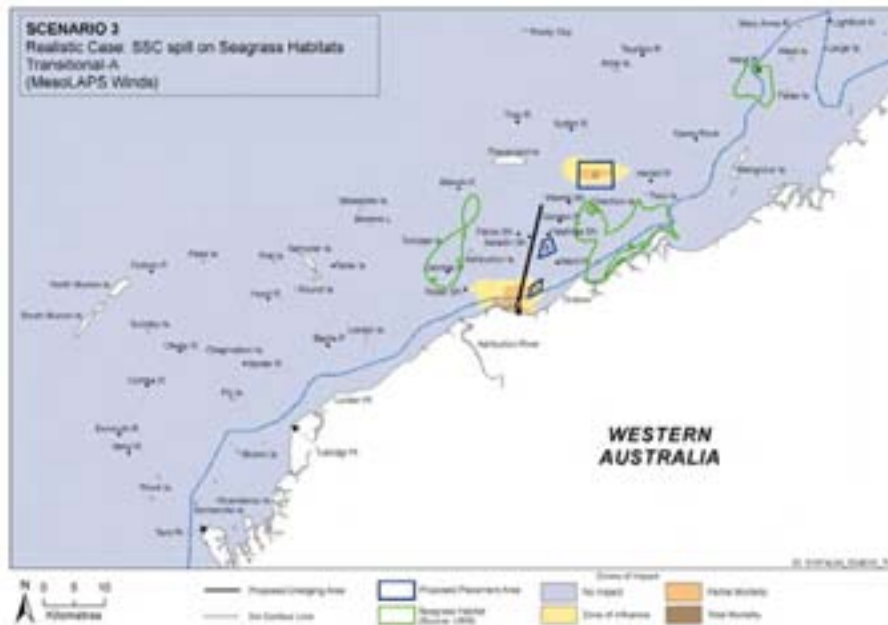


Figure A.115 Scenario 3, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.116 Scenario 3, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Table A.29 Summary of Impacts at Sensitive Receptors for Scenario 3, Transitional-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.5	1.3	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.1	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.1	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.1	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.3.6 Transitional-B, Realistic Spill Scenario**



Figure A.117 Scenario 3, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

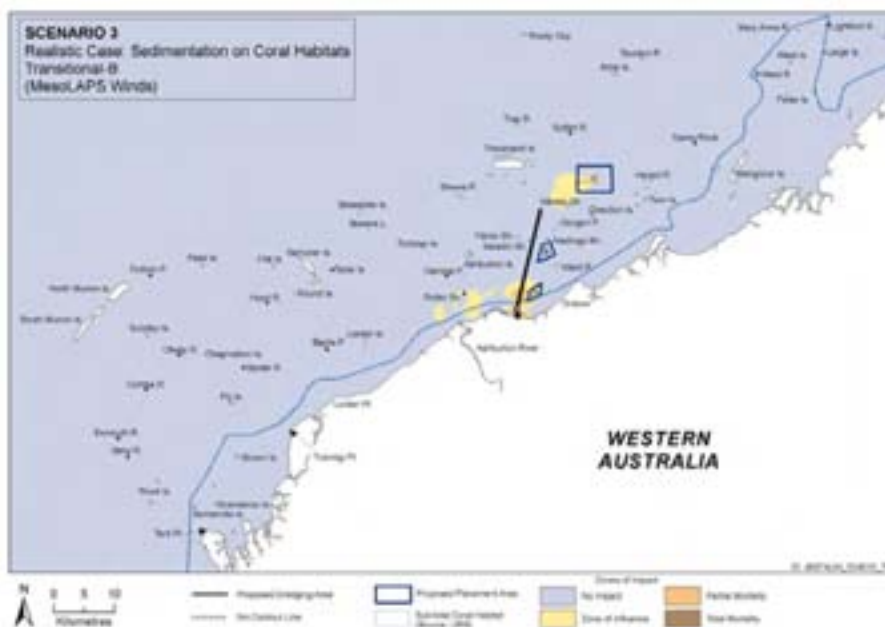


Figure A.118 Scenario 3, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds



A-90

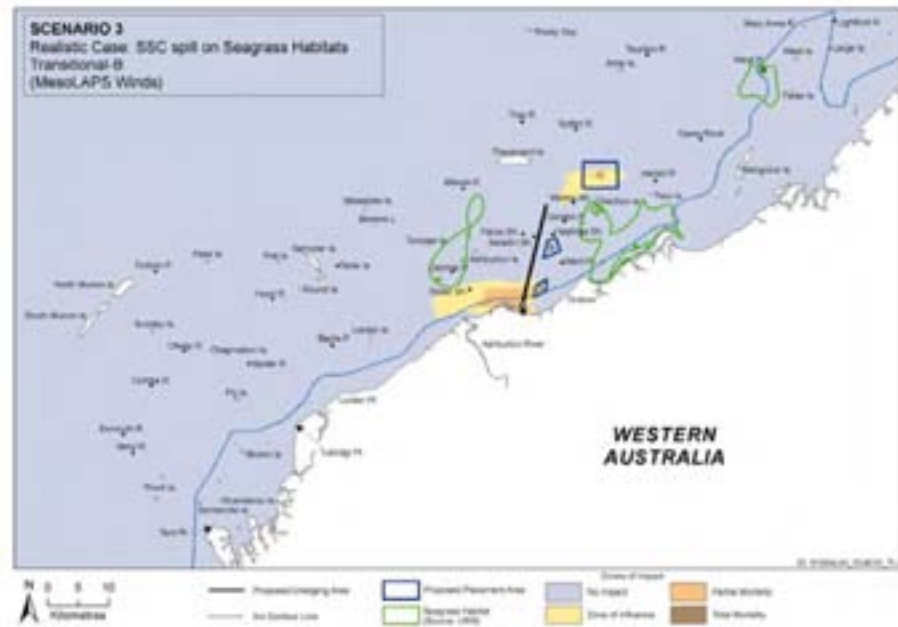


Figure A.119 Scenario 3, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

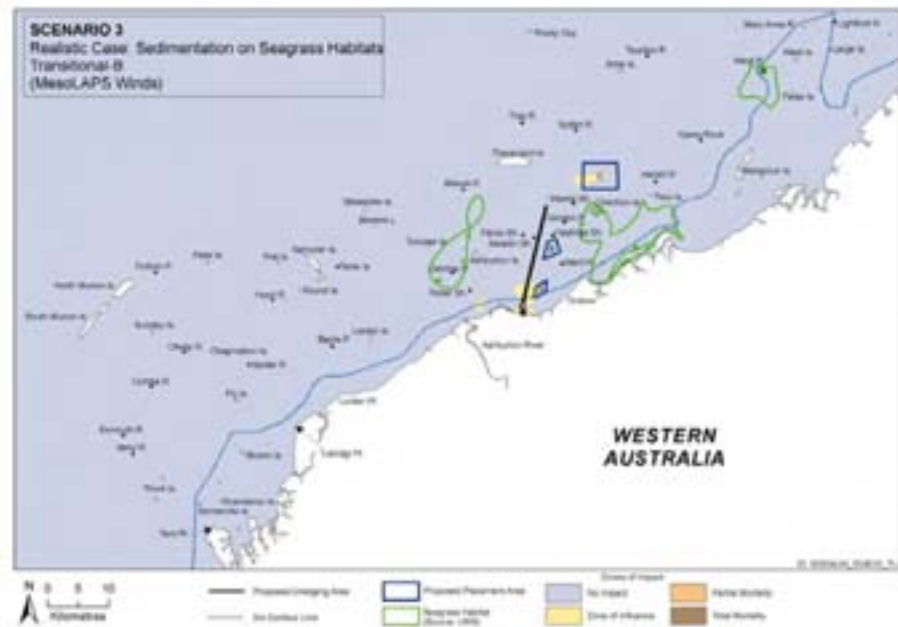


Figure A.120 Scenario 3, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Table A.30 Summary of Impacts at Sensitive Receptors for Scenario 3, Transitional-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.7	11.6	1.8	0.0	0.0	
3	Ashburton Island	286705	7611075	0.2	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.6	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.7	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.8	1.3	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.4	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.5	0.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.2	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.3.7 Summer-A, Worst Case Spill Scenario**

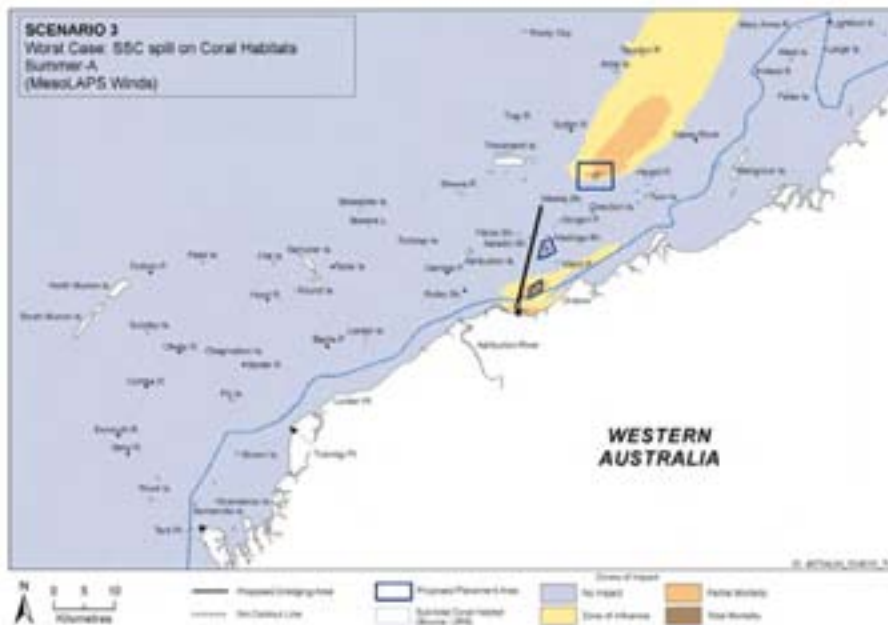


Figure A.121 Scenario 3, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

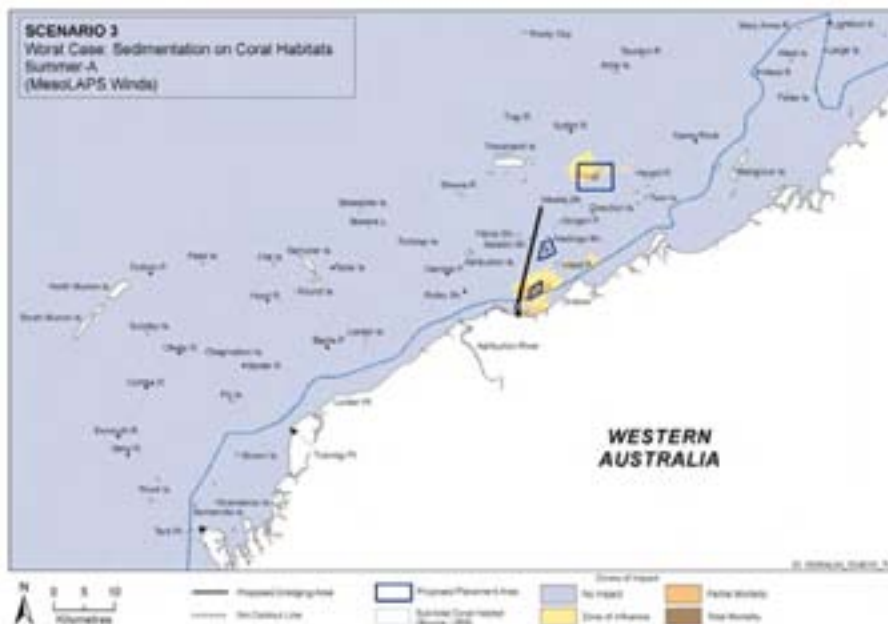


Figure A.122 Scenario 3, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

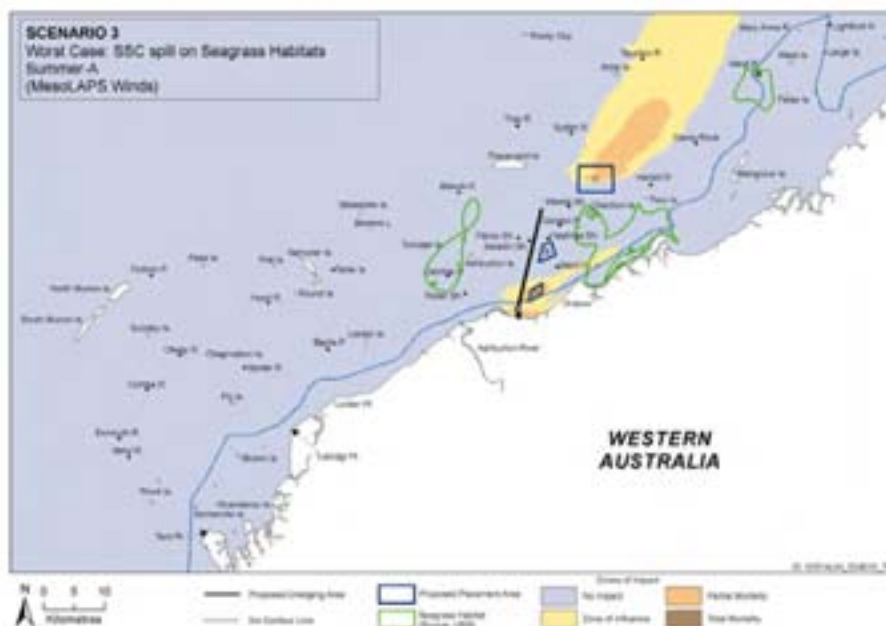


Figure A.123 Scenario 3, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

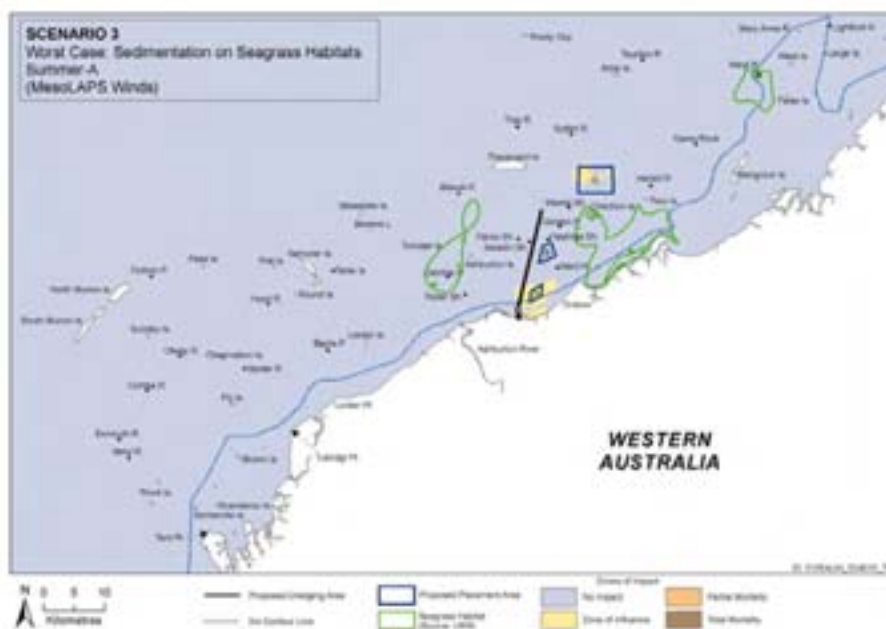


Figure A.124 Scenario 3, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-94



Table A.31 Summary of Impacts at Sensitive Receptors for Scenario 3, Summer-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.8	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.9	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.3	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.3	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.2	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.5	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.7	12.2	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.4	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	1.7	0.7	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.6	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.6	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	1.3	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.4	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.3.8 Summer-B, Worst Case Spill Scenario**

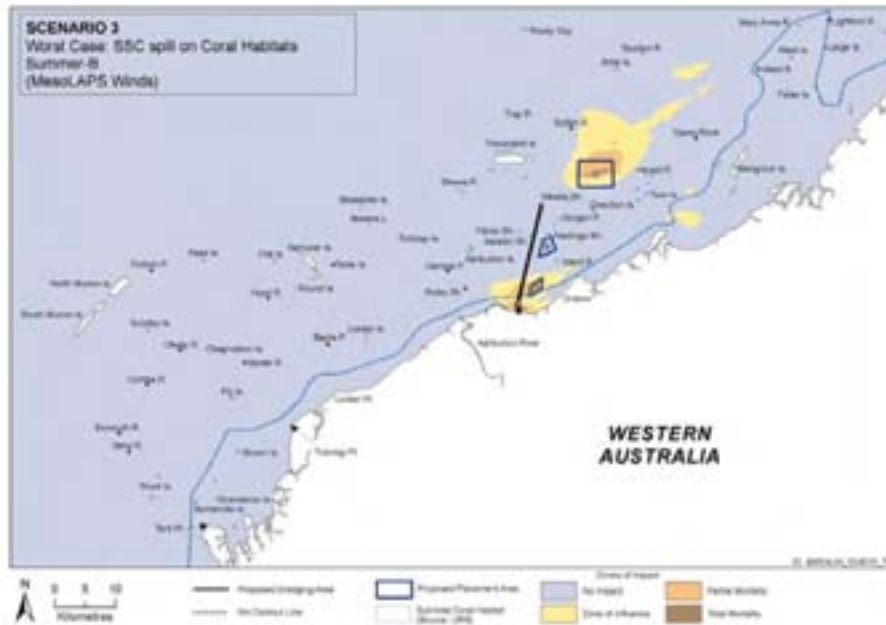


Figure A.125 Scenario 3, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

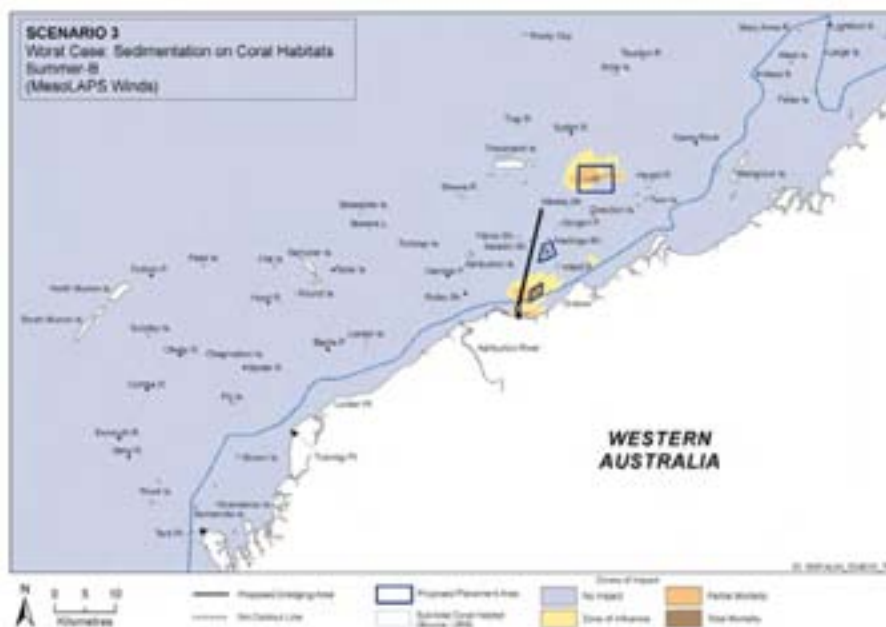


Figure A.126 Scenario 3, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

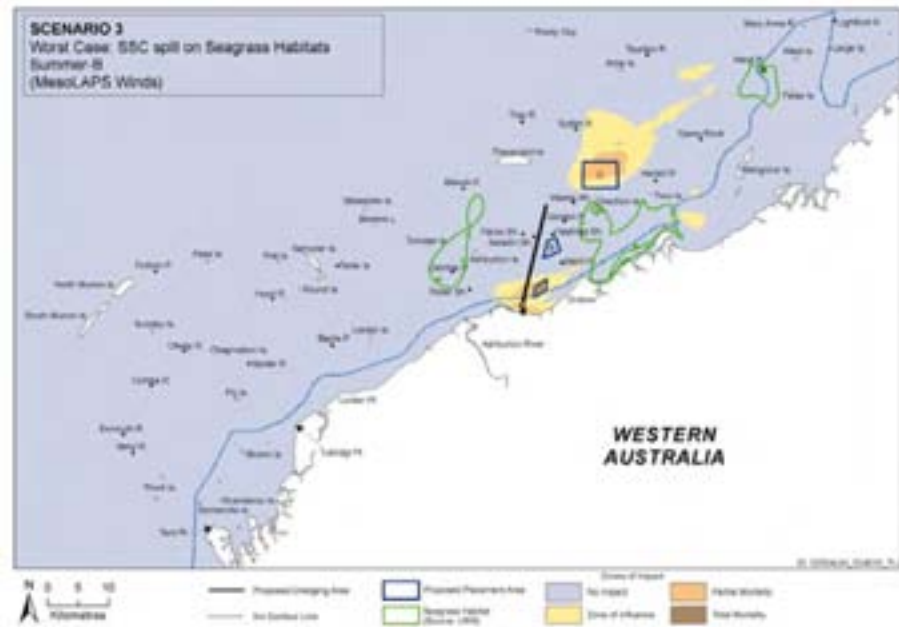


Figure A.127 Scenario 3, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

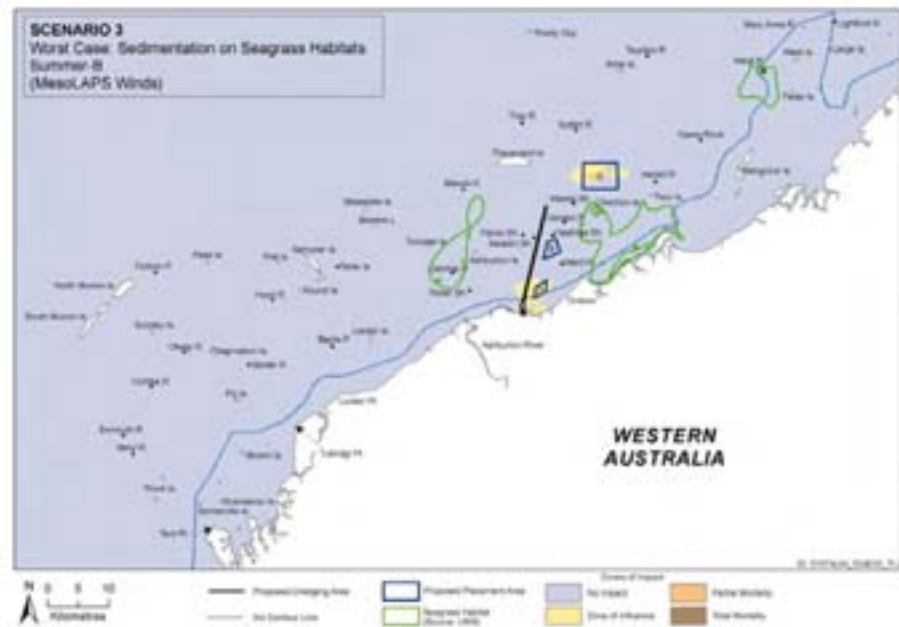


Figure A.128 Scenario 3, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



Table A.32 Summary of Impacts at Sensitive Receptors for Scenario 3, Summer-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.3	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.8	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.8	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.2	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.6	0.4	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.1	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.5	0.0	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	1.2	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.4	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	1.2	0.4	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.4	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.5	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	1.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.2	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**A.3.9 Winter-A, Worst Case Spill Scenario**

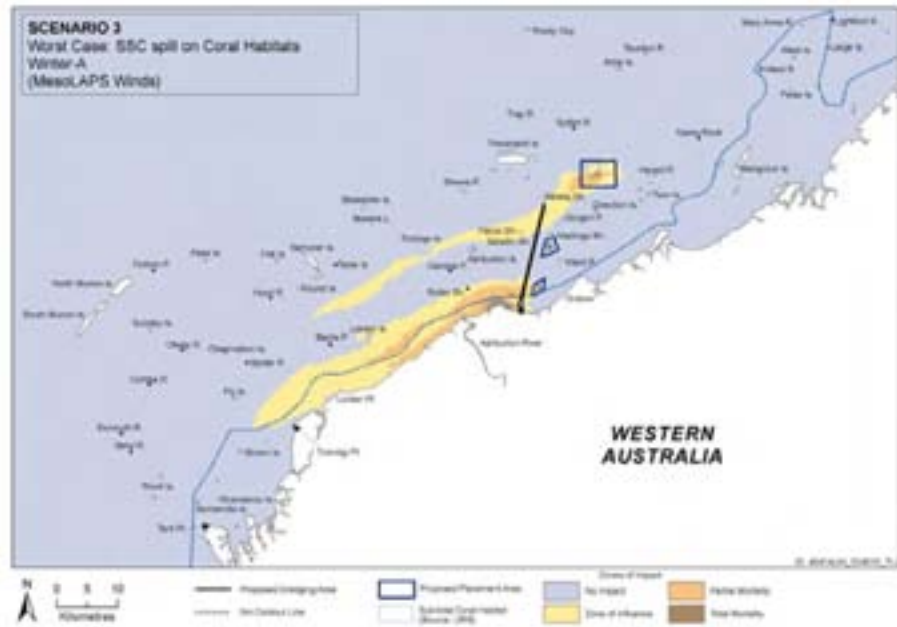


Figure A.129 Scenario 3, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

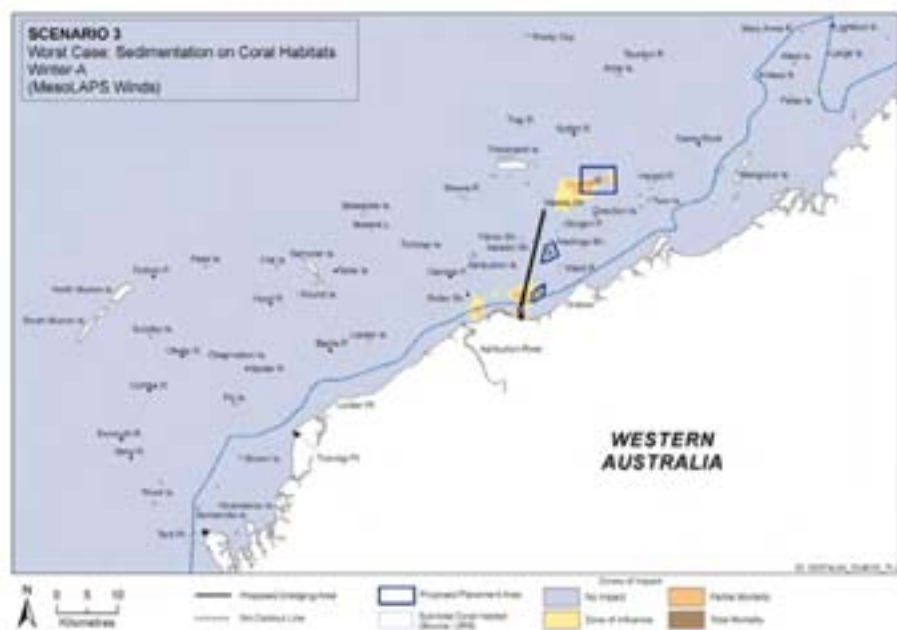


Figure A.130 Scenario 3, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

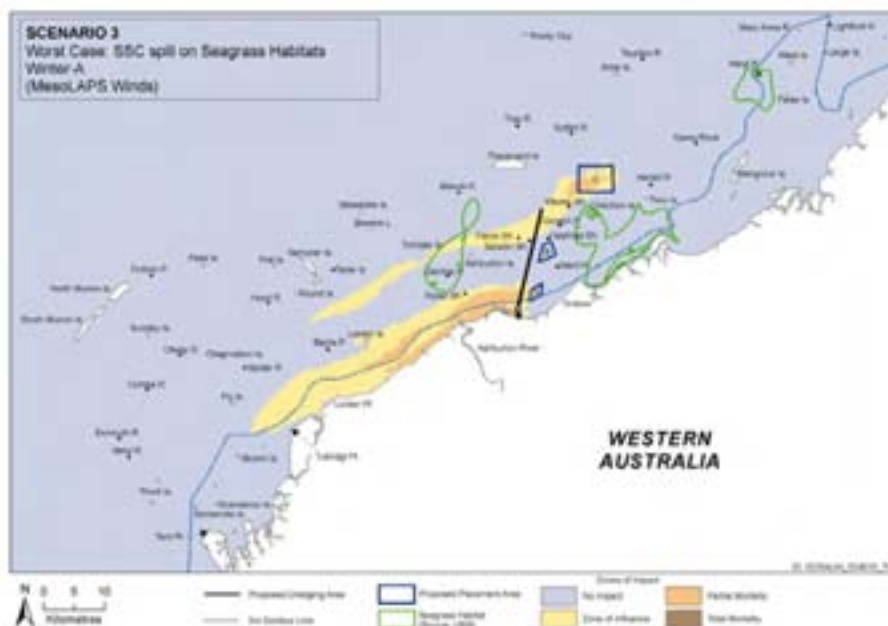


Figure A.131 Scenario 3, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

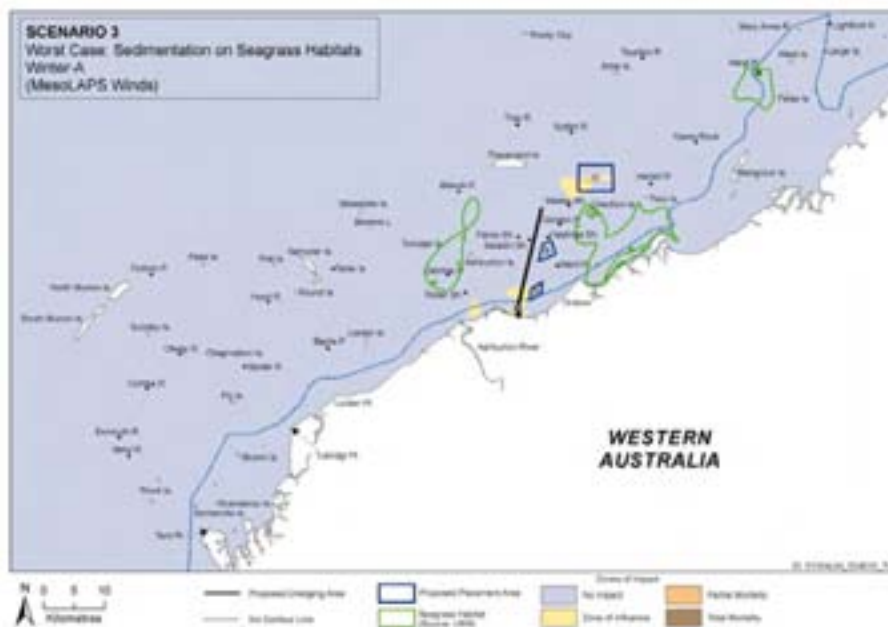


Figure A.132 Scenario 3, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-100



Table A.33 Summary of Impacts at Sensitive Receptors for Scenario 3, Winter-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.7	1.5	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.6	8.6	0.9	0.0	0.0	
3	Ashburton Island	286705	7611075	0.5	0.6	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.4	5.9	0.7	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.6	2.2	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.2	8.3	2.7	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.2	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.4	0.1	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.4	0.4	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	2.1	7.6	1.5	0.1	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.1	4.8	0.4	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-101



**A.3.10 Winter-B, Worst Case Spill Scenario**

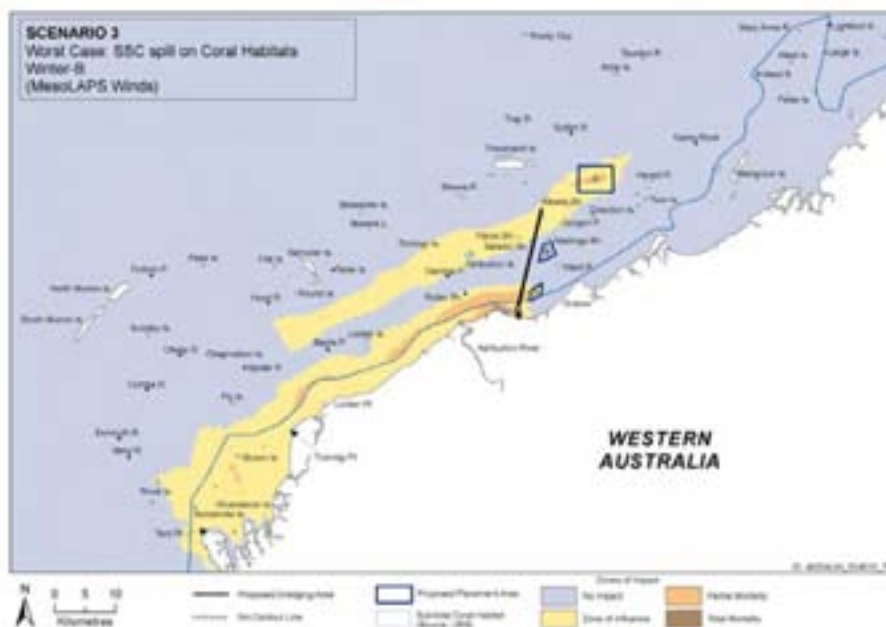


Figure A.133 Scenario 3, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

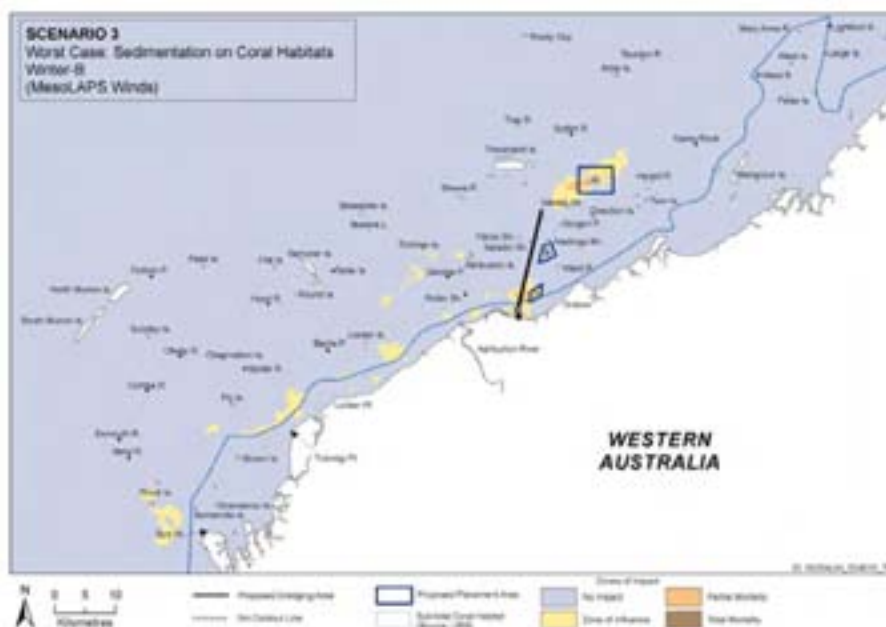


Figure A.134 Scenario 3, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

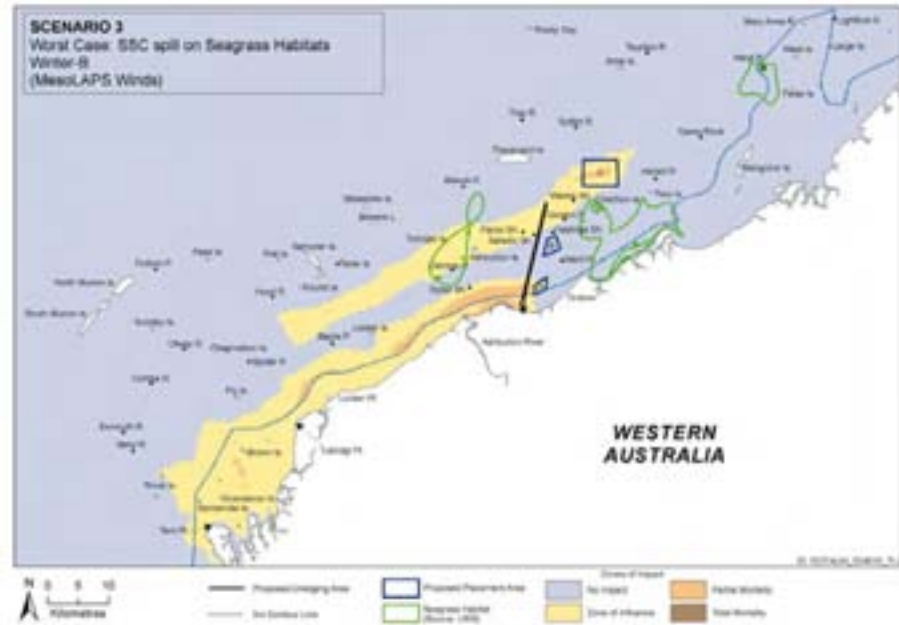


Figure A.135 Scenario 3, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

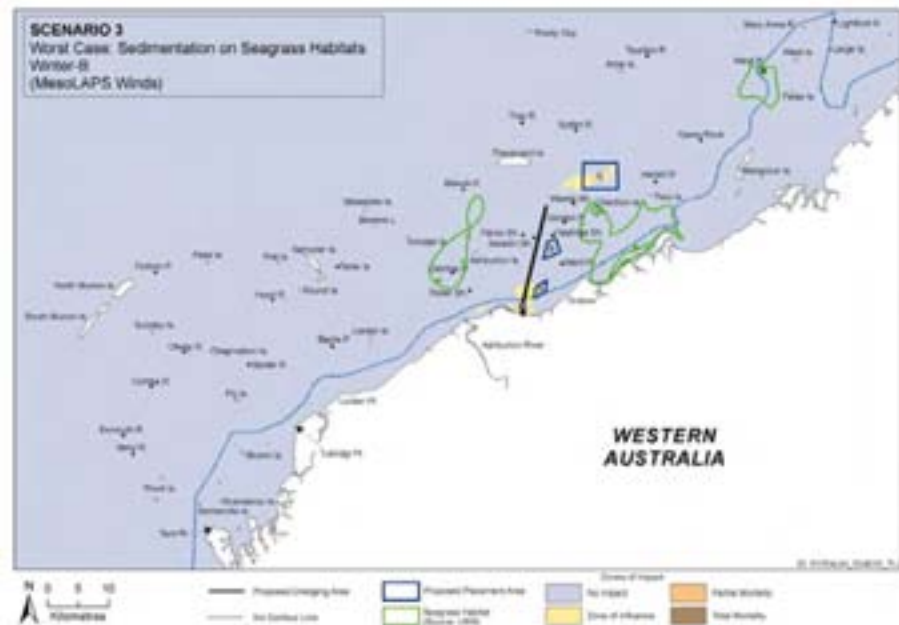


Figure A.136 Scenario 3, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Table A.34 Summary of Impacts at Sensitive Receptors for Scenario 3, Winter-B, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.3	4.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.5	10.5	1.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.3	3.0	0.0	0.0	0.5	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.2	15.3	0.9	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.1	3.7	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.9	11.9	1.6	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.4	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.7	2.4	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.9	4.9	0.3	0.0	0.1	
15	Weeks Shoal	302245	7618926	2.0	11.1	1.6	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.7	1.8	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.1	11.9	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.2	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.3.11 Transitional-A, Worst Case Spill Scenario**

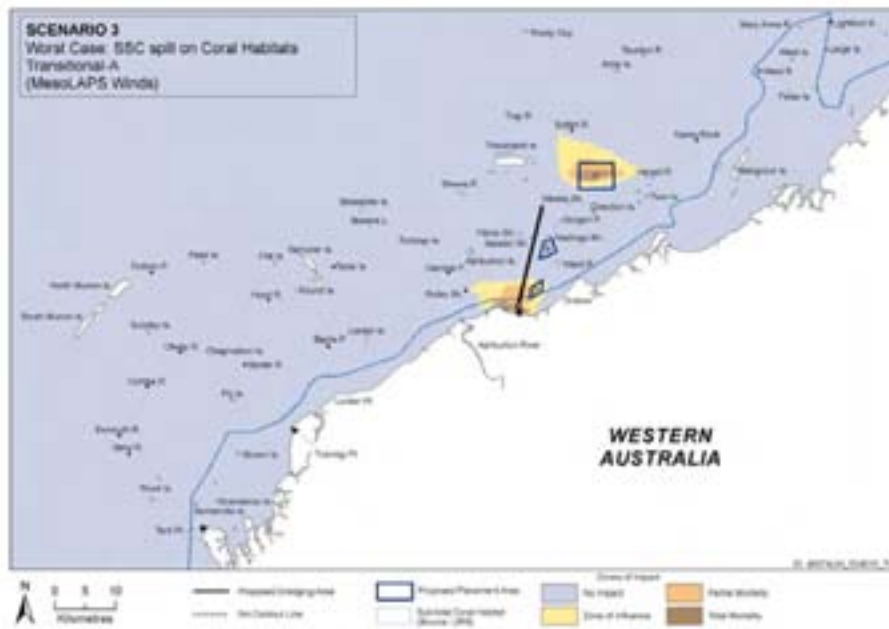


Figure A.137 Scenario 3, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

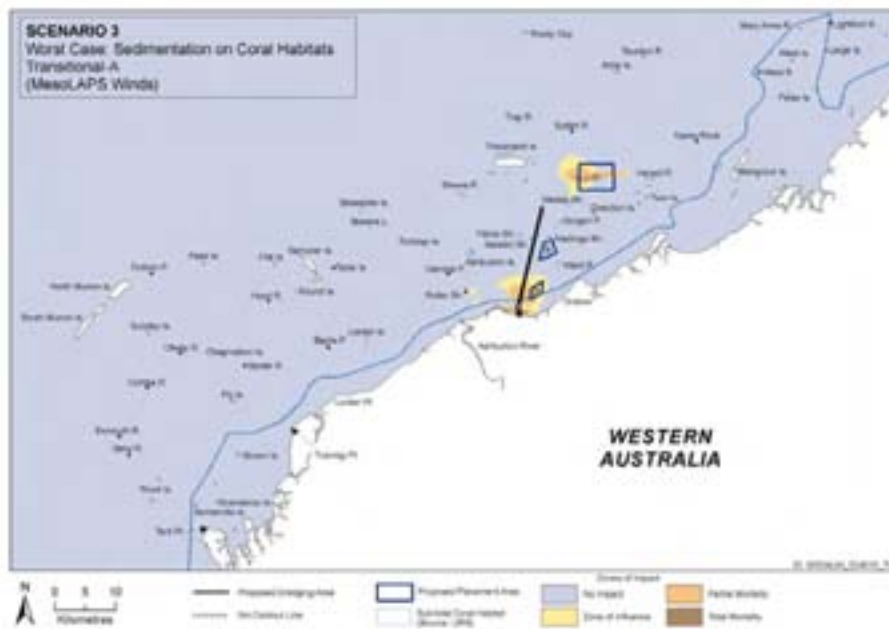


Figure A.138 Scenario 3, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

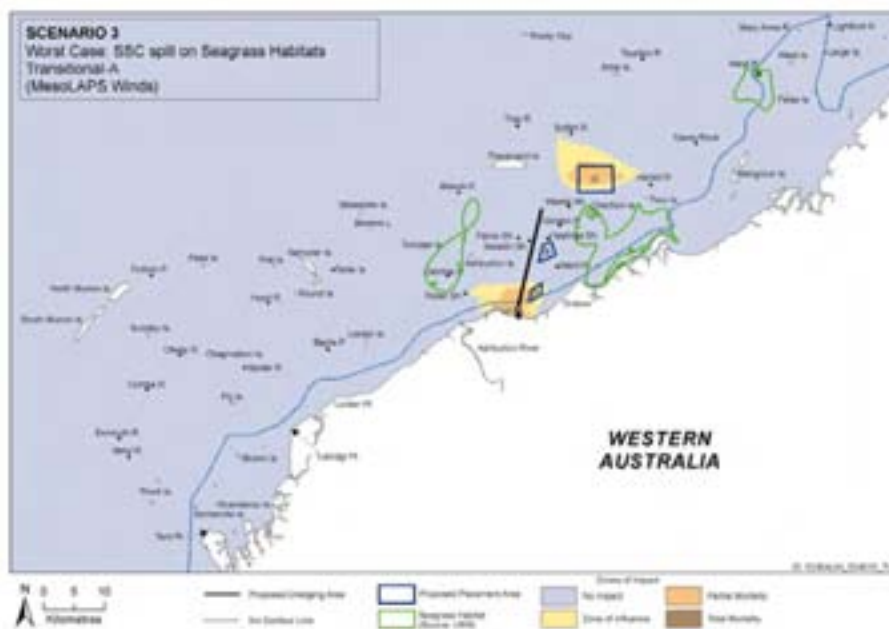


Figure A.139 Scenario 3, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

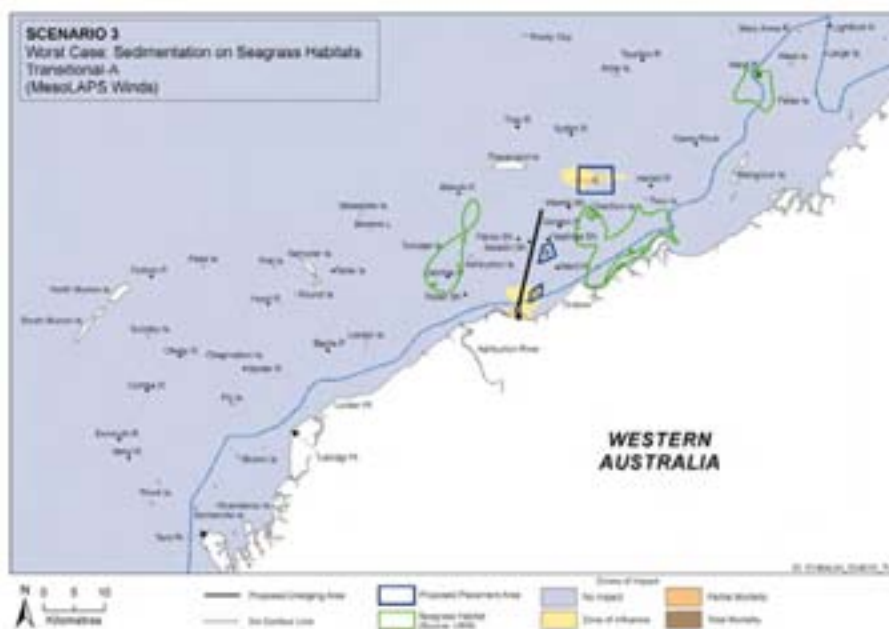


Figure A.140 Scenario 3, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



A-106



Table A.35 Summary of Impacts at Sensitive Receptors for Scenario 3, Transitional-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.5	1.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.1	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.2	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.2	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.2	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.3.12 Transitional-B, Worst Case Spill Scenario**



Figure A.141 Scenario 3, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.142 Scenario 3, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

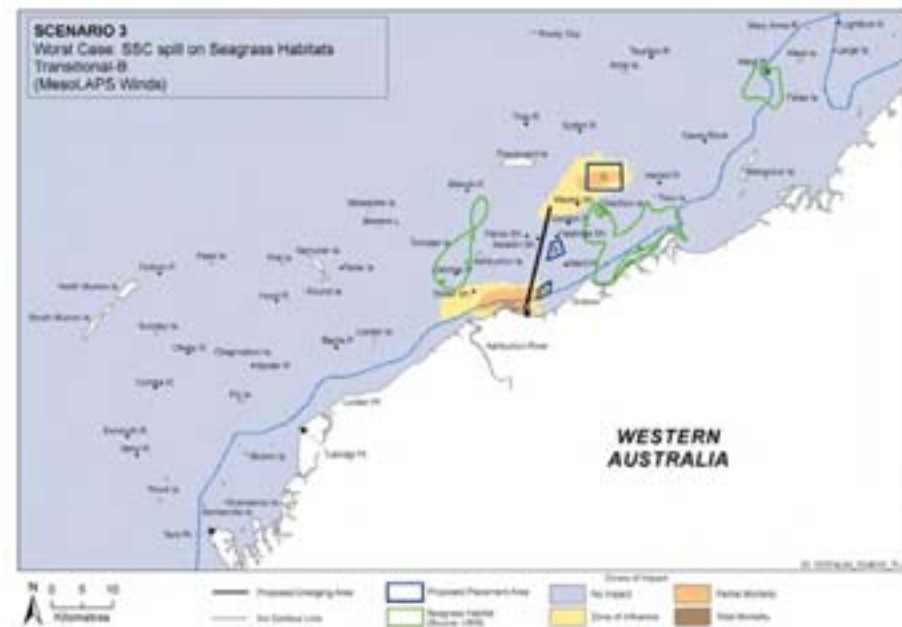


Figure A.143 Scenario 3, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.144 Scenario 3, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



Table A.36 Summary of Impacts at Sensitive Receptors for Scenario 3, Transitional-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.4	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.8	11.6	1.9	0.0	0.0	
3	Ashburton Island	286705	7611075	0.2	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.8	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.4	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.3	4.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.3	5.6	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.4	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.7	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.5	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.2	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4 Dredging Scenario 4**

**A.4.1 Summer-A, Realistic Spill Scenario**

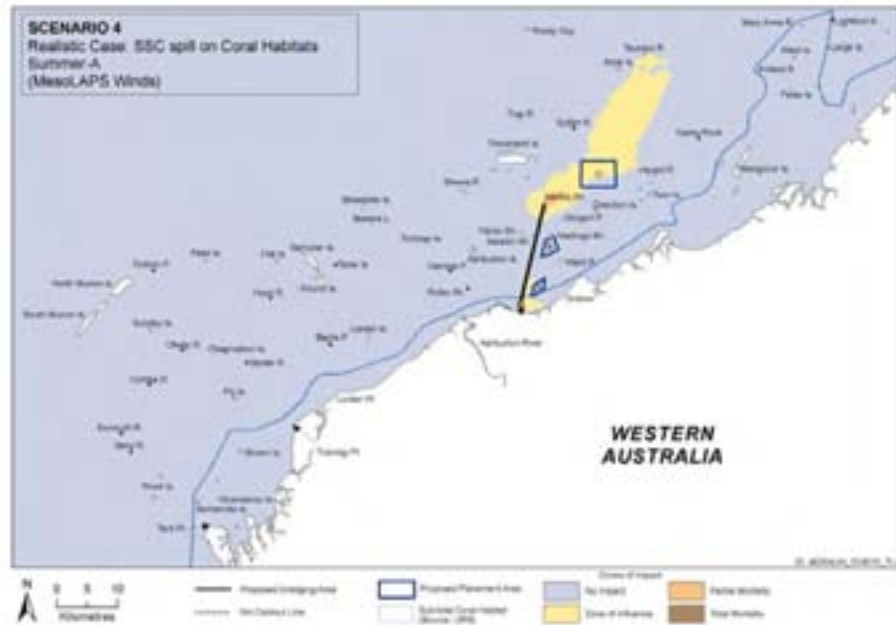


Figure A.145 Scenario 4, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.146 Scenario 4, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

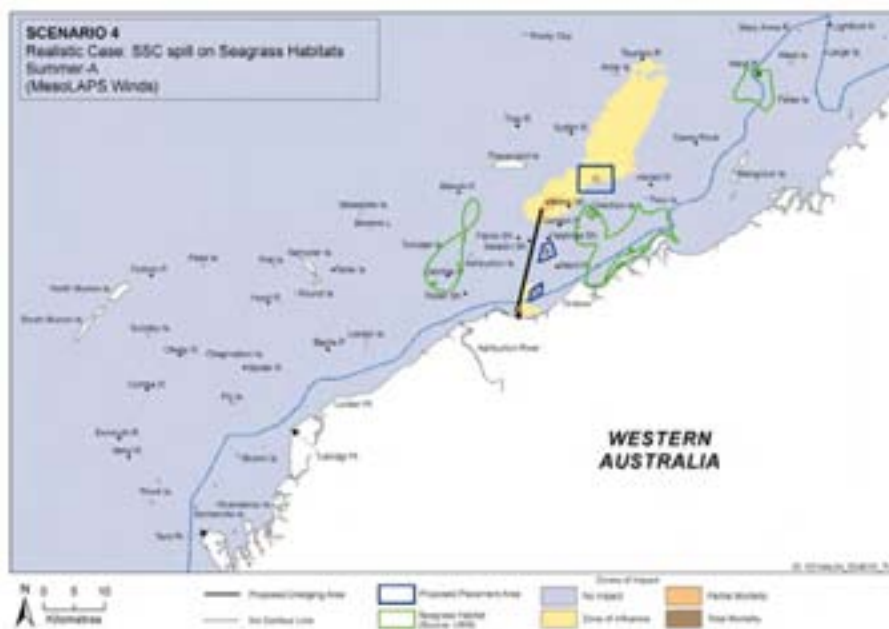


Figure A.147 Scenario 4, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

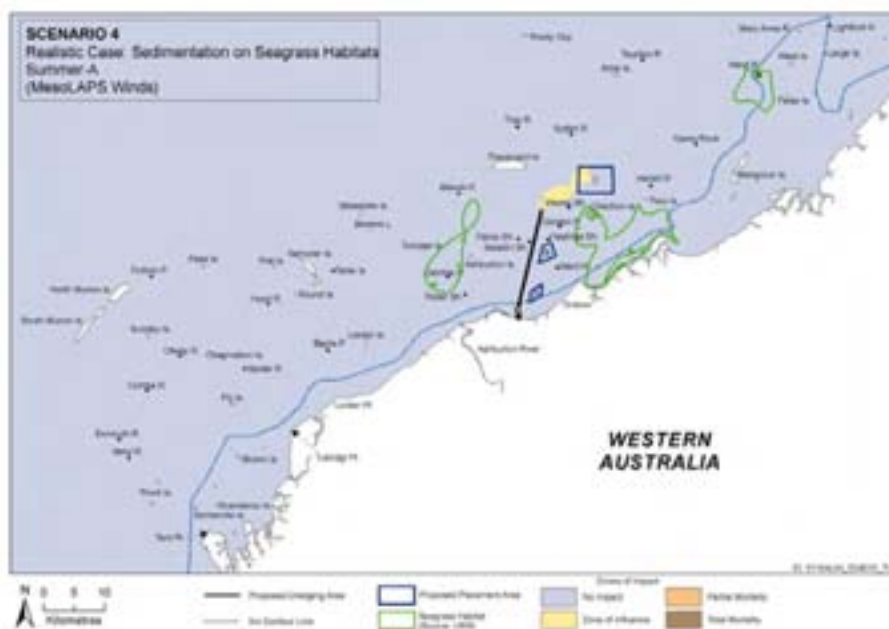


Figure A.148 Scenario 4, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-112



Table A.37 Summary of Impacts at Sensitive Receptors for Scenario 4, Summer-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.7	15.5	9.7	1.5	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.3	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.3	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.5	8.5	2.5	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.4	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.2	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.5	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.5	3.6	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.6	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.2	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.4	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4.2 Summer-B, Realistic Spill Scenario**

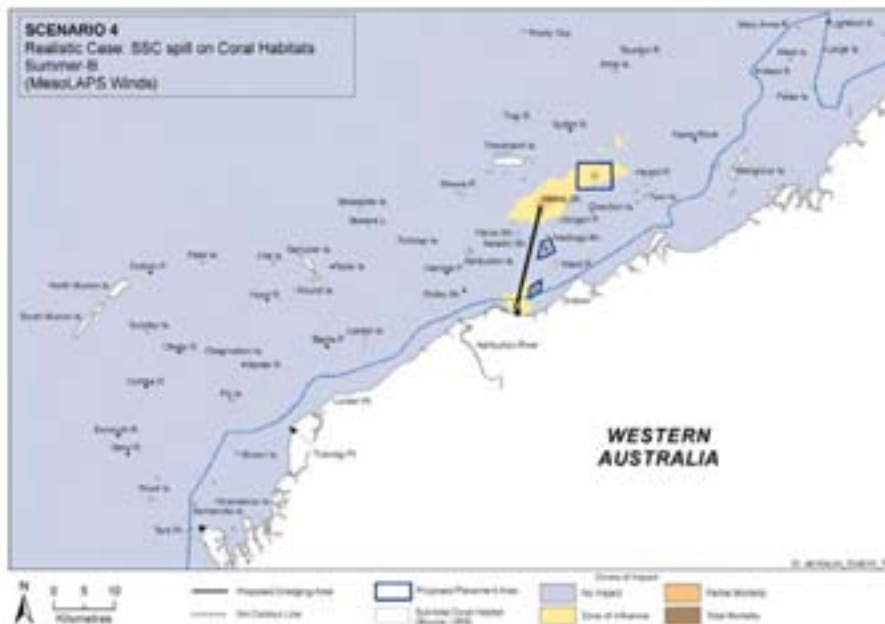


Figure A.149 Scenario 4, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

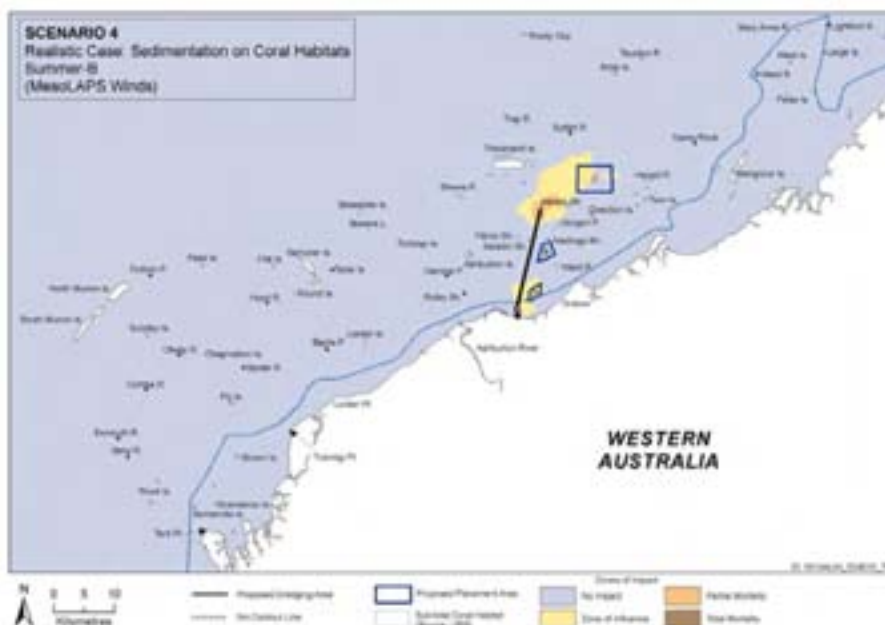


Figure A.150 Scenario 4, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds



A-114

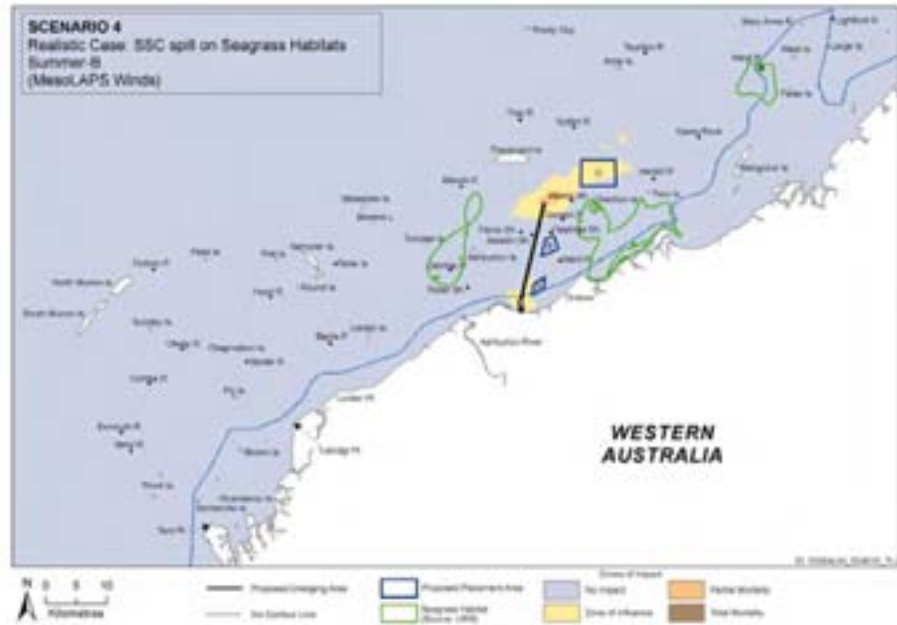


Figure A.151 Scenario 4, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.152 Scenario 4, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Table A.38 Summary of Impacts at Sensitive Receptors for Scenario 4, Summer-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	3.6	20.8	10.7	1.6	1.8	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.2	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.2	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.6	2.4	0.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.4	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.3	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.7	0.0	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	1.2	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.4	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.3	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4.3 Winter-A, Realistic Spill Scenario**

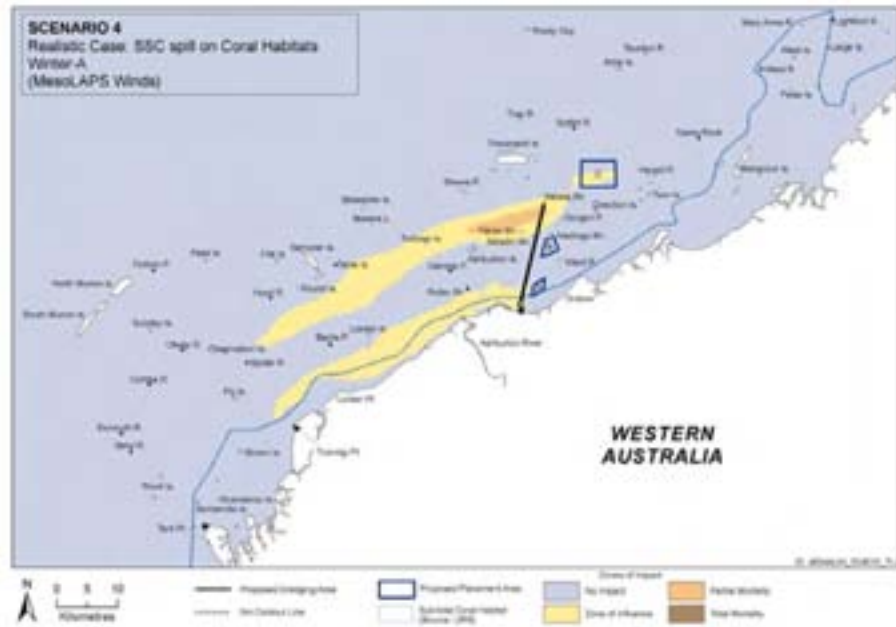


Figure A.153 Scenario 4, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

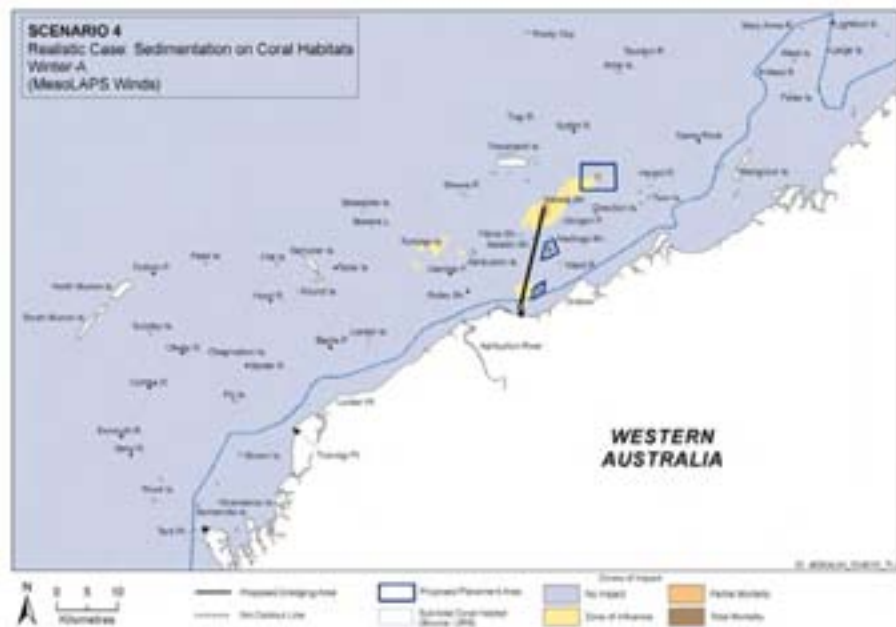


Figure A.154 Scenario 4, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-117

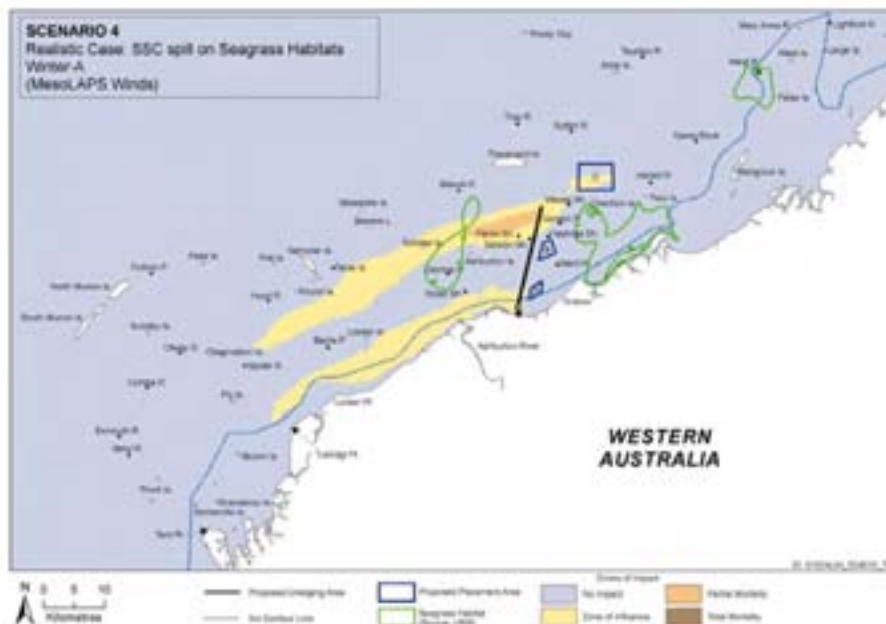


Figure A.155 Scenario 4, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.156 Scenario 4, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-118



Table A.39 Summary of Impacts at Sensitive Receptors for Scenario 4, Winter-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	2.1	7.7	0.7	0.0	0.1	
2	Roller Shoal	285367	7604532	0.8	0.9	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.6	0.7	0.0	0.0	0.2	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.4	9.7	1.2	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.6	2.7	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	3.2	22.6	6.7	0.6	1.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.8	1.8	0.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	3.2	13.8	1.2	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.3	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4.4 Winter-B, Realistic Spill Scenario**

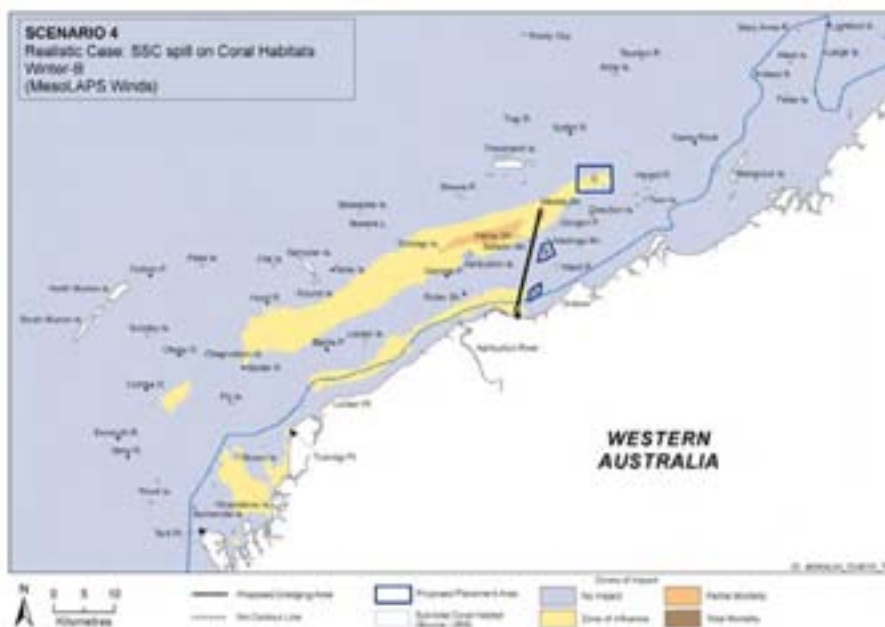


Figure A.157 Scenario 4, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

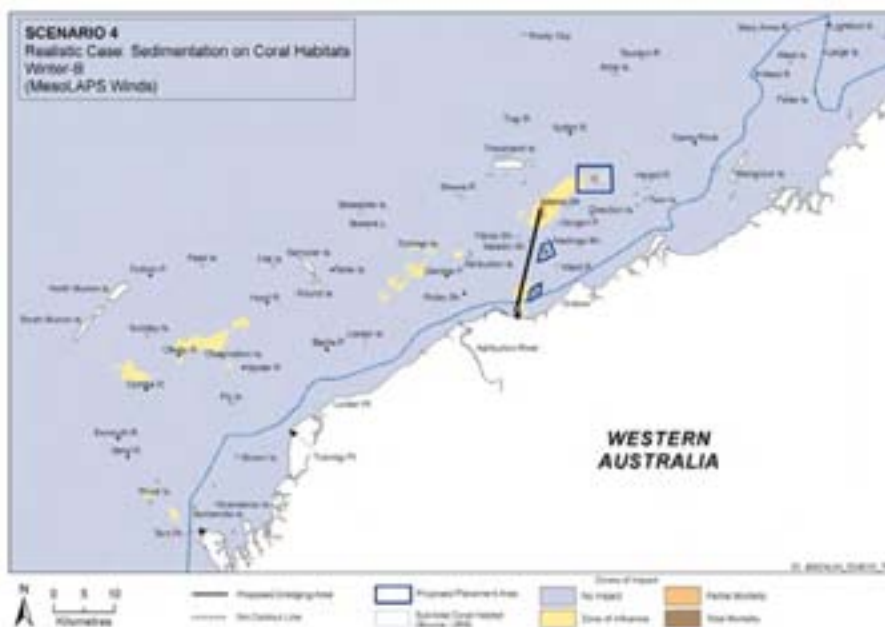


Figure A.158 Scenario 4, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-120

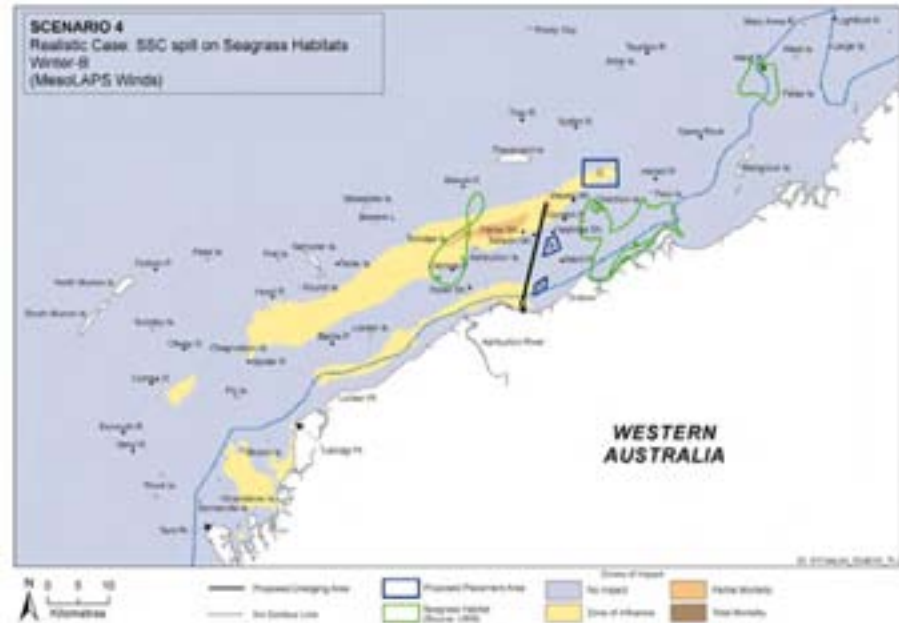


Figure A.159 Scenario 4, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.160 Scenario 4, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Table A.40 Summary of Impacts at Sensitive Receptors for Scenario 4, Winter-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	2.0	16.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.6	0.1	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.9	1.6	0.0	0.0	0.2	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.2	17.8	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.7	0.4	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	4.0	29.6	9.5	0.3	1.5	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.0	1.0	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.5	0.6	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	3.1	26.6	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.2	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**A.4.5 Transitional-A, Realistic Spill Scenario**

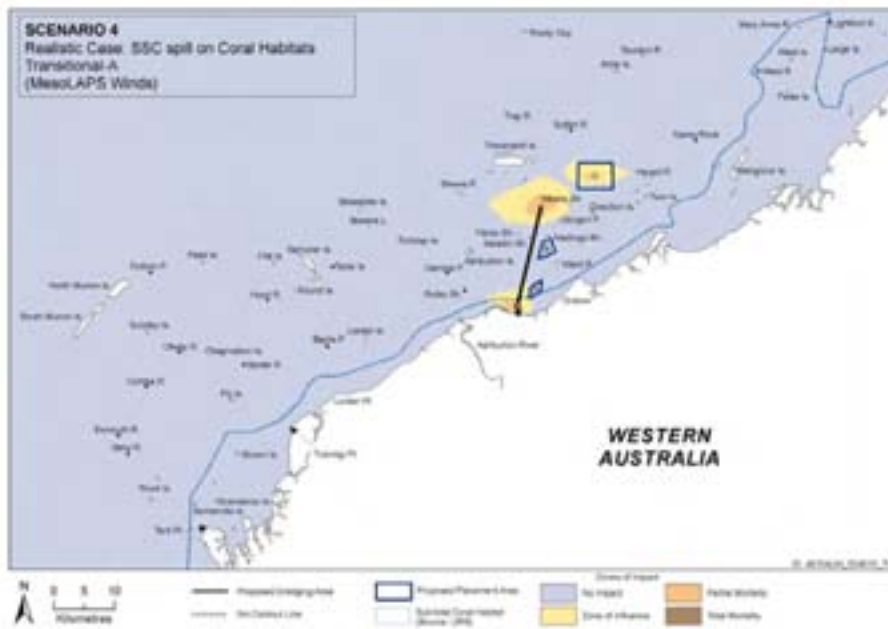


Figure A.161 Scenario 4, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

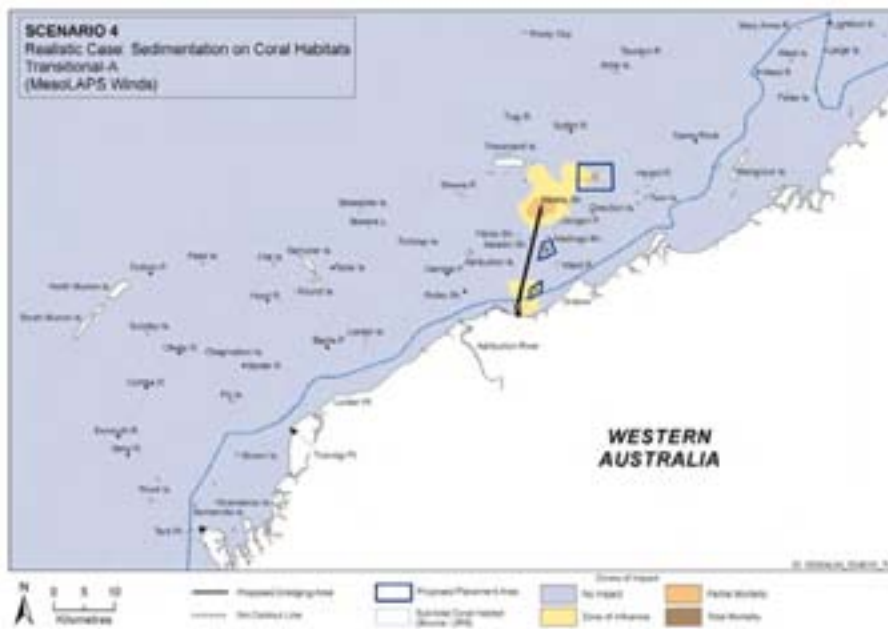


Figure A.162 Scenario 4, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-123

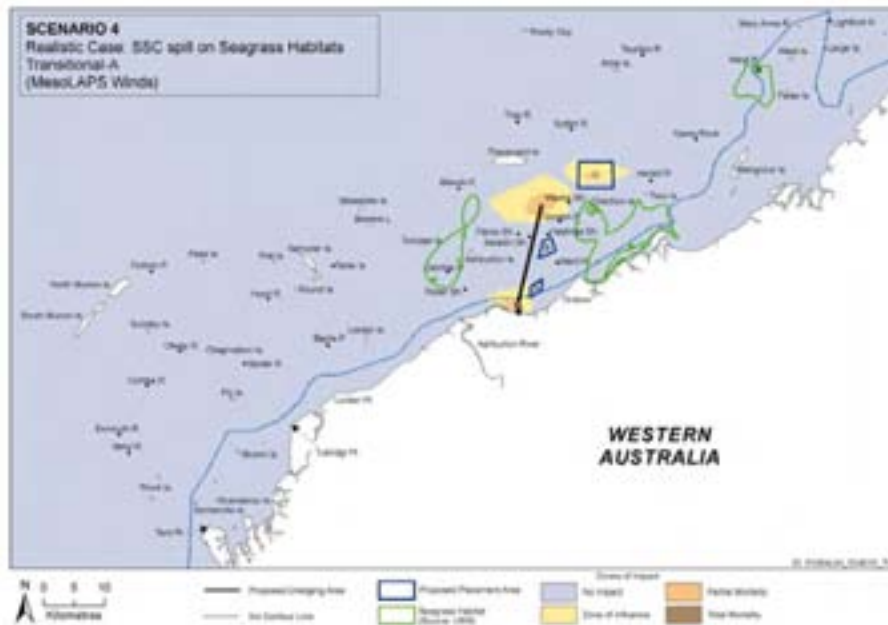


Figure A.163 Scenario 4, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.164 Scenario 4, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-124



Table A.41 Summary of Impacts at Sensitive Receptors for Scenario 4, Transitional-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.5	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.2	0.0	0.0	0.0	0.1	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	4.3	28.2	8.2	1.2	2.1	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.4	0.1	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.0	6.2	2.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.3	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.2	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4.6 Transitional-B, Realistic Spill Scenario**



Figure A.165 Scenario 4, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

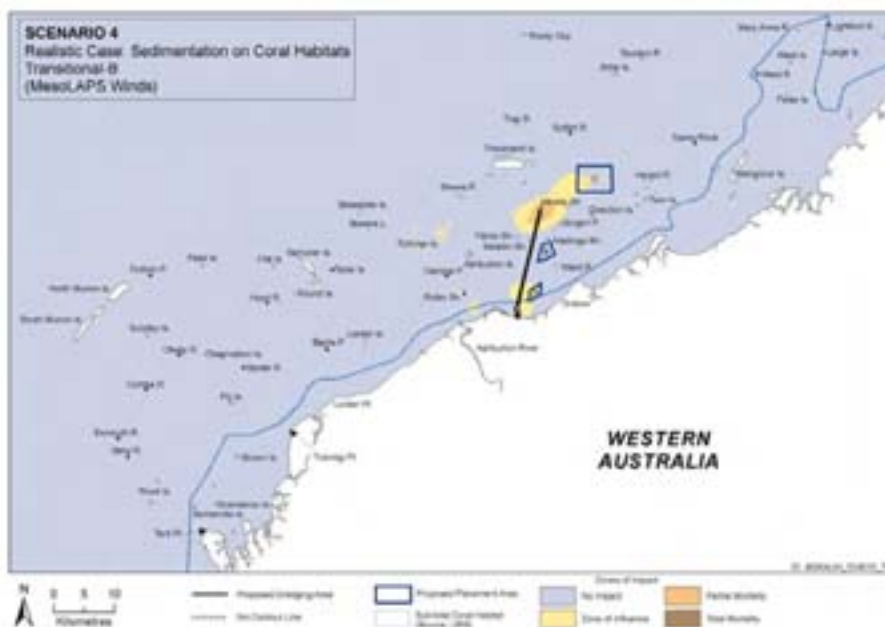


Figure A.166 Scenario 4, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-126

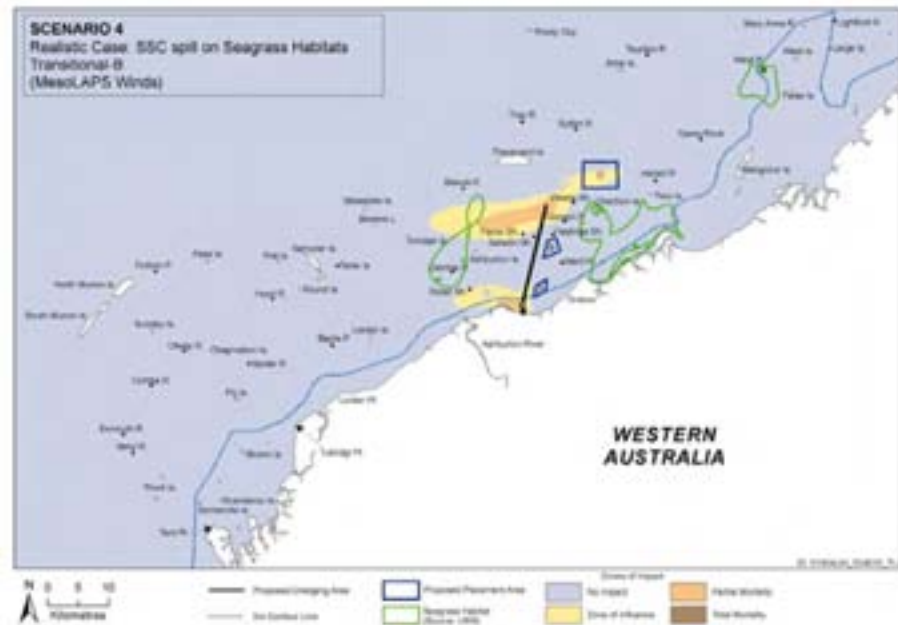


Figure A.167 Scenario 4, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.168 Scenario 4, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Table A.42 Summary of Impacts at Sensitive Receptors for Scenario 4, Transitional-B, Realistic Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.7	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.0	2.5	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.3	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.2	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.5	7.0	0.3	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	4.6	32.7	10.3	1.2	2.3	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.4	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.8	1.2	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.5	1.2	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	1.3	5.5	0.0	0.0	0.1	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4.7 Summer-A, Worst Case Spill Scenario**

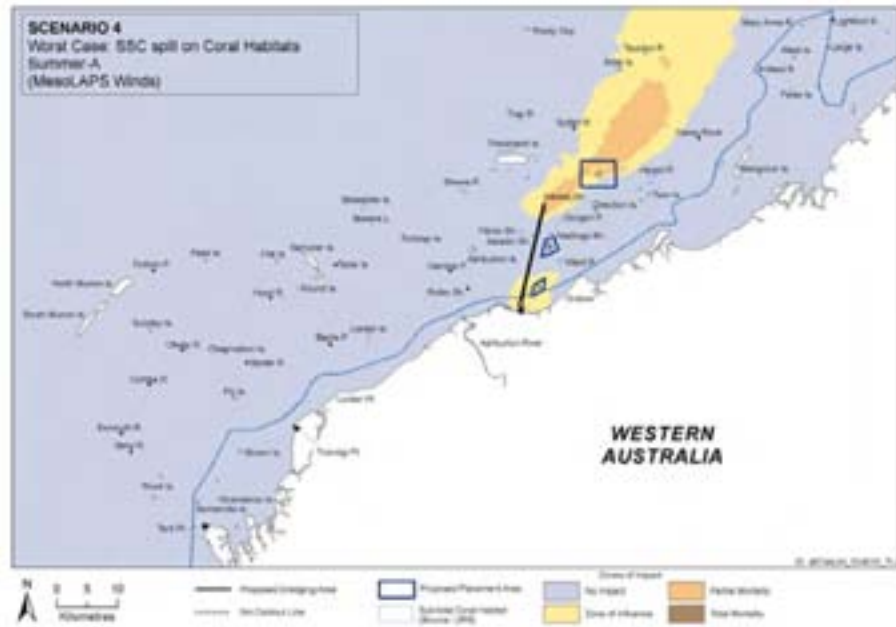


Figure A.169 Scenario 4, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

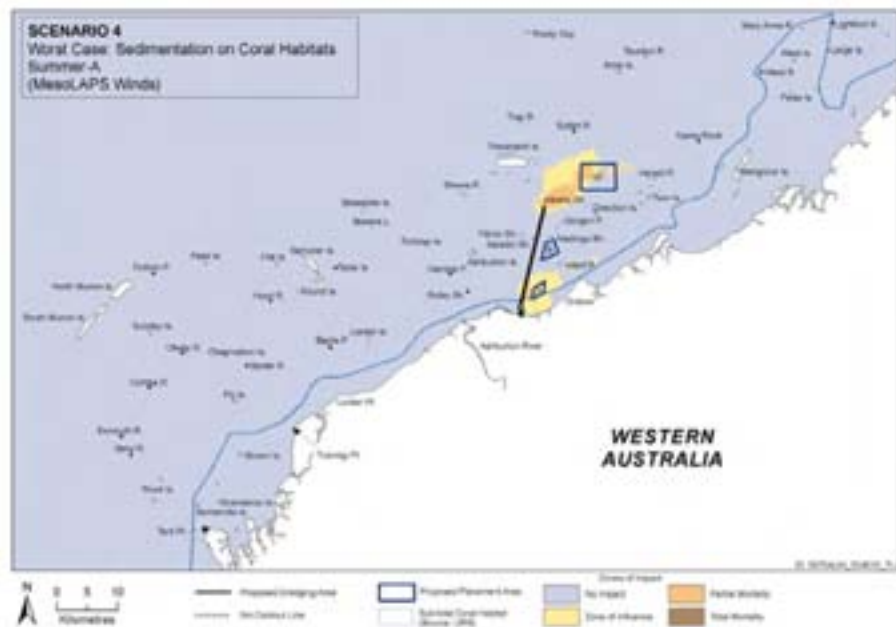


Figure A.170 Scenario 4, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

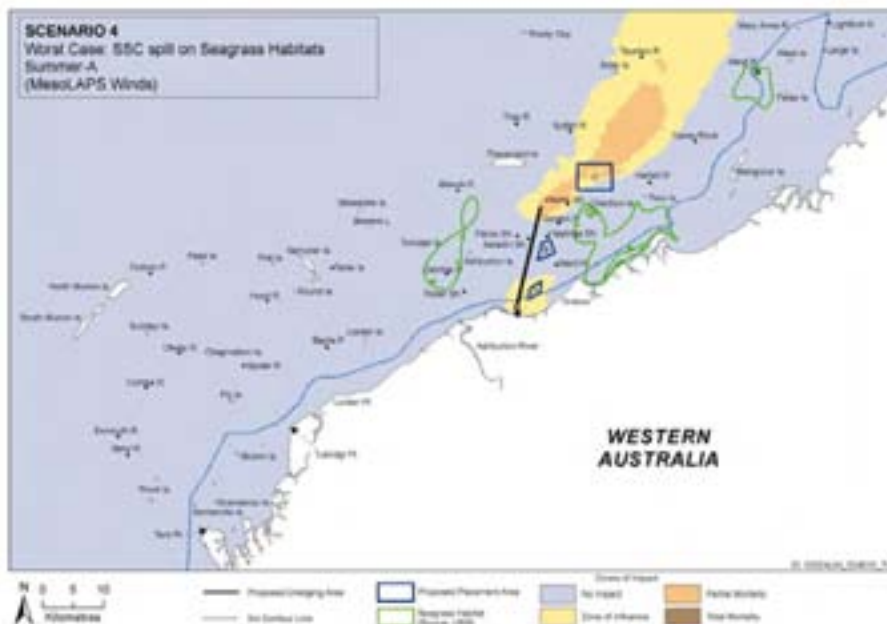


Figure A.171 Scenario 4, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

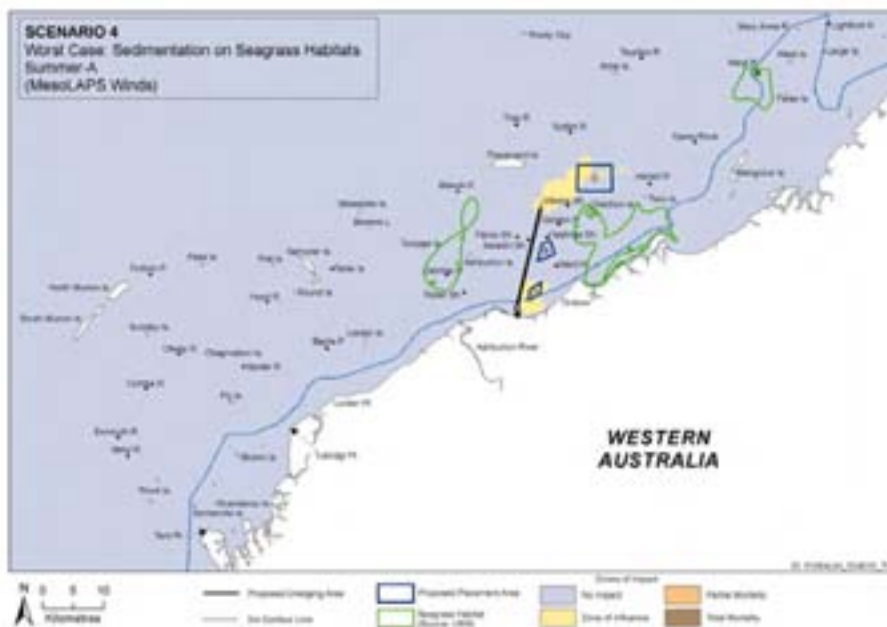


Figure A.172 Scenario 4, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



A-130



Table A.43 Summary of Impacts at Sensitive Receptors for Scenario 4, Summer-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	4.5	17.7	12.5	6.7	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.7	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.7	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	2.1	13.1	5.1	0.4	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.2	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.2	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.8	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.4	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.8	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	2.7	23.2	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.3	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	1.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.3	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.3	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.9	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.3	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4.8 Summer-B, Worst Case Spill Scenario**

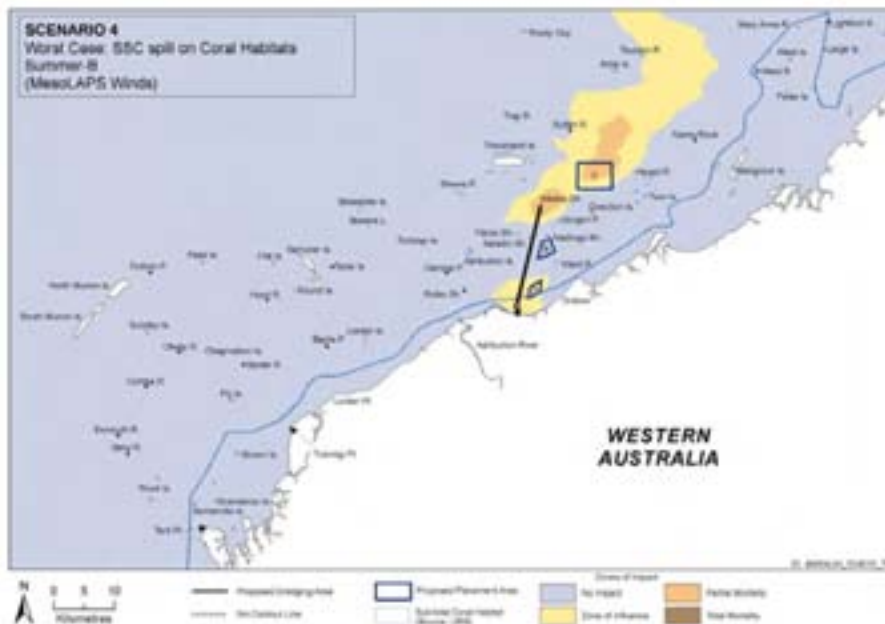


Figure A.173 Scenario 4, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

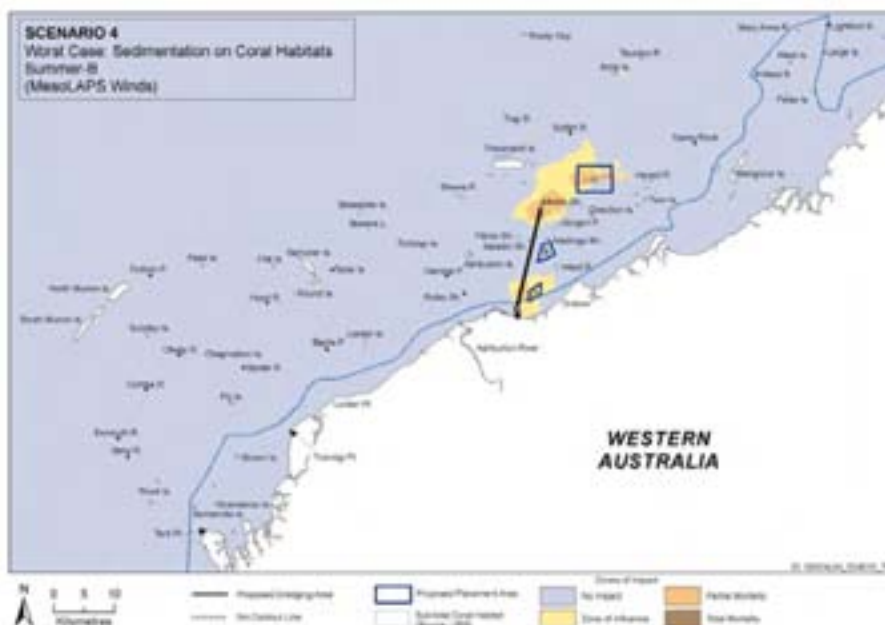


Figure A.174 Scenario 4, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-132

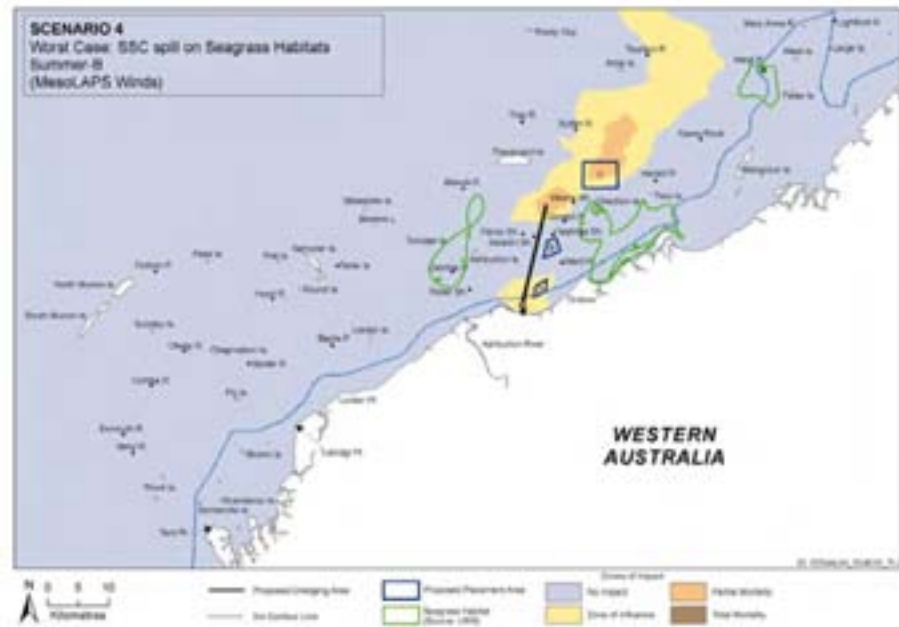


Figure A.175 Scenario 4, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.176 Scenario 4, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



Table A.44 Summary of Impacts at Sensitive Receptors for Scenario 4, Summer-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	5.4	26.0	15.2	5.1	4.1	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.2	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.5	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.5	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.8	4.2	0.9	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.9	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.7	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	1.1	0.0	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	2.1	5.2	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.3	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.8	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.2	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.3	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.6	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4.9 Winter-A, Worst Case Spill Scenario**

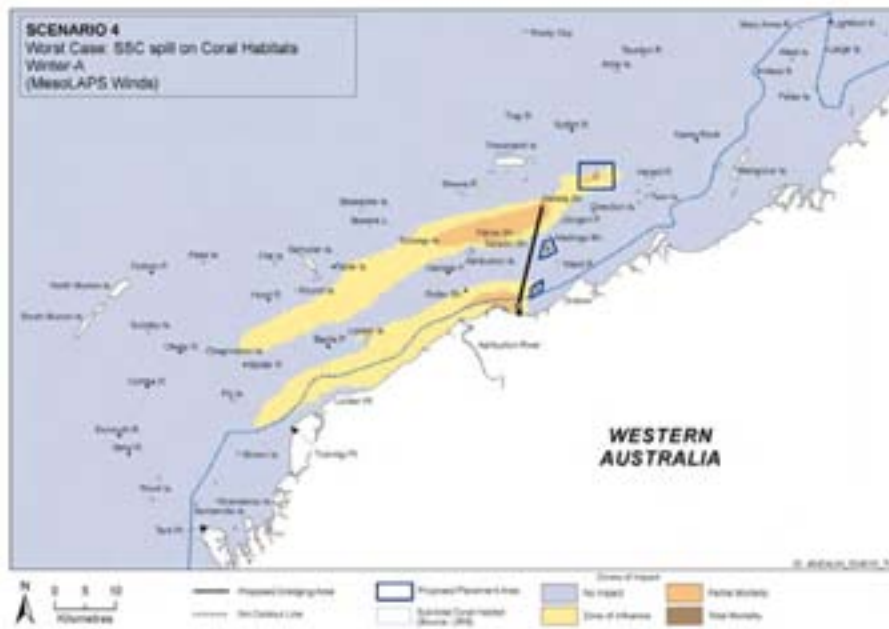


Figure A.177 Scenario 4, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

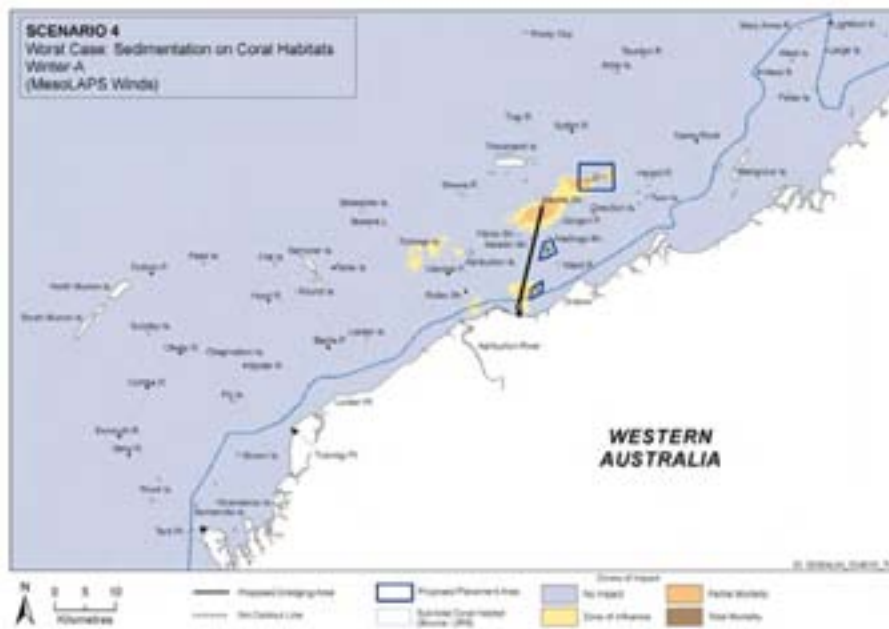


Figure A.178 Scenario 4, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-135

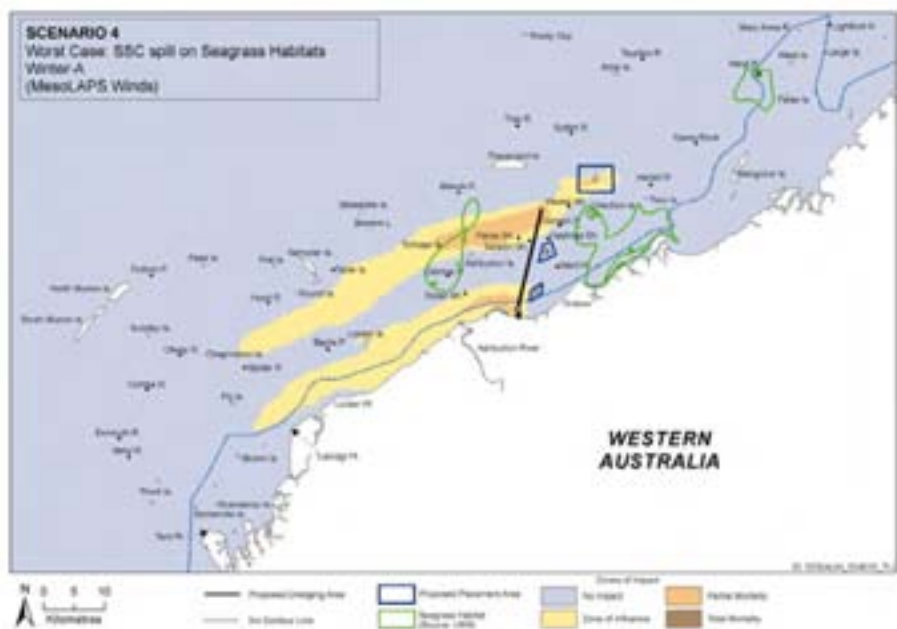


Figure A.179 Scenario 4, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

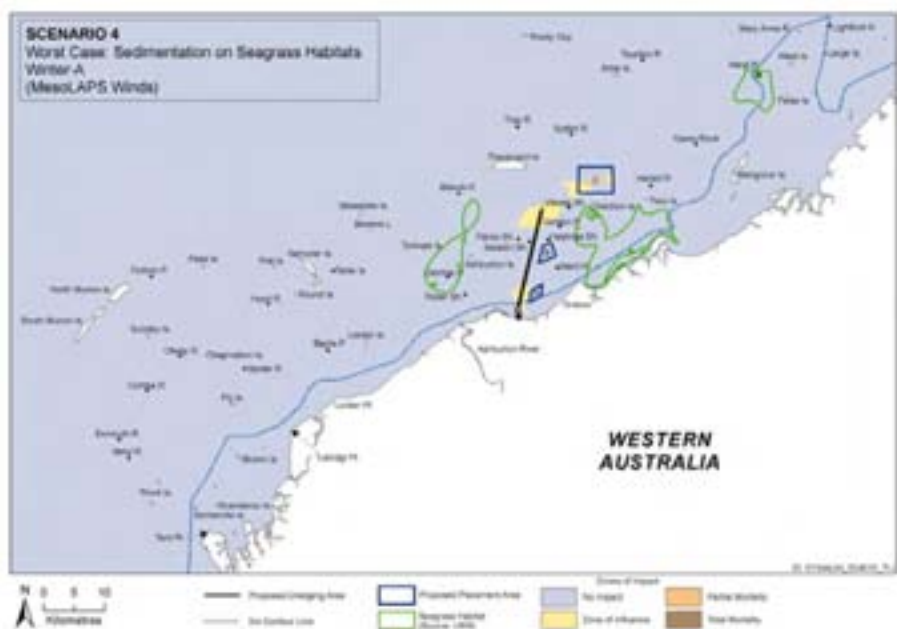


Figure A.180 Scenario 4, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-136



Table A.45 Summary of Impacts at Sensitive Receptors for Scenario 4, Winter-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	3.1	12.0	4.6	0.0	0.2	
2	Roller Shoal	285367	7604532	1.5	6.7	0.4	0.0	0.0	
3	Ashburton Island	286705	7611075	0.9	0.9	0.0	0.0	0.3	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	3.3	22.3	2.1	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.9	3.6	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	5.2	34.8	14.0	1.9	2.7	
9	Hastings Shoal	298803	7613488	0.2	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.1	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.4	0.3	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.8	5.2	1.6	0.3	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.4	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	4.7	46.8	5.8	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4.10 Winter-B, Worst Case Spill Scenario**

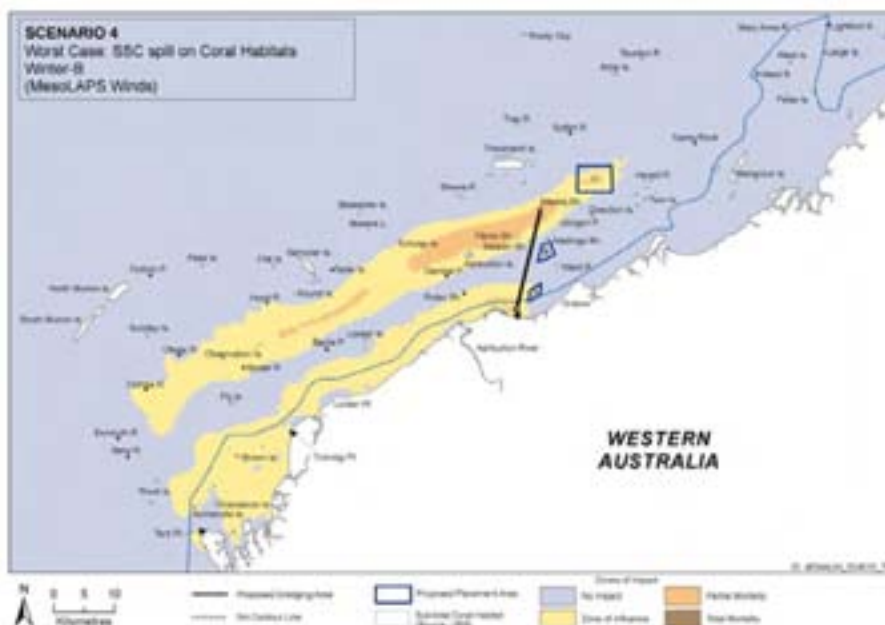


Figure A.181 Scenario 4, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

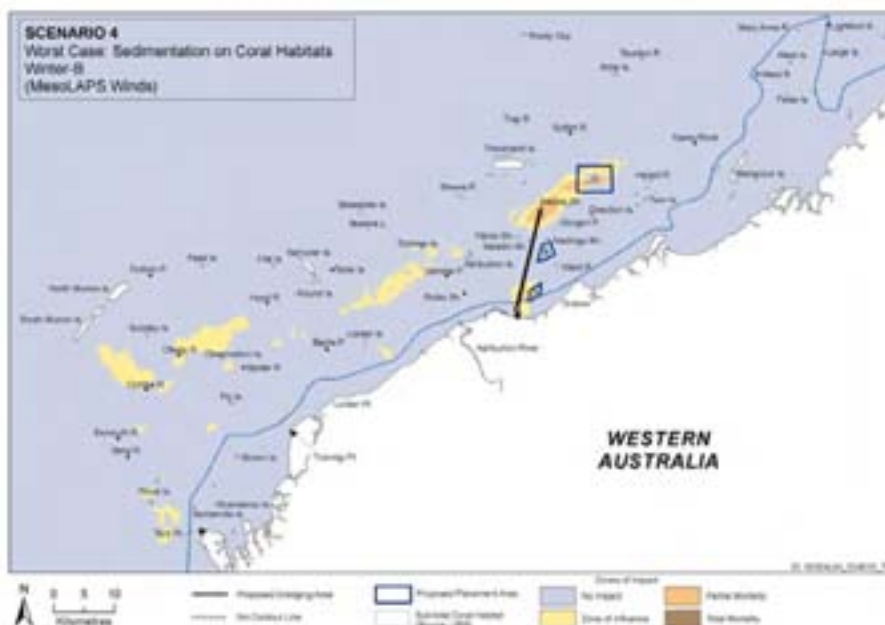


Figure A.182 Scenario 4, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds



A-138

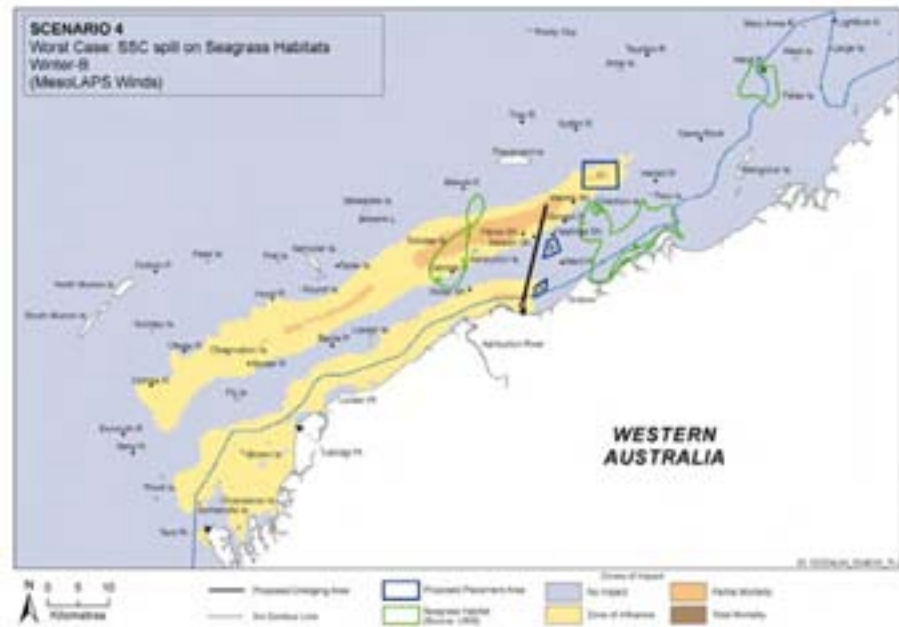


Figure A.183 Scenario 4, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

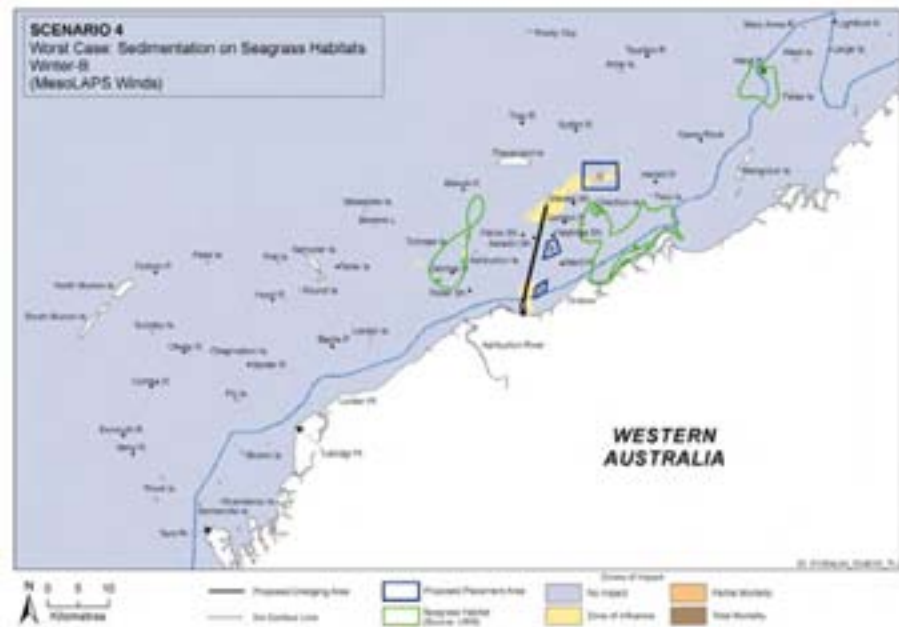


Figure A.184 Scenario 4, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Table A.46 Summary of Impacts at Sensitive Receptors for Scenario 4, Winter-B, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	2.9	25.1	3.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.2	6.2	0.4	0.0	0.0	
3	Ashburton Island	286705	7611075	1.5	7.1	0.1	0.0	0.6	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.9	27.9	1.8	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.2	5.3	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	5.9	42.2	17.2	2.1	3.1	
9	Hastings Shoal	298803	7613488	0.3	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.7	0.9	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.8	2.2	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.7	6.4	0.6	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airrie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.9	3.4	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	4.2	41.6	7.9	0.0	0.2	
27	S of Brew is Reef	286445	7618545	0.3	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4.11 Transitional-A, Worst Case Spill Scenario**

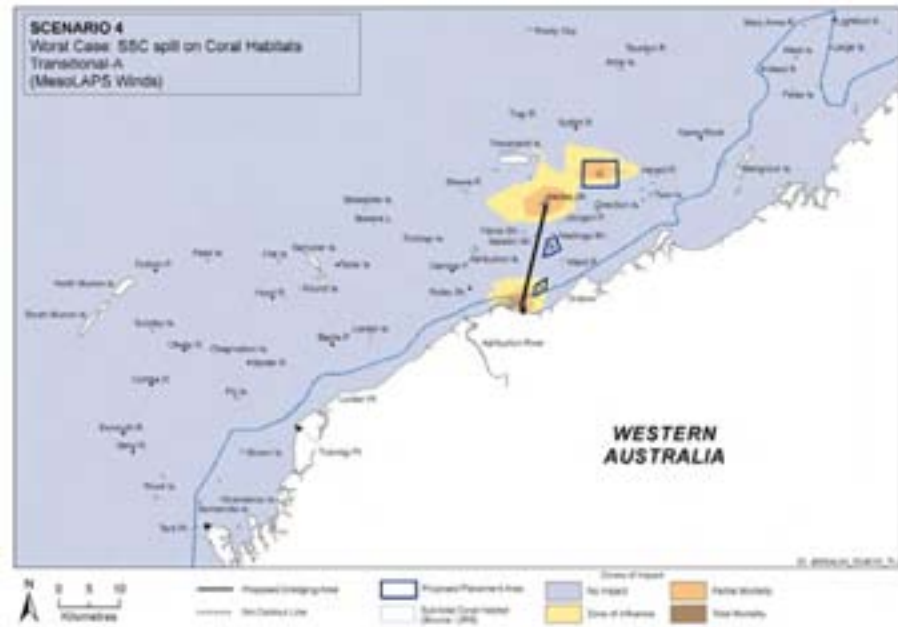


Figure A.185 Scenario 4, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

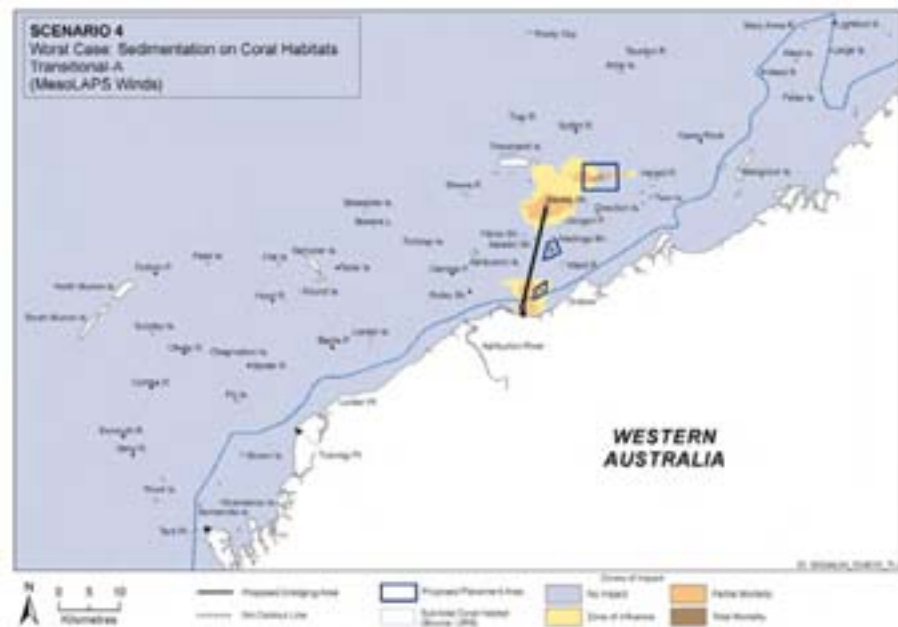


Figure A.186 Scenario 4, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-141

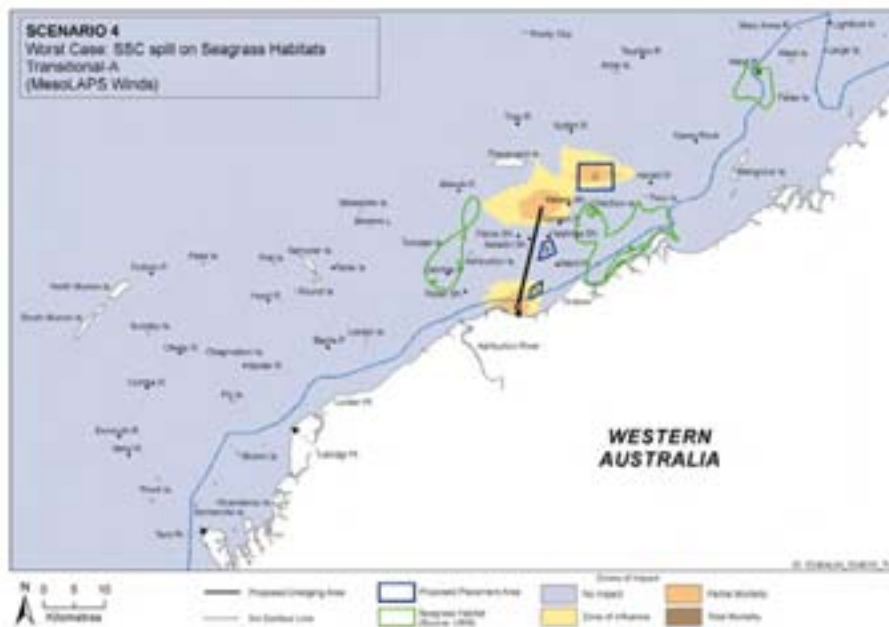


Figure A.187 Scenario 4, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

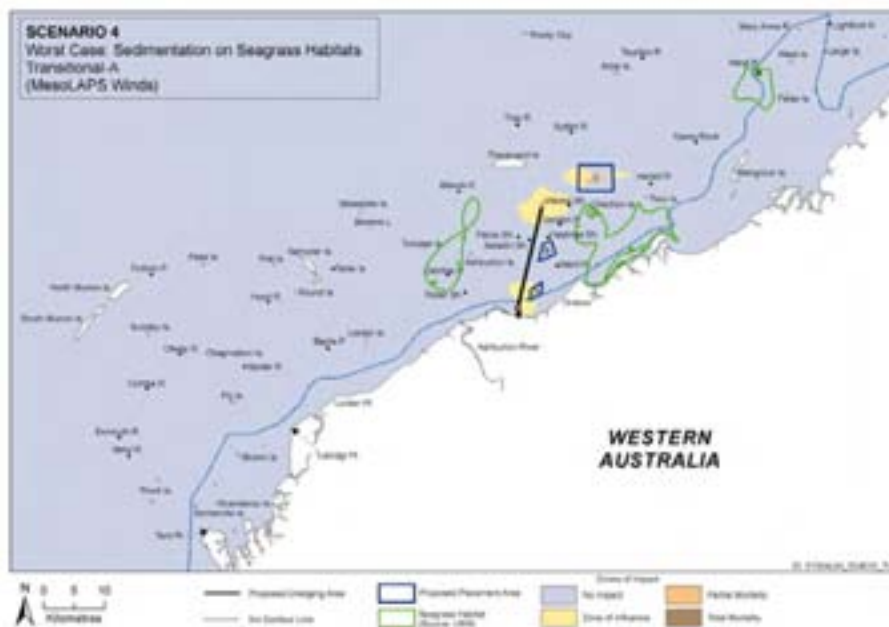


Figure A.188 Scenario 4, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-142



Table A.47 Summary of Impacts at Sensitive Receptors for Scenario 4, Transitional-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.4	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.6	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.2	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.2	0.0	0.0	0.0	0.1	
7	Saladin Shoal	295913	7613337	0.1	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	6.1	38.2	17.8	3.3	3.3	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.4	0.3	0.0	0.0	0.2	
15	Weeks Shoal	302245	7618926	1.4	9.1	3.9	0.1	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.5	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.3	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.4.12 Transitional-B, Worst Case Spill Scenario**

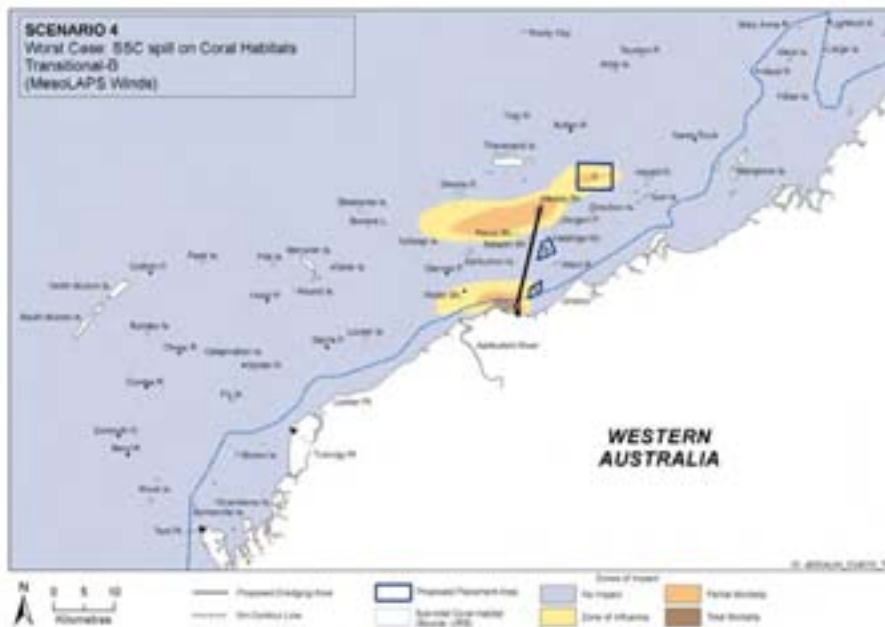


Figure A.189 Scenario 4, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

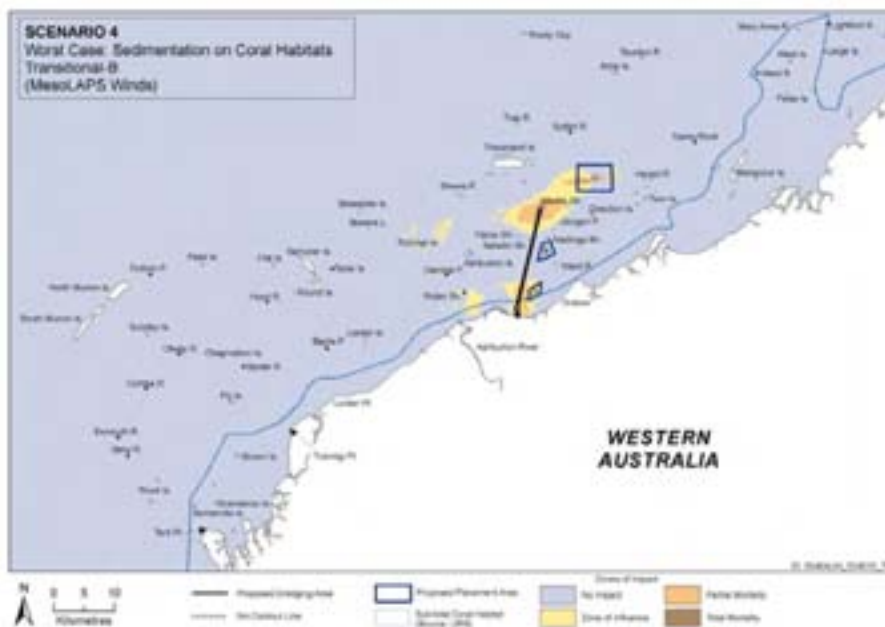


Figure A.190 Scenario 4, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-144

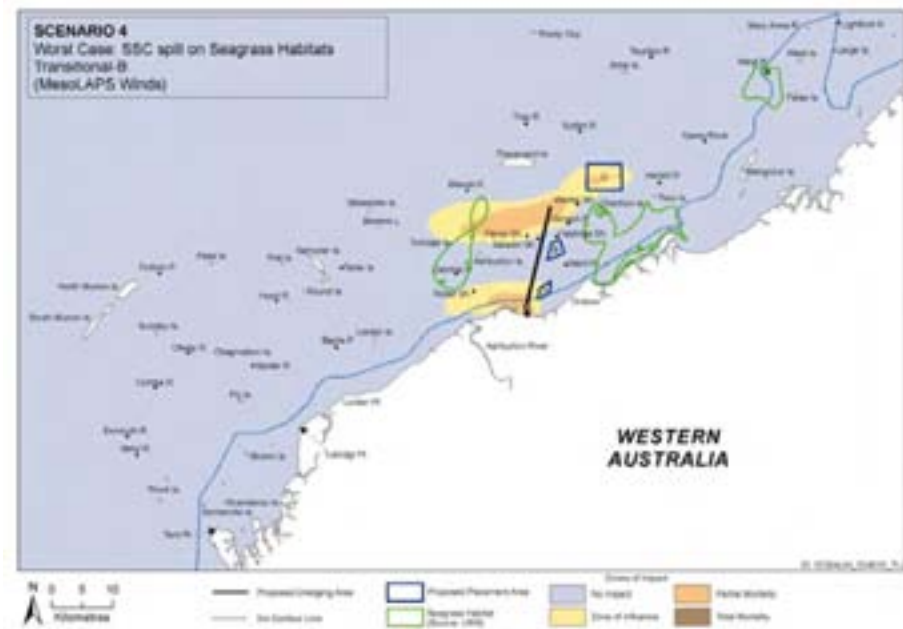


Figure A.191 Scenario 4, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

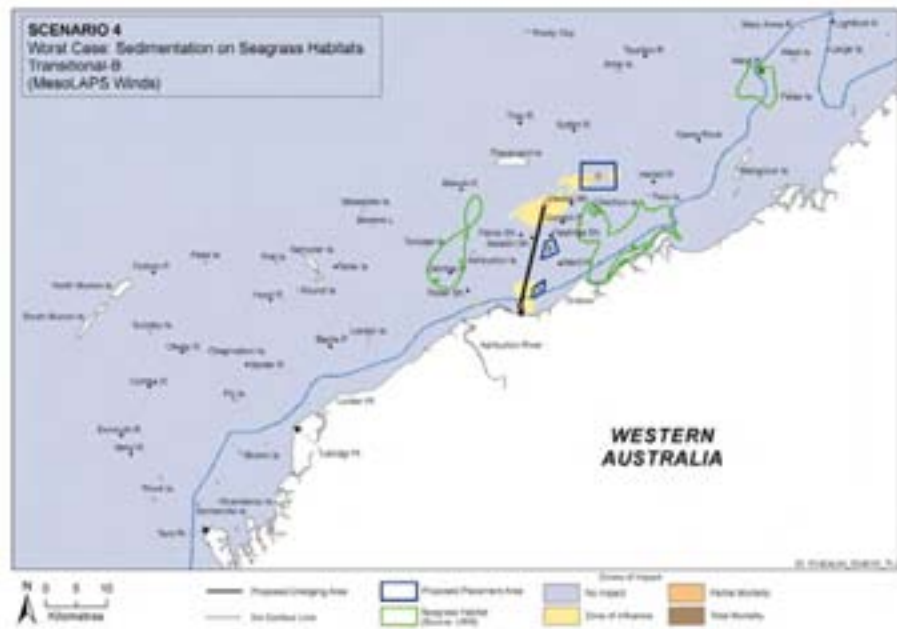


Figure A.192 Scenario 4, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



Table A.48 Summary of Impacts at Sensitive Receptors for Scenario 4, Transitional-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.5	8.6	1.3	0.0	0.0	
3	Ashburton Island	286705	7611075	0.2	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.4	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.3	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.0	12.2	0.7	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.7	0.3	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	6.9	51.7	19.3	3.3	4.0	
9	Hastings Shoal	298803	7613488	0.2	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.3	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.6	1.2	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.4	5.2	0.3	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.3	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.0	4.5	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	1.8	11.6	0.3	0.0	0.1	
28	Thevenard Island South	294521	7622970	0.2	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**A.5 Dredging Scenario 5**

**A.5.1 Summer-A, Realistic Spill Scenario**

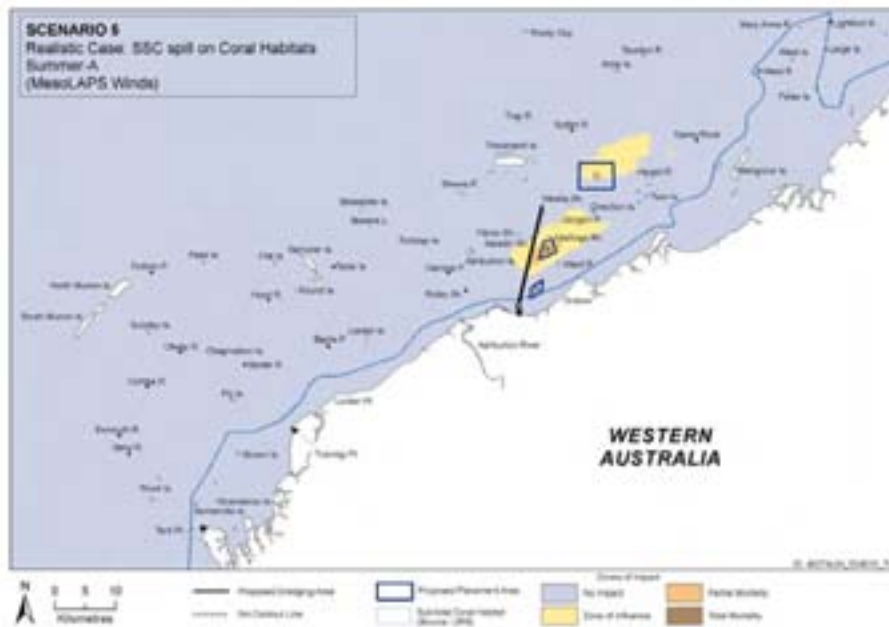


Figure A.193 Scenario 5, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

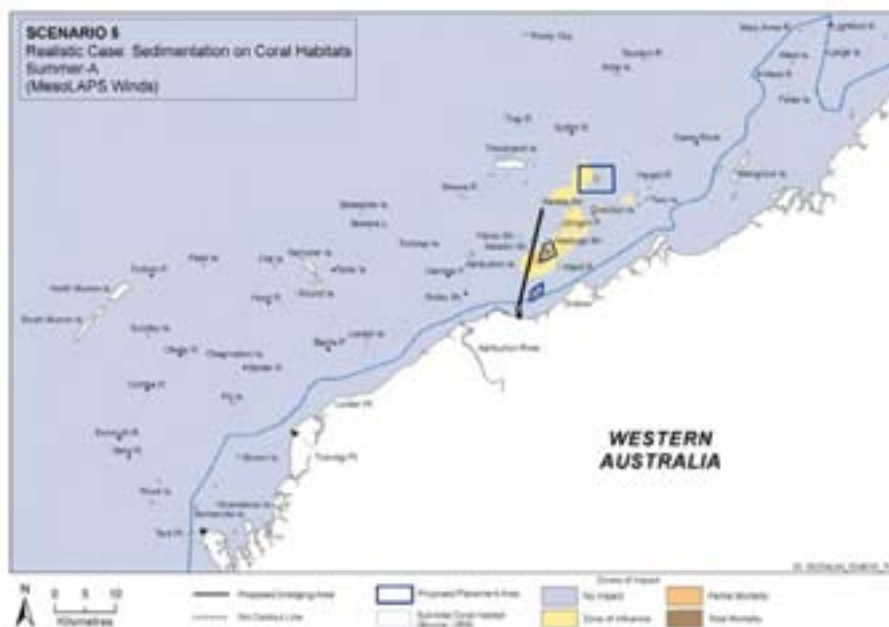


Figure A.194 Scenario 5, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

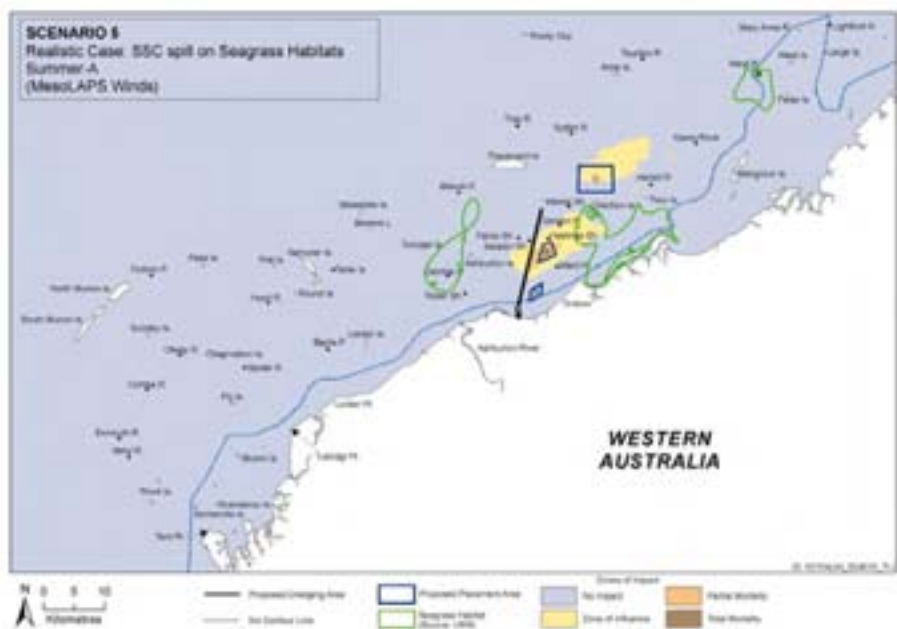


Figure A.195 Scenario 5, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

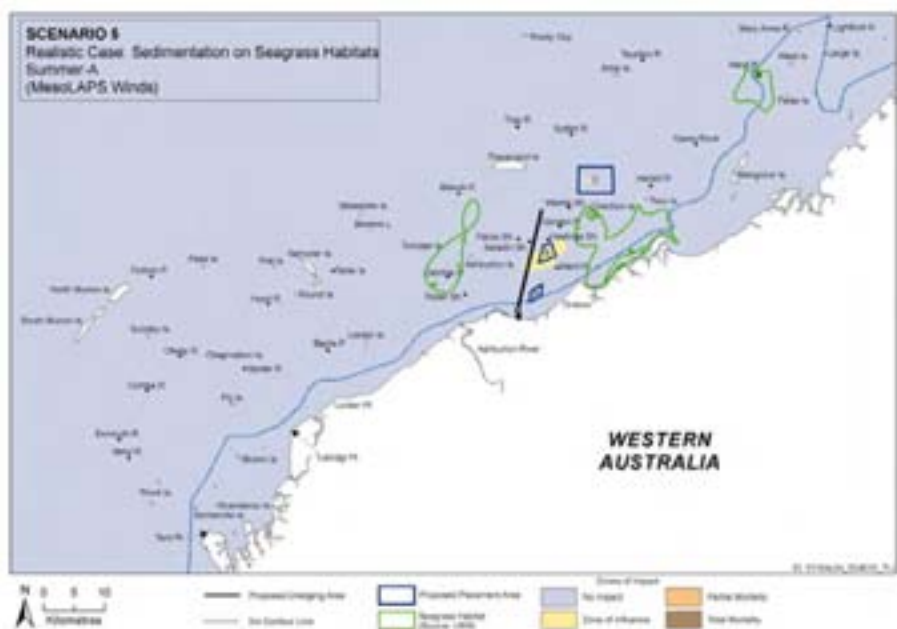


Figure A.196 Scenario 5, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-148



Table A.49 Summary of Impacts at Sensitive Receptors for Scenario 5, Summer-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.6	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.7	0.1	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	2.3	14.6	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	3.1	21.8	6.2	0.1	0.0	
11	Ward Reef	300410	7608868	0.6	0.3	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.4	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.7	5.2	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	1.7	5.2	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.3	0.3	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	2.5	11.9	0.0	0.0	0.7	
17	NW of Direction Island	304867	7618549	1.7	0.6	0.0	0.0	0.0	
18	Direction Island	307431	7617732	1.6	0.0	0.0	0.0	0.8	
19	NE Tw in Island	314029	7620738	1.4	0.6	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	1.6	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.6	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.4	0.4	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.8	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	1.7	2.1	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.3	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.6	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	1.4	0.1	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.5.2 Summer-B, Realistic Spill Scenario**



Figure A.197 Scenario 5, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

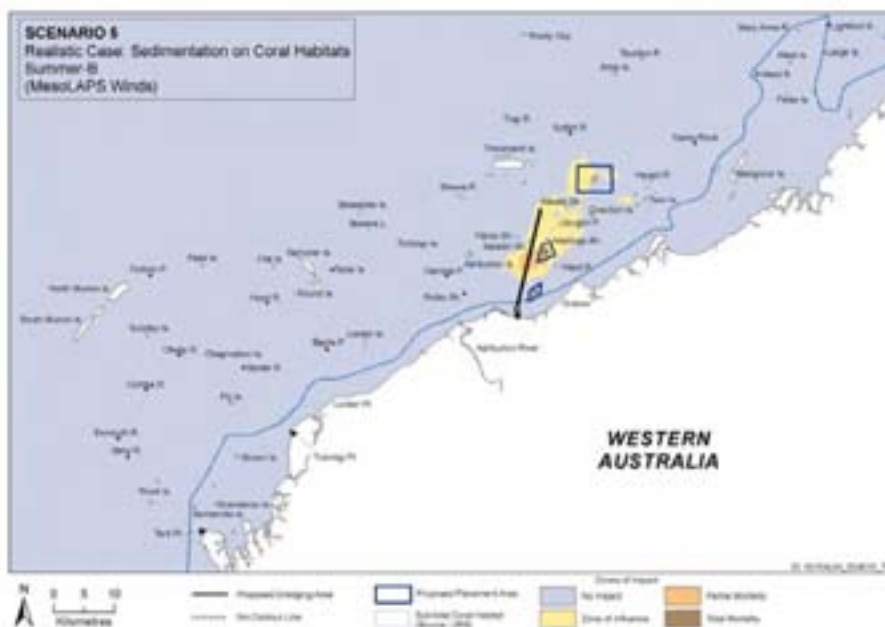


Figure A.198 Scenario 5, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-150

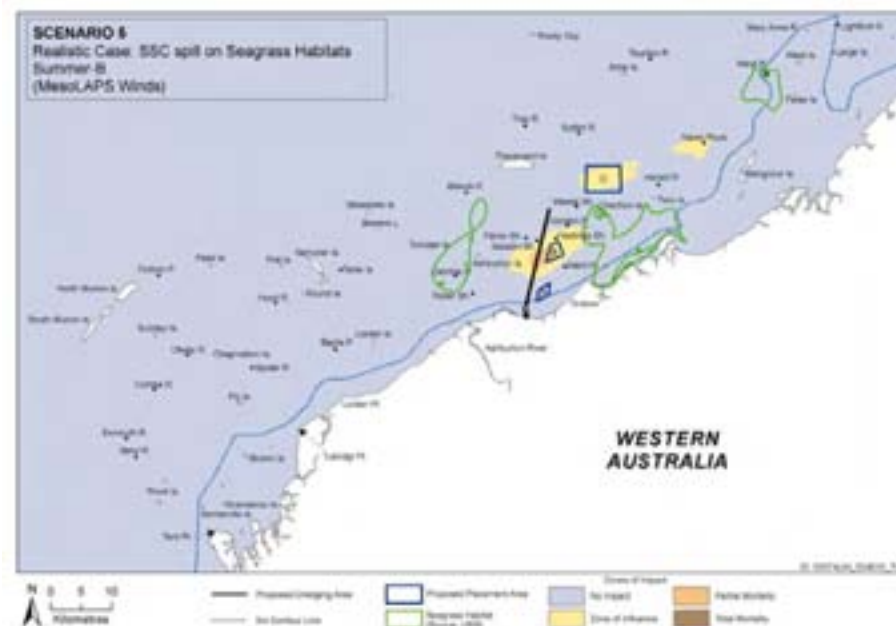


Figure A.199 Scenario 5, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.200 Scenario 5, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Table A.50 Summary of Impacts at Sensitive Receptors for Scenario 5, Summer-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brewis Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.4	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.2	1.8	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.0	0.1	0.0	0.0	0.3	
9	Hastings Shoal	298803	7613488	2.1	8.2	0.0	0.0	0.6	
10	North West Ward Reef	299018	7610106	2.3	16.6	4.9	0.0	0.8	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.6	1.8	0.0	0.0	0.4	
14	Gorgon Patch	300859	7615993	1.4	1.5	0.0	0.0	0.3	
15	Weeks Shoal	302245	7618926	0.9	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.3	2.2	0.0	0.0	0.3	
17	NW of Direction Island	304867	7618549	1.0	0.3	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.7	0.0	0.0	0.0	0.2	
19	NE Tw in Island	314029	7620738	0.6	0.3	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.9	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.3	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.5	5.3	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.1	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.7	1.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.2	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.6	0.1	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.5.3 Winter-A, Realistic Spill Scenario**

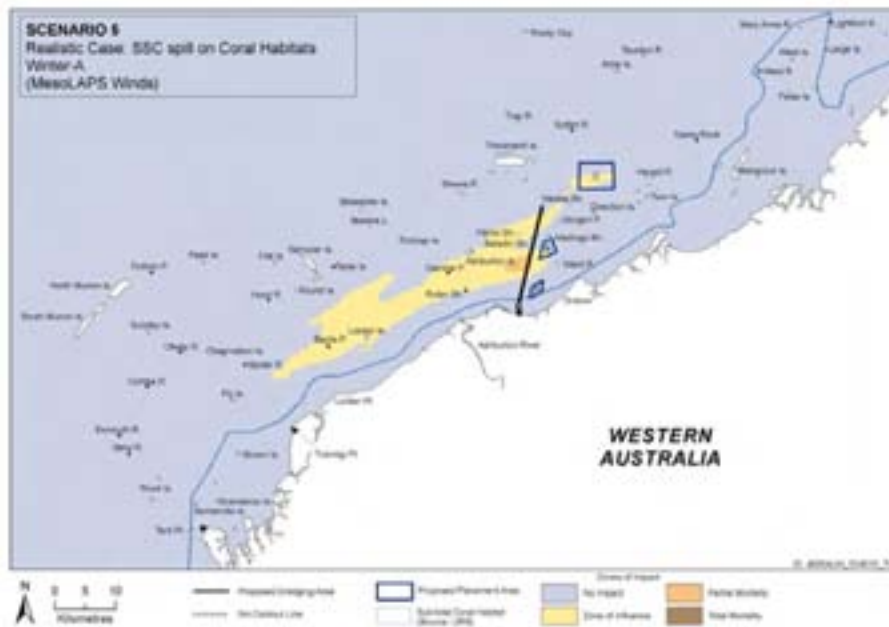


Figure A.201 Scenario 5, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

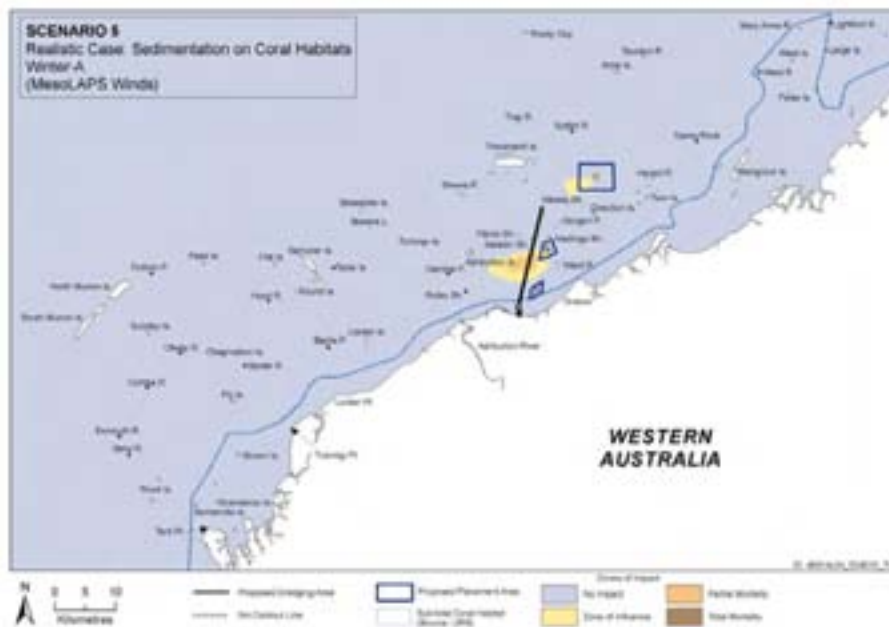


Figure A.202 Scenario 5, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

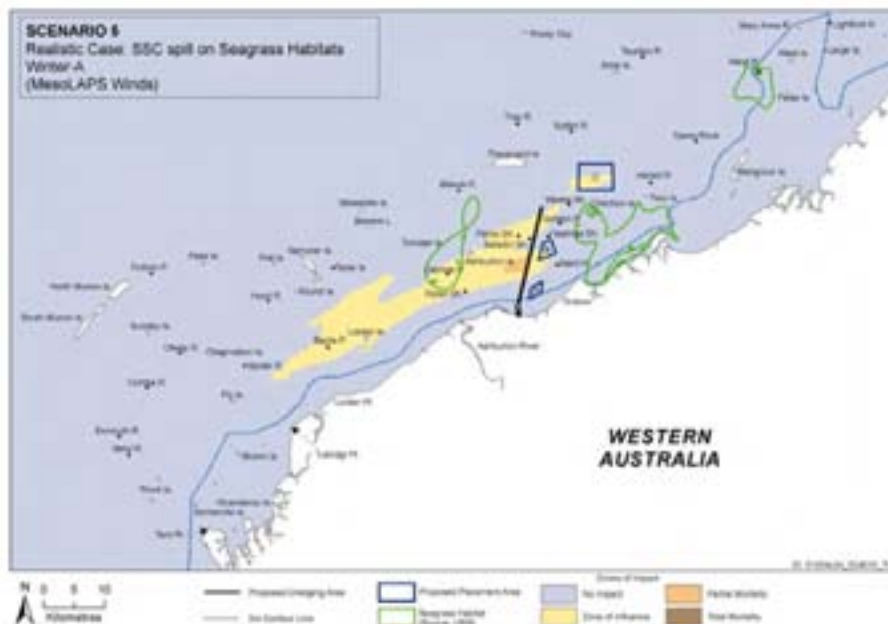


Figure A.203 Scenario 5, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.204 Scenario 5, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



A-154



Table A.51 Summary of Impacts at Sensitive Receptors for Scenario 5, Winter-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.6	0.1	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.0	1.8	0.6	0.0	0.0	
3	Ashburton Island	286705	7611075	0.9	2.5	0.0	0.0	0.6	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.2	3.9	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.0	3.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.0	3.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.3	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.5	2.8	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.8	1.8	0.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.3	3.6	1.8	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.0	0.3	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.5.4 Winter-B, Realistic Spill Scenario**

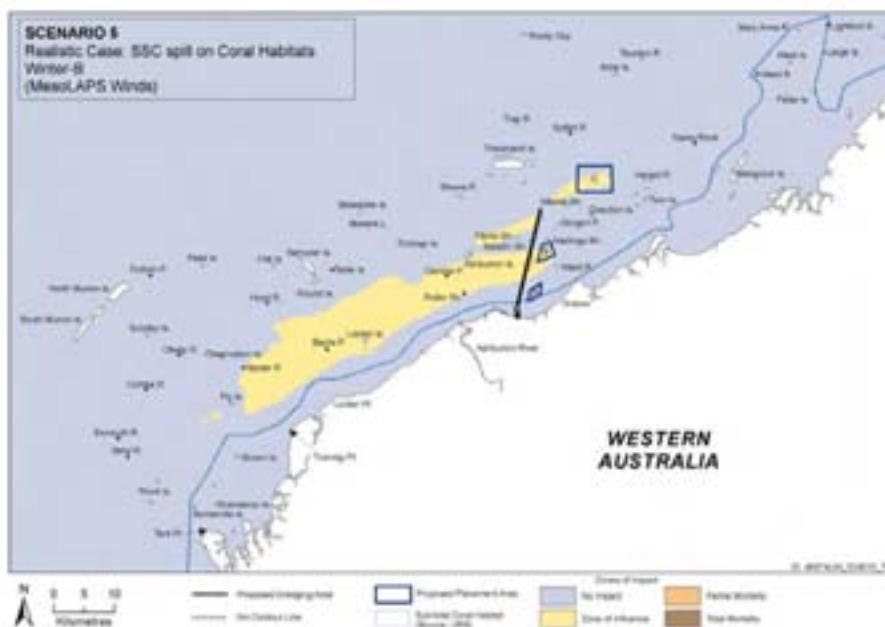


Figure A.205 Scenario 5, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

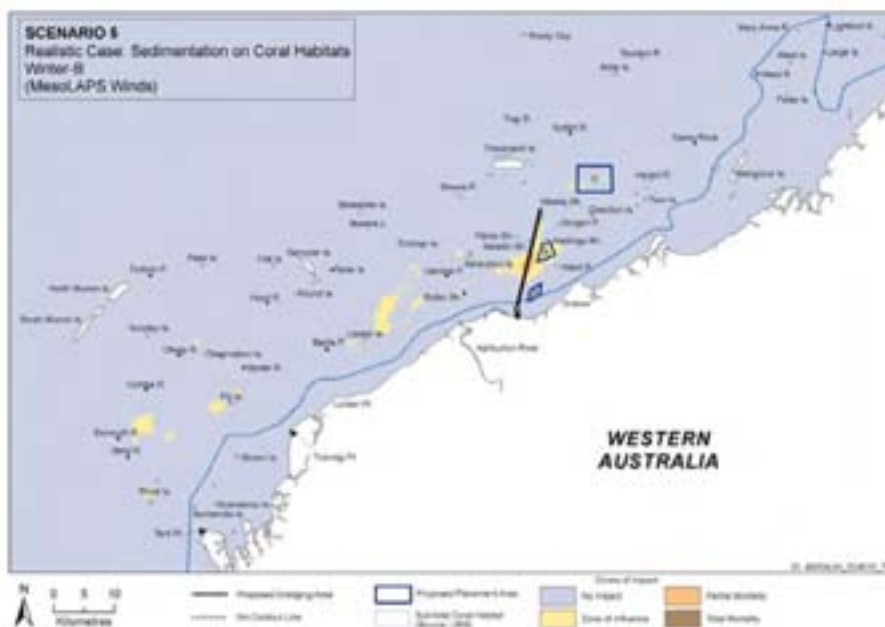


Figure A.206 Scenario 5, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-156

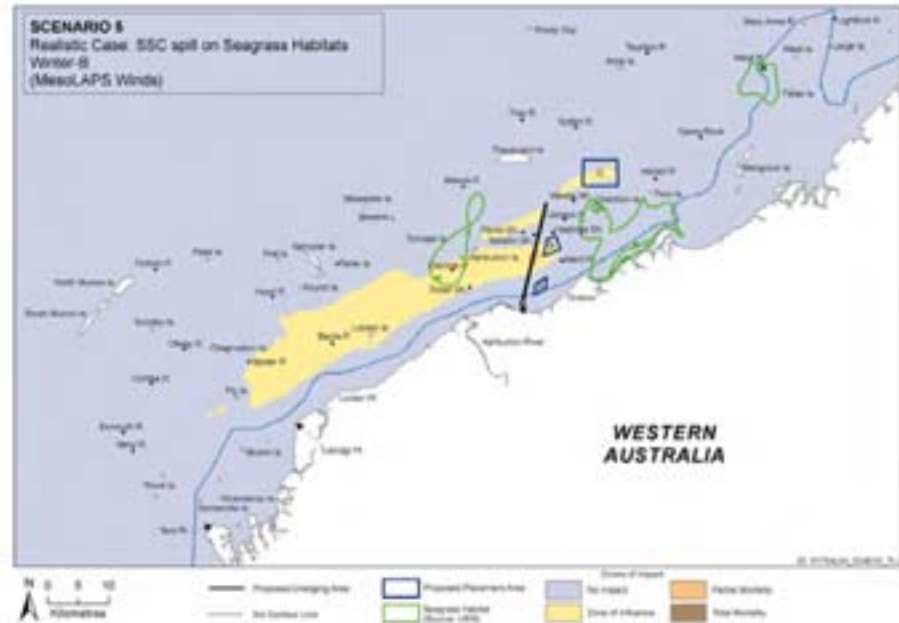


Figure A.207 Scenario 5, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.208 Scenario 5, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-157



Table A.52 Summary of Impacts at Sensitive Receptors for Scenario 5, Winter-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.9	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.1	3.4	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.2	2.1	0.0	0.0	0.7	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.5	1.6	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.0	0.6	0.0	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	1.3	2.1	0.0	0.0	0.1	
9	Hastings Shoal	298803	7613488	0.4	0.0	0.0	0.0	0.2	
10	North West Ward Reef	299018	7610106	0.9	5.5	0.7	0.0	0.4	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.4	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.8	0.9	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.9	9.5	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.5	1.3	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.1	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.5.5 Transitional-A, Realistic Spill Scenario**

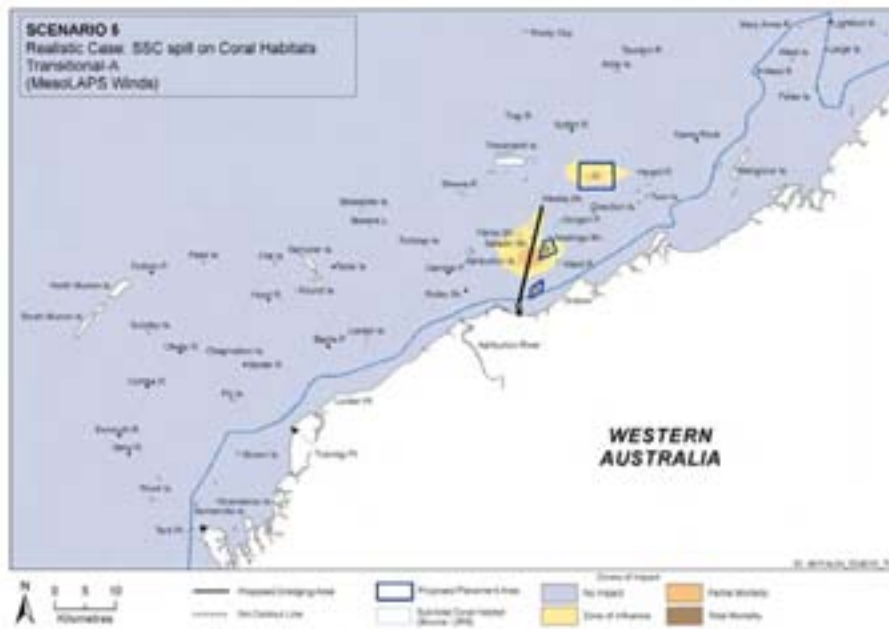


Figure A.209 Scenario 5, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

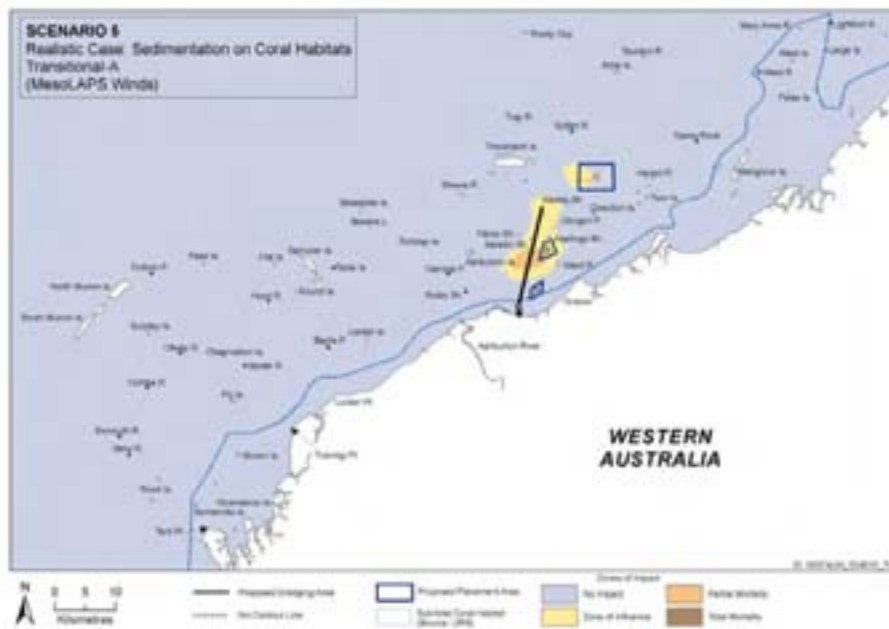


Figure A.210 Scenario 5, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

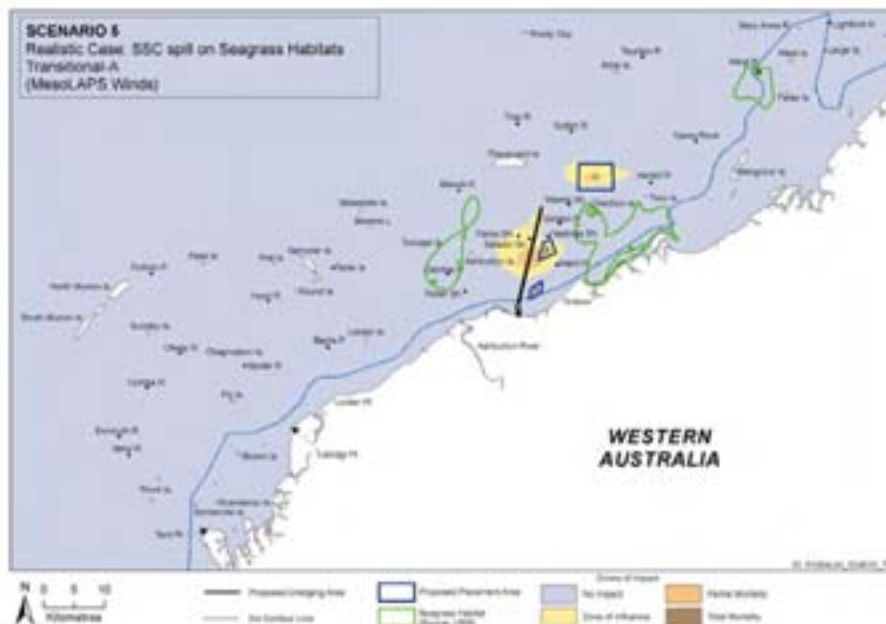


Figure A.211 Scenario 5, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.212 Scenario 5, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-160



Table A.53 Summary of Impacts at Sensitive Receptors for Scenario 5, Transitional-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.2	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.3	3.4	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.8	5.5	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.4	2.8	0.0	0.0	0.4	
9	Hastings Shoal	298803	7613488	1.5	0.3	0.0	0.0	0.5	
10	North West Ward Reef	299018	7610106	2.6	19.8	6.2	0.0	0.6	
11	Ward Reef	300410	7608868	0.4	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.3	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.9	0.1	0.0	0.0	0.3	
14	Gorgon Patch	300859	7615993	0.7	0.0	0.0	0.0	0.2	
15	Weeks Shoal	302245	7618926	0.4	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.3	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-161



**A.5.6 Transitional-B, Realistic Spill Scenario**

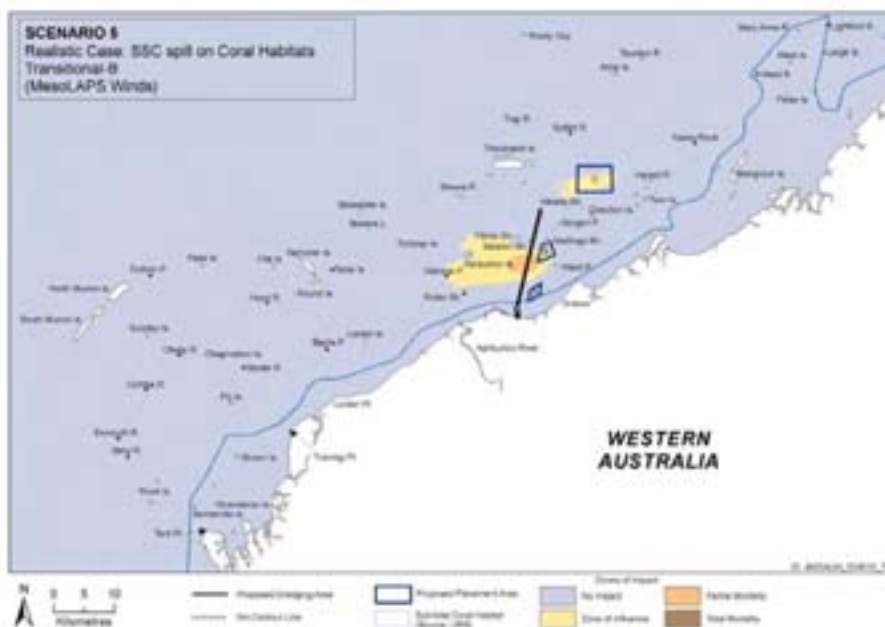


Figure A.213 Scenario 5, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

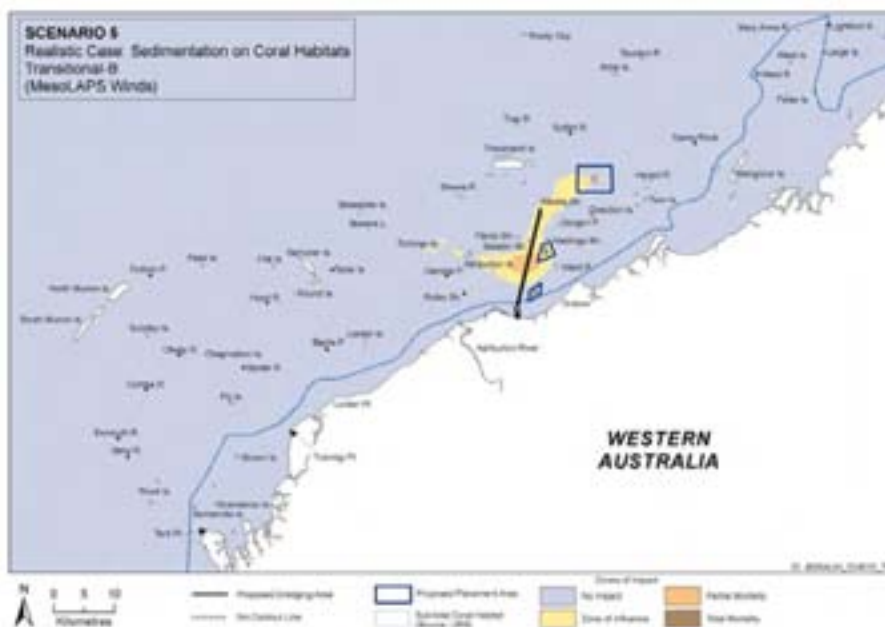


Figure A.214 Scenario 5, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



A-162

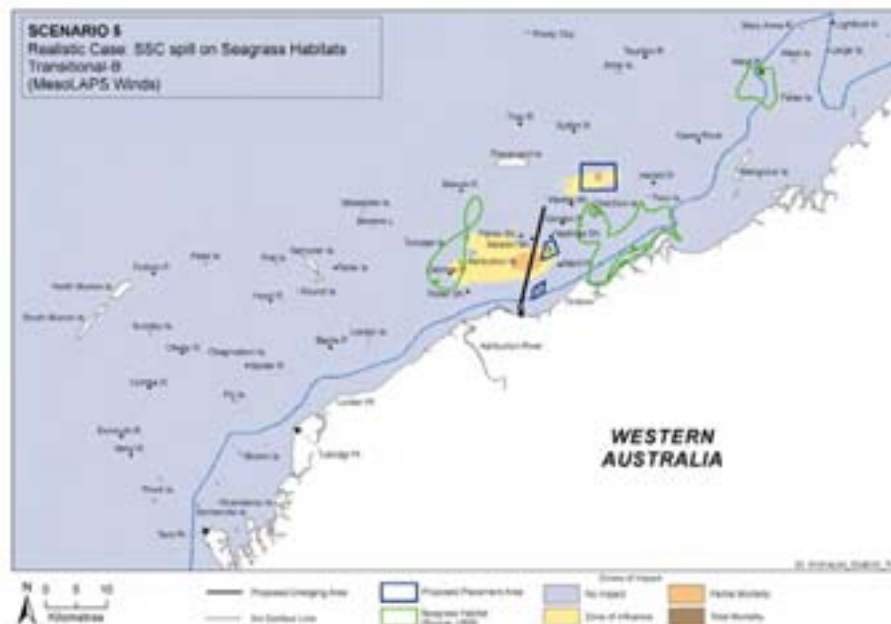


Figure A.215 Scenario 5, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.216 Scenario 5, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Table A.54 Summary of Impacts at Sensitive Receptors for Scenario 5, Transitional-B, Realistic Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.5	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.4	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.1	1.8	0.0	0.0	0.5	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.4	1.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.3	0.9	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.2	0.3	0.0	0.0	0.2	
9	Hastings Shoal	298803	7613488	0.7	0.0	0.0	0.0	0.1	
10	North West Ward Reef	299018	7610106	1.4	9.2	2.1	0.0	0.2	
11	Ward Reef	300410	7608868	0.2	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.7	0.6	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.1	1.8	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.3	1.5	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.5	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-164



**A.5.7 Summer-A, Worst Case Spill Scenario**

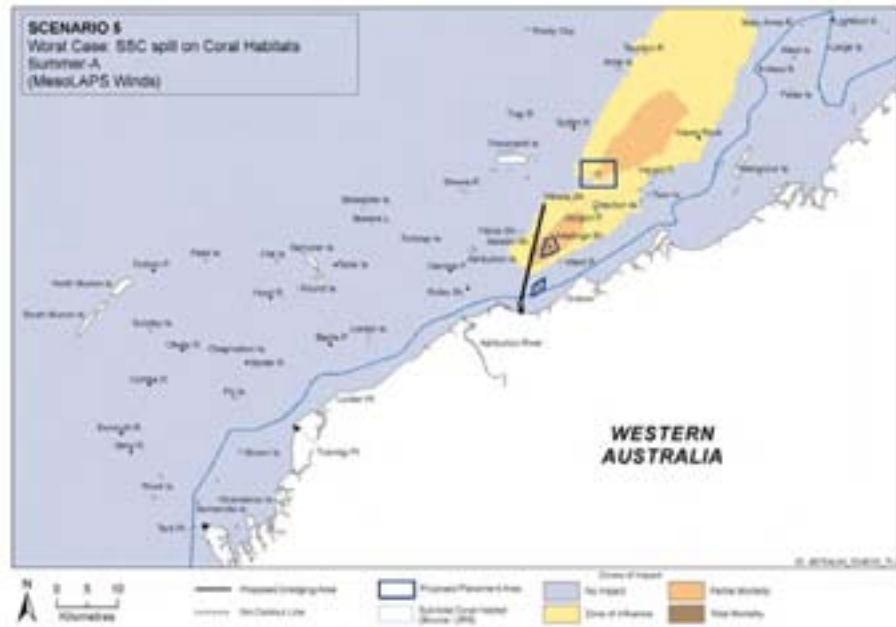


Figure A.217 Scenario 5, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

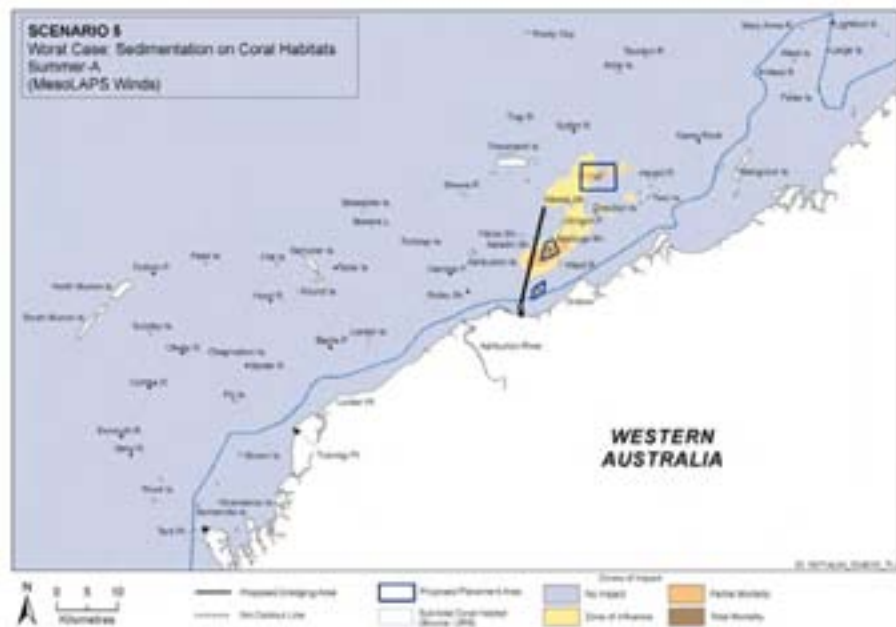


Figure A.218 Scenario 5, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-165

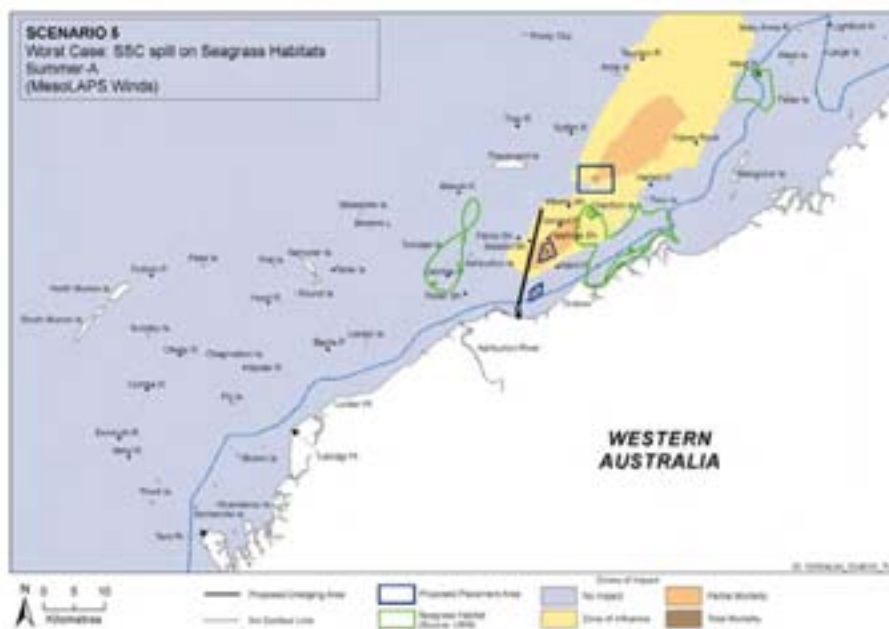


Figure A.219 Scenario 5, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

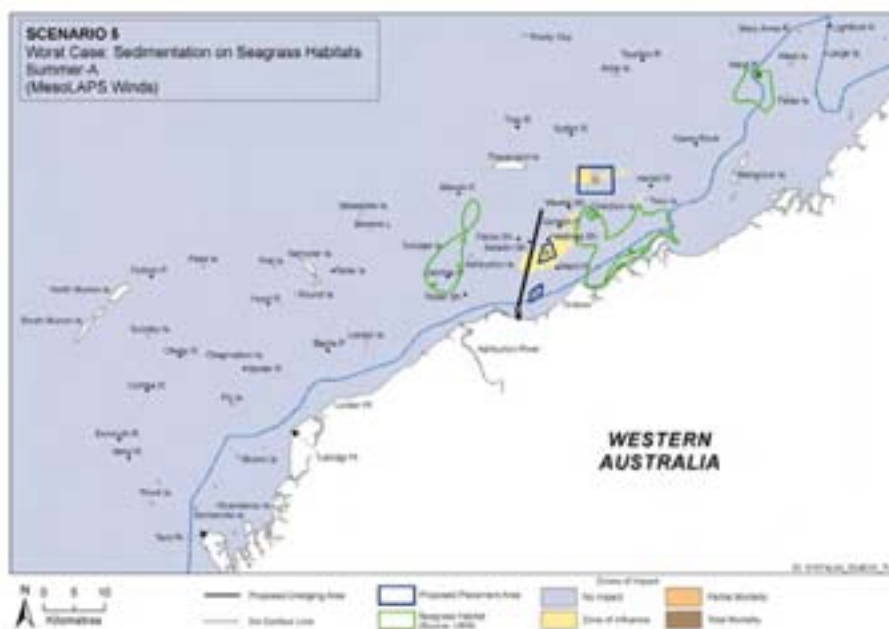


Figure A.220 Scenario 5, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-166



Table A.55 Summary of Impacts at Sensitive Receptors for Scenario 5, Summer-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.2	0.7	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.0	5.5	0.1	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.6	8.5	0.4	0.0	0.0	
9	Hastings Shoal	298803	7613488	3.6	30.2	3.4	0.0	0.0	
10	North West Ward Reef	299018	7610106	4.6	29.4	14.0	2.2	0.0	
11	Ward Reef	300410	7608868	0.6	0.4	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.4	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	3.0	22.6	0.6	0.0	0.0	
14	Gorgon Patch	300859	7615993	3.0	24.7	0.6	0.0	0.0	
15	Weeks Shoal	302245	7618926	2.3	11.6	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	3.6	25.1	1.3	0.0	1.0	
17	NW of Direction Island	304867	7618549	2.6	13.1	0.1	0.0	0.0	
18	Direction Island	307431	7617732	2.3	3.7	0.0	0.0	1.1	
19	NE Tw in Island	314029	7620738	1.9	1.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	2.2	2.5	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.7	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	2.0	5.3	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.6	11.1	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	2.3	8.3	0.1	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.4	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.7	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	1.8	1.6	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.5.8 Summer-B, Worst Case Spill Scenario**

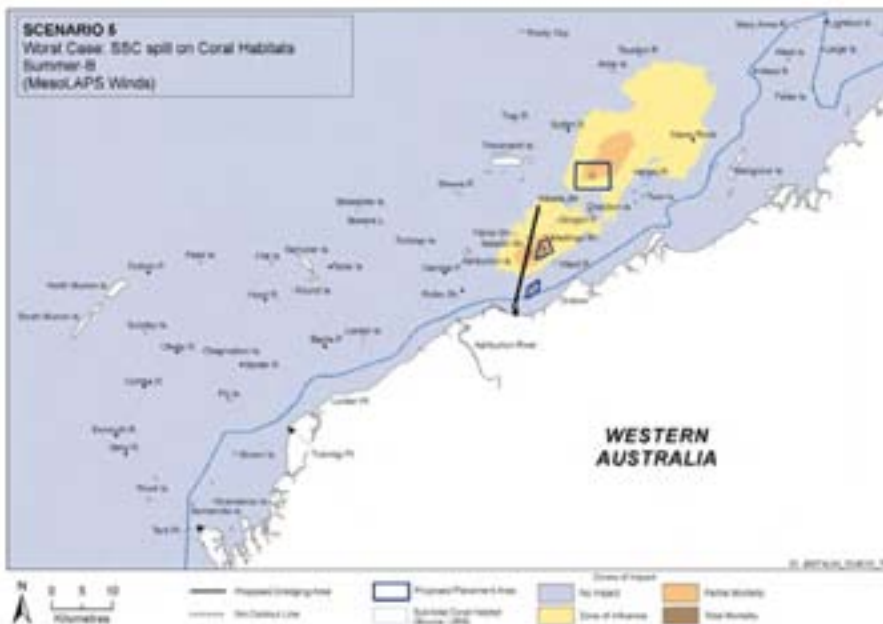


Figure A.221 Scenario 5, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

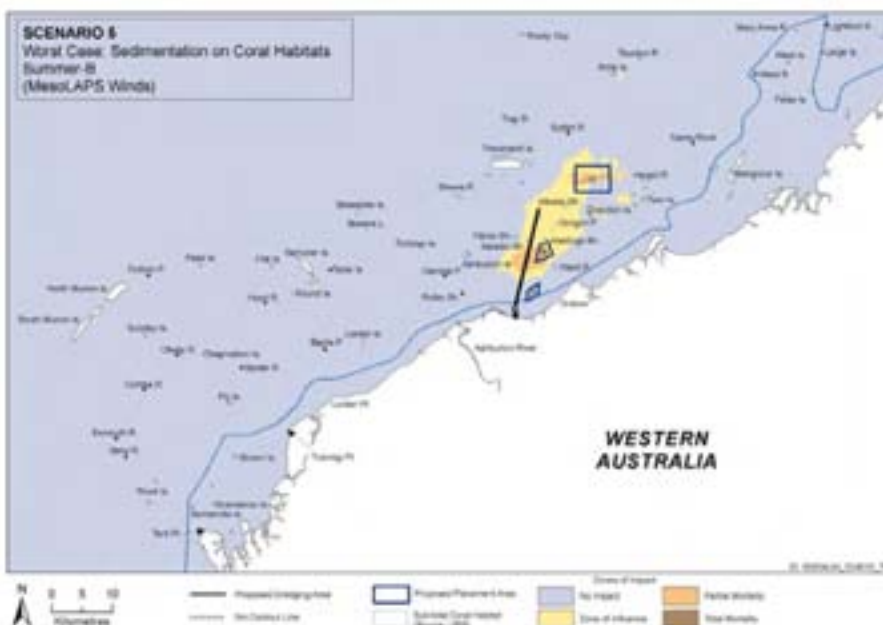


Figure A.222 Scenario 5, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-168

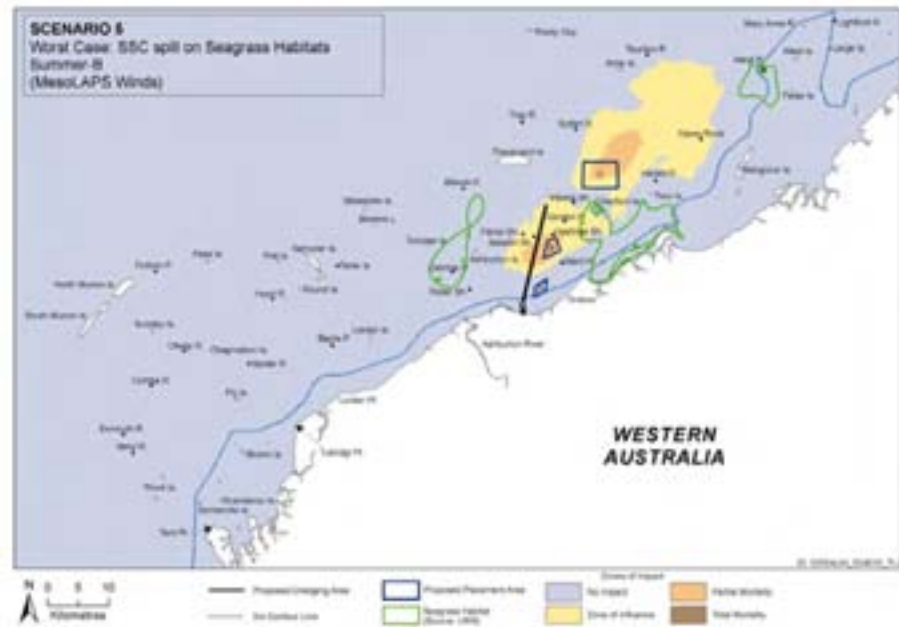


Figure A.223 Scenario 5, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

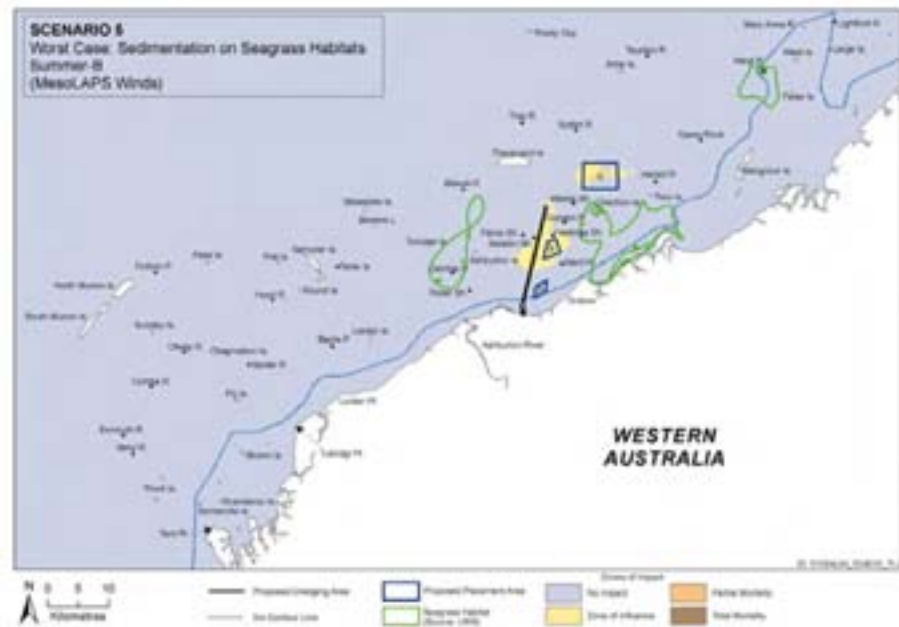


Figure A.224 Scenario 5, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



Table A.56 Summary of Impacts at Sensitive Receptors for Scenario 5, Summer-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.8	3.1	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	2.1	12.0	1.0	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	2.2	8.8	0.3	0.0	0.7	
9	Hastings Shoal	298803	7613488	3.5	29.7	2.5	0.0	1.1	
10	North West Ward Reef	299018	7610106	3.3	22.4	10.1	0.4	1.5	
11	Ward Reef	300410	7608868	0.2	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	2.7	14.6	0.6	0.0	0.8	
14	Gorgon Patch	300859	7615993	2.4	11.3	0.3	0.0	0.5	
15	Weeks Shoal	302245	7618926	1.7	2.4	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.9	7.0	0.6	0.0	0.5	
17	NW of Direction Island	304867	7618549	1.5	2.4	0.0	0.0	0.0	
18	Direction Island	307431	7617732	1.1	0.3	0.0	0.0	0.4	
19	NE Tw in Island	314029	7620738	0.9	0.6	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	1.3	0.9	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.4	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	2.1	15.2	0.1	0.0	0.0	
23	Airlie Island	307006	7640697	0.6	0.0	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	2.1	1.6	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.9	1.9	0.6	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.3	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.8	0.4	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



A-170



**A.5.9 Winter-A, Worst Case Spill Scenario**

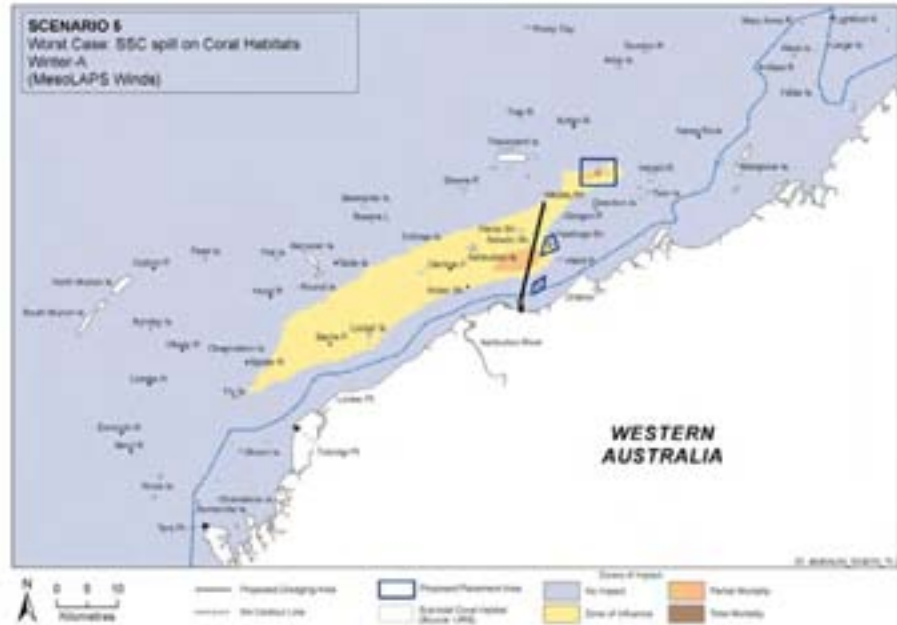


Figure A.225 Scenario 5, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

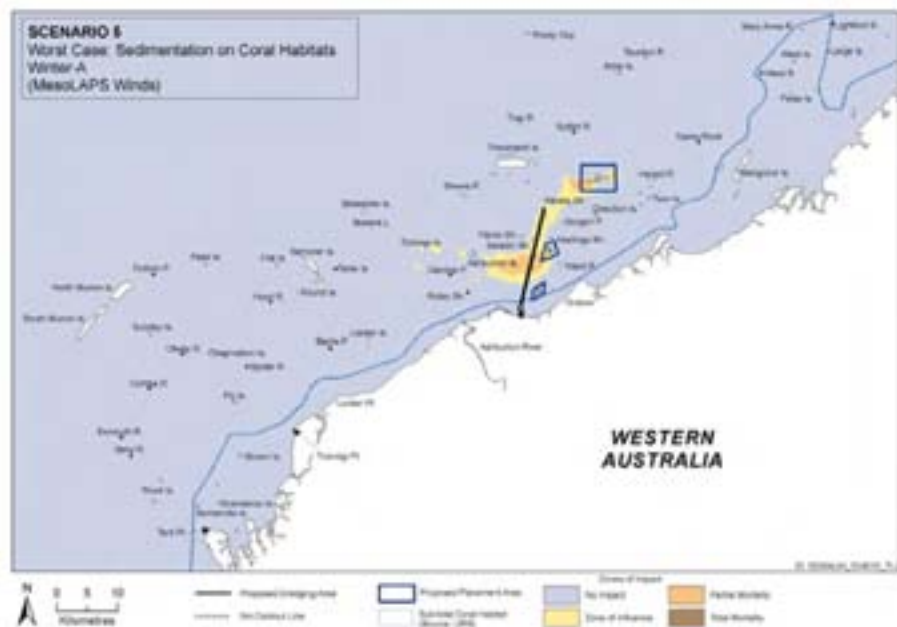


Figure A.226 Scenario 5, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-171

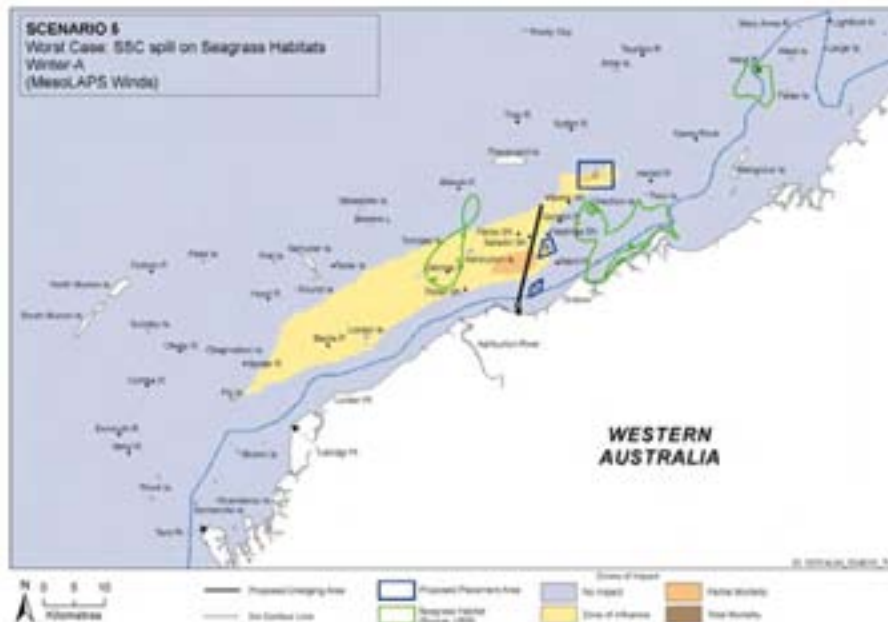


Figure A.227 Scenario 5, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.228 Scenario 5, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-172



Table A.57 Summary of Impacts at Sensitive Receptors for Scenario 5, Winter-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.2	1.6	0.4	0.0	0.0	
2	Roller Shoal	285367	7604532	1.3	1.9	0.6	0.0	0.0	
3	Ashburton Island	286705	7611075	1.6	3.9	0.6	0.0	1.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.7	12.5	2.1	0.0	0.0	
7	Saladin Shoal	295913	7613337	2.1	11.1	1.5	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.2	9.7	1.6	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.6	0.6	0.0	0.0	0.1	
10	North West Ward Reef	299018	7610106	0.8	5.8	0.1	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.4	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.4	0.3	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.7	5.1	1.6	0.3	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	2.0	4.9	2.8	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.2	4.9	1.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-173



**A.5.10 Winter-B, Worst Case Spill Scenario**

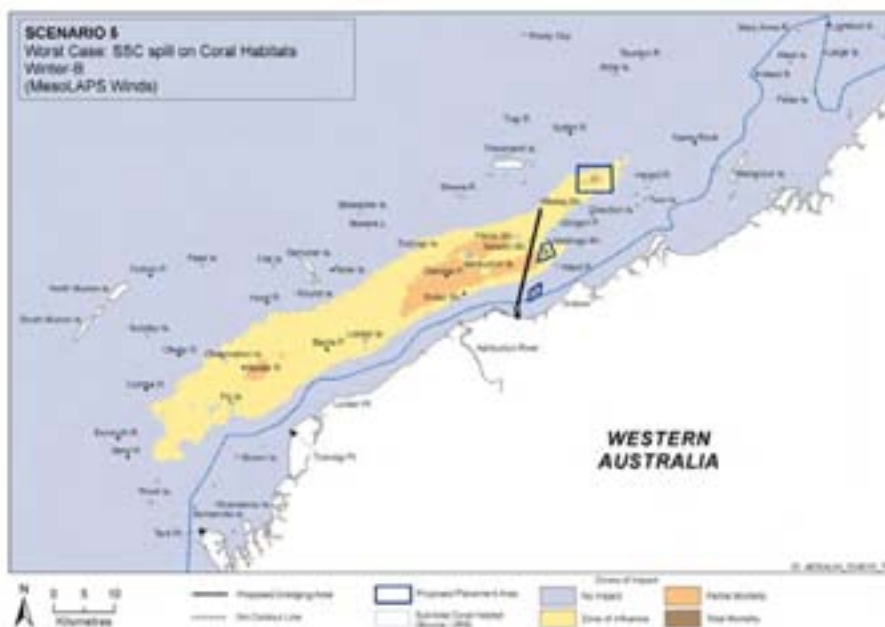


Figure A.229 Scenario 5, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

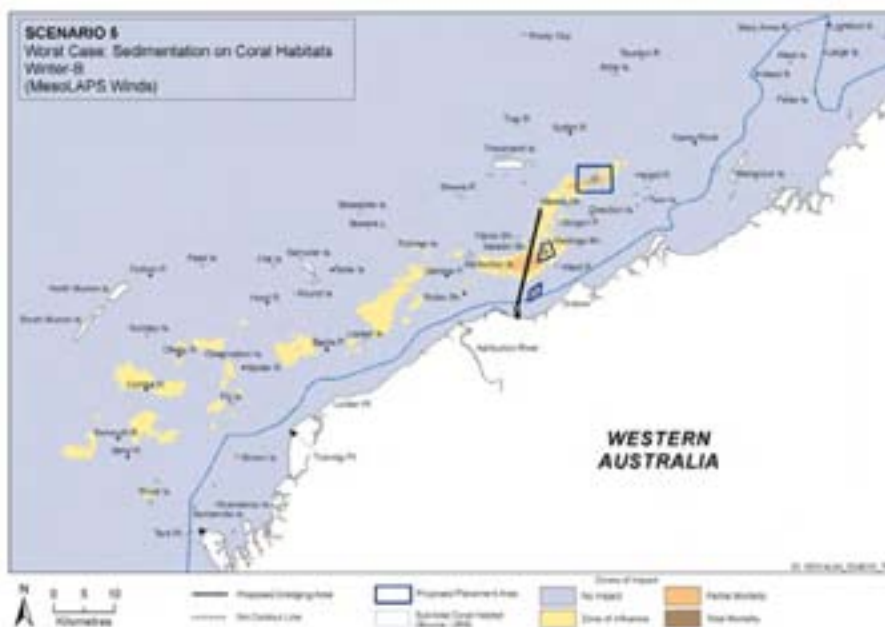


Figure A.230 Scenario 5, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

A-174

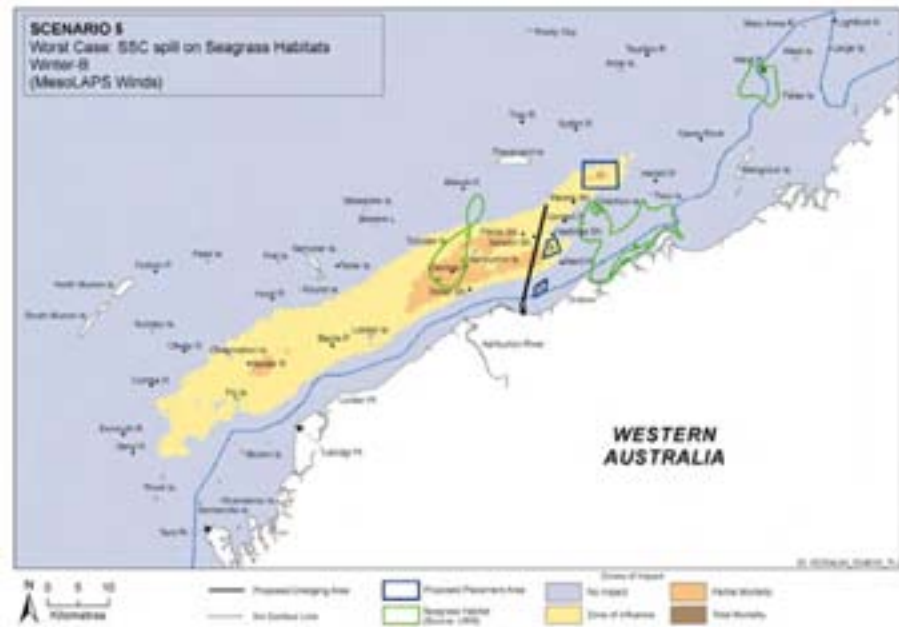


Figure A.231 Scenario 5, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

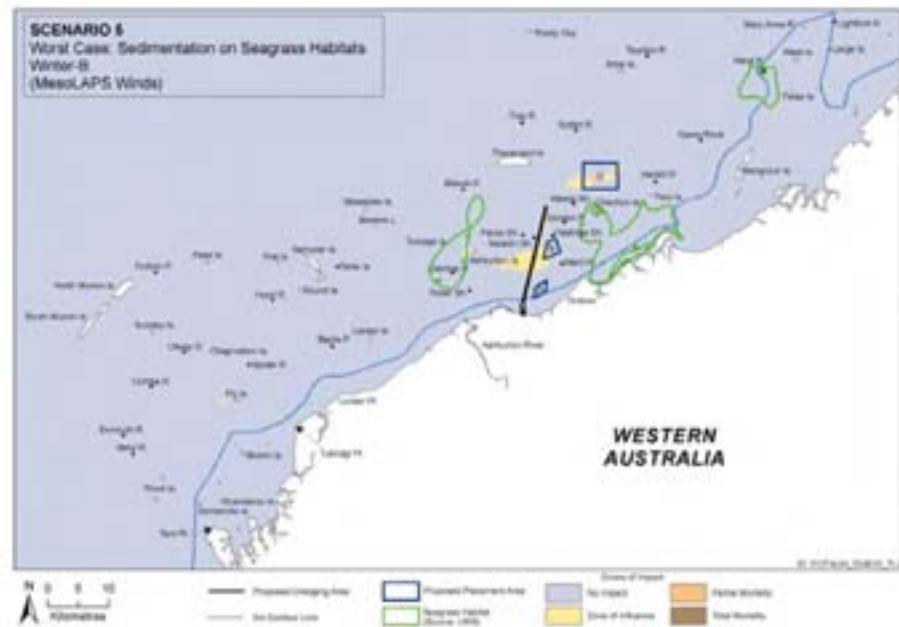


Figure A.232 Scenario 5, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-175



Table A.58 Summary of Impacts at Sensitive Receptors for Scenario 5, Winter-B, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.5	6.5	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.3	5.6	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	2.5	21.1	0.4	0.0	1.5	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.8	20.5	1.5	0.0	0.1	
7	Saladin Shoal	295913	7613337	2.2	12.5	1.8	0.0	0.2	
8	End of Wheatstone Shipping Channel	298328	7617464	2.5	14.1	1.0	0.0	0.3	
9	Hastings Shoal	298803	7613488	1.0	2.7	0.0	0.0	0.4	
10	North West Ward Reef	299018	7610106	1.4	8.5	2.5	0.0	0.5	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.0	1.3	0.0	0.0	0.3	
14	Gorgon Patch	300859	7615993	1.0	2.1	0.0	0.0	0.2	
15	Weeks Shoal	302245	7618926	1.6	5.8	0.6	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	3.0	27.8	2.5	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.5	18.4	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.0	0.0	0.0	0.1	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.5.11 Transitional-A, Worst Case Spill Scenario**

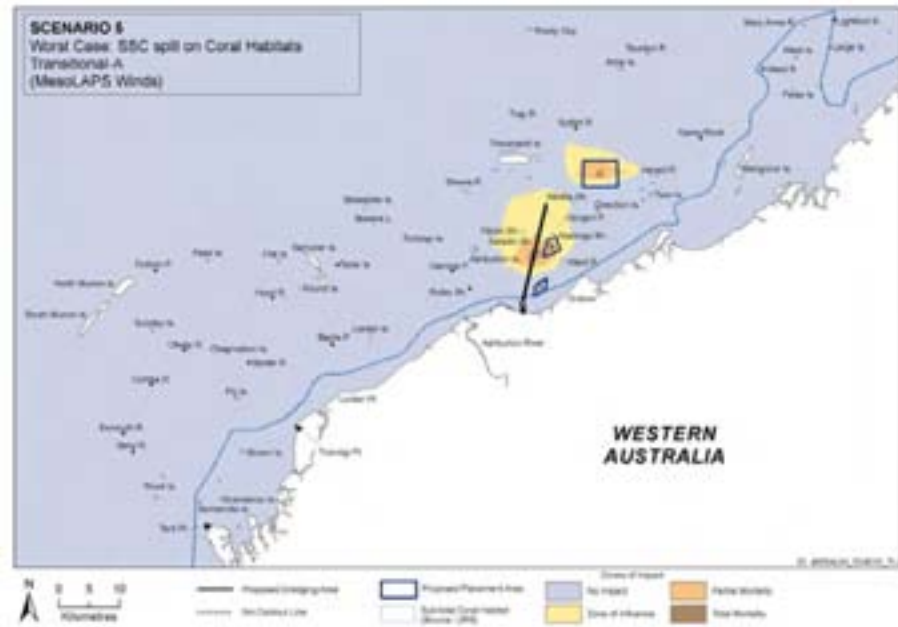


Figure A.233 Scenario 5, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

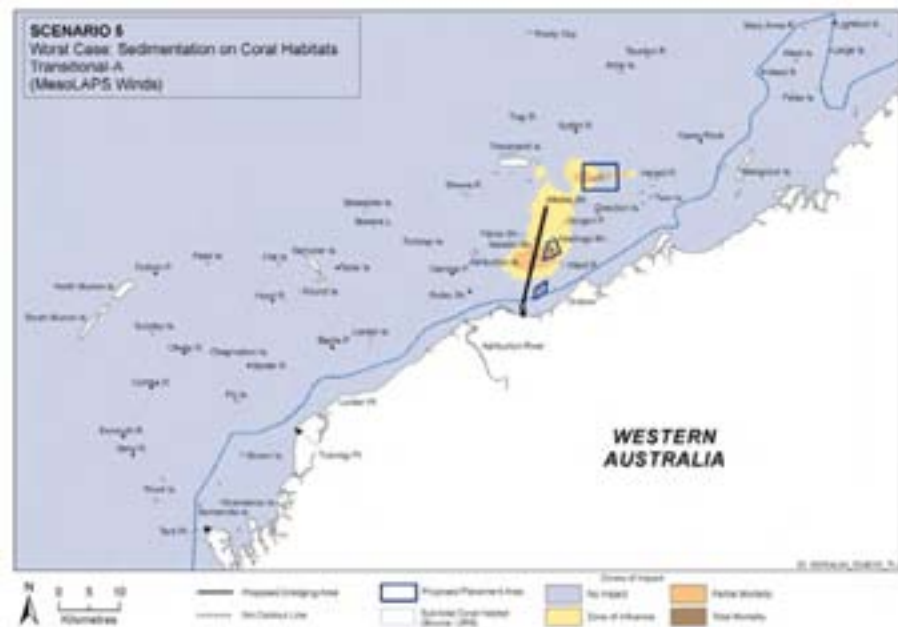


Figure A.234 Scenario 5, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-177

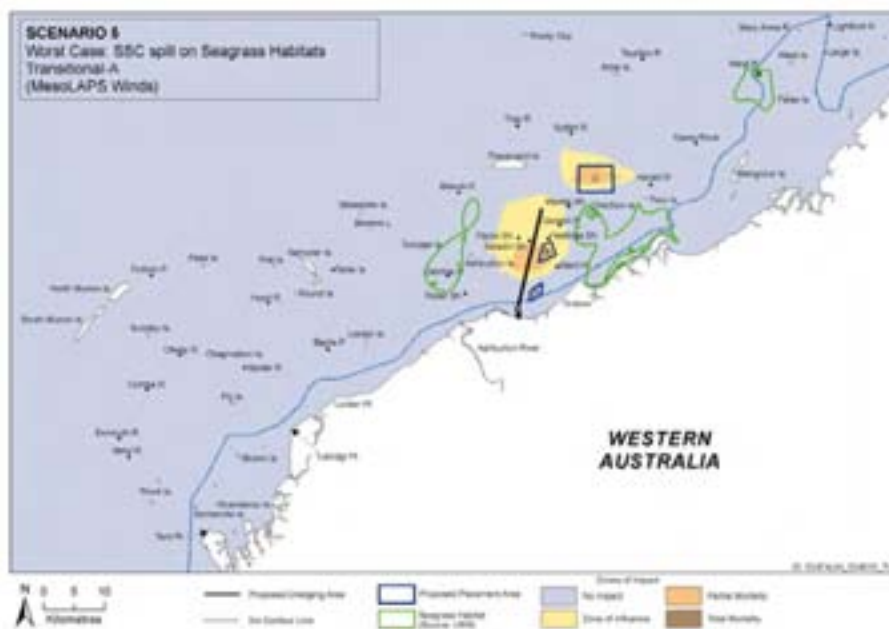


Figure A.235 Scenario 5, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

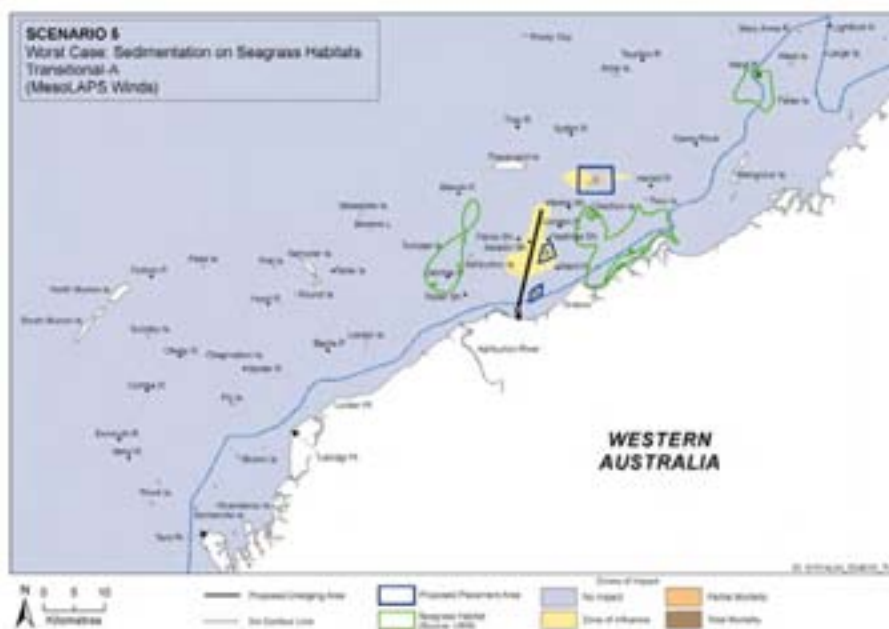


Figure A.236 Scenario 5, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



A-178



Table A.59 Summary of Impacts at Sensitive Receptors for Scenario 5, Transitional-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.3	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.4	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.1	15.3	1.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	3.2	23.6	2.1	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	2.9	16.5	1.6	0.0	1.0	
9	Hastings Shoal	298803	7613488	2.7	15.3	0.6	0.0	1.0	
10	North West Ward Reef	299018	7610106	3.7	24.7	11.9	1.0	1.2	
11	Ward Reef	300410	7608868	0.5	1.3	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.3	0.4	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.8	5.6	0.1	0.0	0.6	
14	Gorgon Patch	300859	7615993	1.4	4.2	0.0	0.0	0.4	
15	Weeks Shoal	302245	7618926	0.8	1.2	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.4	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.5.12 Transitional-B, Worst Case Spill Scenario**



Figure A.237 Scenario 5, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

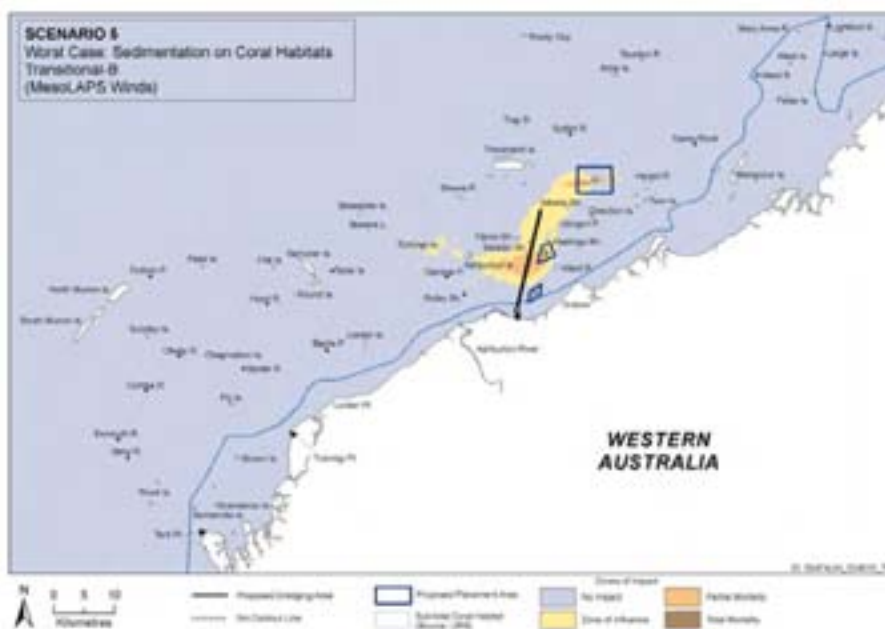


Figure A.238 Scenario 5, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-180

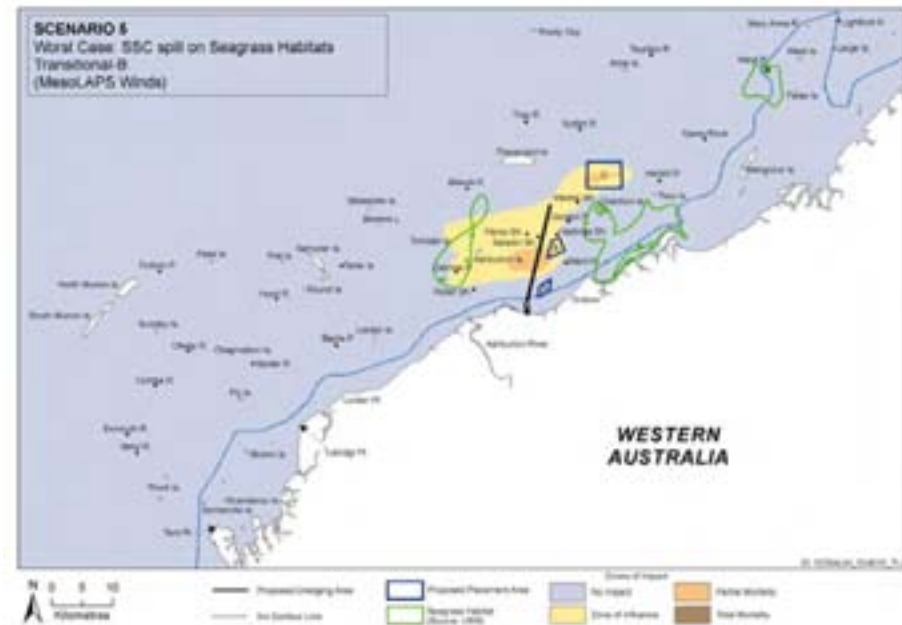


Figure A.239 Scenario 5, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

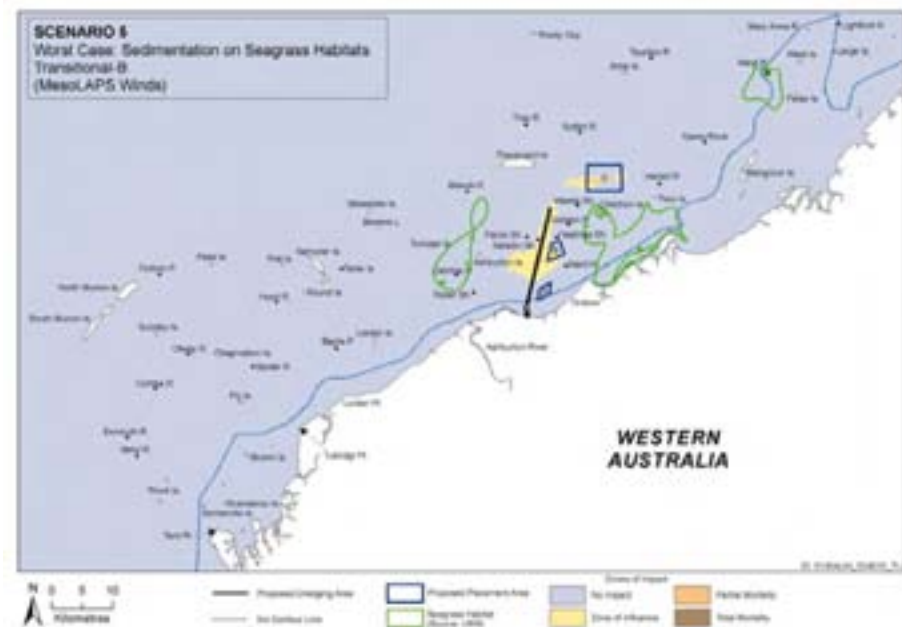


Figure A.240 Scenario 5, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-181



Table A.60 Summary of Impacts at Sensitive Receptors for Scenario 5, Transitional-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.9	0.3	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.5	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.5	6.4	0.0	0.0	0.6	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.2	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.4	14.9	0.1	0.0	0.0	
7	Saladin Shoal	295913	7613337	2.5	9.5	1.6	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.5	11.1	0.6	0.0	0.8	
9	Hastings Shoal	298803	7613488	1.3	3.7	0.0	0.0	0.4	
10	North West Ward Reef	299018	7610106	1.9	11.3	4.9	0.0	0.6	
11	Ward Reef	300410	7608868	0.3	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.2	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.9	1.6	0.0	0.0	0.4	
14	Gorgon Patch	300859	7615993	0.7	0.1	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.2	4.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.3	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.3	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.4	5.2	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.9	8.2	0.0	0.0	0.2	
27	S of Brew is Reef	286445	7618545	0.8	0.0	0.0	0.0	0.1	
28	Thevenard Island South	294521	7622970	0.2	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.6 Dredging Scenario 6**

**A.6.1 Summer-A, Realistic Spill Scenario**

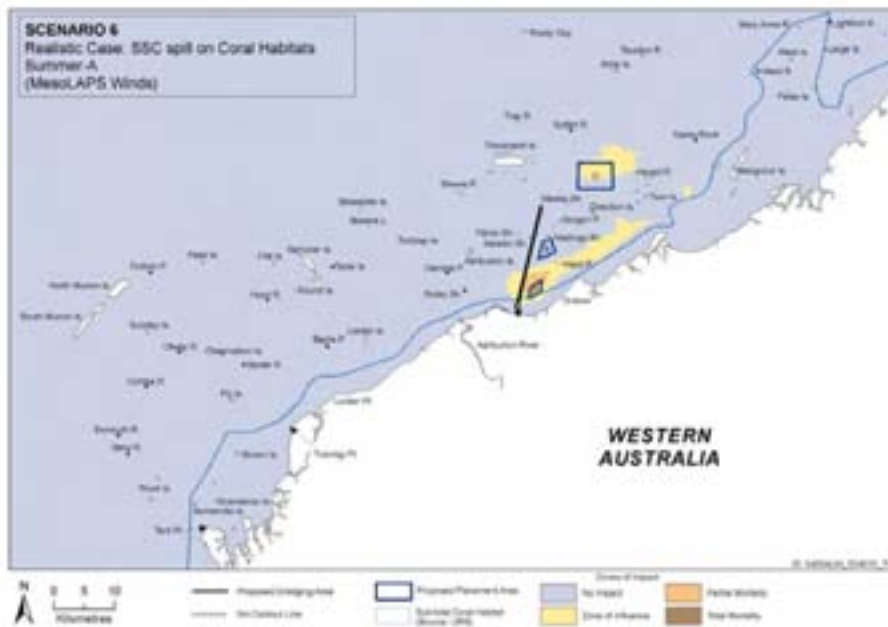


Figure A.241 Scenario 6, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

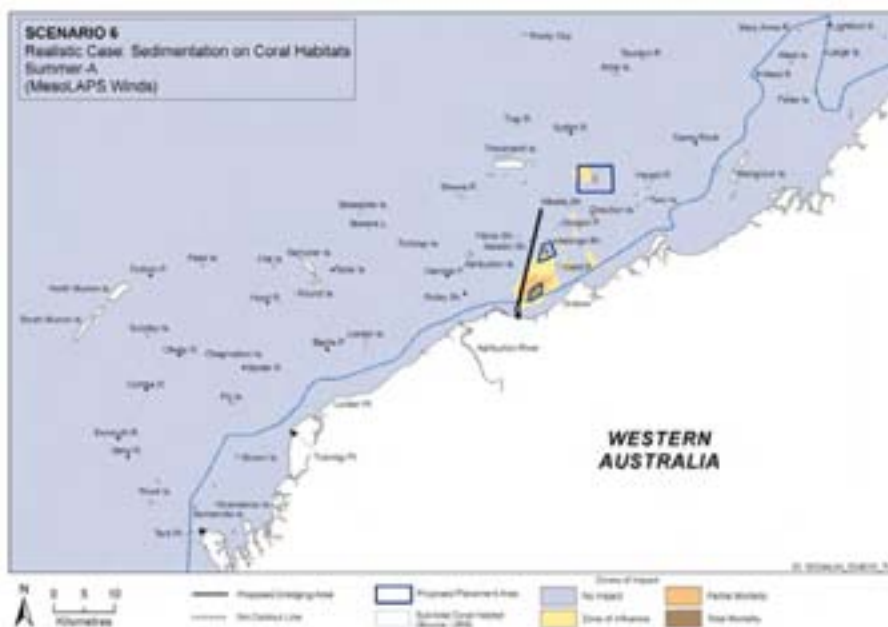


Figure A.242 Scenario 6, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

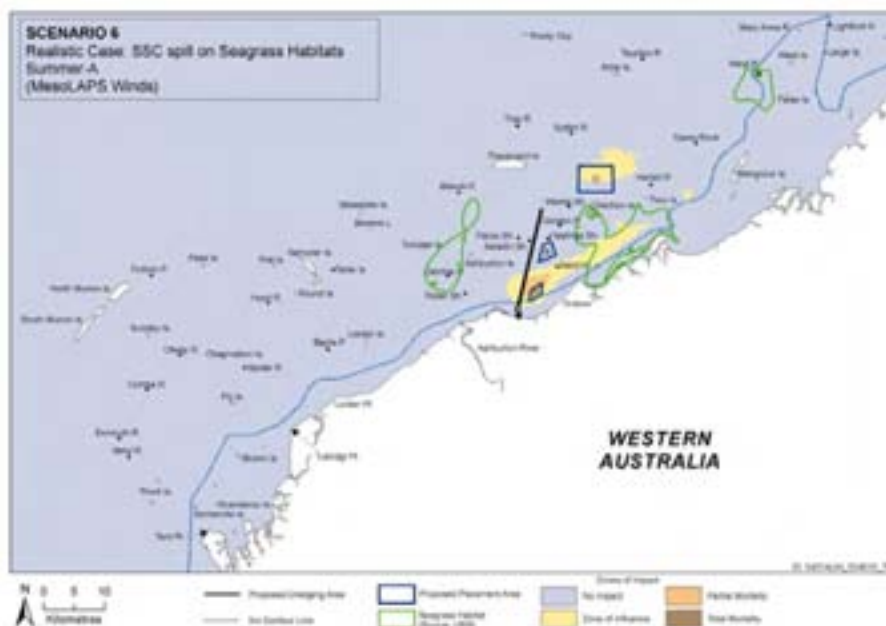


Figure A.243 Scenario 6, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

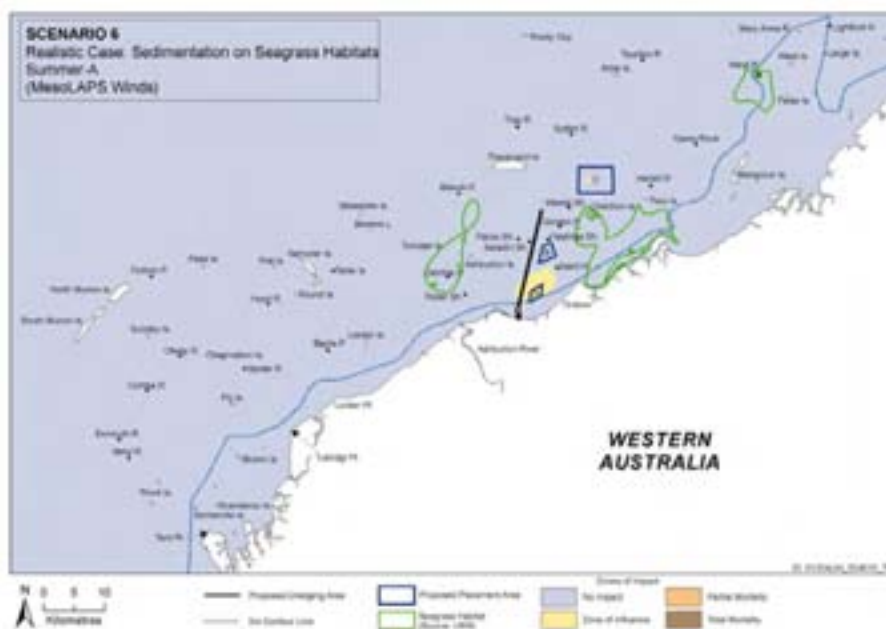


Figure A.244 Scenario 6, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-184



Table A.61 Summary of Impacts at Sensitive Receptors for Scenario 6, Summer-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.2	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.7	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	1.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	2.4	9.7	0.3	0.0	0.0	
12	Ward Reef	301120	7609196	2.4	8.8	0.3	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.2	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.8	0.0	0.0	0.0	0.2	
17	NW of Direction Island	304867	7618549	0.6	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.5	0.0	0.0	0.0	0.1	
19	NE Tw in Island	314029	7620738	1.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.9	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.6	0.7	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.1	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.6	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	1.4	0.3	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	2.3	8.6	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.2	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	2.0	1.3	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	1.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.6.2 Summer-B, Realistic Spill Scenario**

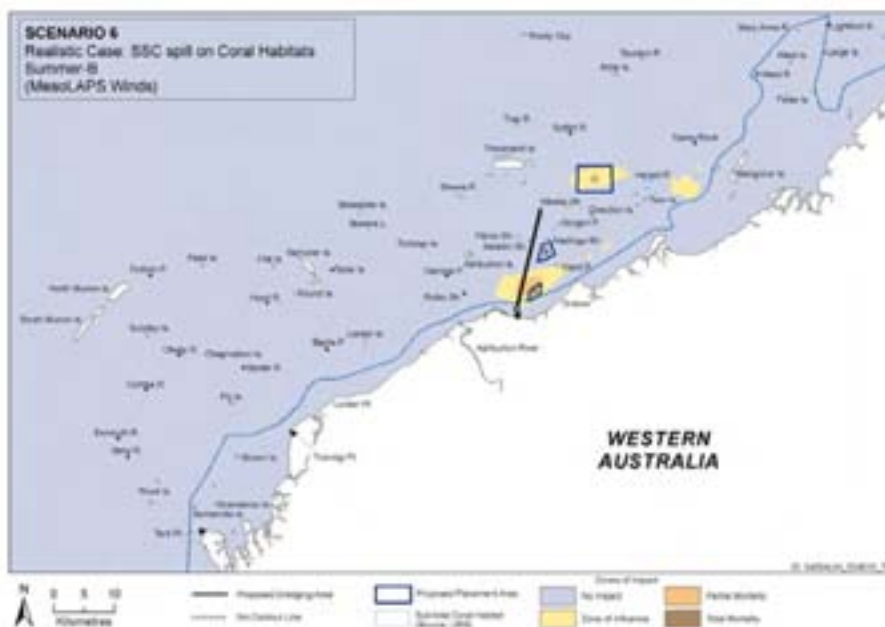


Figure A.245 Scenario 6, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

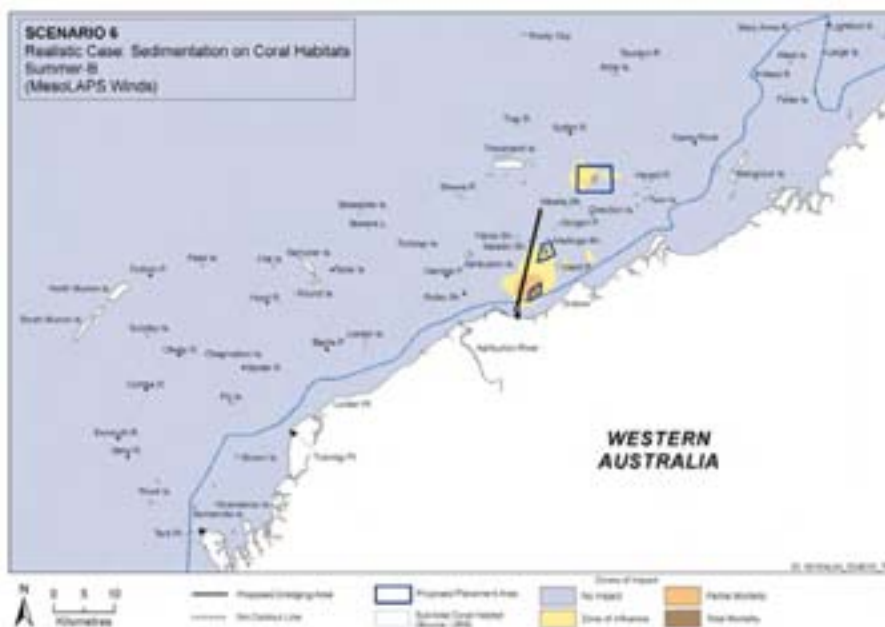


Figure A.246 Scenario 6, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds



A-186

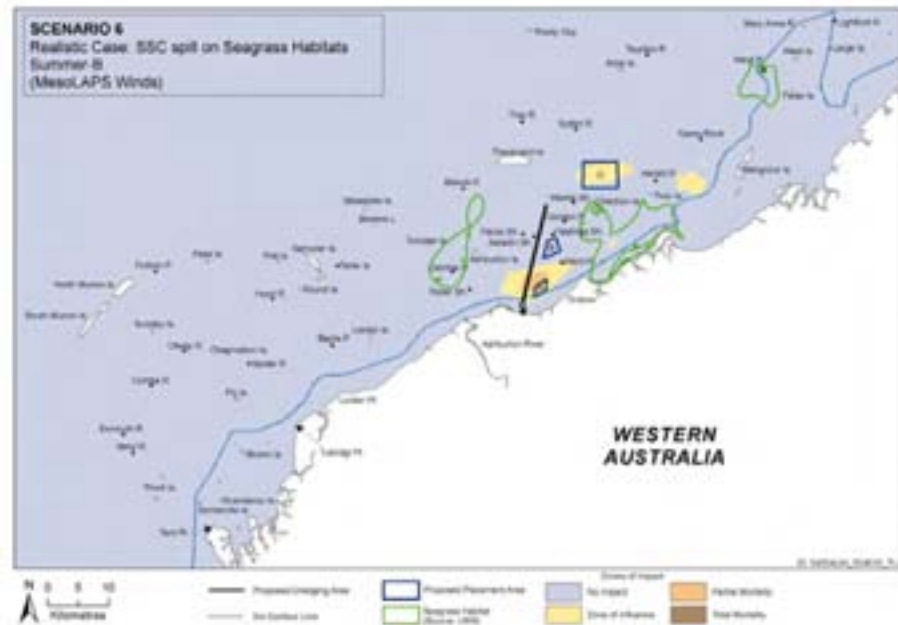


Figure A.247 Scenario 6, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.248 Scenario 6, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Table A.62 Summary of Impacts at Sensitive Receptors for Scenario 6, Summer-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.1	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.6	0.0	0.0	0.0	0.2	
10	North West Ward Reef	299018	7610106	1.1	0.0	0.0	0.0	0.2	
11	Ward Reef	300410	7608668	1.5	3.7	0.0	0.0	0.2	
12	Ward Reef	301120	7609196	1.3	2.1	0.4	0.0	0.1	
13	SW of Gorgon Patch	300094	7615177	0.4	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.2	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.5	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.3	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.3	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.4	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.5	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.6	4.3	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.6	0.6	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.6	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.8	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	1.4	1.6	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	1.2	0.3	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.5	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.6.3 Winter-A, Realistic Spill Scenario**

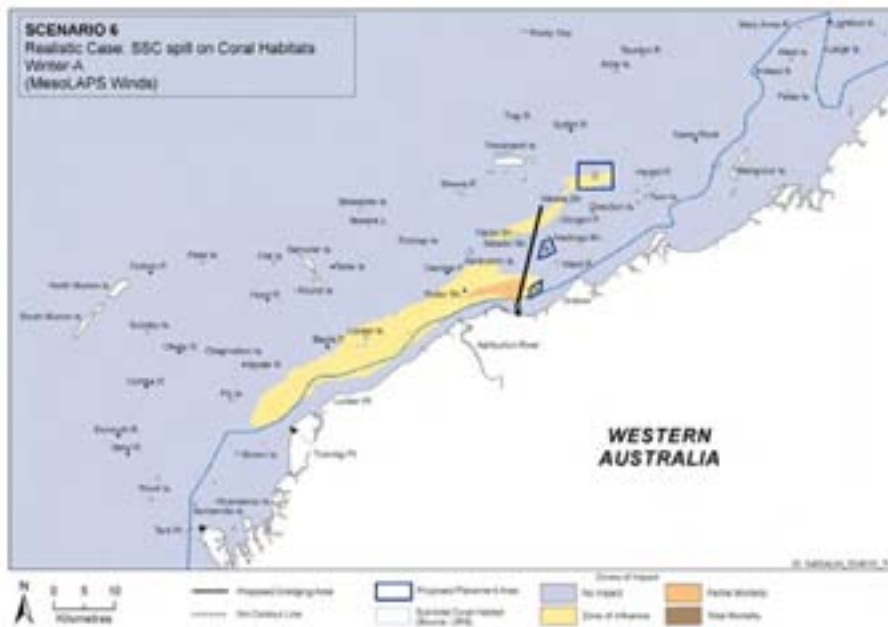


Figure A.249 Scenario 6, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

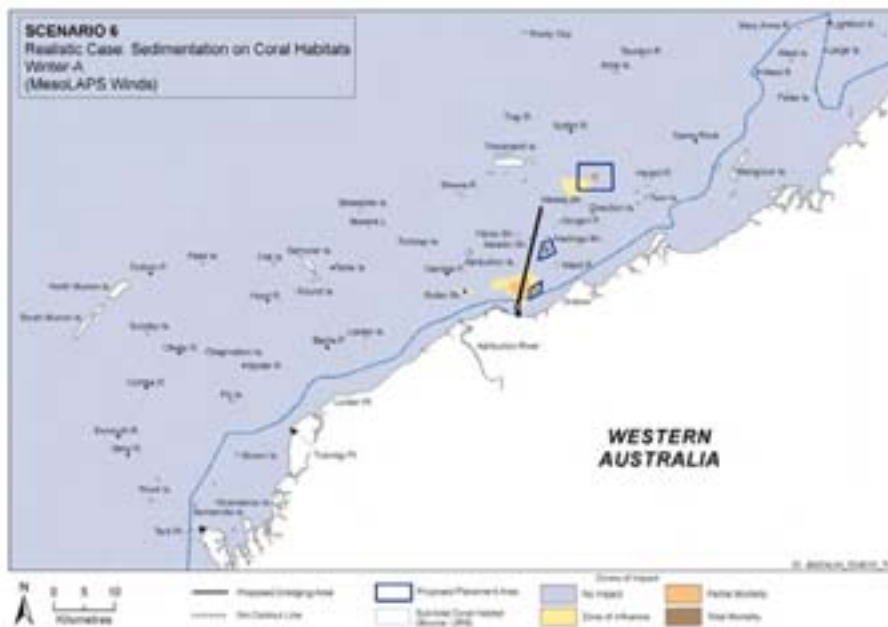


Figure A.250 Scenario 6, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-189

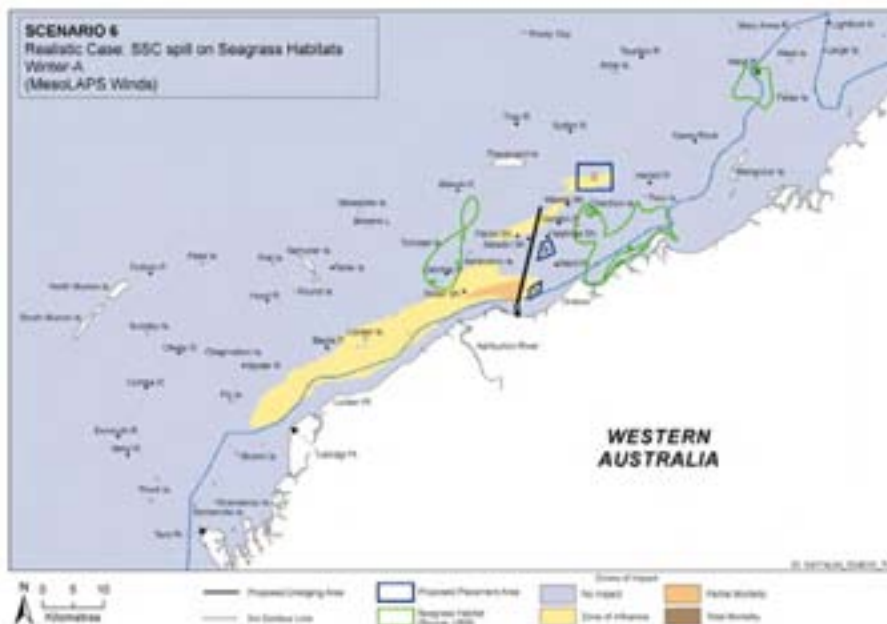


Figure A.251 Scenario 6, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.252 Scenario 6, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-190



Table A.63 Summary of Impacts at Sensitive Receptors for Scenario 6, Winter-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	2.8	16.6	4.3	0.0	0.0	
3	Ashburton Island	286705	7611075	0.4	0.0	0.0	0.0	0.2	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.6	3.1	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.6	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.7	3.1	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.9	2.1	0.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.5	1.9	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.3	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.6.4 Winter-B, Realistic Spill Scenario**

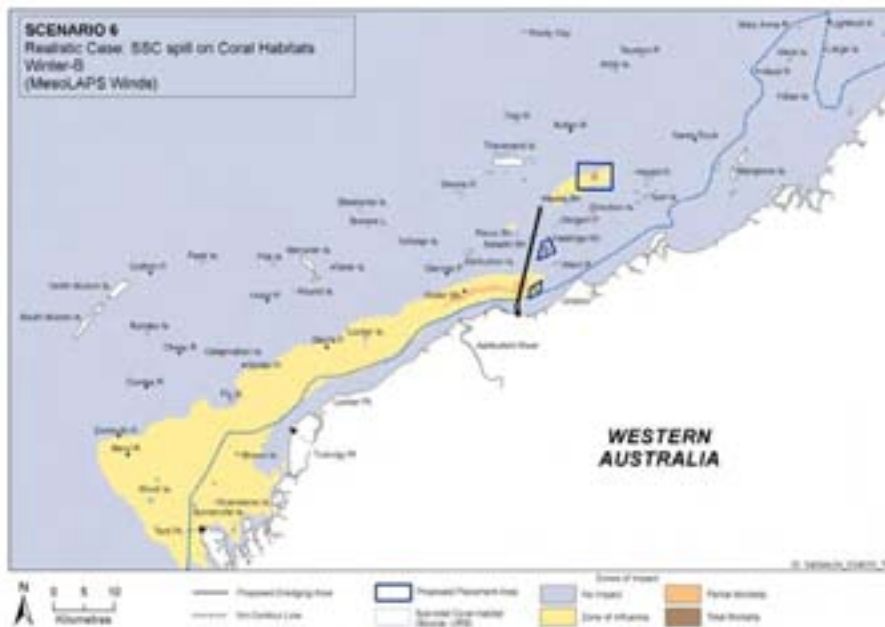


Figure A.253 Scenario 6, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

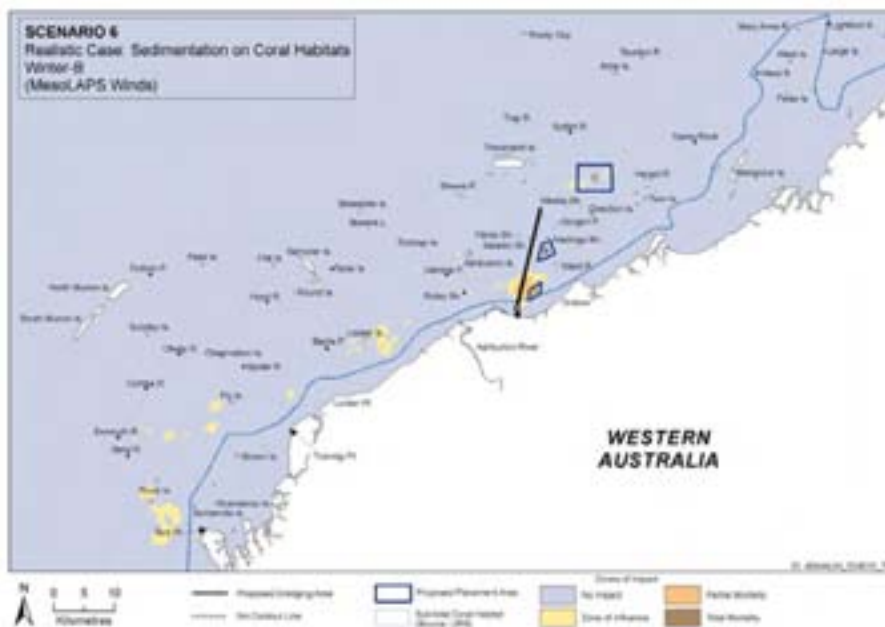


Figure A.254 Scenario 6, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-192

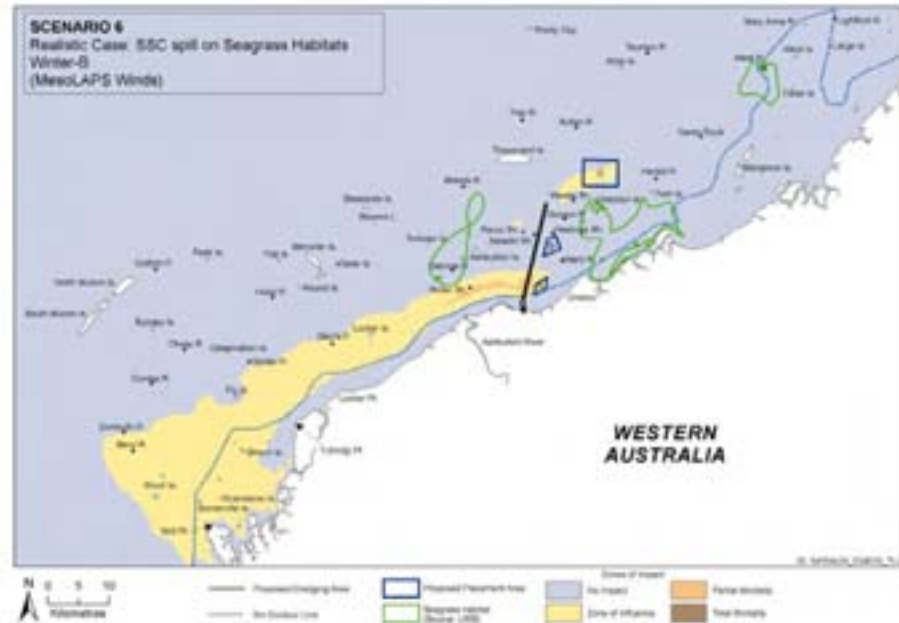


Figure A.255 Scenario 6, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.256 Scenario 6, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Table A.64 Summary of Impacts at Sensitive Receptors for Scenario 6, Winter-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.4	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	2.6	21.8	4.6	0.0	0.0	
3	Ashburton Island	286705	7611075	0.7	0.3	0.0	0.0	0.4	
4	Brewis Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.8	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.6	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.6	0.0	0.0	0.0	0.1	
9	Hastings Shoal	298803	7613488	0.3	0.0	0.0	0.0	0.1	
10	North West Ward Reef	299018	7610106	0.2	0.0	0.0	0.0	0.1	
11	Ward Reef	300410	7608668	0.4	0.4	0.0	0.0	0.2	
12	Ward Reef	301120	7609196	0.4	0.0	0.0	0.0	0.1	
13	SW of Gorgon Patch	300094	7615177	0.4	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.8	1.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.8	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.6	0.0	0.0	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



A-194



**A.6.5 Transitional-A, Realistic Spill Scenario**

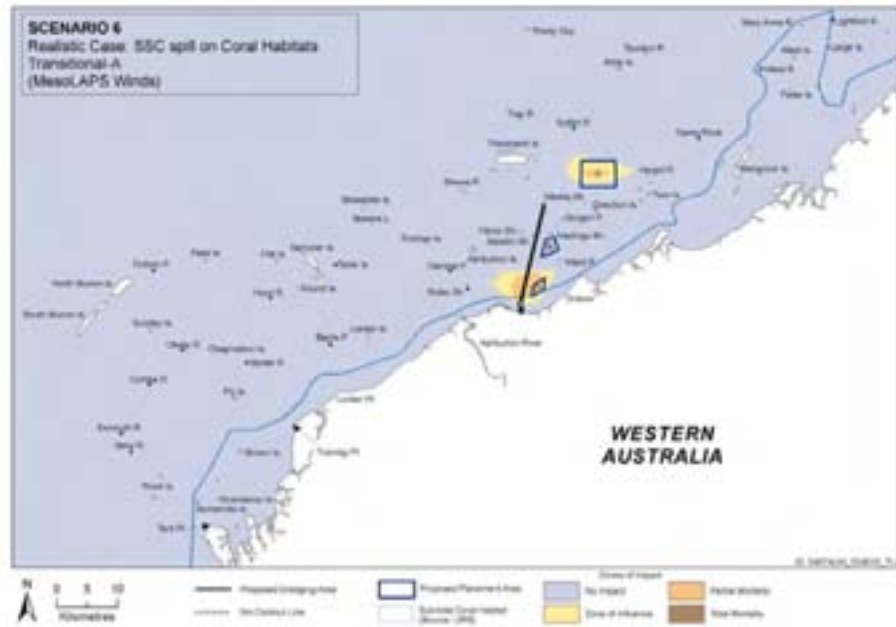


Figure A.257 Scenario 6, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

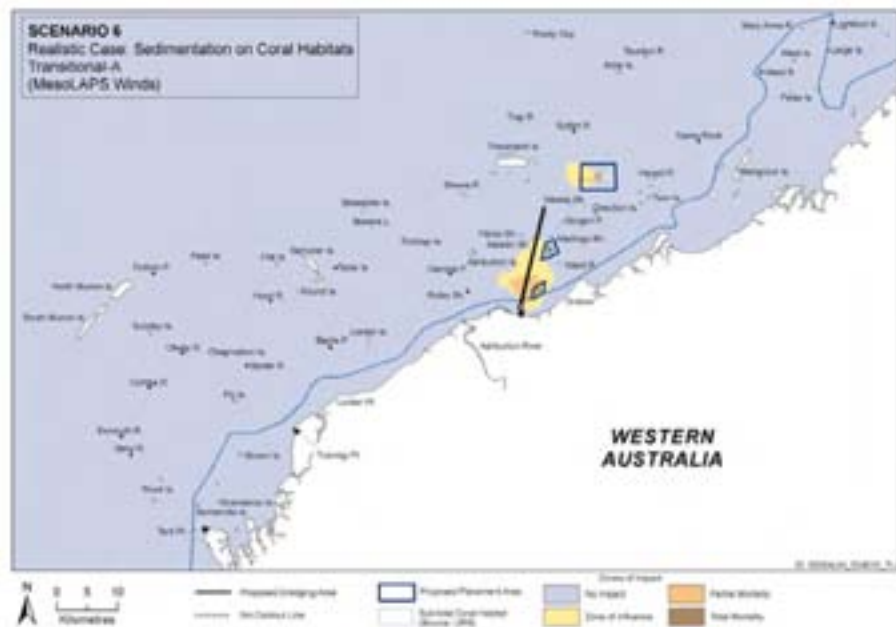


Figure A.258 Scenario 6, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-195

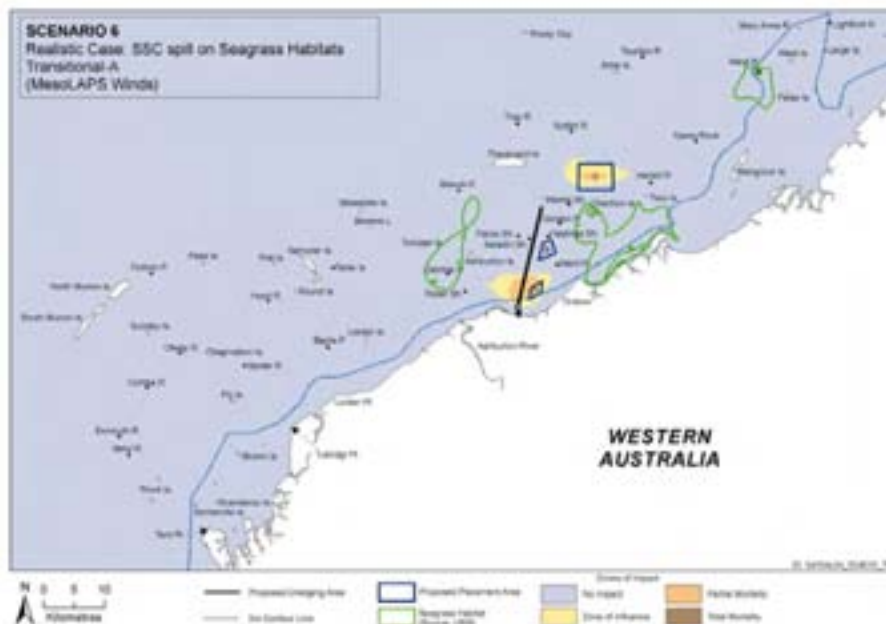


Figure A.259 Scenario 6, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.260 Scenario 6, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-196



Table A.65 Summary of Impacts at Sensitive Receptors for Scenario 6, Transitional-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.4	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brewis Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.4	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.6	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.2	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.4	0.0	0.0	0.0	0.2	
10	North West Ward Reef	299018	7610106	0.5	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.4	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.3	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.1	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.6.6 Transitional-B, Realistic Spill Scenario**



Figure A.261 Scenario 6, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.262 Scenario 6, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-198

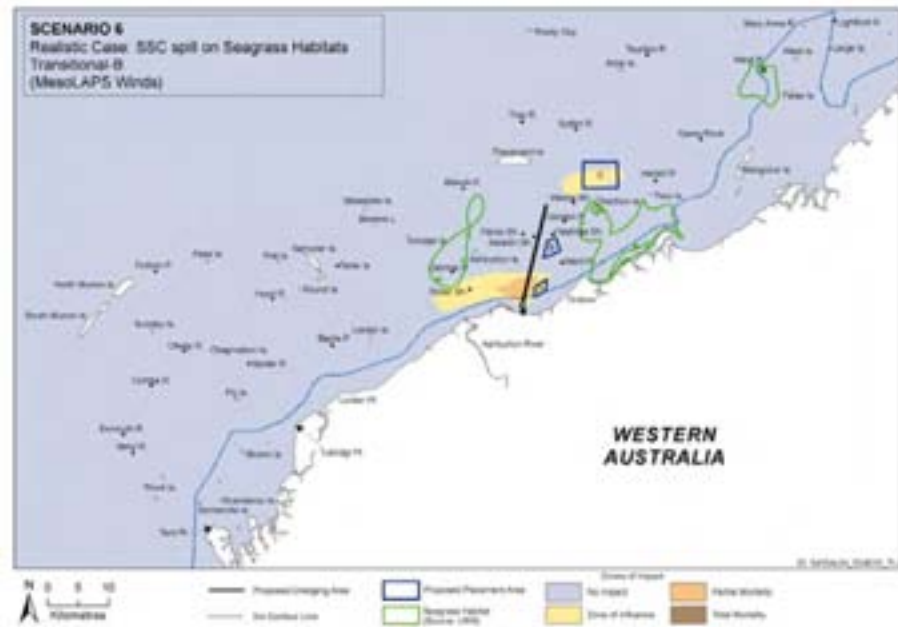


Figure A.263 Scenario 6, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.264 Scenario 6, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Table A.66 Summary of Impacts at Sensitive Receptors for Scenario 6, Transitional-B, Realistic Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.3	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	2.0	14.1	1.9	0.0	0.0	
3	Ashburton Island	286705	7611075	0.6	0.0	0.0	0.0	0.3	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.6	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.6	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.3	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.4	0.4	0.0	0.0	0.0	
11	Ward Reef	300410	7608668	0.3	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.3	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.7	0.7	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.6	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.7	0.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.2	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-200



**A.6.7 Summer-A, Worst Case Spill Scenario**

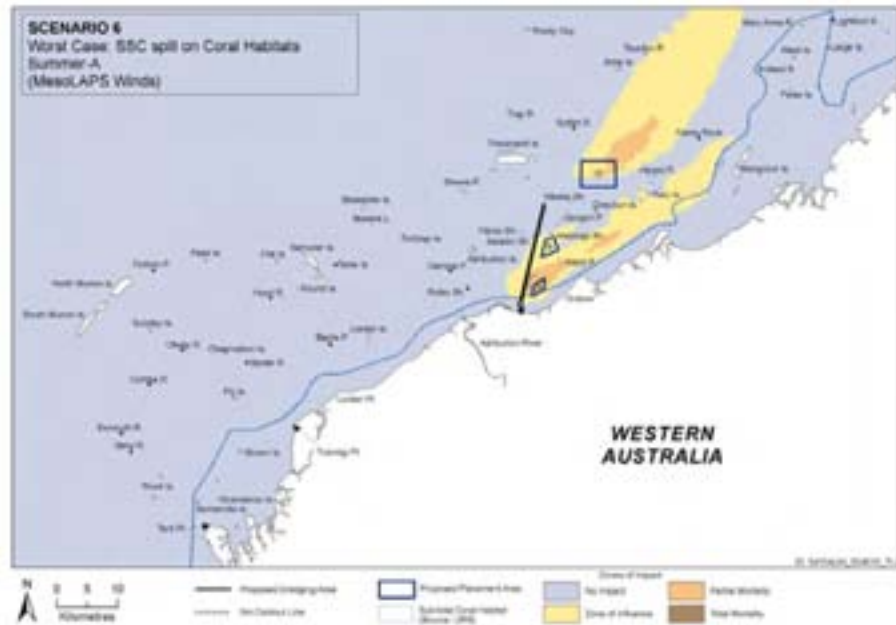


Figure A.265 Scenario 6, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

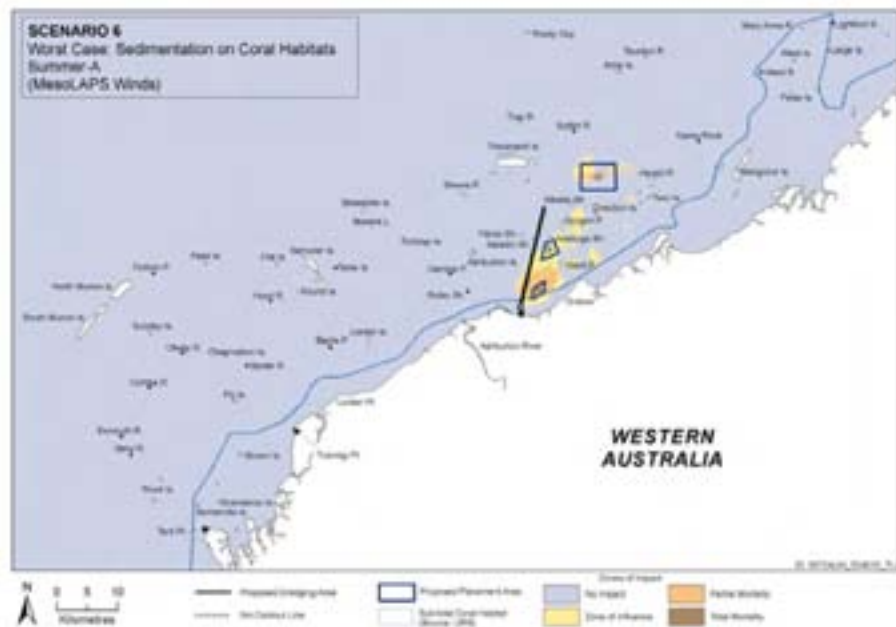


Figure A.266 Scenario 6, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-201

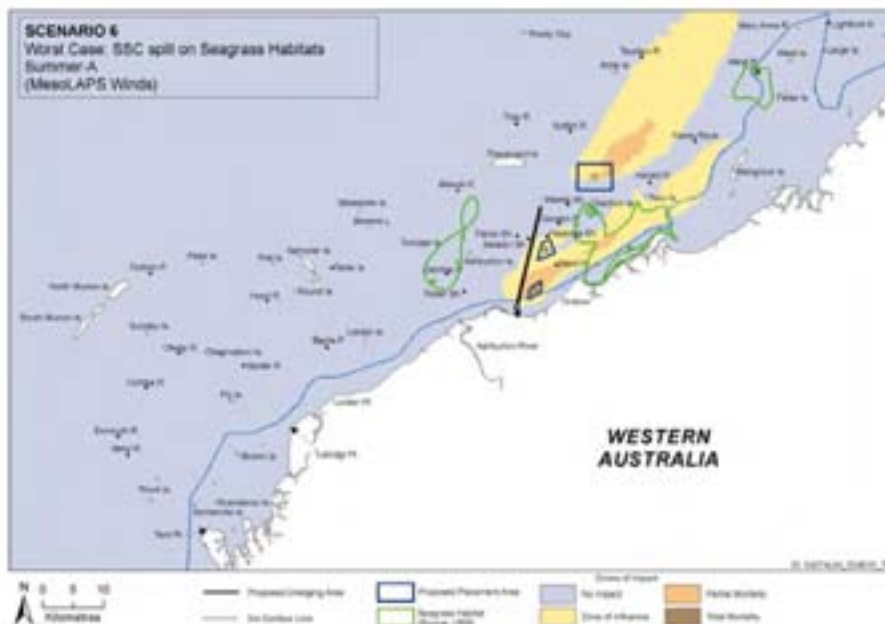


Figure A.267 Scenario 6, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

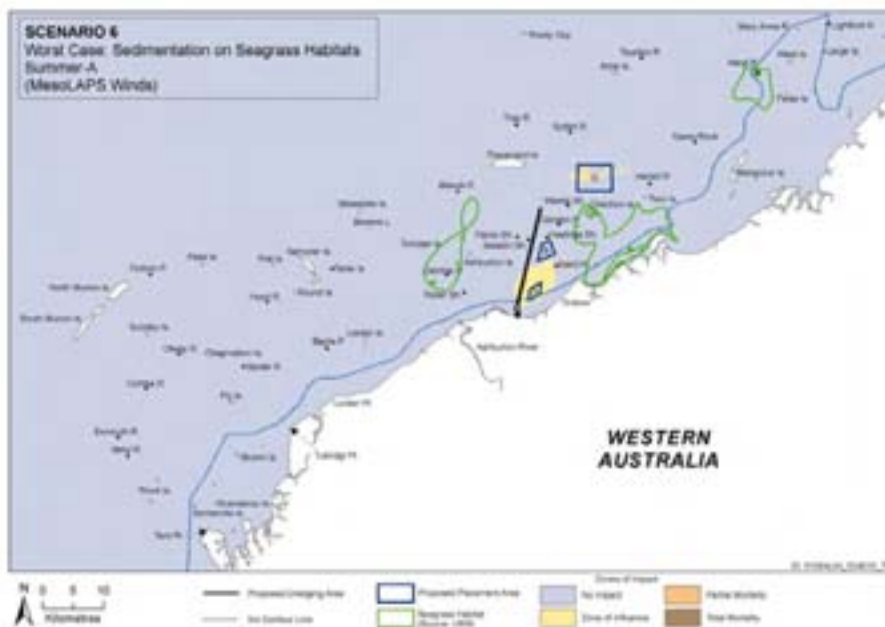


Figure A.268 Scenario 6, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



A-202



Table A.67 Summary of Impacts at Sensitive Receptors for Scenario 6, Summer-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brewis Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	0.1	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.1	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	1.6	4.8	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	1.9	4.6	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	3.8	27.6	1.8	0.0	0.0	
12	Ward Reef	301120	7609196	3.6	25.0	1.6	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.0	1.2	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.9	0.4	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.5	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.4	2.1	0.0	0.0	0.4	
17	NW of Direction Island	304867	7618549	1.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.8	0.0	0.0	0.0	0.4	
19	NE Tw in Island	314029	7620738	1.7	4.3	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	1.5	0.1	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	2.4	10.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.7	0.9	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.2	5.2	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	2.3	13.8	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	3.3	23.8	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.2	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.2	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	2.9	16.2	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	1.7	3.1	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.6.8 Summer-B, Worst Case Spill Scenario**



Figure A.269 Scenario 6, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

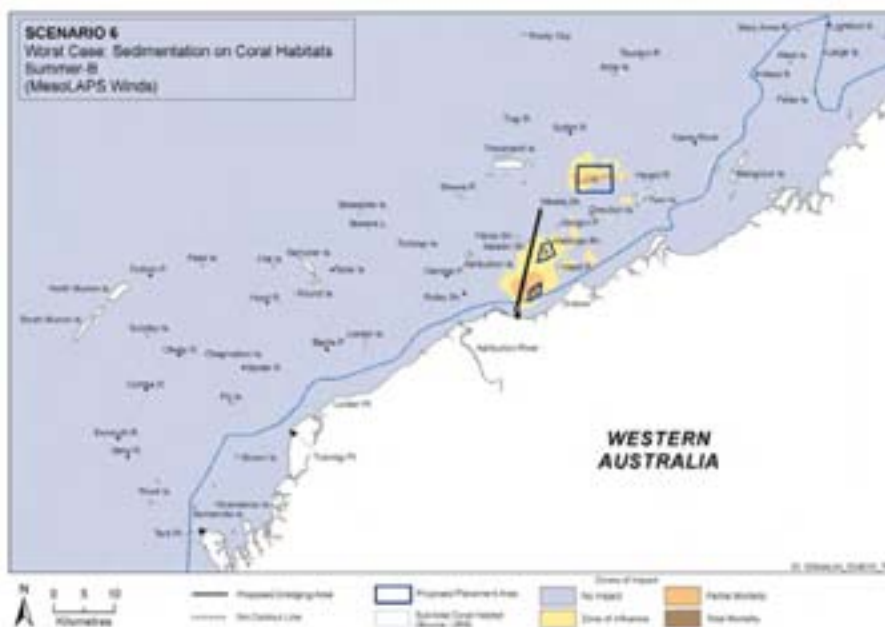


Figure A.270 Scenario 6, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-204

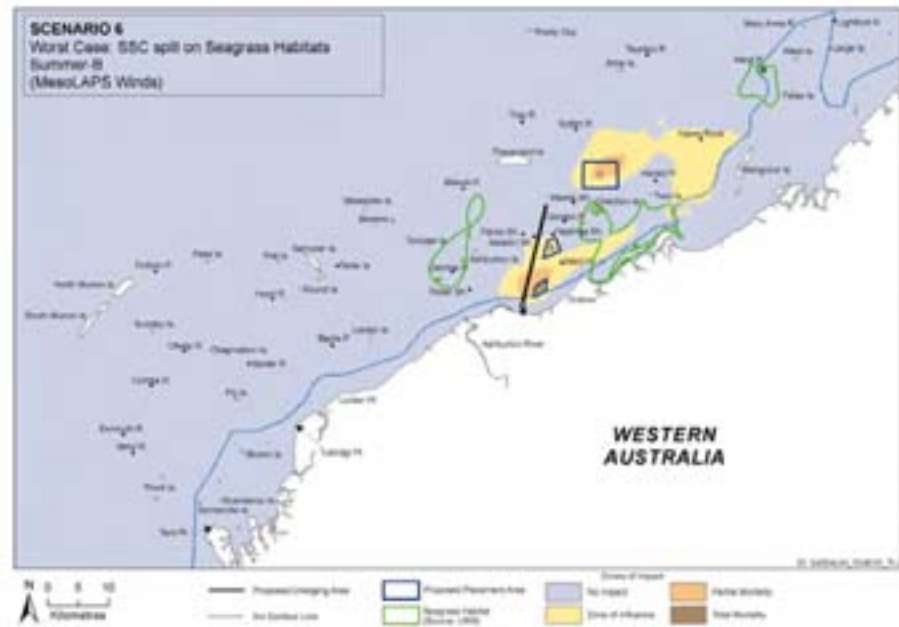


Figure A.271 Scenario 6, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

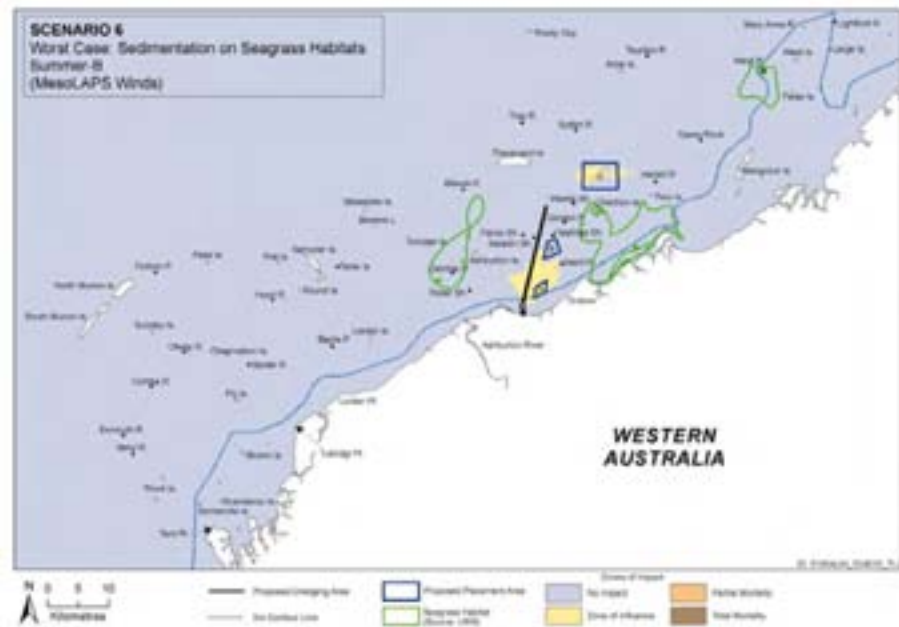


Figure A.272 Scenario 6, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



Table A.68 Summary of Impacts at Sensitive Receptors for Scenario 6, Summer-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.8	0.3	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.2	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	1.3	2.2	0.0	0.0	0.3	
10	North West Ward Reef	299018	7610106	2.0	4.9	0.0	0.0	0.3	
11	Ward Reef	300410	7608868	2.3	12.3	0.9	0.0	0.3	
12	Ward Reef	301120	7609196	2.1	8.8	1.0	0.1	0.1	
13	SW of Gorgon Patch	300094	7615177	0.8	0.0	0.0	0.0	0.2	
14	Gorgon Patch	300859	7615993	0.7	0.0	0.0	0.0	0.2	
15	Weeks Shoal	302245	7618926	0.3	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.8	0.4	0.0	0.0	0.2	
17	NW of Direction Island	304867	7618549	0.6	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.5	0.0	0.0	0.0	0.1	
19	NE Tw in Island	314029	7620738	0.7	0.1	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.9	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	2.5	11.4	0.1	0.0	0.0	
22	Nares Rock	323379	7629437	2.5	18.1	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.4	0.0	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	1.2	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	1.2	0.1	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	2.0	5.5	0.6	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.2	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	1.8	1.3	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.8	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-206



**A.6.9 Winter-A, Worst Case Spill Scenario**

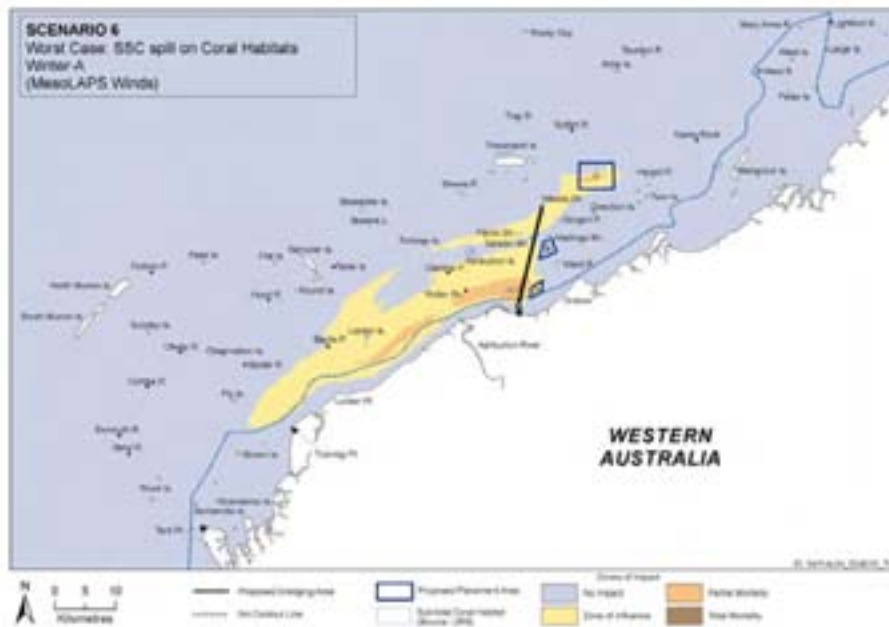


Figure A.273 Scenario 6, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

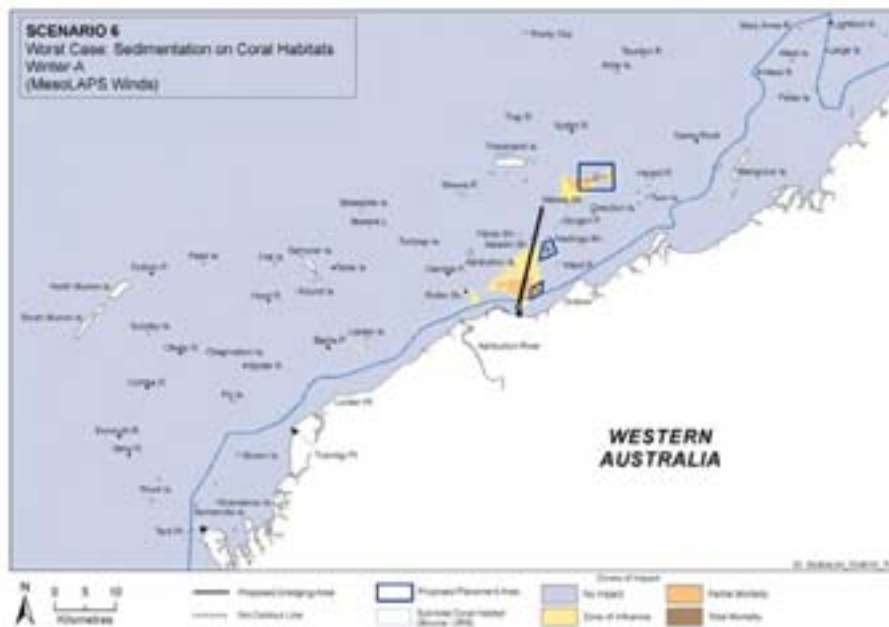


Figure A.274 Scenario 6, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-207

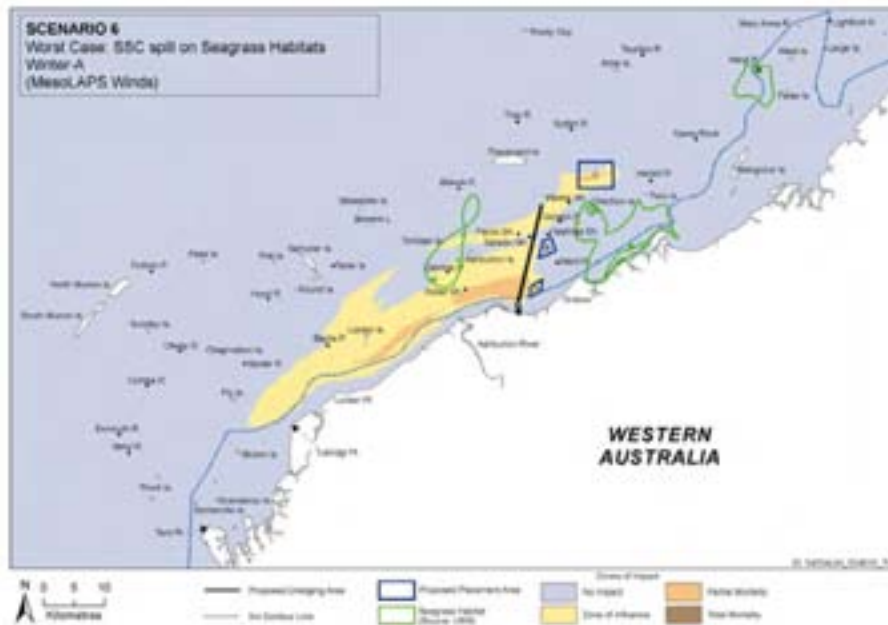


Figure A.275 Scenario 6, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.276 Scenario 6, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

A-208



Table A.69 Summary of Impacts at Sensitive Receptors for Scenario 6, Winter-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.5	0.9	0.3	0.0	0.0	
2	Roller Shoal	285367	7604532	3.7	23.8	6.4	0.7	0.0	
3	Ashburton Island	286705	7611075	0.8	0.9	0.0	0.0	0.4	
4	Brewis Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.1	4.2	0.4	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	1.9	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.4	4.0	1.5	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.2	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.2	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.7	5.1	1.6	0.3	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.0	3.0	1.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.8	1.8	0.4	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.6.10 Winter-B, Worst Case Spill Scenario**

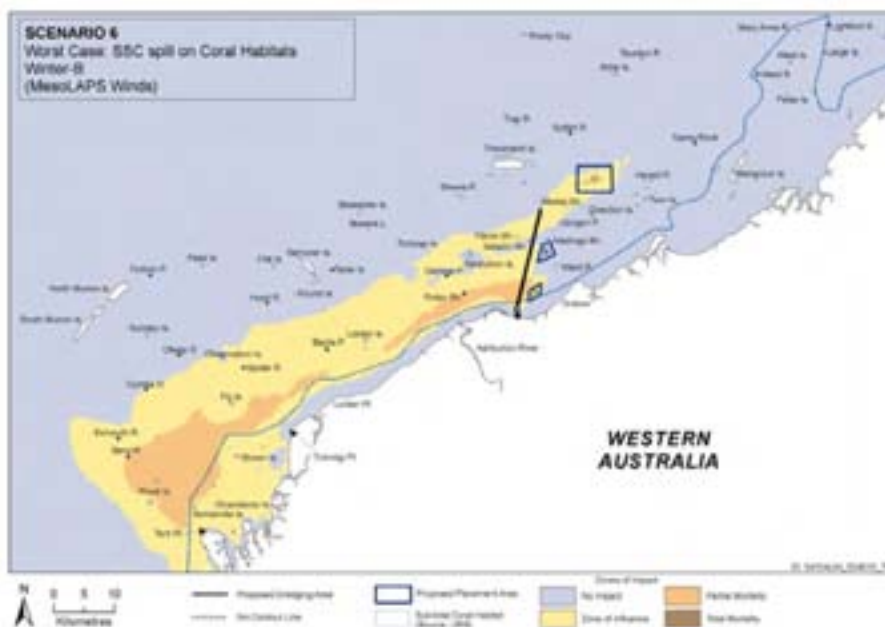


Figure A.277 Scenario 6, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

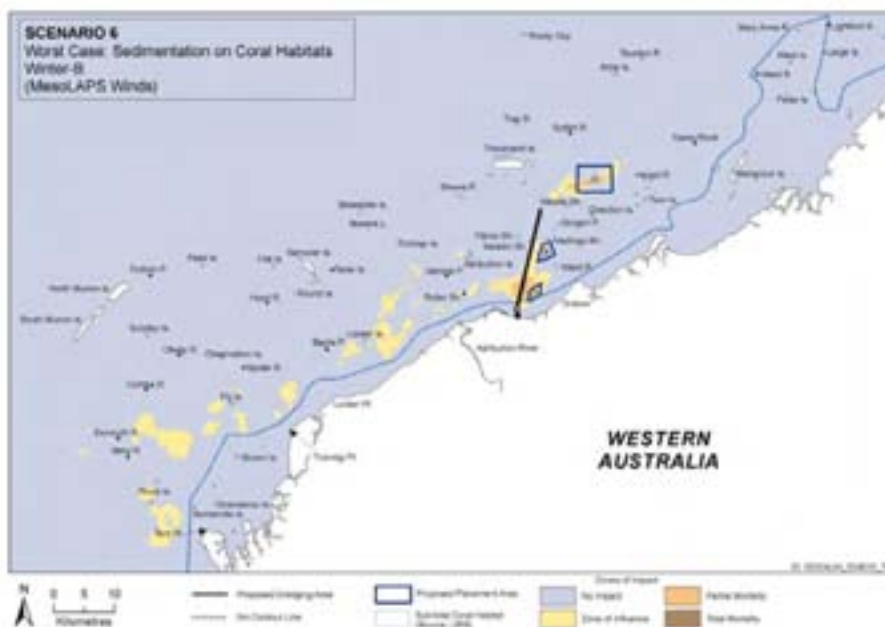


Figure A.278 Scenario 6, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds



A-210

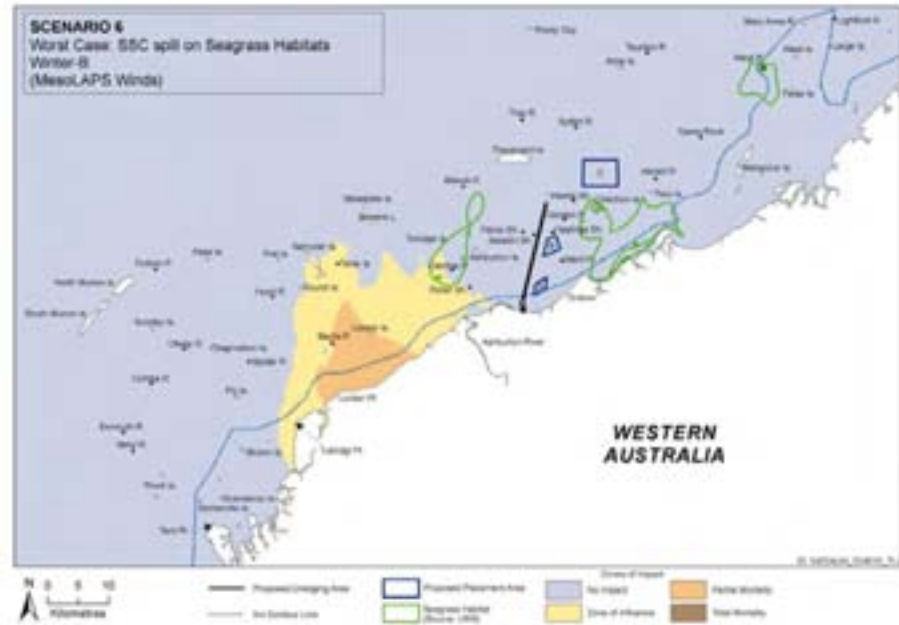


Figure A.279 Scenario 6, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

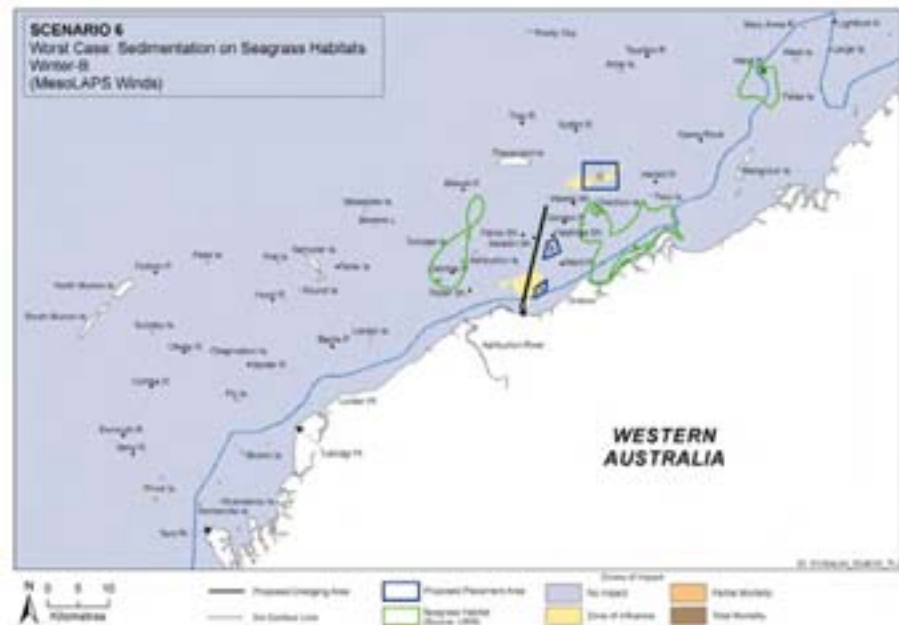


Figure A.280 Scenario 6, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Table A.70 Summary of Impacts at Sensitive Receptors for Scenario 6, Winter-B, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.0	0.3	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	3.7	28.2	12.2	0.0	0.0	
3	Ashburton Island	286705	7611075	1.3	1.3	0.0	0.0	0.6	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.7	10.1	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.0	0.9	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.5	7.4	0.9	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.5	0.0	0.0	0.0	0.2	
10	North West Ward Reef	299018	7610106	0.3	0.0	0.0	0.0	0.1	
11	Ward Reef	300410	7608868	0.3	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.2	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.6	0.3	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.7	2.1	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.4	5.9	0.6	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.5	3.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.7	5.6	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.6.11 Transitional-A, Worst Case Spill Scenario**

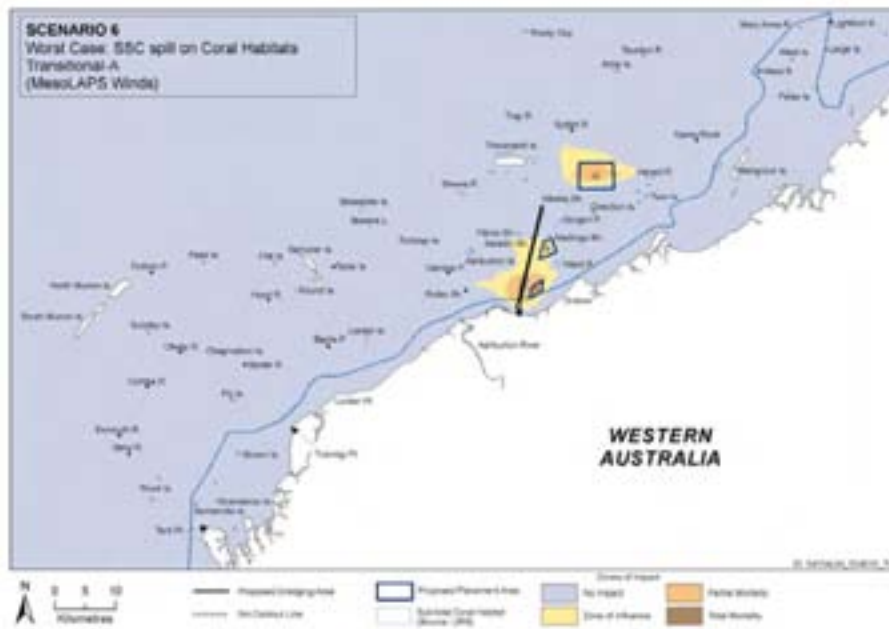


Figure A.281 Scenario 6, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

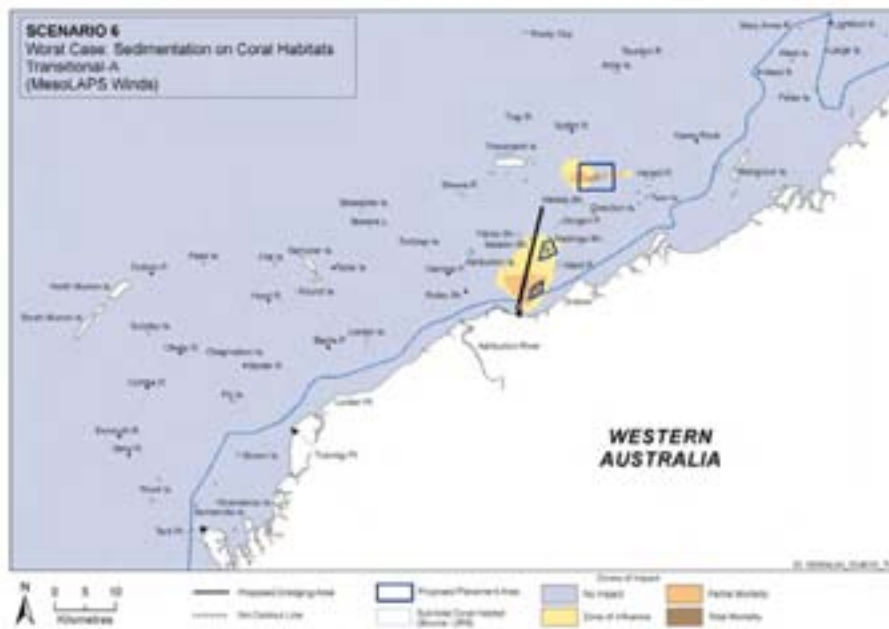


Figure A.282 Scenario 6, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-213

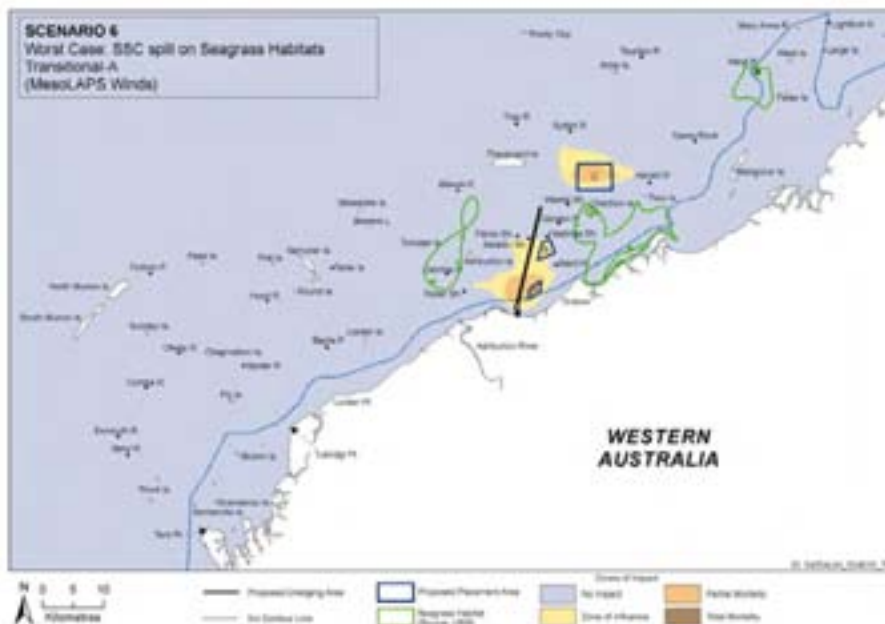


Figure A.283 Scenario 6, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

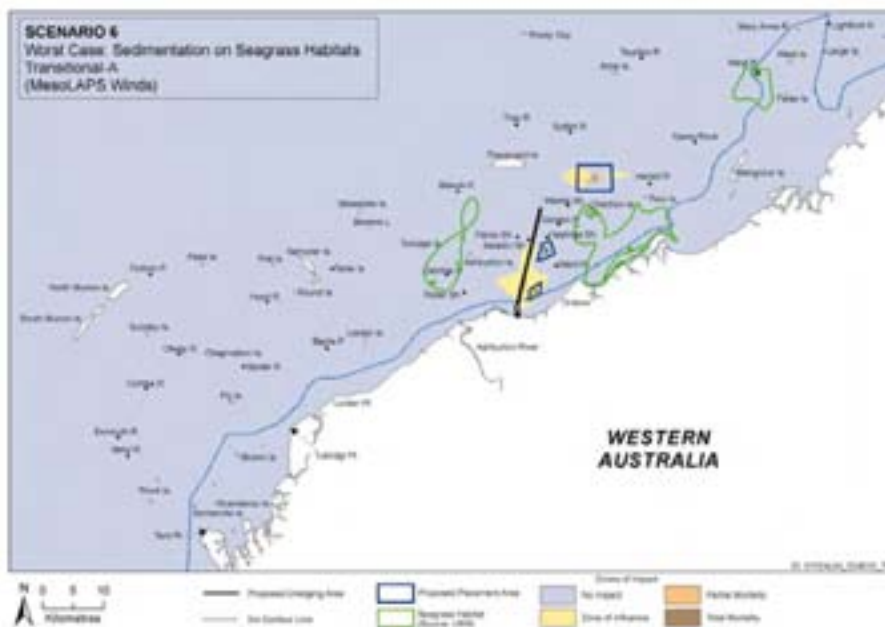


Figure A.284 Scenario 6, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-214



Table A.71 Summary of Impacts at Sensitive Receptors for Scenario 6, Transitional-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.5	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.2	0.0	0.0	0.0	0.0	
4	Brewis Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.8	0.1	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.3	1.3	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.4	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	1.0	0.1	0.0	0.0	0.3	
10	North West Ward Reef	299018	7610106	1.1	3.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.7	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.5	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.4	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.2	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.6.12 Transitional-B, Worst Case Spill Scenario**



Figure A.285 Scenario 6, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

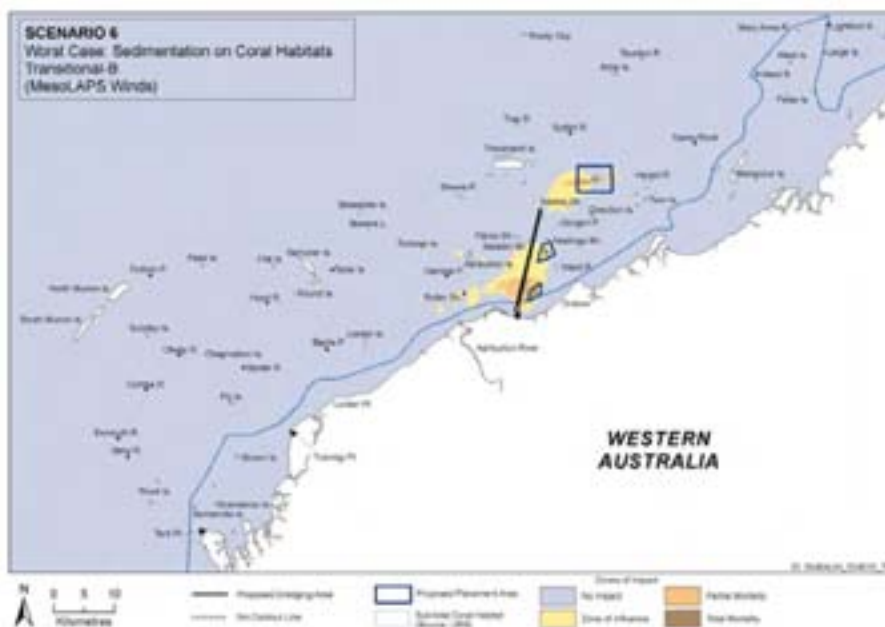


Figure A.286 Scenario 6, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-216

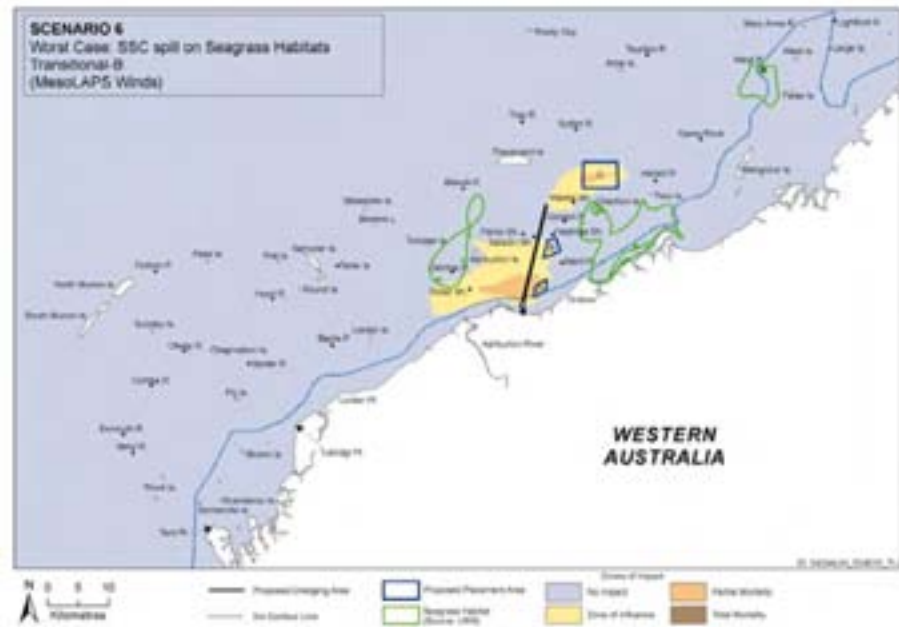


Figure A.287 Scenario 6, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

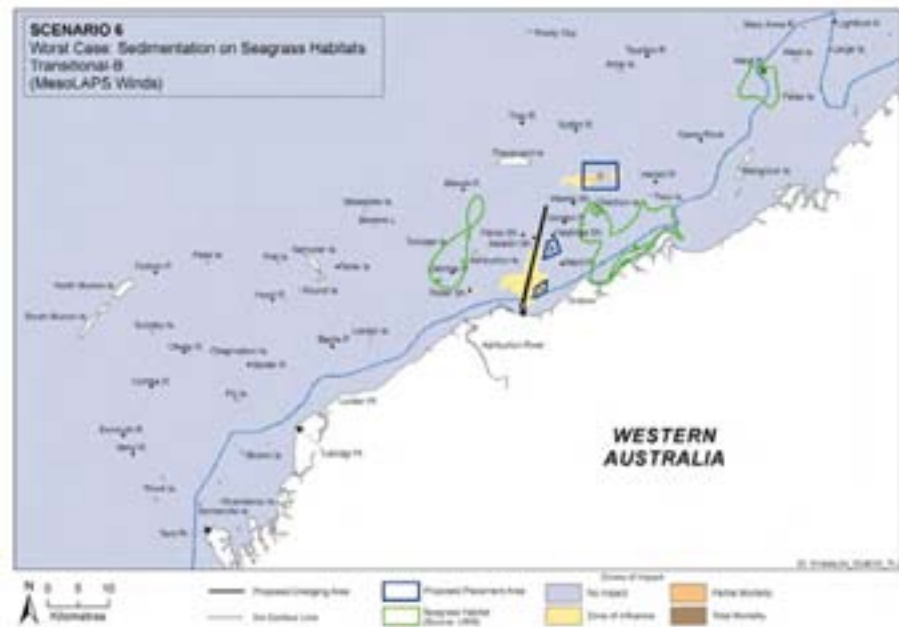


Figure A.288 Scenario 6, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



Table A.72 Summary of Impacts at Sensitive Receptors for Scenario 6, Transitional-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.5	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	2.6	19.3	3.4	0.0	0.0	
3	Ashburton Island	286705	7611075	0.9	0.9	0.0	0.0	0.4	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.9	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.8	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.0	1.8	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.5	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.7	2.2	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.6	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.5	0.7	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.1	3.7	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.8	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.0	0.3	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**A.7 Dredging Scenario 7**

**A.7.1 Summer-A, Realistic Spill Scenario**

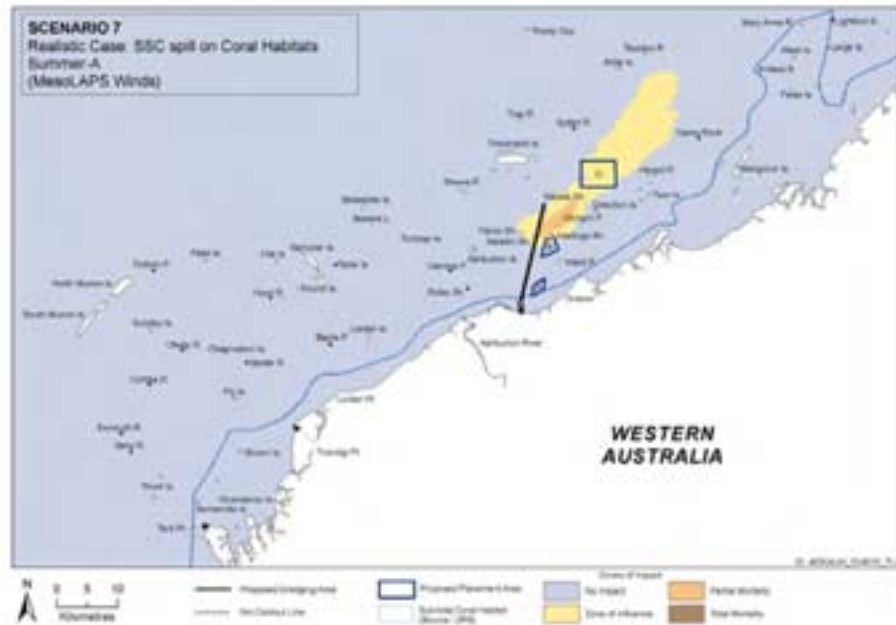


Figure A.289 Scenario 7, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

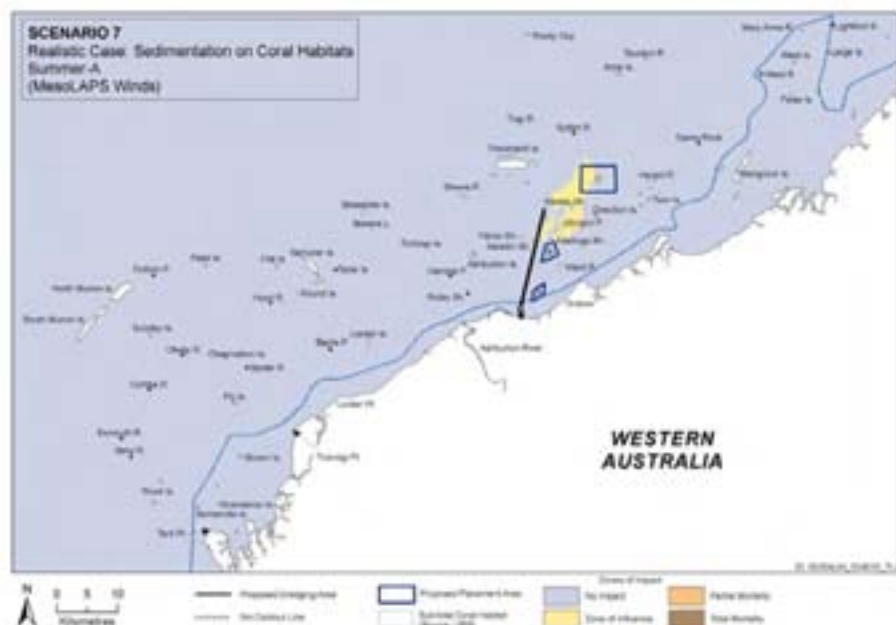


Figure A.290 Scenario 7, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-219

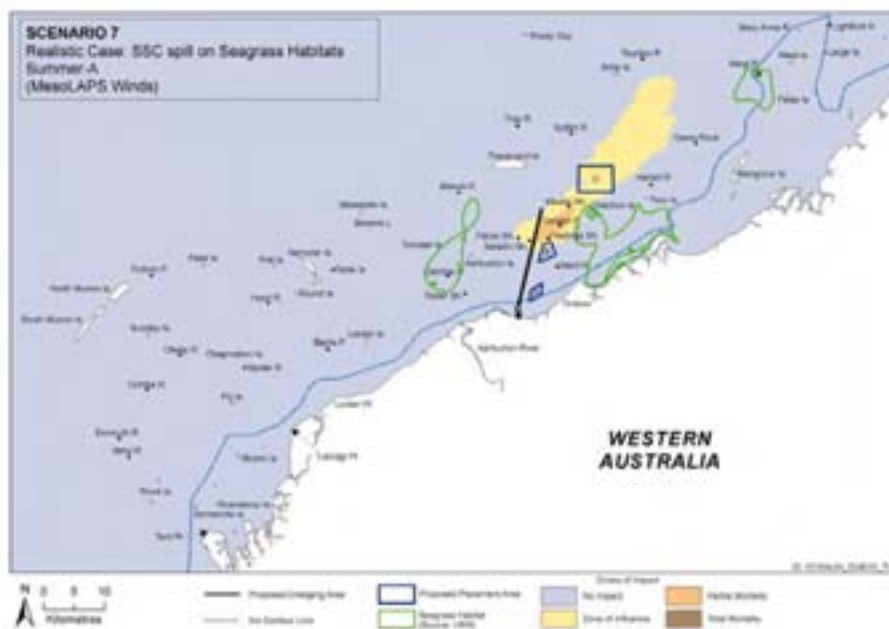


Figure A.291 Scenario 7, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

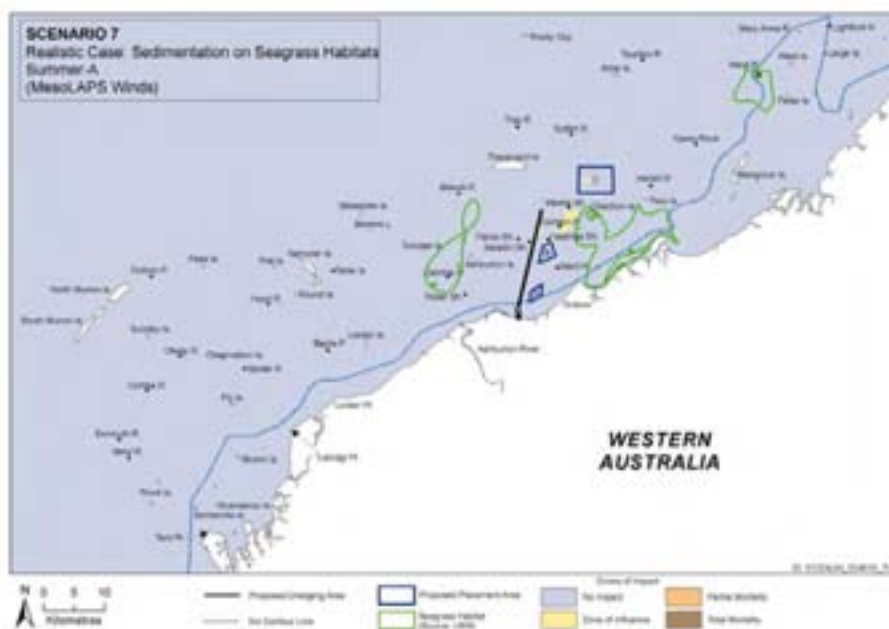


Figure A.292 Scenario 7, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-220



Table A.73 Summary of Impacts at Sensitive Receptors for Scenario 7, Summer-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.3	3.0	0.9	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.6	8.8	3.9	0.6	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.3	8.3	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	3.4	20.1	9.7	0.4	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	4.3	32.4	10.7	0.3	0.0	
14	Gorgon Patch	300859	7615993	4.6	38.5	10.8	0.1	0.0	
15	Weeks Shoal	302245	7618926	3.0	21.2	0.6	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.6	0.7	0.0	0.0	0.2	
17	NW of Direction Island	304867	7618549	1.4	3.9	0.6	0.0	0.0	
18	Direction Island	307431	7617732	0.3	0.0	0.0	0.0	0.1	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.2	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.3	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.0	0.7	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-221



**A.7.2 Summer-B, Realistic Spill Scenario**

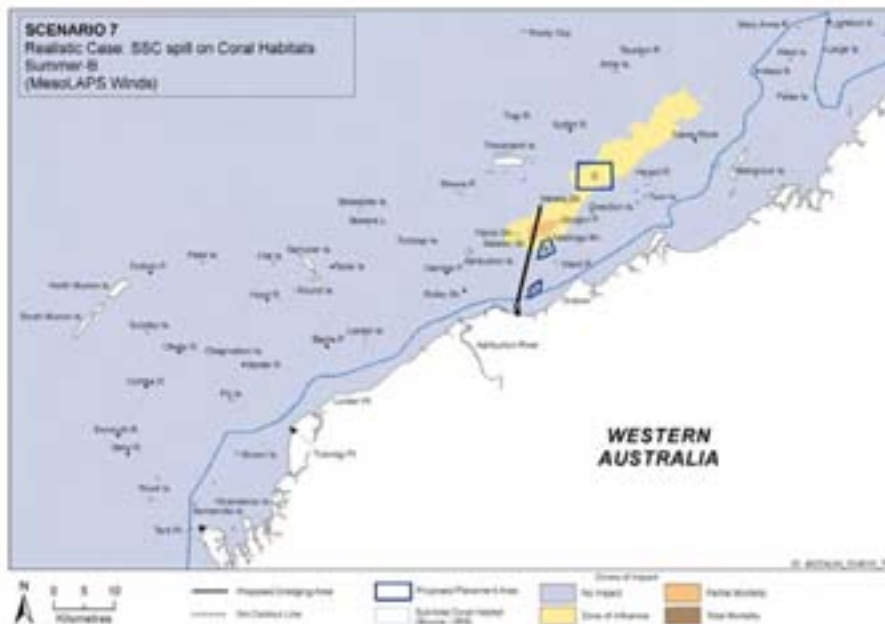


Figure A.293 Scenario 7, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

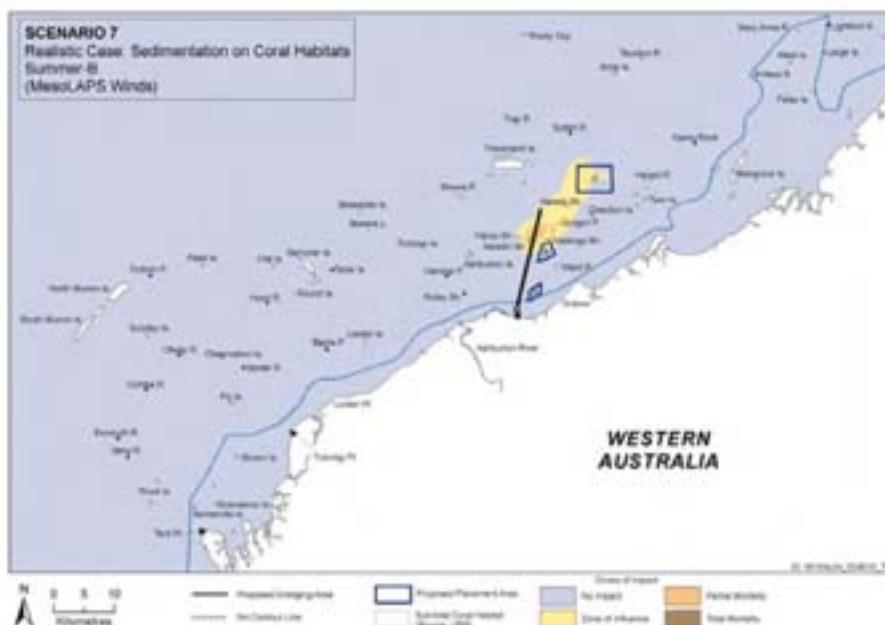


Figure A.294 Scenario 7, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-222

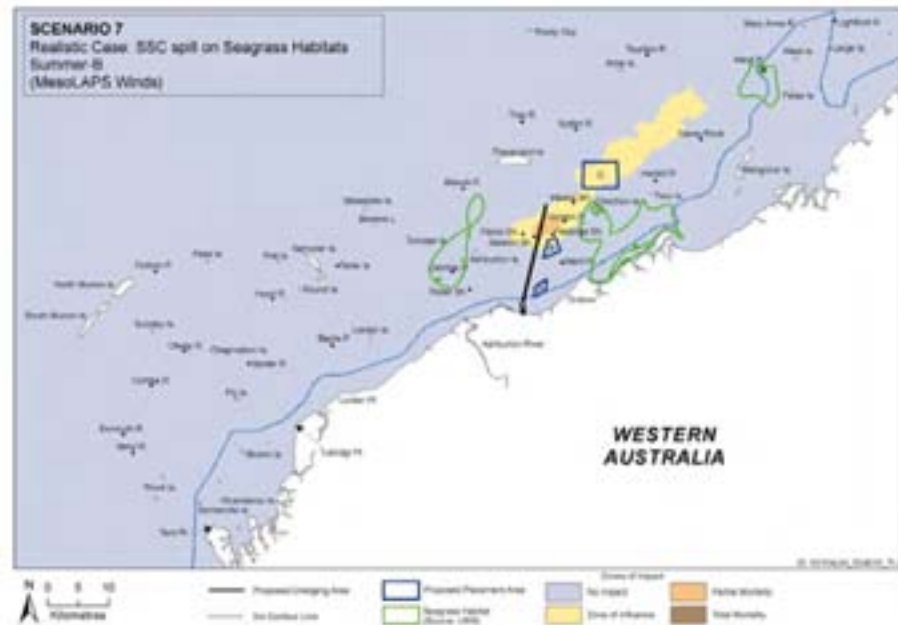


Figure A.295 Scenario 7, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.296 Scenario 7, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Table A.74 Summary of Impacts at Sensitive Receptors for Scenario 7, Summer-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.6	10.8	3.3	0.1	0.0	
7	Saladin Shoal	295913	7613337	3.5	22.4	8.8	1.2	0.2	
8	End of Wheatstone Shipping Channel	298328	7617464	1.7	8.3	0.1	0.0	0.5	
9	Hastings Shoal	298803	7613488	3.1	19.9	7.1	0.3	0.9	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	3.5	27.6	8.6	0.0	1.7	
14	Gorgon Patch	300859	7615993	2.8	19.6	3.9	0.1	0.9	
15	Weeks Shoal	302245	7618926	1.9	4.5	0.3	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.5	1.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.3	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.3	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



A-225

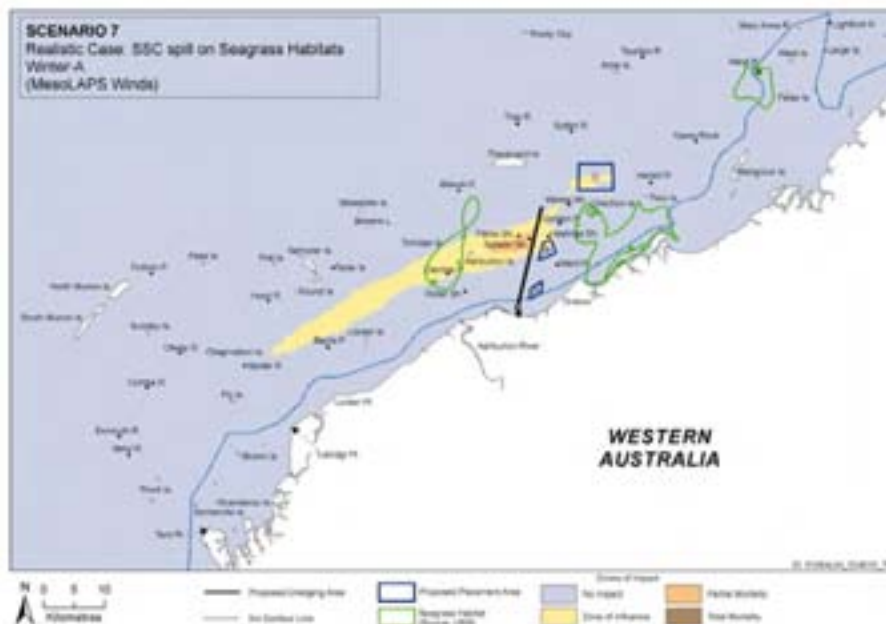


Figure A.299 Scenario 7, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.300 Scenario 7, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



A-226



Table A.75 Summary of Impacts at Sensitive Receptors for Scenario 7, Winter-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.6	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	2.3	7.0	2.5	0.0	1.6	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.7	18.9	5.1	0.0	0.0	
7	Saladin Shoal	295913	7613337	4.6	32.1	11.7	2.4	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.6	2.8	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	1.5	11.0	2.5	0.0	0.8	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.6	2.7	0.1	0.0	0.3	
14	Gorgon Patch	300859	7615993	0.2	0.1	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.6	1.3	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.5	3.7	1.3	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.2	0.7	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.7.4 Winter-B, Realistic Spill Scenario**

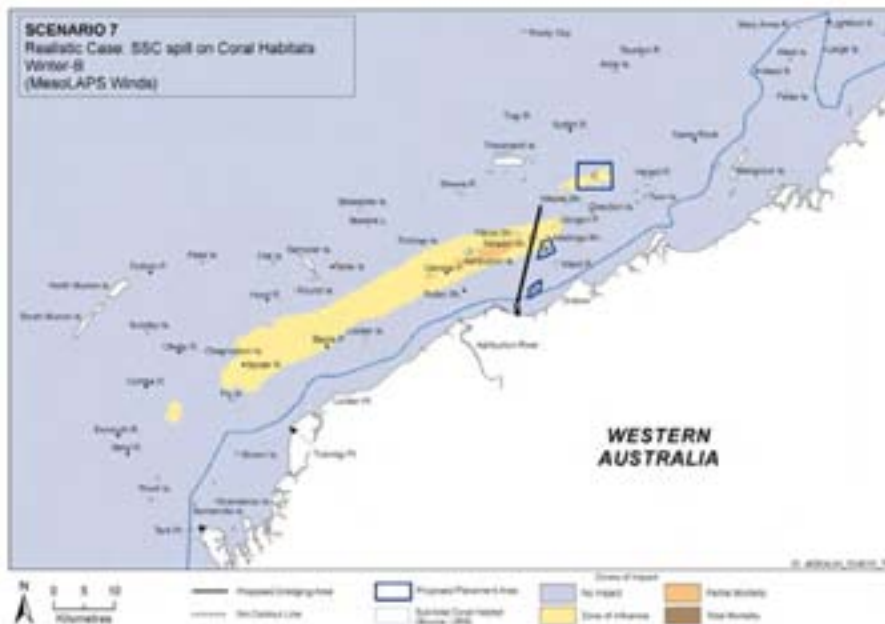


Figure A.301 Scenario 7, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

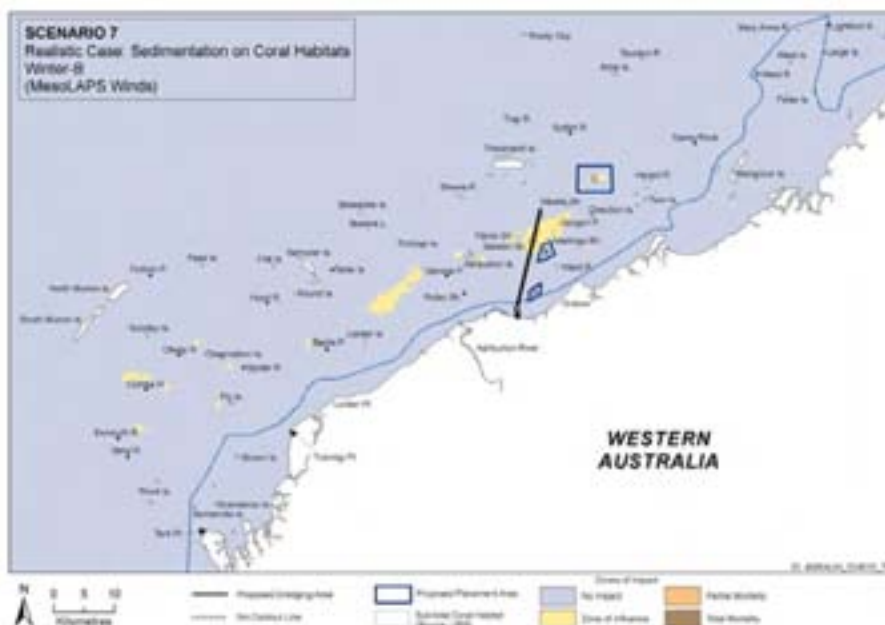


Figure A.302 Scenario 7, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-228

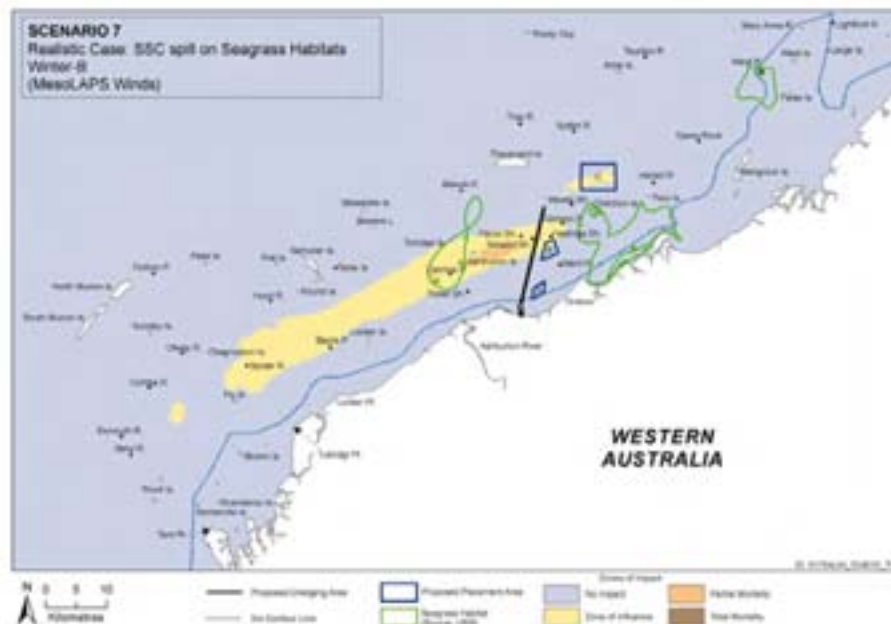


Figure A.303 Scenario 7, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.304 Scenario 7, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-229



Table A.76 Summary of Impacts at Sensitive Receptors for Scenario 7, Winter-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.7	0.1	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	2.6	19.9	1.6	0.0	1.6	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.6	16.3	4.9	0.0	0.3	
7	Saladin Shoal	295913	7613337	3.8	25.0	9.7	2.1	0.6	
8	End of Wheatstone Shipping Channel	298328	7617464	0.6	0.1	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	2.0	13.2	4.2	0.1	0.8	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.0	4.0	0.9	0.0	0.5	
14	Gorgon Patch	300859	7615993	1.0	3.7	0.4	0.0	0.5	
15	Weeks Shoal	302245	7618926	0.7	0.3	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	2.6	20.5	2.5	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.4	3.4	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-230



**A.7.5 Transitional-A, Realistic Spill Scenario**

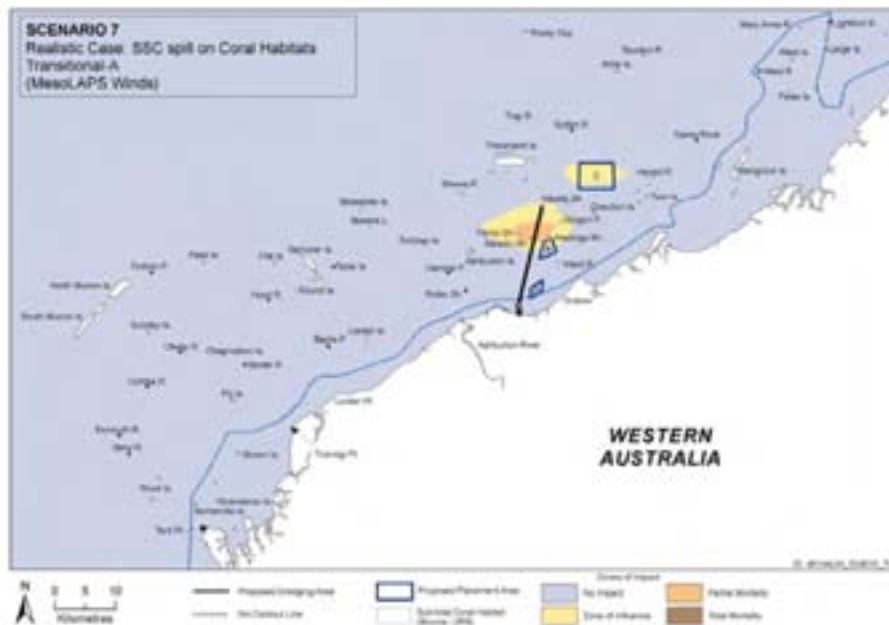


Figure A.305 Scenario 7, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

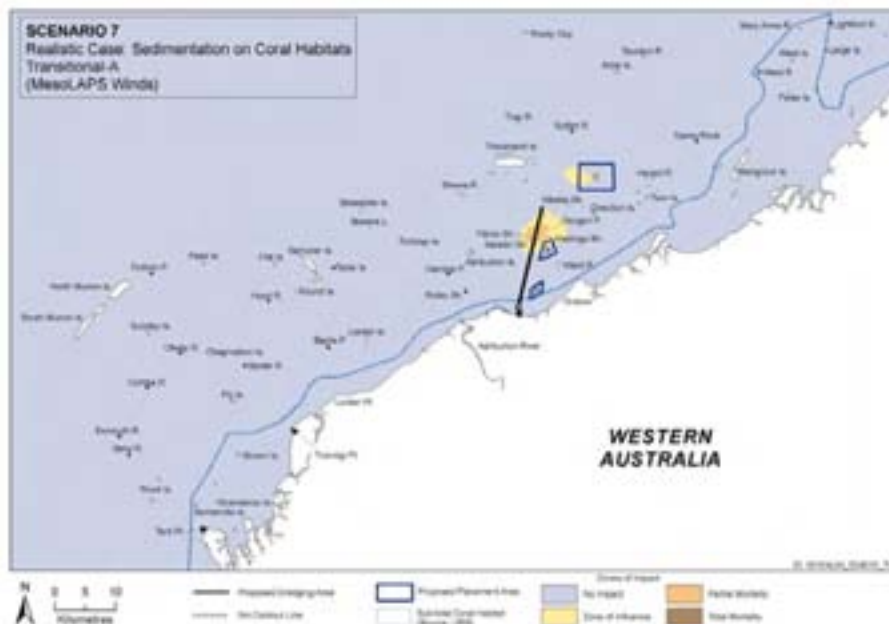


Figure A.306 Scenario 7, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-231

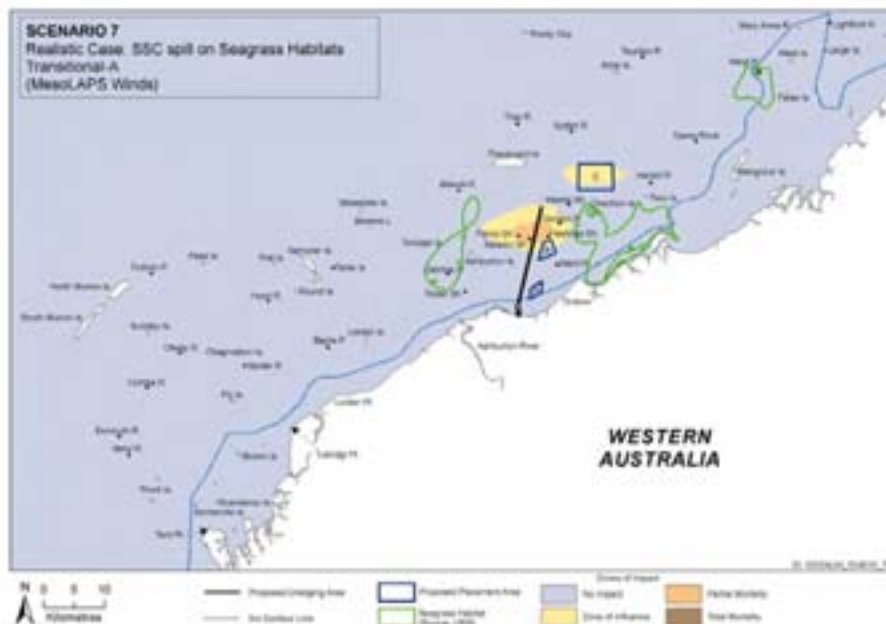


Figure A.307 Scenario 7, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.308 Scenario 7, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-232



Table A.77 Summary of Impacts at Sensitive Receptors for Scenario 7, Transitional-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	3.1	26.3	8.5	0.6	0.0	
7	Saladin Shoal	295913	7613337	4.8	37.0	11.6	1.5	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.4	9.7	0.0	0.0	0.2	
9	Hastings Shoal	298803	7613488	4.0	29.9	8.5	0.6	1.6	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	2.8	20.1	4.6	0.0	0.8	
14	Gorgon Patch	300859	7615993	1.7	10.3	1.8	0.0	0.5	
15	Weeks Shoal	302245	7618926	0.3	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.1	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-233



**A.7.6 Transitional-B, Realistic Spill Scenario**



Figure A.309 Scenario 7, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

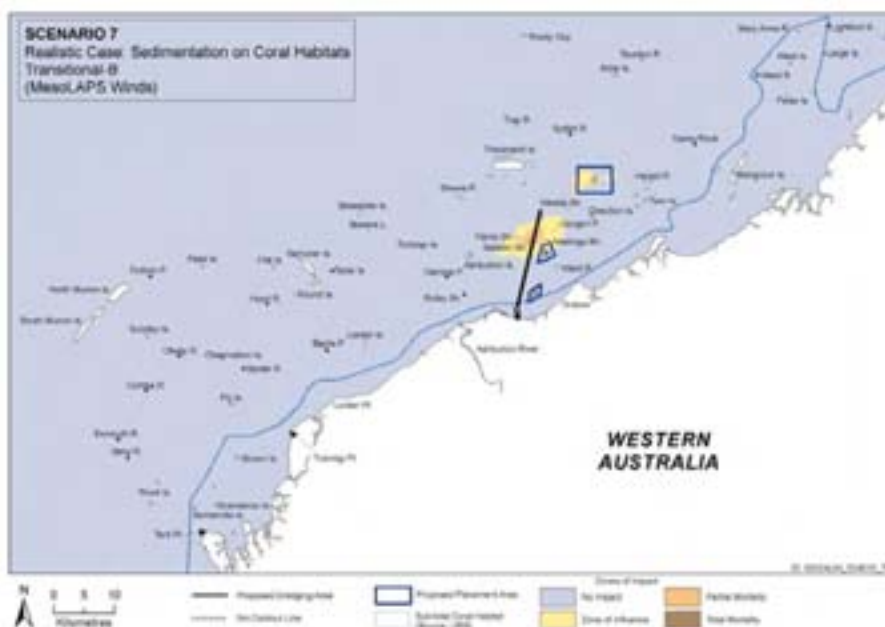


Figure A.310 Scenario 7, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds



A-234

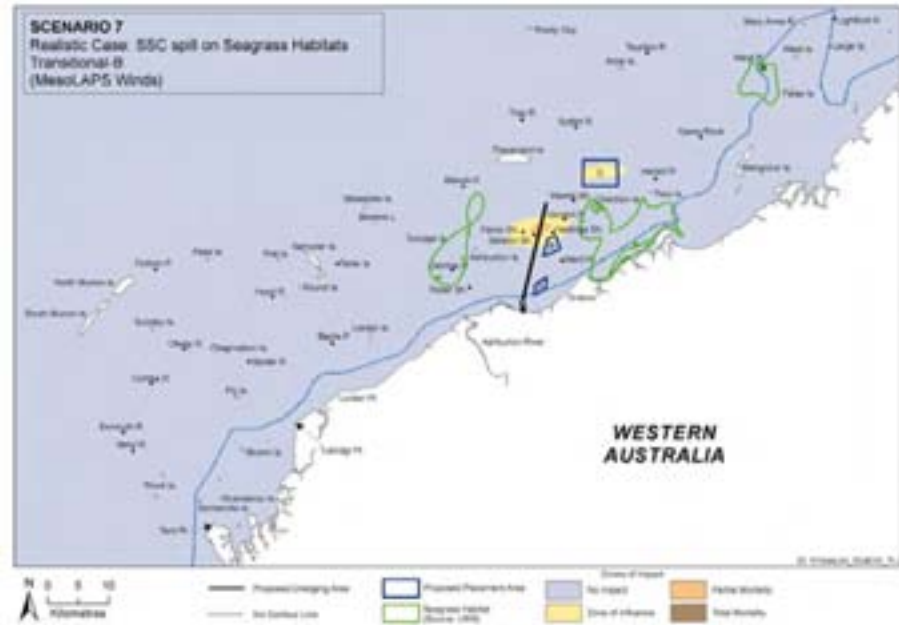


Figure A.311 Scenario 7, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.312 Scenario 7, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-235



Table A.78 Summary of Impacts at Sensitive Receptors for Scenario 7, Transitional-B, Realistic Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.3	0.0	0.0	0.0	0.1	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.5	9.2	1.8	0.0	0.0	
7	Saladin Shoal	295913	7613337	4.0	28.2	10.1	1.3	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.7	0.7	0.0	0.0	0.2	
9	Hastings Shoal	298803	7613488	2.7	17.8	5.3	0.3	1.2	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	2.7	19.2	6.2	0.0	1.3	
14	Gorgon Patch	300859	7615993	1.9	10.1	1.9	0.0	0.8	
15	Weeks Shoal	302245	7618926	0.8	0.0	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-236



**A.7.7 Summer-A, Worst Case Spill Scenario**

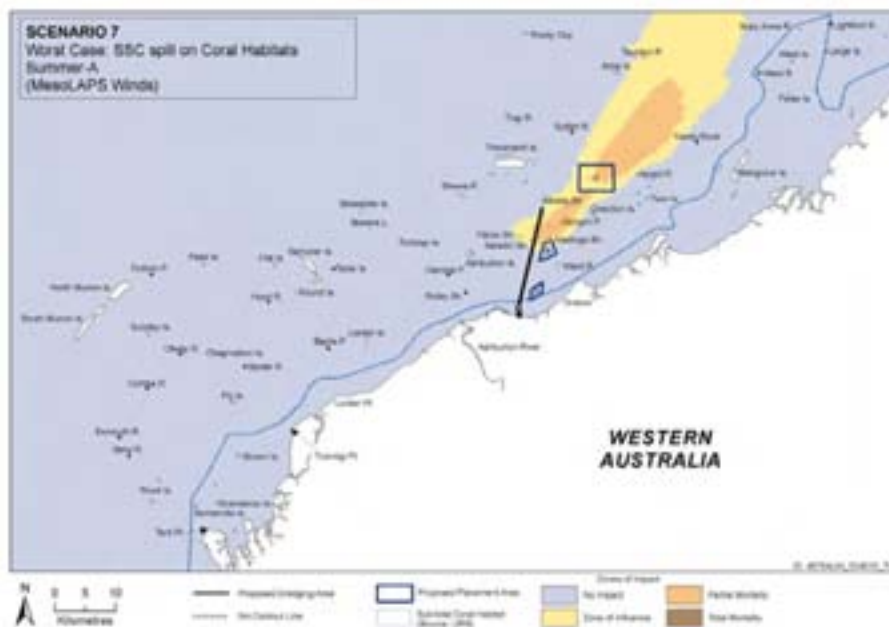


Figure A.313 Scenario 7, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

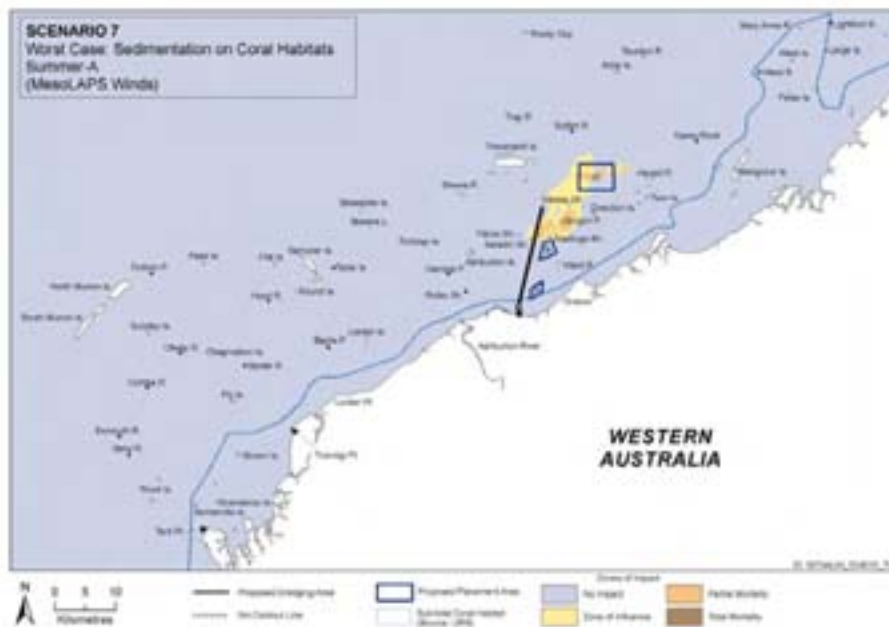


Figure A.314 Scenario 7, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-237

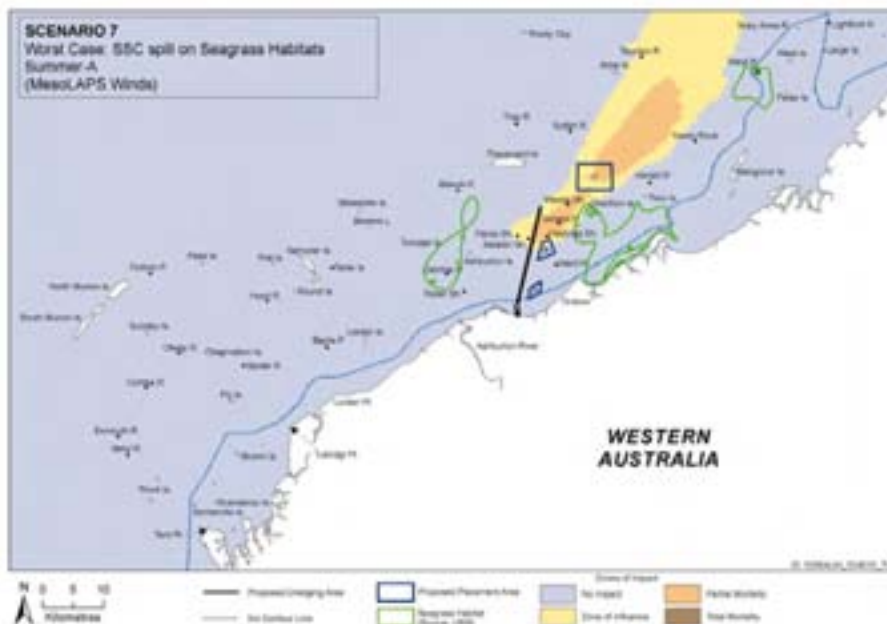


Figure A.315 Scenario 7, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

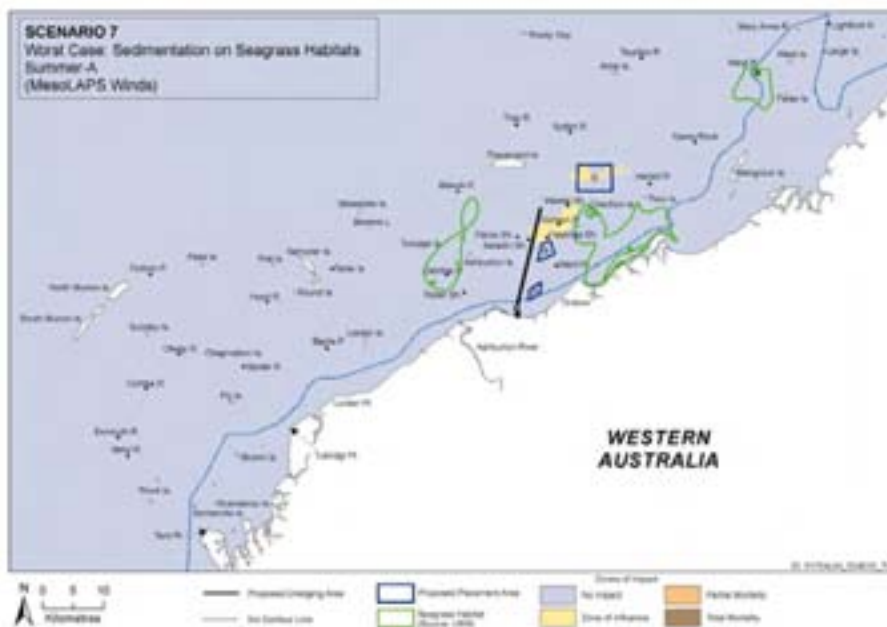


Figure A.316 Scenario 7, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-238



Table A.79 Summary of Impacts at Sensitive Receptors for Scenario 7, Summer-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.5	3.6	1.5	0.0	0.0	
7	Saladin Shoal	295913	7613337	2.4	11.3	6.5	1.5	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.9	14.0	2.4	0.0	0.0	
9	Hastings Shoal	298803	7613488	5.0	25.6	15.2	5.3	0.8	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	6.2	41.5	20.1	3.7	1.1	
14	Gorgon Patch	300859	7615993	6.6	49.2	20.1	3.6	0.4	
15	Weeks Shoal	302245	7618926	4.1	33.7	6.5	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.7	1.2	0.3	0.0	0.2	
17	NW of Direction Island	304867	7618549	1.8	6.8	1.3	0.0	0.0	
18	Direction Island	307431	7617732	0.3	0.0	0.0	0.0	0.1	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.2	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.5	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.7	14.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.7.8 Summer-B, Worst Case Spill Scenario**

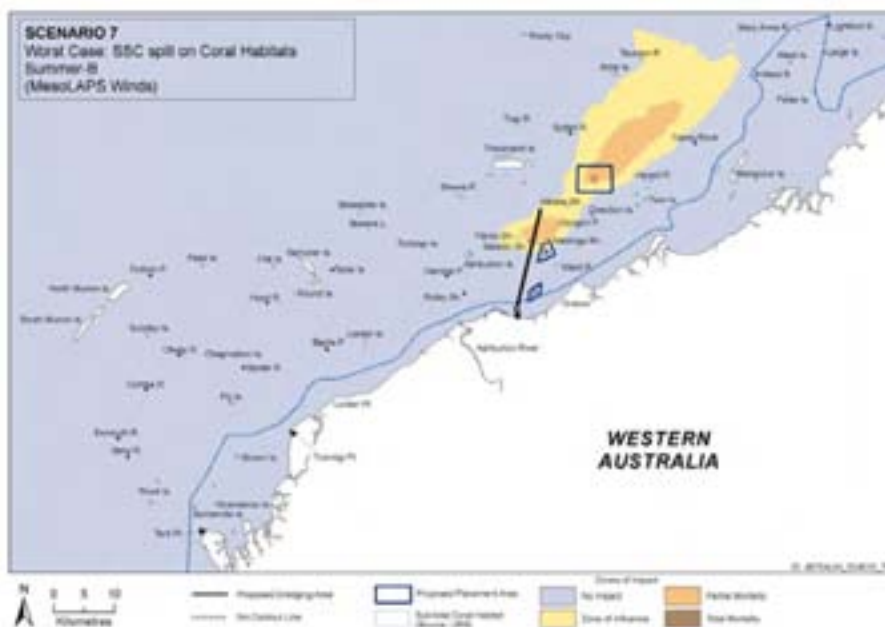


Figure A.317 Scenario 7, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

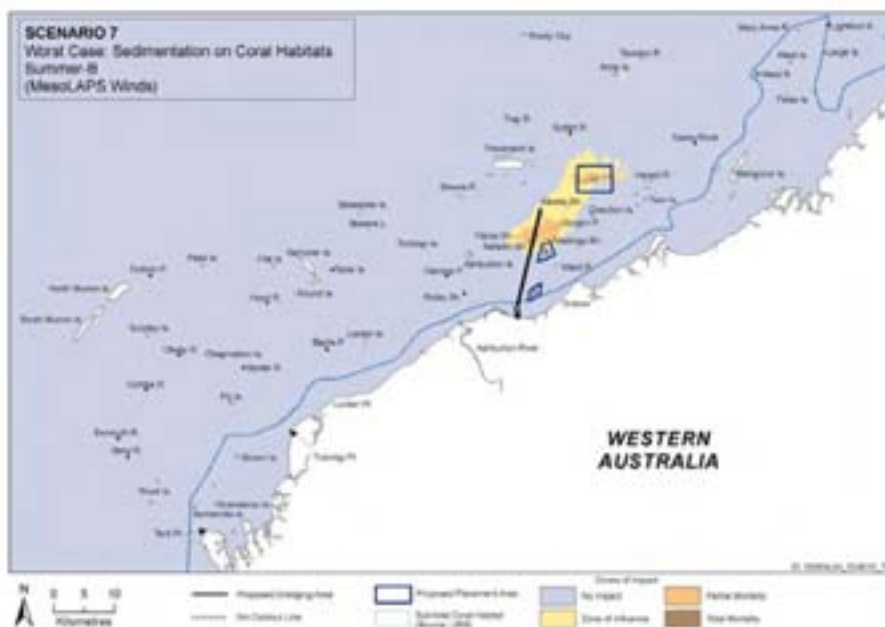


Figure A.318 Scenario 7, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-240

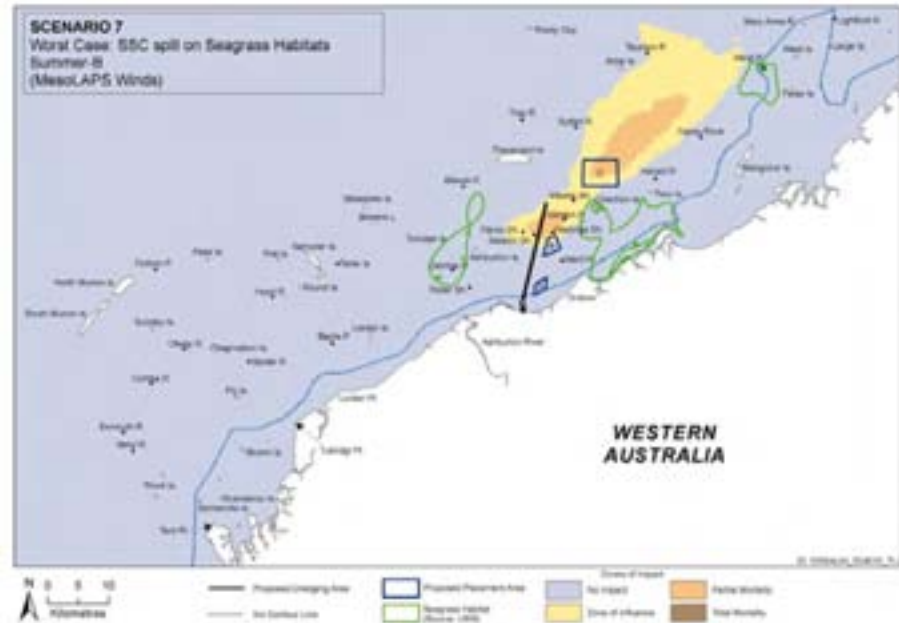


Figure A.319 Scenario 7, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

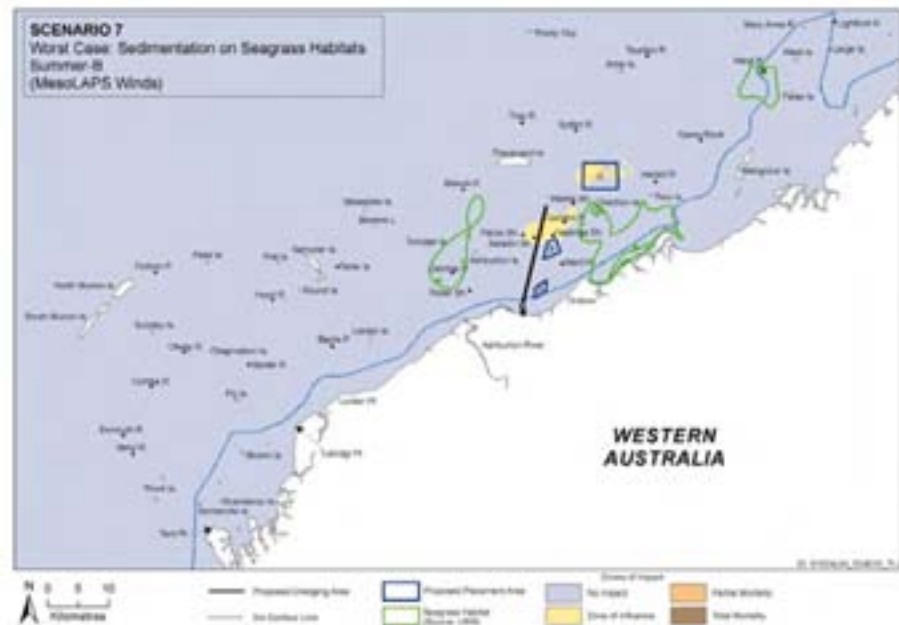


Figure A.320 Scenario 7, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-241



Table A.80 Summary of Impacts at Sensitive Receptors for Scenario 7, Summer-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.4	15.6	6.4	1.2	0.0	
7	Saladin Shoal	295913	7613337	4.9	29.4	14.4	3.0	0.3	
8	End of Wheatstone Shipping Channel	298328	7617464	2.3	15.9	1.5	0.0	0.6	
9	Hastings Shoal	298803	7613488	4.5	27.2	11.7	3.1	1.8	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	5.0	35.1	15.8	2.7	3.5	
14	Gorgon Patch	300859	7615993	3.9	29.3	9.7	0.6	1.5	
15	Weeks Shoal	302245	7618926	2.7	16.5	1.2	0.0	0.2	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.7	2.2	0.1	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.4	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.6	0.0	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	2.1	5.9	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**A.7.9 Winter-A, Worst Case Spill Scenario**

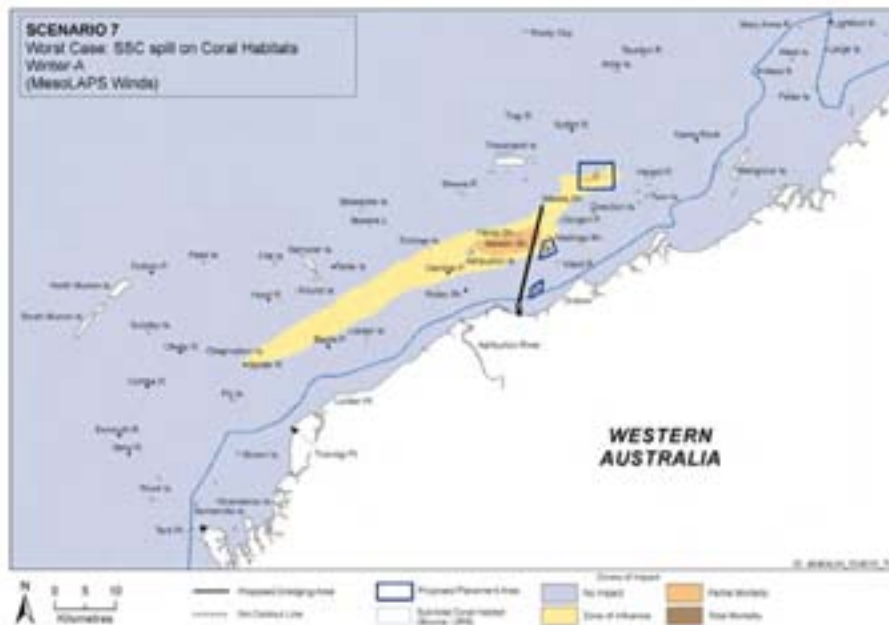


Figure A.321 Scenario 7, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

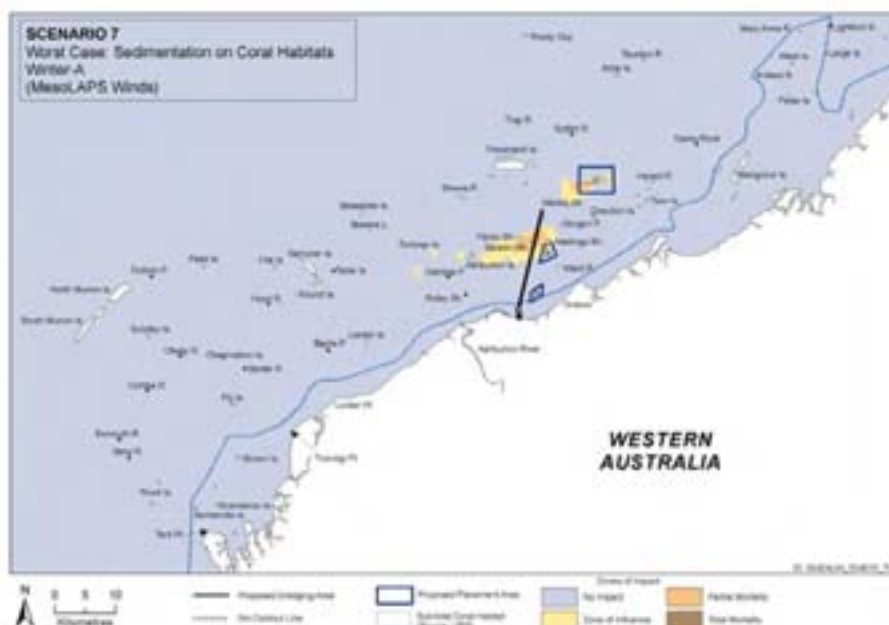


Figure A.322 Scenario 7, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-243

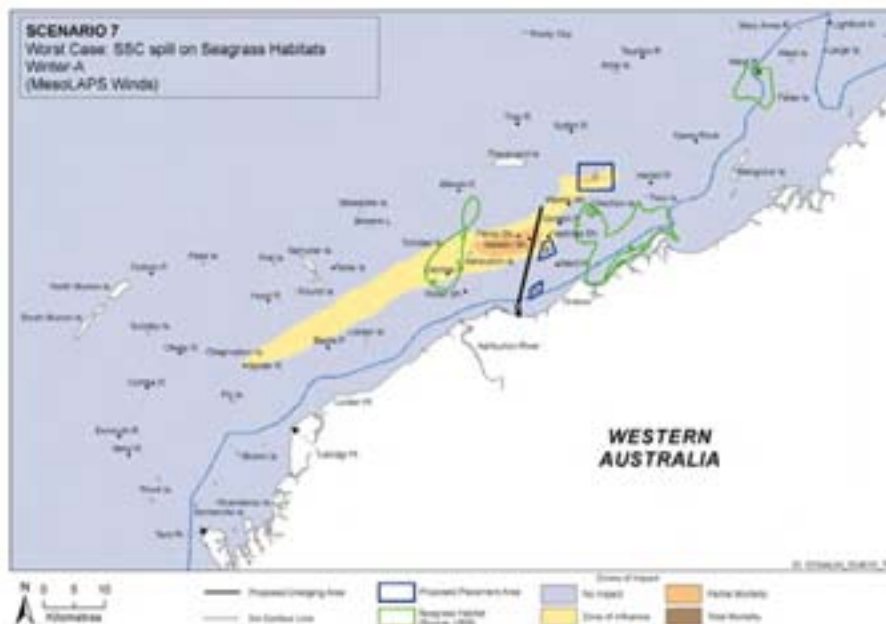


Figure A.323 Scenario 7, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

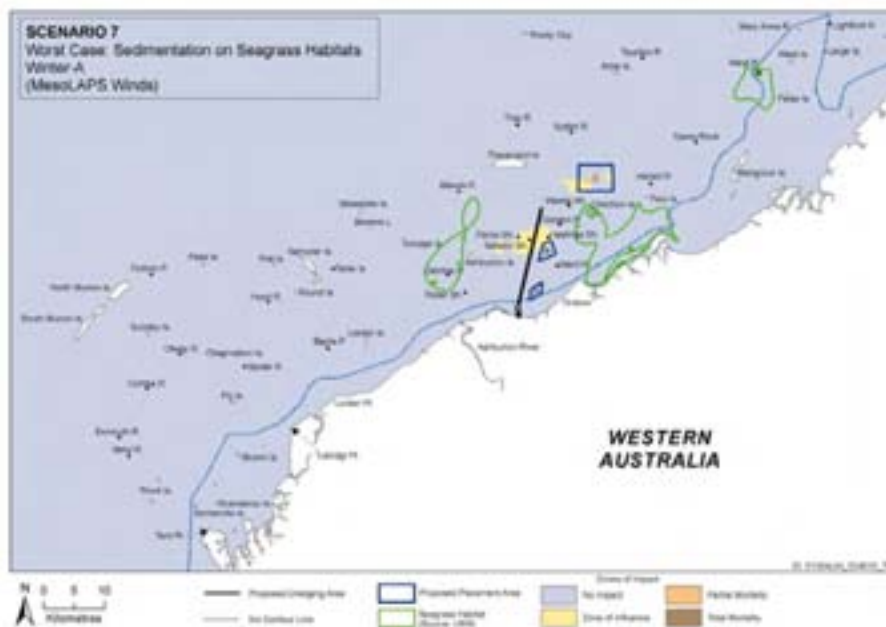


Figure A.324 Scenario 7, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-244



Table A.81 Summary of Impacts at Sensitive Receptors for Scenario 7, Winter-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.9	1.2	0.3	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	3.2	13.7	4.9	0.1	2.1	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	4.3	27.8	11.7	1.8	0.0	
7	Saladin Shoal	295913	7613337	7.3	43.7	21.1	7.4	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.3	4.0	1.3	0.0	0.0	
9	Hastings Shoal	298803	7613488	2.2	16.5	6.4	0.4	1.6	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.9	5.6	1.3	0.0	0.6	
14	Gorgon Patch	300859	7615993	0.5	0.7	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.5	3.6	1.6	0.3	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	2.1	5.2	2.1	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.8	5.2	1.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.7.10 Winter-B, Worst Case Spill Scenario**

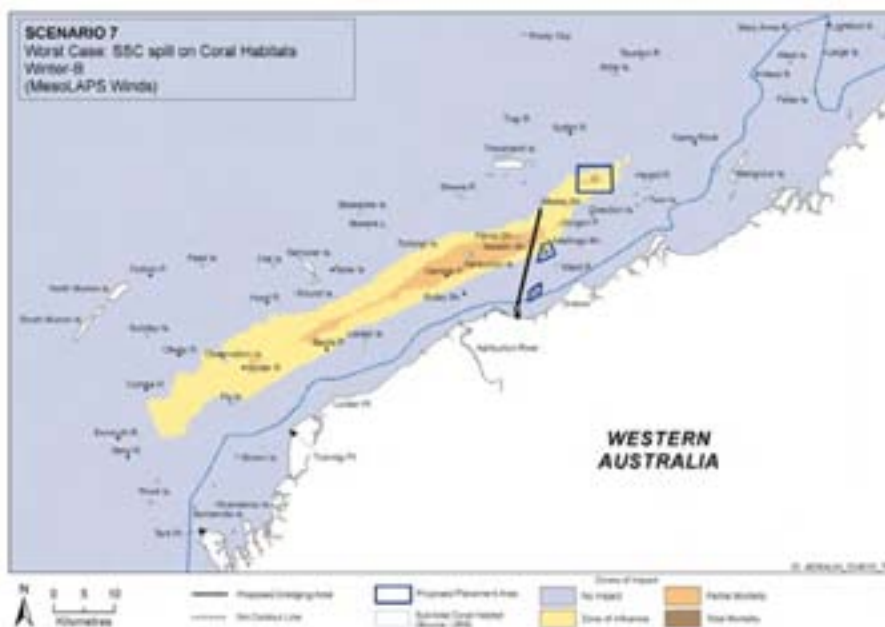


Figure A.325 Scenario 7, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

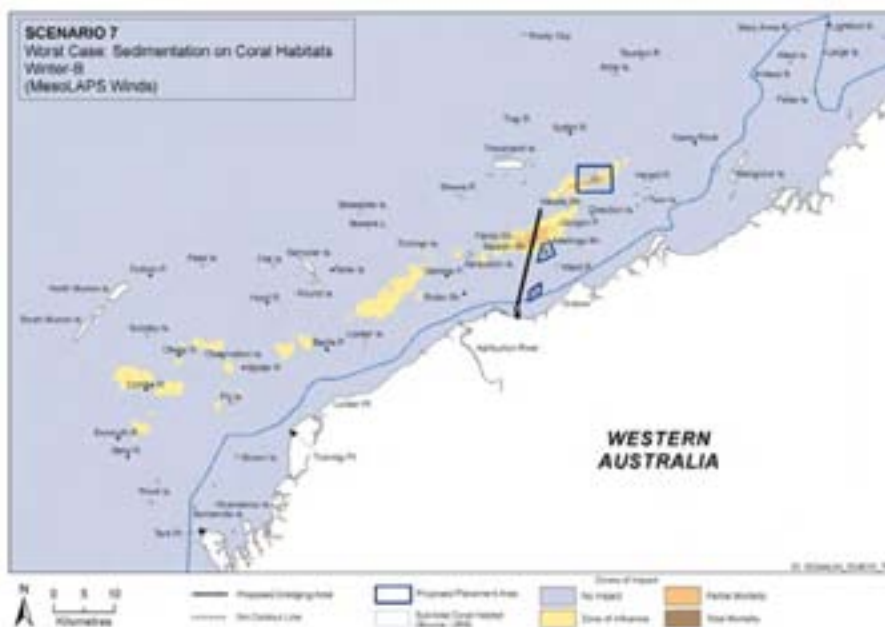


Figure A.326 Scenario 7, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-246

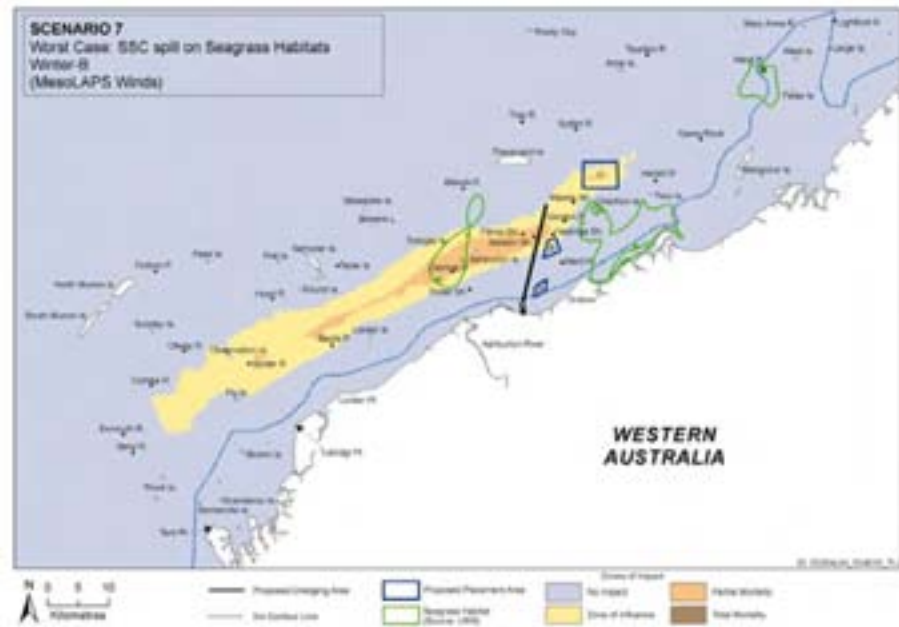


Figure A.327 Scenario 7, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

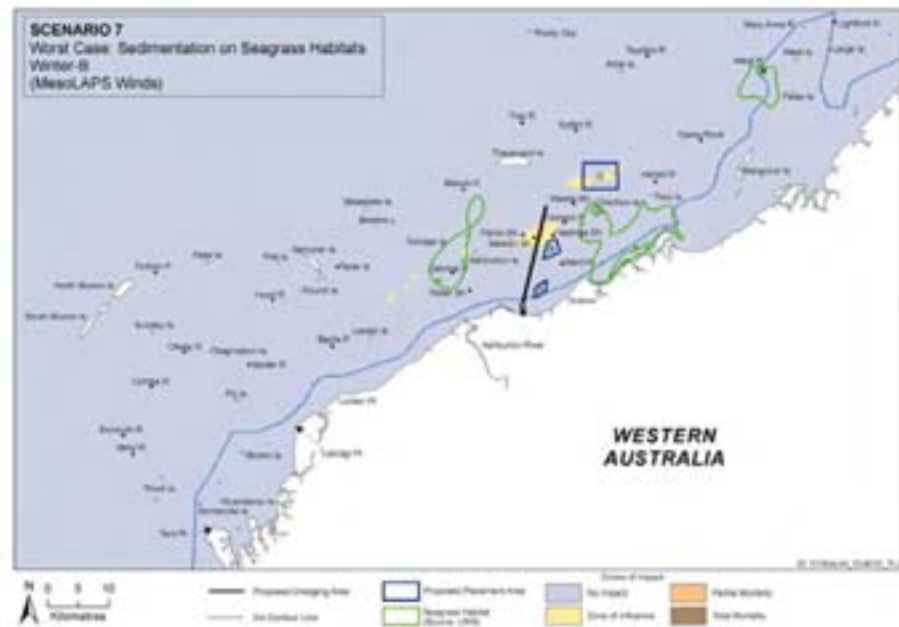


Figure A.328 Scenario 7, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds



Table A.82 Summary of Impacts at Sensitive Receptors for Scenario 7, Winter-B, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.2	5.2	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	3.6	32.7	8.9	0.0	1.9	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	4.3	29.1	9.4	2.2	0.5	
7	Saladin Shoal	295913	7613337	6.1	36.1	15.9	5.2	0.8	
8	End of Wheatstone Shipping Channel	298328	7617464	1.4	6.4	0.7	0.0	0.0	
9	Hastings Shoal	298803	7613488	3.0	18.9	7.3	1.2	1.9	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.9	9.7	1.6	0.1	0.2	
14	Gorgon Patch	300859	7615993	1.8	8.3	2.5	0.1	0.9	
15	Weeks Shoal	302245	7618926	1.6	5.2	0.4	0.0	0.2	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	3.4	29.6	6.7	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.4	18.1	1.6	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.7.11 Transitional-A, Worst Case Spill Scenario**

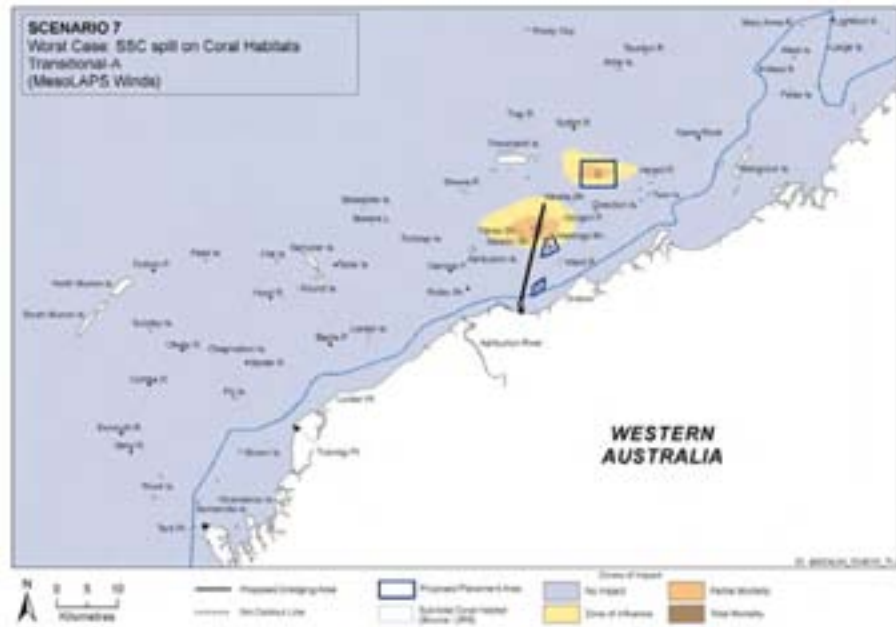


Figure A.329 Scenario 7, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

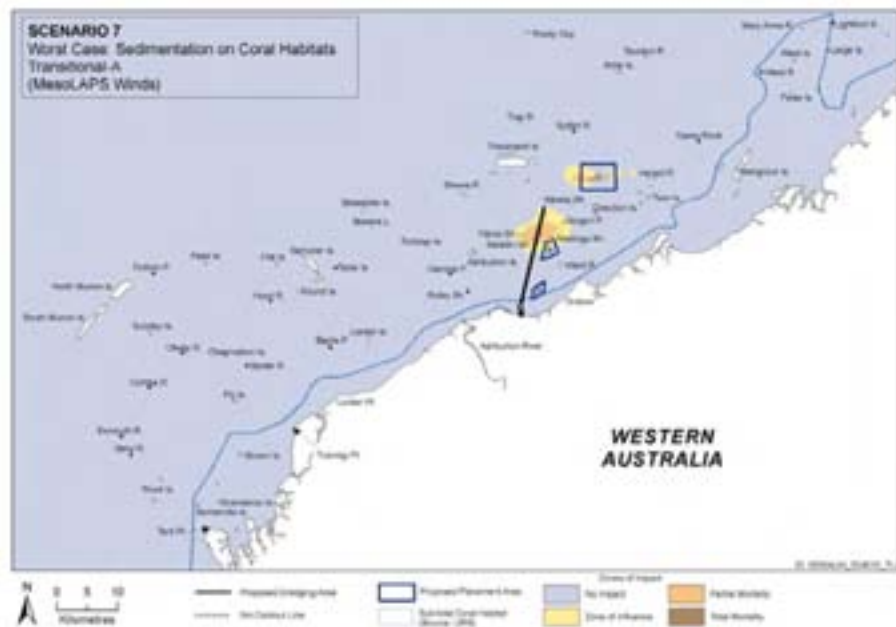


Figure A.330 Scenario 7, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

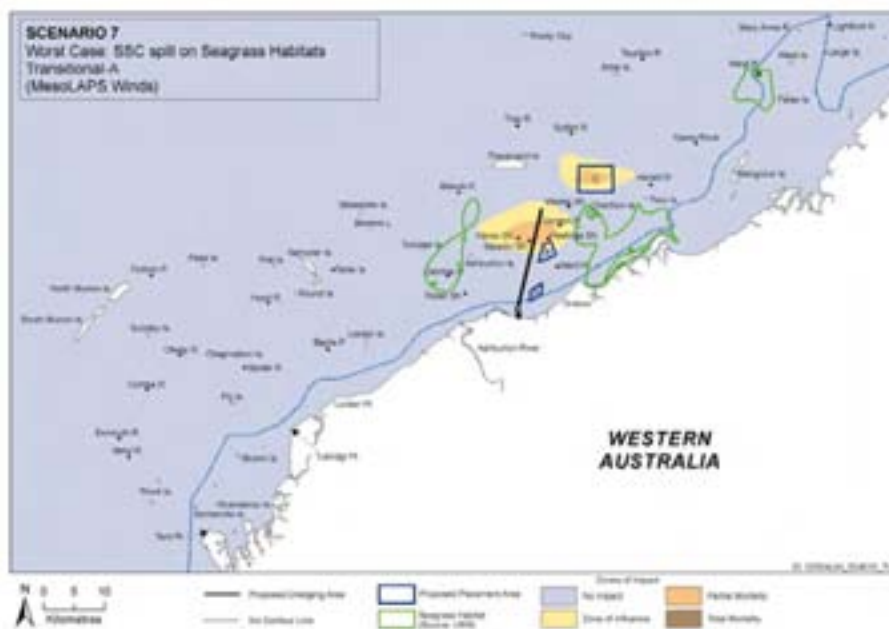


Figure A.331 Scenario 7, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



Figure A.332 Scenario 7, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds



A-250



Table A.83 Summary of Impacts at Sensitive Receptors for Scenario 7, Transitional-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	4.1	33.1	14.3	1.3	0.0	
7	Saladin Shoal	295913	7613337	6.5	46.5	18.9	3.7	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.9	14.7	0.7	0.0	0.3	
9	Hastings Shoal	298803	7613488	5.5	38.6	16.0	2.5	2.7	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	4.0	26.6	10.5	1.0	1.2	
14	Gorgon Patch	300859	7615993	2.6	15.5	4.8	0.0	1.0	
15	Weeks Shoal	302245	7618926	0.5	0.6	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.3	0.7	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.6	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.7.12 Transitional-B, Worst Case Spill Scenario**



Figure A.333 Scenario 7, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

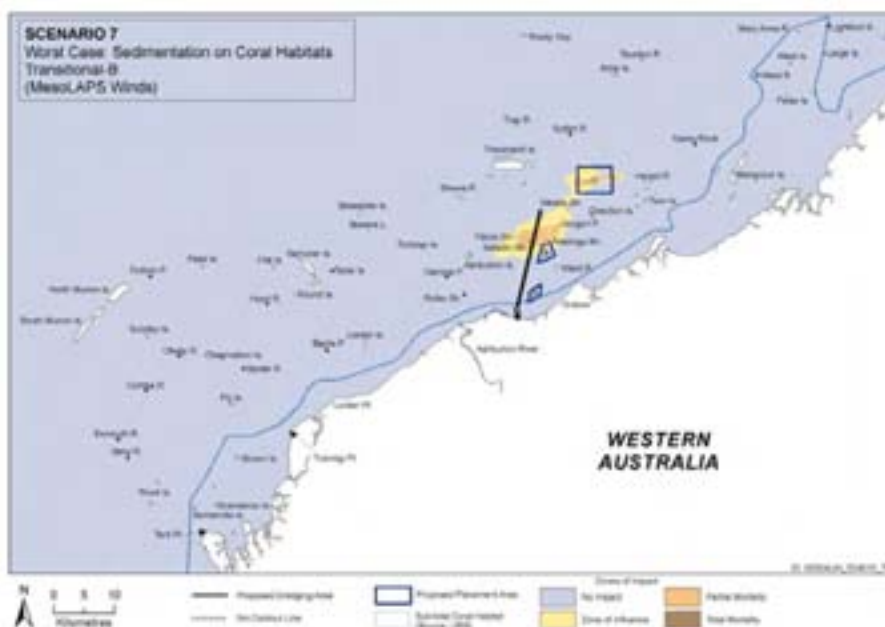


Figure A.334 Scenario 7, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-252

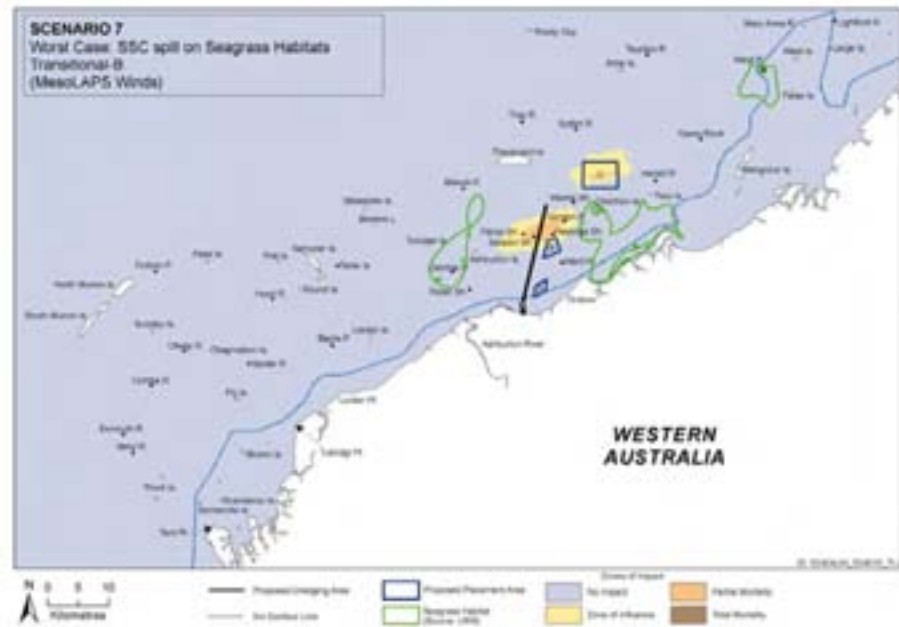


Figure A.335 Scenario 7, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

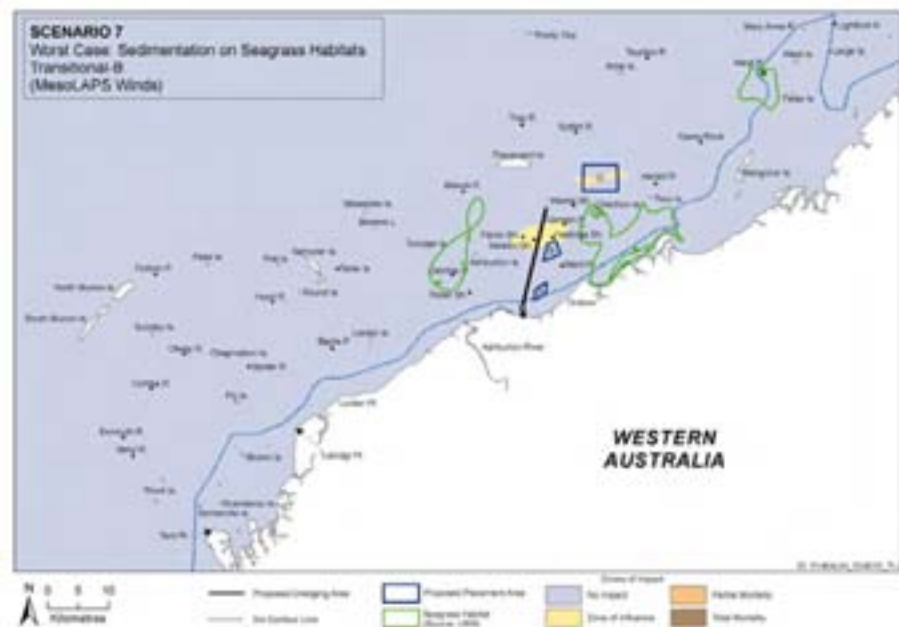


Figure A.336 Scenario 7, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-253



Table A.84 Summary of Impacts at Sensitive Receptors for Scenario 7, Transitional-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.4	0.6	0.0	0.0	0.2	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.4	15.5	5.6	0.7	0.0	
7	Saladin Shoal	295913	7613337	5.8	38.8	17.7	3.7	0.2	
8	End of Wheatstone Shipping Channel	298328	7617464	1.2	2.2	0.0	0.0	0.3	
9	Hastings Shoal	298803	7613488	3.9	25.1	9.8	2.5	1.9	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	4.0	29.1	11.3	1.2	2.2	
14	Gorgon Patch	300859	7615993	2.9	19.2	5.2	0.1	1.5	
15	Weeks Shoal	302245	7618926	1.3	1.9	0.0	0.0	0.2	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.3	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.4	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.1	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.8 Dredging Scenario 7A**

**A.8.1 Summer-A, Realistic Spill Scenario**

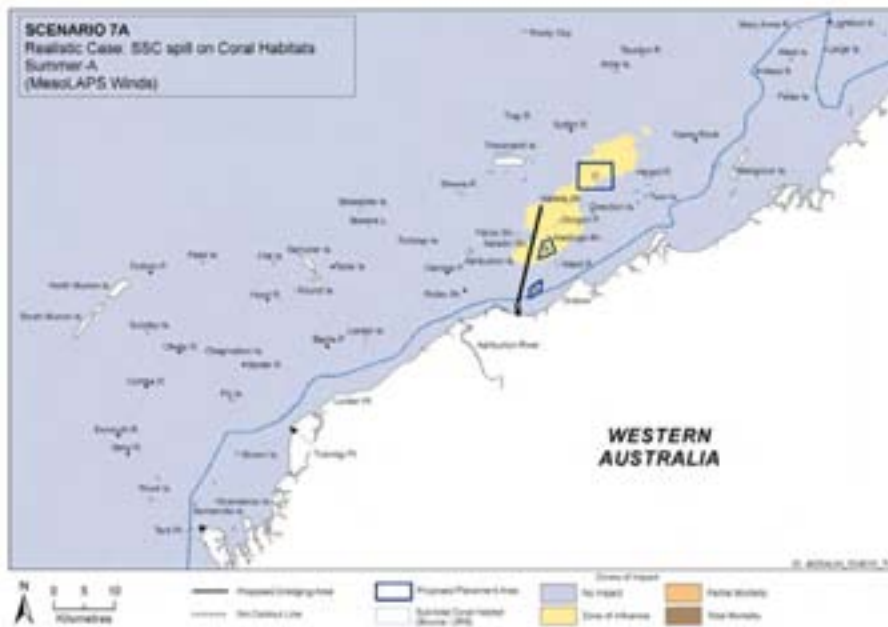


Figure A.337 Scenario 7A, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.338 Scenario 7A, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

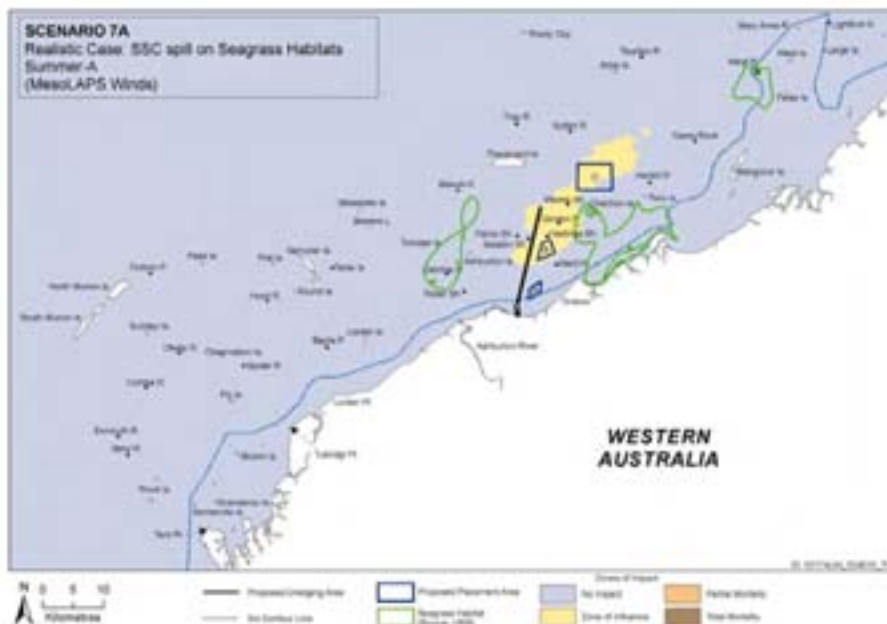


Figure A.339 Scenario 7A, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.340 Scenario 7A, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-256



Table A.85 Summary of Impacts at Sensitive Receptors for Scenario 7A, Summer-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	1.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.4	13.7	6.5	0.6	0.0	
9	Hastings Shoal	298803	7613488	2.3	12.9	0.6	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.9	5.2	1.9	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.9	8.0	0.3	0.0	0.0	
14	Gorgon Patch	300859	7615993	2.0	5.8	1.2	0.0	0.0	
15	Weeks Shoal	302245	7618926	2.6	15.5	2.8	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.6	5.6	0.0	0.0	0.5	
17	NW of Direction Island	304867	7618549	1.4	0.6	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.9	0.0	0.0	0.0	0.4	
19	NE Tw in Island	314029	7620738	0.4	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.6	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.6	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.4	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.4	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.8.2 Summer-B, Realistic Spill Scenario**



Figure A.341 Scenario 7A, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

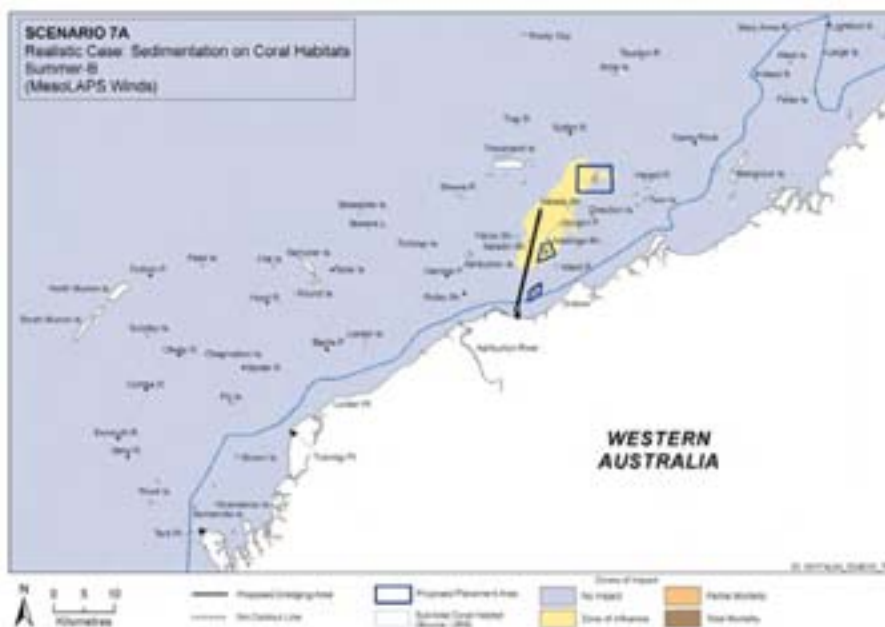


Figure A.342 Scenario 7A, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds



A-258

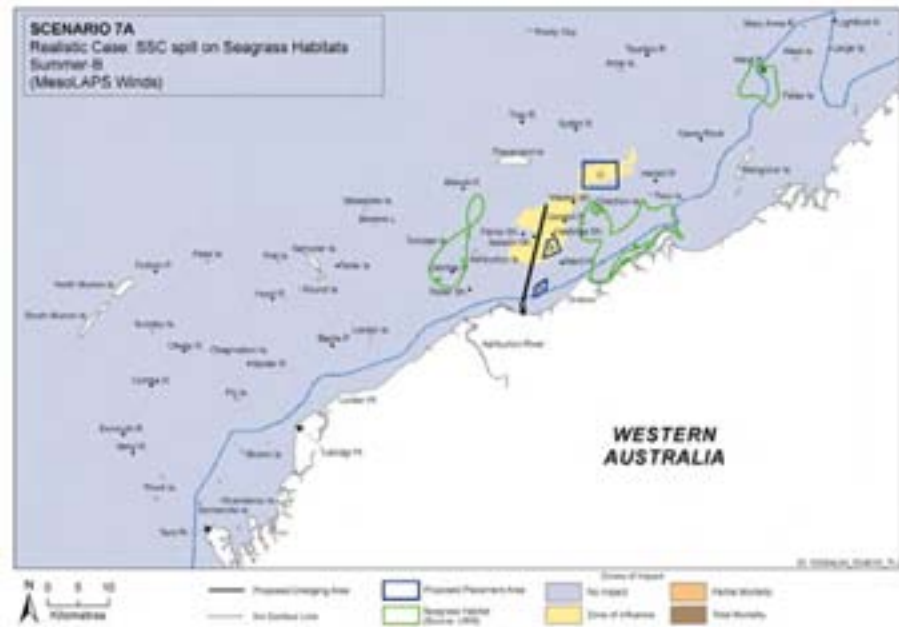


Figure A.343 Scenario 7A, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.344 Scenario 7A, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Table A.86 Summary of Impacts at Sensitive Receptors for Scenario 7A, Summer-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.5	0.6	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.1	1.9	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.9	15.2	5.1	0.9	0.9	
9	Hastings Shoal	298803	7613488	1.7	3.9	0.0	0.0	0.4	
10	North West Ward Reef	299018	7610106	0.7	3.0	0.7	0.0	0.2	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.6	5.9	0.1	0.0	0.5	
14	Gorgon Patch	300859	7615993	1.6	7.4	0.7	0.0	0.6	
15	Weeks Shoal	302245	7618926	1.3	3.4	0.3	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.7	1.5	0.0	0.0	0.2	
17	NW of Direction Island	304867	7618549	0.6	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.5	0.0	0.0	0.0	0.1	
19	NE Tw in Island	314029	7620738	0.2	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.4	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.6	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.1	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.2	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-260



**A.8.3 Winter-A, Realistic Spill Scenario**

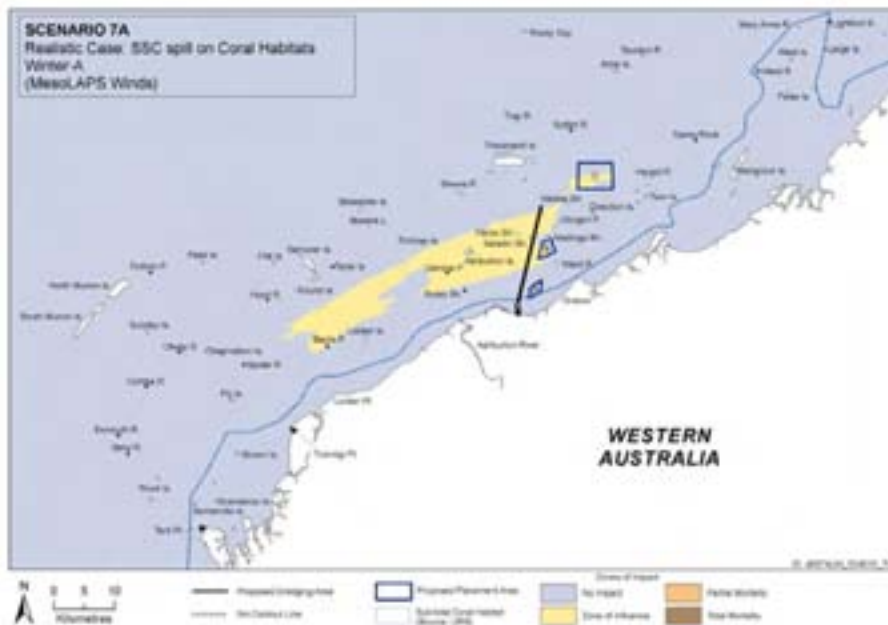


Figure A.345 Scenario 7A, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

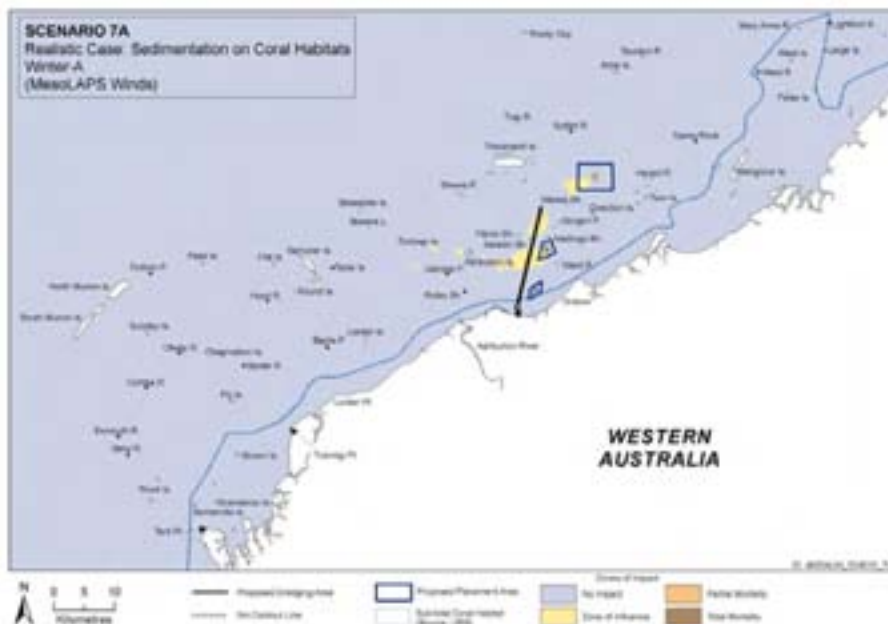


Figure A.346 Scenario 7A, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-261

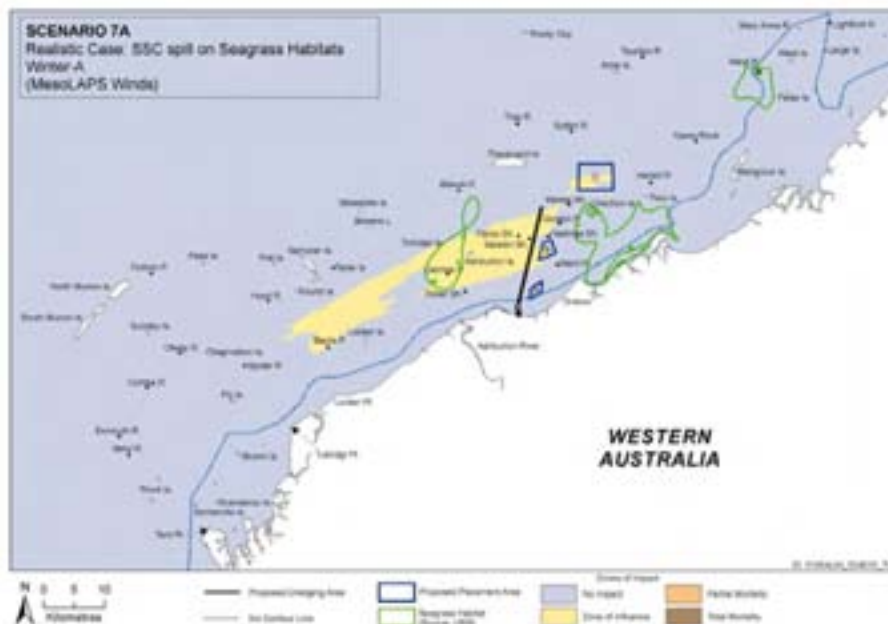


Figure A.347 Scenario 7A, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.348 Scenario 7A, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-262



Table A.87 Summary of Impacts at Sensitive Receptors for Scenario 7A, Winter-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.9	0.7	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.2	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.3	4.3	0.7	0.0	0.8	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.9	16.5	3.9	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.4	5.5	0.1	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.2	7.0	1.6	0.0	0.1	
9	Hastings Shoal	298803	7613488	0.4	0.1	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.2	0.3	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.4	2.1	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.3	0.7	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.7	1.3	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.2	3.6	0.9	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.7	3.6	0.3	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.8.4 Winter-B, Realistic Spill Scenario**

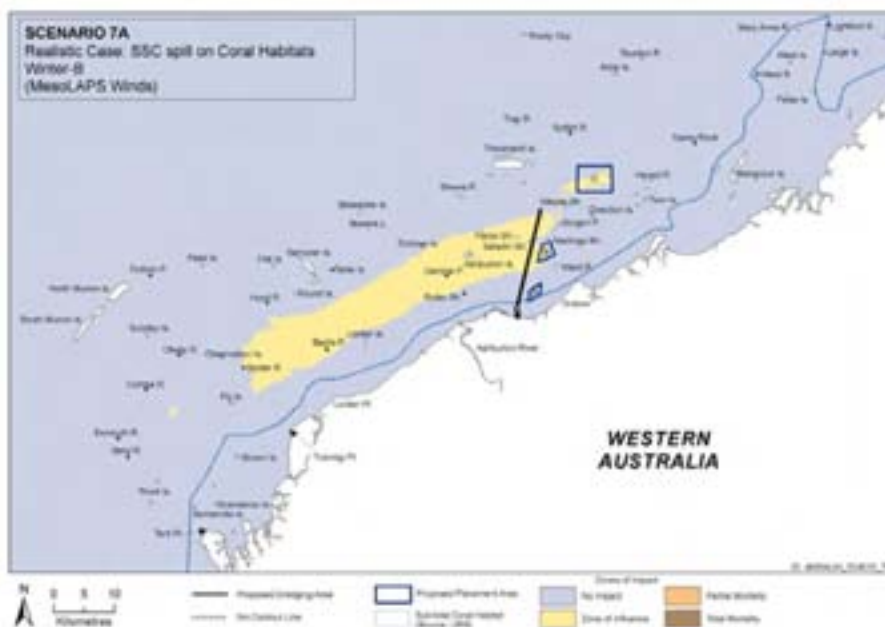


Figure A.349 Scenario 7A, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

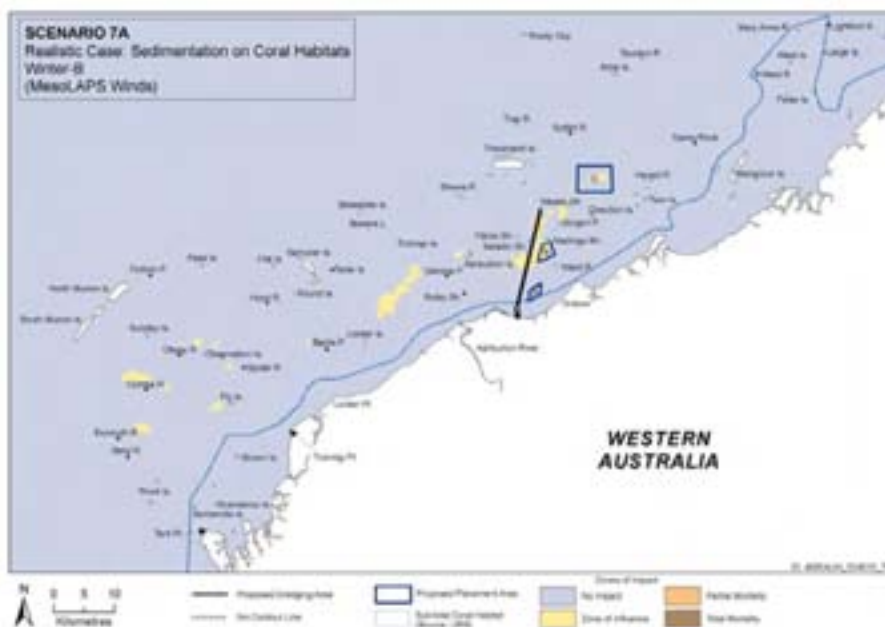


Figure A.350 Scenario 7A, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-264

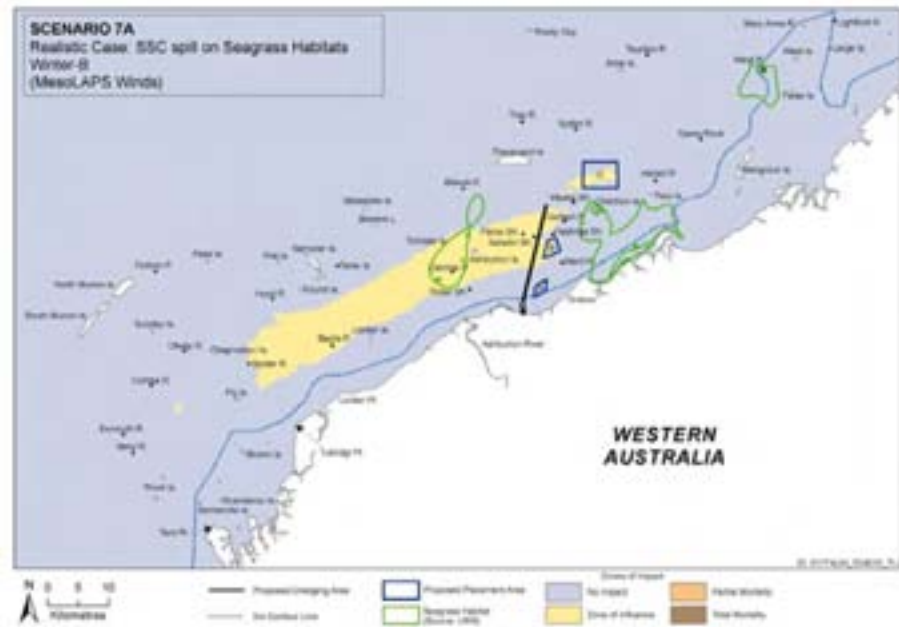


Figure A.351 Scenario 7A, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.352 Scenario 7A, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-265



Table A.88 Summary of Impacts at Sensitive Receptors for Scenario 7A, Winter-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.0	1.6	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.6	5.8	0.0	0.0	1.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.2	14.6	1.5	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.2	3.9	0.0	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	1.6	6.2	2.1	0.0	0.6	
9	Hastings Shoal	298803	7613488	0.6	0.1	0.0	0.0	0.3	
10	North West Ward Reef	299018	7610106	0.2	0.1	0.0	0.0	0.1	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.9	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.5	1.8	0.0	0.0	0.2	
15	Weeks Shoal	302245	7618926	0.8	1.5	0.0	0.0	0.2	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	2.0	11.7	0.3	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.8	8.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



A-266



**A.8.5 Transitional-A, Realistic Spill Scenario**

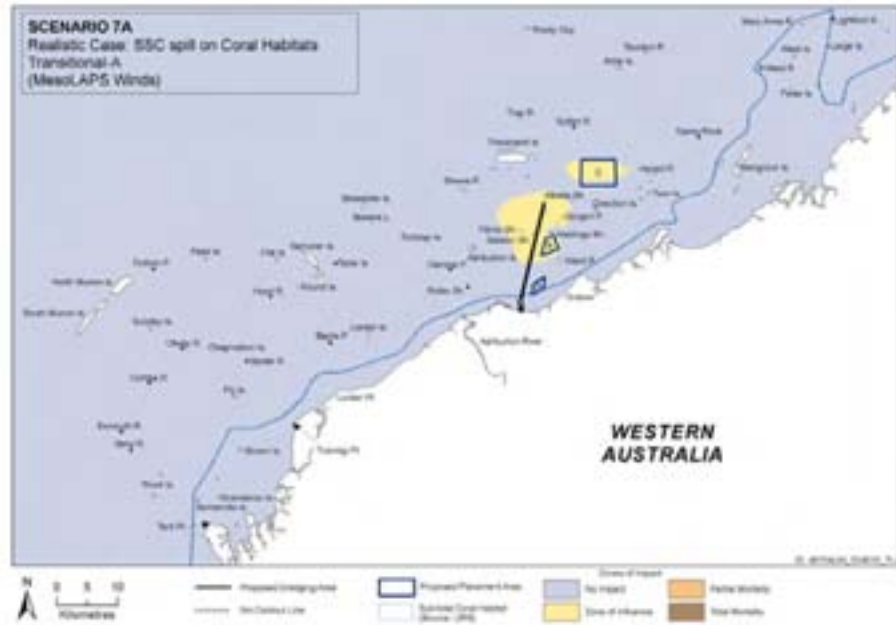


Figure A.353 Scenario 7A, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

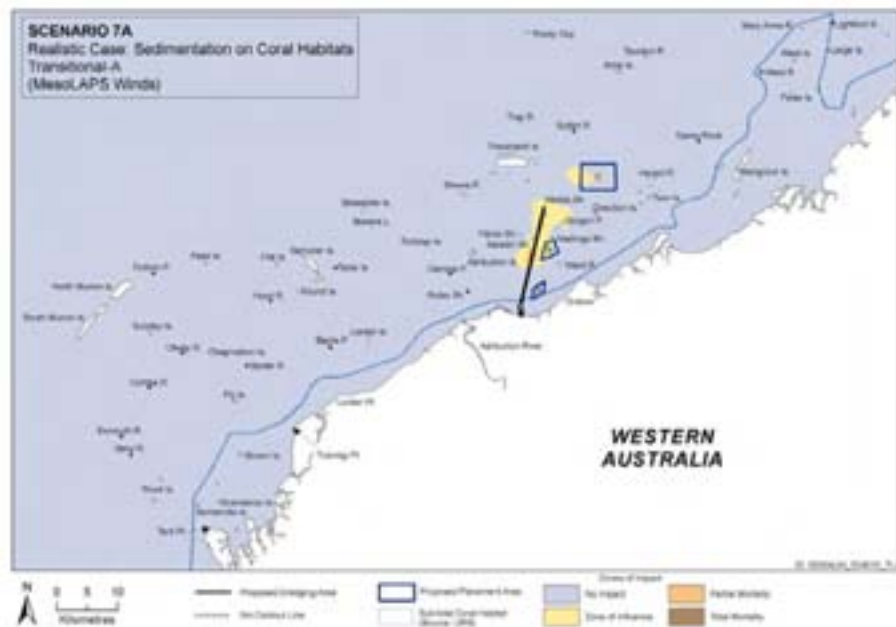


Figure A.354 Scenario 7A, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-267

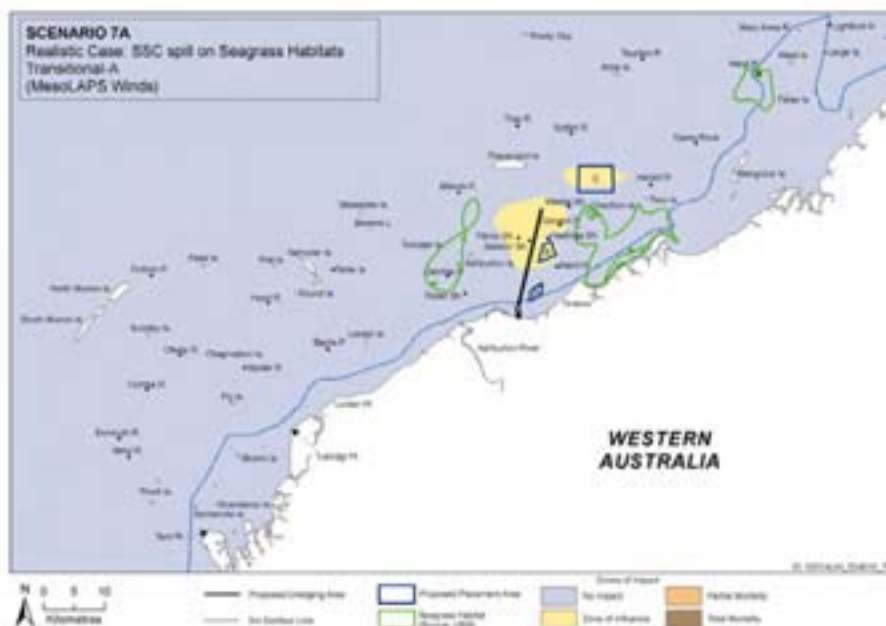


Figure A.355 Scenario 7A, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.356 Scenario 7A, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-268



Table A.89 Summary of Impacts at Sensitive Receptors for Scenario 7A, Transitional-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.3	6.7	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.6	6.1	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	3.1	18.3	4.8	0.3	1.1	
9	Hastings Shoal	298803	7613488	1.4	1.3	0.0	0.0	0.4	
10	North West Ward Reef	299018	7610106	0.7	2.7	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.1	4.3	1.0	0.0	0.2	
14	Gorgon Patch	300859	7615993	1.2	5.9	1.8	0.0	0.2	
15	Weeks Shoal	302245	7618926	0.5	0.9	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.8.6 Transitional-B, Realistic Spill Scenario**



Figure A.357 Scenario 7A, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

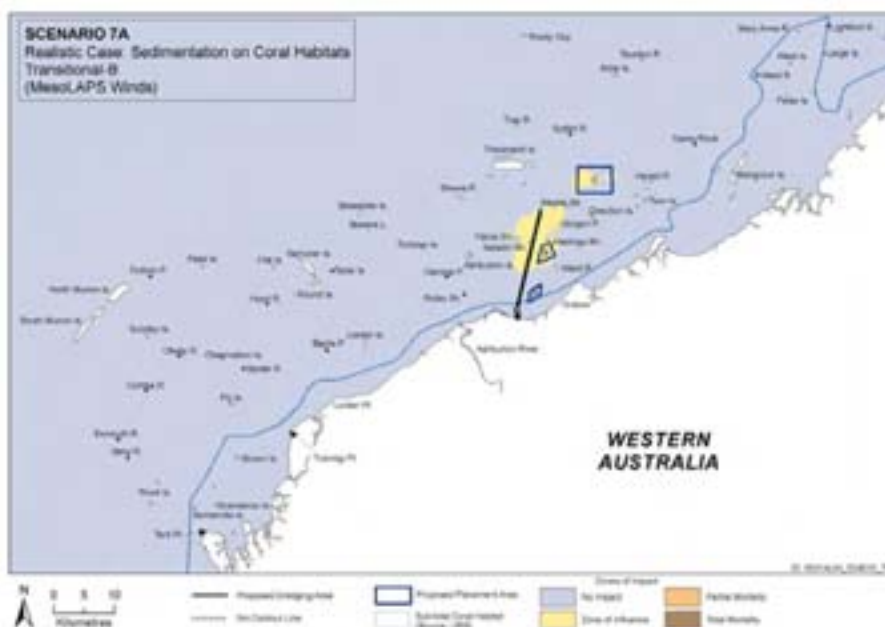


Figure A.358 Scenario 7A, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-270

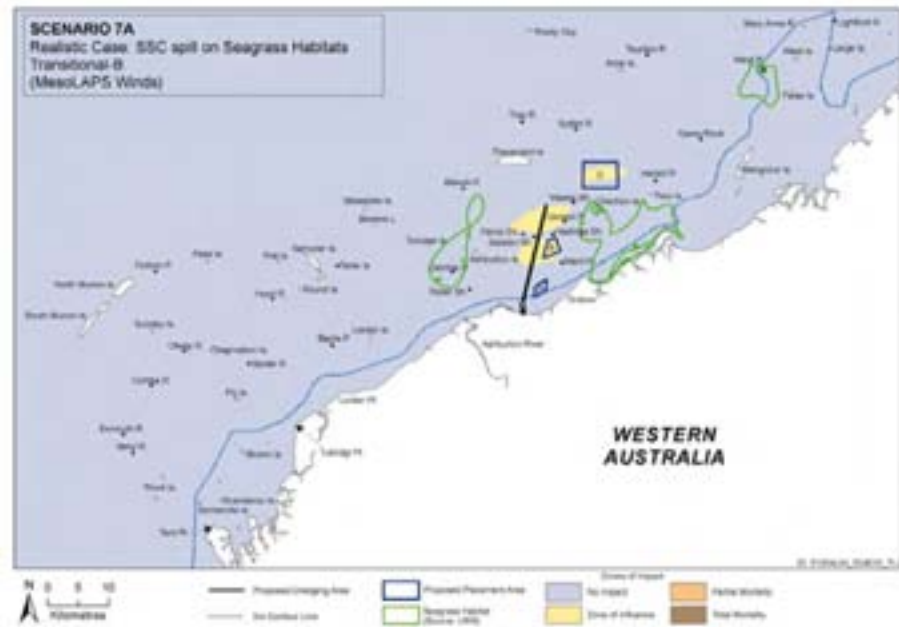


Figure A.359 Scenario 7A, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.360 Scenario 7A, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-271



Table A.90 Summary of Impacts at Sensitive Receptors for Scenario 7A, Transitional-B, Realistic Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.8	2.1	0.3	0.0	0.2	
7	Saladin Shoal	295913	7613337	0.8	0.9	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.0	10.7	3.3	0.3	0.8	
9	Hastings Shoal	298803	7613488	0.8	0.3	0.0	0.0	0.3	
10	North West Ward Reef	299018	7610106	1.1	6.1	1.3	0.0	0.5	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.8	3.0	0.4	0.0	0.3	
14	Gorgon Patch	300859	7615993	0.8	4.3	0.3	0.0	0.4	
15	Weeks Shoal	302245	7618926	0.7	0.9	0.0	0.0	0.2	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.3	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-272



**A.8.7 Summer-A, Worst Case Spill Scenario**

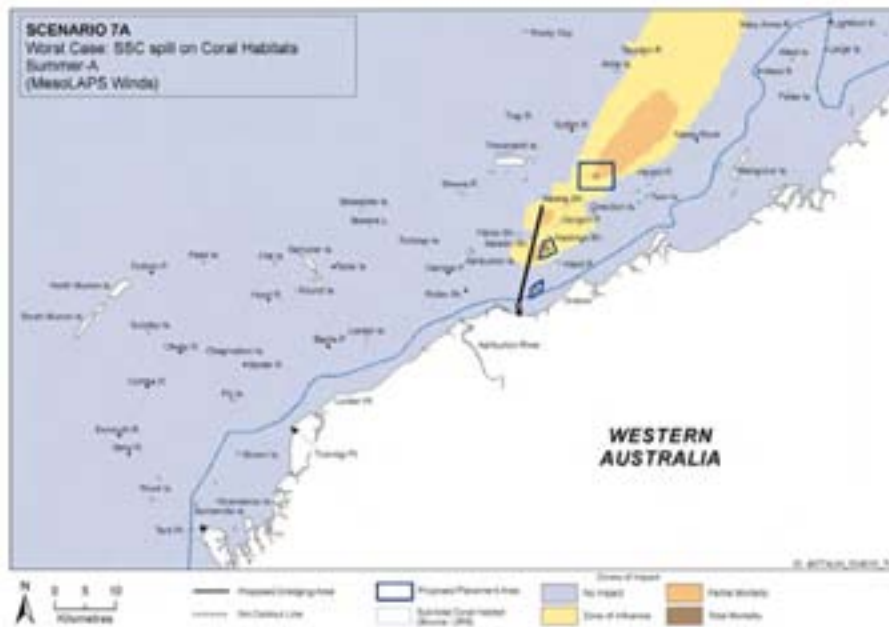


Figure A.361 Scenario 7A, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

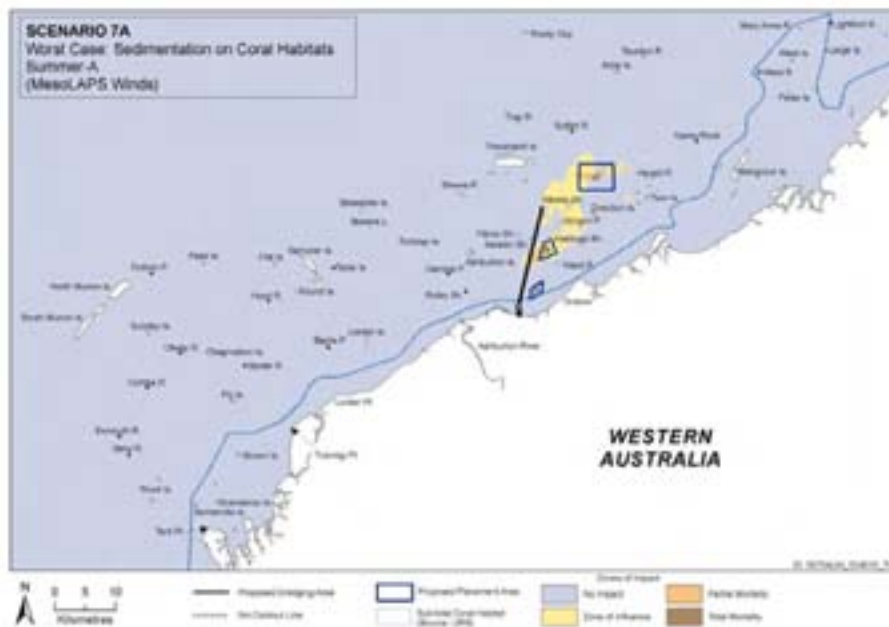


Figure A.362 Scenario 7A, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-273

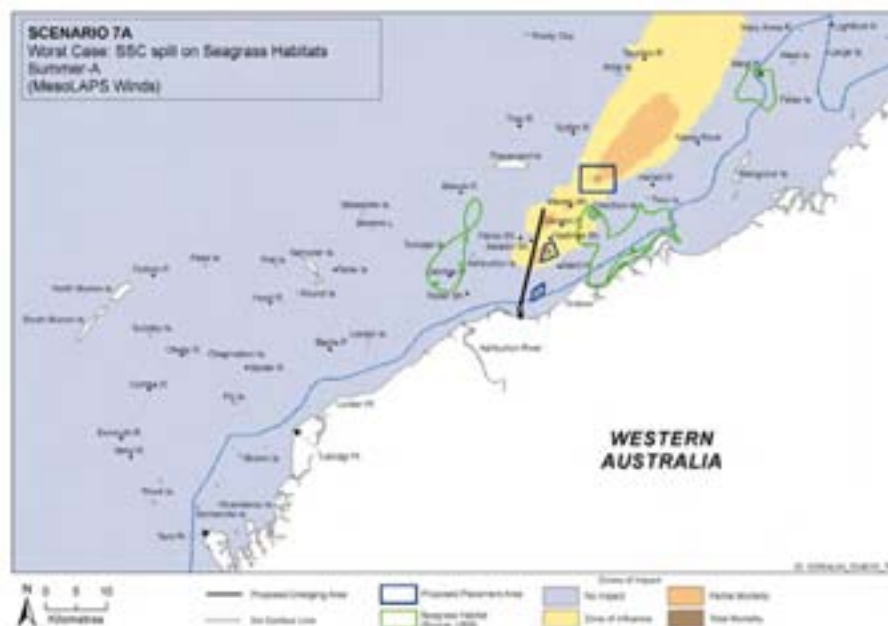


Figure A.363 Scenario 7A, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds

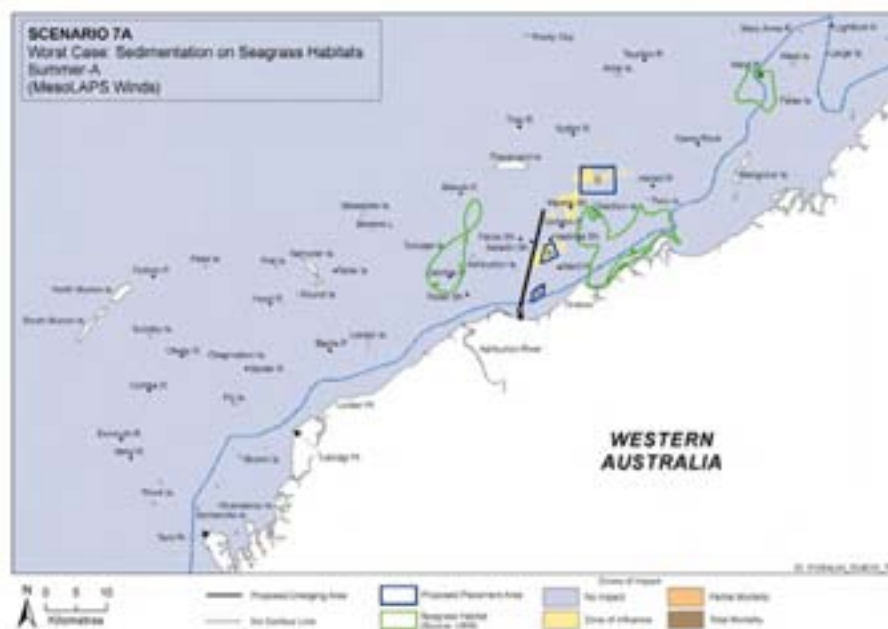


Figure A.364 Scenario 7A, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesoLAPS winds



A-274



Table A.91 Summary of Impacts at Sensitive Receptors for Scenario 7A, Summer-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.7	2.1	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	3.8	17.4	9.7	3.7	0.0	
9	Hastings Shoal	298803	7613488	3.0	22.0	4.3	0.0	0.0	
10	North West Ward Reef	299018	7610106	1.4	7.9	4.0	1.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	2.4	14.3	1.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	2.6	14.1	1.9	0.3	0.0	
15	Weeks Shoal	302245	7618926	3.7	25.0	8.0	0.4	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	2.2	11.1	0.4	0.0	0.6	
17	NW of Direction Island	304867	7618549	1.9	3.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	1.3	0.6	0.0	0.0	0.6	
19	NE Tw in Island	314029	7620738	0.6	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.9	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.2	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.9	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.8	13.4	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.6	0.1	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.6	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.8.8 Summer-B, Worst Case Spill Scenario**

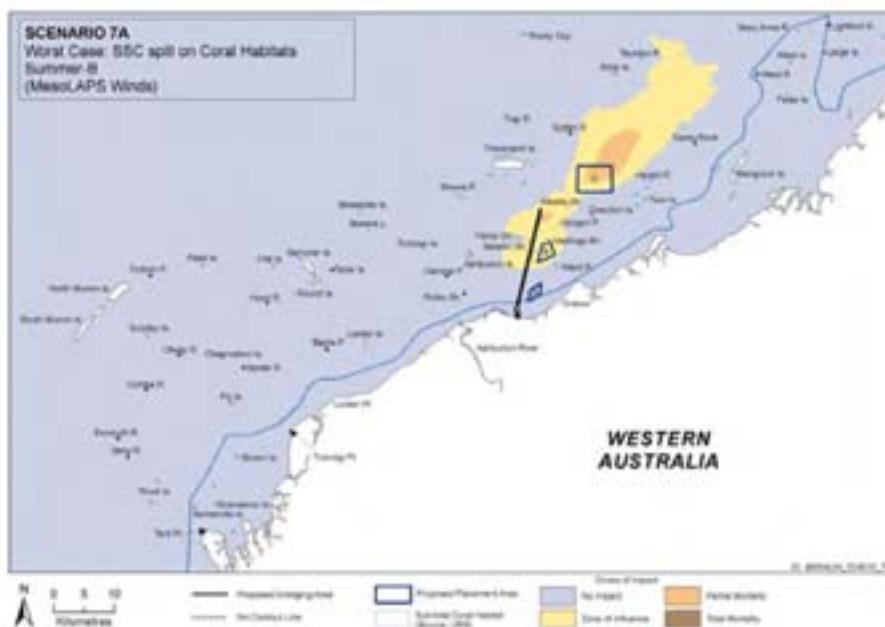


Figure A.365 Scenario 7A, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on MesoLAPS winds

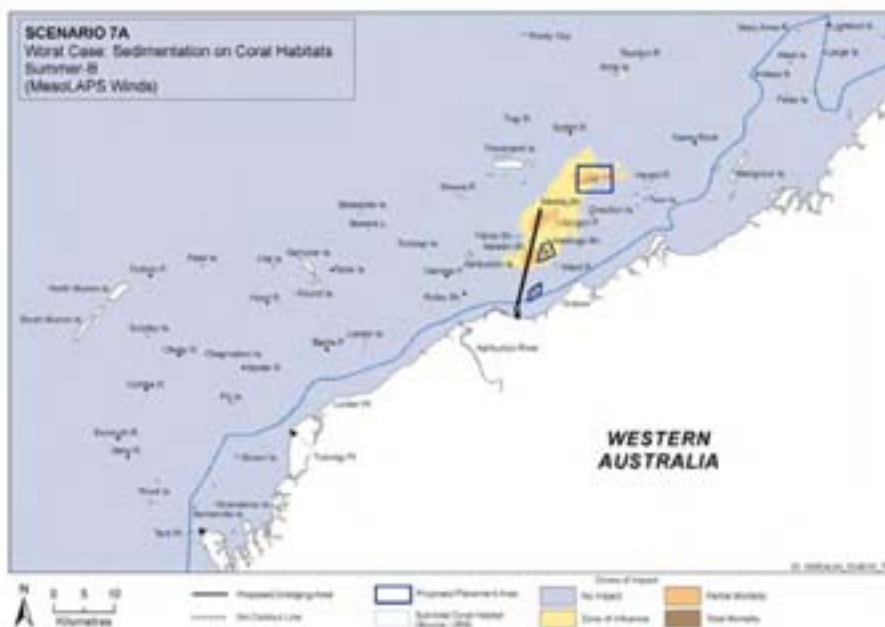


Figure A.366 Scenario 7A, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on MesoLAPS winds

A-276

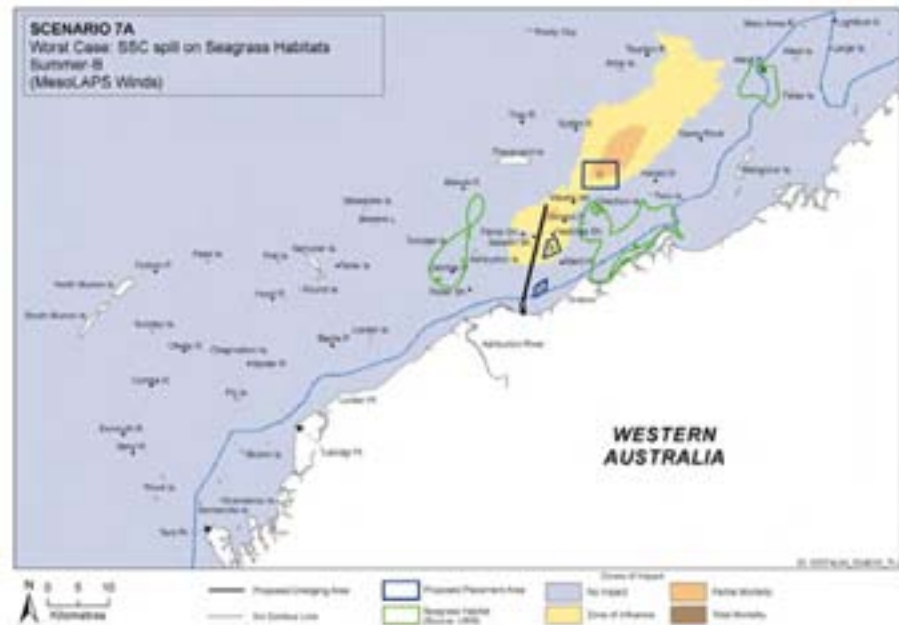


Figure A.367 Scenario 7A, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesolAPS winds

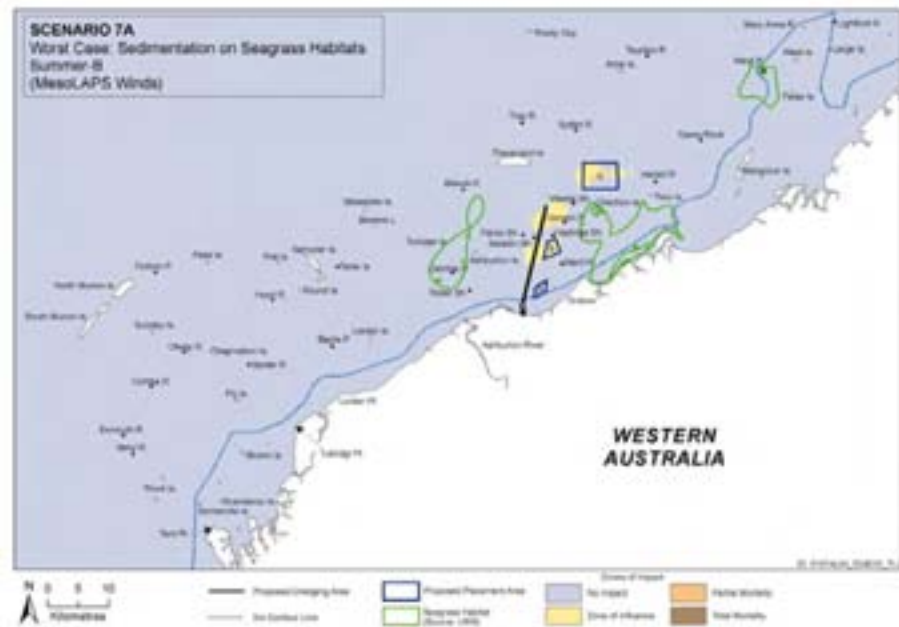


Figure A.368 Scenario 7A, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on MesolAPS winds

A-277



Table A.92 Summary of Impacts at Sensitive Receptors for Scenario 7A, Summer-B, Worst Case Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.6	1.8	0.3	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.4	4.6	0.1	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	4.4	29.0	8.5	2.2	1.4	
9	Hastings Shoal	298803	7613488	2.3	11.6	0.4	0.0	0.5	
10	North West Ward Reef	299018	7610106	1.0	5.8	1.9	0.1	0.4	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	2.2	10.5	1.8	0.0	0.6	
14	Gorgon Patch	300859	7615993	2.2	11.4	3.4	0.0	1.1	
15	Weeks Shoal	302245	7618926	1.9	7.3	0.9	0.1	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.0	2.2	0.0	0.0	0.3	
17	NW of Direction Island	304867	7618549	0.9	0.6	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.7	1.0	0.0	0.0	0.2	
19	NE Tw in Island	314029	7620738	0.3	0.4	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.5	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.8	0.3	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.7	0.0	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	2.0	1.2	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.4	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.3	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-278



**A.8.9 Winter-A, Worst Case Spill Scenario**

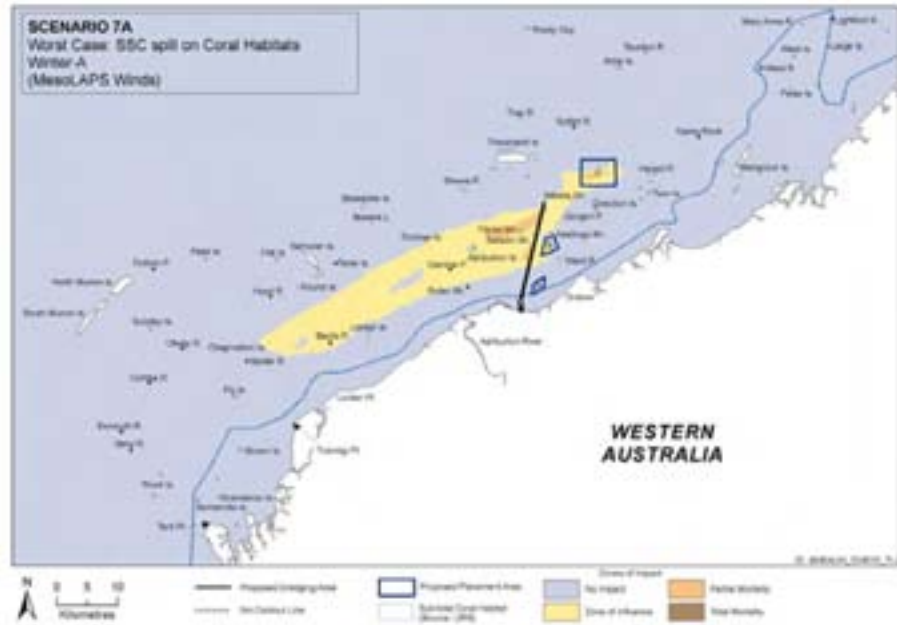


Figure A.369 Scenario 7A, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

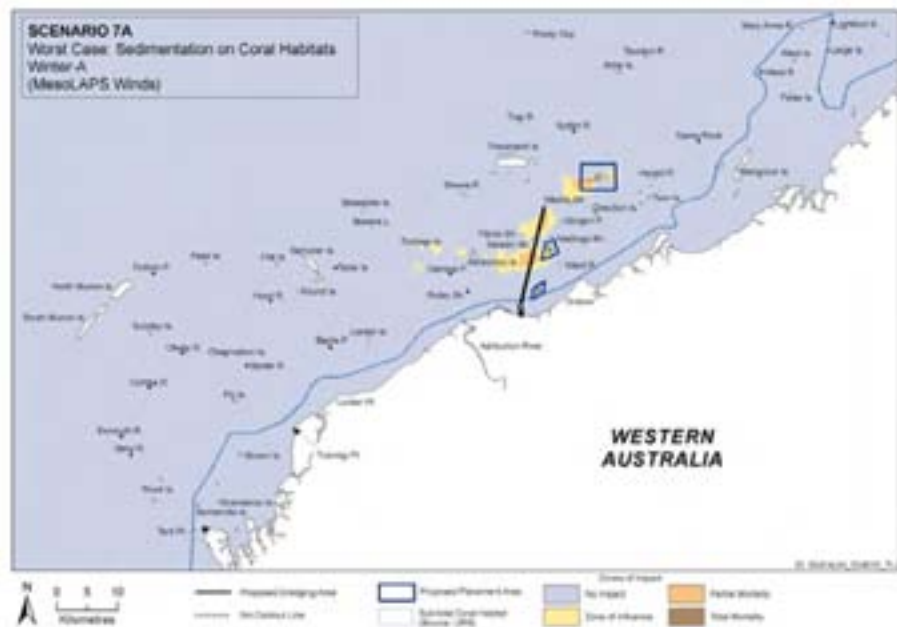


Figure A.370 Scenario 7A, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-279

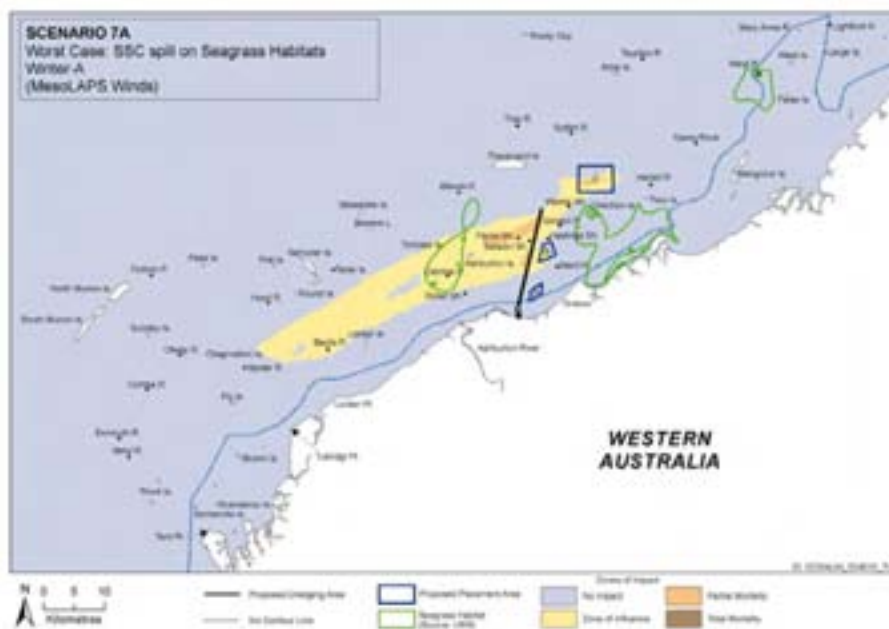


Figure A.371 Scenario 7A, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

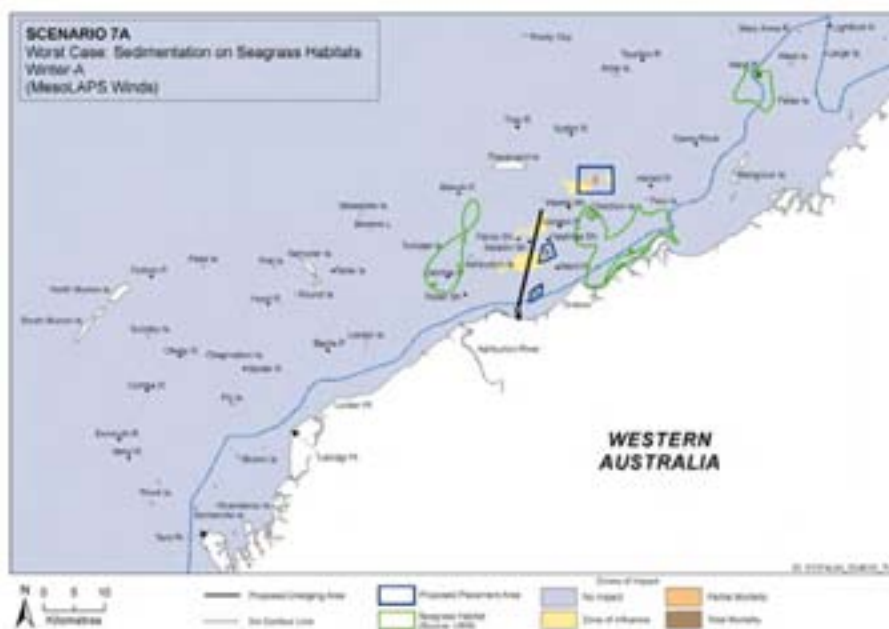


Figure A.372 Scenario 7A, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-280



Table A.93 Summary of Impacts at Sensitive Receptors for Scenario 7A, Winter-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.4	2.8	0.6	0.0	0.1	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.8	4.5	1.0	0.0	1.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	4.5	32.5	9.1	0.7	0.0	
7	Saladin Shoal	295913	7613337	1.9	9.1	0.3	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.3	10.7	4.5	0.1	1.0	
9	Hastings Shoal	298803	7613488	0.6	1.3	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.3	1.2	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.7	3.4	0.4	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.5	1.5	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.6	3.6	1.6	0.3	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.6	4.3	1.9	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.8	10.8	2.8	0.1	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.8.10 Winter-B, Worst Case Spill Scenario**

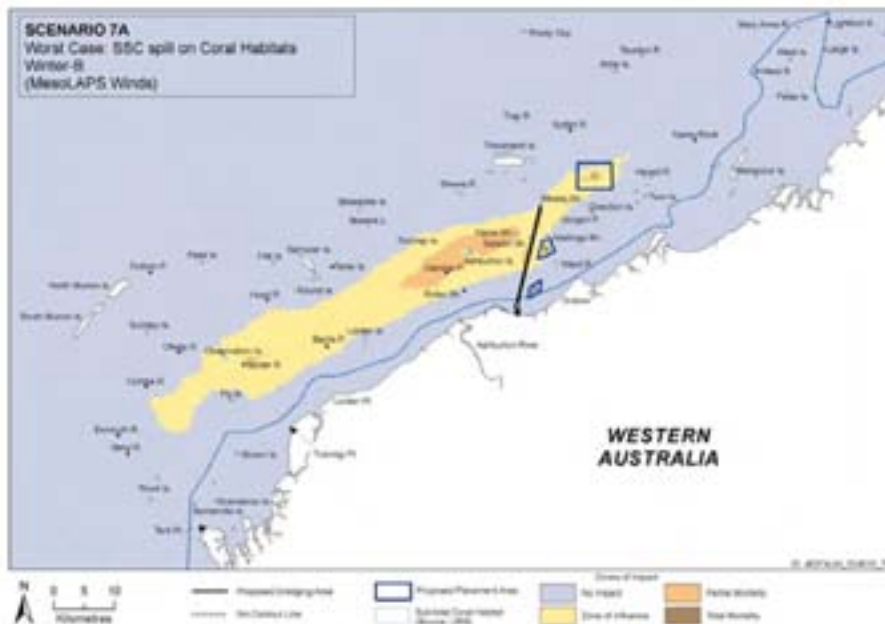


Figure A.373 Scenario 7A, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on MesoLAPS winds

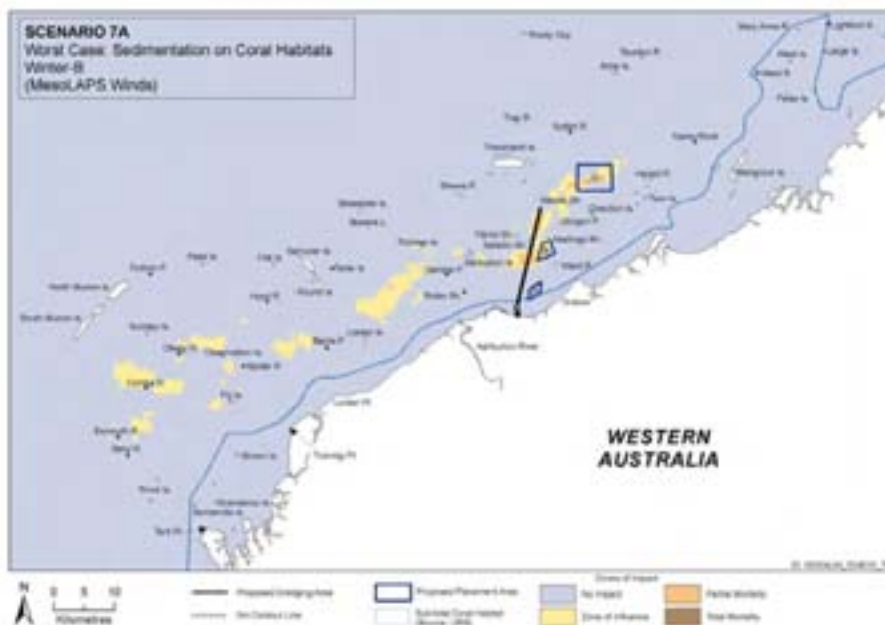


Figure A.374 Scenario 7A, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on MesoLAPS winds



A-282

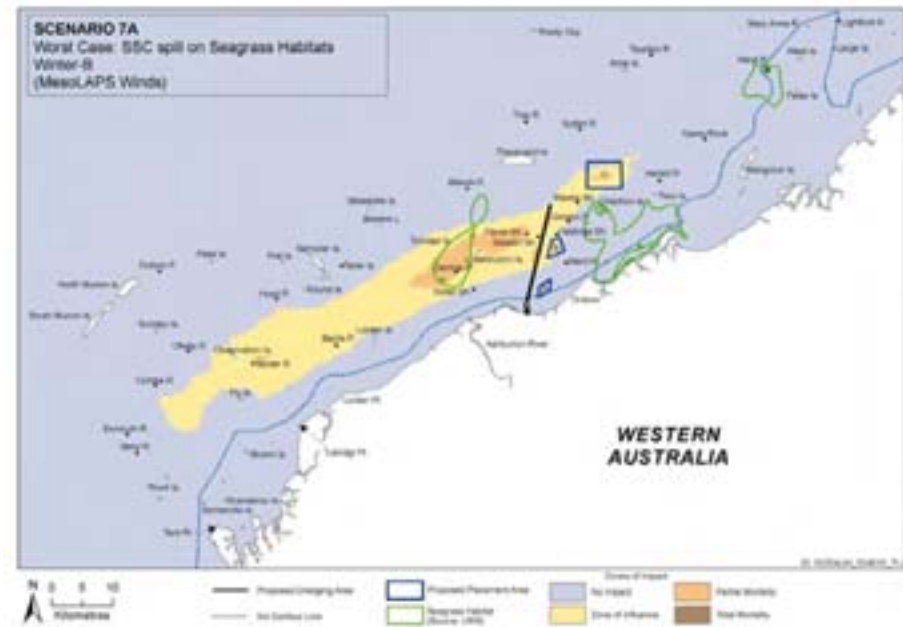


Figure A.375 Scenario 7A, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

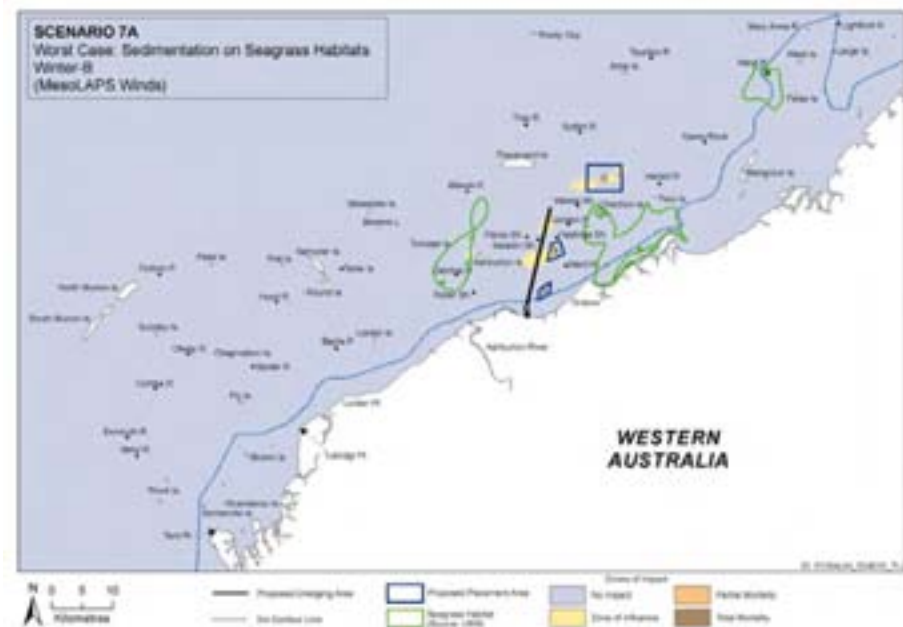


Figure A.376 Scenario 7A, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on MesoLAPS winds

A-283



Table A.94 Summary of Impacts at Sensitive Receptors for Scenario 7A, Winter-B, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.6	10.1	0.7	0.0	0.0	
2	Roller Shoal	285367	7604532	0.4	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	2.6	21.0	1.2	0.0	1.5	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	3.4	28.4	5.2	0.3	0.0	
7	Saladin Shoal	295913	7613337	1.8	9.2	0.4	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	2.8	15.3	5.1	0.3	0.0	
9	Hastings Shoal	298803	7613488	0.9	1.2	0.0	0.0	0.4	
10	North West Ward Reef	299018	7610106	0.3	0.4	0.0	0.0	0.1	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.9	2.7	0.0	0.0	0.2	
14	Gorgon Patch	300859	7615993	1.1	4.9	0.3	0.0	0.2	
15	Weeks Shoal	302245	7618926	1.8	8.0	1.2	0.0	0.4	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	2.8	26.2	1.5	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.9	23.9	2.7	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.8.11 Transitional-A, Worst Case Spill Scenario**

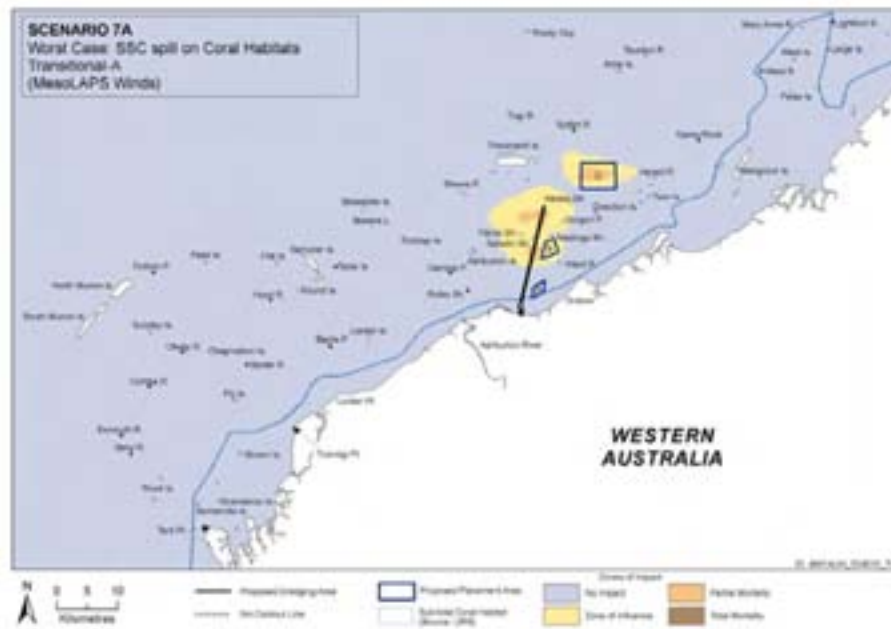


Figure A.377 Scenario 7A, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

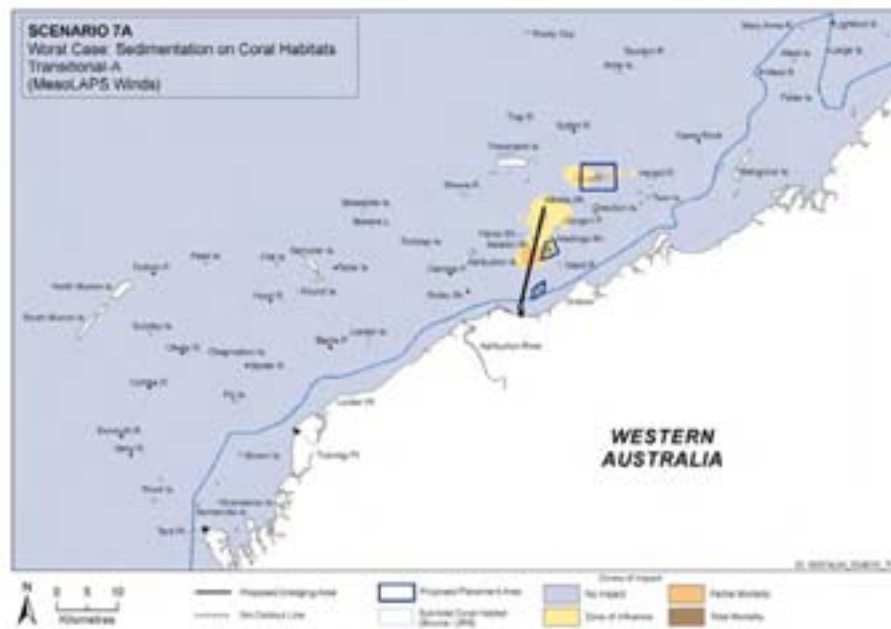


Figure A.378 Scenario 7A, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

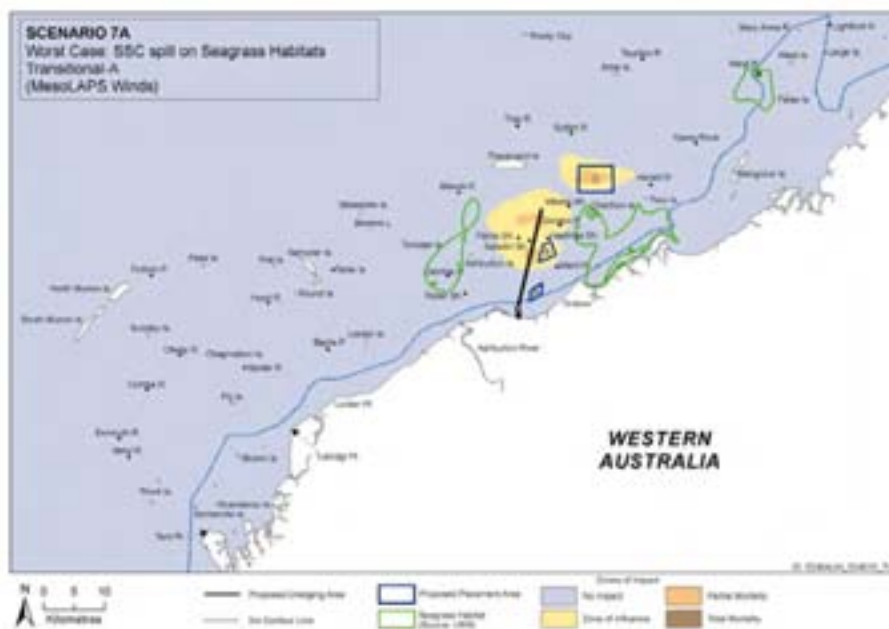


Figure A.379 Scenario 7A, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

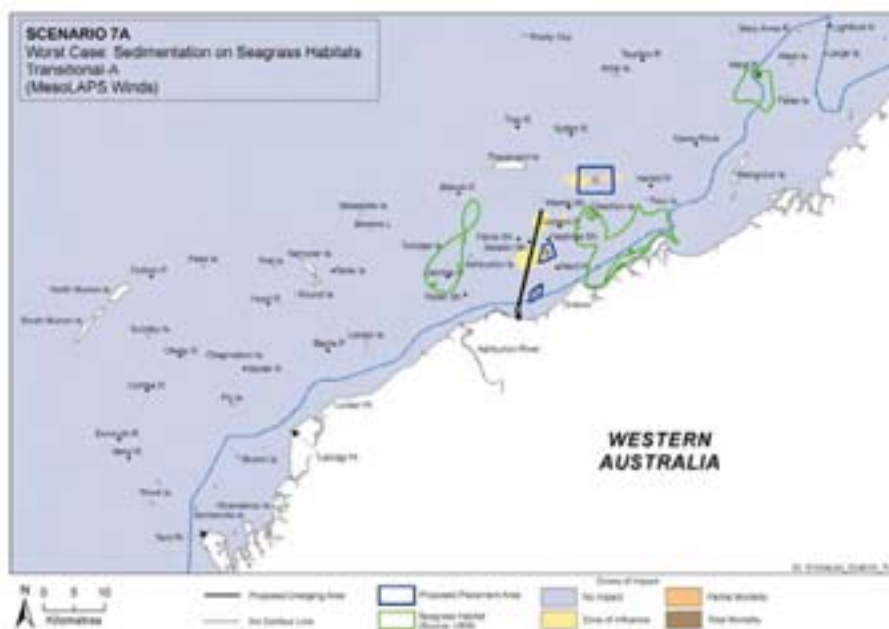


Figure A.380 Scenario 7A, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-286



Table A.95 Summary of Impacts at Sensitive Receptors for Scenario 7A, Transitional-A, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.2	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.3	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.6	11.0	0.7	0.0	0.0	
7	Saladin Shoal	295913	7613337	2.0	11.6	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	4.5	29.0	10.8	0.7	1.5	
9	Hastings Shoal	298803	7613488	1.7	2.5	0.0	0.0	0.5	
10	North West Ward Reef	299018	7610106	1.0	7.6	0.9	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.6	7.1	2.2	0.6	0.2	
14	Gorgon Patch	300859	7615993	1.7	9.7	4.0	0.6	0.5	
15	Weeks Shoal	302245	7618926	0.8	4.6	0.3	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.6	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.8.12 Transitional-B, Worst Case Spill Scenario**

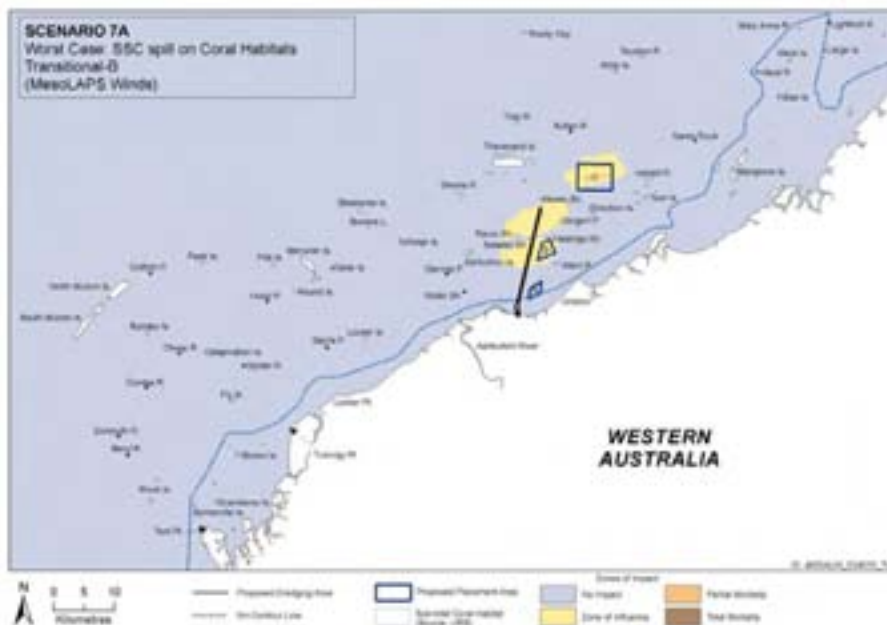


Figure A.381 Scenario 7A, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

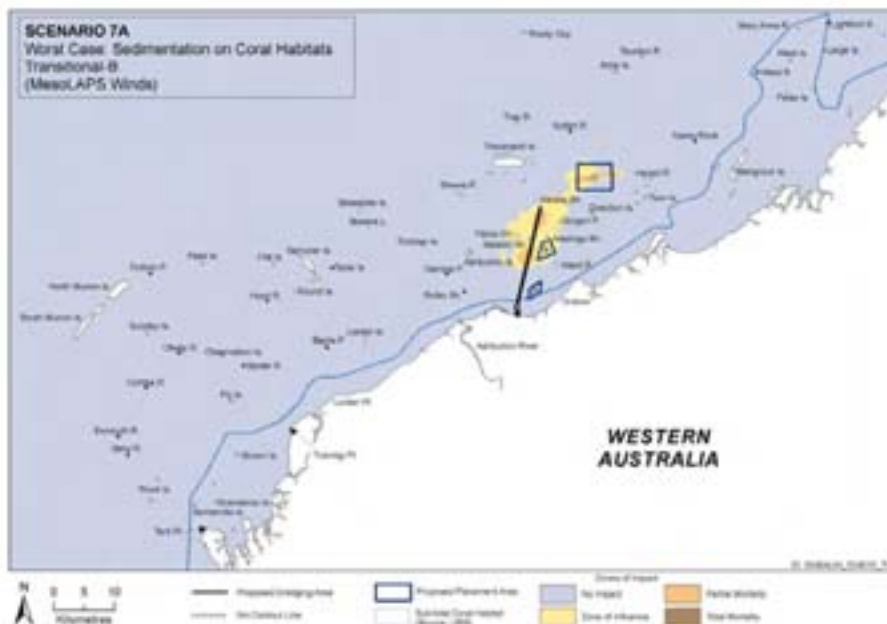


Figure A.382 Scenario 7A, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-288

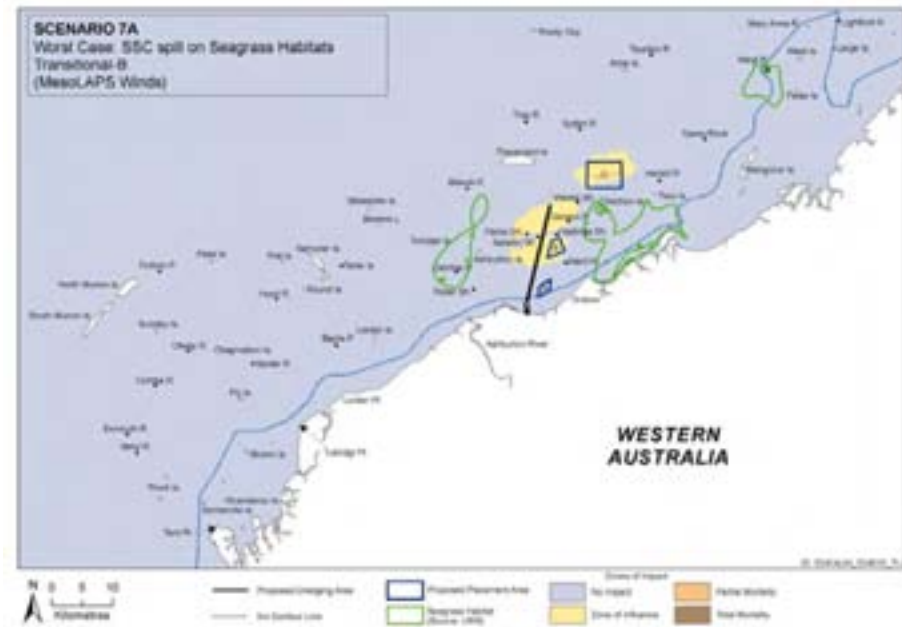


Figure A.383 Scenario 7A, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

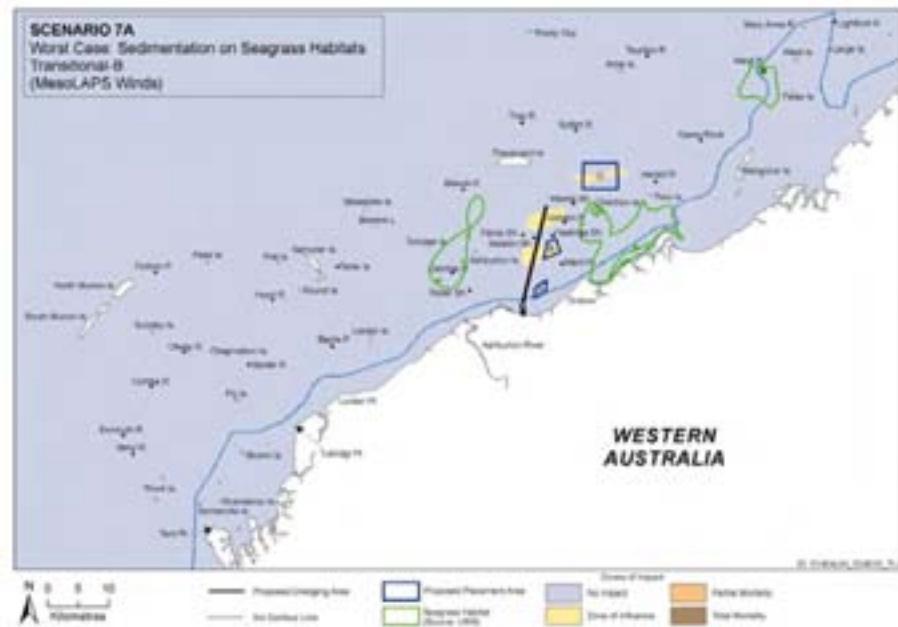


Figure A.384 Scenario 7A, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on MesoLAPS winds

A-289



Table A.96 Summary of Impacts at Sensitive Receptors for Scenario 7A, Transitional-B, Worst Case Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.1	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.1	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.2	5.2	1.0	0.0	0.2	
7	Saladin Shoal	295913	7613337	1.0	1.6	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	3.2	19.3	6.5	1.5	1.7	
9	Hastings Shoal	298803	7613488	1.0	0.9	0.0	0.0	0.4	
10	North West Ward Reef	299018	7610106	1.6	8.5	4.2	0.1	0.9	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.2	5.6	1.2	0.0	0.5	
14	Gorgon Patch	300859	7615993	1.2	7.0	1.6	0.0	0.6	
15	Weeks Shoal	302245	7618926	1.1	4.6	0.0	0.0	0.2	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.4	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.2	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.1	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.3	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



A-290



### A.9 Pipeline Trenching Scenario P1

#### A.9.1 Summer-A, Realistic Spill Scenario

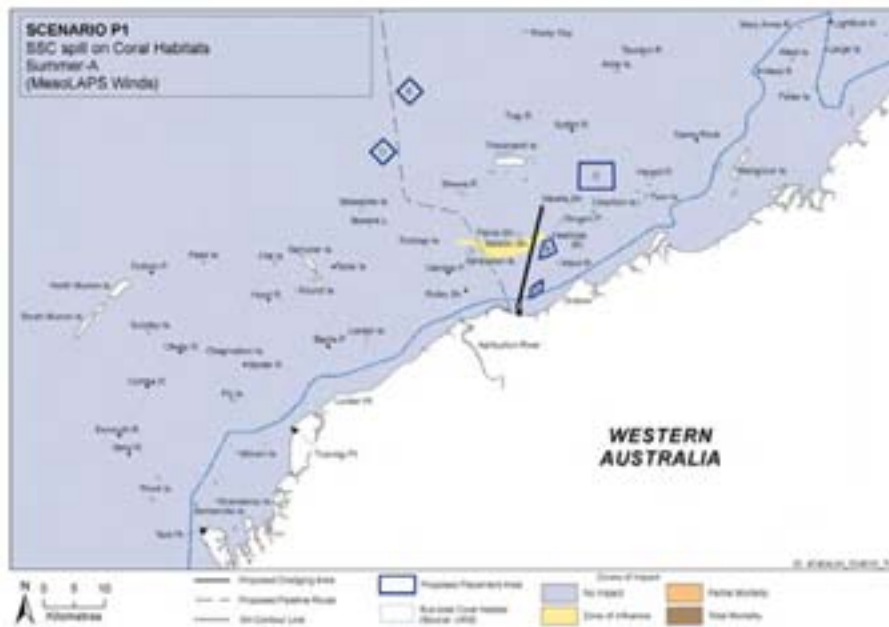


Figure A.385 Scenario P1, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

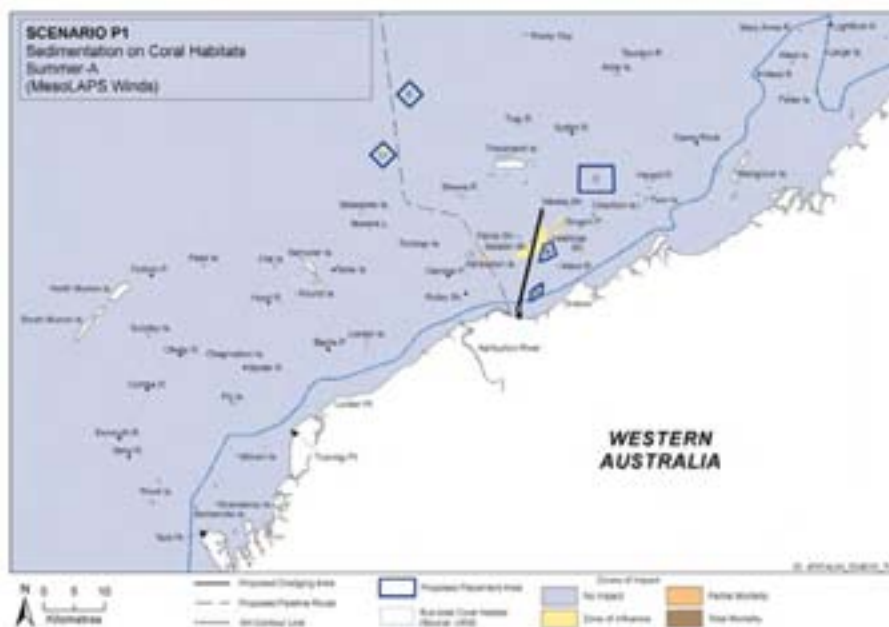


Figure A.386 Scenario P1, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-291

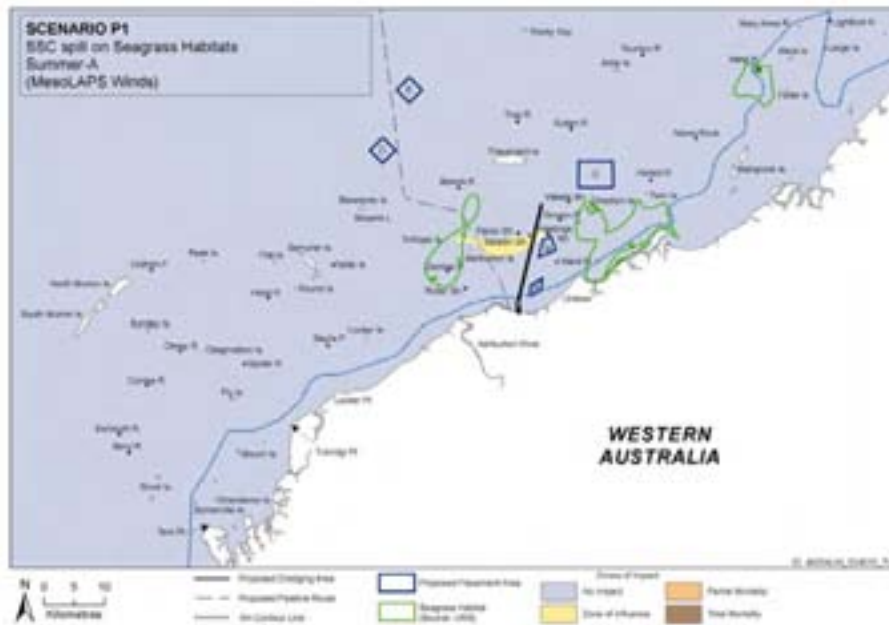


Figure A.387 Scenario P1, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

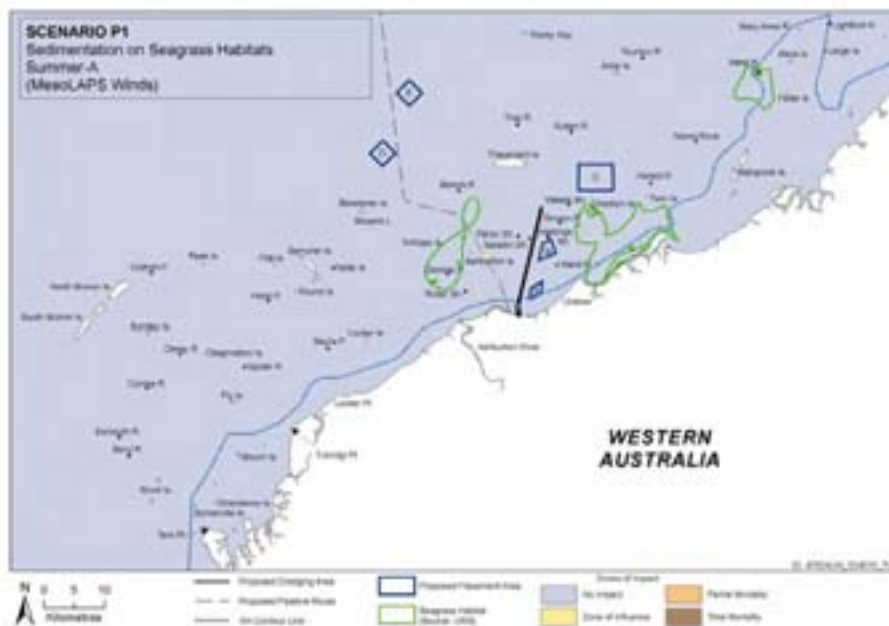


Figure A.388 Scenario P1, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

A-292



Table A.97 Summary of Impacts at Sensitive Receptors for Scenario P1, Summer-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.0	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.0	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.0	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	0.0	0.0	0.0	0.0	0.0	
7	Ashburton Island - West	285206	7610873	0.0	0.0	0.0	0.0	0.0	
8	Ashburton Island - North	286288	7611699	0.0	0.0	0.0	0.0	0.0	
9	Ashburton Island - East	286705	7611075	0.0	0.0	0.0	0.0	0.0	
10	Paroo Shoals	293805	7614023	1.0	0.1	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	1.7	3.6	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.6	0.0	0.0	0.0	0.0	
13	Hastings Shoal	298803	7613488	0.8	1.5	0.0	0.0	0.3	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.9	0.7	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.7	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brew is Reef - South	284693	7620029	0.0	0.0	0.0	0.0	0.0	
20	Brew is Reef - North	283817	7620713	0.0	0.0	0.0	0.0	0.0	
21	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.3	1.3	0.0	0.0	0.0	
24	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.9.2 Summer-B, Realistic Spill Scenario**



Figure A.389 Scenario P1, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

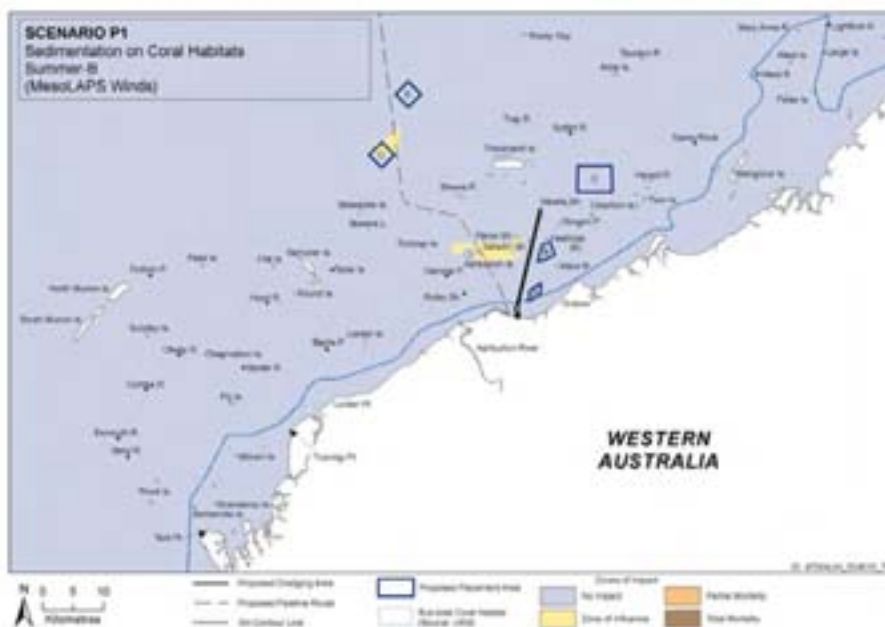


Figure A.390 Scenario P1, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-294

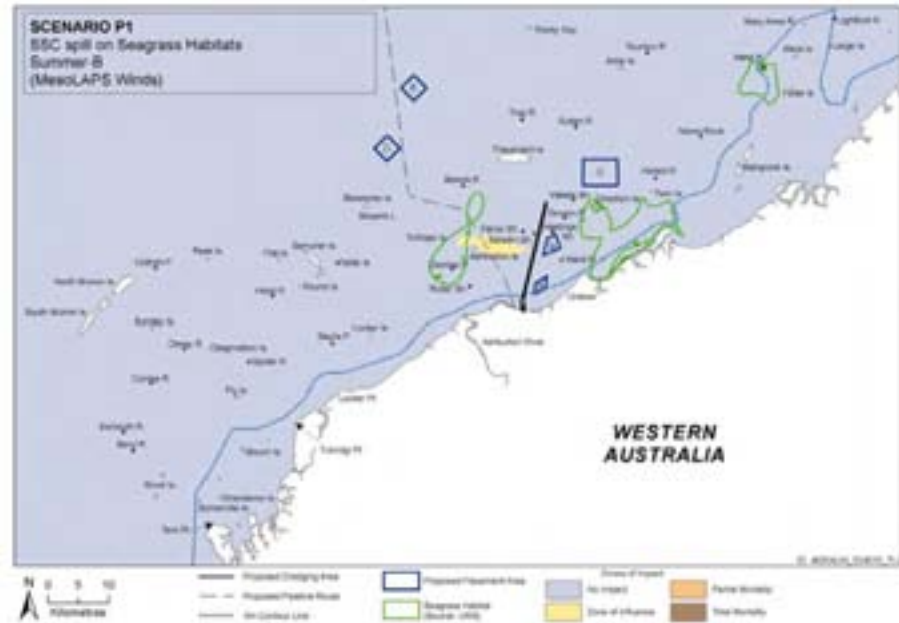


Figure A.391 Scenario P1, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds



Figure A.392 Scenario P1, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-295



Table A.98 Summary of Impacts at Sensitive Receptors for Scenario P1, Summer-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.0	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.0	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.0	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	0.5	1.8	0.0	0.0	0.0	
7	Ashburton Island - West	285206	7610873	0.4	0.9	0.0	0.0	0.0	
8	Ashburton Island - North	286288	7611699	0.9	3.3	0.7	0.0	0.0	
9	Ashburton Island - East	286705	7611075	0.6	1.9	0.7	0.0	0.0	
10	Paroo Shoals	293805	7614023	0.9	0.0	0.0	0.0	0.2	
11	Saladin Shoal	295913	7613337	0.6	0.0	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.3	0.0	0.0	0.0	0.1	
13	Hastings Shoal	298803	7613488	0.3	0.7	0.0	0.0	0.1	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.1	
17	Weeks Shoal	302245	7618926	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brewis Reef - South	284693	7620029	0.0	0.0	0.0	0.0	0.0	
20	Brewis Reef - North	283817	7620713	0.0	0.0	0.0	0.0	0.0	
21	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.3	0.1	0.0	0.0	0.1	
24	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-296



**A.9.3 Winter-A, Realistic Spill Scenario**

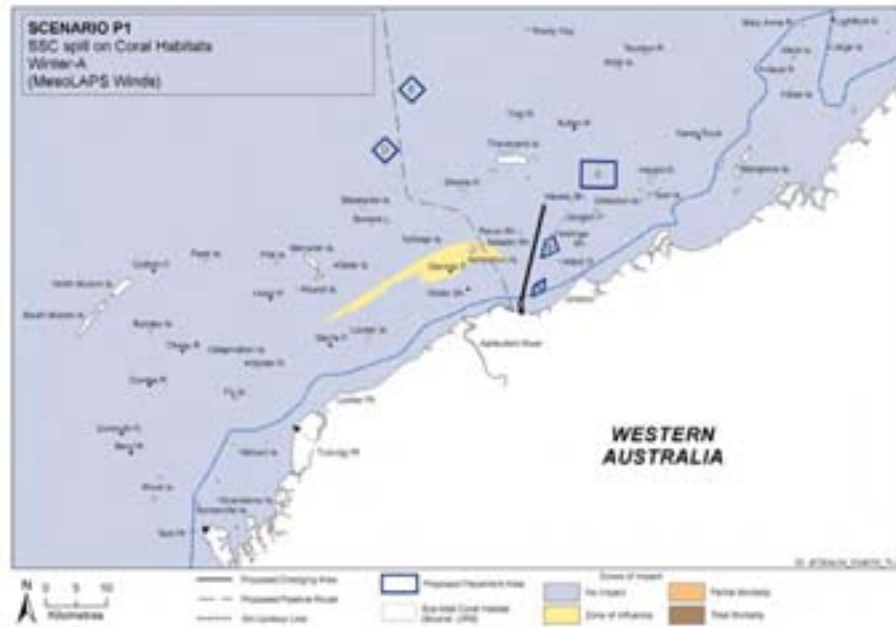


Figure A.393 Scenario P1, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

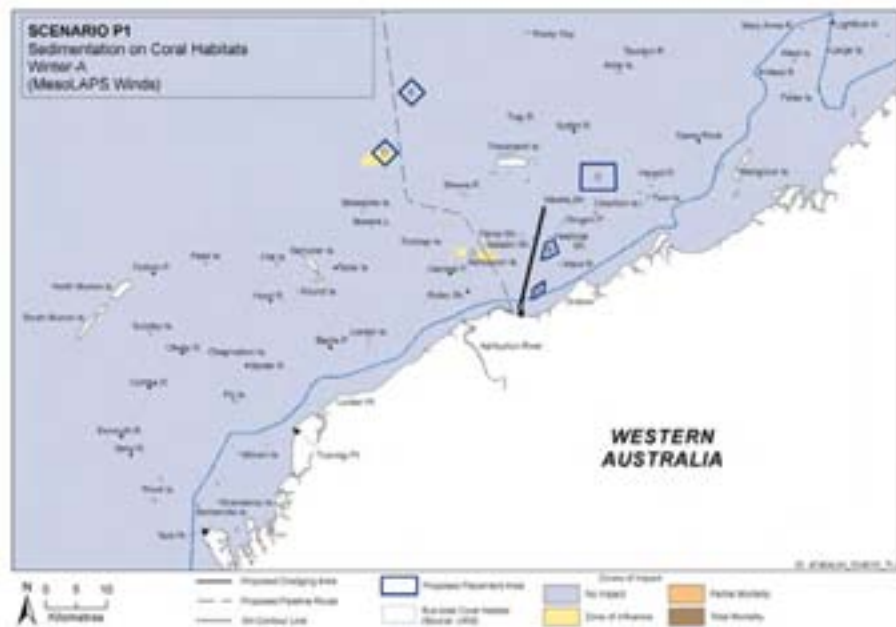


Figure A.394 Scenario P1, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-297

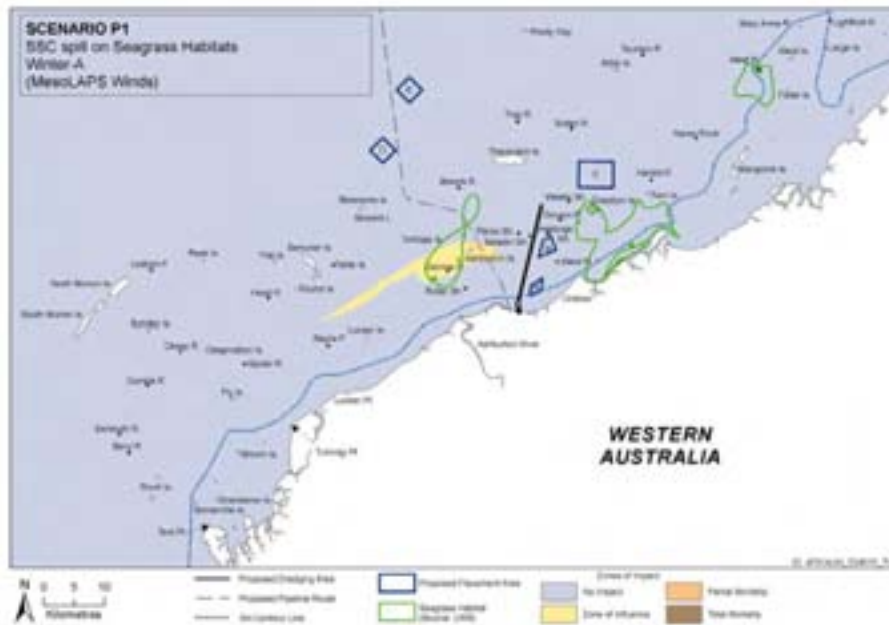


Figure A.395 Scenario P1, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

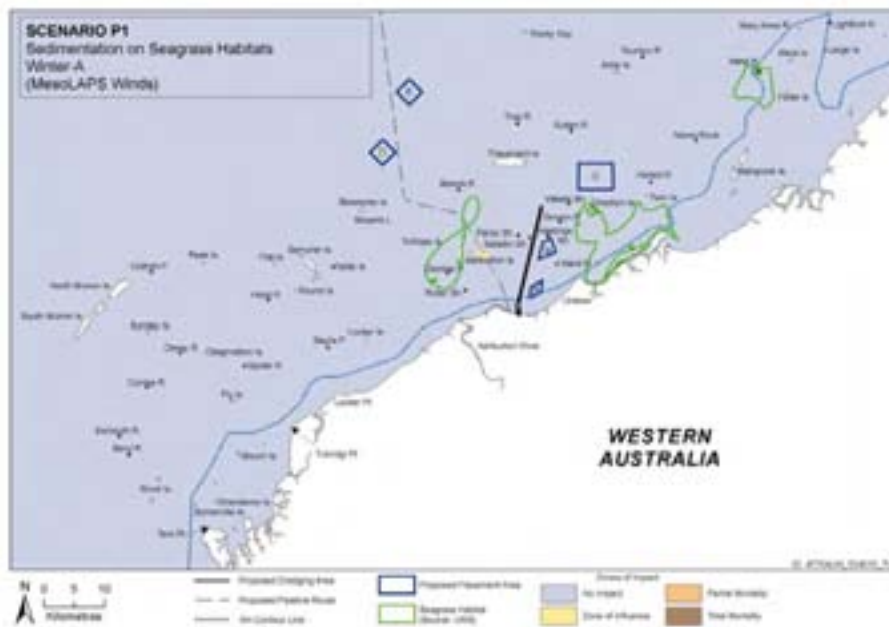


Figure A.396 Scenario P1, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds



A-298



Table A.99 Summary of Impacts at Sensitive Receptors for Scenario P1, Winter-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.0	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.0	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.0	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	1.8	8.8	0.9	0.0	0.0	
7	Ashburton Island - West	285206	7610873	1.2	3.6	0.1	0.0	0.4	
8	Ashburton Island - North	286288	7611699	2.7	18.6	2.8	0.0	0.0	
9	Ashburton Island - East	286705	7611075	1.8	8.9	0.4	0.0	0.6	
10	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
13	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brew is Reef - South	284693	7620029	0.0	0.0	0.0	0.0	0.0	
20	Brew is Reef - North	283817	7620713	0.0	0.0	0.0	0.0	0.0	
21	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	1.0	3.0	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
24	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.9.4 Winter-B, Realistic Spill Scenario**



Figure A.397 Scenario P1, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds

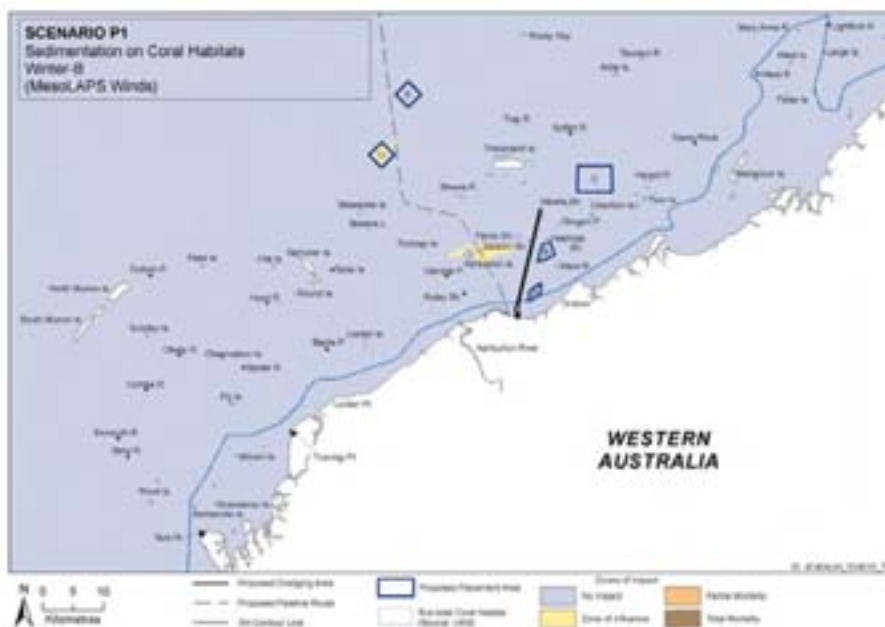


Figure A.398 Scenario P1, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-300

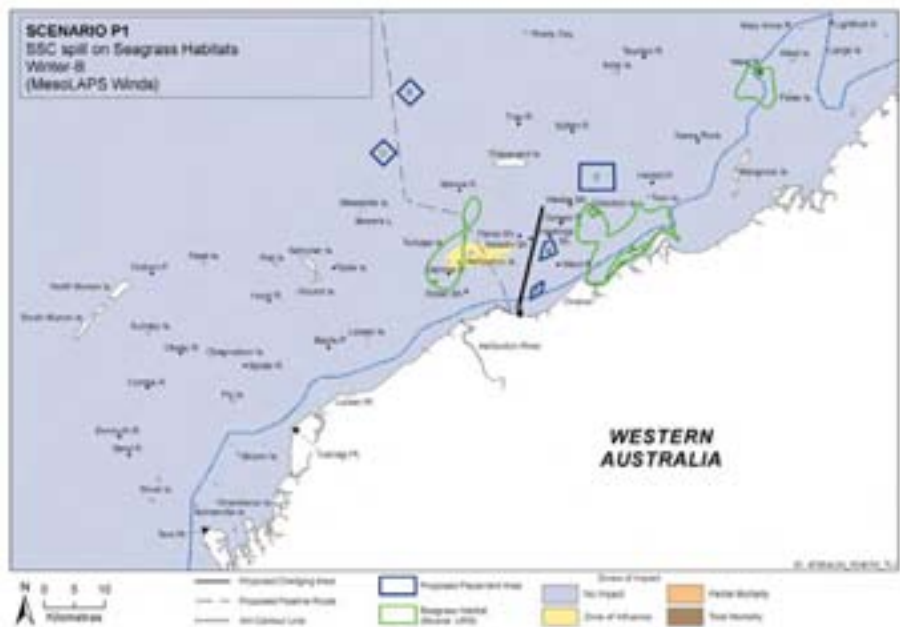


Figure A.399 Scenario P1, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

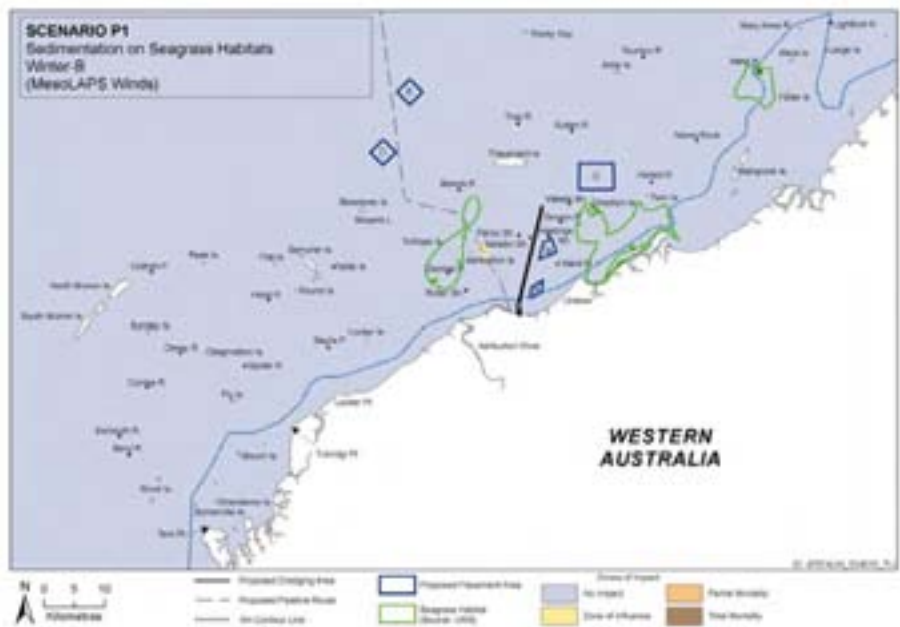


Figure A.400 Scenario P1, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-301



Table A.100 Summary of Impacts at Sensitive Receptors for Scenario P1, Winter-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.0	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.0	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.0	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	1.7	9.4	2.4	0.0	0.0	
7	Ashburton Island - West	285206	7610873	0.9	1.9	0.0	0.0	0.1	
8	Ashburton Island - North	286288	7611699	1.8	11.3	2.7	0.0	0.0	
9	Ashburton Island - East	286705	7611075	1.7	10.4	3.3	0.0	0.1	
10	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	0.2	0.0	0.0	0.0	0.1	
12	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
13	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.1	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brewis Reef - South	284693	7620029	0.0	0.0	0.0	0.0	0.0	
20	Brewis Reef - North	283817	7620713	0.0	0.0	0.0	0.0	0.0	
21	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	0.8	1.3	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
24	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-302



**A.9.5 Transitional-A, Realistic Spill Scenario**

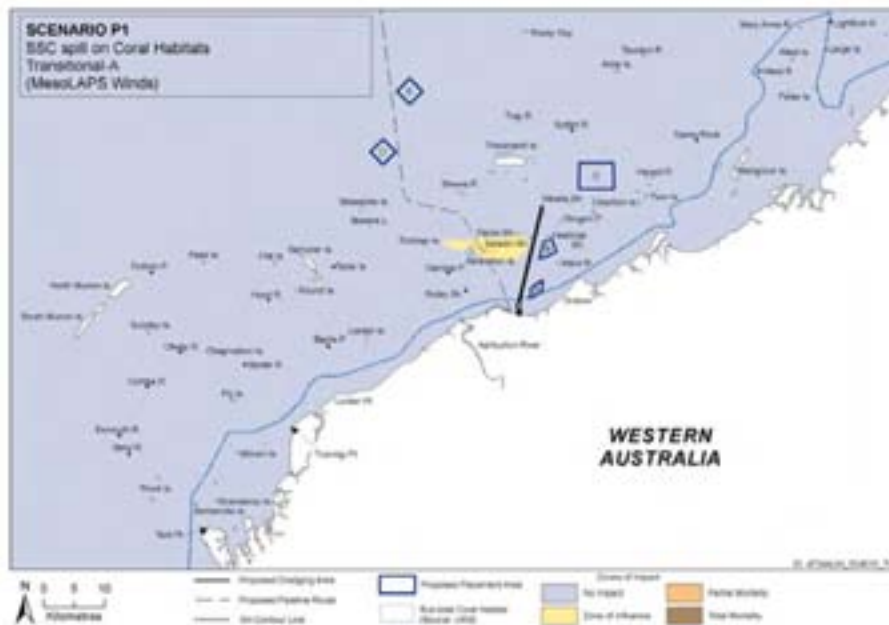


Figure A.401 Scenario P1, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

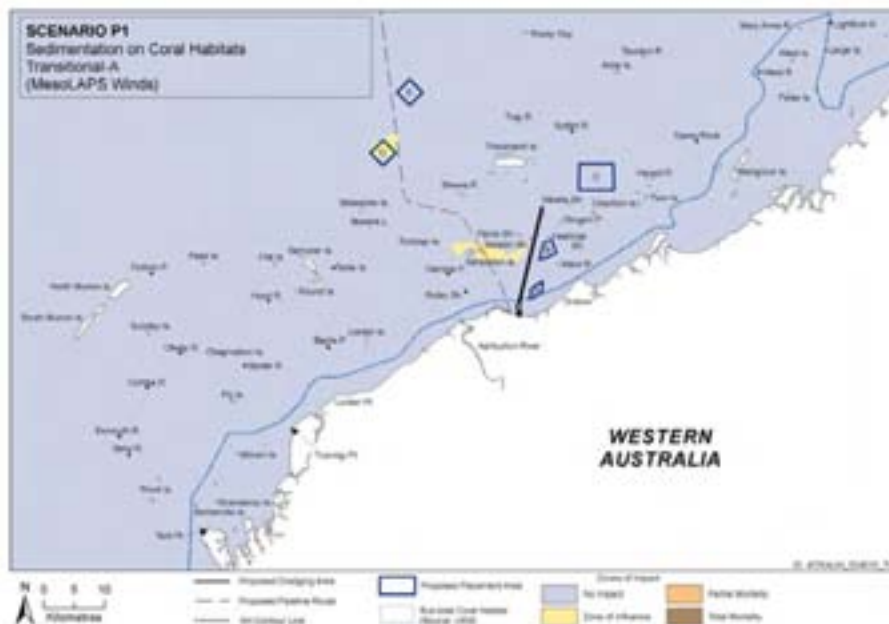


Figure A.402 Scenario P1, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-303

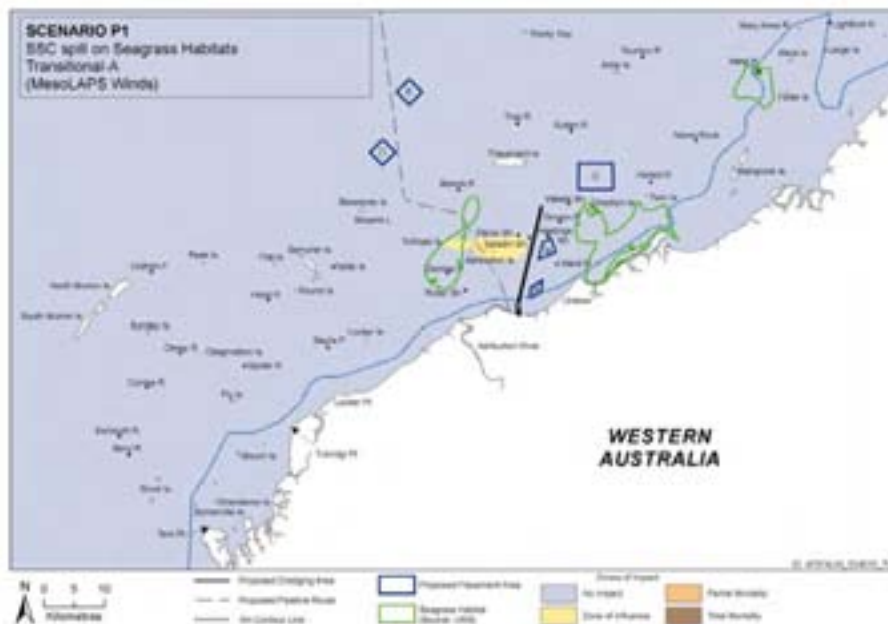


Figure A.403 Scenario P1, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

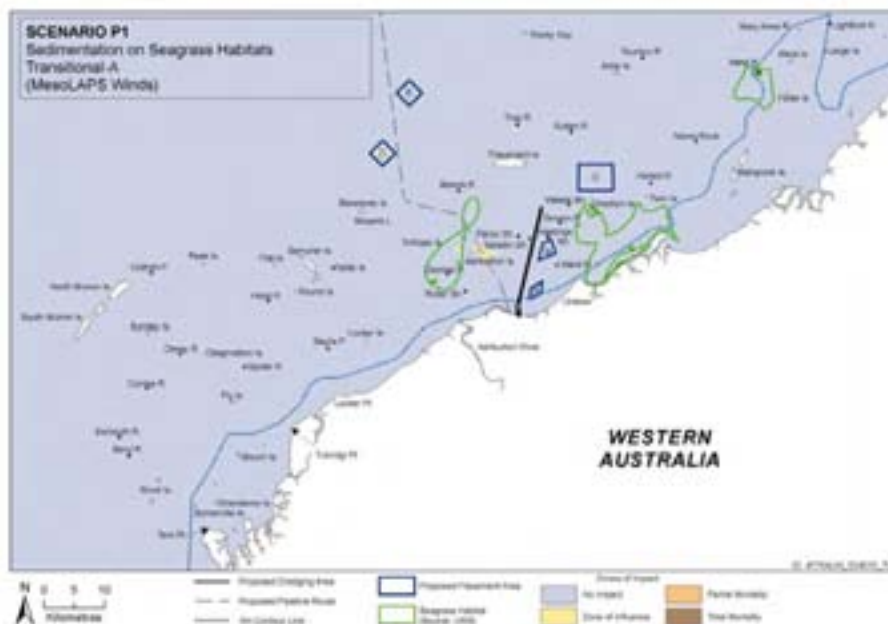


Figure A.404 Scenario P1, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-304



Table A.101 Summary of Impacts at Sensitive Receptors for Scenario P1, Transitional-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.0	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.0	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.0	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	0.7	0.0	0.0	0.0	0.1	
7	Ashburton Island - West	285206	7610873	0.8	0.9	0.0	0.0	0.3	
8	Ashburton Island - North	286288	7611699	1.3	3.7	0.0	0.0	0.2	
9	Ashburton Island - East	286705	7611075	0.6	0.9	0.0	0.0	0.1	
10	Paroo Shoals	293805	7614023	1.1	1.2	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	0.7	1.6	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.3	0.0	0.0	0.0	0.1	
13	Hastings Shoal	298803	7613488	0.2	0.0	0.0	0.0	0.1	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brew is Reef - South	284693	7620029	0.1	0.0	0.0	0.0	0.0	
20	Brew is Reef - North	283817	7620713	0.0	0.0	0.0	0.0	0.0	
21	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.7	0.9	0.0	0.0	0.1	
24	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.9.6 Transitional-B, Realistic Spill Scenario**



Figure A.405 Scenario P1, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds



Figure A.406 Scenario P1, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds



A-306

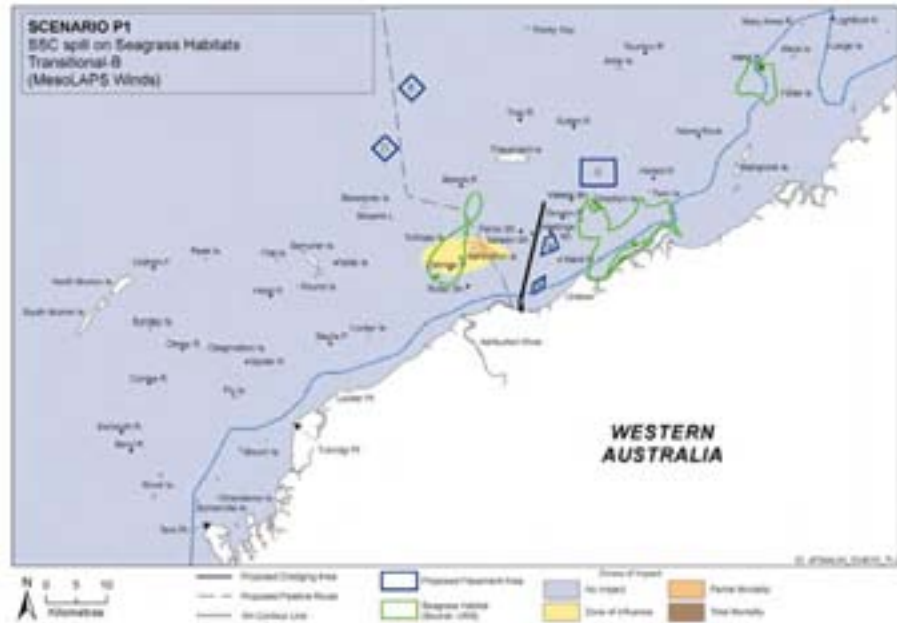


Figure A.407 Scenario P1, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

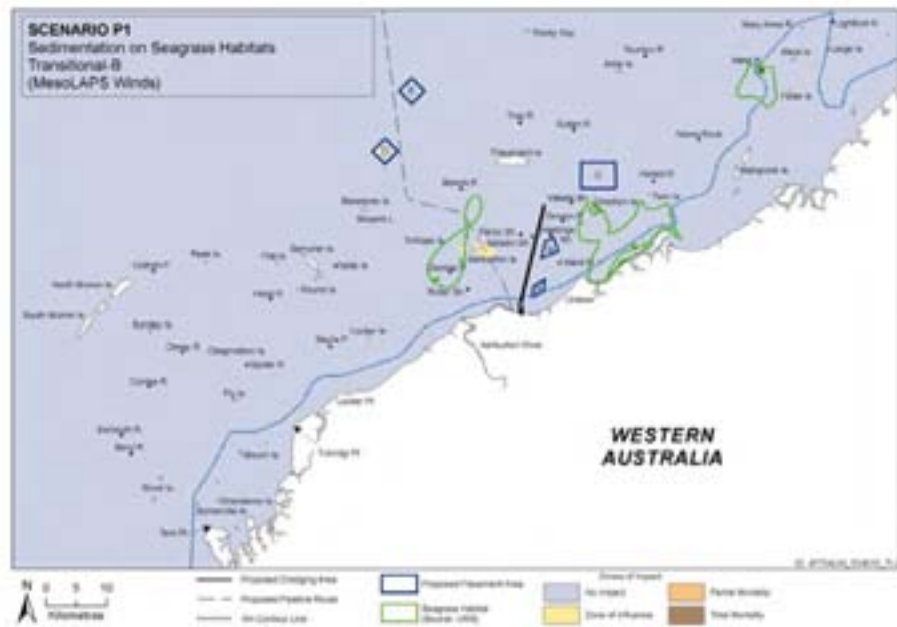


Figure A.408 Scenario P1, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-307



Table A.102 Summary of Impacts at Sensitive Receptors for Scenario P1, Transitional-B, Realistic Spill based on MesolAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.0	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.0	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.0	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	2.7	21.0	3.1	0.0	0.1	
7	Ashburton Island - West	285206	7610873	2.0	11.3	0.4	0.0	0.5	
8	Ashburton Island - North	286288	7611699	3.5	26.7	7.9	0.0	0.1	
9	Ashburton Island - East	286705	7611075	2.7	20.2	4.5	0.0	0.0	
10	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
13	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brewis Reef - South	284693	7620029	0.0	0.0	0.0	0.0	0.0	
20	Brewis Reef - North	283817	7620713	0.0	0.0	0.0	0.0	0.0	
21	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	1.3	7.4	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.3	0.0	0.0	0.0	0.0	
24	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-308



## A.10 Pipeline Trenching Scenario P2

### A.10.1 Summer-A, Realistic Spill Scenario



Figure A.409 Scenario P2, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesoLAPS winds

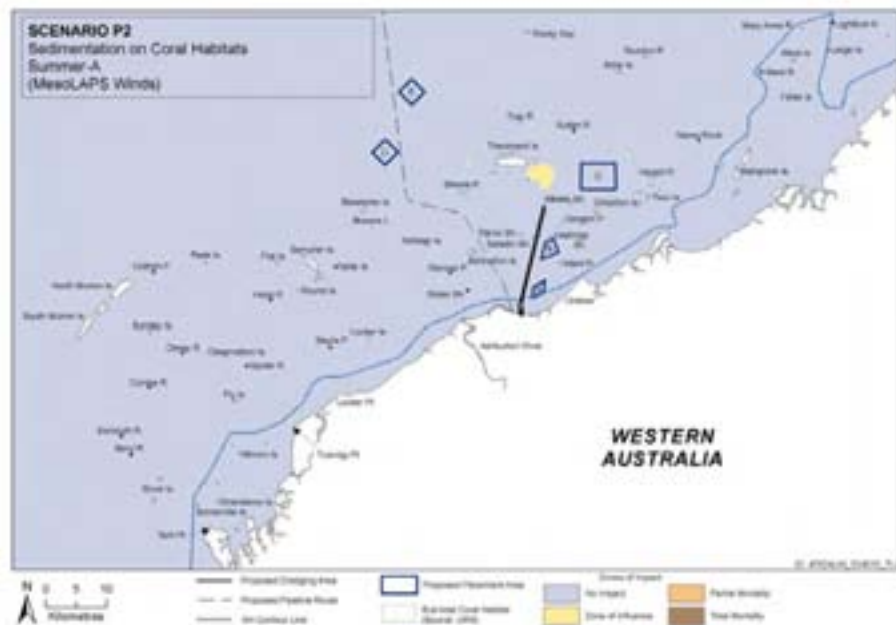


Figure A.410 Scenario P2, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesoLAPS winds

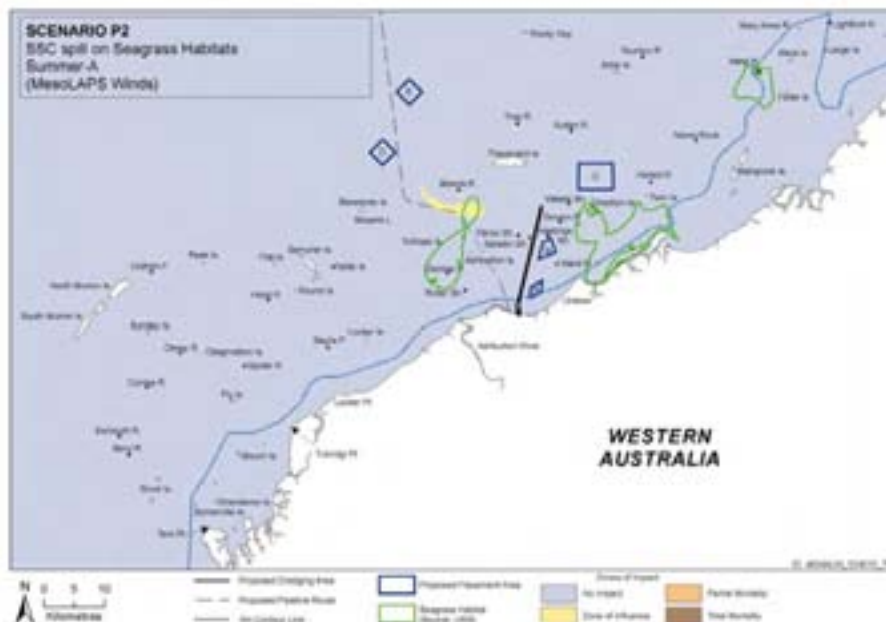


Figure A.411 Scenario P2, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

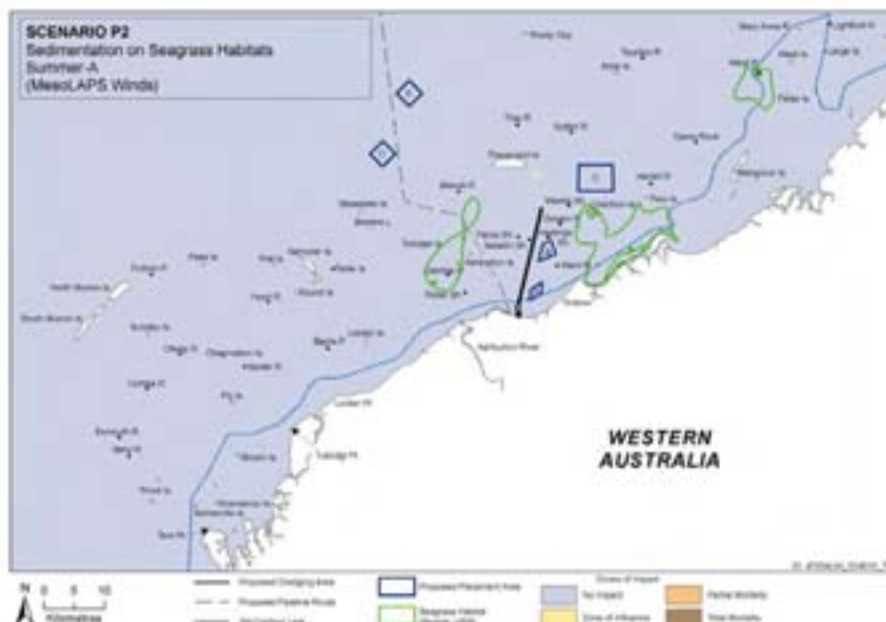


Figure A.412 Scenario P2, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-310



Table A.103 Summary of Impacts at Sensitive Receptors for Scenario P2, Summer-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.0	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.0	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.0	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	0.0	0.0	0.0	0.0	0.0	
7	Ashburton Island - West	285206	7610873	0.0	0.0	0.0	0.0	0.0	
8	Ashburton Island - North	286288	7611699	0.0	0.0	0.0	0.0	0.0	
9	Ashburton Island - East	286705	7611075	0.0	0.0	0.0	0.0	0.0	
10	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
13	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brew is Reef - South	284693	7620029	1.3	1.9	0.0	0.0	0.0	
20	Brew is Reef - North	283817	7620713	1.3	1.6	0.0	0.0	0.0	
21	Thevenard Island West	288492	7624016	0.5	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
24	S of Brew is Reef	286445	7618545	1.6	4.8	0.0	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.6	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.10.2 Summer-B, Realistic Spill Scenario**



Figure A.413 Scenario P2, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on MesolAPS winds

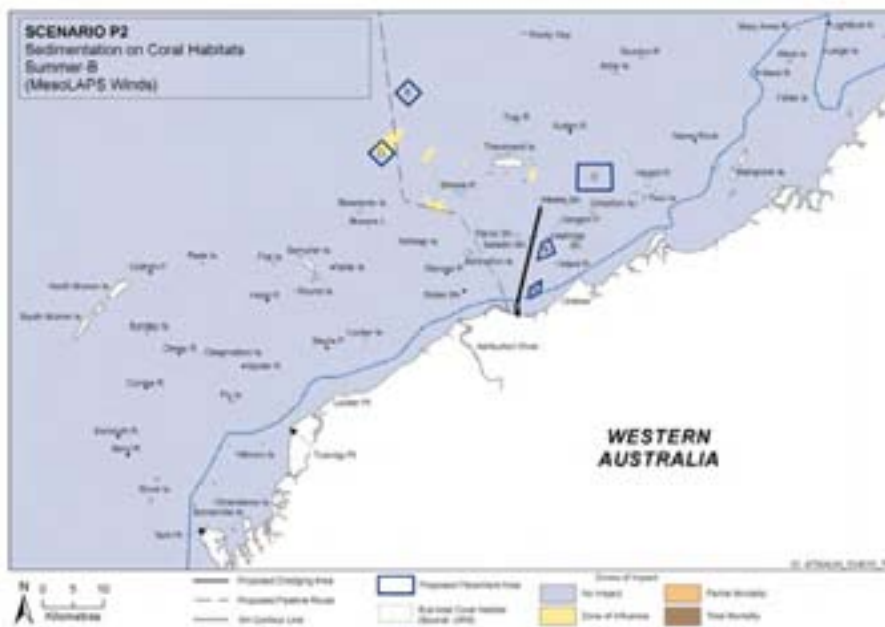


Figure A.414 Scenario P2, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on MesolAPS winds

A-312

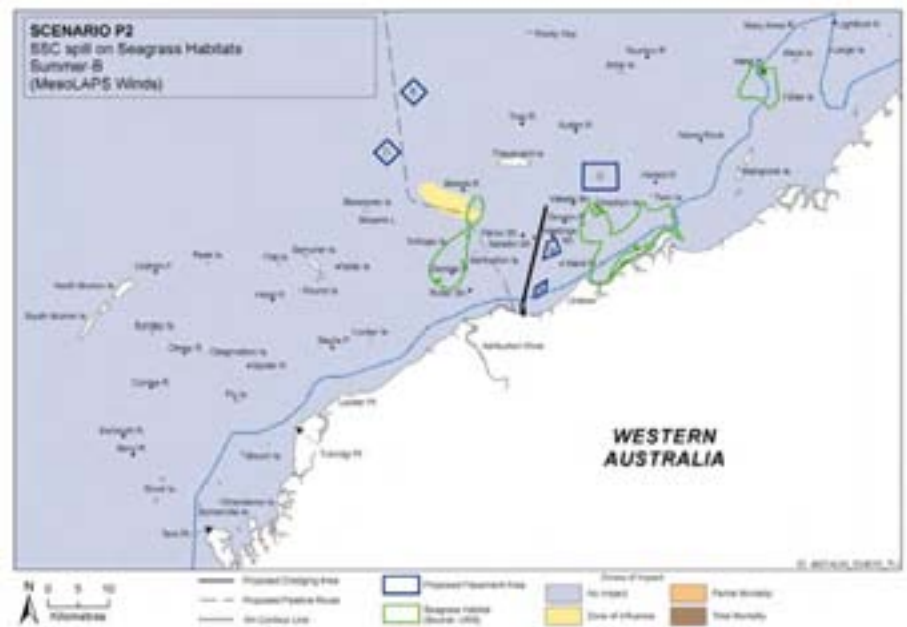


Figure A.415 Scenario P2, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

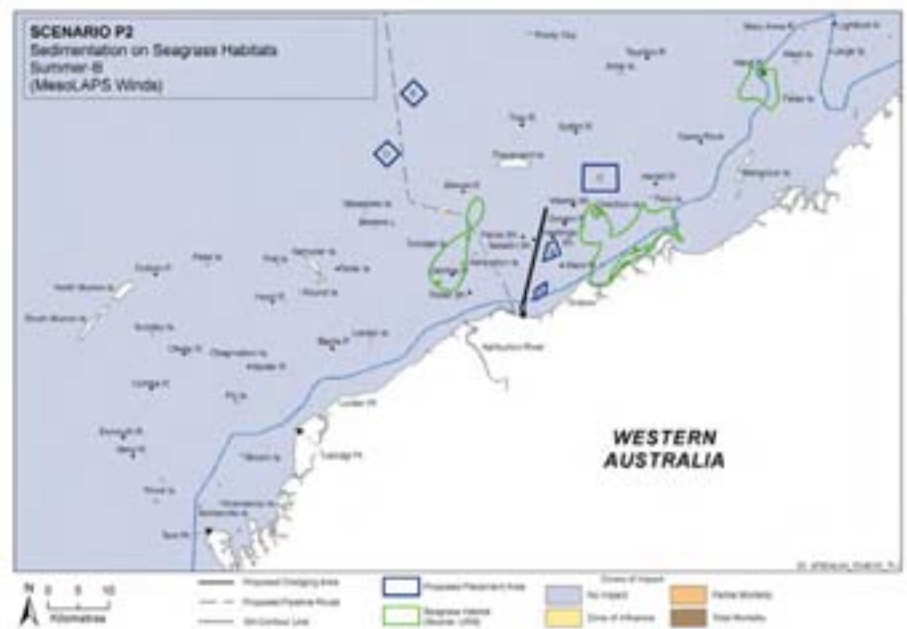


Figure A.416 Scenario P2, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on MesoLAPS winds

A-313



Table A.104 Summary of Impacts at Sensitive Receptors for Scenario P2, Summer-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.0	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.0	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.0	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	0.0	0.0	0.0	0.0	0.0	
7	Ashburton Island - West	285206	7610873	0.0	0.0	0.0	0.0	0.0	
8	Ashburton Island - North	286288	7611699	0.0	0.0	0.0	0.0	0.0	
9	Ashburton Island - East	286705	7611075	0.0	0.0	0.0	0.0	0.0	
10	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
13	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brewis Reef - South	284693	7620029	1.7	3.0	0.0	0.0	0.0	
20	Brewis Reef - North	283817	7620713	1.6	1.8	0.0	0.0	0.1	
21	Thevenard Island West	288492	7624016	0.3	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
24	S of Brewis Reef	286445	7618545	1.3	1.2	0.0	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.2	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



A-314



**A.10.3 Winter-A, Realistic Spill Scenario**



Figure A.417 Scenario P2, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.418 Scenario P2, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-315

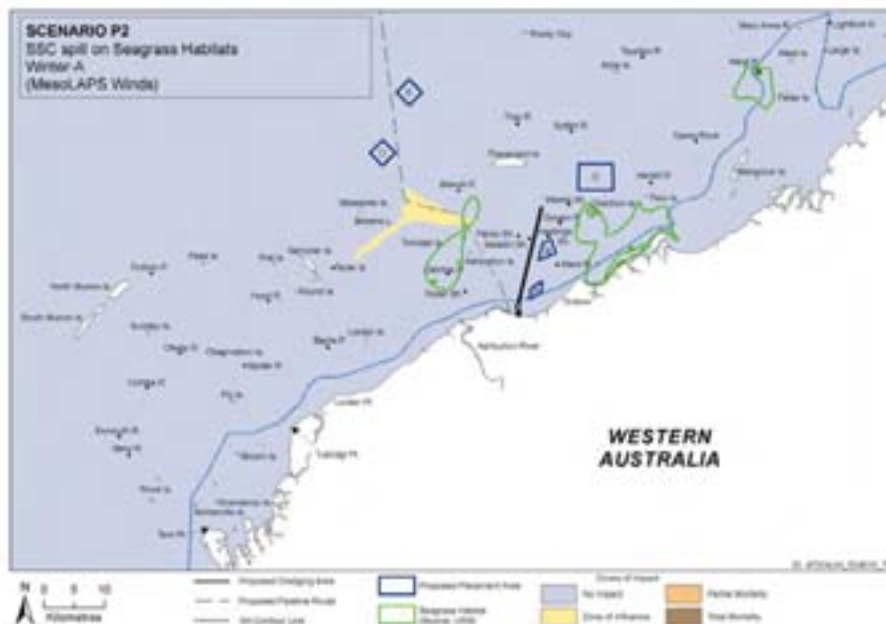


Figure A.419 Scenario P2, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

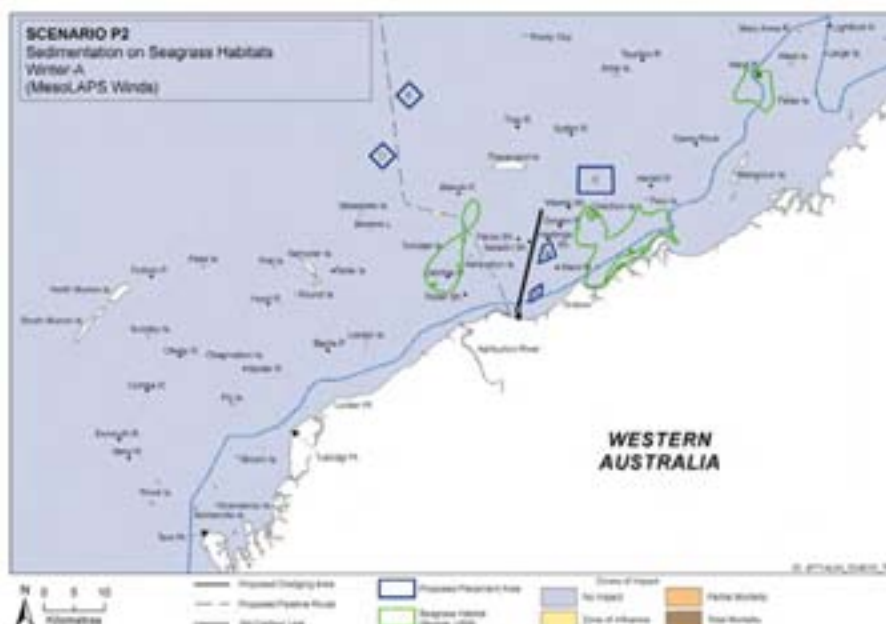


Figure A.420 Scenario P2, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-316



Table A.105 Summary of Impacts at Sensitive Receptors for Scenario P2, Winter-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.1	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.1	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.3	1.3	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	0.0	0.0	0.0	0.0	0.0	
7	Ashburton Island - West	285206	7610873	0.0	0.0	0.0	0.0	0.0	
8	Ashburton Island - North	286288	7611699	0.0	0.0	0.0	0.0	0.0	
9	Ashburton Island - East	286705	7611075	0.0	0.0	0.0	0.0	0.0	
10	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
13	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brew is Reef - South	284693	7620029	0.1	0.0	0.0	0.0	0.0	
20	Brew is Reef - North	283817	7620713	0.0	0.0	0.0	0.0	0.0	
21	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
24	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**A.10.4 Winter-B, Realistic Spill Scenario**



Figure A.421 Scenario P2, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on MesoLAPS winds



Figure A.422 Scenario P2, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-318

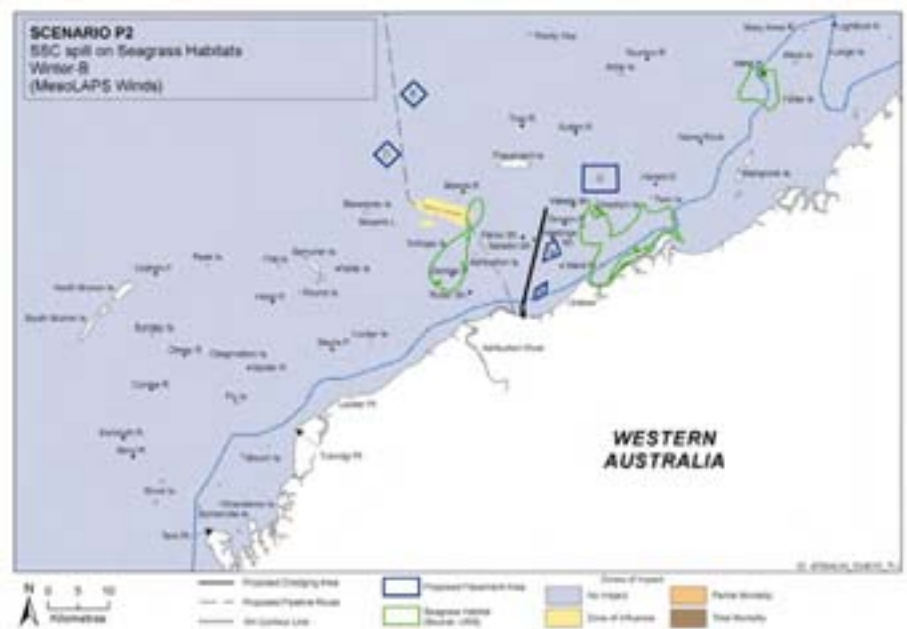


Figure A.423 Scenario P2, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

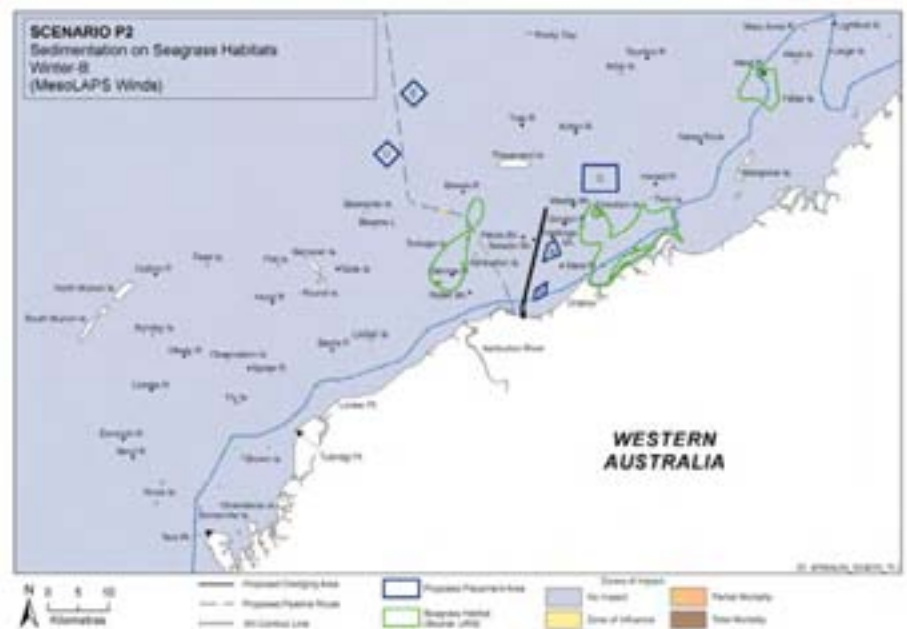


Figure A.424 Scenario P2, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on MesoLAPS winds

A-319



Table A.106 Summary of Impacts at Sensitive Receptors for Scenario P2, Winter-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.1	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.1	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.3	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	0.0	0.0	0.0	0.0	0.0	
7	Ashburton Island - West	285206	7610873	0.0	0.0	0.0	0.0	0.0	
8	Ashburton Island - North	286288	7611699	0.0	0.0	0.0	0.0	0.0	
9	Ashburton Island - East	286705	7611075	0.0	0.0	0.0	0.0	0.0	
10	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
13	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brewis Reef - South	284693	7620029	0.3	0.0	0.0	0.0	0.0	
20	Brewis Reef - North	283817	7620713	0.2	0.0	0.0	0.0	0.1	
21	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
24	S of Brewis Reef	286445	7618545	0.4	0.7	0.0	0.0	0.2	
25	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-320



**A.10.5 Transitional-A, Realistic Spill Scenario**



Figure A.425 Scenario P2, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

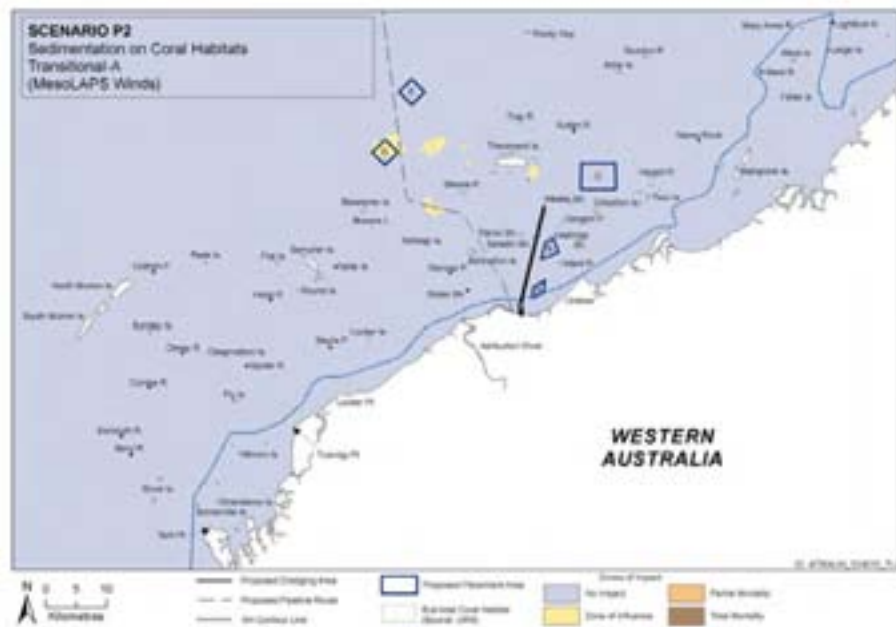


Figure A.426 Scenario P2, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-321

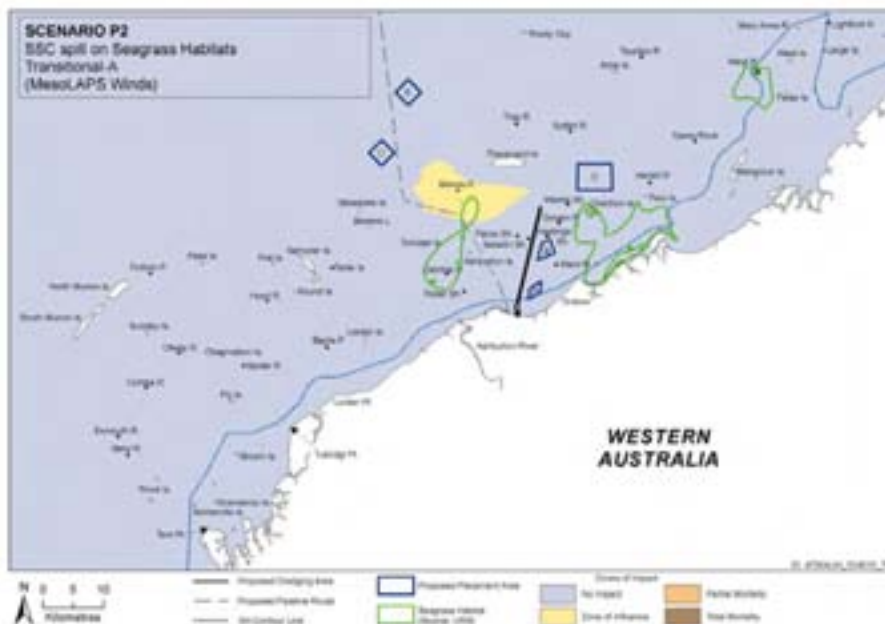


Figure A.427 Scenario P2, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

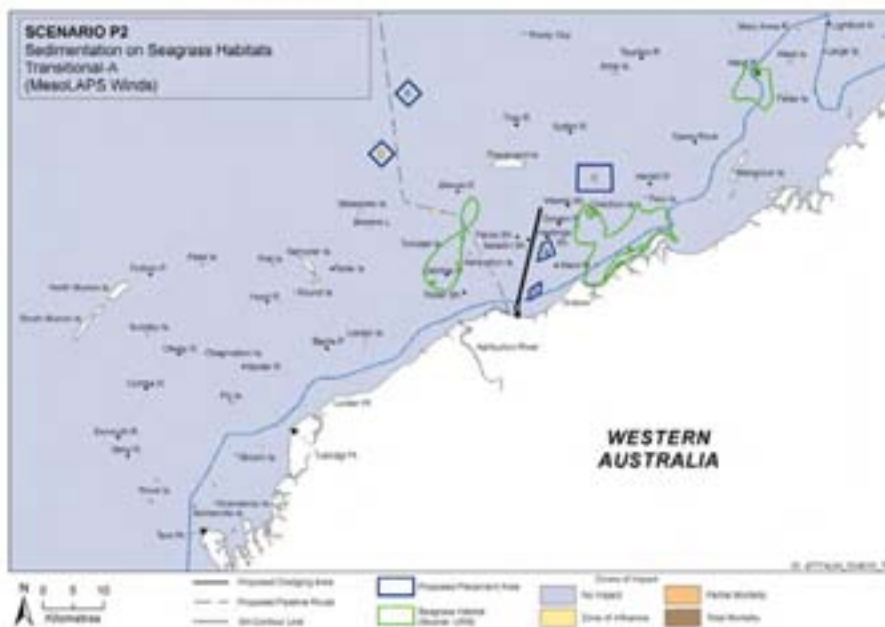


Figure A.428 Scenario P2, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds



A-322



Table A.107 Summary of Impacts at Sensitive Receptors for Scenario P2, Transitional-A, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.0	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.0	0.0	0.0	0.0	0.0	
3	Bowers Ledge	269852	7615345	0.0	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	0.0	0.0	0.0	0.0	0.0	
7	Ashburton Island - West	285206	7610873	0.0	0.0	0.0	0.0	0.0	
8	Ashburton Island - North	286288	7611699	0.0	0.0	0.0	0.0	0.0	
9	Ashburton Island - East	286705	7611075	0.0	0.0	0.0	0.0	0.0	
10	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
13	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brew is Reef - South	284693	7620029	2.8	24.2	0.0	0.0	0.0	
20	Brew is Reef - North	283817	7620713	2.6	20.5	0.0	0.0	0.0	
21	Thevenard Island West	288492	7624016	0.4	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
24	S of Brew is Reef	286445	7618545	2.6	19.6	0.1	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.3	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

A-323



**A.10.6 Transitional-B, Realistic Spill Scenario**

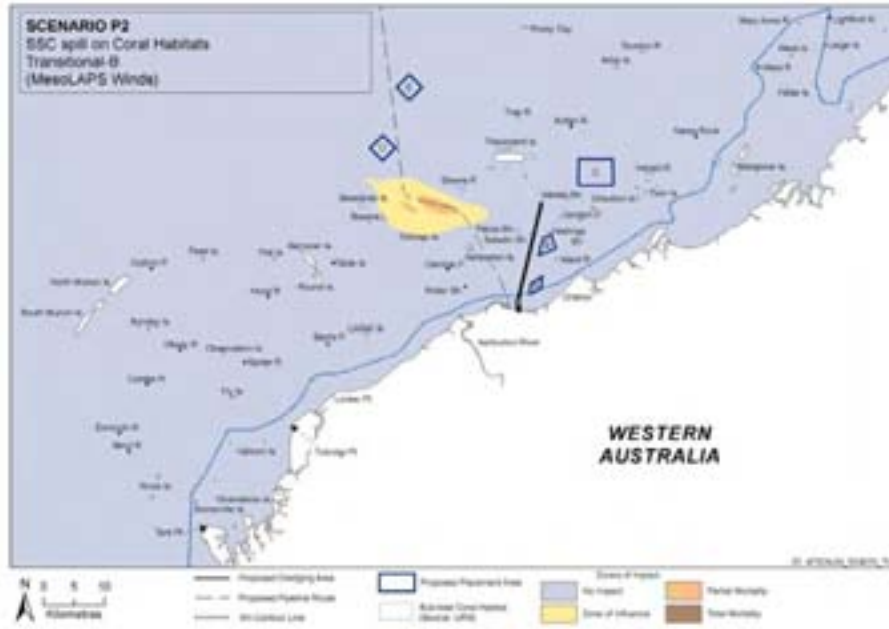


Figure A.429 Scenario P2, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on MesoLAPS winds

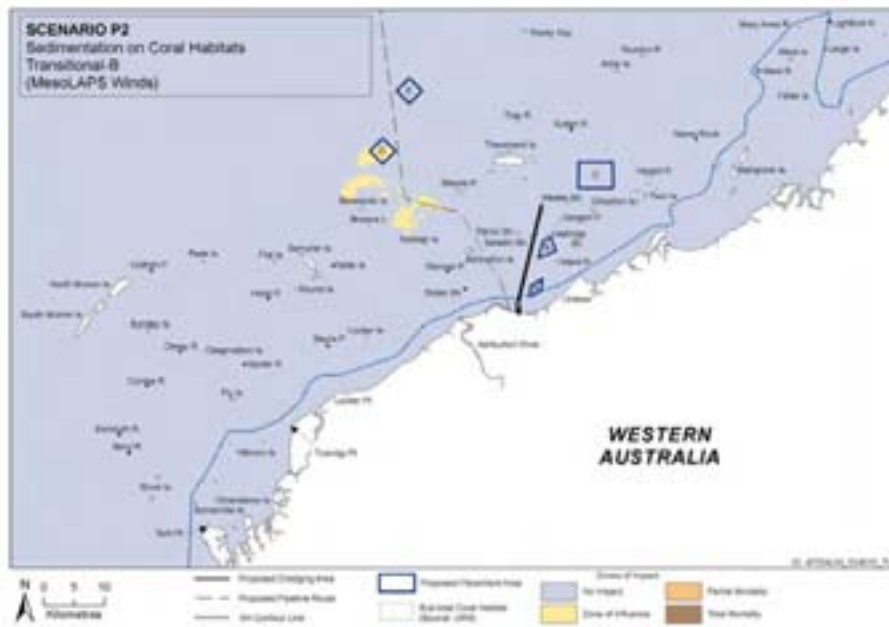


Figure A.430 Scenario P2, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on MesoLAPS winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

A-324

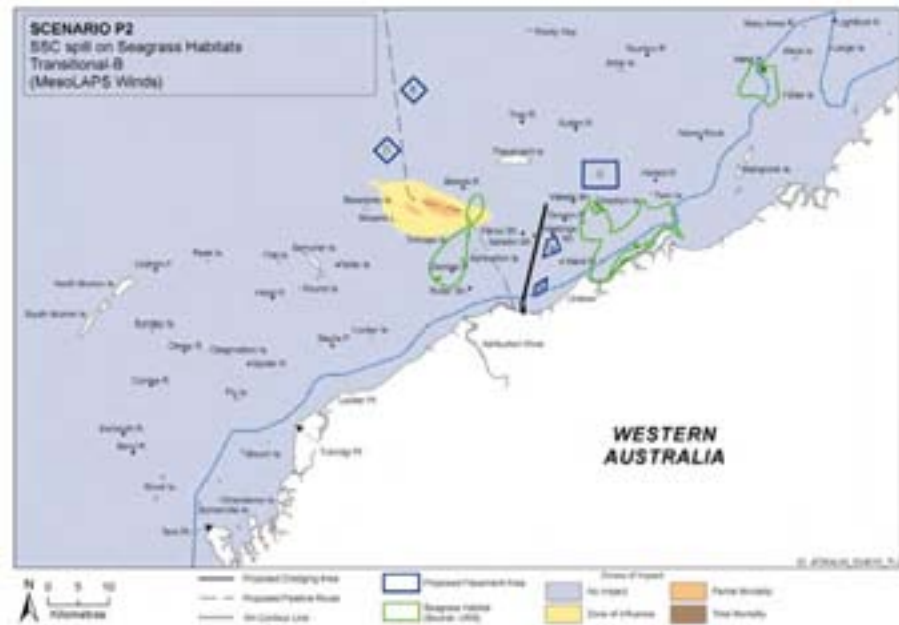


Figure A.431 Scenario P2, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

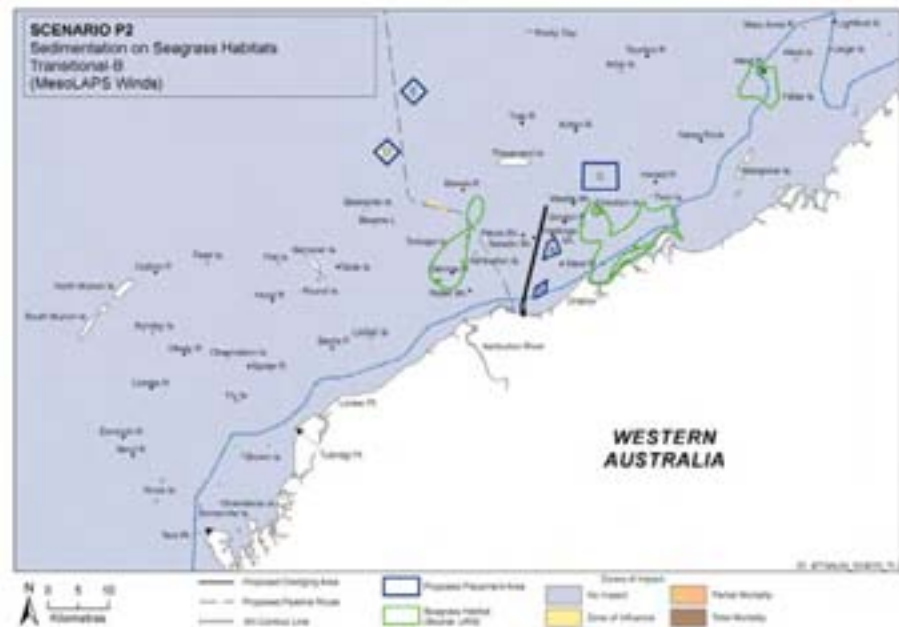


Figure A.432 Scenario P2, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on MesoLAPS winds

A-325



Table A.108 Summary of Impacts at Sensitive Receptors for Scenario P2, Transitional-B, Realistic Spill based on MesoLAPS winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Bessieres Island - North	268883	7618450	0.3	0.0	0.0	0.0	0.0	
2	Bessieres Island - South	268855	7617482	0.3	0.0	0.0	0.0	0.1	
3	Bowers Ledge	269852	7615345	0.4	0.0	0.0	0.0	0.0	
4	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
5	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
6	Ashburton Island - South	286174	7610189	0.0	0.0	0.0	0.0	0.0	
7	Ashburton Island - West	285206	7610873	0.0	0.0	0.0	0.0	0.0	
8	Ashburton Island - North	286288	7611699	0.0	0.0	0.0	0.0	0.0	
9	Ashburton Island - East	286705	7611075	0.0	0.0	0.0	0.0	0.0	
10	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
11	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
12	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
13	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
14	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
15	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
16	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
17	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	Brewis Reef - South	284693	7620029	0.4	0.0	0.0	0.0	0.0	
20	Brewis Reef - North	283817	7620713	0.3	0.0	0.0	0.0	0.0	
21	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
22	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
23	NW of Ashburton Island	283603	7613038	0.1	0.4	0.0	0.0	0.0	
24	S of Brewis Reef	286445	7618545	0.6	0.6	0.0	0.0	0.0	
25	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-1



***APPENDIX B***  
***Processed Model Results Based On Onslow Winds***

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



**B.1 Dredging Scenario 1**

**B.1.1 Summer-A, Realistic Spill Scenario**



Figure B.1 Scenario 1, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

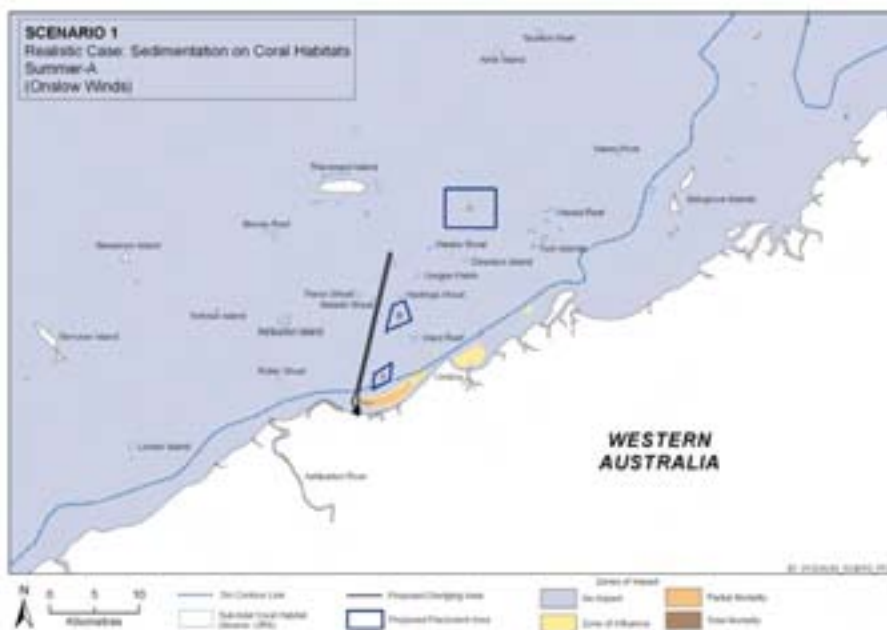


Figure B.2 Scenario 1, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-3

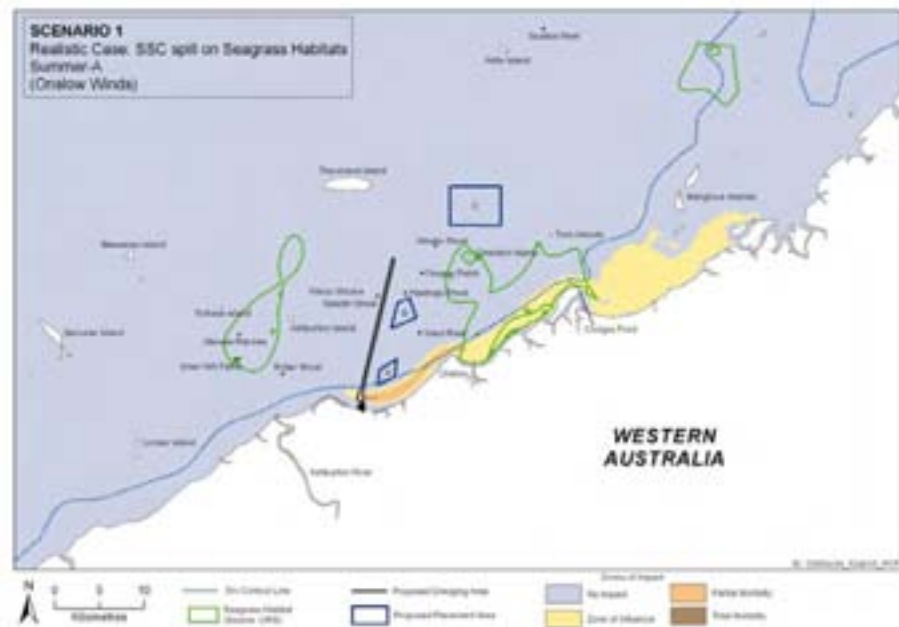


Figure B.3 Scenario 1, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds



Figure B.4 Scenario 1, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds



Table B.1 Summary of Impacts at Sensitive Receptors for Scenario 1, Summer-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.7	0.7	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.1	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.2	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	3.2	19.0	2.7	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	3.1	15.6	0.1	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.3	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



B-5



**B.1.2 Summer-B, Realistic Spill Scenario**



Figure B.5 Scenario 1, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

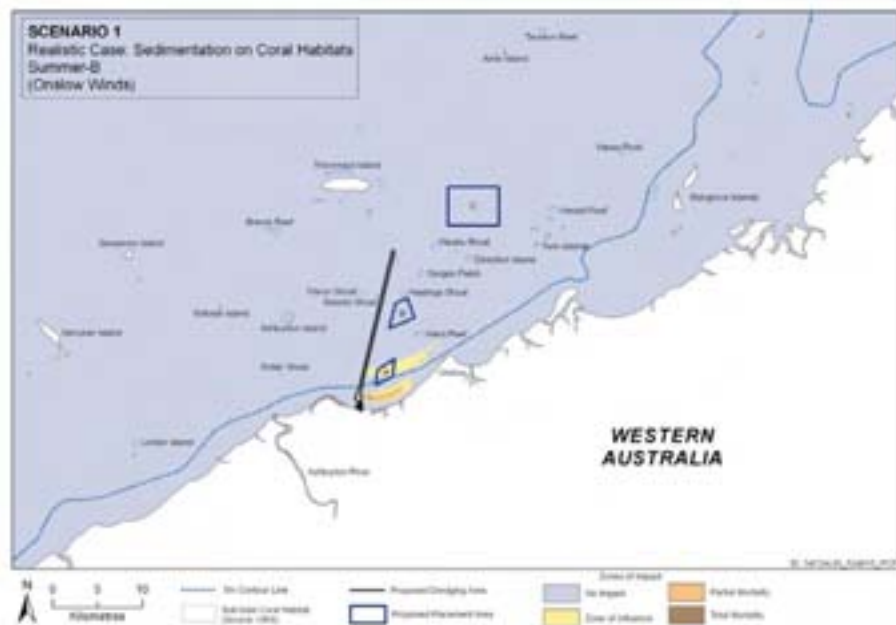


Figure B.6 Scenario 1, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

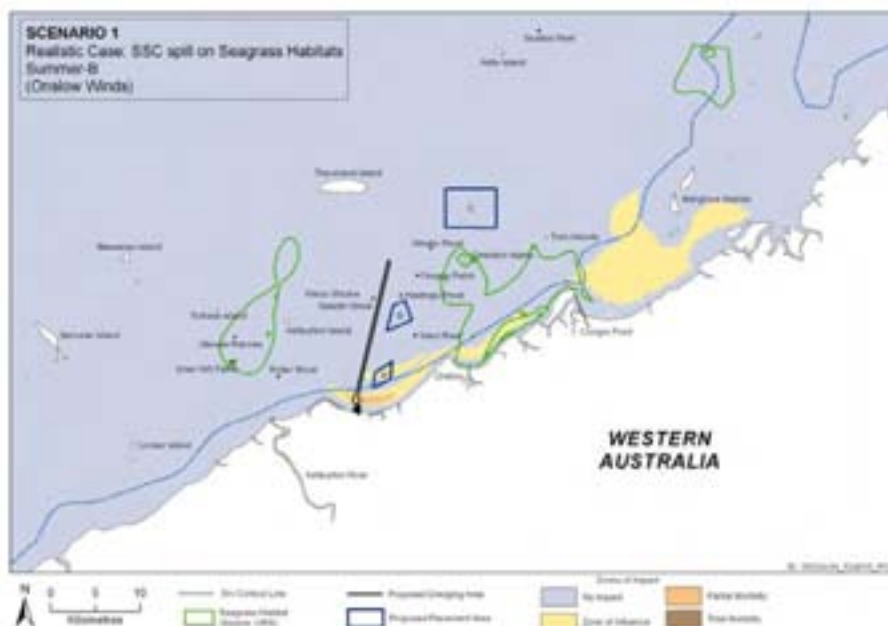


Figure B.7 Scenario 1, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

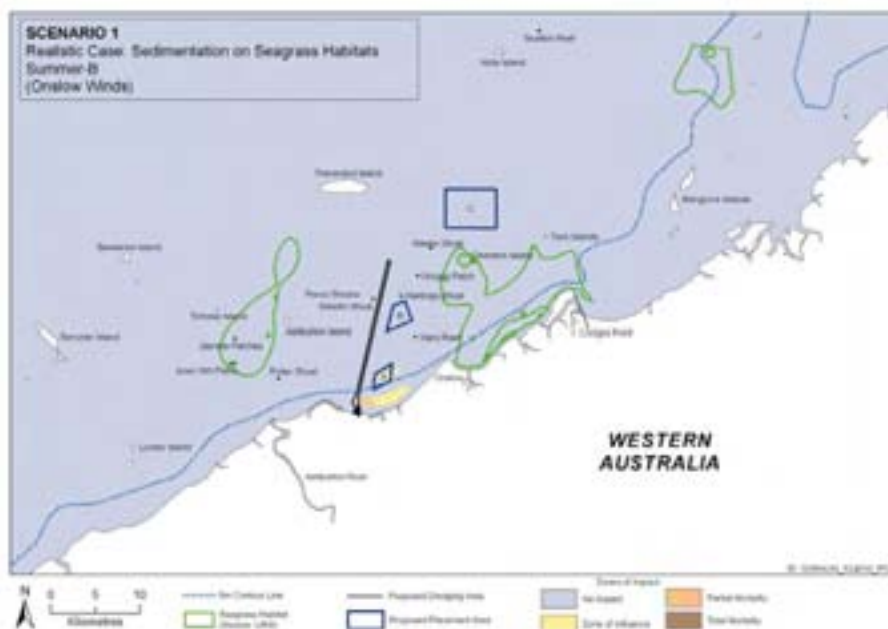


Figure B.8 Scenario 1, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-7



Table B.2 Summary of Impacts at Sensitive Receptors for Scenario 1, Summer-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.5	6.4	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.7	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.7	0.1	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	1.0	5.2	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.9	4.2	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.6	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.1.3 Winter-A, Realistic Spill Scenario**

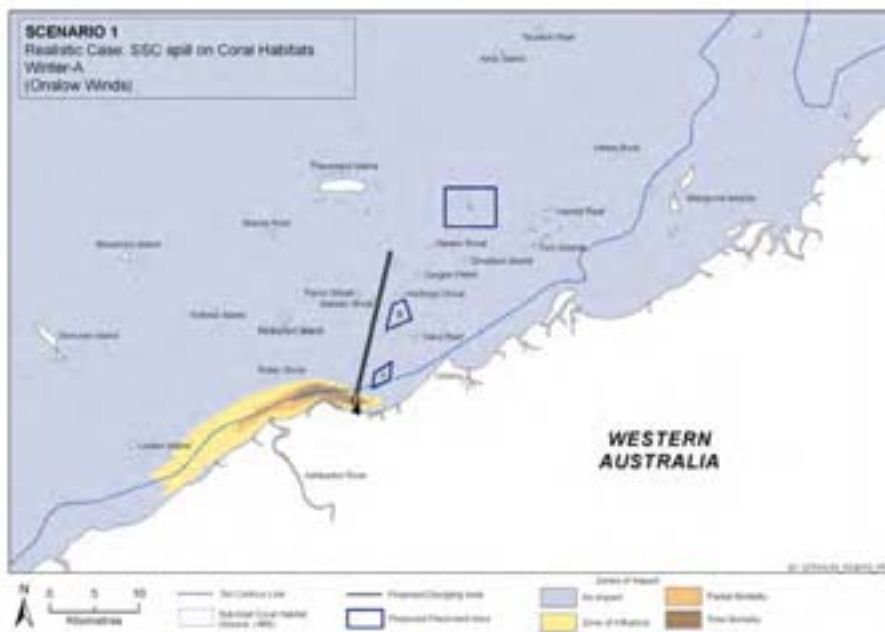


Figure B.9 Scenario 1, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

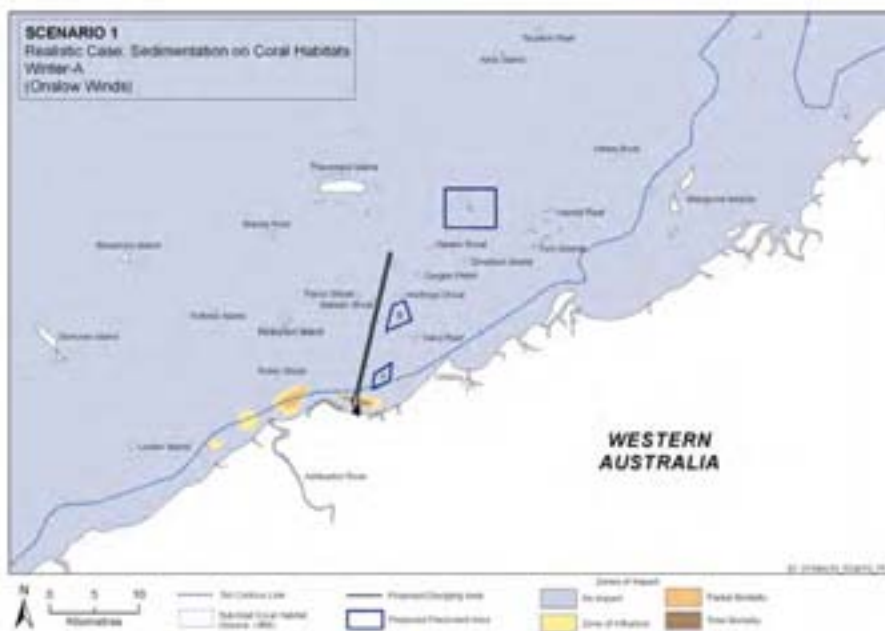


Figure B.10 Scenario 1, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

B-9

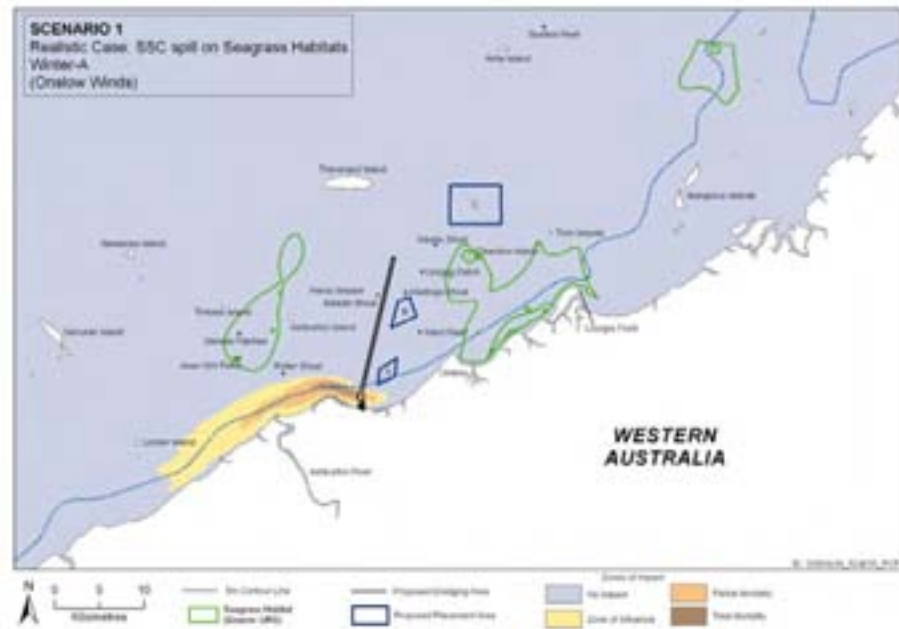


Figure B.11 Scenario 1, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

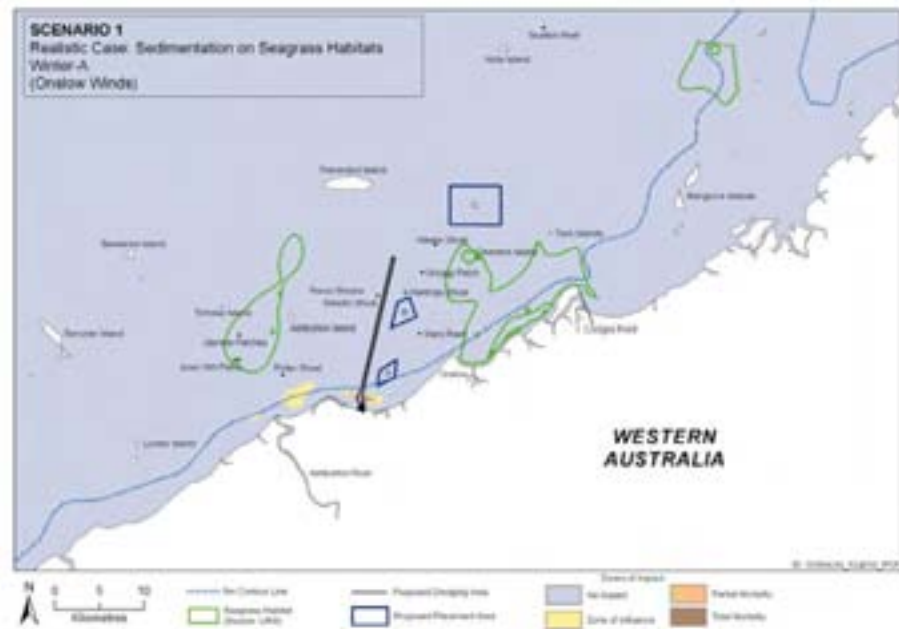


Figure B.12 Scenario 1, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

B-10



Table B.3 Summary of Impacts at Sensitive Receptors for Scenario 1, Winter-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brewis Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-11



**B.1.4 Winter-B, Realistic Spill Scenario**

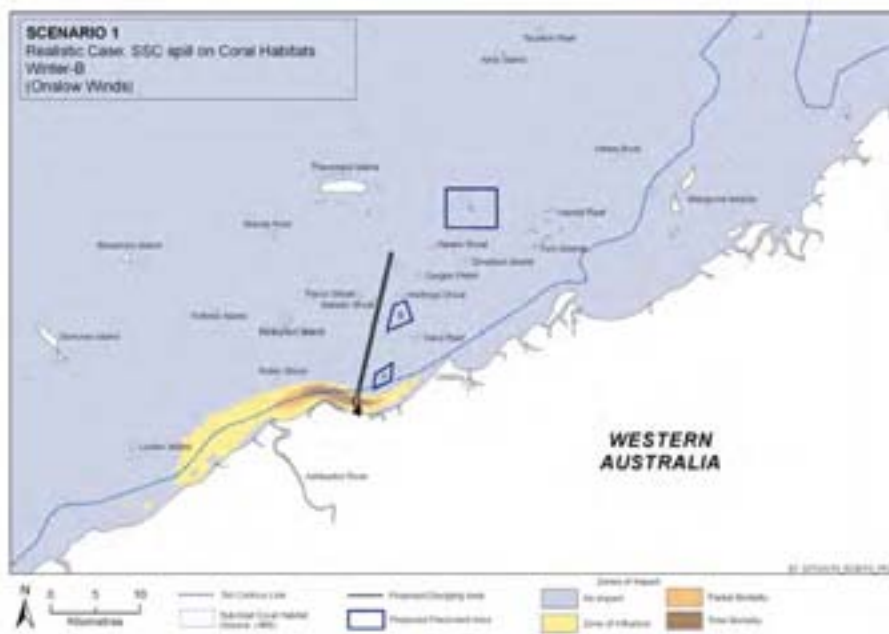


Figure B.13 Scenario 1, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

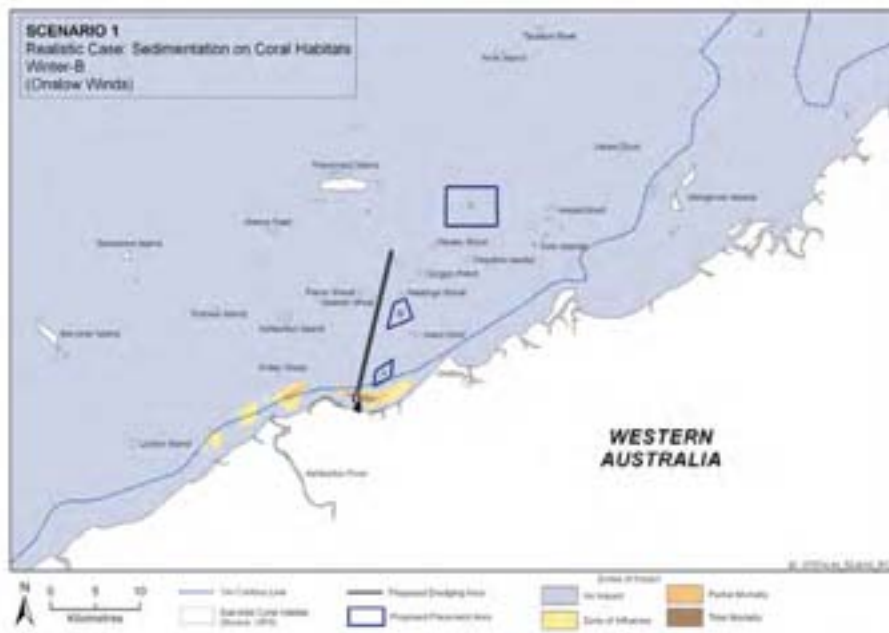


Figure B.14 Scenario 1, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

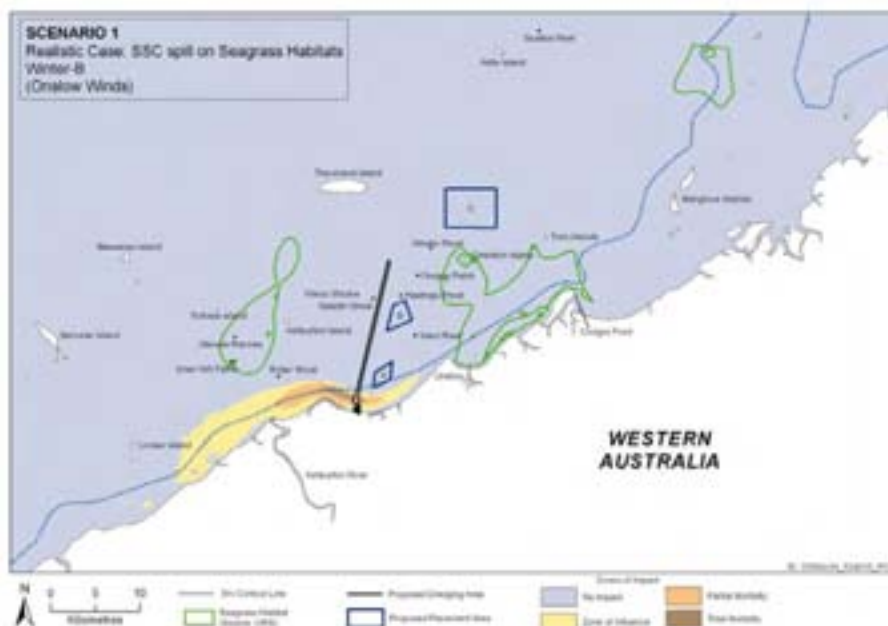


Figure B.15 Scenario 1, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

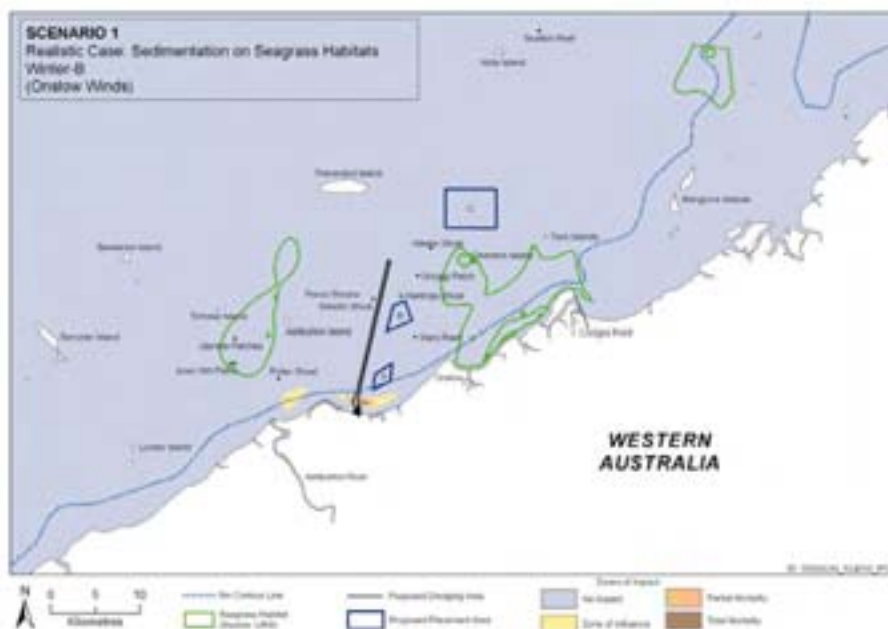


Figure B.16 Scenario 1, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds



B-13



Table B.4 Summary of Impacts at Sensitive Receptors for Scenario 1, Winter-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.1.5 Transitional-A, Realistic Spill Scenario**

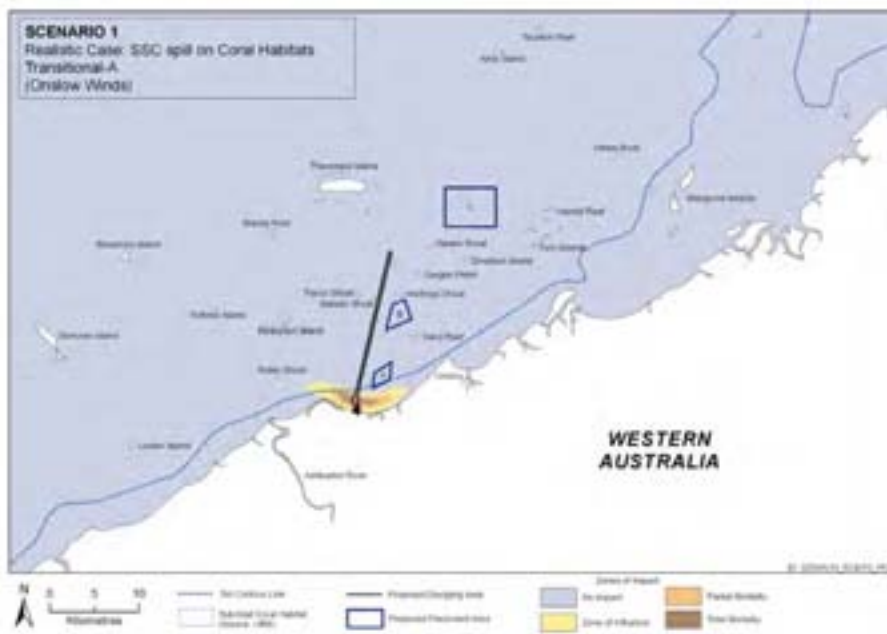


Figure B.17 Scenario 1, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

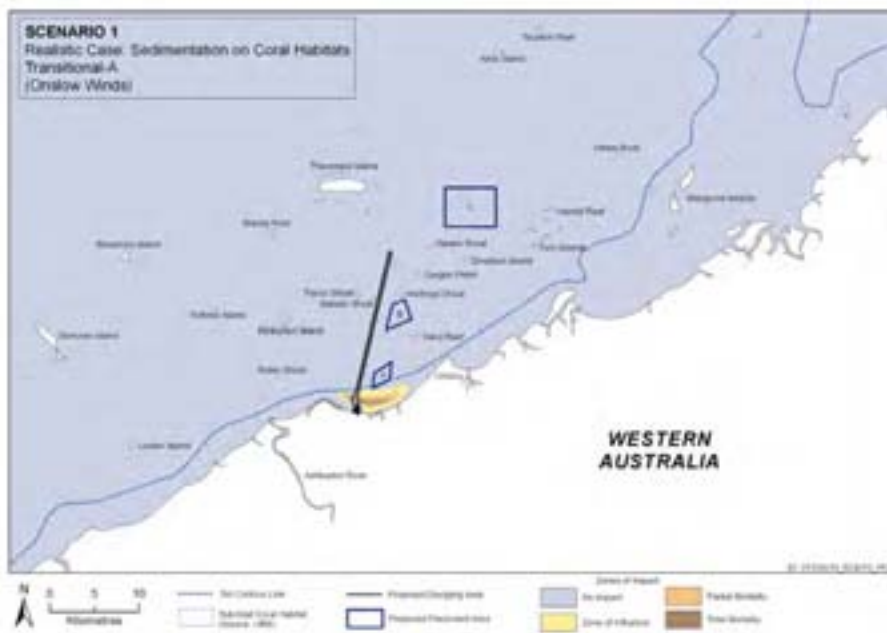


Figure B.18 Scenario 1, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

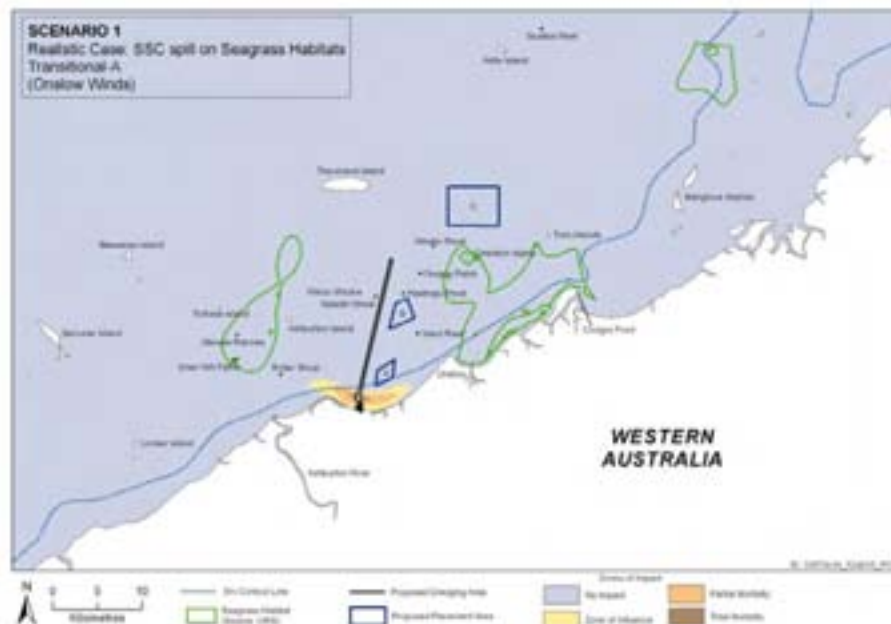


Figure B.19 Scenario 1, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

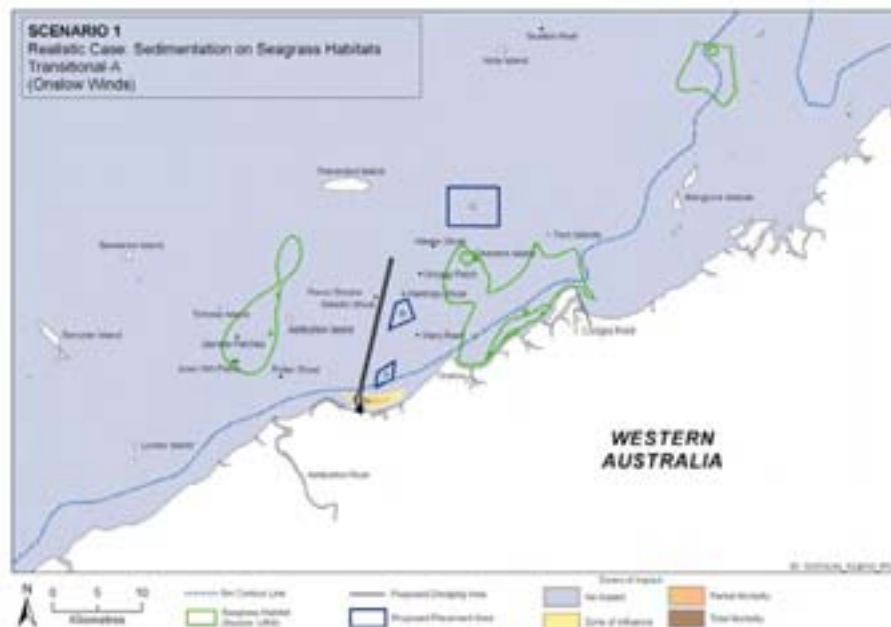


Figure B.20 Scenario 1, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds



Table B.5 Summary of Impacts at Sensitive Receptors for Scenario 1, Transitional-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.1.6 Transitional-B, Realistic Spill Scenario**

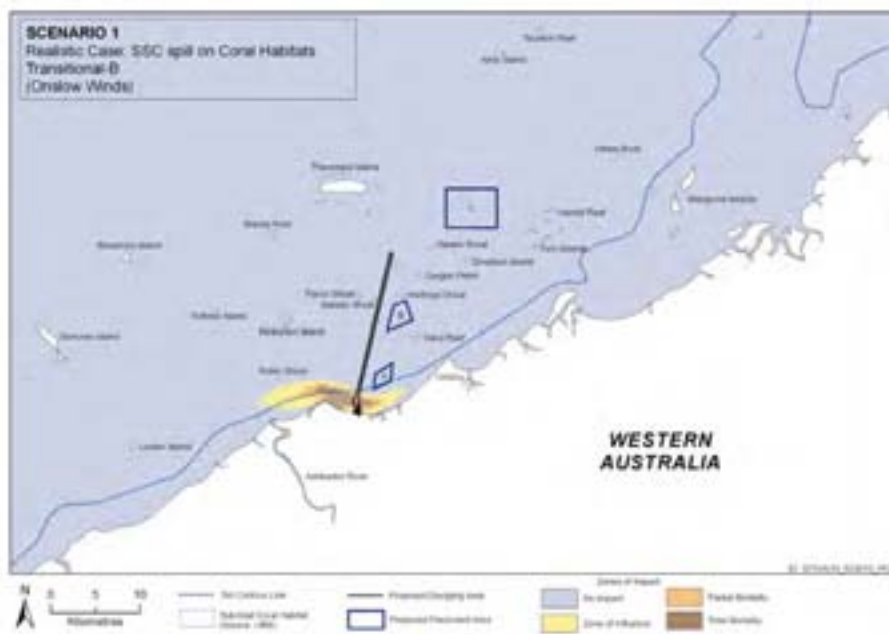


Figure B.21 Scenario 1, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

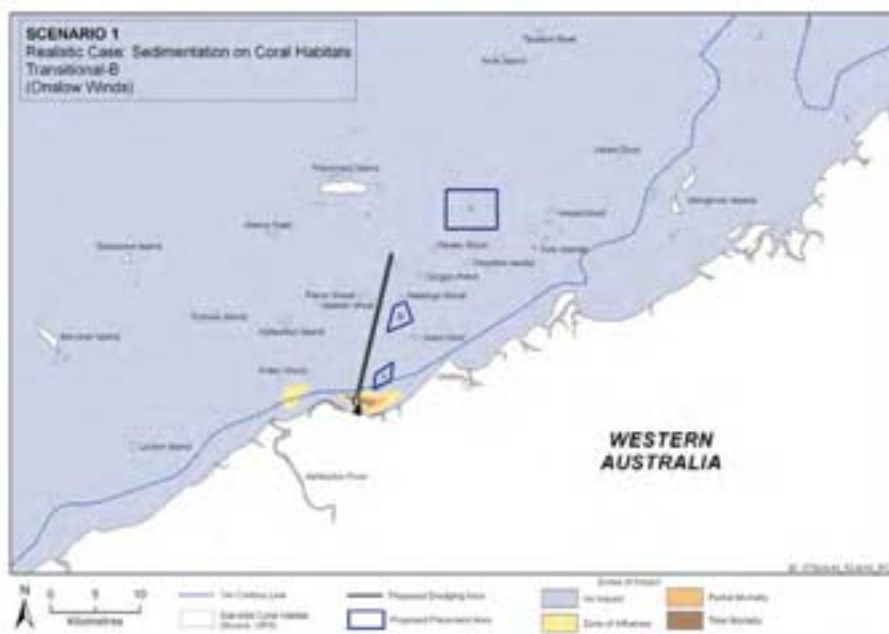


Figure B.22 Scenario 1, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds



Figure B.23 Scenario 1, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds



Figure B.24 Scenario 1, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-19



Table B.6 Summary of Impacts at Sensitive Receptors for Scenario 1, Transitional-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.1.7 Summer-A, Worst Case Spill Scenario**



Figure B.25 Scenario 1, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

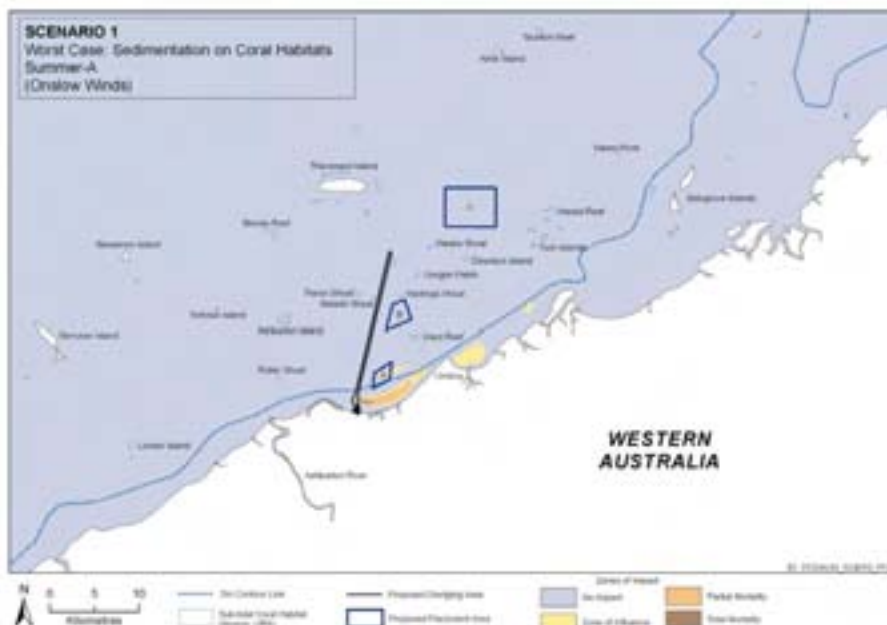


Figure B.26 Scenario 1, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds



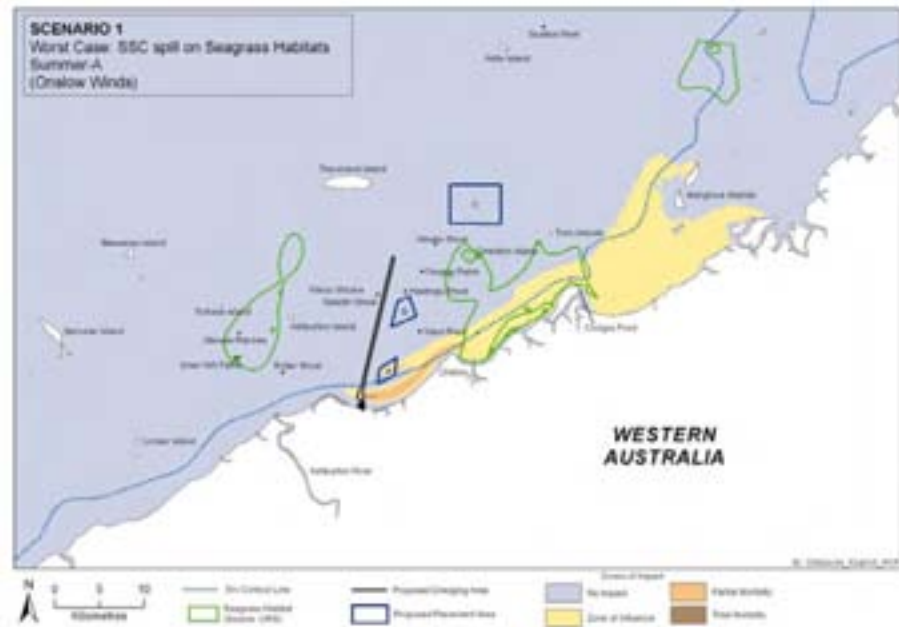


Figure B.27 Scenario 1, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

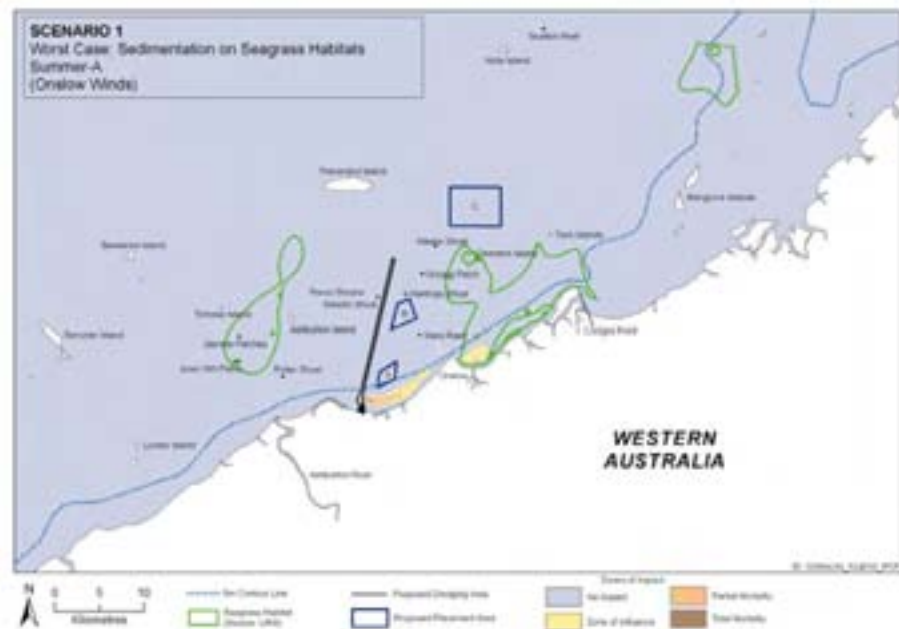


Figure B.28 Scenario 1, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds



Table B.7 Summary of Impacts at Sensitive Receptors for Scenario 1, Summer-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.2	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.2	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.5	5.1	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.4	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	1.2	0.3	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	3.2	19.0	2.7	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	3.1	16.9	0.6	0.0	0.0	
33	S of Tw in Islands	314942	7616406	1.2	0.4	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.2	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.1.8 Summer-B, Worst Case Spill Scenario**

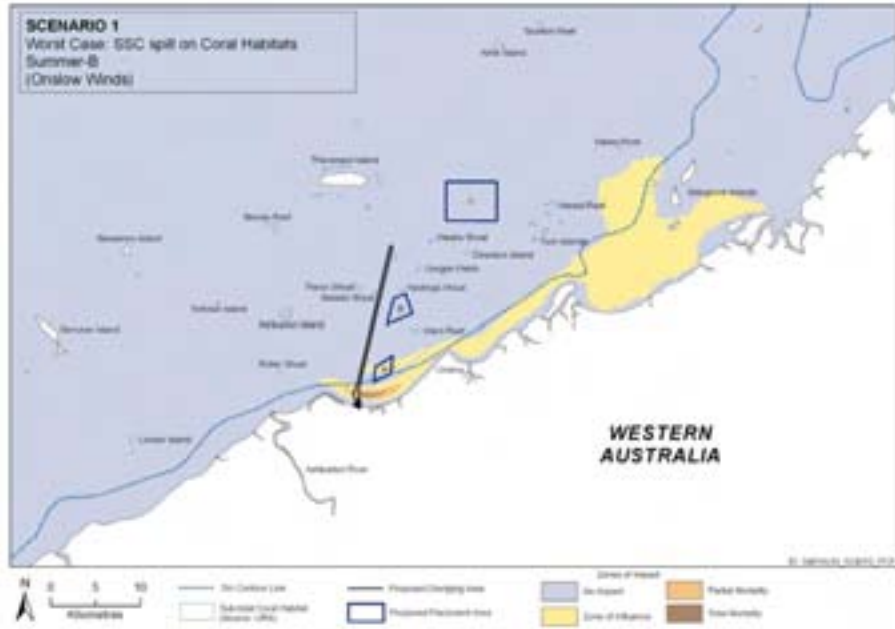


Figure B.29 Scenario 1, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

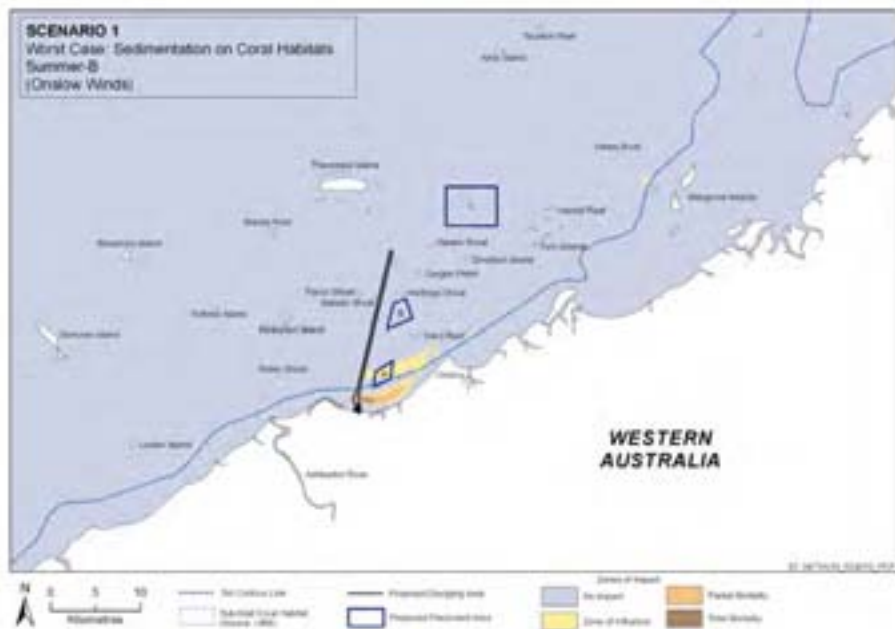


Figure B.30 Scenario 1, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

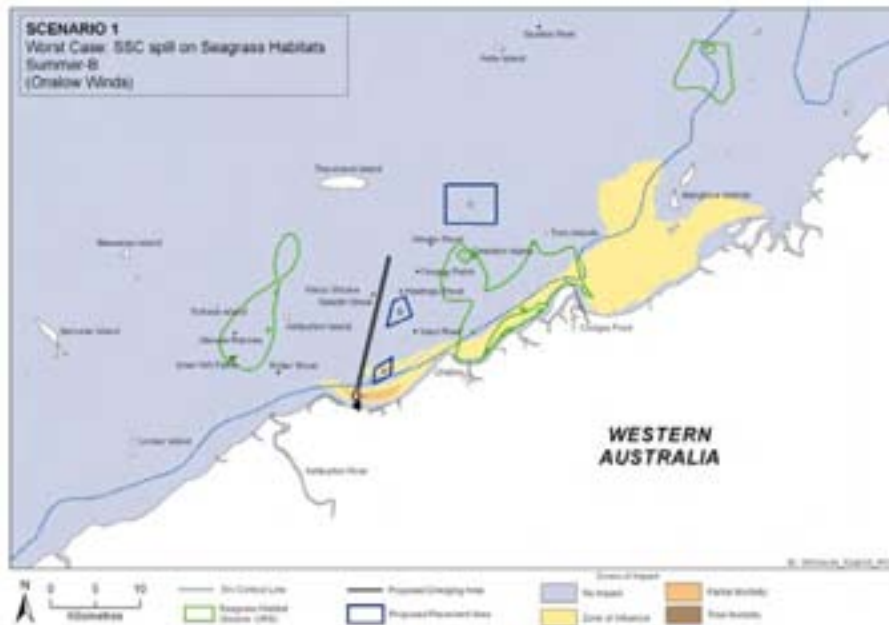


Figure B.31 Scenario 1, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds



Figure B.32 Scenario 1, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

B-25



Table B.8 Summary of Impacts at Sensitive Receptors for Scenario 1, Summer-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	2.0	14.3	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.9	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.8	0.1	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	1.5	8.6	3.1	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	1.4	7.4	1.6	0.0	0.1	
33	S of Tw in Islands	314942	7616406	0.7	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.1.9 Winter-A, Worst Case Spill Scenario**

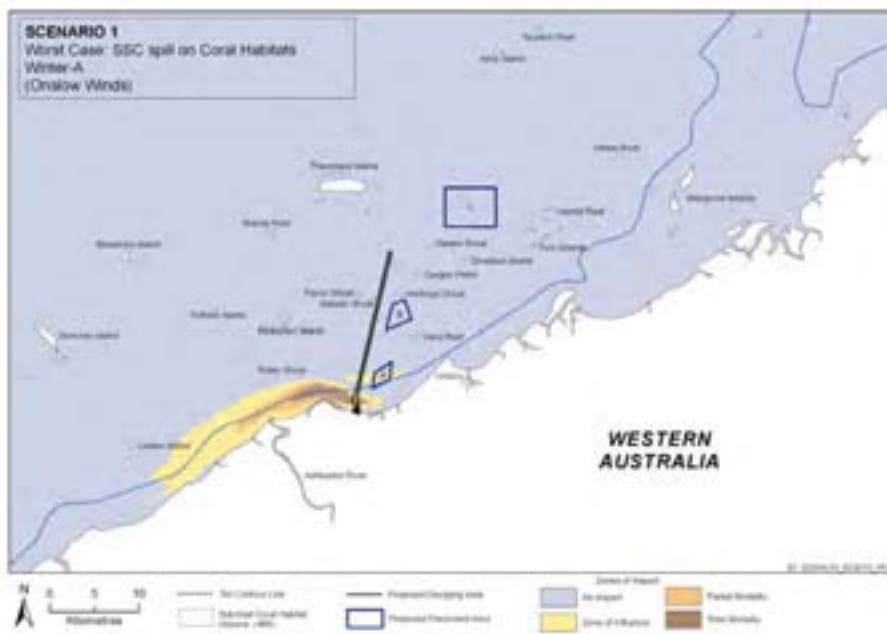


Figure B.33 Scenario 1, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

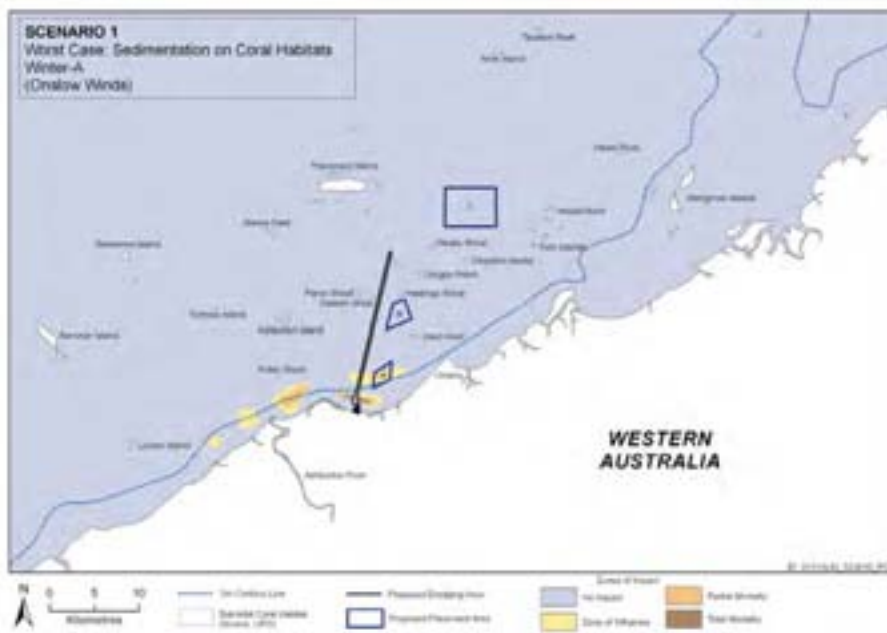


Figure B.34 Scenario 1, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

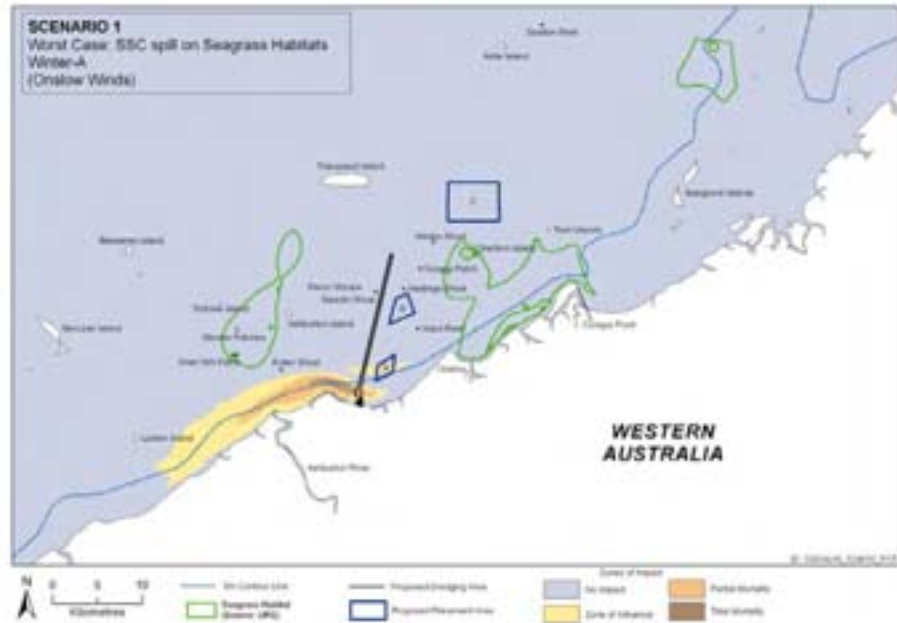


Figure B.35 Scenario 1, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

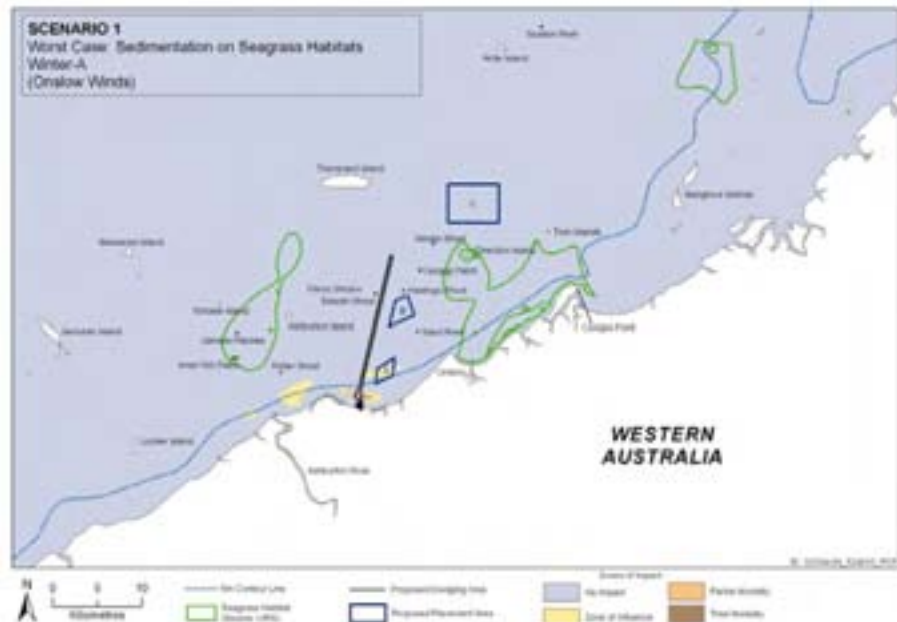


Figure B.36 Scenario 1, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds



Table B.9 Summary of Impacts at Sensitive Receptors for Scenario 1, Winter-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**B.1.10 Winter-B, Worst Case Spill Scenario**

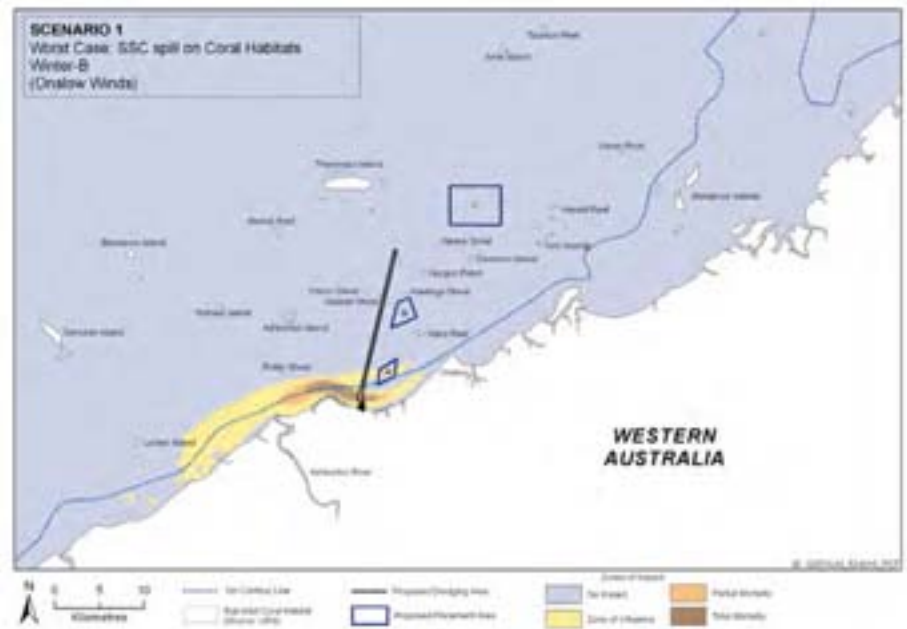


Figure B.37 Scenario 1, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

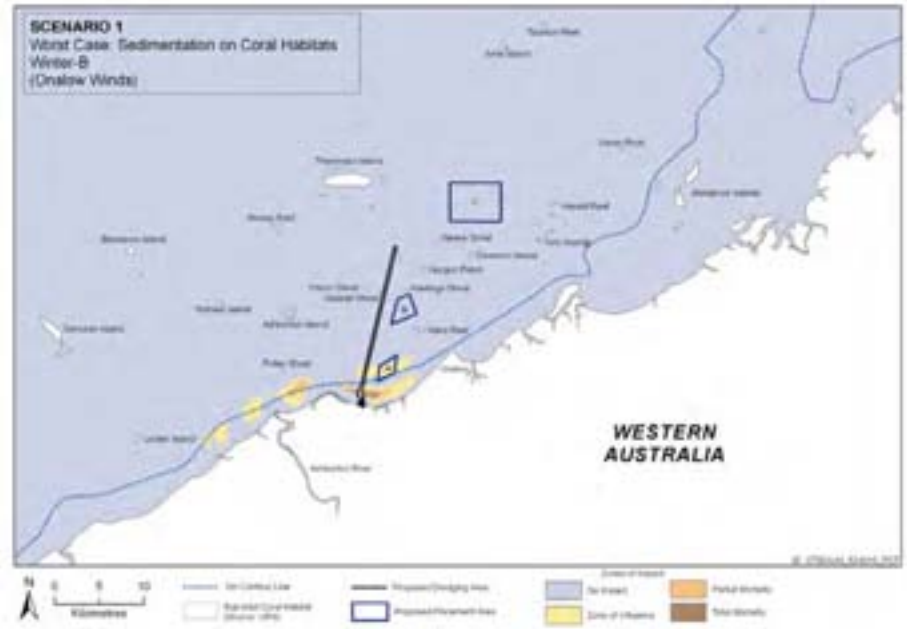


Figure B.38 Scenario 1, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

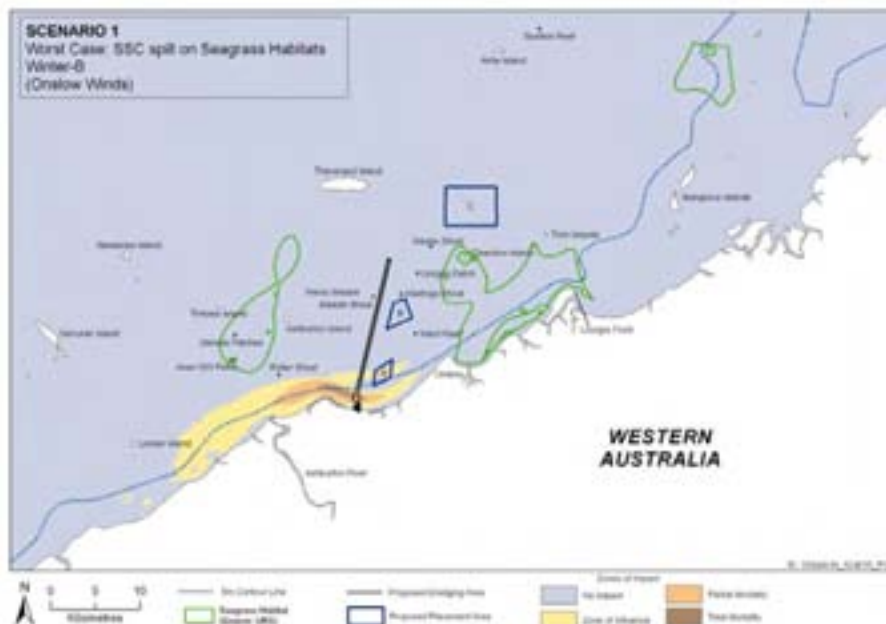


Figure B.39 Scenario 1, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

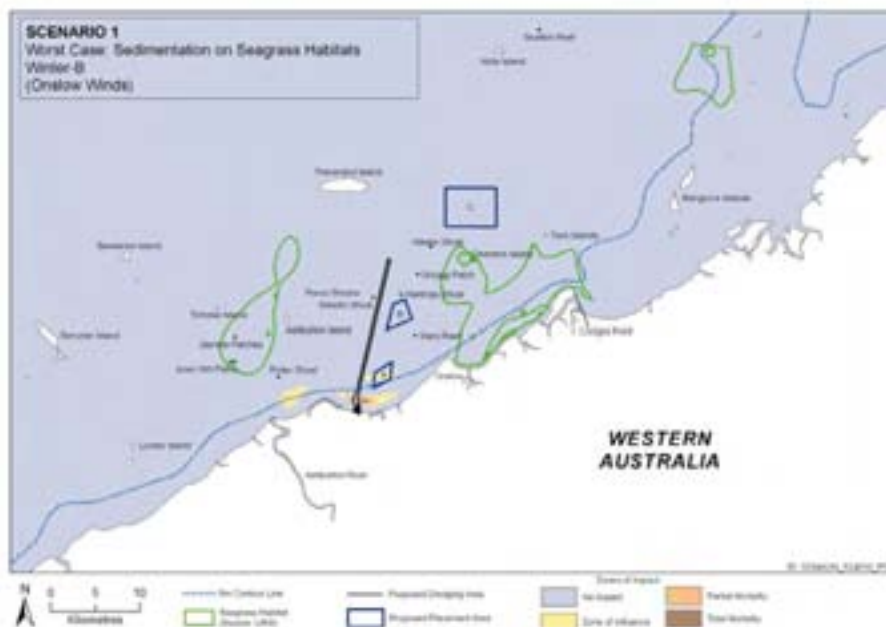


Figure B.40 Scenario 1, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-31



Table B.10 Summary of Impacts at Sensitive Receptors for Scenario 1, Winter-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.4	0.3	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.1.11 Transitional-A, Worst Case Spill Scenario**



Figure B.41 Scenario 1, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

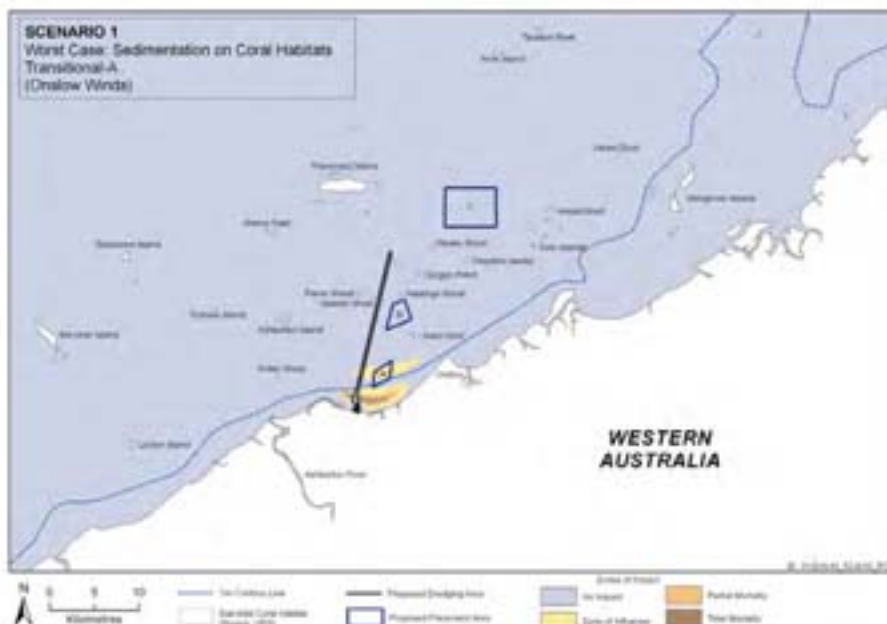


Figure B.42 Scenario 1, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

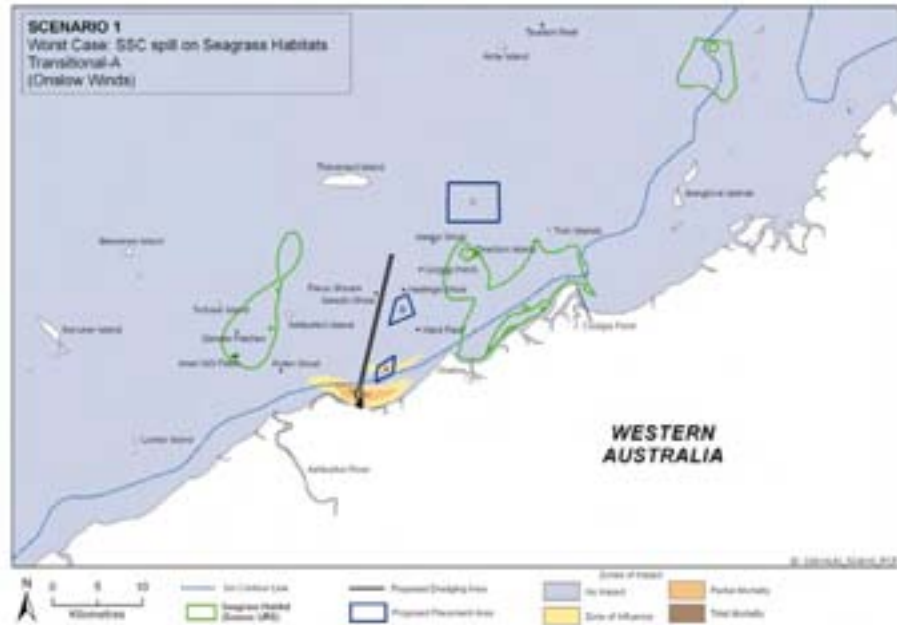


Figure B.43 Scenario 1, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

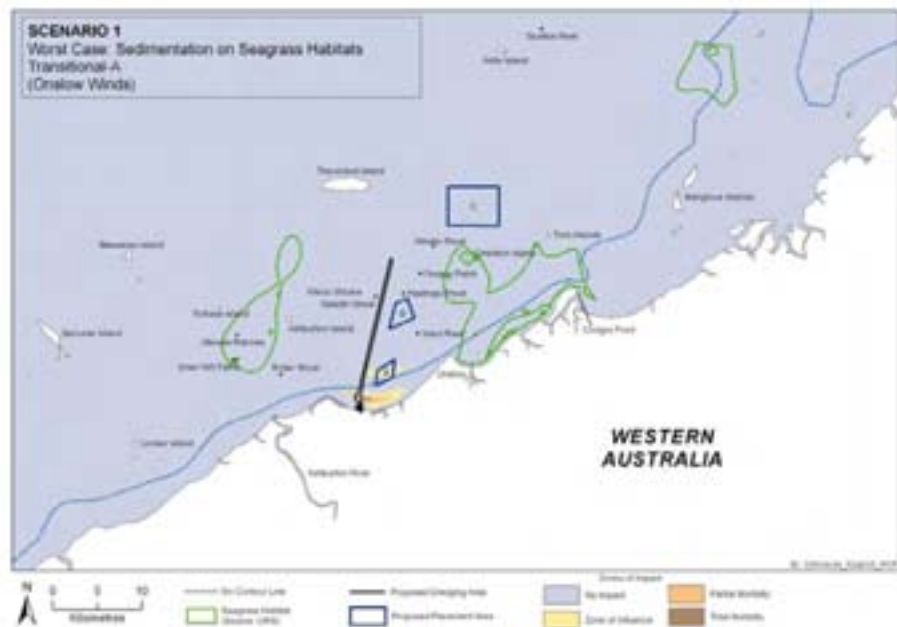


Figure B.44 Scenario 1, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds



Table B.11 Summary of Impacts at Sensitive Receptors for Scenario 1, Transitional-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608668	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.1.12 Transitional-B, Worst Case Spill Scenario**



Figure B.45 Scenario 1, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

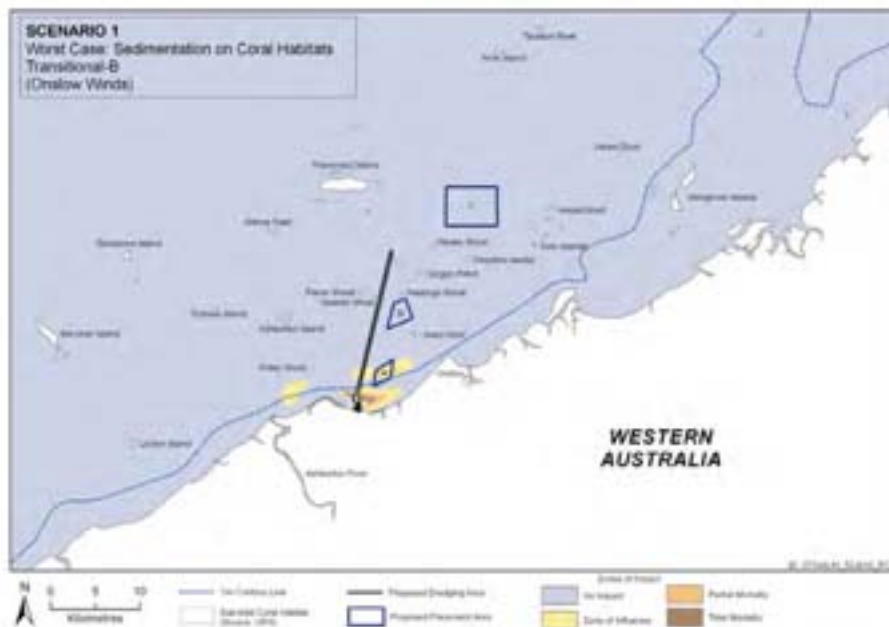


Figure B.46 Scenario 1, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

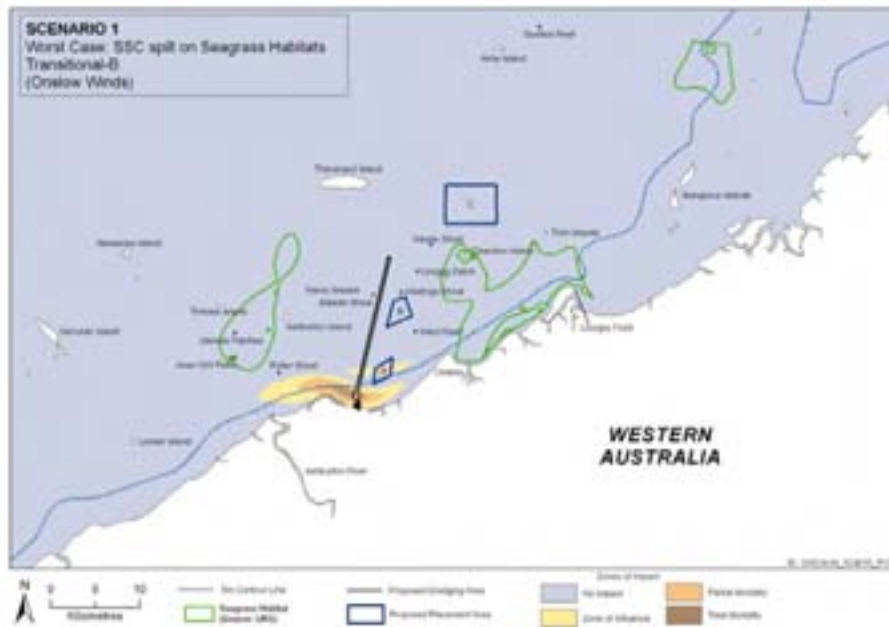


Figure B.47 Scenario 1, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

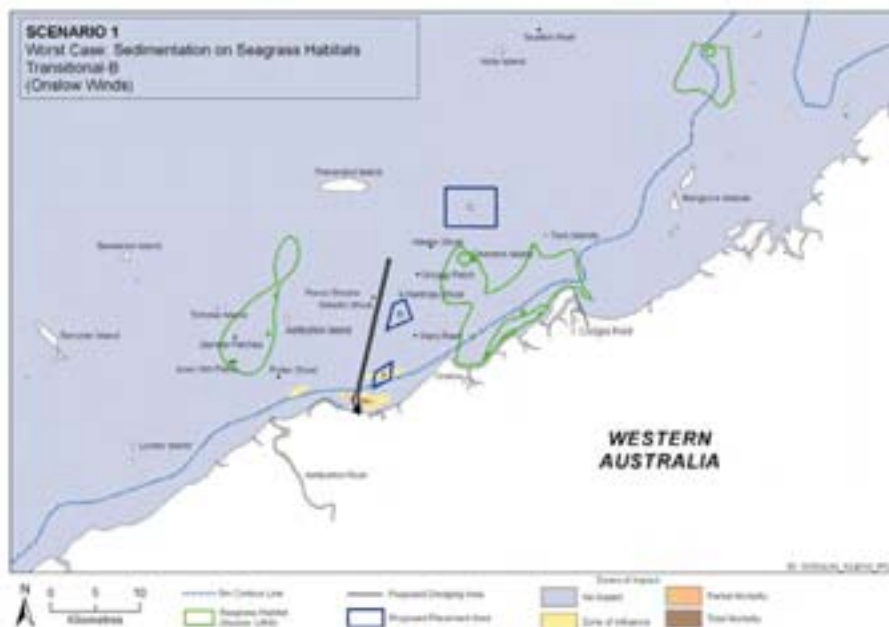


Figure B.48 Scenario 1, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds



B-37



Table B.12 Summary of Impacts at Sensitive Receptors for Scenario 1, Transitional-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.2	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.4	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.4	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.2 Dredging Scenario 2**

**B.2.1 Summer-A, Realistic Spill Scenario**



Figure B.49 Scenario 2, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

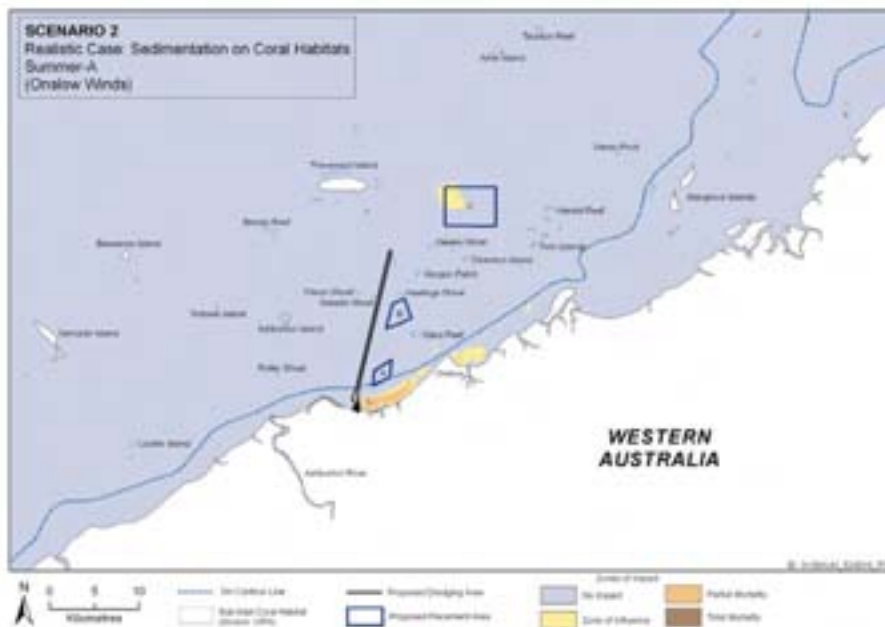


Figure B.50 Scenario 2, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

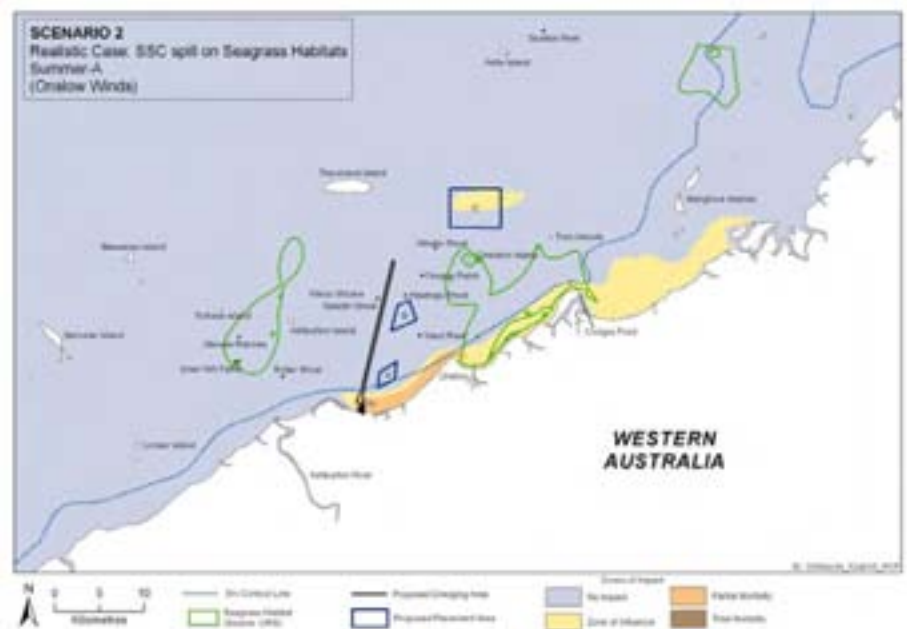


Figure B.51 Scenario 2, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

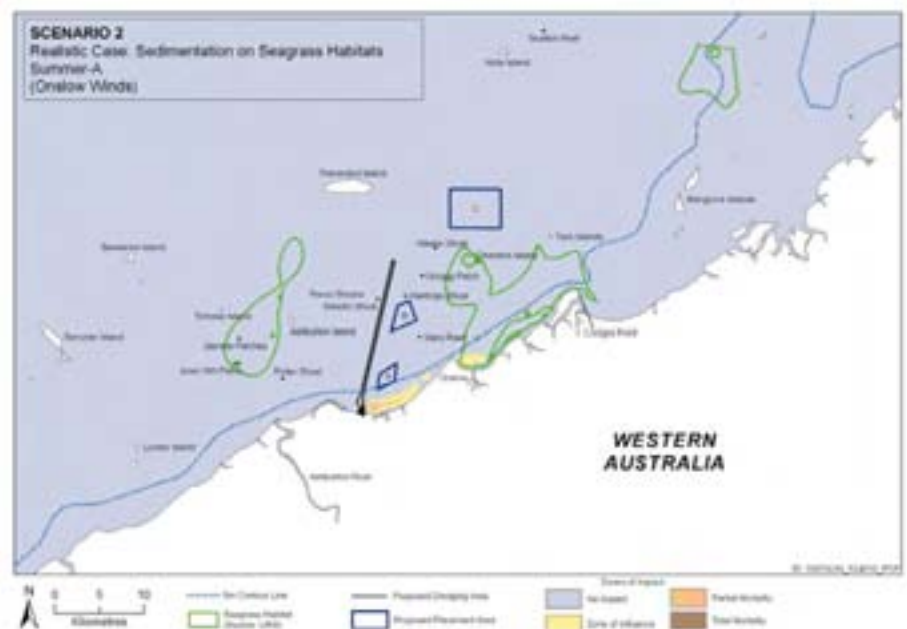


Figure B.52 Scenario 2, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-40



Table B.13 Summary of Impacts at Sensitive Receptors for Scenario 2, Summer-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.6	0.1	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.1	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.6	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	20.0	
30	SE of Direction Island	309948	7612830	0.3	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	3.6	25.9	3.4	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	3.4	21.2	0.7	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.3	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-41



**B.2.2 Summer-B, Realistic Spill Scenario**



Figure B.53 Scenario 2, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

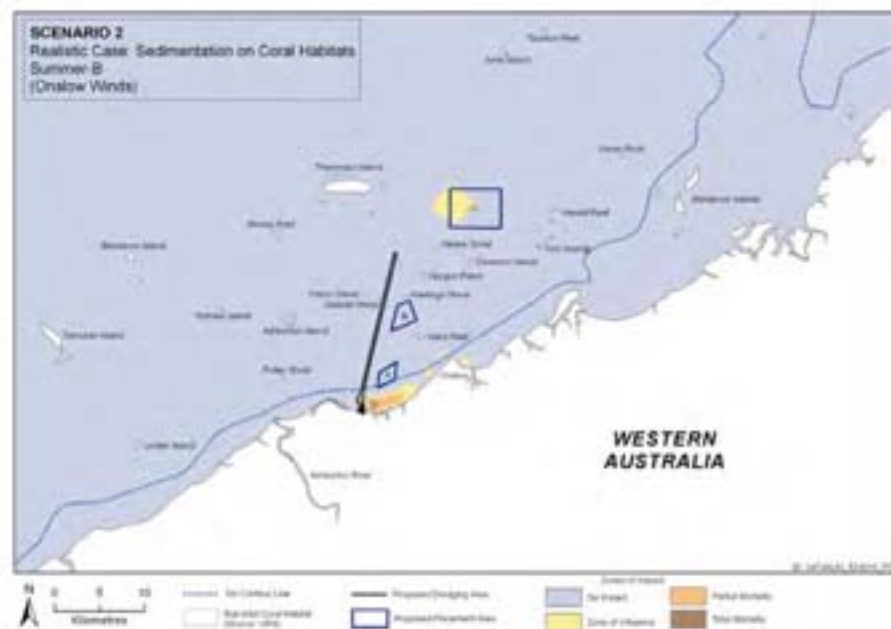


Figure B.54 Scenario 2, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

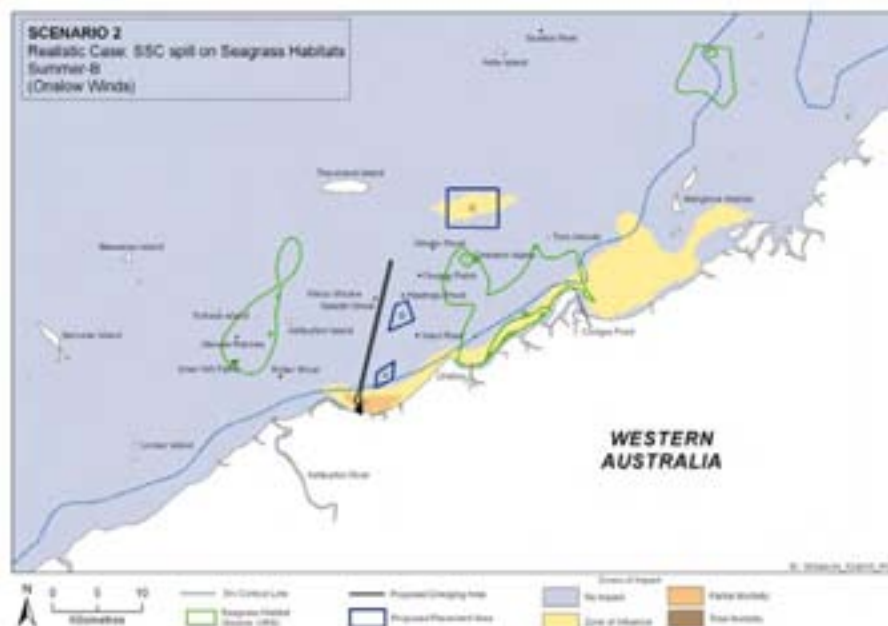


Figure B.55 Scenario 2, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

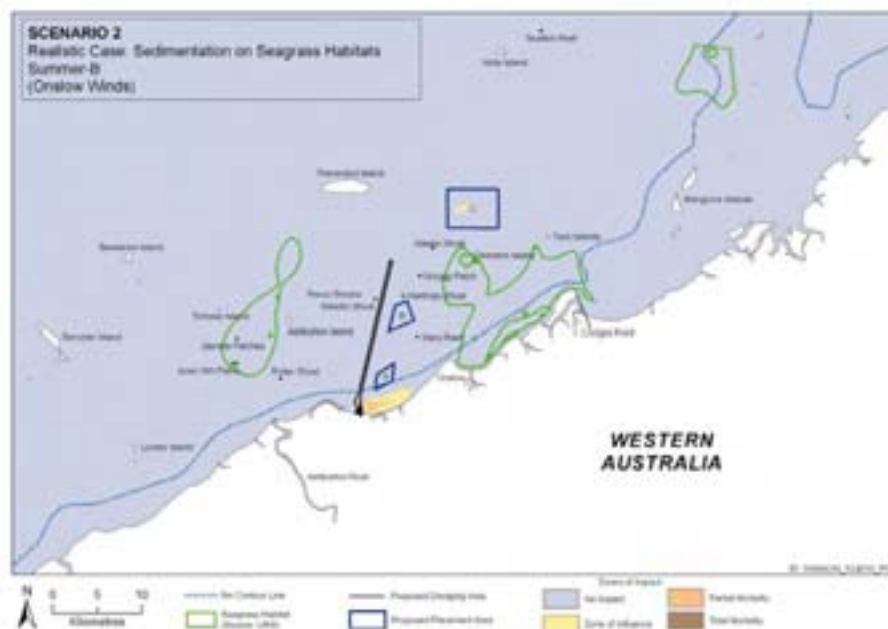


Figure B.56 Scenario 2, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-43



Table B.14 Summary of Impacts at Sensitive Receptors for Scenario 2, Summer-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.1	3.9	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.4	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.4	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.3	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	1.5	7.9	2.2	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	1.4	8.5	1.3	0.0	0.1	
33	S of Tw in Islands	314942	7616406	0.3	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.2.3 Winter-A, Realistic Spill Scenario**

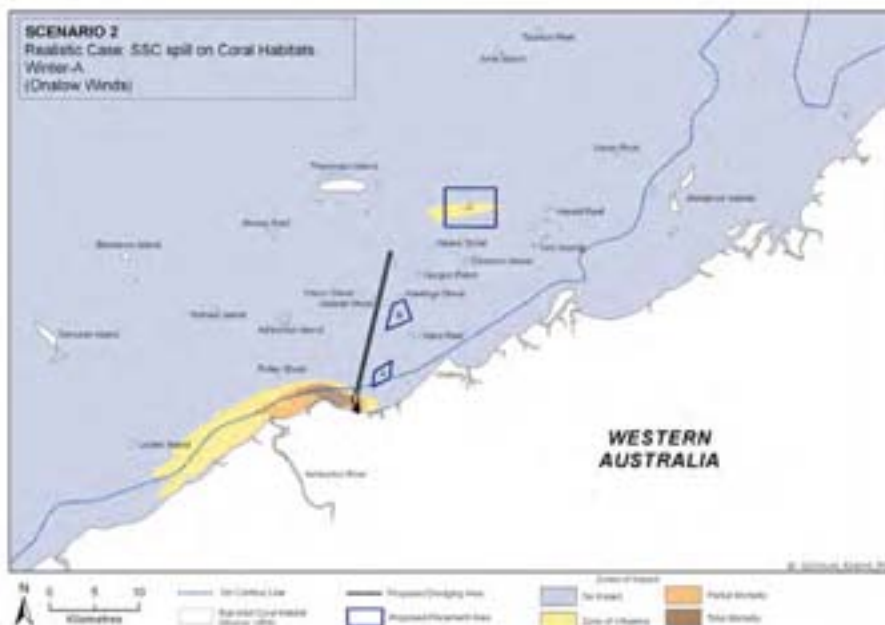


Figure B.57 Scenario 2, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

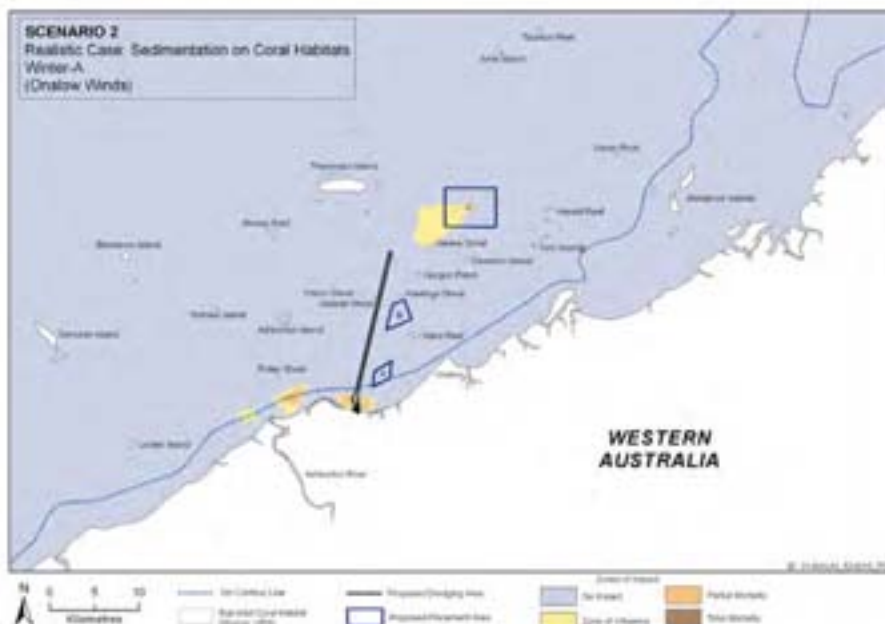


Figure B.58 Scenario 2, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds



B-45

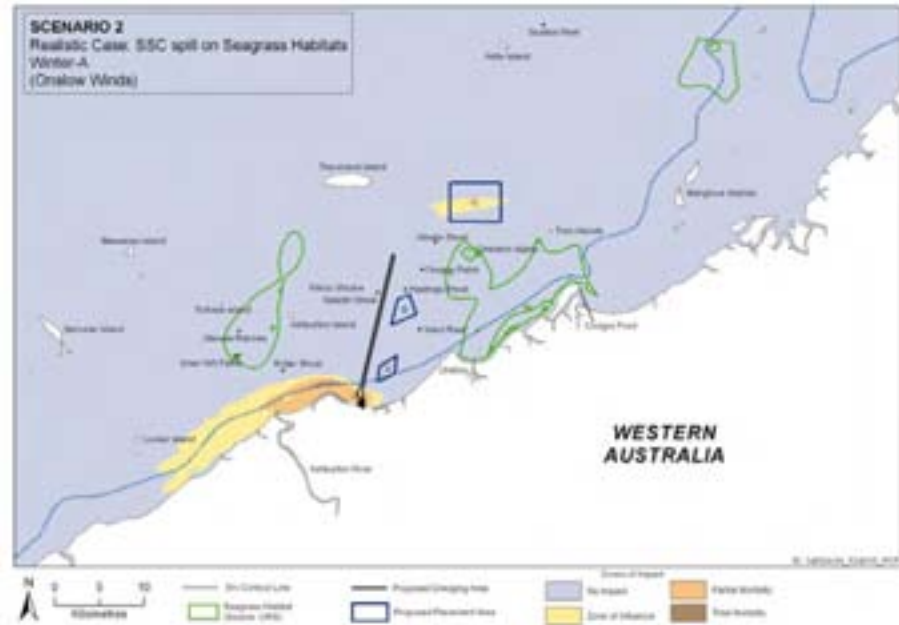


Figure B.59 Scenario 2, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds



Figure B.60 Scenario 2, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds



Table B.15 Summary of Impacts at Sensitive Receptors for Scenario 2, Winter-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.1	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.2	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.1	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.3	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.5	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.2.4 Winter-B, Realistic Spill Scenario**

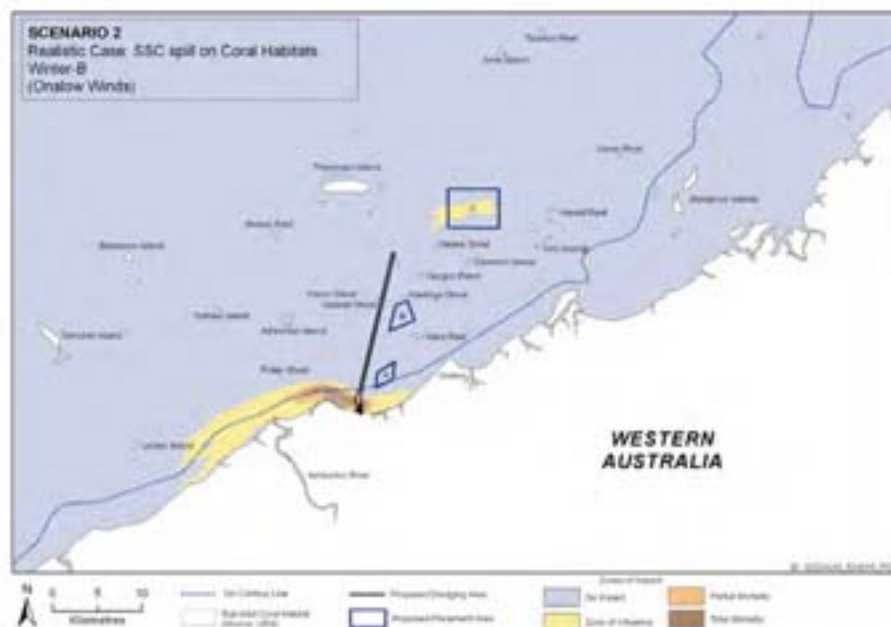


Figure B.61 Scenario 2, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

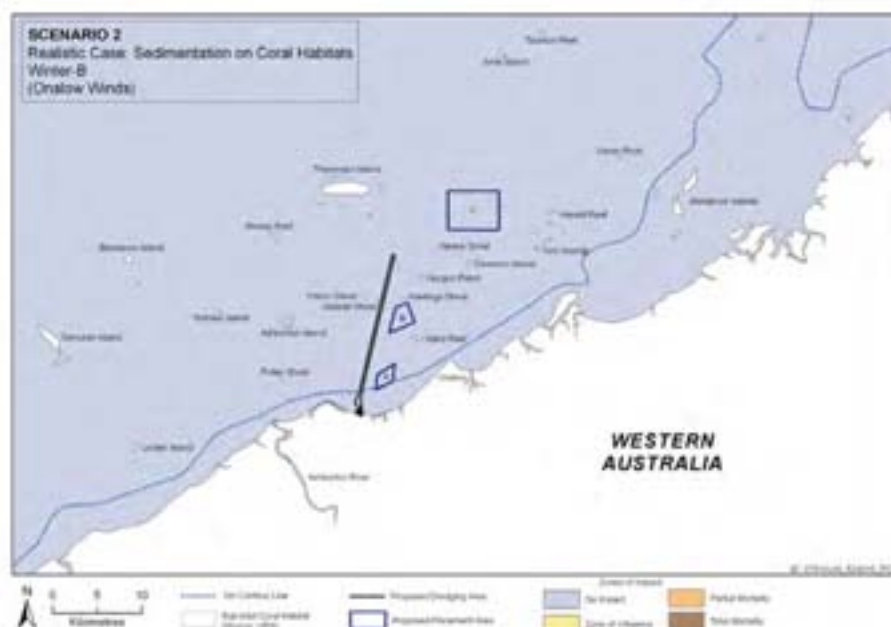


Figure B.62 Scenario 2, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

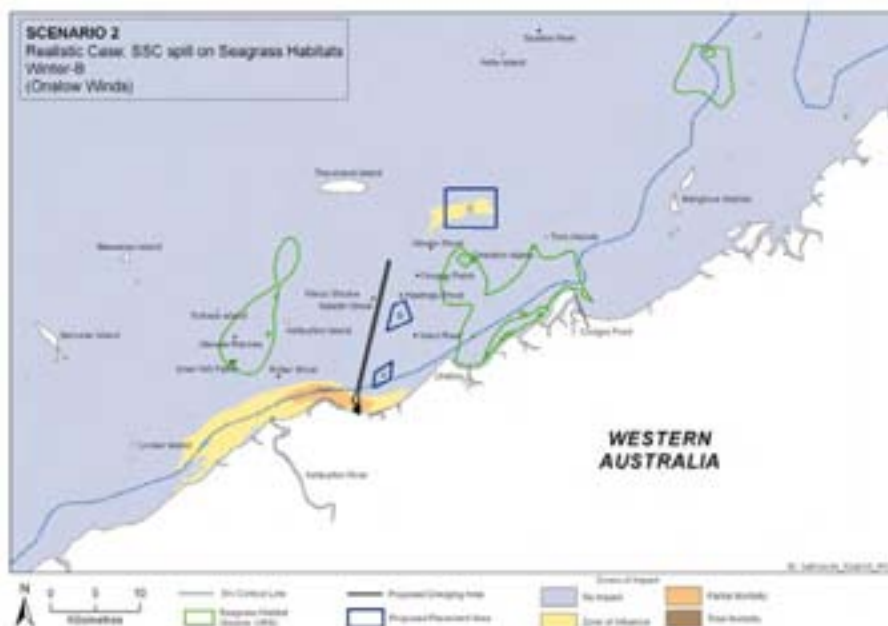


Figure B.63 Scenario 2, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

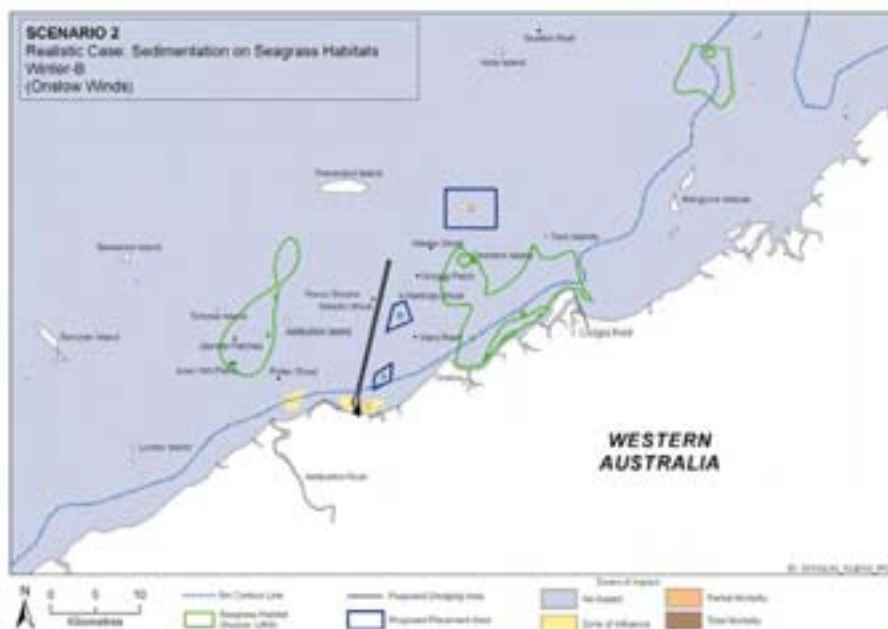


Figure B.64 Scenario 2, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

B-49



Table B.16 Summary of Impacts at Sensitive Receptors for Scenario 2, Winter-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.3	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.7	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.4	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.6	0.0	0.0	0.0	0.1	
9	Hastings Shoal	298803	7613488	0.2	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.7	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.5	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.2.5 Transitional-A, Realistic Spill Scenario**

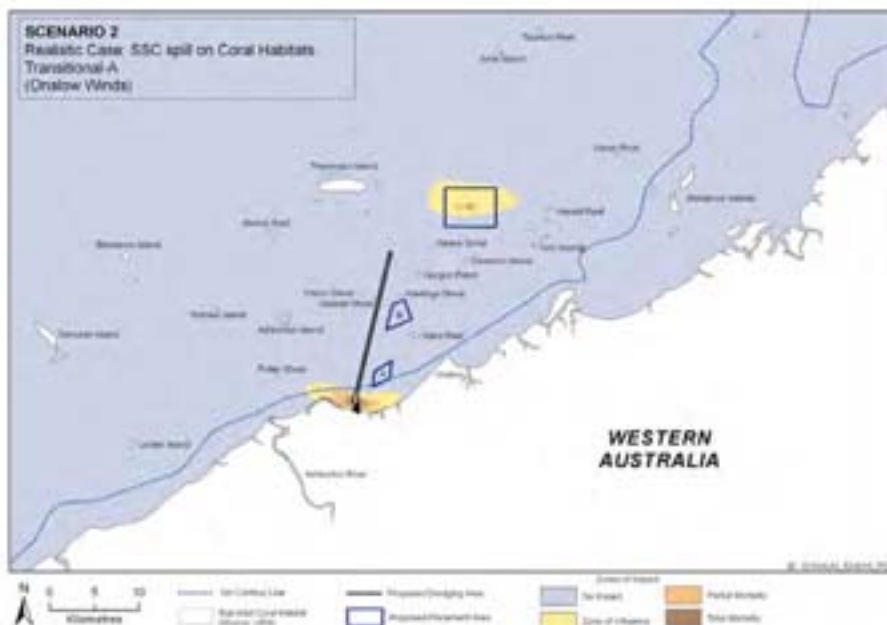


Figure B.65 Scenario 2, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

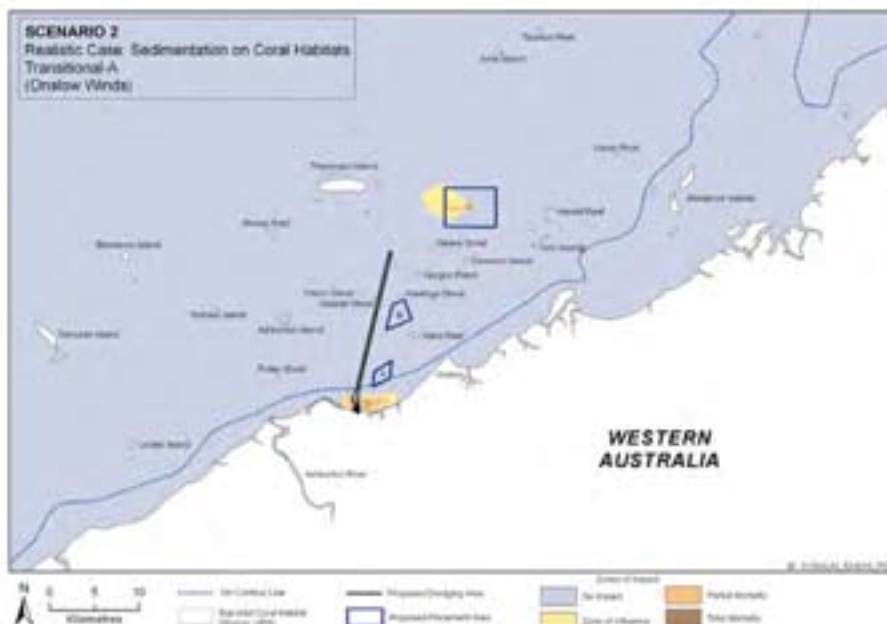


Figure B.66 Scenario 2, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

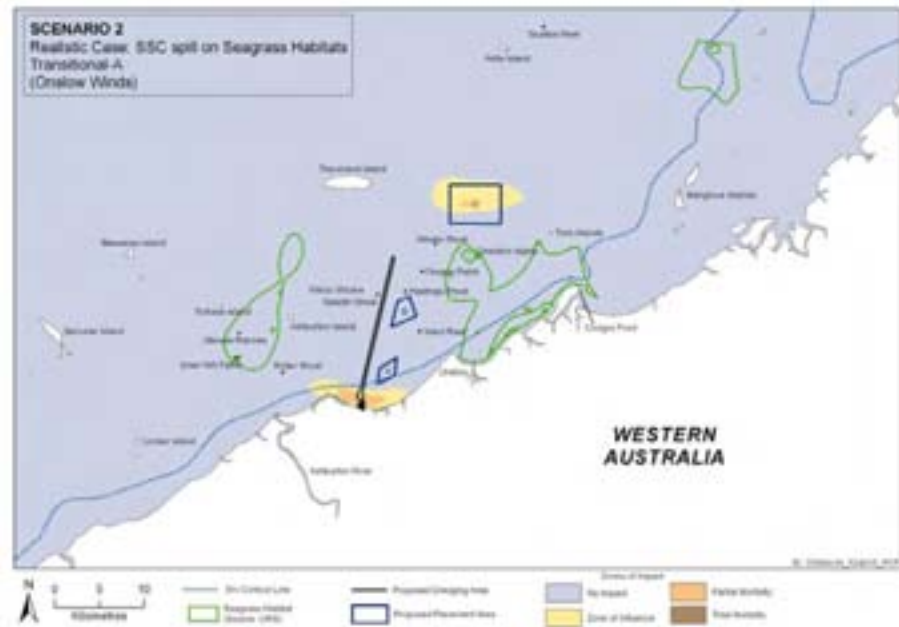


Figure B.67 Scenario 2, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds



Figure B.68 Scenario 2, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds



Table B.17 Summary of Impacts at Sensitive Receptors for Scenario 2, Transitional-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**B.2.6 Transitional-B, Realistic Spill Scenario**

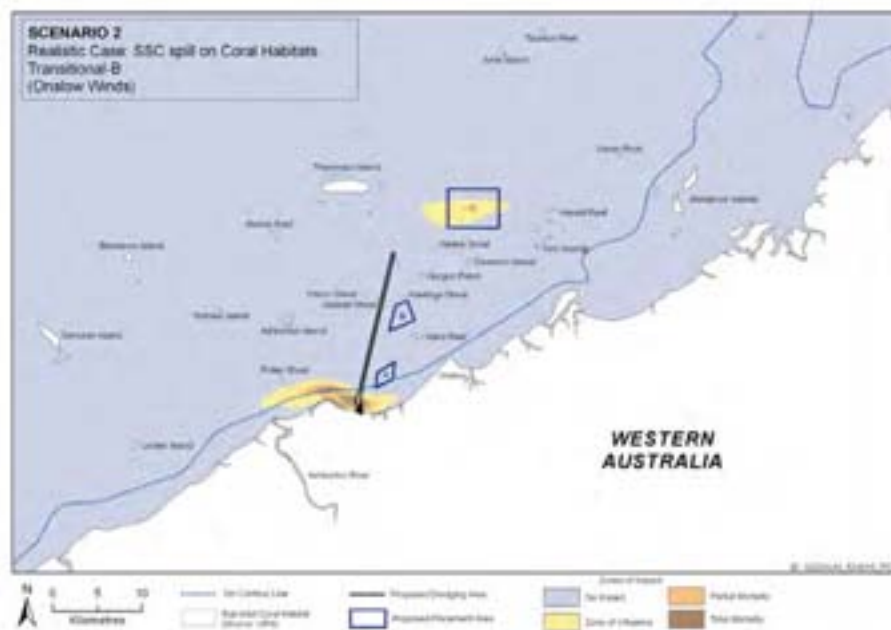


Figure B.69 Scenario 2, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

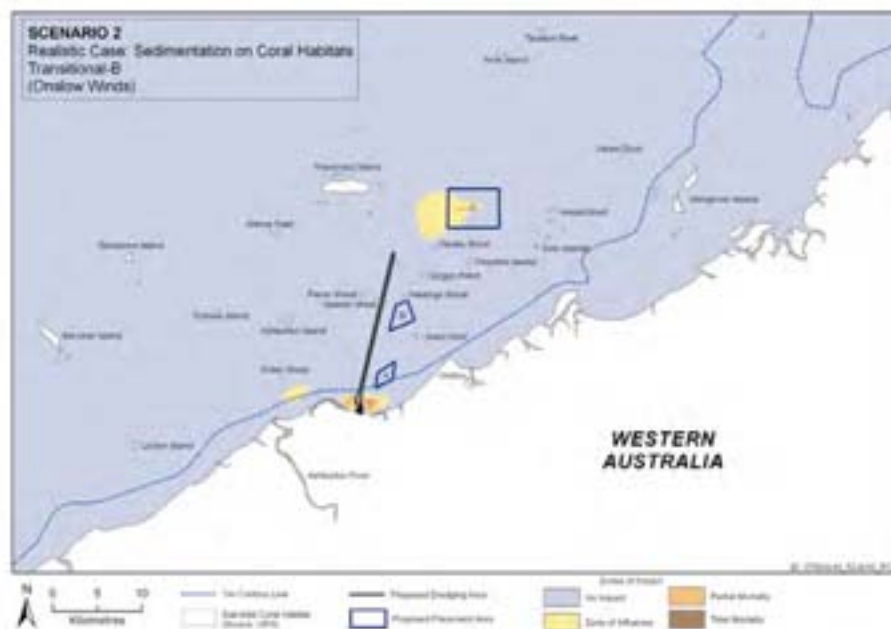


Figure B.70 Scenario 2, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

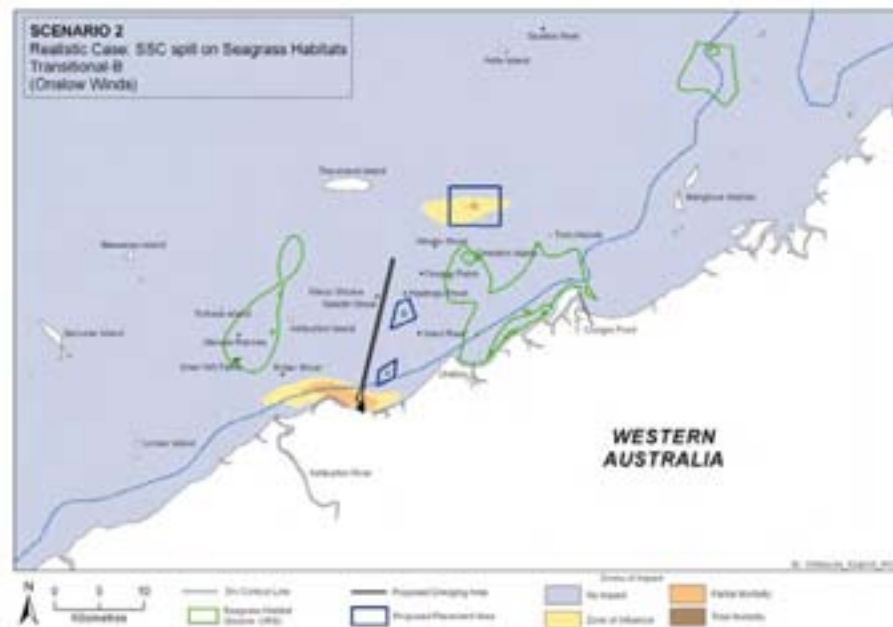


Figure B.71 Scenario 2, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

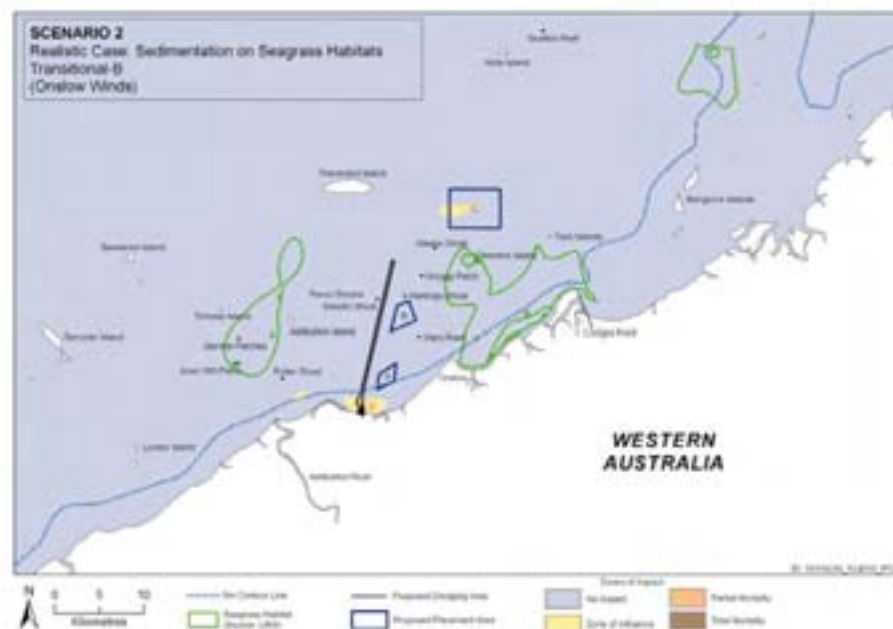


Figure B.72 Scenario 2, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-55



Table B.18 Summary of Impacts at Sensitive Receptors for Scenario 2, Transitional-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.2	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.2	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.4	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.2.7 Summer-A, Worst Case Spill Scenario**

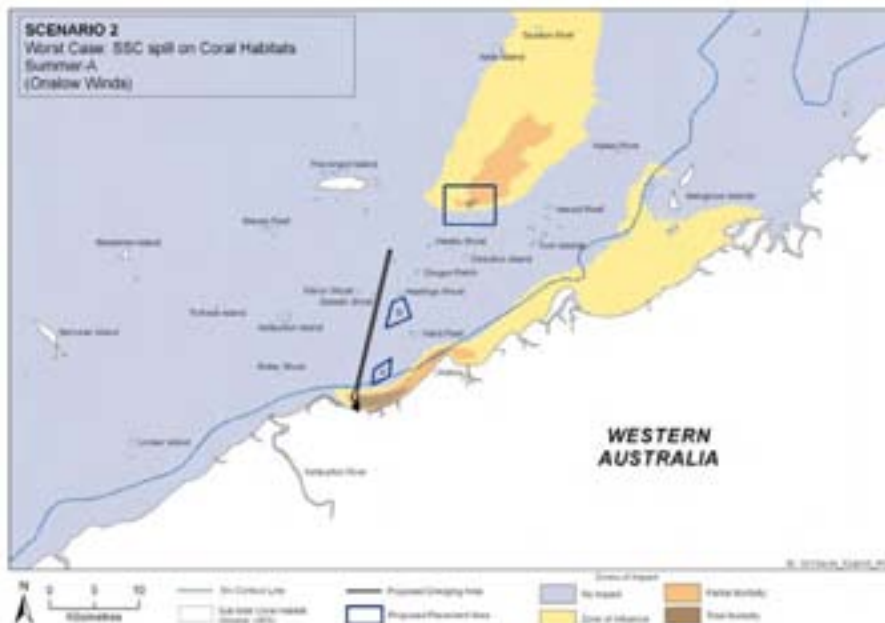


Figure B.73 Scenario 2, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds



Figure B.74 Scenario 2, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

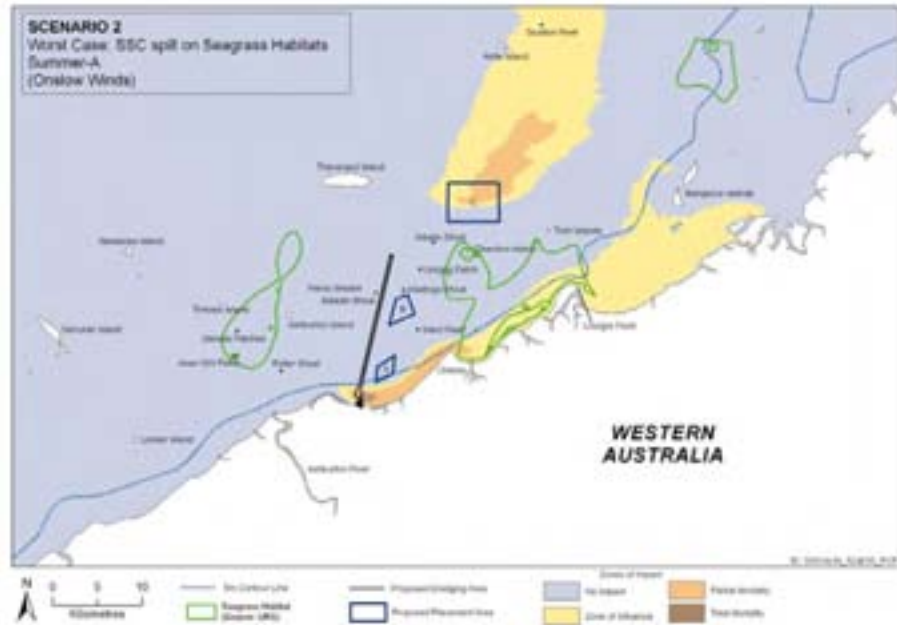


Figure B.75 Scenario 2, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

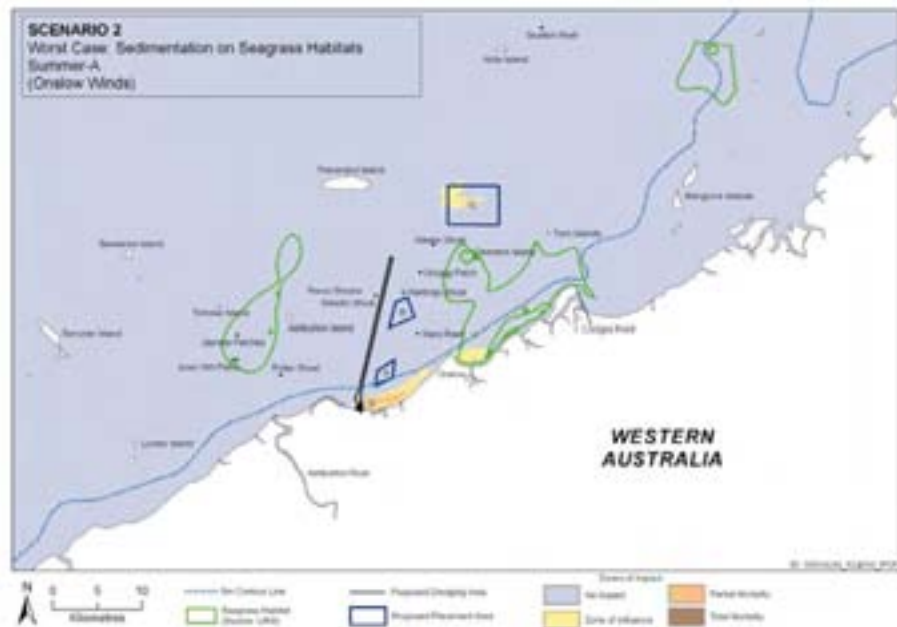


Figure B.76 Scenario 2, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds



Table B.19 Summary of Impacts at Sensitive Receptors for Scenario 2, Summer-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.8	1.6	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.2	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.8	11.1	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.3	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	4.8	38.6	6.5	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	4.6	37.0	3.7	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.4	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.2.8 Summer-B, Worst Case Spill Scenario**

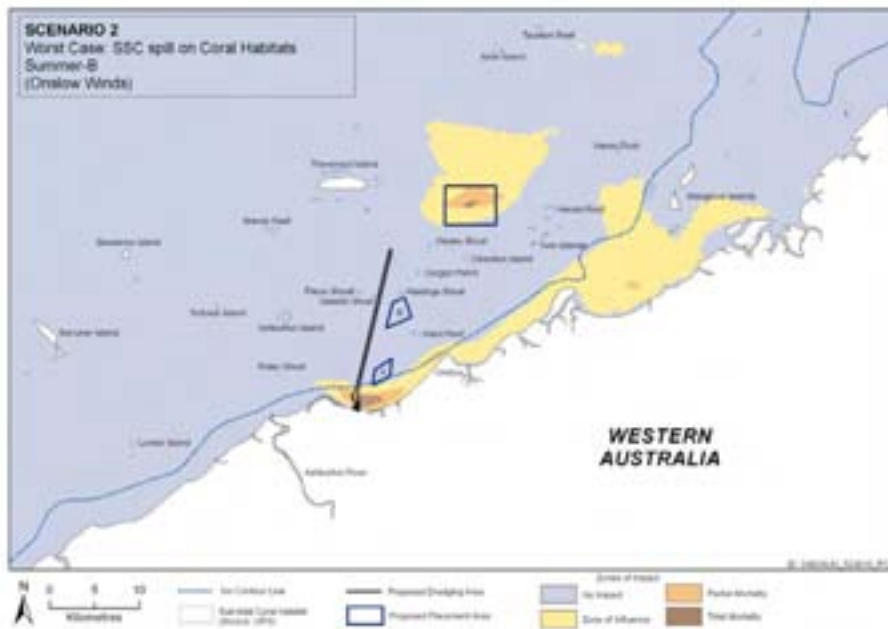


Figure B.77 Scenario 2, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

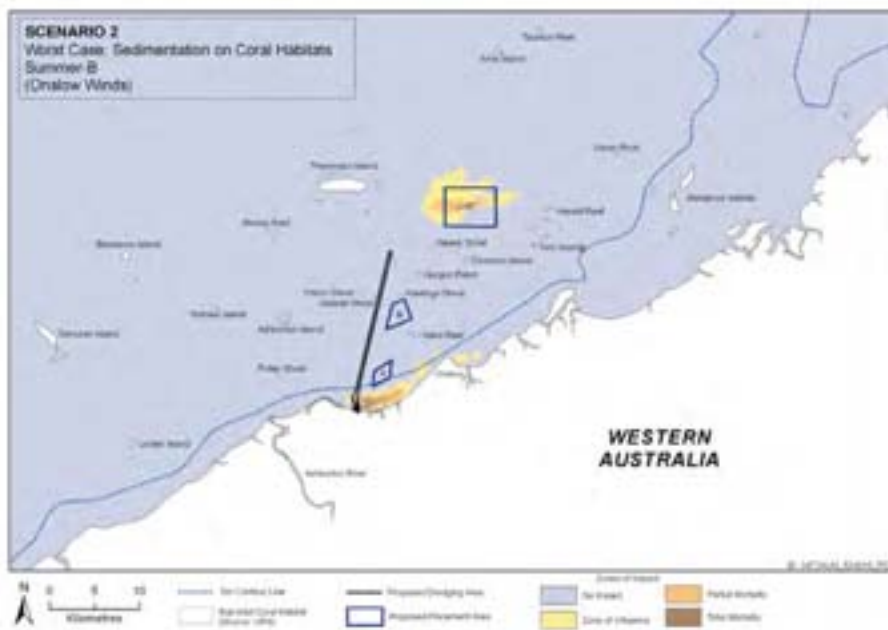


Figure B.78 Scenario 2, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

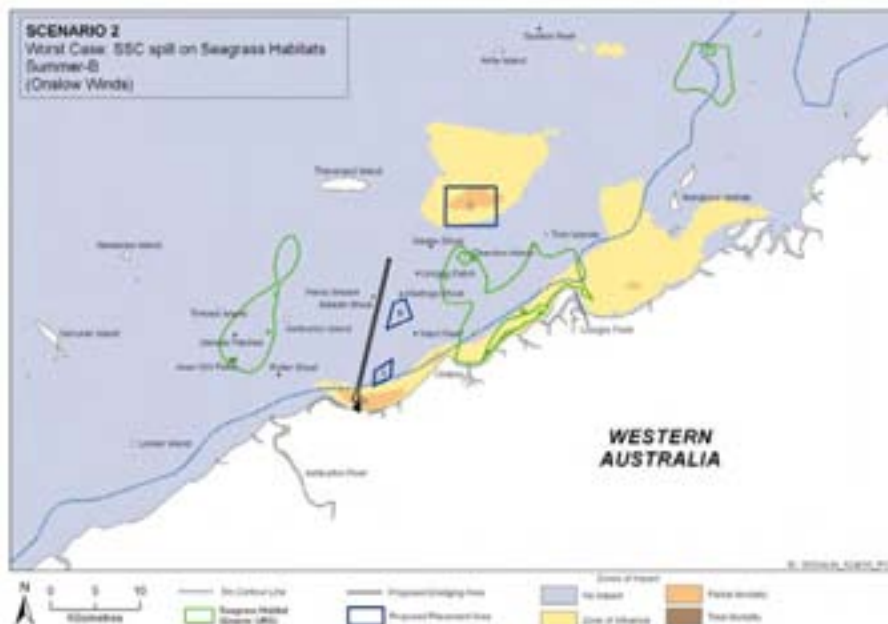


Figure B.79 Scenario 2, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

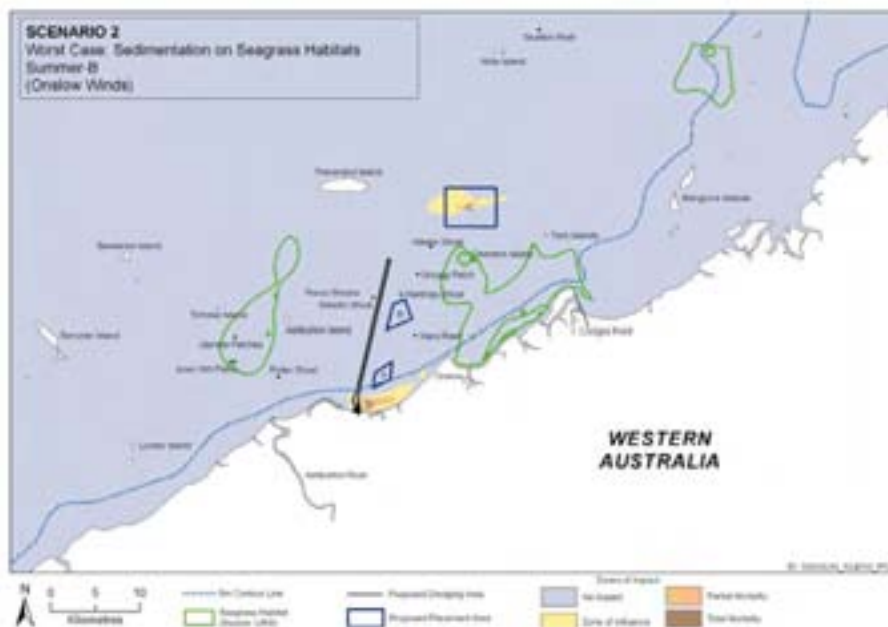


Figure B.80 Scenario 2, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds



B-61



Table B.20 Summary of Impacts at Sensitive Receptors for Scenario 2, Summer-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.5	11.4	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.6	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.6	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.1	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.4	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	2.2	10.3	3.4	0.0	0.1	
32	SW of Coolgra Point	314624	7612352	2.0	9.8	3.6	0.0	0.1	
33	S of Twin Islands	314942	7616406	0.4	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.2.9 Winter-A, Worst Case Spill Scenario**

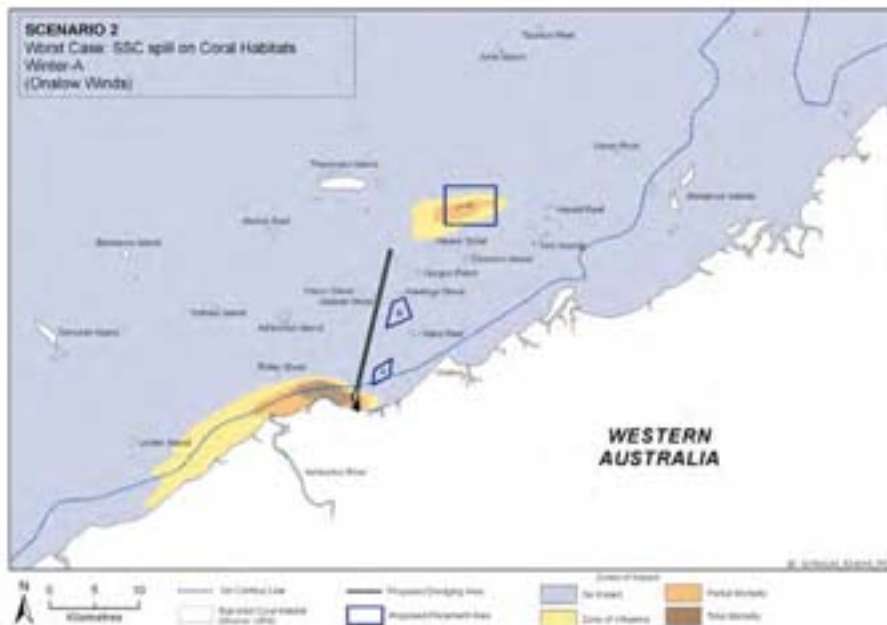


Figure B.81 Scenario 2, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

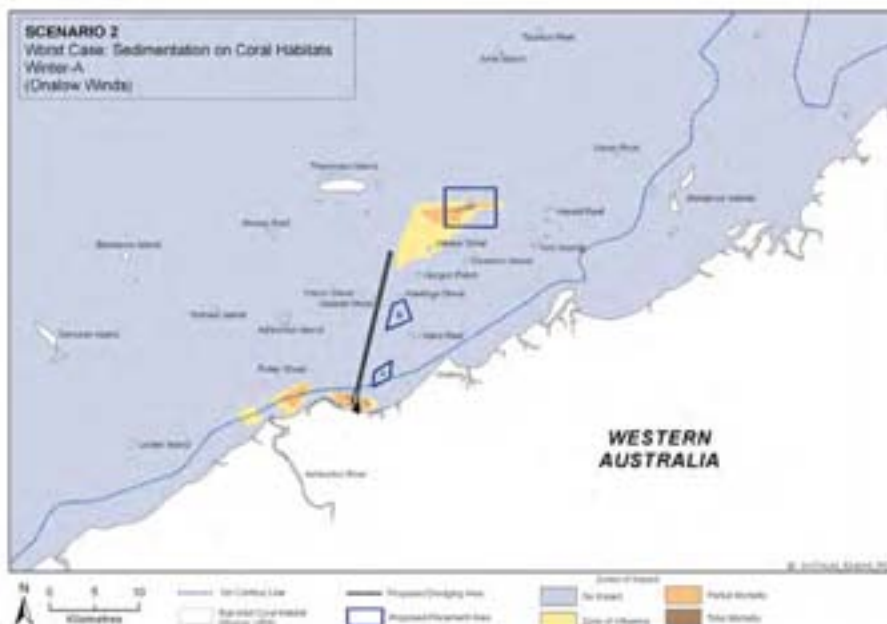


Figure B.82 Scenario 2, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

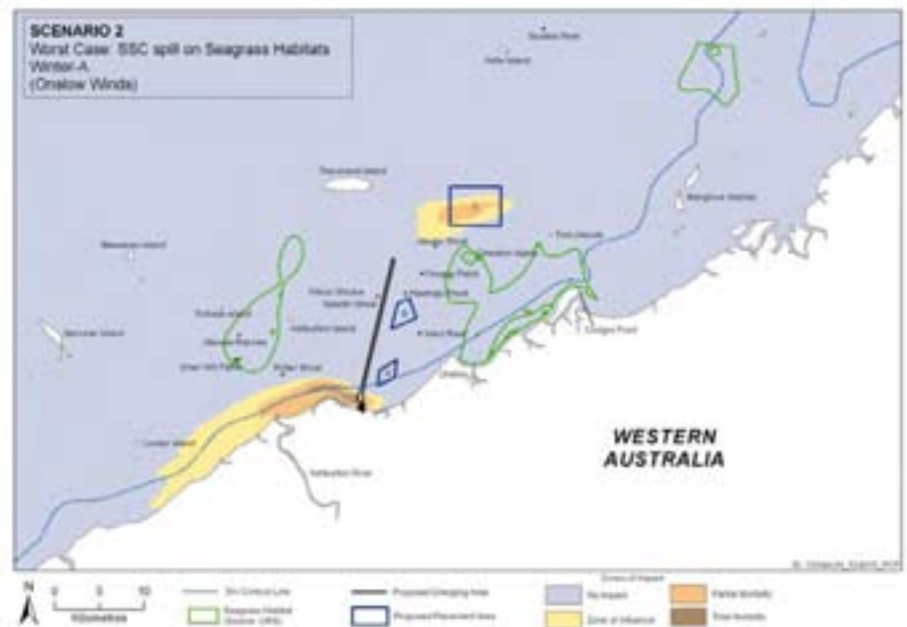


Figure B.83 Scenario 2, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

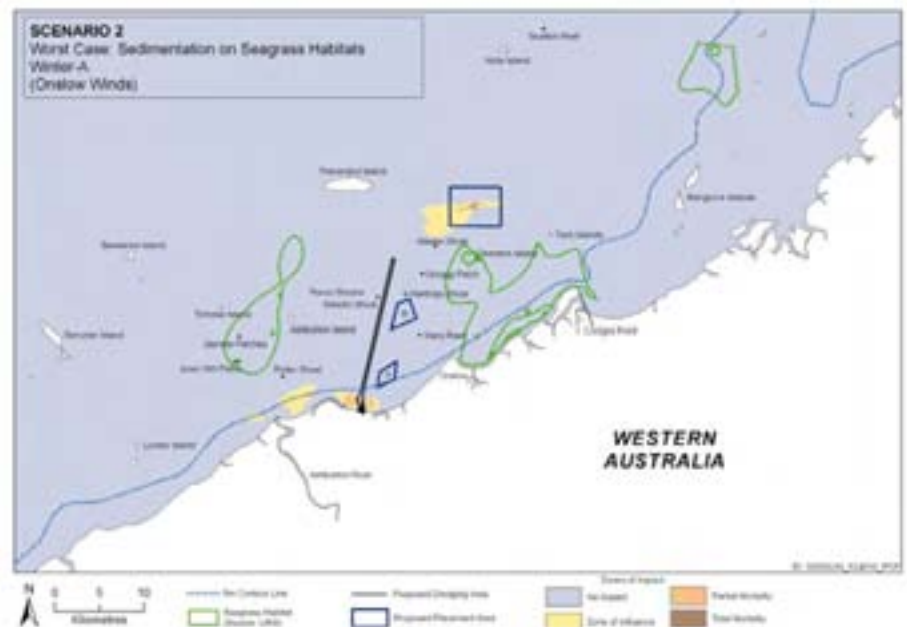


Figure B.84 Scenario 2, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds



Table B.21 Summary of Impacts at Sensitive Receptors for Scenario 2, Winter-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.4	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.6	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.2	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.0	0.9	0.0	0.0	0.1	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.2	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.5	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.2.10 Winter-B, Worst Case Spill Scenario**

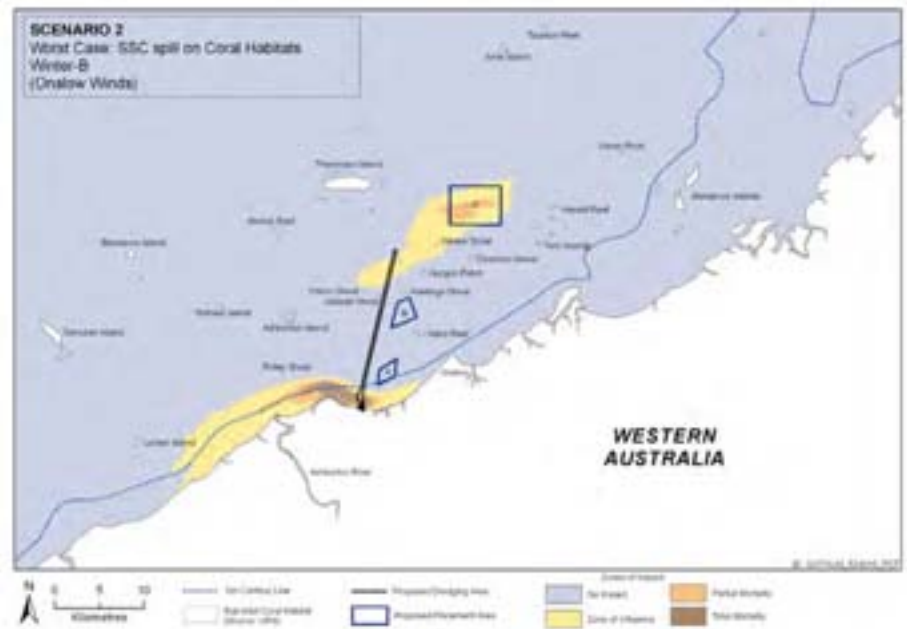


Figure B.85 Scenario 2, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

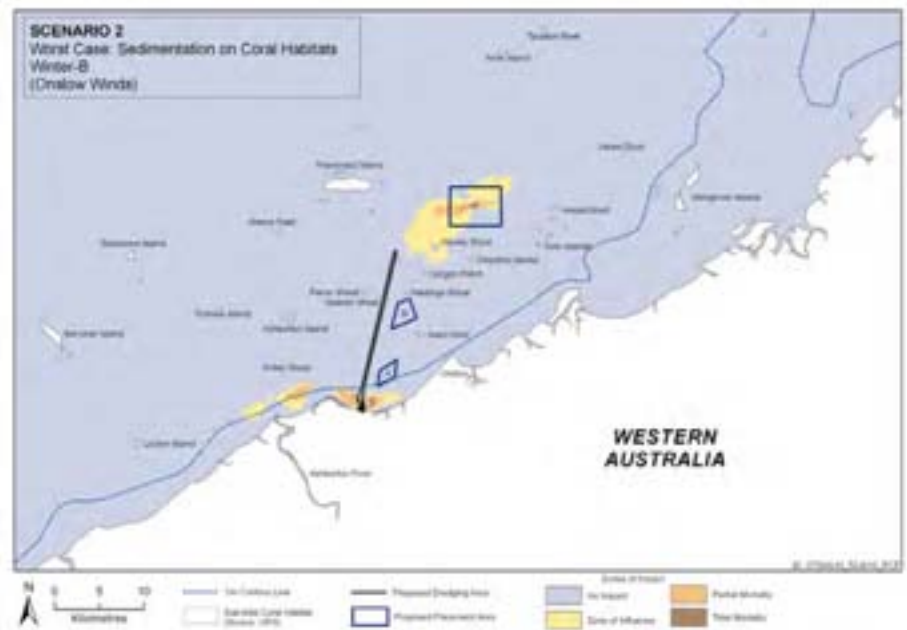


Figure B.86 Scenario 2, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

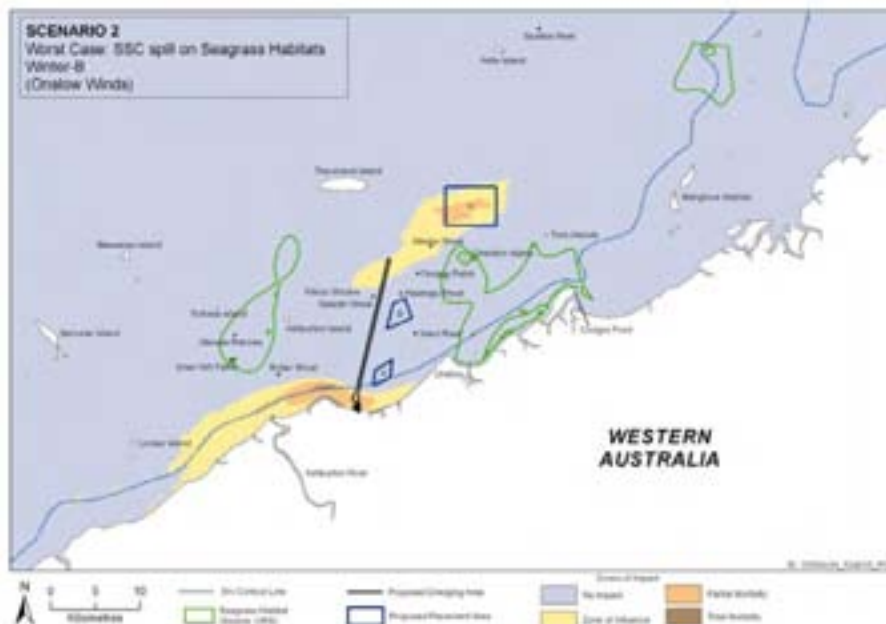


Figure B.87 Scenario 2, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

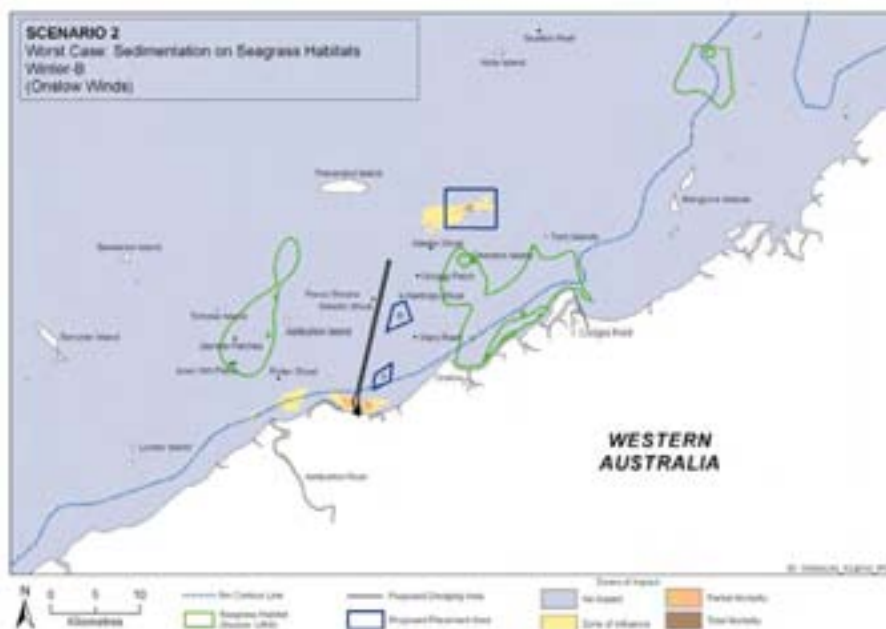


Figure B.88 Scenario 2, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-67



Table B.22 Summary of Impacts at Sensitive Receptors for Scenario 2, Winter-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.7	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.2	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.3	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.3	1.2	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.9	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.1	3.6	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.3	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.6	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.5	6.2	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.0	0.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.2.11 Transitional-A, Worst Case Spill Scenario**

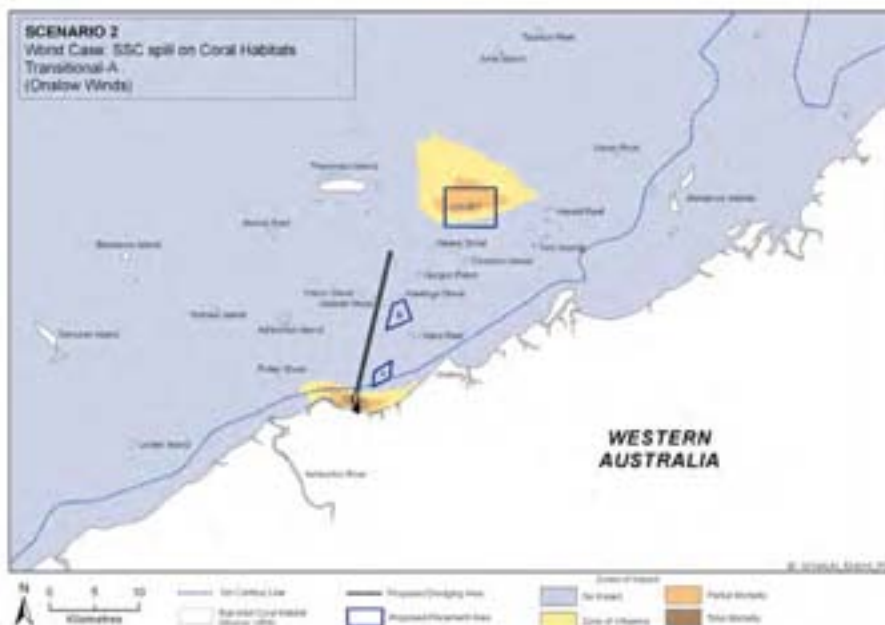


Figure B.89 Scenario 2, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

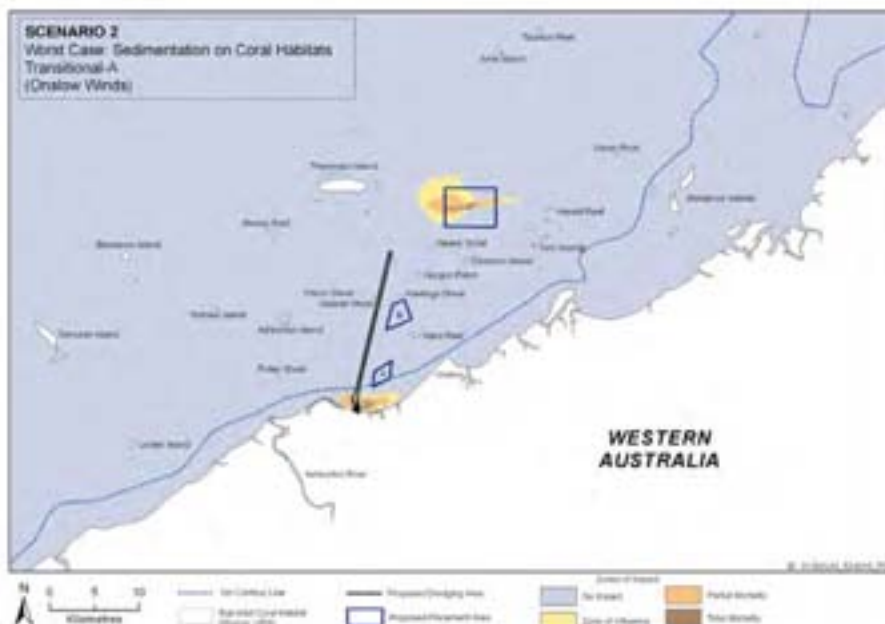


Figure B.90 Scenario 2, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds



B-69



Figure B.91 Scenario 2, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

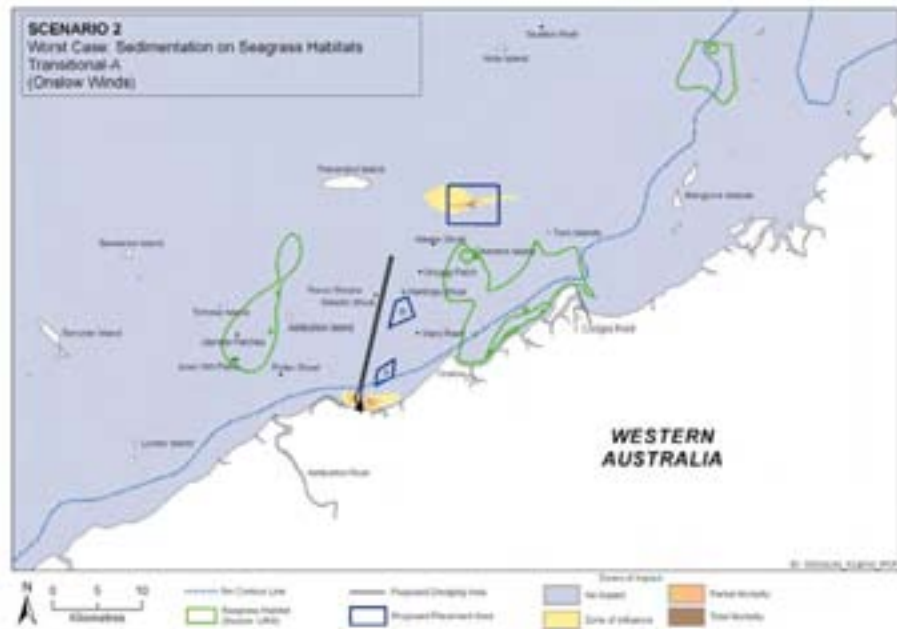


Figure B.92 Scenario 2, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

B-70



Table B.23 Summary of Impacts at Sensitive Receptors for Scenario 2, Transitional-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.2	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-71



**B.2.12 Transitional-B, Worst Case Spill Scenario**

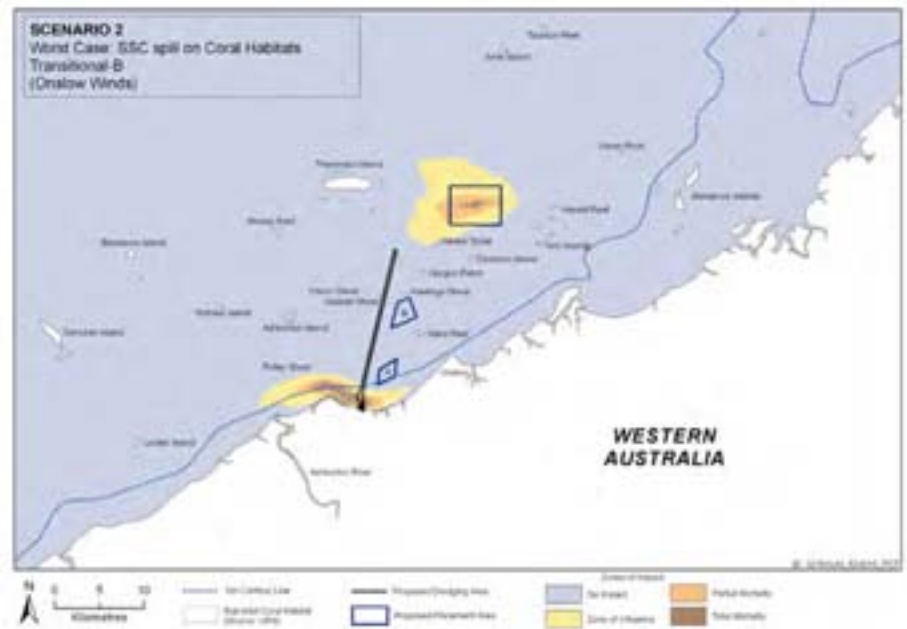


Figure B.93 Scenario 2, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

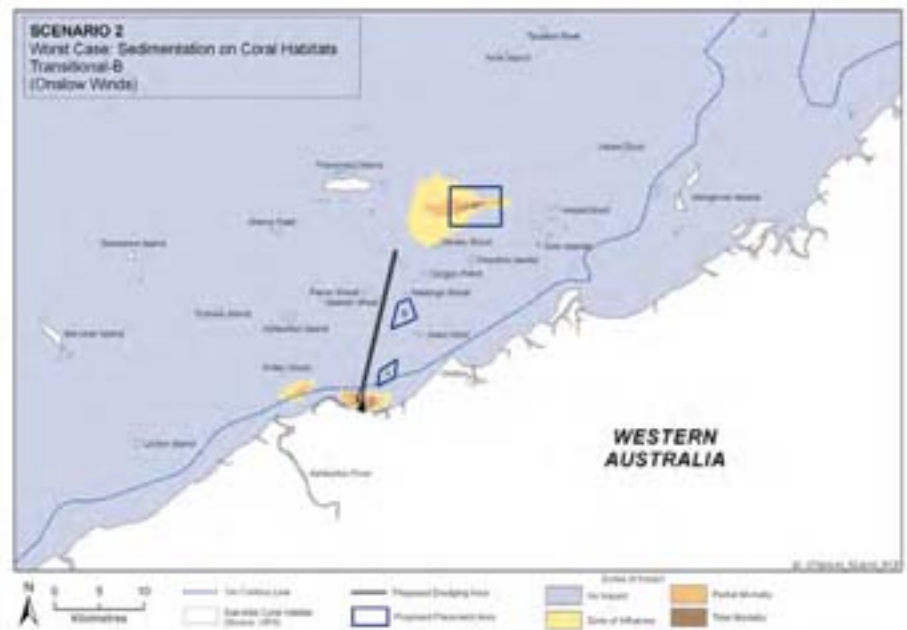


Figure B.94 Scenario 2, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

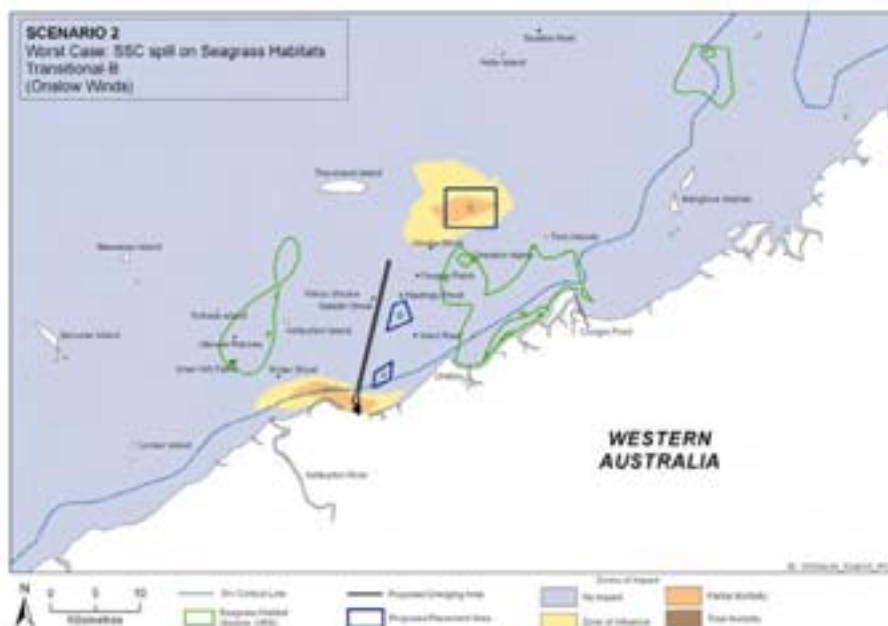


Figure B.95 Scenario 2, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

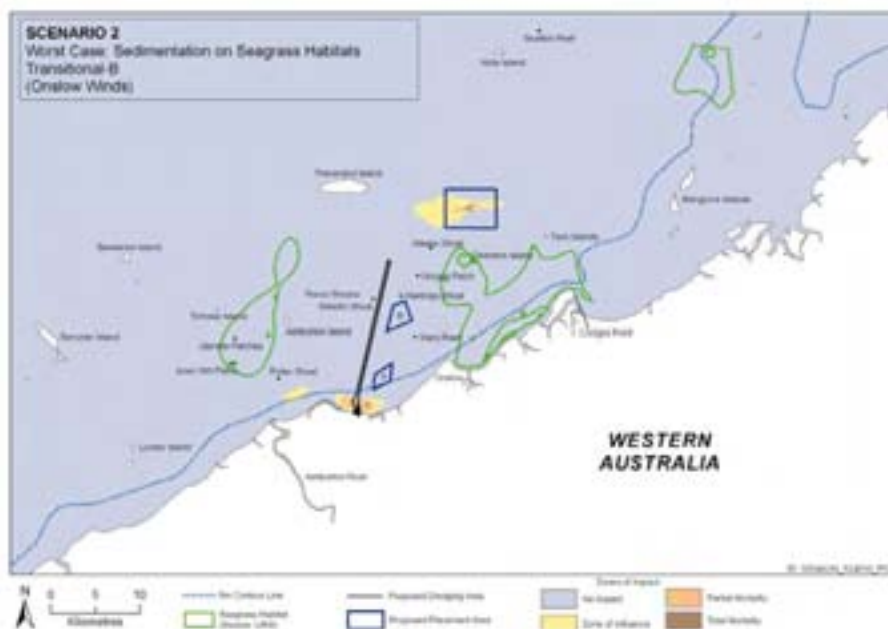


Figure B.96 Scenario 2, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

B-73



Table B.24 Summary of Impacts at Sensitive Receptors for Scenario 2, Transitional-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.3	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.2	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.2	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.8	1.2	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.3 Dredging Scenario 3**

**B.3.1 Summer-A, Realistic Spill Scenario**

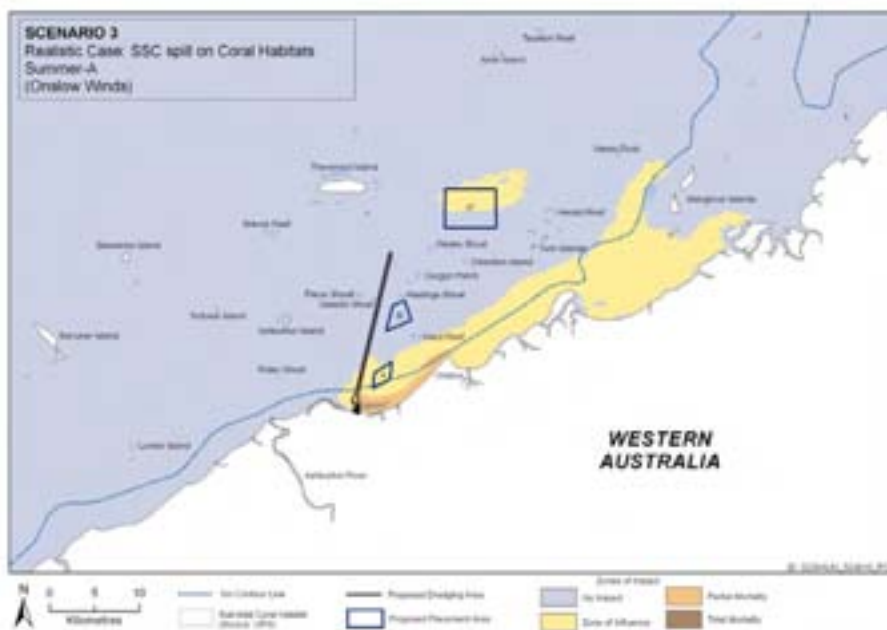


Figure B.97 Scenario 3, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

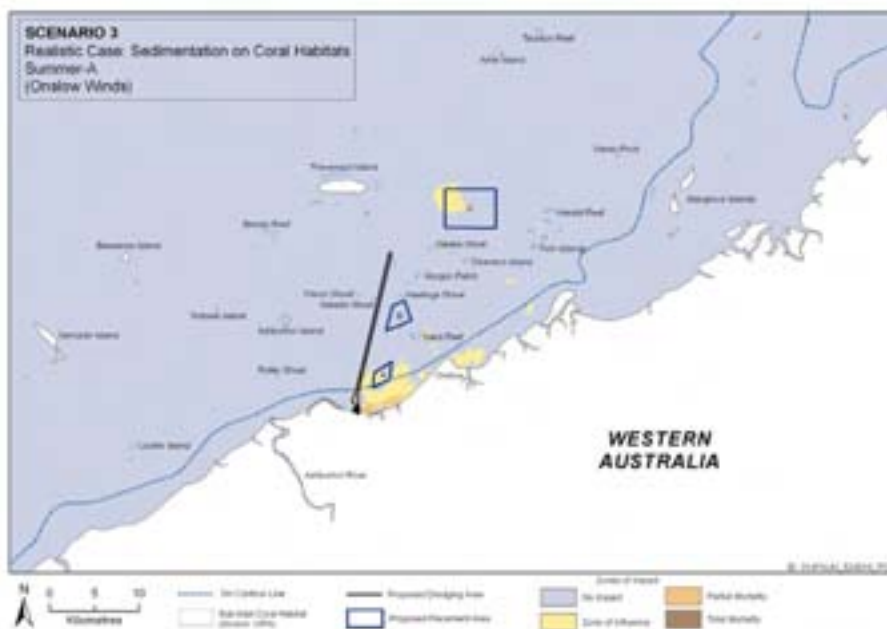


Figure B.98 Scenario 3, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

B-75

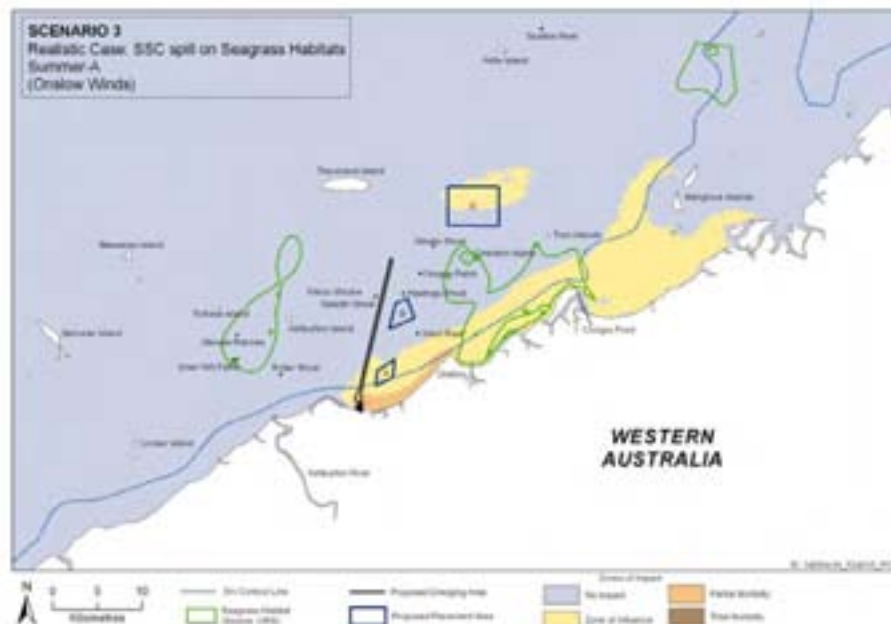


Figure B.99 Scenario 3, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

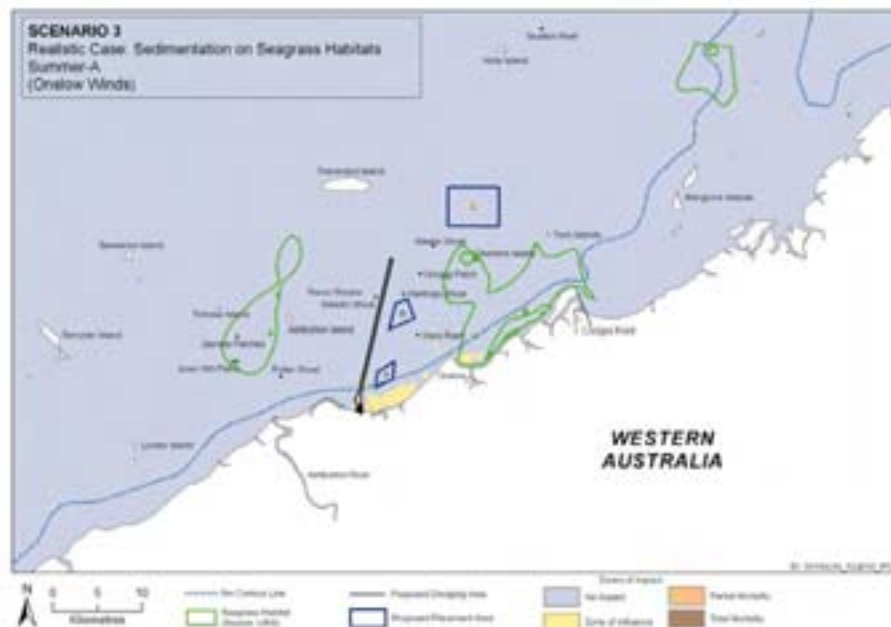


Figure B.100 Scenario 3, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds



Table B.25 Summary of Impacts at Sensitive Receptors for Scenario 3, Summer-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	1.3	0.7	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	1.3	1.2	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.2	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.8	1.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.7	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	2.5	12.3	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.8	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.9	0.4	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	3.0	16.3	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	2.2	11.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	2.3	7.9	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	2.6	9.8	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.9	0.7	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**B.3.2 Summer-B, Realistic Spill Scenario**

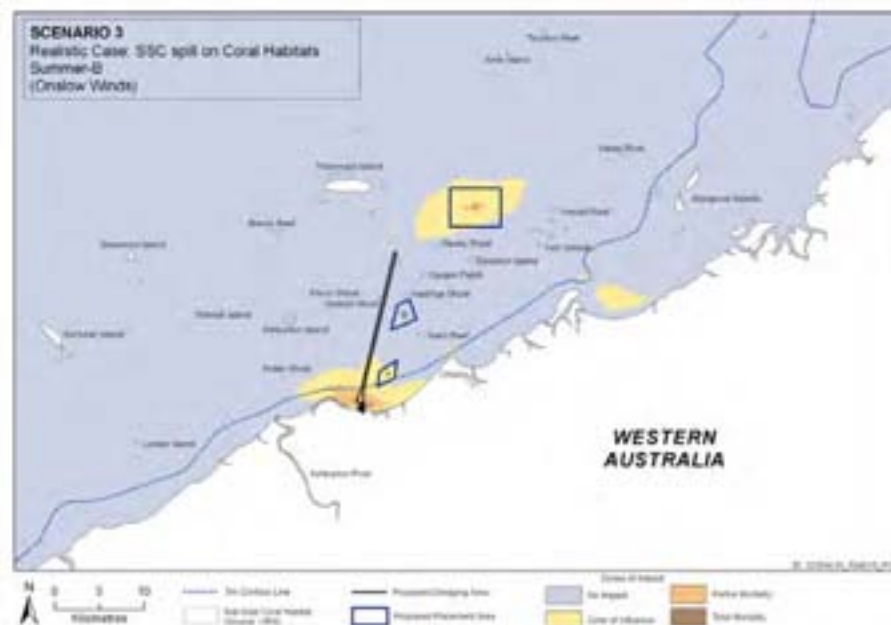


Figure B.101 Scenario 3, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

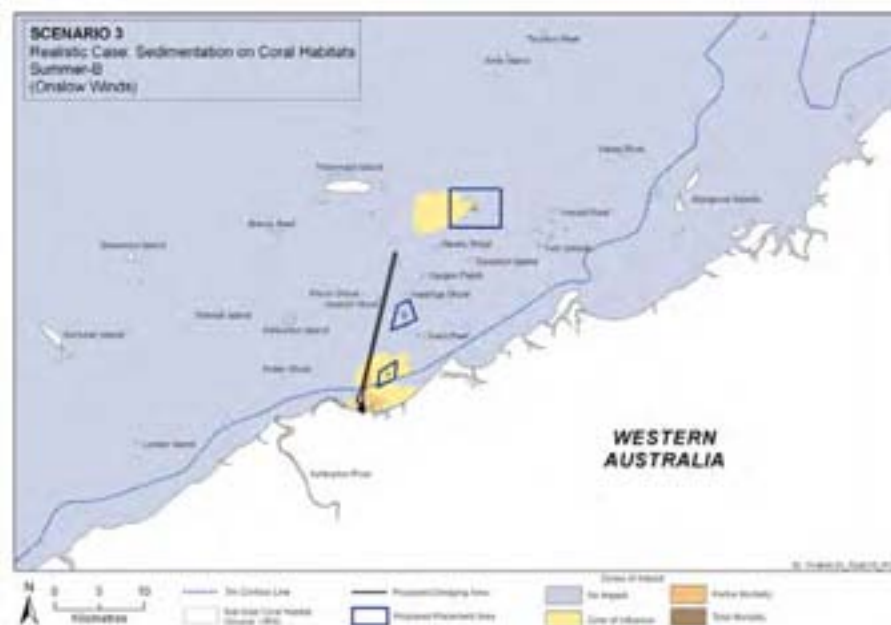


Figure B.102 Scenario 3, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

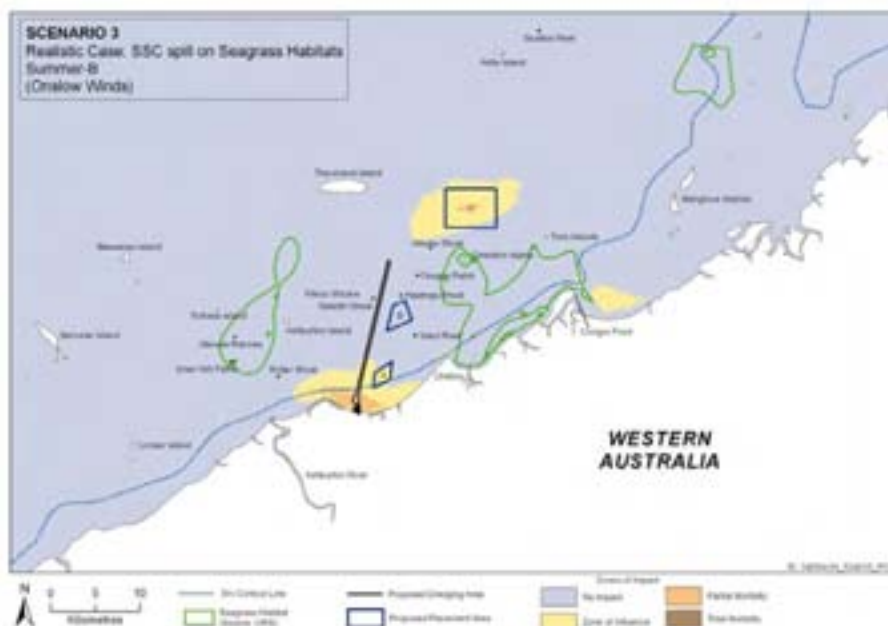


Figure B.103 Scenario 3, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

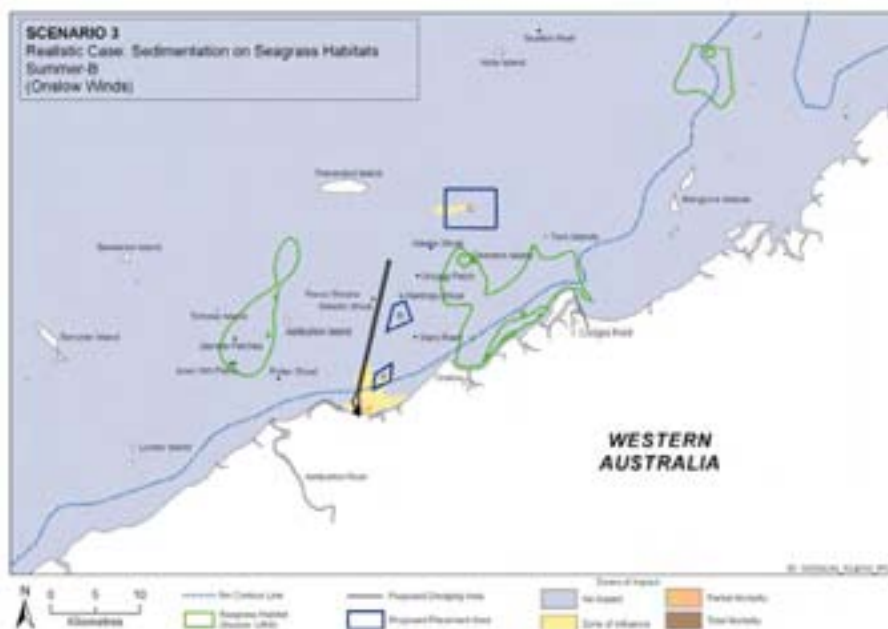


Figure B.104 Scenario 3, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-79



Table B.26 Summary of Impacts at Sensitive Receptors for Scenario 3, Summer-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.6	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.6	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.3	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.3	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	2.4	18.7	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.5	2.2	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.5	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.6	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	1.5	1.9	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.8	2.1	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.8	2.4	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	1.3	0.3	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.3	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.3.3 Winter-A, Realistic Spill Scenario**



Figure B.105 Scenario 3, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

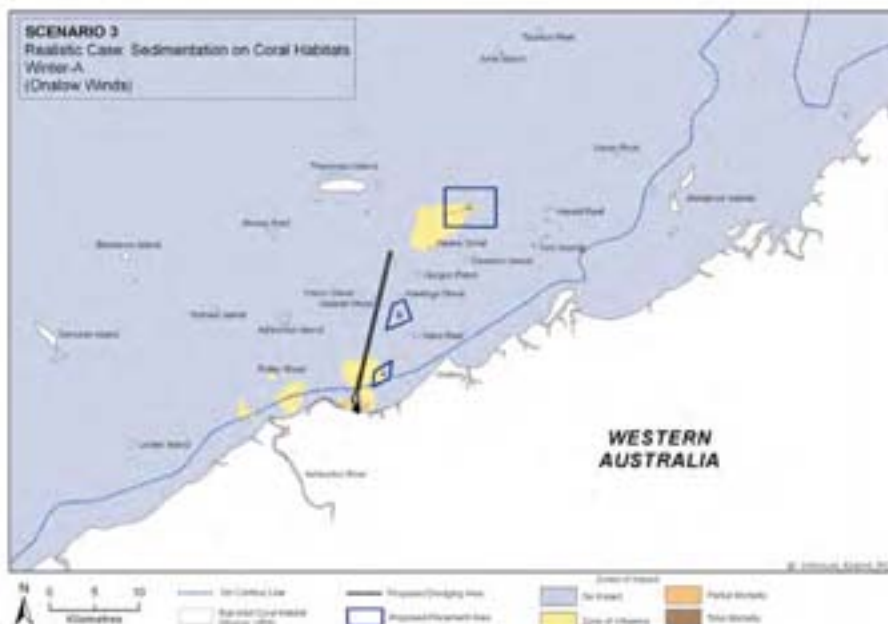


Figure B.106 Scenario 3, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

B-81

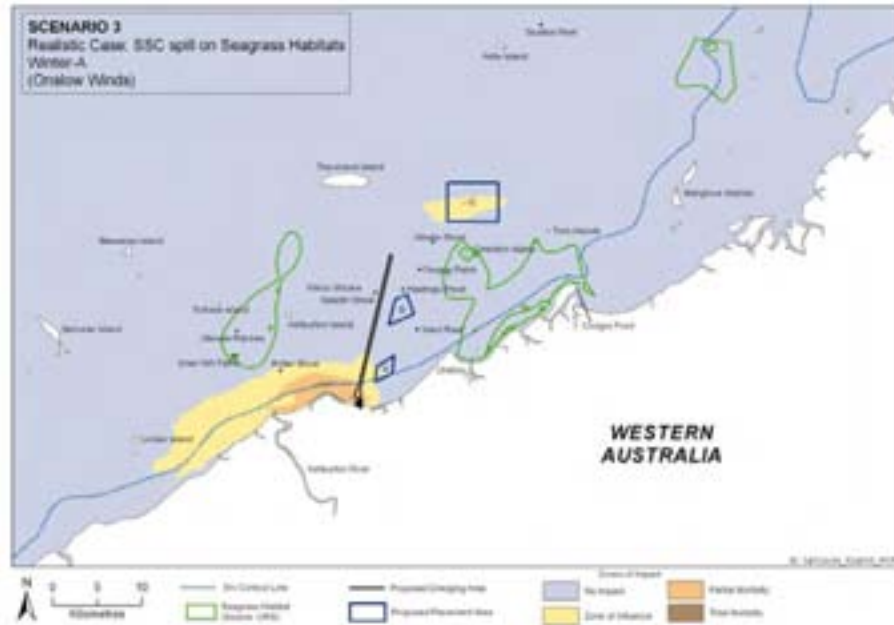


Figure B.107 Scenario 3, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

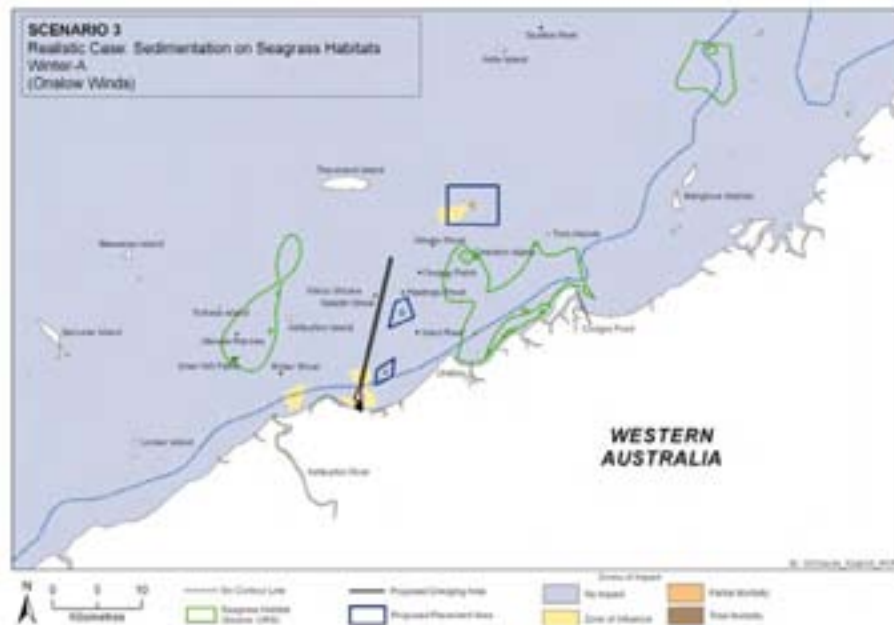


Figure B.108 Scenario 3, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds



Table B.27 Summary of Impacts at Sensitive Receptors for Scenario 3, Winter-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	2.2	12.9	1.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.2	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.1	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.4	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.7	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.3.4 Winter-B, Realistic Spill Scenario**

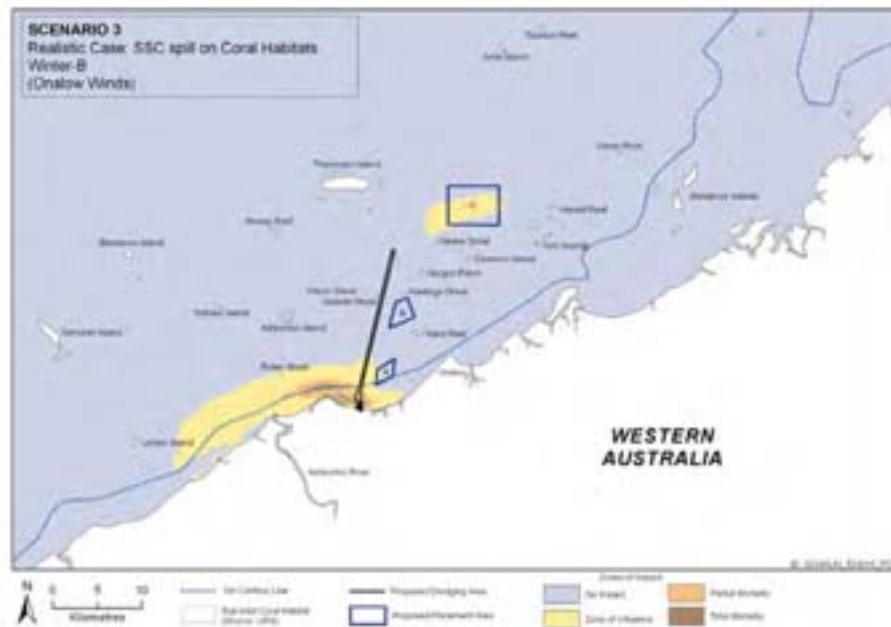


Figure B.109 Scenario 3, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

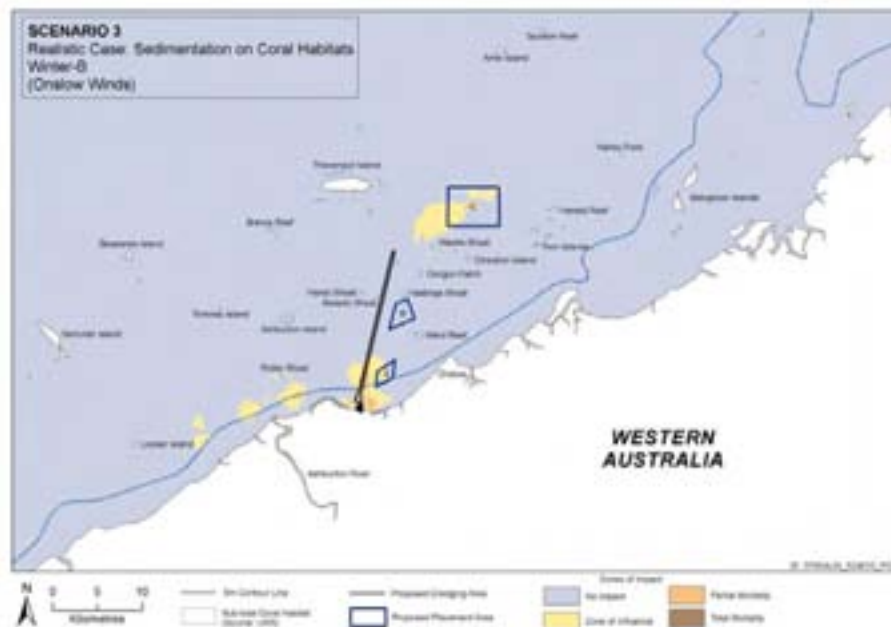


Figure B.110 Scenario 3, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

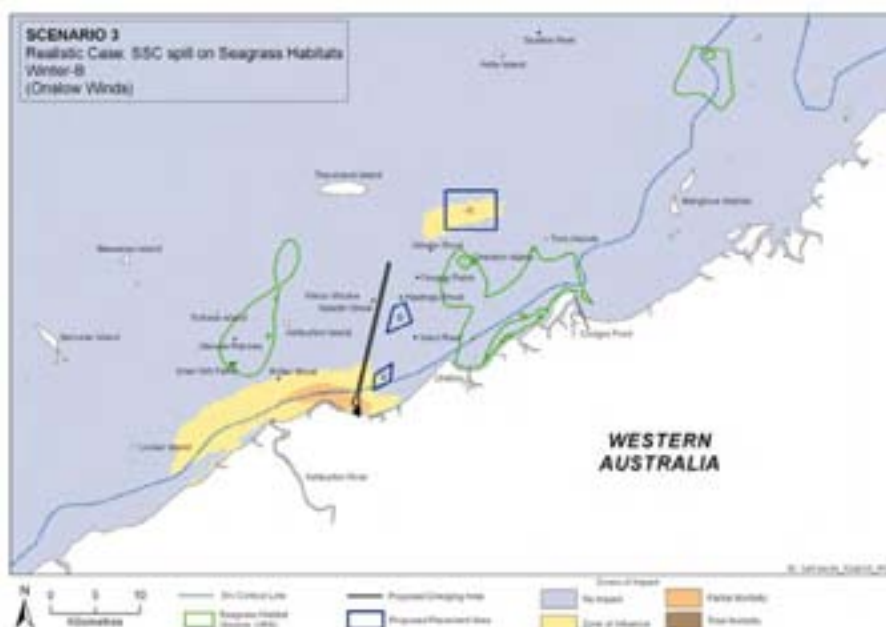


Figure B.111 Scenario 3, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

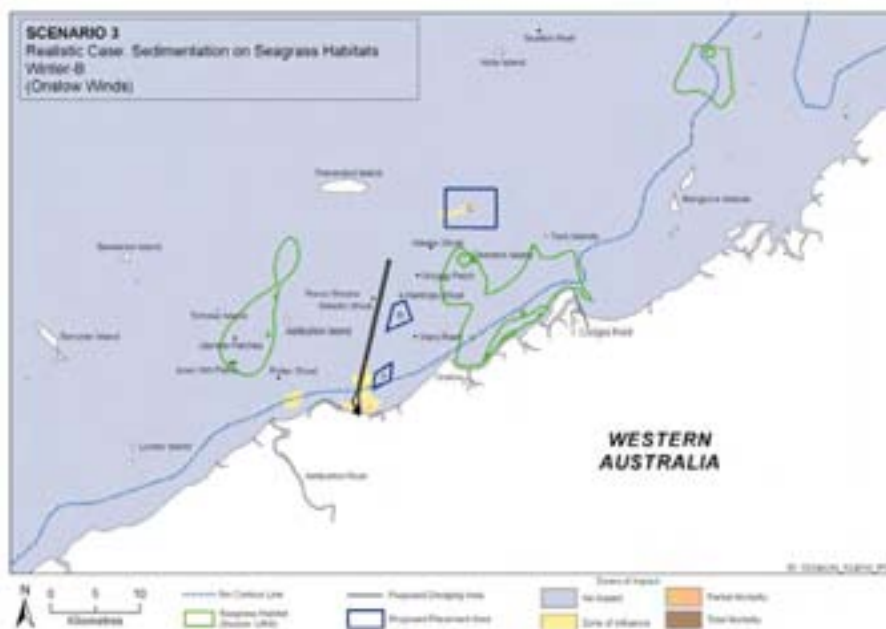


Figure B.112 Scenario 3, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds



B-85



Table B.28 Summary of Impacts at Sensitive Receptors for Scenario 3, Winter-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.3	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.8	12.6	1.9	0.0	0.0	
3	Ashburton Island	286705	7611075	0.2	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.8	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.6	0.3	0.0	0.0	0.1	
9	Hastings Shoal	298803	7613488	0.2	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.8	0.7	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.6	0.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.3.5 Transitional-A, Realistic Spill Scenario**

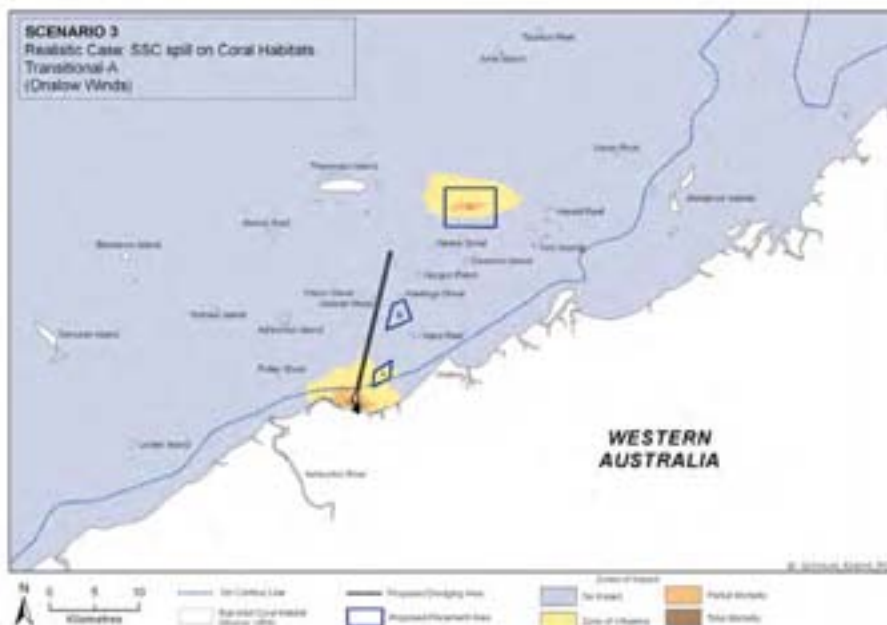


Figure B.113 Scenario 3, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

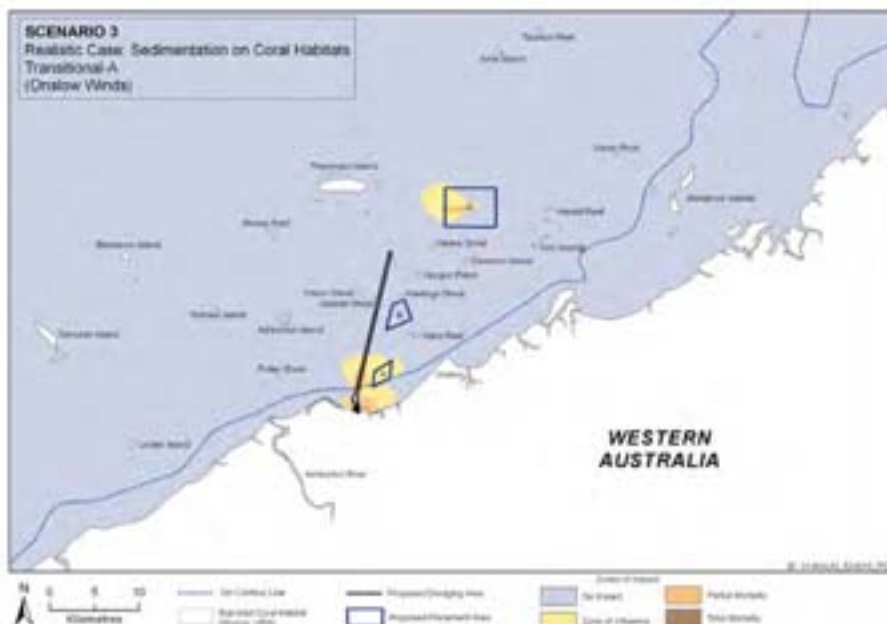


Figure B.114 Scenario 3, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

B-87

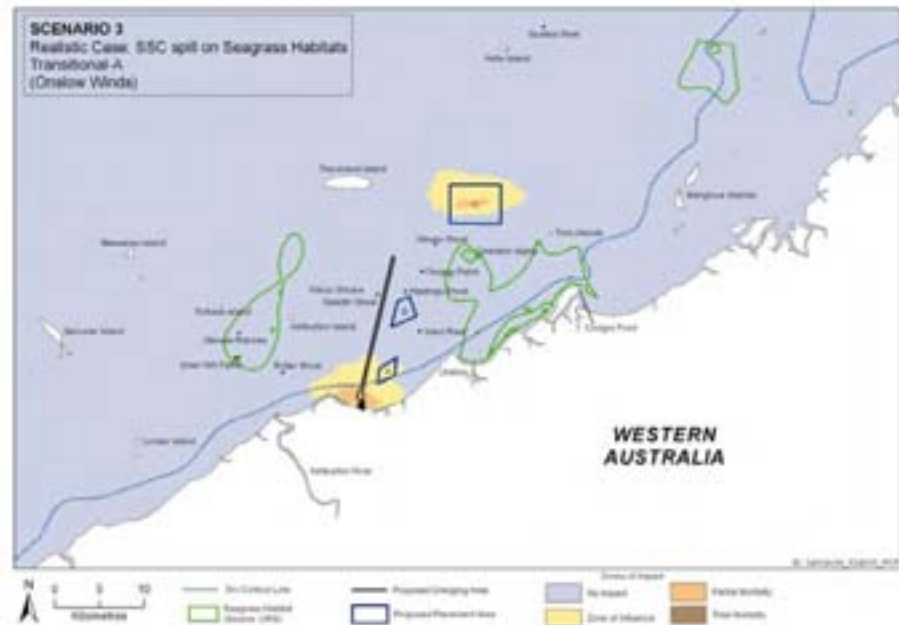


Figure B.115 Scenario 3, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds



Figure B.116 Scenario 3, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds



Table B.29 Summary of Impacts at Sensitive Receptors for Scenario 3, Transitional-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.2	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.3	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.4	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.2	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.3.6 Transitional-B, Realistic Spill Scenario**

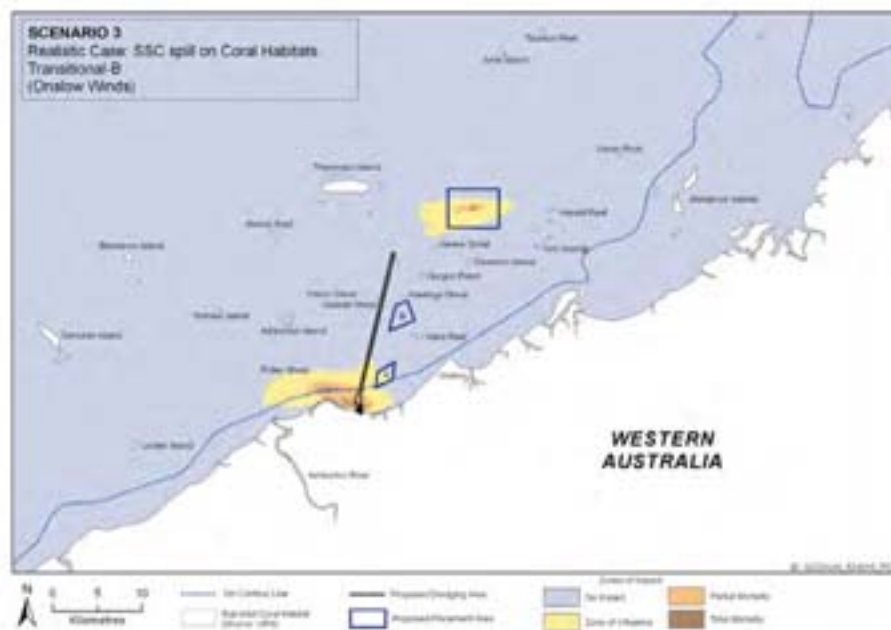


Figure B.117 Scenario 3, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

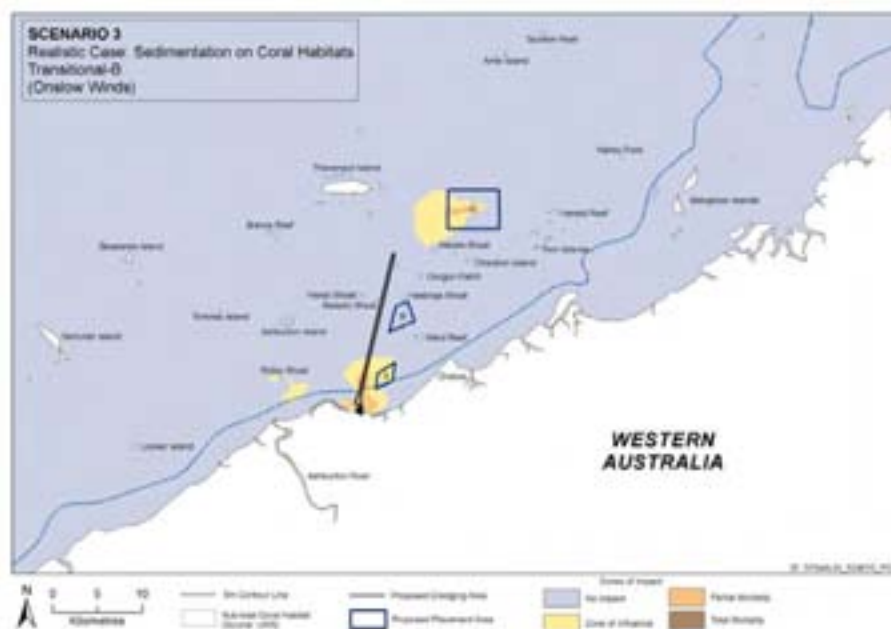


Figure B.118 Scenario 3, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

B-90

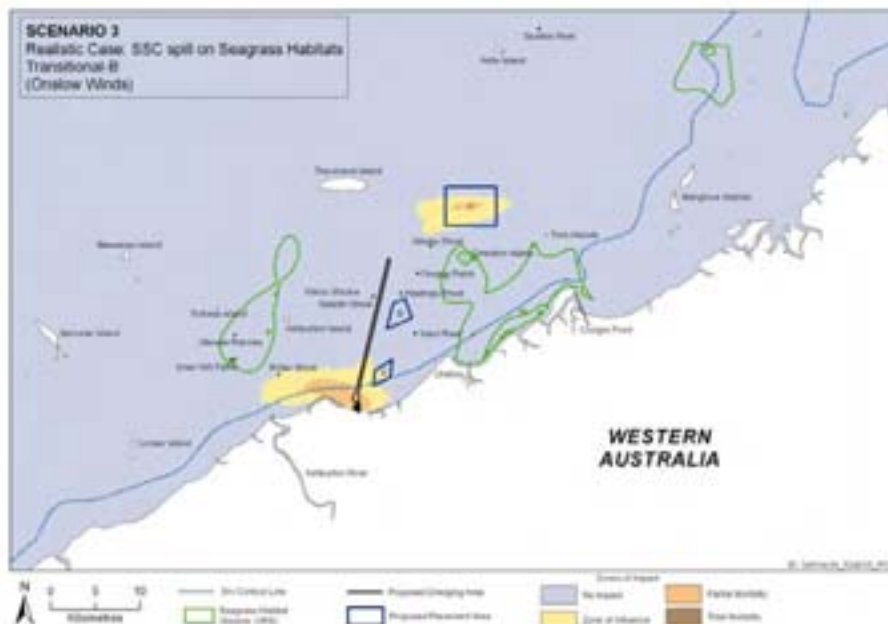


Figure B.119 Scenario 3, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

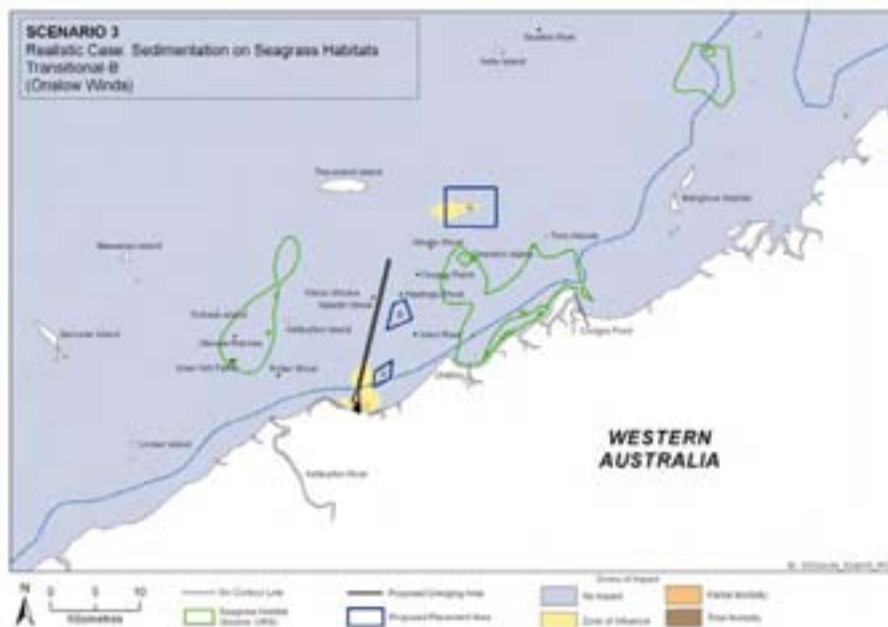


Figure B.120 Scenario 3, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-91



Table B.30 Summary of Impacts at Sensitive Receptors for Scenario 3, Transitional-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.2	5.3	0.9	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.1	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.2	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.5	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.7	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.7	0.4	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.5	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.3.7 Summer-A, Worst Case Spill Scenario**

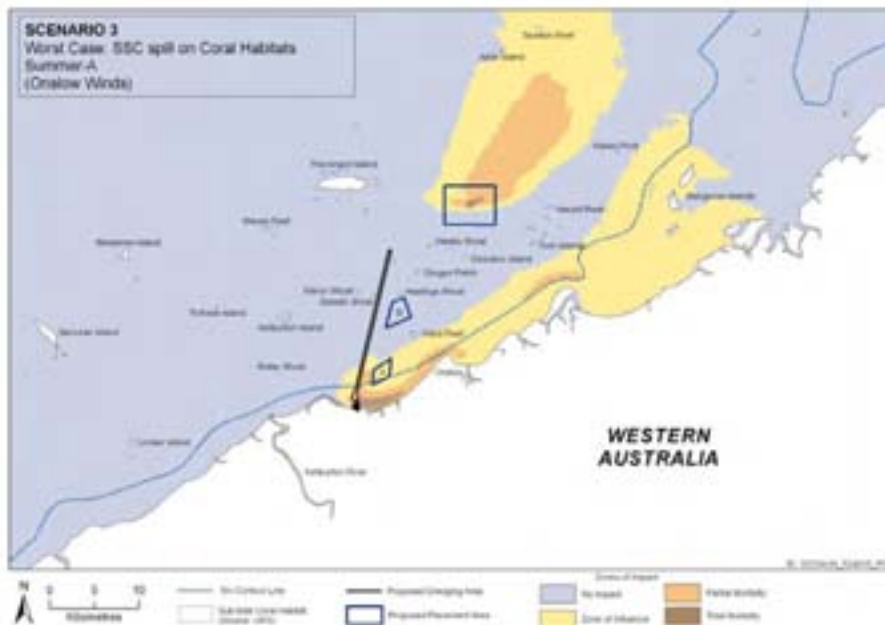


Figure B.121 Scenario 3, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

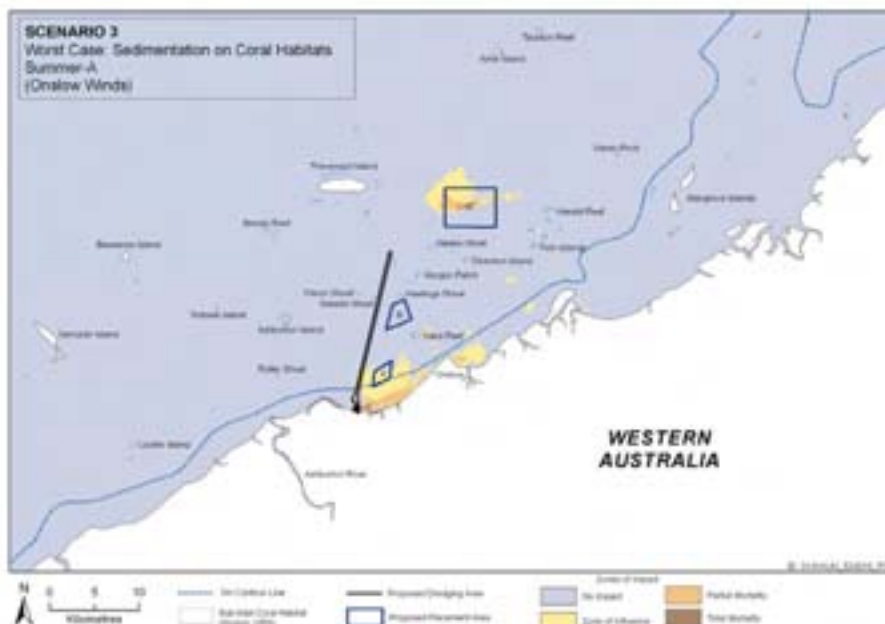


Figure B.122 Scenario 3, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds



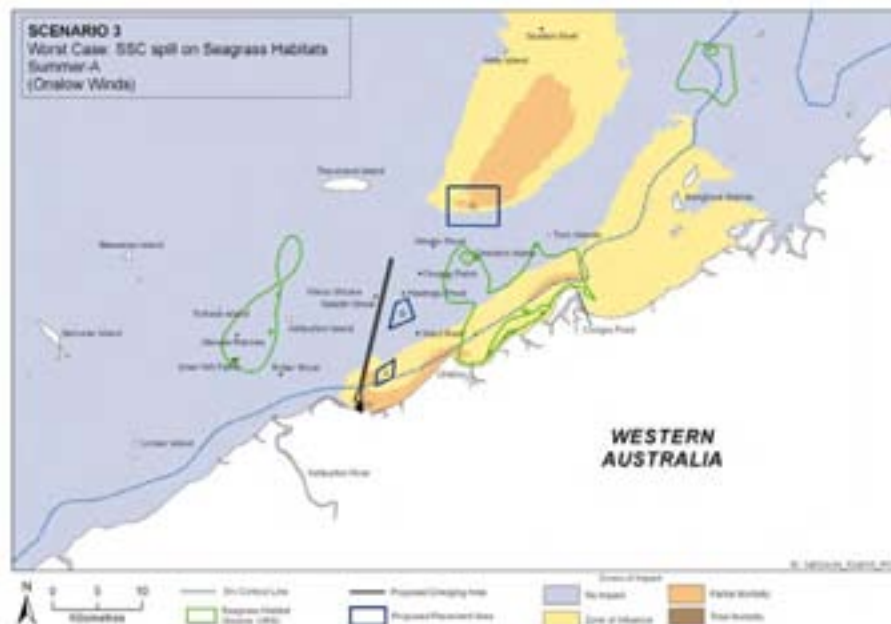


Figure B.123 Scenario 3, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

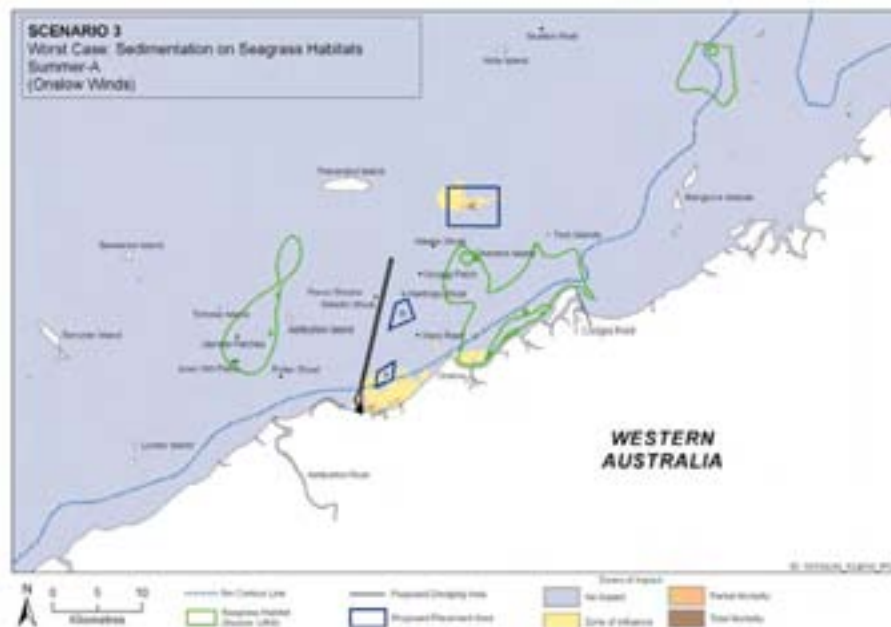


Figure B.124 Scenario 3, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds



Table B.31 Summary of Impacts at Sensitive Receptors for Scenario 3, Summer-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.2	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	1.5	1.6	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	1.5	2.7	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.2	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	1.0	2.8	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.9	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	3.2	23.8	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.2	1.5	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.5	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	2.2	18.4	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	1.1	1.6	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	3.7	29.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	3.1	21.1	1.2	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	3.2	19.5	0.4	0.0	0.0	
33	S of Tw in Islands	314942	7616406	3.2	22.7	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	1.1	2.2	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.3.8 Summer-B, Worst Case Spill Scenario**



Figure B.125 Scenario 3, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

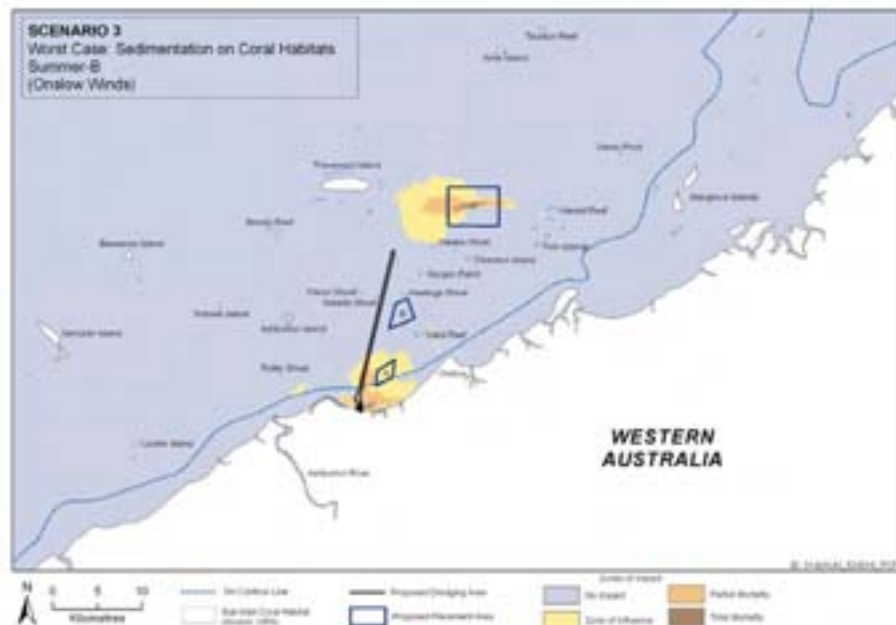


Figure B.126 Scenario 3, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds



Figure B.127 Scenario 3, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

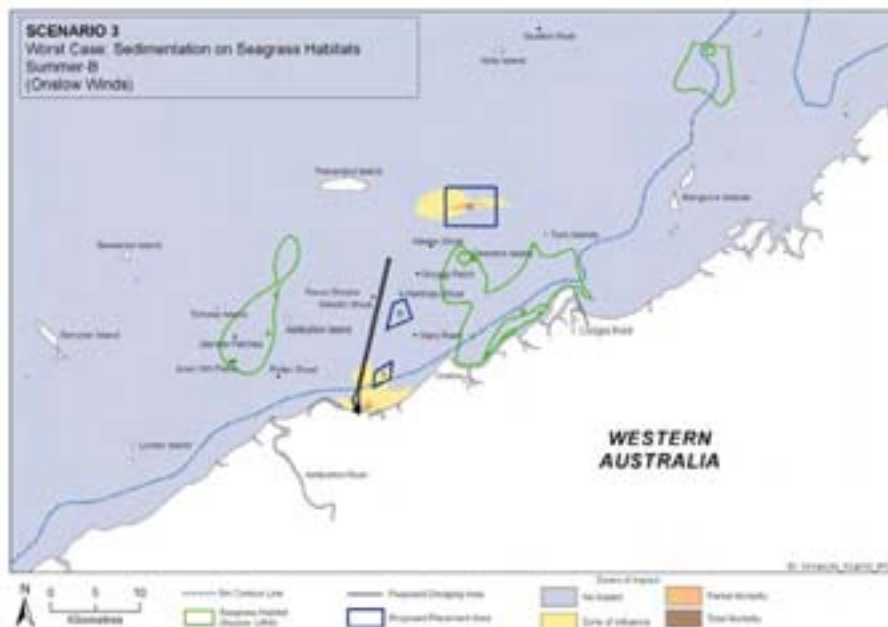


Figure B.128 Scenario 3, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

B-97



Table B.32 Summary of Impacts at Sensitive Receptors for Scenario 3, Summer-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.7	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.8	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.4	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.3	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	3.4	30.6	3.3	0.0	0.0	
22	Nares Rock	323379	7629437	2.0	15.9	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.7	0.1	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.5	0.7	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.7	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	2.0	7.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	1.2	6.4	0.3	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	1.3	6.5	0.0	0.0	0.1	
33	S of Tw in Islands	314942	7616406	1.7	2.7	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.4	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.3.9 Winter-A, Worst Case Spill Scenario**

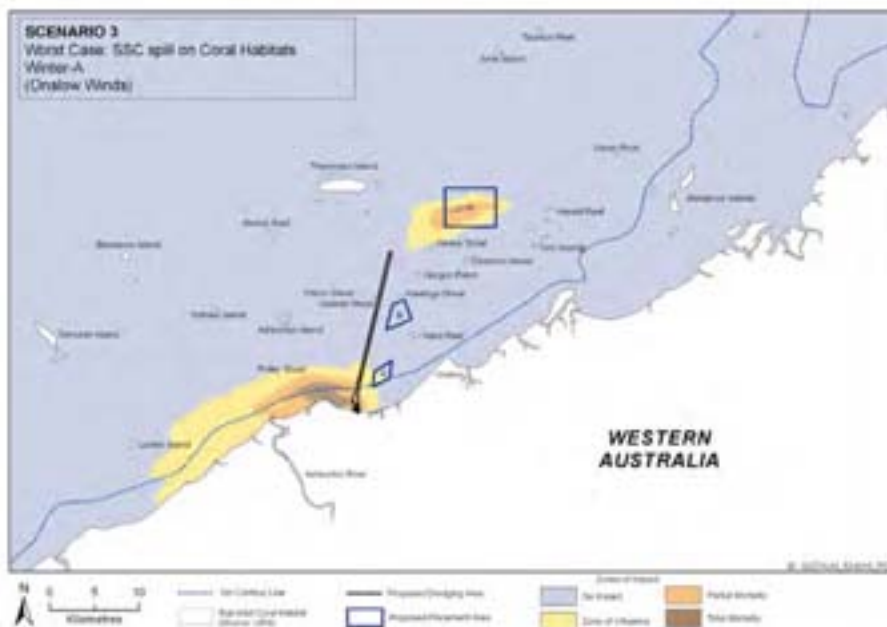


Figure B.129 Scenario 3, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

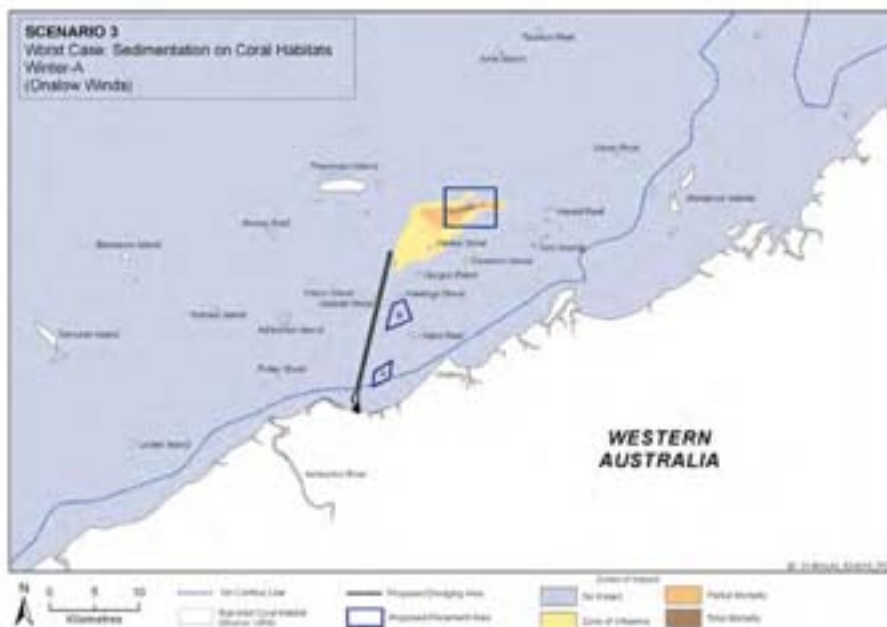


Figure B.130 Scenario 3, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-99

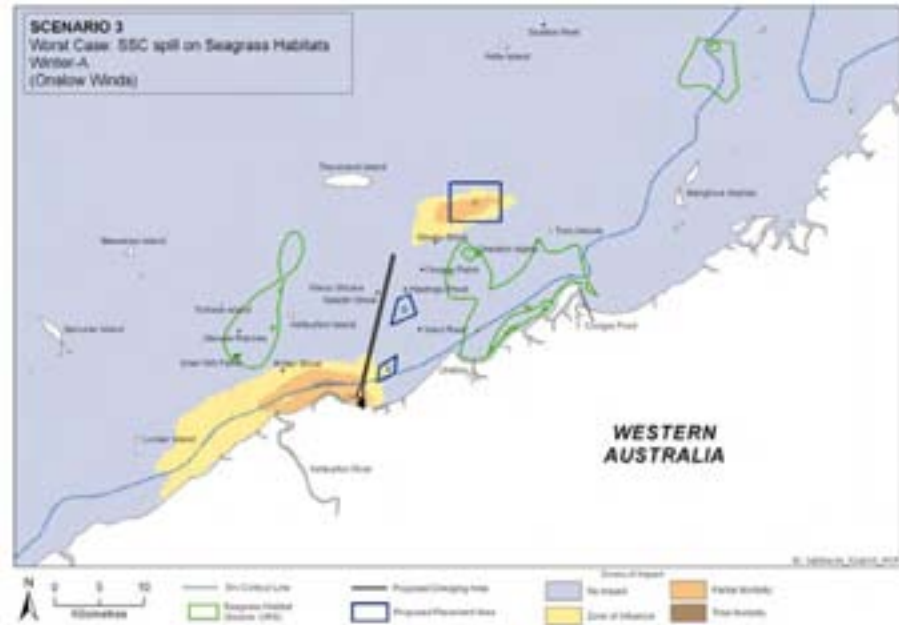


Figure B.131 Scenario 3, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

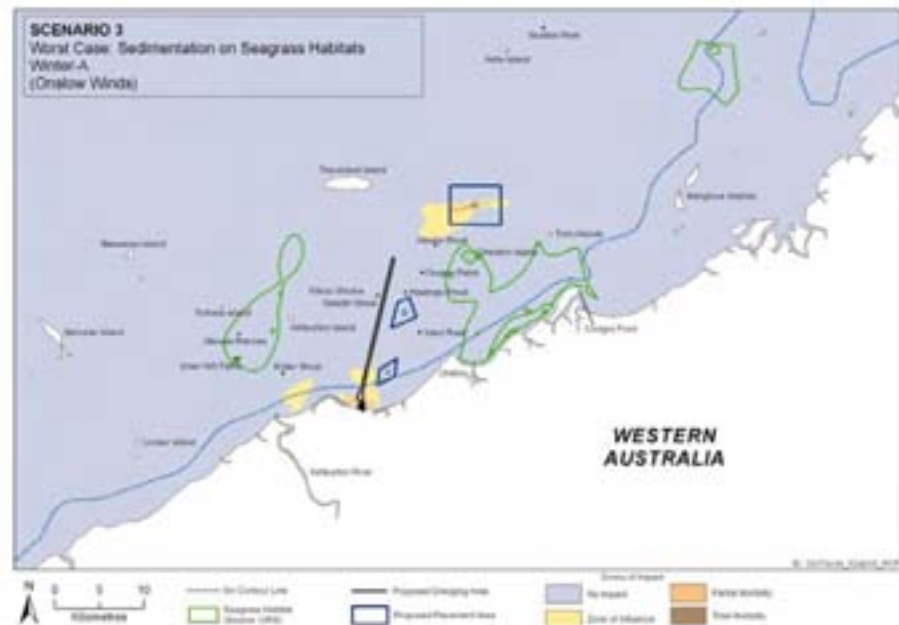


Figure B.132 Scenario 3, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-100



Table B.33 Summary of Impacts at Sensitive Receptors for Scenario 3, Winter-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.5	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	2.5	14.3	2.7	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.7	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.3	1.5	0.0	0.0	0.1	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608668	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.6	0.9	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.7	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



B-101



**B.3.10 Winter-B, Worst Case Spill Scenario**

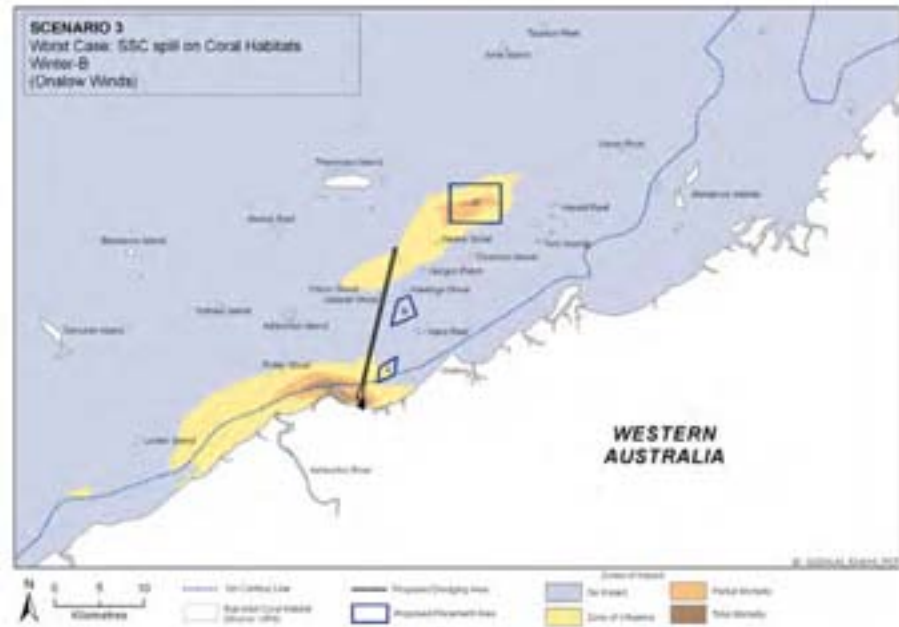


Figure B.133 Scenario 3, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

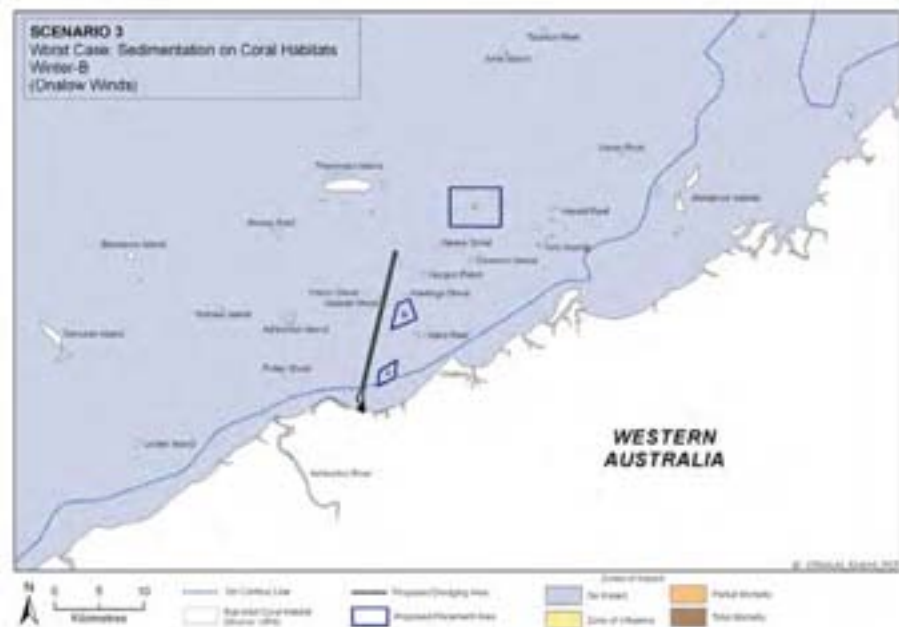


Figure B.134 Scenario 3, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-102

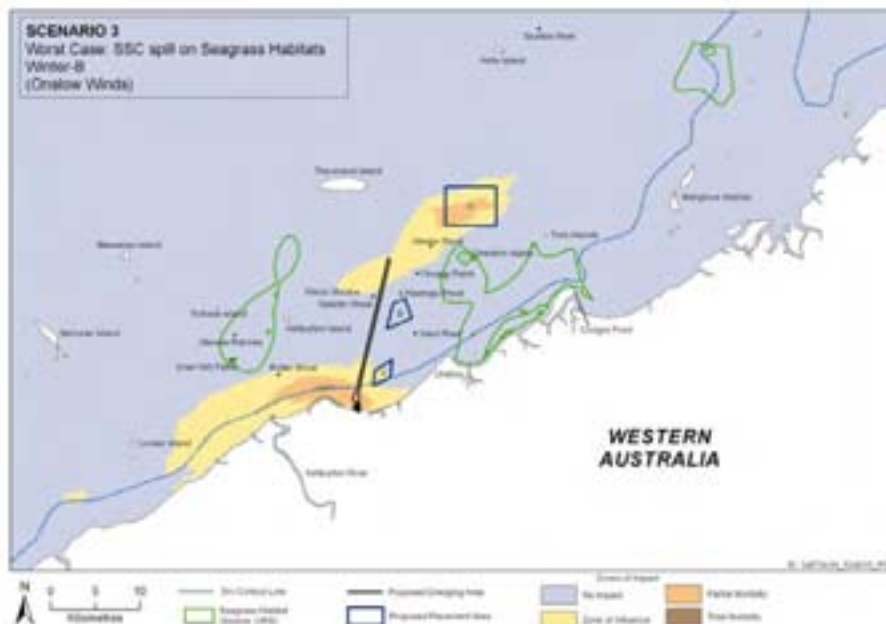


Figure B.135 Scenario 3, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

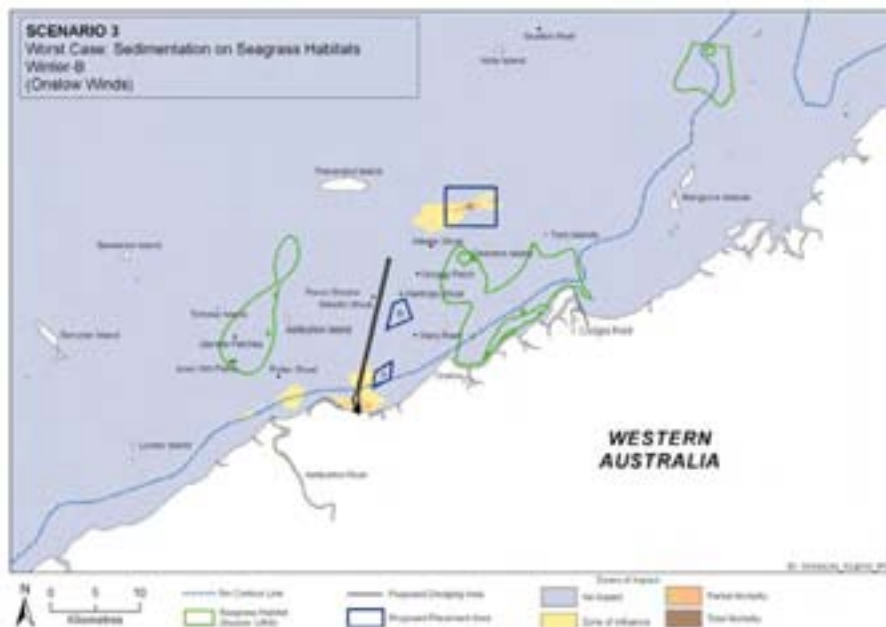


Figure B.136 Scenario 3, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-103



Table B.34 Summary of Impacts at Sensitive Receptors for Scenario 3, Winter-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.8	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	2.1	15.5	3.6	0.0	0.0	
3	Ashburton Island	286705	7611075	0.4	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.5	4.2	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.0	1.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.3	5.3	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.4	0.0	0.0	0.0	0.1	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.6	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.7	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.7	10.5	0.1	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.2	0.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.3.11 Transitional-A, Worst Case Spill Scenario**

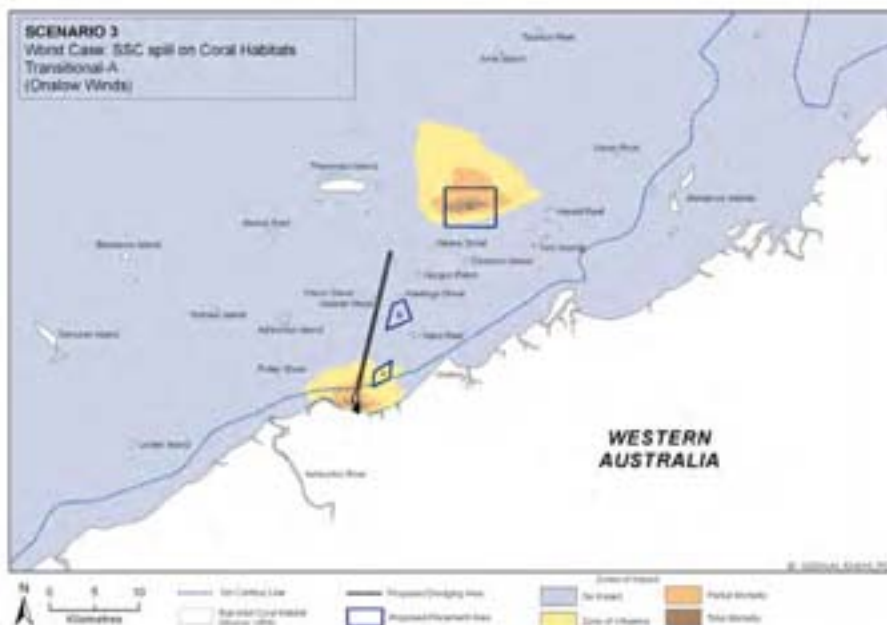


Figure B.137 Scenario 3, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

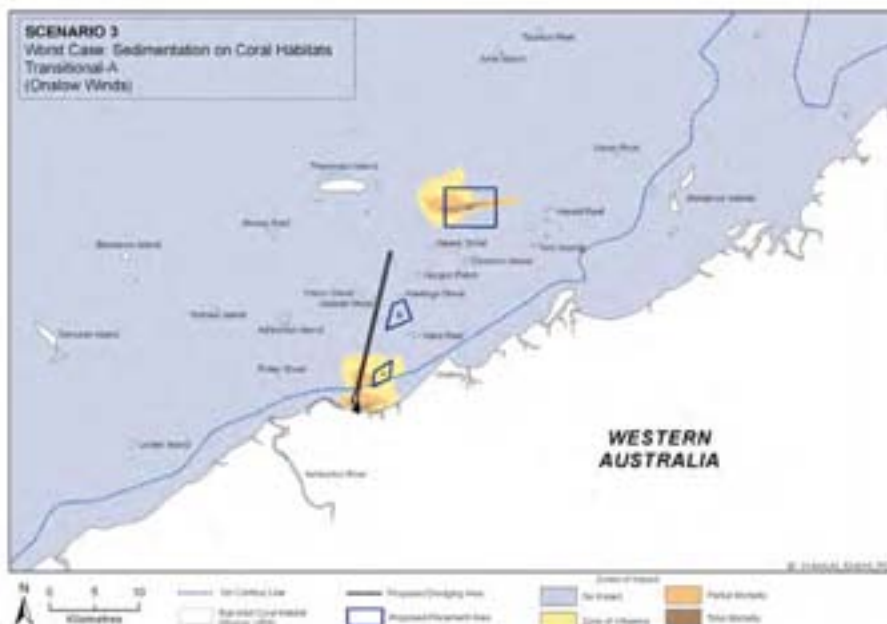


Figure B.138 Scenario 3, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

B-105

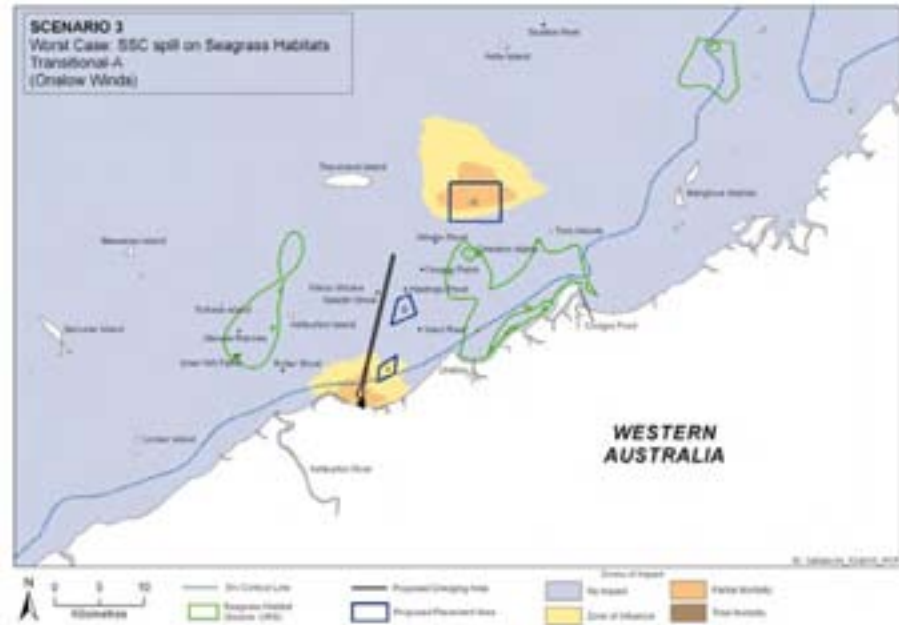


Figure B.139 Scenario 3, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

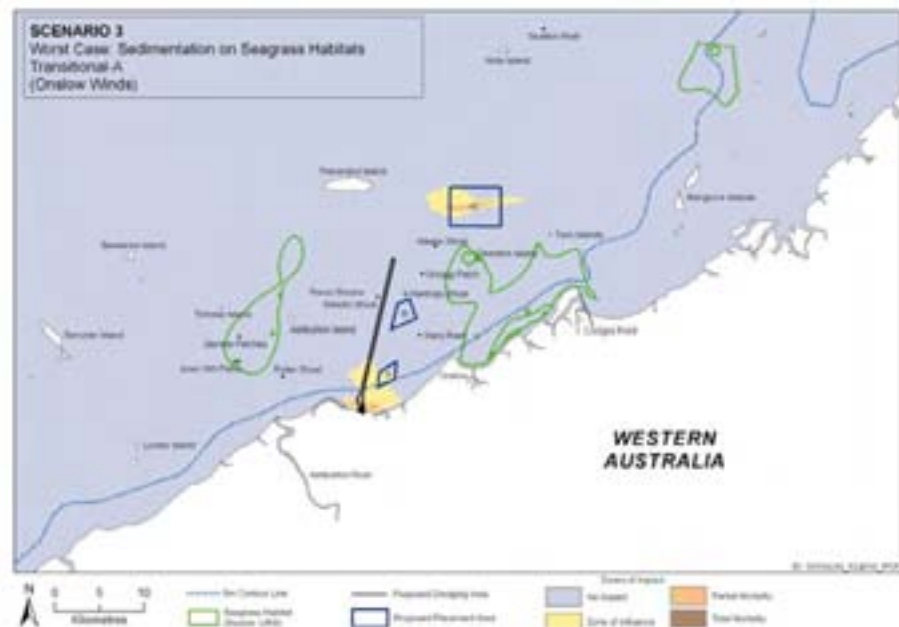


Figure B.140 Scenario 3, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

B-106



Table B.35 Summary of Impacts at Sensitive Receptors for Scenario 3, Transitional-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.2	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.4	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.5	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.0	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.0	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.5	0.0	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.3	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.3	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.3.12 Transitional-B, Worst Case Spill Scenario**

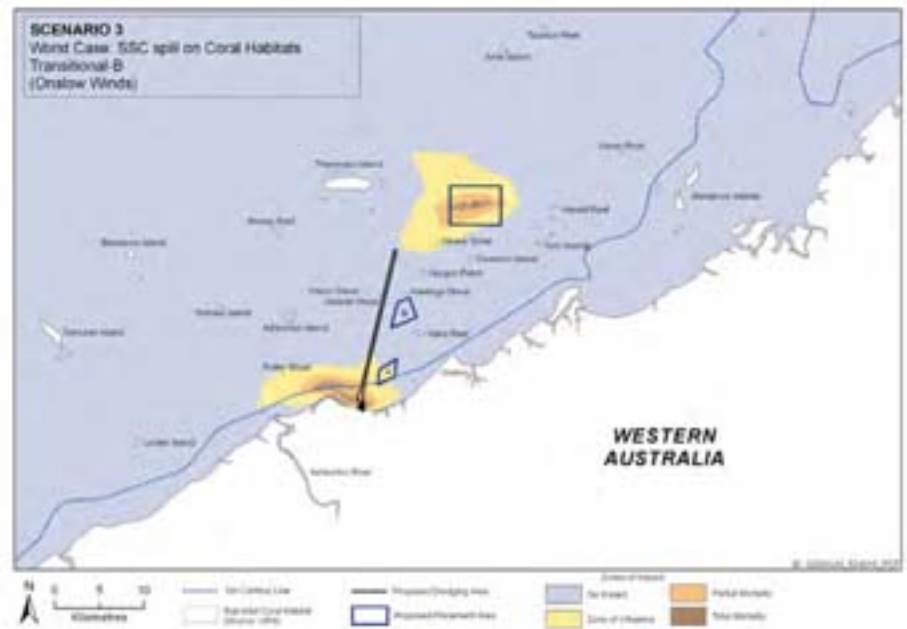


Figure B.141 Scenario 3, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

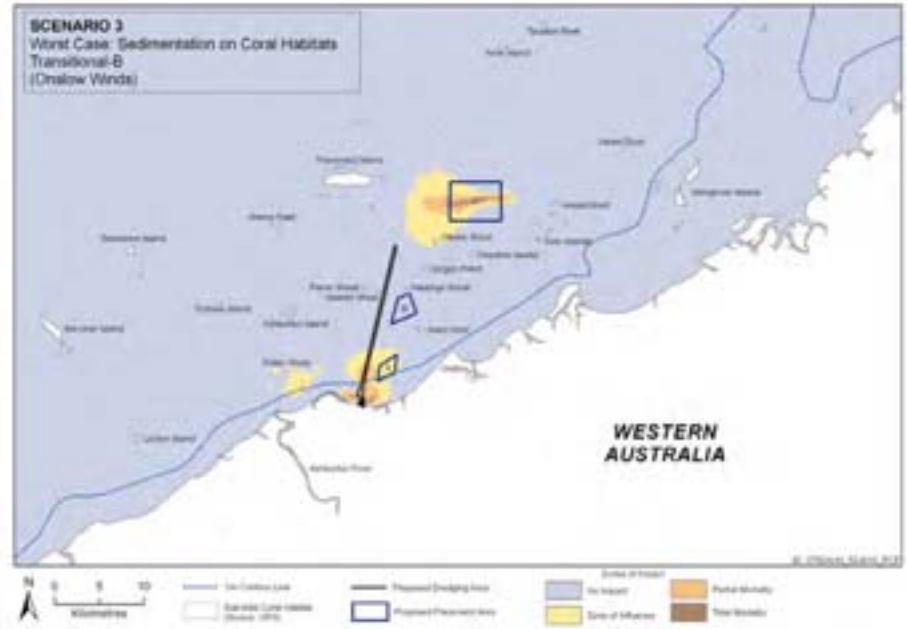


Figure B.142 Scenario 3, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

B-108



Figure B.143 Scenario 3, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

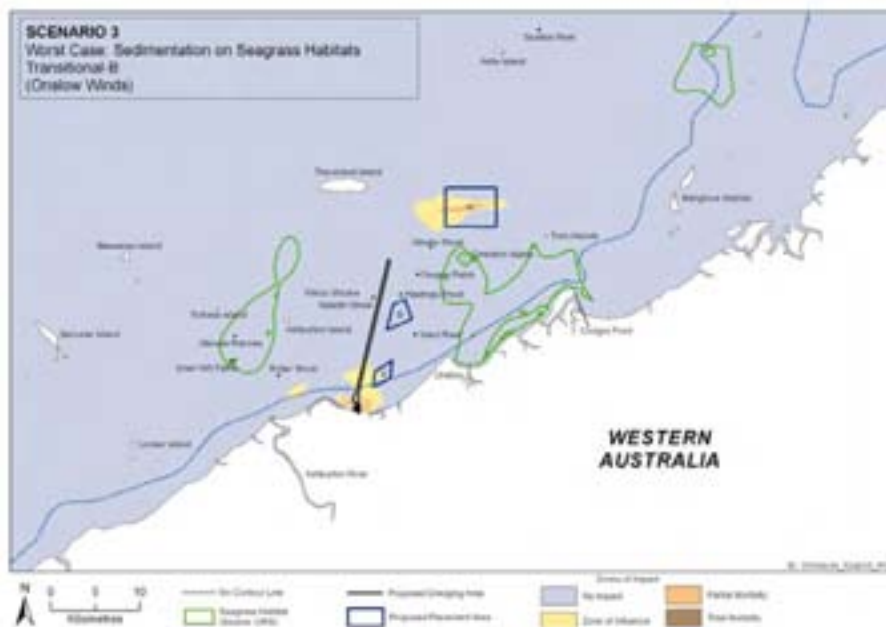


Figure B.144 Scenario 3, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds



B-109



Table B.36 Summary of Impacts at Sensitive Receptors for Scenario 3, Transitional-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.3	7.3	1.3	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.1	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.4	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.6	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.8	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.9	0.7	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.0	2.8	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.3	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.5	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-110



**B.4 Dredging Scenario 4**

**B.4.1 Summer-A, Realistic Spill Scenario**

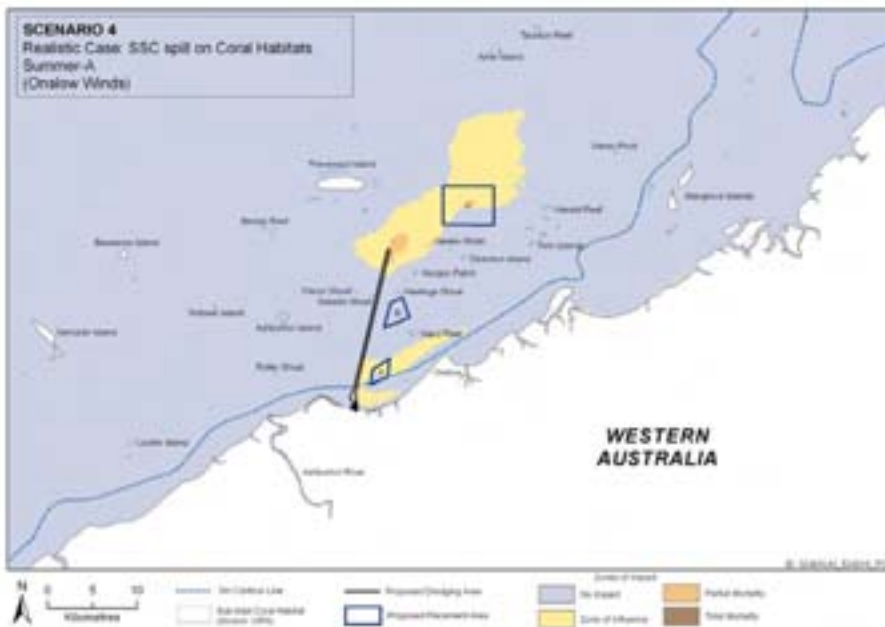


Figure B.145 Scenario 4, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

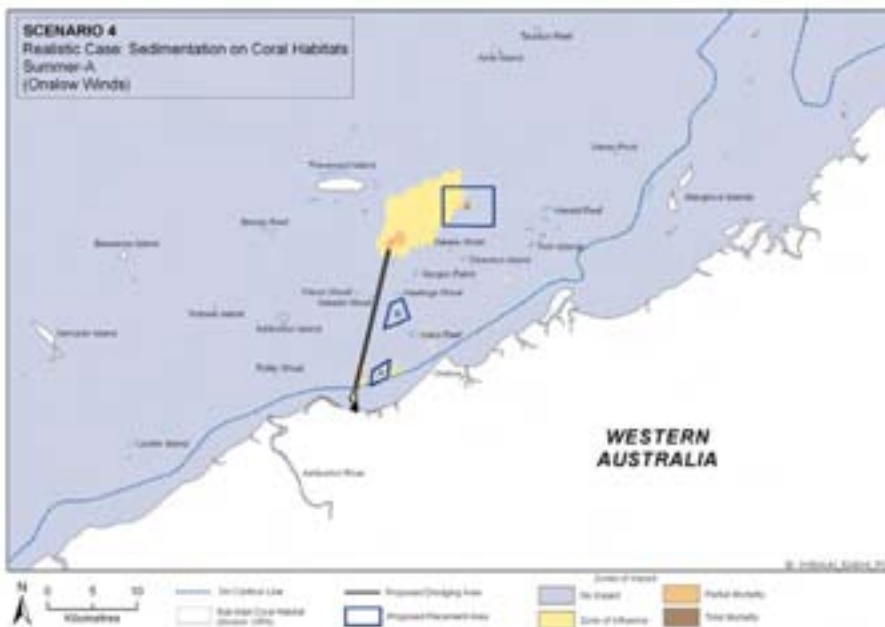


Figure B.146 Scenario 4, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-111

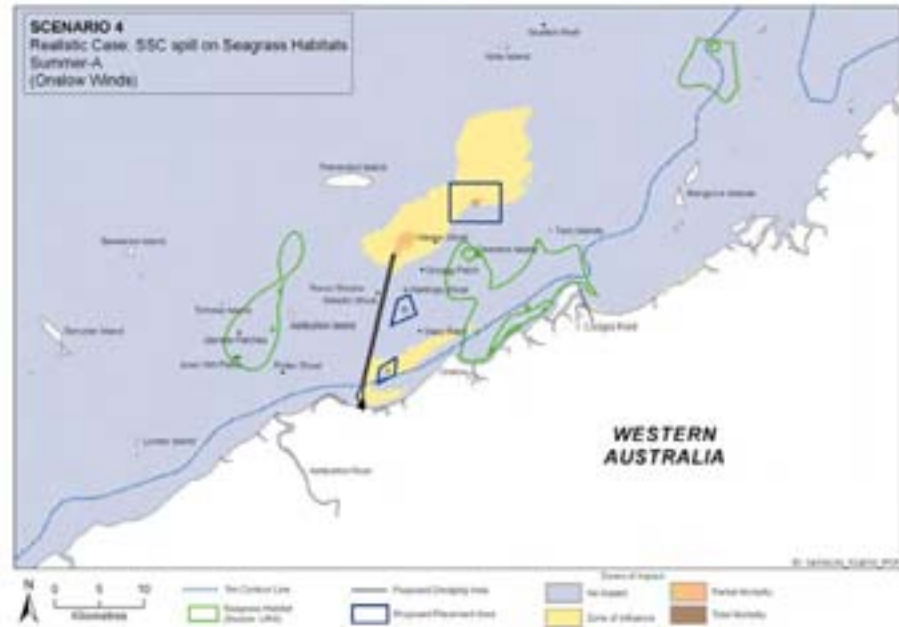


Figure B.147 Scenario 4, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

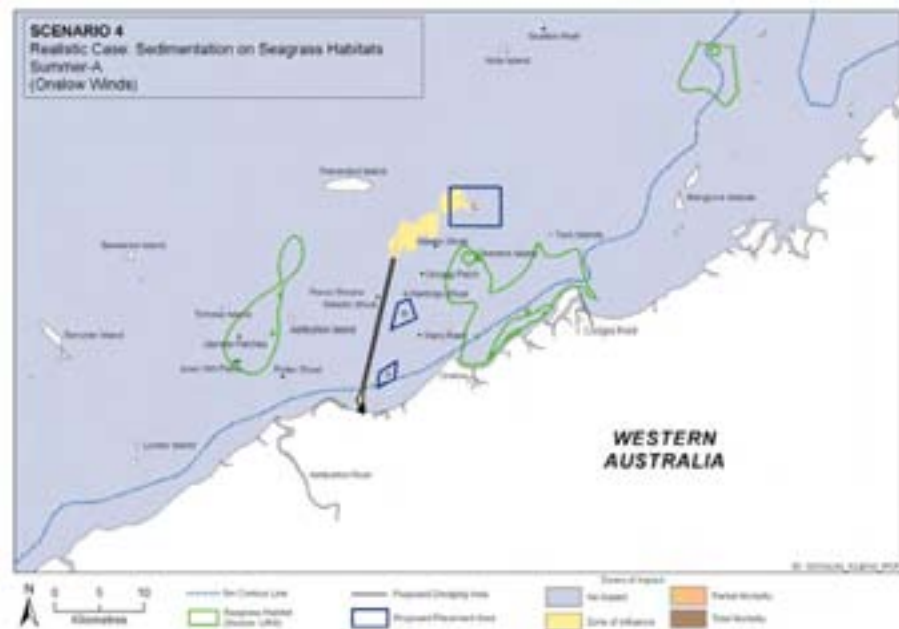


Figure B.148 Scenario 4, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-112



Table B.37 Summary of Impacts at Sensitive Receptors for Scenario 4, Summer-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.8	16.6	10.4	0.9	0.0	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.6	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.7	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.4	8.8	2.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.4	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.4	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	1.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.5	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.9	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.4	0.7	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.4	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	1.4	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.9	0.9	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.9	0.1	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	1.2	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.4	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-113



**B.4.2 Summer-B, Realistic Spill Scenario**



Figure B.149 Scenario 4, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

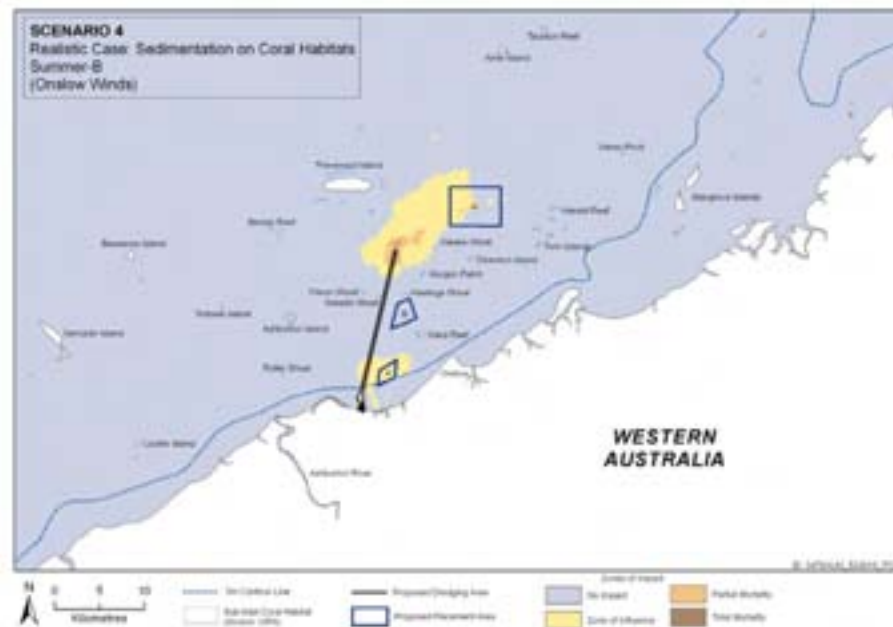


Figure B.150 Scenario 4, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

B-114

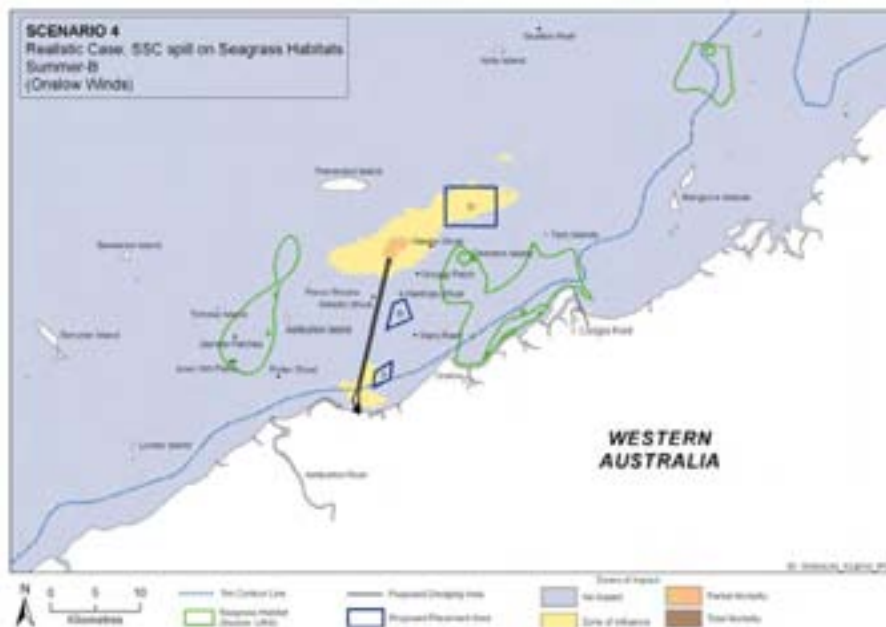


Figure B.151 Scenario 4, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

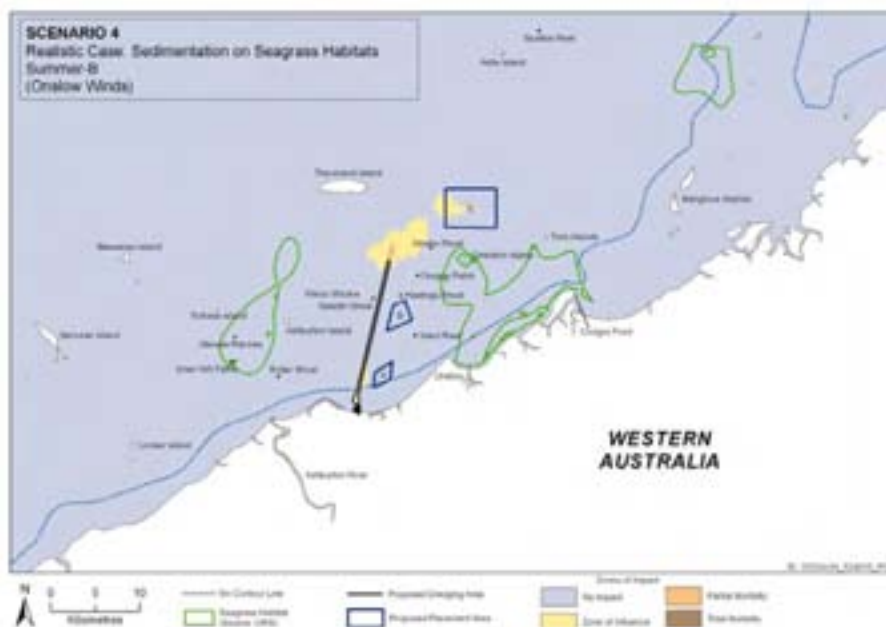


Figure B.152 Scenario 4, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-115



Table B.38 Summary of Impacts at Sensitive Receptors for Scenario 4, Summer-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	3.3	21.8	9.5	0.6	1.9	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.3	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.3	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.6	3.4	0.4	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.9	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.7	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.8	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.7	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.3	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.3	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.5	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.2	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-116



**B.4.3 Winter-A, Realistic Spill Scenario**

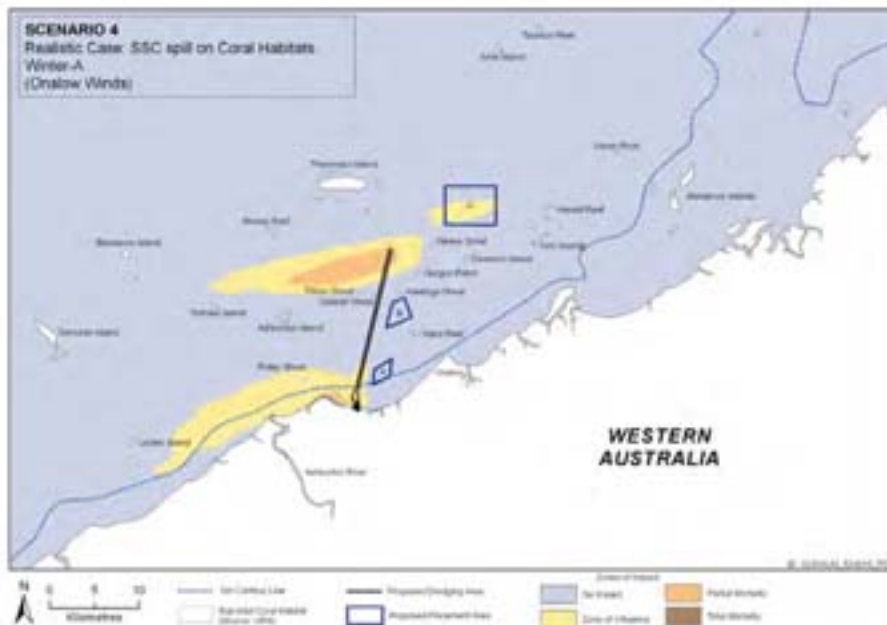


Figure B.153 Scenario 4, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

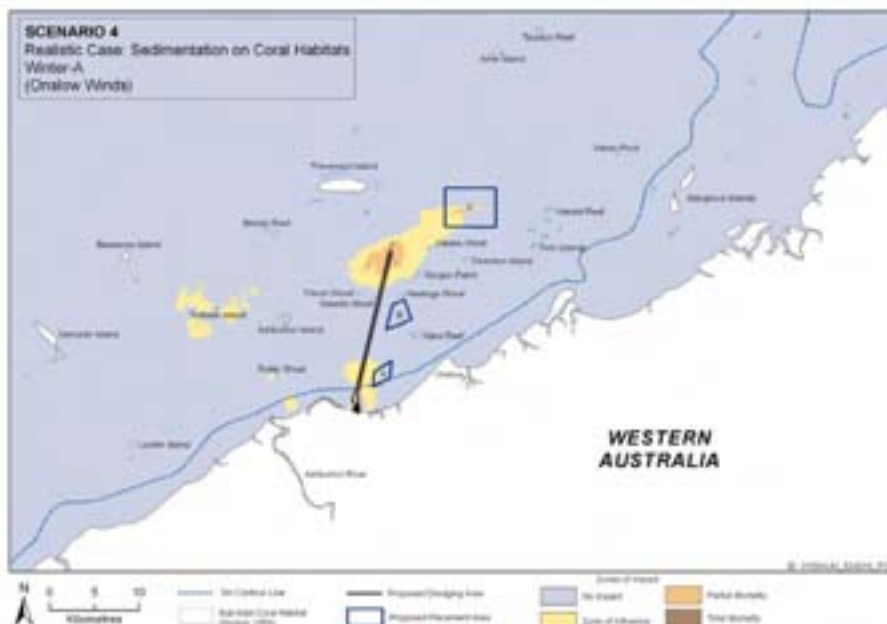


Figure B.154 Scenario 4, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



B-117

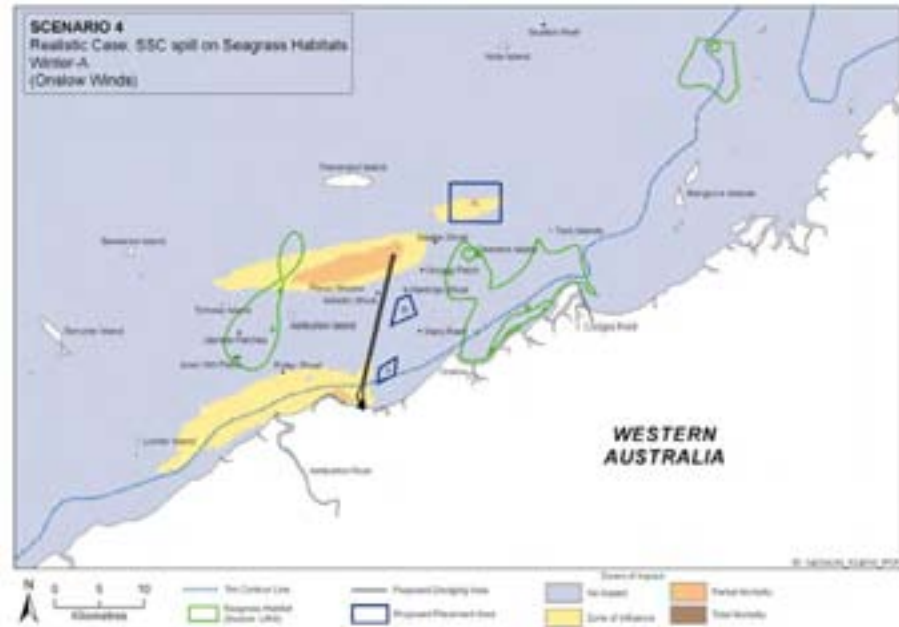


Figure B.155 Scenario 4, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

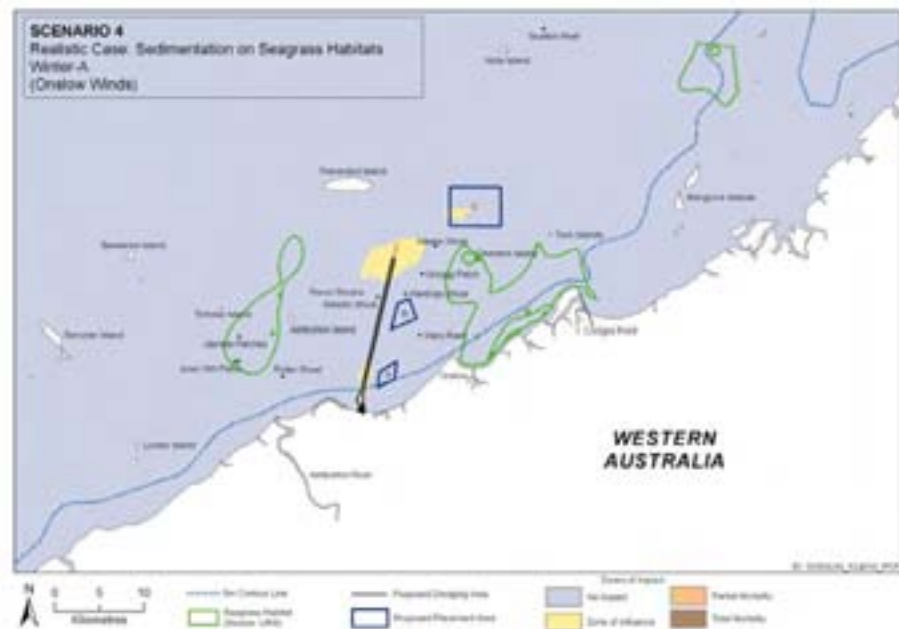


Figure B.156 Scenario 4, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

B-118



Table B.39 Summary of Impacts at Sensitive Receptors for Scenario 4, Winter-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.5	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.2	2.7	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.6	2.4	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	3.6	25.9	7.7	0.9	2.3	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.7	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.3	1.2	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.6	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.4.4 Winter-B, Realistic Spill Scenario**

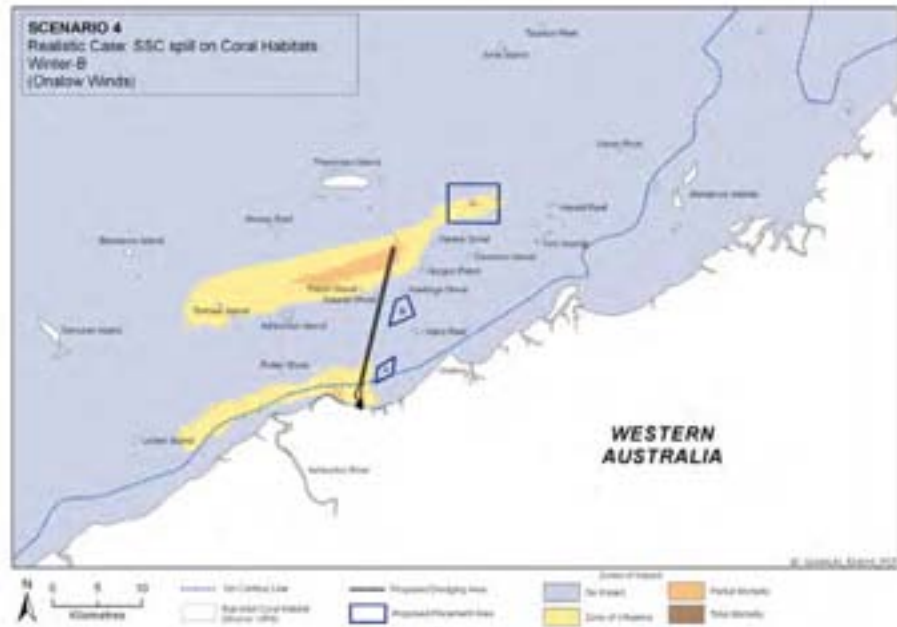


Figure B.157 Scenario 4, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

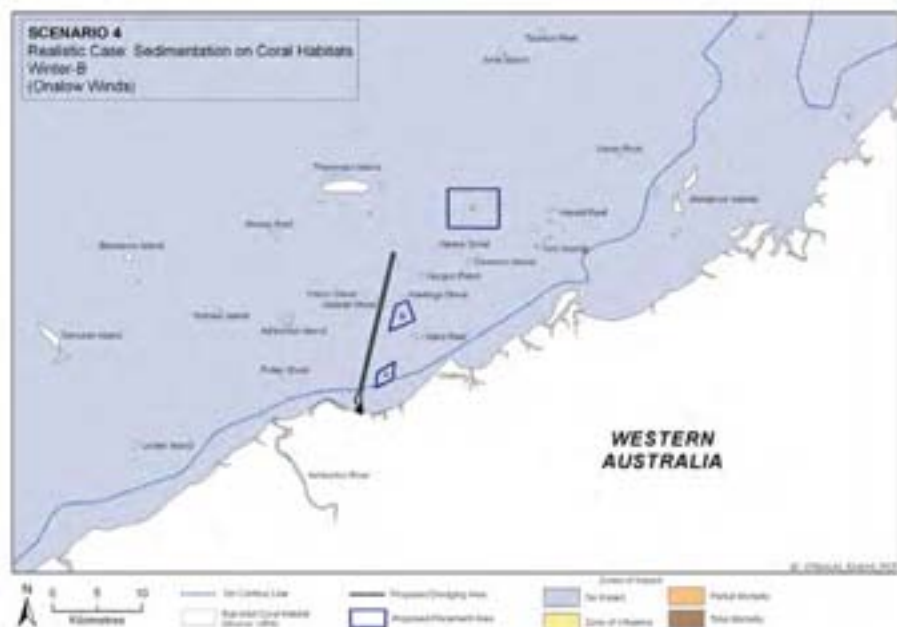


Figure B.158 Scenario 4, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

B-120

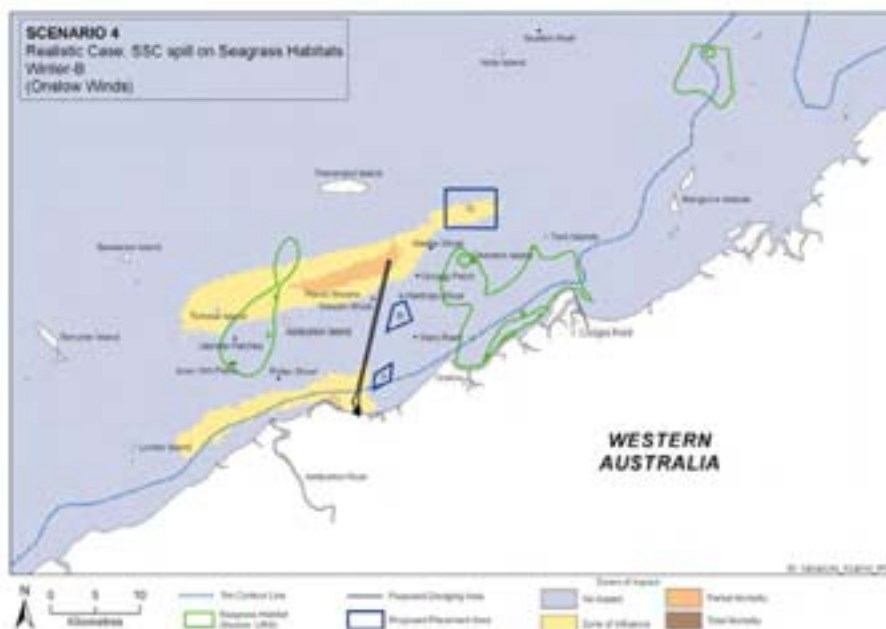


Figure B.159 Scenario 4, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

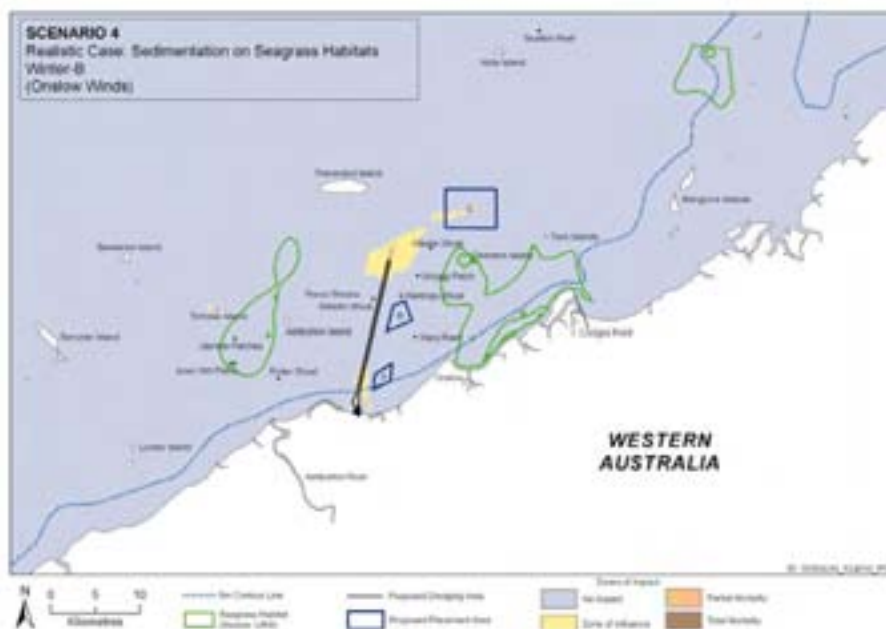


Figure B.160 Scenario 4, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

B-121



Table B.40 Summary of Impacts at Sensitive Receptors for Scenario 4, Winter-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.8	6.1	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.9	1.5	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.3	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.9	10.1	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.7	0.7	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	4.1	27.8	9.4	0.4	1.8	
9	Hastings Shoal	298803	7613488	0.3	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.4	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.9	0.6	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.5	17.1	0.0	0.0	0.3	
27	S of Brew is Reef	286445	7618545	0.5	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-122



**B.4.5 Transitional-A, Realistic Spill Scenario**

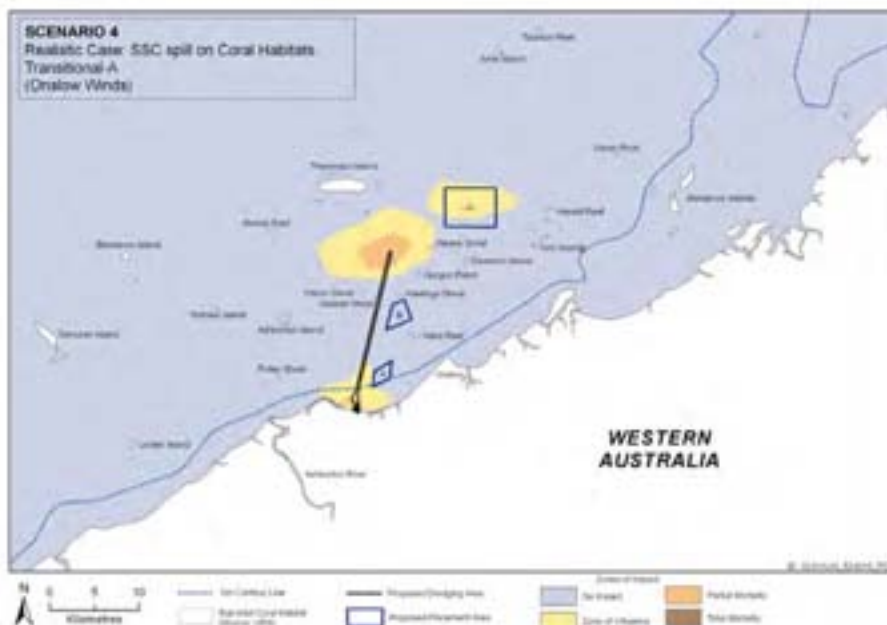


Figure B.161 Scenario 4, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

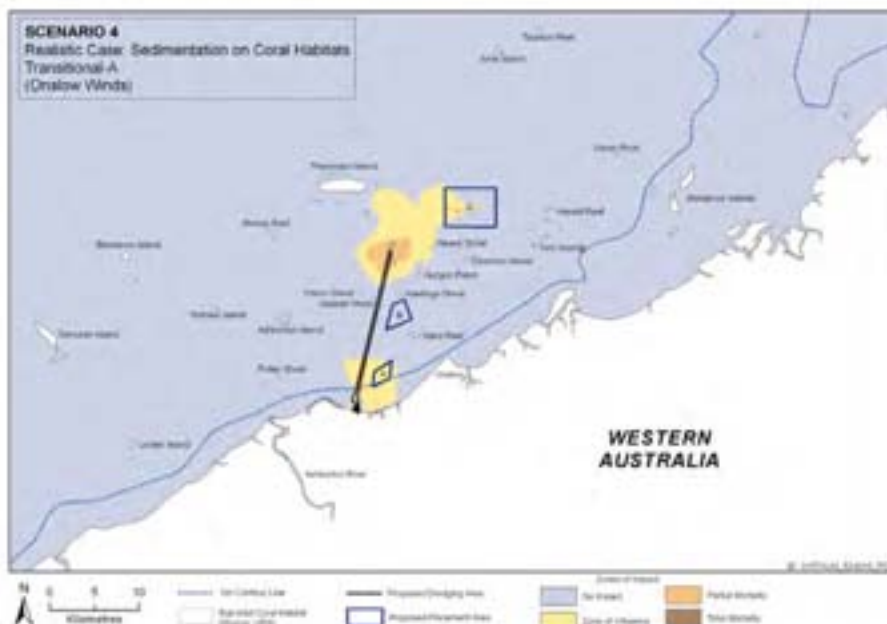


Figure B.162 Scenario 4, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-123

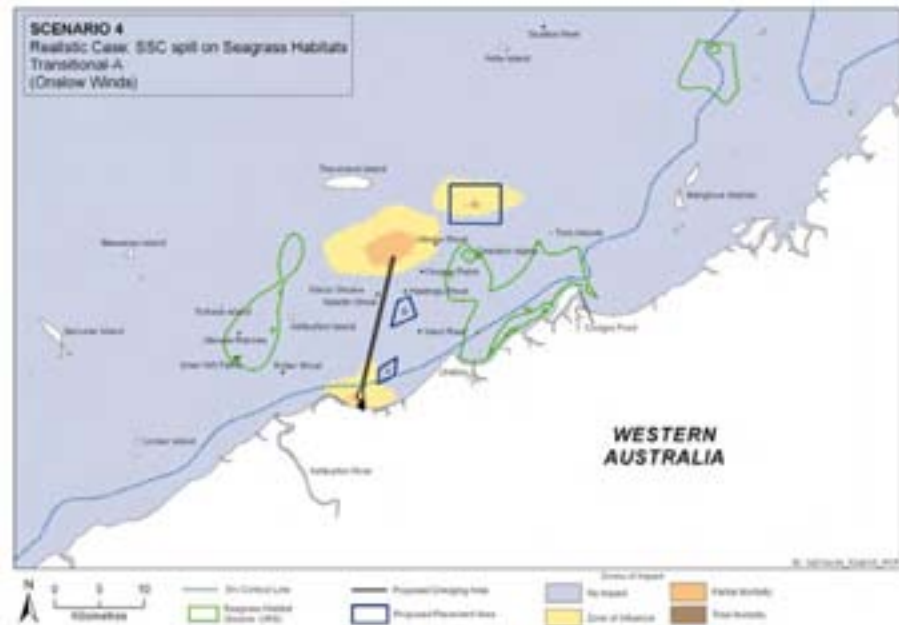


Figure B.163 Scenario 4, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

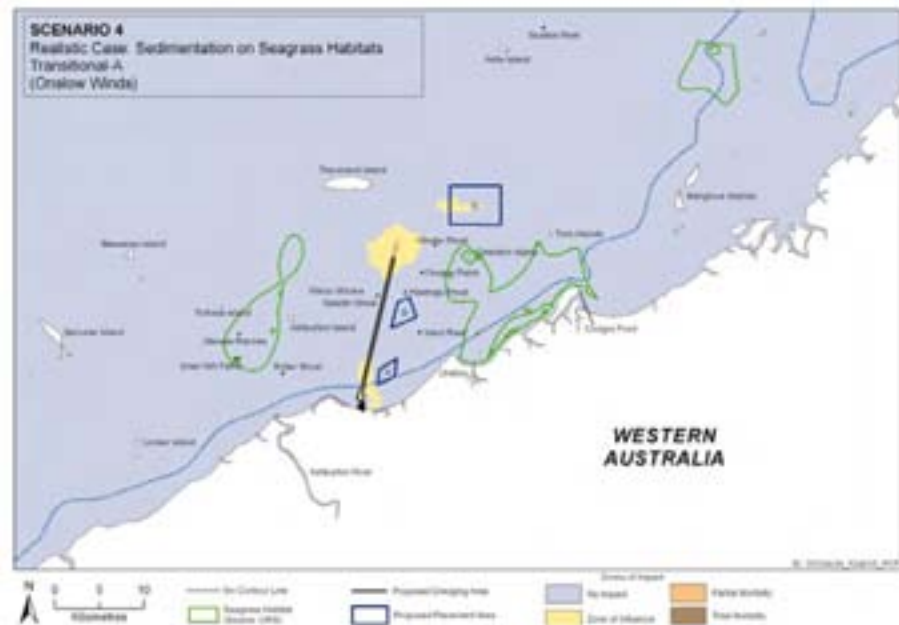


Figure B.164 Scenario 4, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-124



Table B.41 Summary of Impacts at Sensitive Receptors for Scenario 4, Transitional-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.2	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	4.2	28.5	8.9	0.9	2.4	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.1	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.8	6.5	2.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



B-125



**B.4.6 Transitional-B, Realistic Spill Scenario**

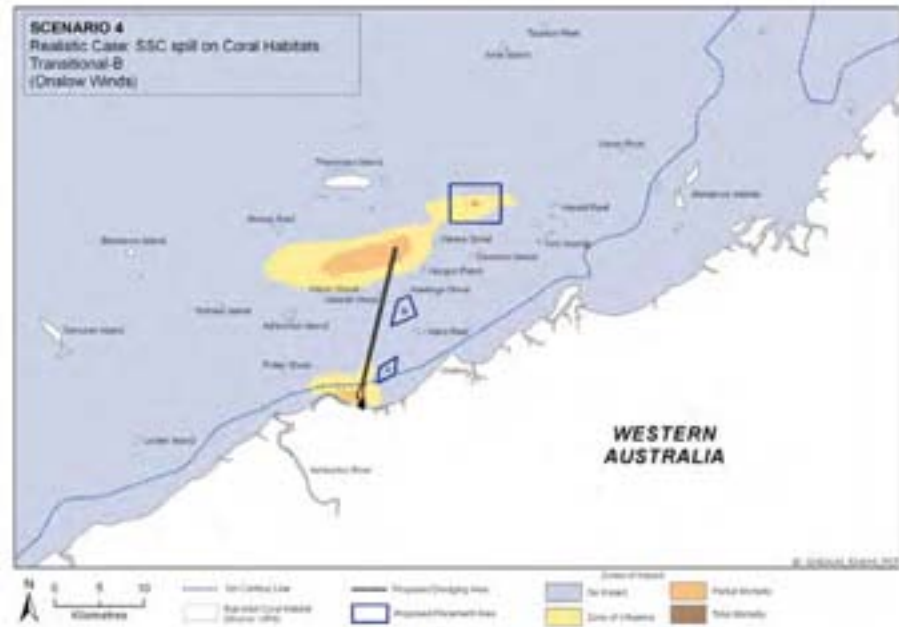


Figure B.165 Scenario 4, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

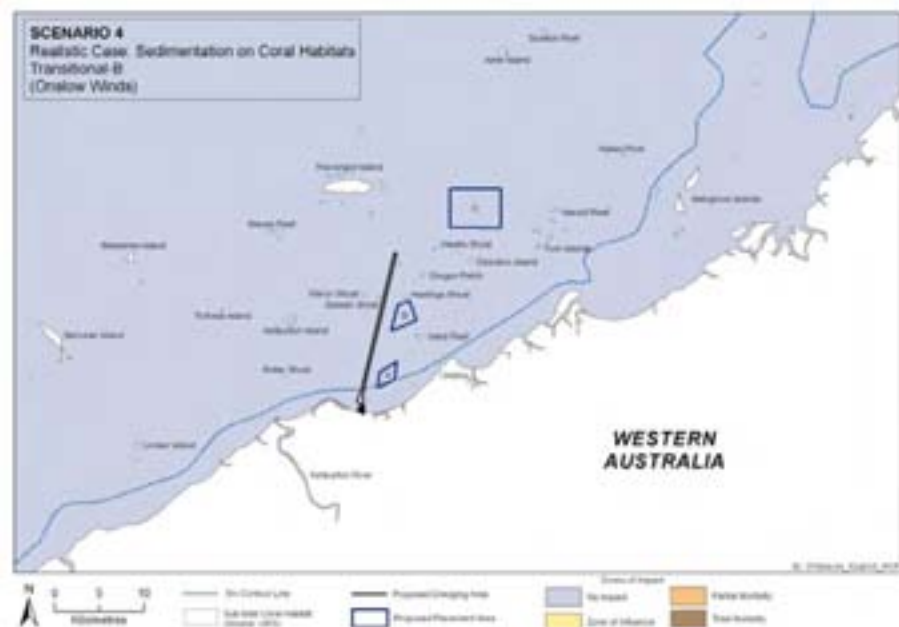


Figure B.166 Scenario 4, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

B-126

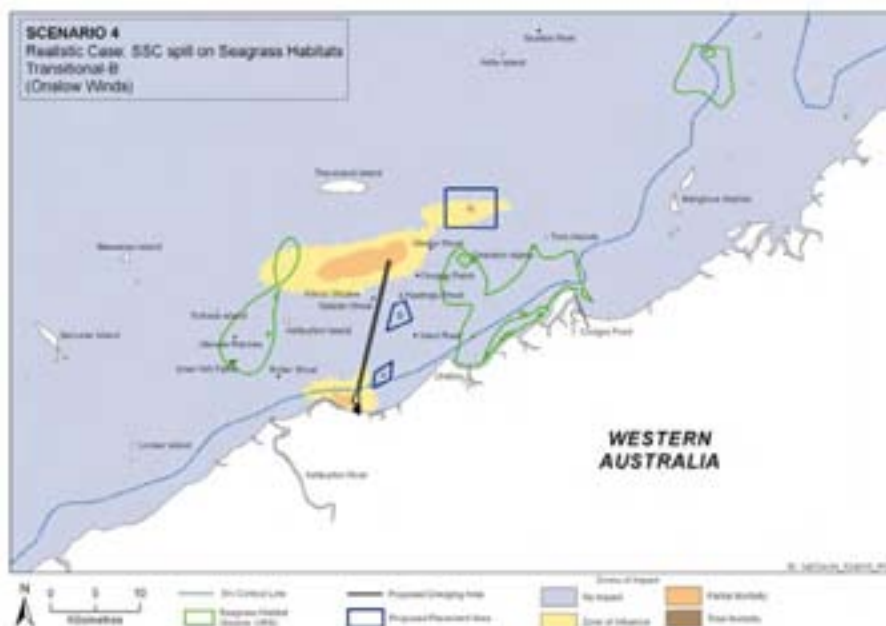


Figure B.167 Scenario 4, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

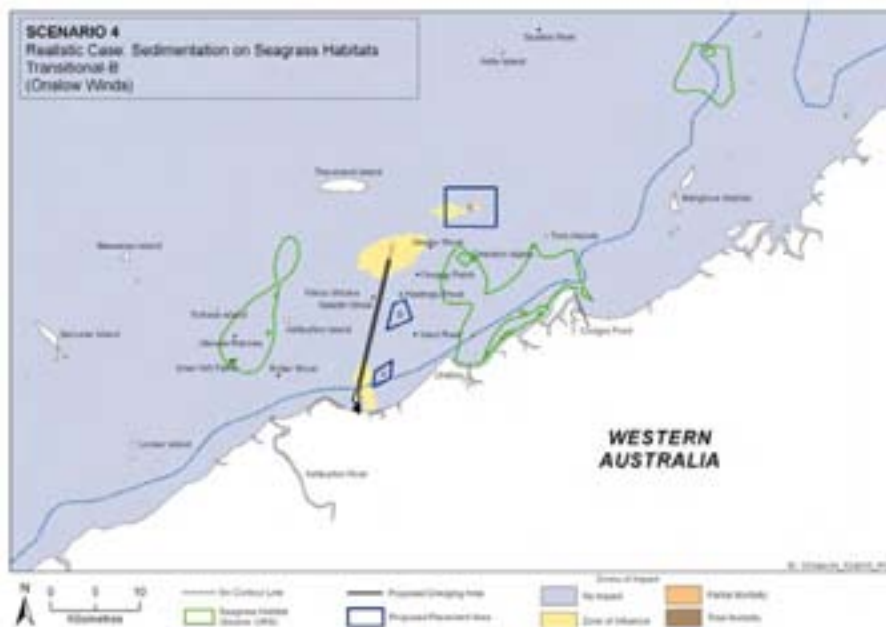


Figure B.168 Scenario 4, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-127



Table B.42 Summary of Impacts at Sensitive Receptors for Scenario 4, Transitional-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.1	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.6	0.6	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.1	3.3	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	4.5	32.1	9.2	0.9	2.3	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.2	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.3	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.3	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.7	0.7	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.6	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	1.1	3.7	0.0	0.0	0.1	
28	Thevenard Island South	294521	7622970	0.2	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.4.7 Summer-A, Worst Case Spill Scenario**

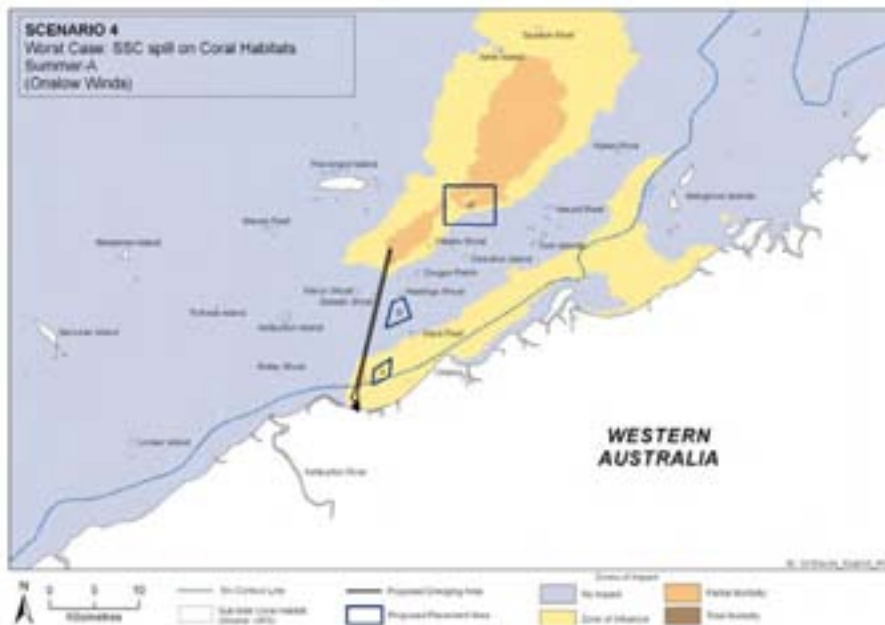


Figure B.169 Scenario 4, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

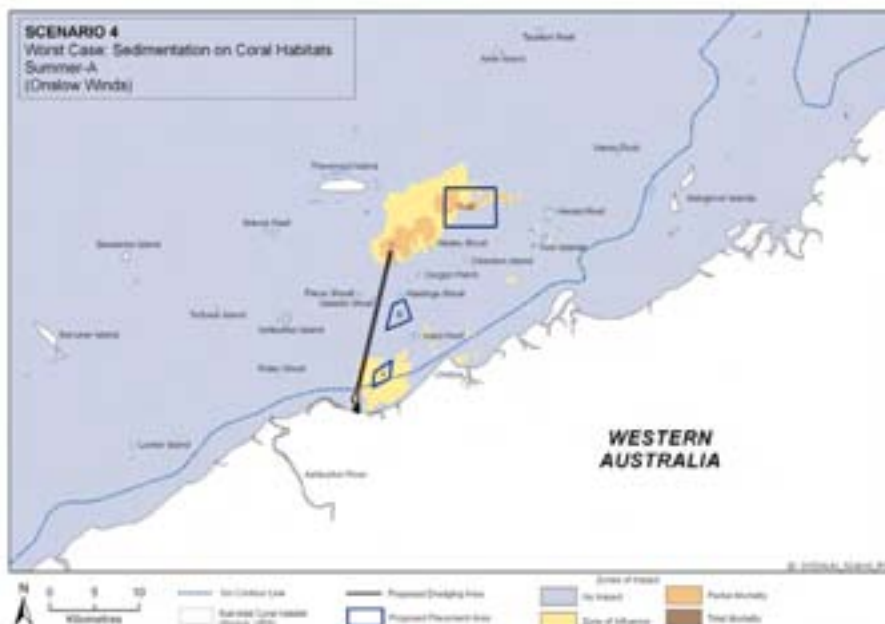


Figure B.170 Scenario 4, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

B-129

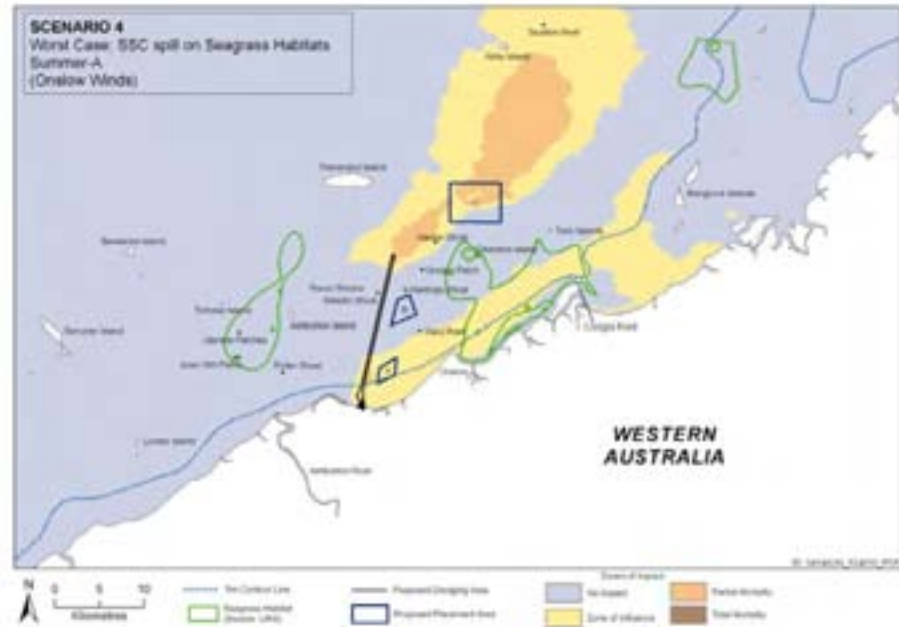


Figure B.171 Scenario 4, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

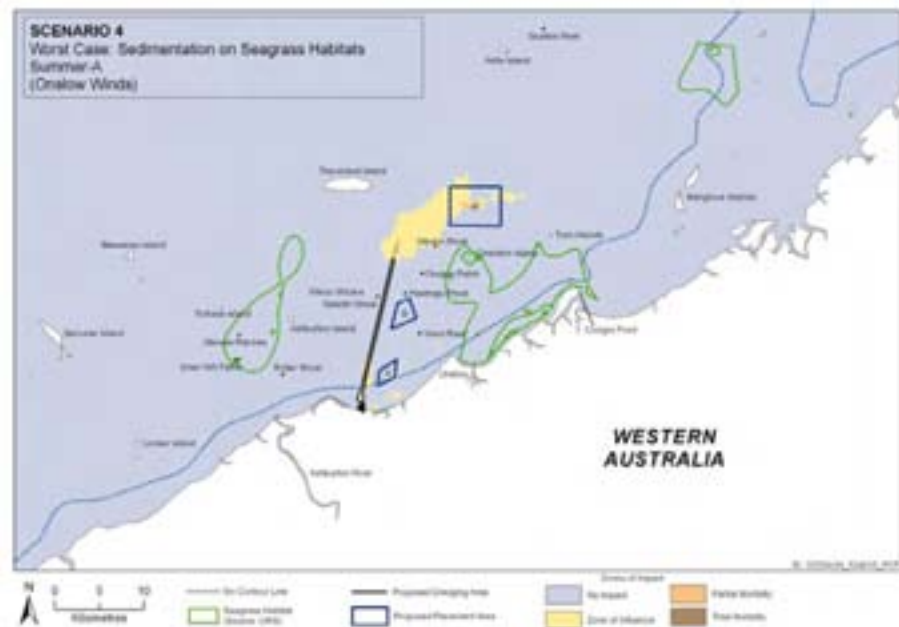


Figure B.172 Scenario 4, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

B-130



Table B.43 Summary of Impacts at Sensitive Receptors for Scenario 4, Summer-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	4.7	20.2	14.3	6.8	0.1	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	1.3	3.1	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	1.3	2.7	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.9	11.1	5.1	0.3	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.7	0.3	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.6	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	2.2	6.1	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.9	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	1.4	4.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	2.7	25.1	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.8	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	2.5	10.5	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	1.6	3.1	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	1.7	3.3	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	2.2	4.2	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.8	0.3	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-131



**B.4.8 Summer-B, Worst Case Spill Scenario**

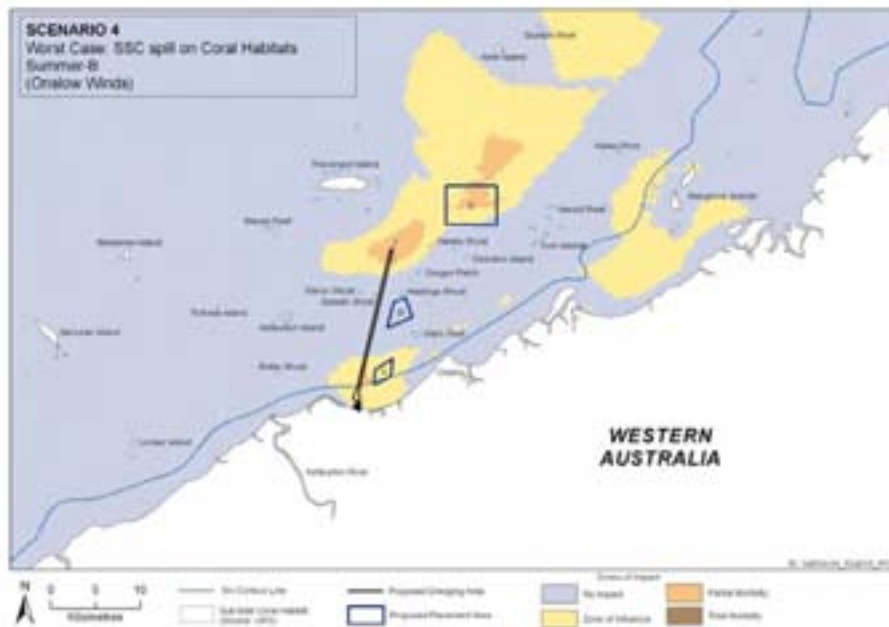


Figure B.173 Scenario 4, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

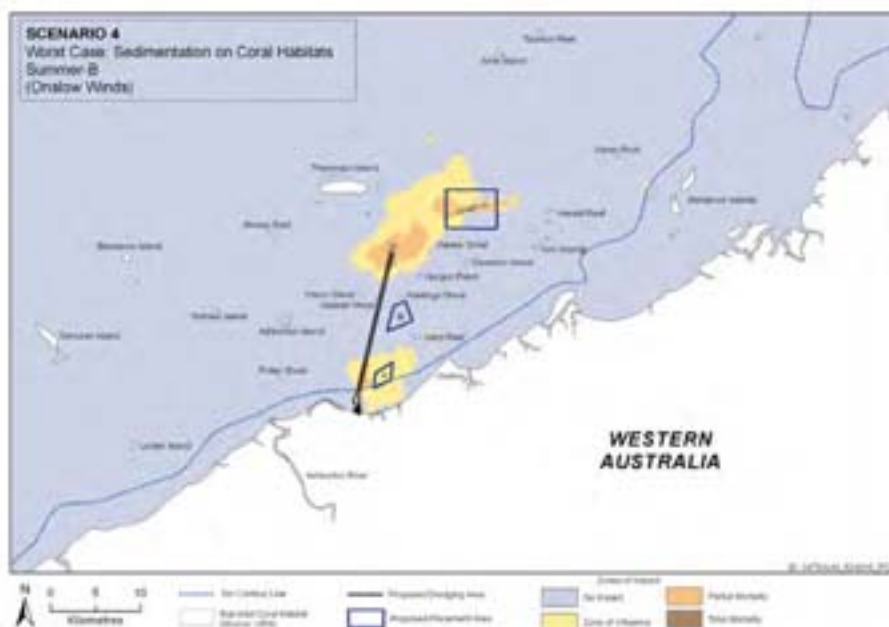


Figure B.174 Scenario 4, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

B-132



Figure B.175 Scenario 4, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

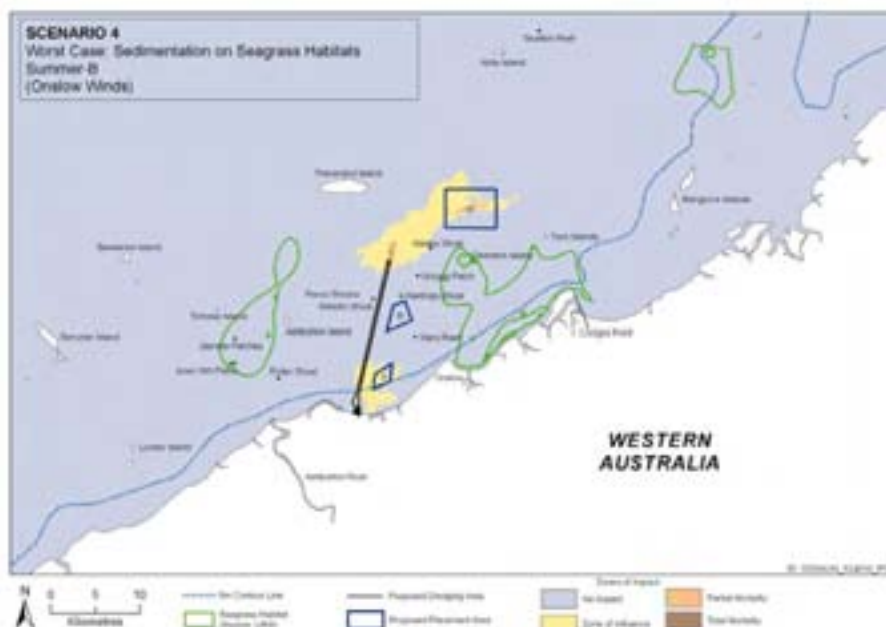


Figure B.176 Scenario 4, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds



B-133



Table B.44 Summary of Impacts at Sensitive Receptors for Scenario 4, Summer-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	5.0	28.2	16.2	5.6	4.1	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.6	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.6	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.0	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.9	5.8	1.3	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.3	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.2	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	2.0	5.3	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.3	0.1	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	1.3	1.2	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	1.8	3.1	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.5	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	1.3	1.5	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.6	0.7	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.6	0.3	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	1.1	0.3	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.3	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.4.9 Winter-A, Worst Case Spill Scenario**

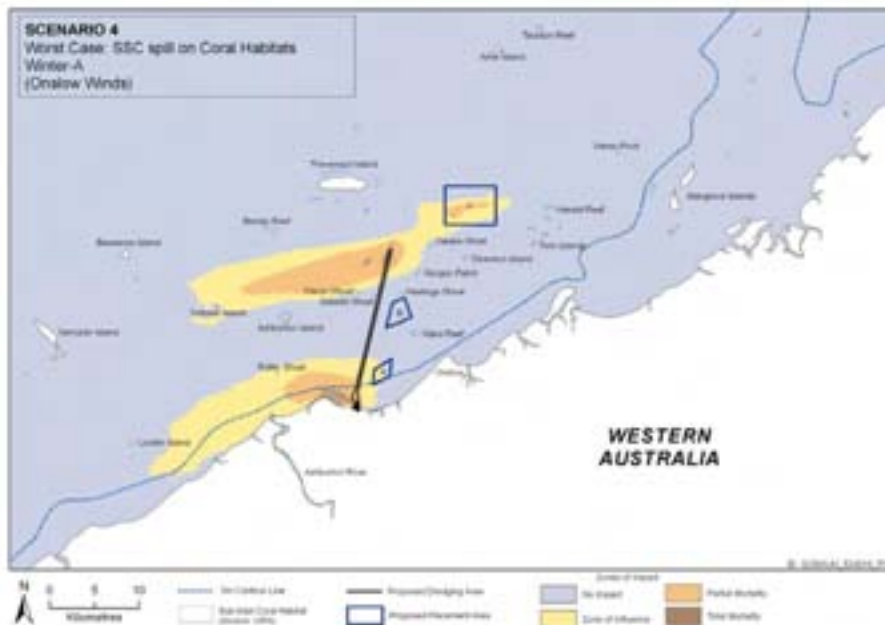


Figure B.177 Scenario 4, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

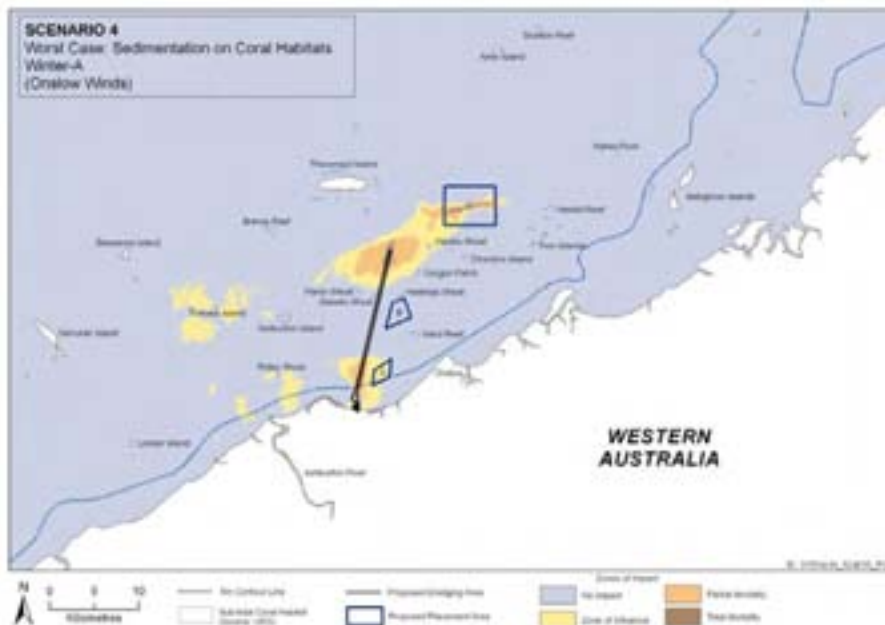


Figure B.178 Scenario 4, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-135

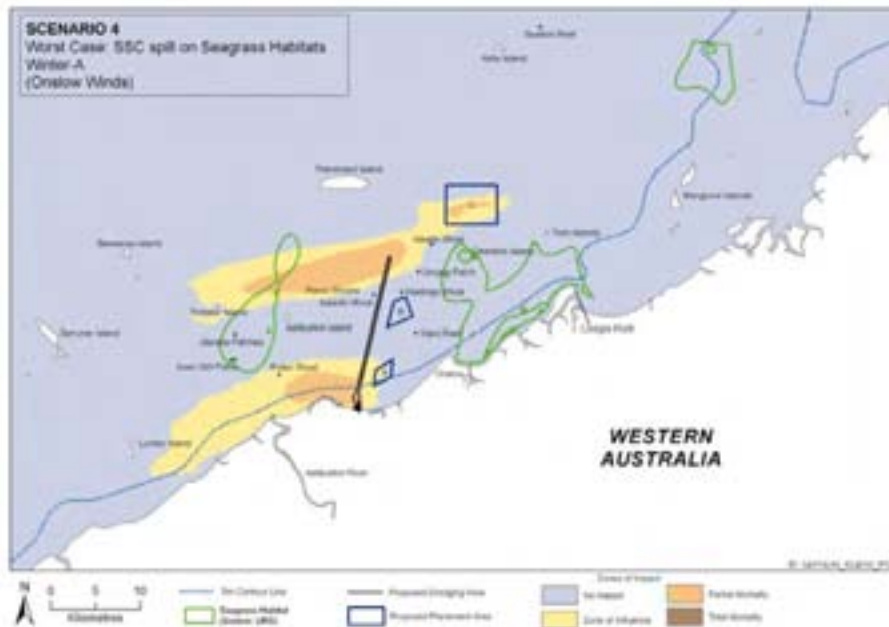


Figure B.179 Scenario 4, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

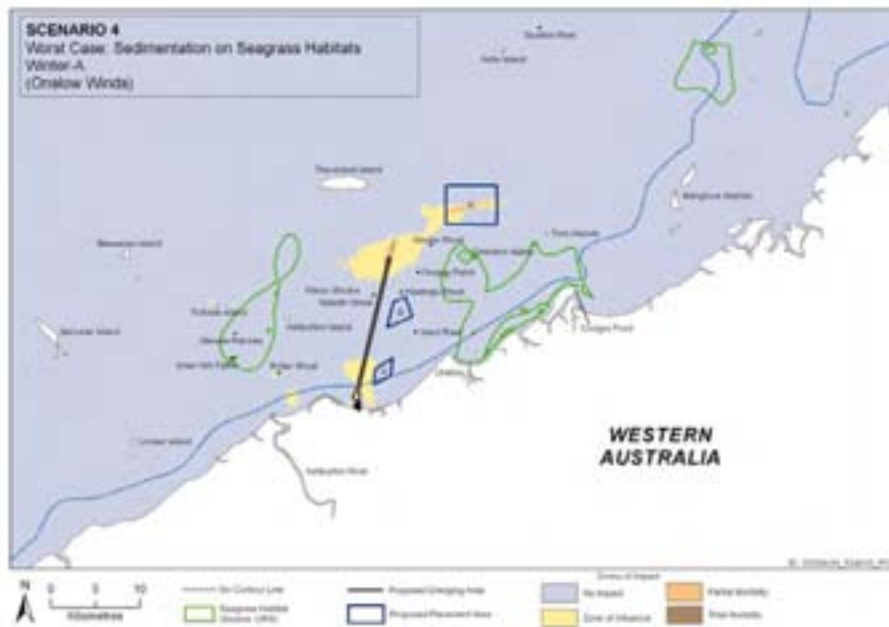


Figure B.180 Scenario 4, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-136



Table B.45 Summary of Impacts at Sensitive Receptors for Scenario 4, Winter-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	2.2	1.3	0.0	0.0	0.1	
2	Roller Shoal	285367	7604532	2.1	11.9	0.9	0.0	0.0	
3	Ashburton Island	286705	7611075	0.2	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.3	9.4	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	5.5	39.4	15.2	2.2	4.4	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.2	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.3	0.7	0.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	3.3	17.7	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.9	1.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.4.10 Winter-B, Worst Case Spill Scenario**

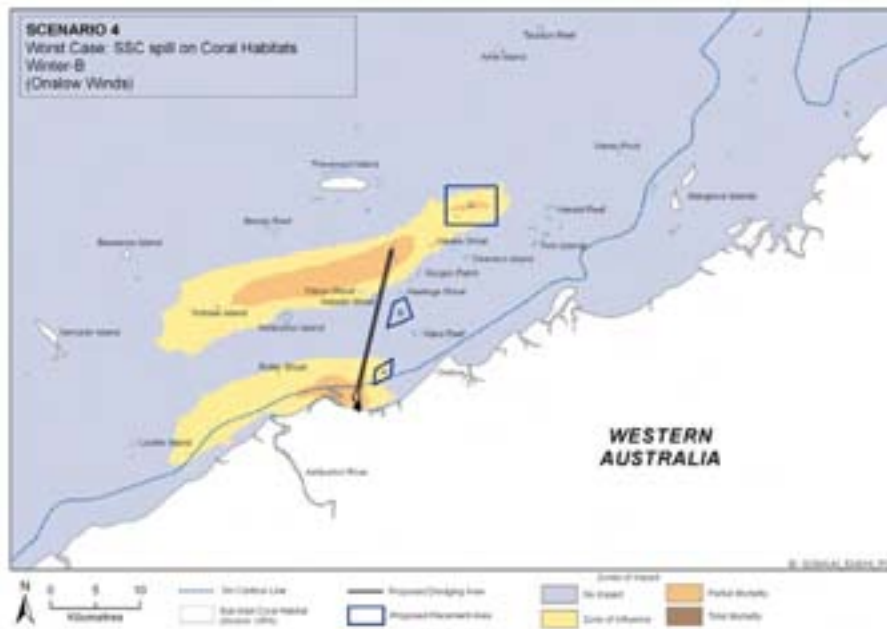


Figure B.181 Scenario 4, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

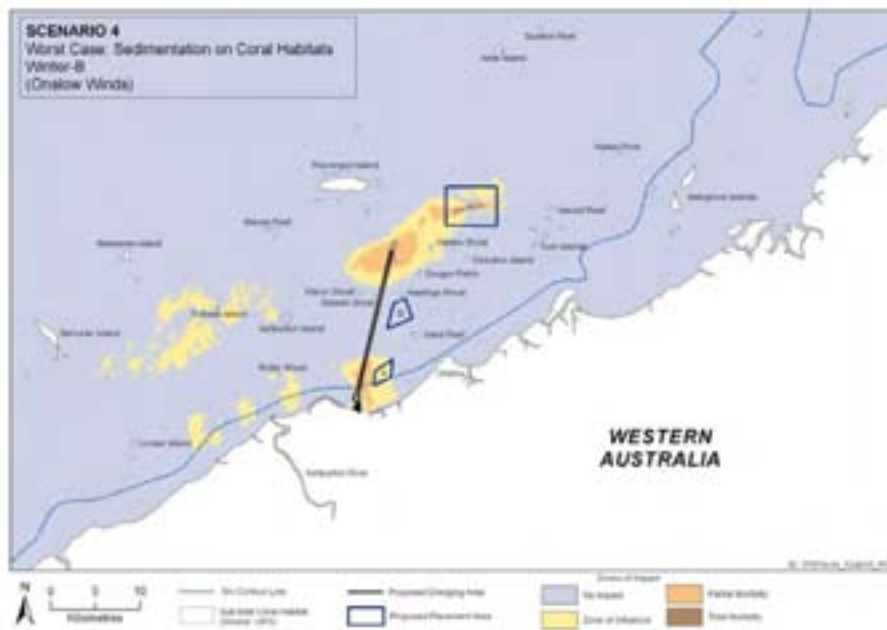


Figure B.182 Scenario 4, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-138

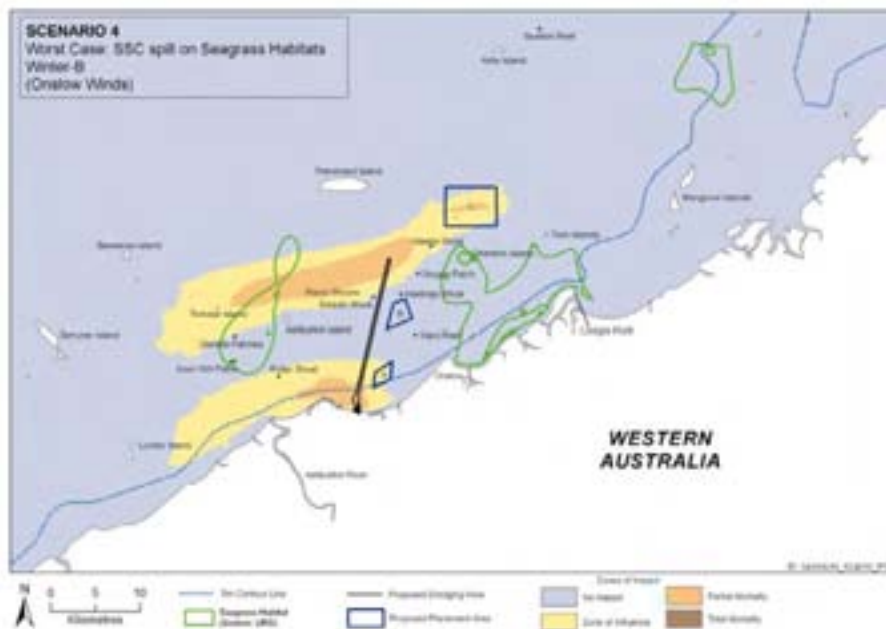


Figure B.183 Scenario 4, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

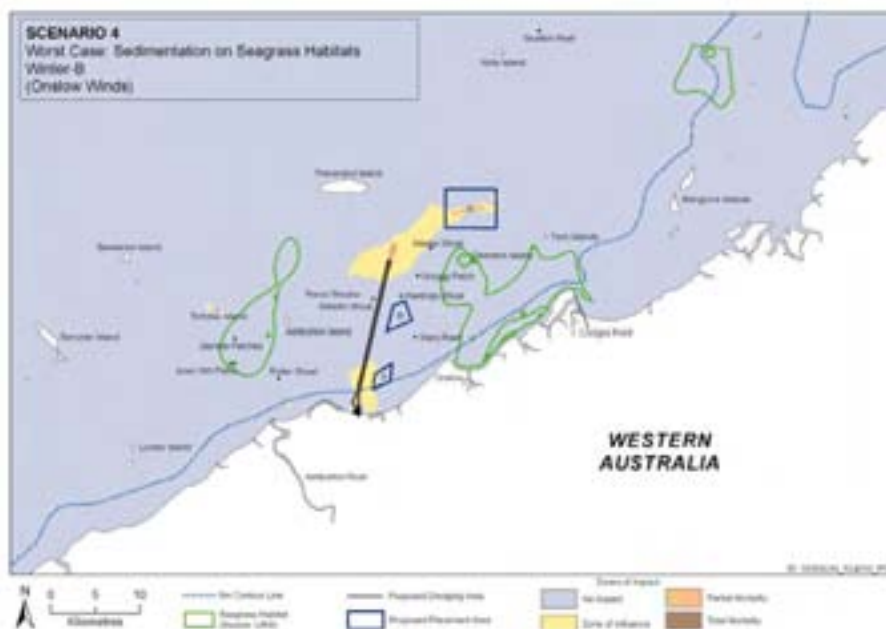


Figure B.184 Scenario 4, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-139



Table B.46 Summary of Impacts at Sensitive Receptors for Scenario 4, Winter-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	2.6	19.3	0.9	0.0	0.1	
2	Roller Shoal	285367	7604532	1.7	10.3	1.5	0.0	0.0	
3	Ashburton Island	286705	7611075	0.4	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.5	15.2	1.9	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.1	1.9	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	6.2	43.8	19.0	3.6	3.3	
9	Hastings Shoal	298803	7613488	0.4	0.0	0.0	0.0	0.1	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.7	0.6	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.7	0.9	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.7	5.3	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	3.6	31.5	1.2	0.0	0.3	
27	S of Brew is Reef	286445	7618545	0.7	0.1	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-140



**B.4.11 Transitional-A, Worst Case Spill Scenario**

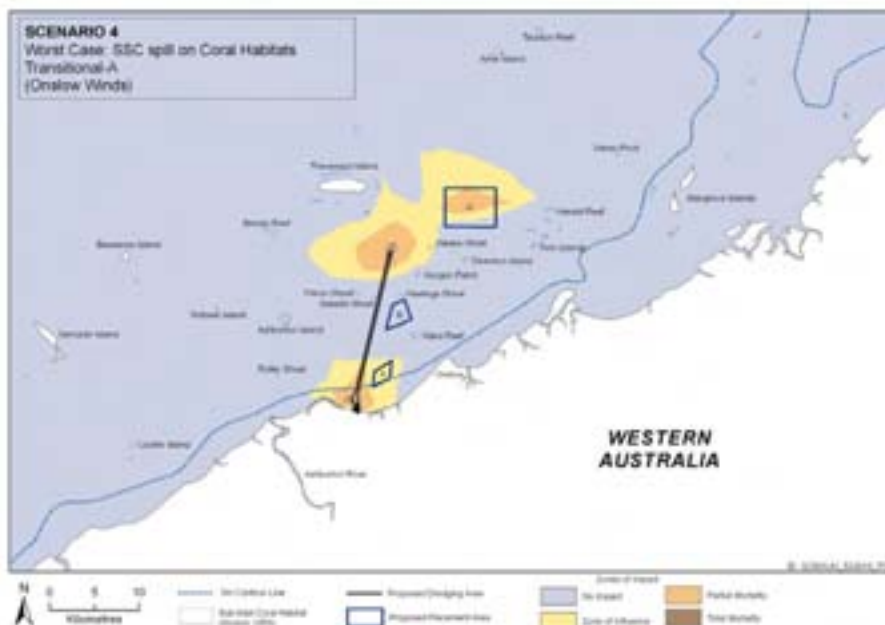


Figure B.185 Scenario 4, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

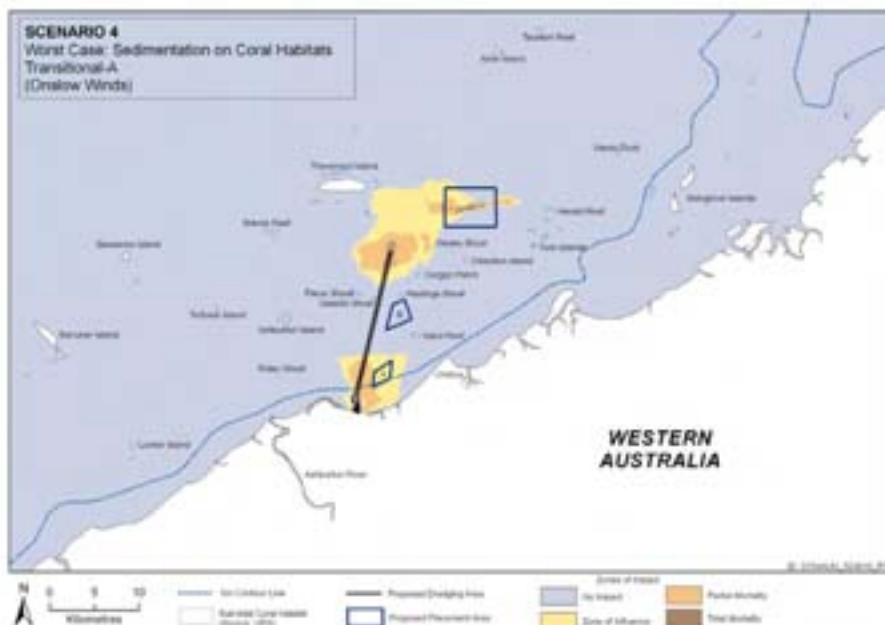


Figure B.186 Scenario 4, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



B-141

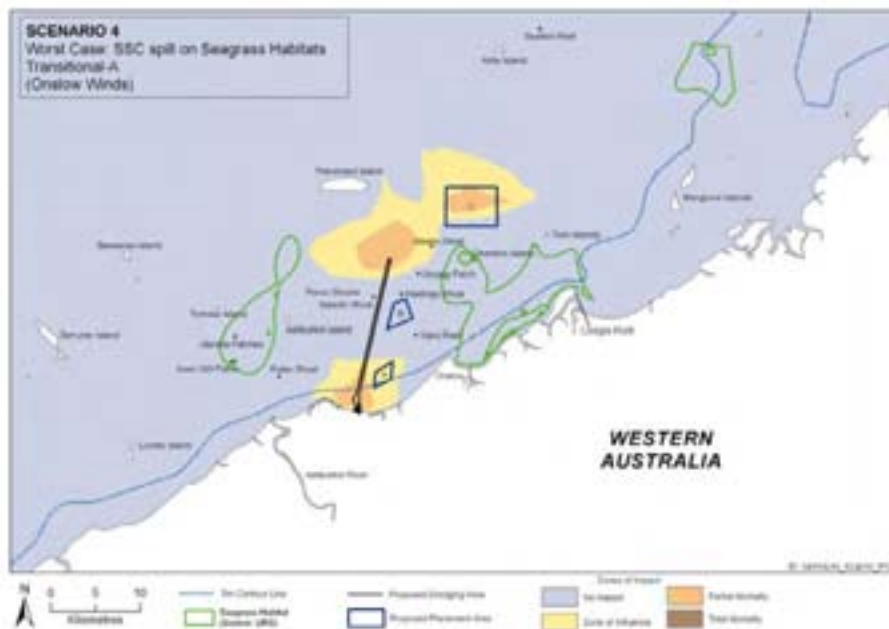


Figure B.187 Scenario 4, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds



Figure B.188 Scenario 4, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

B-142



Table B.47 Summary of Impacts at Sensitive Receptors for Scenario 4, Transitional-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.3	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.2	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.1	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	5.9	39.2	17.1	3.1	3.8	
9	Hastings Shoal	298803	7613488	0.0	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.3	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.3	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.2	0.1	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.2	8.6	4.0	0.3	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.0	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.5	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-143



**B.4.12 Transitional-B, Worst Case Spill Scenario**

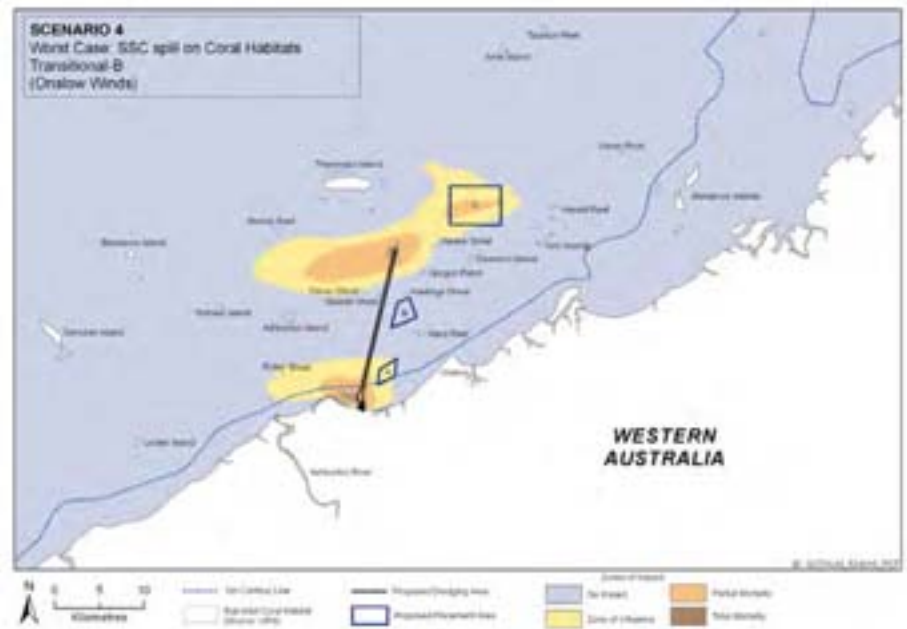


Figure B.189 Scenario 4, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

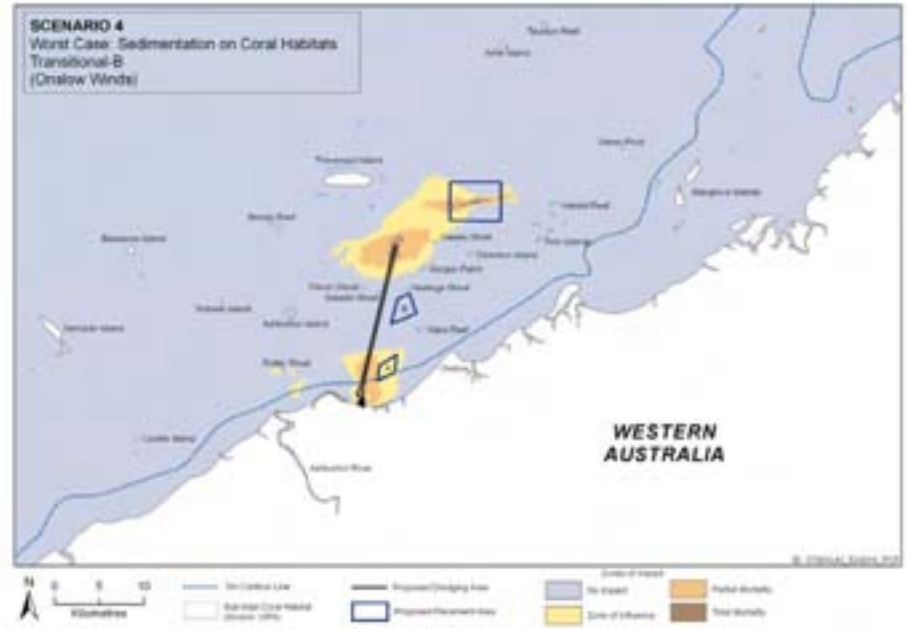


Figure B.190 Scenario 4, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

B-144

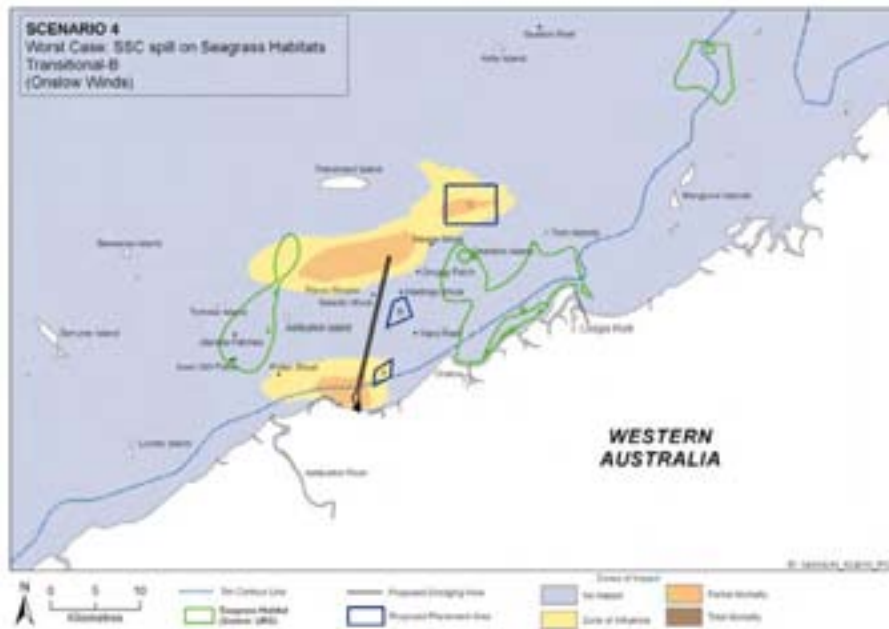


Figure B.191 Scenario 4, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

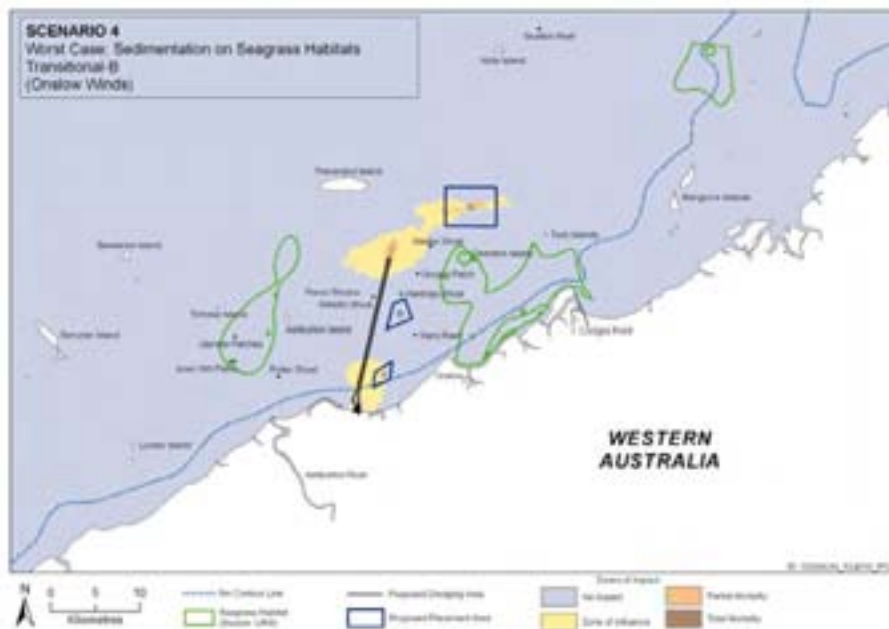


Figure B.192 Scenario 4, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

B-145



Table B.48 Summary of Impacts at Sensitive Receptors for Scenario 4, Transitional-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.1	4.8	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.3	6.1	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	6.5	47.4	18.4	3.7	3.8	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.4	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.6	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.6	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.1	3.6	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.7	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	1.4	7.9	0.0	0.0	0.1	
28	Thevenard Island South	294521	7622970	0.3	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-146



**B.5 Dredging Scenario 5**

**B.5.1 Summer-A, Realistic Spill Scenario**

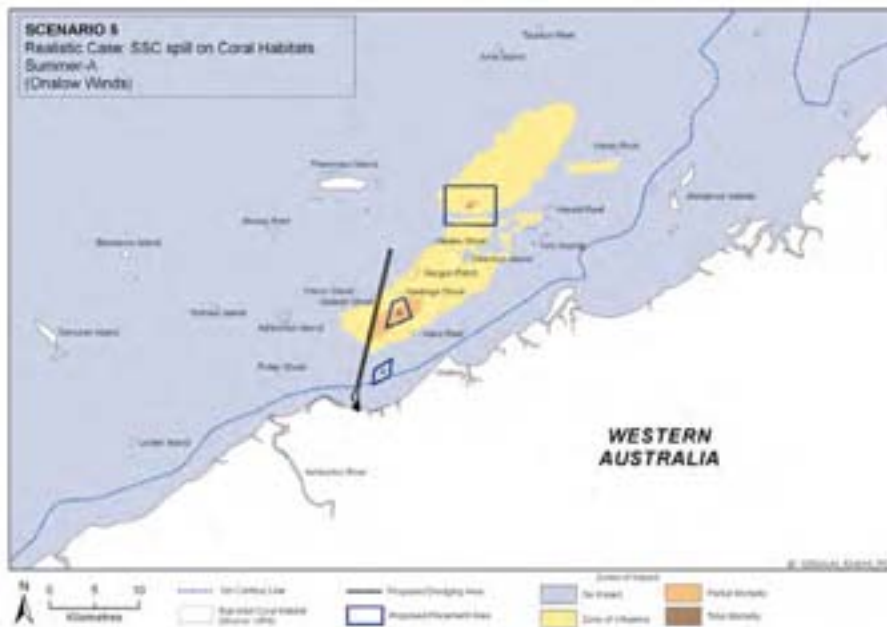


Figure B.193 Scenario 5, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

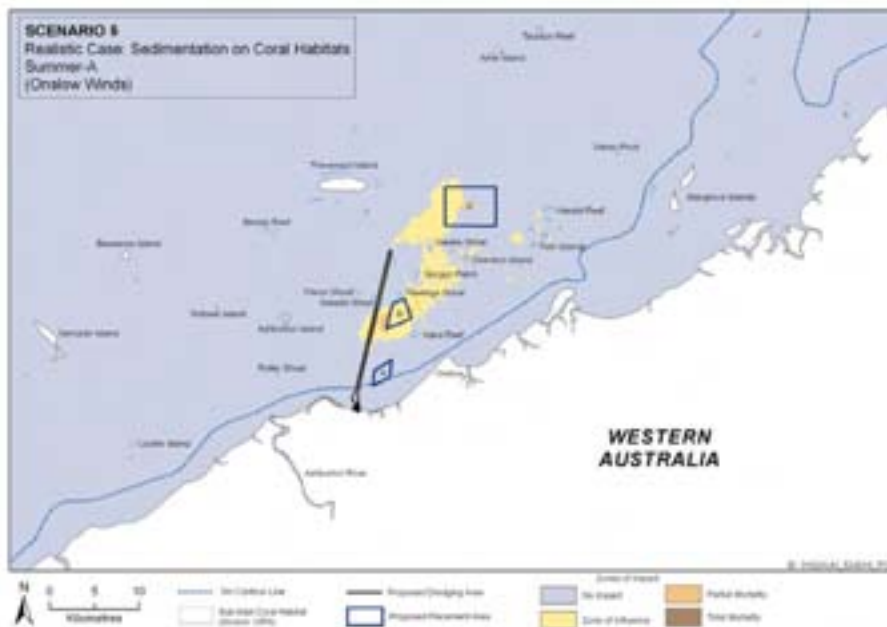


Figure B.194 Scenario 5, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-147

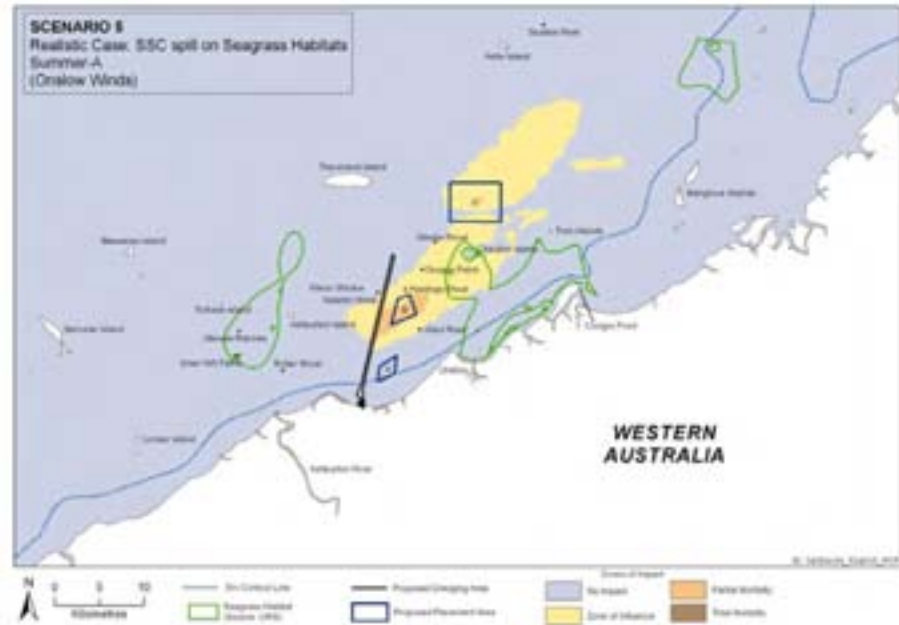


Figure B.195 Scenario 5, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

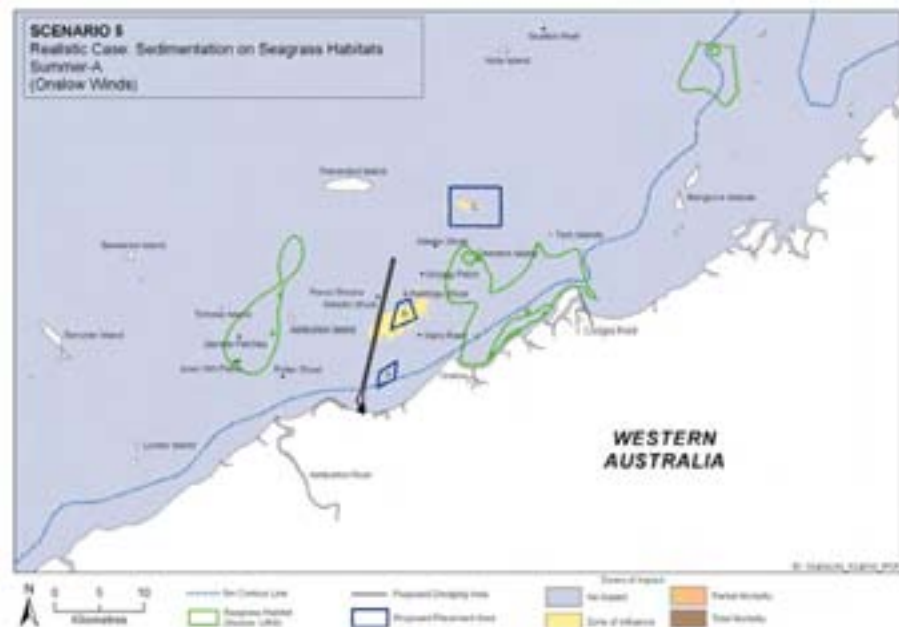


Figure B.196 Scenario 5, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-148



Table B.49 Summary of Impacts at Sensitive Receptors for Scenario 5, Summer-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.6	0.9	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.8	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	2.1	10.5	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	3.3	23.2	7.6	0.0	0.0	
11	Ward Reef	300410	7608868	0.9	1.8	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.8	1.6	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.8	6.4	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	1.9	7.6	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.6	2.5	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	2.8	16.5	0.4	0.0	0.6	
17	NW of Direction Island	304867	7618549	2.2	7.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	1.8	2.2	0.0	0.0	0.9	
19	NE Tw in Island	314029	7620738	1.4	1.3	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	1.8	0.4	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.7	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.6	1.5	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.1	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	1.5	2.7	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.4	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.5	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	1.3	0.4	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	





**B.5.2 Summer-B, Realistic Spill Scenario**

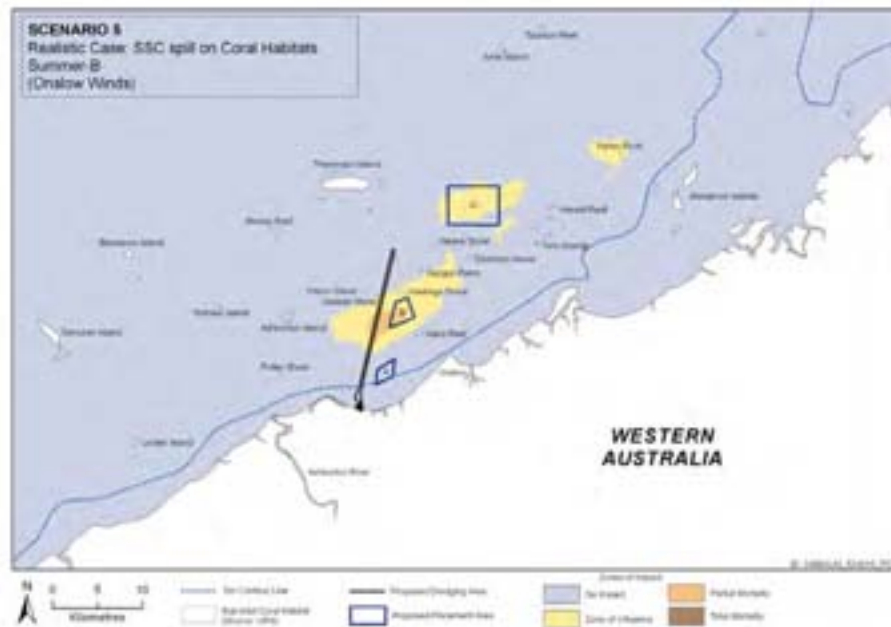


Figure B.197 Scenario 5, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

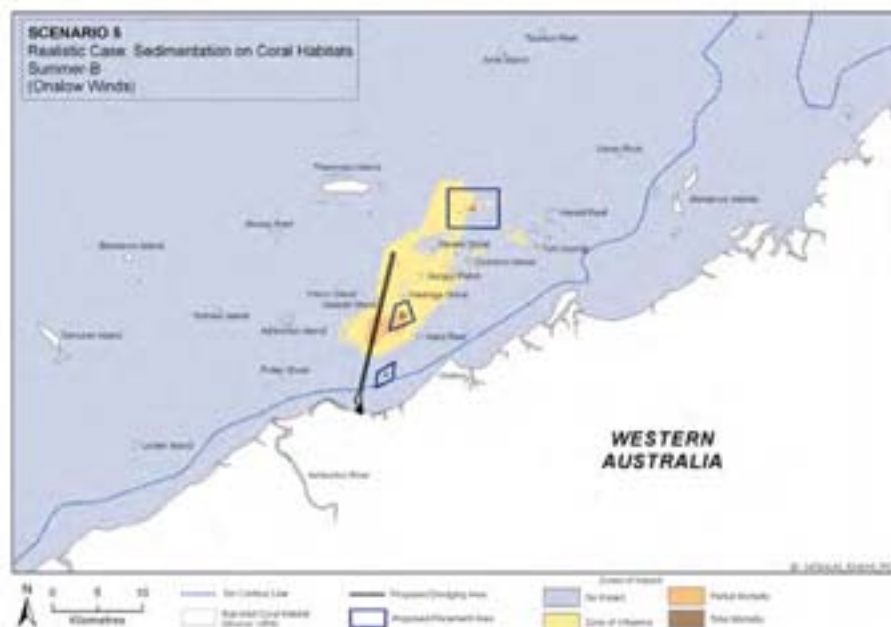


Figure B.198 Scenario 5, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

B-150

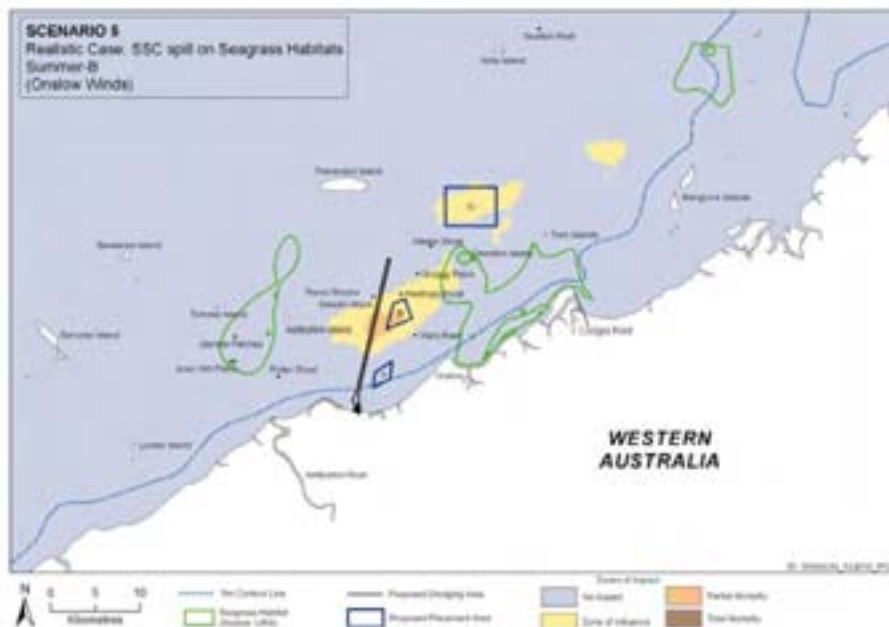


Figure B.199 Scenario 5, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

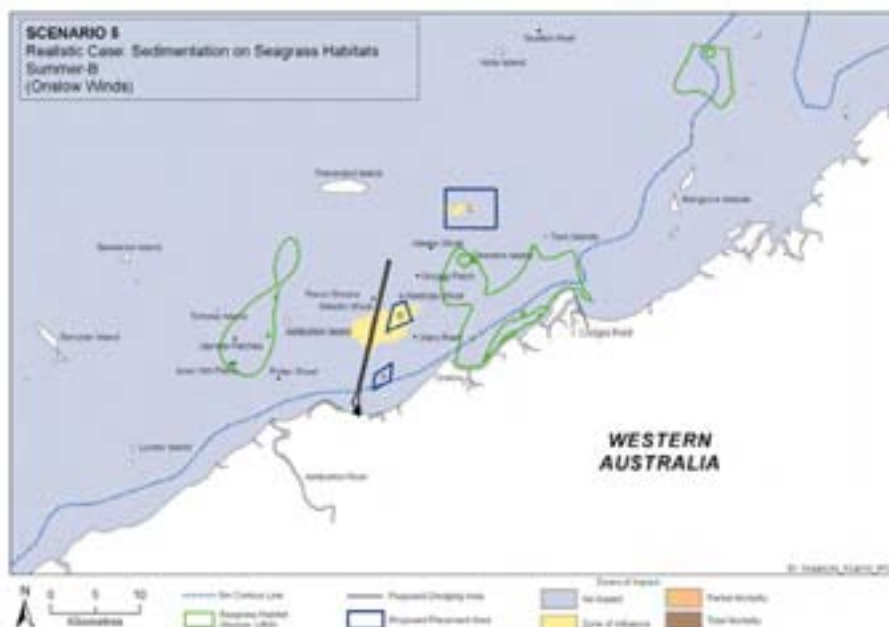


Figure B.200 Scenario 5, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-151



Table B.50 Summary of Impacts at Sensitive Receptors for Scenario 5, Summer-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.4	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.0	1.9	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.0	0.3	0.0	0.0	0.2	
9	Hastings Shoal	298803	7613488	1.9	6.8	0.0	0.0	0.5	
10	North West Ward Reef	299018	7610106	2.7	18.3	5.3	0.0	0.8	
11	Ward Reef	300410	7608868	0.3	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.2	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.4	2.1	0.0	0.0	0.4	
14	Gorgon Patch	300859	7615993	1.3	1.8	0.0	0.0	0.3	
15	Weeks Shoal	302245	7618926	0.9	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.3	3.9	0.0	0.0	0.3	
17	NW of Direction Island	304867	7618549	1.2	1.9	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.8	0.3	0.0	0.0	0.3	
19	NE Tw in Island	314029	7620738	0.5	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.9	0.1	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.3	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.3	3.4	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.1	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.5	0.9	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.2	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.5	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.5.3 Winter-A, Realistic Spill Scenario**

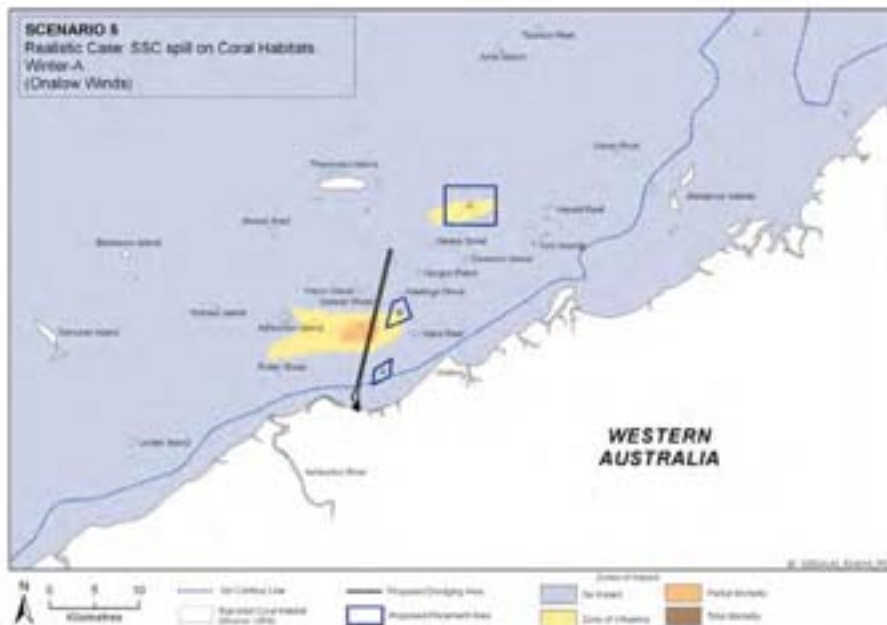


Figure B.201 Scenario 5, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

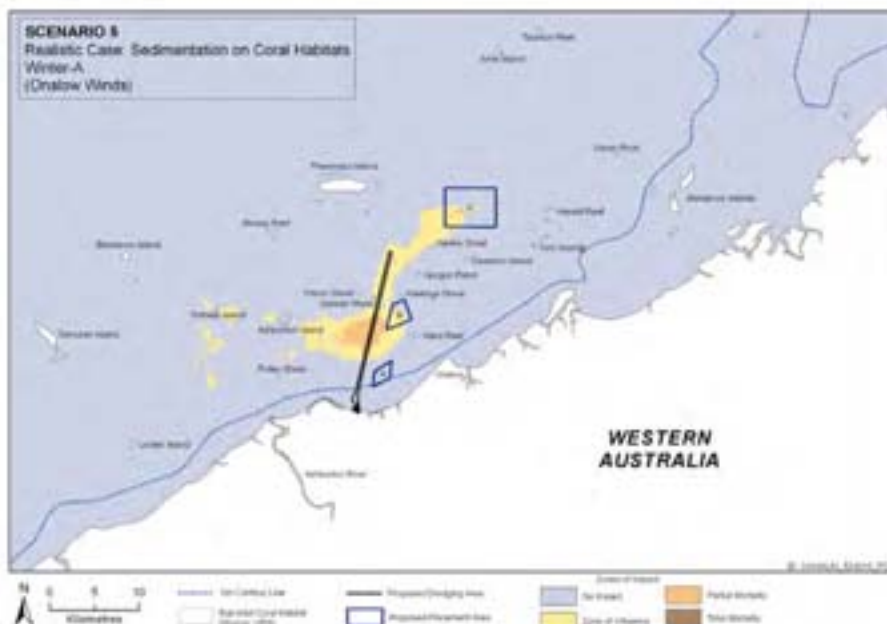


Figure B.202 Scenario 5, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

B-153

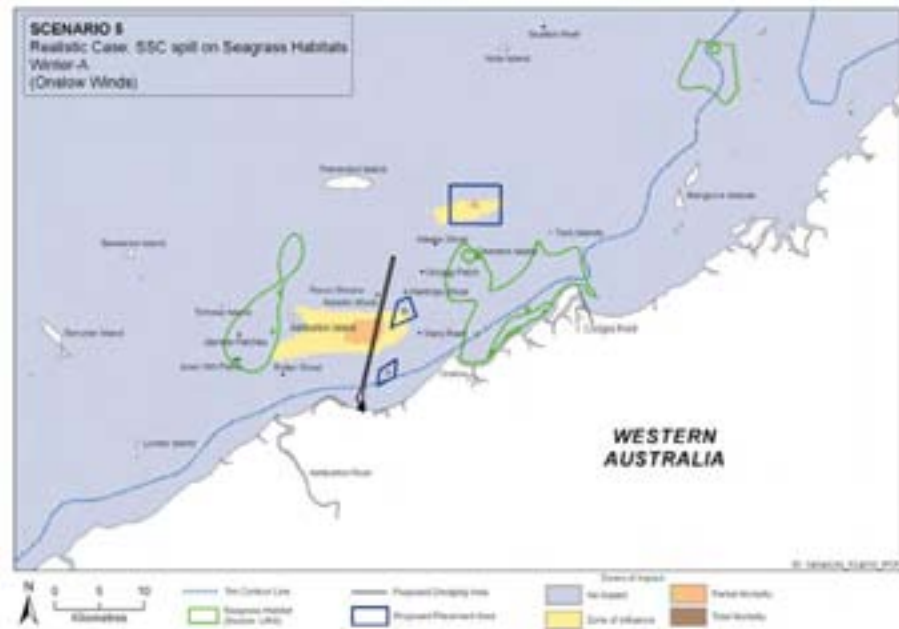


Figure B.203 Scenario 5, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

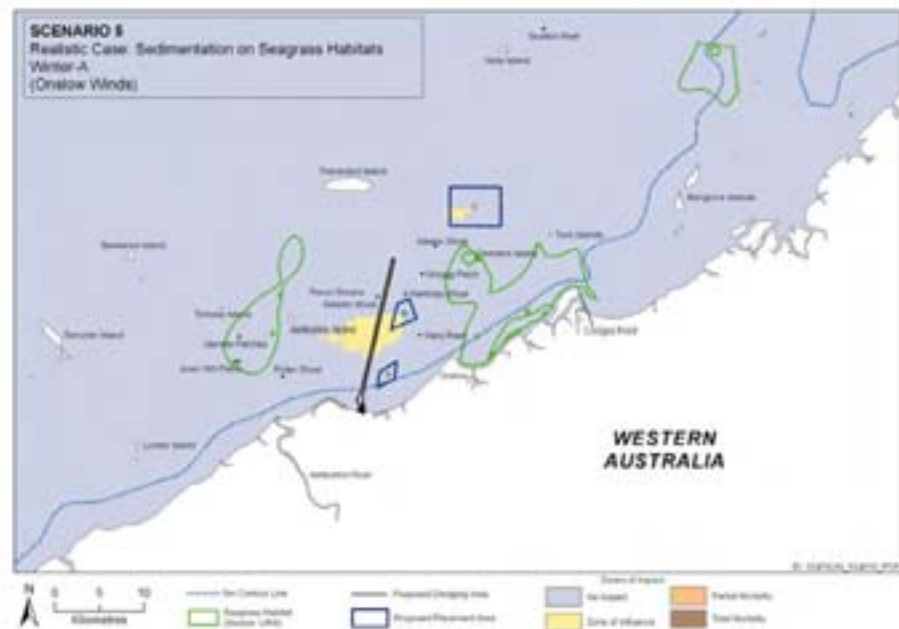


Figure B.204 Scenario 5, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

B-154



Table B.51 Summary of Impacts at Sensitive Receptors for Scenario 5, Winter-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.7	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.2	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.0	0.6	0.0	0.0	0.6	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.2	0.1	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.9	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.8	0.0	0.0	0.0	0.1	
9	Hastings Shoal	298803	7613488	0.3	0.0	0.0	0.0	0.2	
10	North West Ward Reef	299018	7610106	0.6	4.0	0.3	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.6	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.3	0.6	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.2	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-155



**B.5.4 Winter-B, Realistic Spill Scenario**

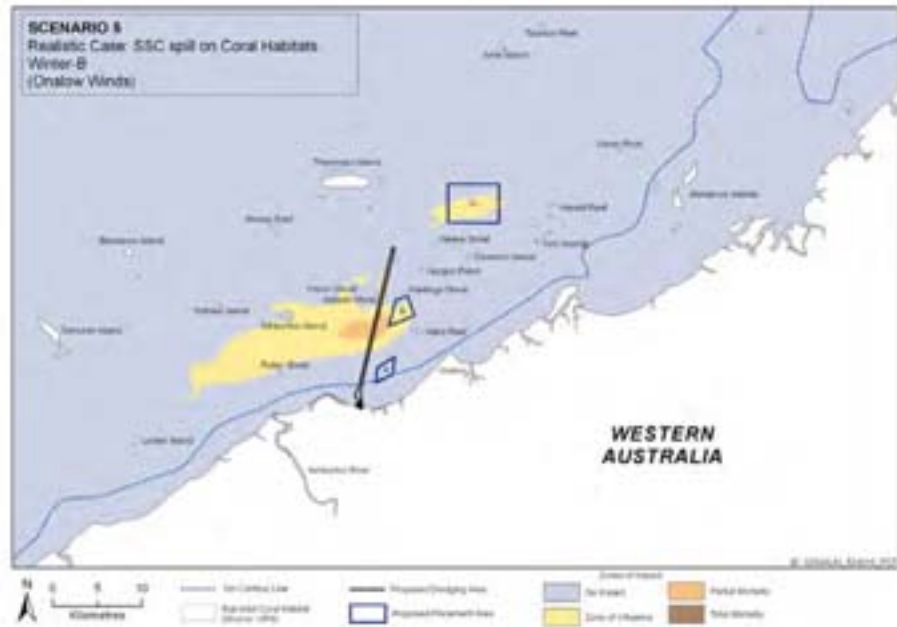


Figure B.205 Scenario 5, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

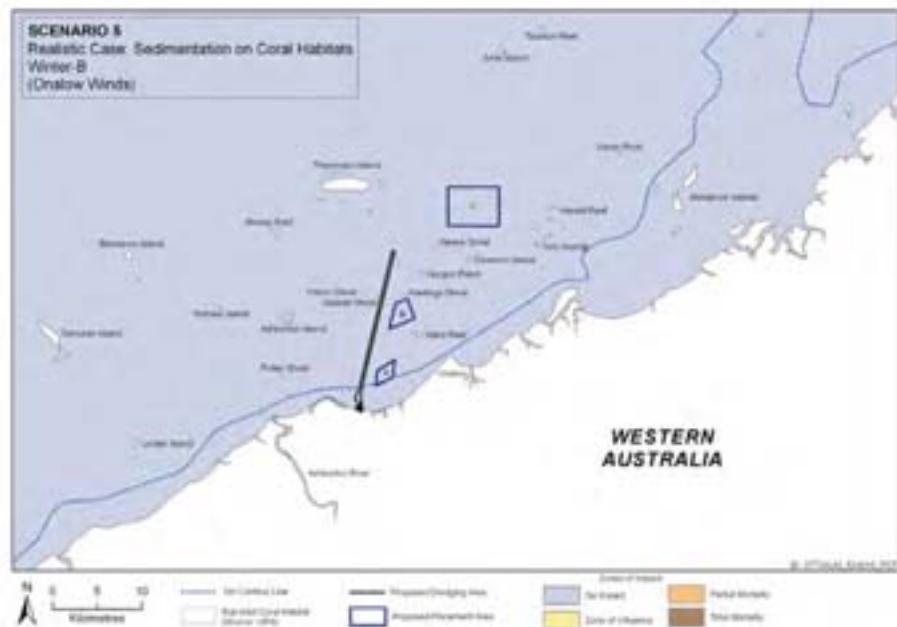


Figure B.206 Scenario 5, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-156



Figure B.207 Scenario 5, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

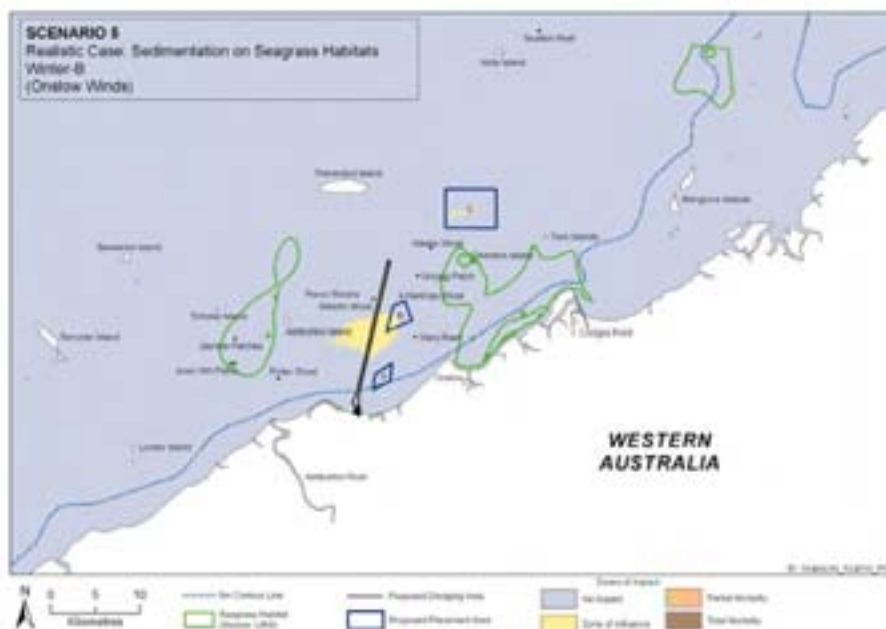


Figure B.208 Scenario 5, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds



B-157



Table B.52 Summary of Impacts at Sensitive Receptors for Scenario 5, Winter-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.8	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.5	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.3	4.8	0.0	0.0	0.7	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.4	2.1	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.3	2.1	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.1	0.3	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.8	0.0	0.0	0.0	0.1	
10	North West Ward Reef	299018	7610106	1.1	5.6	0.9	0.0	0.4	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.6	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.5	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.9	0.6	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.7	8.6	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.3	0.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.5.5 Transitional-A, Realistic Spill Scenario**

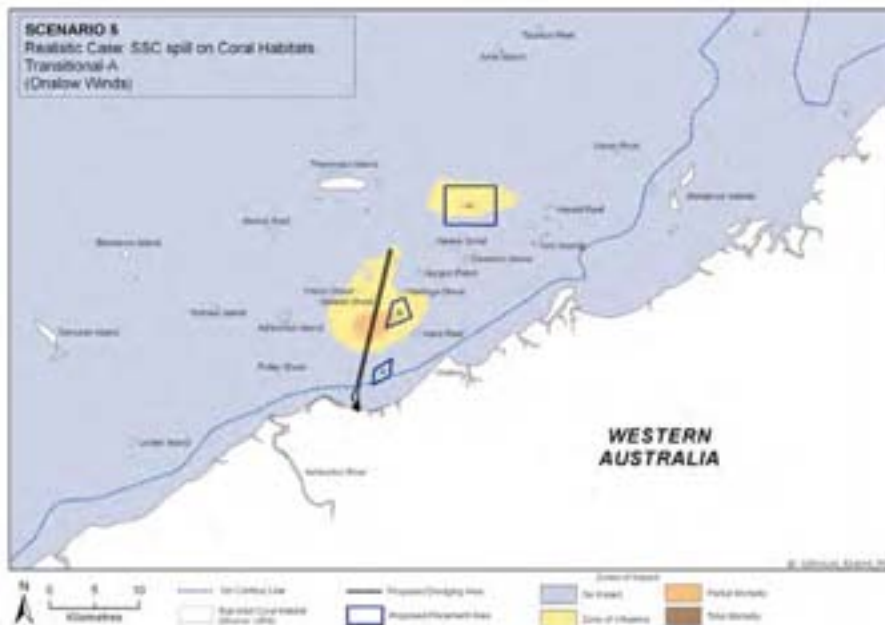


Figure B.209 Scenario 5, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

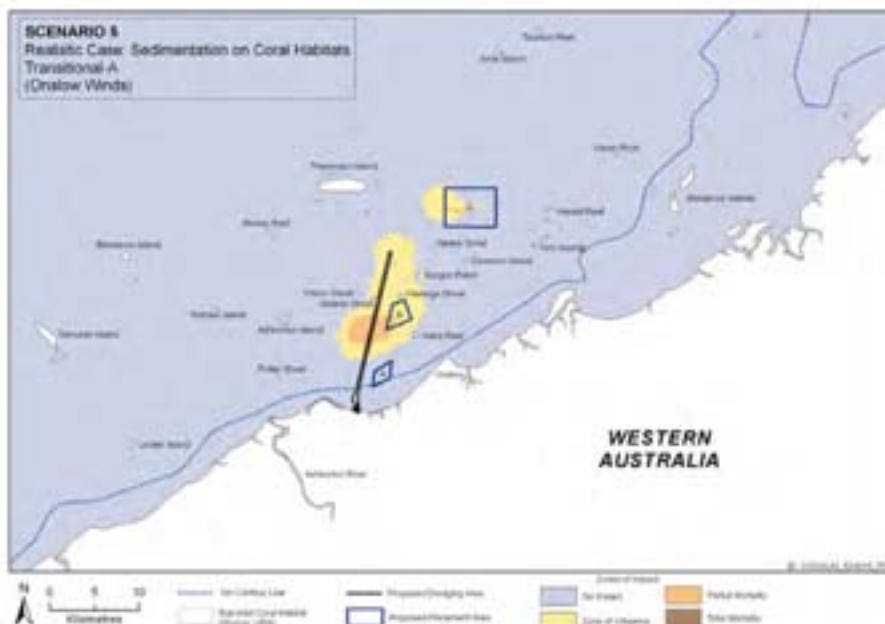


Figure B.210 Scenario 5, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-159

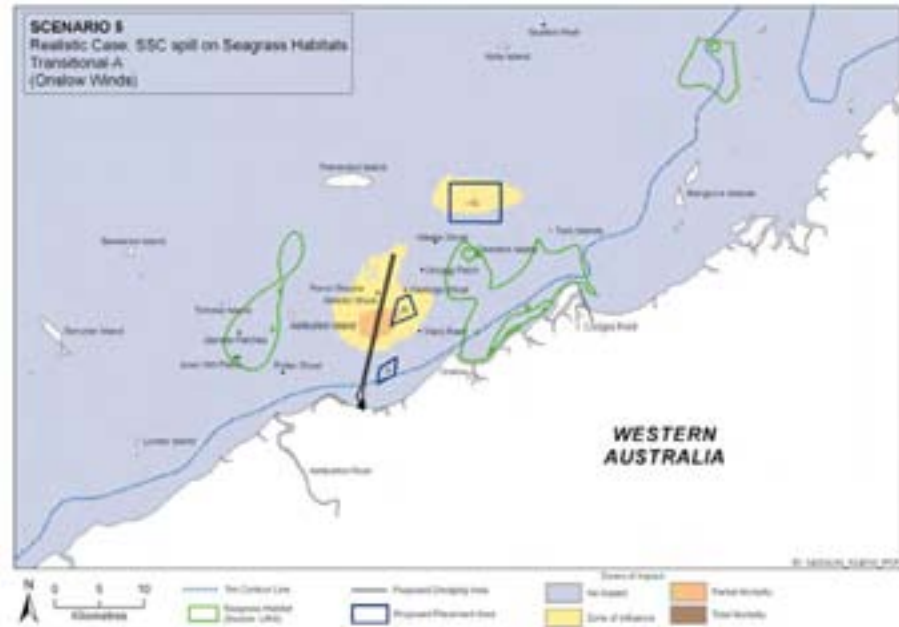


Figure B.211 Scenario 5, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

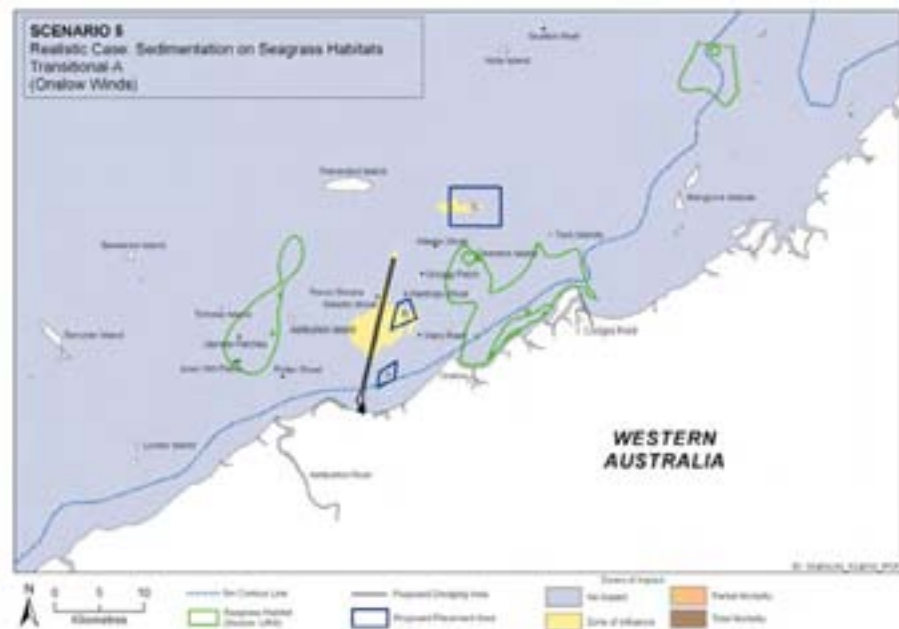


Figure B.212 Scenario 5, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-160



Table B.53 Summary of Impacts at Sensitive Receptors for Scenario 5, Transitional-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.1	3.3	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.8	5.5	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.4	3.6	0.0	0.0	0.6	
9	Hastings Shoal	298803	7613488	1.6	3.7	0.0	0.0	0.6	
10	North West Ward Reef	299018	7610106	2.1	16.2	4.0	0.0	0.2	
11	Ward Reef	300410	7608868	0.2	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.2	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.1	0.3	0.0	0.0	0.4	
14	Gorgon Patch	300859	7615993	0.9	0.1	0.0	0.0	0.2	
15	Weeks Shoal	302245	7618926	0.6	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.5	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.3	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.2	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.2	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-161



**B.5.6 Transitional-B, Realistic Spill Scenario**

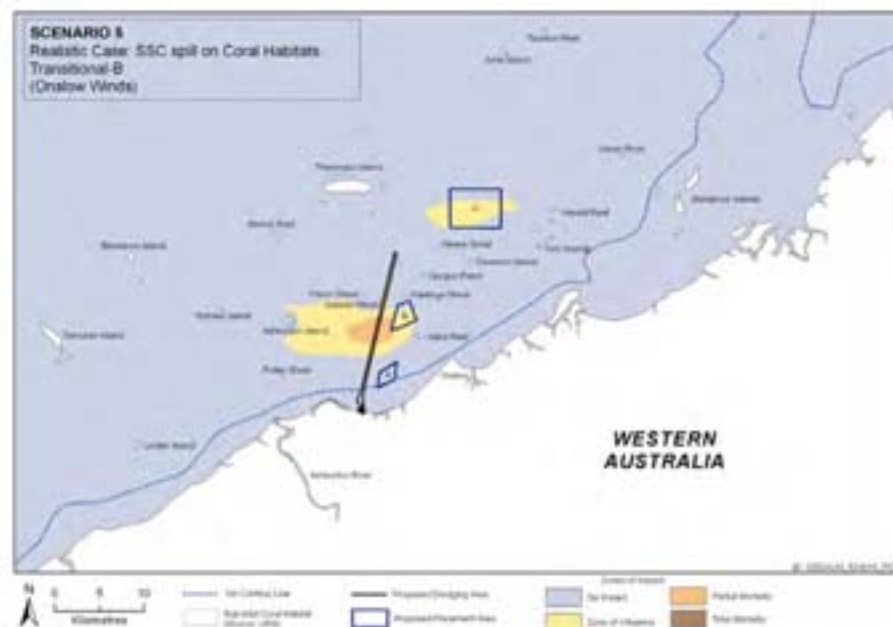


Figure B.213 Scenario 5, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

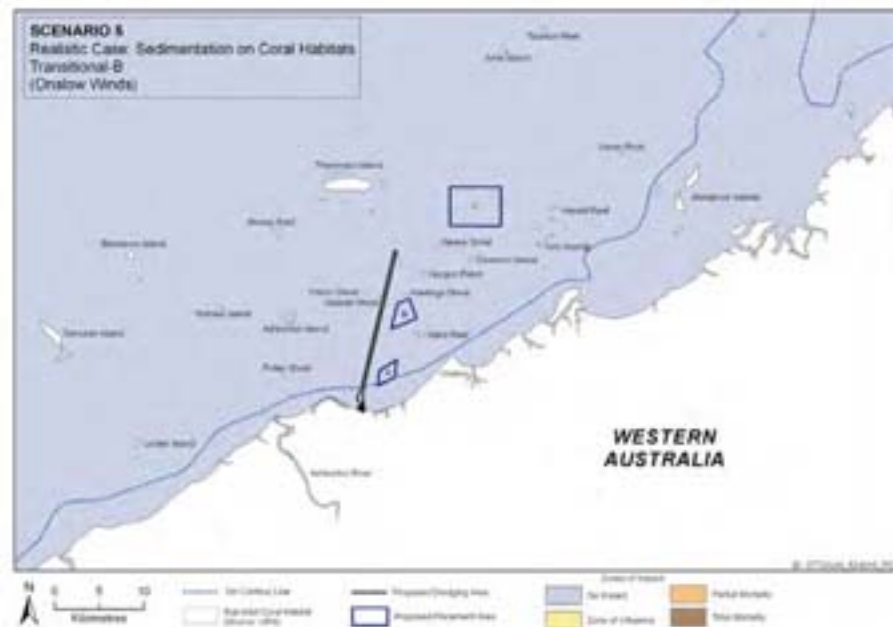


Figure B.214 Scenario 5, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

B-162

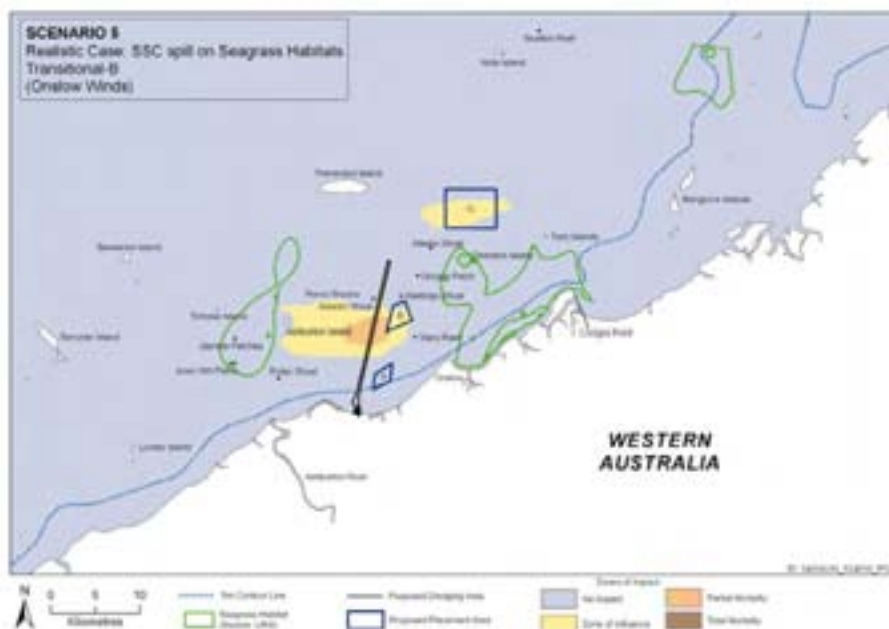


Figure B.215 Scenario 5, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

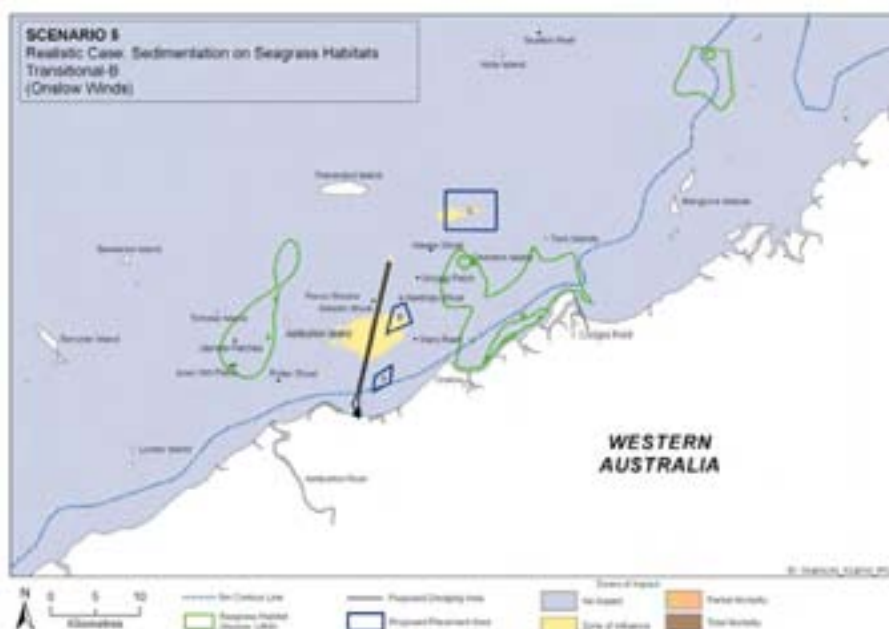


Figure B.216 Scenario 5, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-163



Table B.54 Summary of Impacts at Sensitive Receptors for Scenario 5, Transitional-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.8	0.6	0.0	0.0	0.4	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.4	0.3	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.4	0.7	0.0	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	1.1	0.1	0.0	0.0	0.2	
9	Hastings Shoal	298803	7613488	1.1	0.1	0.0	0.0	0.3	
10	North West Ward Reef	299018	7610106	1.8	10.8	3.7	0.0	0.4	
11	Ward Reef	300410	7608868	0.2	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.7	0.0	0.0	0.0	0.2	
14	Gorgon Patch	300859	7615993	0.5	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.6	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.3	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.4	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.8	0.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.3	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.5.7 Summer-A, Worst Case Spill Scenario**

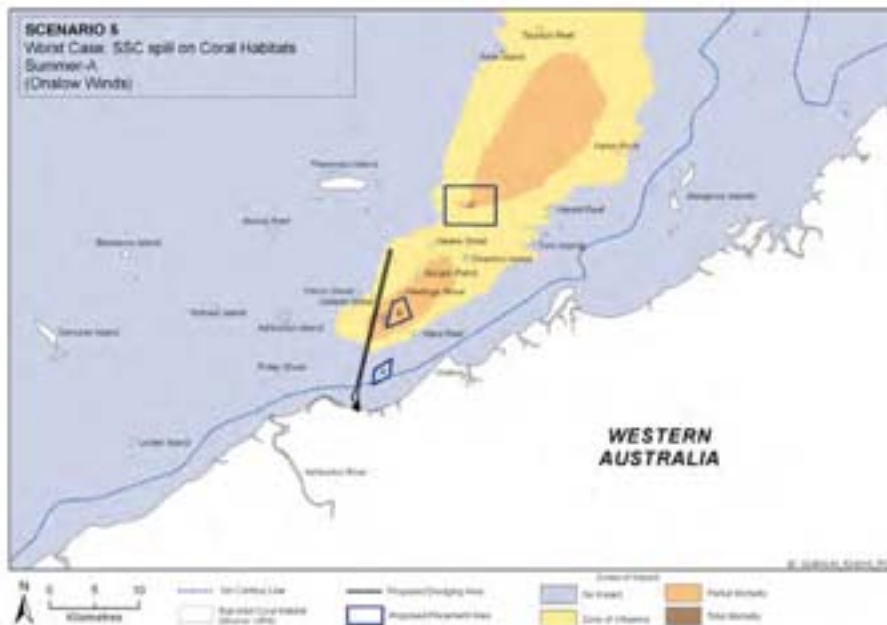


Figure B.217 Scenario 5, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

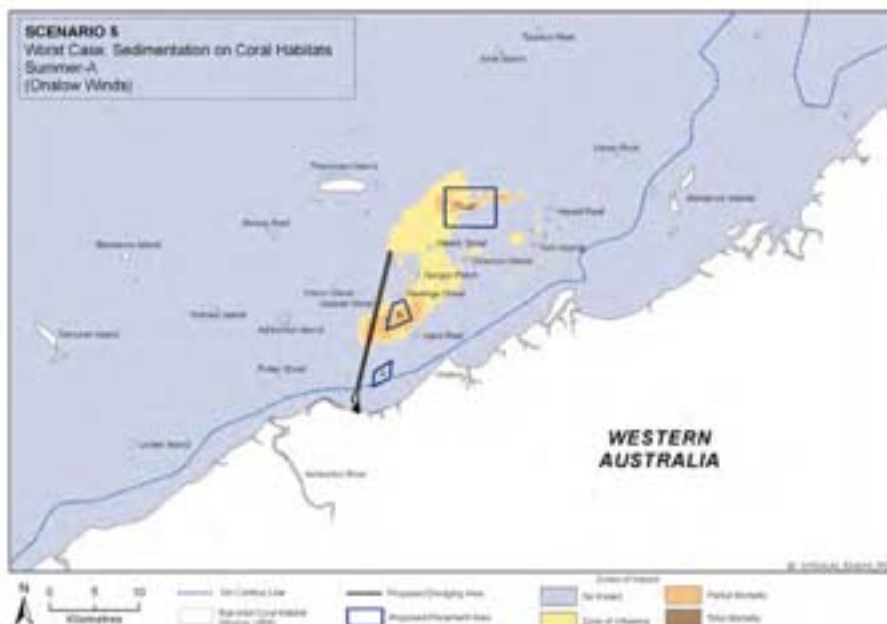


Figure B.218 Scenario 5, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds



B-165

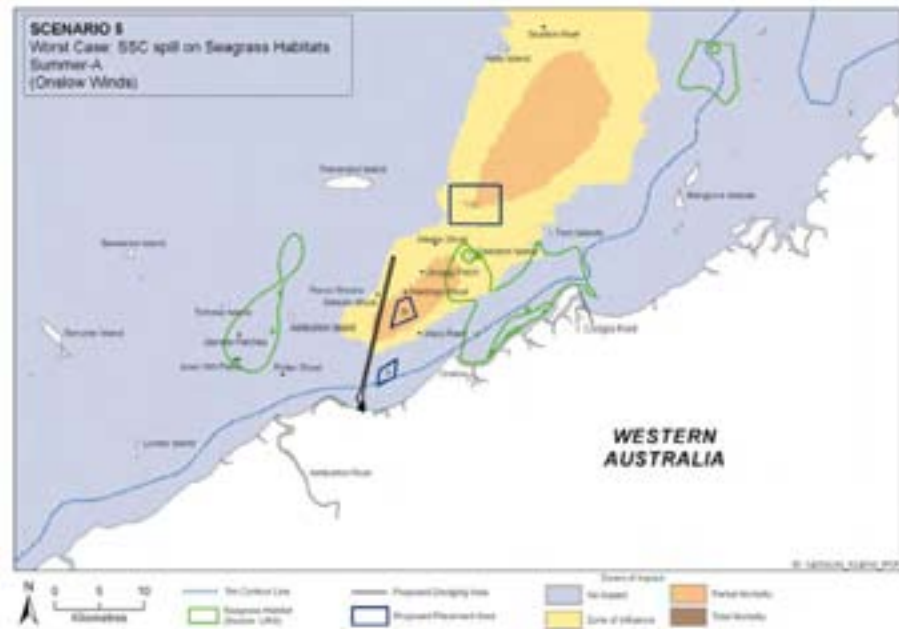


Figure B.219 Scenario 5, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

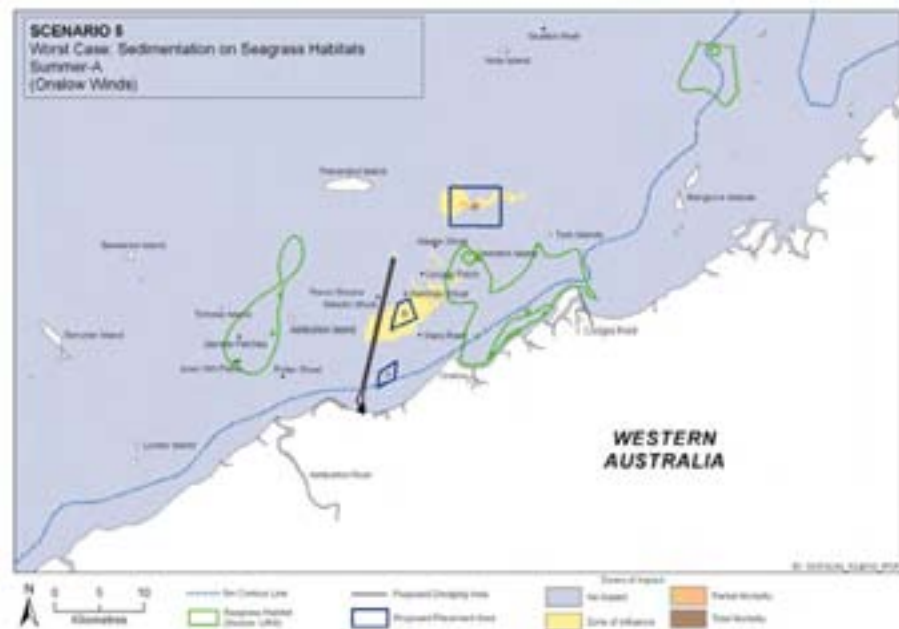


Figure B.220 Scenario 5, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

B-166



Table B.55 Summary of Impacts at Sensitive Receptors for Scenario 5, Summer-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.2	0.3	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.1	6.1	0.7	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.7	7.6	0.1	0.0	0.0	
9	Hastings Shoal	298803	7613488	3.4	27.8	3.3	0.0	0.0	
10	North West Ward Reef	299018	7610106	4.8	31.6	15.5	2.8	0.0	
11	Ward Reef	300410	7608868	0.9	1.9	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.9	2.1	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	3.1	21.4	0.6	0.0	0.0	
14	Gorgon Patch	300859	7615993	3.2	23.3	0.9	0.0	0.0	
15	Weeks Shoal	302245	7618926	2.6	16.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	4.0	31.6	4.0	0.0	0.9	
17	NW of Direction Island	304867	7618549	3.2	18.9	0.9	0.0	0.0	
18	Direction Island	307431	7617732	2.6	8.2	0.0	0.0	1.3	
19	NE Tw in Island	314029	7620738	1.8	3.7	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	2.3	4.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.8	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	2.2	8.2	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.6	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	2.3	22.1	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	1.8	5.9	0.7	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.4	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.6	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	1.6	1.6	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-167



**B.5.8 Summer-B, Worst Case Spill Scenario**

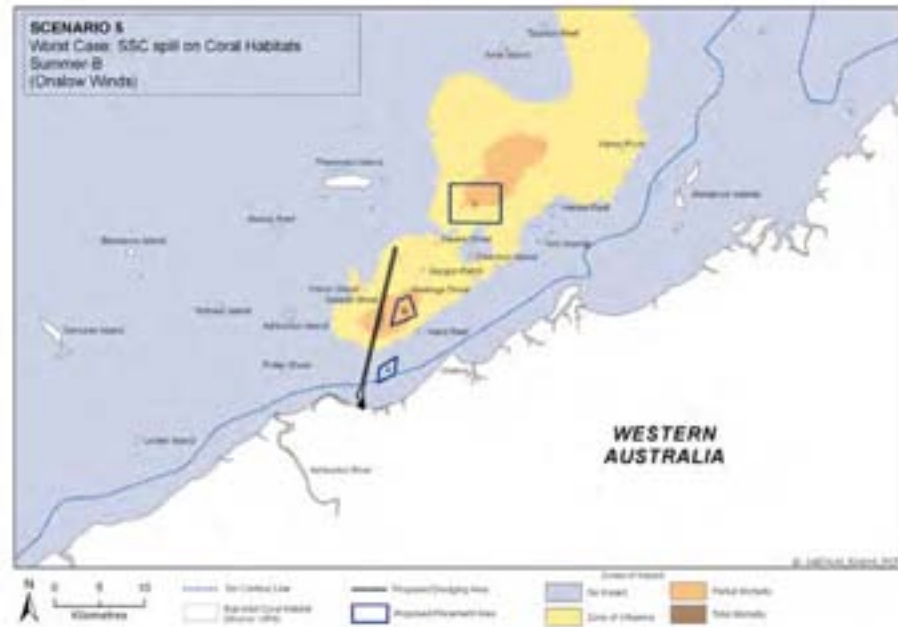


Figure B.221 Scenario 5, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

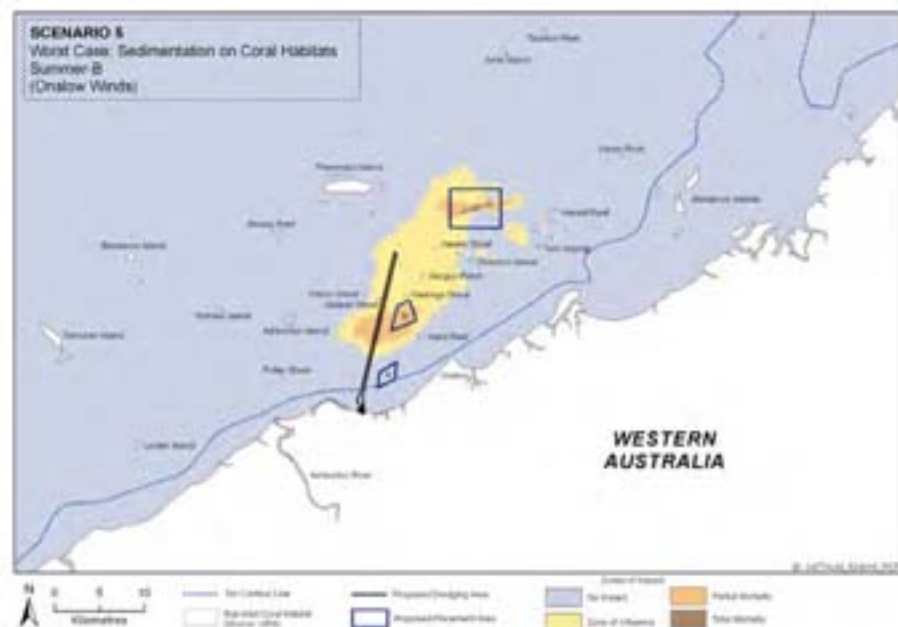


Figure B.222 Scenario 5, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

B-168

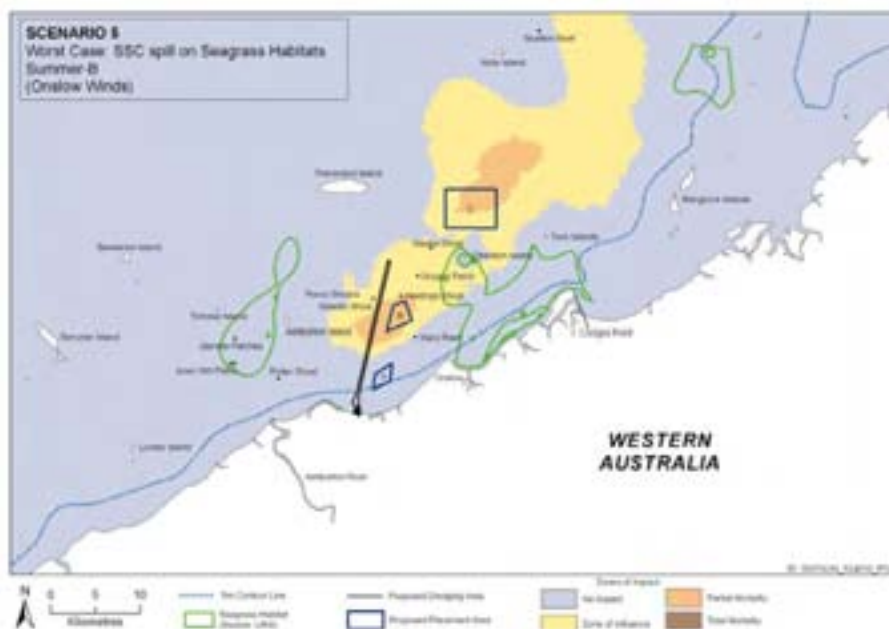


Figure B.223 Scenario 5, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

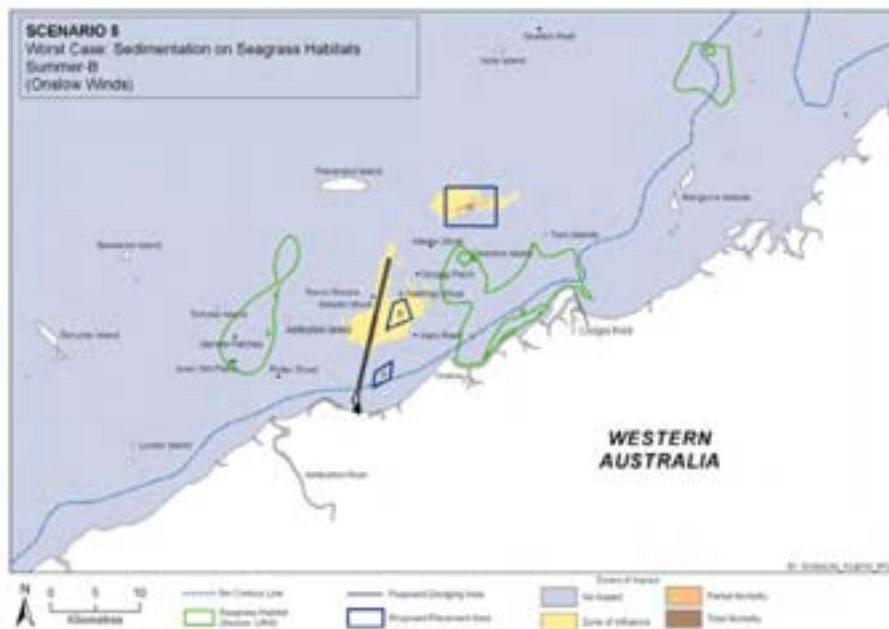


Figure B.224 Scenario 5, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-169



Table B.56 Summary of Impacts at Sensitive Receptors for Scenario 5, Summer-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.9	3.7	0.1	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.9	10.4	0.9	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.0	7.7	0.3	0.0	0.6	
9	Hastings Shoal	298803	7613488	3.2	24.2	1.5	0.0	0.9	
10	North West Ward Reef	299018	7610106	3.9	26.7	12.2	1.0	1.8	
11	Ward Reef	300410	7608868	0.3	0.0	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	0.2	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	2.4	13.1	0.7	0.0	0.8	
14	Gorgon Patch	300859	7615993	2.3	10.0	0.4	0.0	0.6	
15	Weeks Shoal	302245	7618926	1.7	5.2	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.8	6.8	1.3	0.0	0.4	
17	NW of Direction Island	304867	7618549	1.8	5.5	0.3	0.0	0.0	
18	Direction Island	307431	7617732	1.1	1.3	0.0	0.0	0.5	
19	NE Tw in Island	314029	7620738	0.7	0.6	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	1.3	1.5	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.3	0.1	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	1.8	11.3	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.9	0.1	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	2.1	0.9	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.7	1.0	0.1	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.2	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.6	0.3	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-170



**B.5.9 Winter-A, Worst Case Spill Scenario**

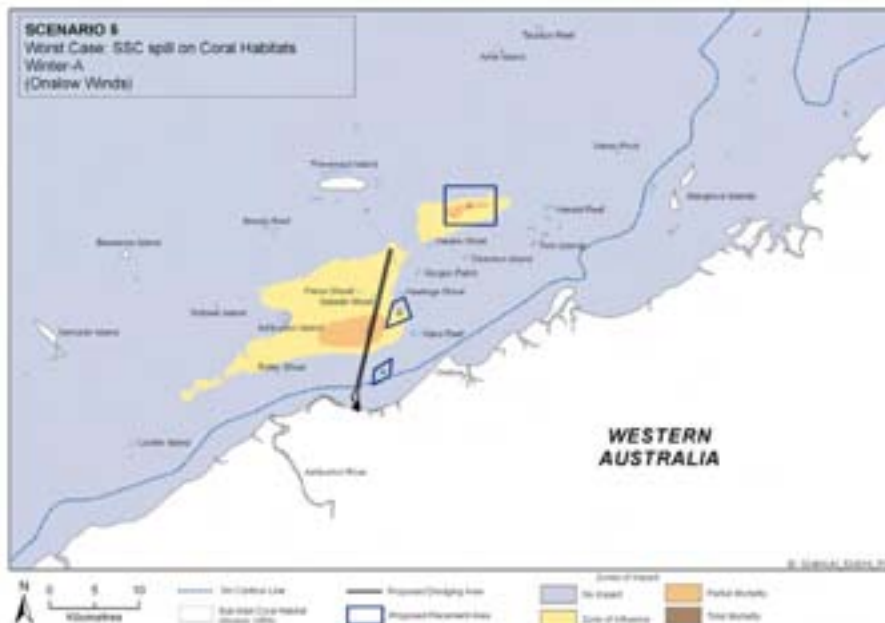


Figure B.225 Scenario 5, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

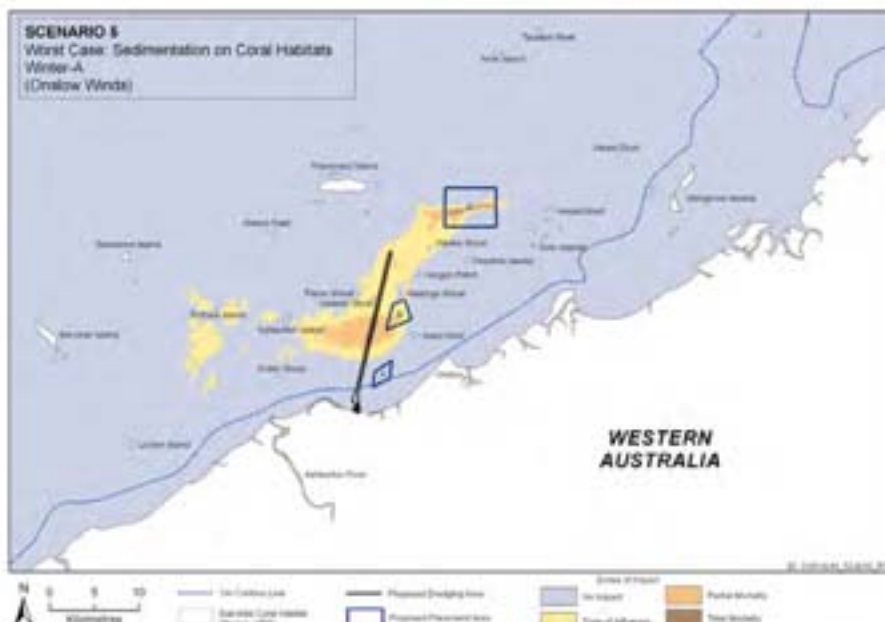


Figure B.226 Scenario 5, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-171

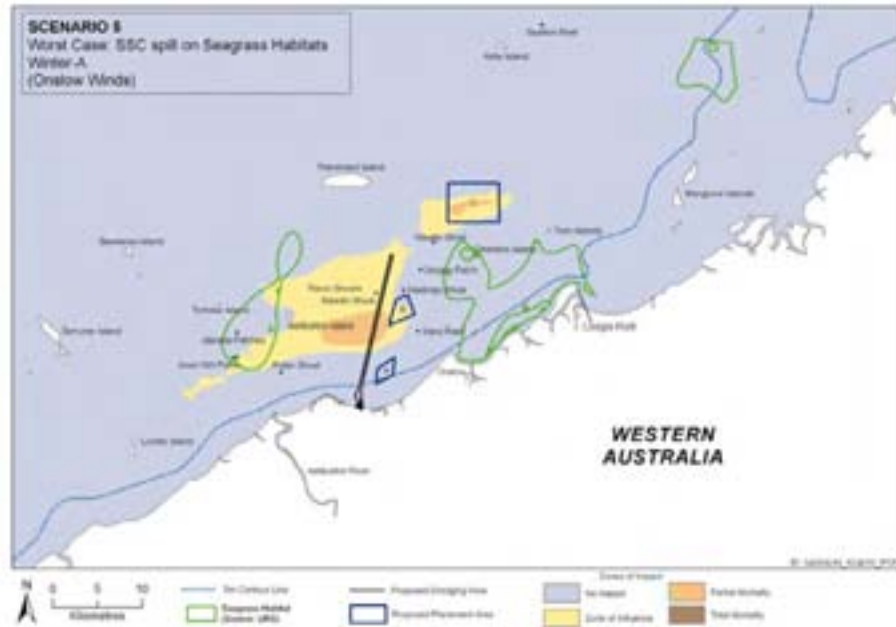


Figure B.227 Scenario 5, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

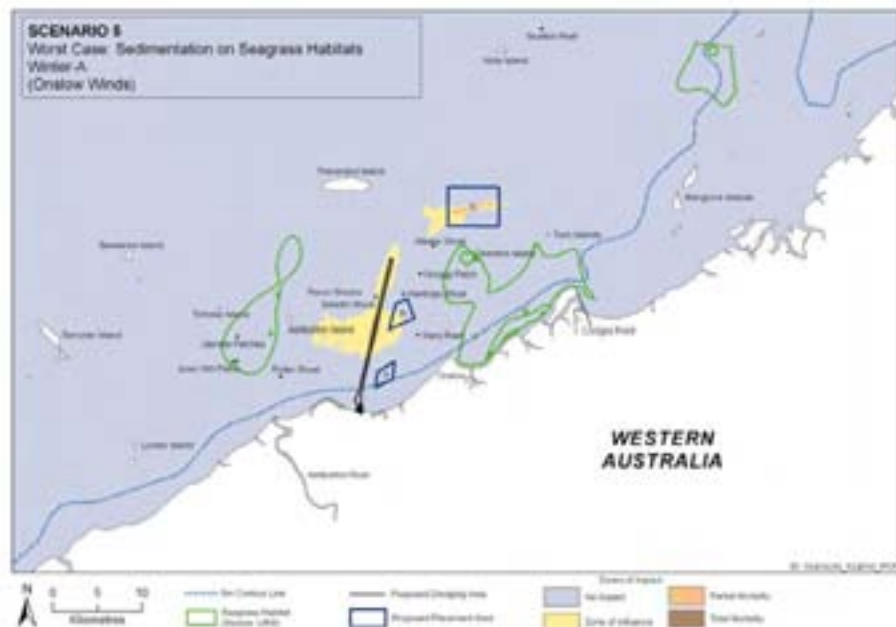


Figure B.228 Scenario 5, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-172



Table B.57 Summary of Impacts at Sensitive Receptors for Scenario 5, Winter-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.3	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.4	1.3	0.0	0.0	0.7	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.5	10.8	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	2.0	8.3	0.3	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.9	5.9	0.0	0.0	0.6	
9	Hastings Shoal	298803	7613488	0.7	0.4	0.0	0.0	0.4	
10	North West Ward Reef	299018	7610106	0.8	6.4	1.3	0.0	0.0	
11	Ward Reef	300410	7608668	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.0	0.0	0.0	0.3	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.3	0.3	0.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.8	3.3	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.2	2.7	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.2	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



B-173



**B.5.10 Winter-B, Worst Case Spill Scenario**

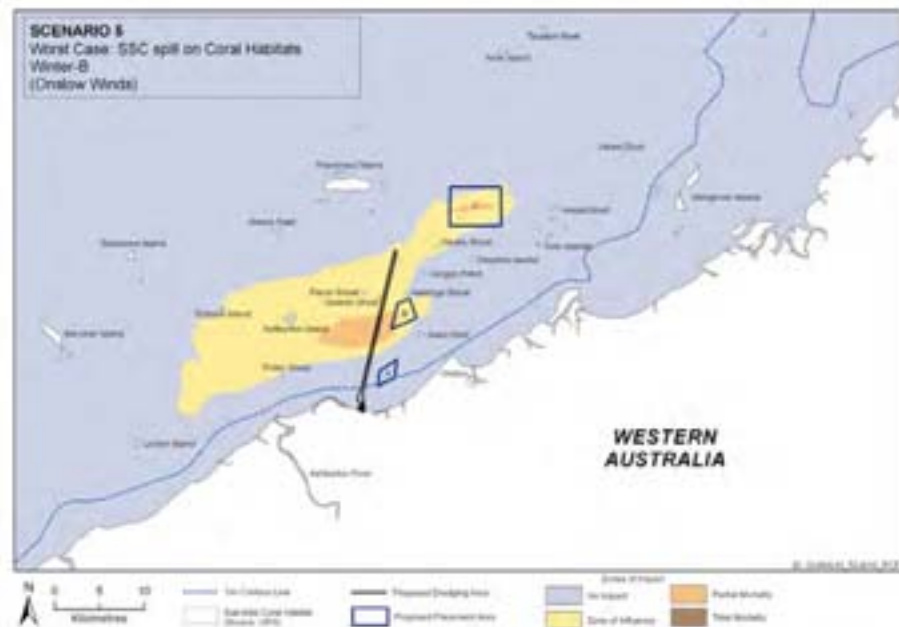


Figure B.229 Scenario 5, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

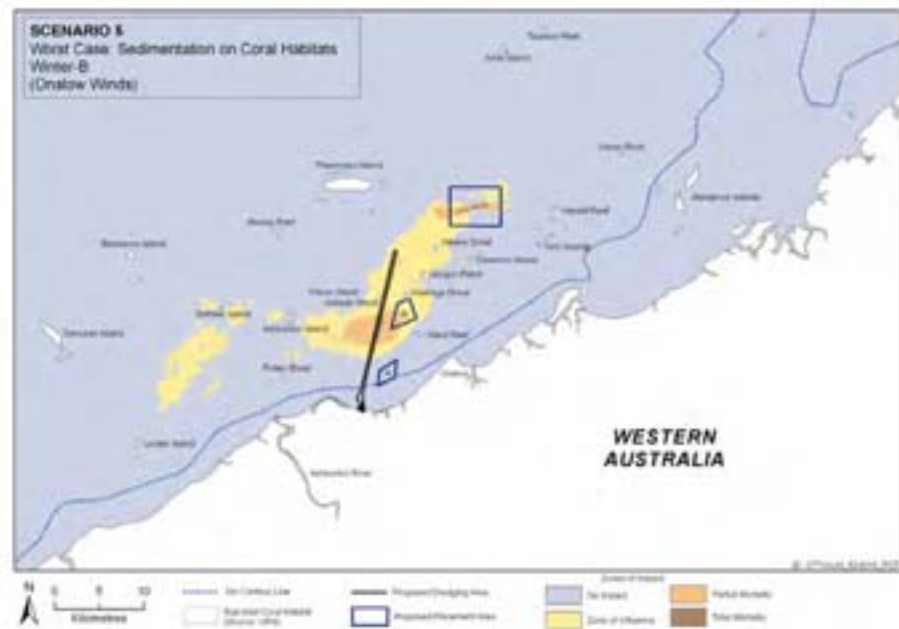


Figure B.230 Scenario 5, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-174

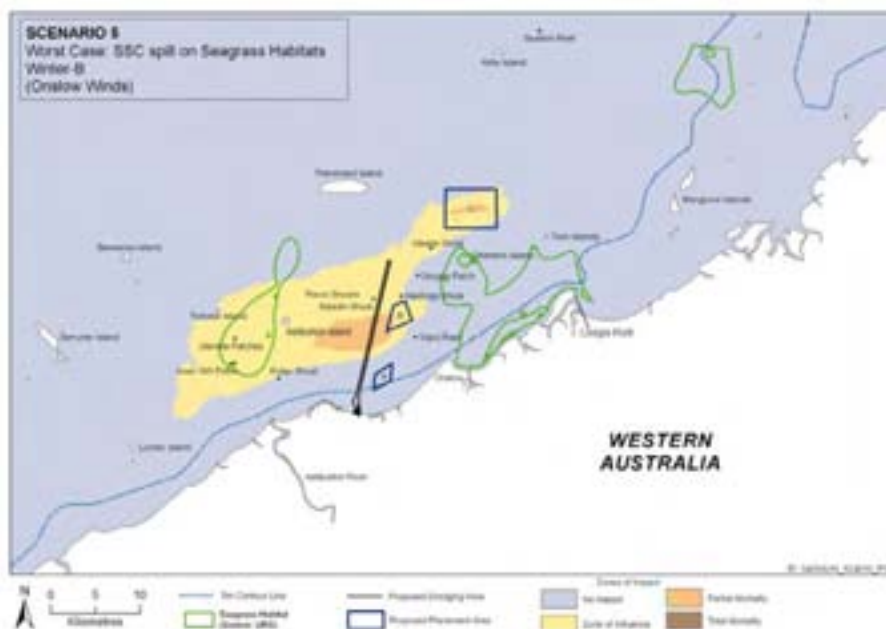


Figure B.231 Scenario 5, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

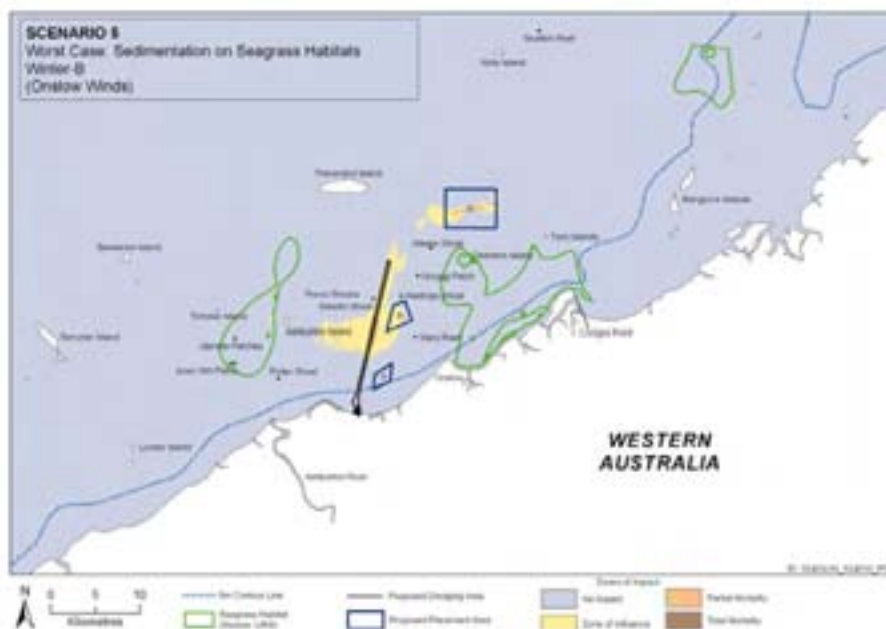


Figure B.232 Scenario 5, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-175



Table B.58 Summary of Impacts at Sensitive Receptors for Scenario 5, Winter-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.4	2.7	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.6	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.7	9.2	0.0	0.0	0.9	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.5	16.0	0.4	0.0	0.0	
7	Saladin Shoal	295913	7613337	2.3	11.3	1.8	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	2.4	10.7	0.3	0.0	0.6	
9	Hastings Shoal	298803	7613488	1.5	4.2	0.0	0.0	0.5	
10	North West Ward Reef	299018	7610106	1.5	10.8	2.1	0.0	0.4	
11	Ward Reef	300410	7608868	0.1	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.1	0.9	0.0	0.0	0.3	
14	Gorgon Patch	300859	7615993	1.1	0.6	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.7	5.1	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.4	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.4	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	2.3	11.6	1.6	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.3	11.6	0.0	0.0	0.2	
27	S of Brew is Reef	286445	7618545	0.2	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.5.11 Transitional-A, Worst Case Spill Scenario**

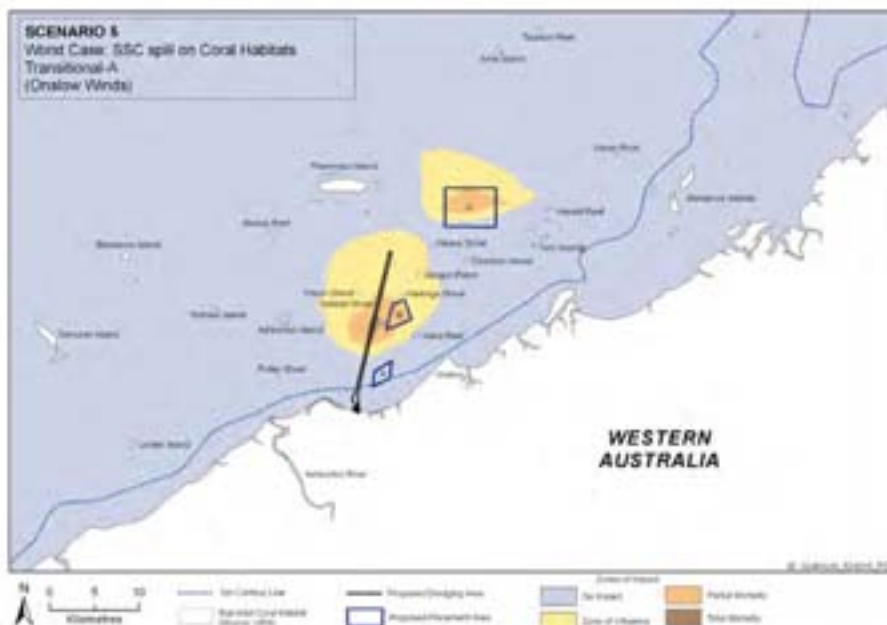


Figure B.233 Scenario 5, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

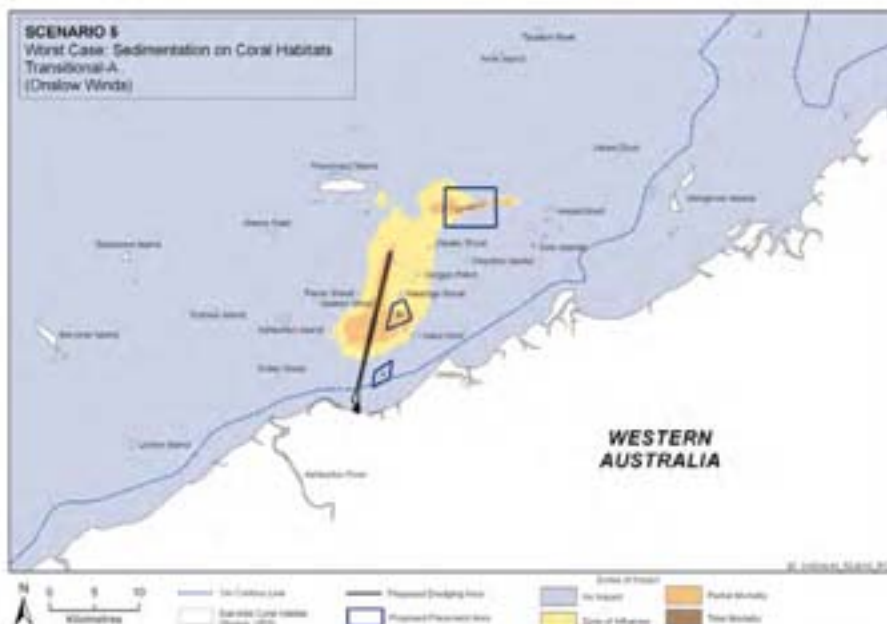


Figure B.234 Scenario 5, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

B-177

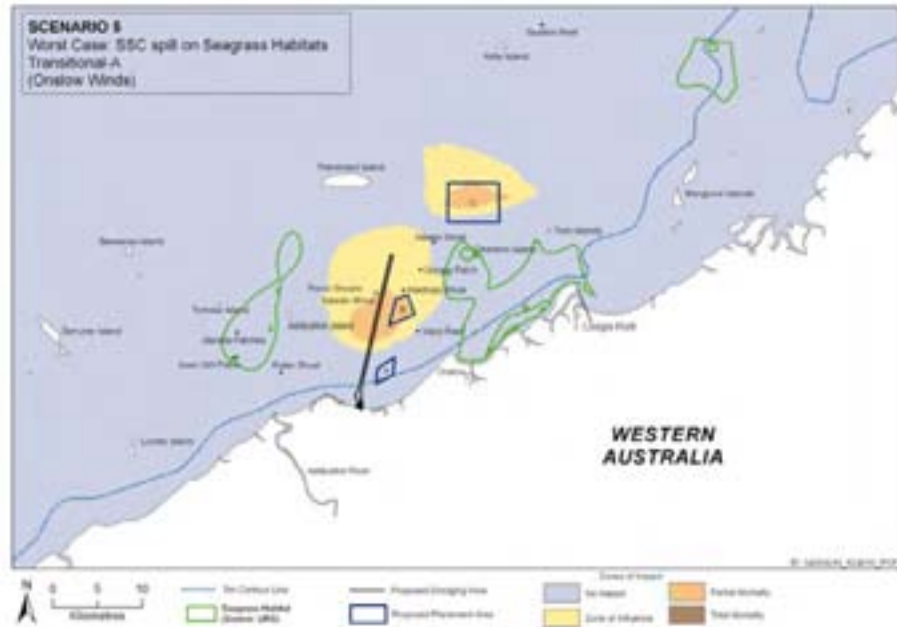


Figure B.235 Scenario 5, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

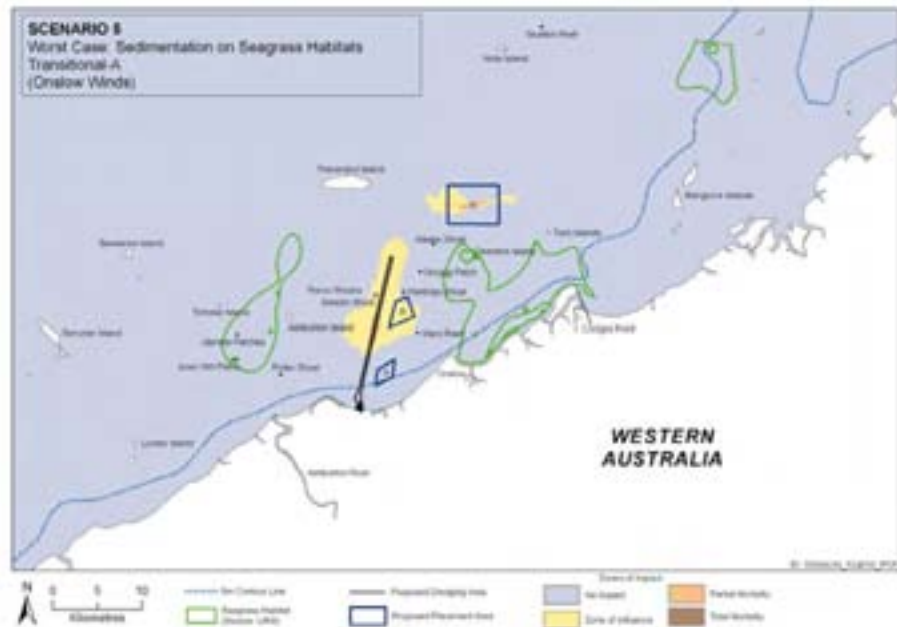


Figure B.236 Scenario 5, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

B-178



Table B.59 Summary of Impacts at Sensitive Receptors for Scenario 5, Transitional-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brewis Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.0	14.3	0.6	0.0	0.1	
7	Saladin Shoal	295913	7613337	3.2	22.1	2.2	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	2.8	16.2	1.3	0.0	1.4	
9	Hastings Shoal	298803	7613488	2.7	22.9	1.5	0.0	0.9	
10	North West Ward Reef	299018	7610106	3.0	21.4	9.2	0.9	0.5	
11	Ward Reef	300410	7608868	0.3	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.2	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.9	10.7	0.3	0.0	0.6	
14	Gorgon Patch	300859	7615993	1.6	6.2	0.1	0.0	0.4	
15	Weeks Shoal	302245	7618926	1.1	2.1	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.7	0.3	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.5	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.3	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-179



**B.5.12 Transitional-B, Worst Case Spill Scenario**

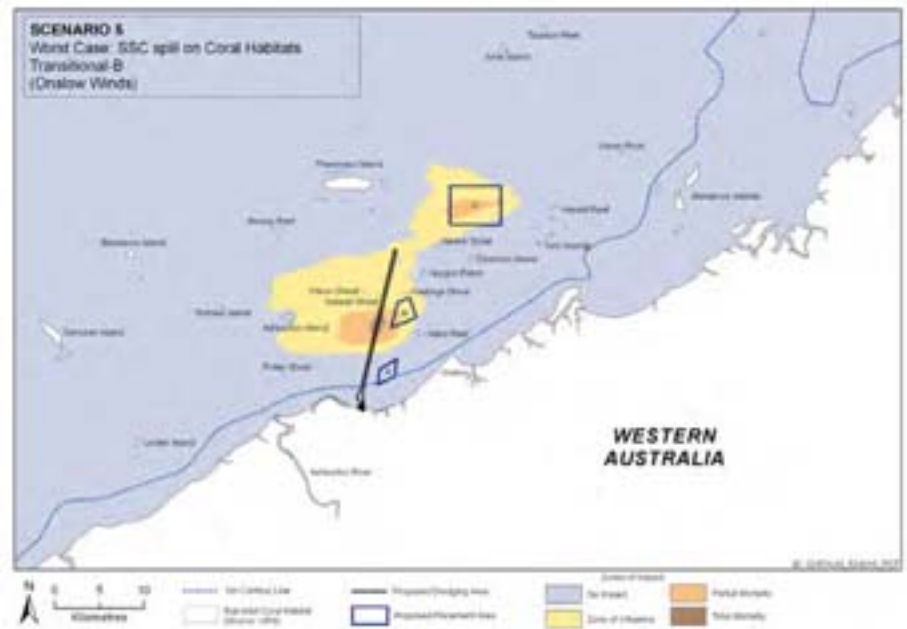


Figure B.237 Scenario 5, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

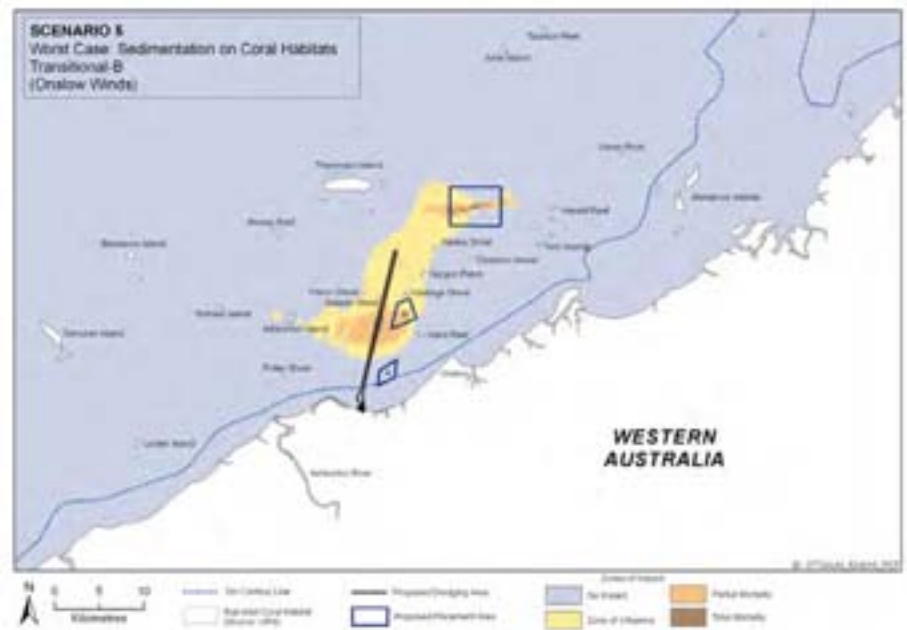


Figure B.238 Scenario 5, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

B-180

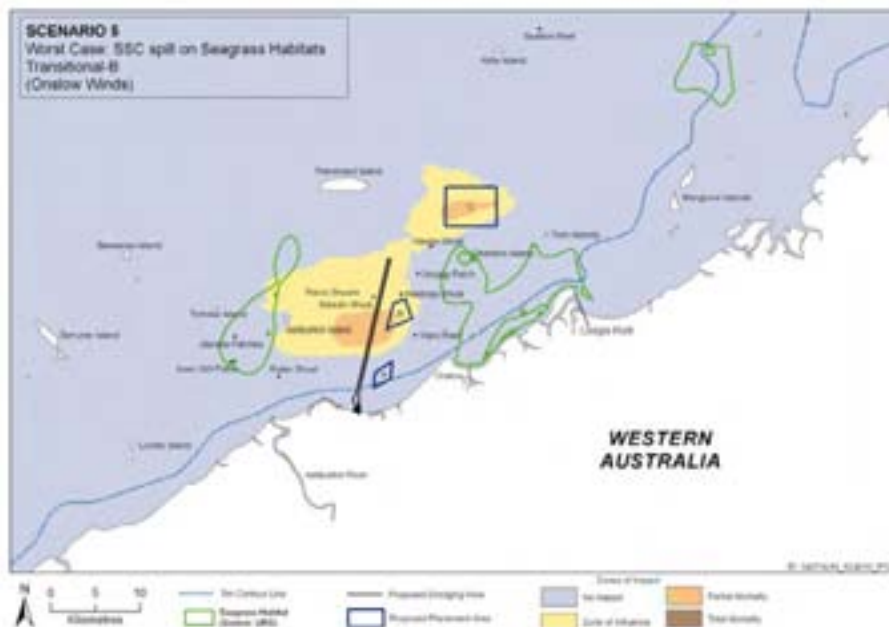


Figure B.239 Scenario 5, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

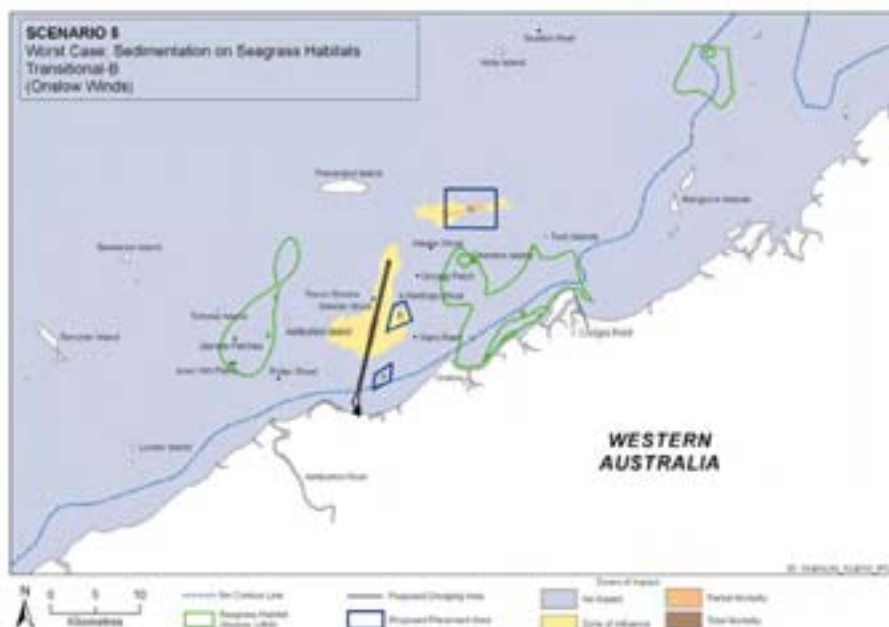


Figure B.240 Scenario 5, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds



B-181



Table B.60 Summary of Impacts at Sensitive Receptors for Scenario 5, Transitional-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.1	2.7	0.0	0.0	0.4	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.3	12.8	0.3	0.0	0.1	
7	Saladin Shoal	295913	7613337	2.6	11.7	0.9	0.0	0.2	
8	End of Wheatstone Shipping Channel	298328	7617464	2.3	8.6	0.4	0.0	0.8	
9	Hastings Shoal	298803	7613488	1.9	6.1	0.1	0.0	0.6	
10	North West Ward Reef	299018	7610106	2.4	14.0	6.5	0.0	0.8	
11	Ward Reef	300410	7608868	0.2	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.1	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.2	2.1	0.0	0.0	0.6	
14	Gorgon Patch	300859	7615993	0.9	0.7	0.0	0.0	0.2	
15	Weeks Shoal	302245	7618926	1.1	1.6	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.5	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.4	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.2	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.5	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.2	1.9	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.5	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-182



**B.6 Dredging Scenario 6**

**B.6.1 Summer-A, Realistic Spill Scenario**

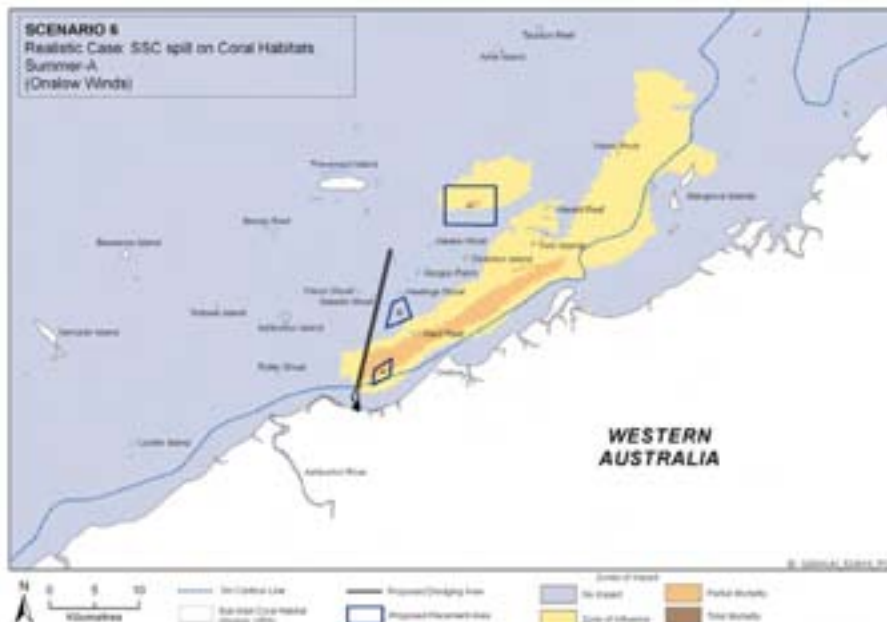


Figure B.241 Scenario 6, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

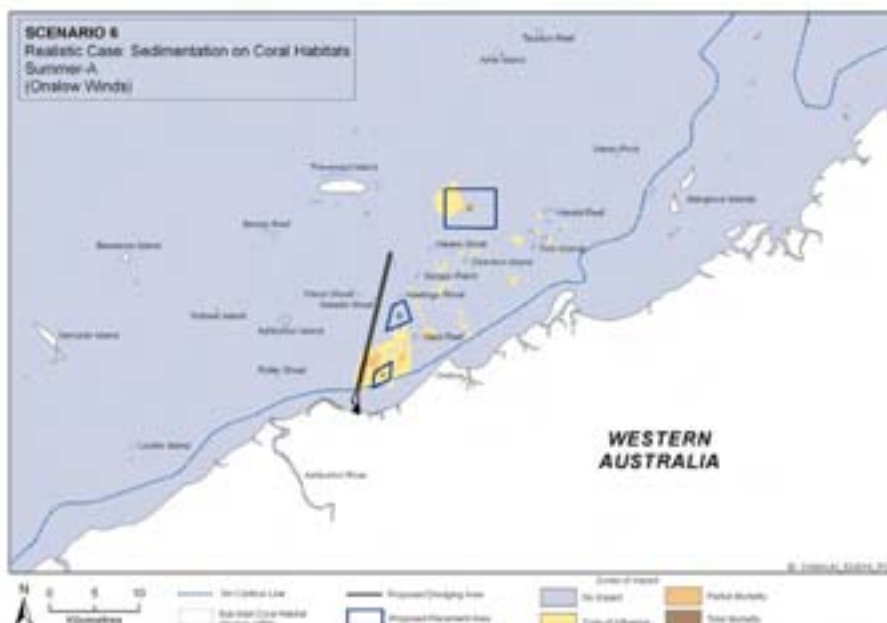


Figure B.242 Scenario 6, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-183

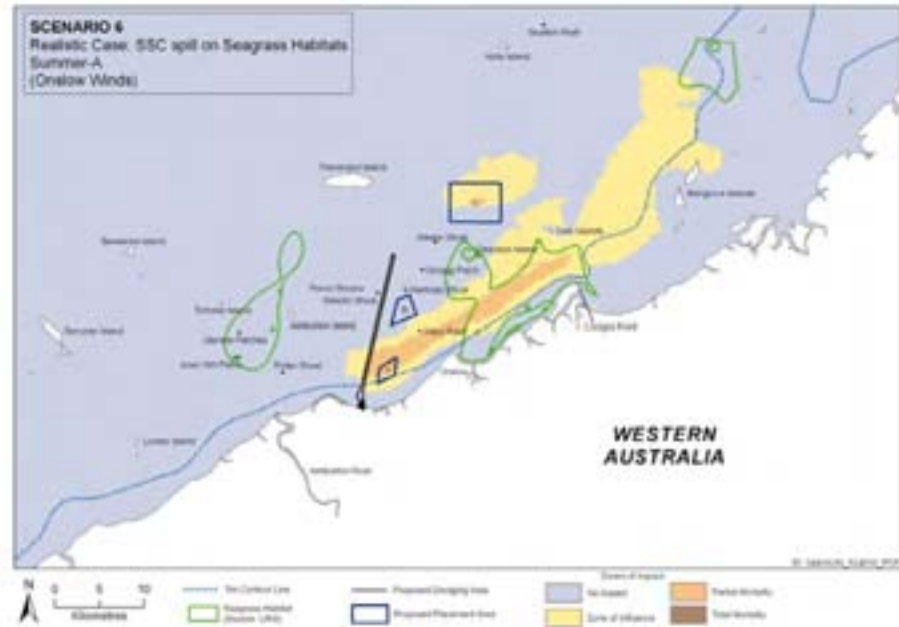


Figure B.243 Scenario 6, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

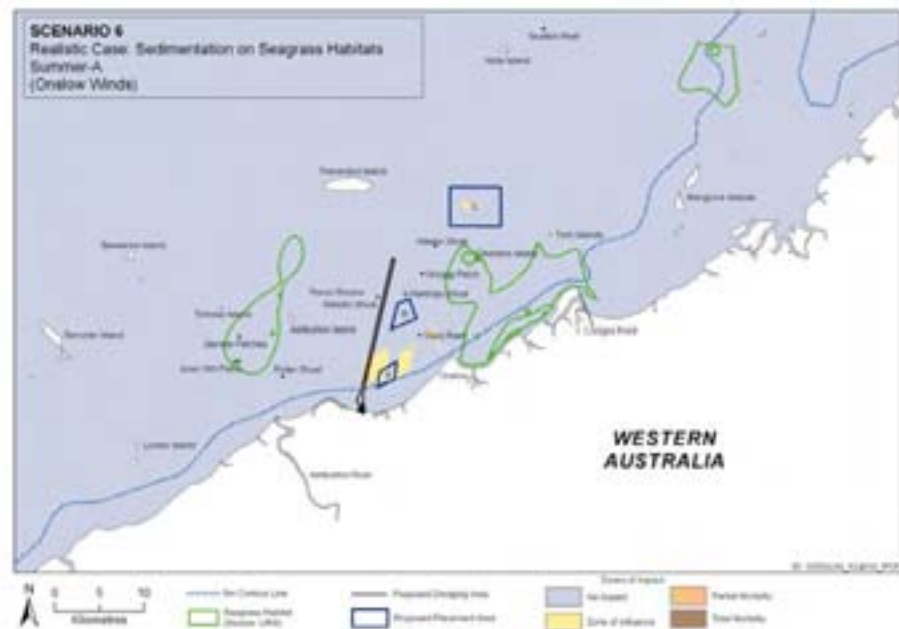


Figure B.244 Scenario 6, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-184



Table B.61 Summary of Impacts at Sensitive Receptors for Scenario 6, Summer-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.2	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.0	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.6	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	1.2	1.3	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	3.6	25.1	5.3	0.0	0.0	
12	Ward Reef	301120	7609196	3.5	25.1	4.3	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.5	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.4	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.1	0.1	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.8	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.8	0.0	0.0	0.0	0.3	
19	NE Tw in Island	314029	7620738	1.9	7.7	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	1.8	4.2	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	3.3	21.8	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	2.0	3.9	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.8	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	2.3	12.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	4.1	31.9	1.3	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.5	0.6	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.7	0.1	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	3.7	27.6	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	2.0	6.5	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-185



**B.6.2 Summer-B, Realistic Spill Scenario**

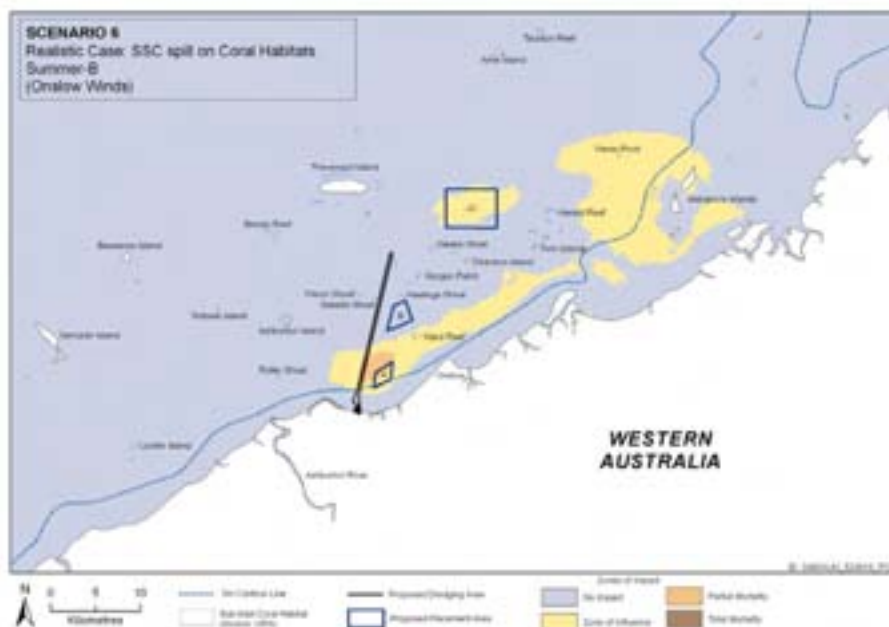


Figure B.245 Scenario 6, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

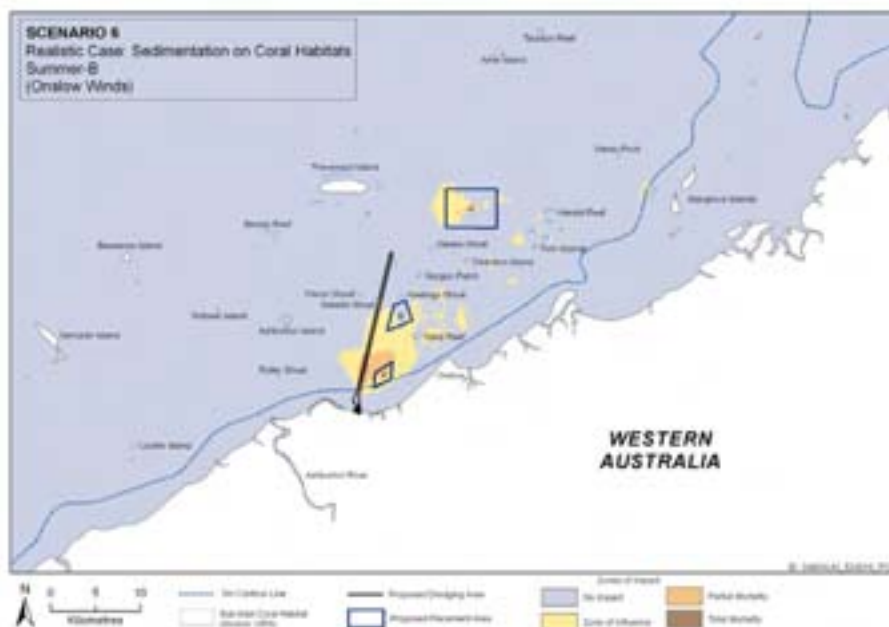


Figure B.246 Scenario 6, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

B-186

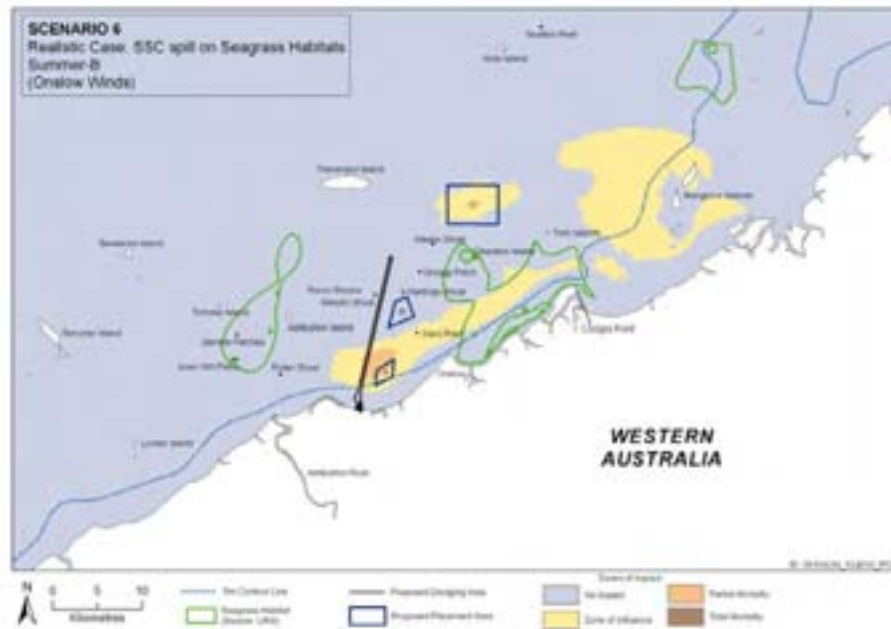


Figure B.247 Scenario 6, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

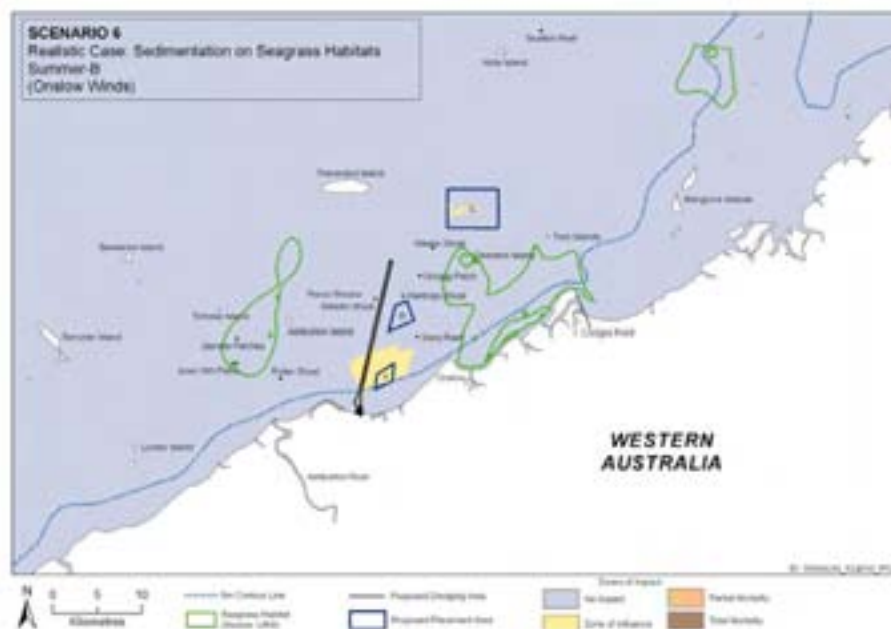


Figure B.248 Scenario 6, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-187



Table B.62 Summary of Impacts at Sensitive Receptors for Scenario 6, Summer-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.1	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.5	0.0	0.0	0.0	0.1	
10	North West Ward Reef	299018	7610106	0.9	0.0	0.0	0.0	0.1	
11	Ward Reef	300410	7608868	1.9	7.3	1.3	0.0	0.3	
12	Ward Reef	301120	7609196	1.8	6.1	0.7	0.0	0.2	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.2	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.6	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.4	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.4	0.0	0.0	0.0	0.1	
19	NE Tw in Island	314029	7620738	0.7	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.7	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	2.5	12.9	0.4	0.0	0.0	
22	Nares Rock	323379	7629437	2.3	17.4	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.8	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	1.3	0.0	0.0	0.0	0.1	
30	SE of Direction Island	309948	7612830	1.9	6.8	0.6	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.1	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.2	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	1.7	1.9	0.1	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.7	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.6.3 Winter-A, Realistic Spill Scenario**



Figure B.249 Scenario 6, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

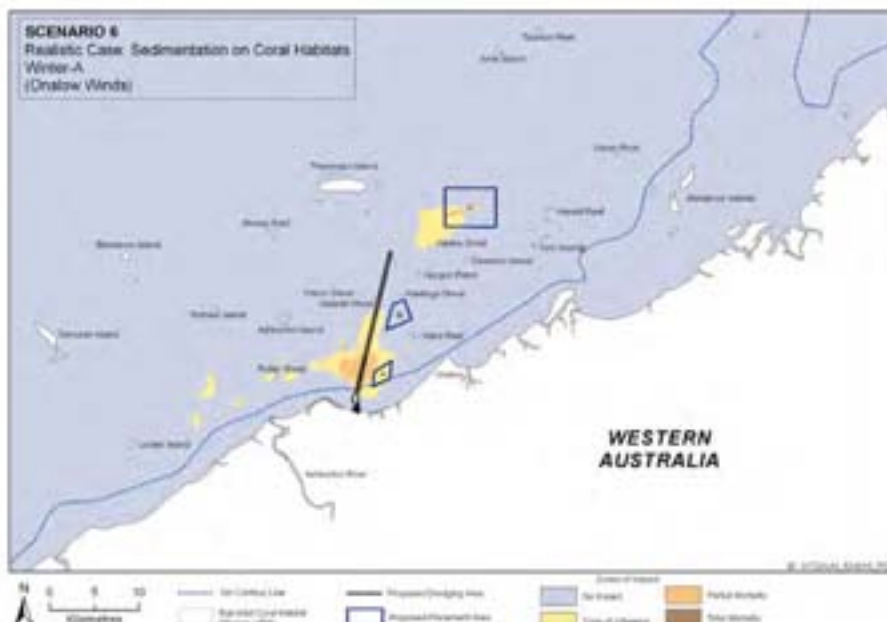


Figure B.250 Scenario 6, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



B-189

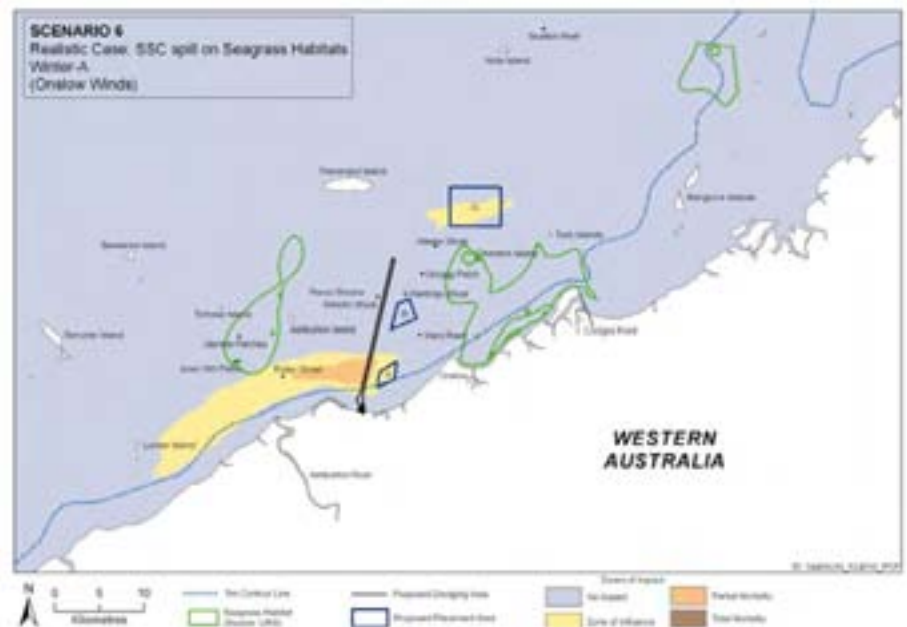


Figure B.251 Scenario 6, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

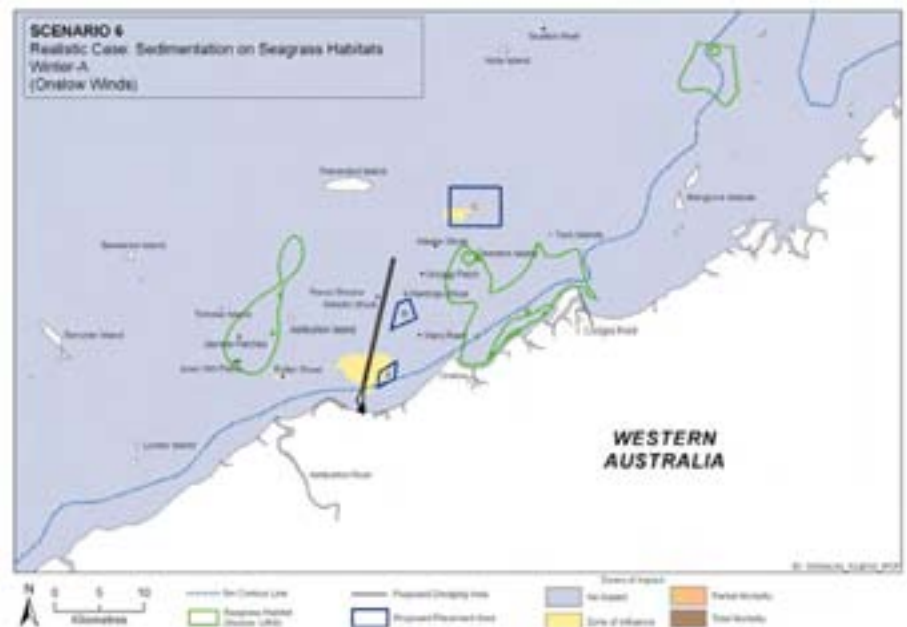


Figure B.252 Scenario 6, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

B-190



Table B.63 Summary of Impacts at Sensitive Receptors for Scenario 6, Winter-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.3	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	3.1	19.2	3.3	0.0	0.0	
3	Ashburton Island	286705	7611075	0.5	0.0	0.0	0.0	0.3	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.2	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.1	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.4	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.1	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.1	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.1	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.7	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.5	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.4	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-191



**B.6.4 Winter-B, Realistic Spill Scenario**

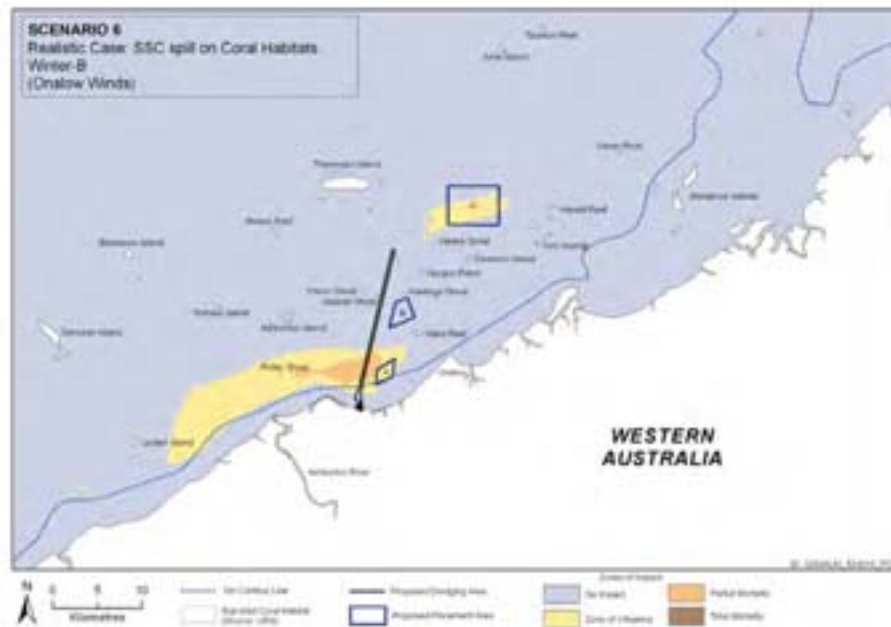


Figure B.253 Scenario 6, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

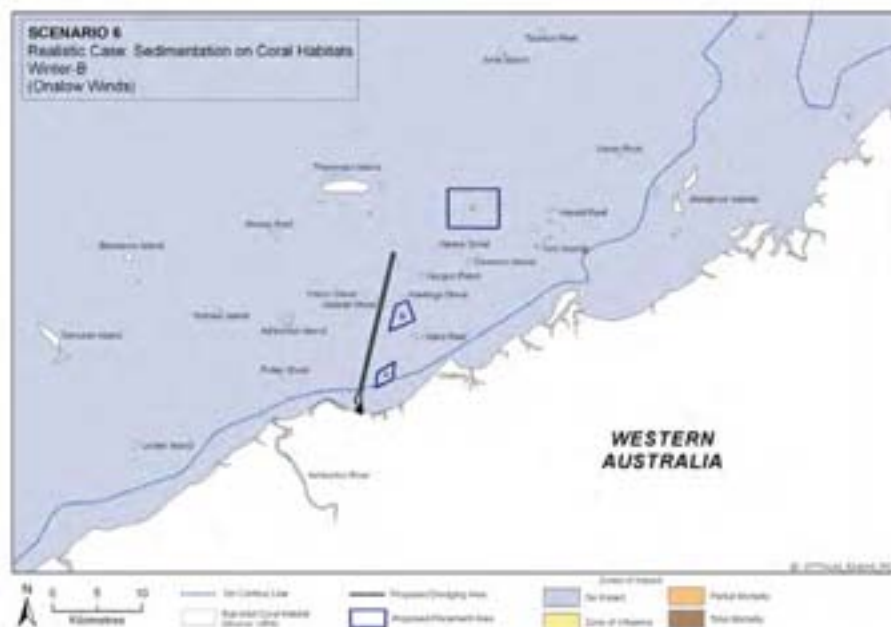


Figure B.254 Scenario 6, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

B-192

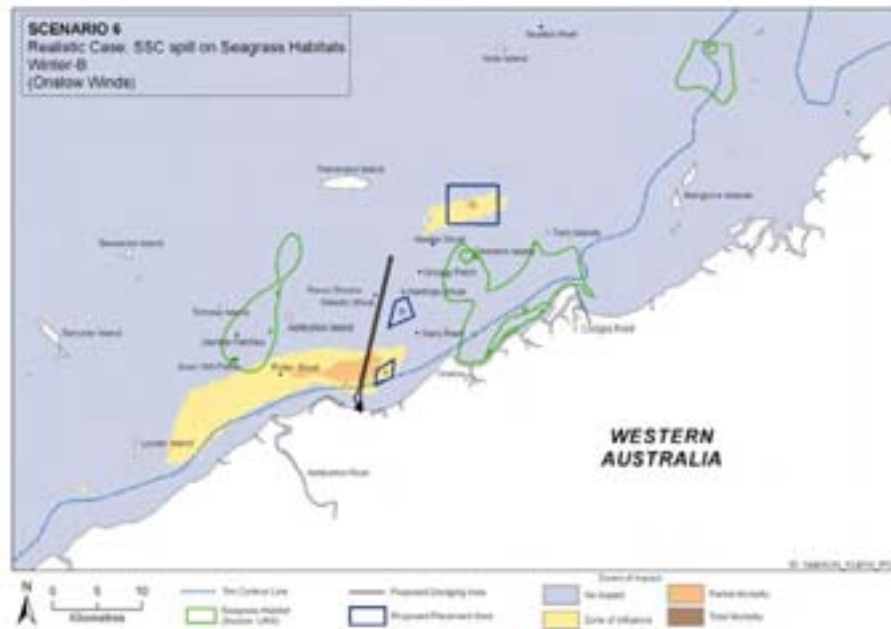


Figure B.255 Scenario 6, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

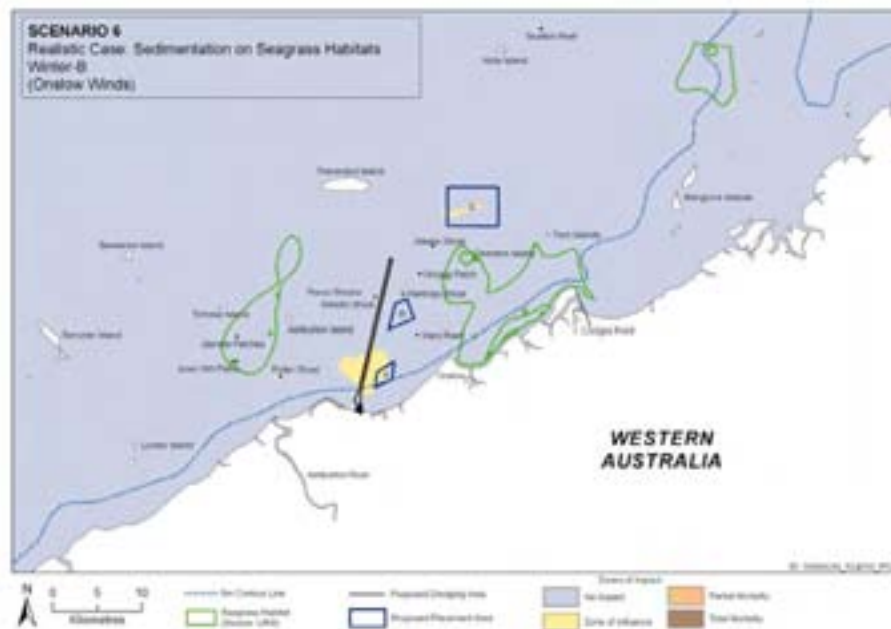


Figure B.256 Scenario 6, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

B-193



Table B.64 Summary of Impacts at Sensitive Receptors for Scenario 6, Winter-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.4	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	2.6	21.8	4.6	0.0	0.0	
3	Ashburton Island	286705	7611075	0.7	0.3	0.0	0.0	0.4	
4	Brewis Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.8	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.6	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.6	0.0	0.0	0.0	0.1	
9	Hastings Shoal	298803	7613488	0.3	0.0	0.0	0.0	0.1	
10	North West Ward Reef	299018	7610106	0.2	0.0	0.0	0.0	0.1	
11	Ward Reef	300410	7608868	0.4	0.4	0.0	0.0	0.2	
12	Ward Reef	301120	7609196	0.4	0.0	0.0	0.0	0.1	
13	SW of Gorgon Patch	300094	7615177	0.4	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.8	1.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.8	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.6	0.0	0.0	0.0	0.0	
27	S of Brewis Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.6.5 Transitional-A, Realistic Spill Scenario**

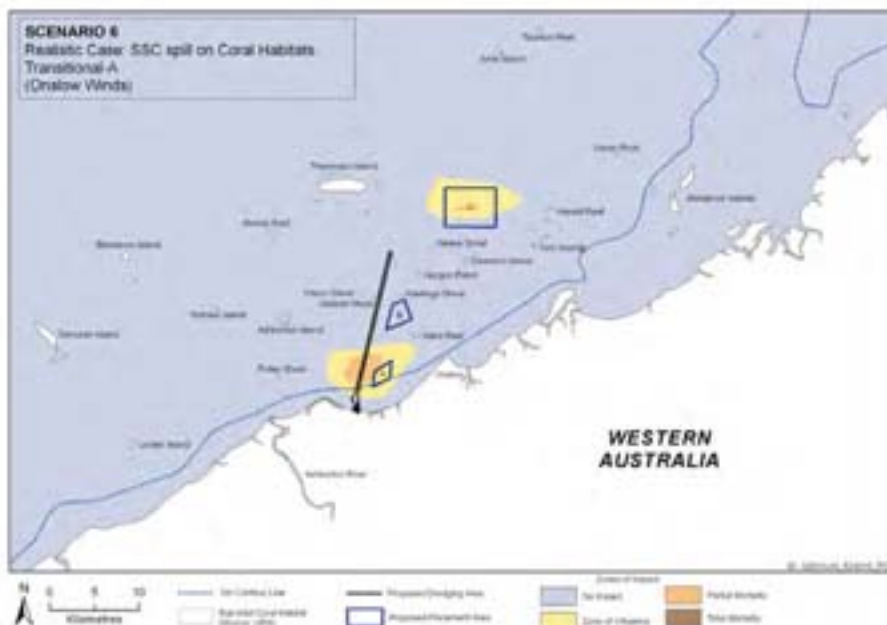


Figure B.257 Scenario 6, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

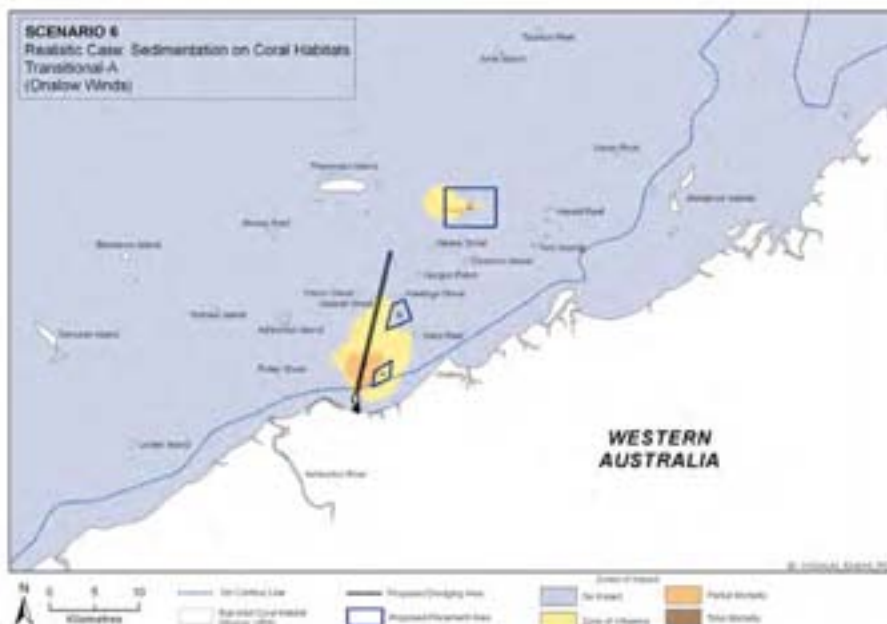


Figure B.258 Scenario 6, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

B-195

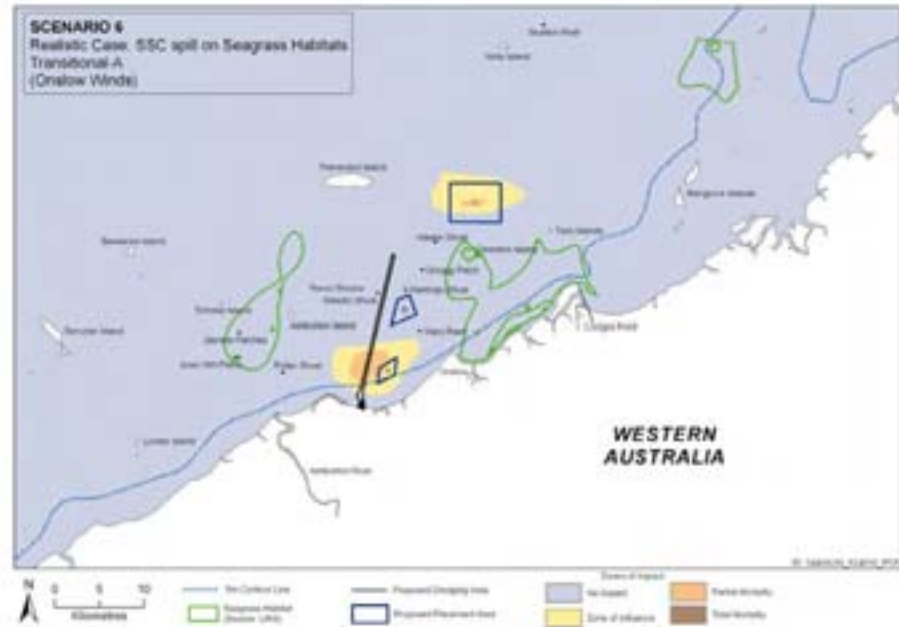


Figure B.259 Scenario 6, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

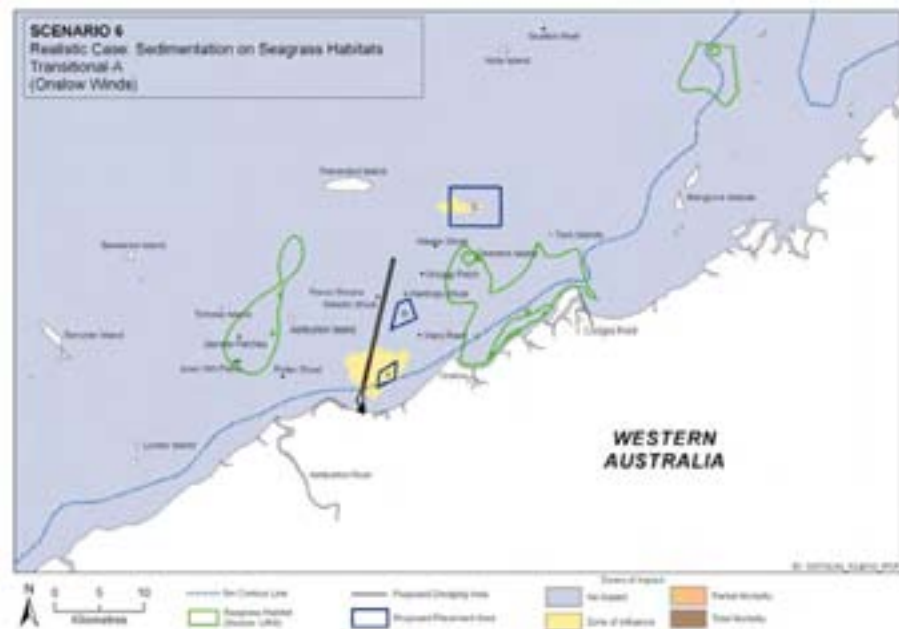


Figure B.260 Scenario 6, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-196



Table B.65 Summary of Impacts at Sensitive Receptors for Scenario 6, Transitional-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.3	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.1	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.4	0.0	0.0	0.0	0.1	
10	North West Ward Reef	299018	7610106	0.7	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	1.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.9	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.1	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.2	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.4	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.2	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



B-197



**B.6.6 Transitional-B, Realistic Spill Scenario**

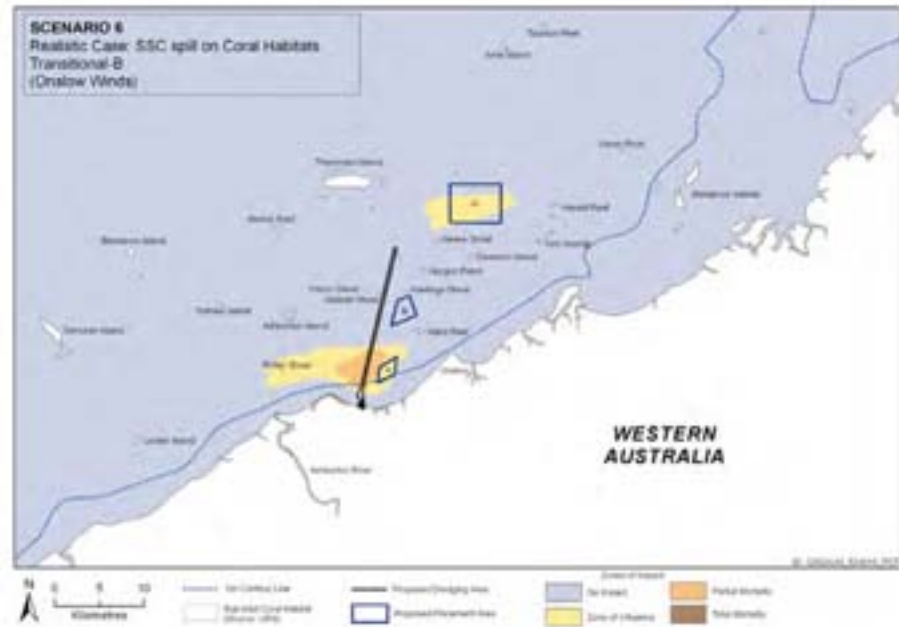


Figure B.261 Scenario 6, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

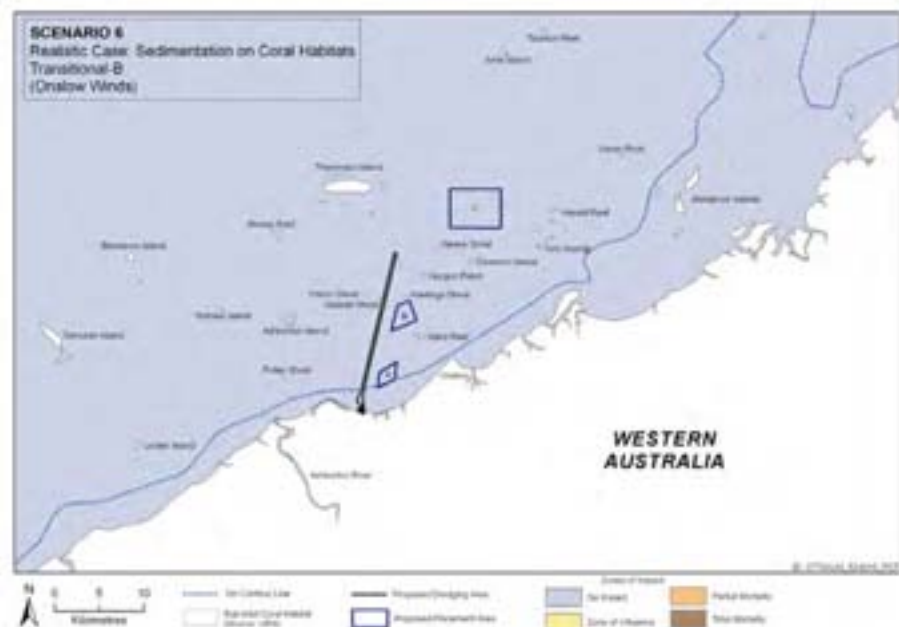


Figure B.262 Scenario 6, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

B-198

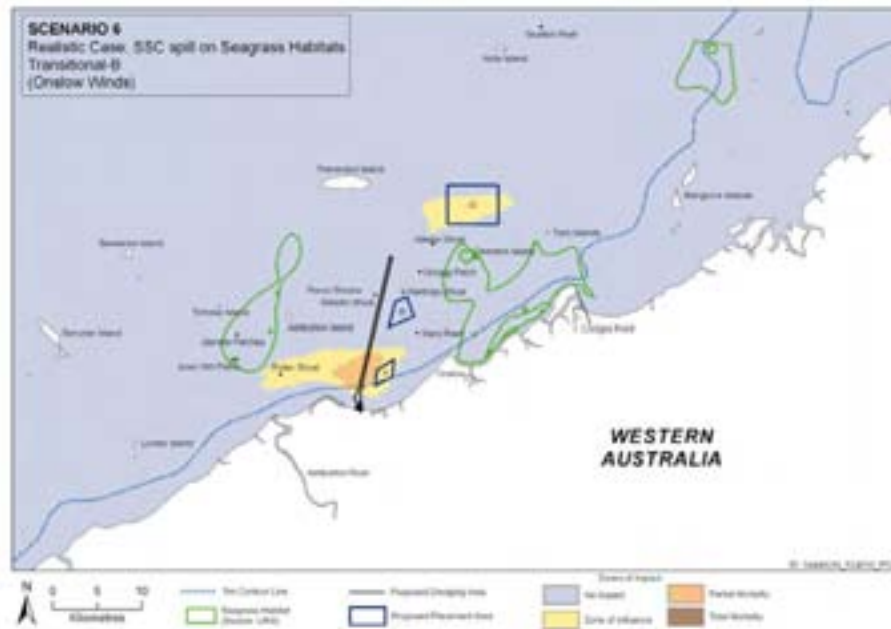


Figure B.263 Scenario 6, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

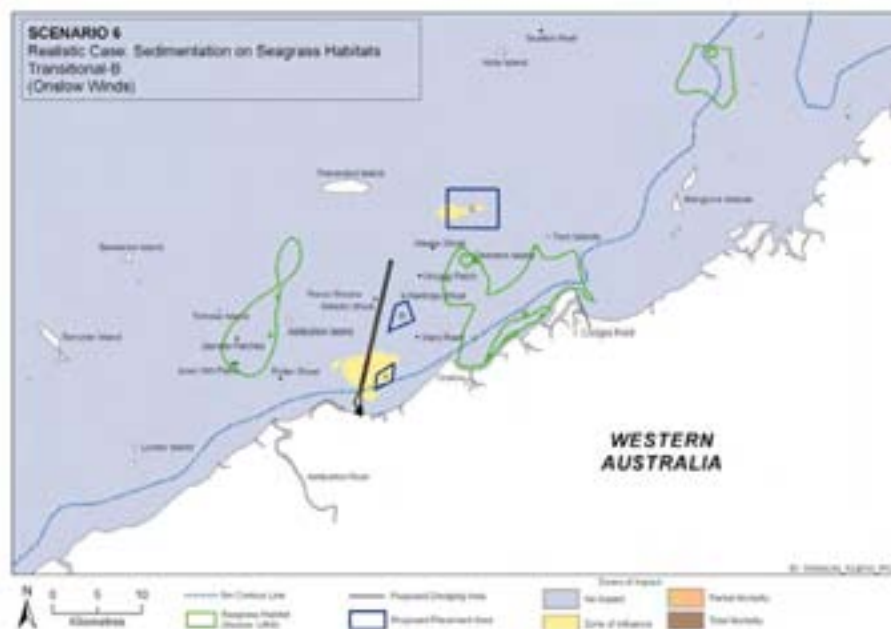


Figure B.264 Scenario 6, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-199



Table B.66 Summary of Impacts at Sensitive Receptors for Scenario 6, Transitional-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.1	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.3	6.5	0.4	0.0	0.0	
3	Ashburton Island	286705	7611075	0.4	0.0	0.0	0.0	0.2	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.4	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.3	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.5	0.0	0.0	0.0	0.1	
10	North West Ward Reef	299018	7610106	1.2	1.9	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	1.0	0.0	0.0	0.0	0.2	
12	Ward Reef	301120	7609196	1.0	0.6	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.3	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.6	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.3	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.3	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.2	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.2	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.3	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.3	0.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.2	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-200



**B.6.7 Summer-A, Worst Case Spill Scenario**

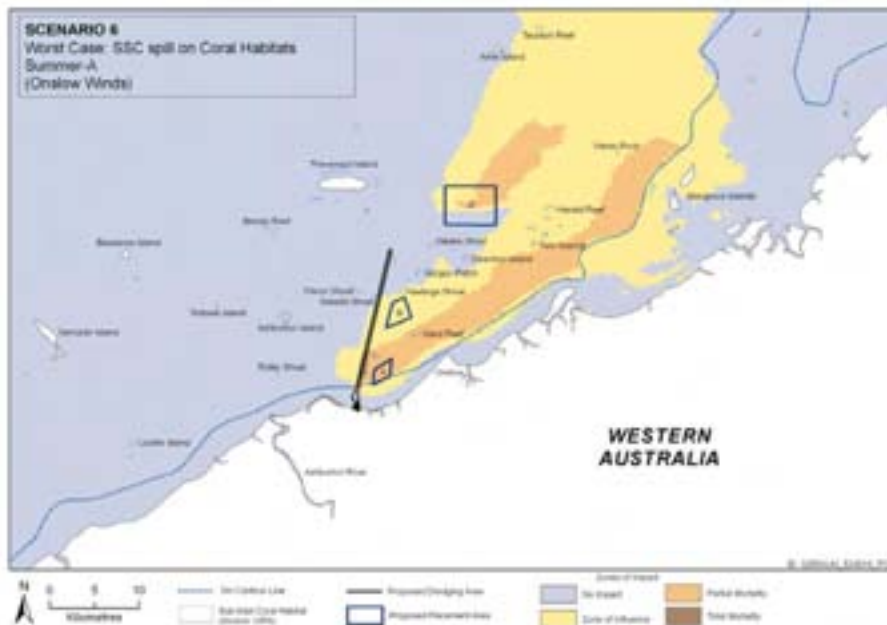


Figure B.265 Scenario 6, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

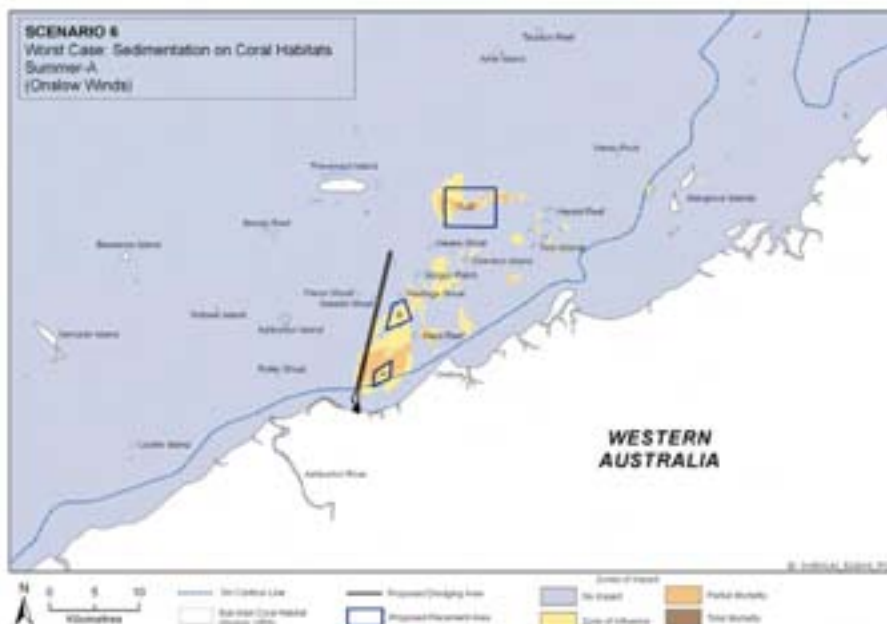


Figure B.266 Scenario 6, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-201

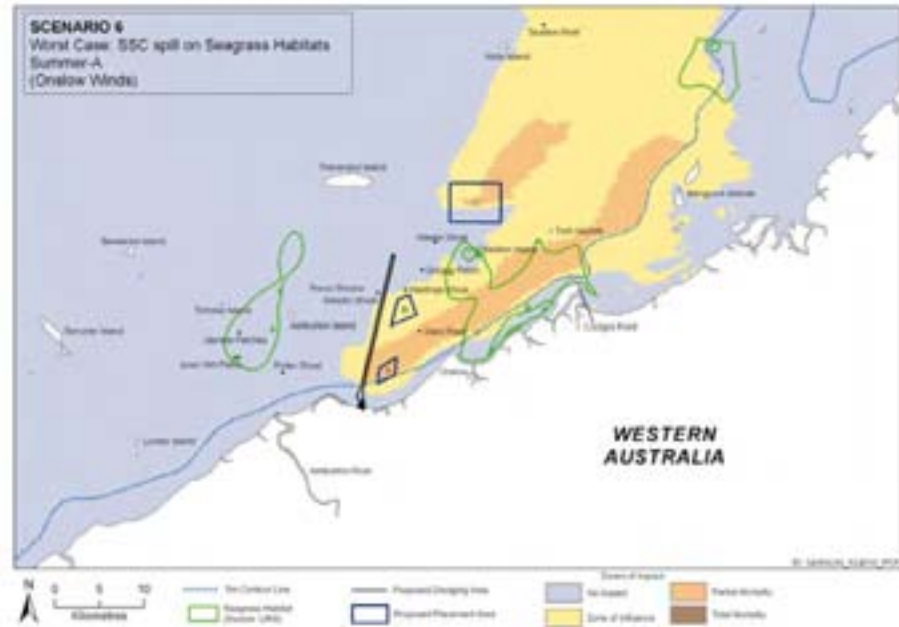


Figure B.267 Scenario 6, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

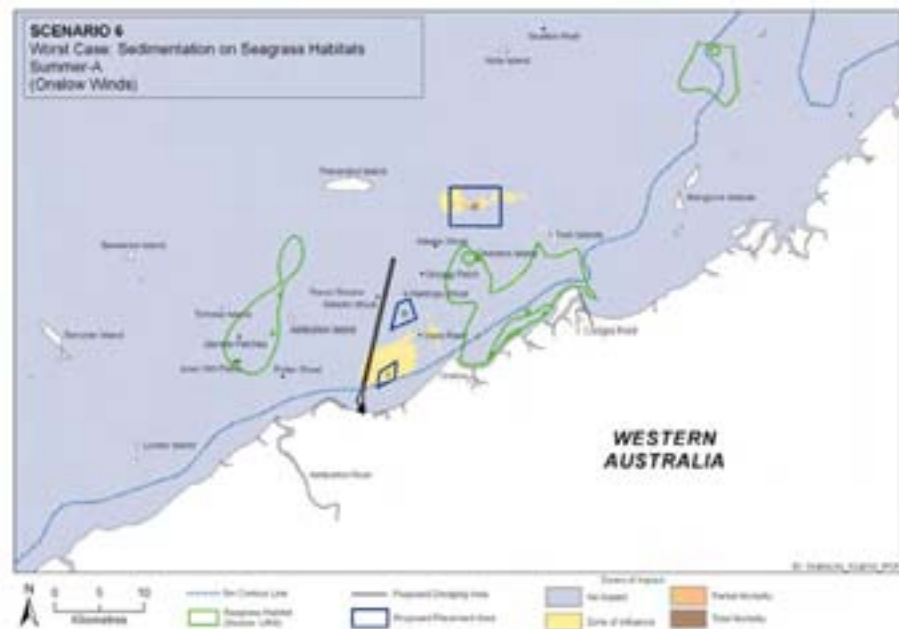


Figure B.268 Scenario 6, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

B-202



Table B.67 Summary of Impacts at Sensitive Receptors for Scenario 6, Summer-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.4	0.4	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.1	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	1.5	4.3	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	2.0	7.7	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	5.2	41.8	11.7	0.4	0.0	
12	Ward Reef	301120	7609196	5.1	40.0	11.9	0.1	0.0	
13	SW of Gorgon Patch	300094	7615177	1.0	1.3	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	1.0	0.4	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	0.7	0.3	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.7	4.0	0.0	0.0	0.3	
17	NW of Direction Island	304867	7618549	1.3	0.9	0.0	0.0	0.0	
18	Direction Island	307431	7617732	1.2	1.0	0.0	0.0	0.5	
19	NE Tw in Island	314029	7620738	2.8	16.5	0.4	0.0	0.0	
20	North Herald Reef	315701	7623270	2.5	11.6	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	4.6	40.6	3.0	0.0	0.0	
22	Nares Rock	323379	7629437	2.9	19.8	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.7	9.5	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	3.4	24.8	1.2	0.0	0.0	
30	SE of Direction Island	309948	7612830	5.6	51.7	8.8	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.6	0.7	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.8	0.6	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	5.1	49.3	0.6	0.0	0.0	
34	SW Tw in Island	313878	7618776	2.9	17.8	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-203



**B.6.8 Summer-B, Worst Case Spill Scenario**

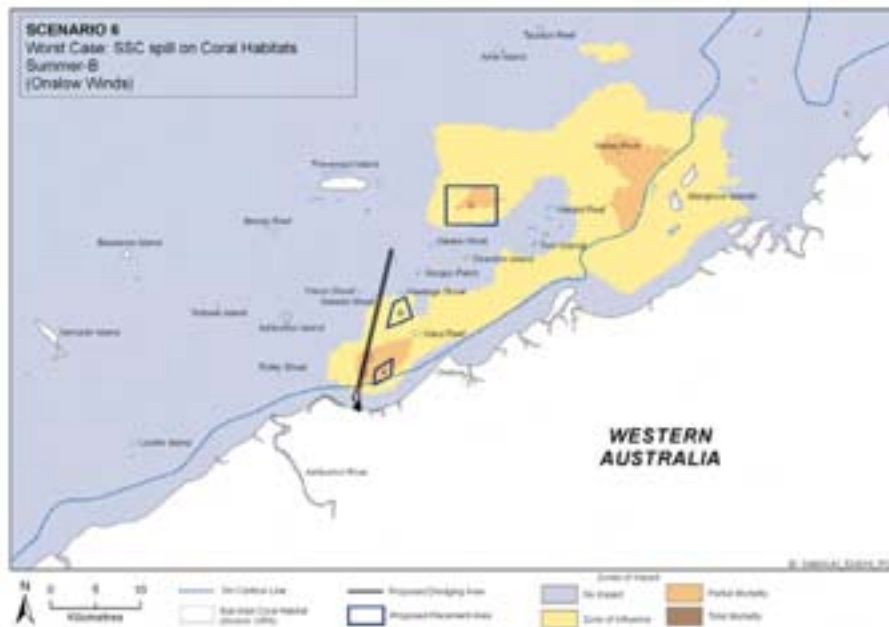


Figure B.269 Scenario 6, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

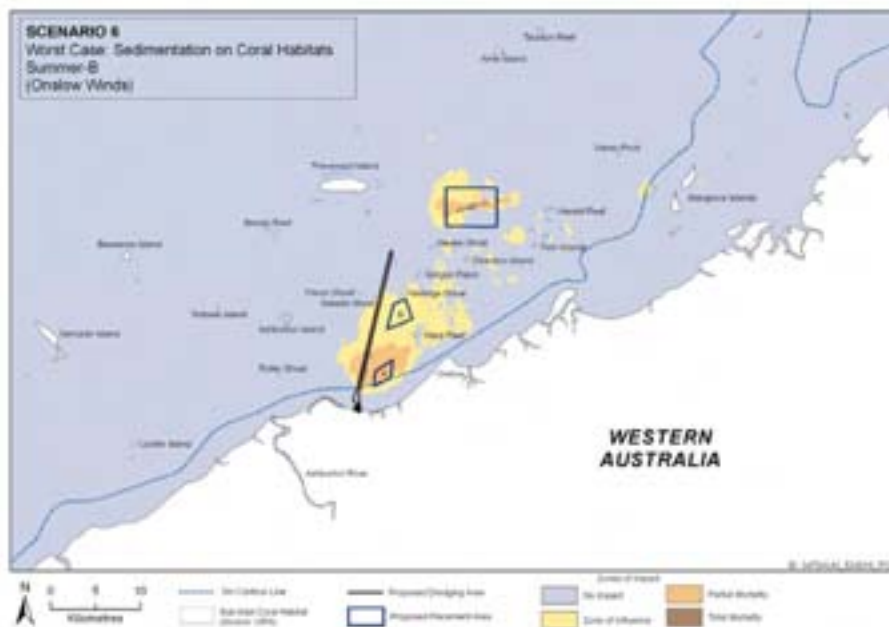


Figure B.270 Scenario 6, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

B-204

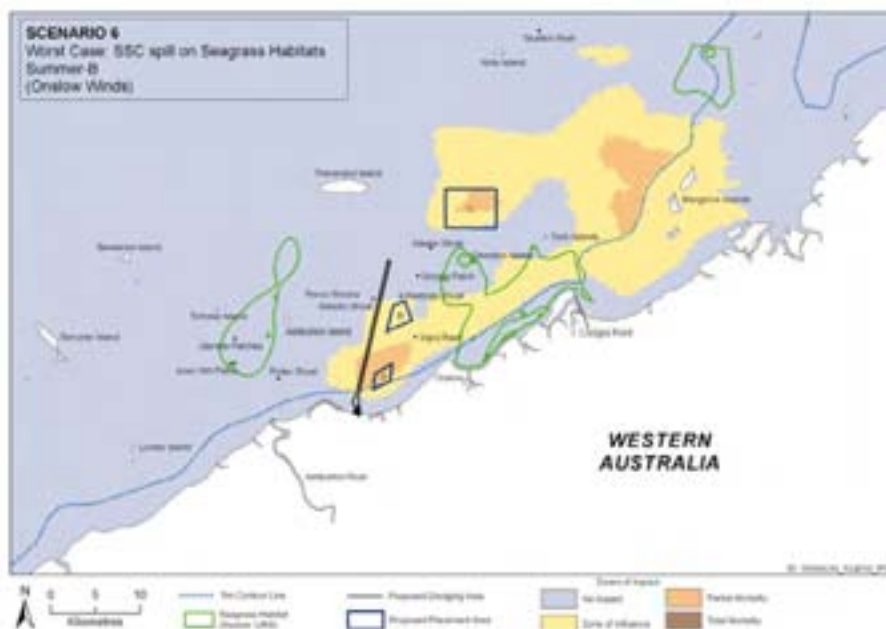


Figure B.271 Scenario 6, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

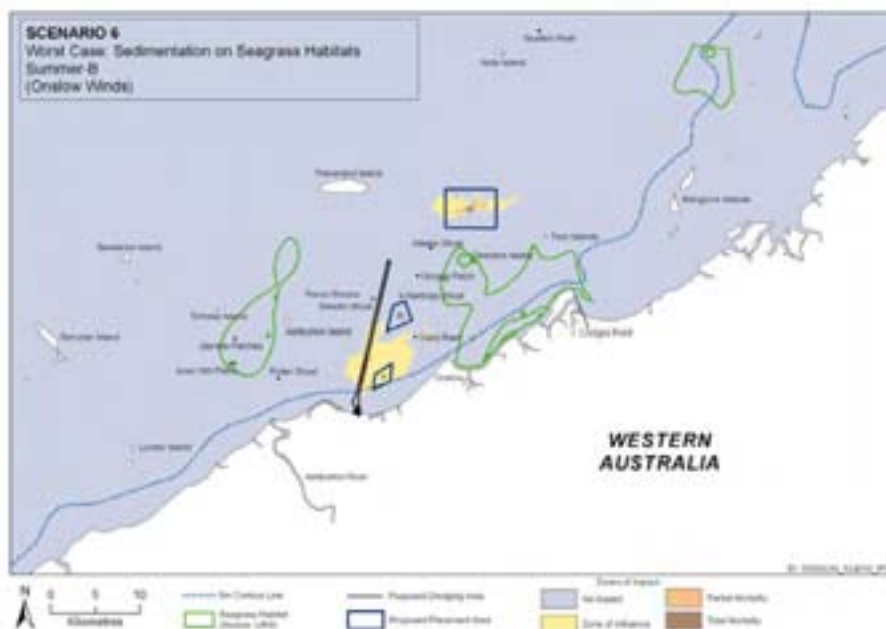


Figure B.272 Scenario 6, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds



B-205



Table B.68 Summary of Impacts at Sensitive Receptors for Scenario 6, Summer-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.2	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.7	0.4	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.1	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	1.1	1.0	0.0	0.0	0.3	
10	North West Ward Reef	299018	7610106	1.7	5.6	0.0	0.0	0.3	
11	Ward Reef	300410	7608868	2.9	17.8	3.0	0.3	0.6	
12	Ward Reef	301120	7609196	2.7	14.0	2.2	0.3	0.2	
13	SW of Gorgon Patch	300094	7615177	0.7	0.0	0.0	0.0	0.3	
14	Gorgon Patch	300859	7615993	0.6	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.4	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.1	0.9	0.0	0.0	0.2	
17	NW of Direction Island	304867	7618549	0.8	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.6	0.0	0.0	0.0	0.2	
19	NE Twin Island	314029	7620738	1.1	0.9	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	1.2	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	3.6	26.9	4.3	0.0	0.0	
22	Nares Rock	323379	7629437	3.4	30.5	1.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.6	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.6	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	1.9	3.3	0.0	0.0	0.1	
30	SE of Direction Island	309948	7612830	2.6	16.0	2.1	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.2	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.2	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	2.5	12.5	0.6	0.0	0.0	
34	SW Twin Island	313878	7618776	1.2	0.3	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.6.9 Winter-A, Worst Case Spill Scenario**



Figure B.273 Scenario 6, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

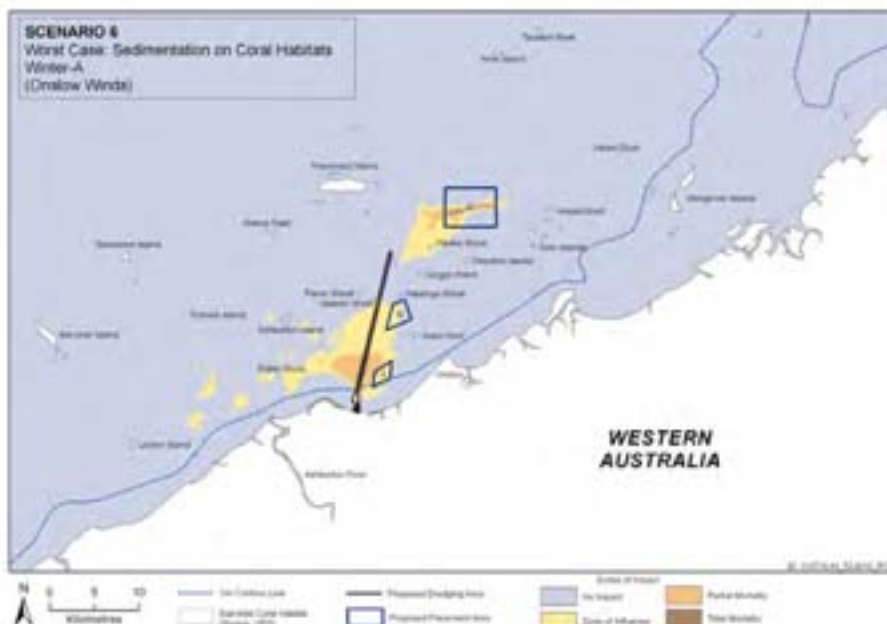


Figure B.274 Scenario 6, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-207

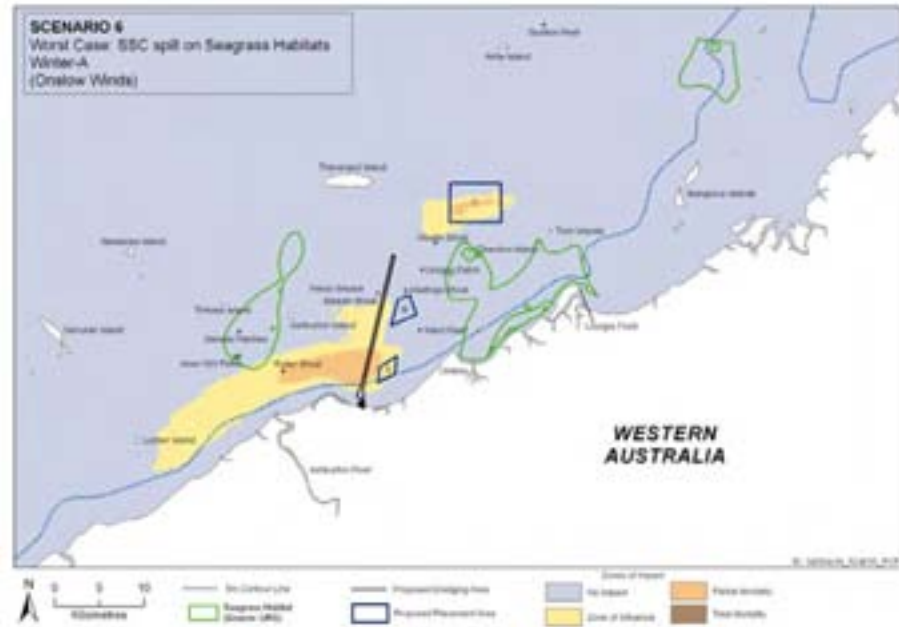


Figure B.275 Scenario 6, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

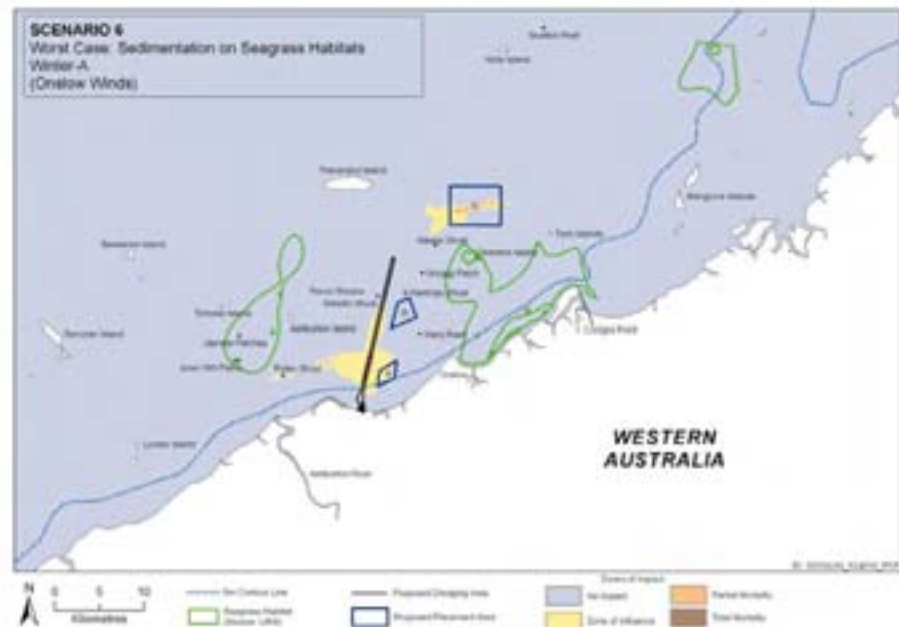


Figure B.276 Scenario 6, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-208



Table B.69 Summary of Impacts at Sensitive Receptors for Scenario 6, Winter-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.5	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	3.9	28.1	5.8	0.0	0.0	
3	Ashburton Island	286705	7611075	0.8	0.0	0.0	0.0	0.5	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.5	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.3	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.8	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.1	0.0	0.0	0.0	0.0	
10	North West Ward Reef	299018	7610106	0.2	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.2	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.3	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.2	0.3	0.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.8	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.7	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-209



**B.6.10 Winter-B, Worst Case Spill Scenario**

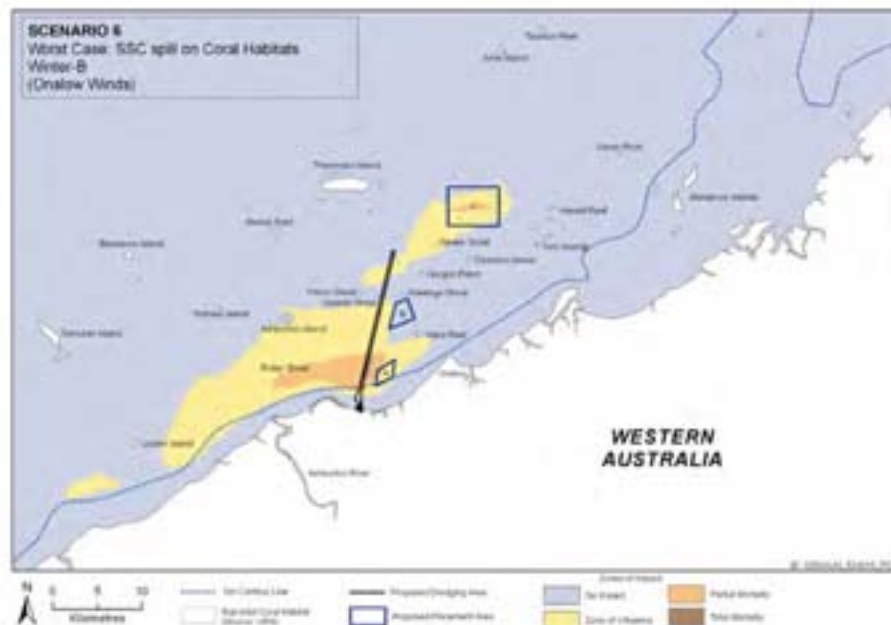


Figure B.277 Scenario 6, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

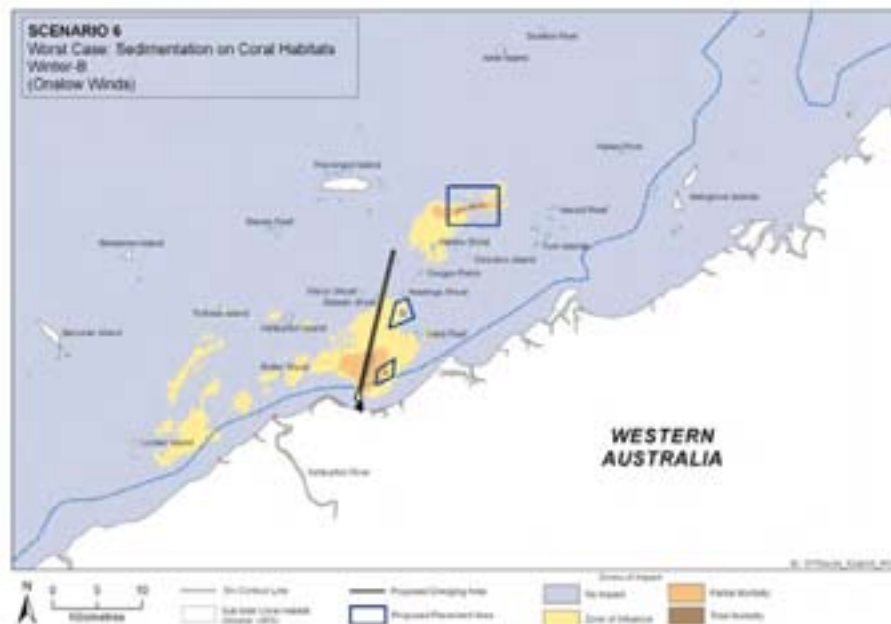


Figure B.278 Scenario 6, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-210

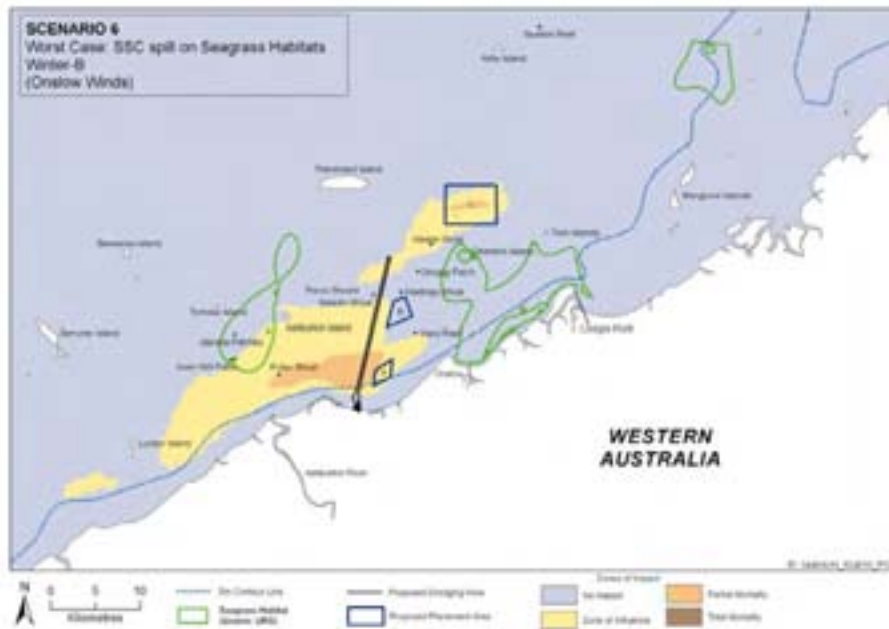


Figure B.279 Scenario 6, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

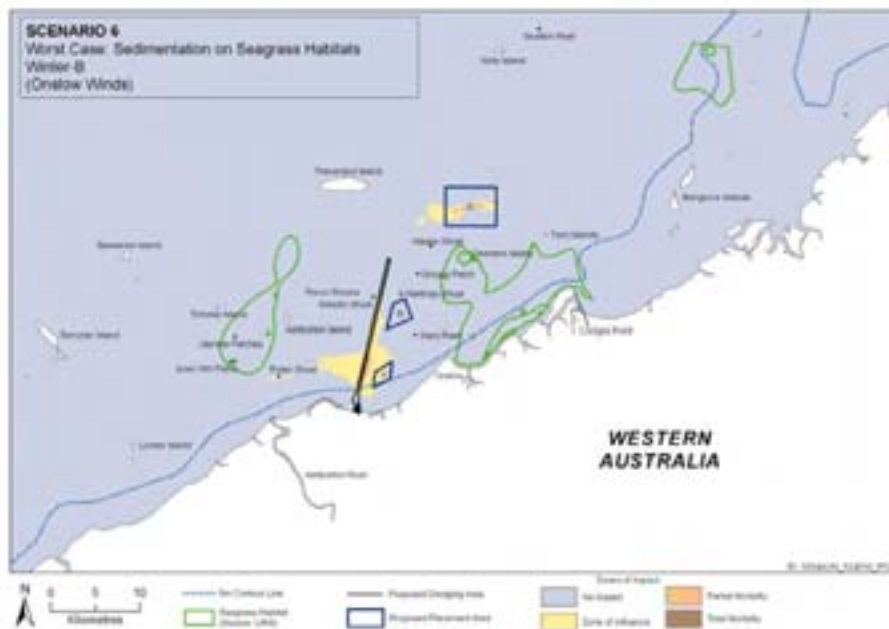


Figure B.280 Scenario 6, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-211



Table B.70 Summary of Impacts at Sensitive Receptors for Scenario 6, Winter-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.7	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	3.2	26.0	7.4	0.0	0.0	
3	Ashburton Island	286705	7611075	1.2	2.7	0.0	0.0	0.6	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.2	0.6	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.0	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.0	3.4	0.0	0.0	0.1	
9	Hastings Shoal	298803	7613488	0.7	0.1	0.0	0.0	0.2	
10	North West Ward Reef	299018	7610106	0.5	0.0	0.0	0.0	0.2	
11	Ward Reef	300410	7608868	0.7	2.8	0.0	0.0	0.3	
12	Ward Reef	301120	7609196	0.7	1.2	0.0	0.0	0.2	
13	SW of Gorgon Patch	300094	7615177	0.6	0.0	0.0	0.0	0.1	
14	Gorgon Patch	300859	7615993	0.7	0.4	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.5	5.1	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.2	3.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.0	0.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.2	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-212



**B.6.11 Transitional-A, Worst Case Spill Scenario**

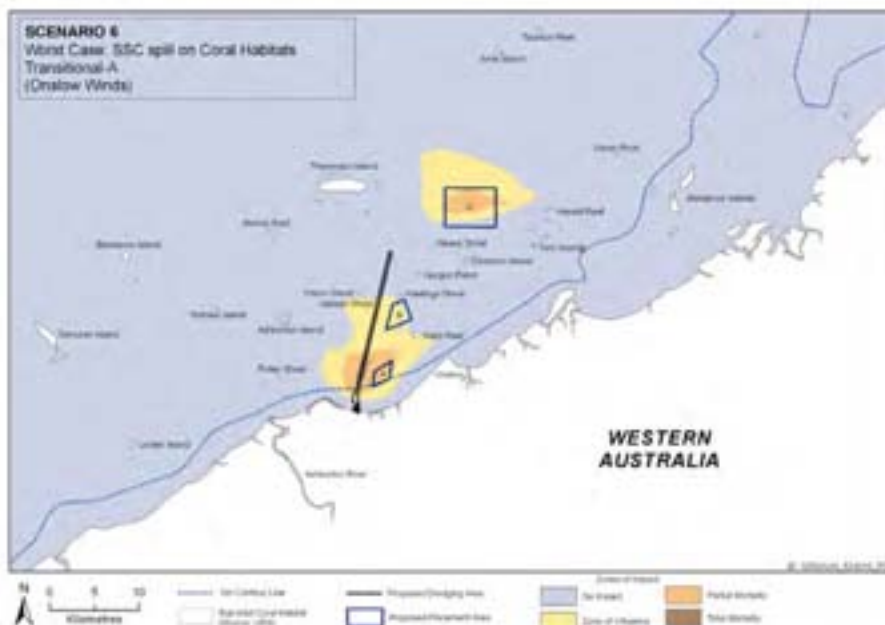


Figure B.281 Scenario 6, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

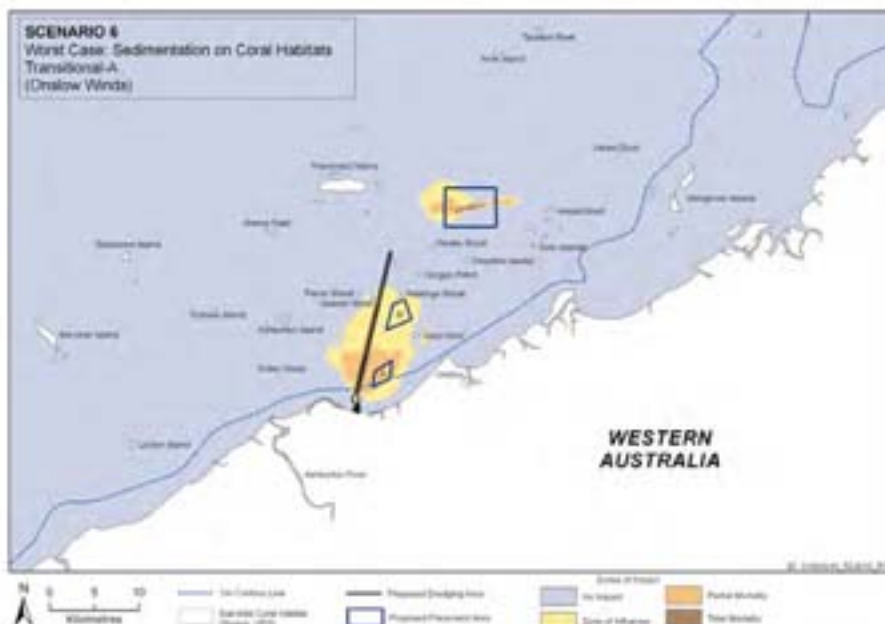


Figure B.282 Scenario 6, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



B-213

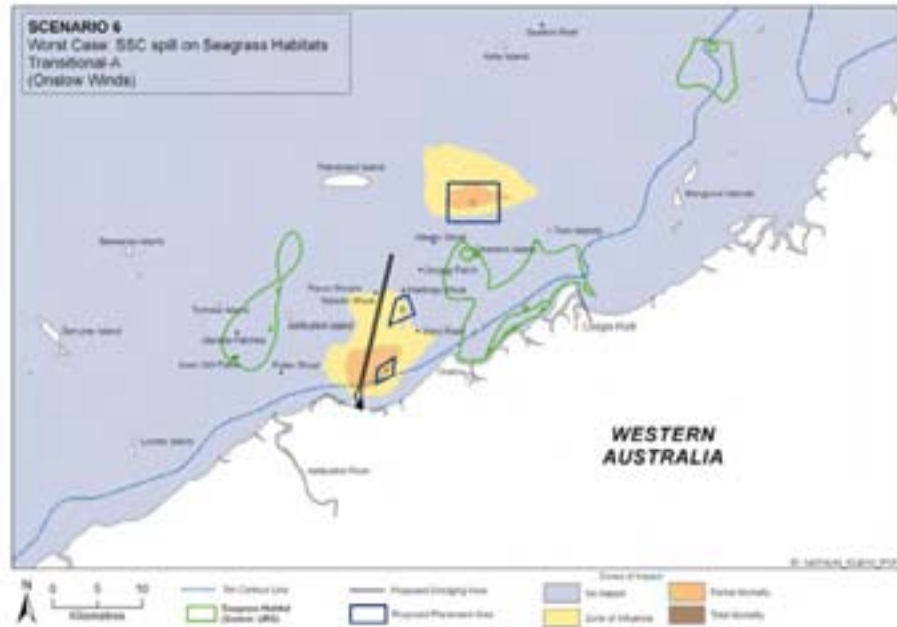


Figure B.283 Scenario 6, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

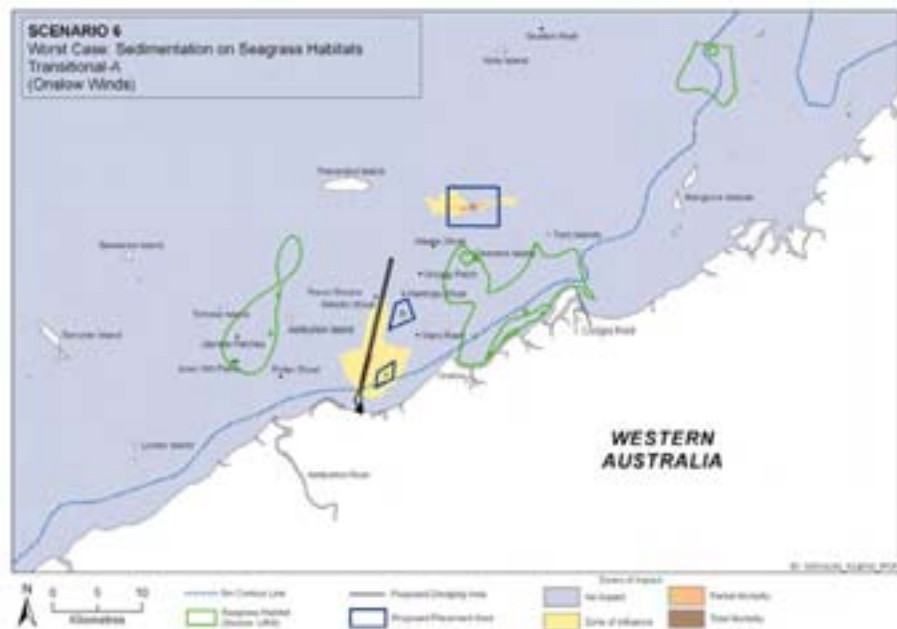


Figure B.284 Scenario 6, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

B-214



Table B.71 Summary of Impacts at Sensitive Receptors for Scenario 6, Transitional-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.6	0.3	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.0	2.2	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.3	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.9	0.3	0.0	0.0	0.3	
10	North West Ward Reef	299018	7610106	1.3	2.2	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	1.6	6.2	0.0	0.0	0.1	
12	Ward Reef	301120	7609196	1.5	2.2	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.0	0.0	0.0	0.2	
14	Gorgon Patch	300859	7615993	0.4	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.3	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.4	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.3	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.3	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.6	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.3	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.2	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.2	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-215



**B.6.12 Transitional-B, Worst Case Spill Scenario**

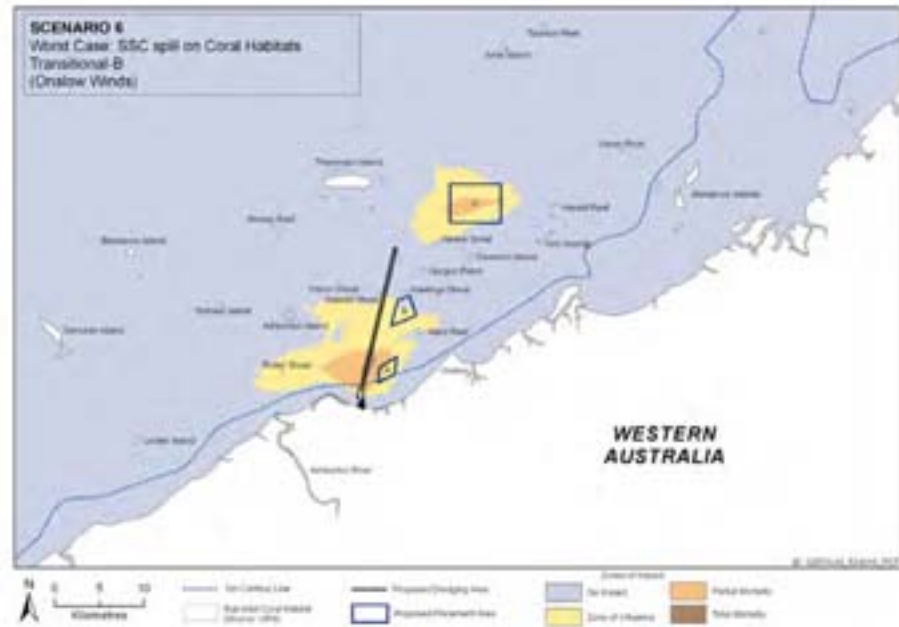


Figure B.285 Scenario 6, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

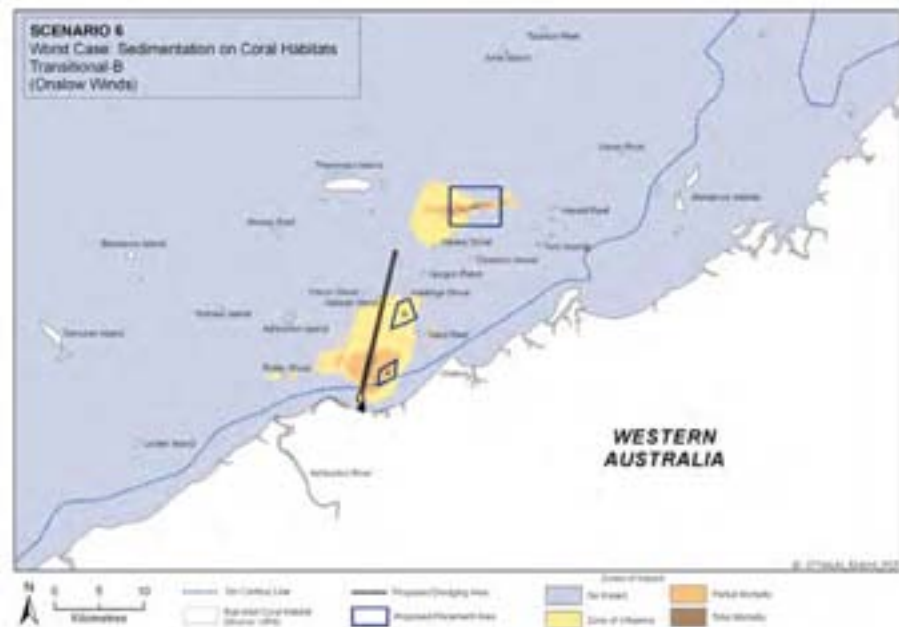


Figure B.286 Scenario 6, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

B-216

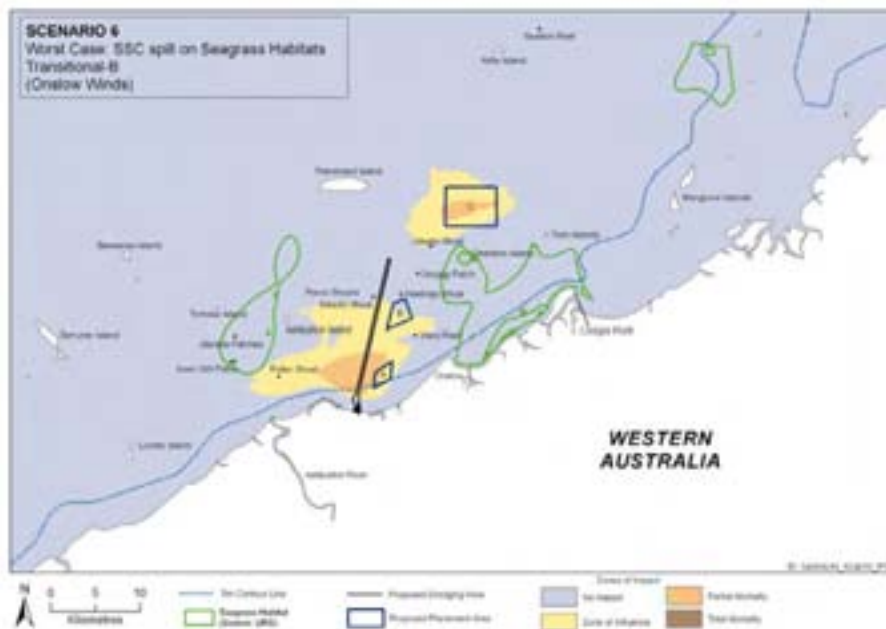


Figure B.287 Scenario 6, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

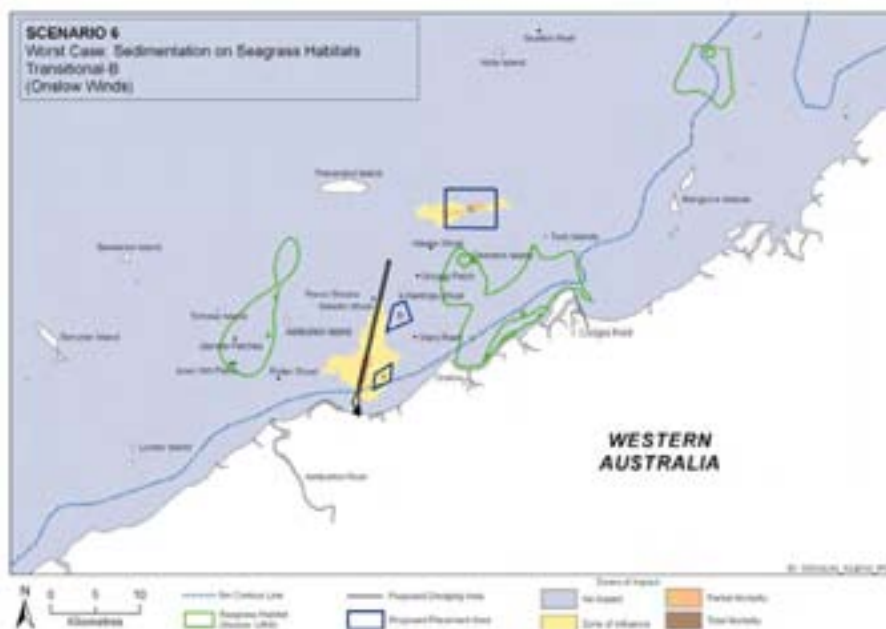


Figure B.288 Scenario 6, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

B-217



Table B.72 Summary of Impacts at Sensitive Receptors for Scenario 6, Transitional-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.1	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	1.7	11.6	1.8	0.0	0.0	
3	Ashburton Island	286705	7611075	0.6	0.0	0.0	0.0	0.3	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.6	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.8	0.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.5	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	0.8	0.0	0.0	0.0	0.2	
10	North West Ward Reef	299018	7610106	1.7	5.6	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	1.4	1.2	0.0	0.0	0.2	
12	Ward Reef	301120	7609196	1.4	3.4	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	0.0	0.0	0.0	0.0	
14	Gorgon Patch	300859	7615993	0.5	0.0	0.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	1.0	1.6	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.4	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.5	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.3	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.2	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.2	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.4	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.5	0.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.3	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.2	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-218



**B.7 Dredging Scenario 7**

**B.7.1 Summer-A, Realistic Spill Scenario**

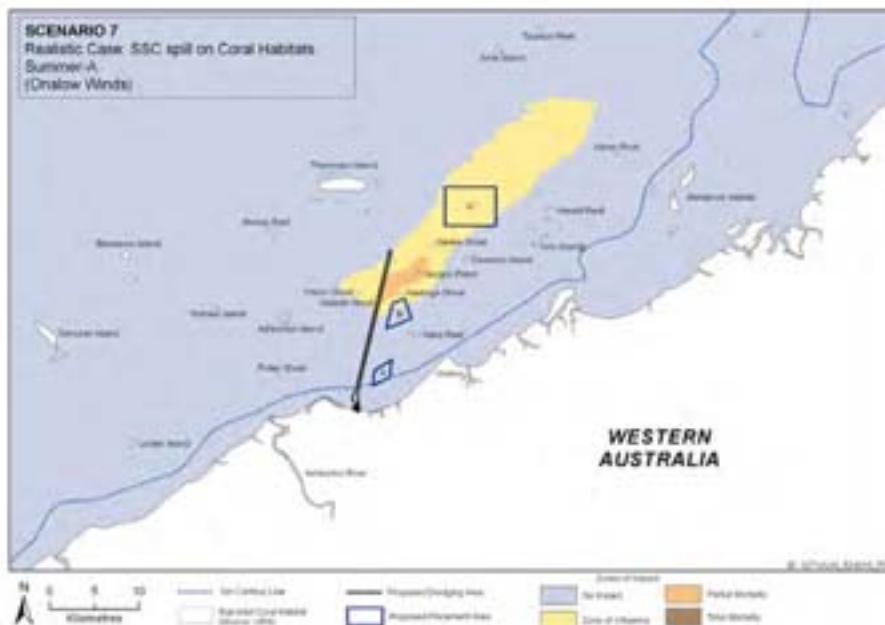
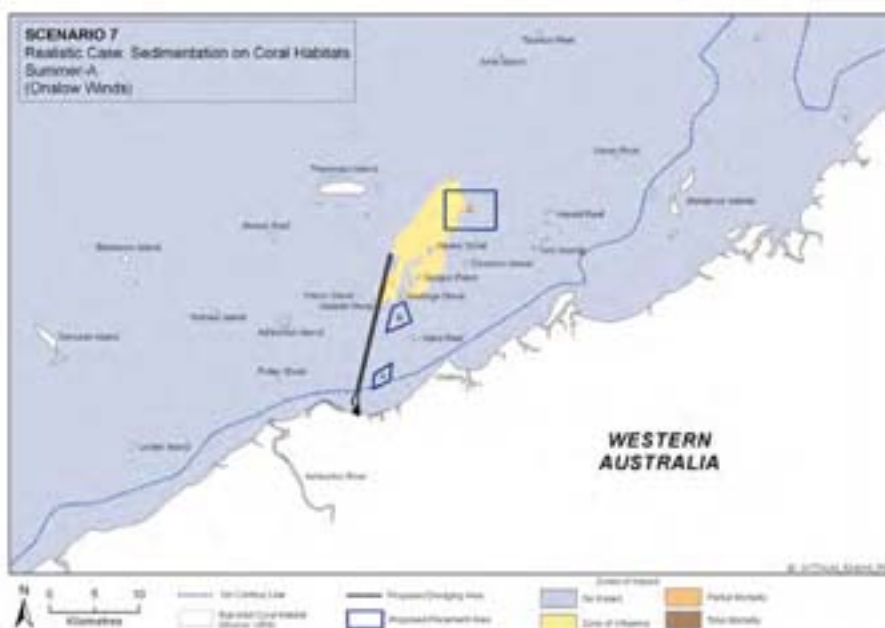


Figure B.289 Scenario 7, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds



SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-219



Figure B.290 Scenario 7, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

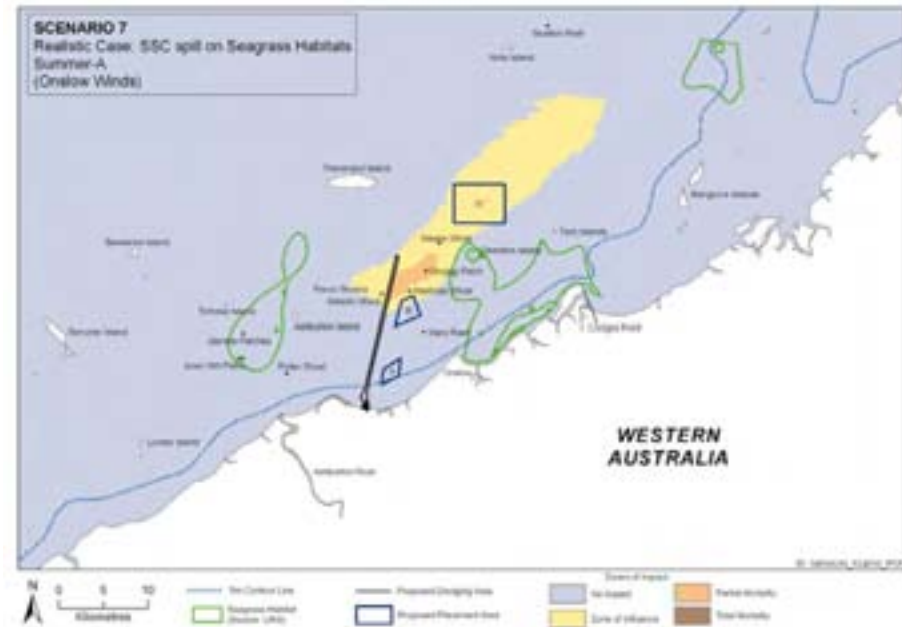


Figure B.291 Scenario 7, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

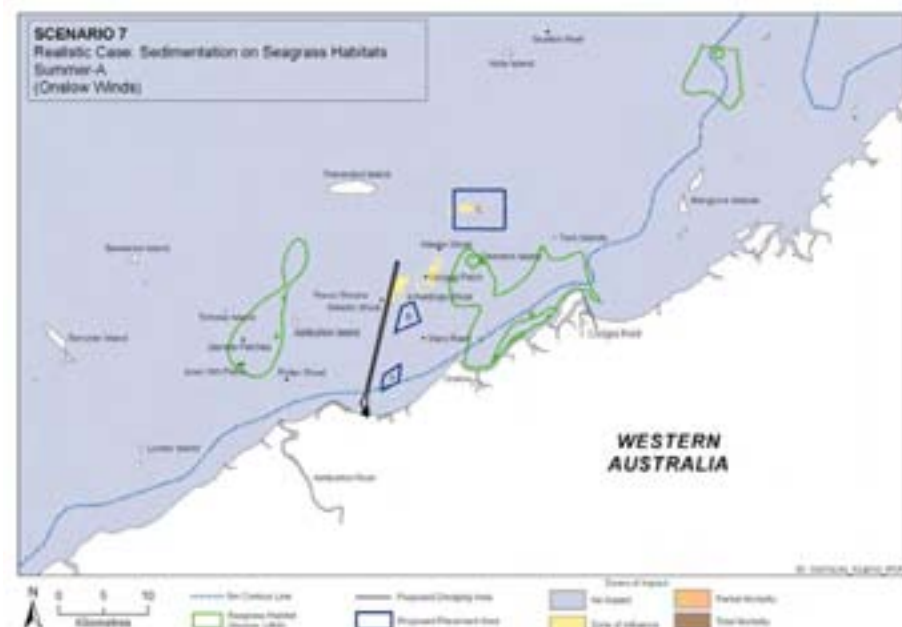


Figure B.292 Scenario 7, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-220



Table B.73 Summary of Impacts at Sensitive Receptors for Scenario 7, Summer-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.5	3.6	1.2	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.6	10.0	4.3	0.7	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.6	9.5	1.2	0.0	0.0	
9	Hastings Shoal	298803	7613488	3.1	18.1	8.9	0.1	0.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	4.0	28.1	10.5	0.3	0.0	
14	Gorgon Patch	300859	7615993	4.3	33.3	10.0	0.0	0.0	
15	Weeks Shoal	302245	7618926	2.8	16.9	2.8	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.4	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.8	1.9	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.2	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.3	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.4	0.4	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



B-221



**B.7.2 Summer-B, Realistic Spill Scenario**

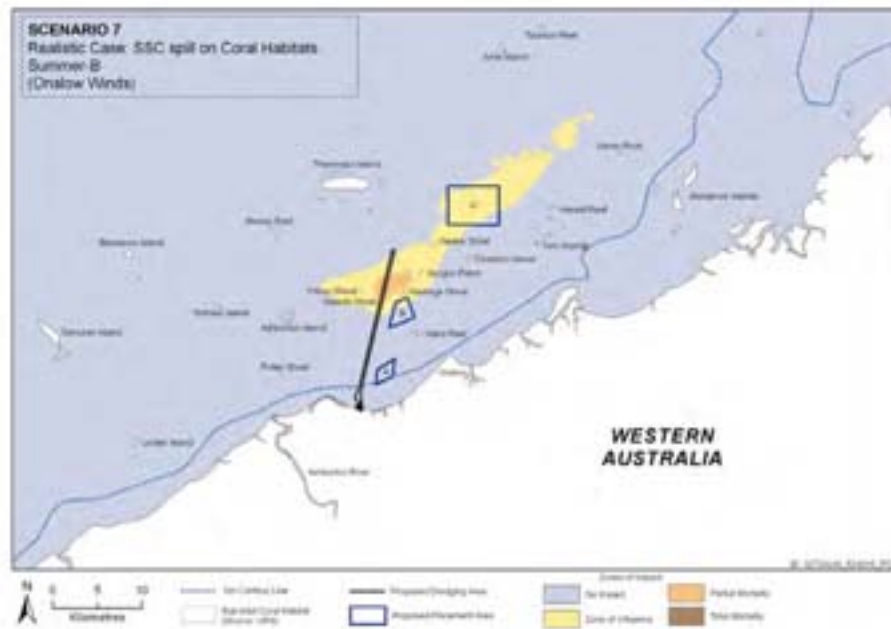


Figure B.293 Scenario 7, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

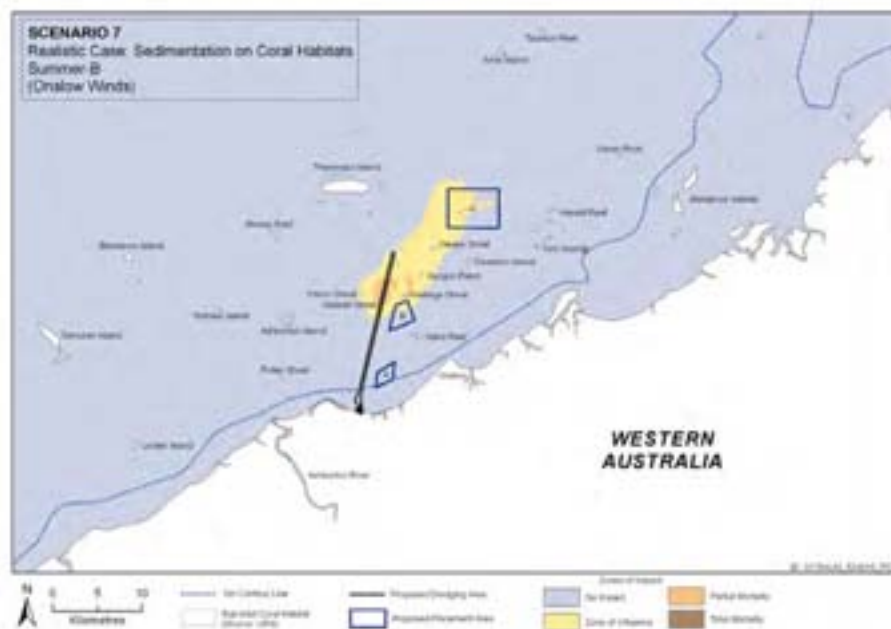


Figure B.294 Scenario 7, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

B-222

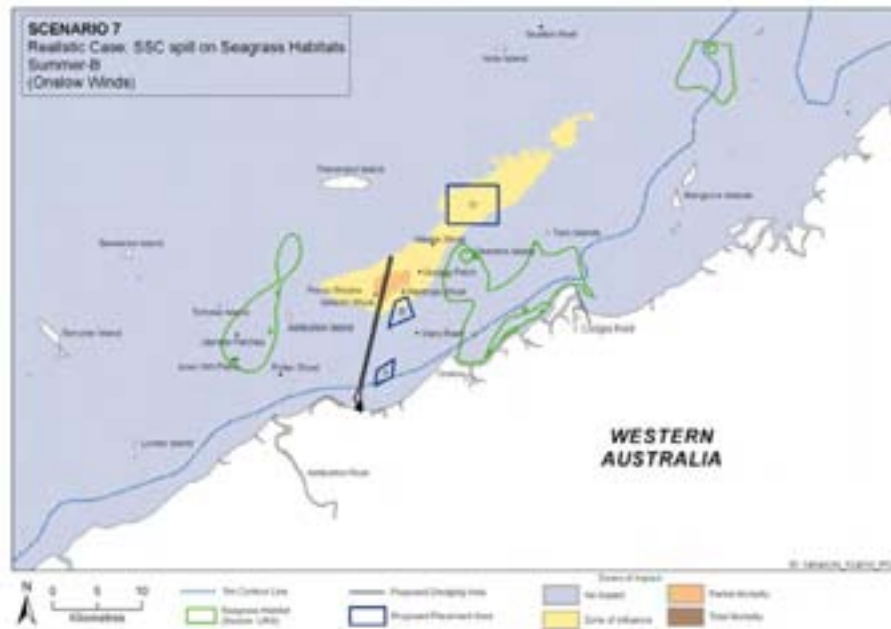


Figure B.295 Scenario 7, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

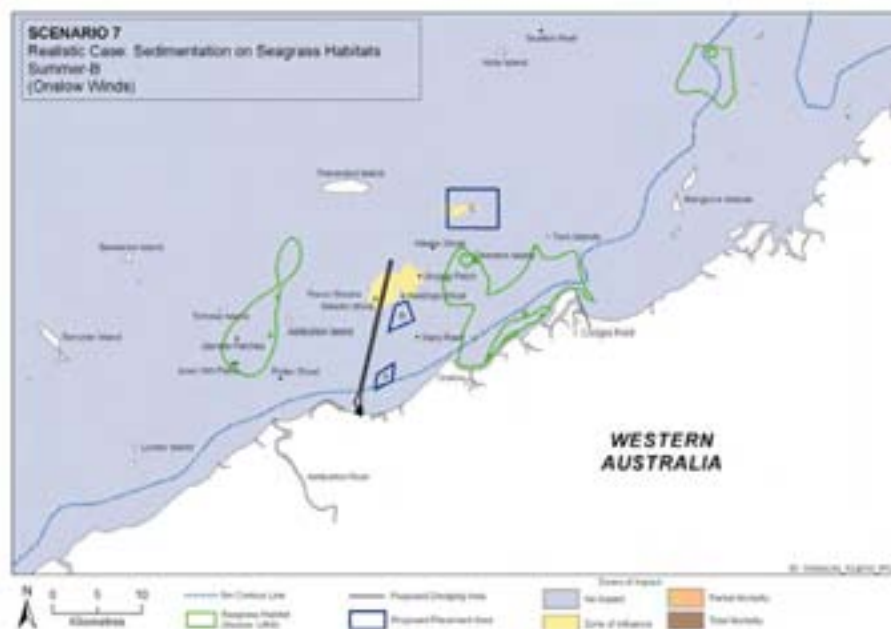


Figure B.296 Scenario 7, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-223



Table B.74 Summary of Impacts at Sensitive Receptors for Scenario 7, Summer-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.8	17.1	3.3	0.0	0.1	
7	Saladin Shoal	295913	7613337	3.2	23.8	7.9	0.9	0.2	
8	End of Wheatstone Shipping Channel	298328	7617464	1.5	7.3	0.1	0.0	0.3	
9	Hastings Shoal	298803	7613488	2.8	18.4	7.7	0.0	0.7	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	3.0	22.6	7.3	0.0	1.4	
14	Gorgon Patch	300859	7615993	2.5	18.3	5.8	0.0	1.0	
15	Weeks Shoal	302245	7618926	1.6	5.9	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.3	0.9	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.2	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.5	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.1	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-224



**B.7.3 Winter-A, Realistic Spill Scenario**

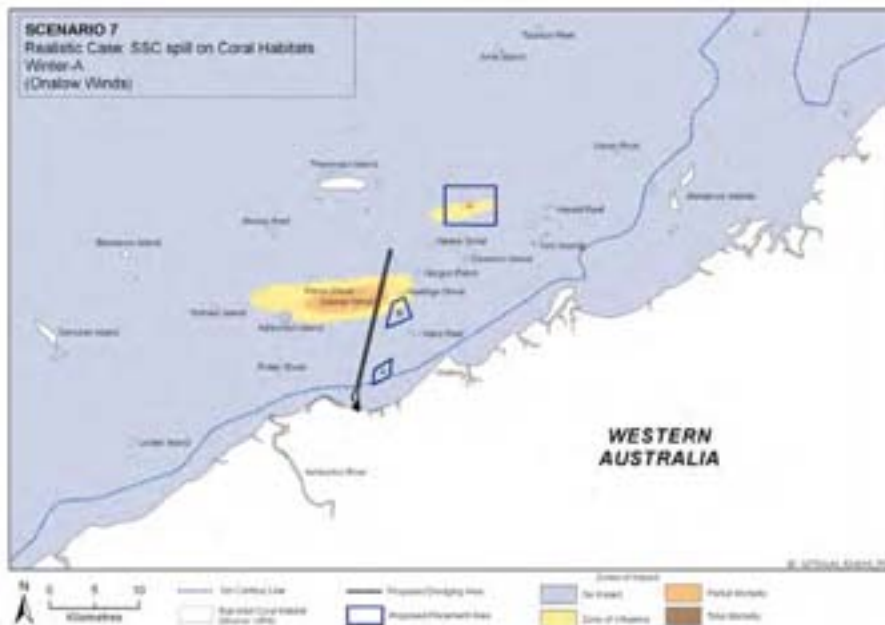


Figure B.297 Scenario 7, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds



Figure B.298 Scenario 7, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-225

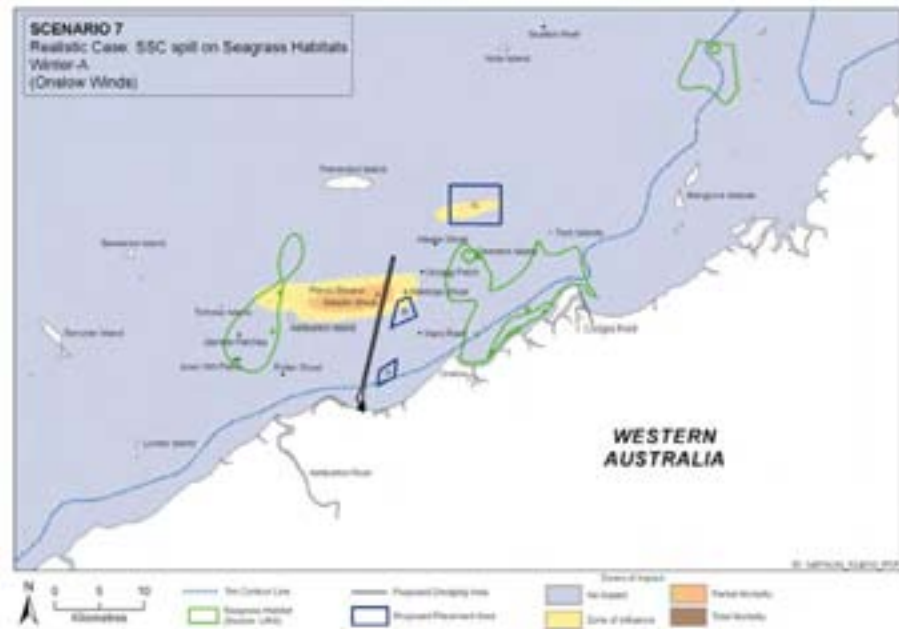


Figure B.299 Scenario 7, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

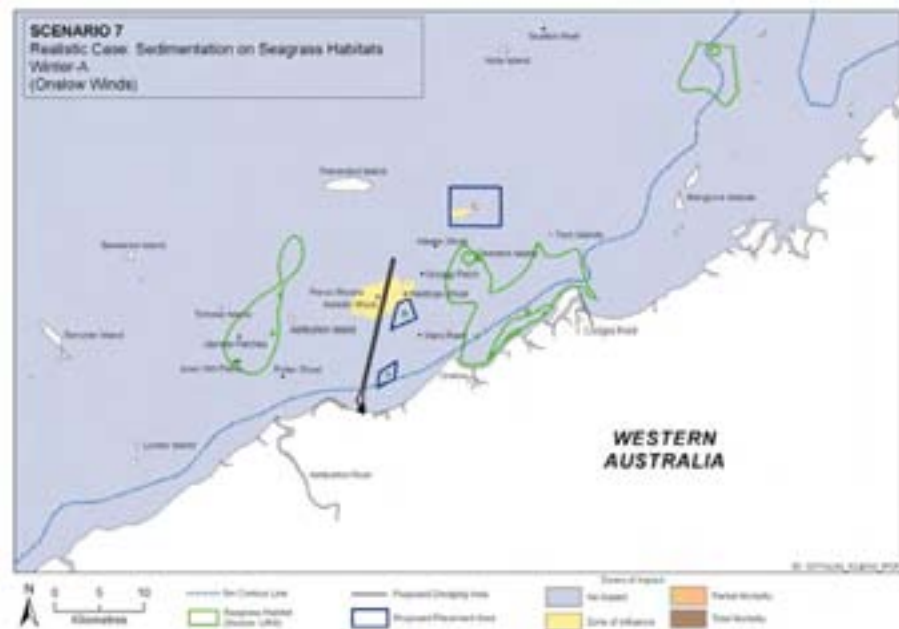


Figure B.300 Scenario 7, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

B-226



Table B.75 Summary of Impacts at Sensitive Receptors for Scenario 7, Winter-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.8	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.6	1.9	0.0	0.0	0.8	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	3.4	24.1	6.2	0.3	0.0	
7	Saladin Shoal	295913	7613337	5.1	38.5	12.2	1.6	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.3	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	1.9	13.7	4.2	0.0	1.3	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.7	3.7	0.7	0.0	0.7	
14	Gorgon Patch	300859	7615993	0.2	0.0	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.5	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.6	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.8	5.2	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-227



**B.7.4 Winter-B, Realistic Spill Scenario**

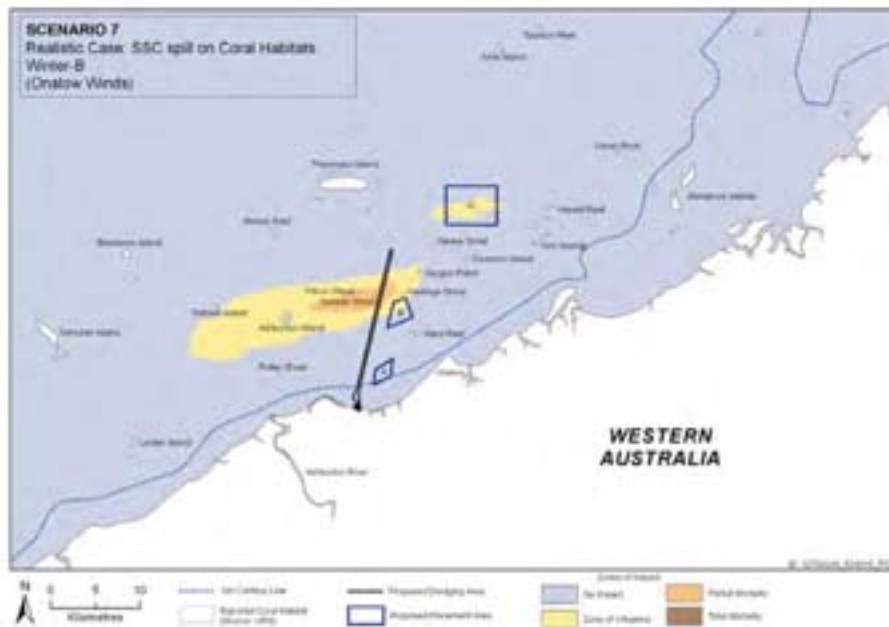


Figure B.301 Scenario 7, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

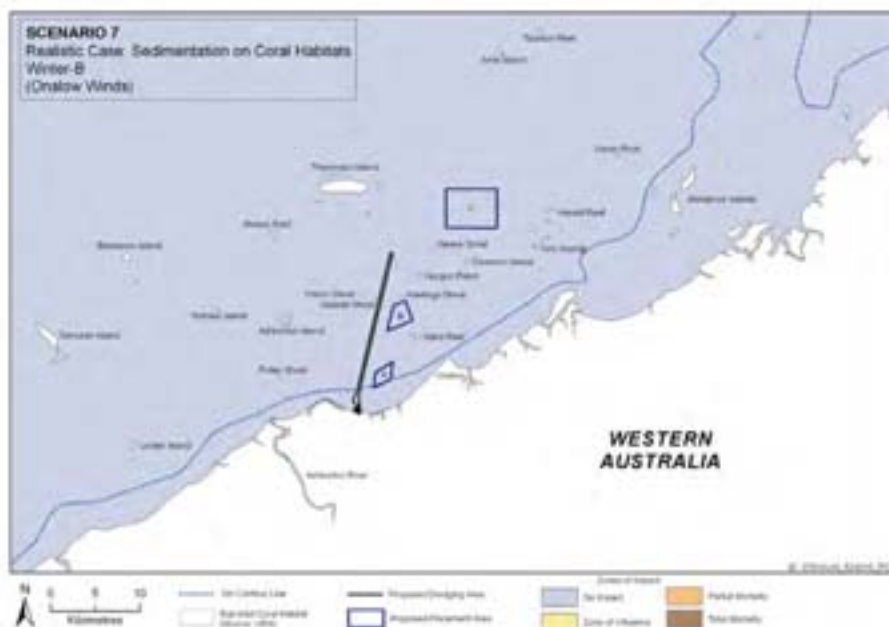


Figure B.302 Scenario 7, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

B-228



Figure B.303 Scenario 7, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

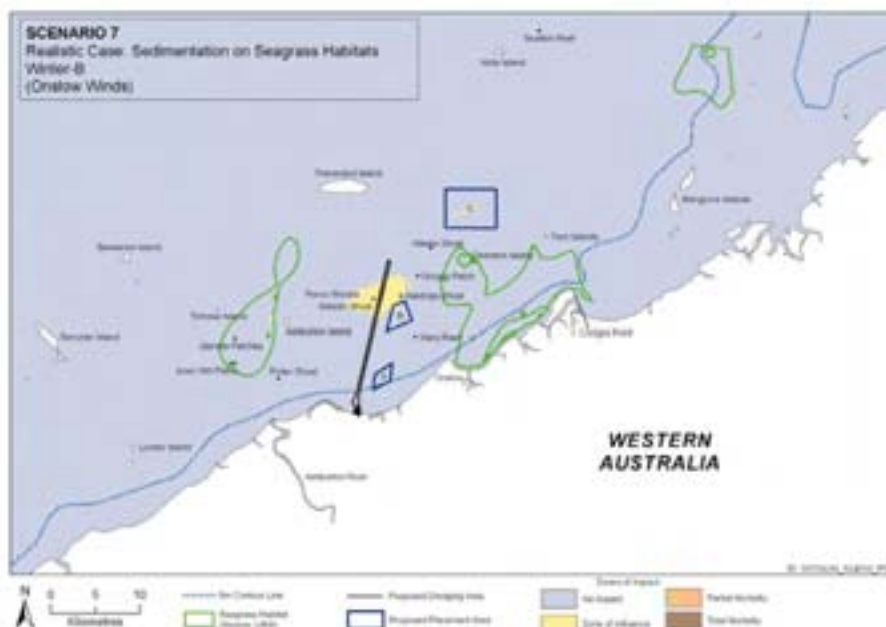


Figure B.304 Scenario 7, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds



B-229



Table B.76 Summary of Impacts at Sensitive Receptors for Scenario 7, Winter-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.0	1.8	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.8	9.5	0.4	0.0	0.9	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	3.2	21.5	6.5	0.0	0.2	
7	Saladin Shoal	295913	7613337	4.4	30.5	10.4	2.1	0.4	
8	End of Wheatstone Shipping Channel	298328	7617464	0.6	0.0	0.0	0.0	0.1	
9	Hastings Shoal	298803	7613488	2.7	19.3	6.1	0.0	2.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.4	5.5	1.0	0.0	0.7	
14	Gorgon Patch	300859	7615993	1.2	5.1	0.4	0.0	0.5	
15	Weeks Shoal	302245	7618926	1.0	0.0	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.1	1.9	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.8	10.0	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-230



**B.7.5 Transitional-A, Realistic Spill Scenario**

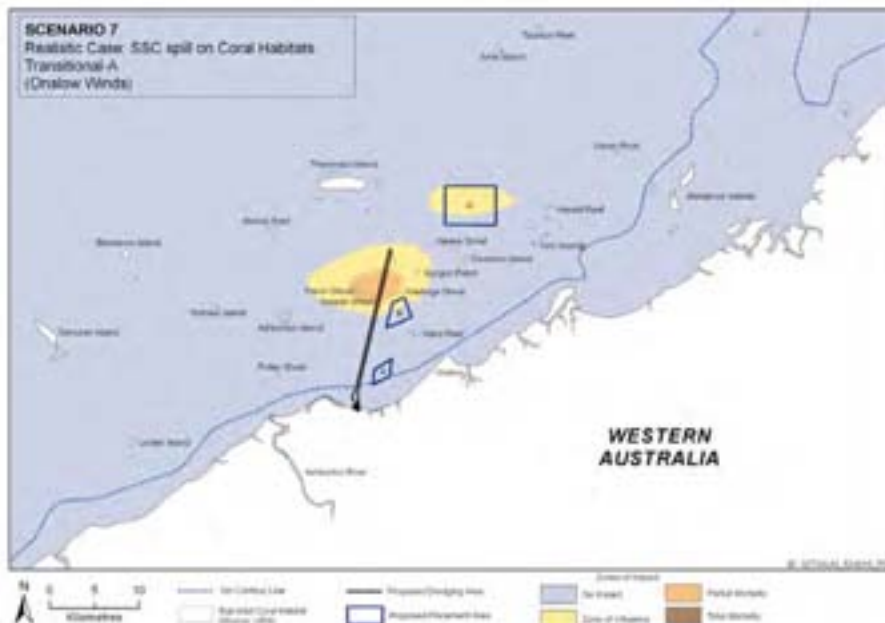


Figure B.305 Scenario 7, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

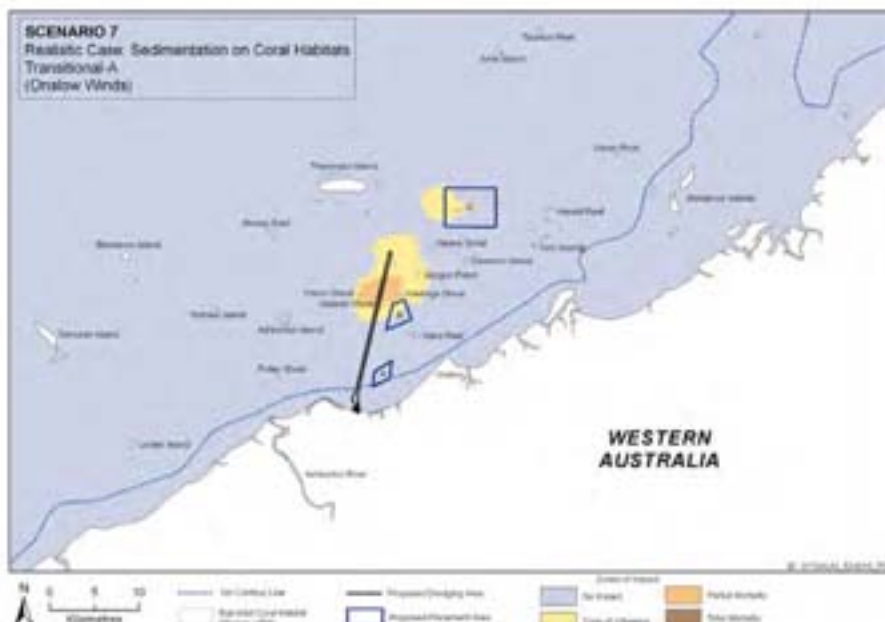


Figure B.306 Scenario 7, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-231



Figure B.307 Scenario 7, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

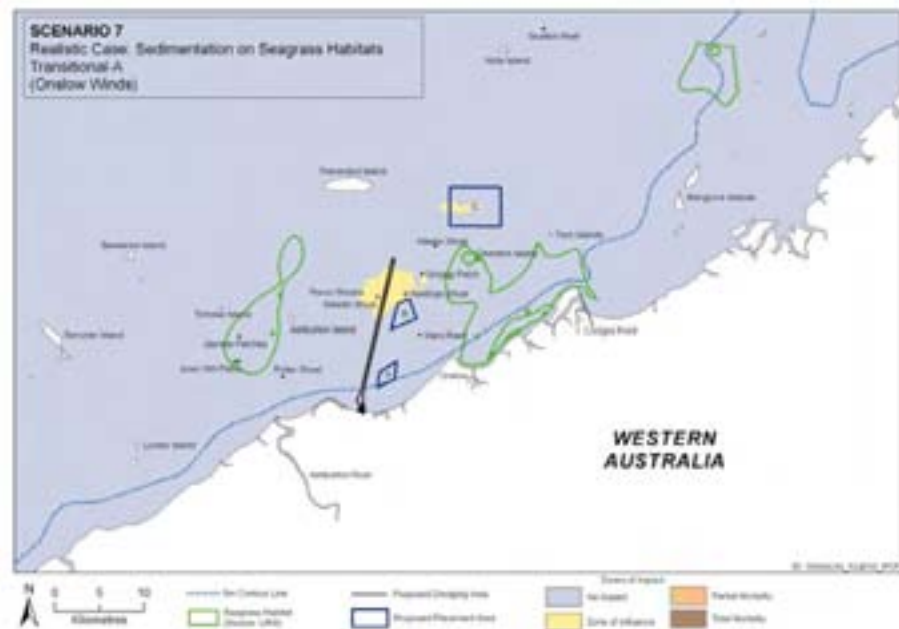


Figure B.308 Scenario 7, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-232



Table B.77 Summary of Impacts at Sensitive Receptors for Scenario 7, Transitional-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	3.4	28.8	8.3	0.1	0.2	
7	Saladin Shoal	295913	7613337	5.3	40.0	12.0	1.6	0.2	
8	End of Wheatstone Shipping Channel	298328	7617464	1.9	15.0	0.1	0.0	0.5	
9	Hastings Shoal	298803	7613488	3.2	24.4	7.7	0.4	2.0	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	2.2	16.6	4.5	0.0	0.8	
14	Gorgon Patch	300859	7615993	1.7	13.1	4.2	0.0	0.9	
15	Weeks Shoal	302245	7618926	0.7	0.4	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.3	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-233



**B.7.6 Transitional-B, Realistic Spill Scenario**

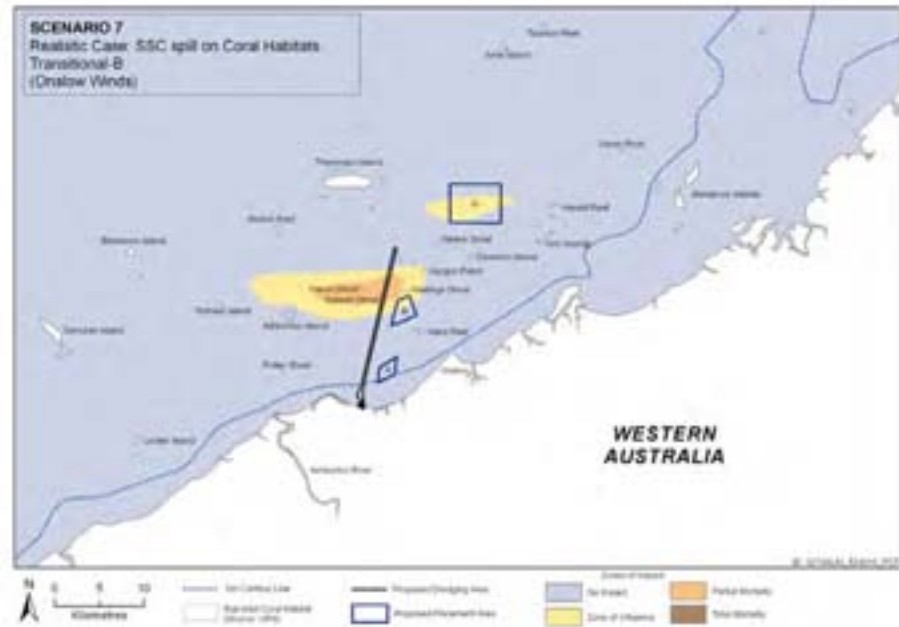


Figure B.309 Scenario 7, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

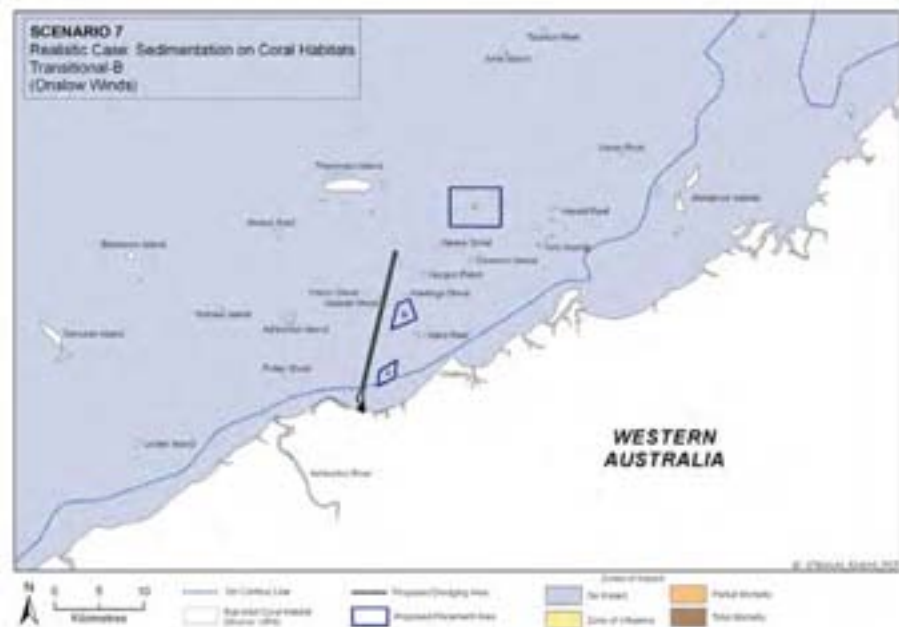


Figure B.310 Scenario 7, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

B-234

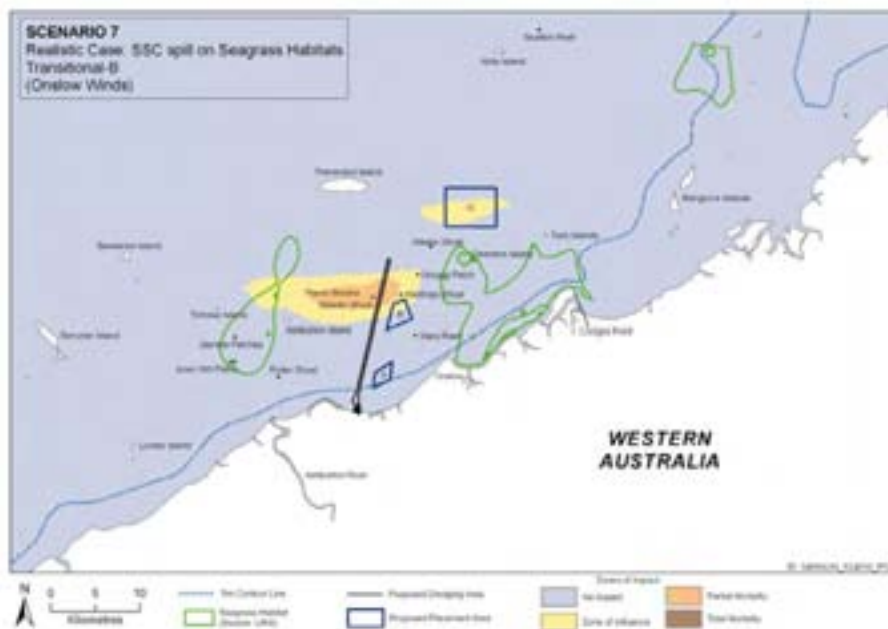


Figure B.311 Scenario 7, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

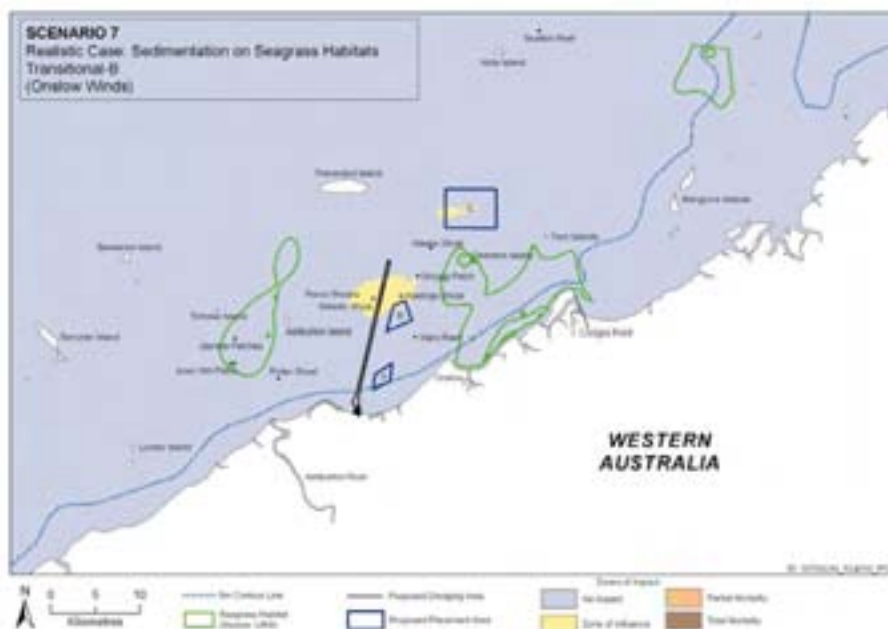


Figure B.312 Scenario 7, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-235



Table B.78 Summary of Impacts at Sensitive Receptors for Scenario 7, Transitional-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.6	0.0	0.0	0.0	0.1	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	4.1	35.7	7.6	0.3	0.0	
7	Saladin Shoal	295913	7613337	5.5	45.6	12.6	0.9	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	0.6	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	3.3	23.2	7.3	0.3	2.2	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.7	11.3	3.6	0.0	1.1	
14	Gorgon Patch	300859	7615993	0.9	4.0	1.0	0.0	0.4	
15	Weeks Shoal	302245	7618926	0.7	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.4	6.2	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.2	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-236



**B.7.7 Summer-A, Worst Case Spill Scenario**

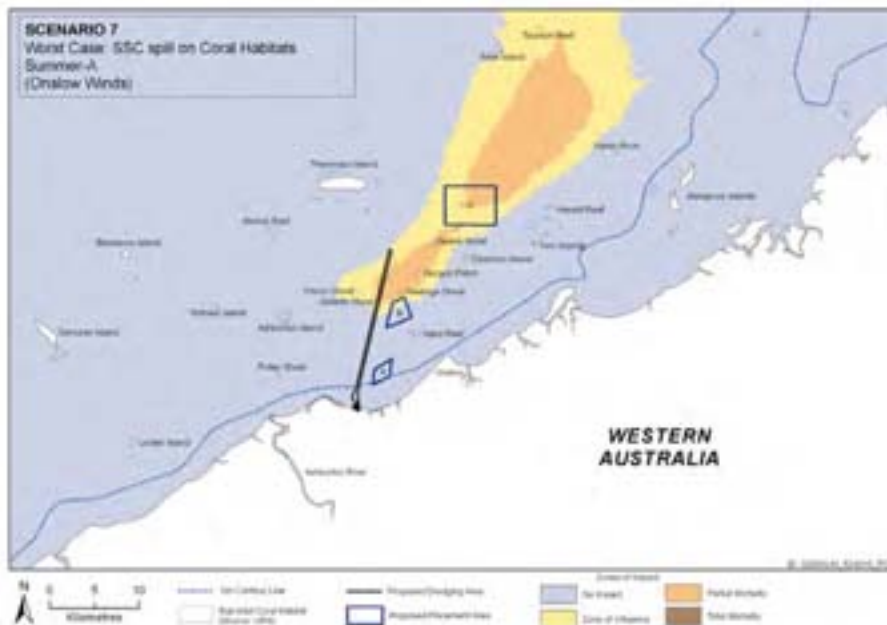


Figure B.313 Scenario 7, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

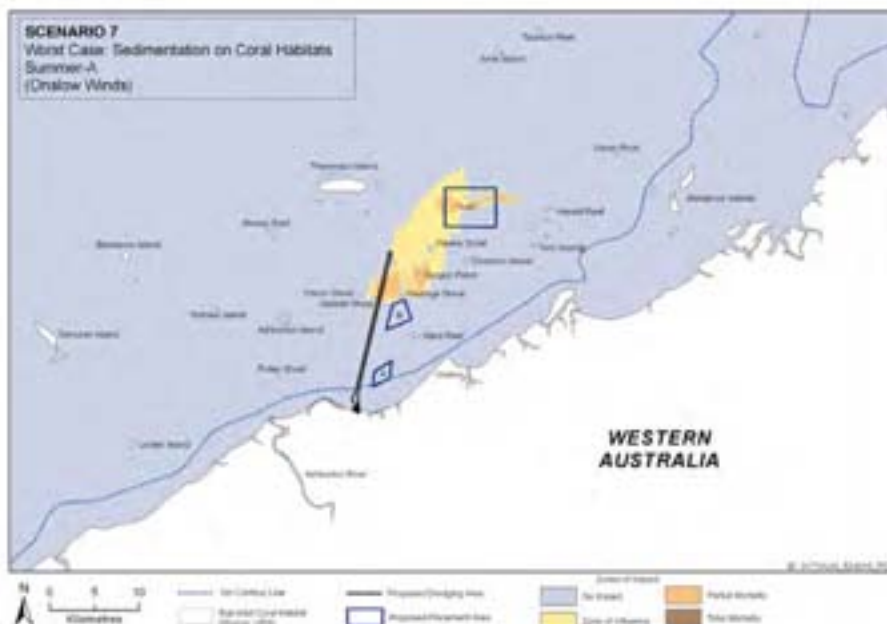


Figure B.314 Scenario 7, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



B-237

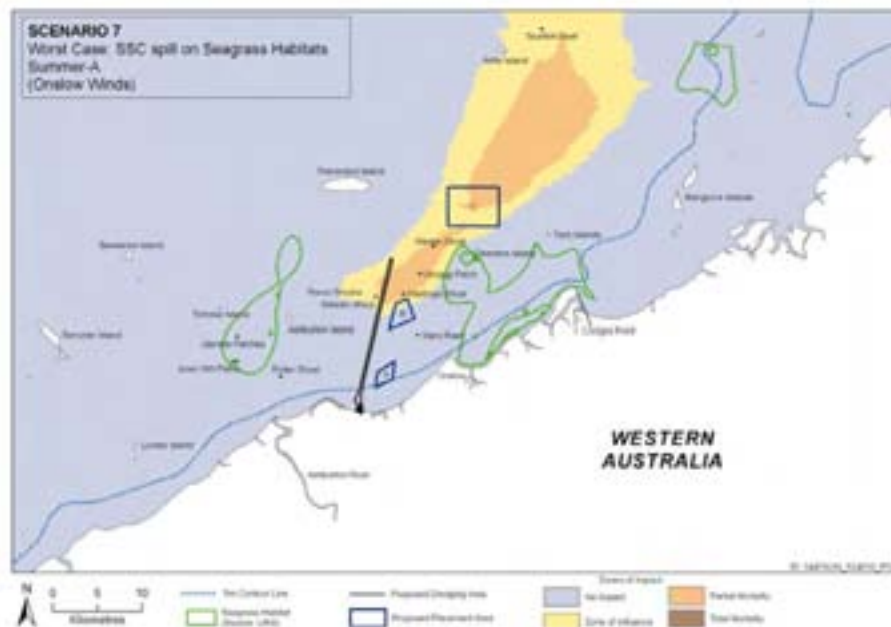


Figure B.315 Scenario 7, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

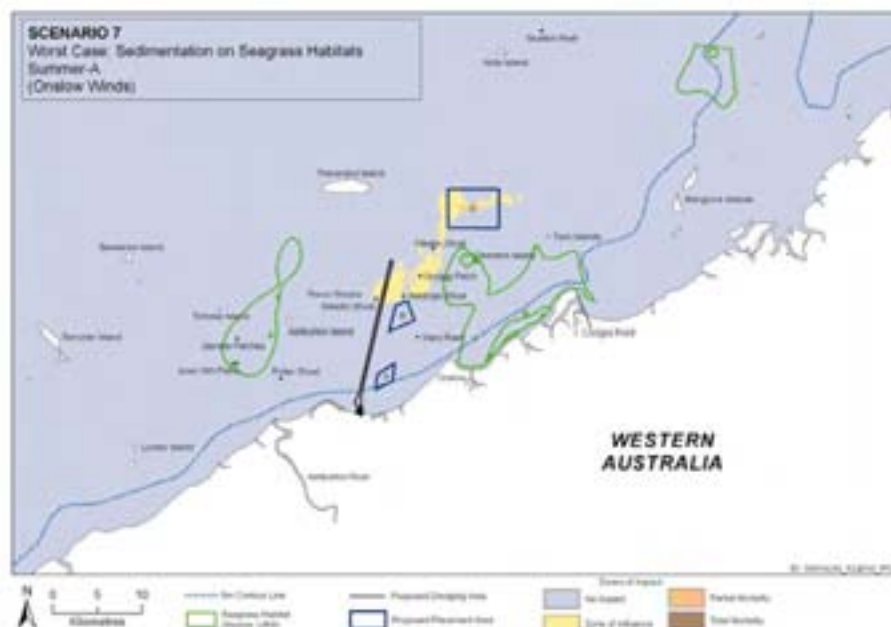


Figure B.316 Scenario 7, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

B-238



Table B.79 Summary of Impacts at Sensitive Receptors for Scenario 7, Summer-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.7	4.6	2.4	0.4	0.0	
7	Saladin Shoal	295913	7613337	2.4	12.9	7.9	1.9	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.3	15.2	3.3	0.0	0.0	
9	Hastings Shoal	298803	7613488	4.6	22.7	12.6	4.9	1.4	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	5.8	36.6	18.4	4.3	0.7	
14	Gorgon Patch	300859	7615993	6.3	44.0	19.8	3.6	1.1	
15	Weeks Shoal	302245	7618926	3.9	28.7	7.4	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.5	0.4	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	1.0	3.6	0.1	0.0	0.0	
18	Direction Island	307431	7617732	0.2	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.3	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.6	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	2.4	25.1	0.1	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-239



**B.7.8 Summer-B, Worst Case Spill Scenario**

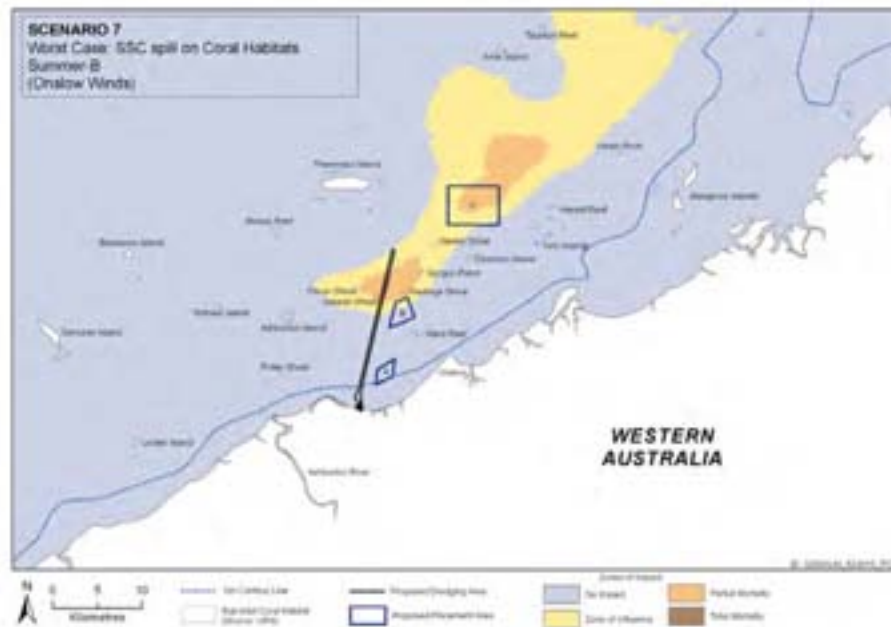


Figure B.317 Scenario 7, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

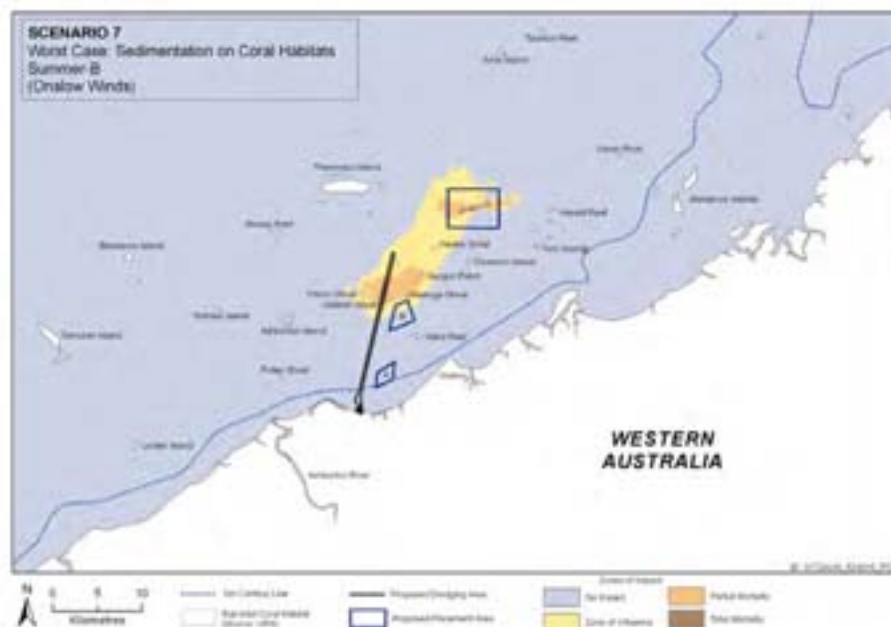


Figure B.318 Scenario 7, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

B-240

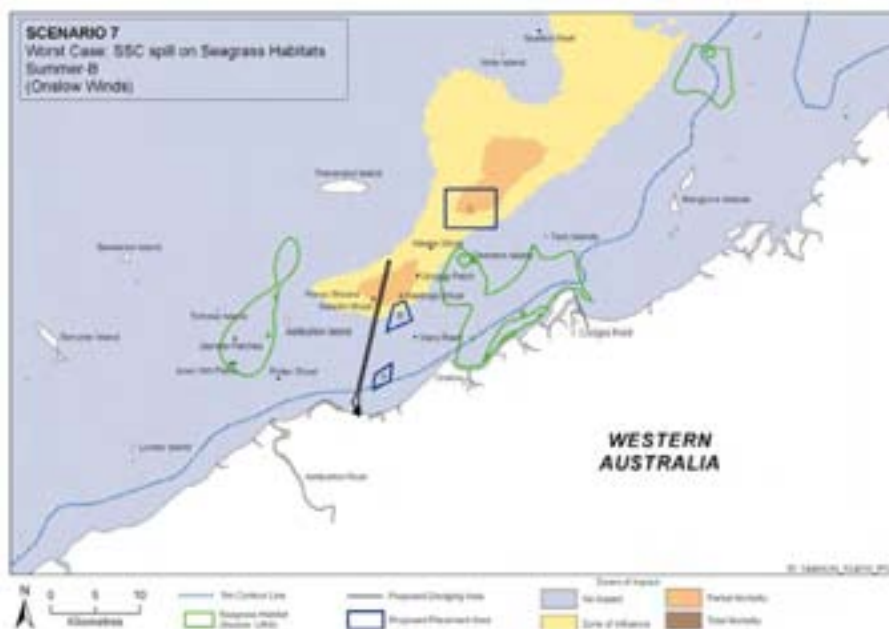


Figure B.319 Scenario 7, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

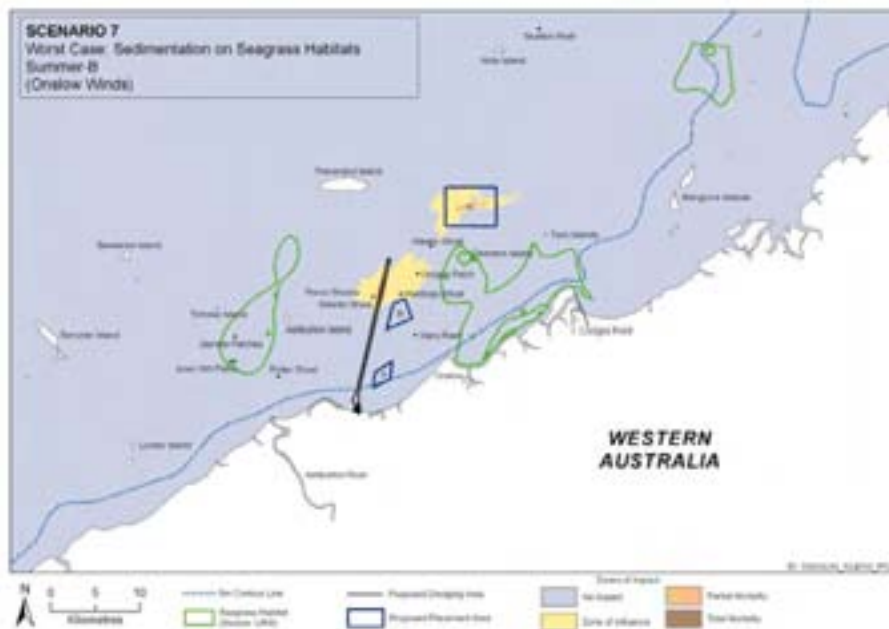


Figure B.320 Scenario 7, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

B-241



Table B.80 Summary of Impacts at Sensitive Receptors for Scenario 7, Summer-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.6	20.1	8.5	0.6	0.1	
7	Saladin Shoal	295913	7613337	4.6	29.6	15.2	2.8	0.3	
8	End of Wheatstone Shipping Channel	298328	7617464	2.1	15.0	2.1	0.0	0.5	
9	Hastings Shoal	298803	7613488	4.1	23.8	13.1	3.4	1.4	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	4.4	29.9	12.8	2.4	3.0	
14	Gorgon Patch	300859	7615993	3.6	24.7	11.1	1.2	1.8	
15	Weeks Shoal	302245	7618926	2.2	14.4	0.7	0.0	0.2	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.4	1.5	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.1	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.2	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.9	0.1	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	2.0	1.6	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.7.9 Winter-A, Worst Case Spill Scenario**

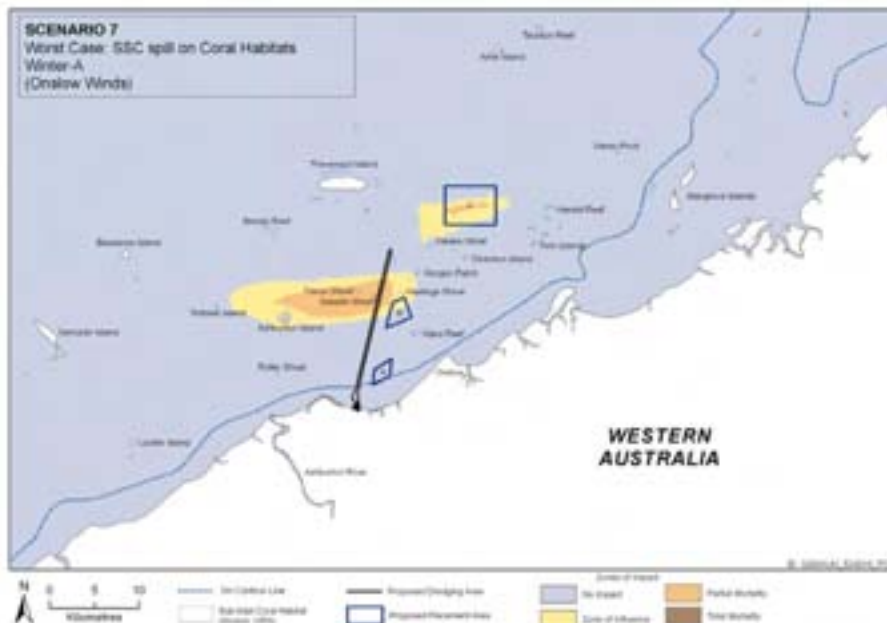


Figure B.321 Scenario 7, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

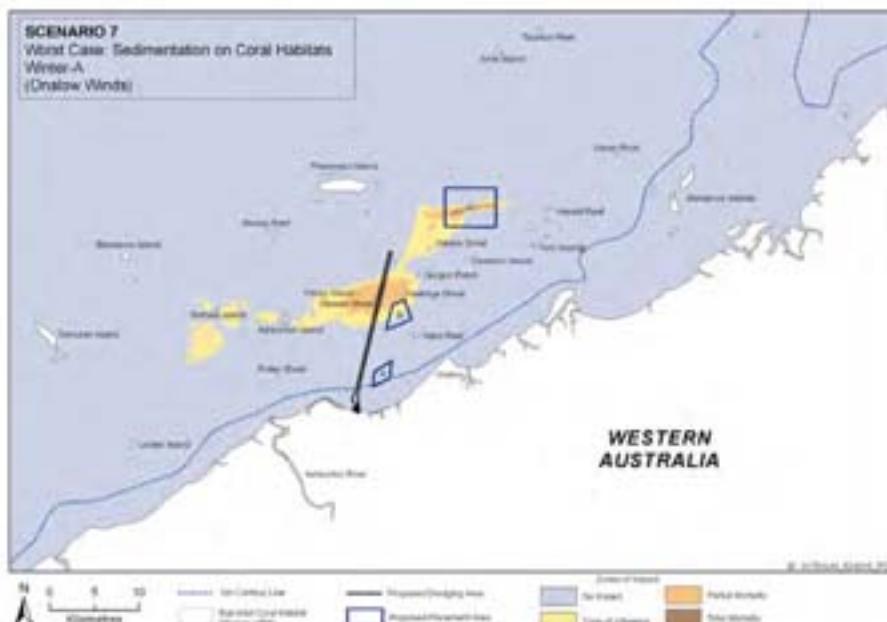


Figure B.322 Scenario 7, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-243

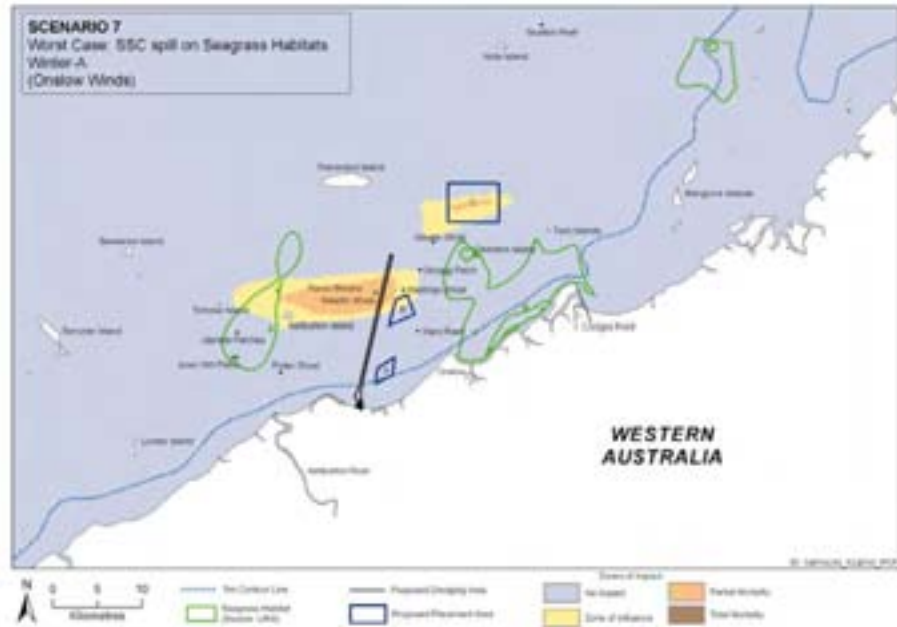


Figure B.323 Scenario 7, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

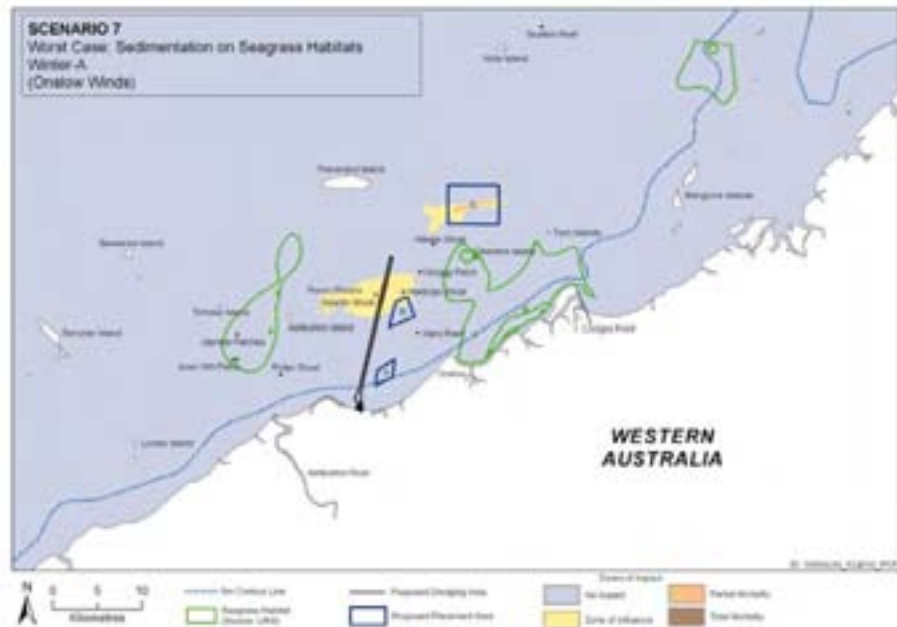


Figure B.324 Scenario 7, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-244



Table B.81 Summary of Impacts at Sensitive Receptors for Scenario 7, Winter-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.2	0.3	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	2.1	4.5	0.0	0.0	1.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	5.1	39.8	13.5	2.1	0.0	
7	Saladin Shoal	295913	7613337	7.6	53.0	22.4	4.6	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	0.8	0.0	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	2.8	18.7	8.6	1.3	2.4	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.1	6.4	2.2	0.1	1.3	
14	Gorgon Patch	300859	7615993	0.4	0.4	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	1.2	0.3	0.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.8	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.4	14.3	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



B-245



**B.7.10 Winter-B, Worst Case Spill Scenario**

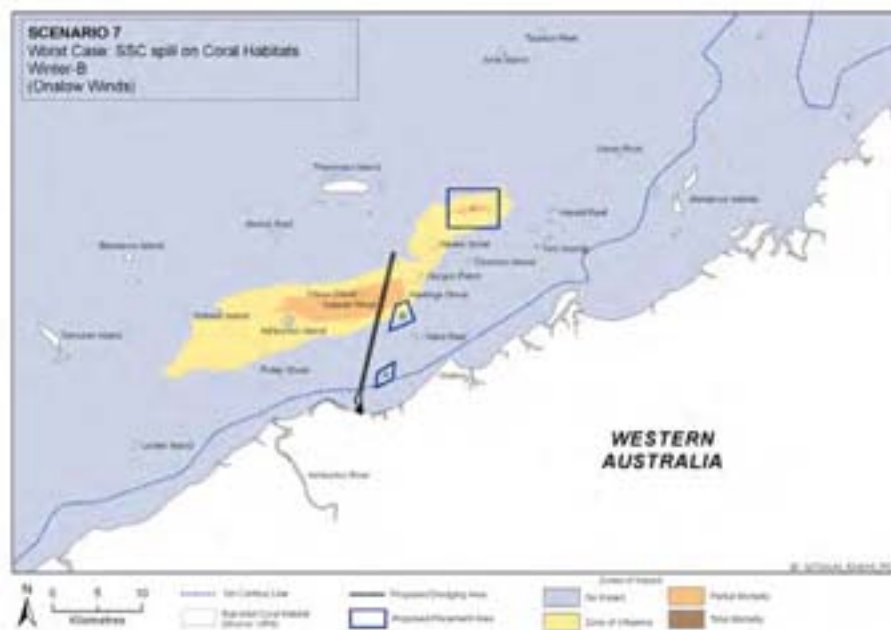


Figure B.325 Scenario 7, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

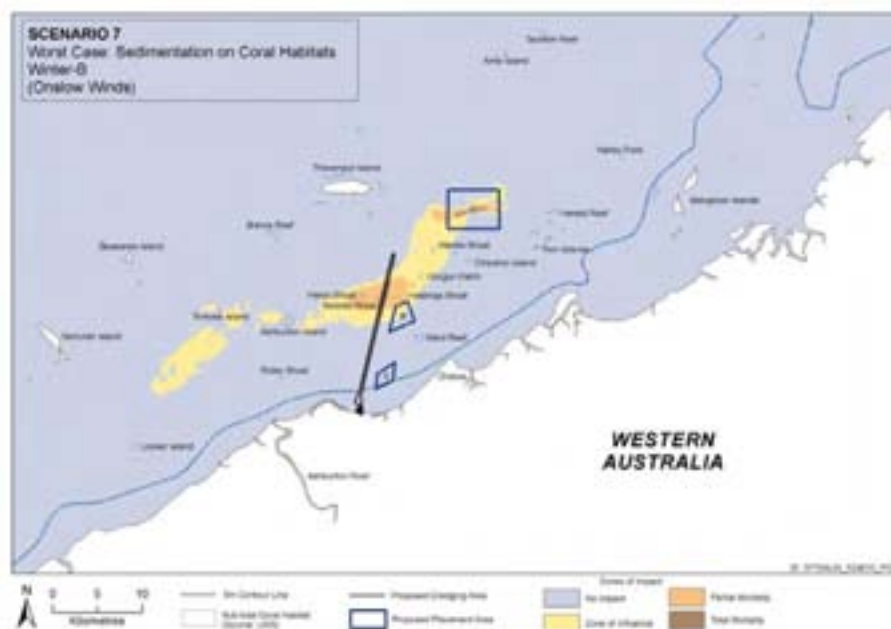


Figure B.326 Scenario 7, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-246

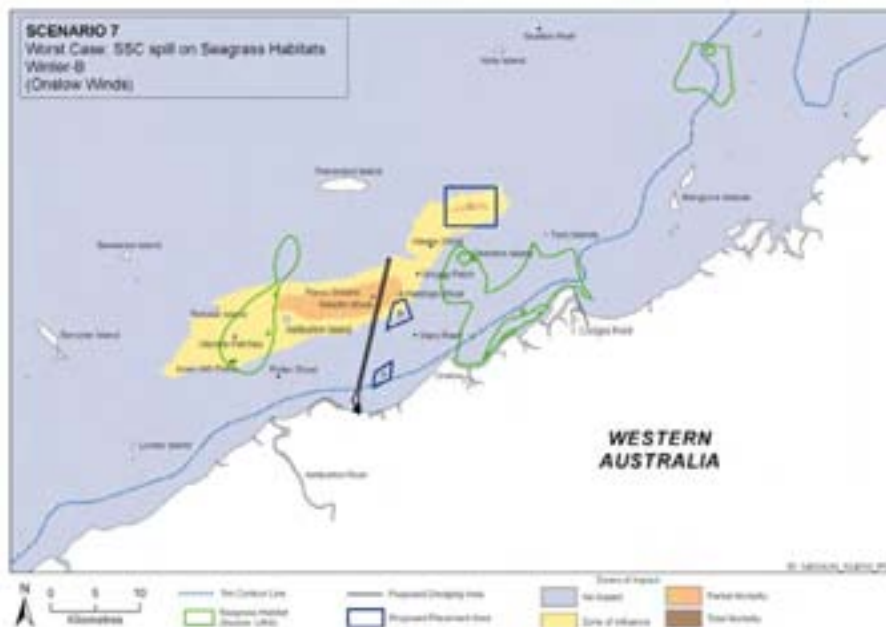


Figure B.327 Scenario 7, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

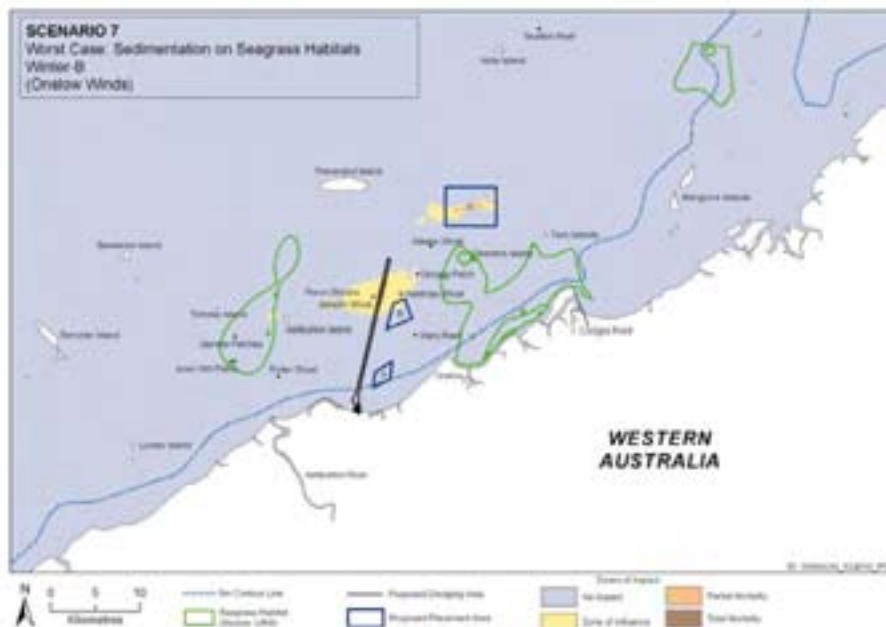


Figure B.328 Scenario 7, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-247



Table B.82 Summary of Impacts at Sensitive Receptors for Scenario 7, Winter-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.4	3.3	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.1	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	2.3	14.3	1.3	0.0	1.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	4.8	37.9	11.6	1.8	0.0	
7	Saladin Shoal	295913	7613337	6.5	44.9	18.3	4.6	0.6	
8	End of Wheatstone Shipping Channel	298328	7617464	1.1	2.8	0.0	0.0	0.2	
9	Hastings Shoal	298803	7613488	3.8	26.0	11.0	1.3	3.5	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	2.1	11.6	2.1	0.1	1.1	
14	Gorgon Patch	300859	7615993	1.8	7.9	1.8	0.0	0.7	
15	Weeks Shoal	302245	7618926	1.9	3.7	0.0	0.0	0.2	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.3	6.4	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.6	17.1	0.9	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-248



**B.7.11 Transitional-A, Worst Case Spill Scenario**

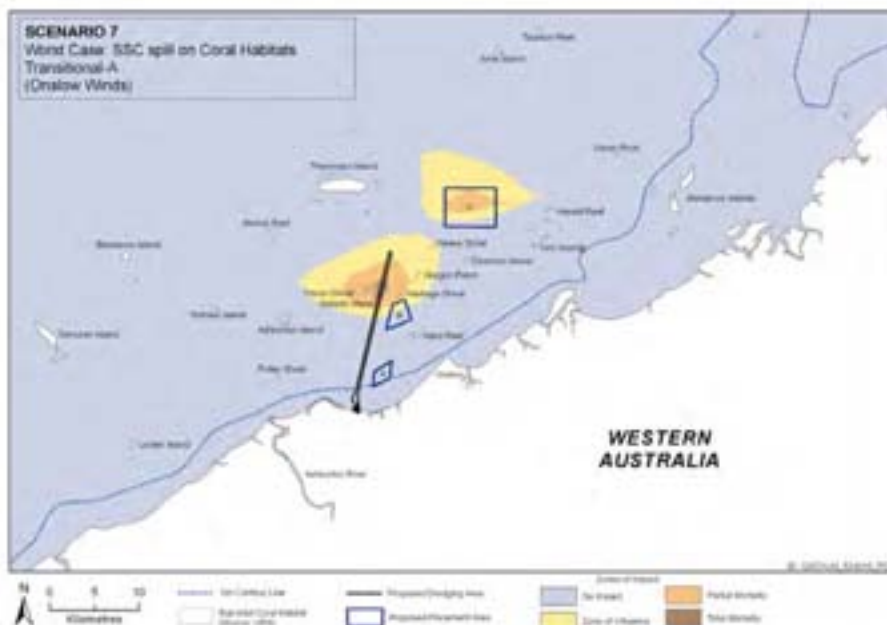


Figure B.329 Scenario 7, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

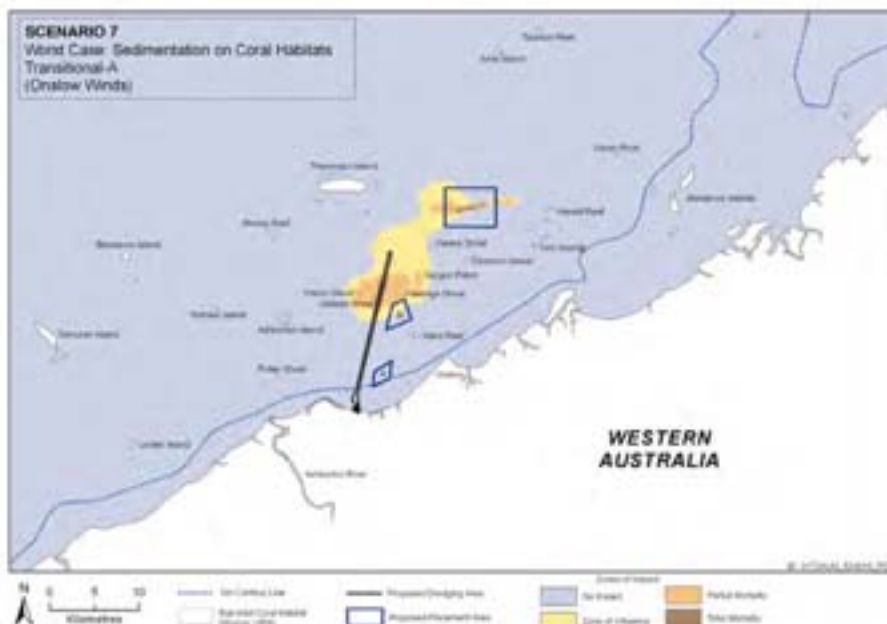


Figure B.330 Scenario 7, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-249



Figure B.331 Scenario 7, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

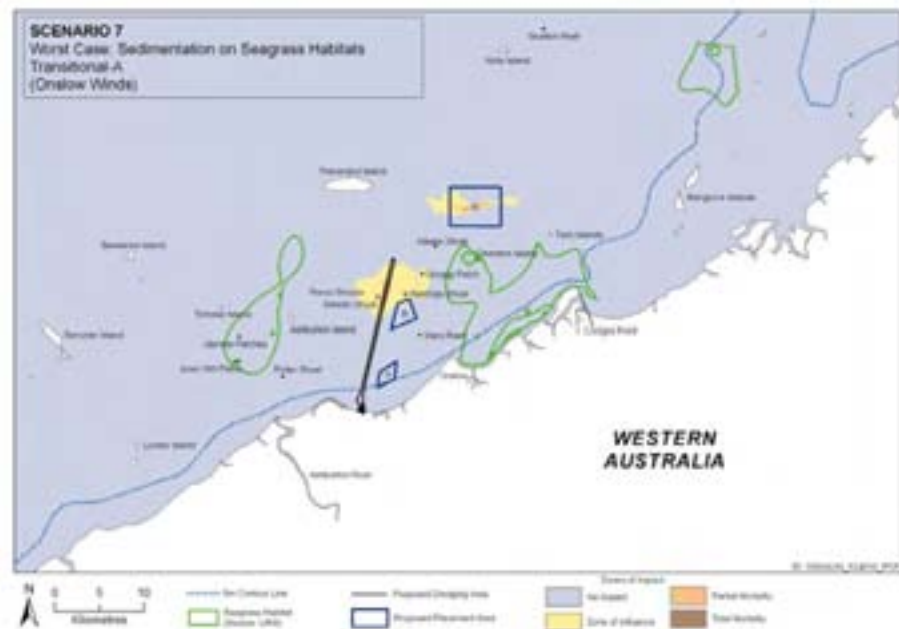


Figure B.332 Scenario 7, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

B-250



Table B.83 Summary of Impacts at Sensitive Receptors for Scenario 7, Transitional-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	4.6	34.9	16.9	1.2	0.1	
7	Saladin Shoal	295913	7613337	7.3	51.9	21.0	3.3	0.2	
8	End of Wheatstone Shipping Channel	298328	7617464	2.5	25.4	1.6	0.0	0.7	
9	Hastings Shoal	298803	7613488	4.4	29.7	14.3	2.2	3.5	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	3.1	23.0	10.4	1.0	1.3	
14	Gorgon Patch	300859	7615993	2.4	17.7	7.6	0.4	1.8	
15	Weeks Shoal	302245	7618926	1.1	5.5	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-251



**B.7.12 Transitional-B, Worst Case Spill Scenario**

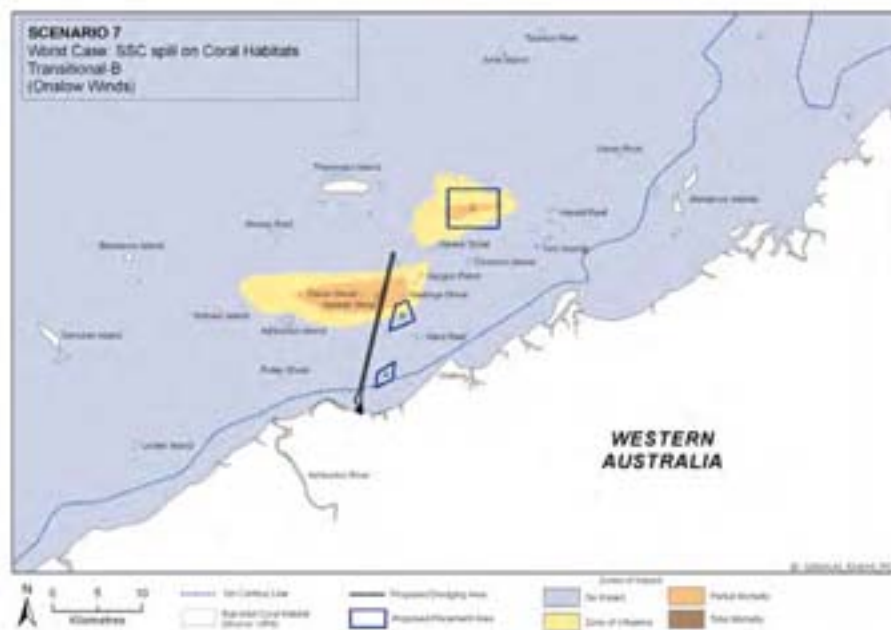


Figure B.333 Scenario 7, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

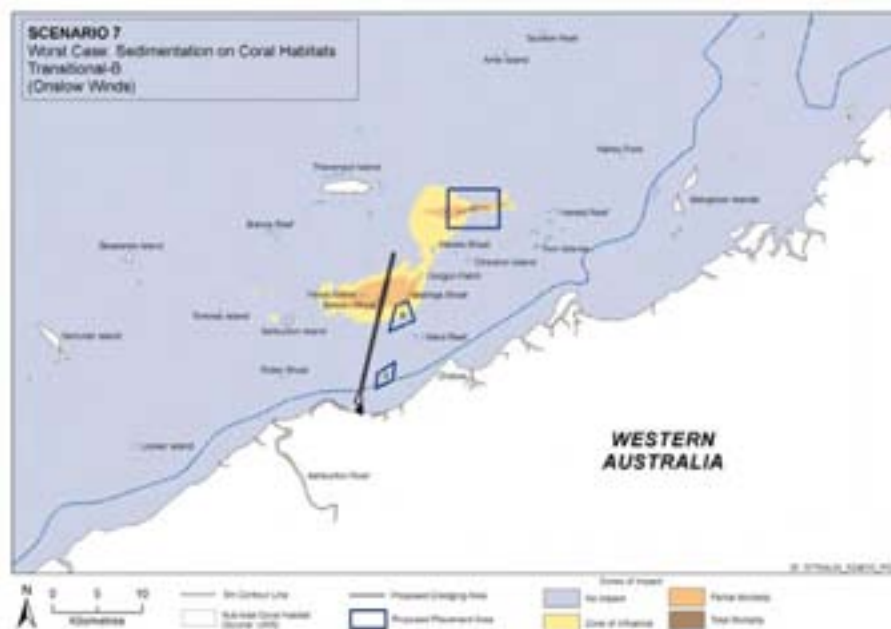


Figure B.334 Scenario 7, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

B-252

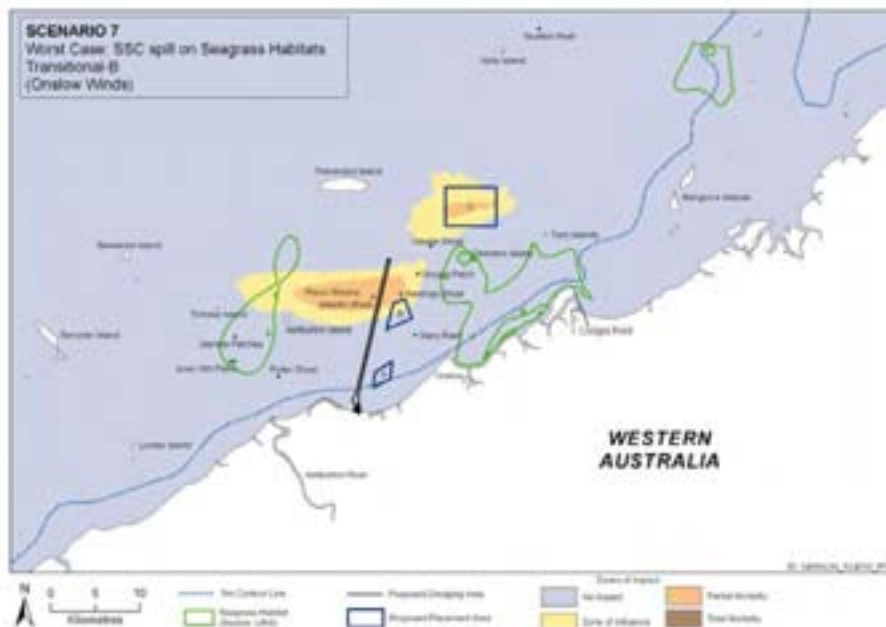


Figure B.335 Scenario 7, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

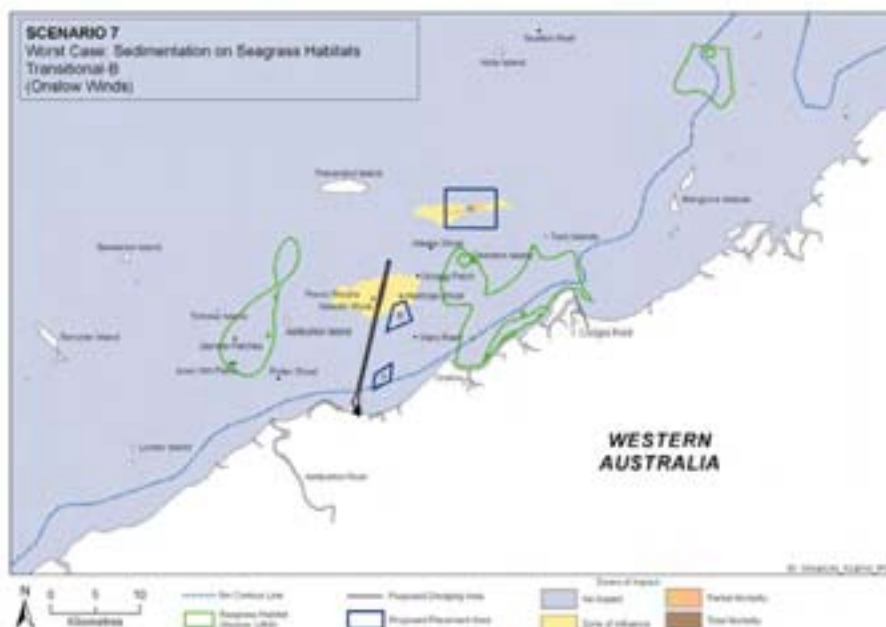


Figure B.336 Scenario 7, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds



B-253



Table B.84 Summary of Impacts at Sensitive Receptors for Scenario 7, Transitional-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.3	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.7	0.0	0.0	0.0	0.2	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	5.7	49.5	17.4	0.9	0.3	
7	Saladin Shoal	295913	7613337	7.8	62.1	25.7	3.4	0.2	
8	End of Wheatstone Shipping Channel	298328	7617464	1.0	0.7	0.0	0.0	0.0	
9	Hastings Shoal	298803	7613488	4.6	33.6	13.4	1.5	3.9	
10	North West Ward Reef	299018	7610106	0.0	0.0	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	2.4	16.2	5.8	0.6	1.8	
14	Gorgon Patch	300859	7615993	1.4	7.4	2.4	0.0	0.8	
15	Weeks Shoal	302245	7618926	1.1	1.2	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.1	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.7	8.9	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.3	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.8 Dredging Scenario 7A**

**B.8.1 Summer-A, Realistic Spill Scenario**

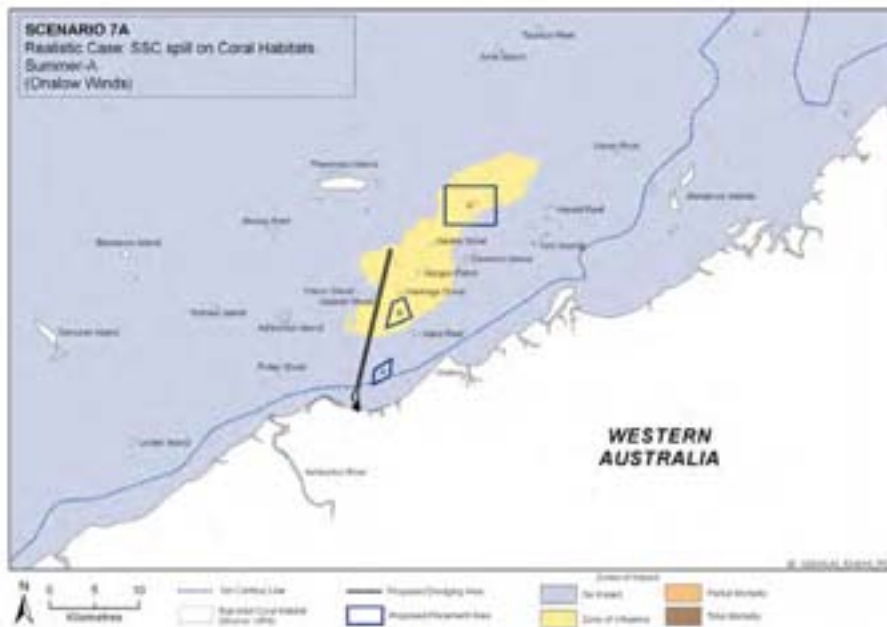


Figure B.337 Scenario 7A, Summer-A, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

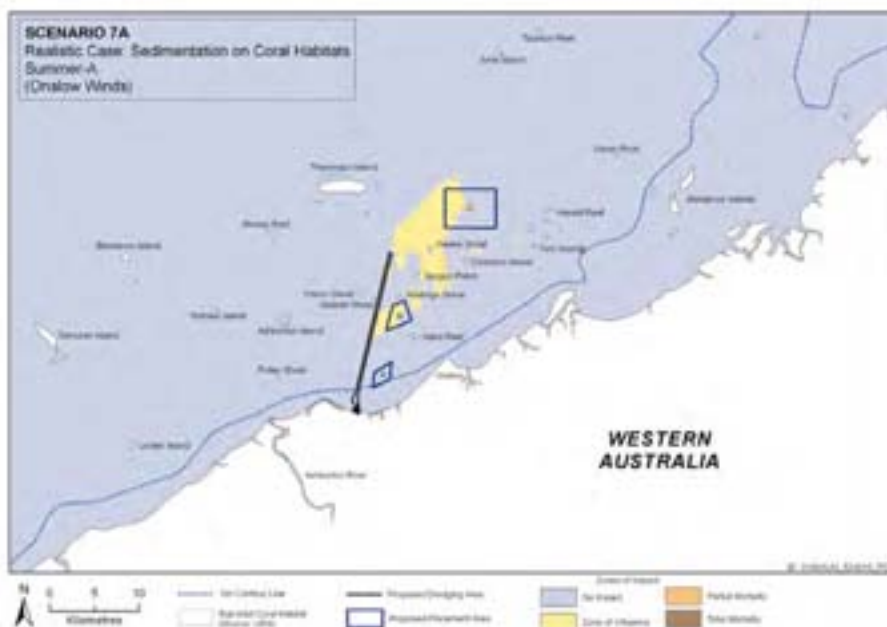


Figure B.338 Scenario 7A, Summer-A, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-255

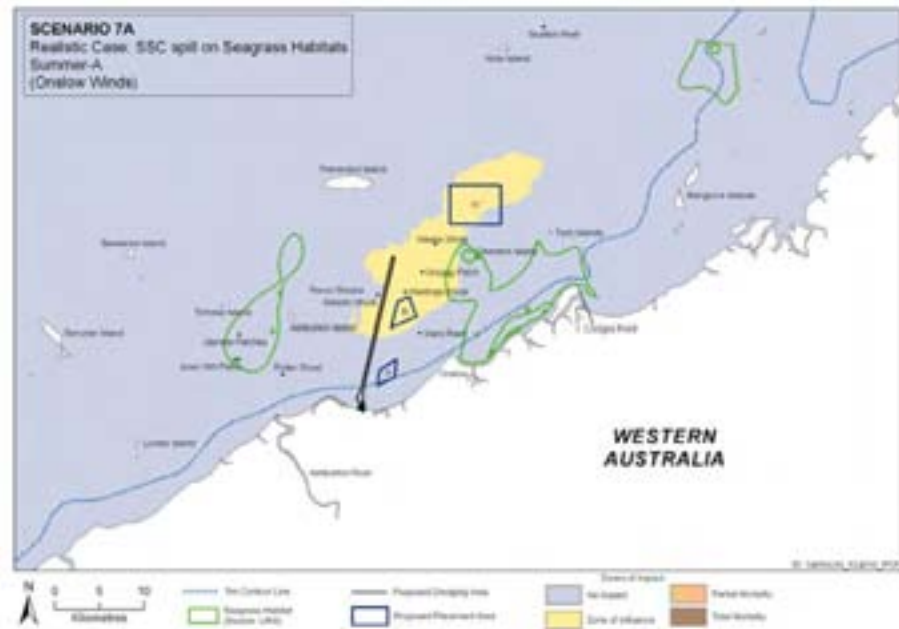


Figure B.339 Scenario 7A, Summer-A, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

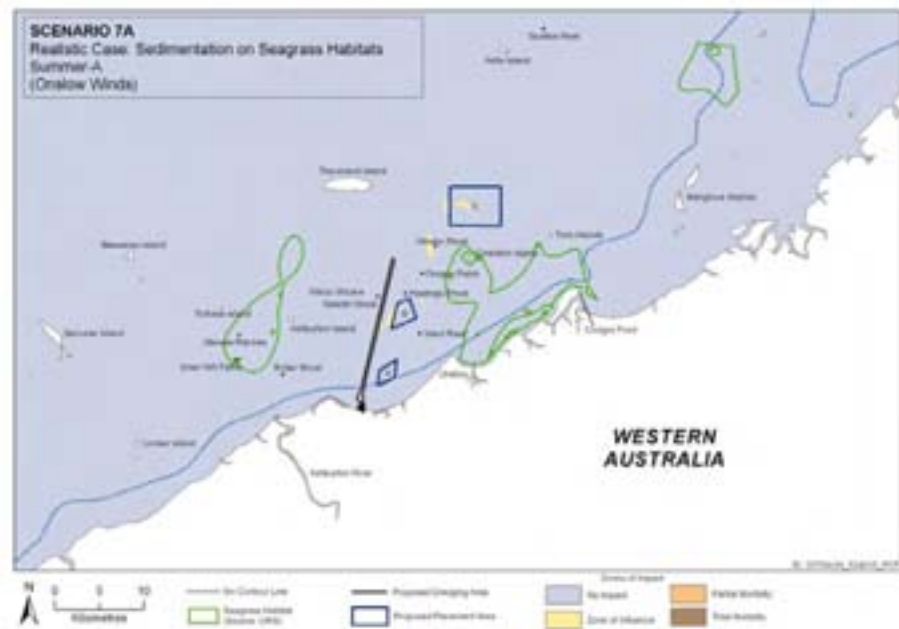


Figure B.340 Scenario 7A, Summer-A, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-256



Table B.85 Summary of Impacts at Sensitive Receptors for Scenario 7A, Summer-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.0	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.5	1.0	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.4	13.8	7.0	1.0	0.0	
9	Hastings Shoal	298803	7613488	2.0	8.6	0.4	0.0	0.0	
10	North West Ward Reef	299018	7610106	1.0	5.9	1.8	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.9	6.7	0.1	0.0	0.0	
14	Gorgon Patch	300859	7615993	2.0	9.5	0.4	0.0	0.0	
15	Weeks Shoal	302245	7618926	2.6	15.9	2.4	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	1.6	6.1	0.0	0.0	0.3	
17	NW of Direction Island	304867	7618549	1.4	2.5	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.8	0.0	0.0	0.0	0.3	
19	NE Tw in Island	314029	7620738	0.4	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.6	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.2	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.7	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.4	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.2	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.4	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.2	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.2	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.3	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-257



**B.8.2 Summer-B, Realistic Spill Scenario**

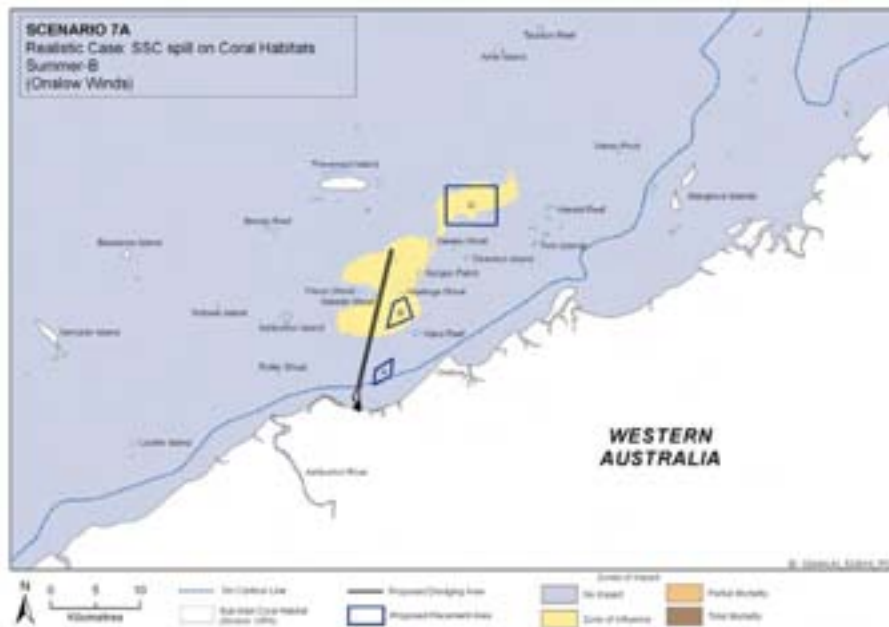


Figure B.341 Scenario 7A, Summer-B, Realistic: SSC Zones of Impact for Corals during Summer Conditions with Realistic Spill based on Onslow winds

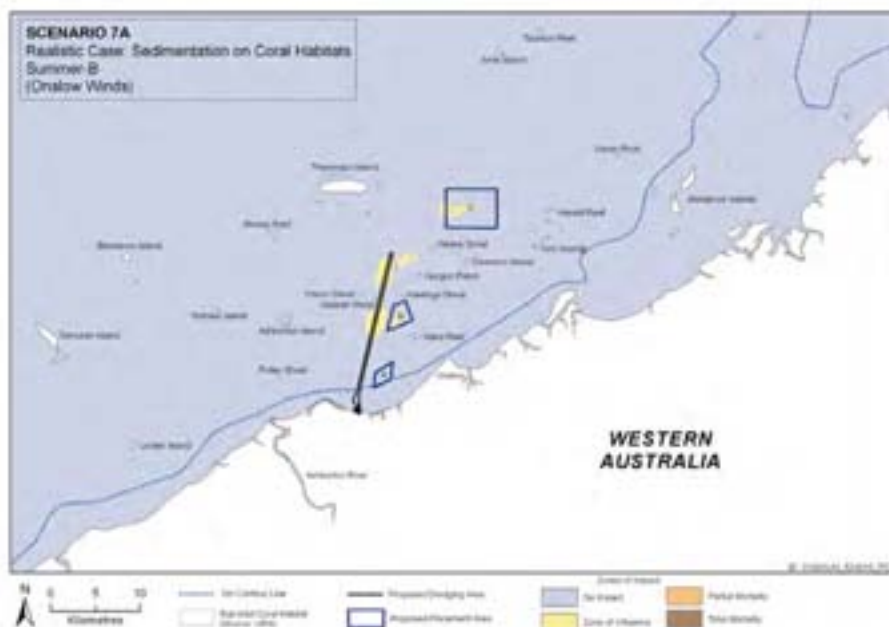


Figure B.342 Scenario 7A, Summer-B, Realistic: Sedimentation Zones of Impact for Corals, during Summer Conditions with Realistic Spill based on Onslow winds

B-258

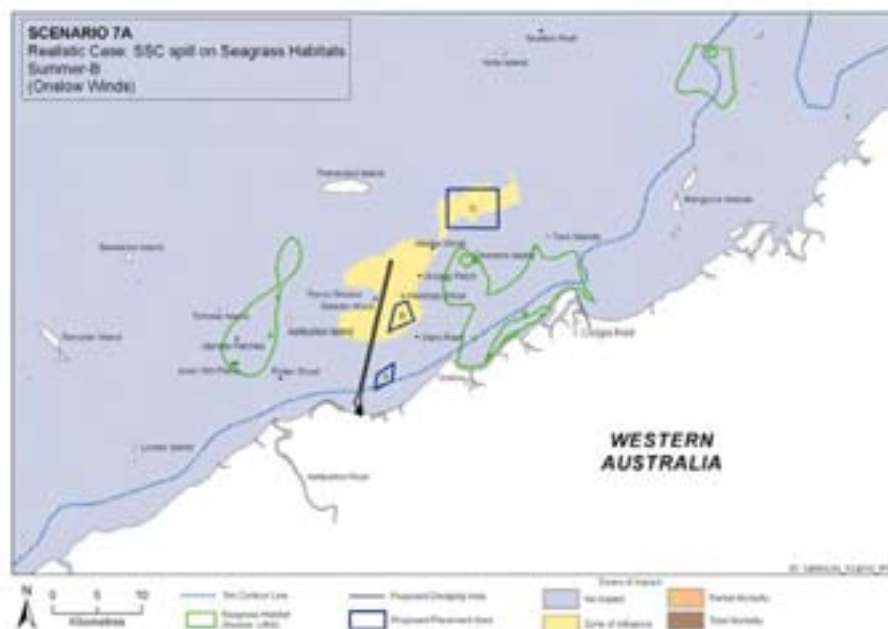


Figure B.343 Scenario 7A, Summer-B, Realistic: SSC Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

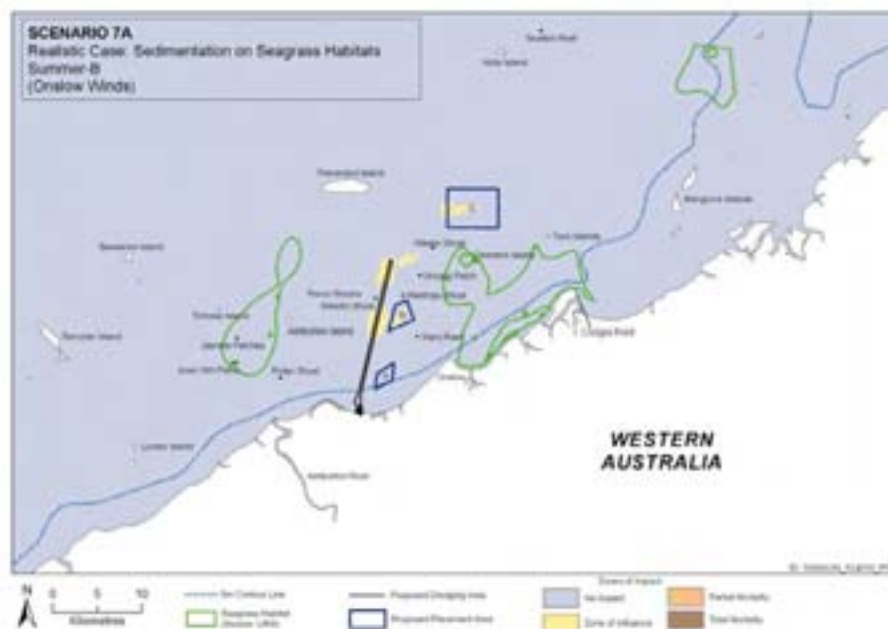


Figure B.344 Scenario 7A, Summer-B, Realistic: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Realistic Spill based on Onslow winds

B-259



Table B.86 Summary of Impacts at Sensitive Receptors for Scenario 7A, Summer-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.5	0.9	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.9	1.2	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.5	13.1	3.6	1.0	0.5	
9	Hastings Shoal	298803	7613488	1.3	3.1	0.0	0.0	0.3	
10	North West Ward Reef	299018	7610106	0.6	3.7	0.9	0.0	0.1	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.4	3.9	0.3	0.0	0.5	
14	Gorgon Patch	300859	7615993	1.4	5.6	1.0	0.0	0.4	
15	Weeks Shoal	302245	7618926	1.1	2.5	0.4	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.6	1.6	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.7	0.3	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.4	0.0	0.0	0.0	0.1	
19	NE Twin Island	314029	7620738	0.1	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.3	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.5	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.5	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	1.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.1	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-260



**B.8.3 Winter-A, Realistic Spill Scenario**

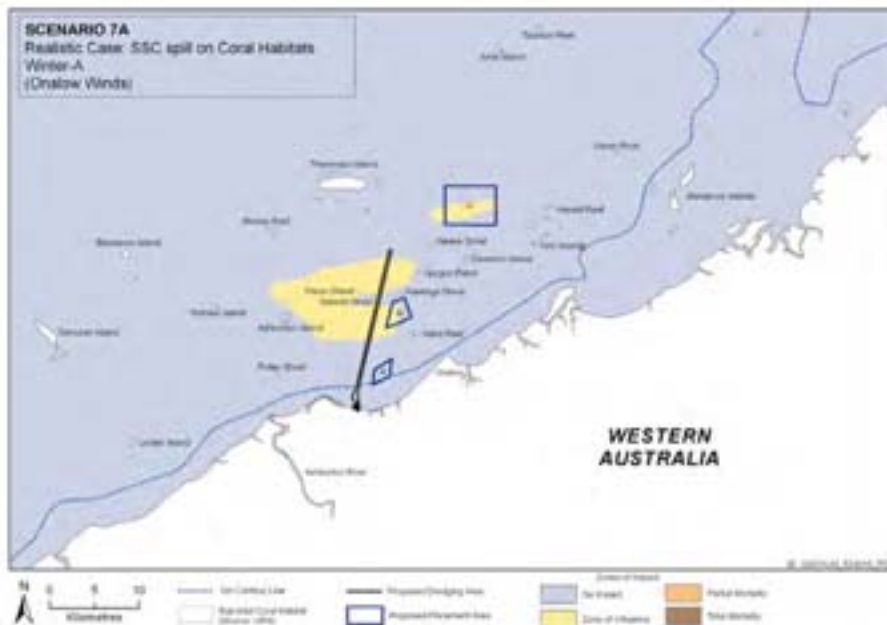


Figure B.345 Scenario 7A, Winter-A, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

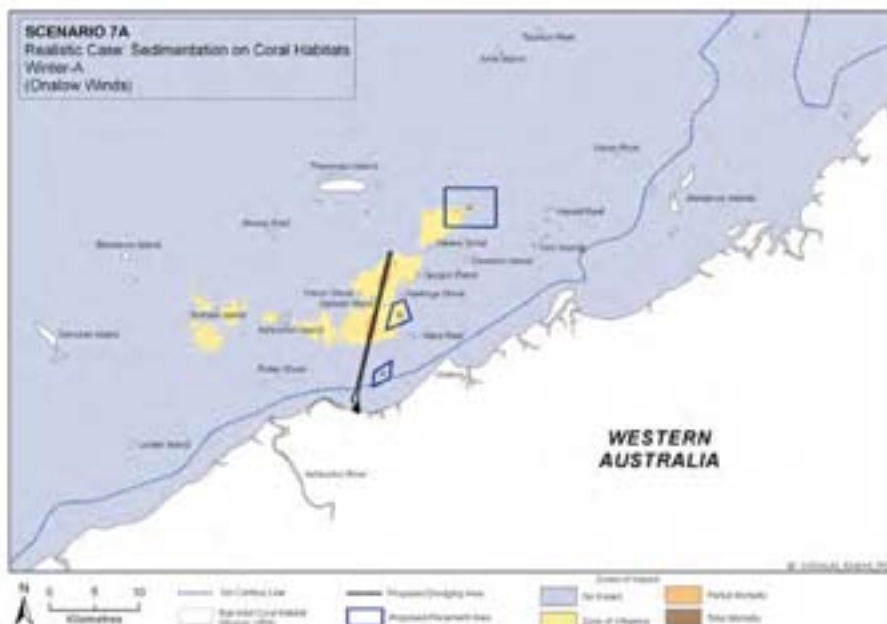


Figure B.346 Scenario 7A, Winter-A, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10



B-261

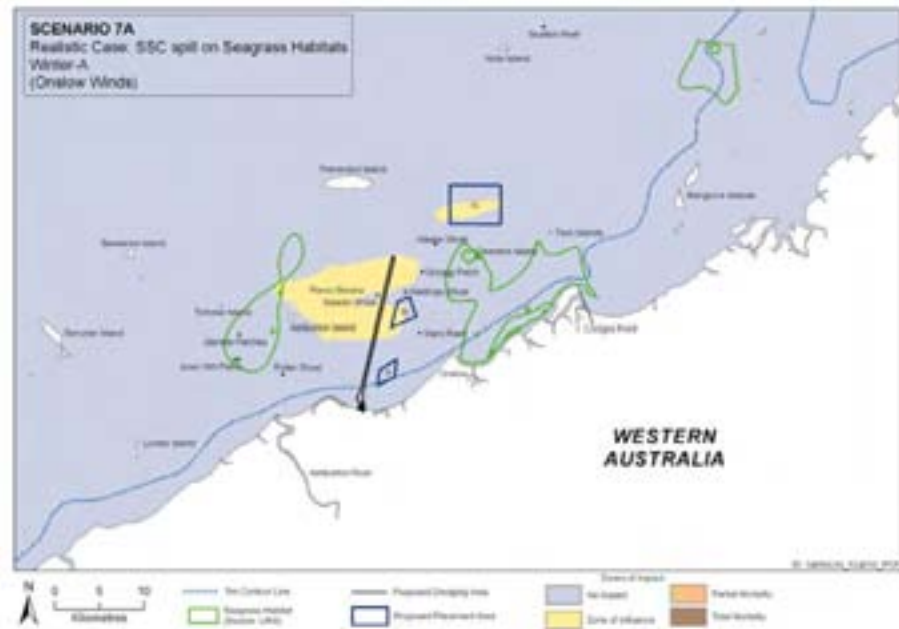


Figure B.347 Scenario 7A, Winter-A, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

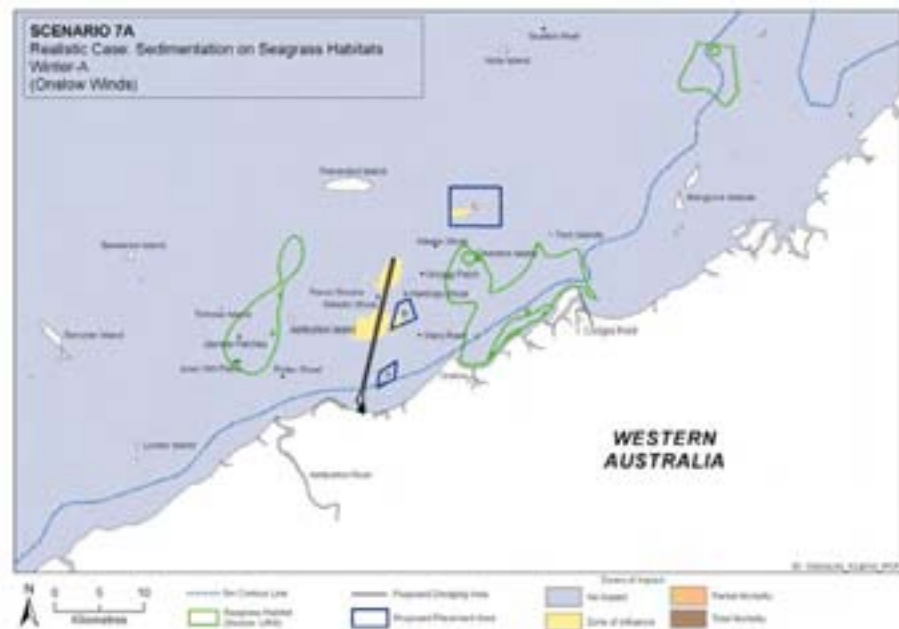


Figure B.348 Scenario 7A, Winter-A, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

B-262



Table B.87 Summary of Impacts at Sensitive Receptors for Scenario 7A, Winter-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.0	0.6	0.0	0.0	0.6	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.7	14.3	1.5	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.3	2.1	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	1.3	6.5	2.1	0.0	0.8	
9	Hastings Shoal	298803	7613488	0.4	0.0	0.0	0.0	0.2	
10	North West Ward Reef	299018	7610106	0.1	0.3	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.5	3.0	0.1	0.0	0.3	
14	Gorgon Patch	300859	7615993	0.4	1.6	0.0	0.0	0.2	
15	Weeks Shoal	302245	7618926	0.5	0.0	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.9	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.0	0.6	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-263



**B.8.4 Winter-B, Realistic Spill Scenario**

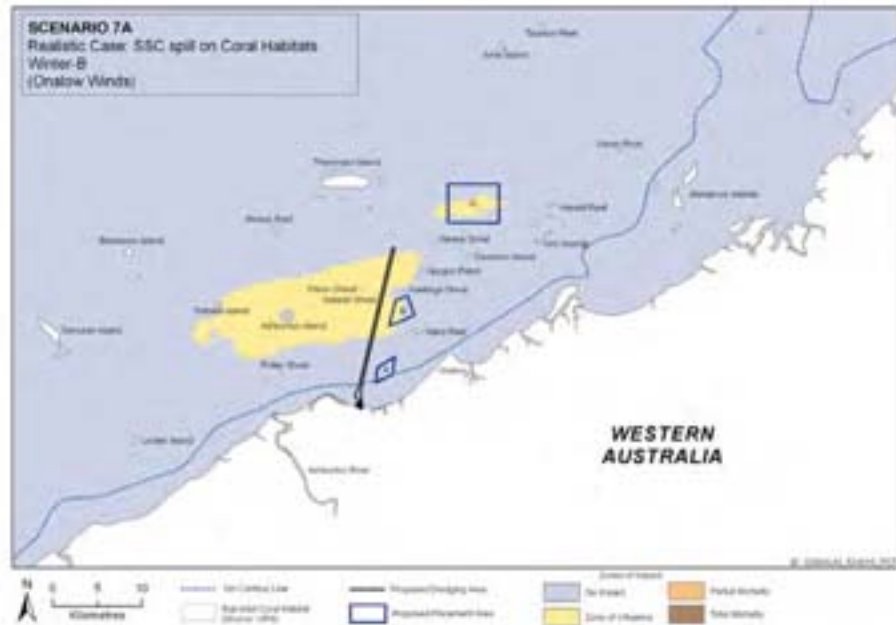


Figure B.349 Scenario 7A, Winter-B, Realistic: SSC Zones of Impact for Corals during Winter Conditions with Realistic Spill based on Onslow winds

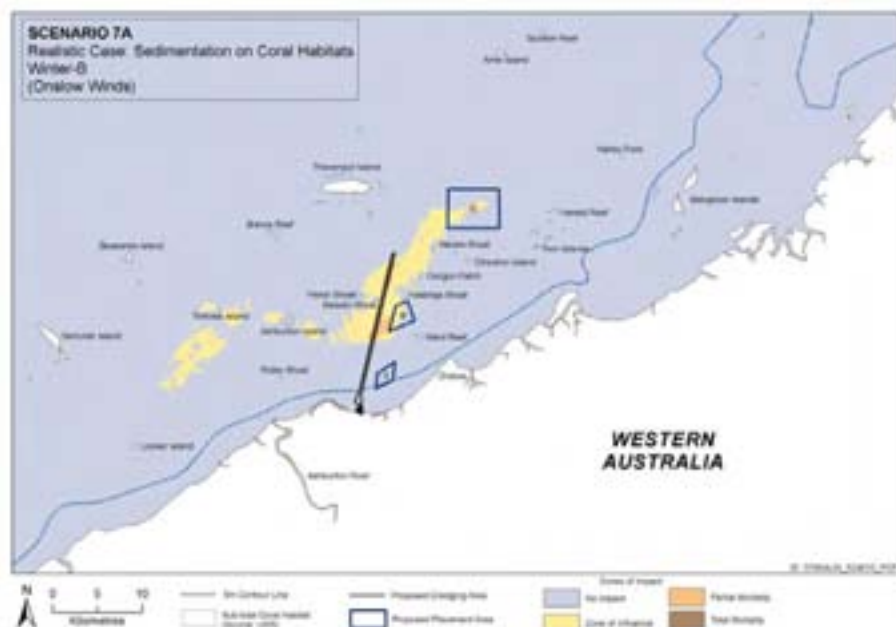


Figure B.350 Scenario 7A, Winter-B, Realistic: Sedimentation Zones of Impact for Corals, during Winter Conditions with Realistic Spill based on Onslow winds

B-264

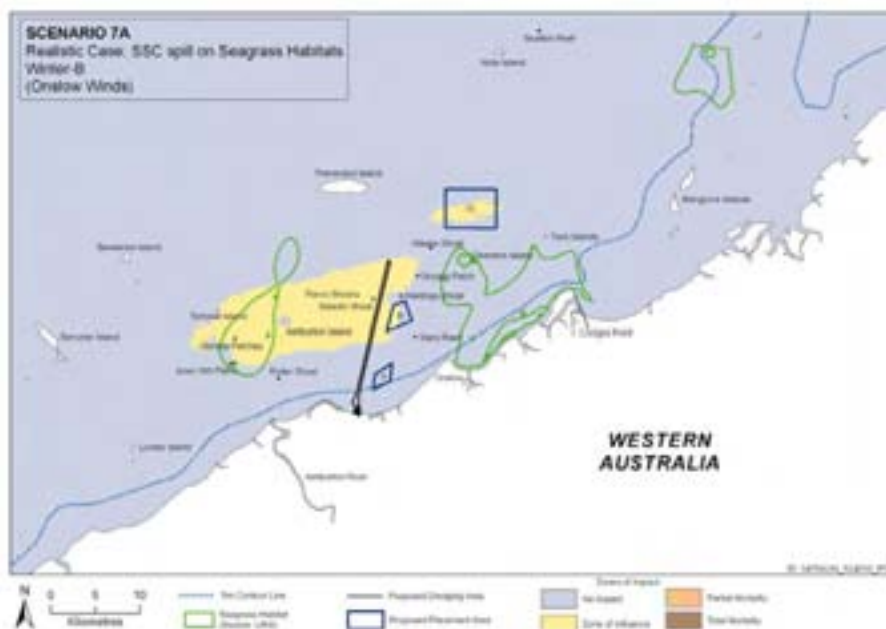


Figure B.351 Scenario 7A, Winter-B, Realistic: SSC Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

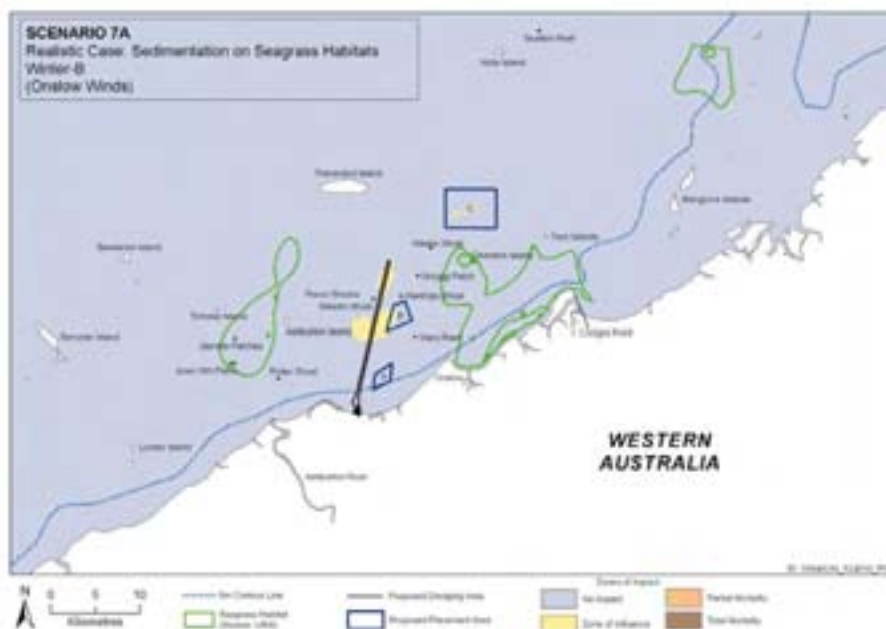


Figure B.352 Scenario 7A, Winter-B, Realistic: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Realistic Spill based on Onslow winds

B-265



Table B.88 Summary of Impacts at Sensitive Receptors for Scenario 7A, Winter-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.2	2.4	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.2	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.4	4.6	0.0	0.0	0.7	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.3	13.4	1.5	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.6	3.7	0.1	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	1.7	6.7	3.1	0.0	0.3	
9	Hastings Shoal	298803	7613488	1.0	0.6	0.0	0.0	0.3	
10	North West Ward Reef	299018	7610106	0.2	0.1	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.8	2.7	0.1	0.0	0.2	
14	Gorgon Patch	300859	7615993	0.7	1.5	0.0	0.0	0.1	
15	Weeks Shoal	302245	7618926	0.9	0.0	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.4	4.8	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.1	10.3	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-266



**B.8.5 Transitional-A, Realistic Spill Scenario**



Figure B.353 Scenario 7A, Transitional-A, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

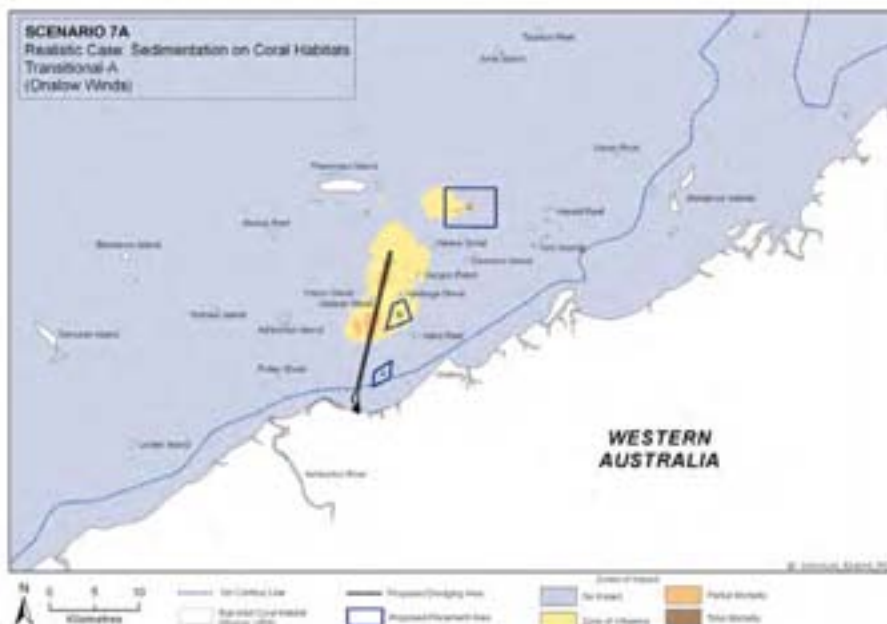


Figure B.354 Scenario 7A, Transitional-A, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

B-267

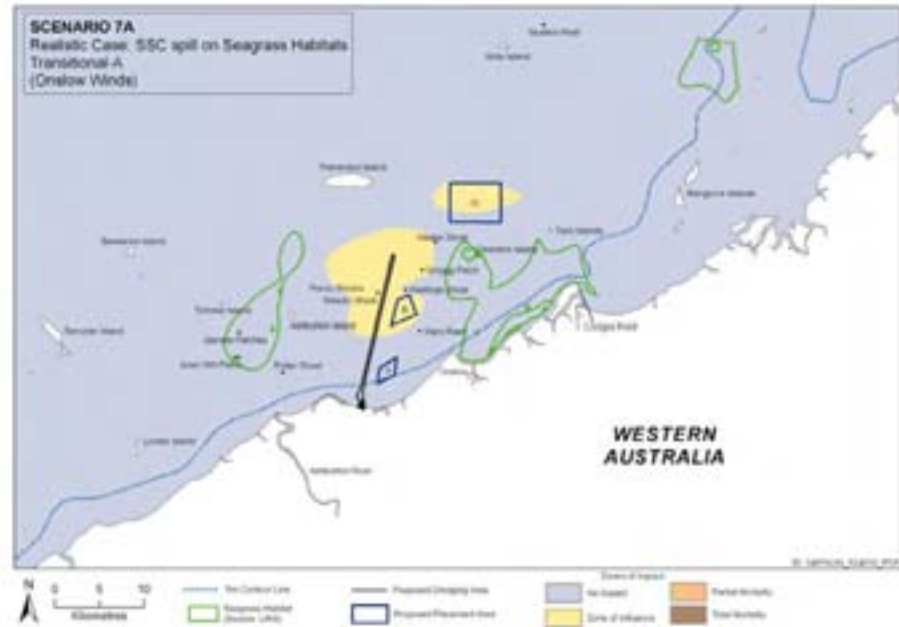


Figure B.355 Scenario 7A, Transitional-A, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

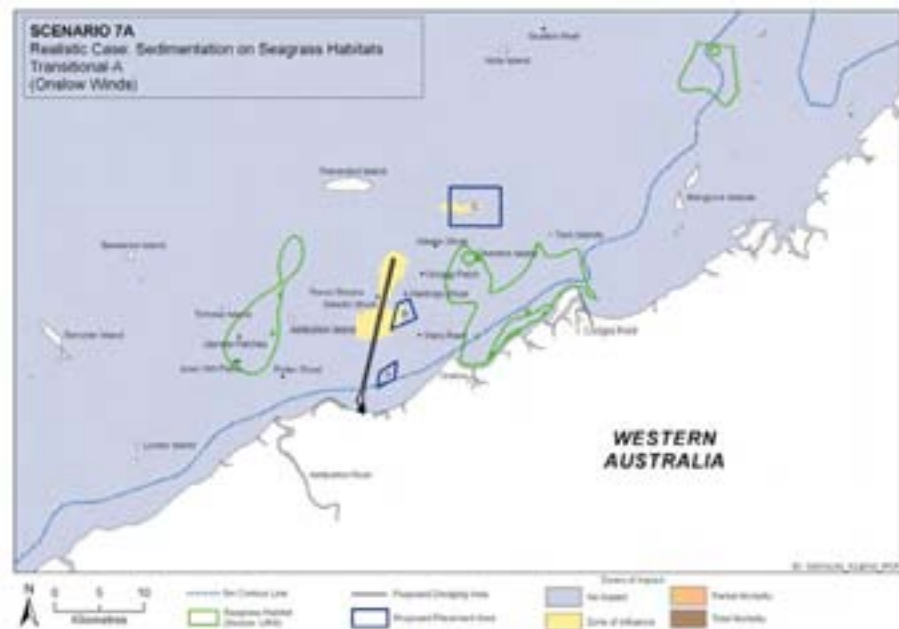


Figure B.356 Scenario 7A, Transitional-A, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-268



Table B.89 Summary of Impacts at Sensitive Receptors for Scenario 7A, Transitional-A, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.3	6.1	0.1	0.0	0.1	
7	Saladin Shoal	295913	7613337	1.9	7.7	0.0	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	2.9	19.2	6.4	0.4	1.2	
9	Hastings Shoal	298803	7613488	1.3	2.8	0.0	0.0	0.5	
10	North West Ward Reef	299018	7610106	0.6	4.2	0.7	0.0	0.0	
11	Ward Reef	300410	7608668	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.2	4.0	0.9	0.0	0.4	
14	Gorgon Patch	300859	7615993	1.1	4.3	0.9	0.0	0.3	
15	Weeks Shoal	302245	7618926	0.7	2.5	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



B-269



**B.8.6 Transitional-B, Realistic Spill Scenario**

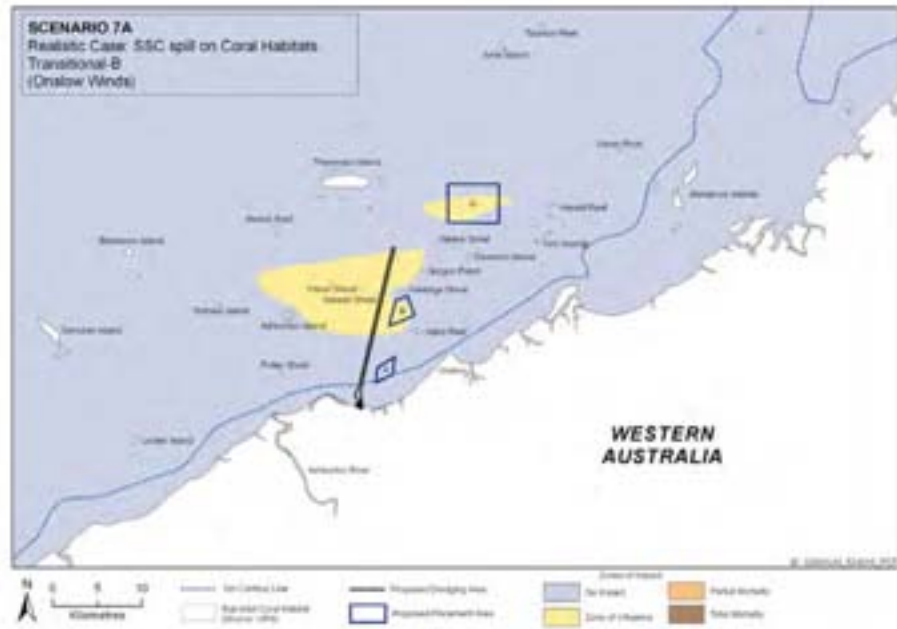


Figure B.357 Scenario 7A, Transitional-B, Realistic: SSC Zones of Impact for Corals during Transitional Conditions with Realistic Spill based on Onslow winds

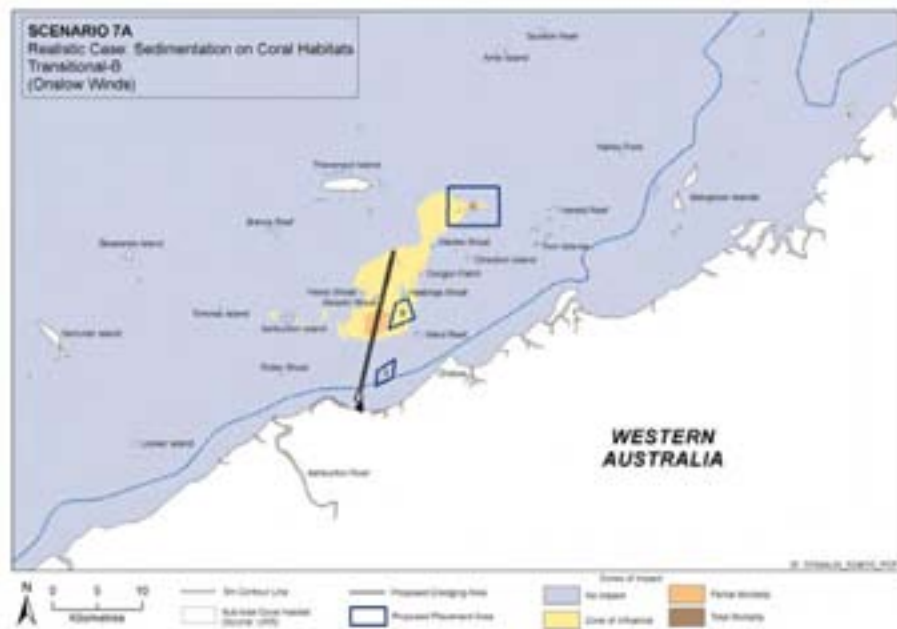


Figure B.358 Scenario 7A, Transitional-B, Realistic: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Realistic Spill based on Onslow winds

B-270

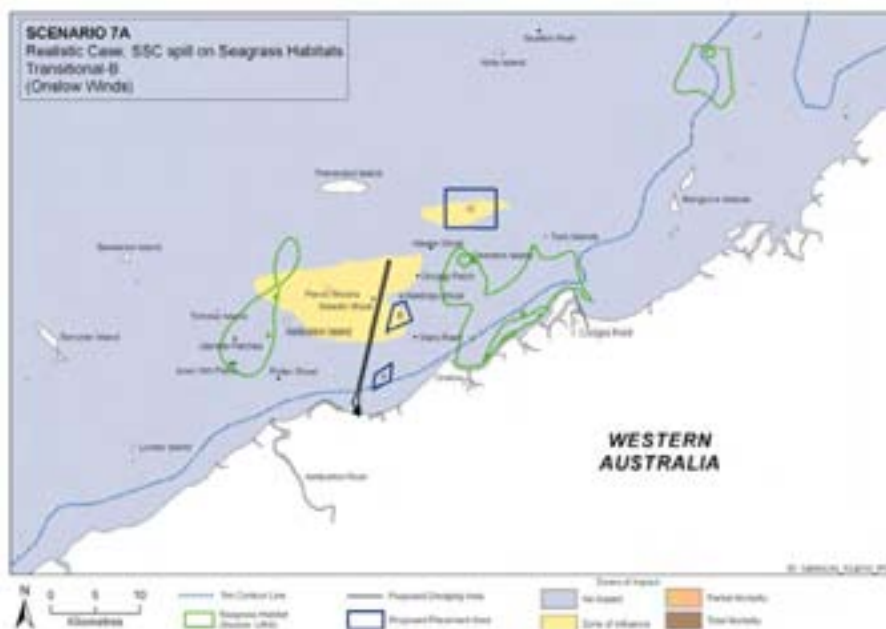


Figure B.359 Scenario 7A, Transitional-B, Realistic: SSC Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

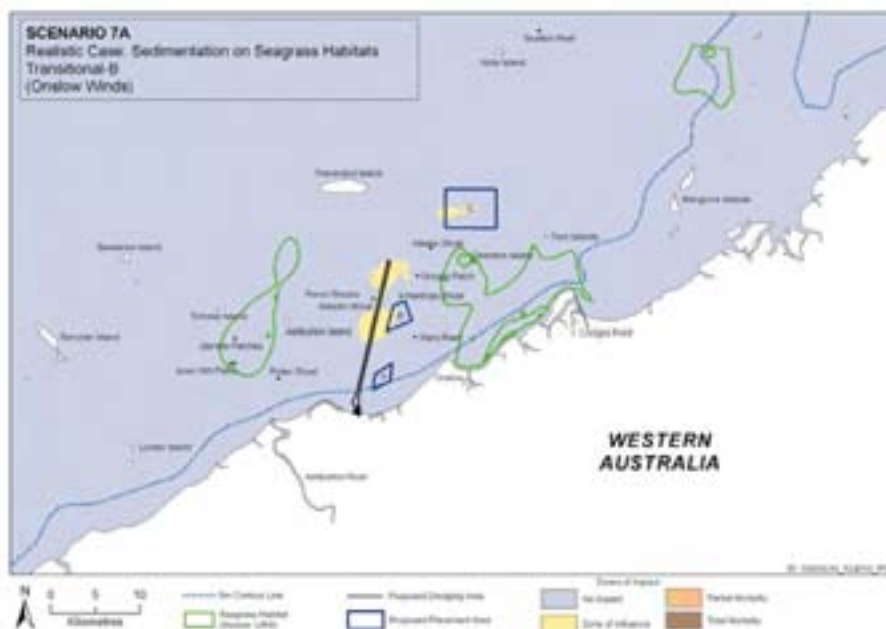


Figure B.360 Scenario 7A, Transitional-B, Realistic: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Realistic Spill based on Onslow winds

B-271



Table B.90 Summary of Impacts at Sensitive Receptors for Scenario 7A, Transitional-B, Realistic Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.2	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.7	0.0	0.0	0.0	0.3	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	2.3	16.2	0.7	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.6	3.7	0.0	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	2.2	9.8	3.3	0.3	0.8	
9	Hastings Shoal	298803	7613488	1.1	1.0	0.0	0.0	0.5	
10	North West Ward Reef	299018	7610106	0.8	3.4	1.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.9	4.2	0.3	0.0	0.6	
14	Gorgon Patch	300859	7615993	0.6	3.1	0.0	0.0	0.2	
15	Weeks Shoal	302245	7618926	0.7	0.3	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.1	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.1	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.1	0.9	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.3	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-272



**B.8.7 Summer-A, Worst Case Spill Scenario**

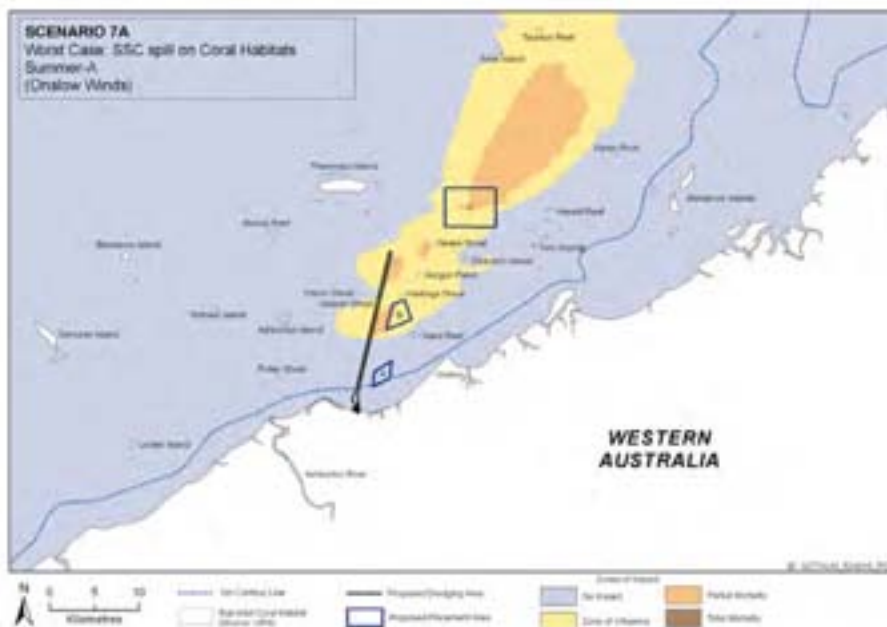


Figure B.361 Scenario 7A, Summer-A, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

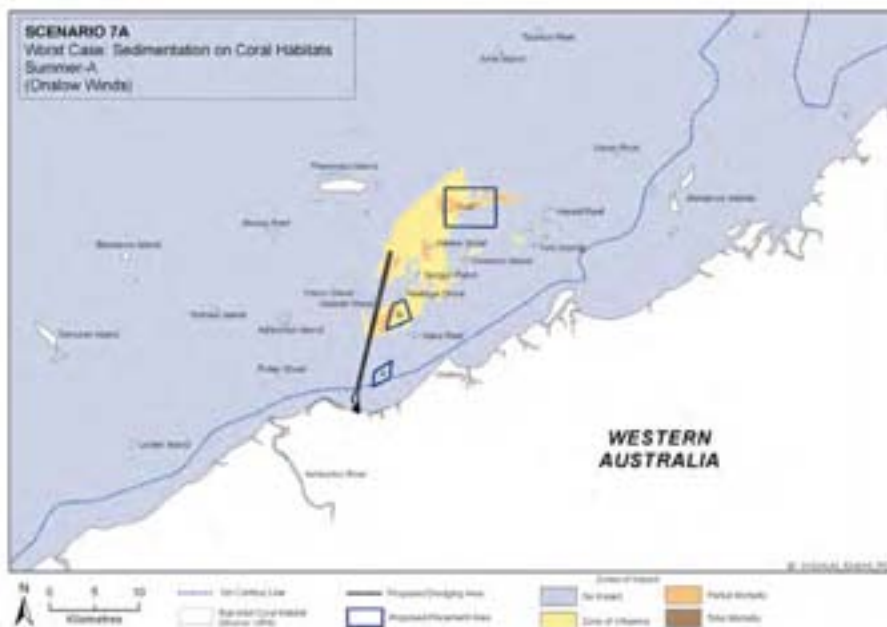


Figure B.362 Scenario 7A, Summer-A, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-273

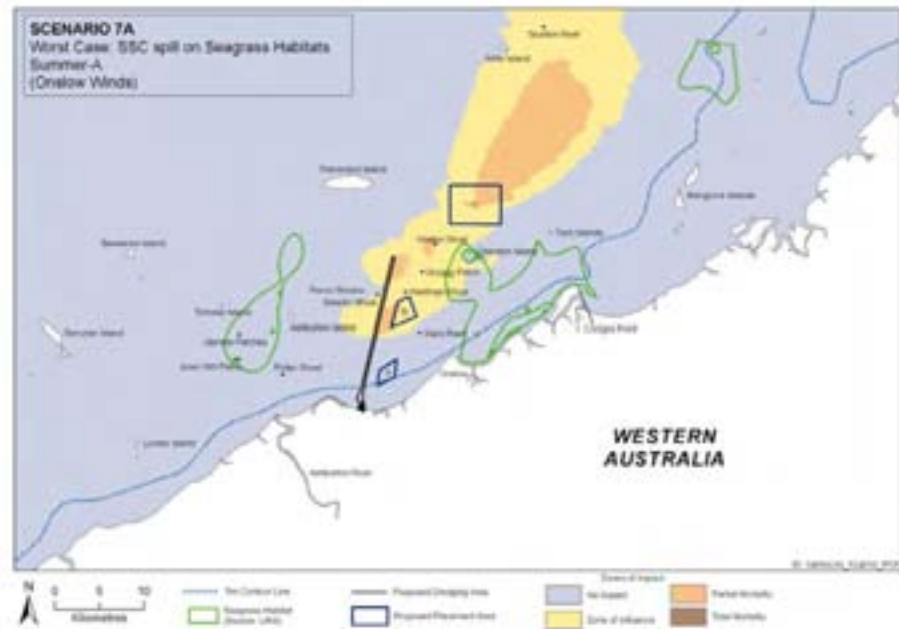


Figure B.363 Scenario 7A, Summer-A, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

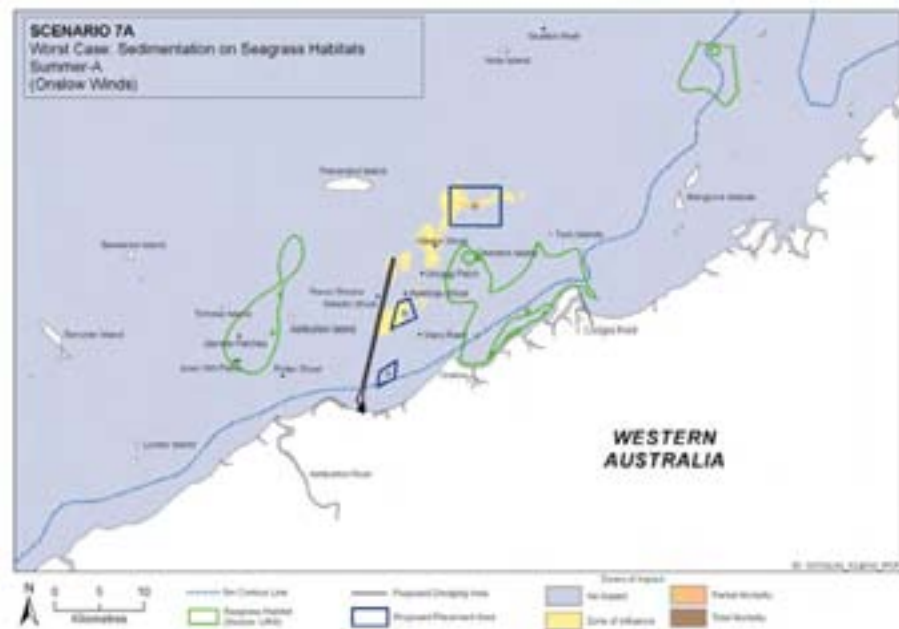


Figure B.364 Scenario 7A, Summer-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

B-274



Table B.91 Summary of Impacts at Sensitive Receptors for Scenario 7A, Summer-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.1	0.0	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	0.7	3.1	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	3.8	16.6	9.7	3.9	0.0	
9	Hastings Shoal	298803	7613488	2.6	15.5	2.8	0.0	0.0	
10	North West Ward Reef	299018	7610106	1.6	8.8	4.3	0.9	0.0	
11	Ward Reef	300410	7608668	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	2.4	12.9	1.3	0.0	0.0	
14	Gorgon Patch	300859	7615993	2.7	15.8	3.7	0.0	0.0	
15	Weeks Shoal	302245	7618926	3.8	26.3	8.9	0.3	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	2.3	12.0	1.0	0.0	0.6	
17	NW of Direction Island	304867	7618549	1.9	5.6	0.6	0.0	0.0	
18	Direction Island	307431	7617732	1.2	0.4	0.0	0.0	0.5	
19	NE Tw in Island	314029	7620738	0.5	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.9	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.2	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.9	0.0	0.0	0.0	0.0	
23	Airle Island	307006	7640697	0.7	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	2.2	21.8	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.5	0.6	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.2	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.1	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.2	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.4	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-275



**B.8.8 Summer-B, Worst Case Spill Scenario**

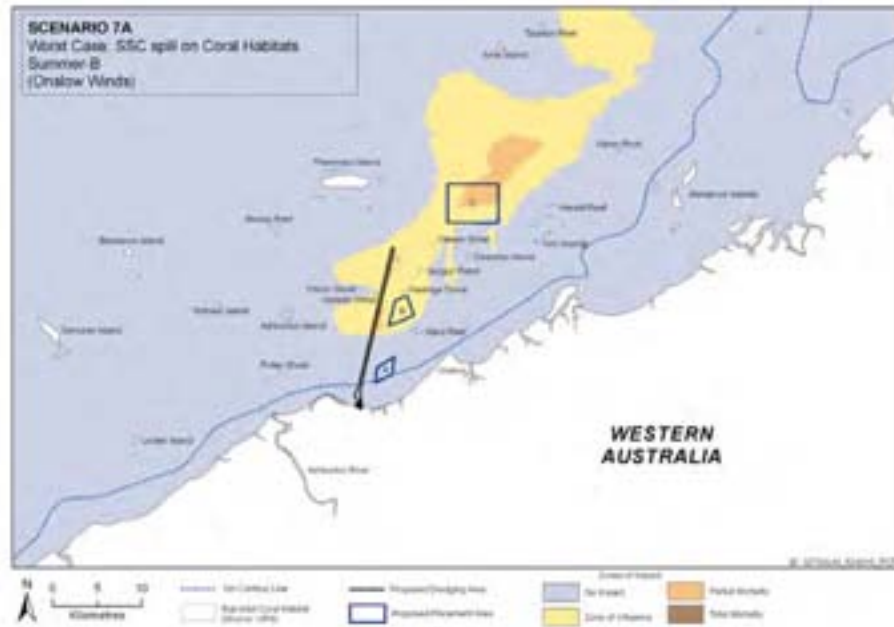


Figure B.365 Scenario 7A, Summer-B, Worst Case: SSC Zones of Impact for Corals during Summer Conditions with Worst Case Spill based on Onslow winds

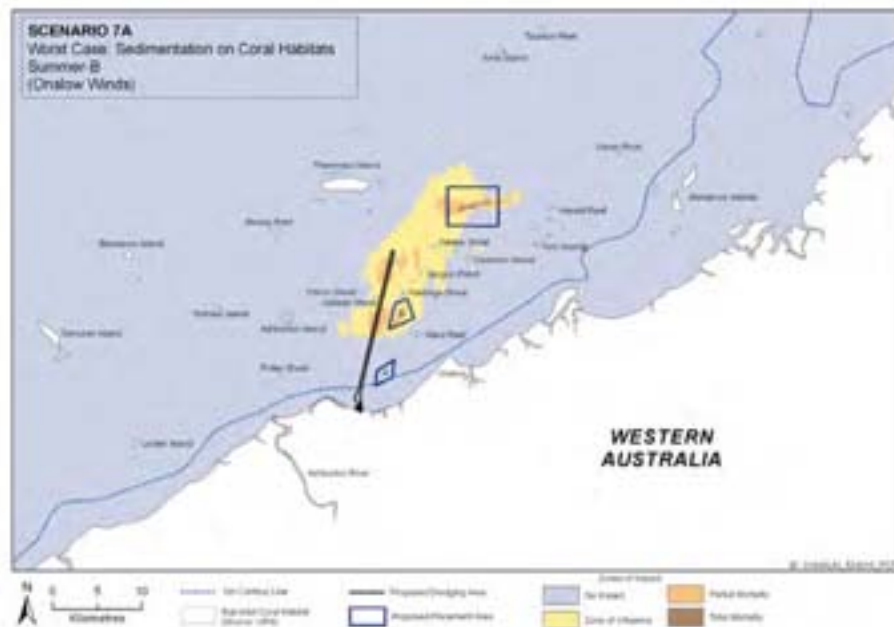


Figure B.366 Scenario 7A, Summer-B, Worst Case: Sedimentation Zones of Impact for Corals, during Summer Conditions with Worst Case Spill based on Onslow winds

B-276

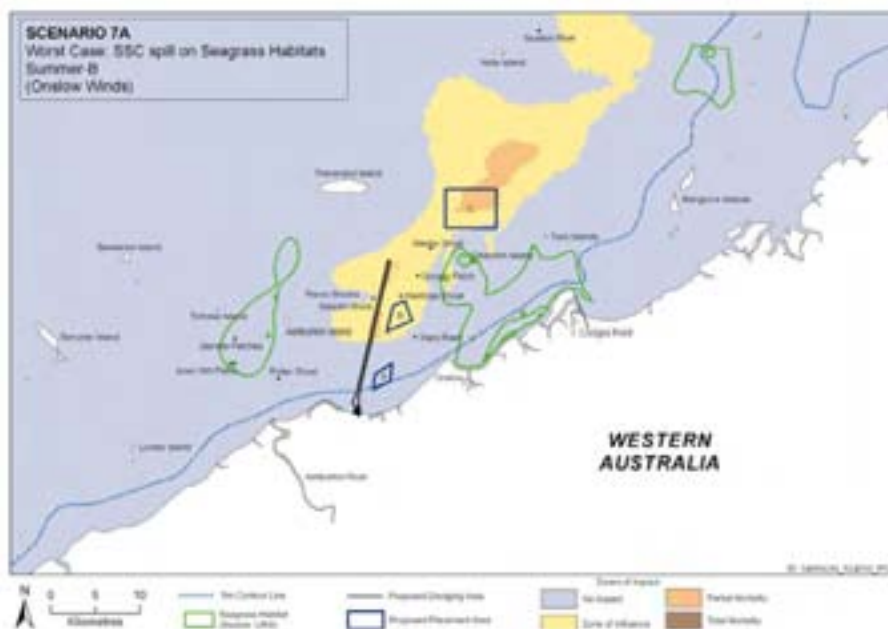


Figure B.367 Scenario 7A, Summer-B, Worst Case: SSC Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds

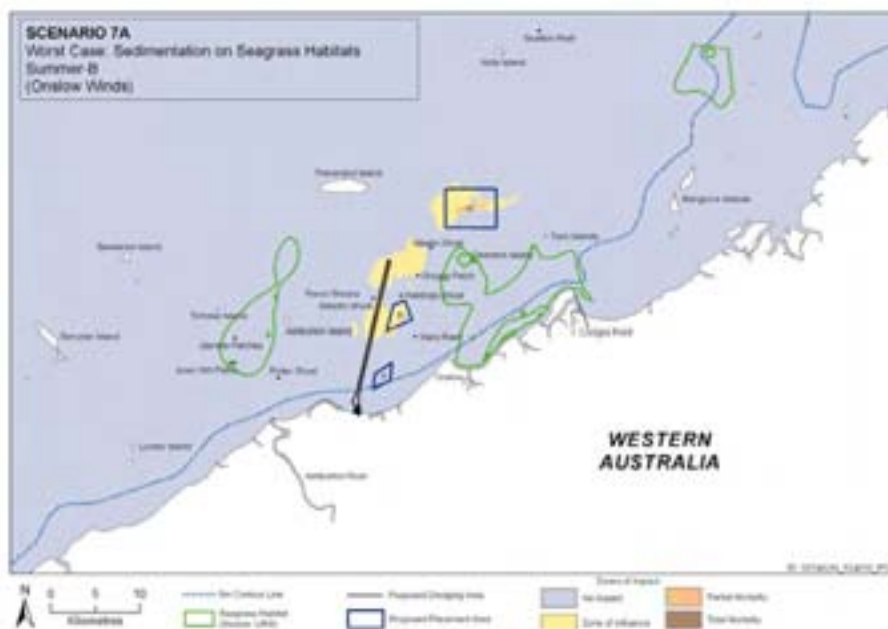


Figure B.368 Scenario 7A, Summer-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Summer Conditions with Worst Case Spill based on Onslow winds



B-277



Table B.92 Summary of Impacts at Sensitive Receptors for Scenario 7A, Summer-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.0	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	0.6	1.2	0.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.2	3.7	0.1	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	3.8	22.0	7.4	2.4	0.8	
9	Hastings Shoal	298803	7613488	1.8	8.2	0.1	0.0	0.4	
10	North West Ward Reef	299018	7610106	0.9	5.5	2.2	0.1	0.3	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.8	8.3	1.0	0.0	0.6	
14	Gorgon Patch	300859	7615993	2.0	9.2	2.5	0.1	0.7	
15	Weeks Shoal	302245	7618926	1.7	6.5	1.3	0.1	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.8	3.1	0.3	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.9	1.0	0.3	0.0	0.0	
18	Direction Island	307431	7617732	0.6	1.3	0.0	0.0	0.2	
19	NE Twin Island	314029	7620738	0.2	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.4	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.1	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.7	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.9	0.1	0.0	0.0	0.1	
24	Taunton Reef	315570	7642531	1.8	0.7	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.0	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.0	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.1	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.1	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.1	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.2	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-278



**B.8.9 Winter-A, Worst Case Spill Scenario**

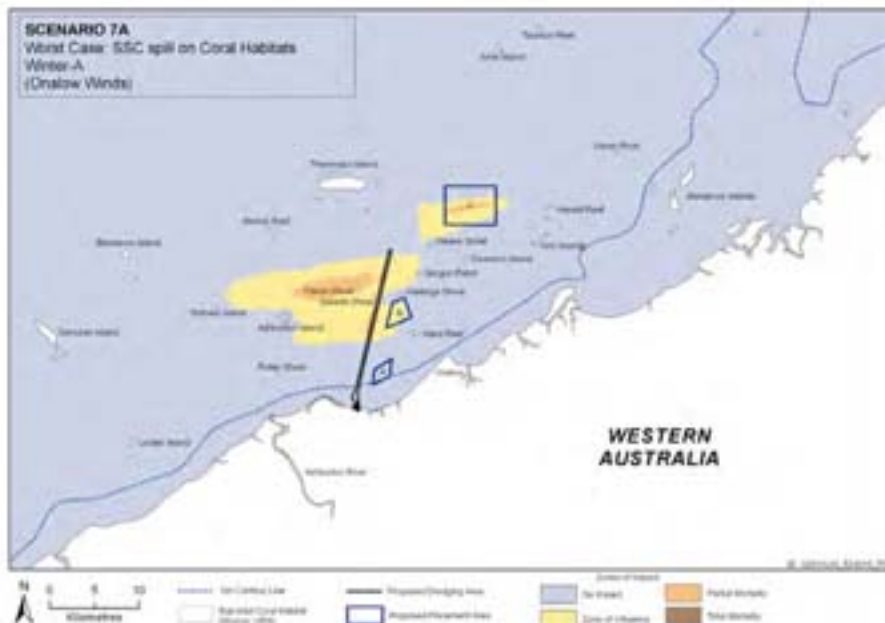


Figure B.369 Scenario 7A, Winter-A, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

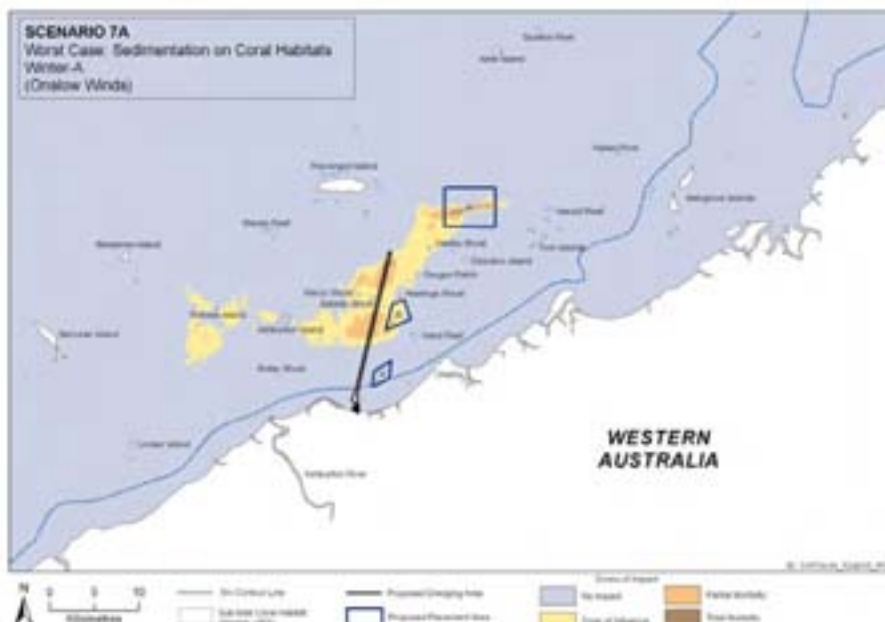


Figure B.370 Scenario 7A, Winter-A, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-279

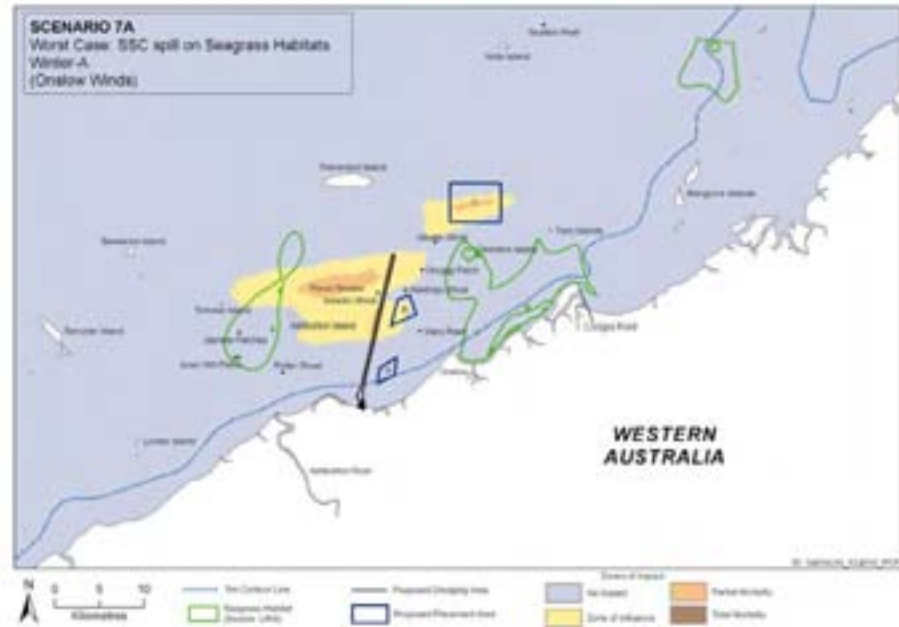


Figure B.371 Scenario 7A, Winter-A, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

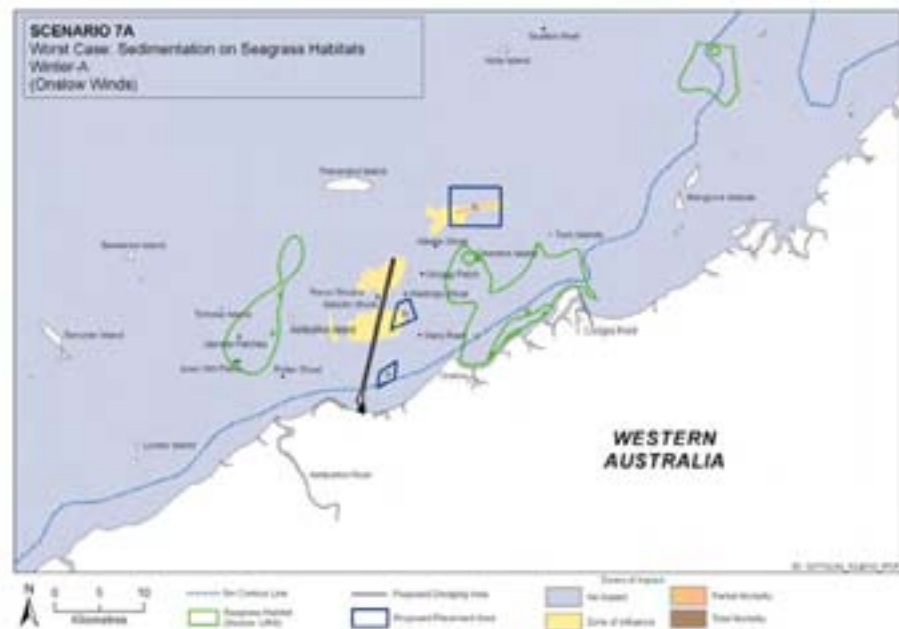


Figure B.372 Scenario 7A, Winter-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-280



Table B.93 Summary of Impacts at Sensitive Receptors for Scenario 7A, Winter-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.5	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.2	0.7	0.0	0.0	0.6	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	4.0	30.2	4.5	0.1	0.3	
7	Saladin Shoal	295913	7613337	1.7	4.2	0.0	0.0	0.0	
8	End of Wheatstone Shipping Channel	298328	7617464	2.3	11.0	4.0	0.3	1.6	
9	Hastings Shoal	298803	7613488	0.5	0.0	0.0	0.0	0.2	
10	North West Ward Reef	299018	7610106	0.2	0.4	0.0	0.0	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	0.8	5.3	0.7	0.0	0.4	
14	Gorgon Patch	300859	7615993	0.6	2.7	0.6	0.0	0.3	
15	Weeks Shoal	302245	7618926	1.2	0.3	0.1	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.0	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.1	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.0	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.2	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.8	11.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

Impact Zones

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-281



**B.8.10 Winter-B, Worst Case Spill Scenario**

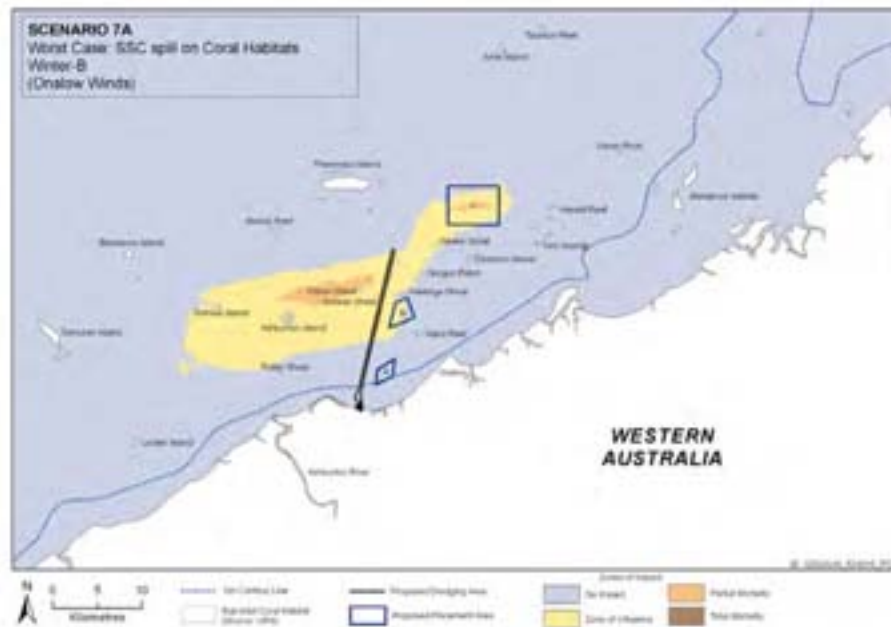


Figure B.373 Scenario 7A, Winter-B, Worst Case: SSC Zones of Impact for Corals during Winter Conditions with Worst Case Spill based on Onslow winds

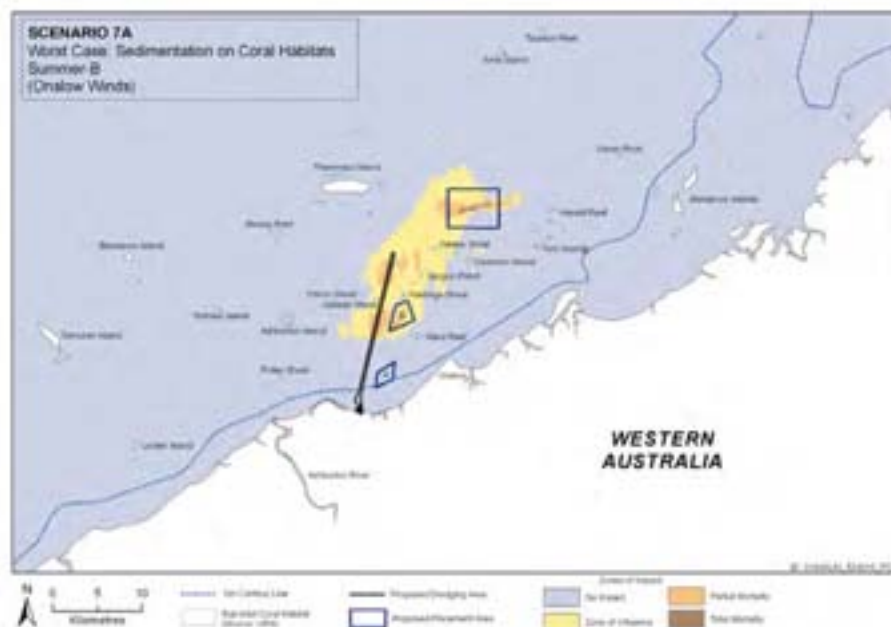


Figure B.374 Scenario 7A, Winter-B, Worst Case: Sedimentation Zones of Impact for Corals, during Winter Conditions with Worst Case Spill based on Onslow winds

B-282

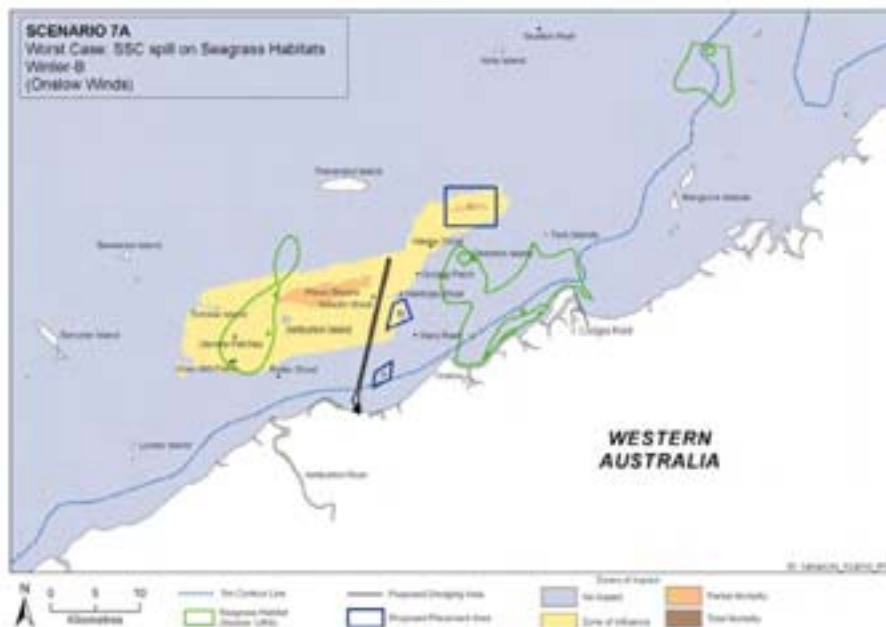


Figure B.375 Scenario 7A, Winter-B, Worst Case: SSC Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

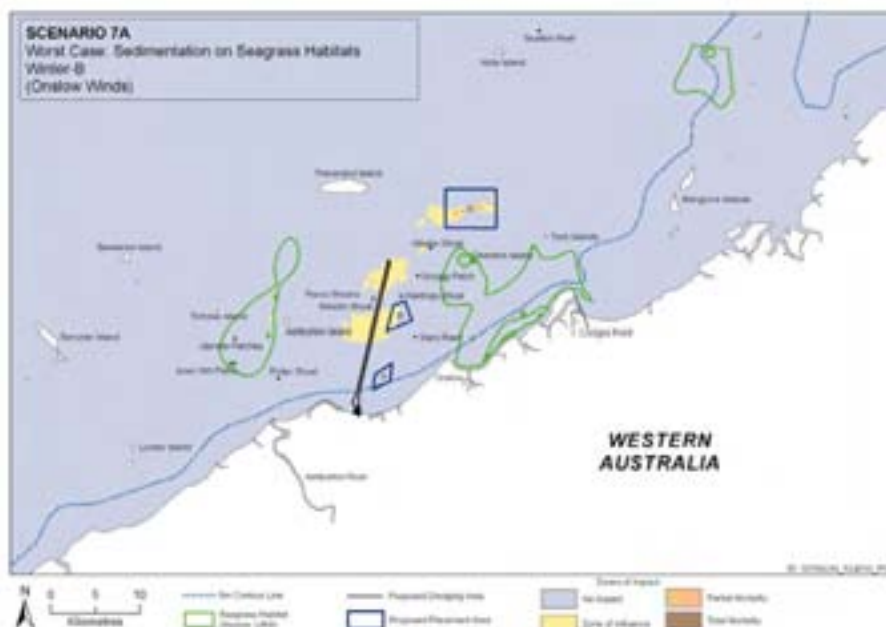


Figure B.376 Scenario 7A, Winter-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Winter Conditions with Worst Case Spill based on Onslow winds

B-283



Table B.94 Summary of Impacts at Sensitive Receptors for Scenario 7A, Winter-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	1.7	6.7	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.2	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	1.6	8.8	0.0	0.0	0.8	
4	Brew is Reef East	286437	7621988	0.0	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	3.3	25.3	5.1	0.0	0.0	
7	Saladin Shoal	295913	7613337	2.0	8.6	0.7	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	2.8	13.4	5.8	1.3	0.9	
9	Hastings Shoal	298803	7613488	1.3	1.6	0.0	0.0	0.4	
10	North West Ward Reef	299018	7610106	0.3	0.4	0.0	0.0	0.1	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.2	4.2	1.0	0.0	0.4	
14	Gorgon Patch	300859	7615993	1.1	3.7	0.1	0.0	0.2	
15	Weeks Shoal	302245	7618926	1.7	4.0	0.0	0.0	0.1	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.1	
17	NW of Direction Island	304867	7618549	0.3	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.0	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	1.8	7.9	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	2.9	19.0	1.6	0.0	0.2	
27	S of Brew is Reef	286445	7618545	0.1	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	



**B.8.11 Transitional-A, Worst Case Spill Scenario**

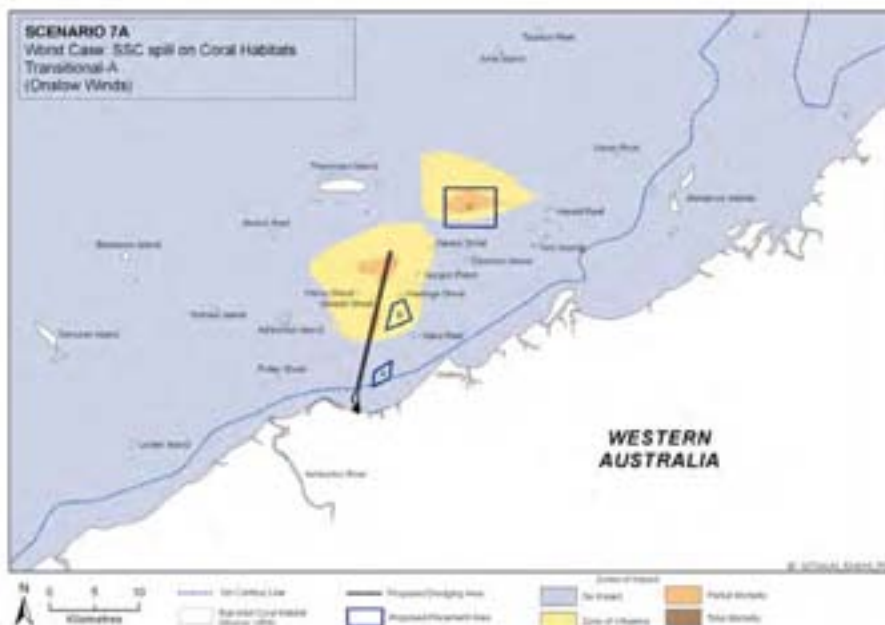


Figure B.377 Scenario 7A, Transitional-A, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

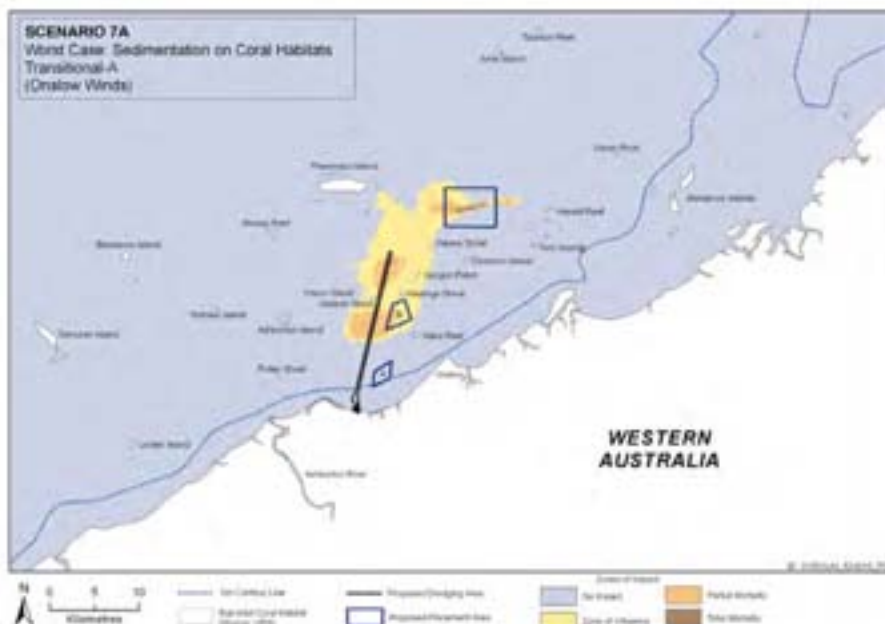


Figure B.378 Scenario 7A, Transitional-A, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds



B-285

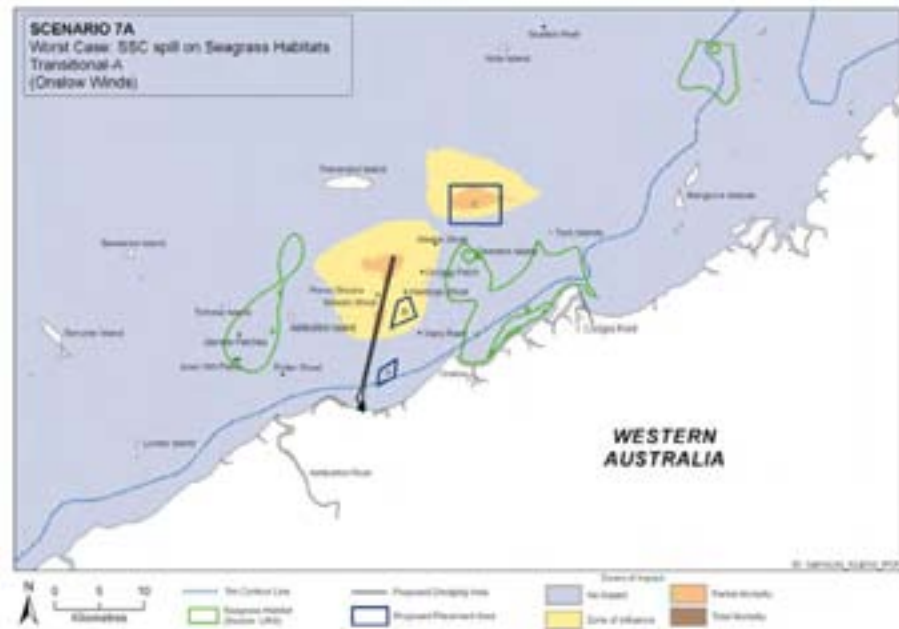


Figure B.379 Scenario 7A, Transitional-A, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

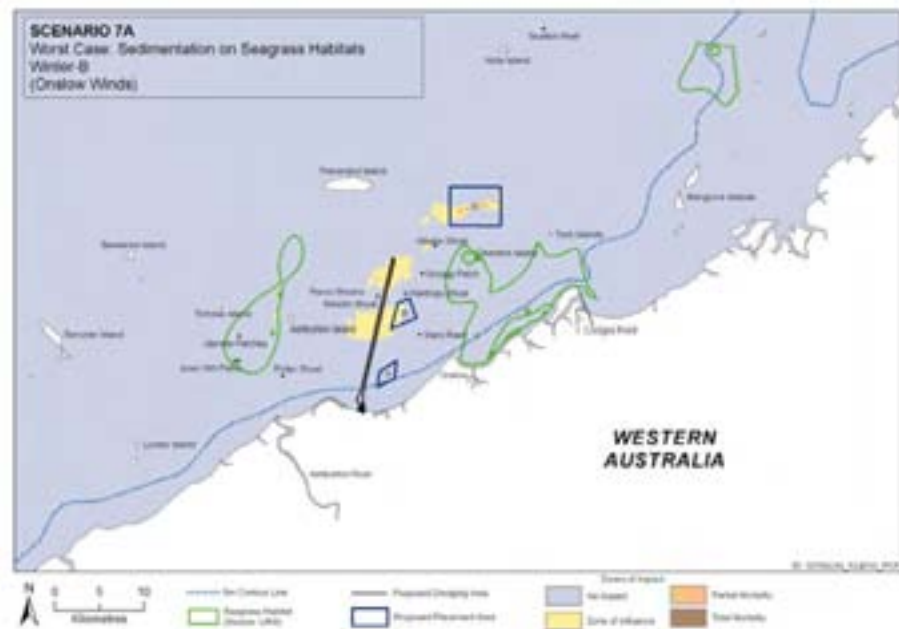


Figure B.380 Scenario 7A, Transitional-A, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

B-286



Table B.95 Summary of Impacts at Sensitive Receptors for Scenario 7A, Transitional-A, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.0	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.1	0.0	0.0	0.0	0.0	
4	Brew is Reef East	286437	7621988	0.2	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.0	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	1.6	8.9	0.4	0.0	0.1	
7	Saladin Shoal	295913	7613337	2.3	12.0	0.1	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	4.2	27.5	12.3	1.5	1.9	
9	Hastings Shoal	298803	7613488	1.7	6.7	0.1	0.0	0.6	
10	North West Ward Reef	299018	7610106	1.0	6.4	1.9	0.3	0.0	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.6	6.4	1.8	0.0	0.5	
14	Gorgon Patch	300859	7615993	1.6	8.2	2.4	0.4	0.5	
15	Weeks Shoal	302245	7618926	1.1	4.8	0.7	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.3	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.3	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Tw in Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airile Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.0	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	0.1	0.0	0.0	0.0	0.0	
27	S of Brew is Reef	286445	7618545	0.5	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.0	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Tw in Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Tw in Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

B-287



**B.8.12 Transitional-B, Worst Case Spill Scenario**

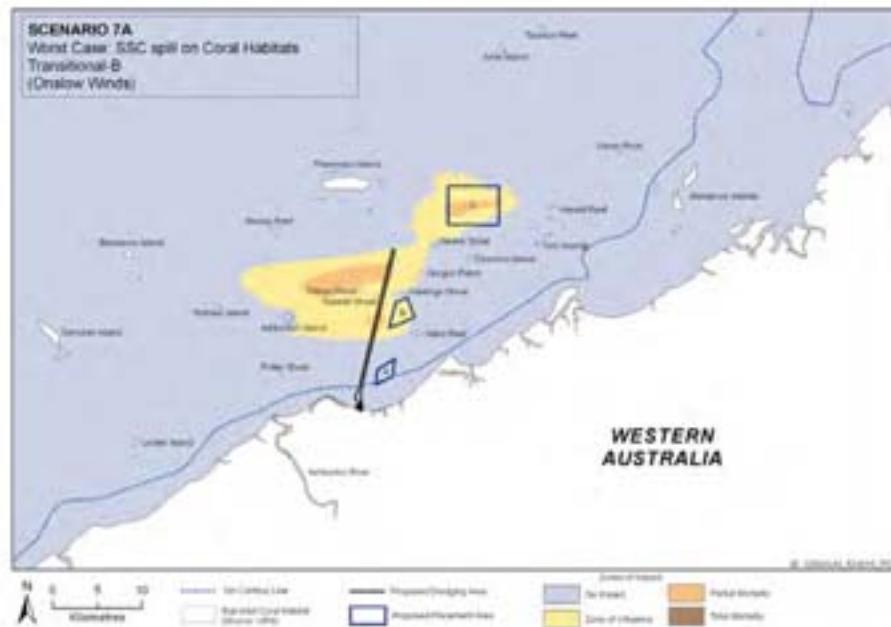


Figure B.381 Scenario 7A, Transitional-B, Worst Case: SSC Zones of Impact for Corals during Transitional Conditions with Worst Case Spill based on Onslow winds

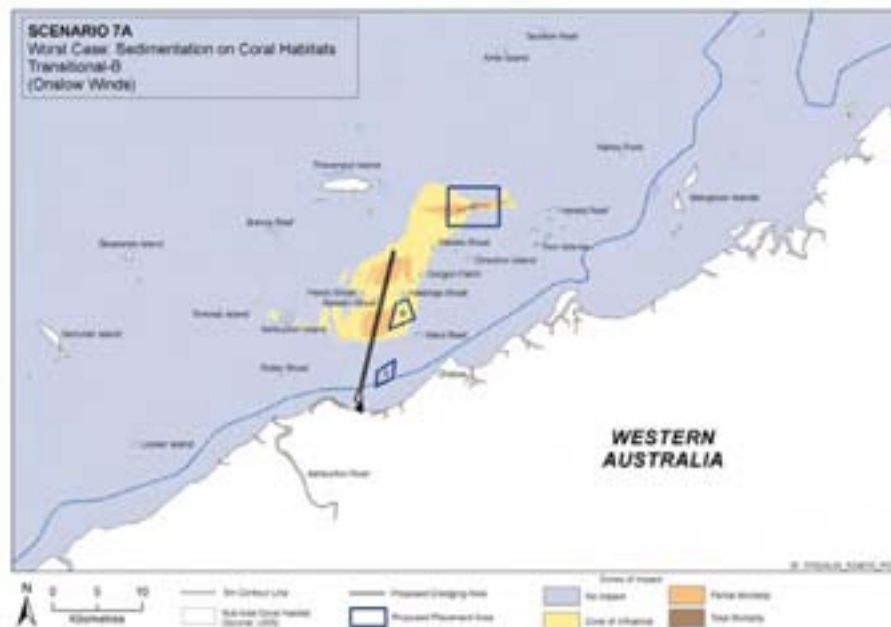


Figure B.382 Scenario 7A, Transitional-B, Worst Case: Sedimentation Zones of Impact for Corals, during Transitional Conditions with Worst Case Spill based on Onslow winds

B-288

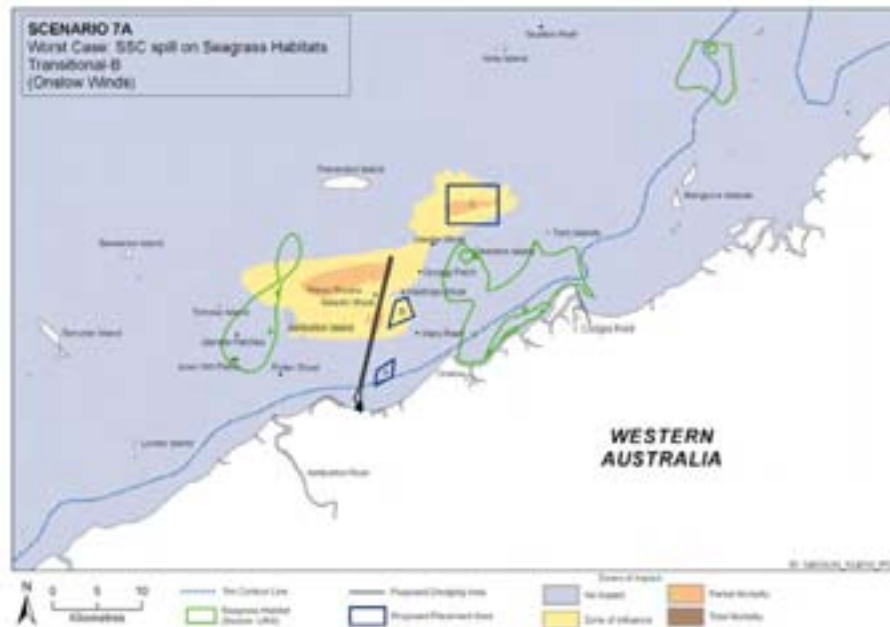


Figure B.383 Scenario 7A, Transitional-B, Worst Case: SSC Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

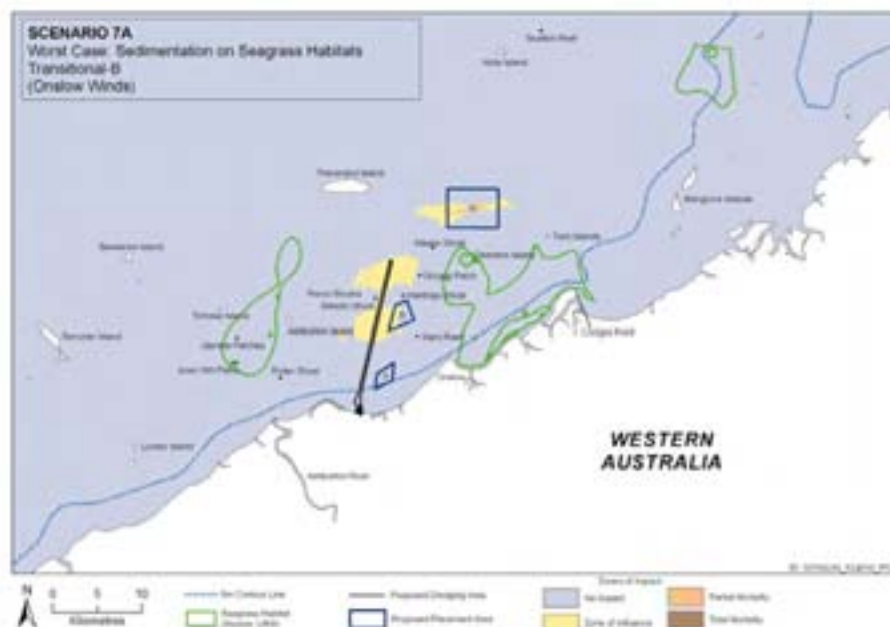


Figure B.384 Scenario 7A, Transitional-B, Worst Case: Sedimentation Zones of Impact for Seagrass during Transitional Conditions with Worst Case Spill based on Onslow winds

SG5240-06/Chevron Wheatstone Dredge Plume Impact Assessment/Final/mjj/05-10

B-289



Table B.96 Summary of Impacts at Sensitive Receptors for Scenario 7A, Transitional-B, Worst Case Spill based on Onslow winds

Sensitive Receptor	Geographic Name	Easting	Northing	Mean TSS (mg/l)	Ex 5mg/l (%)	Ex 10mg/l (%)	Ex 25mg/l (%)	Sedimentation Rate (mm/14 days)	Overall Impact Zone
1	Tortoise Island	278710	7612383	0.3	0.0	0.0	0.0	0.0	
2	Roller Shoal	285367	7604532	0.0	0.0	0.0	0.0	0.0	
3	Ashburton Island	286705	7611075	0.9	0.9	0.0	0.0	0.4	
4	Brew is Reef East	286437	7621988	0.1	0.0	0.0	0.0	0.0	
5	Thevenard Island West	288492	7624016	0.1	0.0	0.0	0.0	0.0	
6	Paroo Shoals	293805	7614023	3.0	22.9	3.0	0.0	0.0	
7	Saladin Shoal	295913	7613337	1.9	5.8	0.0	0.0	0.1	
8	End of Wheatstone Shipping Channel	298328	7617464	3.4	17.4	6.4	1.5	1.8	
9	Hastings Shoal	298803	7613488	1.4	2.1	0.0	0.0	0.6	
10	North West Ward Reef	299018	7610106	1.1	6.4	1.9	0.0	0.2	
11	Ward Reef	300410	7608868	0.0	0.0	0.0	0.0	0.0	
12	Ward Reef	301120	7609196	0.0	0.0	0.0	0.0	0.0	
13	SW of Gorgon Patch	300094	7615177	1.3	6.8	1.8	0.0	1.0	
14	Gorgon Patch	300859	7615993	0.9	4.0	1.0	0.0	0.3	
15	Weeks Shoal	302245	7618926	1.1	1.9	0.0	0.0	0.0	
16	Unnamed shoal to NE of Koolinda Patch	304144	7615544	0.2	0.0	0.0	0.0	0.0	
17	NW of Direction Island	304867	7618549	0.2	0.0	0.0	0.0	0.0	
18	Direction Island	307431	7617732	0.1	0.0	0.0	0.0	0.0	
19	NE Twin Island	314029	7620738	0.0	0.0	0.0	0.0	0.0	
20	North Herald Reef	315701	7623270	0.0	0.0	0.0	0.0	0.0	
21	West middle Mangrove Is	323143	7622099	0.0	0.0	0.0	0.0	0.0	
22	Nares Rock	323379	7629437	0.0	0.0	0.0	0.0	0.0	
23	Airlie Island	307006	7640697	0.3	0.0	0.0	0.0	0.0	
24	Taunton Reef	315570	7642531	0.0	0.0	0.0	0.0	0.0	
25	West Glennie Patches	282228	7607307	0.3	0.0	0.0	0.0	0.0	
26	NW of Ashburton Island	283603	7613038	1.4	5.1	0.0	0.0	0.1	
27	S of Brew is Reef	286445	7618545	0.4	0.0	0.0	0.0	0.0	
28	Thevenard Island South	294521	7622970	0.1	0.0	0.0	0.0	0.0	
29	S of Direction Island	307170	7613858	0.0	0.0	0.0	0.0	0.0	
30	SE of Direction Island	309948	7612830	0.0	0.0	0.0	0.0	0.0	
31	Nearshore NE of Onslow	310515	7609475	0.0	0.0	0.0	0.0	0.0	
32	SW of Coolgra Point	314624	7612352	0.0	0.0	0.0	0.0	0.0	
33	S of Twin Islands	314942	7616406	0.0	0.0	0.0	0.0	0.0	
34	SW Twin Island	313878	7618776	0.0	0.0	0.0	0.0	0.0	

**Impact Zones**

Zone of Total Mortality	
Zone of Partial Mortality	
Zone of Influence	
No Impact	

This page is intentionally blank



**Chevron Australia Pty Ltd**

ABN 29 086 197 757

250 St Georges Terrace  
Perth WA 6000  
Australia

Tel: +61 8 9216 4000  
Fax: +61 8 9216 4444  
Email: [ask@chevron.com](mailto:ask@chevron.com)  
[www.chevronaustralia.com](http://www.chevronaustralia.com)