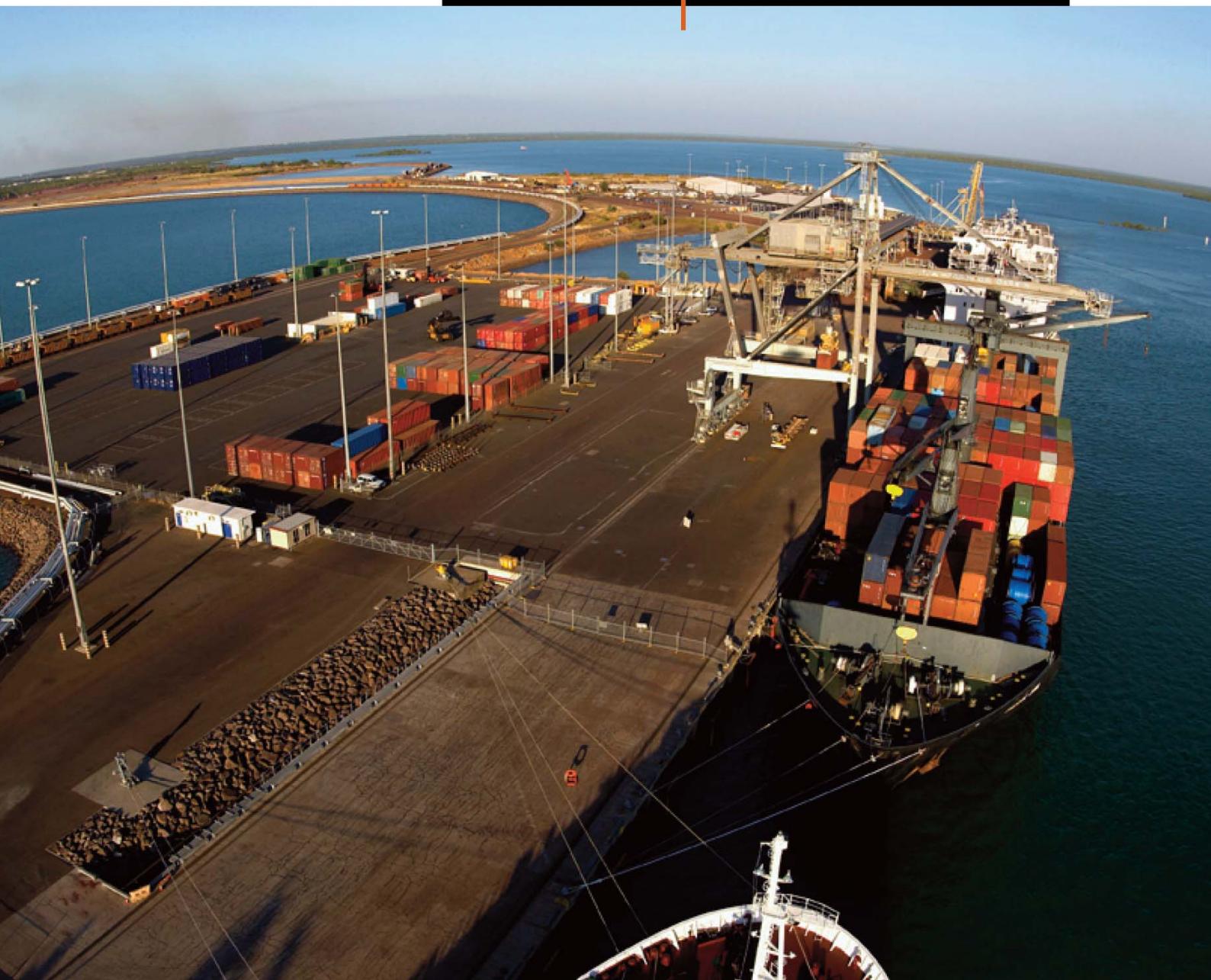


East Arm Wharf Expansion Project

DRAFT ENVIRONMENTAL IMPACT STATEMENT

VOLUME 2 OF 4

Main Report



MAY 2011

Prepared for Northern Territory Department of Lands and Planning



Table of Contents

1	Introduction and Background	1
1.1	Proponent	1
1.2	The Project	2
1.2.1	Background	3
1.2.2	Objective of the Proposed Action	4
1.2.3	Location of the Proposed Action	4
1.3	Environmental Assessment Process.....	6
1.3.1	Initial Notification (Notice of Intent and EPBC Referral).....	6
1.3.2	Level of Assessment Set for the EAW Expansion Project	6
1.3.3	Public Review of the Guidelines	8
1.3.4	Preparation of the Draft EIS	8
1.3.5	Submission of Draft EIS and Public Review	8
1.3.6	Preparation of the Final EIS	8
1.3.7	Government Assessment and Final Approval	8
1.4	Other Approvals.....	9
1.5	Relevant Legislation, Other Obligations and Policies.....	9
1.5.1	Legislation	9
1.5.2	Other Obligations.....	14
1.6	Structure of this Draft Environmental Impact Statement	17
	References.....	19
2	Description of the Proposal	20
2.1	Overview	20
2.1.1	Barge Ramp and Hardstand Area	24
2.1.2	Marine Supply Base.....	24
2.1.3	Rail Loop and Spur	26
2.1.4	Construction of Tug Pens and Small Vessels Berths.....	28
2.1.5	Dredging Methodologies.....	29
2.1.6	Dredged Spoil Ponds (if required under the Dredge Management Plan).....	30
2.2	Objectives and Benefits of the Proposal	30
2.2.1	Barge Ramp and Hardstand.....	30
2.2.2	Marine Supply Base.....	30
2.2.3	Rail Loop.....	31

2.2.4	Construction of Tug Pens and Small Vessel Berths	32
2.3	Timeframes, Schedules and Staging	32
2.4	Local Planning Context	33
2.4.1	Darwin Harbour Strategy.....	33
2.4.2	East Arm Wharf Facilities Masterplan 2030	34
2.4.3	Tenure	34
2.5	Relationship to Other Actions	36
2.6	Infrastructure.....	36
2.6.1	Traffic and Access	36
2.6.2	Roads	37
2.7	Construction Methods, Machinery, and Equipment Requirements	38
2.7.1	Dredging	38
2.7.2	Barge Ramp and Hardstand Area	38
2.7.3	Marine Supply Base.....	39
2.7.4	Rail Loop and Spur	40
2.7.5	Berths for Tugs and Small Vessels.....	41
2.7.6	Laydown Areas	42
2.7.7	Dredged Spoil Ponds.....	42
2.8	Materials	43
2.8.1	Inputs	43
2.8.2	Outputs	44
2.9	Ongoing Maintenance	45
2.10	Employment	45
	Reference.....	46
3	Alternatives.....	47
3.1	Project Location.....	47
3.2	Alternative Scenarios for Port Facilities	47
3.3	Alternative Dredging Methods and Dredge Spoil Reuse / Disposal	49
3.4	Alternative Sources of Raw Materials for the Project	50
3.5	Alternative Management Techniques for Moderate to High Impacts	50

3.6	Consequences of Adopting the “No Development” Option	51
	References.....	52
4	Land-use	53
4.1	Existing Environment	53
4.1.1	Land Tenure	53
4.1.2	Existing East Arm Wharf Land-Uses	55
4.1.3	Existing Adjacent Land Uses (Outside Project Area)	56
4.2	Site Designations.....	57
4.3	Policy and Legislative Requirements	58
4.3.1	Relevant Strategies and Plans	58
4.3.2	Northern Territory Planning Legislation, Policies and Controls.....	60
4.3.3	Assessment against NT Planning Scheme	63
4.4	Additional Approvals Associated with the Proposed Development	73
	References.....	74
5	Infrastructure and Transport.....	75
5.1	Existing Infrastructure.....	75
5.1.1	Rail.....	75
5.1.2	Ports	80
5.1.3	Road	83
5.1.4	Air	86
5.1.5	Water Supply	87
5.1.6	Waste Water	91
5.1.7	Electricity	95
5.1.8	Gas	97
5.1.9	Telecommunications	97
5.2	Potential Impacts	98
5.2.1	Roads	98
5.2.2	Rail.....	99
5.3	Management of Potential Impacts.....	99
5.3.1	Road	99
5.3.2	Rail.....	99

5.4 Commitments	99
References.....	100
6 Geology, Landforms and Soils	101
6.1 Existing Environment.....	101
6.1.1 Surface Elevations and Bathymetry	101
6.1.2 Geology.....	106
6.1.3 Seismicity	106
6.2 Previous Investigations.....	106
6.3 Potential Impacts and Management.....	114
6.3.1 Soil Erosion and Disturbance.....	114
6.3.2 Acid Sulphate Soils	114
6.3.3 Sourcing of Fill.....	114
6.3.4 Foundations and Geotechnical Matters	115
6.4 Commitments	116
References.....	117
7 Climate	120
7.1 Regional Climate.....	120
7.2 Darwin Climate	121
7.3 Cyclone Activity	122
7.4 Storm Surge	126
7.5 Projected Trends in Climate Variability for Darwin Region	127
References.....	129
8 Oceanic Process and Natural Features.....	130
8.1 Existing Environment.....	130
8.2 Potential Impacts	136
8.2.1 Potential Impacts on Currents, Waves and Bed Shear Stress.....	136
8.2.2 Potential Impacts on Suspended Sediment Concentration and Sediment Bottom Thickness.....	137
8.3 Management of Impacts	139
8.3.1 Objectives and Standards.....	139
8.3.2 Management Requirements	139
8.3.3 Monitoring and Reporting	140

8.4	Commitments	140
	References	141
9	Marine Water	143
9.1	Existing Water and Sediment Quality	143
9.1.1	Existing Water Quality	143
9.1.2	Sediment Quality	146
9.1.3	Beneficial Uses and Water Quality Objectives	149
9.2	Potential Impacts	150
9.2.1	Construction Impacts	151
9.3	Management of Impacts	154
9.4	Commitments	155
	References	156
10	Terrestrial Water	161
10.1	Existing Environment	161
10.1.1	Surface Water Hydrology	161
10.1.2	Hydrogeology	165
10.2	Potential Impacts	165
10.2.1	Groundwater	165
10.2.2	Surface Water	166
10.3	Management of Impacts	166
10.3.1	Objectives and Standards	166
10.3.2	Management Requirements	166
10.3.3	Monitoring and Reporting	168
10.4	Commitments	169
	References	170
11	Air Quality	171
11.1	Existing Environment	171
11.1.1	Background Air Quality	171
11.1.2	Sensitive Receptors	173
11.2	Potential Impacts	173
11.3	Management of Impacts	175

11.3.1 Objectives and Standards.....	175
11.3.2 Management Requirements	175
11.3.3 Monitoring and Reporting	176
11.4 Commitments	177
References.....	178
12 Greenhouse Gas Emissions.....	179
12.1 Existing Environment.....	179
12.2 Potential Impacts	181
12.2.1 Construction Phase	182
12.2.2 Operational Phase	183
12.3 Management of Impacts	183
12.3.1 Objectives and Standards.....	183
12.3.2 Management Requirements	184
12.3.3 Monitoring and Reporting.....	184
12.4 Commitments	185
References.....	186
13 Marine Noise.....	187
13.1 Important Marine Fauna with Regard to Noise Generation	187
13.1.1 Cetaceans	187
13.1.2 Sirenians	187
13.1.3 Turtles	188
13.1.4 Saltwater Crocodiles	188
13.1.5 Fish.....	189
13.1.6 Invertebrates	189
13.2 Components of Anthropogenic Noise	190
13.2.1 Overview	190
13.2.2 Vessels.....	190
13.2.3 Dredges.....	191
13.2.4 Pile Driving	192
13.3 Categories of Sound Impacts	192
13.3.1 Zones of Influence	193
13.3.2 Exposure Criteria for Injury	194

13.3.3	Exposure Criteria for Behaviour	195
13.4	Potential Effects of EAW Noise on Marine Fauna.....	195
13.5	Dredging	196
13.6	Pile Driving	196
13.7	Shipping Noise.....	198
13.8	Mitigation Measures	198
13.9	Operational Management Procedures	199
13.9.1	Marine Fauna Exclusion Zones	199
13.9.2	Initial Start-Up Procedures.....	200
13.9.3	Stop Work Trigger.....	201
13.9.4	Elevated Sea Conditions	201
13.9.5	Night Time and Low Visibility Activities.....	201
13.9.6	Additional Operating Procedures (AOPs)	202
13.10	Conclusion	202
13.11	Commitments	203
	References.....	204
14	Terrestrial Noise.....	207
14.1	Existing Environment	207
14.1.1	Noise Sensitive Locations	207
14.1.2	Existing Baseline Noise Monitoring.....	207
14.2	Potential Impacts	209
14.2.1	Project Assessment Criteria.....	209
14.2.2	Noise Modelling Methodology	214
14.2.3	Construction Phase Noise	214
14.2.4	Operational Phase Noise.....	216
14.2.5	Sleep Disturbance.....	217
14.2.6	Off-Site Traffic Noise	217
14.2.7	Rail Noise and Vibration.....	218
14.2.8	Construction Phase Vibration	219
14.2.9	Operational Phase Vibration.....	219
14.2.10	Summary of Potential Noise and Vibration Impacts	220
14.3	Management of Impacts	220

14.4	Objectives and Standards	221
14.5	Management Requirements	221
14.6	Monitoring and Reporting	222
14.7	Commitments	223
	References.....	224
15	Marine Ecology.....	226
15.1	Introduction	226
15.1.1	Marine Communities.....	226
15.2	Marine Communities of the Project Area.....	229
15.2.1	Rocky Shore Communities	229
15.2.2	Hard Coral Communities.....	229
15.2.3	Filter Feeder Communities.....	229
15.2.4	Macroalgae and Seagrasses.....	229
15.2.5	Soft sediment communities	231
15.2.6	Mangrove Communities	231
15.2.7	Fish.....	233
15.3	Protected Species in Darwin Harbour.....	233
15.4	Marine Pests.....	236
15.4.1	Ballast Water	237
15.4.2	Biofouling	238
15.5	Potential Impacts	239
15.5.1	Alteration of Habitat.....	240
15.5.2	Artificial Habitats	242
15.5.3	Dredging	243
15.5.4	Management of Habitat Alteration	249
15.5.5	Dredge Spoil Disposal.....	249
15.6	Commitments	249
	References.....	250
16	Terrestrial Ecology.....	254
16.1	Background	254
16.1.1	Flora Surveys	255
16.1.2	Fauna Survey	257

16.2 Existing Environment	260
16.2.1 Flora	260
16.2.2 Fauna.....	266
16.2.3 Threatened Flora and Fauna Species	268
16.2.4 Threatened Flora and Fauna Species Recorded in Surrounding Areas	271
16.2.5 Migratory and Marine Species	272
16.2.6 Habitat Significance.....	280
16.2.7 Declared Weeds and Other Naturalised Species.....	282
16.3 Potential Impacts	283
16.4 Management of Impacts	285
16.4.1 Objectives and Standards.....	285
16.4.2 Management Requirements	286
16.4.3 Monitoring and Reporting	287
16.5 Commitments	287
References.....	289
17 Visual Amenity	291
17.1 Existing Environment	291
17.1.1 Darwin Harbour landscape	291
17.1.2 Visual User Groups.....	291
17.1.3 Visual Accessibility	292
17.2 Potential Impacts	293
17.3 Management of Potential Impacts	295
17.3.1 Vegetated Buffers	295
17.3.2 Lighting	295
17.3.3 Air Emissions	295
17.4 Commitments	295
References.....	296
18 Historic and Cultural Heritage Values	297
18.1 Legislative and Social Basis for Cultural Heritage Protection	297
18.1.1 Commonwealth Acts	297
18.1.2 Northern Territory Acts	298
18.2 Register Searches.....	299

18.2.1 Northern Territory Heritage Register	299
18.2.2 Northern Territory Archaeological Site Database	300
18.2.3 Sacred Sites Register Inspection.....	301
18.2.4 Australian Heritage Database	301
18.2.5 Australian National Shipwreck Database	301
18.3 History of Darwin and its Environment.....	301
18.4 WWII Archaeological at East Arm	304
18.4.1 RAAF Catalina Squadrons and Flying Boat Base at East Arm	306
18.4.2 Archaeology of the RAAF Flying Boat Base	306
18.4.3 Anti Aircraft Operations at East Arm	307
18.4.4 Z Special Unit at East Arm	307
18.4.5 Archaeological Features of the Lugger Maintenance Section	308
18.5 Maritime Cultural Heritage – Darwin Harbour	308
18.5.1 Shipwrecks in Darwin Harbour.....	310
18.6 Flying Boat Wreck Sites in the East Arm Area.....	311
18.6.1 19 th February 1942 and the US Navy Catalina Aircraft.....	312
18.6.2 RAAF Catalina Aircraft Wrecks	314
18.7 Background Ethnography.....	314
18.8 Indigenous Archaeology of Darwin Harbour.....	315
18.9 Results of Heritage Study	317
18.9.1 Terrestrial Archaeology.....	317
18.9.2 Indigenous Cultural Heritage.....	317
18.9.3 Historic Cultural Heritage.....	317
18.9.4 Heritage Site Images.....	321
18.10 Maritime Archaeology within the Vicinity of Development Areas	323
18.10.1 Unidentified Shipwreck 1	324
18.10.2 Kelat Shipwreck	324
18.10.3 Catalina Aircraft Wrecks	326
18.11 Heritage Significance Assessment	326
18.11.1 Indigenous Cultural Heritage.....	329
18.11.2 Cultural Significance	329
18.11.3 Indigenous Archaeology Assessment.....	329
18.11.4 WWII Terrestrial Site Assessment.....	330

18.11.5 Heritage Significance of the WWII Aircraft Wreck Sites	331
18.11.6 Heritage Value of Maritime Shipwrecks.....	331
18.12 Cultural Heritage Management	332
18.12.1 Sites of Interest.....	332
18.12.2 Cultural Heritage Management Summary	332
18.12.3 Construction Cultural Heritage Management Plan.....	335
18.12.4 Indigenous Cultural Heritage Sites	335
18.12.5 Historic WWII Archaeological Sites	335
18.12.6 Maritime Wreck sites outside the proposed development area.....	336
18.12.7 Maritime Wrecks Site within the proposed development zone.....	336
18.13 Commitments	336
References.....	337
19 Biting Insects.....	338
19.1 Background	338
19.2 Existing Environment	343
19.2.1 Mosquitoes	343
19.2.2 Midges.....	345
19.3 Potential Impacts	346
19.3.1 Potential Impact to Health.....	346
19.3.2 Potential Impact on Mosquito Habitats	349
19.4 Management of Impacts	350
19.4.1 Objectives and Standards.....	350
19.4.2 Management Requirements	351
19.4.3 Monitoring and Reporting	353
19.5 Commitments	353
References.....	355
20 Economics	357
20.1 Introduction	357
20.1.1 Objectives.....	357
20.1.2 Assumptions	358
20.2 Baseline Economic Conditions	358
20.2.1 Current Facilities.....	358

20.2.2 Operating Volumes	359
20.2.3 Demand for East Arm Port Services	360
20.2.4 Integration with Rail.....	362
20.2.5 Demand Projections	364
20.2.6 Operational Capacity to Meet Increased Demand	364
20.2.7 Proposed Project	364
20.3 Potential Impacts - Economic.....	367
20.3.2 Macro Effects of Port Operation and on the NT Economy	368
20.3.3 Risk Assessment	369
References.....	370
21 Fire	371
21.1 Existing Environment.....	371
21.2 NT Fire Management Regulatory Framework.....	378
21.3 Fire History	379
21.4 Potential Impacts	381
21.5 Fire Risk.....	381
21.6 Impacts of the Proposal	381
21.6.1 Changes to the Fire Regime	381
21.6.2 Flammable Materials.....	382
21.6.3 Sources of Ignition	382
21.7 Fire Management and Mitigation Measures	382
21.7.1 General Measures	382
21.7.2 Management Measures	383
21.8 Emergency Preparedness, Response and Recovery	384
21.9 Residual Risk	385
21.10 Commitments	385
References.....	386
22 Waste, Hazardous Materials and Environmental Nuisance.....	387
22.1 Introduction	387
22.2 Waste	387
22.2.1 Liquid Wastes.....	387
22.2.2 Solid Wastes.....	388

22.3 Management and Mitigation Measures	389
22.3.1 Waste.....	389
22.3.2 Sewage.....	390
22.4 Commitments	391
References.....	392
23 Social Environment.....	393
23.1 Existing Conditions	393
23.1.1 Data Sources and Limitations	393
23.1.2 Description of Local Area	394
23.1.3 Demography	395
23.1.4 Health	398
23.1.5 Education.....	398
23.1.6 Housing.....	399
23.1.7 Industry of Employment, Labour Force and Income	400
23.1.8 Community Infrastructure and Services	403
23.2 Potential Social Environment Impacts.....	405
23.2.2 Employment	405
23.2.3 Local Content.....	406
23.2.4 Access to Community Goods and Services	406
23.2.5 Community Health, Safety and Disturbance	407
23.2.6 Social / Community Structures	408
23.2.7 Housing and Accommodation	408
23.2.8 Changes to Land Use, Physical Environment and Amenity.....	408
23.3 Management of Impacts	409
23.3.1 General.....	409
23.3.2 Monitoring and Reporting	410
23.4 Commitments	410
References.....	412
24 Stakeholder Consultation.....	414
24.1 Stakeholder Consultation Strategy	414
24.2 Identification of Key Stakeholders	414
24.3 Consultation Program	415

24.4	Phase 1 Consultation Feedback.....	416
24.5	Consultation during Exhibition of this DEIS	424
	References.....	425
25	Risk Assessment	426
25.1	Introduction	426
25.2	Approach	426
25.2.1	Overview of the Approach	426
25.2.2	What is Risk?	428
25.3	Risk Identification	428
25.3.1	Event Trees.....	429
25.3.2	Estimating Likelihoods.....	430
25.3.3	Estimating Consequences.....	430
25.3.4	Risk Register	431
25.4	Impact Analysis.....	435
25.5	Impact Evaluation	435
25.5.1	Known Impacts	436
25.5.2	Potential Impacts (Risks)	440
25.6	Conclusions	449
26	Environment Management Plan.....	450
26.1	Environmental Management Framework.....	450
26.1.1	Overview of the Environmental Management System	450
26.1.2	DPC Environmental Policy.....	451
26.1.3	Plan.....	454
26.1.4	Do	454
26.1.5	Check	454
26.1.6	Review	454
26.2	EMP Roles and Responsibilities	454
26.2.1	Darwin Port Corporation	454
26.2.2	Other Parties	457
26.2.3	Specific Advisory Bodies.....	458
26.2.4	Government Agencies.....	459
26.3	Risk Management Approach.....	460

26.3.1	Estimating Likelihoods and Consequences	461
26.3.2	Risk Register	462
26.4	Development of Objectives and Targets	462
26.5	Management and Implementation	463
26.5.1	Overview	463
26.5.2	Systems	463
26.5.3	Regulatory Compliance.....	464
26.5.4	Planning	464
26.5.5	Communication Management Plan	465
26.5.6	Energy and Resource Management Plan	466
26.5.7	Air Quality and Emissions Management Plan.....	467
26.5.8	Land and Soils Management Plan.....	468
26.5.9	Water and Marine Sediments Management Plan.....	469
26.5.10	Flora and Fauna Management Plan	470
26.5.11	Biting Insect Management Plan.....	472
26.5.12	Hydrocarbons and Hazardous Materials Management Plan	473
26.5.13	Waste Management Plan.....	474
26.5.14	Cargo Handling – Bulk Minerals Management Plan.....	475
26.5.15	Cultural Heritage Management Plan	475
26.6	Social Management Plan.....	476
	References.....	478
27	Draft Dredge Management Plan	479
27.1	Introduction	479
27.2	Geotechnical Information.....	480
27.3	Dredge Material Disposal	480
27.4	Environmental Effects	481
27.5	Environmental Management	481
	References.....	482
28	Commitments Register	483
29	Glossary.....	489
30	List of Contributors.....	491

31 Limitations 493