

TABLE OF CONTENTS

	<i>Page Number</i>
LIST OF FIGURES.....	IX
LIST OF TABLES.....	XI
LIST OF APPENDICES	XII
1 EXECUTIVE SUMMARY.....	XIV
1.1 INTRODUCTION.....	XIV
1.2 TERMS OF REFERENCE	XVI
1.3 REGULATORY FRAMEWORK.....	XVI
1.4 ENVIRONMENTAL SETTING & BASELINE.....	XVI
1.5 REGIONAL LOCATION.....	XVII
1.6 SITE SPECIFIC LOCATIONS.....	XVII
1.7 APPROACH & METHODOLOGY	XVIII
1.8 PROJECT DESCRIPTION.....	XVIII
1.9 POTENTIAL IMPACTS IDENTIFIED	XVIII
1.9.1 <i>Negative</i>	xviii
1.9.2 <i>Positive</i>	xix
1.10 IMPACT MITIGATION	XIX
1.11 IMPACT MAXIMIZATION.....	XX
1.12 CONCLUSION.....	XX
1.12.1 <i>Recommendations</i>	xxi
2 POLICY, LEGISLATION AND REGULATIONS	23
2.1 POLICY, LEGAL & ADMINISTRATIVE FRAMEWORK	23
2.1.1 <i>ALCOA'S POLICIES, PRINCIPLES AND GUIDELINES</i>	23
2.1.1.1 Alcoa's Environmental Policy	23
2.1.1.2 Alcoa's Environmental Principles.....	24
2.1.1.3 Alcoa's Bauxite Mine Rehabilitation Standards & Guidelines	26
2.2 LOCAL POLICIES, LEGISLATION AND REGULATIONS	29
2.2.1 <i>Policy, Legislation, Regulations & Standards</i>	29
2.2.1.1 AGENDA 21.....	30
2.2.1.2 Natural Resources Conservation Authority Act, 1991	32
2.2.1.3 Wildlife Protection Act, 1945	33
2.2.1.4 Watershed Protection Act, 1963.....	34
2.2.1.5 Mining Act, 1975	34
2.2.1.6 Minerals (Vesting) Act, 1947.....	34
2.2.1.7 Bauxite and Alumina (Special Provisions) Act, 1978	34
2.2.1.8 Bauxite and Alumina Encouragement Act, 1950	35
2.2.1.9 Town & Country Planning Act, 1987	35
2.2.1.10 Forestry Act, 1937.....	35
2.2.1.11 Water Resources Act; the Underground Water Control Act, 1959.....	36
2.2.1.12 Jamaica National Heritage Trust Act, 1985.....	36
2.2.1.13 The Beach Control Act (1956).....	37
2.2.1.14 The Public Health Act (1974)	39
2.2.1.15 Disaster Preparedness and Emergency Management Act, 1993.....	39
2.2.1.16 National Solid Waste Management Authority Act, 2001	40
2.2.1.17 Occupational Safety & Health Act, 2003 (DRAFT)	40
2.2.1.18 Clarendon Parish Provisional Development Order, 1982.....	41
2.2.1.19 Manchester Parish Provisional Development Order, 1974.....	41
2.2.2 <i>Summary of the Legislation and Responsible Agencies</i>	42
3 DESCRIPTION OF THE ENVIRONMENT	44
3.1 LAND USE AND AESTHETICS	44
3.1.1 <i>LAND USE</i>	44
3.1.1.1 Introduction.....	44

3.1.1.2	Historical.....	44
3.1.1.3	Topography	46
3.1.1.4	Area and Land Cover.....	47
3.1.1.5	Land Capability.....	48
3.1.1.6	Development Strategy.....	49
3.1.1.7	Industrial	51
3.1.1.8	Parish Council/Land use Zoning	53
3.1.2	<i>Aesthetics</i>	54
3.1.3	<i>Potential Uses</i>	54
3.2	GEOTECHNICAL ANALYSIS AND SOIL.....	56
3.2.1	<i>TERMS OF REFERENCE</i>	57
3.2.2	<i>EXPANSION OF JAMALCO REFINERY AND RESIDUE DISPOSAL AREA, HAYES, CLARENDON</i>	57
3.2.2.1	GEOLOGY	57
3.2.2.2	GEOTECHNICAL CHARACTERISTICS.....	62
3.2.2.3	SOILS	64
3.2.2.4	MINERAL RESOURCES	66
3.2.3	<i>PROPOSED MINING EXPANSION AREAS, MANCHESTER</i>	66
3.2.3.1	GEOLOGY	66
3.2.3.2	GEOTECHNICAL CHARACTERISTICS	70
3.2.3.3	SOILS	72
3.2.3.4	MINERAL RESOURCES	73
3.3	AIR QUALITY AND WEATHER.....	74
3.3.1	<i>Air Quality</i>	74
3.3.1.1	Air Quality Management Program.....	74
3.4	WEATHER.....	79
3.4.1	<i>Regional Setting/Sphere of Influence</i>	79
3.4.1.1	Proposed Mining Area	79
3.4.1.2	Refinery Area.....	79
3.4.1.3	Rocky Point Port	80
3.4.1.4	Mining Area Climate	80
3.4.1.5	Refinery and Port Climate.....	81
3.4.2	<i>Rainfall</i>	81
3.5	WATER RESOURCES	83
3.5.1	<i>Hydrogeology</i>	83
3.5.1.1	Hydrostratigraphy	83
3.5.1.2	Hydrogeologic Characteristics	86
3.5.1.3	Structure.....	89
3.5.1.4	Topography and Drainage.....	91
3.5.2	<i>Hydrology</i>	92
3.5.2.1	Surface Water Hydrology	92
3.5.2.2	Ground Water Hydrology	93
3.5.3	<i>Water Resources</i>	95
3.5.3.1	Well Locations and Yields	95
3.5.3.2	Groundwater Levels	100
3.5.3.3	Discharge	103
3.5.3.4	Reservoir Volume	103
3.5.4	<i>Water Quality</i>	104
3.5.4.1	Ambient Water Quality	104
3.5.4.2	Groundwater Chemical Types.....	106
3.5.4.3	Sources of Groundwater Contamination	106
3.5.4.4	Contamination Criteria.....	108
3.5.5	<i>Expansion of Plant-Impact on Water Resources</i>	127
3.5.5.1	Introduction.....	127
3.5.5.2	Risks	127
3.5.6	<i>Flood Risk</i>	136
3.5.7	<i>Early Warning/Monitoring System</i>	139
3.5.8	<i>Conclusions</i>	141
3.6	WILDLIFE AND VEGETATION.....	143
3.6.1	<i>Introduction</i>	143

3.6.2	<i>Terms of Reference</i>	145
3.6.3	<i>Methodology</i>	145
3.6.4	<i>Ecological Context</i>	145
3.6.4.1	National Biological diversity – International and National levels.....	146
3.6.5	<i>Findings</i>	147
3.6.5.1	Description of Vegetation types	147
3.6.5.2	Other Important Ecological Areas.....	152
3.6.5.3	Railway Route Mine to Plant	153
3.6.5.4	Residue Disposal Area	157
3.6.5.5	Coastal vegetation	161
3.6.5.6	Protected areas	168
3.6.5.7	Faunal studies.....	168
3.6.5.8	Other fauna.....	171
3.6.5.9	Ecological Relationships.....	180
3.6.5.10	Biodiversity levels.....	180
3.6.6	<i>Conclusions & Recommendations</i>	182
3.6.6.1	Conclusions.....	182
3.6.6.2	Recommendations.....	182
3.7	MARINE ASSESSMENT	185
3.7.1	<i>INTRODUCTION</i>	185
3.7.1.1	Regional Setting.....	185
3.7.1.2	Study Area Demarcation:.....	189
3.7.2	<i>MARINE ASSESSMENT METHOD DESCRIPTION:</i>	190
3.7.2.1	Aerial Photo Interpretation:.....	190
3.7.2.2	Ground Verification	190
3.7.2.3	Oceanographic Assessment Methods:.....	192
3.7.2.4	Limitations	194
3.7.3	<i>OBSERVATIONS</i>	194
3.7.3.1	Aerial Photo Analysis – Marine Observations:.....	194
3.7.3.2	Diver-assisted Visual Observations – Substrate Zonations:.....	195
3.7.3.3	Diver-assisted Visual Observations- Marine Species:.....	197
	<i>Caulerpa verticillata</i>	202
3.7.3.4	Percentage Cover Reef Resources:.....	203
3.7.3.5	Oceanography - Aerial Photo and Drogue Tracking Observations	203
3.7.4	<i>CONCLUSIONS:</i>	205
3.7.4.1	Reef Resources Status:.....	205
3.7.4.2	Oceanography:	206
3.7.4.3	Comparison with 1996 Study.....	206
3.7.4.4	Implications for Future Development of the Terminal.....	207
3.8	ARCHAEOLOGICAL AND HISTORICAL RESOURCES	208
3.8.1	<i>Summary</i>	208
3.8.1.1	Manchester.....	208
3.8.1.2	Clarendon.....	208
3.8.1.3	National Monuments.....	209
3.8.1.4	Protected Natural heritage Sites	209
3.8.2	<i>Expounded Overview</i>	211
3.8.2.1	Clarendon's Heritage Sites.....	211
3.8.2.2	Manchester's Heritage Sites.....	215
3.8.2.3	Churches	217
3.8.2.4	Great Houses of Manchester	219
3.9	NOISE LEVELS AND VIBRATION	222
3.9.1	<i>Mining</i>	222
3.9.2	<i>Refinery</i>	222
3.9.3	<i>Audiometric Survey</i>	222
3.9.3.1	Port.....	226
3.9.4	<i>Vibration Analysis</i>	227
3.10	NATURAL HAZARD VULNERABILITY	228
3.10.1	<i>Natural Hazard Vulnerability - Clarendon</i>	228
3.10.1.1	Flooding.....	228
3.10.1.2	Landslides	230

3.10.1.3	TECTONICS AND FAULTING	232
3.10.1.4	Seismic Activity.....	233
3.10.1.5	Conclusion	237
3.10.2	Natural Hazard Vulnerability - Manchester.....	238
3.10.2.1	Flooding.....	238
3.10.2.2	Landslides	238
3.10.2.3	Tectonics and Faulting	238
3.10.2.4	Seismic Activity.....	239
3.10.2.5	CONCLUSIONS.....	240
4	PROJECT DESCRIPTION	242
4.1	BACKGROUND	242
4.2	THE BAYER PROCESS	243
4.3	THE PROPOSAL.....	246
4.3.1	<i>Major Material Consumption</i>	247
4.3.2	<i>Project Schedule</i>	248
4.3.3	<i>Project Location</i>	248
4.3.4	<i>BAUXITE MINING.....</i>	251
4.3.4.1	Natural Heritage Resources.....	251
4.3.4.2	Bauxite Resource Area.....	251
4.3.4.3	Ore Transportation Systems	252
4.3.4.4	Haul-roads.....	253
4.3.4.5	Land Acquisition and Resettlement	253
4.3.5	<i>Bauxite Mining and Load Station</i>	254
4.3.5.1	Load Station	254
4.3.5.2	Sewage Treatment.....	255
4.3.5.3	Run-off treatment and sedimentation control.....	255
4.3.6	<i>Restoration and Rehabilitation</i>	255
4.3.6.1	Refinery and Efficiency Upgrade.....	255
4.3.6.2	Solid Waste Management	257
4.3.7	<i>PORT UPGRADE.....</i>	257
4.3.7.1	Solid Waste Management	257
4.3.8	<i>UTILITY IMPROVEMENTS.....</i>	257
4.3.8.1	Energy Supply.....	258
4.3.8.2	Sewage Treatment.....	258
4.3.8.3	Residue Disposal Area	260
5	ENVIRONMENTAL IMPACTS	265
5.1	FUGITIVE EMISSIONS	265
5.1.1	<i>Mining.....</i>	265
5.1.2	<i>Transportation of Ore to Plant</i>	265
5.1.3	<i>Refinery.....</i>	265
5.1.4	<i>Transportation of Alumina from Refinery to Port</i>	266
5.1.5	<i>Port</i>	266
5.1.6	<i>Construction Activities.....</i>	266
5.2	AIR QUALITY	267
5.2.1	<i>Mining.....</i>	267
5.2.2	<i>Refinery.....</i>	267
5.3	NOISE.....	268
5.3.1	<i>Mining.....</i>	268
5.3.2	<i>Refinery.....</i>	268
5.3.3	<i>Transportation by Rail and Truck</i>	268
5.3.4	<i>Port</i>	269
5.4	LOSS OF BIODIVERSITY	270
5.4.1	<i>Mining.....</i>	270
5.4.2	<i>Refinery.....</i>	270
5.4.3	<i>Port</i>	270
5.5	WATER SUPPLY	271

5.5.1	<i>Mining</i>	271
5.5.2	<i>Refinery</i>	271
5.5.3	<i>Port</i>	271
5.6	WASTE MANAGEMENT.....	272
5.6.1	<i>Mining</i>	272
5.6.2	<i>Refinery</i>	272
5.6.3	<i>Port</i>	272
5.7	SEWAGE	273
5.7.1	<i>Mining</i>	273
5.7.2	<i>Refinery</i>	273
5.7.3	<i>Port</i>	273
5.8	VIBRATION.....	274
5.8.1	<i>Mining</i>	274
5.8.2	<i>Rail Corridors</i>	274
5.8.3	<i>Refinery and Port</i>	274
5.9	LABOUR	275
5.9.1	<i>Mining</i>	275
5.9.2	<i>Refinery</i>	275
5.9.3	<i>Port</i>	275
5.10	AESTHETICS	276
5.10.1	<i>Mining</i>	276
5.10.2	<i>Refinery and Port</i>	276
5.11	ARCHAEOLOGICAL AND HISTORICAL HERITAGE.....	277
5.11.1	<i>Mine</i>	277
5.11.2	<i>Refinery and Port</i>	277
5.12	STRATEGIC ELEMENTS OF THE EIA.....	278
5.12.1	<i>Macro Economic Level</i>	278
5.12.2	<i>Planned Developments</i>	279
6	SOCIO-ECONOMIC ANALYSIS OF PROJECT IMPACTS	281
6.1	SUMMARY	281
6.1.1	<i>Introduction</i>	281
6.1.2	<i>Objective</i>	281
6.1.3	<i>Methodology</i>	281
6.1.4	<i>The Survey Population</i>	283
6.1.5	<i>Main Findings</i>	283
6.1.5.1	Opinions on the Community	283
6.1.5.2	Awareness and Opinions on Existing Bauxite Operations	284
6.1.5.3	Knowledge and Views on Upgrade Plans	285
6.1.5.4	Availability of Water.....	286
6.2	SOUTHERN CLARENDON.....	287
6.2.1	<i>The Communities</i>	287
6.2.2	<i>Demographic and Social Profile</i>	289
6.2.3	<i>Finding of the Study for the Communities</i>	289
6.2.3.1	Mineral Heights	290
6.2.3.2	Bowens.....	292
6.2.3.3	Raymonds	296
6.2.3.4	Savanna.....	299
6.2.3.5	Hayes Cornpiece	302
6.2.3.6	Hayes Newtown	305
6.2.3.7	Lionel Town.....	308
6.2.3.8	Mitchell Town.....	311
6.2.3.9	Rocky Point.....	314
6.2.3.10	Alley	317
6.2.3.11	Brokenbank/Water Lane	320
6.2.3.12	Cockpit.....	323
6.2.3.13	New Gayle	326
6.2.3.14	Old Gayle	328

6.2.3.15	Portland Cottage.....	331
6.2.3.16	Race Course	334
6.2.3.17	Salt River	337
6.2.3.18	Kemps Hill	340
6.3	NORTHERN MANCHESTER	343
6.3.1	<i>The Communities</i>	343
6.3.2	<i>Demographic and Social Profile</i>	343
6.3.3	<i>FINDINGS OF THE STUDY FOR COMMUNITIES</i>	344
6.3.3.1	Mile Gully.....	344
6.3.3.2	Chudleigh/Lichfield	348
6.3.3.3	Comfort Hall	351
6.3.3.4	Contrivance	353
6.3.3.5	Halifax	356
6.3.3.6	Malton.....	358
6.3.3.7	Grove Place	361
6.3.3.8	Greenvale	364
6.3.3.9	Ballynure.....	367
6.3.3.10	Devon.....	370
6.3.3.11	Race Course/Oxford Land Settlement.....	372
6.3.3.12	MAIN FINDINGS	372
6.3.3.13	Ticky Ticky	375
7	IDENTIFICATION AND ANALYSIS OF ALTERNATIVES.....	378
7.1	ANALYSIS OF ALTERNATIVES.....	378
7.1.1	<i>No Action Alternative</i>	378
7.1.2	<i>Plant Alternatives</i>	378
7.1.2.1	Commission another Plant	378
7.1.2.2	Move Plant and expanded facility to new location.....	378
7.1.2.3	Substitute New Equipment in the Existing Process.....	379
7.1.3	<i>Residue Disposal Alternatives</i>	379
7.1.3.1	Use Alternative Technology for Residue Disposal	379
7.1.3.2	Continued Use of Sealed Impoundments	379
7.1.3.3	At Sea using Pipelines or Barges	380
7.1.3.4	Unsealed Red Mud Lakes	380
7.1.3.5	Disposal in Surface Waterways (Rivers and Streams)	380
7.1.3.6	Shoreline Land Reclamation	380
7.1.4	<i>Mining Alternatives</i>	380
7.1.4.1	Mine Bauxite from areas other than those proposed	380
7.1.5	<i>Port Alternatives</i>	381
7.1.5.1	Share Port Facilities	381
7.1.5.2	Increase Berths at Rocky Point Port.....	381
7.1.6	<i>Transportation Alternatives</i>	381
7.1.6.1	Use Conveyors to Transport Ore to Rail	381
7.1.6.2	Extend Rail Lines to Mines.....	381
7.1.6.3	Transport Alumina to Port via Trucks.....	381
7.1.6.4	Transport Construction Equipment from Port via Rail.....	382
7.1.6.5	Transport Construction Equipment from Port via Existing Roadway	382
7.1.6.6	Transport Construction Equipment from Port via Temporary Access Path.....	382
8	MITIGATION ACTIONS.....	385
8.1	FUGITIVE EMISSIONS.....	385
8.1.1	<i>Mining</i>	385
8.1.2	<i>Transportation of Ore to Plant</i>	385
8.1.3	<i>Refinery</i>	385
8.1.4	<i>Port</i>	386
8.1.5	<i>Construction Activities</i>	386
8.2	AIR QUALITY	387
8.2.1	<i>Mining</i>	387
8.2.2	<i>Refinery</i>	387

8.3	NOISE.....	389
8.3.1	<i>Mining</i>	389
8.3.2	<i>Refinery</i>	389
8.3.3	<i>Transportation by Rail and Truck</i>	389
8.3.4	<i>Port</i>	390
8.4	LOSS OF BIODIVERSITY	391
8.4.1	<i>Mining</i>	391
8.4.1.1	MEMORANDUM OF UNDERSTANDING between JAMALCO and FORESTRY DEPARTMENT OF JAMAICA	394
8.4.1.2	EMERGENCY RESPONSE.....	395
8.4.1.3	Photo-Inventory	396
8.4.2	<i>Refinery</i>	398
8.4.3	<i>Port</i>	398
8.5	WATER SUPPLY.....	399
8.5.1	<i>Mining</i>	399
8.5.2	<i>Refinery</i>	399
8.5.3	<i>Port</i>	399
8.6	WASTE MANAGEMENT.....	400
8.6.1	<i>Mining</i>	400
8.6.2	<i>Refinery</i>	400
8.6.3	<i>Port</i>	400
8.6.4	<i>Closure Plans for Construction</i>	400
8.7	SEWAGE	402
8.7.1	<i>Mining</i>	402
8.7.2	<i>Refinery</i>	402
8.7.3	<i>Port</i>	402
8.8	VIBRATION.....	403
8.8.1	<i>Mining</i>	403
8.8.2	<i>Rail Corridors</i>	403
8.8.3	<i>Refinery and Port</i>	403
8.9	LABOUR	404
8.9.1	<i>Mining</i>	404
8.9.2	<i>Refinery</i>	404
8.9.3	<i>Port</i>	404
8.10	AESTHETICS	405
8.10.1	<i>Mining</i>	405
8.10.2	<i>Refinery and Port</i>	405
8.11	ARCHAEOLOGICAL AND HISTORICAL HERITAGE.....	406
8.11.1	<i>Mines</i>	406
9	ENVIRONMENTAL MANAGEMENT AND TRAINING	408
9.1	ENVIRONMENTAL MANAGEMENT	408
9.1.1	<i>Training</i>	409
10	MONITORING PROGRAMME.....	412
10.1	ENVIRONMENTAL MONITORING PROGRAMME	412
10.2	STRUCTURAL INTEGRITY TESTING	414
11	ENVIRONMENTAL WASTE AND OCCUPATIONAL HEALTH AND SAFETY	417
11.1	RISK ASSESSMENT AND HUMAN HEALTH RISK.....	417
11.2	OCCUPATIONAL HEALTH AND SAFETY.....	419
11.2.1	<i>JAMALCO'S OH&S POLICY</i>	419
11.2.2	<i>DRAFT OCCUPATIONAL HEALTH AND SAFETY ACT 2003</i>	419
11.2.3	<i>Solid and Hazardous Waste Management</i>	420
11.2.3.1	<i>Solid Waste Management</i>	421
11.2.3.2	<i>Hazardous Waste Management</i>	422

11.2.3.3	Landfill Management Program	423
12	PUBLIC INVOLVEMENT	425
12.1	INTRODUCTION.....	425
12.2	COMMUNITY CONTRIBUTIONS	426
12.2.1	<i>Education.....</i>	426
12.2.2	<i>Health</i>	427
12.2.3	<i>Infrastructure Upgrade.....</i>	427
12.2.4	<i>Sports</i>	427
12.3	COMMUNITY CONSULTATION ON EFFICIENCY UPGRADE	428
13	APPENDICES	430
	APPENDIX I: SURVEY INSTRUMENT.....	430
	APPENDIX II: 'JAMALCO AND YOU' Q & A BOOKLET	437
	APPENDIX III: REFORESTATION PLAN IN JAMAICA -MEMORANDUM OF UNDERSTANDING BETWEEN MINISTRY OF AGRICULTURE- FORESTRY DEPARTMENT AND ALCOA	443
14	TERMS OF REFERENCE	448
14.1	SCOPE OF WORK.....	448
1)	<i>Legislative & Regulatory Considerations</i>	448
2)	<i>Land Use and Aesthetics</i>	449
3)	<i>Geotechnical Analysis and Soil.....</i>	449
4)	<i>Air Quality and Weather</i>	449
5)	<i>Water Resources</i>	450
6)	<i>Wild Life and Vegetation.....</i>	450
7)	<i>Marine Assessment.....</i>	451
8)	<i>Archaeological/Historic Resources.....</i>	451
9)	<i>Socio- Economics</i>	452
10)	<i>Noise Levels</i>	452
11)	<i>Solid and Hazardous Waste Management Practice/Landfill</i>	452
12)	<i>Occupational Safety and Health Issues</i>	453
13)	<i>Risk Assessment</i>	453
15)	<i>Natural Hazard Vulnerability.....</i>	454
16)	<i>Analysis of Alternative</i>	454
17)	<i>Closure Plans for Construction Phase</i>	454
18)	<i>Structural Integrity Testing</i>	454
15	TEAM MEMBERS	456
15.1	PROJECT TEAM.....	456
	BIBLIOGRAPHY.....	458

List of Figures

	<i>Page Number</i>
FIGURE 1: PLANNING REGIONS.....	45
FIGURE 2: AGRICULTURAL LAND CAPABILITY	48
FIGURE 3: DEVELOPMENT STRATEGY	50
FIGURE 4: AREAS CLASSIFIED AS URBAN.....	52
FIGURE 5: LOCALITY MAP OF THE PROPOSED PROJECT SITE.....	56
FIGURE 6: GEOLOGY MAP OF SOUTHERN CLARENDON	58
FIGURE 7: HAYES GRAVEL AT SITE OF PROPOSED RESIDUE DISPOSAL POND	60
FIGURE 8: WELL LOGS THROUGH THE HAYES GRAVELS	61
FIGURE 9: PHOTO OF AN RDA DYKE	64
FIGURE 10: SOILS MAP OF HAYES, CLARENDON	65
FIGURE 11: PROPOSED MINING AREA IN MILE GULLY AND CHRISTIANA DEVELOPMENT AREAS.....	67
FIGURE 12: GEOLOGY MAP OF THE JAMALCO PROSPECT AREA, MANCHESTER.....	68
FIGURE 13: LOOKING NORTH OVER ORE BODY N 18° 09.139 W 77° 33.987	70
FIGURE 14: LOOKING EAST AT ORE BODY 90 N 18° 09.991 W 77° 35.119	72
FIGURE 15: SOIL AND SLOPE MAP OF THE JAMALCO MINING PROSPECT AREA IN MANCHESTER.....	73
FIGURE 16: BASIN LOCATION.....	83
FIGURE 17: BASIN WATERSHED MANAGEMENT UNITS	84
FIGURE 18: HYDROSTRATIGRAPHY MAP OF PROJECT AREAS.....	85
FIGURE 19: LOCATION OF CAW	86
FIGURE 20: GEOLOGY OF AREA.....	87
FIGURE 21: CROSS-SECTION – EAST-WEST DIRECTION ACROSS THE HALSE HALL AREA	90
FIGURE 22: CROSS-SECTION – NORTH-SOUTH DIRECTION ACROSS THE HALSE HALL AREA.....	91
FIGURE 23: HYDROLOGIC SUB-DIVISION OF THE RIO MINHO BASIN.....	92
FIGURE 24: LOCATION OF PRODUCTION WELLS	95
FIGURE 25: LOCATION OF THE MONITOR WELLS	98
FIGURE 26: WATER TABLE ELEVATION MAP	102
FIGURE 27: MW 5-PLOT OF SODIUM, CHLORIDE AND SULPHATE CONCENTRATIONS-1994-2004.....	113
FIGURE 28: MW 9-PLOT OF SODIUM, CHLORIDE AND SULPHATE CONCENTRATIONS-1994-2004.....	114
FIGURE 29: MW10-PLOT OF SODIUM, CHLORIDE AND SULPHATE CONCENTRATIONS-1994-2004.....	115
FIGURE 30:HAYES PUBLIC WELL PLOT OF SODIUM, CHLORIDE AND SULPHATE CONCENTRATIONS 1989-2004	116
FIGURE 31: ISO-SODIUM PLOT - APRIL 2004	119
FIGURE 32: FLOOD BOUNDARIES AROUND THE CAW FOR THE 1986 FLOOD EVENTS	138
FIGURE 33: LOCALITY OF THE PROPOSED PROJECT SITE	144
FIGURE 34: TYPICAL VEGETATION RECORDED IN THE PROPOSED MINING AREA - WET LIMESTONE RUINATE	148
FIGURE 35: EPIPHYTIC SPECIMEN ON LARGE TREE SPECIES.....	151
FIGURE 36- LOCATION OF IMPORTANT ECOLOGICAL AREAS.....	153
FIGURE 37: TYPICAL STANDS OF WILD POPONAX FOUND ON AND AROUND RDA	157
FIGURE 38- RDA AND ITS PROXIMITY TO THE RIO MINHO	161
FIGURE 39: VIEW OF COASTLINE APPROACH TO ALUMINA WITH VIEW OF BRAZILETTO MOUNTAINS	161
FIGURE 40: VIEW OF VEGETATION ALONG RAILWAY.....	162
FIGURE 41: BURNT VEGETATION ALONG THE RAILWAY	162
FIGURE 42: BLACK MANGROVES SHOWING DISTINCT PNUEMATOPHORES	164
FIGURE 43: LARGE SPECIMEN OF RED MANGROVE - NOTE DAMAGE FROM HUMAN INTERVENTION.....	164
FIGURE 44- PORTLAND BIGHT PROTECTED AREA	168
FIGURE 45: COMPARISON OF BIODIVERSITY LEVELS.....	181
FIGURE 46: ROCKY POINT PORT	186
FIGURE 47: ENVIRONMENT CONTAINED WITHIN THE PORTLAND BIGHT PROTECTED AREA– LANDSAT TM IMAGE	187

FIGURE 48: COASTAL AND MARINE RESOURCES ADJOINING JAMALCO TERMINAL.....	188
FIGURE 49: MARINE RESOURCES AT JAMALCO MARINE TERMINAL, IMAGE SOURCE .SURVEY DEPT.....	189
FIGURE 50: JAMALCO BENTHIC STUDY TRANSECTS	191
FIGURE 51: JAMALCO CURRENT STUDY STATIONS	193
FIGURE 52: SEAFLOOR SUBSTRATE CHARACTER DEDUCED FROM AIR PHOTO STUDY	195
FIGURE 53: BOTTOM PROFILE AND SUBSTRATE CHARACTER.....	196
FIGURE 54: CURRENT MOVEMENT AS INTERPRETED.....	204
FIGURE 55: CURRENT SPEED AND DIRECTION AS MEASURED BY DROGUES –IMAGE SOURCE SURVEY DEPT.	
.....	205
FIGURE 56: LOCATION OF SELECTED HERITAGE SITES.....	210
FIGURE 57: HALSE HALL GREAT HOUSE.....	212
FIGURE 58: MAY PEN CLOCK TOWER	213
FIGURE 59: ROXBOROUGH CASTLE PLANTATION.....	217
FIGURE 60: MARLBOROUGH GREAT HOUSE, SPUR TREE	218
FIGURE 61: MARSHALL'S PEN GREAT HOUSE.....	219
FIGURE 62: 1986 FLOOD BOUNDARY AND MONITORING WELLS AT CLARENDON ALUMINA WORKS.....	229
FIGURE 63: LANDSLIDE SUSCEPTIBILITY MAP OF SOUTHERN CLARENDON.....	230
FIGURE 64: GRASS COVERING SLOPE OF DYKE OF RESIDUE DISPOSAL AREA.	231
FIGURE 65: CONTOUR MAP SHOWING LIMESTONE ELEVATIONS UNDER PLAIN (ELEVATIONS IN FEET ABOVE SEA LEVEL).	232
FIGURE 66: EPICENTRES OF EARTHQUAKES OCCURRING BETWEEN 1998 AND 2001 IN THE VICINITY OF JAMAICA	234
FIGURE 67: EPICENTRES OF EARTHQUAKES OCCURRING BETWEEN 1998 AND 2001 LOCATED IN AND AROUND JAMAICA	235
FIGURE 68: FAULT MAP OF JAMALCO OF THE JAMALCO MINING PROSPECT AREA IN MANCHESTER.....	239
FIGURE 69: BAYER PROCESS SCHEMATIC	245
FIGURE 70: MINING ACTIVITY	249
FIGURE 71: REFINERY	250
FIGURE 72: PORT.....	251
FIGURE 73: SEPL 530 BOUNDARY	252
FIGURE 74: UPGRADED PLANT LAYOUT.....	256
FIGURE 75: ENUMERATION DISTRICTS SURVEYED IN SOUTHERN CLARENDON - MAP 1 OF 3	287
FIGURE 76: ENUMERATION DISTRCTS SURVEYED IN SOUTHERN CLARENDON - MAP 2 OF 3	288
FIGURE 77: ENUMERATION DISTRICTS SURVEYED IN SOUTHERN CLARENDON - MAP 3 OF 3	288
FIGURE 78: ENUMERATION DISTRICTS SURVEYED FOR NORTHERN MANCHESTR	343
FIGURE 79: ACTIVE MINING IN PROGRESS	396
FIGURE 80: 'MINED-OUT' ORE BODY	396
FIGURE 81: MINED-OUT OREBODY SHOWING COMMENCEMENT OF RECLAMATION	397
FIGURE 82: REHABILITATED 'MINED-OUT' OREBODY BEING USED FOR A PLAYING FIELD AND PASTURE....	397
FIGURE 83: REHABILITATED 'MINED-OUT' AREA RETURNED TO PASTURE	397
FIGURE 84: REHABILITATED LAND RESORED TO HOUSING AND FARMING	398

List of Tables

	<i>Page Number</i>
TABLE 1: NATIONAL LEGISLATION AND RESPONSIBLE AGENCIES	42
TABLE 2: AGRICULTURAL LAND CAPABILITY	49
TABLE 3: URBAN SETTLEMENT DEVELOPMENT.....	53
TABLE 4: PROPERTIES OF VARIOUS SOIL GROUPS (ADAPTED FROM CONRAD DOUGLAS & ASSOCIATES EIA)	63
TABLE 5: ANNUAL RAINFALL - INCHES. JAMALCO REFINERY	81
TABLE 6: TEMPERATURE - JAMALCO REFINERY	82
TABLE 7: AREAS OF THE HYDROSTRATIGRAPHY UNITS OF THE SUB-DIVISIONS OF THE RIO MINHO HYDROLOGIC BASIN	85
TABLE 8: LIST OF PRODUCTION WELLS EAST OF THE RIO MINHO AND WITHIN THE VICINITY OF THE CAW	96
TABLE 9: CONSTRUCTION DETAILS OF MONITOR WELLS-JAMALCO-CAW	99
TABLE 10: COMPARISON OF WATER TABLE ELEVATIONS FOR THE MONITOR WELLS.....	102
TABLE 11: TYPICAL BACKGROUND QUALITY OF GROUNDWATER IN THE LIMESTONE AQUIFER-CLARENDRON.	105
TABLE 12: PARAMETERS ANALYZED FOR EACH WATER SAMPLE, MW1 TO 12.....	111
TABLE 13: LIST OF WELLS AND PARAMETERS-MONTHLY SAMPLING PROGRAMME JAMALCO	111
TABLE 14: LIST OF FACILITIES, SOURCES, SAMPLE SITES AND PARAMETERS ANALYZED.....	112
TABLE 15: ANALYTICAL RESULTS OF HEAVY METALS FOR HAYES PUBLIC WELL (NWC) – APRIL 2004	117
TABLE 16: SUMMARY OF ANALYTICAL RESULTS AND FIELD DATA – APRIL 2004.....	121
TABLE 17: SUMMARY OF ANALYTICAL RESULTS AND FIELD DATA – APRIL 2004.....	122
TABLE 18: ANALYTICAL RESULTS-METALS-JANUARY 2004	123
TABLE 19: ANALYTICAL RESULTS-NON-METALS AND BACTERIOLOGICAL-JANUARY 2004.....	124
TABLE 20: ANALYTICAL RESULTS-PESTICIDES/PCBS-JANUARY 2004	125
TABLE 21: ANALYTICAL RESULTS-ORGANICS-JANUARY 2004	126
TABLE 22: ANNUAL ABSTRACTION FROM WELLS SUPPLYING CAW-1988 TO 2004	131
TABLE 23: COMPARISON OF MAXIMUM ABSTRACTION FROM WELLS TO CAW VERSUS LICENSED	132
TABLE 24-FLORA DIVERSITY	146
TABLE 25- FAUNA DIVERSITY	146
TABLE 26: WET LIMESTONE (RUINATE).....	148
TABLE 27: WET LIME STONE LOWER REGION	150
TABLE 28: THORN SCRUB	158
TABLE 29: COASTAL SPECIES	165
TABLE 30: LIMESTONE	170
TABLE 31: COASTAL AND THORN SCRUB	171
TABLE 32: SPECIES LIST - ZONE A	199
TABLE 33: SPECIES LIST - ZONE B	201
TABLE 34: SPECIES LIST - ZONE E.....	202
TABLE 35: PROPOSED UPGRADE CHANGES - PORT	246
TABLE 36: PROPOSED UPGRADE CHANGES -REFINERY	246
TABLE 37: PROPOSED UPGRADE CHANGES -REFINERY - CONTINUED	247
TABLE 38: PROPOSED CHANGES UPGRADE - MINES.....	247
TABLE 39: PRESENT AND CURRENT QUANTITIES OF MATERIALS FOR UPGRADE	247
TABLE 40: RISKS AND THEIR PREVENTATIVE ACTIONS	417

List of Appendices

	<i>Page Number</i>
APPENDIX I: SURVEY INSTRUMENT	430
APPENDIX II: ‘JAMALCO AND YOU’ Q & A BOOKLET.....	437
APPENDIX III: REFORESTATION PLAN IN JAMAICA –MEMORANDUM OF UNDERSTANDING BETWEEN MINISTRY OF AGRICULTURE- FORESTRY DEPARTMENT AND ALCOA.....	443