Appendix VIII. Results of the causal chain analyses for Main Area of Concern 01: Water Quality Degradation

Table A1.1: Environmental Impacts Water Quality Degradation (Severity and Scope)

Environmental Impacts	1.1.	1.2.	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.3.6	1.3.7	1.3.8	1.3.9		
	Alteration of natural river flow and changes in	Degradation of ground and surface water quality	Microbiological contamination	Nutrient enrichment	Chemical contamination (excluding oil spills)	Suspended solids	Solid wastes / marine debris (plastics etc.)	Oil spills (drilling, exploitation, transport, processing, storage	Noise pollution	Thermal pollution	Radioactive contamination	SEVERITY	SCOPE
Degradation of freshwater	1	4										5	4
Reduction in freshwater discharge	4											4	3
Altered coastal sediment dynamics	4											4	3
Shoreline changes (erosion/accretion)	4											4	4
Increased siltation	4					4						8	3
Reduction in clarity of coastal waters (light available for photosynthetic organisms)	4					4		1				9	3
Salinisation of soils	4	2										6	3
Degradation of soil quality	1	2						1				4	3
Degradation of floodplains	4						1	2				7	3
Degradation of deltas	4					1	1	2				8	3
Degradation of salt marshes	4					1	1	2				8	3
Degradation of estuaries	4	3				1	1	2				11	3
Damage to sandy beaches	1					1	1	2				5	3
Damage to rocky shores	1						1	2				4	2
Degradation of mangroves	4	1				2	1	2				10	4
Degradation of coral reefs	3					3	1	2				9	4
Degradation of seagrass	4					3	1	2				10	4
Altered extent of mud beds	4					3						7	3
Decreased natural productivity	4	2	1		1	3		2				13	3
Changes in nutrient input	4	2		3								9	3

Environmental Impacts	**1.1.**	**1.2.**	**1.3.1**	**1.3.2**	**1.3.3**	**1.3.4**	**1.3.5**	**1.3.6**	**1.3.7**	**1.3.8**	**1.3.9**		
	Alteration of natural river flow and changes in	**Degradation of ground and surface water quality**	**Microbiological contamination**	Nutrient enrichment	Chemical contamination (excluding oil spills)	Suspended solids	**Solid wastes / marine debris (plastics etc.)**	**Oil spills (drilling, exploitation, transport, processing, storage**	Noise pollution	Thermal pollution	Radioactive contamination	**SEVERITY**	**SCOPE**
Loss of biodiversity	4	1	1	2	1	1	1	3			1	15	3
Modification of habitats (phase shifts)	3	1		2		1		2		1		10	3
Mortality of fish and macro-benthos	1		1	2	1		1	1			1	8	3
Declines in seabird populations	1				1		1	2				5	3
Declines in turtle populations	1				1		2	2				6	3
Declines in marine mammal populations					1		1	3	2		1	8	3
Sub-lethal affects on marine organisms					1	1		2			1	5	3
Chronic effects on marine organisms					1			2			1	4	3
Bio-accumulation of toxins up the food chain					3			3				6	3
Reduction in water quality (smells and colour)		1	2	3	2	3		3				14	3
Eutrophication and anoxic conditions ("Dead zones")		1	3	3				2				9	3
Algal blooms		1	2	3						1		7	3
Increase in the incidences of diseases in marine organisms			3	1	1							5	3
High levels of pathogenic organisms			3	1	1							5	3

Table A1.2: Inter-relationship between Water Quality Degradation issues and other issues.

1.1.	1.2.	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.3.6	1.3.7	1.3.8	1.3.8	
Alteration of natural river flow and changes in freshwater input and sediment load	Degradation of ground and surface water quality	Microbiological contamination	Nutrient enrichment	Chemical contamination (excluding oil spills)	Suspended solids	Solid wastes / marine debris (plastics etc.)	Oil spills (drilling, exploitation, transport, processing, storage, chemical)	Noise pollution	Thermal pollution	Radioactive contamination	**Issue**
→											Shoreline modification and coastal erosion
→			→			→	→				Degradation of coastal habitats (beaches, dunes)
→		→	→	→	→	→	→		→		Degradation of coral reefs
→	→	→	→	→	→	→	→		→	→	Degradation of seagrass beds
→	→	→	→	→	→	→	→				Degradation of mangroves
→	→	→	→	→		→	→				Degradation of wetlands
→		→		→		→	→			→	Declines in shore/seabirds
→		→		→		→	→	→		→	Declines in marine mammals
→		→		→		→	→			→	Declines in sea turtles
→		→					→			→	Declines in commercial fish
→		→					→			→	Decline in prawns and shrimps

Table A1.3: Ecosystem Services affected by environmental impacts of Water Quality Degradation on

	PROVISIONING SERVICES								REGULATING SERVICES									SUPPORTING				CULTURAL& AMENITY SERVICES							
Environmental Impacts	**Pro01** Food (e.g. fish, game fruit)	**Pro02** Freshwater (e.g. for drinking, irrigation, cooling)	**Pro03** Raw materials (e.g. fibre, timber, fuel wood, fodder, fertilizer)	**Pro04** Genetic resources (e.g. for crop improvement and medicinal purposes)	**Pro05** Biochemical medicines and pharmaceuticals (e.g. biochemical	**Pro06** Ornamental resources (e.g. artisan work, decorative plants, pet animals, fashion)	**Pro07** Geological resources*	**Pro08** Energy*	**Reg01** Air quality regulation (e.g. Capturing dust, chemicals, etc)	**Reg02** Climate regulation (e.g. Carbon sequestration, influence of vegetation on	**Reg03** Natural hazard regulation (e.g. Storm protection and flood prevention)	**Reg04** Regulation of water flows (e.g. Natural drainage, irrigation and drought	**Reg05** Waste treatment (especially water purification)	**Reg06** Erosion regulation / prevention	**Reg07** Nutrient cycling and maintenance of fertility (incl. soil formation)*	**Reg08** Pollination	**Reg09** Biological control (e.g. Seed dispersal, pest and disease control)	**Sup02** Maintenance of life cycles (incl. nursery, breeding, feeding, feeding)	**Sup02** Maintenance of genetic diversity (gene pool protection)	**Sup03** Photosynthesis and primary production*	**Sup04** Secondary production*	**Cul01** Aesthetics information	**Cul02** Opportunities for recreation, tourism and lifestyle	**Cul03** Inspiration for culture, art and design (Cultural heritage values)	**Cul04** Spiritual experience	**Cul05** Bequest, intrinsic and existence*	**Cul06** Information for cognitive development Knowledge systems and education	**Cul07** Social relations*	**Cul08** Sense of place*
Degradation of freshwater quality	↑	↑															↑	↑				↑	↑						
Reduction in freshwater discharge	↑	↑						↑																					
Altered coastal sediment dynamics														↑														?	
Shoreline changes (erosion/accretion)											↑	↑		↑															
Increased siltation												↑	↑															?	
Reduction in clarity of coastal waters (light available for photosynthetic organisms)																		?				↑	↑			↑			
Salinisation of soils		↑											↑		↑					↑									
Degradation of soil quality	↑														↑					↑	↑								
Degradation of floodplains		↑										↑			↑														
Degradation of deltas															↑														
Degradation of salt marshes	↑														↑														
Degradation of estuaries	↑														↑			↑											
Contamination of sandy beaches														↑	↑			↑				↑	↑			↑		↑	
Contamination of rocky shores																		↑											

	PROVISIONING SERVICES								REGULATING SERVICES									SUPPORTING				CULTURAL& AMENITY SERVICES							
	Pro01	**Pro02**	**Pro03**	**Pro04**	**Pro05**	**Pro06**	**Pro07**	**Pro08**	**Reg01**	**Reg02**	**Reg03**	**Reg04**	**Reg05**	**Reg06**	**Reg07**	**Reg08**	**Reg09**	**Sup02**	**Sup02**	**Sup03**	**Sup04**	**Cul01**	**Cul02**	**Cul03**	**Cul04**	**Cul05**	**Cul06**	**Cul07**	**Cul08**
Environmental Impacts	Food (e.g. fish, game fruit)	Freshwater (e.g. for drinking, irrigation, cooling)	Raw materials (e.g. fibre, timber, fuel wood, fodder, fertiliser)	Genetic resources (e.g. for crop improvement and medicinal purposes)	Biochemical medicines and pharmaceuticals (e.g. biochemicals, genetic plants, pet animals, fashion)	Ornamental resources (e.g. artisan work, decorative plants, pet animals, fashion)	Geological resources*	Energy*	Air quality regulation (e.g. Capturing dust, chemicals, etc)	Climate regulation (e.g. Carbon sequestration, influence of vegetation on rainfall and temperature)	Natural hazard regulation (e.g. Storm protection and flood prevention)	Regulation of water flows (e.g. Natural drainage, irrigation and drought prevention)	Waste treatment (especially water purification)	Erosion regulation / prevention	Nutrient cycling and maintenance of fertility (incl. soil formation)*	Pollination	Biological control (e.g. Seed dispersal, pest and disease control)	Maintenance of life cycles (incl. nursery, resting, breeding, feeding)	Maintenance of genetic diversity (gene pool protection)	Photosynthesis and primary production*	Secondary production*	Aesthetics information	Opportunities for recreation, tourism and lifestyle	Inspiration for culture, art and design (Cultural heritage value)	Spiritual experience	Bequest, intrinsic and existence*	Information for cognitive development (knowledge systems and education)	Social relations*	Sense of place*
Degradation of mangroves	↑													↑	↑											↑			
Degradation of coral reefs	↑				↑									↑	↑			↑		↑	↑					↑			
Degradation of seagrass	↑														↑											↑			
Altered extent of mud beds	↑														↑														
Decreased natural productivity	↑					↑									↑					↑	↑								
Changes in nutrient input	↑														↑			↑		↑	↑								
Loss of biodiversity	↑				↑	↑											↑	↑	↑	↑	↑	↑	↑	↑		↑	↑	↑	↑
Modification of habitats (phase shifts)	↑									↑							↑	↑		↑		↑	↑	↑		↑	↑	↑	↑
Mortality of fish and macro-benthos	↑					↑											↑	↑	↑	↑	↑								
Declines in seabird populations																						↑	↑			↑			
Declines in turtle populations																	↑					↑	↑			↑			
Declines in marine mammal populations																	↑					↑	↑			↑			
Sub-lethal affects on marine organisms	↑					↑												↑					↑			↑			
Chronic effects on marine organisms	↑					↑												↑					↑			↑			
Bio-accumulation of toxins up the food chain																										↑			
Reduction in water quality (smells and colour)													↑					↑		↑	↑	↑	↑			↑			

	PROVISIONING SERVICES								REGULATING SERVICES									SUPPORTING				CULTURAL& AMENITY SERVICES							
	Pro01	**Pro02**	**Pro03**	**Pro04**	**Pro05**	**Pro06**	**Pro07**	**Pro08**	**Reg01**	**Reg02**	**Reg03**	**Reg04**	**Reg05**	**Reg06**	**Reg07**	**Reg08**	**Reg09**	**Sup02**	**Sup02**	**Sup03**	**Sup04**	**Cul01**	**Cul02**	**Cul03**	**Cul04**	**Cul05**	**Cul06**	**Cul07**	**Cul08**
Environmental Impacts	Food (e.g. fish, game fruit)	Freshwater (e.g. for drinking, irrigation, cooling)	Raw materials (e.g. fibre, timber, fuel wood, fodder, fertilizer)	Genetic resources (e.g. for crop improvement and medicinal purposes)	Biochemical medicines and pharmaceuticals (e.g. biochemicals, genetic plants, pet animals, fashion)	Ornamental resources (e.g. artisan work, decorative plants, pet animals, fashion)	Geological resources*	Energy*	Air quality regulation (e.g. Capturing dust, aerosols, etc)	Climate regulation (e.g. Carbon sequestration, influence of vegetation on climate)	Natural hazard regulation (e.g. Storm protection and flood prevention)	Regulation of water flows (e.g. Natural drainage, irrigation and drought protection)	Waste treatment (especially water purification)	Erosion regulation / prevention	Nutrient cycling and maintenance of fertility (incl. soil formation)*	Pollination	Biological control (e.g. Seed dispersal, pest and disease control)	Maintenance of life cycles (incl. nursery, breeding habitat, feeding)	Maintenance of genetic diversity (gene pool protection)	Photosynthesis and primary production*	Secondary production*	Aesthetics information	Opportunities for recreation, tourism and lifestyle	Inspiration for culture, art and design (Cultural heritage values)	Spiritual experience	Bequest, intrinsic and existence*	Information for cognitive development (Knowledge systems and education)	Social relations*	Sense of place*
Eutrophication and anoxic conditions ("Dead zones")	↑																↑	↑		↑	↑	↑	↑			↑			
Algal blooms	↑																↑	↑		↑	↑	↑	↑			↑			
Increase in the incidences of diseases in marine organisms	↑					↑											↑	↑								↑			
High levels of pathogenic organisms																	↑									↑			

Table A1.4: Socio-economic impacts as a result of the loss of Ecosystem Services due to Declines in Living Marine Resources

	PROVISIONING SERVICES								REGULATING SERVICES									SUPPORTING					
	Pro01	Pro02	Pro03	Pro04	Pro05	Pro06	Pro07	Pro08	Reg01	Reg02	Reg03	Reg04	Reg05	Reg06	Reg07	Reg08	Reg09	Sup02	Sup02	Sup03	Sup04	CuI01	CuI02
Socio-economic Impacts	Food (e.g. fish, game fruit)	Freshwater (e.g. for drinking, irrigation, cooling)	Raw materials (e.g. fibre, timber, fuel wood, fodder, fertilizer)	Genetic resources (e.g. for crop improvements and medicinal purposes)	Biochemical medicines and pharmaceuticals (e.g. biochemical products, and test organisms)	Ornamental resources (e.g. artisan work, decorative plants, pet animals, fashion)	Geological resources*	Energy*	Air quality regulation (e.g. Capturing dust, chemicals, etc)	Climate regulation (e.g. Carbon sequestration, influence of vegetation on rainfall etc.)	Natural hazard regulation (e.g. Storm protection and flood prevention)	Regulation of water flows (e.g. Natural drainage, irrigation and drought prevention)	Waste treatment (especially water purification)	Erosion regulation / prevention	Nutrient cycling and maintenance of fertility (incl. soil formation)*	Pollination	Biological control (e.g. Seed dispersal, pest and disease control)	Maintenance of life cycles (incl. nursery, spawning, breeding, feeding)	Maintenance of genetic diversity (gene pool protection)	Photosynthesis and primary production*	Secondary production*	Aesthetics information	Opportunities for recreation, tourism and lifestyle
Reduction in quantity of freshwater available for drinking / irrigation etc		←																←					
Reduction in quality of freshwater for drinking / irrigation		←																					
Increased vulnerability to coastal flooding (loss of life and property)											←												
Increased cost of coastal defence											←												
Reduction in hydroelectric power generation potential								←															
Damage to coastal infrastructure																							
Reduction in agricultural productivity (due to salt water intrusion)	←																						
Reduction in opportunities for tourism and leisure											←											←	←
Reduction in aesthetics																						←	←
Reduction in future use value																							
Loss of fisheries resources and revenue	←																						

	PROVISIONING SERVICES								REGULATING SERVICES									SUPPORTING					
	Pro01	**Pro02**	**Pro03**	**Pro04**	**Pro05**	**Pro06**	**Pro07**	**Pro08**	**Reg01**	**Reg02**	**Reg03**	**Reg04**	**Reg05**	**Reg06**	**Reg07**	**Reg08**	**Reg09**	**Sup02**	**Sup02**	**Sup03**	**Sup04**	**Cul01**	**Cul02**
Socio-economic Impacts	Food (e.g. fish, game fruit)	Freshwater (e.g. for drinking, irrigation, cooling)	Raw materials (e.g. fibre, timber, fuel wood, fodder, fertilizer)	Genetic resources (e.g. for crop improvements and medicinal purposes)	Biochemical medicines and pharmaceuticals (e.g. biochemical products, and test organisms)	Ornamental resources (e.g. artisan work, decorative plants, pet animals, fashion)	Geological resources*	Energy*	Air quality regulation (e.g. Capturing dust, chemicals, etc)	Climate regulation (e.g. Carbon sequestration, influence of vegetation on rainfall etc.)	Natural hazard regulation (e.g. Storm protection and flood prevention)	Regulation of water flows (e.g. Natural drainage, irrigation and drought prevention)	Waste treatment (especially water purification)	Erosion regulation / prevention	Nutrient cycling and maintenance of fertility (incl. soil formation)*	Pollination	Biological control (e.g. Seed dispersal, pest and disease control)	Maintenance of life cycles (incl. nursery, spawning, breeding, feeding)	Maintenance of genetic diversity (gene pool protection)	Photosynthesis and primary production*	Secondary production*	Aesthetics information	Opportunities for recreation, tourism and lifestyle
Reduction in fish availability	←																						
Loss of income generating livelihoods associated with fisheries	←										←												
Loss of income generating livelihoods associated with tourism																						←	←
Increased unemployment																							
Reduced quality of seafood products	←																						
Threats to public health	←	←															←						
Human health risk through contact recreation													←										
Human health risk through ingestion of contaminated seafood	←																						
Reduced productivity of workforce due to sickness and ill health	←												←										
Increased cost of living	←							←			←												
Reduction of foreign income / revenues	←																←	←	←	←	←	←	←
Loss of national revenues / reduction in GDP	←					←		←									←	←	←	←			

	PROVISIONING SERVICES								REGULATING SERVICES									SUPPORTING					
	Pro01	**Pro02**	**Pro03**	**Pro04**	**Pro05**	**Pro06**	**Pro07**	**Pro08**	**Reg01**	**Reg02**	**Reg03**	**Reg04**	**Reg05**	**Reg06**	**Reg07**	**Reg08**	**Reg09**	**Sup02**	**Sup02**	**Sup03**	**Sup04**	**Cul01**	**Cul02**
Socio-economic Impacts	Food (e.g. fish, game fruit)	Freshwater (e.g. for drinking, irrigation, cooling)	Raw materials (e.g. fibre, timber, fuel wood, fodder, fertilizer)	Genetic resources (e.g. for crop improvements and medicinal purposes)	Biochemical medicines and pharmaceuticals (e.g. biochemical products, and test organisms)	Ornamental resources (e.g. artisan work, decorative plants, pet animals, fashion)	Geological resources*	Energy*	Air quality regulation (e.g. Capturing dust, chemicals, etc)	Climate regulation (e.g. Carbon sequestration, influence of vegetation on rainfall etc.)	Natural hazard regulation (e.g. Storm protection and flood prevention)	Regulation of water flows (e.g. Natural drainage, irrigation and drought prevention)	Waste treatment (especially water purification)	Erosion regulation / prevention	Nutrient cycling and maintenance of fertility (incl. soil formation)*	Pollination	Biological control (e.g. Seed dispersal, pest and disease control)	Maintenance of life cycles (incl. nursery, spawning, breeding, feeding)	Maintenance of genetic diversity (gene pool protection)	Photosynthesis and primary production*	Secondary production*	Aesthetics information	Opportunities for recreation, tourism and lifestyle
Reduction in wellbeing		←												←								←	←
Reduced resilience	←										←	←		←									
Increasing poverty	←	←			←	←		←				←										←	←
Impacts upon religious festivals / rituals													←										
Loss of social cohesion	←																					←	←

Table A1.5: Socio-Economic Impacts of Water Quality Degradation

Socio-economic Impacts	**1.1.**	**1.2.**	**1.3.1**	**1.3.2**	**1.3.3**	**1.3.4**	**1.3.5**	**1.3.6**	**1.3.7**	**1.3.8**	**1.3.9**

	Alteration of natural river flow and changes in	Degradation of ground and surface water quality	Microbiological contamination	Nutrient enrichment	Chemical contamination (excluding oil spills)	Suspended solids	Solid wastes / marine debris (plastics etc.)	Oil spills (drilling, exploitation, transport,	Noise pollution	Thermal pollution	Radioactive contamination
Reduction in quantity of freshwater available for drinking / irrigation etc	✓	✓									
Reduction in quality of freshwater for drinking / irrigation	✓	✓									
Increased vulnerability to coastal flooding (loss of life and property)	✓										
Increased cost of coastal defence	✓										
Reduction in hydroelectric power generation potential	✓										
Damage to coastal infrastructure	✓										
Reduction in agricultural productivity (due to salt water intrusion)	✓	✓									
Reduction in opportunities for tourism and leisure	✓	✓	✓	✓	✓	✓	✓	✓			✓
Reduction in aesthetics	✓	✓	✓	✓	✓	✓	✓	✓			
Reduction in future use value	✓	✓	✓	✓	✓	✓	✓	✓			
Loss of fisheries resources and revenue	✓	✓	✓	✓	✓	✓		✓			
Reduction in fish availability	✓			✓	✓	✓		✓			
Loss of income generating livelihoods associated with fisheries	✓		✓	✓	✓	✓		✓			✓
Loss of income generating livelihoods associated with tourism	✓	✓	✓	✓	✓	✓	✓	✓			✓
Increased unemployment	✓	✓	✓	✓	✓	✓	✓	✓			
Reduced quality of seafood products			✓		✓			✓			✓
Threats to public health	✓	✓	✓		✓		✓	✓			✓
Human health risk through contact recreation			✓		✓		✓	✓			
Human health risk through ingestion of contaminated seafood		✓	✓		✓			✓			✓
Reduced productivity of workforce due to sickness and ill health		✓	✓		✓						✓
Increased cost of living		✓	✓		✓			✓			
Reduction of foreign income / revenues	✓	✓	✓		✓	✓	✓	✓			
Loss of national revenues / reduction in GDP	✓	✓	✓		✓	✓	✓	✓			
Reduction in wellbeing	✓	✓	✓	✓	✓	✓	✓	✓			✓

Socio-economic Impacts	**1.1.**	**1.2.**	**1.3.1**	**1.3.2**	**1.3.3**	**1.3.4**	**1.3.5**	**1.3.6**	**1.3.7**	**1.3.8**	**1.3.9**
	Alteration of natural river flow and changes in	Degradation of ground and surface water quality	Microbiological contamination	Nutrient enrichment	Chemical contamination (excluding oil spills)	Suspended solids	Solid wastes / marine debris (plastics etc.)	Oil spills (drilling, exploitation, transport,	Noise pollution	Thermal pollution	Radioactive contamination
Reduced resilience	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Increasing poverty	✓	✓	✓	✓	✓	✓	✓	✓			✓
Impacts upon religious festivals / rituals	✓	✓									
Loss of social cohesion	✓	✓					✓	✓			

Table A1.6: Stakeholders affected by Socio-Economic Impacts of Water Quality Degradation

STAKEHOLDERS																									
	Fisheries and Aquaculture						Agriculture and Forestry											Tourism				Mining			
Socio-economic Impacts	Artisanal fishers	Industrial fishers	Recreational fishers	Seaweed farmers	Industrial prawn farmers	Fish & shellfish farmers	Charcoal makers	Small-scale loggers	Industrial loggers	Small-scale farmers	Large-scale farmers	Forest users/herbalists	Pastoralists	Ranchers	Poultry farmers	Dairy farmers	Beekeepers	Tourists	Hotel owners & operators	Small-scale traders	Tour, boat & SCUBA operators	Coral/lime miners	Sand miners	Small-scale salt producers	Industrial salt works
Reduction in quantity of freshwater available for drinking / irrigation etc																									
Reduction in quality of freshwater for drinking / irrigation																									
Increased vulnerability to coastal flooding (loss of life and property)																									
Increased cost of coastal defence																									
Reduction in hydroelectric power generation potential																									
Damage to coastal infrastructure																									
Reduction in agricultural productivity (due to salt water intrusion)																									
Reduction in opportunities for tourism and leisure																									
Reduction in aesthetics																									
Reduction in future use value																									
Loss of fisheries resources and revenue																									
Reduction in fish availability																									
Loss of income generating livelihoods associated with fisheries																									
Loss of income generating livelihoods associated with tourism																									
Increased unemployment																									
Reduced quality of seafood products																									
Threats to public health																									

STAKEHOLDERS																									
	Fisheries and Aquaculture						Agriculture and Forestry											Tourism				Mining			
Socio-economic Impacts	Artisanal fishers	Industrial fishers	Recreational fishers	Seaweed farmers	Industrial prawn farmers	Fish & shellfish farmers	Charcoal makers	Small-scale loggers	Industrial loggers	Small-scale farmers	Large-scale farmers	Forest users/herbalists	Pastoralists	Ranchers	Poultry farmers	Dairy farmers	Beekeepers	Tourists	Hotel owners & operators	Small-scale traders	Tour, boat & SCUBA operators	Coral/lime miners	Sand miners	Small-scale salt producers	Industrial salt works
Human health risk through contact recreation																									
Human health risk through ingestion of contaminated seafood																									
Reduced productivity of workforce due to sickness and ill health																									
Increased cost of living																									
Reduction of foreign income / revenues																									
Loss of national revenues / reduction in GDP																									
Reduction in wellbeing																									
Reduced resilience																									
Increasing poverty																									
Impacts upon religious festivals / rituals																									
Loss of social cohesion																									

Table A1.6 (continued): Stakeholders affected by Socio-Economic Impacts of Water Quality Degradation

STAKEHOLDERS																					
	Industry				Transportation								Energy Production			Urbanisation					
Socio-economic Impacts	Heavy manufacturing industry	Light manufacturing industry	Agro-processing industries	Oil refining	Ports	Dredging companies	Clearing and forwarding	Railway	Roads (incl. traffic)	Airports	Airlines	Shipping	Hydro-dam operators	Power station operators	Renewable energy producers	Solid waste operators	Sewage managers	Property developers	Property owners	Town planners	Coastal community
Reduction in quantity of freshwater available for drinking / irrigation etc																					
Reduction in quality of freshwater for drinking / irrigation																					
Increased vulnerability to coastal flooding (loss of life and property)																					
Increased cost of coastal defence																					
Reduction in hydroelectric power generation potential																					
Damage to coastal infrastructure																					
Reduction in agricultural productivity (due to salt water intrusion)																					
Reduction in opportunities for tourism and leisure																					
Reduction in aesthetics																					
Reduction in future use value																					
Loss of fisheries resources and revenue																					
Reduction in fish availability																					
Loss of income generating livelihoods associated with fisheries																					
Loss of income generating livelihoods associated with tourism																					
Increased unemployment																					
Reduced quality of seafood products																					
Threats to public health																					
Human health risk through contact recreation																					

STAKEHOLDERS																					
	Industry				Transportation								Energy Production			Urbanisation					
Socio-economic Impacts	Heavy manufacturing industry	Light manufacturing industry	Agro-processing industries	Oil refining	Ports	Dredging companies	Clearing and forwarding	Railway	Roads (incl. traffic)	Airports	Airlines	Shipping	Hydro-dam operators	Power station operators	Renewable energy producers	Solid waste operators	Sewage managers	Property developers	Property owners	Town planners	Coastal community
Human health risk through ingestion of contaminated seafood																					
Reduced productivity of workforce due to sickness and ill health																					
Increased cost of living																					
Reduction of foreign income / revenues																					
Loss of national revenues / reduction in GDP																					
Reduction in wellbeing																					
Reduced resilience																					
Increasing poverty																					
Impacts upon religious festivals / rituals																					
Loss of social cohesion																					

Table A1.7A: Direct Causes of Water Quality Degradation (Contribution & Irreversibility)

Direct Causes	1.1.	1.2.	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.3.6	1.3.7	1.3.8	1.3.9	
	Alteration of natural river flow and changes in freshwater input and sediment load	Degradation of ground and surface water quality	Microbiological contamination	Nutrient enrichment	Chemical contamination (excluding oil spills)	Suspended solids	Solid wastes / marine debris (plastics etc.)	Oil spills (drilling, exploitation, transport, processing, storage, shipping).	Noise pollution	Thermal pollution	Radioactive contamination	Contribution
Rainfall variability	1	1					1					**3**
Natural topography	1	1										**2**
Increased evaporation	1	1										**2**
Increased water abstraction	3	1										**4**
Obstruction of natural flows	4	1										**5**
Changes in land use and vegetation cover	4	4		3		4						**15**
Deforestation	4	4		1		4						**13**
Increased sediment loads	3	3	2	2		4	1				1	**16**
Release of un undertreated effluents from point sources		4	3	4	4	2	1			1		**19**
Release of un undertreated effluents from nonpoint sources		4	4	4	2	2	1					**17**
Surface runoff (from agricultural land and urban areas)		4	3	3	2	2	3					**17**
Inappropriate disposal of solid wastes		2	1	1	2	2	4				2	**14**
Accidental release of oil during extraction, refining and transport		2						4				**6**
TOTAL	**21**	**32**	**13**	**18**	**10**	**20**	**11**	**4**	**0**	**1**	**3**	

Table A1.7B: Direct Causes of Water Quality Degradation - Irreversibility

Direct Causes	1.1.	1.2.	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.3.6	1.3.7	1.3.8	1.3.9	
	Alteration of natural river flow and changes in freshwater input and sediment load	Degradation of ground and surface water quality	Microbiological contamination	Nutrient enrichment	Chemical contamination (excluding oil spills)	Suspended solids	Solid wastes / marine debris (plastics etc.)	Oil spills (drilling, exploitation, transport, processing, storage, shipping)	Noise pollution	Thermal pollution	Radioactive contamination	**Irreversibility**
Rainfall variability	4	4					2					**12**
Natural topography	4	4										**8**
Increased evaporation	4	4										**5**
Increased water abstraction	3	3										**4**
Obstruction of natural flows	3	3										**4**
Changes in land use and vegetation cover	4	4		4		4						**16**
Deforestation	2	2		2		2						**8**
Increased sediment loads	2	2	2	2		2	2				2	**14**
Release of un- undertreated effluents from point sources		1	1	1	1	1	1			1		**7**
Release of un -undertreated effluents from non-point sources		2	2	2	2	2	2					**12**
Surface run-off (from agricultural land and urban areas)		3	3	3	3	3	3					**18**
Inappropriate disposal of solid wastes		1	1	1	1	1	1				1	**7**
Accidental release of oil during extraction, refining and transport		4						4				**4**
TOTAL	**26**	**37**	**9**	**15**	**7**	**15**	**11**	**4**	**0**	**1**	**3**	

Table A1.8 : Direct Causes and Sectors contributing towards Water Quality Degradation

	Urbanisation	Tourism	Agriculture & Forestry	Industry	Transportation & Shipping	Mining	Fisheries (industrial / commercial)	Fisheries (semi-industrial - local)	Fisheries (artisanal / traditional)	Fisheries (small scale)	Fisheries (inshore trawl fishery	Fisheries (recreational)	Fisheries (sports)	Fisheries (poaching)	Fisheries (mariculture)	Energy	Environmental	**TOTAL (no. sectors)**
Rainfall variability																	←	**1**
Natural topography																	←	**1**
Increased evaporation																	←	**1**
Increased water abstraction	←	←	←	←		←										←		**6**
Obstruction of natural flows	←	←	←	←	←	←										←		**7**
Changes in land use and vegetation cover	←	←	←	←	←	←												**6**
Deforestation	←	←	←	←		←										←		**6**
Increased sediment loads			←	←		←												**3**
Release of un- undertreated effluents from point sources	←	←	←	←	←	←									←	←		**8**
Release of un -undertreated effluents from non-point sources			←		←										←			**3**
Surface run-off (from agricultural land and urban areas)	←	←	←															**3**
Inappropriate disposal of solid wastes	←	←		←		←										←		**5**
Accidental release of oil during extraction, refining and transport				←	←	←										←		**4**
TOTAL (no. of causes)	**7**	**7**	**8**	**8**	**5**	**8**									**2**	**6**	**3**	

Table A1.9 : Sectors, Resource Use Practices, Underlying and Root Causes

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
		[A]Inappropriate governance	[B]Economic drivers	[C] Inadequate financial resources	[D] Inadequate knowledge & awareness	[E] Cultural traditions	[F] Population pressure & demographics	[G] Poverty & inequality	[H] Climate change & natural processes	[I] Voluntary action fills the governance void	[J] Personal Attitude
1.1.	**Alteration of natural river flow**										
Industry											
(1) Water abstraction and usage for industries	Expansion of industrial sector and increased demand for water		←				←				
	Economic development pressure		←				←				
	Market demand		←				←				
	Lack of planning	←					←				
	Wealth creation and corruption	←									
	Low enforcement and compliance	←									
	Inadequate investment	←		←							
	Inappropriate incentives / subsidies - cheap water (historical)	←					←				
Agriculture & Forestry											
(2) Irrigation practices e.g. (i) Diversion of water courses (ii) Damming / impoundment of rivers (iii) High abstraction and water use	Expansion of agriculture and commercial agriculture sector	←	←		←		←	←			
	Increased demand for food		←				←				
	Lack of technology use of inappropriate methods			←	←						
	Weak national planning regulatory frameworks	←									
	Inadequate planning, lack of land use plans and environmental policy	←			←		←				
	Incorrect incentives for water use		←		←						
	Cultural and historical practices					←					
	Low enforcement and compliance	←		←							
	Wealth creation and corruption	←	←	←				←			
Degradation of catchments and poor land use practices e.g. **(3)** Land clearing for commercial agriculture or logging	High demand for agricultural land, timber, fuel wood		←	←			←	←	←		
	External market demand for timber or agricultural products		←				←	←			
	Weak economy and need for finances		←	←							
	Inadequate or lack of land use plans and environmental policy	←			←		←				
	Weak national planning regulatory frameworks	←									
	Slow policy development	←									
	Low enforcement and compliance	←		←			←	←			
	Lack of monitoring and control capacity	←		←							
	Wealth creation and corruption	←									
(4) Traditional land use practices (slash and burn)	Lack of education and awareness				←	←	←	←			
	Increased demand for farmland		←				←	←			
	External market demand for food products)		←				←		←		

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
		[A]Inappropriate governance	[B]Economic drivers	[C] Inadequate financial resources	[D] Inadequate knowledge & awareness	[E] Cultural traditions	[F] Population pressure & demographics	[G] Poverty & inequality	[H] Climate change & natural processes	[I] Voluntary action fills the governance void	[J] Personal Attitude
	Lack of outreach and education	←		←				←			
	Lack of appropriate technology			←	←			←			
(5) Introduction of alien species (high water consumption)	Wealth creation and corruption	←	←								
	Weak regulatory frameworks	←									
	Slow policy development	←									
	Law enforcement and compliance	←					←	←			
(6) Unsustainable harvesting of timber for fuel wood	Internal market demand for fuel wood	←	←			←	←	←			
	Lack of alternative fuel source				←			←			
	Income generating livelihood		←				←	←			
	Lack of technology			←	←			←			
(7) Seasonally inappropriate farming activities (e.g. ploughing before rain or not applying soil conservation measures).	Lack of education of awareness				←				←		
	Lack of outreach (extension officers)	←		←							
	Lack of appropriate information of seasonal rainfall	←		←	←				←		
	Weak regulatory frameworks	←									
	Low compliance with regulations				←	←	←	←			
(8) Timber for commercial harvesting	Market value driven		←								
	Lack of capacity for compliance	←		←							
Mining											
(9) High water usage / abstraction for processing in commercial mining e.g (i) Open cast mining sand deposits (ii) Alluvial mining	Expansion of commercial mining	←	←				←				
	Employment opportunities and income generating livelihood						←	←			
	External market demand for natural resources		←								
	Global economies		←								
	Lack of or inadequate planning	←									
	Slow policy development	←									
	Low enforcement and compliance	←		←							
	External companies with weak environmental management policies	←									
	Lack of monitoring and control capacity	←		←							
	Weak economy and need for finances			←							
	Wealth creation and corruption	←									
(10) Water abstraction for artisanal / traditional mining e.g. for sapphire and gold	Expansion of artisanal / traditional mining		←				←	←			
	Income generating livelihood						←	←			
	External market demand for natural resources		←								
	Global economies		←								
	Lack of planning	←									

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
		[A]Inappropriate governance	[B]Economic drivers	[C] Inadequate financial resources	[D] Inadequate knowledge & awareness	[E] Cultural traditions	[F] Population pressure & demographics	[G] Poverty & inequality	[H] Climate change & natural processes	[I] Voluntary action fills the governance void	[J] Personal Attitude
	Slow policy development	←									
	Lack of regulation of artisanal mining	←						←			
	Limited capacity for monitoring and control	←		←							
	Weak economy and need for finances			←							
	Wealth creation and corruption	←									
Energy											
(11) Damming / impoundment of rivers for hydroelectric power generation	Increased electricity demand		←				←				
	Economic development pressure		←				←				
	Lack of investment in alternative technologies (e.g. solar)	←		←	←						
(12) High use of water for cooling (e.g. coal / nuclear)	Increased electricity demand		←				←		←		
	Economic development pressure		←				←				
	Demand for cheap power for industries and households						←	←			
	Inadequate energy legislation/policy	←									
	Inadequate investment	←		←							
	Lack of investment in alternative technologies (e.g. solar)	←		←	←						
	Low enforcement and compliance	←									
	Wealth creation and corruption	←									
Tourism											
(13) High water consumption by tourism sector	Increased numbers of tourists		←								
	Weak planning and implementation, lack of land use plans and environmental policy	←		←	←						
	Lack of regulation to encourage water saving	←		←	←						
	Low uptake of alternative technologies (e.g. rain water harvest or grey water recycling)	←		←	←			←			
	Law enforcement and compliance	←									
	Wealth creation and corruption	←									
(14) Clearing of land for tourism	Expansion of tourism sector		←				←				
	Economic development pressures		←				←				
	Limited suitable land available and increased demand		←				←				
	Inadequate planning, lack of land use plans and environmental policy	←		←	←						
	Lack of regulation to encourage sustainable tourism development	←		←	←						
	Lack of capacity for monitoring and control	←		←	←						
	Low enforcement and compliance	←									
(15) Large scale changes to topography and inappropriate drainage	Expansion of tourism sector	←									

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
		[A]Inappropriate governance	[B]Economic drivers	[C] Inadequate financial resources	[D] Inadequate knowledge & awareness	[E] Cultural traditions	[F] Population pressure & demographics	[G] Poverty & inequality	[H] Climate change & natural processes	[I] Voluntary action fills the governance void	[J] Personal Attitude
	Gaps in regulations		←				←				
	Badly planned construction processes	←			←						
	Lack of capacity for monitoring and control	←		←	←						
	Law enforcement and compliance	←									
Urbanisation											
(16) Domestic water usage	Increased urbanisation	←	←				←				
	Increased demand for piped water		←				←				
	Increased service delivery and availability of piped water		←				←				
	Lack of or inadequate planning and policy development	←			←						
	Inadequate investment in infrastructure	←		←							
	Lack of investment in alternative technologies (e.g. rain water harvest)	←		←	←						
(17) Domestic water disposal	Increased urbanisation	←	←				←				
	Increased volume of waste water		←				←				
	Inadequate planning and policy development	←			←						
	Inadequate investment in municipal waste water disposal infrastructure	←		←							
(**18)** Damming for water supply	Increased demand for domestic water		←				←				
	Inadequate planning and policy development	←			←						
	Lack of investment in alternative technologies (e.g. rain water harvest)			←	←						
	Weak understanding of potential alternative technologies				←						
(19) Construction activities	Increased development and construction of modern homes	←	←				←	←			
	Inadequate planning and policy development	←			←						
	Inadequate regulation of construction activities	←									
	Low enforcement and compliance	←		←							
	Lack of monitoring and enforcement	←		←							
	Wealth creation and corruption	←									
(20) Increased surface run-off (hard impermeable structures)	Expansion of urban areas		←	←			←				
	Inadequate planning, lack of land use plans and environmental policy	←			←						
	Lack of investment in upgrading drainage systems			←							
	Lack of investment in alternative technologies (e.g. rain water harvest)	←		←	←						
Transportation & Shipping											
(21) Land clearing and topographic changes for road construction	Expansion of road network		←				←				
	Poor construction practices	←	←		←						

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
		[A]Inappropriate governance	[B]Economic drivers	[C] Inadequate financial resources	[D] Inadequate knowledge & awareness	[E] Cultural traditions	[F] Population pressure & demographics	[G] Poverty & inequality	[H] Climate change & natural processes	[I] Voluntary action fills the governance void	[J] Personal Attitude
	Lack of or inadequate regulation	←			←						
(22) Inappropriate drainage and canalisation for roadways	Lack of or inadequate planning	←			←						
	Poor road construction practices	←	←		←						
	Lack of compliance with regulations	←	←		←						
Environmental											
High rainfall variability									←		
Increased evaporation									←		
Increased Flooding									←		
Wild Fires									←		
1.2.	**Degradation of ground and surface water quality**										
Agriculture & Forestry											
(1) Poor land use management and farming practices (e.g. lack of crop rotation)	High demand for food production		←				←				
	Lack of education, knowledge and awareness	←			←	←					
	Lack of incentives for good practice	←		←							
	Lack of agricultural extension officers	←		←		←					
	Lack of compliance						←				
(2) Increased use of agrochemicals (fertilizers and pesticides)	Expansion of commercial agricultural sector										
	Increased demand for food						←				
	High demand for food production		←				←				
	External market demand		←								
	Inadequate land use planning	←									
	Lack of or inadequate regulation	←									
	Lack of compliance	←					←				
	Lack of capacity for monitoring or enforcement	←		←							
	Lack of incentives for good practice	←		←							
(3) Increased surface run-off (through agriculture and forestry)	Expansion of commercial agricultural sector										
	Increased demand for food, timber etc						←				
	Lack of education, knowledge and awareness				←						
	Inadequate land use planning	←									
	Lack of or inadequate regulation	←									
	Lack of capacity for monitoring or enforcement	←		←							
	Lack of incentives for good practice	←		←							
(4) Inadequate management and disposal of livestock waste	Lack of education, knowledge and awareness				←			←			
	Increased demand for food						←				

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
		[A]Inappropriate governance	[B]Economic drivers	[C] Inadequate financial resources	[D] Inadequate knowledge & awareness	[E] Cultural traditions	[F] Population pressure & demographics	[G] Poverty & inequality	[H] Climate change & natural processes	[I] Voluntary action fills the governance void	[J] Personal Attitude
	Increased livestock production		←								
	Inadequate land use planning	←			←						
	Lack of or inadequate regulation	←									
	Lack of capacity for monitoring or enforcement	←		←							
	Lack of incentives for good practice	←		←							
Urbanisation											
(5) Disposal of un and under treated municipal waste water	Increased urbanisation		←				←				
	Employment opportunities greater in urban areas		←				←				
	Increased urbanisation	←	←	←					←		
	Inadequate planning for urban areas	←									
	Inadequate provision for waste water treatment and management	←		←			←				
	Inadequate investment in infrastructure	←		←							
	Lack of capacity for planning			←	←						
(6) Construction activities	Increased urbanisation		←				←				
	Inadequate legislation / weak enforcement of regulations	←		←							
(7) Seepage from pit latrines	Poor maintenance	←		←							
(8) Leachate from waste disposal sites	Poor selection of waste disposal site	←									
	Lack of capacity for planning			←	←						
(9) Surface water run-off	Lack of drainage systems	←		←							
	Inadequate planning for urban areas	←									
	Lack of capacity			←	←						
	Inadequate legislation / weak enforcement	←									
Tourism											
(10) Disposal or seepage of un under treated waste water **(**	Expansion of tourism sector		←				←				
	Economic growth potential and employment opportunities		←				←				
	Global economic market demand		←								
	Lack of adequate waste water treatment infrastructure	←		←							
	Lack of investment		←								
	Lack of or inadequate development planning, inadequate legislation	←									
	Lack of planning	←		←							
	Lack of capacity for planning	←		←							
	Lack of capacity for monitoring and enforcement			←	←	←					
(11) Construction activities	Expansion of tourism sector		←				←				
(e.g. increased surface run-off, inadequate building practices)	Economic growth potential and employment opportunities		←				←				

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
		[A]Inappropriate governance	[B]Economic drivers	[C] Inadequate financial resources	[D] Inadequate knowledge & awareness	[E] Cultural traditions	[F] Population pressure & demographics	[G] Poverty & inequality	[H] Climate change & natural processes	[I] Voluntary action fills the governance void	[J] Personal Attitude
	Global economic market demand		←								
	Inadequate legislation / weak enforcement	←		←							
	Inadequate regulation of construction activities	←		←							
	Lack of capacity for monitoring and enforcement			←	←	←					
	Lack of investment	←		←							
	Lack of or inadequate planning and enforcement of EIA regulation	←		←			←				
Industry											
(13) Inappropriate disposal of un or under treated effluents	Expansion of industries in the catchment		←				←				
	Inadequate planning for industrial areas	←		←	←						
	Lack of industrial effluents treatment systems and disposal infrastructure	←		←							
	Lack of capacity for planning	←		←	←						
	Difficulty in identifying polluting industries	←		←	←						
	Inadequate monitoring and enforcement	←		←							
	Lack of monitoring capacity	←		←							
	Weak compliance	←	←	←							
(1 4) Surface run-off	Lack of drainage systems / infrastructure	←		←							
	Lack of planning for industrial development	←			←						
	Lack of or inadequate capacity for enforcement of legislation	←		←							
Mining											
(15) Processing of mine wastes / washing of tailings etc Surface run-off	Expansion of mining sector		←								
	Lack of enforcement of legislation	←		←							
	Lack of or inadequate planning	←									
	Lack of stakeholder participation and involvement	←		←							
Environmental											
Algal blooms									←		
Floods									←		
Droughts									←		
Climate variability and change									←		
1.3.1	**Microbiological contamination**										
Urbanisation											
(1) Disposal of un or undertreated municipal wastewater	Expansion of urban areas and increased volume of waste water		←				←				
	Inadequate waste water treatment and disposal facilities and sanitation	←		←			←				
	Lack of planning	←									
	Lack of investment	←		←							

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
		[A]Inappropriate governance	[B]Economic drivers	[C] Inadequate financial resources	[D] Inadequate knowledge & awareness	[E] Cultural traditions	[F] Population pressure & demographics	[G] Poverty & inequality	[H] Climate change & natural processes	[I] Voluntary action fills the governance void	[J] Personal Attitude
(2) Increased surface run-off	Expansion of urban areas without adequate drainage		←				←				
	Inadequate municipal drainage or poor maintenance	←		←			←				
	Lack of planning	←									
	Lack of investment	←		←							
(3) Seepage from pit latrines	Expansion of urban areas without adequate drainage		←				←				
	Inadequate municipal drainage or poor maintenance	←		←							
	Lack of planning	←									
	Lack of investment	←		←							
Tourism											
(4) Disposal of un undertreated municipal wastewater	Expansion of tourism sector		←								
	Inadequate municipal drainage or poor maintenance	←		←							
	Lack of planning	←									
	Lack of investment	←		←							
	Low compliance with regulations (e.g. all hotels are meant to have their own wastewater processing facilities)	←									
	Limited capacity for post construction monitoring and enforcement	←		←							
	Wealth creation and corruption		←								
(5) Increased surface run-off	Expansion of tourism development without adequate drainage		←				←				
	Inadequate municipal drainage or poor maintenance	←		←							
	Lack of planning	←									
	Lack of investment	←		←							
	Wealth creation and corruption		←								
Agriculture											
(6) Free roaming livestock	Demand for food		←				←	←			
	Lack of treatment of agricultural waste	←									
Transportation & Shipping											
(7) Disposal of ship waste	Increase in shipping traffic (cruises)		←								
	Lack of Port disposal facilities	←	←	←							
1.3.5	**Solid wastes / marine debris (plastics etc.)**										
Urbanisation											
(1) Inappropriate disposal of solid waste	Increased urbanisation and volume of waste		←				←	←			
	Lack of planning for increased urbanisation	←		←			←				
	Lack of or inadequate municipal waste collection system	←		←			←				
	Lack of or inappropriate municipal waste disposal sites	←		←			←				

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
		[A]Inappropriate governance	[B]Economic drivers	[C] Inadequate financial resources	[D] Inadequate knowledge & awareness	[E] Cultural traditions	[F] Population pressure & demographics	[G] Poverty & inequality	[H] Climate change & natural processes	[I] Voluntary action fills the governance void	[J] Personal Attitude
	Inadequate legislation on solid waste management	←									
	Inadequate monitoring and enforcement	←		←							
	Lack of capacity for monitoring and enforcement			←	←						
	Lack of awareness				←						
	Limited understanding about the environment				←						←
	No social attachment to coastal environment (no beach culture)				←	←					←
	Unresolved disputes over land ownership for disposal sites.	←									
	Finances available for waste disposal - unspent	←									
	Weak or unimplemented legislation	←									
	Waste management organised voluntarily (in the absence of government action) questioned – is this a problem?									←	
	Different political priorities	←		←							
(2) Dumping of garbage	Lack / weak enforcement	←		←							
	Inadequate capacity				←						
	Lack of waste collection system	←		←							
(3) Solid waste carried in surface run-off	Inadequate planning of urban area	←			←		←				←
(4) Solid wastes carried in river run-off	Inadequate maintenance of watercourses	←			←		←				←
Fisheries & Aquaculture											
(5) Throwing / dumping solid waste / garbage overboard	Inadequate monitoring and enforcement	←		←							
	Lack of awareness and education					←					←
	Inadequate capacity			←	←						
(6) Discarded and lost fishing gear	Inappropriate fishing practices		←		←	←	←	←			←
	Lack of awareness and education				←	←					←
	Inadequate capacity			←	←						
Tourism											
(7) Inappropriate disposal of solid waste	Expansion of tourism sector		←								
	Lack of adequate waste collection system and disposal site	←	←	←			←				
	Weak enforcement	←		←							
	Political priorities			←							
(8) Beach littering	Expansion of tourism sector	←		←			←				
	Lack of adequate number of bins and garbage collection system	←		←			←				
	Lack of education and awareness				←						←
	Inadequate monitoring and enforcement	←		←							
	Lack of capacity			←	←						

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
		[A]Inappropriate governance	[B]Economic drivers	[C] Inadequate financial resources	[D] Inadequate knowledge & awareness	[E] Cultural traditions	[F] Population pressure & demographics	[G] Poverty & inequality	[H] Climate change & natural processes	[I] Voluntary action fills the governance void	[J] Personal Attitude
Industry											
(9) Dumping of garbage	Expansion of coastal industries		←								
	Inadequate garbage collection facilities	←	←								←
	Lack of knowledge and awareness				←						
	Weak enforcement	←									
Transportation & Shipping											
(10) Throwing solid wastes overboard	Lack of facilities for collection and disposal of solid waste at ports	←		←							
	Inadequate monitoring and enforcement	←		←							
	Lack of capacity			←	←						
	Lack of awareness, carelessness				←						←
(11) Waste disposal at sea / dumping (at sea and on land)	Lack of enforcement of maritime legislation	←									
Agriculture & Forestry											
(12) No composting (80% of waste biodegradable)	No traditional practice of composting					←					
	No resources for collection			←							
	Lack of awareness				←						
	No training provided				←						
1.3.6 Oil spills											
Mining											
(1) Risk of accidental oils spill during exploratory drilling	Increased market demand for oil		←				←				
	Global economies		←								
	Potential for economic development		←								
	Lack of funds or insufficient allocation of funds for monitoring and checking	←		←							
(2) Risk of oil spills from point of extraction	Expansion of the oil sector		←								
	Global economies - market demand		←								
	Foreign companies with inadequate environmental management policies	←									
	Poor regulation of foreign companies	←	←		←						
	Poor operational management	←									
	Untrained personnel			←	←						
	Lack of proper equipment and maintenance			←	←						
	Lack of appropriate safety procedures			←	←						
	No Emergency response plans in place				←						
	Limited knowledge, skills and use of best practice				←						
	Lack of capacity for handling cleanup operation	←		←	←						
	Insufficient allocation of funds for monitoring companies	←		←							
(3) Oil spills from refineries during processing and storage	Increased market demand for oil		←								

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
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	Global economies		←								
	Weak national planning / regulatory frameworks	←									
	Weak operational management of refineries		←								
	Untrained personnel				←						
	Lack of proper equipment and maintenance				←						
	Lack of appropriate safety procedures				←						
	No Emergency response plans in place				←						
	Limited knowledge, skills and use of best practice				←						
	Inadequate investment		←	←							
Energy											
(4) Oil spill from storage facility	Increased internal demand for energy		←				←				
	Lack of funds for monitoring and checking			←							
	Lack of capacity for handling clean up operation	←			←						
(5) Oil spills at point of energy generation	Market demand for energy		←				←				
	Weak national planning / regulatory frameworks	←									
	Weak operational management of facilities		←								
	Untrained personnel				←						
	Lack of proper equipment and maintenance			←	←						
	Lack of appropriate safety procedures			←	←						
	Emergency response plans in place			←	←						
	Limited knowledge, skills and use of best practice				←						
	Inadequate investment			←							
Transportation & Shipping											
(6) Higher Risk of oil spill in areas in proximity to shipping lanes	Increased shipping traffic		←								
	Lack of or inadequate navigational resources	←		←	←						
	Lack of or inadequate planning for shipping lanes (being addressed through WIO-highways)	←			←						
	Global economies - market demand		←								
	Negligence				←						←
	Lack of information about possible natural hazards (weather, storms, freak waves)				←				←		
(7) Risk of large scale spill	Expansion of oil industry and increased shipping traffic		←								
	Global economies - market demand		←								
	Economic development pressure		←								
	High risk poorly maintained vessels used for transport	←	←								←

Sector and Underlying Resource Use Practice	Underlying Social, Economic, Legal and Political Causes	Root Causes									
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	Negligence										←
	Lack of information about possible natural hazards (weather, storms, freak waves)				←				←		
(8) Risk of large scale spill during loading off loading	Expansion of oil industry and increased shipping traffic		←								
	Out of date inadequate infrastructure at ports	←		←	←						
	Carelessness / Negligence				←						←
(9) Small scale spills through cleaning / disposal of ballast	Expansion of oil industry and increased shipping traffic		←								
	Inadequate cleaning and waste disposal facilities at port	←									
	Carelessness / Negligence				←						←