29. SUMMARY OF MITIGATION AND MANAGEMENT COMMITMENTS

The purpose of the summary of mitigation and management commitments is to collate all the mitigation and management measures that appear in the various chapters of the EIS (see Tables 29.1, 29.2, 29.3 and 29.4).

These mitigation and management commitments were obtained from individual specialist studies and used in their assessments (see the appendices). There is repetition, but it has been retained to highlight the measures that the specialists considered most important. Mitigation and management commitments will be condensed into comprehensive and effective management plans and procedures in the preparation of the environmental management plan.

Table 29.1 LNG Facilities mitigation and management commitments

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
M1	Establish and enforce project-wide quarantine management procedures as part of the ecology, natural habitat and biodiversity plan.	Construction Operations	Operator Contractor
M2	Establish and enforce pest and weed management procedures for the LNG Facilities site as part of the ecology, natural habitat and biodiversity plan.	Construction Operations	Operator Contractor
M3	Where practicable locate perimeter fence and other facilities to the landward side of the mudflats and wetlands.	Construction	Operator Contractor
M4	As far as practicable, clearing of riparian vegetation should be limited to the width required to safely accommodate roads, and watercourse crossings.	Construction	Operator Contractor
M5	Limit ground disturbance and vegetation clearing for LNG Facilities site, camps, lay down areas to the area within the perimeter fence (plus working buffer zone).	Construction Operations	Operator Contractor
M6	Prohibit works from exceeding the design disturbance width and enforce boundaries through use of security fencing.	Construction	Operator Contractor
M7	Where practicable revegetate promptly areas no longer required for construction or support services (e.g., the areas set aside for future LNG trains).	Construction Operations	Operator Contractor
M8	During operations, prohibit staff from disturbing migratory species and associated habitats, especially along perimeter fence adjacent to mudflat habitat.	Operations	Operator
M9	Prohibit disturbance/harassment of wildlife, hunting of fauna, gathering of plants or bush foods, collection of firewood or possession of wildlife products by project workers or contractors while working, travelling in project vehicles, and residing in project field accommodation. Implement appropriate inductions and education to encourage staff to comply with regulations.	Construction Operations	Operator Contractor
M10	Limit machinery and vehicle movements to defined works areas and designated project roads. Note that anywhere within the perimeter fence will be accessible during construction.	Construction Operations	Operator Contractor
M11	Develop a reclamation management plan, which would include as a priority the regeneration of natural vegetation communities, wetland substrates and savanna as close to natural levels as possible through seed collection and/or use of topsoil as a seed resource.	Construction	Operator Contractor
M12	Where practicable strip and salvage topsoil. Where salvaged, protect topsoil from loss or degradation. Use topsoil in reclamation management plan.	Construction	Operator Contractor

Table 29.1 LNG Facilities mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
M13	Conduct a preclearance survey for sandalwood and other listed species and develop management plan in the unlikely event of discovering listed species.	Construction	Operator Contractor
M14	Where tree removal is necessary for road construction, limit damage to surrounding habitats by felling trees away from existing stands where practicable taking into account the value and safety of the areas into which the trees are being felled.	Construction	Operator Contractor
M15	Limit the scraping of standing tree trunks by machinery as far as practicable.	Construction	Operator Contractor
M16	Use appropriately qualified ecologist to inspect trees prior to felling in order to locate any *Pharotis imogene* colonies. If located, use controlled felling methods to allow the colony to relocate.	Construction	Operator Contractor
M17	Use cleared vegetation where practicable for dust control and revegetation.	Construction	Operator Contractor
M18	Where practicable, disturbed areas will be returned to former landforms and vegetation of exposed areas will occur as soon as practicable once construction activities are completed in any particular location. Areas prone to erosion will receive particular attention.	Construction Operations	Operator Contractor
M19	All watercourse crossings, diversions and culverts will be designed to accommodate expected streamflows. Similarly, the drainage system within the LNG Facilities site will be designed to minimise changes to flow regimes and sediment transport of existing creeks including any works on the North Vaihua River tributaries and Karulla Creek.	Construction	Operator Contractor
M20	Conduct community consultation regarding fishing, mud crab and mangrove wood collection and how the project will minimise impacts to these activities.	Construction Operations	Operator
M21	Conduct community consultation regarding burning in the vicinity of the LNG Facilities site.	Operations	Operator
M22	At new or improved road crossings, maintain connectivity of wet season flow in watercourses, avoiding the creation of high-velocity 'chutes' or step-down cascades in order to enable fish migration.	Construction	Operator Contractor
M23	Establish and enforce a sediment and erosion control management plan that limits the mobilisation and dispersion of sediment into freshwater and estuarine environments particularly in relation to site preparation earthworks watercourse diversions, site drainage design and road crossings.	Construction	Operator Contractor
M24	Use silt curtains and other industry good practice management controls as appropriate when working in mangroves, particularly near the seaward extent.	Construction	Operator Contractor

Table 29.1 LNG Facilities mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
M25	Vehicles and machinery maintained to a high level of safety with respect to leaks. Drivers will be appropriately trained and have the required driving licence.	Construction Operations	Contractor
M26	Fuel, lubricating oils and chemicals will be stored in appropriately designed and sized designated areas that have impervious liners and/or bunds as appropriate.	Construction Operations	Operator Contractor
M27	Establish a spill response plan appropriate to the project phase and include staff training at induction to inform workers of their responsibilities under the plan.	Construction Operations	Operator Contractor
M28	Develop and implement an acid sulfate soil management plan within the proposed water management plan.	Construction Operations	Operator Contractor
M29	The waste and wastewater management approach for the LNG Facilities site as described in this EIS is to be used for the preparation of the relevant management plans.	Construction Operations	Operator Contractor
M30	Suitable containment provided for all parts of the plant area where hazardous or dangerous goods are stored or used.	Construction Operations	Operator Contractor
M31	Install a groundwater monitoring network within the LNG Facilities site and on the downstream hydraulic gradient side of potentially contaminating/impacting activities (e.g., the landfill site).	Construction Operations	Operator
M32	Place spoil into low, rounded stockpiles to limit erosion and dust effects of soil and spoil.	Construction Operations	Operator Contractor
M33	Construction vehicles and equipment will be maintained in order to limit emissions.	Construction Operations	Operator Contractor
M34	During construction, spray unsealed project construction roads (not using saline water) when required and limit speed of traffic.	Construction	Contractor
M35	Establish blasting procedures within a noise management plan (for both the terrestrial and marine environments) considering ANZECC guidelines, or similar and in consultation with local communities.	Construction	Operator Contractor
M36	Establish and enforce speed limit for project traffic on all roads. Liaise with government agencies and local villages with regard to general road safety and traffic regulation.	Construction Operations	Operator Contractor
M37	Undertake measures in planning and design to limit flare and venting as much as practicable, including a 'smokeless' flare design that would apply to normal operation.	Operations	Operator
M38	Locate facility components according to safe constructability and operations.	Construction	Operator

Table 29.1 LNG Facilities mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
M39	Excepting LNG facilities, utilities and other process areas, use materials for camps, administration buildings, warehouses and other non-process areas that are visually compatible with the surrounding landscape where practicable.	Operations	Operator
M40	Respond to community views regarding visual effects if raised through general ongoing public consultation during construction and operation.	Construction	Operator
M41	Where practicable, utilise treatments for the reduction of light spill into the marine environment to reduce visibility of the site from Ihidi Island where turtles may be nesting. Reduce lighting on jetty when not loading while meeting navigation and security guidelines.	Construction Operations	Operator Contractor
M42	Develop an air emissions management plan (including dust) for the LNG Facilities site including project roads.	Construction Operations	Operator Contractor
M43	Use low NOx turbines in the LNG Plant.	Operations	Operator
M44	Where practicable, use low sulfur diesel for equipment and machinery during construction of the LNG Facilities site.	Construction	Operator Contractor
M45	Stabilise exposed areas susceptible to wind erosion during site earthworks using industry good practice measures such as water, agglomerating agents, temporary grass/hydromulch or mulch where appropriate.	Construction	Operator Contractor
M46	Collect and dispose of BTEX emissions through thermal destruction or industry best practice from all significant sources.	Operations	Operator
M47	Regularly inspect and maintain valves, pipes and tanks, etc., to reduce fugitive VOC emissions.	Operations	Operator
M48	Waste heat recovery units will utilise heat from the exhaust from the aero-derivative turbines driving the two propane refrigeration compressors to provide the main source of heat to the hot-oil system.	Operations	Operator
M49	Turbine generators will use dry, low-emissions technology to maintain NO_X and CO concentrations at less than 25 ppm.	Operations	Operator

Table 29.2 Upstream mitigation and management commitments

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M50	Prohibit transportation of live animals, plants or seeds to the Juha or Hides Ridge areas.	X	X	X	Construction Operations	Operator Contractor
M51	At Hides Ridge, hydrotest water sourced off the ridge will be discharged into the same watershed as its source to prevent cross-contamination with live organisms from another catchment.		X		Construction	Contractor
M52	Establish a weed, exotic pest and pathogen plan as part of the proposed ecology, natural habitat and biodiversity management plan.	X	X	X	Construction	Operator
M53	Establish procedures to prohibit PNG LNG Project workers or contractors from establishing any gardens or introducing or transporting any plants, seeds or animals within the project area (including the translocation of fish species).	X	X	X	Construction Operations	Operator Contractor
M54	Establish and enforce a project-wide quarantine management protocols as part of the ecology, natural habitat and biodiversity management plan.	X	X	X	Construction Operations	Operator Contractor
M55	Establish a project-specific safety plan to perform risk assessments for various activities including excavations.		X		Construction	Operator
M56	Where safe and practicable, patrol open trench to rescue and record fauna that fall into the open pipeline trench.		X		Construction	Operator Contractor
M57	Prohibit disturbance/harassment of wildlife, hunting of fauna, gathering of plants or bush foods, or possession of wildlife products by project workers or contractors while working, travelling in project vehicles, and residing in project field accommodation.	X	X	X	Construction Operations	Operator Contractor
M58	Implement appropriate inductions to encourage staff to comply with hunting and collecting regulations.	X	X	X	Construction Operations	Operator Contractor
M59	Contractor to control speed limits on project unsealed roads and pipeline ROWs via posted speed limit signs, where practicable, and keep vehicles to marked trafficable areas to prevent injury to fauna.	X	X		Construction	Operator

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M60	If fire hazard exists, pushed vegetation can be left to rot at forest edge rather than burnt.		X	X	Construction	Operator Contractor
M61	Develop and implement a bush and forest fire management plan for the construction and operations phases of the project.	X	X	X	Construction Operations	Operator
M62	The conservation activities of environmental non-government organisations in the project area will be encouraged.	X	X	X	Operations	Operator
M63	Encourage conservation education in villages in the project area.	X	X	X	Operations	Operator
M64	Clearing of riparian vegetation will be limited to the width required to safely accommodate pipeline ROWs and access ways and watercourse crossings. Also, the number of watercourse crossings will be reduced, to the extent practicable, to limit riparian soil erosion and sediment delivery to watercourses.	X	X		Construction	Operator Contractor
M65	ROWs and roadways will be located within or adjacent to existing disturbed areas where practicable.	X	X		Construction	Operator Contractor
M66	Wellpads will be designed and located to reduce the extent of vegetation clearing and earthworks by limiting to the extent practicable, the size of the wellpads.	X			Construction	Operator Contractor
M67	No quarries beyond cut to be established on the Hides Ridge where practicable.	X	X		Construction	Operator Contractor
M68	Minimise the number of quarries developed by: – Using previously worked (old) quarries, where practicable. – Using limestone generated by construction activities for road base material.	X	X	X	Construction	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M69	Road base and foundation aggregate material sourced from in-country quarries not developed by the project will be in accordance with the requirements of Land and Community Affairs guidelines and procedures, that provides controls for the amount of gravel extracted from quarries.	X	X	X	Construction	Operator Contractor
M70	No construction camps allowed on Hides Ridges beyond Hides Wellpad A (with the exception of drilling camps).	X	X		Construction	Operator Contractor
M71	If a temporary drilling camp is necessary on Hides Ridge there should be only one and it is to be located near Hides Wellpad D and to be used by successive drilling campaigns.	X			Construction	Operator Contractor
M72	Promote use of timber felled during wellpad, pipeline, ROW, roadways and facility site clearing for project uses to the extent practicable.	X	X	X	Construction	Operator Contractor
M73	Industry good practice for construction camps will also apply to management of environmental effects from temporary fly camps and pioneer camps.	X	X	X	Construction	Operator Contractor
M74	Where practicable, land clearing will utilise techniques that preserve the rootstock of removed vegetation in the ground. Cleared vegetation will be spread back on to the rehabilitated ROW and access ways as mulch, where practicable.		X		Construction	Operator Contractor
M75	The extent of clearing and earthworks along the ROW will be limited and the time for which surfaces are exposed prior to natural revegetation will be reduced to the extent practicable.		X	X	Construction Operations	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M76	The standard ROW width for the project is 30 m and following construction the ROW will be allowed to naturally regenerate except for 15 m, to allow for a gap in the canopy for aerial surveillance of the pipeline. If there is a requirement to exceed the ROW design width, the contractor shall seek approval through a formal procedure from the operator.		X		Construction	Operator Contractor
M77	The design criteria for ROW width on Hides Ridge is 18 m. During operations the ROW will be allowed to regenerate except for a 10-m-wide access road required for ongoing drilling and maintenance access to the wellpads on the ridge.	X	X		Construction Operations	Operator Contractor
M78	Where trees are to be felled by hand, use directional felling for trees > 50 cm dbh so they land in natural slots between standing trees or along the axis of tracks to reduce damage to the remaining forest.		X		Construction	Operator Contractor
M79	Reduce scraping by machinery of standing tree trunks adjacent to, or off, the ROW.		X		Construction	Operator Contractor
M80	No herbicides to be used unless for the eradication of a serious invasive environmental weed.	X	X	X	Construction Operations	Operator Contractor
M81	No machinery will leave the ROW or access ways to unnecessarily clear additional forest.		X		Construction	Operator Contractor
M82	On Hides Ridge and between Hides Ridge and Juha, align the route to bypass potentially high-value conservation swamps that might provide juvenile nursery habitat or swamps in sinkholes <50 m deep where practicable. At sites where this is impractical, reduce sidecast into these high-value habitats.		X		Construction	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M83	Locate the temporary Juha drilling camp within the footprint of the Juha Production Facility.	X			Design Phase 4	Operator
M84	Locate the temporary Angore drilling camp within the footprint of the Hides Gas Conditioning Plant.	X			Design Phase 2	Operator
M85	Provide protection for stream heads in the Baia River area and elsewhere in the upstream project area above 1,800 m, to reduce erosion material entering the watercourse.		X		Construction	Operator Contractor
M86	If practical and safe, retain trees over 1 m dbh at camp locations.	X	X	X	Construction	Operator Contractor
M87	Establish procedures to prohibit PNG LNG Project workers or contractors disturbing bird-of-paradise and bowerbird display grounds or trees identified next to the ROW. Conduct a preclearance survey to identify such sites.		X		Construction	Operator Contractor
M88	All new project road sections constructed for logistics transfer between Kopi and the Hides Gas Conditioning Plant will have controlled access for project use only following completion of construction.		X		Operations	Operator
M89	All pipeline ROWs and roadways between the Omati River Landfall and the Kopi deviation will be made impassable at the end of project construction, and those on Hides Ridge will be made impassable at the end of the project.	X	X		Operations	Operator
M90	Control access to Hides Ridge and Juha on the Juha and Hides Ridge access ways to the west of Hides Wellpad A and implement a permit system for vehicle access for the lifetime of project.	X	X	X	Construction Operations	Operator

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M91	Establish pipeline security procedures, including procedures for heavy logging trucks on road sections where the pipeline is buried.		X		Operations	Operator
M92	Prohibit disposal of any waste into forest, streams or sinkholes.	X	X	X	Construction Operations	Operator Contractor
M93	Dispose of drilling fluids, drilling cuttings and other drilling materials in an appropriate manner away from Hides Ridge.	X			Construction	Operator Contractor
M94	Dispose of wastes from ROWs and access ways construction activities (not spoil) and camps (including the drilling camp) away from Hides Ridge.	X	X		Construction	Operator Contractor
M95	Establish waste management procedures to control and appropriately manage all non-biodegradable materials.	X	X	X	Construction Operations	Operator Contractor
M96	Manage sewage in an appropriate manner to limit environmental contamination.	X	X	X	Construction Operations	Operator Contractor
M97	Incinerate organic waste and bury at specified sites, as required.	X	X	X	Construction Operations	Operator
M98	Where employed, high-temperature incinerator waste will be controlled through the project environmental management plan.			X	Construction Operations	Operator
M99	Prohibit washdown or fuel handling near or in streams.	X	X	X	Construction	Operator
M100	Establish appropriate fuel handling transport and storage procedures in the environmental management plans.	X	X	X	Construction Operations	Operator
M101	Establish appropriate materials handling, storage and disposal in the environmental management plans.	X	X	X	Construction Operations	Operator

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M102	Establish appropriate storage and handling of radioactive material in the environmental management plans.	X		X	Construction Operations	Operator
M103	Establish appropriate waste handling procedures in the environmental management plans that will: ▪ Comply with the relevant and applicable parts of the IFC Environmental, Health, and Safety Guidelines – General EHS Guidelines: Environmental Waste Management (IFC, 2007k). ▪ Comply with the relevant and applicable parts of the IFC Environmental, Health, and Safety Guidelines – Waste Management Facilities (IFC, 2007l). ▪ Meet the intent of the emission limits in US EPA 40 CFR Part 60, Standard of Performance for New Stationary Sources (NSPS), including Subpart AAAA, Standards of Performance for Small Municipal Waste Combustion Units, or Subpart CCCC, Standards of Performance for Commercial and Industrial Solid Waste Incineration Units (EPA US, 2008), as applicable.	X	X	X	Construction Operations	Operator
M104	Direct lights at facilities to eliminate shine into surrounding forest, where security allows.	X	X	X	Construction Operations	Operator Contractor
M105	Conduct a preclearance survey of pinnacles along the ROW and access ways for caves to determine presence of bat colonies, and where colonies are located in proximity to the ROW and access ways, establish procedures to reduce disturbance, where practicable. Potential quarry sites should not be located near caves with colonies containing protected bat species.	X	X	X	Construction	Operator

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M106	Investigate the potential Bulmer's fruit-bat colony near Angore and design and implement a management plan should a colony be found near Angore or elsewhere in the project area.	X	X	X	Construction Operations	Operator
M107	Establish cave management protocols for worker and contractor inductions, to prohibit unnecessary disturbance of bat colonies by project workers.	X	X	X	Construction Operations	Operator
M108	Consider restricting access to caves with bats and prohibit unnecessary disturbance by project workers.	X	X	X	Construction Operations	Operator Contractor
M109	Limit or control (where practicable) blasting within 100 m of known colonies of cave bats.	X	X	X	Construction	Operator Contractor
M110	Conduct: grade 1 bat surveys, where practicable, prior to construction in areas likely to be inhabited by bats; grade 2 bat surveys in areas where blasting is contemplated; and grade 3 bat surveys where required (after checking with the local community for presence of bat caves near the route) to limit disturbance.	X	X	X	Construction	Operator Contractor
M111	Control vehicle speed via posted speed limit signs on project unsealed roads and pipeline ROWs (when required) and keep vehicles to marked trafficable areas.	X	X		Construction Operations	Operator
M112	The number of special vehicle parks will be reduced, and placed in areas of existing disturbance, where practicable.		X		Construction	Operator Contractor
M113	Develop an approved chain of custody for timber sourced for the project.	X	X	X	Construction	Operator Contractor
M114	Review of the reduced emissions from deforestation and degradation mechanism as a means of limiting potential indirect forest degradation and deforestation along the ROW warrants consideration.		X		Operations	Operator

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M115	Develop a management plant to reduce impacts on pandanus swamp forest. Design ROW and roadways to allow adequate surface and subsurface flows.		X		Construction	Operator Contractor
M116	Develop management procedures to reduce impacts on *Nothofagus* forest and the spread of dieback as part of the ecology, natural habitat and biodiversity management plan. Design to allow adequate surface and subsurface flows and avoid redirection of stream flows where practicable.		X		Construction	Operator Contractor
M117	Implement vehicle washdown facilities. Ban the import of exotic species, including seed into the project area.	X	X	X	Construction Operations	Operator Contractor
M118	Establish weed and exotic pest control management measures that identify foreign and invasive weed and exotic pest threats and appropriate control measures as part of the ecology, natural habitat and biodiversity management plan.	X	X	X	Construction Operations	Operator Contractor
M119	Develop a reclamation management plan that will include measures to assist revegetation in areas found to be slow to revegetate naturally.	X	X		Construction	Operator Contractor
M120	Areas requiring active revegetation will be identified: ▪ On Hides Ridge. ▪ In areas between Idauwi and Homa, in particular unstable volcanic terrains.	X	X		Construction	Operator Contractor
M121	Where practicable, soil, mulch and discarded vegetation debris (including natural seed stock) will be spread on reclaimed or rehabilitated disturbed land surfaces to facilitate natural revegetation.	X	X	X	Construction	Operator Contractor
M122	Where practicable, topsoil will be conserved in designated topsoil stockpile areas at facility construction sites for later reuse.			X	Construction	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M123	Salvage topsoil for rehabilitation of slopes, where practicable.	X	X	X	Construction	Operator Contractor
M124	Where salvaged, reduce damage to topsoil and mulch with sterile medium to protect seed resource.	X	X	X	Construction	Operator Contractor
M125	Drilling fluids and additives to be sourced from reputable suppliers.	X			Construction	Operator Contractor
M126	Well development waters will be captured within mud pits and make-up water pits or similar. Where warranted, alternative methods of disposal can be implemented, e.g., via reinjection.	X			Construction	Contractor
M127	Wastewater streams associated with drilling, such as water-based, non-toxic whole drilling fluids and completion drilling fluids, will be discharged in accordance with permit requirements.	X			Construction	Operator Contractor
M128	Combustible wastes will be incinerated at project-specified sites.	X	X	X	Construction Operations	Operator Contractor
M129	Effluents treated to appropriate standard and disposed of to combined outfall. For example stormwater and oily wastes treated in corrugated-plate interceptor facility to appropriate standard prior to disposal in retention pond. In addition, sufficient time is allowed for sediment and solids to settle within the pond prior to final offsite discharge in accordance with the environment (waste discharge) permit.			X	Operations	Operator
M130	Diesel storage system will be purpose-built, above ground and within double-walled tanks or containment bunds. Hydrocarbon spill prevention and response procedures will be detailed in the spill response plan.	X	X	X	Construction Operations	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M131	MEG slop storage tanks will be purpose-built full-containment tanks and bunded. Hydrocarbon spill prevention and response procedures will be detailed in the spill response plan.			X	Operations	Operator
M132	Biological, pharmaceutical and medical wastes will be treated and disposed of using appropriate technologies that will be detailed in the environmental management plan.	X	X	X	Construction Operations	Operator Contractor
M133	Sewage treatment plants will be operated in accordance with the manufacturer's specifications and will comply with the conditions for discharge quality (including disinfection) specified in the environment (waste discharge) permit.	X	X	X	Construction Operations	Operator Contractor
M134	All water and wastewater discharges will be treated to comply with conditions for discharge quality specified in the relevant environment (water discharge) permits.	X	X	X	Construction Operations	Operator Contractor
M135	All bunded open drain areas at facility sites will be concreted, kerbed and sloped to drain catchpits. The catchpits will feed to interception pits for separation of oil and water. The de-oiled water will be transferred to retention ponds for treatment as appropriate prior to disposal in accordance with the environment (waste discharge) permit. Waste oil that is collected from the interception pits and other facility sumps will be recycled by reinjection into the condensate being sent to the Kutubu Central Processing Facility where practicable.			X	Operations	Operator Contractor
M136	Non-equipment areas at plant facilities will be graded and sloped to allow uncontaminated storm water to drain naturally via the stormwater drains prior to routing offsite.			X	Operations	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M137	Water taken from watercourses or groundwater will meet environment (water extraction) permit conditions.	X	X	X	Construction Operations	Operator Contractor
M138	Where practicable, trees felled into watercourses will be removed and used for revegetation works.		X		Construction	Operator Contractor
M139	Where practical, stabilise cleared banks to provide a suitable habitat for recolonisation.		X		Construction	Contractor
M140	Where practicable, the pipeline ROWs and access ways alignment approaches to watercourses will be kept as close to right angles as possible to limit disturbances to the banks of watercourses.		X		Construction	Operator Contractor
M141	Conduct fine-scale routing of the ROWs and access ways to reduce traversing particularly erosive soils on steep slopes and to limit the number of pipeline crossings of clear-water streams, sinkholes, off-channel waterbodies and other karst terrain, where practicable.		X		Construction	Operator Contractor
M142	Where a watercourse crossing is considered too large and fast-flowing for the use of conventional open-cut trenching methods, horizontal directional drilling may be used to install the pipeline.		X		Construction	Operator Contractor
M143	Horizontal direction drilling sites on either side of a watercourse will be re-contoured, graded and rehabilitated after pipe installations are completed to reduce soil erosion and fugitive sediment.		X		Construction	Operator Contractor
M144	For watercourse crossings at which horizontal directional drilling techniques are used, a drilling fluids and cuttings management system, including drill cuttings settlement and slurry containment pits, will be implemented.		X		Construction	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M145	As part of the water management plan develop hydrotest disposal management procedures that includes adherence to guidelines and measures as follows: • Disposal of hydrotest waters in accordance with industry good practice engineering codes for system gauging, hydrotesting and disposal, and discharges will be required to meet the prescribed quality criteria for ambient water (see Table 18.15) as part of the relevant environmental (waste discharge) permit conditions. • Measures to hold and treat hydrotest wastewater where necessary prior to release so the quality meets the requirements of the relevant environment (water discharge) permit. • Predischarge sampling and analysis of hydrotest water to check that quality complies with the conditions attached to the relevant environment (water discharge) permit. • If the wastewater is to be discharged to land for infiltration, the outflow energies will be dissipated (e.g., via sprinkler or T-bar arrangements) to prevent possible problematic soil erosion.		X		Construction	Operator Contractor
M146	Fuel, lubricating oils and chemicals will be stored in appropriately sized designated areas that have impervious liners and bunds, or are in double-hulled tanks. This includes temporary fuel stores along the ROW and access ways.	X	X	X	Construction Operations	Operator Contractor
M147	Procedures for vehicle/equipment refuelling will be implemented to prevent spillages, and appropriate spill containment equipment will be available at refuelling sites and construction sites. All drivers will be appropriately trained in emergency spill response procedures.	X	X	X	Construction	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M148	Vehicles and machinery are to be maintained to a high level of safety with respect to leaks. Drivers will be appropriately trained and have the required driving licence.	X	X	X	Construction Operation	Operator Contractor
M149	Operations sites will be designed to intercept potentially contaminated water.	X	X	X	Operations	Operator
M150	The washing of equipment, vehicles or machinery near or within watercourses will be prohibited.	X	X	X	Construction	Operator Contractor
M151	An appropriate number of staff will be trained in the handling of emergency response and spill scenarios.	X	X	X	Construction Operations	Operator Contractor
M152	Conduct post-construction inspections along the upgraded ROW and roadway within the catchment of Lake Kutubu including: • Checking for problematic erosion areas and implementing remedial works as appropriate. • Inspecting ditches and culverts and removing accumulated debris, where required. • Reviewing feedback from water quality monitoring for advance warning of deteriorated water quality due to increased suspended sediment loading.		X		Construction Operations	Operator Contractor
M153	The duration of construction activities at watercourse crossings will be as short as practicable.		X		Construction	Construction Operator
M154	The construction of bridges, abutments and in-river bridge supports (where needed) will take into account the hydraulics of the watercourse in their design to consider stability and flow disruptions.		X		Construction	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M155	Incorporate erosion and sediment control procedures into the water management plan for all construction-related activities to: • Implement industry good practice erosion and sediment control measures at watercourse crossings, as necessary. • Reduce stockpiling spoil and topsoil materials close to waterways (i.e., maintaining a minimum of 10 m from the waterline), where practicable. • Control sediment runoff from stockpiles and cleared areas around watercourses. • Implement sediment control measures downstream of sidecast material where safe and practicable. • Limit erosion and sediment delivery to streams from new quarries. • Prohibit sidecasting material directly into waterways where practicable. • Grade pipeline ROW and access ways alignments adjacent to streams away from watercourses. • Monitor and maintain erosion and sediment control measures until adequate soil stabilisation has been achieved. • Install diversion drains to intercept uncontaminated surface runoff around facilities and away from construction areas. • Install sediment control structures to intercept sediment-laden surface runoff to reduce sediment delivery to watercourses. • Monitor for and rectify areas of problematic erosion at reclaimed watercourse crossings.	X	X	X	Construction	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M156	Fine-scale routing will be implemented during FEED and detailed design to mitigate impacts from sidecasting in steep terrain areas and to reduce traversing areas prone to mass failure by: • Examining the separation of the pipeline ROWs and roadways or access tracks to reduce sidecasting where practicable. • Using fine particle size organic matting or lattice framework or similar in karst areas to trap organic matter across sidecast where safe and practicable. • Implementing sediment control measures downstream of sidecast material where safe and practicable.		X		Construction	Operator Contractor
M157	Perform terrain evaluation/mapping to identify past landform instabilities (i.e., landslides).		X		Construction	Operator Contractor
M158	River/stream crossings will be limited in areas of high, unstable banks.		X		Construction	Operator Contractor
M159	A surface water and stormwater management plan will be implemented.	X	X	X	Construction Operations	Operator Contractor
M160	Watercourse crossing construction management plans will be incorporated into the water management plan to address the sensitivities of crossings on an individual watercourse basis. Plans will consider, where relevant: • Watercourse diversions requirements. • Disturbance limits. • Equipment limitations.	X	X	X	Construction	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M160 (cont'd)	• Erosion control measures. • Fine-scale routing at crossing sites to limit disturbance of particularly large and established riparian vegetation and complex bank habitat structure. • Delay of clearing of banks for temporary vehicle crossing until the need for the crossing is imminent, where practicable.					
M161	Design the modified and new wharfs at Kopi Shore Base to parallel the existing frontage of the Kikori River and to take account of channel hydraulics and other hydrodynamic characteristics of the lower Kikori River that may affect the long-term stability of the river frontage.		X	X	Construction Operations	Operator
M162	The construction and rehabilitation of the ROW in the Omati River swamp area will be managed to maintain natural hydrologic flows and connectivity in the surrounding area. Monitoring of vegetation condition in the vicinity of the ROW will be conducted to assess the need for post construction remedial works in this area. The scope of the monitoring program will be developed in the environmental management plan.		X		Construction Operations	Operator Contractor
M164	A water quality baseline monitoring plan will be developed for the Hides Gas Conditioning Plant and Juha Production Facility. The plan will be implemented as part of the project's water management plan.			X	Construction Operations	Operator Contractor
M165	Post-rehabilitation monitoring of vegetation will be undertaken in swamp areas between Kopi and the Omati River to determine whether additional remediation is necessary to maintain hydraulic flows in the area of project works.		X		Operations	Operator
M166	Water and sediment quality of streams draining the Juha Production Facility will undergo further baseline characterisation prior to construction.			X	Construction Phase 4	Operator Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M167	Design the facility to reduce routine flaring and venting of associated gas.	X		X	Operations	Operator
M168	At the Hides Gas Conditioning Plant waste heat from the exhaust of the pipeline compressor gas turbines will be used to provide heat to the thermal fluid-based hot oil system.			X	Operations	Operator
M169	With the exception of drilling activities, limit construction works at night time where practicable to meet agreed project noise criteria.		X	X	Construction	Operator Contractor
M170	Where practical, noise mitigation measures (including consultation with local citizens) will be implemented at drilling sites to minimise the noise level as much as possible.	X			Construction	Operator Contractor
M171	Adhere to specific criteria for construction and operations that are aligned to the intent of the IFC and WHO Guidelines on Environmental Noise Management 5A boundary noise limit of 55 dBA L_{eq} during the day period and 45 dBA L_{eq} during the night from noise sourced from the construction and operation of the facilities will apply to protect the amenity of landowners. A property fence line will be constructed around the facilities to coincide with the calculated nighttime noise limit of 45 dBA L_{eq}. Current receptors that are within the perimeter fence location will be resettled as appropriate.	X		X	Operations	Operator
M172	Select construction plant and equipment based on industry good practice and OHS standards and document requirements in the environmental management plans.	X	X	X	Construction	Operator Contractor
M173	Noise suppression devices on construction vehicles and equipment will be maintained.	X	X	X	Construction Operations	Contractor

Table 29.2 Upstream mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Project Component			Relevant Phase	Responsible Party
		Drilling	Pipeline and Logistics	Facilities		
M174	Where high intensity noise from construction activities may affect local villagers and/or sensitive locations (i.e., school), the affected parties will be notified of the intended work and its duration.	X	X	X	Construction Operations	Operator Contractor
M175	Establish a noise management plan considering ANZECC guidelines, or similar and in consultation with local communities.	X	X	X	Construction	Operator Contractor
M176	Diesel-powered equipment will be regularly serviced and low-sulfur diesel fuel will be used where practicable.	X	X	X	Construction Operations	Operator Contractor
M177	Fixed and mobile equipment (i.e., generators required for welding) will be located sensitively with respect to local people.	X	X	X	Construction	Operator Contractor
M178	Speed limits will be controlled via posted speed limit signs on project unsealed roads and pipeline ROWs (when required) and vehicles kept to marked trafficable areas which will be maintained in a damp and compacted condition (when required) to enhance safety and minimise dust emissions.	X	X	X	Construction	Operator Contractor
M179	BTEX emissions will be disposed by thermal destruction or industry good practice.			X	Operations	Operator
M180	Low-NOx emissions equipment will be fitted on the turbine generators and gas compressors.			X	Operations	Operator
M181	High-temperature incinerator wastes will be controlled through the project environmental management plan.		X	X	Construction Operations	Operator
M182	Site-specific security measures will be considered and appropriately applied at excavation sites. These measures will include security (watchmen), active dewatering, provision of a physical barrier, community awareness programs and signage as appropriate.		X	X	Construction	Operator Contractor

Table 29.3 Marine mitigation and management commitments

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
M183	Notify local communities, particularly inhabitants of fishing camps adjacent to the Omati River Landfall, with respect to offshore construction activities and the associated dangers of approaching vessels too closely.	Construction	Operator Contractor
M184	Limit interfering with, or restricting local fishers' access to, fishing camps during construction activities in the Omati River as far as practicable.	Construction	Operator Contractor
M185	Notify local communities about project barge traffic and the associated dangers of approaching vessels too closely.	Construction	Operator Contractor
M186	Undertake sedimentation and geomorphologic characterisation studies of the Omati River to collect baseline data of the portion of the riverbed in which the proposed LNG Project Gas Pipeline will be laid so that any future changes can be compared to pre-construction conditions.	Construction Operations	Operator Contractor
M187	In order to discharge marine hydrotest water, the project will require an environment (waste discharge) permit from the department of Environment and Conservation. The project will comply with the requirements of the permit when discharging.	Construction	Operator Contractor
M188	The storage, use and handling of all hazardous chemicals, materials and wastes on project vessels will be in accordance with IMO MARPOL (1973/1978) requirements. Appropriate spill response procedures and training for workers will be implemented.	Construction	Operator Contractor
M189	A marine fauna observation procedure will be implemented, requiring all observations and encounters with marine mammals (such as whales and dugongs) and turtles to be documented in an observation log. In the event of any close approach (e.g., within 500 m) by marine mammals, the vessel crew will be alerted.	Construction	Operator Contractor
M190	Fine-scale routing (using bathymetry and geotechnical data) of offshore pipeline to: • Avoid coral reefs and reduce the extent of sea grass beds traversed. • Limit activities that cause most disturbance to seabed (i.e., trenching and anchor deployment). • Reduce the placement of anchors and/or anchor chains on sensitive habitat (e.g., the shallow areas south of Caution Bay).	Construction	Operator Contractor
M191	Bury pipeline 2 to 3 m below the seabed in water depths less than 15 m LAT in Caution Bay.	Construction	Operator Contractor
M192	Request commercial vessels to remain outside a safe buffer zone around the pipeline installation vessels and the anchor cables (if used).	Construction	Operator Contractor

Table 29.3 Marine mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
M193	Barge transport will be managed to control wake and prevent incidents with small boats.	Construction Operations	Operator Contractor
M194	The LNG Project Gas Pipeline will be buried in the bed of the Omati River to protect the pipeline and limit potential causes of interruptions to natural bed sediment transport processes.	Construction	Operator Contractor
M195	Vessel decks will not be illuminated at night more than is necessary for safe operations.	Construction Operations	Operator Contractor
M196	An oxygen scavenger and a biocide will be added to the hydrotest water to control marine organisms present in the water and the hydrotest water will, if necessary, be filtered prior to filling and emptying the pipeline to remove most solid material.	Construction	Operator Contractor
M197	The offshore pipeline route will be aligned to cross the LNG tanker shipping channel at an angle as perpendicular as practicable to the channel and the pipeline will be buried (or covered with rocks) through the shipping channel.	Construction	Operator Contractor
M198	Advise prawn trawl operators and National Fishing Authority prior to construction.	Construction	Operator Contractor
M199	Engineering techniques will be used in the design of the pipeline to reduce potential for entanglement including: • Span reduction methods. • Active burial (trenching or grout bag support) in parts of the Omati River and Caution Bay where required.	Construction Operations	Operator Contractor
M200	Provide as-laid location of pipeline to PNG Hydrographer's Office.	Operations	Operator
M201	Develop a procedure for the evaluation and payment of compensation for any loss of fishing gear through consultation with relevant parties.	Construction Operations	Operator
M202	Implement an awareness program to educate local fishers about the dangers of dynamite fishing in proximity to high-pressure gas pipelines and LNG marine facilities in Caution Bay.	Operations	Operator
M203	Notify local communities with respect to offshore construction activities and the associated dangers of approaching vessels too closely. Implement marine traffic and navigation procedures relevant to the area and document in the project environmental management plans.	Construction	Operator Contractor
M204	Minimise sediment release resulting from construction of the Materials Offloading Facility.	Construction	Operator Contractor
M205	Design marine outfall to ensure adequate dispersion of desalination brine to comply with environment (waste discharge) permit conditions.	Construction	Operator Contractor

Table 29.3 Marine mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
M206	Consider discharging wastewater and brine in the same vicinity to assist with salinity dilutions.	Construction Operations	Operator Contractor
M207	Validation baseline monitoring of sedimentation will be undertaken during construction and will be similar in scope to that undertaken for the EIS characterisation baseline or expanded as required.	Construction Operations	Operator Contractor
M208	Limit marine habitat disturbance and mangrove clearing for Materials Offloading Facility/Jetty construction to the area within the perimeter fence (plus working buffer zone). Prohibit works from exceeding the design disturbance width and enforce boundaries through use of markers/tape and worker awareness.	Construction	Operator Contractor
M209	Establish an offshore spill response plan appropriate to the project phase and include staff training at induction to inform workers of their responsibilities under the plan.	Construction Operations	Operator Contractor
M210	Implement marine waste management (discharges to sea) procedures as part of the waste management plan complying with MARPOL standards and international port policies and procedures.	Construction Operations	Operator Contractor
M211	Adhere to Environment Australia (Commonwealth) guidelines or other similar industry good practice with respect to dredging and disposal of dredged material.	Construction Operations	Operator Contractor
M212	Employ a soft start for piling activities during the construction of the jetty to allow any marine fauna in the vicinity the opportunity to move away.	Construction	Operator Contractor
M213	Conduct a preblasting clearance survey (e.g., for turtles).	Construction	Operator Contractor
M214	Model dispersion characteristics of hydrotest water that will be discharged in Caution Bay prior to discharge.	Construction	Operator Contractor
M215	Measures to minimise sediment release resulting from construction of the earthen causeway will include setting a lower limit of particle size for material used for LNG Jetty/Materials Offloading Facility causeway construction and/or use of a geotextile lining or similar industry good practise to minimise the release of fine sediment into the water column.	Construction	Operator Contractor
M216	Silt curtains and/or other industry good practice management controls will be used to restrict the spread of sediment released during construction of the combined LNG Jetty/Materials Offloading Facility earthen causeway, particularly when working in mangroves, or adjacent to the reef and seagrass areas.	Construction	Operator Contractor
M217	Selection of dredging equipment (cutter, suction/hopper, etc.) by the contractor will be appropriate to the depths and material types to be dredged and to minimise the creation of plumes.	Construction	Operator Contractor

Table 29.3 Marine mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
M218	Disposal of the dredge spoil will be undertaken off the continental shelf presenting minimal risk of impact to the outer barrier reef. Locations for disposal will be selected based on hydrodynamic modelling to ensure no spoil settles on outer reef site.	Construction	Operator Contractor
M219	Treated effluent will be sent to retention pond(s) for polishing prior to discharge into Caution Bay in accordance with the required environment (waste discharge) permit conditions.	Operations	Operator Contractor
M220	Where practicable, light spill into the marine environment during construction and operation will be managed by shielding to reduce visibility of the LNG Facilities (including the marine facilities) from Idihi Island.	Construction Operations	Operator Contractor
M221	Compensation for loss of either access to and/or marine resources as a result of marine facilities exclusion zones will be managed through consultation with relevant communities to determine details of how compensation measures will be implemented.	Construction Operations	Operator
M222	A project-wide quarantine management plan will follow International Maritime Organization requirements and industry good practice with respect to ballast water discharge and hull cleaning to prevent the introduction of pest species.	Construction Operations	Operator Contractor
M223	Maintain existing alongshore sediment transport patterns in the vicinity of the Vaihua River mouth.	Construction Operations	Operator

Table 29.4 Cultural heritage mitigation and management commitments

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
Project-wide Measures			
M224	Conduct preconstruction surveys (including consultation with relevant project area landowners), by systematically recording and mapping cultural heritage sites in all project footprint areas. The surveys will inform the cultural heritage management plan that will be developed for the project (see M230).	Construction	Operator Contractor
M225	Undertake additional preconstruction surveys (including consultation with relevant project area landowners), in any additional impact areas that could not be surveyed for the EIS.	Construction	Operator Contractor

Table 29.4 Cultural heritage mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
Project-wide Measures (cont'd)			
M226	Consult and liaise with the PNG National Museum and Art Gallery as required for preconstruction surveys. Appropriately qualified professional archaeologists will supervise all preconstruction surveys. Liaison with the National Cultural Commission (NCC) will be through the PNG National Museum and Art Gallery as appropriate.	Construction	Operator Contractor
M227	Detail in the cultural heritage management plan the appropriate management measures for each site, once the preconstruction surveys are complete, the ROW has been cut and all cultural sites are identified.	Construction	Operator Contractor
M228	Consult local communities and cultural heritage specialists, to identify oral tradition sites during preconstruction surveys, and before obtaining their consent for the damage or destruction of cultural heritage sites.	Construction	Operator Contractor
M229	Conduct further research of appropriate archives as part of site preconstruction works, where relevant and required.	Construction	Operator Contractor
M230	Develop and implement a cultural heritage management plan (see Chapter 30, Environmental, Management, Monitoring and Reporting) in consultation with the PNG National Museum and Art Gallery, archaeologists and cultural heritage specialists.	Construction Operations	Operator Contractor
M231	Salvage, where required, highly significant sites specified in the cultural heritage management plan that may be destroyed by project activities.	Construction	Operator Contractor
M232	Engage appropriately qualified archaeologists and/or cultural heritage–trained personnel to coordinate and direct salvage activities. Salvage activities will be supported by the University of Papua New Guinea and will be in consultation with the PNG National Museum and Art Gallery, as required. Minimum qualification levels will be detailed in the cultural heritage management plan.	Construction	Operator Contractor
M233	Avoid significant sites during design and construction of pipelines and project facilities, as specified in the cultural heritage management plan.	Construction	Operator Contractor
M234	Develop management procedures for the recording and subsequent reburial of any human remains that may be unearthed during project site clearance salvage works and later, as part of project construction earthworks. This procedure will be prepared in consultation with the PNG National Museum and Art Gallery and representatives of the local communities. The procedure will be detailed in the cultural heritage management plan.	Construction	Operator Contractor

Table 29.4 Cultural heritage mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
Specific Measures for the LNG and Marine Facilities Cultural Environment			
M235	Develop and implement a cultural awareness program before early works and over the duration of project construction activities. The cultural heritage management plan will detail this program.	Construction Operations	Operator Contractor
M236	Develop monitoring programs and protocols for salvage (including artefact acquisitions) in consultation with the PNG National Museum and Art Gallery. The cultural heritage management plan will detail these programs and protocols.	Construction	Operator Contractor
M237	Develop protocols for timely and regular consultation with community representatives on matters concerning the management of those cultural heritage sites that will be impacted by project activities. The protocols will be developed in consultation with the local communities and the PNG National Museum and Art Gallery. The cultural heritage management plan will list these protocols.	Construction	Operator Contractor
M238	Engage appropriately qualified archaeologists or cultural heritage–trained personnel to monitor construction activities, and to ensure that any previously unknown sites are treated appropriately and according to measures and protocols detailed in the cultural heritage management plan.	Construction	Operator Contractor
M239	Periodically monitor cultural sites within the vicinity of pipelines and facilities (but which may not necessarily lie within the project footprint), to ensure that project personnel are not disturbing sites outside the area of disturbance.	Construction Operations	Operator Contractor
M240	Mark known offshore cultural sites on nautical charts and add a GIS reference on site construction plans for avoidance where practicable.	Construction	Operator Contractor
M241	Detail in the cultural heritage management plan the project personnel engaged to manage cultural heritage matters associated with the construction and operations stages of the project.	Construction Operations	Operator Contractor
M242	Consider whether it is feasible, practical and safe to train a cultural heritage officer to sample dredge spoil for the purpose of investigating the presence of submerged prehistoric artefacts in Caution Bay. The decision will be taken in consultation with the PNG National Museum and Art Gallery, and if the decision is affirmative, then the training program will be detailed in the cultural heritage management plan.	Construction	Operator

Table 29.4 Cultural heritage mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
Specific Measures for the LNG and Marine Facilities Cultural Environment (cont'd)			
M243	Liaise with a marine archaeologist to review the detailed side-scan sonar data obtained for areas to be developed offshore of Caution Bay. Management and/or future survey of any credible anomalies of cultural heritage origin will be detailed in the cultural heritage management plan, including avoidance where practicable. The project will liaise with PNG, Australian and international agencies involved in the recording and reporting of WWII war graves and artefacts as appropriate.	Construction	Operator
M244	Limit the movement of employees and contractors to within the site security fence and designated traffic and transport routes or locations outside of the LNG Facilities site. Employees will be prohibited from visiting local areas or villages around the site. These mitigation measures will be detailed in the cultural heritage management plan and implemented through the project early works and construction EMPs.	Construction	Operator
M245	Avoid sites identified outside the project area of development including Buria (CB10), Aemakara, Dirora, Darebo (CB11), Dori Hill (CB12), Daeroto, the four sites associated with Edai Siabo's first lagatoi story (CB6, CB7, CB8, ASM) and the three sunken lagatoi sites (CB16, CB17 and CB18). Measures to avoid these sites and to mitigate indirect and cumulative impacts will be detailed in the cultural heritage management plan and implemented through the project early works and construction EMPs.	Construction	Operator
M246	Engage a social anthropologist to record the Koita and Motu place names and their oral traditions within the LNG Facilities site lease boundary, which includes land immediately surrounding the site security fence area. This survey will be undertaken in consultation with relevant local communities.	Construction	Operator
M247	Cross-check the ARE, ARB and ARJ sites against previous sites formally recorded on the PNG National Museum and Art Gallery/University of PNG registers, i.e., sites AAIP, AAIO and AAIQ respectively. This cross-check will be undertaken as part of future site archaeology salvage and management, which will be detailed in the cultural heritage management plan and implemented through the project early works and construction EMPs.	Construction	Operator

Table 29.4 Cultural heritage mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
Specific Measures for the LNG and Marine Facilities Cultural Environment (cont'd)			
M248	Ensure that the ancient village of Konekaru (CB1, JD1, JD2, JD3, JD5, ML3, including the beach area; SC4) will be avoided by major site earthworks. Minor disturbance may occur during construction of the low-level post-and-wire fence around the lease perimeter boundary. Mitigation measures M228, M237 and M238 will be undertaken and will be managed in accordance with the cultural heritage management plan.	Construction	Operator
M249	Avoid the ancestral oral tradition sites including Davage, Taubarau, Ava Garau and the associated archaeological sites, as per M233. These sites are located more than 1.5 km south of the LNG Facility exclusion fence near Boera and are of the highest level of cultural heritage significance.	Construction	Operator
M250	Avoid the significant ancestral oral tradition sites of Buria (CB10), Aemakara, Dirora, Darebo (CB11), Dori Hill (CB12) and Daeroto located outside the LNG Facilities site security fence. Mitigation measures will be detailed in the cultural heritage management plan and implemented through the project early works and construction EMPs.	Construction	Operator
M251	Identify on site plans and create buffer zones to avoid, where practicable, the cultural heritage sites: • CB6, which lies well outside the project footprint, but will need to be identified on nautical charts for avoidance by shipping activities, as per M240. • CB7, which lies between the site security and site perimeter fence boundaries. • CB16, CB17, CB18, CB8 and ASM. Mitigation measures for each of these sites will be detailed in the cultural heritage management plan and implemented through the project early works and construction EMPs.	Construction	Operator
M252	Follow mitigation measures M231 and M232 for the SC3 and SC5 complex of sites, located within the LNG Facilities site security fence. The program to salvage and record sites will be detailed in the cultural heritage management plan.	Construction	Operator

Table 29.4 Cultural heritage mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
Specific Measures for the Upstream Cultural Environment			
M253	Ensure that major earthworks avoid the SC1 and SC4 sites, and the northern section of the ancient village site complex known as Aemakara. Minor disturbances may occur in these areas during construction of the low-level wire-and-post fence around the lease perimeter boundary. Construction will follow mitigation measures M228 and M238 and any sites discovered will be managed in accordance with mitigation measures detailed in the cultural heritage management plan, which will include measures to protect sites through cultural awareness training (as per M235) and movement restrictions for project personnel and contractors (as per M244). No excavation or salvage is proposed in these areas.	Construction	Operator
M254	Follow mitigation measures M228, M231, M232 and M238 for sites that are located within the site security fence boundary. The program to salvage and record sites will be detailed in the cultural heritage management plan.	Construction	Operator
M255	Liaise with the communities of the project area and various government agencies as appropriate to investigate and agree to strategic community programs.	Construction	Operator
M256	Revisit the P-39 aircraft crash site (CB4) and the cultural pipe bridge structure site (CB3) during the preconstruction survey. These heritage sites lie outside the project site security fence area but inside the site lease boundary area. Management measures will be detailed in the cultural heritage management plan.	Construction	Operator
M257	Avoid the aircraft crash site at Lea Lea (CB21), located outside the project area of development. Cultural awareness training, as per M235, implemented as part of the cultural heritage management plan, will prevent project personnel and contractors from visiting the site. There will be no further survey work of this site by the project.	Construction	Operator
M258	Indicate on site construction maps, and avoid, where practicable, the general area of known lagatoi wreck sites CB16, CB17 and CB18. If sunken lagatoi remains are discovered during site construction activities, works will stop and remains will be managed and protected as appropriate in consultation with the PNG National Museum and Art Gallery.	Construction	Operator
M259	Consider the Boera battery (CB30) when developing mitigation measure M235.	Construction	Operator

Table 29.4 Cultural heritage mitigation and management commitments (cont'd)

Mitigation Item Number	Mitigation Measure	Relevant Phase	Responsible Party
Specific Measures for the Upstream Cultural Environment			
M260	Include in the cultural heritage management plan management measures for the extent of Lake Kutubu (with particular attention to the avoidance of rock art sites and ossuaries; sites LK001-037, 056-063).	Construction	Operator
M261	Identify on site plans and create buffer zones to avoid, where practicable: • The two ossuary sites LK040 and LK041, which are located 1.4 km and 700 m southeast of the pipeline respectively, and include one of the largest ossuaries in the region. • The myth site Sisibuitono (LK043), which is located approximately 2.7 km southeast of the pipeline. • The Mount Ru complex, which is located approximately 10 km east of the LNG Project Gas Pipeline and west of Kopi Shore Base, and is associated with travels of the spirits of the dead. • The small hill at Helipad 14 (KG125), located 8 km east of the pipeline. • The area located 10 km east of the proposed pipeline, between Utiti Creek in the north, the Kikori River western bank in the east, and an area 500 m to the south and to the west of the existing Kopi base camp. • The major ritual lake Iba Mabuli (HD011) and the associated ritual sites (HD037, HD009, HD010 and HD012), all located about 1km north of the pipeline. • The Datore gebeanda ritual site (HD016), located about 2 km north of the pipeline. • The ritual site HD017, located about 4 km north of the pipeline. • The cultural sites at the north boundary of the Tipuripu HGCP Alternative Site, including sites HD225, HD209 and HD211. Mitigation measures for each of the sites will be detailed in the cultural heritage management plan and implemented through the project early works and construction EMPS.	Construction	Operator
M262	Conduct a cultural heritage assessment on limestone hills before quarrying, to determine whether the hills are culturally significant. The assessment will be undertaken in consultation with locals and the PNG National Museum and Art Gallery.	Construction	Operator