

RISK AND DISASTER MANAGEMENT PLAN

1. APPROACH

Risk analysis and Disaster Management for Kochi Water Metro Project (KWMP) involves planning what to do before, during and after a disaster or emergency occurs. Through further understanding these hazards and assessing a structure's behaviour to them, helps in better preparation for disasters management.

A risk-informed, performance-based approach is adopted offering opportunities to better understand and identify credible hazards and develop alternatives that allow stakeholders (owners, government, etc.) to make risk-informed decisions as to how best protect heritage, environment, lives, livelihood and meet disaster mitigation objectives.

This approach provides tremendous value including:

- Preserving our heritage and environment
- Embrace local heritage, resources, and methodologies
- Limit damage and aesthetic impact
- Cost-effective solutions
- Maintain functionality of sites
- Enhance life safety

For the Kochi Water metro project disaster assessment is carried out in 2 stages,

1. Construction phase of the project
2. Operational phase of the project

2. PROCEDURE

The disaster management for Kochi project involves the following stages

- Hazard and Risk Identification Process
- Classification and frequency of Hazard identification process
- Disaster Mitigation Planning
- Emergency Access Assessments
- Emergency Response Equipment Planning
- Disaster mitigation and Preparedness Planning
- Disaster Response Planning
- Disaster Recovery Planning

3. RISK/HAZARD IDENTIFICATION PROCESS

Hazard identification process is the first stage of the preliminary Hazard Identification (PHA). It is a systematic and structured assessment of potential accidents. During the assessment, consideration will be given to all potential scenarios that might occur regardless of their likelihood, and how the system will be operated in practice, including the potential for operator errors. Safety requirements are identified as mitigation measures, which shall then be taken care by the design of the respective Sub-systems. The assessment is based on the experience gained on other metro projects but also takes in to account the specificities of the project, including operation condition, climatic condition and high occupancy period.

Following broad categories has been considered for carrying out PHA for boats. For each of these broad categories, sub-categories are then identified with the help of the participating group based on which detailed PHA sessions are carried out.

- Hazards during preliminary stages of project (Design & construction)
- Abnormal behaviour
- Vandalism
- Collision
- Criminal behaviour
- Overcrowding
- Capsize
- Entrapment
- Evacuation
- Explosion
- Fire
- Security concerns
- Structural damage / collapse
- Natural hazards
- Slip/trip/fall of persons
- Pollution hazard

All hazards identified in this PHA are categorized by their frequency of occurrence and severity. When a hazard is identified, an estimate on the likely frequency of occurrence is made based on the frequency given in Table-1. The severity of the hazard is also ranked based on the definitions given in Table-2. The combination of frequency and severity will determine the risk rating of the hazards. Table-3 is used to categorize the hazards. The potential acceptability of the risk is then assessed according to Table-4. The acceptability will drive the efforts to be paid to mitigate each risk.

Table-1: Classification of Frequency of Hazard Occurrence

Category		Frequency Range	Description
A	Frequent	≥ 100 / year	Likely to occur frequently. The hazard will be almost continually experienced.
B	Probable	$\geq 1 - < 100$ / year	Will occur several times. The hazard can be expected to occur often.
C	Occasional	$\geq 1E-2 - < 1$ / year	Likely to occur several times. The hazard can be expected to occur several times.
D	Remote	$\geq 1E-4 - < 1E-2$ / year	Likely to occur sometimes in the system life cycle. The hazard can be reasonably expected to occur a few times over the system life.
E	Improbable	$\geq 1E-6 - < 1E-4$ / year	Unlikely to occur but possible. It can be assumed that the hazard may exceptionally occur during the system life.
F	Highly Improbable	$< 1E-6$ / year	Extremely unlikely to occur. It can be assumed that the hazard may not occur during the whole system life

Table-2: Hazard Severity Level

Severity Level		Consequences to Persons or Environment
1	Catastrophic	Fatalities and/or multiple severe injuries and/or major damage to the environment.
2	Critical	Single fatality and/or severe injury and/or significant damage to the environment.
3	Marginal	Minor injury and/or significant threat to the environment.
4	Insignificant	Possible minor injury.

Table-3: Safety Risk Matrix

Safety Risk Matrix		Hazard Severity Levels			
		1	2	3	4
Frequency Of Hazard Occurrence	A	R1	R1	R1	R2
	B	R1	R1	R2	R2
	C	R1	R2	R2	R3
	D	R2	R2	R3	R4
	E	R3	R3	R4	R4
	F	R4	R4	R4	R4

Table-4: Risk Rating

R1: Intolerable	Shall be eliminated
R2: Undesirable	Shall only be accepted when risk reduction is impracticable and with the agreement of Client or the local Safety Authority
R3: Tolerable	Acceptable with adequate control and the agreement of the client
R4: Negligible	Acceptable

The various risk identified for the project is given in Table-5&6.

Table-5: Potential risk and mitigation measures during Constructional Phase of the Project

Sl. No	Hazard	Action Plan
1	Accidents, Injuries due to : Working on heights, risk of fall Falling material and collapses Working on wet surfaces/ fragile roof. Mechanical Hazards, Chemical Handling, Electrical Hazards, Hot work	Certified contractors shall maintain high standard of work environment Safety plan shall be prepared and followed stringently on site: • Restricted entry • Permit Systems (wherever applicable) with clear work instructions • Training, supervising site workers to follow safe operating procedures(SOPs) • Signpost slippery areas, safety shoes with a good grip to the workers /supervisors • Use of Proper PPEs like Helmet, safety goggles , safety belts , safety shoes , safety jackets , safety torch • Use of safety nets while working from heights • Covered walkways • Combustible Materials, Paint, Plastics stored on site as per manufacturer guidelines & Safety Regulations. • Electrical equipment shall be regularly checked and properly maintained
2	Fire/Explosion Hazard due to Electrical fire Hot work (cutting, welding & brazing etc.) Storage of Combustible materials	Portable public address system • Dry riser with hydrant outlets on the floors constructed with a fire service inlet • Provision of temporary Fire Fighting Water Supplies and appropriate Fire Suppression Measures. • Prohibition of smoking on site , Restricted smoking Zone during construction • Use of PPEs full covered heavy material cloths , leather high topped fire resistance boots and gloves, use ear plugs or muffs, respiratory Protective equipments, etc.
3	Health hazards due to Biological, Air, Water pollution, Noise/vibration, confinement place entry, painting	Controlling the dust pollution by dust suppression on site . • Cordoning site with barricades • First Aid • Use of Proper PPE • Adequate drinking water and sanitary facilities • Occupational Health, Life safety of Workman during construction

		activity • Nearby hospitals are identified
4	Local flood	Increase in the Finished Ground Level as part of construction stage to prevent rain water accumulated on surrounding areas to enter into the project area. Provision of storm water drains at entry/ exit point to prevent entry of rain water Provision of adequately sized storm water drains to discharge the storm water from the project area into the external storm water drainage system. External Storm water system is sufficient to cater to this additional discharge.
5	Earthquake	The structural design is certified as per IS criteria for earthquake resistant design of structures Certification from Structural Engineer regarding EQ Resistant Design
6	Fire	Underground water storage tank of adequate capacity • Automatic Fire Hydrant System • Automatic Sprinkler System • Portable Fire Extinguishers • Analogue Addressable Fire Alarm System with Emergency Voice Evacuation System • Manual Fire Alarm System • Provision of refuge areas • Fire lifts
7	Noise	• ensure that the site and reserves of building materials and soil are properly enclosed; • equipment can be made quieter by modifications, such as adding new mufflers or sound absorbing materials. • Equipments will be checked for proper maintenance • Temporary barriers/enclosures (e.g. plywood with sound absorbing materials) can be built around noisy equipment. These barriers can significantly reduce noise levels and are relatively inexpensive.

Table-6: Potential risk and mitigation measures during Operational Phase of the project

Sl No	Hazard Description	Potential Cause	Potential Consequence	Risk Ranking			Potential Hazard Elimination / Mitigation Measures (Potential Safety Requirements)
				Freq	Sev	Risk	
1	Water Logging/Water Ingress into the boat	1. Damaged hull 2. Pipeline Failure 3. Grounding/Stranding 4. Stain tube Damage as a result of fishing net entangled in the propeller blades	1. Water entering the boat and leading to sinking 2. Boat Capsizing or boat tilting	D	1	R2	Boat to be designed for 1. Provision to be made to pump out ingress of water from any space inside the hull using a bilge pump. 2. High level Alarm on the console with automatic pumpactivation 3. Intact stability check as per IMO and Kerala IWT 4.Stability to be defined as per IMO rules (Bulkhead Positioning) 5. Provision of buoyant material to make boat unsinkable 6. Provide life jackets for every person (as per capacity) 7. Provide LSA & FFA equipment as per Kerala IWT and India IV Act
2	Environmental erosion	1. Extreme weather conditions 2. Falling of shore site 3. Careless vessel movement	Water pollution due to discharge of suspended solids	D	2	R2	Best Management Practices (BMPs) and engineering design to limit soil erosion and mobilization /transport of sediments from disturbed area
3	Carrying of explosive flammable material	Security flaws, Non operational CCTV, Security	Explosion in Boat, fire, Suffocation due to gasses emitted, Panic situation Fatality due to fire and explosion	D	1	R2	A Redundancy room will be installed at OCC

Sl No	Hazard Description	Potential Cause	Potential Consequence	Risk Ranking			Potential Hazard Elimination / Mitigation Measures (Potential Safety Requirements)
				Freq	Sev	Risk	
4	Improper Quality Control	1. Construction flaws, 2. Improper Housekeeping 3. Air Pollution 4. Noise Pollution	1. Safety concerns 2. Ridership might get affected	D	3	R3	1. Proper quality checks to be imparted during the construction of boats 2. Should maintain Proper housekeeping during operations 3. Regular maintenance to be carried out as per schedule
5	Propulsion System Breakdown	1.Oil based DE Failure 2.Gen set Failure 3. Electric motor , Shafting system failure 4. Control system failure (telemetry failure, governor failure, wire breakage, short circuiting)	1. People will get stranded in middle of water 2. Panic Situation 3. Chances of Stampede and fall of people into water	D	4	R4	1. Lower Anchor immediately to prevent drifting of the boat 2. Inform workboat immediately 3. Redundancy to be provided for engine failure like other alternatives having battery backup for immediate operation 4. Communication system to be provided for emergency message dispatching 5. Spares pool maintenance for immediate replacement 5. Boat should be designed for taking double the capacity for which it is designed. 6. Towing of the damaged boat to be made easy
6	Fire in a Boat	Boat designed using flammable materials and emitting of thick smoke, high temperature, large flames	1. Suffocation due to gasses emitted 2. Water / air Pollution 3. Fatality due to fire	D	1	R2	1. Use of material in accordance to fire/smoke norms applicable to a Boat environment and of low fire load 2.Boat borne smoke detector/under frame fire wire detection to be provided 3. Alarm available for passengers Adequate design of the ventilation system 4. Operational rules to maintain a clear environment to avoid accumulation of potential combustible materials and non-smoking policy in all premises Strict adherence to the PMS Training for the operating staff

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				Freq	Sev	Risk	
7		Jamming of Shafts leading to an overheat propulsion system (Mechanical)	1. Suffocation due to gasses emitted 2. Water / air Pollution 3. Fatality due to fire	E	2	R3	1. Under frame heat detectors to be provided. 2. Adequate periodic maintenance of the boats. 3. Water sprinkler systems to be provided in boat for fighting fire along with standard fire fighting equipments
8		Short circuit leading to ignition of the conductors and connections	1. Suffocation due to gasses emitted 2. Water / air Pollution 3. Fatality due to fire	D	1	R2	1. Boat inborn smoke detector/under frame fire wire detection to be provided. 2. FFS to be provided in boats for fighting electric fires 3. Respect of the state of the art rules during design and maintenance of the electrical equipment
9		Ignition due to overheat of the electrical and mechanical equipment	1. Suffocation due to gasses emitted 2. Water / air Pollution 3. Fatality due to fire	D	1	R2	1. Boat borne smoke detector/under frame fire wire detection 2. Adequate dimensions of the electrical and mechanical equipment in regard to the state of the art rules
10		Due to leak of Fuel/ Battery catching fire due to overheating of electrolyte	1. Suffocation due to gasses emitted 2. Water / air Pollution 3. Fatality due to fire	D	1	R2	1. Fire extinguisher placed. 2. Designed with proper ventilation 3. Battery maintenance to be adhered 4. Flooding of boat (ref: DNV GL report)
11	Insufficient ventilation system of the boat with person trapped in boat for a long period	Obstruction	Suffocation of a person due to lack of air renewal	D	3	R3	1. Communication means available for passengers to warn Driver and OCC 2. Adequate periodic maintenance of the ventilation system schedule to be prepared 3. Procedure to determine the necessity of boat withdrawal in case of single, multiple, total AC/ventilation devices failure

Sl No	Hazard Description	Potential Cause	Potential Consequence	Risk Ranking			Potential Hazard Elimination / Mitigation Measures (Potential Safety Requirements)
				Freq	Sev	Risk	
12		Defect of fan or regulator	Suffocation of a person due to lack of air	D	3	R3	1. Communication means available for passengers to warn Driver or OCC 2. Adequate periodic maintenance of the ventilation system 3. Procedure to determine the necessity of boat withdrawal in case of single, multiple, total AC/ventilation devices failure
13		Defect of power supply	Suffocation of a person due to lack of air renewal	D	3	R3	1.Redundancy of power supply and emergency light should come (ON) 2. Adequate periodic maintenance of power supply equipment 3.Adequate operation procedure to initiate boat evacuation in case of prolonged power failure 4.Communication means available for passengers to warn Driver or OCC
14		Non detection of the gas or smoke accumulation in areas accessible to passengers	Suffocation due to gas emitting or polluting liquid or smoke	D	3	R3	1. Detection of smoke in passengers accessible areas 2. Smoke detectors in non accessible areas to passengers 3. Provision for smoke control system in the Boat (GAS Detection System)
15		Alarm information not sent or not received	Suffocation due to gas emitting or polluting liquid or smoke	D	3	R3	1. Communication equipment redundancy 2. A redundant communication system should be available in case of failure of the communication system 3. Smoke detectors placed in all the areas 4. Word of Mouth or action
16	Presence of polluting materials or fluids	Excessive temperature or incompatibility of the materials	Suffocation due to gas emitting or polluting liquid or smoke	D	3	R3	1. Choice of material in accordance to the state of the art rules applicable to a Boat 2. Rooms that contain batteries should be ventilated, especially as temperature increases (Continuous temp monitoring)

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							3. Alarm should be provided in the OCC in case of ventilation failure in Rooms with batteries
17	Slippery Boat floor	Inadequate design or slippery floor because of rain/sand spillage etc	Person trips or falls	D	3	R3	1. Use of non -slippery material for the Boat floor 2. Adequate operation procedure to limit wet/sandy surfaces 3. Provision to be made to clean the slippery surface immediately
18	Insufficient lighting in Boat	Failure of the Boat lighting system	Person trips or falls	C	3	R2	1. Audio device available to warn the OCC staff of the lack of lighting 2. Adequate number of car lighting equipment -redundant circuitry for lighting 3. Adequate periodic maintenance of the boat lighting 4. Sufficient spare bulbs to be maintained
19	Excessive acceleration/deceleration of a moving Boat	Excessive longitudinal jerk with passenger simultaneously not using support handles	Person trips or falls	E	3	R4	1. Warning chime on speed Limitation of the longitudinal jerk during operations 2. Grab poles and hand rails available for passengers 3. ABLS system at OCC to be activated to show excess speed
20	Excessive side jerk of a moving boat generated by the waves	Over speed in a curve with passenger simultaneously not using support handles Improper planning	Person trips or falls	E	3	R4	1. Definition of the maximum speed limit of the Boat to be displayed and 2. ABLS system at OCC to be activated to show excess speed. 3. Proper training for the staff

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21	Loss of balance of a person during an evacuation operation, passengers heading to the pontoon	panic situation	Person trips or falls	D	3	R3	1. Adequate design of the access from the boat to the pontoon and marking of passage 2. presence of trained staff to manage a panic situation
22		Evacuation from boat	Overcrowding of the rescue boat	D	3	R1	Every boat should be designed to take double the maximum load envisaged
23		Evacuation from boat	Fall of a person during an evacuation on the pontoon	E	1	R3	1. Operation procedure to ensure safe evacuation of passengers 2. Adequate design of the access from the boat to the walkway (no gap) 3. Audio intercommunication and video devices should allow the OCC staff to manage a panic situation
24	Evacuation from a sinking/Engine failure boat	<u>in Midway</u> : Engine Failure, Hull damage	Overcrowding of the rescue boat.	E	1	R3	The boat to be designed to carry 100 % excess passenger capacity (stability).
25		<u>at Jetty</u> : Engine failure, Hull Damage,	tripping and falling in to water when the evacuation from sinking boat at a jetty	E	1	R3	1. The boat should be designed to make maximum people evacuate in the shortest possible time to pontoon. 2. The boats to have guide ways which can be opened with ease in case of an emergency. 3. Additional emergency evacuation door to be added. 4. Adequate number of FFA and LFA 5. Staff trained for emergency situation 6. Provision to alert nearby boats and OCC

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				Freq	Sev	Risk	
26	Contact with a hot surface	Inadequate insulation of parts accessible to passengers or maintenance staff	Burn due to contact with a hot liquid or object	D	2	R2	1. Respect of the state of the art rules concerning thermal insulation of potentially hot equipment. 2. Trainings to be provided to staff and first aid kit 3. Adhere to defined safety norms for maintenance
27		Unexpected overheat of an equipment accessible to passengers or maintenance staff	Burn due to contact with a hot liquid or object	D	2	R2	1. Design of equipment to avoid accessible hot surface 2. Warning Stickers in case of unavoidable hot surface accessible to maintenance workers
28	Person exposed to high voltage in Boat	Contact of a person with installations fitted with high voltage (, electrical equipment boxes...)	Electric shock	D	2	R2	1. Devices fitted with high voltage should not be accessible to passengers. 2. All power supply circuit and equipment are to be designed in accordance to local codes on wiring of electrical equipment Procedure on the maintenance of high voltage devices 3 Use of warning signs
29	Boat departs with passenger trapped between Pontoon and Boat doors	No safety feature considered to prevent starting of the boat under this situation Mistake of the boat driver	Trap of a person between the boat and the pontoon of a person from the boat to the Water	E	1	R3	1. Adequate working conditions and competency test and certification for driver 2. Mirror will be fitted near the driver to have clear vision on the alighting and boarding points 3. Interlocking can be provided between ramp closing and engine starting

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				Freq	Sev	Risk	
30	Weather Hazard	Weather & environmental condition	Erroneous boat detection leading to boat collision at worst case. Capsizing causing fatalities & severe injury	E	1	R3	Proper communication to be maintained between OCC and all boats. This is necessary to warn about adverse weather condition.(NAVTEX)
31	Non or delayed operation of brakes (Propulsion reversal)		Collision of a vehicle in motion with another vehicle : rear-end, side-on or head-on collision	E	1	R3	1.Chances of collision with pontoon 2.Damaged to boat
32	Backward movement of Boats	Failure of the travel direction control	Collision of a vehicle in motion with another vehicle : rear-end, side-on or head-on collision	E	1	R3	1. All stopped boat during evacuation, passengers exchange or parked position should be immobilized in a safe way 2. Operating procedure to ensure that driver applies anchors/ moored properly during evacuation, passenger exchange or parked position
33	Malfunction of Communication other systems equipment	System/Power Failure	Collision of a vehicle in motion with another vehicle : rear-end, side-on or head-on collision	E	1	R3	Redundancy to be provided for all systems and also proper quality checks to be imparted for all COTS components

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				Freq	Sev	Risk	
34	Over speed of a boat or inadequate stopping distance	Driver mishandling	Collision of boat	E	1	R3	The maximum speed target should be set to result in a safe state of operation and operator to be trained on applying proper Prop torque techniques. Alarm system to be incorporated to indicate over speeding
35	Person present in the boat when it is withdrawn from Revenue Service	Non detection of the presence of a person in the boat withdrawn from Revenue Service and the person leaves boat subsequently	1. Suffocation and getting stranded	C	2	R2	Proper inspection to be done before the boats are docked at the end of the day
36	Vehicle overload	Excessive or badly distributed load	Boat can Capsize	B	1	R1	Passenger entry is restricted by the ticketing system
37	Obstacle on the way	Object fallen from infrastructure	Boat can capsize due to a loss of guidance on the route or to an element left on the route or outside environment (e.g. sandstorm, earthquake, flooding, lightning etc.).	A	1	R1	1. Inform the OCC 2.Regular check on fixture of the infrastructure
38	Panton gets detached	1. Wear and tear of fastening equipment 2. Heavy swell	1. Passengers getting stranded in boat	E	2	R2	1. Periodic maintenance and frequent inspection of pontoon fastening system

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				Freq	Sev	Risk	
39	Wrong operation of the Boat doors	doors opening on the opposite side to the Pontoon and people do not notice that the open door is not on the actual side	Drowning	E	1	R3	1. Proper Training to be provided to the operator. 2. Sensor can be placed which talks with the boat door and the pontoons
40	Departure with open door	Failure of the Boat door where person can move in or out of Boat as Boat starts to move	Fall of a person from the boat, drowning	D	1	R3	The departure authorization of a Boat is only allowed when the closed/locked status of the boat door is ensured. This is a safety critical feature Interlocking between door closure and engine starting
41	Breakage of the Boat parts	Breakage of a panel, a windshield, the gangway, the floor	Fall of a person from the boat, Drowning	E	2	R3	1. Respect of the state of the art rules for the dimensions of the parts related to the boat to be followed 2. Stringent quality check to be performed during construction
42	Fall due to rush or to the gap between the pontoon and the boat	Inadequate infrastructure gauge calculation	Trap of a person between the Pontoon and Boat	E	2	R3	1. The infrastructure gauge should allow a maximum gap distance (to be defined) between the boat and the 2. Pontoon in the worst conceivable operation configuration 3. Adequate periodic maintenance of the pontoon 4. Proper Crowd control by attendance
43	Trap of a person in the boat door due to an unexpected closing	closing command failure (closing without warning)	Trap of a person between the Pontoon and Boat	E	2	R3	Audible alarm emitted before the doors closing Obstacle detection during boat door closing

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44	Trap of limbs, baby car, wheelchair, during passengers exchange at the Jetty	Defect of the boat doors motoring or command reception	Trap of a person between the Pontoon and Boat	E	2	R3	Audible alarm emitted before the doors closing Obstacle detection during boat door closing
45	Presence of a sharp object accessible to passengers or maintenance staff	1.Inadequate design 2.Damaged equipment that became sharp	Contact of a person with the sharp object	E	2	R3	1. Respect of the state of the art rule for the design of equipment accessible to passengers to avoid sharp or prominent objects 2. Adequate maintenance/operation procedure on sharp or prominent equipment accessible to staff
46	Insufficient visibility during evacuation on the line	Failure of the lighting system	Delay in the evacuation process in case of fire	D	1	R2	1. High availability of the emergency lighting 2. Audio device available to warn the OCC staff of the lack of lighting 3. All exit lightings and exit signs are designed in accordance to codes with retro reflective tapes
47	Inadequate design of pressurized devices	Design of pressurized air tank	Explosion of a pressurized equipment in the Boat	D	1	R2	1. Adequate dimensions of tanks considering the maximum conceivable pressure values
48	Inadequate design of power electronic component	Design of power electronic component	Explosion of power electronic component in the Boat	D	1	R2	1. Respect of the state of the art rules during design of power electronics equipment

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				Freq	Sev	Risk	
49	Bad boat positioning in regard to the high level walkway	Gangway design issue or low tide	Fall at the interface between the boat and the high level walkway during passenger egress	D	2	R3	1. Floating pontoons at low tide area 2. Proper berthing of the vessel with respect to the jetty by the operator
50	Overcrowding at gangways / terminal	Late arrival of boats to stations	Multiple consequences the worst being passengers being pushed to water and thus getting drowned	C	3	R2	1. Proper boat regulation PA announcement for crowd control 2. Assistance from customer care 3. Controlled access to paid area
51	Suicide by jumping into water or man over board	Access to open door or move around for passengers	This can lead to boat delay, legal litigations and thus unnecessary disturbance to water metro operation.	D	3	R3	Restriction for passenger movement during the journey. Doors to be locked automatically
52	Overloaded Boat	Improper crowd management procedure during boarding	Minor injury to passengers inside boat under normal situations. Under emergency situations, there may be severe injury and difficulty in evacuation	D	2	R2	Effective crowd control during boarding the boat

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53	Public vandalism	Object thrown from neighbourhood	Passenger minor injury. boat damage. Worst case may create boat to capsize	C	3	R2	Liaison with law and order department . Proper security persons to be deployed and material selection to be checked like toughened glass
54	Software bug	System connection to unauthorized networks / poor fire wall provisions / No antivirus software etc.	Malfunction of critical software like AFC system may lead to serious safety consequences leading severe injury due to crowding and stampede	C	3	R2	Special protection at the design level shall be considered to restrict the unauthorized access to external devices such as external storage devices etc., provision of restricted login control shall be provided.
55	Improper CCTV & coverage quality	Poor design (coverage & equipment)	Security lapse which in worst case can lead to severe consequence like bomb blast in stations	B	2	R1	Design coverage prediction and post implementation coverage study shall be conducted Reputed vendors to be selected during contract award process.
56	Incompetent security staff	Poor resource management	Security lapse which in worst case can lead to severe consequence like bomb blast in stations	B	2	R1	Government security agencies shall be employed by KMRL .

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57	Improper Terminal closing procedure	Poor safety consideration in procedures	Possibility of passengers trap inside station, sabotage motive can cause severe damage to Terminal infrastructures	B	2	R1	Proper Terminal closure procedure considering safety issues
58	Poor intrusion detection system	No design consideration	Security lapse which in worst case can lead to severe consequence like bomb blast at jetties	C	2	R2	CCTV system & ACIDS (access control and intrusion detection system) shall detect unauthorized movement
59	Pollution	1. Water pollution due to littering 2 Air pollution due to DE engine 3. Noise pollution 4. Oil pollution from hydraulic system if fitted	Affect the marine life				1. Periodic servicing to be done for all engine related components as per SOP's 2. People to be educated about safeguarding the environment through the visual display system in the boat 3. Proper maintenance schedule to be maintained at the OCC level in which the system identifies the maintenance schedule and the information is passed on the boat yard which withdraws the boat from service for maintenance 4. The boat to be covered with no provision for littering into water 5. Trashcans to be provided inside the boats

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				Freq	Sev	Risk	
60	Not having Safe Means of Access and Egress	1. Improper Access planning 2. Negligence towards safe access to site 3. Illumination 4. House Keeping 5. Not having proper barrications	1. Trip, fall into water and drowning	A	2	R1	1. Safe means of access and egress should be provided between a working area and (i) safety vessel; (ii) the shore; 2. Efficient lighting should be provided at all means of access and egress. 3. Means of access and egress and their approaches should be free from obstruction and, as far as practicable, kept clear of any substance likely to cause a slip, trip or fall. 4. Green nets to be provided and work area should be barricaded
61	Rescue and Emergency Arrangements	1. Not having approved SOP's 2. Lack of knowledge and concern towards safety	1. Loss of critical time for saving a person 2. Confusions and chaos and panic among workers	A	1	R1	The occurrence of an emergency situation should be informed immediately to the rescue team for immediate launching of appropriate rescue procedures. 2. Sufficient rescue/evacuation boat(s) should be provided and kept ready for immediate use in case of emergency 3. Serious emergency situations should be reported immediately to the public emergency authorities, i.e. Fire Services Department and/or Police, for assistance 4. Standard SOP's should be defined 5. Rescue facilities, including sufficient stretcher(s), portable resuscitation equipment and first aid facilities, should be provided and kept readily accessible for emergency use

Sl No	Hazard Description	Potential Cause	Potential Consequence	Risk Ranking			Potential Hazard Elimination / Mitigation Measures (Potential Safety Requirements)
				Freq	Sev	Risk	
62	Safe Use of Lifejackets/Buoyancy Aids	1. Not having approved SOP's 2. Lack of knowledge and concern towards safety	1. Drowning 2. Fall into water 3. Panic among workers 4. Legal complications	A	2	R1	1. Lifebuoy with a buoyant safety line of 30 meters long should be available for use, and the locations of lifebuoys should be at less than 10 -metre intervals along the edges of places, in vicinity work area. To avoid any delays to rescue operations, lifebuoys should not be tightly tied to posts. 2. Ramps of adequate strength should be provided for the access of work area from shore
63	Safe Use of Lifting Appliances/Mobile Plant		1. Injury to Workers 2. Delay in completion of work	B	2	R1	1. For all equipments risk assessment for work over/near water should be conducted and reviewed periodically by a competent person. 2. Insurance and worthiness should be checked periodically
64	Safe System of Work		Safe System of Work	D	2	R2	1. Tasks specific risk assessment for work over/near water should be conducted and reviewed periodically by a competent person. 2. All potential hazard(s) involved in the work over/near water, e.g. drowning, overturning of mobile plant/equipment into water and collapse in confined spaces, should be identified, listed out and addressed 3. A safety plan for work over/near water should be established and should be reviewed at regular intervals 4. Necessary safety instructions to be displayed
65	Working At Height		1. Trip, fall into water and drowning 2. Loss of life /Fatal injury due to fall 3. Fall leading to disability	A	1	R1	1. Suitable guard-rails and toe-boards should be installed at edges. Openings should be properly covered where persons are liable to fall from height, to land surfaces or into water. 2. Suitable working platforms, with suitable guard-rails and toe boards, should be provided for work at height. Safe means of access and egress should be provided for the working platform.

SI No	Hazard Description	Potential Cause	Potential Consequence	Risk Ranking			Potential Hazard Elimination / Mitigation Measures (Potential Safety Requirements)
				Freq	Sev	Risk	
							3. Safety harnesses with continuous and effective anchorage system should be provided when it is impracticable to provide a suitable working platform, access and egress and safe place of work.
66	Slips, trips, or falls	1. Issues with housekeeping and keeping the work area slippery 2 Not using Safety Nets 3.Safety Harness 4. Collapse of scaffolding 5. Lack of training	1. Slip into Water and drowning 2. Bodily Injury from Fall	A	2	R1	All employees must receive training on the nature of the fall hazards at the site and on how to avoid falls. When work takes place over water, both of the following must be in place: A skiff or boat for emergency rescue operations, equipped with paddle or oars, a ring buoy or other life preserver, and a reach extension device. One or more ring buoys, with at least 90 ft. (27.4 m) of line attached, located at 200 ft. (61.0 m) intervals across the distance of the work area that is over water.
67	Collapse of Temporary structures	1. Building temporary structures near flood plain 2. Soil Erosion		E	1	R3	
68	Water Pollution (Oil/Lubrication/ Paint/Varnishes Spillage)	1. Issues with storage 2. Carelessness in Handling	Water Pollution	A	3	R1	Adequate trainings to be provided to employees working at waterfront. Proper Covering to be done prior to finishing to ensure that paints are not seeped into water
69	Waste Disposal	1. Improper training and lack of awareness 2. Lack of Trashcans and non-periodic cleaning	1. Soil and Water Pollution 2.Leptospirosis	A	3	R1	Adequate trainings to be provided to employees working at waterfront. Dustbins to be provided and awareness camps to be conducted. Schedule for waste pickup to be developed and awareness camps to be conducted
70	Collapse of Temporary structures	Weather & environmental conditions	1. Trip, fall into water and drowning 2. Loss of life /Fatal injury due to fall	D	1	R2	Emergency procedures, including rescue/evacuation procedures, should be formulated and reviewed regularly in the safety plan for, but not limited to, adverse weather (typhoon, thunderstorm, heavy

Sl No	Hazard Description	Potential Cause	Potential Consequence	Risk Ranking			Potential Hazard Elimination / Mitigation Measures (Potential Safety Requirements)
				Freq	Sev	Risk	
			3. Injury from flying objects				rainstorm, etc.), fire, injuries of workers, etc. An emergency contact list (internal and external) should be displayed on board.

4. DISASTER MANAGEMENT

“Disaster Management” means a continuous and integrated process of planning, organising, coordinating and implementing measures which are necessary or expedient for the following:

- Prevention of danger or threat of any disaster;
- Mitigation or reduction of risk of any disaster or its severity or consequences;
- Capacity-building;
- Preparedness to deal with any disaster;
- Prompt response to any threatening disaster situation or disaster;
- Assessing the severity or magnitude of effects of any disaster;
- Evacuation, rescue and relief;
- Rehabilitation and reconstruction

4.1 Objective

The objective of the DMP is:

- To save life and alleviate sufferings;
- To minimize any adverse effects on people, damage to property or harm to the environment;
- To facilitate a rapid and effective emergency response and recovery;
- To provide assistance to emergency and security services;
- To communicate vital information to all relevant persons involved (both internal personnel and external agencies) with a minimum of delay; and
- To keep all systems ready to handle any disastrous situation.

The Disaster Management Manual and the associated Standard Operating Procedures that accompany the DMM serve as the centralized repository for the information, tasks and procedures that would be necessary to facilitate KMRL management’s decision making process and its timely response to any disruptive or extended interruption of the department’s normal business operations and services. This is especially important if the cause of the interruption is such that a prompt resumption of operations cannot be accomplished by employing only normal daily operating procedures.

KMRL shall ensure that its employees are trained and prepared through emergency planning arrangements through specific post and competency requirements, training modules and participation in emergency exercises.

4.2 Levels of Incidents/ Disaster

Level 0: An event or series of events causing no adverse impact on person(s), property, environment or services, but which may require attention of operation & maintenance staff.

Level 1: An event or series of events causing delay to services up to 30 minutes during peak and 45 minutes in off-peak hours or limited damage to property or minor injury to person or death due to nonoperational reasons e.g. medical condition. OCC manages the level 1 event, with or without the assistance of external services, without the need for immediate information to concessionaire/authorities or trigger of the Disaster Management Manual. However, Chief Controller may inform OCC Manager if required.

Level 2: An event or series of events causing delay of boat services exceeding 30 minutes during peak and 45 minutes in off-peak hours or limited damage to persons, property or the environment. OCC manages the level 2 event as per Incident Management Plan, with or without the assistance of external services. Chief Controller shall inform OCC Manager or On-call Senior Manager who will inform concessionaire/authorities if the disruption is over 30 minutes.

Level 3: An event or series of events causing severe injury or death to one or more persons, significant damage to property or the environment, or security threat which lead to the triggering of the Disaster Management Manual. OCC Chief Controller shall immediately inform the authorities for any event of level 3. OCC Manager or senior member of management shall coordinate activities with other authorities and external agencies. Authorities will trigger Disaster Management Manual and mobilize additional resources.

4.3 Disasters In Water Metro Project

Following situations shall be treated as Disaster for Kochi Water Metro

- Fire
- Boat Accidents (Collision, Capsizing)
- Man over board or Suicide
- Terrorist Attacks and Bomb Blast
- Bomb Threat
- Unmanageable Crowd
- Natural Calamities
- Wide Spread Violence And Public Disturbance
- Reckless Operation of Boat
- Driving under the Influence of Alcohol
- Equipment Failure

The management of incidents causing delays and disruptions to passenger services are dealt separately through KWM's Operations and Maintenance Plans and the supporting Standard Operating Procedures to these Plans. These incidents of level 0 and 1 are, therefore, not considered in this Plan. Incident / accident of level 2 may lead to the implementation of the DMM, while Level 3 events trigger it automatically.

Approach

Averting a disaster or response to mitigate the severity of disaster, as it relates to passenger boat accidents, require

- (i) prior and adequate advance Knowledge of likely incidents;
- (ii) availability of instruments/facilities to contain the risks;
- (iii) arrangements/ tools to facilitate quick resurrection; and above all
- (iv) facility of skilled manpower support to organize the pre and post event response mechanisms.

Thus the guidelines are presented in five related segments as below:

- **Weather Forecasting & Early Warning System-** This is dealt in the second chapter wherein the spatial and temporal variations in climate characteristics and the resultant impacts are discussed. It is essential that boat owners and water way management authorities must pay attention on weather bulletins and guidelines issued by local meteorological organizations to avert boat tragedies.
- **Safety Standards & Specifications** - These aspects have been discussed in chapter 3 wherein the importance of safety measures are discussed in details. The general safety measures expected to be adopted by boat operators are dealt with in this chapter. In addition, safety standards for mechanized and non-mechanized boats are also discussed.
- **Regulatory & Legal Issues-** This is discussed in chapter 4. The regulatory provisions of national waterways, the existing ferry acts and rules and other legal issues are discussed in this chapter. The model rules are discussed in this chapter with roles and responsibilities of the proposed Inspectorate of Safety.
- **Search and Rescue** - The Search and Rescue operations in the aftermath of boat accidents are equally important as the mitigation measures. The chapter 5 discusses these issues in details in reference to boat and navigation safety. Some of the important aspects like Standard Operating Procedures (SOPs), Accident Management Plan, Emergency Search and Rescue, Response mechanisms at boats/vessels, rescue elements at Jetties, medical action plans etc. are discussed in this chapter.
- **Capacity Development-** The Capacity Development aims to create enabling environment with appropriate policy and legal framework, institutional development including community participation through which individuals, organizations and societies obtain, strengthen and maintain capabilities to set and achieve their own development objectives over time.

The plan includes KWM's detailed approach to managing disasters by:

- Regular assessment of the risks involved in Operation and Maintenance activities with adopting mitigation measures in order to prevent disasters by improving procedures and the use of the systems that support the safety of Kochi Water Metro.
- Continuously development/optimization of Operation and Maintenance procedures in order to prepare for potential disasters and the use of systems based on a change in the assessment of the threat to Kochi Water Metro.

- Effective response in managing all categories of disasters by KWM in terms of the standard and tested approach.
- Speedy recovery from the disastrous situation to the point of normal planned operations and maintenance activities can resume.
- Analysing the disaster management worldwide, adopting lesson learnt to continuously improve existing processes.

KMRL approach to deal with disaster is based on two different levels of emergency plan:

- The Disaster Management Plan which covers incidents that may affect specific corridors, e.g. stalled boats or loss of local communication or power control through to incidents that impact on all three Corridors I, II, and III involving stations and boats, e.g. major power failure, major loss of communications systems, major flooding and terrorist attack;
- Local plans which cover specific locations, e.g. stations, OCC, maintenance Boatyards e.g. station evacuation due to congestion or local security alert.

Both emergency plans are integrated and mutually support one another. The findings of the Risk Assessment Process are used to structure the content of these plans, as necessary. Rules dealing with operational emergencies and incidents are documented in the KMRL Standard Operating Procedures.

In the Standard Operating Procedures (SOPs) that support this Plan, KMRL will detail the specific activities that will apply to each of the disaster scenarios. The SOPs encompass:

a) Accidents

- Accident involving people in a Boat between stations
- Accident involving people at station

b) Fire

- Dealing with fire at Terminal
- Dealing with fire in OCC
- Dealing with fire in Boat (At station or in between stations)
- Dealing with fire in Boatyard
- Dealing with fire adjacent to Terminal

c) Man-made disasters

- Dealing with acts of Sabotage
- Dealing with act of crime including assault on employees
- Dealing with riots, arson, vandalism on a large scale & civil disobedience
- Dealing with terror attack
- Dealing with bomb blast, bomb threats
- Dealing with stampede
- Dealing with nuclear/ Biological/ Chemical attack
- Dealing with Drunken Crew/Passenger

d. Natural disasters

- Dealing with earthquake
- Dealing with floods
- Dealing with pandemic outbreak or potential Epidemic
- Dealing with stormy weather

e. System related disasters

- Dealing with capsizing with casualty
- Dealing with collision with or without passengers
- Dealing with structural damage in steaming
- Dealing with total power failure during steaming

4.4 Organisation and their Roles and Responsibilities Authoritise

The Disaster Management Act, 2005 defines formation of different level of authorities, their roles and responsibilities, members and their key functions during disasters. Following chart explains the authority, members and their key functions during disastrous situations:

Central Government Authorities

National Disaster Management Agency (NDMA)

S. No.	Authority	Members
1	NDMA	Chairperson: Prime Minister Other members: nominated by Chairperson (not exceeding 9)

Roles and Responsibilities of NDMA

- To lay down the policies, plans and guidelines for disaster management for ensuring timely and effective response to disaster
- Approve the National Plan
- Approve plans prepared by the Ministries or Departments of the Government of India in accordance with the National Plan
- Lay down guidelines to be followed by the State Authorities in drawing up the State Plan

National Executive Committee (NEC)

No	Authority	Members
1	NEC	Chairperson: The Cabinet Secretary to The Government of India Other members: The Secretaries to the Government of India in the different Ministries or Departments

Roles and Responsibilities of NEC

- Assist the NDMA in the discharge of its functions
- Implementing the policies and plans of the NDMA
- Prepare National Plan
- Ensure the compliance of directions issued by the Central Govt. for the purpose of disaster management in the country

State Government Authorities

State Disaster Management Authorities (SDMA)

No	Authority	Members
1	SDMA	Chairperson: Chief Minister of State Other members: (not exceeding 9) nominated by Chairperson; and Chairperson of the State Executive Committee

Roles and Responsibilities of SDMA

- Lay down the State disaster management policy
- Approve the State Plan in accordance with the guidelines laid down by the National Authority
- Approve the Disaster Management Manuals prepared by the departments of the Government of the State Coordinate the implementation of the State Plan
- Recommend provision of funds for mitigation and preparedness measures
- Review the development plans of the different departments of the state and ensure that prevention and mitigation measures are mitigated therein;
- Review the measures being taken for mitigation, capacity building and preparedness by the departments of the Government of the State and issue such guidelines as may be necessary.

District Disaster Management Authority (DDMA)

No	Authority	Members
1	SDMA	Chairperson: Collector or District Magistrate Other Members: Elected representative of the local authority; Chief Executive Officer of the District Authority; Superintendent of Police; Chief Medical Officer of the district; not exceeding two other district level officers, to be appointed by the State Government.

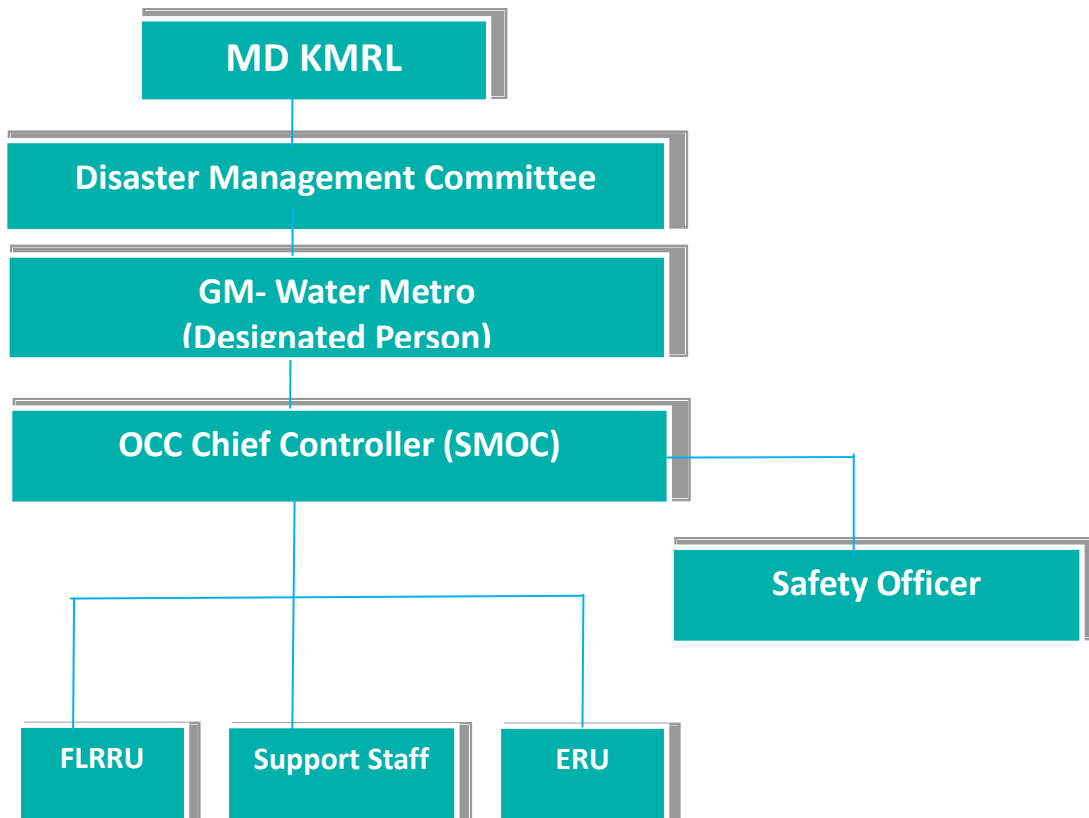
Roles and Responsibilities of SDMA

- Prepare a Disaster Management Manual including district response plan for the district
- Coordinate and monitor the implementation of the National Policy, State Policy, National Plan, State Plan and District Plan
- Advise, assist and coordinate the activities of the Departments of the

- Government at the district level, statutory bodies and other governmental and nongovernmental organizations in the district engaged in the disaster management;

Kochi Water Metro

Kochi Water Metro administration at different level has following set up of organization to deal with the Disastrous situations arising in Water Metro. The organization to deal with any eventualities is as follows. The roles and responsibilities and the standard operating procedures will be captured in a separate document.



Disaster Management Organization (DMO)

First Line Response & Recovery Unit (FLRRU) always on site, initiate recovery actions within the first minutes of an incident, and are trained - and supported by adequate operating procedures - to mitigate and contain the effect of a disruption on service or on passengers comfort, until further intervention of the SLRT. This team includes OCC Staff, Terminal Staff, Boat Operation staff and in some cases Maintenance staff.

Second Line Response Unit (ERU or SLRRU) consisting of systems' specialists provides emergency response capability across the entire system. The ERU is available to attend incidents on 24-hour standby basis and is trained to deal with all foreseeable boat related incidents. These units are located in the boatyard, on site or on-call whenever possible, and are scheduled and deployed so that they can attend to an incident on the mainline

within 30 min to 45 min. They are trained and equipped with all necessary spare parts and tooling to permanently fix the failure (if not exceptional failure). This team includes Team leaders of different department of maintenance division, Boat Crew Controllers, Assistant Managers, Safety Manager and other experts from different divisions. Managers of different departments of Operation, Maintenance and Other divisions can also be called upon.

Disaster Management Committee (DMC) consisting of Managing Director, All Directors, Executive assistants - will be involved in providing all needed assistance, damage control and keep liaison with non-emergency external agencies, take strategic decisions.

No	Name of Unit	Members
1	FLRRU	All field staff on duty (Station controller, Boat Operator, Boatyard Controller, Engineers, Technicians, Security Staff, OCC Staff)
2	ERU	System experts/specialists and Managers of concerned Divisions (Operation, Maintenance, QHSE, Other divisions); Nominated LIO; al
3	DMC	MD, Directors (P), Director (S), Delegated representative, Admin Support

Roles and Responsibilities of DMO

No	Name of Unit	Members
1	FLRRU	24/7 on call to attend any emergency across the 3 corridors Gather information, Transmit to all concerned, Evacuate, Provide relief, Save life, Seek assistance, Barricade, Coordinate with external agencies locally
2	ERU	Carry out relief and recovery activities, Coordinate and help with external agencies, Provide technical inputs, Provide probable time of restoration, Assess the loss/damage and seek assistance accordingly. Monitor and supervise the movement on other sections. Provide technical instructions on infrastructure/ system related issues. Update information to DMC about the rescue
3	DMC	Prepare the DMM. Provide advice on safety matters, provide all admin related support, relief and restoration activities. Manage interface with external authorities, Monitor all Relief and Rescue activities. Damage control, Media management, Plan Long term response and recovery process, Key strategic decision making, Liaison with nonemergency external bodies like
4	LIO	Monitor and control all rescue & relief activities; Single point of contact with OCC; Close liaison with other agencies;
5	Contractor's Staff	Assist and help LIO as per his instructions.

4.5 Preventive Capability of Kochi Water Metro

Preventive capabilities of Kochi Metro may be ensured by drafting Operational procedures and with state of art systems. These can be defined as follows:

KMRL Organizational Capabilities:

Senior Manager (Chief Officer) on Call (SMOC)

Senior Manager shall be called by OCC Chief Controller only for Level 2 and 3 incidents. Exceptionally, Senior Manager can be called upon by Chief Controller if this one has strong presumption the situation could deteriorate to a level 2 or 3 incident without exceptional measures.

Operational Control Centre (OCC)

OCC is a centralized control centre for controlling and coordinating the boat running and other workstation operational activities on the water. The OCC is continuously staffed for:

- a) Control Monitoring and control of the boat service,
- b) Control of power and environmental systems,
- c) Incident Management, and
- d) Dissemination of Information, as required.

OCC is fully equipped with system facilities for controlling the boat movements and incident management. In the event that the OCC is rendered inoperable by a disaster.

Communication workstation - For effective communication between different actors

BMS workstation - For controlling Auxiliary systems (Lift/Escalator/ Light/ Ventilation)

CCTV workstation - For monitoring and supervising different areas of station

Fire Alarm Control Panel - For controlling and monitoring Fire detection and suppression system.

OCC is placed under the responsibility of the Chief Controller who is managing all operational activities on the entire Kochi Water Metro

Competent and Trained Manpower

KMRL will provide best training to all employees in order to achieve the world class services. All employees are provided with an Initial Training program to bring them to the required competence level and shall also be regularly provided refresher training. In addition to refresher trainings, regular practice sessions on safety critical issues shall also be planned in the form of drills by Respective Assistant Manager Level to keep the knowledge of all employees updated. The drills shall include “First aid and firefighting” practice in addition to other operational and maintenance activities.

Initial Training is split in 3 different phases as follows:

- Induction training

- General training
- Job specific training (includes disaster Management)

KMRL emphasizes to build confident, competent and effective manpower by providing training which involves handling the crisis situations. In regard to disaster management, training includes roles & responsibilities of each employee, first intervention/response by the employee that is specific to their role, individual training in the collective response that is specific to their role and the group drills testing the collective response. Individual skills are emphasised in the initial training as detailed in the Training Modules. Collective skills are emphasised in drills. All employees will receive the following crisis management training apart to job-related training:

- a) First aid
- b) Fire Fighting training

Practical hands on exercises are part of the training program and ensure every staff member will have the opportunity to perform and learn their role entrusted on him in Standard Operating Procedures of different scenario of crisis/ disaster situations.

Supporting Agencies

In addition to KMRL staffs, supporting agencies are required to manage emergency situation. In order to ensure both KMRL and supporting agencies are capable of handling emergency situation they are required to participate in at least two or more disaster exercises each year including a fire response. This is an exercise simulating a disaster scenario where KMRL emergency response staff must respond and recover from disaster along with supporting agencies.

KMRL Liaison and Interface with Other Agencies

The main point of contact between KMRL and other agencies is the Chief Controller located in the OCC. Chief Controller has all available communication means to enter in contact with agencies. Points of contact within these agencies are identified as follows.

Agency	Point of contact of OCC Chief Controller	Responsible to call
Fire Brigade		TPC
Police		OCC
Medical		OCC
KMRL		SMOL

Site Inspections and Familiarisation

Other agencies will, in order to be able to apprehend the management of an emergency situation, be familiarized with Metro premises, installation and operation. During familiarization the concerned agency shall also be shown the designated place to report

during the emergencies. These designated reporting points shall be mentioned in SWO of concerned station. This is done thru site inspections along with KMRL staff.

Joint Drills

Joint drills will be organized between KMRL and other agencies in order to:

- Implement defined process by all parties,
- Test communication channels,
- Test equipment,
- Further improve processes.

Two of such drills will be initiated in a year, nature of the drills will be proposed by (QHSE Division) to agencies.

Staff Deployment

Kochi Water Metro's proposed deployment of staff is based on our assumptions for minimum number of staff required for smooth operations. KMRL's detailed staff deployment plans are contained in respective Operational Plans.

Depending on the severity of the incident/ accident, and skills required to solve it, the following means can be called out and implemented:

4.6 Preparedness

Level Of Alertness

Preparedness is of prime importance in order to manage an emergency situation as it shall whether avoid an emergency situation to occur or to limit the consequences of such emergency situation by an early detection.

Alertness is providing KMRL the framework of:

- defined behaviors& attitudes to be followed,
- defined processes to be implemented,
- additional equipment installation and use,
- additional staff to be deployed.

3 levels of alertness are defined for man-made disaster (terrorism) and natural disasters: low, medium and high.

Natural disasters

Pandemic alert

The following table various prevention measures to be taken in case of pandemic alert.

The pandemic alert level shall be initiated/driven by the local DDMA and communicated to KMRL thru OCC Chief Controller in case of status change.

Prevention Measures at Various Pandemic Alert Levels			
Item	Low	Medium	High
Changes in PPE		Face masks issued	

		staff	
Vehicle Cleaning Practices		Disinfect all surfaces in Boat	
Station Cleaning Practices		Disinfect surfaces in public areas	
Vehicle Equipment Checks		Increase replacement frequency of HVAC filters	Staff taken out of public area and will only work in separate areas
Staff Deployment			Staff taken out of public area and will only work in separate areas
Passenger Communications			Communicate to passengers to travel only if its required

Storm Alert

The following table provides various prevention measures to be taken for various storm alert levels.

The storm alert level shall be initiated/driven by the local DDMA and communicated to KMRL through OCC Chief Controller in case of status change.

Prevention Measures at Various Storm Alert Levels			
Item	Low	Medium	High
Vehicle Availability	Normal procedures	As per Law	No preventive maintenance to be undertaken and all vehicles available
Pump Checks	Normal Schedule Checks	Additional visual check of Pumps	Test run pumps
Drainage Checks	Normal scheduled checks	Additional visual check of drainage	As per Medium

Terrorism Alert

The terrorism alert level shall be initiated/driven by the local Police department and communicated to KMRL thru OCC Chief Controller in case of status change.

The following table provides various prevention measures to be taken for various terrorism alert levels.

Prevention Measures at Various Terrorism Alert			
Item	Low	Medium	High
Vigilance	Ensure staff and contractors aware of: • suspicious	Ensure staff and contractors aware of:	Ensure staff and contractors remain vigilant for items as for Medium, as well as unusual items in air conditioning systems, fans,

	Items left in high traffic areas or adjacent to key facilities; • unattended • parked vehicles • in secure areas; • suspicious • behaviour (taking photos of infrastructure or storage areas, persons evading view)	• suspicious - Items left in high traffic areas or adjacent to key facilities; • unattended parked vehicles in secure areas; • suspicious behaviour (taking photos of infrastructure or storage areas, persons evading view)	and blowers. Especially in isolated areas.
Public Communications	Normal communications focusing on prevention of criminal activity	Provide the travelling public additional message on general alertness	Provide the public with regular PA's regarding leaving items unattended and to report suspicious activities or items to police or facility management
Staff training		Provide staff with specific refreshing course on emergency situation (evacuation, crowd management.	Same as medium + weekly drill for evacuation
Boatyard security		Provide additional security staff for Boatyard roving / CCTV monitoring. Random ID checks within the Boatyard.	Prohibit all external access to the Boatyard (no visitors). Limit if possible supplier delivery. Systematic ID checks inside the Boatyard.
Infrastructure		Additional infrastructure checks for lost/suspicious items	Reinforced systematical infrastructure checks for lost/suspicious items.
Police		Police presence	Daily update on the situation.

interface		within the metro (roving teams)	Higher police presence inside the metro. Army presence within the metro
Operation		Unclaimed or unattended baggage systematically considered as suspicious items Stabled Boat at night on line to be guarded	As for Medium, and particularly for Litter bin management: ▫remove all litter bins from high traffic/circulation/evacuation areas; ▫clear plastic bags on metal or plastic hoops to be retained at low traffic density sites;

4.7 Response

Communication Flow

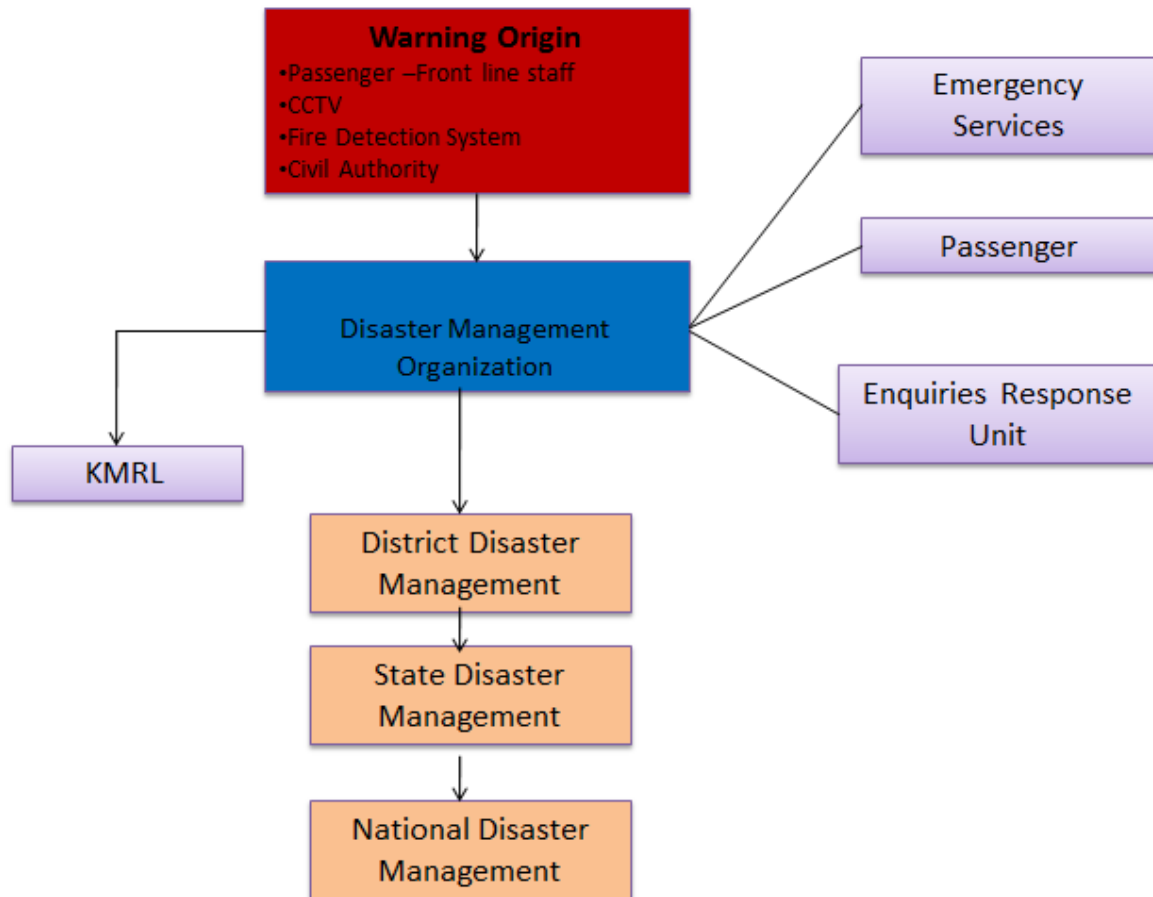
Good communication is vital for the success of the DMO and key to a satisfactory outcome to the incident. It is very important for all members of the DMC to feel they have been heard, and that the OCC Chief Controller resists the temptation to hoard information and utilises broadcast opportunities appropriately, providing up to date summaries on what is happening for everyone in the room.

The warning can come from different sources, such as:

- Passenger or front line staff reporting to the OCC
- CCTV detection from OCC or SCR
- Fire detection system
- Civil Authorities

Contact Details

Communication flow management between agencies following a warning is presented in the below diagram:



Communication protocol (OCC CC to Police or Fire Brigade)

Mobile phone communications, other than those for the purpose of managing the incident, are to be kept to a minimum. Note that mobile phones are likely to be unreliable during a crisis due to overloading of the network. It is important to note that all information collected and recorded may need to be scrutinized later. All logs and notes taken by KMRL staff in the ERU/FLRRU must not be disposed of.

SMOC Communication Protocol (OCC CC to SMOC)

For communication initiation, the following information shall be transmitted by the Chief Controller to the SMOC:

- Date and time of incident
- Description of nature and extent of the incident (including location/affected area)
- Description of impact of incident (including how many customers have been or may be affected)
- Details of the threat or potential threat to transport or public safety
- Reason(s) for the incident occurring / possible cause(s) of the incident
- Actions taken or proposed to be taken to rectify the incident and its impacts

4.8 Reflex Action

Alert and containment is done at this very first stage. The actions are taken in the first 3 minutes of an incident, on receipt of an incident report. The OCC determine the applicable Disaster Management SOPs, and alert the Senior Manager On-Call (SMOC).

The OCC also warn the different emergency services as required per the situation, and mobilise the right response team (First line response, second line response). Emergency service information is priority on SMOC information.

4.9 Degraded Operation

Within the next 5 minutes, the OCC Chief Controller make an analysis and introduces the best possible service (dependent upon the incident severity) to enable passenger to reach their destinations with minimum disruption. If the service cannot be maintained, the OCC Chief Controller stops all the boats on stations, with doors open, as far as possible. At this time the OCC Chief Controller designate a Local Incident Officer (LIO) to handle the interface locally with the authorities while he keeps the centralized coordination and to ensure safety precautions are established and procedures followed.

4.10 Mobilisation

Based upon inputs from the Chief Controller and in consultation with the Managing Director, the SMOC decides the mobilisation of internal resources in case of an event of level 2 or 3. Following his decision, he will request all other members to join the premises.

DMC is located in the OCC building, next to the OCC and is fitted with monitoring and communication equipment.

The purpose of the DMC is to monitor closely the rescue / relief operation, control and minimise loss (human, financial, resource, reputation) related to an escalating critical incident or crisis, and to protect the interests of all those with a vested interest with Kochi Metro Rail Limited. The DMC focuses on the longer term response and recovery arrangements and looks into business continuity.

The DMC provides a high level oversight role, and key strategic decision making and planning for longer term business continuity, including looking into reputation risk that the FLRRU/SLRRU do not involve itself with. The DMC will be responsible for the external liaison with other non-emergency services bodies and media response.

All communications and decision within OCC should go through the OCC Chief Controller who remains the operation in charge, implementing decision taken by DMC. The DMC representatives can use checklists assigned to them presented in Appendix to assist & guide them with carrying out their actions in response to the incident. Below is a summary of the roles and responsibilities of the various roles within the DMO:

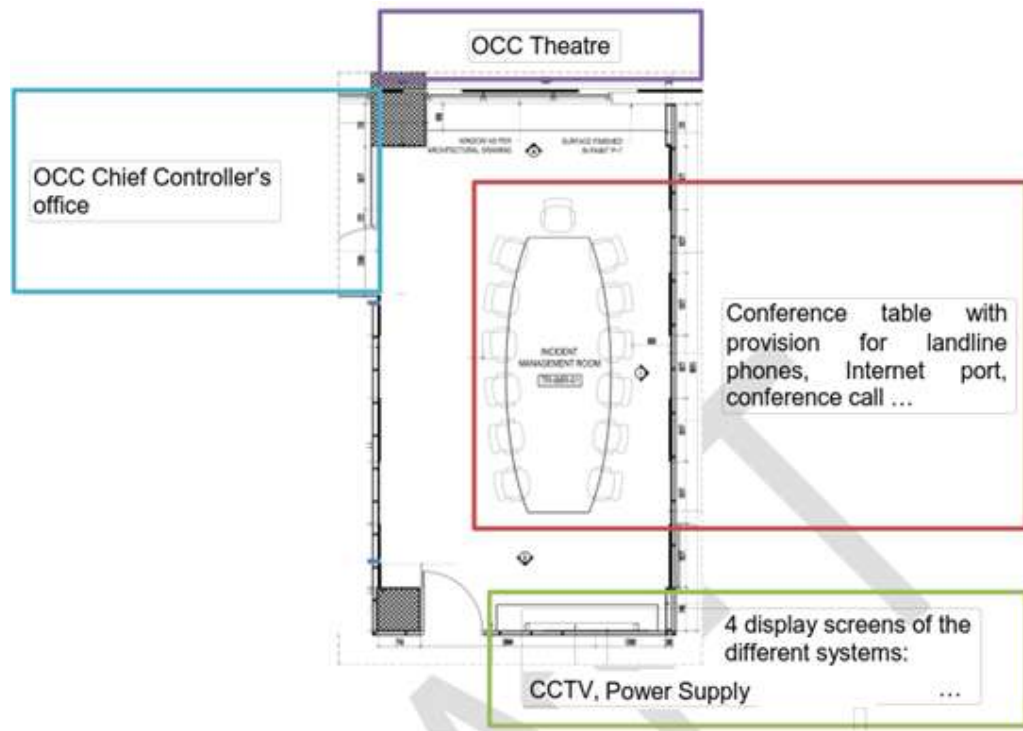
- OCC Chief Controller: This person is the key decision maker for determining the immediate and short term response and recovery arrangements resulting from a disaster or an incident that could lead to a disaster. The OCC Chief Controller shall be part of deliberation/ decisions taken by DMC. OCC Chief Controller may be supported by OCC, Station and Operations manager to provide their advice and manage rosters if required (part of the SLRRU), also provide support on operational procedures, take key decision in consultation with MD, liaise with head of civil authorities for better coordination, make efforts for speedy recovery and introduction of normal services.
- Chief QHSE Officer: Provide safety advice to DMC and maintain contact with the Chief Surveyor, Port of Registry during the incident.
- CFO - Provide financial support as and when required.
- CHR - Provide support to other divisions, liaison with civil defence for additional manpower,
- Help admin to provide drinking water, refreshment for working team
- Admin Support: Provide administrative support to the DMC, including its setup, updating the
- DMC whiteboards, plotting & logging events, updating status of events, send and retrieve faxes & emails, organise vehicles for movement of men/material, arrange petty cash for emergency purchases, organise catering, if required.
- LIO - Coordinate rescue and relief activities, single point of contact between OCC and site, liaise with external agencies; LIO shall wear specially designed jacket so that he can be easily identified by external agencies.
- Representative of external agencies (police, fire brigade, Cost Guard, Navy, Port Trust)

4.11 Disaster Management Room

The Disaster Management Room is fitted with the below equipment:

- Fax / printer
- Network connection
- Landline connection
- Radio communication equipment
- CCTV monitoring equipment
- Signalling monitoring equipment
- Building Management System monitoring equipment
- Power Supply monitoring equipment

Below is the Disaster Management Room layout showing the position of equipment:



4.12 Disaster Response Kit

The Disaster Response Kit is kept in Disaster Management Room and should include following items:

- updated KMRL Disaster Response Plan and SOPs
- updated KMRL manuals, policies and procedures
- maps & site plans
- pre - printed forms for log entry as in Appendix
- dedicated laptop with appropriate network access
- marker pens;
- pens
- updated call out list
- catering company contact details

4.13 Coordination With Emergency Services

While handling incidents which require involvement of emergency services, proper coordination and task distribution between metro personnel and emergency services personnel is imperative. The main principle is that command of rescue work will be with

the emergency services. They will carry out actual work while water metro personnel will support them by providing necessary information on incident, guidance on safety aspects from OHE and providing available resources as requested for handling the situation.

Following tasks are performed by metro personnel during crisis management:

- Inform the incident details and access points for incident site on call.
- Depute one metro employee in uniform at designated access point for guidance to all external
- agencies summoned for rescue and relief work.
- Liaise with external emergency agencies through LIO.
- Brief In-charge of external agency on safety aspects like Boat movement.
- Guide Emergency Services to the field.
- Provide safe access into metro premises and hand over the incident site.
- Gathering of incident information.
- Assist in/provide rescue and relief work.
- Stay at disposal if required.
- Make necessary arrangement for required action.
- Provide resources if required.
- Take clearance for service resumption.

Following tasks are performed by emergency services personnel while dealing with incidents in metro premises:

- In case of Fire, Fire Service Officer will be overall in-charge of incident management.
- In case of Collision, Law & Order situations Police Officer will be in-charge of the incident management.
- Liaise with metro personnel on site (LIO) for necessary information and required arrangements.
- Provide rescue and relief in coordination with LIO.
- Be responsible for safety of their staff and act in liaison with Water metro personnel in charge to ensure safe working condition on incident site.
- Give clearance to Water metro personnel for resumption of services.
- During the intervention of emergency services, OCC remains in charge of coordinating metro activities. Thus he shall be informed of emergency services requests.

- Information and support to families of victims is done by the concerned emergency authorities.

Handling of Different Types of Disasters in Kochi Water Metro

The main objectives of disaster management are to:

- Arrange rescue and relief work to save life and alleviate sufferings
- Minimize the damage
- Restoration of normal working as soon as practicable.

In order to achieve these objectives KMRL has laid down following guidelines for handling different disaster scenario in Kochi Water Metro. In addition to the basics of disaster handling following actions shall be taken by OCC and LIO during the course of rescue and relief work.

S. No.	Type of Disaster	Actions by Staff
1	Fire	• Use available fire extinguishing material • Regulate Traffic • Barricade area • Evacuate the passengers, if required. • Remove inflammable material from site.
2	Collision	• Regulate Traffic • Evacuate Passengers; seek assistance (Medical, Police, Fire etc.), Barricade area • Save life & administer first aid • Assess damage • Mobilize required assistance • Monitor Rescue & relief work • Collect live information and disseminate to all concerned • Take fitness after rescue operation is over • Restore normal work
3	Capsizing	• Regulate Traffic • Collect vital information • Evacuate passengers, if any • Save life and administer first aid, if required • Mobilize required assistance • Collect information and disseminate • Take clearance and fitness of all vital systems • Restore normal work
4	Passenger in Water, water on board (Suicide)	• Inform all concerned authorities • Take action as per SOP
5	Bomb Threat (detection)	• Collect as much information as available • Inform security, Call Police • Evacuate passengers, if requested by Security • Make relevant announcement • Coordinate with security

S. No.	Type of Disaster	Actions by Staff
		• Take clearance
6	Terrorist Attack	• Stop Boat movement • Evacuate all passengers from all corridors • Inform Police • Coordinate with Police • Take clearance and restore normal operation
7	Stampede (overcrowding)	• Reduce passenger intake in station • Inform Police • Coordinate with Police • Take clearance from Police
8	Law & Order	• Stop Boat or close Jetties • Manage service in other part of the line • Inform Police • Coordinate with police • Take clearance
9	Natural Calamities	• Stop Boat movement • Evacuate passengers • Inform DDMA • Coordinate with DDMA • Take clearance and restore operation
10	Alcohol Consumption by Crew	• Offload from operations of boat • Inform OCC Chief Controller • Mobilize new crew for substitution

4.14 Evidence Preservation

All evidence potential for investigation shall be protected unless required to be removed:

- 1) to save lives;
- 2) to eliminate exposure to hazards;
- 3) to minimize damage to properties;
- 4) to comply with existing incident handling procedures.

Staff involved in the incident should seek authorization from LIO before removing or disturbing the evidence at the scene, unless it is necessary to do so expeditiously for any of the following reasons: Local incident Officer will authorize incident recovery, area cleaning or repair at the scene (thus removal or disturbance of evidence) after consulting the Chief Controller and the local Authority representative (Police usually). This shall be strictly followed in particular in case of fatalities or severe injuries. Additional manpower for industrial accident fatality may also be called in by the Police through concerned ministry.

Chief controller will check if evidence shall be preserved in coordination with the in-house technical department prior to his approval. This shall allow on-site investigation if required and also quick service recovery when possible.

Local Incident Officer shall capture incidents details in photographs, where possible, or sketches swiftly to capture available information.

Representatives of parties involved in the on-site investigation shall minimise disruption to passenger service, if it is so affected.

4.15 Recovery

The aim of the recovery phase is to restore operation to a normal level of service. It differs from the response phase in its focus, as recovery efforts are concerned with issues and decisions that must be made after immediate needs are addressed. The recovery phase starts after the immediate threat to human life has subsided.

At the onset of a disaster scenario, actions are to be taken to enhance the effectiveness of recovery operations. Recovery is both a short-term activity intended to make the affected areas safe, in addition to returning some level of boat service to operation, and a long-term activity designed to return infrastructure and boat operations systems to pre-incident conditions.

The welfare of the affected people is addressed in the recovery phase and will be carried out by the lead Emergency Services agency

For KMRL, the main focus of the recovery phase is to return the site to its previous state. This can only occur after the lead Emergency Services agency or the Kochi City Police has declared the site safe, and no longer a crime scene or disaster scene.

Once deemed safe to do so, the priority of the DMC in the recovery phase is to resume services as quickly as possible. In a terrorism or major crime scenario, there are likely to be longer term business continuity issues for Kochi Metro Rail Limited. These issues are to be discussed Chief Controller in coordination with the SLRRU, who will communicate to the DMC if they require any assistance.

Service Recovery

The specifics of each service recovery will depend on the nature of the incident and may involve the progressive introduction of services until a full level of service can be reached. KMRL has a number of SOP's that detail operational methods in different degraded modes. Various combinations of these can be used.

4.16 Operations

There are a number of alternatives that can be used individually or in combination to commence a service recovery of services after a disaster these include:

- Recovery of disabled Boat as per the General Rules and SOP Boat Rescue
- Operating short loop services on either side of a contained disaster site as per SOP on Provisional Services and the SOP on Short Loop Services

- Operating on a single line around the contained disaster site as per SOP on Single Line
- Working
- Management of the operation through a degraded mode as detailed in the General Rules

Recovery of operations may also include re-instating certain equipment that had been shut down as a result of a disaster scenario, an example could be the shutting down of OHE. In this case, the reinstatement of equipment would be done in accordance with the General Rules and the procedures for the reinstatement of equipment such as the SOP Powering Up a Section Post Maintenance.

4.17 Maintenance

The role of maintenance in the recovery revolves around the inspection and repair of assets after a disaster. Maintenance SOPs detail inspection requirements and repair activities for each category of assets. These will be applied as appropriate during the recovery to return the asset to an operable state as quickly as possible.

Systems and Data Recovery

KMRL will maintain backups of all data and will secured it off-site in a protected location. Operation control systems are designed with redundancy with a secondary system which is in a position to relieve a primary system in the event of primary system failure. This reduces the probability of data loss. In the event of a loss of data from both the primary and secondary system, KMRL will use the backups to recover the data with minimal loss. During the response phase, it will be the responsibility of the SLRRU to plan for data recovery.

Staff Recovery

Due to the high intensity nature of disasters during the preparation and response phases, it is often easy to overlook the stresses that these incidents place on staff. The actions of staff are often enhanced by a combination and a sense of duty and adrenaline creating a situation where exhaustion and stress can be managed by the individual in the short term. However, this can create issues during the recovery phase as staff exhaustion can restrict the recovery of operations.

Shift Management

Disaster situations often require staff to work for extended periods particularly during the preparation and response phase. Despite the workload during the phases, it is essential that there are sufficient rested staffs to recover the service once the situation is contained.

During the response phase, when the SLRRU is focused on the incident, it will be the responsibility of the DMC to conduct staff planning for the recovery and to ensure there are sufficient rested staffs available to operate the recovery services.

Counseling

Staffs are often required to deal with extremely stressful situations during a disaster situation and the inability to manage these stressors can lead to post-traumatic stress both in the short and the long term. During the disaster scenario, KMRL will engage with the provider of employee counseling services to provide counseling to staff during the response, recovery and post-incident. This will be managed by the DMC.