BroadwayMalyan BM

Diyar AL MUHARRAQ

BOOKLET 3

CONSTRUCTION DOCUMENTS

Contents

3.1 Environmental Management Plan (EMP)

3.2 Construction Regulations

Environmental Management Plan

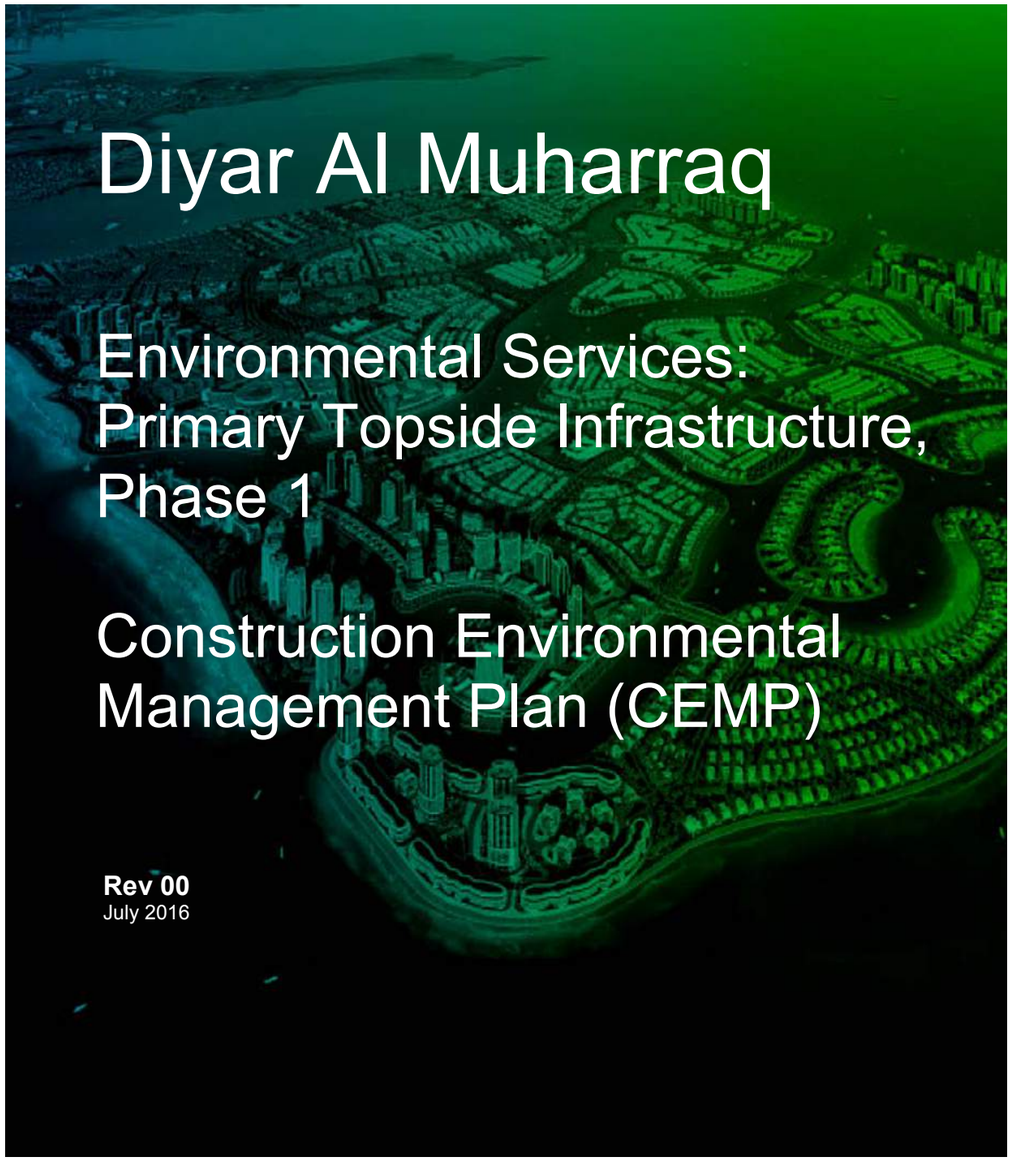
AECOM **Civil and Infrastructure**

Submitted to:

Supreme Council for Environment
P.O. Box 18233
Al Seef District
Manama
Kingdom of Bahrain

Submitted by:

AECOM Middle East Ltd.
PO Box 640
Manama
Kingdom of Bahrain



Diyar Al Muharraq

Environmental Services: Primary Topside Infrastructure, Phase 1

Construction Environmental Management Plan (CEMP)

Rev 00
July 2016

Prepared for

Supreme Council for Environment
P.O. Box 18233
Al Seef District
Manama
Kingdom of Bahrain

Prepared by

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TABLE OF CONTENTS

1 INTRODUCTION 13
1.1 BACKGROUND 13
1.2 DEFINITION OF CEMP 13
1.3 OBJECTIVES OF A CEMP 13
1.4 APPLICATION AND APPROACH 14
1.5 PROJECT TEAM IDENTIFICATION (KEY STAKEHOLDERS) 14
1.5.1 Primary Topside Infrastructure Environmental Project Team 15
1.6 Environmental Baseline Surveys (JOD & P, 2012) 15
1.7 CEMP REPORT STRUCTURE 16

2 PROJECT DESCRIPTION 18
2.1 PROJECT LOCATION AND COORDINATES 18
2.2 IDENTIFICATION OF NEARBY SENSITIVE RECEPTORS 20
2.3 LANDUSE OF THE PROJECT 20
2.4 ACCESS TO PROJECT SITE 22
2.5 INFRASTRUCTURE REQUIREMENTS 22
2.5.1 Roads 22
2.5.2 Service Corridors 23
2.5.3 Storm Water 23
2.5.4 Potable Water and Fire Fighting 25
2.5.5 Sewerage Network and Treatment 25
2.5.6 Irrigation/ Treated Sewage Effluent (TSE) Network 25
2.5.7 Electrical Demand 26
2.5.8 Telecommunications 26
2.6 ENVIRONMENTAL BASELINE CONDITIONS 27
2.6.1 Marine Water 27
2.6.2 Soil and Groundwater 28
2.6.3 Marine Ecology 29
2.6.4 Ambient Noise Levels 29
2.6.5 Results of Brief Baseline Traffic Survey 34
2.6.6 Ambient Air Quality 35
2.6.7 Terrestrial Ecology 39
2.7 DEVELOPMENT PHASING STRATEGY 46
2.8 PROPOSED CONSTRUCTION ACTIVITIES 47
2.9 CONSTRUCTION LOGISTICS 48
2.9.1 Site Access 48
2.9.2 Safety Signage 50
2.9.3 Workforce 50
2.9.4 Working Hours 50
2.9.5 Welfare Facilities for Workers 50
2.9.6 Other Temporary Facilities 51
2.9.7 Construction Materials 51
2.9.8 Potable Water Supply 52
2.9.9 Sanitary Wastewater Management 52
2.9.10 Power 52
2.9.11 Construction Waste Generated 52

3 ENVIRONMENTAL MANAGEMENT 53
3.1 POLICY STATEMENT 53
3.2 KEY ENVIRONMENTAL OBJECTIVES & COMMITTMENTS 53
3.3 ENVIRONMENTAL MANAGEMENT SYSTEMS 54

3.4 ROLES AND RESPONSIBILITIES 55
3.4.1 Project Proponent – Diyar Al Muharraq WLL 57
3.4.2 Regulatory Authority – The Supreme Council for Environment (SCE) 57
3.4.3 Environmental Consultant 57
3.4.4 The Project Environmental Manager / Environment, Health & Safety Manager (Corporate) to be appointed by DAM 57
3.4.5 Contractor Environmental Manager 58
3.4.6 Contractor Environment, Health & Safety (EHS) Manager 58
3.4.7 Site Personnel 59
3.4.8 Sub-contractors and Visitors 59
3.5 KEY REGULATORS AND LEGAL REQUIREMENTS 61
3.5.1 Key Regulators in Bahrain 61
3.5.2 Contact Details and Environmental Controls 62
3.5.3 Environmental Commitments, Legislation and Regulations 63
3.6 ENVIRONMENTAL HEALTH AND SAFETY (EHS) REGULATIONS AND GENERAL SITE REQUIREMENTS 65
3.6.1 Human Health and Safety Commitment Statement 65
3.6.2 Occupational Health & Safety 65
3.6.3 National Legislation 65
3.6.4 Health & Safety Management Requirements 65
3.6.4.1 Heat Stress 65
3.6.4.2 Air Quality 66
3.6.4.3 Noise 66
3.6.4.4 Vibration 66
3.6.4.5 Building Materials 67
3.6.4.6 Ground Surfaces 67
3.6.4.7 Lighting 67
3.6.4.8 Health & Safety Related Equipment 67
3.6.4.9 EHS Training & Meetings 67
3.6.4.10 Provision of Drinking Water & Sanitary Facilities 68
3.6.4.11 Other 68
3.6.4.12 Site Security 68
3.6.4.13 Housekeeping & Site Storage 69
3.7 ENVIRONMENTAL AWARENESS AND TRAINING 70
3.7.1 Environmental Site Induction 71
3.7.2 Training Records 71
3.8 COMMUNICATION, ADDRESSING AND RECORDING COMPLAINTS 71
3.8.1 Communication 71
3.8.2 Environmental Records 72
3.8.3 Addressing Complaints 73
3.8.4 Complaints Management 73
3.8.5 Environmental Incident Management and Reporting 74
3.9 CEMP DOCUMENT REVIEW AND UPDATES 75

4 ENVIRONMENTAL IMPACTS 76
4.1 AIR QUALITY – EMISSIONS IMPACTS 76
4.1.1 Dust Emissions 76
4.1.2 Gaseous Pollutants 76
4.1.3 Odour 77
4.2 SURFACE WATER 77
4.3 SOIL AND GROUNDWATER 78
4.4 TERRESTRIAL ECOLOGY 78
4.5 MARINE ECOLOGY 79

	4.6	NOISE AND VIBRATION	79
	4.7	TRAFFIC	80
	4.8	WASTE MANAGEMENT	81
	4.9	SOCIO-ECONOMIC IMPACTS	81
	4.10	LANDSCAPE AND VISUAL IMPACTS	82
	4.11	ANTICIPATED ENVIRONMENTAL IMPACTS	82
5	ENVIRONMENTAL MITIGATION MEASURES		83
	5.1	AIR QUALITY MANAGEMENT PLAN	83
	5.2	EROSION AND SEDIMENT CONTROL PLAN	85
	5.3	SOIL AND GROUNDWATER CONTROL PLAN	87
	5.4	ECOLOGICAL MANAGEMENT CONTROL PLAN	90
	5.5	WATER QUALITY CONTROL PLAN	91
	5.6	NOISE AND VIBRATION CONTROL PLAN	91
	5.7	TRAFFIC AND ACCESS CONTROL PLAN	93
	5.8	WASTE MANAGEMENT CONTROL PLAN	94
	5.9	CHEMICAL HAZARDS AND MATERIAL MANAGEMENT PLAN	98
	5.10	SPILL CONTINGENCY PLAN	100
	5.11	EMERGENCY MANAGEMENT PLAN	103
	5.11.1	Levels of Emergency Response	103
	5.12	SECURITY PLAN	106
	5.13	INFRASTRUCTURE PLAN	107
6	MONITORING AND AUDITING		108
	6.1	ENVIRONMENTAL PERFORMANCE MONITORING	108
	6.1.1	Environmental Inspections	108
	6.1.2	Environmental Audits	108
	6.2	NON-CONFORMANCE CONTROL, CORRECTIVE AND PREVENTIVE ACTION	109
	6.3	DOCUMENT CONTROL AND RECORDS	110
	6.4	REPORTING REQUIREMENTS	110
	6.4.1	Incident Reports	111
	6.4.2	Periodic or Quarterly Performance Reports	111
	6.4.3	Monitoring Compliance Reports	112
	6.4.4	Environmental Checklist	112
7	REFERENCES		113
8	APPENDICES		114

APPENDIX A – Official Correspondence

APPENDIX B – Environment, Health and Safety Audit Checklist

APPENDIX C – Incident Report Format

APPENDIX D – Complaints Report

APPENDIX E – Waste Log Format

Construction Environmental Management Plan (CEMP) Rev 00

LIST OF TABLES

Table 1.1: Diyar Al Muharraq Phase 1 Project Team 14
Table 1.2: CEMP Environmental Project Team 15
Table 2.1: Boundary Coordinates of Diyar Al Muharraq 18
Table 3.1: Key Environmental Objectives 54
Table 3.2: Project Environmental, Health and Safety (EHS) Management Roles and Responsibilities 60
Table 3.3: Regulators concerned with Environmental Control 61
Table 4.1: Anticipated Infrastructure Construction Waste 81
Table 4.2: Summary of Anticipated Environmental Impacts 82
Table 5.1: Air Quality Management Plan 83
Table 5.2: Erosion and Sediment Control Plan (ESCP) 86
Table 5.3: Soil and Groundwater Control Plan 87
Table 5.4: Ecological Management Plan 90
Table 5.5: Noise and Vibration Control Plan 92
Table 5.6: Traffic and Access 93
Table 5.7: Waste Management Control Plan 95
Table 5.8: Chemical Hazards and Material Management Plan 98
Table 5.9: Mitigation Actions in the event of a Spill of Hazardous Material 100
Table 5.10: Various levels of Emergency Response 104
Table 5.11: Emergency Contacts 105
Table 5.12: Avoidance, Mitigation and Control Measures for Environmental Pollution incidents 106
Table 6.1: Suggested Layout for Monthly CEMP Monitoring Report 110

LIST OF FIGURES

Figure 2.1: Concept Master Plan of the Diyar Al Muharraq Development 19
Figure 2.2: Location of the Diyar Al Muharraq Development (Left: Kingdom of Bahrain, Right: Diyar Al Muharraq with coordinate points A to D) 20
Figure 2.3: Location of the Diyar Al Muharraq Development in Relation to the Kingdom of Bahrain's 2030 National Land Use Strategy 21
Figure 2.4: Storm Water Outfall Network 24
Figure 2.5: View of the Diyar Al Muharraq Reclamation from the North West coastline of the Amwaj Islands (Air and Noise monitoring location B) 30
Figure 2.6: Locations of Air and Noise Monitoring Stations 31
Figure 2.7: Photographs of Air and Noise Quality Monitoring Stations 32
Figure 2.8: Noise Monitoring Instrument and its Specifications 33
Figure 2.9: Wolf Pack and PDR 1500 Air Monitoring Instruments with Specifications 37
Figure 2.10: Leica binoculars and Optolyth telescope used for bird survey work 40
Figure 2.11: A flock of 8,000 – 10,000 Lesser-crested Terns - photograph taken on April 21st 2012 42
Figure 2.12: Western Reef Herons found in Block 13B during April1 4th 2012 Survey 43
Figure 2.13: Evidence of breeding pairs of Saunder's Little Terns captured during the April 14th 2012 survey in Block 17 43
Figure 2.14: Locations of significant bird sites in Diyar Al Muharraq 2011 - 2012 45
Figure 2.15: Development Phasing Strategy for the DAM Development 46
Figure 2.16: Diyar Al Muharraq Site Access Gate 48
Figure 2.17: Centralised Contractor Compound 49
Figure 3.1: Environmental Management Team and Reporting Lines within the Contractor Organization and with External Organisations 56
Figure 3.2: Summary of Relevant Local, Regional and International Legislation and Guidelines 64
Figure 5.1: Example of Incident Response Procedure 102

Construction Environmental Management Plan (CEMP) Rev 00

LIST OF ABBREVIATIONS

%	Percentage
°C	Degrees Celsius
µg	Microgram
AQMP	Air Quality Management Plan
As	Arsenic
BDF	Bahrain Defence Force
BOD	Biological Oxygen Demand
CD	Chart Datum
BRDM	Bahrain Roads Design Manual
Cd	Cadmium
CDFSD	Civil Defence & Fire Service Directorate
CEMP	Construction Environmental Management Plan
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
CPO	Central Planning Office
Cu	Copper
DAM	Diyar Al Muharraq
dB	Decibels
DCP	District Cooling Plant
EA-1	Data Form for Environmental Screening of Infrastructure Projects
EA-2	Data Form for Environmental Screening of Industrial Projects
EDD	Electricity Distribution and Street Lighting
EHS	Environment, Health & Safety
EIA	Environmental Impact Assessment
EIA-12	GDEWP's (SCE) CEMP Guidelines
ESCP	Erosion and Sediment Control Plan
EWA	Electricity and Water Authority
GCC	Gulf Cooperation Council
GPS	Global Positioning System
H&S	Health & Safety
Ha	Hectares
HAJ	Hisham Abdulrahman Jaffer
Hg	Mercury
Hr	Hour
JOD & P	Jennings O'Donovan & Partners
Km	Kilometre
L	Litre
m	Metre
mg	Milligram
mm	Millimetre
MMA	Ministry of Municipalities and Agriculture
MMR	Meet Me Room
MoW	Ministry of Works
MPN	Most Probable Number
MSDS	Material Safety Data Sheet
MSDS	Material Safety Data Sheet
MVA	Mega Volt Amps

NSD	National Survey Datum
No.	Number
NO_2	Nitrogen Dioxide
NVCP	Noise and Vibration Control Plan
Pb	Lead
PDR	Personal Data Ram
PEM	Project Environmental Manager
PIC	Person(s) in Charge
$PM_{(10)}$	Particulate Matter (with a diameter of 10 micrometres or less)
PMEW	Public Commission for the Protection of Marine Resources, Environment and Wildlife
PSD	Planning Studies Directorate
PSS	Primary Substation
RPDD	Roads Planning and Design Directorate
RTR	Reinforced Thermosetting Resin
SCE	Supreme Council for Environment
SDD	Sewage and Drainage Directorate
sec	Second
SEPPD	Sanitary Engineering Planning & Projects Directorate
STP	Sewage Treatment Plant
t	Tonne
TIA	Traffic Impact Assessment
TPH	Total Petroleum Hydrocarbons
TRA	Telecom Regulatory Authority
TSE	Treated Sewage Effluent
UK	United Kingdom
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
uPVC	Unplasticised Polyvinyl Chloride
VOC	Volatile Organic Carbon
WDD	Water Distribution Directorate
WMCP	Waste Management Control Plan
WRD	Water Resources Directorate

Construction Environmental Management Plan (CEMP) Rev 00

DEFINITION OF TERMS

Air Quality Standards	The level of pollutants prescribed by regulations that are not be exceeded
Aquifer	An underground geological formation or group of formations, containing water. Aquifer is a source of groundwater for wells and spring
Assessment Area	The physical area identified by the consultant and proponent for assessment of potential environmental impacts
Audit	An audit will involve a systematic review of the relevant CEMP documents and records, possibly backed up by some level of inspection
Best Management Practices	Schedules of activities; prohibitions of practices; maintenance procedures; and other physical, structural, control equipment and/or managerial practices to prevent or reduce environmental pollution
Bund	An impermeable enclosure or structure to contain spillages under or around an area where hazardous substances are stored or handled. Bunds should typically be provided at refuelling stations, under any container with hazardous substances (oil, fuel, paints, solvents etc.) or any piece of machinery (i.e. generators) which may leak fuel, lubricants or hydraulic fluids. It is good practice to provide drip trays under construction vehicles prone to leaking lubricants. Bunds vary in complexity depending on level or risks for spillage and the quantities of hazardous substance
Capping layer	A layer that provides cover over an in situ material that has a design California Bearing Ratio of less than 3.0% but not less than 1.0%.
Clean-up	Actions taken to deal with a release or threat of release of a hazardous substance or hazardous spill that could affect humans and/or the environment. The term "clean-up" sometimes used interchangeably with the terms remediation, remedial action, removal action, response action, or corrective action.
Construction	The time period that corresponds to any event, process, or activity that occurs during construction phase (e.g. building of site, buildings, and processing units) of the proposed project or development. The construction phase terminates when the development goes into full operation or use
Construction Activity	All the activities carried on construction site including site clearing, grading, excavation, and any other activity, which disturbs the surface of the land. Such activities may include road building; construction of residential houses, office buildings, or industrial buildings; and demolition activities
Construction Dewatering	Temporary works performed during the construction phase and include instilling a dewatering system for removing storm water or/and lowering groundwater table by means of pumping, draining and/or evaporation from the construction site
Construction Environmental Management Plan	A detailed plan of action prepared by a registered environmental consultant on behalf of the Project Proponent and/or Contractor(s) to organise and coordinate environmental mitigation, and monitoring so that positive impacts are enhanced, and negative impacts and damage to the environment are avoided or minimised during the construction phase of the project

Continued DEFINITION OF TERMS

Construction Staff	The entire workforce including people employed by the Contractor(s), persons involved with activities related to the project, or persons present or visiting the construction area, including permanent, contract or casual labour and informal traders
Contaminant	Any physical, chemical, biological, or radiological substance or matter that has an adverse effect on the environment including air, water, or soil
Contamination	Introduction into water, air, and soil of chemicals, microorganisms, toxic substances, wastes, or wastewater in a concentration that makes the medium unfit for its intended use. Also applies to properties such as objects, buildings, and various household and agricultural use products
Contractor and subcontractor	Companies employed by the source owner to perform construction or decommissioning activities at the project site. the main contractor and subcontractors are responsible for adhering to the requirements in approved Environmental Management Plans and all applicable environmental regulations
Decommissioning	The time period that corresponds to any event, process, or activity that occurs during the decommissioning phase (i.e. destruction or dismantling) of the proposed project or development. The decommissioning phase follows the operation phase
Discharge	Discharge of liquid effluent from a facility or to chemical emissions into the air through designated venting mechanisms.
Disposal	Final placement or destruction waste including non-hazardous and hazardous substances
Emission	Pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residential chimneys; and from motor vehicle, locomotive, or aircraft exhausts
Environment	The environment is made up of: the soil, water and atmosphere; fauna and flora; any part, combination or interrelationships among these; and all the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being
Environmental Impact	The impact of any activity on the environment, whether desirable or undesirable. Undesirable or negative environmental impacts will result in damage and/or pollution of, or detriment to the environment, or in danger to the public, whether immediate, delayed direct or indirect
Environmental Incident	An unexpected or sudden occurrence including major emissions, spills, fires, explosions or erosion leading to serious or potentially serious negative environmental impacts. The level of emergency response will vary according to the nature of the incident.
Environmental Performance	Measurable results of an organization's management of its environmental aspects. In the context of environmental management systems, results can be measured against the organization's environmental policy, environmental objectives, environmental targets and other environmental performance requirements
Groundwater	Water in a saturated zone or stratum beneath the land surface or a surface water body

Construction Environmental Management Plan (CEMP) Rev 00

Continued DEFINITION OF TERMS

Hazard	Any substance, physical effect, or condition with potential to harm people, property, or the environment
Hazardous Waste	Waste containing properties that are potentially harmful to human health and the environment, such as toxic, explosive, flammable or radioactive substances
Inspection	An inspection will be a series of visual checks and / or measurements of the physical aspects of the works
Method Statement	A statement that outlines the activities to be performed by the contractor and the methods to be implemented for minimizing environmental impacts and ensuring compliance with environmental regulations
Oil Spill	An accidental or intentional discharge of oil that reaches and contaminates the environment including water bodies, soil and groundwater.
Operation	The time period that corresponds to any event, process, or activity that occurs during the operational phase (fully functioning) of the proposed project or development. (The operation phase follows the construction phase and then terminates when the project or development foes into the decommissioning phase)
Person in Charge (PIC)	The PIC is an employee responsible for heading the troubleshooting team and documenting the problem. The person in charge, or "PIC," helps ensure consistency throughout the troubleshooting process
Project Area	The physical area within which the proposed development – all construction, operations, and decommissioning activities and processes – will take place (the boundary of a project area is defined by a titled property boundary). The project area is equivalent to the project site.
Project Site	Definition the same as project area.
Proponent	The developer, permit applicant, company or agency associated with a proposed development
Reuse	Using a product or component of waste in its original form more than once; e.g., refilling a container such as glass bottle, can or drum that has been returned.
Sewage	Refuse liquids or waste matter usually carried off by sewers.
Site	Land or water area where any "facility, structure or activity" is physically located or conducted
Solid Waste	Rubbish, debris, garbage and discarded solid materials resulting from the activities
Storm Sewer	Sewer that is designed to carry storm water. Also called storm drainage.
Storm water	Also called rainfall
Water Quality	Chemical, physical, and biological characteristics of water, usually with respect to its suitability for a particular use or purpose

1 INTRODUCTION

1.1 BACKGROUND

Initially, the Construction Environmental Management Plan (CEMP) for the Diyar Al Muharraq (DAM) Primary Infrastructure Phase 1 Project was conducted by Jennings O'Donovan & Partners (JOD & P) in 2012. The EA-1 Screening Form for this Project was submitted to the Supreme Council for Environment (SCE) by Jennings O'Donovan & Partners in October 2011, after which they were informed by the Environmental Licensing Section in letter reference (EL/24/11/119/SS/BM, dated November 2011) that a full Environmental Impact Assessment (EIA) would not be required. The SCE instructed the Consultant to proceed with the production of a CEMP. This document was submitted to the SCE in July 2012 (See **Appendix A**).

Following approval of the CEMP there were subsequent changes to the design of the Diyar Al Muharraq Phase 1 infrastructure (including road networks, storm water, electricity, sewerage networks, phasing plans etc.), as well as the Environmental Consultant appointed to the Project. On the 8th January 2015, AECOM was requested by the Client (letter reference DAM/CEO/L/0028/2015) to provide a scope for the inclusion of all Environmental Studies into the revised master plan and construction for Diyar Al Muharraq. AECOM suggested that a revision to the current CEMP (2012) would be necessary, to allow the incorporation of all master plan adaptations, amend all predicted impacts associated with these, and therefore establish more suitable auditing and environmental management/mitigation responses for both the Contractor and Environmental Consultant to implement.

In summary, this Construction Environmental Management Plan (CEMP) has been updated by AECOM as a guidance document for the construction phase of the Primary Topside Infrastructure of the Diyar Al Muharraq Development Phase 1.

1.2 DEFINITION OF CEMP

By definition, a CEMP is a site-specific plan developed to enable application of appropriate environmental management practices during the construction phase of a project, which often forms part of contract documentation. It is intended as a guidance document for the Construction Contractor(s) during preparation of their own CEMP and site-specific management procedures.

The CEMP has been prepared in accordance with legislation and requirements of the Kingdom of Bahrain, specifically the SCE's EIA-12 CEMP Guidelines (2011), whilst also incorporating regional regulations and international best practice, in order to establish a framework which considers all aspects of environmental protection, pollution control, waste management and health and safety during the infrastructure construction of Diyar Al Muharraq Phase 1.

1.3 OBJECTIVES OF A CEMP

The primary objectives of the CEMP are as follows:

i. Raise environmental awareness of key personnel associated with the project.
ii. Provide and suggest practical measures for dealing with specific issues that may affect sensitive receptors (e.g. noise, waste management).

Construction Environmental Management Plan (CEMP) Rev 00

iii. Provide easy access to key environmental regulations, roles and contact details of key stakeholders (e.g. the SCE) and standards (and/or guidance) that have specific relevance to the project.
iv. Provide a framework for monitoring compliance with key mitigation advice.

1.4 APPLICATION AND APPROACH

All contractors and developers employed to work within the Diyar Al Muharraq Phase 1 site during the construction phase shall be contractually obliged by the Client to adhere to the recommendations and guidance made within this document, in order to guarantee all works are conducted in an environmentally sensitive and acceptable manner to facilitate the avoidance wherever possible, or minimisation, of all potential environmental impacts of the development, ensuring compliance throughout all construction activities. To this end, the CEMP documentation should be read and understood by all relevant staff, particularly those responsible for ensuring and reviewing quality performance and compliance with applicable guidance and legislation.

It should be noted that this CEMP document is intended as a 'live' document which should be periodically updated by the Consultant throughout the construction works as and when unexpected changes occur.

Review and update of the CEMP will be required at the following points:

i. Before the commencement of site works (i.e. following approval of the method statement by the SCE).
ii. Where there is a significant change to the scope of the project (e.g. requirement to alter the construction methodology following review by the SCE and/or an appointed environmental consultant).

Reviews and updates should be recorded on the document history register at the start of this CEMP document.

1.5 PROJECT TEAM IDENTIFICATION (KEY STAKEHOLDERS)

The Diyar Al Muharraq Phase 1, Topside Primary Infrastructure Project Team, including the Proponent, lead contractors and subcontractors, alongside their contact details are provided within **Table 1.1.**

Table 1.1: Diyar Al Muharraq Phase 1 Project Team

Role	Company	Address	Contact Person	Contact Details
Project Proponent	Diyar Al Muharraq WLL	P.O. Box 75777, Manama, Bahrain	Dr. Maher Al Shaer *Chief Executive Officer*	+973- 77 155 555
Project Managers	Hisham Abdulrahman Jaffer (HAJ)	P.O. Box 10507, Bahrain	David Burrell *Senior Project Manager*	+973- 17 821 222
Environmental Consultant Primary Topside Infrastructure	AECOM	P.O. Box 18378, Manama Bahrain	Daniel Edwards *Team Leader, Environment*	+973- 17 556 634

Primary Infrastructure Consultant	AECOM	P.O. Box 18378, Manama Bahrain	Pieter Joubert *Senior Project Manager*	+973- 17 556 634
Master Planner	Broadway Malyan	P.O. Box 53670, Abu Dhabi	Steven Hancock *Associate*	+971- 24 999 100
Registered Surveyors	Ansari Engineering Services (AES)	P.O. Box 10122, Manama, Bahrain	Mohammed Al Ansari *Manager IT and Survey*	+973- 17 533 406
Cost Consultant	DG Jones	26122, Manama, Bahrain	Kevin Penhale Associate Director	+973- 17 256 826

1.5.1 Primary Topside Infrastructure Environmental Project Team

The roles and contact details of the key stakeholders associated with the Environmental Application for the Primary Topside Infrastructure, including those responsible for documentation, Environmental Baseline Surveys and those accountable for the eventual implementation of the contents of the CEMP alongside future Environmental Management responsibilities are demonstrated within **Table 1.2**.

Table 1.2: CEMP Environmental Project Team

Company / Persons	Role	Contact	Title	Tel	E-mail
Supreme Council for Environment	Key National Environmental Body / Environmental Control & Licensing	Luma Al Mahroos	Head of Environmental Assessment Section	+973- 17 386 564	lalmahroos@sce.gov.bh
	Review of Environmental reports	Luma Al Mahroos	Head of Environmental Assessment Section	+973- 17 386 564	lalmahroos@sce.gov.bh
		Sara Taqi	Environmental Specialist	+973- 17 386 988	staqi@sce.gov.bh
AECOM	Environmental Consultant – Topside Primary Infrastructure Application	Daniel Edwards	Environmental Team Leader	+973- 17 556 634	daniel.edwards@aecom.com
		Jackelyn Wren	Environmental Specialist	+973- 17 556 634	jackelyn.wren@aecom.com
		Annique Harris	Environmental Specialist	+973- 17 556 634	annique.harris@aecom.com

1.6 Environmental Baseline Surveys (JOD & P, 2012)

The Construction Environmental Management Plan (CEMP) for Diyar Al Muharraq Phase 1, Primary Topside Infrastructure, according to Section 4.1 of the EIA-12 Guidelines, is required to report the 'current condition of the environment' and 'reference baseline data taken from the EIA performed for the project or other studies where baseline data adequately represents the condition of the environment at the proposed project site and adjacent surroundings'.

In the absence of a full EIA and certain current Environmental Baseline Studies, JOD & P conducted the following surveys, as agreed by the SCE under letter dated 23th April 2012, for inclusion within the CEMP:

i. Baseline noise levels (EnviroTech);
ii. Ambient air quality (EnviroTech); and an
iii. Avifaunal survey (Brendan Kavanagh).

The following sections provide details regarding the sub-consultants hired to assist JOD & P with the Environmental Baseline Surveys:

EnviroTech Consultancy WLL

EnviroTech Consultancy WLL (a division of NewTech International WLL) possesses a broad range of environmental monitoring experience within the Kingdom of Bahrain and Qatar including knowledge of EIA baseline requirements. The company has also been authorised by the Public Commission for the Protection of Marine Resources, Environment and Wildlife (PMEW).

A summary and results of the baseline surveys carried for ambient noise levels and ambient air quality can be found within **Section 2.6.4** and **Section 2.6.6**, respectively.

Professor Brendan Kavanagh

Professor Brendan Kavanagh, a Species Biologist and professional Ornithologist, established the first sustained bird ringing programme within the Kingdom, using the British Trust for Ornithology Ringing Scheme, training local personnel, Wildlife Rangers from Saudi Arabia and conducted extensive research on the Grey Hypocolius, a species endemic to the Middle East. Prof. Kavanagh has ringed almost 10,000 birds and amassed a significant data set on the morphology of migrants in the Gulf Region.

Dr. Kavanagh conducted an avifaunal survey during the dredging and reclamation phase of the Diyar Al Muharraq Phase 1 project, and was therefore able to provide historical data and perform a comprehensive baseline review of the site. The scope of the avifaunal studies alongside a summary of the results can be found within **Section 2.6.7.**

1.7 CEMP REPORT STRUCTURE

This document is structured in seven main chapters plus Appendices, as detailed below:

i. **Chapter 1: Introduction** – An introduction to the Diyar Al Muharraq Primary Topside Infrastructure CEMP document, key stakeholders and project team.

ii. **Chapter 2: Project Description** – Provides an overall description of Diyar Al Muharraq Development with particular emphasis for the proposed primary infrastructure works and project location with adjacent developments. This section includes the overall project planned construction activities, project schedule and milestones. Baseline environmental conditions are covered and sensitive receptors are identified within this section.

iii. **Chapter 3: Environmental Management** – This section includes the information regarding the policy statement, Environmental Management Systems, project personnel roles and responsibilities, Environmental Health and Safety (EHS) regulations and requirements, environmental awareness training, CEMP review and updates, and environmental commitments.

iv. **Chapter 4: Environmental Impacts** – Possible environmental impacts associated with construction activities have been included in this section.

v. **Chapter 5: Environmental Mitigation Measures** – This chapter includes a series of "Environmental Control Plans" which provides procedures for managing and mitigating expected impacts due to construction activities. Proposed mitigation strategies are based on the best available management practices and technologies that will eliminate or minimize adverse impacts to health, safety, and environment in the project site and the surrounding area.

vi. **Chapter 6: Monitoring and Auditing** – This chapter includes information regarding the monitoring and auditing of environmental performance, as well as information on reporting requirements, environmental checklists, and monitoring review.

vii. Chapter 7: References

viii. Appendices

2 PROJECT DESCRIPTION

2.1 PROJECT LOCATION AND COORDINATES

The Diyar Al Muharraq project is located off the North Coast of Muharraq Island, in the Kingdom of Bahrain. The overall project consists of Phase 1 and Phase 2 with an area of approximately 1,078 hectares (ha). The Phase 1 of the development on reclaimed land has approximate dimensions of 3 km (east/west) x 4 km (north/south). A Phase 2 site is planned of similar size, located immediately adjacent to the North Western boundary of the Phase 1 site. The proposed Concept Master Plan is illustrated in **Figure 2.1.**

The scope of this report is to provide details on the "Primary Infrastructure within Phase 1" excluding any utility facilities.

The boundary coordinates of the development and the coordinates for the access causeway are provided in **Table 2.1** below and illustrated in **Figure 2.2**.

Table 2.1: Boundary Coordinates of Diyar Al Muharraq

Location Reference	Easting	Northing
A	463747	2913197
B	466015	2911522
C	464376	2908257
D	461533	2910082

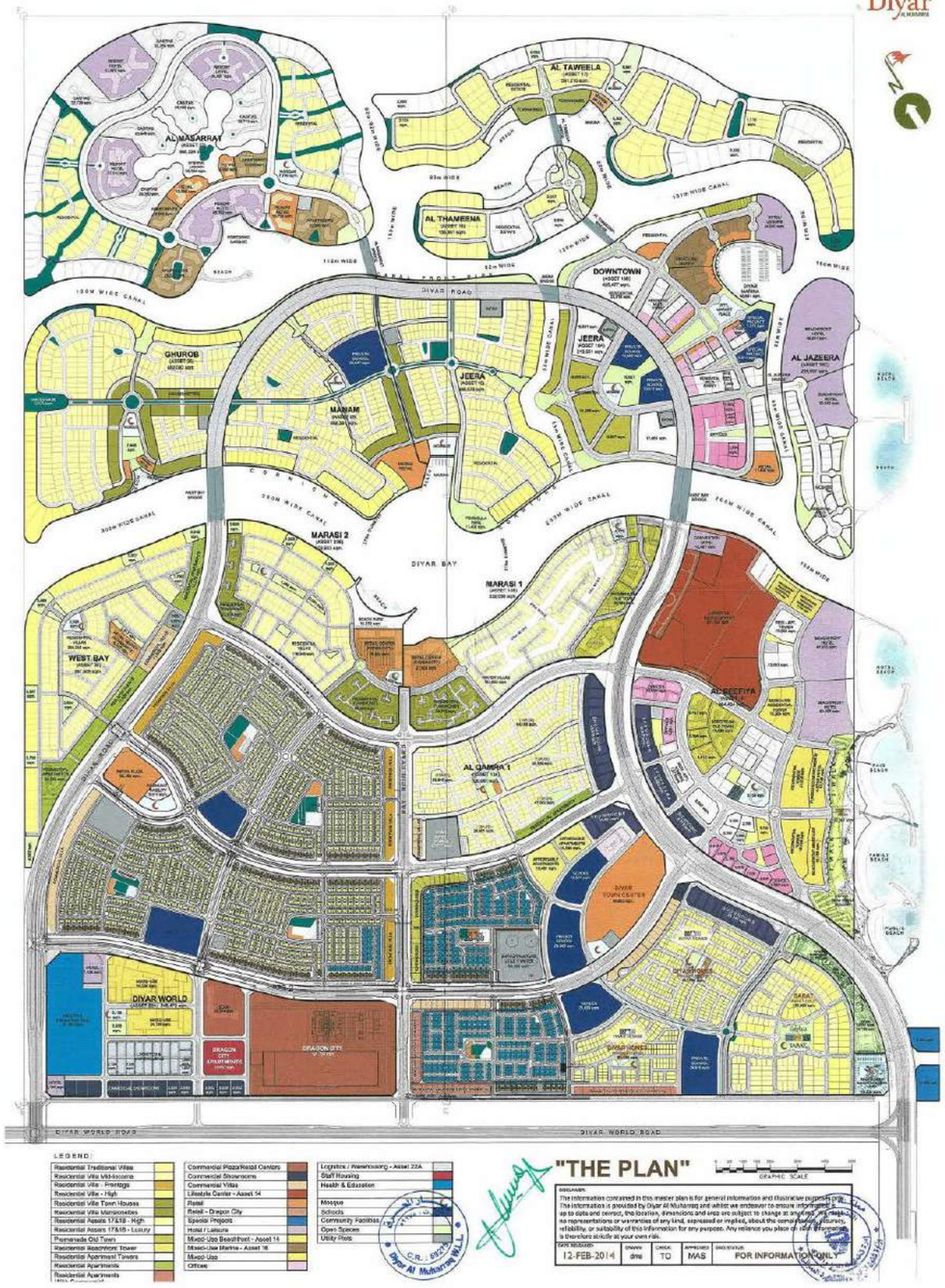


Figure 2.2: **Location of the Diyar Al Muharraq Development**
(Left: Kingdom of Bahrain, Right: Diyar Al Muharraq with coordinate points A to D)

2.2 IDENTIFICATION OF NEARBY SENSITIVE RECEPTORS

Numerous reclamation projects have been completed, are under construction and have been proposed adjacent to the DAM site. The surrounding major existing and proposed developments include: Amwaj Islands, Dilmunia, Investment Gateway Bahrain (light industrial and bulky goods warehousing), further expansion of West Hidd / Arad and West Busaiteen, the Hidd Light Industrial Area and plans for major expansion of Bahrain International Airport. **Figure 2.2** shows the location of Diyar Al Muharraq in relation to the existing and proposed surrounding large developments.

The DAM Phase 1 plot is situated approximately 1.6 km and 1.5 km north of the coastal villages of Al Dair and Samaheej at their closest points respectively, and 2 km north-west of the village of Galali situated on the north eastern corner of the Muharraq coastline. The DAM development is also located 1.2 km north-north west of the reclaimed Amwaj Islands.

2.3 LANDUSE OF THE PROJECT

The developer's Master Plan for Phase 1 comprises of seven islands, split into 21 zones, each differing in character through planned variation in buildings and landscaping, linked by open and public space as shown in **Figure 2.1.** Concept Master Plan.

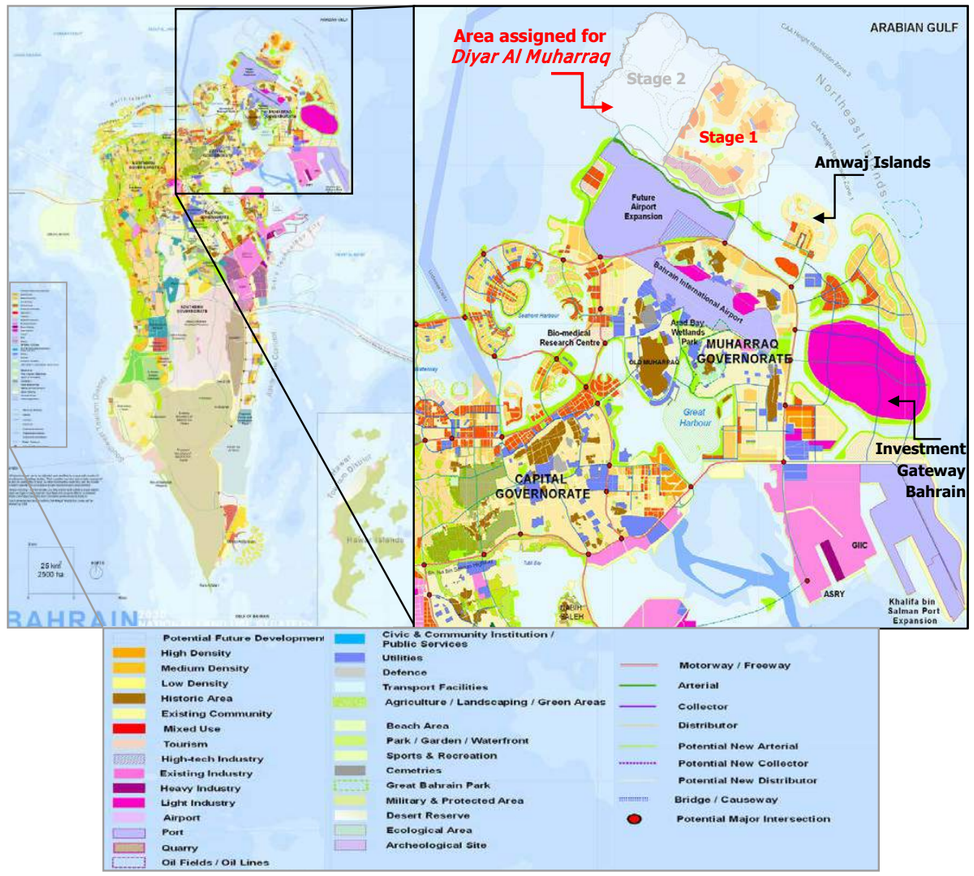
The Diyar Al Muharraq Phase 1 plot is to provide predominantly residential mixed use, high density real estate development, with the remainder intended to provide public services primarily for the residential community; divided between retail, leisure, commercial, recreation and other uses (including utilities). The Client intends to provide the primary infrastructure, to subdivide the land and to sell plots to third party developers.

The Third Party Development will include leisure and retail facilities, community facilities (providing a schools, healthcare centres, mosques and petrol stations, public spaces (marinas parklands,

landscaped open spaces, promenades, walkways and cycle paths, playgrounds and beaches) and water ways (canals).

Build out of the plot will be will be phased according to demand, initially beginning with the south east corner adjacent to the access corridor, extending North and Eastward as the development progresses.

Figure 2.3: Location of the Diyar Al Muharraq Development in Relation to the Kingdom of Bahrain's 2030 National Land Use Strategy



2.4 ACCESS TO PROJECT SITE

Currently, access to DAM consists of a causeway linking the south east corner of the site to the existing Dry-dock Highway.

The Master Plan indicates that access to DAM will be via three (3) primary roadway connections / causeways linking the site to the Muharraq Ring Road on Muharraq Island.

2.5 INFRASTRUCTURE REQUIREMENTS

The Developer intends to supply the necessary infrastructure through a mixture of Government supplies, supplemented by internal private infrastructure. The proposed primary infrastructure works will comprise the following components:

i. Roads and Highways
ii. Service Corridors
iii. Storm Water
iv. Potable Water and Fire Fighting
v. Sewerage
vi. Irrigation/TSE networks
vii. Electrical Transmission networks

2.5.1 Roads

A hierarchy of roads has been established as follows:

i. **Loop Road:** An Arterial class dual four (4) lane highway, which will provide the principal access to the Diyar development during the advanced works part of the Diyar development. The road connects to the Muharraq costal highway and road provides the principal connectivity between Assets.

ii. **Spine Road:** A Collector class dual two (2) lane highway.

iii. **Ribs:** There are three Collector class roads which run east to west across the Southern Island and provide connectivity between plots to the central Spine Road.

There are no bridges within the Scope of Works for the Primary Infrastructure Consultant.

Construction materials will be in accordance with the Bahrain Roads Design Manual (BRDM). Main carriageway areas will be predominantly flexible asphalt construction, while block paving will accommodate services routes within highway corridors, founded on a concrete base in vehicular traffic zones.

Required capping works will more than likely involve a capping layer of varying thickness. A capillary break layer, which may consist of a non-woven geo-textile, can be laid on top of the formation where the ground water level is within 1.5 m of the finished road level. In this regard, it should be noted that ground water levels have risen over recent years, particularly in areas adjoining sites reclaimed from the sea. The desirable minimum finished road level in Bahrain is +2.6 m NSD (National Survey Datum).

The key aim of the transport strategy for the development is to provide an appropriate transport system that facilitates ease of travel within and to/from the Diyar Al Muharraq Development. The transport strategy also attempts to integrate cycling routes with public and private facilities. The

transport strategy will be developed in conjunction with the results of the Traffic Impact Assessment (TIA).

2.5.2 Service Corridors

The road corridors are generally driven by the corridor requirements of the various utilities. The widths detailed herein are those required by the Kingdom of Bahrain authorities and the requirements of Chapter 1 of the “CPO Code of Practice for Service Installation” (May 1986) for the various utility corridors. The electrical 220 kV and 66 kV cables, and water transmission mains are routed to the Bulk Supply Point and Primary Sub-Stations, and Water Transfer locations respectively within the development along the Loop, Spine and Rib roads.

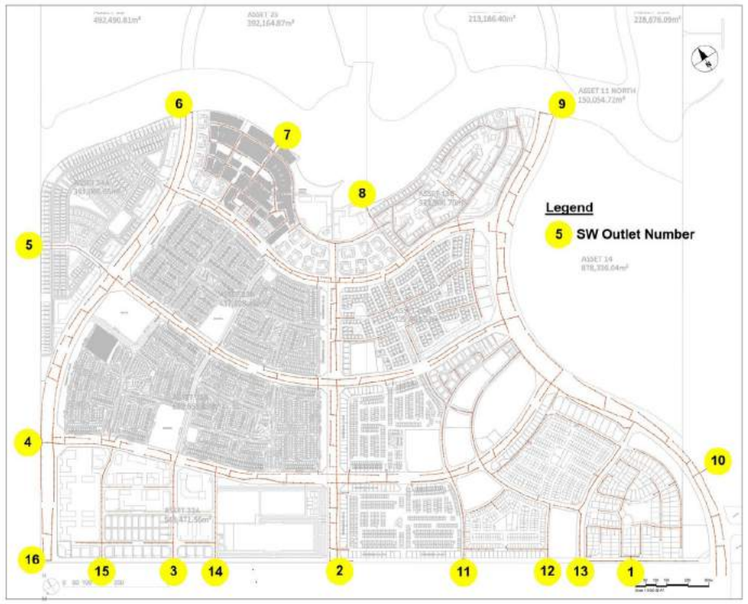
2.5.3 Storm Water

The Primary Infrastructure Storm Water system will be a positive (piped) network, running within the designated Asset 11 utility corridors. This system will drain the main highway roads, including secondary infrastructure from other Assets. Where possible, ‘coastline’ assets will drain to secondary outlets, thus reducing the discharge demand on the primary system.

There are 16 storm water outfalls proposed in the Southern Island, as indicated on **Figure 2.4** (Storm Water Outfall Numbers 1-16)**.**

Oil separators are to be installed upstream of each outfall, as per Sanitary Engineering Planning & Projects (SEPPD) requirements.

Figure 2.4: Storm Water Outfall Network



2.5.4 Potable Water and Fire Fighting

Diyar Al Muharraq is proposed to be served from the water works in Asset 12 B. A DN 800 mm rising main from Hidd Pumping station will serve the water works where one day storage for the demand is envisaged. The distribution system will be fed from an over Head Tank of 27 m static height to the boundary limit of Assets / Residential Plots as required.

Underground type fire hydrants will be located along the rights of ways and on easements allocated to potable water utility reserves. As per Civil Defence requirement, fire hydrants will be placed at 150 m to 200 m maximum spacing and the minimum fire flow for an individual fire hydrant has been taken as 12.62 l/s. The network is designed as combined potable and firefighting pressurized network. Fire hydrant locations are given by General Directorate of Civil Defence.

2.5.5 Sewerage Network and Treatment

The sewerage network will be designed as a gravity sewer network with a terminal pumping station. The pumping station will transport the sewage and discharge into a 5 km rising main terminating at the public Dry Dock Highway lifting station.

A summary of the main factors for the design is as follows –

i. Ultimately designed as a gravity network, discharging into a Deep Gravity Sewer (DGS) that in turn terminates at the proposed Diyar Terminal Lifting Station (TLS).
ii. The TLS will pump the collected sewage to the North East Muharraq Trunk Sewer (NETS) which will supply the STP at Muharraq.
iii. Up until the NETS is constructed, the TLS will act as the Diyar Terminal Pumping Station (TPS), whereby it will pump all collected flow along a 6km Rising Main to the Hidd Intermediate Pumping Station on Dry Dock Highway. Final details of this temporary connection are still to be agreed with SEPPD.
iv. The primary network does not include any intermittent Pumping Stations.
v. The final DGS diameter will be 1,500mm in size however is subject to change based on authority approvals.
vi. The final invert level at the TLS is currently approx. -14.4mOD.
vii. The overall system is sized for the ultimate situation where all parts of Diyar Al Muharraq contribute flow.

2.5.6 Irrigation/ Treated Sewage Effluent (TSE) Network

It is proposed to use Treated Sewage Effluent (TSE) as irrigation water for the landscape planting. The TSE Irrigation network will be built to Bahraini Adoptable Standards.

There is no existing TSE distribution network in the vicinity of the Diyar Al Muharraq development. A TSE transmission main is to be laid from the Muharraq Sewage Treatment Plant (STP), located at Hidd. It is proposed to connect the internal Diyar distribution mains running along the Diyar access road to the proposed TSE storage reservoir, situated adjacent to the Diyar Terminal Pumping Station (TPS). Details of the TSE transmission connection options are still under investigation with SEPPD.
There will be a booster pumping station located in the vicinity of the connection to the Muharraq STP TSE reservoir. This will provide sufficient pressure to convey TSE to the boundary of individual assets. Individual assets will then pump within their respective secondary network. The assets will be temporarily supplied by tankers until the construction of the Muharraq STP TSE transmission line.

Construction Environmental Management Plan (CEMP) Rev 00

The Government provides TSE free of charge to Municipalities for irrigation of road corridors and landscaping, and to farms to irrigate crops. It is likely that a tariff will be applied to the TSE supplied by the Muharraq STP to irrigate landscape areas in other privately owned land uses.

2.5.7 Electrical Demand

This report describes the design details of electrical infrastructure for the Diyar Al Muharraq Development. The power requirement for the development will be supplied by two Bulk Supply Points (BSP); one proposed and one existing.

At detailed design stage, a total load of 744MVA has been considered for the entire development, requiring sixteen (16) PSS.

Please note that all infrastructure is to be designed and built to Bahrain Adoptable Standards.

2.5.8 Telecommunications

The Diyar Al Muharraq Development (DAM) requires a communications infrastructure which will provide tenants with:

i. A modern telephone system;
ii. High speed data networking; and
iii. Cable television services.

To achieve this, a modern fibre optic cabling system is required than can provide the bandwidth requirements of their tenants now and in the future. Additionally the infrastructure will provide the connectivity to enable any planned CCTV systems and provide the backhaul route for the planned GSM (GSM4 and/or LTE) reinforcement. To further this, the chambers and ducts for the telecom cables will be provided as part of the primary infrastructure serving the development.

The Telecommunications Infrastructure can be divided into the following three categories:

i. Civil Infrastructure – i.e. Ducts, Manholes, PEH Buildings, NOC's, etc.
ii. Passive Infrastructure – i.e. Fibre Optic Cables, Equipment Cabinets, Cable Terminal Equipment, Optical Splitters, Splice Closures, etc.
iii. Active Infrastructure – i.e. Passive Optical Network (PON) Equipment, Ethernet Equipment, etc.

Design and Construction of the Civil Infrastructure will be the responsibility of Diyar Al Muharraq. The infrastructure will be designed to allow equal and open access by any or all interested Telecommunications Companies (Vendor Neutral). Supply and installation of Passive and Active Infrastructure will be the responsibility of the respective Telecommunications Companies.

2.6 ENVIRONMENTAL BASELINE CONDITIONS

Baseline conditions regarding water quality, soil and groundwater conditions and marine ecology have been summarized from the previously conducted surveys and environmental studies. As the development will be entirely sited on reclaimed land, no existing in-situ archaeological or cultural heritage features will be present.

The following current surveys have been carried out by JOD (2011-2012) to determine the baseline environmental conditions which prevail within the Diyar Al Muharraq reclamation plot and nearby sensitive receptors:

i. Baseline noise levels
ii. Ambient air quality
iii. Avifaunal survey

Particular attention was given to the baseline noise levels, ambient air quality and current status of avifaunal species within the reclamation footprint to avoid any adverse impacts from the construction activities.

2.6.1 Marine Water

Prior to the reclamation phase of Diyar Al Muharraq, a baseline survey to determine the water quality was undertaken and presented within the Environmental Statement report prepared by Scott Wilson (2006). The following text represents the baseline conditions observed as a result of this water quality survey carried out in 2006 in the absence of current baseline data availability[1].

TPH (Total Petroleum Hydrocarbons), total coliforms, arsenic (As), mercury (Hg), Lead (Pb), Cadmium (Cd), Copper (Cu), COD (Chemical Oxygen Demand), BOD (Biological Oxygen Demand and TSS (Total Suspended Solids) parameters were measured on the water samples collected from a number of selected locations to identify the baseline water quality levels.

TPH levels for the water samples were all less than 1 mg/l, which would be expected unless there had been a very recent incident involving the release of hydrocarbon products (e.g. fuel oil). The TSS values for the study area varied between 1.8 – 3.4 mg/l. These figures indicate normal readings for seawater based on previous surveys conducted by Posford Haskoning Environment Gulf (PHE Gulf) and conversations with members of Marine Resources Directorate (MRD) and General Directorate for the Protection of Environment and Wildlife (GDEWP)[2].

At all sites, a BOD level of 1.0 mg/l was recorded, indicating that there was no excessive biological pollution within the study area. If the BOD levels are less than 4 mg/l, then water is not considered polluted, whilst waters with levels of greater than 10 mg/l are considered polluted[3]. COD levels within the study area were fairly homogenous at the sample stations, and ranged from 25-29 mg/l. As a general rule, levels of >200 mg/l are considered to be high and likely to cause harm to aquatic life, however, this is for wastewater effluent standards.

[1] Diyar Al Muharraq, Environmental Statement (Volume 1 – Main Text), September 2006.

[2] Now the 'Supreme Council for Environment (SCE)'

[3] http://www.unep.org/padelia/publications/VOLUME2T42.htm

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The total coliforms and faecal coliforms have long served as an indicator of the microbial quality of water. No coliform bacteria were identified in water samples collected and they were recorded as zero MPN/100 ml at all stations within the survey area indicating there was no bacteriological pollution within water. The local Bahraini Standards for the effluent discharges has a standard of 1000 MPN / 100 ml as a monthly average and it allows 10,000 MPN/100 ml as maximum value.

Heavy metals analysis were carried out to determine the level of arsenic (As), mercury (Hg), Lead (Pb), Cadmium (Cd) and Copper (Cu) in water samples collected from selected stations. Levels of arsenic and mercury were lower than 0.005 mg/l. Levels of lead and copper was found to be lower than 0.05 mg/l, while cadmium levels were observed to be lower than 0.02 mg/l. No heavy metal was detected as the method of analysis applied can only identify the levels of heavy metals if their level higher than this threshold values, therefore, it can be concluded that there was no heavy metal contamination in water samples analysed.

Overall, as the site is offshore and not influenced by land-based inputs (i.e. industrial discharges etc.), the water quality was good, with no organic or inorganic pollution.

It should be noted that marine water quality issues associated with the land-formation of Diyar Al Muharraq are the responsibility of the reclamation contractor and supervising engineer.

2.6.2 Soil and Groundwater

Chemical analyses of the sediments in both the borrow area and over the reclamation area has been completed. Surveys indicate that sediments were not contaminated and were suitable for reclamation without any treatment. Since Diyar Al Muharraq is a fully reclaimed plot comprised of contamination free reclamation material, and there was no previous land use on the reclamation area, it is expected that soil is free of any contamination.

The site has been filled to + 3.60 m CD (+ 2.14 m NSD). The site strata comprises 'made ground' of fine to coarse sand with gravel and shell fragments, overlying medium dense sand with abundant gravel and shell fragments, overlying carbonate siltstone and sandstone.

The A and B aquifers (Neogene & Alat aquifers and Khobar aquifer, respectively) are present beneath the Diyar Al Muharraq site, overlain by approximately 8 m of sand deposits and 30 m of the clays and limestones of the Neogene Formation.

According to existing information, there is fresh groundwater beneath the site as a result of through flow from the recharge area in Saudi Arabia towards the south east, and also from deep upwards leakage. The equilibrium ground water level as measured in 2011 is + 1.85 m CD (+ 0.390 m NSD). Thus, the ground water table is some 1.75 m below the existing ground level.

It has recently been estimated that the average recharge rate of the A and B aquifers is 112 Mm^3/year. Present-day abstraction, however, has been estimated at approximately 190 Mm^3/year[4]. This comparison seems to support the view that over-pumping from these two aquifers is occurring and also explains the significant drawdown in groundwater levels in the A aquifer to the north of Bahrain. Groundwater is currently primarily used for agriculture in Al Muharraq and the north of Bahrain, but is also mixed with desalination water (at a ratio of 1 to 3, groundwater to desalination water) for potable supply. Any impacts on groundwater as a result of the development may therefore have potentially significant consequences on water supply.

[4] Swar, Mohamed Ali., 2002. MSc thesis (Arabian Gulf University, Bahrain) entitled "Groundwater Quantity and Quality Assessment of the Dammam Aquifer in the Kingdom of Bahrain, 1991 – 2001". Internal Reference Number: 20-034.

2.6.3 Marine Ecology

Marine ecological surveys were conducted as part of the Dredging and Reclamation EIA. The offshore, subtidal reclamation area habitats were surveyed using dropdown video, followed by dive surveys prior to the reclamation. The development area is not associated with any protected areas or areas recognized as important for any protected or endangered species.

The Phase 1 reclamation area supported a variety of benthic habitats ranging from rock, sand and silt seabed, to more diverse habitats such as 'Mosaic', 'Macroalgae' and 'Seagrass'. These diverse habitats were of ecological importance as they contribute to primary and secondary productivity. The extent of the surveyed biotopes across the Phase 1 reclamation area was found to be as follows:

i. Seagrass (>50 % coverage): 50 Hectares
ii. Seagrass (<50 % coverage): 875 Hectares
iii. Macroalgae: 500 Hectares
iv. Mosaic: 350 Hectares
v. Rock with Sand Veneer: 1925 Hectares
vi. Sand: 2850 Hectares
vii. Fine sand/silt: 900 Hectares

2.6.4 Ambient Noise Levels

Baseline Monitoring Stations

The proposed monitoring stations and methodology for the baseline noise survey has been approved by SCE with the letter dated on 23th April 2012 (Appendix A). The noise measurements have been carried out at the approved monitoring stations in accordance with the accepted methodology.

Four monitoring locations both on site and off site were selected to identify the baseline noise levels on and around the DAM reclaimed plot. **Figure 2.6** presents the locations of the stations where noise monitoring levels were measured:

i. One on site station at the site entrance of Diyar Al Muharraq; alongside
ii. Three off site locations near to sensitive receptors;
    a. One located within the north westerly branch of Amwaj (1.2 km);
    b. One located within the village of Samaheej (1.5 km); and
    c. One located within the village of Al Dair (1.6 km).

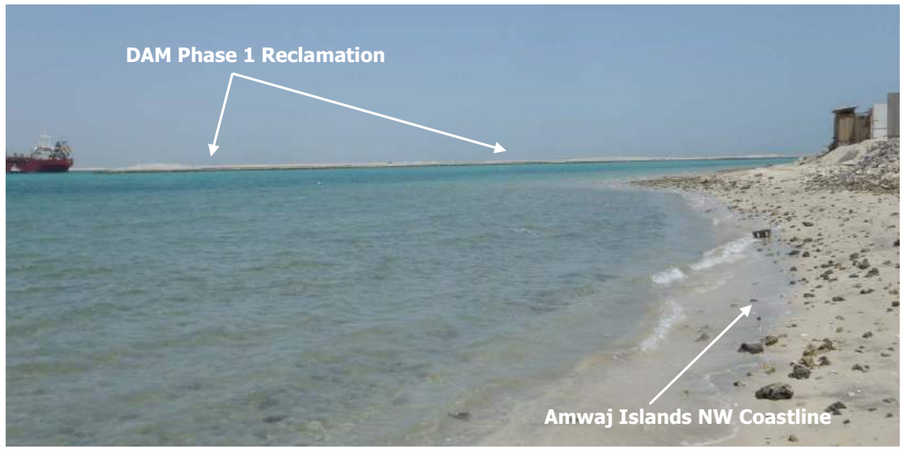
A previous site visit was conducted by Emily Morton and Dr. Gulnur Jasim prior to the noise and air quality surveys to identify potential monitoring stations. The monitoring station selected at Al Dair village was located next to the social club and a road experiencing light traffic flow. The location was quiet, despite some nearby on-going villa construction activities.

The selected station at Samaheej village was on the road side, adjacent to the central cemetery, which experienced a heavier traffic flow of passing traffic vehicles.

The Diyar Al Muharraq site entrance was located within the site gate, and adjacent to the main road for construction vehicles within the Site, experiencing a greater still traffic flow with Heavy Goods Vehicles.

The monitoring station selected in Amwaj Island was the closest point to the Diyar Al Muharraq reclamation plot and approximately 25 metres from the coastline. Light construction noise was noted within villas adjacent to where the noise monitoring station. The DAM reclamation plot was within the vision of residents/visitors from the North West Amwaj Coastline, as seen within **Figure 2.5**.

Figure 2.5: **View of the Diyar Al Muharraq Reclamation from the North West coastline of the Amwaj Islands (Air and Noise monitoring location B)**



Noise and air quality monitoring was conducted by two EnviroTech staff with support of Emily Morton, Environmental Specialist from JOD & Partners. A Garmin ETrex 20 GPS was used to determine the exact geographical coordinates during the noise survey conducted on 9th May 2012. **Table 2.2** provides the coordinates of the selected monitoring stations. During the ambient air and noise surveys conducted on 9th May 2012, a traffic count was conducted for correlation against the datasets collated during the baseline monitoring.

Table 2.2: Coordinates of Noise Baseline Monitoring Stations

Location Reference	Location	Coordinates	
		Northing	Easting
A	DAM Site Entrance	2908342	4642634
B	Amwaj (NW)	2908655	4657534
C	Al Dair	2907492	462522
D	Samaheej	2906919	463440

The exact locations of the noise monitoring stations used in the survey are shown in **Figure 2.6.**

Figure 2.6: Locations of Air and Noise Monitoring Stations

Key:

Diyar Al Muharraq Phase 1: **A** – Site Entrance

Adjacent residential areas : **B** – Amwaj Islands

C – Al Dair Village

D – Samaheej Village

A selection of photographs captured at the noise and air quality monitoring locations is provided in **Figure 2.7**.

Figure 2.7: Photographs of Air and Noise Quality Monitoring Stations

Monitoring Location at Al Samaheej Village

Monitoring Location at Al Dair Village

Monitoring Location at DAM Site Gate

Monitoring Station at Amwaj Island

Methodology for Baseline Noise Survey

Baseline noise monitoring has been conducted three times on May 9th 2012 (Wednesday) to represent noise levels during morning hours (7:00 am - 9:00 am), afternoon (1:00 pm – 3:00pm) and evening hours (5:00 pm – 7:00 pm). These particular times have been chosen as they correspond to the peak hours of traffic and therefore might indicate the highest noise and air emissions levels due to increased traffic flow. Monitoring locations surveyed are Samaheej Village, Al Dair Village, Diyar Al Muharraq site entrance and Amwaj Island in order.

JOD believed the noise data obtained on May 9th 2012 could be used to represent a worst case scenario. The results show the highest noise levels at selected monitoring stations due to peak hours of traffic. As little or no construction activity is expected on Fridays, noise generated by traffic is assumed to be much reduced over the weekends.

The methodology used in the baseline noise survey together with location of monitoring stations is summarised in **Table 2.3.**

Table 2.3: Noise Baseline Monitoring Survey Details

Noise Monitoring Stations	1 on site station at the site entrance of Diyar Al Muharraq, alongside; 3 off site locations near to sensitive receptors; 1 located within the North Westerly branch of Amwaj (1.2 km); 1 located within the village of Samaheej (1.5 km); and 1 located within the village of Al Dair (1.6 km). (See **Figure 2.6**)
Measurement Parameters	L_{Aeq} , L_{Amin} , L_{Amax} , L_{A10} , L_{A10} and L_{A90}
Noise Measuring Instrument	SOLO O1dB
Duration of Monitoring	15 minutes continuous monitoring at one monitoring station per round
Frequency of Monitoring	3 rounds at each monitoring stations at morning, afternoon and evening hours

A photograph of the noise monitoring instrument, 'SOLO O1 dB', alongside its specifications is provided in **Figure 2.8**.

Figure 2.8: Noise Monitoring Instrument and its Specifications

'SOLO 01 dB' Specifications

SOLO SLM, the first instrument in 01 dB's sound level of meters.

SOLO SLM can be used to measure L_{ea} equivalent continuous levels. Data are stored in a non–volatile memory and can be further read or directly printed.

For measurements performed in a quite atmosphere, SOLO SLM allows for measurements of noise levels as low as 30 db.

Compliant with new standard IEC 61672 -1.

Atmospheric Conditions during Site Survey

Both the temperature and relative humidity were measured on site to represent the current atmospheric conditions during survey.

The temperature and relative humidity records are summarised in **Table 2.4** and **Table 2.5,** respectively.

Table 2.4: Temperature at Monitoring Stations during Survey

Station Name	Temperature (°C)		
	Morning	Afternoon	Evening
Al Samaheej Village	32.5	35.6	30.7
Al Dair Village	32.7	35.6	29.9
DAM Site Gate Entrance	34.2	35.5	28.6
Amwaj Island	34.6	34.8	28.1
Average	**33.5**	**35.4**	**29.3**

Table 2.5 Relative Humidity at Monitoring Stations during Survey

Station Name	Relative Humidity (%)		
	Morning	Afternoon	Evening
Al Samaheej Village	51.4	39.2	47.8
Al Dair Village	42.7	38.0	49.6
DAM Site Gate Entrance	44.2	39.3	53.1
Amwaj Island	41.3	42.2	52.2
Average	**44.9**	**39.7**	**50.7**

2.6.5 Results of Brief Baseline Traffic Survey

The results of this brief traffic survey are presented within **Table 2.6**.

Table 2.6: Results of Traffic Survey

Station	Vehicle Category		
	Light Vehicles	Heavy Vehicles	Construction Vehicles
Results from Morning Survey (07:00 - 09:00 hours)			
Al Samaheej Village	8	0	0
Al Dair Village	12	3	0
DAM Site Gate Entrance	3	28	0
Amwaj Island	2	1	1
Results from Afternoon Survey (13:00 – 15:00 hours)			
Al Samaheej Village	10	0	0
Al Dair Village	24	1	2
DAM Site Gate Entrance	9	7	5
Amwaj Island	3	0	3
Results from Evening Survey (17:00 – 19:00 hours)			
Al Samaheej Village	19	0	0
Al Dair Village	30	0	0
DAM Site Gate Entrance	17	3	2
Amwaj Island	0	0	0

Results of Baseline Noise Survey

The average noise levels recorded during 15 minutes of continuous noise measurements, on May 9th 2012, are presented in **Table 2.7**.

Table 2.7: Results of Noise Monitoring Survey

Station	L_{Aeq}	L_{omax}	L_{min}	L_{05}	L_{10}	L_{90}
Results from Morning Survey (07:00 - 09:00 hours)						
Al Samaheej Village	38.7	68.3	38.7	38.6	38.6	38.6
Al Dair Village	37.8	67.4	37.8	37.7	37.7	37.7
DAM Site Gate Entrance	45.1	74.7	45.1	45.0	45.0	45.0
Amwaj Island	33.7	52.1	33.7	33.6	33.6	33.6
Average	**38.8**	**65.6**	**38.8**	**38.7**	**38.7**	**38.7**
Results from Afternoon Survey (13:00 – 15:00 hours)						
Al Samaheej Village	39.9	69.0	39.9	39.8	39.8	39.8
Al Dair Village	40.4	70.0	40.4	40.3	40.3	40.3
DAM Site Gate Entrance	38.8	68.9	38.4	38.3	38.3	38.3
Amwaj Island	41.8	58.4	41.8	41.7	41.7	41.7
Average	**40.2**	**66.6**	**30.5**	**40.0**	**40.0**	**40.0**
Results from Evening Survey (17:00 – 19:00 hours)						
Al Samaheej Village	39.8	69.3	39.8	39.7	39.7	39.7
Al Dair Village	38.7	68.2	38.7	38.6	38.6	38.6
DAM Site Gate Entrance	40.1	69.6	40.1	40.0	40.0	40.0
Amwaj Island	31.9	31.9	31.9	31.8	31.8	31.8
Average	**37.6**	**59.8**	**37.6**	**37.5**	**37.5**	**37.5**

The Bahrain Noise Standards set up by concerned authorities are presented in **Table 2.8.**

Table 2.8: Bahrain Noise Standards

	Maximum Allowable Noise Limit L_{Aeq}, dB (A)		
	Daytime (07:00 - 16:00 hours)	**Evening (16:00 – 23:00 hours)**	**Night-time (23:00 – 07:00 hours)**
Residential Area	55	50	45
Residential Area with Some Commercial Activity	60	55	50
Commercial Area	70	70	70

The areas surveyed including Al Samaheej and Al Dair Village, DAM Site entrance and Amwaj Island can be accepted as purely residential areas based upon their characteristics. According to the noise standards established in Bahrain, as presented **Table 2.8**, noise levels (L_{Aeq}) are required to be less than 55 dB during the day time and less than 50 dB during the evening hours. All recorded noise levels were much lower than the highest acceptable noise level across all monitoring stations and sessions during the morning, afternoon and evening. The average levels of noise measured were found to be 38.8 dB (L_{Aeq}), 40.2 dB (L_{Aeq}) and 37.6 dB (L_{Aeq}) during morning, afternoon and evening rounds of the survey, respectively.

The highest noise levels were observed at the Diyar Al Muharraq monitoring station during morning round of the survey, correlating with the number of passing heavy vehicles observed passing the monitoring station during the 15 minute period (28 heavy vehicles - refer to **Table 2.6**).

2.6.6 Ambient Air Quality

Methodology for Baseline Ambient Air Quality Survey

The same monitoring locations, as presented in **Figure 2.6**, were used to determine ambient air quality levels. The air quality baseline survey was also undertaken on May 9th 2012, the same day as

the baseline noise monitoring survey in three rounds; morning, afternoon and evening. The key air quality pollutant parameters measured were; particulate matter (PM_{10}), Nitrogen Dioxides (NO_2), Sulphur Dioxides (SO_2) and Carbon Monoxide (CO). Qualitative surveys were conducted by appropriately qualified and experienced staff by using a Wolf Pack and Personal Data Ram (PDR) 1500. All equipment was installed two meters above ground level.

The methodology employed during the ambient air quality baseline survey, together with location of monitoring stations, is summarised in **Table 2.9**.

Table 2.9: Ambient Air Quality Baseline Monitoring Survey

Ambient Air Quality Monitoring Stations	1 on site station at the site entrance of Diyar Al Muharraq; 3 off site locations near to sensitive receptors; 1 located within the North Westerly branch of Amwaj (1.2 km); 1 located within the village of Samaheej (1.5 km); and 1 located within the village of Al Dair (1.6 km). (See **Figure 2.6**)
Measurement Parameters	1. Carbon Monoxide (CO) 2. Nitrogen Dioxides (NO_2) 3. Sulphur Dioxides (SO_2) 4. Particulate Matter (PM_{10})
Ambient Air Quality Measuring Instrument	Wolf Pack Area monitored for: 1. Carbon Monoxide (CO) 2. Nitrogen Dioxides (NO_2) 3. Sulphur Dioxides (SO_2)
	Personal Data Ram (PDR) 1500 for: Particulate matter (PM_{10})
Duration of Monitoring	15 minute continuous monitoring per station per round; using Wolf Pack Area, monitoring for: 1. Carbon Monoxide (CO) 2. Nitrogen Dioxides (NO_2) 3. Sulphur Dioxides (SO_2)
	15 minute continuous monitoring per station per round; using PDR 1500, monitoring for: 1. Particulate matter (PM_{10})
Frequency of Monitoring	3 rounds at each monitoring station; morning, afternoon and evening to represent peak hours

The monitoring instrument used to measure CO, NO_2 and SO_2 levels (Wolf Pack) and Personal Data Ram (PDR) 1500 used for monitoring Particulate Matter (PM_{10}) is shown in **Figure 2.9**. Specifications are also included.

Figure 2.9: Wolf Pack and PDR 1500 Air Monitoring Instruments with Specifications

Wolf Pack and PDR 1500 Specifications
The Wolf Pack is a Modular Area Monitor for environmental air monitoring applications. PID sensor is used for VOCs and NDIR sensor is used for CO_2. Electrochemical sensors have been used to gas measure the other parameters.
The Thermo Scientific Personal Data RAM PDR-1000AN is a passive, real-time, personal aerosol monitor/data logger. This palm-sized unit is capable of real-time, mass concentration measurements of dust, smoke, mists and fumes in real-time. The pDR-1000AN sounds an audible alarm whenever the user-defined level is exceeded. Light-scattering photometer offers high correlation with gravimetric measurement of respirable and thoracic fractions with optimal response to 0.1-10µm size particles.

Results of Baseline Ambient Air Quality Survey

The results of air quality measurements taken during morning, afternoon and evening rounds of the survey undertaken on May 9th 2012, are summarised in **Table 2.10**.

Table 2.10: Air Quality Baseline Monitoring Results

Station Name	CO (mg/m^3)	SO_2 (mg/m^3)	NO_2 (mg/m^3)	PM_{10} (mg/m^3)
Results from Morning Survey (07:00 - 09:00 hours)				
Al Samaheej Village	3.1	0.0	0.01	0.618
Al Dair Village	0.4	0.2	0.02	2.158
DAM Site Gate Entrance	1.8	0.4	0.01	3.168
Amwaj Island	3.4	0.3	0.00	0.773
Average	**2.2**	**0.2**	**0.01**	**1.679**
Results from Afternoon Survey (13:00 – 15:00 hours)				
Al Samaheej Village	1.2	0.0	0.03	0.610
Al Dair Village	1.2	0.1	0.04	1.013
DAM Site Gate Entrance	1.8	0.0	0.02	2.155
Amwaj Island	0.1	0.0	0.03	0.806
Average	**1.1**	**0.03**	**0.03**	**1.146**
Results from Evening Survey (17:00 – 19:00 hours)				
Al Samaheej Village	1.6	0.1	0.07	0.695
Al Dair Village	2.4	0.2	0.06	0.498
DAM Site Gate Entrance	0.5	0.0	0.01	1.515
Amwaj Island	0.0	0.0	0.00	0.438
Average	**1.1**	**0.1**	**0.04**	**0.786**

The air quality standards for the Kingdom of Bahrain are presented in **Table 2.11**.

Table 2.11: Air Quality Standards in Bahrain

Pollutant	Exposure Period	Bahrain Air Quality Standard
Sulphur Dioxide (SO_2)	1-hour 24-hour Annual Mean	350 µg/m³ 125 µg/m³ 50 µg/m³
Nitrogen Dioxide (NO_2)	1-hour 24-hour Annual Mean	200 µg/m³ 150 µg/m³ 40 µg/m³
Particulate Matter (PM_{10})	24-hour Annual Mean	340 µg/m³ 80 µg/m³
Carbon Monoxide (CO)	1-hour 8-hour	30.2 mg/m³ 10 mg/m³
Ozone	1-hour	100 ppb
Non-Methane hydrocarbons	3-hour	240 ppb

Bahrain Air Quality standards limit CO to 30.2 mg/m^3 as maximum concentration within a one-hour exposure period. The CO levels measured were found to be minimum zero during evening round and the maximum 3.4 mg/m^3 during the morning round in Amwaj. The average CO concentration at all monitoring stations was found to be 2.175 mg/m^3, 1.075 mg/m^3 and 1.125 mg/m^3 during morning, afternoon and evening rounds of the survey respectively. All CO levels measured were less than the Bahraini standards acceptable limit of 30.2 mg/m^3, therefore ambient air quality was acceptable in terms of CO concentrations.

Bahrain Air Quality standards maximum concentration of SO_2 within a one-hour period is 350 µg/m³. The SO_2 levels measured were found to range between a minimum of zero during the morning round of surveys within Al Samaheej village and a maximum 4.0 mg/m^3 during the morning round at the DAM Site entrance which exceeds the standard value. This exceedance can be correlated with the emissions created by the heavy vehicles (28 heavy vehicles) observed during the morning round of the survey at this station. Average SO_2 concentration at all monitoring stations were found to be 0.225 mg/m^3, 0.225 mg/m^3 and 0.075 mg/m^3 during morning, afternoon and evening rounds of the survey, respectively. Average SO_2 levels measured were less than the Bahraini standards; therefore, ambient air quality was acceptable in terms of SO_2 concentrations within the survey data.

Bahrain Air Quality standards limit for NO_2 concentrations within a one hour exposure period to 200 µg/m³. The NO_2 levels were recorded as zero at two locations (**Table 2.10**), with a maximum of 0.07 mg/m^3 (70 µg/m³) during the evening round within Al Samaheej Village. The average NO_2 concentrations across all monitoring stations was found to be 0.01 mg/m^3, 0.03 mg/m^3 and 0.035 mg/m^3 (corresponds 10 µg/m³, 30 µg/m³ and 35 µg/m³ respectively) during the morning, afternoon and evening rounds of the survey, in turn. These values are much lower than the highest acceptable limit of 200 µg/m³ per hour, therefore the ambient air quality was found to be acceptable considering NO_2 concentrations monitored during the brief baseline survey.

Bahrain Air Quality standards maximum PM_{10} concentration within a 24 hour exposure period is 340µg/m. The PM_{10} concentration measurements ranged between a minimum of 0.438 mg/m^3 in Amwaj during the evening survey round and a maximum 3.168 mg/m^3 at the DAM site gate during morning survey round. Amwaj Island was found to experience much lower ambient air particulate matter concentrations, correlating with the lowest traffic flows observed at this survey location (**Table 2.6**).

Average PM_{10} concentrations at all monitoring stations were found to be 1.679 mg/m^3, 1.146 mg/m^3 and 0.786 mg/m^3 during morning, afternoon and evening rounds of the survey, respectively. These values are higher than the acceptable limit of 340 µg/m³ for PM_{10}. JOD believed that these high values of PM_{10} concentration were related with the particulate matter emissions released from vehicles - including light, heavy and construction vehicles.

To test the effect of traffic related particulate emissions on ambient air quality, JOD conducted one measurement (average over 15 minutes) at a control station within Amwaj, during the morning monitoring round. The PM_{10} concentration was found to be 0.773 mg/m^3 at the selected monitoring station in Amwaj – which is directly exposed to traffic emissions, whereas the control location – which was sheltered from any passing traffic, was found to be only 0.089 mg/m^3. The PM_{10} concentration at the monitoring station in Amwaj was 8.67 times higher than the PM_{10} concentration recorded at control station. Therefore, JOD assumed that the highest results of PM_{10} values were related to vehicles emissions, which are dispersed quickly within the air to reach acceptable levels.

JOD's survey results confirm that heavy vehicles movement and increased levels of traffic can be considered a source of air pollutants within the survey area although observed levels of noise and air quality parameters comply well with local Bahraini standards and do not show any sensitivities, special attention should therefore be given to manage the traffic flows during construction period of DAM development particularly near to DAM site entrance.

2.6.7 Terrestrial Ecology

There are no potentially affected areas of terrestrial ecology since the DAM project site is entirely located offshore. Being on the extreme north end of the Kingdom, Diyar Al Muharraq is the first dry land site available to migrating birds, followed by the Amwaj Islands to DAM's East. The open landscape is attractive to birds having travelled across the open sea on their passage through Bahrain to and from Africa. The island offers a much needed respite from the long flight over water.

An avifaunal survey was conducted to identify the current status of the avifaunal population within DAM land reclamation.

Scope of the Avifaunal Survey

The scope of the avifaunal survey was:

i. To identify the current status of birds present;
ii. To identify the locations of the major concentrations of birds;
iii. To identify a list of the species utilizing the area and their numbers;
iv. To identify the seasonal variations in bird species utilization;
v. To identify the tidal influence on the bird distribution and abundance;
vi. To review the historical data on wintering and breeding birds on site and;
vii. To propose mitigating factors that could be incorporated into the development in support of the avifauna have been gathered, analysed and reported.

Although the avifaunal survey proposed to identify the present condition of avifaunal population and their major location within DAM reclaimed plot, the seasonal fluctuations in bird species and numbers were also discussed in the sub-consultant report. The avifaunal survey was subcontracted to a specialised local ornithologist, Brendan Kavanagh and he included information and data collected in summer period of 2011 within DAM site. Therefore, it was possible to get a professional evaluation of the avifauna during spring and summer.

Construction Environmental Management Plan (CEMP) Rev 00

Methodology of the Baseline Avifaunal Survey

The site was surveyed using a 4 X 4 vehicle. All perimeters, internal waterways and individual sub-islands were surveyed using 7 X 42 Leica binoculars and TBS80 optolyth telescope where appropriate (**Figure 2.10**).

All areas of the site were surveyed from land. The survey route followed the coast line, beginning at the sandy beach area in Block 14 (see concept master plan, **Figure 2.1**), moving northeast along the shoreline to the first sea inlet at Block 16 C. From here the route re-joined the access road to and crossed the sea bridge to survey Block 16A then returned east to cover Block 16B.

The route then returned west to survey Block 18 and then northeast to Block 17. From the north western tip of Block 17 the route returned south on the west side of Block 18 (which was still attached to 17 on the west side) onto Blocks 15, 25 and 26. From there the route turned north to survey Block 27. The survey returned southwest to cover Blocks 23, 24 and 22 surveying the western coastline. The same route was followed on both surveys in April 2012.

The number of birds of each species was recorded over two days of survey on the 14th and 21st of April 2012. These surveys coincided with high tide and low tide respectively, which allowed the identification of any tidal influence on the bird distribution and abundance.

Figure 2.10: Leica binoculars and Optolyth telescope used for bird survey work

Previous visits to the island were conducted to by Brendan Kavanagh during 2011, and birds recorded during these visits are also presented within this report. During the two major visits in April 2012, all birds present were recorded with their location identified. Earlier surveys in 2011 did not record such data but all breeding birds were identified and a number of birds were ringed (see **Table 2.12**).

Two half-day avifaunal surveys were undertaken on 14th April and 21st April 2012 which is corresponding on high tide and on low tide respectively. This allowed the identification of any tidal influence on the bird distribution and abundance. Over two days of survey, on the 14th and 21st April 2012, the birds species observed were identified and the number of birds of each species was recorded. Their locations of major concentrations were also identified and presented within **Figure 2.14**.

Results of the Baseline Avifaunal Survey

Variety of bird species have been identified and counted during the avifaunal survey. The results of avifaunal surveys carried out in 2011 and in April 2012 are summarised in **Table 2.12**.

Table 2.12: Bird Species Present at Diyar Al Muharraq Site and their Numbers

Common Name	Scientific name	10/6/11	18/6/11	1/7/11	14/4/12	21/4/12
Great Cormorant	*Phalacrocorax carbo*				3	5
Socotra Cormorant	*Phalacrocorax nigrogularis*			1		
Western Reef Heron	*Egretta garzetta/gularis*			2	3	3
Grey Plover	*Pluvialis squatarola*	1	9	5	1	1
Kentish Plover	*Charadrius alexandrines*	10	6		4	7
Lesser Sand Plover	*Charadrius atrifrons*			54		
Greater Sand Plover	*Charadrius leschenaultii*	2	Present	2		
Whimbrel	*Numenius phaeopus*	2	Present	4		
Eurasian Curlew	*Numenius arquata*	1	Present	25		
Common Redshank	*Tringa tetanus*			4	2	
Ruddy Turnstone	*Arenaria interpres*			9		1
Curlew Sandpiper	*Calidris ferruginea*		4			
Terek Sandpiper	*Xenus cinereus*					3
Lesser Crested Tern	*Sterna bengalensis*	10		2	7000-8000	8000-10000
Saunders's Tern	*Sternula (albifrons) saundersi*	6		1	4	10
White-cheeked Tern	*Sterna repressa*	100	130	4		10
Slender-billed Gull	*Larus genei*				5	1
Yellow-legged Gull	*Larus cachinnans-barabensis*					5
Swallow	*Hirundo rustica*					25
Willow Warbler	*Phylloscopus trochilus*					1
Isabelline Wheatear	*Oenanthe isabellina*				1	2

* The yellow cells presents the data obtained during summer 2011 while pink cells present the findings of April 2012 survey

The most significant record during the two site visits in April 2012 was the discovery of 8,000-10,000 Lesser-crested Terns gathering on the new shoreline in the Great Lakes construction site. These terns were returning to the Gulf after the winter in the Indian Ocean and had formed a large gathering in preparation for dispersal to breeding colonies at Fasht Al Jarim and further afield on several sandy islands of the Saudi coast. A flock of 8,000 – 10,000 Lesser-crested Terns, shown in **Figure 2.11**, was recorded at the Great Lakes site at Block 27 on the Master Plan for Diyar Al Muharraq on April 21st 2012.

Construction Environmental Management Plan (CEMP) Rev 00

Figure 2.11: A flock of 8,000 – 10,000 Lesser-crested Terns - photograph taken on April 21st 2012.

This flocking behaviour has never been recorded before and probably has significance in helping birds relocate their partners after the winter at sea. This was the largest gathering of Lesser-crested Terns ever seen by the author of the report in Bahrain since he arrived here in 2004. The location of Diyar Al Muharraq on the north eastern tip of the Bahrain, quite far out to sea, is obviously a major attraction for the birds prior to dispersal to the breeding colonies.

The sandy beaches along the south-east coast of Diyar Al Muharraq can be expected to host important numbers of Curlew, Greater and Lesser Sand Plovers, Grey Plovers, various Sandpipers and Dunlin. The number of waders found in Bahrain is dependent on the seasons. In autumn large numbers of birds pass through the Kingdom on route to winter quarters in the United Arab Emirates and Oman. Many of these birds stop off for the winter and can be seen all around the coast of Bahrain. In spring, especially in February and March the number of birds increases again as the waders stop off to build up their reserves on route back to their breeding grounds in Northern Europe and Asia. However, the timing of the surveys in Diyar Al Muharraq in April 2012 occurred after most waders had left the Kingdom hence the low counts of waders reported in **Table 2.12.**

Western Reef Herons are resident species in Bahrain and can be found on the sandy shores the Diyar Al Muharraq site. They feed on small fish and invertebrates found in shallow water. **Figure 2.12** shows an image of a Western Reef Heron, observed in Block 13B on April 14th 2012.

Figure 2.12: Western Reef Herons found in Block 13B during April1 4th 2012 Survey

A number of breeding species were recorded on site including Kentish Plovers, Saunder's Little Terns and Lesser-crested Terns. Saunder's Little Terns are known to breed in many areas around the coast of Bahrain. They spend the winter out in the Indian Ocean, returning each spring to breed. They breed at low densities in less disturbed corners and often go unnoticed to the untrained eye. Two pairs were located on site in 2011 and the most recent survey on April 21st 2012 – two nests were recorded, each with 2 eggs. **Figure 2.13** shows the photograph taken in Block 17 on April 14th 2012.

Figure 2.13: Evidence of breeding pairs of Saunder's Little Terns captured during the April 14th 2012 survey in Block 17

Construction Environmental Management Plan (CEMP) Rev 00

Despite the disturbance, the lack of vegetation and the unattractive nature of the land/sea interphase, Diyar Al Muharraq still has an attraction for several species of breeding, passage migrant and wintering birds.

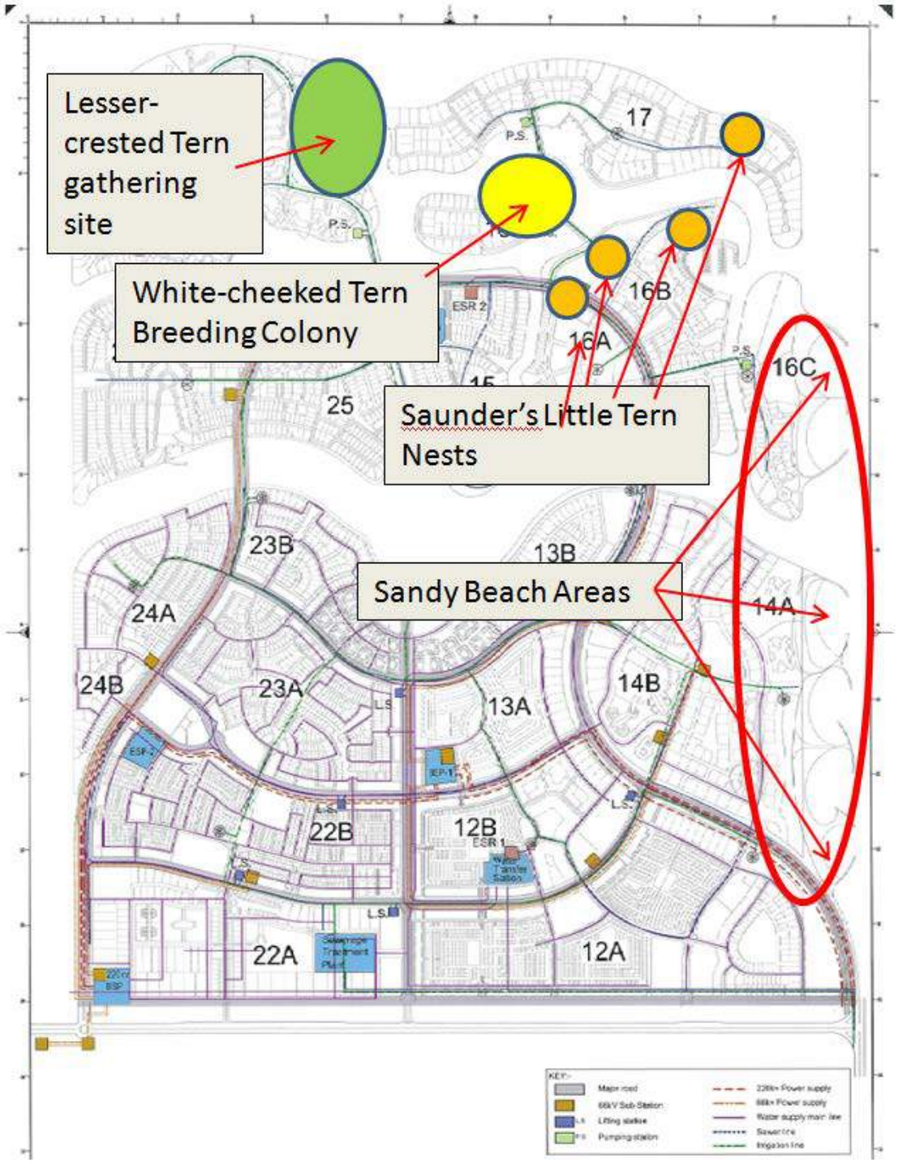
A large number of bird species select Bahrain as their wintering destination. Of these, the waders, which live along the shoreline, are most likely to occur in Diyar Al Muharraq. The island offers two opportunities for waders in winter, a safe roosting site during high tide and a small area of shoreline for feeding purposes.

The main species recorded were the Grey Plover, Kentish Plover, Greater and Lesser Sand Plovers, Curlew, Whimbrel, Redshank, Turnstone and Curlew Sandpiper. Greater and Socotra Cormorants were also observed roosting on the headlands along the southern side and on manmade structures immediately off shore. A small number of Western Reef Herons was also recorded.

The sandy beaches along the southeast coast of Diyar Al Muharraq can be expected to host important numbers of Curlew, Greater and Lesser Sand Plovers, Grey Plovers, various Sandpipers and Dunlin. The timing of the surveys, however, did not coincide with the seasonal occurrence of waders hence the low counts reported in **Table 2.12**.

A number of locations have been identified with the major concentrations of birds within DAM site. These places are mostly located in the northern part of the DAM reclamation plot. **Figure 2.14** provides the main locations observed with the presence of bird populations.

Figure 2.14: Locations of significant bird sites in Diyar Al Muharraq 2011 - 2012

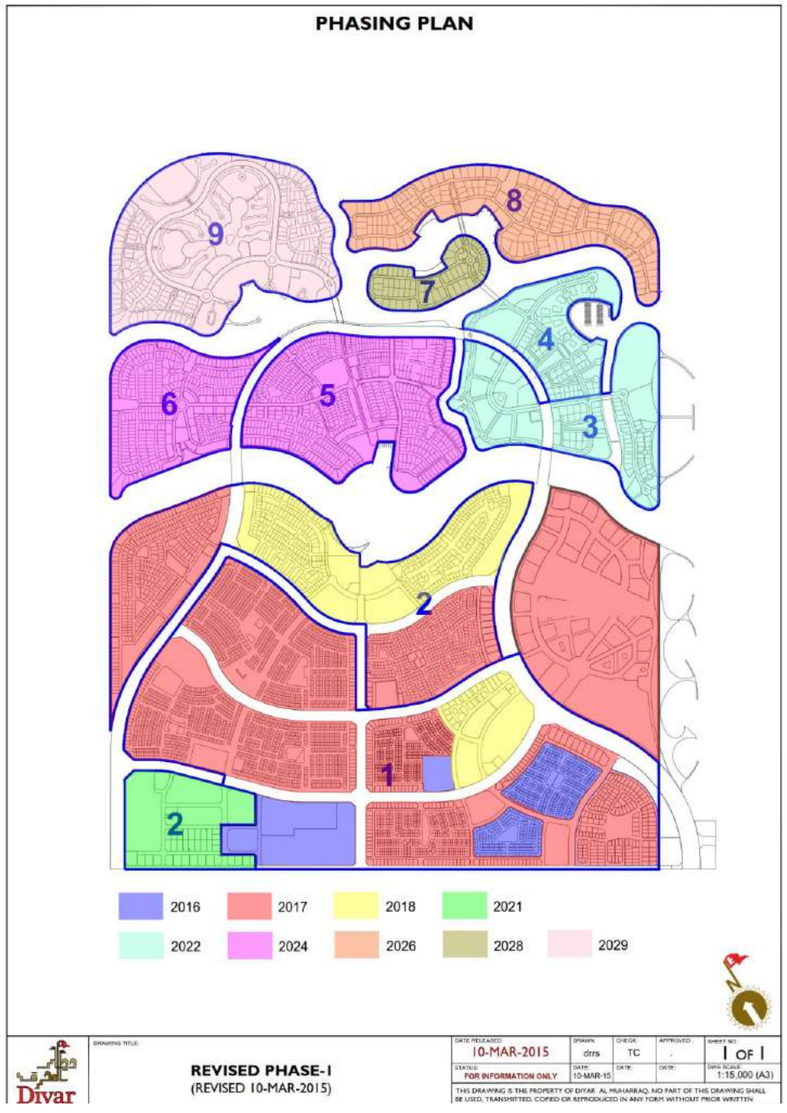


2.7 DEVELOPMENT PHASING STRATEGY

This Section briefly describes the construction activities, work programme and logistics. A phased approach is anticipated for the proposed construction activities. **Figure 2.15** demonstrates the phasing plan for the initial stages of the DAM Development.

The CEMP is applicable to all construction activities and contractors allocated to conduct construction works within the Diyar Al Muharraq Phase 1 plot.

Figure 2.15: Development Phasing Strategy for the DAM Development



2.8 PROPOSED CONSTRUCTION ACTIVITIES

A wide range of construction activities may be undertaken during the primary infrastructure works as follows:

i. Excavation, shoring and dewatering;
ii. Ground improvement;
iii. Piling;
iv. Backfilling and compaction;
v. Substructure and superstructure;
vi. Installation of services;
vii. Plant installation, fitting and commissioning;
viii. Infrastructure works (various); and
ix. Building Construction.

Specific construction method statements will be made available at later stages by the appointed Contractor(s).

Re-use options of the excavated material should be considered first. Excavated material will likely be material previously extracted and filled during dredging, it should therefore be suitable for use as a fill material elsewhere on the project.

Where excavations are below the local groundwater level, a local dewatering system needs to be installed to maintain a dry excavation. The Contractor(s) is responsible for detailing all dewatering plans including dewatering discharge points, treatment and testing of discharges. The Contractor(s) must obtain approval from the relevant authority for the dewatering system and discharge point(s). Mitigation measures for the dewatering are discussed in detail within the “Soil and Groundwater Control Plan” (**Section 5.3**).

Construction Environmental Management Plan (CEMP) Rev 00

2.9 CONSTRUCTION LOGISTICS

2.9.1 Site Access

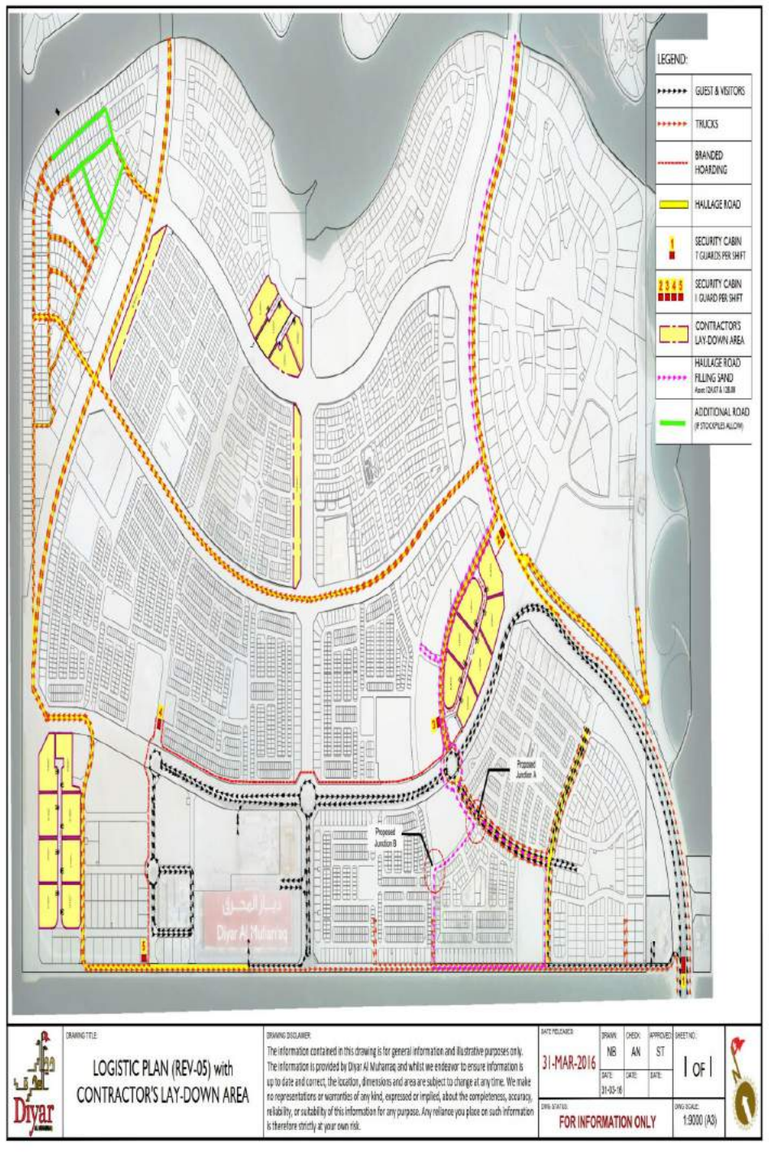
To facilitate best possible access and egress to and from the site, the Contractor(s) will implement a logistics strategy (to be approved by the TIO) who maintain and update a centralised traffic movement and logistics plan for the overall Diyar al Muharraq site.

Currently, access to DAM consists of a causeway linking the South East corner of the site to the existing Dry-dock Highway. **Figure 2.16** shows the Diyar Al Muharraq Site Access Gate.

Figure 2.16: Diyar Al Muharraq Site Access Gate

All Contractors will be located together in a centralised compound area, with lay-down areas and offices sub-divided as necessary. The compound will be located within Asset 22A, as shown in **Figure 2.17**.

Figure 2.17: Centralised Contractor Compound



The Contractor(s) shall be responsible for the construction of haul roads for transportation and access within the site boundary. Upon completion of the works in this area all access roads shall be removed and made good accordingly to the satisfaction of the Engineer.

2.9.2 Safety Signage

The Contractor(s) shall display at the entrance to the Project and at the entrance to the buildings official safety signage in English, Arabic, Hindi and Urdu indicating the requirement for:

i. Safety Hats;
ii. Safety Footwear;
iii. Hi-visibility vests or jackets;
iv. No Smoking; and
v. Speed limits for vehicles.

In other designated work areas, where other hazards are present, the Contractor will provide the signage indicating the requirement for the following:

vi. Eye Protection;
vii. Ear Defenders; and any
viii. Other required appropriate Signage and Screens.

The Contractor(s) will provide Emergency Exit signage indicating a clear, well lit, safe route to designated Assembly Points.

2.9.3 Workforce

The construction Contractor(s) are required to provide information on the construction workforce, including how many workers will be needed for the proposed construction activities within their specific CEMP, including the proportion of these that will be local Bahrainis. Bahrain Labour Law requires 30 % of those employed to be Bahraini.

2.9.4 Working Hours

It is estimated that there will be construction activities undertaken six days a week on Site. Construction workers are expected to work at least nine hours per day and are not permitted to work during restricted hours throughout the summer period, based on Local Legislation due to heat stress. This midday work ban last two months (July and August) and prevents labourers and other workers subjected to the midday sun, from working between the hours of 12 noon and 4 PM.

The Contractor shall abide to the working hours as required under the Bahrain Labour Law. During all officially declared public or national holidays, the site will be closed.

2.9.5 Welfare Facilities for Workers

There will be no labour camps located on the Diyar Al Muharraq site. Most workers will be accommodated in an off-site camp and will be transported to and from the site by bus. It is expected that construction workers will be provided with a canteen, sanitary facilities including restrooms,

showers, water tanks, and drinking water facilities and health facilities on site. Some details regarding drinking water facilities and hand-wash facilities are provided below:

Drinking Water Facilities

The Contractor shall provide free drinking water facilities for workers working on the Site throughout the Contract. To minimize waste plastic bottles, the drinking water facility can be in the form of a water pot with a cover at the top for water refilling and a tap at the bottom for drawing water, a distilled water drinking fountain or any other form approved. The drinking water facilities shall be provided indoors.

The Contractor shall be responsible for maintaining the drinking water facilities in clean and hygienic condition and refilling drinking water to the facilities before empty. The Contractor shall propose the number, location of placement and the refilling frequency for drinking water facilities provided on the Site for the approval of the Engineer within 14 days from the date of commencement of the Works on the Site. The Supervising Officer and the Contractor shall review regularly the adequacy of drinking water facilities provided by the Contractor throughout the Contract.

Hand-Wash Facilities

The Contractor shall provide hand-wash facilities in the form of water points and sinks for workers working on the Site throughout the Contract, unless otherwise approved by the Engineer that the provision is not necessary. The Contractor shall propose the number of hand-wash facilities, their locations and the system of how to collect the discharge from the wash-water basin for reuse/recycle on the Site for the approval of the Engineer within 14 days from the date of commencement of the Works on the Site. The Engineer and the Contractor shall review regularly the adequacy of hand-wash facilities provided by the Contractor on the Site and the effectiveness of the discharge collection system throughout the Contract.

2.9.6 Other Temporary Facilities

Other temporary facilities required during construction works might include; vehicle wash and decontamination facilities, fencing and security gates/cabins, portable toilets, bulk material stockpile areas and construction materials storage, administration and site offices and flood lighting provisions. Details are to be provided by the allocated Contractor(s) with their CEMP documentation.

2.9.7 Construction Materials

Construction materials will be sourced locally where possible. Materials available locally include but are not limited to the following:

i. Concrete products, road kerbing and paving etc.;
ii. Steel reinforcement;
iii. Building block work;
iv. Pipes and fittings;
v. Tiling and finishing products, roof tiles etc.; and
vi. Asphalt products.

The Contractor(s) should consider waste minimisation issues when estimating the type and amount of construction materials required and aim to order only the minimum materials required by the project to avoid wastage. Non-approved chemicals are not expected to be used on the project site. The list of chemicals and related MSDS (Material Safety Data Sheets) should be provided by contractors to the SCE for their approval.

Construction Environmental Management Plan (CEMP) Rev 00

2.9.8 Potable Water Supply

There is currently no potable water available on site. The appointed Contractor(s) will have to make provisions for the delivery of potable water to site via tankers. The amount and source points have to be determined by the Contractor(s) and provided as part of the Construction Activity description within their CEMP documentation.

2.9.9 Sanitary Wastewater Management

There will be no sewage treatment facilities on site. The appointed Contractor(s) will have to make provisions for the supply and maintenance of temporary sanitary facilities for site staff and employees. The sewage will most likely be removed by tankers to the prescribed treatment facility.

2.9.10 Power

There is currently no electricity available on site. It is most likely that generators will have to be provided by the appointed Contractor(s), as per their requirements. Generators are to be silent running with appropriate shrouding.

2.9.11 Construction Waste Generated

The construction process will generate different types of waste. **Table 2.13** presents the different types of waste, both inert and non-inert which are expected to be produced during the construction phase. During construction, waste will be generated from a number of sources including excavation, construction, vehicle/plant maintenance and workers activities.

Table 2.13 : Anticipated Construction Waste Composition

Inert	Non-inert
Excavated fill	Timber
Concrete blocks and Bricks	Vegetation
Debris	Packaging Waste
Rubble	Organic Material (Food Waste)
Earth	Bitumen
Tiles	Plastics, plastic bottles/containers, plastic sheets and bags, foam
Glass	Hazardous Waste (Oils and fuels, Paints and Solvents, Plasticizers, Cement and Cementation Materials, Cleansing agents and detergents)
Fibreglass	Sewage Sludge
Scrap Aluminium and Steel	Paper and Wood

The Contractor(s) should provide a Waste Management Plan that addresses the handling, management and disposal of these wastes. To assist the creation and implementation of waste management a “Waste Management Plan” is provided in **Section 5.8** in this CEMP report. The Contractor shall provide sufficient rubbish bins with covers at strategic locations on the site for collection and disposal of general wastes generated by workers throughout the contract.

The Contractor(s) shall maintain the cleanliness of rubbish bins, and arrange collection and disposal of waste inside the rubbish bins regularly, but in any case shall be not less than once in very three days. The Contractor shall also make arrangement for collecting papers and packaging on the site to reduce disposal of wastes to landfills. The Contractor shall propose the number and the location of placement of rubbish bins provided on the site together with the arrangement for on-site sorting of aluminium cans, plastic bottles and papers.

3 ENVIRONMENTAL MANAGEMENT

3.1 POLICY STATEMENT

Diyar Al Muharraq WLL is committed to environmental protection, health and safety management and compliance with the applicable regulations and guidelines, recognising the importance of environmental protection and sustainability. DAM aim to minimise the environmental impacts of the construction activities, and eventual operation of the development, by:

i. Ensuring compliance with the applicable laws, regulations and statutory obligations relating to environmental issues;
ii. Implementing the environmental initiatives and programs reported within the CEMP;
iii. Providing sufficient and suitable resources to implement and maintain the Environmental Management System;
iv. Maintaining, monitoring, reporting, reviewing and auditing the Environmental Management System to allow for continual improvement, consistent with certification requirements;
v. Educating and training staff to continually improve awareness, skills and knowledge of environmental issues and practices;
vi. Apply waste, energy and water minimisation principles;
vii. Taking all practicable steps to prevent adverse effects including pollution;
viii. Identifying, investigating, reporting and resolving all environmental incidents and non-conformances, taking action to prevent recurrence;
ix. Communicating regularly with key stakeholders and community groups on environmental issues; and
x. Reporting to the Directorate on environmental performance including infringements and regulatory non-compliance.

All Third Party Developers are obliged to implement and maintain this Policy Statement and its relevant requirements. This prerequisite will be expressed clearly within the appropriate contract documents between Diyar Al Muharraq and all Third Party Developers.

3.2 KEY ENVIRONMENTAL OBJECTIVES & COMMITTMENTS

The CEMP provides and defines the relevant environmental legislation, regulations and obligations relevant to the construction of the Primary Topside Infrastructure of Diyar al Muharraq, Phase 1. The Key Environmental Objectives (protect, maintain or minimize environmental impacts) are provided within **Table 3.1**.

Table 3.1: Key Environmental Objectives

Parameter	Objective (Protect and Minimise)	Target (Manage)
Air Quality	Minimise potential air pollution from construction activities	Maintain air quality management practices throughout the project
Noise and Vibration	Minimise potential impacts of noise and vibration from construction activities	Maintain effective noise and vibration and management practices throughout the project
Ecology (specifically Avifauna)	Protect ecology within the construction area	Minimise potential impacts on avifaunal populations; and Provide effective restoration and rehabilitation opportunities throughout the project
Water & Groundwater Quality	Avoid pollution water bodies	Implement effective materials handling to ensure no spillages of e.g. fuels, oils or chemicals occur
Soil and Groundwater	Apply soil erosion and sediment control principles to minimise water pollution	Maintain effective soil erosion and sediment controls
Waste Management	Minimise waste resulting from construction activities	Reduce, reuse and recycle all wastes (where possible); and Keep accurate records for all waste
Traffic and Access	Minimise potential impacts on traffic during construction	Maintain effective traffic management practices

All Contractors are required to adhere to all obligations of this CEMP document throughout the construction works associated with the development of the primary topside infrastructure of the Diyar Al Muharraq Development – Phase 1.

3.3 ENVIRONMENTAL MANAGEMENT SYSTEMS

This CEMP document outlines the environmental obligations of the project, as approved by the Supreme Council for Environment (SCE). However, communication is fundamental in ensuring the effective control of impacts associated with the construction activities; relying upon liaison with and active involvement of all contractors, sub-contractors and third-party organisations (including Key Regulatory Authorities, introduced within **Section 3.5.1**).

Each contractor and sub-contractor involved in the DAM construction works must define and establish a specific environmental management structure and Control Plan according to their specific construction works. This 'Control Plan' must define the measures intended to ensure full compliance with the CEMP. Roles and responsibilities are described within **Section 3.4**, while Monitoring and Auditing recommendations are provided within **Chapter 6**.

The Project Control Plans should contain the environmental commitments and requirements to ensure good-practice, including inspection and monitoring requirements. The Developer and Contractors are encouraged to call upon specialists and an Environmental Consultant, where sensitivities require environmental monitoring works.

The environmental commitments statement within the Control Plan should describe the following:

i. The nature of the work to be undertaken;
ii. All relevant CEMP and EHS commitments;
iii. Adherence to all outcomes and obligations – the objectives of the Control Plan;
iv. The responsible body for ensuring CEMP environmental commitments;

v. Personnel responsible for monitoring and recording the CEMP environmental commitments are properly fulfilled;

vi. All monitoring activities; and

vii. Proposed mitigation measures for all residual impacts, unexpected releases and anything that compromises worker safety.

The Contractor Personnel responsible for ensuring compliance with the environmental management measures detailed within the Control Plans must be clearly identified at an early stage, with their roles defined within the plan itself.

The Contractor's procedures and programs for Environmental Training must be fully provided within their environmental management systems Control Plan. Training requirements are discussed within **Section 3.7**, 'Environmental Awareness and Training'. All staff must be fully inducted regarding the importance of effective environmental management, environmental sensitivities, and the compliance with the requirements of the CEMP.

Control Plans must be regularly revised, as often as necessary and made available and easily accessible to all staff and visitors – alongside a list of all key environmental management staff and their contact details. The responsibility for checking Control Plans are regularly revised will lie with the supervisory engineer's environmental team.

3.4 ROLES AND RESPONSIBILITIES

It is the responsibility of all contractors and sub-contractors to adhere to requirements contained within the CEMP and all applicable environmental regulations. CEMP adherence requirements should be contained within the contractual documents between the parties.

This Section provides the details regarding suggestions for allocation of Health, Safety and Environmental responsibilities to key personnel and obligations with regard to the establishment, implementation and monitoring of the CEMP requirements.

The Developer / Contractors may wish to sub-Contract Environmental Reporting and site inspection compliance responsibilities to a chosen Environmental Consultant, or this may be requirement of SCE, pending the submission of this Documentation, however this section provides general guidance and advice regarding Roles and Responsibilities – highlighting the importance of establishing an Environmental Management Procedures and Control Plans for dealing with potential issues.

Alongside the requirement for the Developer (PEM) and Contractor (EHS Officers) to devise an Environmental Management Structure and Control Plans, the environmental responsibilities of all personnel within the site and at management level must be clearly defined.

Specific roles and responsibilities of staff must be clearly defined alongside those nominated personnel, as soon as possible. A list of contact details of the key environmental managers / supervisors should be made accessible to all staff together with the Environmental Control Plans. Allocating responsibility for the achievement of environmental objectives leads to greater accountability, therefore increasing the effectiveness of the implementation environmental management measures during the construction process.

The Contractor(s) is responsible for ensuring that the CEMP is implemented including the Subcontractors activities. The Contractor must provide the Project Proponent with a method statement to specify how the requirements of the CEMP will be met. The Contractor(s) is responsible

Construction Environmental Management Plan (CEMP) Rev 00

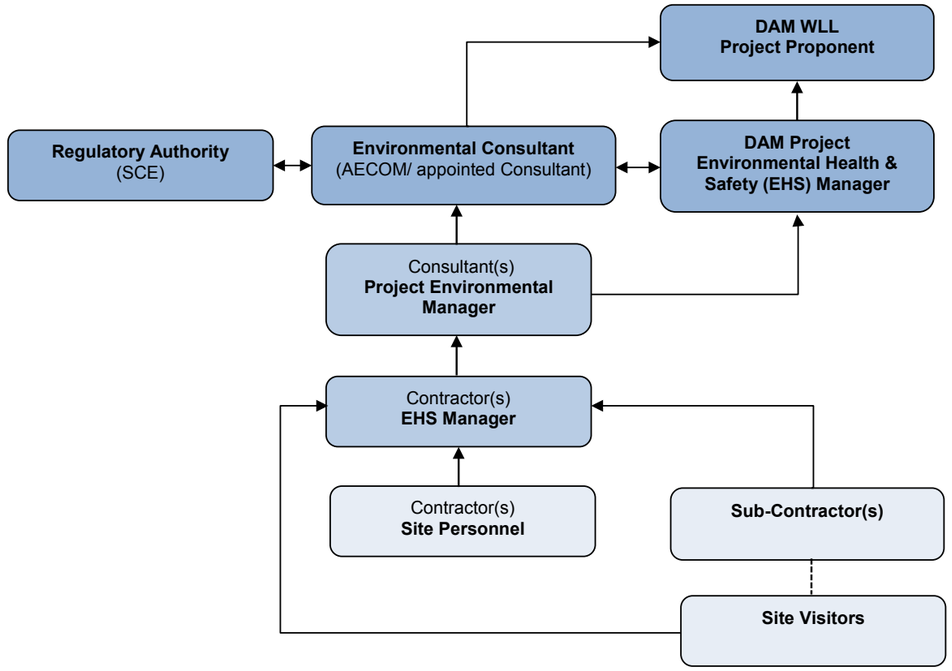
for ensuring that the CEMP is implemented in order to avoid, reduce and minimise the environmental impacts from their activities during the construction phase of the project.

The Contractor will be responsible for conducting daily environmental inspections as outlined in the Environmental Control Plans. This inspection will be the responsibility of the Contractor Site EHS Officer and should be signed off by the Contractor Environment, Health & Safety (EHS) Manager daily (with any exceedances reported to the Contractor Environmental Manager).

The Contractor will provide environmental reports to the Project Proponent (DAM) and the Project Manager on a monthly basis. These environmental reports will include the daily site inspection checklists, monitoring data, incident reports, complaints registered, all code blue and red incidents and their follow up investigations, implementation of corrective actions and close-out.

Figure 3.1, an outline organisational flow chart, illustrates a potential configuration the environmental management structure, demonstrating the relationships between the key staff roles introduced in **Section 3.4** Project specific accountability flow charts should be completed, to include the names and contact details of the appropriate persons. These should be amended as necessary and made easily accessible to all site staff and visitors.

Figure 3.1: Environmental Management Team and Reporting Lines within the Contractor Organization and with External Organisations



3.4.1 Project Proponent – Diyar Al Muharraq WLL

The Project Proponent, Diyar Al Muharraq WLL, has the overall responsibility for the Project. Pre-qualification of Contractors should favour those with Environmental Management System Accreditation in order to ensure effective implementation of the CEMP, execution of HSE requirements, adherence to the objectives of the Environmental Control Plans and aid communication with the Environmental Consultant. Third Party Contract documentation is to include the requirements of the CEMP, including Contractor's supervisory engineers' responsibilities for producing a customised CEMP and Control Plans adhering to the general guidelines of SCE.

Monthly progress reports, prepared by the Environmental Consultant, will be submitted to the Project Proponent for their information, approval and action where necessary. All non-compliance identified during either internal inspections and audits conducted by the Contractor or external audits conducted by the Environmental Consultant will initiate corrective action for undertaking within an appropriate time frame (**Section 6.2**). If a situation is not resolved, the Client will rectify the situation and the cost borne by the Third Party Contractor (alternatively, perhaps DAM will establish a retention fee for environmental mitigation measures).

3.4.2 Regulatory Authority – The Supreme Council for Environment (SCE)

The SCE is responsible for administration of Environmental Laws in the Kingdom of Bahrain. The SCE will evaluate this CEMP and issue any further conditional requirements prior to the commencement of construction. The SCE can carry out site inspections at their discretion to verify the Contractor's compliance with this CEMP.

3.4.3 Environmental Consultant

The Environmental Consultant will be responsible for managing and submitting all documentation required by the SCE, including Contractor CEMPs and environmental monitoring reports (monthly and periodic, as per SCE's requirements).

The Environmental Consultant will undertake fortnightly Environmental Auditing and recommend improvements throughout the construction period to ensure compliance to the SCE standards, as within **Chapter 6**, and assume responsibility for notifying the SCE and any other relevant authorities, should an environmental incident with actual or potential significance for impacts occur.

Progress reports will summarise the Contractor's environmental reports, including; site inspection reports, monitoring data, audit reports, incident reports, complaints registered, all incidents alongside their follow up investigations, implementation of corrective actions and close-out. An Environmental, Health and Safety audit checklist is provided as a guide within **Appendix B** of this report.

3.4.4 The Project Environmental Manager / Environment, Health & Safety Manager (Corporate) to be appointed by DAM

A Project Environmental Manager (PEM) should be appointed as the overall environmental coordinator, ultimately responsible for all Environment, Health & Safety (EHS) aspects of the whole development. The Project Environmental Manager has the responsibility for ensuring that environmental mitigation and control measures are implemented by the Contractor(s). The Project Environmental Manager will receive monthly environmental reports from the Site EHS Manager on the implementation of the CEMP.

The Project Environmental Manager is responsible for:

Construction Environmental Management Plan (CEMP) Rev 00

i. Construction Environmental Management Plan compliance;
ii. Acting as a point of contact for the Project Proponent to the Construction Site Supervising Consultant and Contractor;
iii. Liaising with local Government Authorities and Non-Governmental Organisations and reporting on environmental compliance as required;
iv. Submitting the monthly environmental reports to the SCE as required; and
v. Report environmental issues and non-conformances to DAM WLL.

3.4.5 Contractor Environmental Manager

Project Contractor(s) should appoint an Environmental Manager with overall responsibilities for establishing, implementing and reviewing the CEMP, demonstrating environmental performance and compliance, alongside the following:

i. Ensure sufficient resources are available to implement the CEMP;
ii. Oversee the implementation of the CEMP and ensure that each subcontractor is made aware of, and is fully implementing, its requirements;
iii. Ensure that work is carried out in accordance with the CEMP by inspections and audits on a regular basis;
iv. Ensure that the CEMP is kept up to date and amended accordingly;
v. Inform the Construction Site Supervising Consultant of any received complaints immediately and discuss appropriate action;
vi. Ensure all activities comply with all legislative and company requirements and reports to government authorities on compliance as required;
vii. Assume overall responsibility for environmental emergency situations and coordinate all emergency activities; and
viii. Maintains a complaint and incident register to report to the Project Environmental Manager.

3.4.6 Contractor Environment, Health & Safety (EHS) Manager

A EHS Manager should be appointed by each Contractor working on site, with the following responsibilities:

i. Ensure all site personnel attend site inductions and EHS awareness training programmes;
ii. Conduct toolbox (environmental training) talks, environmental induction /orientation and emergency drills for all employees;
iii. Report EHS awareness training programmes to Contractor Environmental Manager;
iv. Report and investigates any significant adverse environmental incident and ensures that corrective and preventive measures are taken;
v. Perform internal audits, advises employees on subjects concerning environment;
vi. Prepare Environmental Incident Reports, participate in environmental investigations and prepare follow-up reports;
vii. Report any environmental issues to the Contractor Environmental Manager;
viii. Act as an environmental point of contact for Contractor Environmental Manager;
ix. Ensure that Site Operations comply with local regulations and laws; and
x. Prepare monthly monitoring reports, monthly inspection reports and weekly/daily inspection checklists for audit by the Project Environmental Consultant as a Third Party Auditor.

xi. Conduct site briefings;

xii. Conduct environmental inductions for all visitors;

xiii. Undertake all practicable measures to ensure pollution prevention;

xiv. Undertake site visits to ensure appropriate compliances are in place;

xv. Act as focal point for employees on all environmental related matters;

xvi. Understand and implements the requirements of the CEMP and the conditions of the Environmental Permit;

xvii. Present during environmental monitoring;

xviii. Ensures environmental monitoring is done correctly, at the required intervals;

xix. Ensures that personnel are competent, understand the CEMP and have the necessary skills to conduct their CEMP related functions;

xx. Ensure day-to-day implementation of the CEMP by inspecting daily and weekly areas such as hazardous material storage areas, waste collection and storage areas, workshop areas, and conduct assessments such as visual assessment of dust generation;

xxi. Undergo fortnightly inspection; and

xxii. Report any non-compliance or environmental issues should be immediately to the Contractor Project Manager.

3.4.7 Site Personnel

All site project personnel have the following environmental responsibilities:

i. Compliance with instructions given for environmental safeguarding the workplace;

ii. Attend all environmental training (including inductions, pre-start 'tool-box' meetings);

iii. Identify and eliminate environmental harmful work practices at their workplace;

iv. Challenge or refuse work if there is a risk of damage to the environment;

v. Not wilfully harm the environment;

vi. Not wilfully or recklessly interfere with or misuse anything provided for the workplace health, safety and environment in the workplace; and

vii. Immediately inform the employer of all work situations which they reasonably presume entail an immediate danger or the lack in the protection systems with regard to the environment.

3.4.8 Sub-contractors and Visitors

All aforementioned requirements apply equally to sub-contractors working at the site. It is the responsibility EHS Officers and ultimately the PEM to ensure sub-contractors receive a full EHS induction.

Although each Contractor and Sub-contractor should have a designated person with responsibility for Health Safety and Environmental matters, whatever their involvement, overall responsibility still remains with the Developer and their Project Environmental Manager.

Construction Environmental Management Plan (CEMP) Rev 00

The names and contact details of the personnel in relation to the implementation, management and review of CEMP are not available at the moment. Once the Project Environmental Manager, Project Environmental Consultant/Auditor, Contractor(s), Contractor's Health Safety and Environmental Officer and Sub-Contractor(s) are appointed by Diyar Al Muharraq WLL, these contact details will be provided to the concerned parties including e-mail address, phone number and fax number (if applicable).

Table 3.2 provides a summary of the Project Environmental Management and EHS roles expected by the Contractor(s) on site.

Table 3.2: Project Environmental, Health and Safety (EHS) Management Roles and Responsibilities

	Project Environmental Management	Health, Safety and Environment
Establish & Review	Review the CEMP – update as required; Prepare other Control Plans & Procedures for dealing with potential issues; Establish specific environmental Management System; and Identifying the names and roles of staff.	Assist in updating CEMP; Assist in preparation of Control Plans and Procedures for dealing with potential issues; Administrate & regularly review EHS plan and procedures; and Assign Environmental responsibilities to project personnel.
General Responsibilities	Provision of sufficient resources to ensure CEMP practices are implemented Compliance of all activities within the CEMP; Establish environmental controls prior to commencement of construction activities; Ensure environmental aspects are included in the preparation of process procedures; and Ensuring subcontractors fulfil their environmental obligations.	
Training	Ensure all staff are suitably trained & possess necessary skills to undertake designated environmental responsibilities.	Induct and instruct new personnel, sub-contractors and third parties including visitors.
Environmental Compliance & Reporting	Provide continual monitoring of environmental performance – ensure continued effectiveness and compliance with all obligations; Reviewing environmental monitoring & inspection reports and ensuring actions required are initiated; and Produce overall Environmental Monitoring Reports for submission to Authorities, as required.	Ensure non-conformance is registered, investigated and reported to PEM; Ensure non-conformance is resolved within the required time frame and that remedial solutions are effectively implemented; Perform environmental inspections including random spot-checks to verify compliance with EHS plan and CEMP; Complete checklists, logs / diaries as required Investigate accidents, damages and environmental losses; and Prepare and submit monthly environment report to PEM.
Communication & Liaison	Attend meetings with SCE as required; Liaising with Client, stakeholders	Advise staff on EHS issues; Liaison with project staff in monitoring of environmental controls; and

	and interested parties; and Liaison with EHS Officers.	Attending meetings to discuss environmental issues.

3.5 KEY REGULATORS AND LEGAL REQUIREMENTS

3.5.1 Key Regulators in Bahrain

A description of the key regulatory authorities concerned with the protection and management of the environment are introduced within **Table 3.3**.

Table 3.3: Regulators concerned with Environmental Control

The Supreme Council for Environment (SCE)
SCE are responsible for the administration and implementation of the Kingdom of Bahrain's environmental regulations, orders and rules including: Legislative Decree No. 2 of 1995 with respect to Protection of the Wildlife; Legislative Decree No. 21 of 1996 with respect to the Environment; and Legislative Decree No. 20 of 2002 with respect to Organising the Fishing, Utilisation and Protection of Marine Wealth. The Commission was first established under Decree No. 41 and 50 of 2002 and subsequently amended by Decree No. 10 of 2005, transferring the responsibility of all environmental matters from the Ministry of Housing and Agricultural to a separate institution. All Environmental Applications and issues are managed by the Environmental Assessment Section of the SCE. The SCE is responsible for the administering and approval of the EIA process and associated documents, such as this CEMP.
Marine Resources Directorate (MRD)
The MRD are the Authority responsible for all issues regarding the marine environment (excluding shipping and navigation). They are the 'Competent Authority' with respect to Decree No. 20 of 2002.

Frequent dialogue between contractors and relevant authorities, facilitated by the environmental consultant, will maintain the awareness of all parties and ensure a proactive, progressive approach to consultation regarding legal requirements, conditions and management of environmental issues is encouraged.

Should the Proponent or the relevant Contractor(s) wish to communicate with Regulatory Authorities during the Construction phase of the Primary Topside Infrastructure within DAM, a list of Regulatory Authorities, their responsibilities and powers to enforce legislation are provided within **Table 3.4**.

Construction Environmental Management Plan (CEMP) Rev 00

Table 3.4: Responsible Regulatory Authorities

Regulator	Issue
Supreme Council for Environment: - Environmental Assessment Section - Waste Control Section - Waste Disposal Unit	Noise and air quality Waste Management
Supreme Council for Environment - Environmental Monitoring Section	Discharges Compliance monitoring Inspection Pollution Hotline Chemicals Handling and Storage
Marine Resources Directorate	Fisheries interests and marine environment Marine Protected Areas Dredging permit
Water Resources Directorate	Groundwater and surface water quality Aquifers
Traffic and Licensing Directorate, Ministry of Interior	Traffic and access issues
Roads Directorate	Road Accidents
Coastguard Directorate	Maritime navigation Vessel licensing
Ports and Maritime Affairs	Marine navigation Emergency response
General Directorate of Civil Defence	Health and safety, fire, security, emergency spill response

3.5.2 Contact Details and Environmental Controls

Pertinent regulatory information relating to construction activities is highlighted in **Table 3.5**. It shows the regulators and other concerned authorities responsible for each environmental parameter and provides a contact telephone number in case further clarification is required (e.g. in an emergency situation).

Table 3.5: Contact Details of Regulators and Other Concerned Authorities

Regulator	Issue	Contact
Supreme Council for Environment: - Environmental Assessment Section - Waste Control Section - Waste Disposal Unit	Noise and air quality, traffic and waste	17 386 564 / 988
Supreme Council for Environment: - Environmental Monitoring Section	Discharges Compliance monitoring Inspection	17 920 213 mkhalaf@sce.gov.bh
	Pollution Hotline	80 001 112
Marine Resources Directorate	Fisheries interests and marine environment Marine Protected Areas Dredging permit	17 815 881
Water Resources Directorate	Groundwater and surface water quality Aquifers	17 796 772
Traffic and Licensing Directorate, Ministry of Interior	Traffic and access issues	17 872 222
Roads Directorate	Road Accidents	199 (no injuries) or 999 (injuries)
Coastguard Directorate	Maritime navigation Vessel licensing	17 534 343
Ports and Maritime Affairs	Marine navigation Emergency response	17 359 999
General Directorate of Civil Defence	Health and safety, fire, security, emergency spill response	17 293 300 or 999 (emergencies)

3.5.3 Environmental Commitments, Legislation and Regulations

A summarised list of the primary national, regional and international legislation, guidelines and commitments pertinent to the proposed development is provided in **Figure 3.2**.

Specific Bahraini standards with regard to noise and ambient air quality are provided in **Table 2.8** and **Table 2.11** respectively.

Construction Environmental Management Plan (CEMP) Rev 00

Figure 3.2: Summary of Relevant Local, Regional and International Legislation and Guidelines

Bahrain National Legislation

- Legislative Decree No. 21 of 1996 in Respect to the Environment
- Ministerial Order No. 1 of 1998 with Respect to Environmental Evaluation of Projects
- Ministerial Order No. 1 of 1999 with Respect to Control of Ozone Layer Depleting Substances
- Ministerial Order No. 10 of 1999 with Respect to Environmental Standards (Air and Water)
- Ministerial Order No. 6 of 2000 with Respect to Organisation of Industrial Safety in the Establishment, Ministry of Labour
- Ministerial Order No. 3 of 2000 with Respect to the Environment Authority's Recognition of Consulting Firms Involved in the Field of Environmental Evaluation of Projects and Environmental Studies
- Ministerial Order No. 2 of 2001 – Amendments to Ministerial Order No. 10 of 1999 with Respect to Environmental Standards (Air and Water)
- Ministerial Order No. 3 of 2001 – Amendments to Tables in Ministerial Order No. 10 of 1999 with Respect to Environmental Standards (Air and Water) and its Amendments in Ministerial Order No. 2 of 2001
- Ministerial Order No. 7 of 2002 with Respect to Controlling the Import and Use of Banned and Restricted Chemicals
- Ministerial Order No. 8 of 2002 with Respect to Standards for Pollutants and Emissions from Vehicles and Inspection
- Ministerial Order No. 20 of 2002 with Respect to Organising the Fishing, Utilisation and Protection of Marine Wealth
- Ministerial Order No. 3 of 2005 with Respect to Environmental Regulations and Standards in the Work Place
- Ministerial Order No. 4 of 2006 with Respect to the Management of Hazardous Chemicals
- Ministerial Order No. 3 of 2006 with Respect to the Management of Hazardous Materials
- Ministerial Order No. 10 of 2006 with Respect to Source Emissions of Air Pollutants

Regional Legislation

- Protocol concerning Regional Co-operation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency (1978).
- Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution (1978) and associated Protocols.
- Protocol concerning Regional Co-operation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency, Jeddah (1982).
- Protocol for the Protection of the Marine Environment against Pollution from Land-Based Sources, Kuwait (1989).
- Protocol on the Control of Marine Trans-boundary Movements and Disposal of Hazardous Wastes and Other Wastes (1998)
- Convention on the Conservation of Wildlife and Natural Habitats in GCC Countries (2002)

International Legislation

- Convention Relative to the Preservation of Fauna and Flora in their Natural State (1933)
- International Convention for the Protection of Birds (1950)
- International Plant Protection Convention (1951 – Amended 1979, 1983)
- Ramsar Convention on Wetlands (1971); the Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar (1971).
- Convention Concerning the Protection of the World Cultural and National Heritage (1972)
- International Convention on the Prevention of Marine Pollution by the Dumping of Wastes and other matter (London Dumping Convention, 1972/96)
- International Convention for the Prevention of Pollution from Ships (MARPOL, 1973/78)
- Convention for the Prevention of Marine Pollution from Land-based Sources (Paris Convention) (1974 – Amended 1986)
- Convention on Long-range Transboundary Air Pollution (1979) and its associated protocols
- United Nations Convention of the Law of the Sea (1982)
- Montreal Protocol on Ozone Depleting Substances, (1987) and it's amendment on Substances that deplete the Ozone Layer (1990)
- Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes and their Disposal (1989)
- Convention on Transboundary Effects of Industrial Accidents (1992)
- The International Convention on Pollution Preparedness, Response and Cooperation (1990)
- United Nations Framework Convention on Climate Change, New York (1992)
- UNCED Convention on Biological Diversity, Rio de Janeiro (1992)
- USEPA Hotel Water Management for the 21st Century (1994)
- The Barbados Plan of Action (BPOA, 1994)
- Stockholm Convention on Persistent Organic Pollutants (2001)
- UNEP Manual for Water and Waste Management: What the Tourism Industry can do to improve its Performance (2003)
- A Practical Guide to Good Practice – Managing Environmental and Social Issues in the Accommodation Sector (2003)
- Guidelines on Biodiversity and Tourism Development, Secretariat of the Convention on Biological Diversity (2004)
- International Financing Corporation Guidelines for Pollution Prevention and Abatement in the Tourism and Hospitality Sector
- United Nations Environment Programme (UNEP): Guidebook on Energy Efficiency and Renewable Energy in the Tourism Sector

3.6 ENVIRONMENTAL HEALTH AND SAFETY (EHS) REGULATIONS AND GENERAL SITE REQUIREMENTS

3.6.1 Human Health and Safety Commitment Statement

The Contractor(s) must demonstrate a commitment to health and safety matters. Copies of the Contractor(s) established policies and procedures should be submitted for review by the Proponent prior to commencement of works. Competent supervisory EHS staff (EHS Officer and EHS Manager) will be designated by the Contractor(s), with the responsibility of the maintenance of EHS standards, answering to the Contractor(s) Project Manager.

The following sections provide a summary of recommended EHS management guidance and checklists including reference to applicable laws, orders and regulations serving as the minimum standards applicable to Contractor(s) during the entire Construction Phase construction of the primary topside infrastructure of Diyar Al Muharraq Phase 1 in order to ensure the upkeep of site management and safety.

3.6.2 Occupational Health & Safety

Ensuring the Health and Safety of Personnel is crucial. Occupational hazards on site associated with the construction works might result in heat stress, sustaining of injuries such as trips and falls, serious accidents, such as falling equipment and, in the worst-case scenario, death.

3.6.3 National Legislation

Contractors must adhere to all environmental standards and safety requirements established by the Ministry of Health and the SCE.

The Contractor must adhere to Bahraini Labour Law for the Private Sector, 1976, ensuring the protection of workers' rights, throughout the duration of their employment. This document contains legislative guidelines for construction operations and procedures alongside methods of protecting staff from occupational hazards and diseases. Order No. 8 of 1978, forming part of Bahrain's Labour Law, prescribes the Health and Housing Requirements for Workers' Housing Accommodation.

Ministerial Order No. 3 of 2005, 'Bahrain Standards for Occupational Health and Safety' presents the national legal requirements for health and safety in the workplace.

Other imperative national legislation established to protect workers includes:

- A Decree established in 2008, prohibiting outdoor work between the hours of 12:00 and 16:00 during the summer months of July and August; and
- Legislation imposed in 2009, forbidding the transportation of workers in open trucks.

A copy of the applicable legislation should be maintained on-site for reference purposes.

3.6.4 Health & Safety Management Requirements

The following Sections provide a breakdown of the Contractor(s) Health & Safety management requirements.

3.6.4.1 Heat Stress

As per **Section 3.6.3**, outdoor work between the hours of 12:00 and 16:00 during the summer months of July and August is prohibited. In addition, in-order to eliminate the risk of heat stress, the required

Construction Environmental Management Plan (CEMP) Rev 00

effort from personnel (ratio of work to rest) should be based upon the ambient temperature. **Table 3.6**, extracted from MO 3 of 2005, provides demonstrates the suggested ratios between effort and working hours, according to temperature. It is therefore recommended that the Contractor installs the equipment necessary to record real-time temperature data.

Table 3.6: Responsible Regulatory Authorities

Work & Rest Time /Day	Work Effort			
	Low	Medium	Medium-High	High
	Temperature - Degrees Celsius (ºC)			
Continuous	30	28	27	25.5
75% Work and 25% Rest	30.5	29	28	26.5
50% Work and 50% Rest	31.5	30.5	29.5	28.5
25% Work and 75% Rest	32.5	31.5	31.5	30.5

Contractors are encouraged to provide canopies for shade to protect workers from environmental factors (e.g. heat of the sun), as required.

3.6.4.2 Air Quality

The Contractor should ensure air quality is satisfactory, free from unacceptable levels of dust, pollutants, smoke and fumes and masks should be provided to workers on site, as appropriate.

3.6.4.3 Noise

Noise levels should be maintained in accordance with legal requirements and maximum allowable limits for continuous noise exposure (occupational), extracted from MO 3 of 2005, demonstrated within **Table 3.7**.

Table 3.7: **Maximum Allowable Limit for Continuous Noise Exposure (Occupational)**

Working Hours	Allowable Max. Noise Levels (dBA)
8	85
4	88
2	91
1/2	94
1/4	97
1/8	100

Ear protection (defenders or ear plugs) should be provided for workers operating under noisy conditions and in loud conditions.

3.6.4.4 Vibration

Long-term exposure to vibration can cause long-term painful damage to hands, and shocks and jolts from certain types of vehicles can cause severe back pain. Hand-arm vibration originates from the use of hand-held power tools and may present a cause of significant ill health – painful and disabling disorders of the blood vessels, nerves and joints. Hand-Arm Vibration Syndrome (HAVS) is preventable, but once damage is done it is permanent, serious and disabling. Damage from HAVS can include the inability to conduct fine work and cold can trigger painful finger blanching attacks. Whole-Body Vibration (WBV) is transmitted through the seat or feet of employees who drive mobile machines or vehicles over rough and uneven terrain as a main part of their job.

The SCE are responsible for approving Contractors measures for mitigating continuous exposure of workers to vibration and noise (i.e. equipment and machinery).

3.6.4.5 Building Materials

Construction materials must comply with the Government's Resolution No. 4, 2006 with respect to the management of Hazardous Chemicals; not contain banned substances (asbestos or CFCs), and not pose a risk of environmental pollution or to occupational health.

3.6.4.6 Ground Surfaces

Ground surfaces, where possible, should be free from obstructions, pot holes and pits which may pose an occupational hazards.

3.6.4.7 Lighting

The Contractor must ensure adequate lighting is installed where essential, to ensure the provision of safe working conditions. Construction lighting should be maintained at the minimum necessary brightness and directed downwards in an attempt to minimize the potential impacts of lighting further afield. As the DAM reclamation site situated offshore, some distance from residential areas, light pollution is not a likely source of irritation or environmental sensitivity. Although lighting can aid in maximising or lengthening suitable working hours, the Contractor is encouraged to utilise lighting sparingly as required, due to energy requirements and costs.

3.6.4.8 Health & Safety Related Equipment

The Contractor(s) shall provide adequate safety equipment necessary for the protection and safety of the environment and all personnel. Health & Safety materials and equipment located at the work site must include equipment and materials for remediation, fire-fighting, first aid, personal protective equipment (PPE), etc. Contractor(s) shall maintain equipment in a professional manner as dictated by the original manufacturer standards. In addition, the Contractor must keep up-to-date service maintenance and repair records of all said equipment.

The Contractor(s) must ensure sufficient First Aid / CPR equipment and training. Contractors are required, by Law No. 7 of 1976 issued by the Ministry of Health, to provide a fully stocked First Aid box on-site, within easy reach and acceptable distance to workers. This Law provides details of First-Aid responsibilities and requirements regarding contents and storage.

Contractors must ensure provision of ideal clothing for workers on-site alongside the necessary personal protective equipment according to their individual requirements (machinery and equipment). Contractor(s) must ensure personnel wear appropriate PPE for the hazards present at the work site, examples include: hard hats, safety glasses with side shields, protective footwear (boots), hearing protection, hand protection / gloves for handling certain types of materials and waste, flame retardant clothing, masks or respirators for protection from emissions and fumes, fall protection, etc. – as identified by the Contractor, as per PPE Hazard/ Risk Assessment.

3.6.4.9 EHS Training & Meetings

The Contractor(s) should conduct a training needs assessment of the contracted works and develop a training matrix for all training requirements, by occupation / role. The Contractor is responsible for ensuring personnel have been given the identified necessary job-related training. Training certificates must be available for inspection by company personnel.

Construction Environmental Management Plan (CEMP) Rev 00

EHS Orientation

Contractor(s) must ensure all personnel and visitors are given are given onsite work site EHS orientation, regardless of prior experience, prior to accessing the construction site. This orientation shall address potential hazards, emergency plans, procedures, rules and regulations. EHS training must cover best practice requirements and protection from environmental occupational hazards such as ways of dealing with heat stress.

EHS Meetings

Construction crew should hold daily/ shift EHS meetings and pre-commencement, Job Safety Analysis (JSA) toolbox talks. Such meetings should include all affected personnel on the work site.

3.6.4.10 Provision of Drinking Water & Sanitary Facilities

Adequate drinking water must be provided in specific areas on-site, in addition to clean cups, except in provision of water fountain coolers. Rehydration salts should also be offered to workers to avoid heat stress, especially during the summer months.

Toilet and washing facilities must be provided for workers, alongside eye bath facilities and proper cleaning products, in a convenient location on-site.

3.6.4.11 Other

Smoking must only be permitted in Contractor designated smoking areas away from flammable or combustible materials.

3.6.4.12 Site Security

Site security is an important component of environmental management. Security of the site should be ensured by designated security staff, and action taken to tighten security measures employed should any lapses occur. A record of all personnel and visitors entering and leaving the site should be maintained to for security purposes and to enable any missing persons to be accounted for. Site personnel should be given site passes or swipe cards to control access to the site and enable easy identification by security guards.

The construction site itself should be clearly marked with warning signage and fenced off to allow access to only authorised personnel. This warning signage should provide emergency contact details and telephone numbers, and also depict the hazards and protective equipment required to enter the site.

It is crucial to protect from vandalism of site facilities, machinery and site works. The Contractor is encouraged to store valuable and equipment and items exposed to theft from public view, within a lockable container, including crucial emergency and PPE.

Table 3.8 outlines the key recommendations for ensuring site security.

Table 3.8: **Key Recommendations for Site Security**

Key Recommendations for Site Security
Employ security staff (guards);
Provide security passes to permitted personnel;
Where possible, lock access gates;
Install security deterrents e.g. warning signage, lighting and 24 hour security guards;
Ensure signage can be read by all site personnel (may require multi-lingual/colour coded signs);
Secure and immobilize plant and all equipment when not in use to prevent vandalism;

Ensure potentially hazardous materials ,e.g. fuel outlets, are well secured; and Avoid storing materials adjacent to site boundaries.

3.6.4.13 Housekeeping & Site Storage

The Contractor(s) are required to ensure good housekeeping practices are conducted at the work site by all contractor personnel to provide for a safe and orderly working environment. Implementation of established site management practices and procedures can in turn increase site efficiency alongside fewer incidents. Specific Contractor safety requirements should be stated within the Contractors CEMP documentation.

The site should be kept secure as per **Section 3.6.4.12**, tidy, and access / construction vehicle traffic routes maintained clear, marked and signposted where necessary. Particular consideration should be given to the site management and storage of potential environmental hazards i.e. chemicals, fuel storage facilities. Increasing the storage efficiency can have environmental benefits, including the minimisation of resources (e.g. transportation), which can incur costs.

Table 3.9 provides the main considerations for maintaining good housekeeping practices.

Table 3.9: **Key Recommendations for Good Housekeeping Practices**

Good Housekeeping Practices
General
Keep the site tidy and clean; Ensure compliance with all applicable EHS and storage regulations; Establish security procedures (as per **Section 3.6.4.12**) preventing access to unauthorised persons; Plant must not be left unattended where public can gain access to them (i.e. non-construction staff) or in the vicinity of the coast; Establish procedures for transporting waste off site with a certified removal company to an approved disposal facility; and Ensure signage can be read by all site personnel (may require multi-lingual/colour coded signs).
Storage (Plant, Equipment, Materials & Waste)
Ensure all materials and storage spaces are clearly and appropriately labelled; Ensure equipment and plants are stored as per supplier's instructions; Store and lock away appropriate equipment, plant and materials at the end of each day in a secure location; Store materials away from waste storage containers and from vehicle movements that could cause accidental damage; Store specific emergency response equipment adjacent to the appropriate stored material and ensure staff receive the necessary training; Consider a central storage location away from the waters' edge, protected from the elements (e.g. winds); Ensure lightweight materials are protected from wind damage or loss (i.e. covering and/or damping down); Ensure that storage areas and containers are properly managed; Segregate waste into allocated separate bins and remove from site frequently (employing minimization techniques and re-using and recycling as possible); Ensure waste receptacles are emptied before becoming overfilled; and Special care is required for the storage of materials which are potentially environmental hazardous (chemicals, lubricants, fuels). Storage may require incorporation of bunding facilities and provision of safety measures such as emergency spill kits.

Refer to **Section 5.8** Waste Management Control Plan for full details regarding site waste management, reduction, storage and handling and **Section 5.11** for details regarding Emergency Management.

Table 3.10 provides the summarised key recommendations for preventing health and safety risks.

Construction Environmental Management Plan (CEMP) Rev 00

Table 3.10: **Key Recommendations for preventing health and safety risks**

Key Recommendations for preventing health and safety risks
Provision of the following: Delegated EHS management staff – EHS Officer / Site Manager and EHS Manager. Training on site specific and occupational EHS issues; Safety tools and clothing i.e. PPE; Facilities including drinking water and shaded areas, especially during summer months; Emergency equipment such as an adequately stocked and conveniently located first-box; and Correct storage facilities, especially for any hazardous materials.

3.7 ENVIRONMENTAL AWARENESS AND TRAINING

Appropriate environmental training and inductions are required for the success of CEMP implementation, and it is essential that employees and contractors are aware of the importance and benefits of compliance, alongside the consequences of non-compliance.

Site-specific inductions and task oriented training shall be conducted to ensure site personnel are aware of their responsibilities and job description as well as site specific tasks and duties in regard to the CEMP and achieving compliance. Procedures should track personnel training and outline which personnel require which training. This will also assist in tracking professional development and competency.

Requirements should include the following as a minimum, to ensure appropriate understanding of CEMP issues:

i. Regular EHS meetings with recorded minutes arranged for the staff listed with specific responsibilities and for all other senior staff with authority to implement impact mitigation commitment;
ii. Tool box talks targeting specific issues, members of the workforce, as required;
iii. Environmental training;
iv. EHS bulletins and publications with hazard and incident information to promote awareness;
v. Regular analyses of incident statistics and reported hazards to identify trends that allow the project to channel resources to the appropriate areas and avoid reoccurrences or incidents; and
vi. Any changes to the CEMP to be communicated to all related individuals in a timely manner.

All personnel employed on site should undergo environmental awareness training to educate them on their responsibilities, communications procedures and requirements, incident response procedures and integration of environmental management and occupational health and safety.
The Contractor's specific CEMP must define the Contractor's Training requirements, procedures and contents. This should include, but not be limited to:

i. The required competency and names of the training providers;
ii. The required frequency of training;
iii. Identification of training needs and levels of training required for different personnel roles – training should cover a general knowledge of the CEMP alongside tailored, specific advice according to personnel activities (e.g. handling of waste, operation of certain equipment) etc.; and

iv. A description of the environmental awareness training program for personnel, sub-contractors and visitors to ensure compliance with the measures identified within this CEMP.

3.7.1 Environmental Site Induction

Prior to commencement of works on site, all personnel and sub-contractors must undertake a site induction – the responsibility of the Contractor(s) Health and Safety Officer(s), as per the requirements of the PEM. The Induction should address the following:

i. The CEMP – it's purpose, objectives and the key environmental issues
ii. Legal requirements including due diligence and duty of care
iii. Conditions of any licences, permits and approvals
iv. The Construction Contractor's Environmental Policy
v. Significant environmental issues and sensitive environmental areas Environmental Incident management and reporting process
vi. Emergency Response Plans - protection and maintenance of environmental controls i.e. mitigating dust during construction works
vii. Storage location of hazardous materials and MSDS Register
viii. Personnel responsibilities

3.7.2 Training Records

The procedures for maintaining records of all training to be performed must be included with the Control Plans. This record should be maintained on site, as the responsibility of the EHS Officer. This record should include:

i. Name of personnel trained;
ii. Date;
iii. Name of trainer; and
iv. A general description of the training content.

3.8 COMMUNICATION, ADDRESSING AND RECORDING COMPLAINTS

3.8.1 Communication

A suggested framework for communication with internal and external parties can be found within **Table 3.11**.

Construction Environmental Management Plan (CEMP) Rev 00

Table 3.11: Communication Framework with Internal and External Parties

Subject	Responsibility	Action	Recipient	Frequency
CEMP	AECOM	Produce & Submit to SCE	SCE	Prior to construction commencement
Contractor(s) CEMP	Project Environmental Manager, Contractor Project Manager	Produce & Distribute for implementation	Contractor staff	Prior to commencement of site inductions & works commencement
External Site Inspections and Audits	Environmental Consultant	Environmental Inspection Report & Checklists & EHS Checks	PEM and applicable staff	Fortnightly Auditing Monthly Reporting
Liaison with SCE	Project Managers & Environmental Consultant	Progress reports	SCE	Monthly as required
Serious EHS / Pollution incident	Involved staff members	Report incident	EHS Manager / Officer Environmental Consultant & PEM	Immediately after personnel safety check
Serious EHS / Pollution incident Public complaint management	PEM / Environmental Consultant	Contact relevant Telephone details depending on nature of the incident	Emergency Tel No.'s	Verbal notification within 2 hours & Written notification within 24 hours
	PEM	Notification - Circulate Project Information letter with 24 hour contact number	Potentially Affected Residents / Landholders	Prior to commencing work
Public complaint management Discovery of threatened fauna	Environmental Consultant	Maintain complaints register	SCE	Within Progress report
	Environmental Consultant	Telephone details	SCE	Same day
CEMP Non-conformance	Contractor EHS Manager & Environmental Consultant	Issue report	PEM and applicable staff	As required

3.8.2 Environmental Records

The following records should be maintained as part of the Project Records:

i. The CEMP (all versions) with attached regulatory licences and permits;
ii. Details of individuals responsible for environmental monitoring;
iii. Induction and training records;
iv. Auditing Reports (internal and external including any Regulatory Authority Inspection Reports);
v. Inspection checklists;
vi. Non-Conformance Reports;
vii. EHS Accidents / Incidents & Emergency Reports;
viii. Complaint Reports;

ix. Waste Quantity Reports;

x. Monitoring Results;

xi. Report of Management Review Meeting minutes and any action taken; and

xii. Copies of correspondence with regulatory authorities.

AECOM recommends that all records are kept for at least five years after the date of the Final Completion and be accessible to all Project Managers and Authorities, should reference to this material be required.

3.8.3 Addressing Complaints

During construction there should be a system in place to deal with any complaints. It is the responsibility of the Project Environmental Manager to receive, document and address complaints from any parties potentially affected by the construction activities (e.g. local communities). The PEM should ensure any deviation from performance standards is rectified as soon as possible, installing the appropriate mitigation measures.

Contact details of the Developers PEM's office should be made available (signs, as per **Section 3.6.4.12**) to the public in order to provide an opportunity for any necessary communications during the construction period.

The Contractor(s) Project Manager will agree with the Project Site Supervising Consultant and Environmental Manager a timescale for the resolution of the complaint and according actions.

A written report should be forwarded onto the Contractor's Project Manager within one working day of receiving a complaint regarding any environmental issue (see **Sections 3.4.4** and **3.4.5**). Please refer to **Appendix D** for a Complaint Log Format demonstrating the information that should be included within the Complaints Register.

All complaints should be tracked and records kept of the following:

i. Date, time and nature of complaint;

ii. Name, address and contact number of complainant;

iii. Action taken in response to the complaint;

iv. Details of who the complaint was passed on to;

v. Sign off that the complaint has been satisfactorily resolved and corrective actions taken; and

vi. Revision of the CEMP or specific training as required, avoiding repetition of the incident.

3.8.4 Complaints Management

To allow for community complaints during the construction of DAM Phase 1, the following details will be made publically available:

i. Complaints telephone number (24 hour line);

ii. Postal address;

iii. Email address; and

iv. These details shall be provided on the Developer's public website.

The process for managing complaints related to the project construction works is yet to be finalised between the Project Proponent and the Contractor(s), however, a complaints register should be maintained, with entries logged, tracked and responded to within a specified timeframe. Records should register the following:

i. Date;

ii. Time;

iii. Name, contact details and address of complainant;

iv. Nature of complaint and details (i.e. environmental issue, pollution incident etc.);

v. Method of Communication (meeting, telephone call, postal mail, e-mail);

vi. Actions for response, monitoring to ensure satisfactory conditions resumed;

vii. Who complainant dealt with; and

viii. Confirmation of relay of information to EHS Manager and Contractor Project Manager within 24 hours of receipt of complaint (signature).

3.8.5 Environmental Incident Management and Reporting

All environmental incidents must be categorised, logged and investigated as soon as possible after the event. Occurrences must be recorded by the EHS Manager within a Project Environmental Incident Register. The following should be recorded:

i. Details and 'contributing factors' (where, when, how, why & who);

ii. Classification of Severity;

iii. Actions for Rectification (e.g. monitoring); and

iv. Notification requirements.

The EHS Manager and Officer must be appropriately trained to identify and classify the environmental incident based on its severity, extend and clean-up costs. Contractor(s) should have their action plans ready for the different types of incidents to be implemented as quickly as possible. The 'emergency team' should be chosen immediately to investigate the cause and impacts of the incident.

The Contractor EHS team should develop a set of Action Plans providing emergency instructions and responses. The Contractor(s) Project Manager must allocate ensure emergency contact details are provided to all key project personnel. The emergency contact details are not yet known.

All non-compliance identified either during internal inspections and audits conducted by the Contractor or external audits conducted by the Environmental Consultant must initiate corrective action undertaken within the appropriate timeframe (dependent upon criticality), however, if the situation is not resolved, the Client will rectify the situation and the cost borne by the Third Party Contractor (DAM may perhaps require a retention fee for environmental mitigation).

3.9 CEMP DOCUMENT REVIEW AND UPDATES

It is recommended that the CEMP document should remain a 'live document', reviewed periodically to ensure the plan's contents are correct and that it is being correctly implemented. AECOM recommends that the CEMP is revisited by an Environmental Consultant and the Developer's Project Environmental Manager every six months. In case any substantial changes occurred within master plan and/or construction activities or a requirement has been raised by the SCE for the review of CEMP, the CEMP needs to be reviewed and updated.

These reviews will ensure that should conditions arise which alter the plan's contents or requirements – this CEMP remains updated to reflect the changes. As several 'unknowns' remain at the time of production of this CEMP, these revisions will allow for the opportunity to introduce such changes to the SCE, as necessary. This approach crucially allows the CEMP to remain as a 'live' document, capable of modification during the project's life cycle and as circumstances dictate.

Construction Environmental Management Plan (CEMP) Rev 00

4 ENVIRONMENTAL IMPACTS

No sensitive receptors were determined on the project site except from construction workers who will be working on construction site, and in time, those residents of DAM occupying zones of the development during the build-out.

4.1 AIR QUALITY – EMISSIONS IMPACTS

Air emissions are anticipated during the construction activities on Diyar Al Muharraq reclaimed land therefore it is essential to ensure effective management in order to avoid air quality issues.

4.1.1 Dust Emissions

Fill (dredged material) will be excavated so as to facilitate infrastructure construction. Care should be taken to ensure that all excavated material can be re-used without the need for disposal off site.

Likely sources of dust at construction site are as follows:

i. Dust can be generated during construction activities such as excavation, backfilling and grading works;
ii. Windblown dust can be generated from stockpiles, loosely compacted sediment on the reclamation site, materials stored on the vehicles delivering sand, rock and gravel;
iii. Dust can be generated from vehicular movement during haulage of materials both on site and travelling to and from the site; and
iv. Exhaust emissions from the construction equipment/machinery might also increase dust levels.

No data is currently available detailing the program or number of vehicle movements expected to be associated with construction as this will be based on the Contractor(s) Method Statement(s). A full quantitative assessment cannot be undertaken without this type of information. Dust generation, however, will be transient and temporary in nature and can be minimised by careful site management and paid attention to the maintenance and operation of vehicles and plants.

4.1.2 Gaseous Pollutants

Construction traffic may also release pollutants into the atmosphere, but again these are probably unlikely to result in long-term impacts. All vehicles accessing the site should adhere to vehicle emissions standards. Bahrain's air quality standards are provided in Ministerial Order No. 10 of 1999 with Respect to Environmental Standards (Air and Water). Traffic related emissions standards are specifically identified within the Ministerial Order No. 8 of 2002 with Respect to Standards of Pollutants and Emissions of Vehicles of their Exhaust Pipes and Inspection Thereof and the Permitted Levels of Gaseous Pollutants Emitted by Exhaust Pipes of Petrol Powered Vehicles. These standards need to be complied by all the vehicles working on construction site.

A baseline air quality survey undertaken (detailed in **Section 2.6.6**) measured concentrations of the following gases: Nitrogen Dioxides (NO_2), Sulphur Dioxides (SO_2) and Carbon Monoxide (CO). Level of Carbon Monoxide and Nitrogen Dioxides are found to be much lower than the ambient air quality standards settled in Bahrain at all monitoring stations. Only one exceedance was observed in Sulphur Dioxide concentrations at the DAM Site Entrance indicating traffic flows need to be properly managed to control the emissions from construction vehicles. This will be managed through implementing Traffic Control Plans during the whole construction period.

4.1.3 Odour

Compliance with local air quality standards regarding dust, gaseous emissions and any odour causing gas emissions will be managed by implementing appropriate “Air Quality Control Plan” and air quality monitoring studies at the construction site. The Bahraini Ambient Air Quality Standards will be used as reference as presented in **Table 2.11** Air Quality Control Plan together with proposed mitigation measures is presented within **Section 5.1.**

UK Design Manual for Roads and Bridges (May, 2007) recommends that any sensitive receptors within 200 m of a site to be determined and appropriate mitigation measures to be implemented regarding noise and air emissions impacts. There are no identified sensitive receptors located within distance of 200 m from project site. Therefore, no impact assessment was performed for noise and air quality impacts for construction period. Possible impacts on construction workers due to construction activities due to increase level of dust and noise will be mitigated by implementing appropriate mitigation measures. In addition, as occupancy will be staged mirroring the phased build-out of DAM, noise mitigation measures and monitoring will be adapted to ensure minimization of impacts on local residents.

4.2 SURFACE WATER

Storm water discharges and dewatering discharges (if applicable) need to be considered as a part of the topside infrastructure for Diyar Al Muharraq. There are no proposed utility facilities in the form of Sewage Treatment Plant and/or District Cooling Plant within this application (utilities be dealt with separately), therefore there are no anticipated discharges to marine water resources except storm water and dewatering discharges. It is proposed to construct Oil Interceptor Tanks on all pipes that discharge directly into an outfall. The Oil Interceptor Tanks will be located upstream of the outfall.

DAM is formed as newly reclaimed land and there are presently no storm water drains on the site. However, the site is surrounded by sea and this will facilitate disposal of storm water to open waters. **Figure 2.4** shows the proposed storm water network line together with proposed outfall locations for storm water.

Where it is proposed to use a piped network, the pipe sizes will vary from 300 mm to 1600 mm diameter. It is proposed that all pipes will be uPVC or RTR depending on their diameter.

All design works associated with the storm water infrastructure will be carried out in accordance with the Sanitary Engineering Planning and Projects Directorate – Design Manual and Good Engineering Practice.

All storm water pipes will have a minimum cover of 1.0 m and bedding and surround will be in accordance with the Ministry of Works Engineering Standard Details.

In case, there will be any dewatering discharges 20 mg/l (average reading during a 30 day period) or 35 mg/l (maximum value which must not be exceeded at any time) TSS levels should be complied to follow the Bahraini discharge standards. Concrete washings, sewage or any other liquid will not discharged to marine environment.

There might also be a risk of accidental releases of contaminants from construction sites including;

i. Cement and Concrete;
ii. Detergents;
iii. Oils and Fuels; and

Construction Environmental Management Plan (CEMP) Rev 00

iv. Sewage and Waste.

4.3 SOIL AND GROUNDWATER

The potential for the impact of construction works on the surrounding ground and sub- soil is minimal. There is a risk of accidental releases of contaminants from construction sites including:

i. Cement and Concrete;
ii. Detergents;
iii. Oils and fuels; and
iv. Sewage.

Accidental release of these substances might result in negligible to minor level of pollution on soil and groundwater resources. Adoption of appropriate construction environmental management measures to prevent accidental releases of above mentioned materials will be set out in the “Soils and Groundwater Contamination Control Plan” (**Section 5.3**) and proposed actions plans in case any accidental release happens have been included within this CEMP report as per requirement of EIA - 12 CEMP Guidelines. Adoption of appropriate construction environmental management measures to avoid any accidental release of oil/fuel, sewage or concrete washings have been proposed as a part of Soil and Groundwater Management Plan in **Section 5.3**.

4.4 TERRESTRIAL ECOLOGY

As the Diyar Al Muharraq Development is sited entirely on a reclaimed land, there is no impact on terrestrial ecology. JOD, however, conducted a two day avifaunal survey in order to identify the avifaunal populations present within the reclaimed plot and along the access route.

As within the “Avifaunal Baseline Survey” report, Diyar Al Muharraq is the first landmass available to migrating birds as it is now the most northern tip of Muharraq and Bahrain Islands. The open landscape is attractive to birds having travelled across the open sea on their passage through Bahrain to and from Africa. The island offers a much needed respite from the long flight over water.

Some avifaunal population habitats have been lost to the main land of Bahrain in recent years. Sites such as Northern Bahrain New Town to the north west of Bahrain and now Diyar Al Muharraq in the north east have become important new habitats. Amwaj Islands, which supported both White-cheeked and Saunder’s Terns during the early stages of the development, are now more hostile to the birds and numbers have fallen significantly. Therefore, the presence of the DAM reclamation plot has a positive impact on avifaunal populations. This might be further enhanced by implementing appropriate mitigation measures during construction period and considering habitat enhancement options for avifaunal populations for the operation period of the DAM Development.

It was observed that there are particular areas where bird populations have colonized, particularly on the northern part of the DAM development. Sandy beaches have been also observed as attractive places for the bird species. The initial findings from the baseline survey undertaken in April 2012 and from a previous survey carried out during summer 2011 propose that the main value of Diyar Al Muharraq for the avifauna at present is not in the diversity of species or the size of populations but in the quality of the species currently being supported.

This feature of DAM might be enhanced to promote avifaunal populations presence during operation period by creating appropriate habitats and landscape to cater for the requirements of avifaunal

populations. It is not within the scope of CEMP report to identify how to enhance avifaunal population within DAM development for the operational period of the development, therefore no further details have been provided in this subject.

It is expected that construction activities can cause some disturbances on avifaunal populations within DAM. This disturbance to avifauna populations, however, is likely to be temporary in nature and it is thought that such nesting will continue once construction related disturbances have ceased. The appropriate mitigation measures to minimize the disturbances related with construction activities have been summarized as a part of Ecological Management Plan (**Section 5.4**).

4.5 MARINE ECOLOGY

Marine water quality issues concerning the land formation of Diyar Al Muharraq are the responsibility of the Reclamation Contractor and supervising environmental consultant.

As there will be no direct discharge of liquid effluents apart from storm water and dewatering discharges, which will comply with Bahraini discharge standards, there are no expected impacts on marine ecology as a part of the topside construction activities for the primary infrastructure works.

The risk of accidental release of any materials in the form of cement and concrete, cement washouts, detergents, oils and fuels and sewage is minimal. Appropriate measures to avoid these incidences have been covered as a part of the Control Plans offered in **Section 5** of this CEMP report.

Solid waste management will be properly managed to prevent any accidental release of produced solid waste on construction site. For example, wind can transfer light materials (i.e. plastics) to the sea water. Appropriate solid waste storage and disposal options have been covered as a part of the "Waste Management Control Plan" in **Section 5.8**.

4.6 NOISE AND VIBRATION

The proposed development has potential to give rise to noise impacts during the infrastructure construction stage. There are settlements located on the coast; these are largely free of major noise pollution with the exception of traffic-generated noise from the road infrastructure and air traffic from the nearby Bahrain International Airport.

Noise and vibration can be caused during the construction phase by the following:

i. Traffic movements and haulage of construction materials;

ii. Mobile construction plant operating within the site; and

iii. Noise and vibration created due to construction activities such as piling and compaction any other heavy engineering works.

A baseline noise monitoring survey was undertaken to discover sensitivities of the nearby locations to the project site. The areas surveyed included Al Samaheej and Al Dair Village, Diyar Al Muharraq site entrance and Amwaj Island which have residential area characteristics formed by mostly residential buildings/villas.

All the recorded noise levels were much lower than the highest acceptable noise level across all monitoring stations and sessions during the morning, afternoon and evening. The average levels of noise measured were found to be 38.8 dB (L_{Aeq}), 40.2 dB (L_{Aeq}) and 47.6 dB (L_{Aeq}) during morning, afternoon and evening rounds of the survey respectively. According to the noise standards

Construction Environmental Management Plan (CEMP) Rev 00

established in Bahrain as presented **Table 2.9**, noise levels are required to be less than 55 dB during the day time and less than 50 dB during the evening hours. Noise monitoring results indicated that adjacent areas to the DAM project site do not have any sensitivity to the noise and vibration impacts as their baseline noise levels are quite low. Additionally, it is not expected any increase in the level of noise on surrounding areas because they are located more than 1.2 km distance to the project site.

Therefore, focus is only required regarding the management of noise within construction site and near to the entrance of project site. Noise can be reduced by careful site management and attention to the maintenance and operation. Any exceedances or unexpected adverse impacts will be identified and mitigation measures proposed.

It is not anticipated that there will be a requirement for continuous noise monitoring for external sensitive receptors during the construction stage due to the large distance of the development site from the anticipated receptors, however mitigation measures will be outlined where appropriate. Compliance with "Bahraini Noise Standards" will be managed by implementing appropriate "Noise and Vibration Control Plan" and necessary noise monitoring studies across the construction site. The "Noise and Vibration Control Plan" is presented in **Section 5.6**.

As a phased build out is planned, occupancy will therefore be staged and there could potentially be an impact on the residents while construction works are ongoing. The Contractor is to provide noise reduction mitigation measures as part of their CEMP documentation. Environmental monitoring will be adapted to reflect the phasing plan. For each construction contract, the key sensitive receptors will be identified and noise limits imposed at these locations for both day and night (to be outlined within a subsequent Monitoring Plan when further information regarding construction activities, contractor methodologies and completion dates becomes available, together with the requirements of SCE).

In Bahrain, maximum allowable noise limits as shown in **Table 2.9** have been established by the Environmental Authority for residential and commercial developments. Contractor(s) must comply with these limits during construction activities.

Noise limits for occupational health and safety are stated under Schedule 4 of Resolution No. 3 of 2004 with Respect to Environmental Regulations and Standards in the Work Place. These noise limits are summarized within **Table 3.7**.

These noise limits should be obeyed by the Contractor(s) to avoid/minimize problems related with occupational health and safety.

4.7 TRAFFIC

Traffic associated with the construction activities have the potential to increase the background levels of vehicle pollutants (i.e. NO_2, SO_2 and small size particulates) close to the site and along main access routes to and from the site. This impact is linked to the volume of traffic and types of vehicles (i.e. diesel engines are known to produce more particulates). Increased vehicular traffic is also anticipated to increase background noise along the selected access routes.

These issues are dealt with within the "Air Quality Control Plan" and "Noise and Vibration Control Plan" (**Chapter 5**), through the instalment of appropriate mitigation measures and implementation of controls to adhere to national and international emission standards alongside Bahrain Traffic Licensing Directorate Emission Standards.

Potential traffic and access issues including; volumes, pre-selected routes and shifts (outside of peak traffic periods) alongside other matters such as traffic related Health and Safety requirements have been covered as a "Traffic and Access Control Plan" (**Section 5.7**) within this CEMP report to minimise the impact of construction related site traffic.

4.8 WASTE MANAGEMENT

Solid wastes will be generated throughout the primary topside infrastructure construction activities of Diyar Al Muharraq - Phase 1 Development from a number of sources including off cuts and excess materials from construction, damaged materials on site etc. The types of waste may include concrete, tiles, wood, glass, fibreglass, and steel.

Details regarding the anticipated waste produced during the construction phase of the Primary infrastructure development of DAM can be seen in **Table 4.1**.

Table 4.1: Anticipated Infrastructure Construction Waste

Description; Source of Wastes	Composition	Annual Quantity	Disposal method
Inert waste & Excavated spoil materials	Excavated materials; construction waste, dirt, sand, rocks and debris	Currently unknown	Waste collection and removal from storage areas, stockpiles and bins
Building materials	Such as cement blocks and concrete		
Recyclable materials	paper, glass, bottles, cans, metals, plastics etc.		
Composite wastes	Fabrics and plastics		
Biodegradable wastes	Food and kitchen waste, green waste and paper etc. Created by those present during the construction period		
Sanitary waste	Sanitary waste from any temporary facilities which may be present during the construction period		Tankering & removal from site

Generation of waste during the construction stage may comprise non-hazardous surplus materials which could possibly be recycled. Hazardous wastes may also be generated at this stage, for example, there is a potential risk of oil spillages or leaks from storage tanks or from poorly maintained plant. Typical precautions would include provision of bunds to retain spillages, and a programme of scheduled maintenance of plant and machinery. Storage and disposal of foul effluent arising during the construction stage also needs to be properly managed, with disposal arranged by licensed operators.

The construction related wastes requires appropriate storing, collection and transportation from the site to existing waste management and landfill facilities within the Kingdom of Bahrain. No waste will be disposed of into the marine environment. The Waste Management Control Plan was included in **Section 5.8** as part of this CEMP report.

4.9 SOCIO-ECONOMIC IMPACTS

There are some social impacts that are likely to arise during construction phase of the project. None of the social impacts are so serious as to affect implementation of the project.

These social impacts can be summarized as follows:

i. Conflict between expatriate workers and nearby local communities outside the workplace during the construction phase;
ii. Increased health risks during the construction phase;
iii. Language used in the workplace; and
iv. Accidents and health and safety issues.

This infrastructure work will provide employment opportunities for the Bahraini people and will have positive impact on local economy as many construction materials/machines will be sourced locally.

Construction Environmental Management Plan (CEMP) Rev 00

4.10 LANDSCAPE AND VISUAL IMPACTS

There are few visual receptors overlooking the DAM development site. Marine users of the area include fisherman and pleasure boats. No residential areas are located within 500 meter of the DAM Development to cause any visual impact.

The nearest visual receptors are located is Amwaj Island at distance of 1.2 km. The primary infrastructure works do not include any high-rise buildings which might cause any visual impacts; therefore, there will be no anticipated visual impacts due to construction activities of the proposed primary infrastructure works for DAM Development – Phase 1 (Priority Work Areas).

4.11 ANTICIPATED ENVIRONMENTAL IMPACTS

This section summarises the anticipated environmental impacts in relation with the proposed construction activities. The expected impacts that will require mitigation, management and monitoring are summarised in **Table 4.2**, and the mitigation measures in order to prevent or minimise the environmental impacts are included in the Environmental Control Plans provided in **Chapter 5** of this CEMP report.

Table 4.2: Summary of Anticipated Environmental Impacts

Environmental Elements	Potential Impacts	Mitigation Measures Responsibility
Air Quality	Dust arising from earthworks, ground works, and construction traffic on unpaved roads on site affects sensitive receptors. Release of combustion gases from transport vehicles, generators, construction machinery and temporary plants on site. Emissions from other sources (painting, hazardous material usage, etc.).	Contractor(s)
Marine Water	Contamination of marine water due to accidental spillage of hazardous materials, sewage, concrete activities, wash down water discharges, etc. Reduction in marine water quality as a result of storm water and groundwater dewatering discharges due to excavation and dewatering activities.	Contractor(s)
Soil and Groundwater	Contamination of soil (spillage of hazardous materials, sewage, concrete activities, wash down water discharges, etc.) Erosion and sedimentation (construction dewatering, wind and water action, heavy precipitation on disturbed soil) Direct disturbance of existing soils, geology and topography through grading, excavation and ground-works, and foundations)	Contractor(s)
Terrestrial Ecology	Potential impacts to common breeding bird species associated with this habitat and in adjacent areas	Contractor(s)
Noise and Vibration	Increase in day and night time noise levels from operation of construction vehicles, equipment and machinery. Vibration disturbance.	Contractor(s)
Waste	Generation of general domestic waste Generation of construction waste Generation of hazardous waste i.e. waste concrete, hydraulic fluids, lubricants, empty paint cans etc. Increase pressure on public waste disposal facilities.	Contractor(s)
Socio-Cultural Environment	Impact on local economy Creation of job opportunities for Bahraini nationals for construction works. Health impact of foreign construction work-force	Contractor(s)
Visual Impacts	No impacts were expected.	Contractor(s)

5 ENVIRONMENTAL MITIGATION MEASURES

This CEMP stipulates a series of mitigation measures and monitoring requirements in the form of Environmental Control Plans, which are to be implemented by the Contractor during the construction of the primary infrastructure in the Diyar Al Muharraq Development. The following Environmental Control Plans are to be adopted by all parties concerned with the construction of the project:

i. Air Quality Management Plan;
ii. Erosion and Sediment Control Plan;
iii. Soil and Groundwater Control Plan;
iv. Terrestrial Ecology Control Plan;
v. Water Quality and Marine Ecology Control Plan;
vi. Noise and Vibration Control Plan;
vii. Traffic and Access Control Plan;
viii. Waste Management Control Plan;
ix. Chemical Hazards and Materials Management Plan;
x. Contingency Plan;
xi. Emergency Management Plan;
xii. Security Plan; and
xiii. Infrastructure Plan.

5.1 AIR QUALITY MANAGEMENT PLAN

The Air Quality Management Plan (AQMP) establishes a series of mitigation measures to be implemented so as to minimise the release of harmful pollutants to the atmosphere during all construction works for the Diyar Al Muharraq Development project. Dust issues are especially of concern and should be addressed in the Contractor(s) detailed control plan. Mitigation actions are provided as best practice options to allow the contractor to make the best judgement on those actions deemed necessary so as to ensure that construction works do not exceed the standards set out by the Bahraini regulatory authority.

Targets and performance indicators have been identified to enable compliance with AQMP to be monitored by the Contractor(s) Site EHS Officer and the Contractor(s) Site EHS Manager and verified by the Third Party Auditor.

The Bahraini Ambient Air Quality standards provided in **Table 2.11** must be maintained during all construction activities.

The Air Quality Management Plan for Diyar Al Muharraq Development required for implementation by the Contractor(s) is provided in **Table 5.1**:

Table 5.1: Air Quality Management Plan

Responsibility	Contractor(s)
Key Issues to Consider	Operation and movements of construction vehicle/plant such as excavation/earth movement plant and delivery vehicles causing increased dust generation, Release of combustion gases from transport vehicles, generators, construction machinery and temporary plants on site. Wind blowing over stock piled materials, roads, work areas, vehicles. Emissions from other sources (painting, hazardous material usage, etc.).
Performance Objective	To minimise the release of harmful air pollutants and dust into the atmosphere.
Performance Indicator	Air emissions/pollutants including dust, odour, smoke and fumes from the construction activities of Diyar Al Muharraq Development project should not cause significant impacts on construction workers. There is no identified sensitive receptor nearby the project site as described before. Results of dust particulate matter in ambient air if required by SCE.
Performance Target	Air emissions are not above the regulatory requirements for air pollution control. No substantiated complaints of poor air quality related to the construction activities. Complaints related to atmospheric emissions will be responded to within 48 hours.
Evidence of Compliance	Regular site inspection and audit of complaints register.
Environmental Standards and Guidelines	Ministerial Order No.1 of 1999 with Respect to Control of Ozone Layer Depleting Substances Ministerial Order No.10 of 1999 with Respect to Environmental Standards (Air and Water) Ministerial Order No. 2 of 2001 – Amendments to Ministerial Order No.10 of 1999 with Respect to Environmental Standards (Air and Water). Ministerial Order No. 8 of 2002 with respect to Standards for Pollutants and emissions from Vehicles and Inspection. Resolution No (10) for the year 2006 on the emissions of air pollutants from sources.
Environmental Impacts	Operation and movements of construction vehicle/plant such as excavation/earth movement plant and delivery vehicles causing increased dust generation, Release of combustion gases from transport vehicles, generators, construction machinery and temporary plants on site. Wind blowing over stock piled materials, roads, work areas, vehicles.
Mitigation Actions	
Dust Suppression	
Wetting of internal unpaved roads, stockpiles and work areas using recycled water or water from construction dewatering works. Stockpiles of fine material such as sand, topsoil material, cement, etc. will be covered / protected from wind for instance by sheeting or wetting as appropriate. Construction roads will be dampened regularly. Stockpiles giving rise to visible plumes shall be covered or dampened using a (preferably grey-water) bowser (water tanker). Construct dust screens/wind breaks will be used as necessary. Contractors will regularly inspect stockpiles, exposed work areas and construction works practices to ensure compliance. A daily inspection is recommended. Vehicle speeds will be restricted on un-surfaced roads and tracks to less than 30 km/hr to minimise dust. Minimise width of internal site roads to limit the ground area that is disturbed. Avoid excessive vehicular traffic and movement. Locate haul routes away from sensitive receptors.	

Protection from Wind Erosion
Cover with sheet/tarpaulin and/or maintain appropriate freeboard (+ 0.3m) on trucks hauling any loose material that could produce dust when travelling.
Limit dust generating activities during windy periods or reschedule activities in order to be conducted during favourable weather conditions that do not permit dust from migrating offsite.
Cover/protect stockpiles of fine material such as sand, topsoil, cement, etc. to stop dust being windblown.
Encourage stabilisation of surfaces exposed to wind such as disturbed land or stockpiles e.g. by introducing temporary or permanent vegetation.
Consider paving heavily used areas such as site access roads, haulage areas to the main road where practical to prevent dust/erosion.
Use recycled water to suppress dust on roads/stockpiles/work areas using a bowser.
Construct dust screens/wind breaks as necessary.
If deemed necessary work areas may be fenced with suitable dust control materials.
Contractor(s) will regularly inspect stockpiles, exposed work areas and construction works practices to ensure compliance.
Vehicle and Equipment Emissions
Emissions from vehicles and construction equipment's need to be controlled. The proposed mitigation measures together with proposed traffic control strategies have been covered in "Traffic and Access Control Plan" in **Section 5.7**.
Other Emissions
No fires will be allowed on the construction site - burning of waste materials on site will be prohibited.
Ensure fuel and solvent storage containers are sealed except where tank venting is required.
Limit volatile substance emissions/fine particle releases.
Conduct painting/blasting activities in appropriate areas (enclosed and ventilated) to limit volatile substance emissions/fine particle release.
Utilize appropriate hazardous materials management practices.
Prohibit use of ozone depleting substances during construction.
Utilize adhesives, sealants and sealant primers, a coating with low Volatile Organic Carbon (VOC) contents.
Avoid the use of materials that emit high levels of air pollutants including paints & coatings such those which are odorous, irritating and/or harmful.
Cylinders of compressed/flammable gases to be stored upright in secure racks out of direct sunlight & heat.

5.2 EROSION AND SEDIMENT CONTROL PLAN

The Erosion and Sedimentation Control Plan (ESCP) covers all activities associated with the construction works of the Diyar Al Muharraq Development with the potential to cause sedimentation and erosion. Soil eroded during land disturbance and excavation in addition to other construction activities such as drilling and backfilling can wash away and contaminate storm water, nearby surface water (Marine Basin) and deposit sediment on nearby properties. The ESCP establishes a series of mitigation measures in order to control and minimise these issues.

The ESCP also establishes a series of mitigation measures to be implemented so as to minimise the release of dust generated by construction activities alongside wind erosion which will affect ambient air quality.

Construction Environmental Management Plan (CEMP) Rev 00

Targets and performance indicators have been identified to enable monitored of compliance with this management plan by the Contractor(s) Site EHS Manager and Officer, to be verified by an independent Third Party Auditor.

The Erosion and Sediment Control Plan for Diyar Al Muharraq for implementation by the Contractor(s) is provided in **Table 5.2**:

Table 5.2: Erosion and Sediment Control Plan (ESCP)

Responsibility	The Contractor(s)
Key Issues to Consider	Water Discharges e.g., wash-down water, dewatering activities. Site Drainage. Erosion of soil from wind, vehicle movements, construction activities and pollution of water resources by fine particles. Operation and movements of construction vehicle/plants across site causing erosion. Generation of dust from construction activities
Performance Objective	To minimise the risk of water and wind erosion and sea water (Marine Basin) pollution through erosion and sedimentation during the construction works for Diyar Al Muharraq Development project.
Performance Indicator	Test results of water discharges. Change in ground topography. Results of dewatering discharges quality if required by SCE.
Performance Target	No significant impacts to the quality of the soil, ambient air and surface water (Marin Basin).
Evidence of Compliance	Regular site audit and inspection of incident and environmental monitoring reports.
Environmental Standards and Guidelines	Ministerial Order No.10 of 1999 with Respect to Environmental Standards (Air and Water) Ministerial Order No. 2 of 2001 – Amendments to Ministerial Order No.10 of 1999 with Respect to Environmental Standards (Air and Water).
Mitigation Actions	
Soil Erosion Control	
Keep on site traffic to designated routes; Cover temporary roads and routes within site with either asphalt or stone where possible; Maintain recommended maximum vehicle weightings to avoid destabilisation and subsequent erosion of soil surface; Progressive rehabilitation of disturbed land or stockpiles by establishing temporary or permanent vegetation where possible; Flow attenuation - Employ mechanisms to control run off of precipitation such as temporary structures to slow running water to facilitate pollutant removal and infiltration and reduce the runoff erosion; Avoid the creation of steep slopes. Consider implementing terraces instead of long steep slopes to avoid runoff from precipitation; Avoid using soils with low infiltration rates to prevent runoff from precipitation where possible; Prevent over-watering of loose areas for dust suppression; Cover excess work areas or stockpiles with suitable liner materials type where possible; and Provide collection systems under machinery or equipment during wash down to prevent erosion from runoff.	

Sedimentation Control
Locate material and waste stockpiles away from storm water drainage and any natural drainage on site or near the Marin Basin shore line;
Construct collection channels, sediment basins and storm water detention pond capable of collecting all runoff water during storms if deemed necessary;
Construct silt fence on the foot of steep sloops to prevent sediment from being carried off site by storm water;
Consider the use of wheel washers as best environmental management practice to prevent dust/materials being carried off site and deposits on the surrounding streets;
Prohibit the washing of ready mixed concrete trucks on site. All ready mix concrete trucks should be washed at a controlled wash out structure;
Provide methods for removing sediment or diverting runoff water before it leaves the site such as silt fences, sediment traps, earth dikes etc.;
Treat and discharge runoff water from sedimentation tanks and/or retention basin at controlled flow rate through storm water discharge network if permitted;
Inspect and clean the collection channels, sedimentation tanks and retention basin on regular basis to prevent sediment build up; and
Stabilise the site as soon as possible after construction.

5.3 SOIL AND GROUNDWATER CONTROL PLAN

The Soil and Groundwater Management Plan for Diyar Al Muharraq for execution by the Contractor(s) is provided within **Table 5.3**:

Table 5.3: Soil and Groundwater Control Plan

Responsibility	Contractor
Key Issues to consider	Contamination of soil and groundwater due to spillage of hazardous material including fuel oils, waste materials or chemicals; Accidental release of sewage and other liquid effluents such as concrete wash down discharges; Discharge of water from dewatering activities; Accidental release of contaminated wash down water with oils, chemicals from vehicles, equipment and machinery; Erosion and sedimentation (construction dewatering, wind and water action, heavy precipitation on disturbed soil); and Direct disturbance of existing soils, geology and topography through grading, excavation and ground-works, and foundations).
Performance Objective	To minimize the risk of pollution of the soil and groundwater.
Performance Indicator	Number of reports of spillages and pollution incidents.
Performance Target	No significant impacts to the quality of the soil or groundwater.
Evidence of Compliance	Regular site audit and inspection of incident reports. Completion of Environmental Checklists.
Environmental Standards and Guidelines	Resolution No. (3) of 2006 on the management of hazardous waste; Resolution No. (4) for the year 2006 on the management of hazardous chemicals;

Construction Environmental Management Plan (CEMP) Rev 00

	Ministerial Order No.10 of 1999 with Respect to Environmental Standards (Air and Water); and Ministerial Order No. 2 of 2001 – Amendments to Ministerial Order No.10 of 1999 with Respect to Environmental Standards (Air and Water).
Mitigation Measures	
Storage and Handling of Hazardous Substances	
Mitigation measures regarding storage and handling of hazardous substances have been covered in Chemical Hazards and Material Management Plan as presented in **Section 5.9.**	
Maintenance and Wash Down of Vehicles and Machinery	
Ensure all drilling equipment is well maintained and in good working order; A collection system should be provided (i.e. trays or impervious linings) under machinery or equipment that may leak hydrocarbons/hazardous substances (e.g. generator and pumps); Vehicle/machinery repair whether minor or major on open ground or at the side of roads is forbidden; Emergency repairs, mechanical servicing and maintenance of Vehicles/equipment/ site plant to be undertaken at designated workshop area designed to contain any spillage; Oil or lubricants should only be changed at designated workshop locations; and It is prohibited to allow wash water to cause pollution of the ground or groundwater. Vehicle and equipment wash-down should only be undertaken at designated areas. The ground under the wash-down area should be impervious and designed to collect wash water. Install oil interceptors and silt traps where wastewater may be contaminated. Wash water should be re-used where possible (such as vehicle washing, dust suppression) and excess water collected and disposed of by an approved contractor.	
Sanitary Facilities	
Adequate sanitary facilities including restrooms, showers, water tanks, cold drinking water facilities and sewage waste collection facilities should be provided and should drain to a septic tank collection system. Sustainable storm water drainage techniques should be adopted; Septic tanks should be fitted with overflow alarms and emptied on a regular basis at a frequency which ensures no overflow of sewage effluent by an approved waste disposal company; It is prohibited to discharge sewage onto the open ground; It is prohibited to use open ground for sanitary purposes including bathing, defecating, urination, cooking, washing (dishes or clothing); Disposal of settled solids should be in accordance with local legislation. Sludge should also be disposed of on a regular basis at acceptable disposal facilities approved by SCE; and Confirmation of underground infrastructure such as sewage lines should be determined prior to excavation.	
Dewatering Discharges	
Contractors should prepare a Dewatering Management Plan; Regular monitoring of dewatering discharges should be performed as per SCE requirement; Collect/ submit representative dewatering discharge samples for regular monitoring of dewatering discharges should be performed as per SCE requirement; Collect/ submit representative dewatering discharge samples for laboratory analyses at prescribed intervals. Conduct visual inspections at the time of sample collection; Treat all discharges -remove sediments using filtration/settling tank. Prohibit flocculation/chemical coagulation	

methods; and Determine most appropriate disposal option - onsite/offsite recycling/aquifer recharges etc.

Other Considerations
Dumping of waste materials prohibited. Wastes may not be buried. The source of fill material used needs to be assessed to prevent introduction of contaminants.

Construction Environmental Management Plan (CEMP) Rev 00

5.4 ECOLOGICAL MANAGEMENT CONTROL PLAN

The Ecological Management Plan provided within **Table 5.4** establishes a series of mitigation and management measures to control and minimise those issues which have the potential to impact marine and terrestrial ecology (avifauna in the absence of other terrestrial ecology).

Table 5.4: Ecological Management Plan

Responsibility	The Contractor(s)
Key Issues to Consider	Water Discharges e.g., wash-down water, dewatering activities; and Possible disturbance to avifaunal species due to construction activities and noise.
Performance Objective	To minimise impacts on ecological resources.
Performance Indicator	Impacts on terrestrial (avifaunal species) and marine habitats and associated species.
Performance Target	No loss of terrestrial and marine habitats/species of conservation value within or adjacent to the site.
Evidence of Compliance	Regular inspection of site activities and audit of incident register.
Environmental Standards and Guidelines	There are no Bahraini standards to comply with regarding protection of terrestrial and marine ecology.
Mitigation Actions	
Consider presence of sensitive ecological receptors adjacent to the site during planning of construction activities; Do not handle, injure or kill any wild animal or destroy its resting place such as burrow or nest. If a wild animal, nest or burrow is encountered in the working area stop activities immediately and consult site construction Supervising Consultants/Engineer's Ecologist to determine appropriate action; Landscaping schemes should incorporate the use of native and local species that are adapted to the existing environment and will require less management and irrigation. In addition planting native species will avoid the problems of invasive species out-competing local flora; Clearly identify the site boundary and avoid impacting adjacent sites by ensuring that all construction vehicles, construction activities, equipment and waste storage are confined to the allocated site boundary; Ensure that there are gaps in the fencing to allow them to move through when putting up site hoarding in order to ensure that fencing do not traps animals within the site and they cannot escape; To minimise the impacts of lighting, noise and dust on ecological receptors, appropriate mechanisms such as using dust and noise screens should be employed; Floodlighting should be limited during construction where possible (work in the daytime) and sky-ward pointing lighting should not be used; Lights should be directed away from ecologically sensitive areas such as areas of vegetation; Low pressure sodium lamps or LCD should be used in preference to high pressure sodium or mercury lamps. If mercury lamps are used, they should be fitted with UV filters; Road or track-ways in areas important for foraging bats or bird habitat should contain stretches left unlit to avoid isolation of populations; Dust and noise levels will be reduced through the mitigation outlined in the Air and Noise Control Plan; and The lighting should be directed to where it is needed to avoid light spillage. Any upward lighting during construction should be minimal to avoid light pollution. Light can be restricted to selected areas by fitting hoods that direct the light below the horizontal plane. Limiting the height of lighting columns and directing light at a low level reduces the ecological impact of the light.	

Related Environmental Control Measures
Store all hazardous materials including fuel tanks away from the ecological sensitive receptors;
Store oil and fuel facilities a good distance from the sea;
Maintain good storm water and wastewater management as outlined in the Pollution Prevention Plan
Adhere to the Waste Management Plan;
Adequate sanitary facilities shall be provided on site and temporary facilities shall be connected to septic tanks, which will be emptied on a regular basis to a Municipality approved treatment facility;
It is prohibited to discharge sewage onto the open ground or the marine basin;
It is prohibited to use the nearby areas the marine basin or open ground for sanitary purposes including bathing, defecating, urination, cooking, washing (dishes or clothing); and
No sewage or food wastes should be discharged into the nearby areas, the marine basin or onto open ground.
Mitigation Measures proposed for Avifaunal Populations
Apply phasing plan for construction activities to allow unaffected habitat for birds;
Keep construction related traffic minimal;
Avoid high noise activities and use noise mitigation measures on sensitive areas;
Avoid unnecessary lightening at night on locations where avifaunal populations are colonized;
Restrict access to the sandy beaches during construction and control access to the adjacent areas;
Fence the sensitive areas (i.e. avifaunal population's habitats, sandy beaches) with no access policy;
Avoid unnecessary movement of people to peripheral areas to minimize disturbance to bird species;
Feral dogs and cats must be removed once they arrive on construction site to maintain the populations (i.e. Tern colonies);
Keep the disturbance to the sandy beaches along the shoreline to a minimum;
All construction activity should be restricted to the construction site/plot; and
Note: These mitigation measures are important during all seasons but especially in winter months when wader numbers can be accepted to rise.

5.5 WATER QUALITY CONTROL PLAN

There will be no sewage treatment facilities on the DAM site. The appointed contractor will have to make provisions for the supply and maintenance of temporary sanitary facilities for site staff and employees. The sewage will most likely be removed by tankers to the prescribed treatment facility. There will be no direct discharge of sewage to the seawater. Best practices for the disposal of sewage and dewatering discharges have been covered as a part of the "Soil and Groundwater Management Plan" in **Section 5.3.**

5.6 NOISE AND VIBRATION CONTROL PLAN

The aim of the Noise and Vibration Control Plan (NVCP) is to manage the noise issues produced during all construction works of Diyar Al Muharraq Development project, establishing a series of mitigation measures to be implemented so as to prevent disturbance to nearby receptors in the vicinity of the site and construction workers.

A set of mitigation actions are provided as best practice options to allow the Contractor(s) to make the best judgement on those actions deemed necessary which will ensure that noise levels form construction works do not exceed the standards set out by the regulatory authority.

Construction Environmental Management Plan (CEMP) Rev 00

Targets and performance indicators have been identified to enable compliance with this management plan to be monitored by the Contractor(s) Site EHS Manager and the Contractor(s) Site EHS Officer and verified by an independent Third Party Auditor.

The Noise and Vibration Control Plan for Diyar Al Muharraq Development project that needs to be implemented by the Contractor(s) is provided in **Table 5.5** below:

Table 5.5: Noise and Vibration Control Plan

Responsibility	The Contractor(s)
Key Issues to consider	Operation of Plant and Equipment such as: Earthmoving equipment; Piling and vibro compaction equipment; Typical mobile construction equipment ; Generators/ Compressors; Trucks and delivery vehicles transporting material; Concreting work; and & Rising occupancy of DAM while construction works are ongoing.
Performance Objective	Minimise the noise emissions from construction activities, equipment and machinery & to mitigate potential impacts to surrounding residents & DAM residents.
Performance Indicator	Noise levels will not exceed the allowable limits; and Noise levels will not cause significant impact outside the project site.
Performance Target	No substantiated noise complaints.
Evidence of Compliance	Regular site inspection and audit complaints register; and
Environmental Standards and Guidelines	Noise limits will not exceed as specified by Bahraini authorities given in **Table 2.9.**
Environmental Impacts	Increase in day time noise levels from operation of construction vehicles, equipment and machinery; and Vibration disturbance.
Mitigation Actions	
Noise mitigation measures may include, but not be restricted to the following: Divert construction traffic away from the noise sensitive receptors in order to avoid and minimise noise impacts; Use of appropriate noise insulation treatments if necessary; Replace noisy machines and plants that emits high vibration levels above the manufacturer specifications with less noisy vibrating alternatives, shield/screen noise making plant or provide plant which is specifically designed with noise inhibitors such as generators and compressors with silencers and muffled jack-hammers; High noise emitting equipment above manufacturer specifications should be closely screened from any receivers. Sound attenuated earth moving equipment should also be considered for use on the site Noise from delivery vehicles coming and going from the site might be controlled by ensuring that access routes; avoid residential areas. A suitable site access point should be selected that is away from sensitive residential receptors (NSRs); Day time use of reverse alarms should also be managed. Turning circles should be provided for delivery and construction vehicles and tool box talks will help to educate construction vehicles drivers and plant/machinery operators;	

The use of horns should be restricted during construction period of time;
Prohibit unnecessary idling, revving or inappropriate use of equipment;
Generators used on the site should be 'sound-proofed';
Communication lines should be set up between site teams (HSE & Project managers) and sensitive noise; receptors including the local residents to offer information and feedback on disturbances;
All site workers to be trained in noise reduction (such as proper use of machinery and the use of hearing protection) and informed of locations requiring the use of such equipment;
Orientate machinery away from noise sensitive residential areas and other noise sensitive receptors;
Where machines are fitted with engine covers these shall be kept closed, whenever possible;
Ensure all stationary and mobile equipment, construction plant, machinery and vehicles are regularly well maintained and in good working order;
Vibrations must be minimised at any neighbouring premises. Residents of neighbouring premises must be warned of possible vibrations prior to the commencing the activity;
Complaints will be responded to within 24 hours and mitigation measures checked and improved within 48 hours; Should a substantiated noise complaint be received by the Contractor(s), an appropriate noise monitoring campaign shall be instigated by the Contractor(s) to determine the noise source. If necessary appropriate noise mitigation measures, such as noise barriers, will be implemented;
Reducing the impact at sensitive receiver locations where possible and appropriate by implementing noise insulation treatments such as suitable façade constructions, acoustic ventilation paths and minimisation of structure borne sound transmission paths as detailed below;
Construct a solid barrier around generators; and
Orientate machinery away from noise sensitive residential areas and sensitive receptors.

5.7 TRAFFIC AND ACCESS CONTROL PLAN

The basic objective of the Traffic and Access Control Plan is to permit the Contractor(s) to work within the public right of way efficiently and effectively while maintaining a safe, uniform flow of traffic. Construction vehicles and the public travelling through the work zone in vehicles, or as pedestrians must be given equal consideration when developing a traffic control plan.

A TIA has been completed for the operational phase of DAM Phase 1, however, a Construction Traffic Plan (this is not a legislative requirement of SCE) has not yet been devised or routes designated, the contractor is encouraged to adopt the following measures to reduce the impact of site traffic, where practicable (**Table 5.6**).

Table 5.6: Traffic and Access

Responsibility	The Contractor(s)
Key Issues to consider	Access to the site; Avoid frequent movement of construction related vehicles during peak hours of traffic; Noise created by vehicles; and Emissions from vehicles.
Performance Objective	To minimise the noise and emissions from traffic generated by vehicles and to mitigate potential impacts on nearby receptors.
Performance Indicator	Noise levels will not exceed the allowable limits; and Particulate matter and gases emissions will be minimized by implementing appropriate traffic control plan.

Construction Environmental Management Plan (CEMP) Rev 00

Performance Target	No complaints from nearby receptors.
Evidence of Compliance	Regular site inspection and audit complaints register.
Environmental Standards and Guidelines	Noise will not exceed limits specified by Bahraini authorities given in **Table 2.9.**
Environmental Impacts	Increased noise levels and air emissions due to construction related traffic.
Mitigation Measures	
Traffic Controls	
Avoid excessive vehicular traffic and movement;	
Minimise use of internal site roads to limit the ground area that is disturbed;	
Enforce speed limits on un-surfaced roads to minimise dust generation;	
Ensure construction traffic does not disperse mud and sediment onto public roads. This may require the contractor to install wheel washing facilities and/or regular sweeping operations;	
Workforce shifts should commence and finish outside of peak traffic periods and contractors should plan parking for site personnel's vehicles;	
If peak time travel is necessary then a pre-planned route should be established which follows roads where less traffic problems are encountered;	
Locate haul routes and internal roads away from air quality sensitive receptors;	
Construction works should be clearly demarked and signed to that non-construction related personnel are aware of the restrictions to access and the risks to safety. Alternative access arrangements should be made where appropriate;	
The site map and traffic restrictions should be provided to all suppliers, drivers and subcontractors, showing them the agreed access to the site and the appropriate routes;	
Instruct drivers to switch off engines when vehicles are waiting (cool conditions); and	
Consider the use of in-cab communication systems to maintain control over lorry movements.	
Vehicle and Equipment Emissions	
Regular maintenance and minimum exhaust requirements on equipment and vehicles within accepted standards;	
Regular maintenance on particulate traps/filters on trucks as part of the above regime;	
Implement minimum exhaust requirements on equipment (including temporary power generators) and vehicles within the standards outlined in Regulations for the Protection of Air from Pollution;	
Minimize idling of vehicles;	
Use of bus or public transportation for workers to and from site where possible;	
Vehicle emissions should be maintained within accepted standards; and	
Provide preferred parking for low-emitting and fuel efficient vehicles or for carpools/vanpools within car park to encourage alternative transportation/decrease single occupancy vehicle use and thereby reduce pollution.	

5.8 WASTE MANAGEMENT CONTROL PLAN

The Waste Management Control Plan (WMCP) establishes a series of mitigation measures to be implemented so as to prevent: generation of excess waste quantities, inappropriate disposal of waste material and pollution of the environment associated with the construction works for Diyar Al Muharraq Development project. Mitigation Actions are provided as best practice options to allow the Contractor(s) to make the best judgement on those actions deemed necessary so as to ensure that construction works do not exceed the standards set out by the regulatory authority.

For the purpose of this management plan, waste can be classified as either:

Inert / General Waste and Construction Rubble – which includes waste paper, board, cardboard, benign organic and domestic waste, plastic and uncontaminated construction debris such as scrap metal, used bricks, wood, waste concrete, unused subsoil and rubble from excavations or demolished structures.

Hazardous Waste – include materials that are potentially dangerous and may affect human and/or environmental health. This would be because of the wastes' inherent chemical and physical composition, which could be toxic, poisonous, flammable, explosive, carcinogenic or radioactive. Hazardous waste may include items such as spent batteries, waste oils/chemicals, empty chemical containers, used oil filters, sharp objects etc. that require special collection, handling and disposal.
Waste management in Bahrain is governed by two main pieces of Legislation:

i. Law No. 3 for 1975 with Respect to Public Health, Ministry of Health, State of Bahrain; and
ii. Resolution No. (3) of the Year 2006 with respect to the Management of Hazardous Materials.

iii. Law No. 3 is concerned mostly with public health and sanitation; however, Section 6 of this law includes clauses on the Collection and Disposal of Garbage (Waste). Executive Authority for Waste in Bahrain is deemed to lie with the five Municipal Authorities. Waste collection services are sub-contracted out to private enterprise companies.

iv. Resolution No (3) is concerned with the proper isolation, transport and safe disposal of all hazardous waste material. The Resolution defines hazardous waste as:

v. Any solid, semi-solid or liquid matter containing gaseous waste; or
vi. A group of compounds of waste that may lead to a hazard or potential hazard to public health, environment and wildlife because of their quantity, concentration, physical, chemical or biological properties when they are not managed in an environmentally proper manner.

The Waste Management Control Plan for Diyar Al Muharraq Development that needs to be implemented by the Contractor(s) is provided in **Table 5.7**.

Table 5.7: Waste Management Control Plan

Responsibility	The Contractor(s)
Key Issues to consider	Generation of general site waste (including waste materials, packaging and building waste) and domestic waste which needs to be disposed on to Askar landfill: Generation of hazardous waste such as spent batteries, waste oils/chemicals, empty chemical containers, old oil filters, sharp objects etc. that require special collection, handling and disposal: Incorrect storage/disposal of hazardous waste and chemicals; Littering of construction site and surrounding developments from waste; Increase pressure on public waste disposal facilities; and Risk for water pollution due to windblown wastes to waterways.

Construction Environmental Management Plan (CEMP) Rev 00

Performance Objective	To manage waste associated with the construction works for Diyar Al Muharraq project in a sustainable manner and to minimise the impacts on the surrounding environment.
Performance Indicator	Number of recorded incidents of pollution related to poor waste management; Reduction in amount of waste generated on site; Type and amount of waste recycled and/or re-used on site or offsite; Type and amount of waste treated and/or disposed of from the site; and Completion of Environmental Checklists.
Performance Target	No significant impacts on the surrounding environment; and Reduction of waste sent to Askar landfill.
Evidence of Compliance	Regular site inspection and audit of incident reports; Production of monthly waste log reports indicating percentages recycled/reused and any incidence of non-conformance; and Regular audits of the waste Inspection Logs.
Environmental Standards and Guidelines	Law No. 3 for 1975 with Respect to Public Health, Ministry of Health, State of Bahrain; and Resolution No. (3) of the Year 2006 with respect to the Management of Hazardous Materials.
Mitigation Actions	
General	
The Contractor(s) will follow Bahraini regulations for onsite storage, transport, treatment and disposal of hazardous waste; An approved person, such as the Contractor(s) Site EHS Officer, will be given responsibility for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site; The Contractor(s) will appoint an individual responsible for the regular inspection of the site and site clean-up/litter picking; Contractor(s) will apply the waste prevention principals of the 4Rs: reduction, reuse, recycling and recovery (RRRR) wherever possible; The Contractor(s) will ensure that all construction staff is trained in good waste management practice and chemical handling procedures through the site induction process and regular tool-box talks; The Contractor(s) will be responsible for arranging the timely collection of waste material. The Contractor(s) will provide sufficient waste disposal points and regular collection for disposal; and The Contractor(s) should obtain and retain verification records (waste haul receipts, waste management reports, spread sheets etc. to confirm that the diverted materials have been recycled or salvaged as intended.	
Collection and Storage of Waste	
The Contractor(s) will provide adequate facilities for the collection and storage of waste material including litterbins and waste skips. Waste containers will be provided with nets or lids to prevent waste being carried around by scavengers or by the wind. Should temporary storage on ground be the only option, waste will be placed on a protective liner on the ground and covered/surrounded by a screen mesh fence to prevent loose waste being blown across site; Waste containers will not be overfilled; Waste should be segregated as it is generated and containers should be clearly marked with their contents. Appropriate measures will be employed to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers; Construction waste including ruptured equipment, tyres, used oil cans/drums etc. will be separated and put into special bins for removal with other hazardous waste materials;	

Putrescent waste and litter will be collected in designated, leak proof containers;
Hazardous waste (including fuels and chemicals) to be stored in an impervious bunded area and drip trays around mobile plant;
The Contractor(s) will provide designated waste storage areas for the bulk storage of waste prior to removal off-site. Bulk waste storage areas will be constructed on an impervious surface and be readily accessible to collection vehicles. A site plan showing the designated site will be provided to and approved by HAJ; and
Sewage from toilets shall be disposed to the appropriate sewerage system or to a septic tank then removed by a licensed contractor.
Waste Reduction and Sustainability
Good management and control can prevent the generation of significant amounts of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices during construction phase;
Consider recycling cardboard, metal, brick, acoustic tile, concrete, plastic, clean wood, glass, gypsum, wallboard, carpet and insulation;
Purchase materials in the quantity required for the project to minimise unused left-overs;
Purchase materials that have the least amount of packaging to minimise packaging being thrown out;
Recycling of unused chemicals or those with remaining functional capacity where practical;
Maximise the use of reusable steel formwork and metal site hoarding to reduce the amount of construction material going to landfill;
Reuse materials where possible onsite or on a different site;
Select environmentally sustainable building materials in the public domain and provide on-site facilities for recycling. Wherever possible use construction materials with a recycled content (such as fly-ash). Reuse materials where possible onsite or on a different site;
Redirect recyclable recovered resources back to manufacturing process. Redirect reusable materials to appropriate sites;
Collection, segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal. Clearly mark and locate bins and find locations to temporarily store materials. Include bilingual signs and signage in the language of the construction workers. Pictures can help non-English-speaking workers;
Place recycling bins in a location that will prevent misuse or contamination by the public, and that will be as close to the work as possible. Always provide a non-recycling waste container next to recycling bins;
Waste will be segregated in an onsite recycling centre and those components that are recyclable sent to appropriate facilities for construction and demolition waste; and
Implement a recording system for the amount of wastes generated, recycled and disposed. Please refer to **Appendix E** for an example Waste Log Format.
Disposal of Waste
Burning, disposal or burying of any waste on site is prohibited;
Dumping of waste, including roadside dumping and filling on land not within a registered landfill area is prohibited.
The contractor will provide sufficient waste disposal points and regular collection for disposal;
Identify construction haulers and recyclers to handle the designated materials;
All non-recyclable waste will be disposed of by an approved waste contractor or service provider to an approved Municipality site;
The contractor will follow SCE's procedures for the classification, sampling, transport and disposal of hazardous waste;
Waste will be segregated onsite and those components that are recyclable sent to appropriate facilities;
Divert construction, demolition and land clearing debris from landfill disposal. Redirect recyclable recovered resources back to manufacturing process. Redirect reusable materials to appropriate sites; and

Waste material or water containing waste chemicals will not be pumped or disposed of into the storm water drains, and sanitary sewers or into the ground without appropriate treatment and only in accordance with applicable guidelines.
Sanitary Facilities
Septic tanks shall be emptied on a regular basis at a frequency which ensures no overflow of sewage effluent by an approved waste disposal company to a municipality approved site;
It is prohibited to discharge sewage onto the open ground, beaches or into the sea; and
It is prohibited to use prohibited to use beaches or open ground for sanitary purposes including bathing, defecating, urination, cooking, washing (dishes or clothing).

5.9 CHEMICAL HAZARDS AND MATERIAL MANAGEMENT PLAN

The mitigations regarding how to minimize the risks associated with chemical, fuel, and oil spills and accidents; what the appropriate mitigation measures are including proposed containment methods, work practices and storage requirements for chemical and hazardous materials and how to handle these materials have been given in details in **Table 5.8**.

Table 5.8: Chemical Hazards and Material Management Plan

Responsibility	Contractor
Key Issues to consider	Contamination of soil and groundwater due to spillage of hazardous material including fuel oils, waste materials or chemicals. Avoid health and safety problems for the workers on site and visitors due to chemical hazards.
Performance Objective	To minimize the risk of pollution of the soil and groundwater. To avoid chemical hazards on people.
Performance Indicator	Number of reports of spillages and pollution incidents. Number of work related incidents due to inappropriate management of chemicals.
Performance Target	No significant impacts to the quality of the soil or groundwater. No significant health and safety related incidents.
Evidence of Compliance	Regular site audit and inspection of incident reports. Completion of Environmental Checklists.
Environmental Standards and Guidelines	Resolution No. (4) for the year 2006 on the management of hazardous chemicals

Mitigation Measures
Storage and Handling of Hazardous Substances
The contractor should comply with all Environmental Regulations and legislation with regards to the safe storage and handling of hazardous substances.
The contractor is responsible for the training of all personnel on site who will be handling hazardous materials about its proper use, handling, disposal and spills procedures and to provide all staff with appropriate personal protective equipment.
All contractors handling hazardous materials should keep appropriate spill clean-up material adjacent storage and maintenance areas and take immediate action to contain/clean up the spill using sand/suitable absorbent material. Contaminated soil, rags and other clean up material should be disposed of in accordance with Bahraini guidelines.
Waste material or water containing waste chemicals such as thinners, oil, and mineral spirits should not be pumped or disposed of into storm water drains, sanitary sewers or into the ground.
Each contractor should keep a regularly updated list of all hazardous substances present on site and the MSDS for these substances readily available. This list should be provided to the Project Environmental Manager and related authorities.
Each receptacle containing dangerous goods should be marked with the correct technical name of the substance it contains.
Incompatible materials should not be placed in common containment.
All flammable liquids should be stored under cover/in well ventilated areas.
No electrical equipment should be used within 10 meters of the storage area
Cylinders of compressed gas or flammable gases will be stored upright in secure racks and out of direct sunlight or heat source.
Hazardous substances include but are not limited to: fuel, lubrication oils, hydraulic and brake fluid, paints, anti-corrosives, spent batteries, old oil filters, light bulbs, shard objects etc. All hazardous material, including chemicals and fuels, will be stored at a designated site. All hazardous material should be stored in a special air conditioned COSHH container on site during construction.
This COSHH container should store hazardous liquids, in an impervious bund area (volume of the storage bund >110% of the largest storage tank contained within the bund).
Collection systems should be provided/bunded if necessary under machinery or equipment that may leak hydrocarbons/hazardous substances. Bunds should typically be provided under any container with hazardous substances (oil, fuel, paints, solvents etc.) or any piece of machinery (i.e. generators) which may leak fuel, lubricants or hydraulic fluids. It is good practice to provide drip trays under construction vehicles prone to leaking lubricants.
Contractors should minimize the amount of diesel, oil, paint, and other chemicals stored on site that pose potential spillage environmental hazards and use materials that minimize environmental impact such as lead free paints, asbestos free materials etc.
Bulk fuel storage facilities must be impervious to liquid and include concrete block walls, a concrete floor and appropriate surface sealant applied over joins, floor and walls. All refuelling valves should be placed within the bund and ground protection provided adjacent to the bunds to prevent pollution of surrounding environment.
Contractors should locate storage areas away from drains/trenches/wastewater collection device. All hazardous liquids will be stored in an impervious bund area where the volume of the storage bund is >110% of the largest storage tank contained within the bund until collected for off-site disposal by an approved waste contractor at an approved site.
All refuelling and fuel drum loading operations should take place at a designated area within site and the ground under the refuelling and fuel drum loading areas will be protected against pollution caused by spills and/or tank overfills. Refuelling operations should not occur within 100 m of the sea.
Drip and spill trays should be provided where appropriate.
Fill nozzles should be kept within the bunded area when not in use and padlocked.

Construction Environmental Management Plan (CEMP) Rev 00

The contractor should ensure that there is adequate fire-fighting equipment at the fuel and hazardous materials storage area.
Adequate sanitary facilities and appropriate collection systems should be fitted with overflow alarms and regularly inspected and materials sent for disposal.
Regular inspections/audits of hazardous materials usage, handling and storage areas. Regular/thorough maintenance of vehicles and hydraulic systems.
Undertake post operation cleaning of all machines and heavy equipment within a specified washing area that is bunded and paved to prevent pollution.
Use of partitioned settlement tanks to collect wastewater generated from mixer and equipment washing.
Avoid impacting adjacent sites by ensuring all contractors activities, equipment and waste storage to be confined to the allocated site boundary

5.10 SPILL CONTINGENCY PLAN

The main causes of contamination can occur through:

i. Spillage of hazardous material including fuel oils, waste materials or chemicals.
ii. Spillage of wastewater sewage and other liquid effluents.
iii. Spillage of contaminated wash down water with oils, chemicals etc. from vehicles, equipment and machinery.

The following **Table 5.9** provides details on the mitigation actions to be undertaken in the event of a spill of hazardous material.

Table 5.9: Mitigation Actions in the event of a Spill of Hazardous Material

Mitigation Actions/ Emergency Response
Contractors will carry out regular inspections/ audits of hazardous materials usage, handling and storage areas and regular/thorough maintenance of vehicles and hydraulic systems and inspections of sanitary facilities and disposal;
In the event of a spill, immediate action will be taken to contain or clean up the spill using sand or a suitable absorbent material;
All contractors handling hazardous materials will keep appropriate spill clean-up material adjacent to storage and maintenance areas;
Minimise the amount of diesel, oil, paint, thinners and other chemicals stored on site that pose potential spillage environmental hazards and use materials that minimize environmental impact such as lead free paints, asbestos free materials etc.;
Storage areas will be located away from drains/trenches/wastewater collection devices in an impervious bund area (volume of the storage bund >110% of the largest storage tank contained within the bund);
Collection systems will be provided/bunded if necessary under machinery or equipment that may leak hydrocarbons/hazardous substances;
All spillages of hazardous materials will be reported immediately to the EHS Officer. The EHS officer shall submit an incident report to the Contractor's Project Manager, to HAJ and the DAM TIO;
In the event of a major environmental spill, Code Red, the EHS officer will immediately notify HAJ Project Manager and TIO. The area shall be inspected by the Contractor's Project Manager and JOD & P Project

Manager and this shall form part of the incident report;

Contaminated soil, rags and other clean up material shall be kept in appropriate containers before being disposed of in accordance with Bahraini legislation;

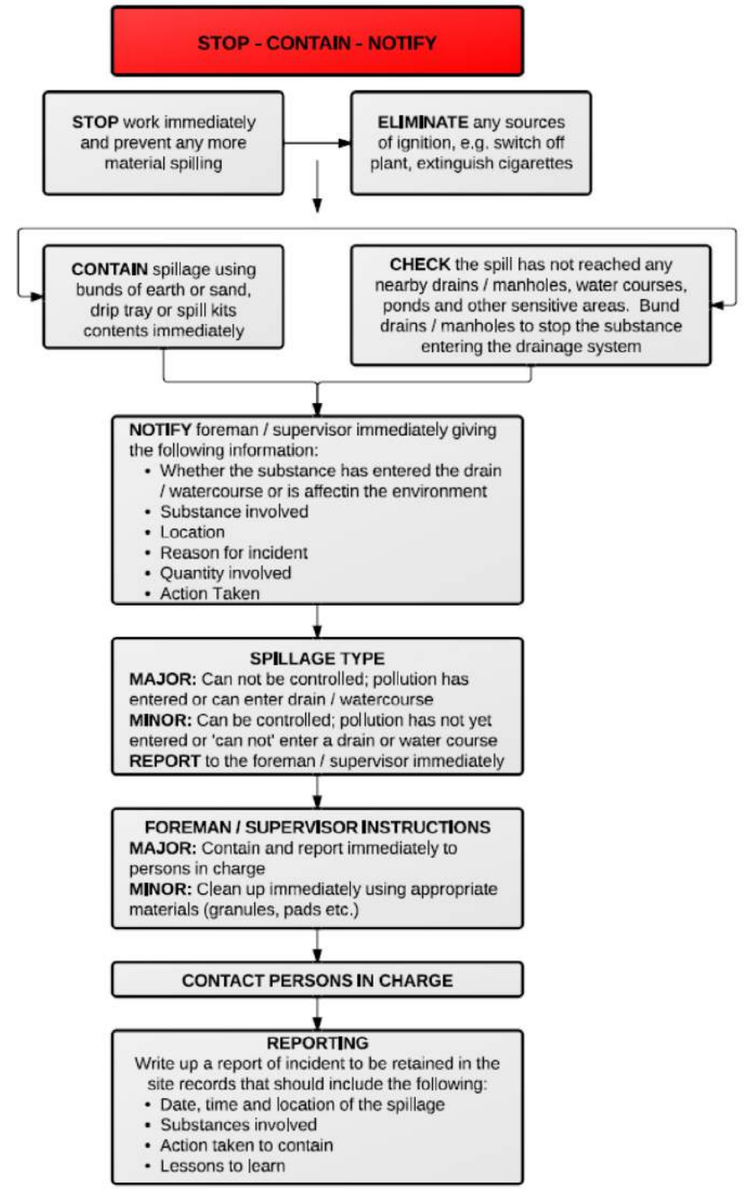
The contractor shall be responsible for training all staff in the procedures for handling spills and shall provide all staff with appropriate personal protective equipment;

The contractor shall provide all staff with appropriate personal protective equipment; and

Avoid impacting adjacent sites by ensuring all contractors activities, equipment and waste storage is confined to the allocated site boundary.

Prior to commencing activities on site, contractors should produce their own written plan illustrating how they intend to deal with a spill emergency on their site. An incident response procedure (see **Figure 5.1**) should be based on the principle of Stop, Contain, Notify and Clean up respectively.

Figure 5.1: Example of Incident Response Procedure



5.11 EMERGENCY MANAGEMENT PLAN

During the construction of Primary Infrastructure of Diyar al Muharraq, emergencies which have an environmental impact may occur. In the event of an emergency, the first response is to locate the source and stop continuation of the situation, followed by the containment, control and mitigation of the situation.

The Emergency Response Procedure will be prominently displayed at the Site Offices within the project site and copies will be kept in every vehicle on site. A copy of the Material Safety Data Sheets (MSDS) for all the chemicals used on the project site will also be kept at each site office and in every vehicle used on the project site. All MSDS forms should be provided within Contractor's Specific CEMP to the SCE.

In the event of pollution of coastal waters, the Site Manager should call the emergency pollution line of the SCE immediately (as per **Table 5.11**). In the incidence of a spillage of a toxic substance (e.g. fuel, oil, chemical) a member of the project management team will initiate emergency procedures and direct on-site resources, liaising with designated qualified individuals regarding spill responses. All land and water that is contaminated as a result of the Contractor's activities will be reported to the Environment Manager immediately following clean-up.

All contamination remediation will be undertaken in accordance with applicable SCE guidelines.

The main objectives of the Emergency Preparedness Response Plan are to:

i. To ensure that all means are available to contain the consequences of an accidental spill, fire or release of oil/fuel;
ii. To ensure that employees are suitably trained to respond to fire and spill;
iii. To ensure that proper reporting takes place; and
iv. To ensure that proper investigation is undertaken.

The Emergency Response Procedure categorizes emergencies with respect to their urgency, severity, control, resource requirement and perceived public perception. The emergency codes categories are presented within **Table 5.10**.

All Contractor personnel and sub-contractors will be instructed and rehearsed, as appropriate, in the requirements of the emergency response procedure. Following control of an incident or emergency, an investigation will be conducted and corrective actions identified and addressed. The Site EHS Manager will verify the close out of environmental related actions. The Project Environmental Manager is responsible for notifying the SCE of any emergency that has a 'Code Red' as presented within **Table 5.10**.

5.11.1 Levels of Emergency Response

Table 5.10 provides a description of the various levels of Emergency Response.

Construction Environmental Management Plan (CEMP) Rev 00

Table 5.10: Various levels of Emergency Response

Code BLUE
An emergency that occurs at the site and can be managed initially without external assistance is categorized in Code Blue. The person in charge (PIC) shall contact the Contractor's Site EHS Officer and/or the Site EHS Manager. The PIC shall initiate an increase in status if: No information is forthcoming from the site of the incident; Situation is escalating or control has not been established immediately; In the PIC's opinion the incident requires additional resources; In the PIC's opinion, the incident may possibly impact reputation of the project; or Resources committed are insufficient.
Code YELLOW
An emergency that may require external assistance initially but can be controlled via resources on site over time. The PIC shall contact the Contractor's EHS Manager, The Site Supervision Consultant and JOD & Partners Environment Manager. The PIC shall initiate an increase in status if: Resources committed are insufficient; Situation is escalating or control has not been established immediately; or Possible impact to project reputation, asset or customers.
Code RED
An emergency where the site's asset resources have been fully committed or the time to bring the incident under control is excessive or significant resources are required to control the incident. All appropriate personnel should be contacted including the Contractor's EHS Manager, The Contractor's Project Manager, the Site Supervision Consultant, JOD & P Environmental Manager and Project Manager, and the appropriate emergency centre. Other characteristics of the emergency include: Facility and/or asset and/or surrounding environment; Life, property and the environment; or Likely impact to project's reputation.

In the case of an emergency, the following emergency telephone numbers should be available for immediate contact as shown in **Table 5.11.**

Table 5.11: Emergency Contacts

Emergency Contact	Issue	Contact
Supreme Council for Environment: - Environmental Assessment Section - Waste Control Section - Waste Disposal Unit	Noise and air quality, traffic and waste	17 386 564/ 988
Supreme Council for Environment: - Environmental Monitoring Section	Discharges Compliance monitoring Inspection	17 920 213 mkhalaf@sce.gov.bh
	Pollution Hotline	80001112
General Directorate for Protection of Marine Resources	Fisheries interests and marine environment Marine Protected Areas Dredging permit	17 815 881
Water Resources Directorate	Groundwater and surface water quality Aquifers	17 796 772
Traffic and Licensing Directorate, Ministry of Interior	Traffic and access issues	17 872 222
Roads Directorate	Road Accidents	199 (no injuries) or 999 (injuries)
Coastguard Directorate	Maritime navigation Vessel licensing	17 534 343
Ports and Maritime Affairs	Marine navigation Emergency response	17 359 999
General Directorate of Civil Defence	Health and safety, fire, security, emergency spill response	17 293 300 or 999 (emergencies)

The Contractor's Emergency Management Plan should provide the following information regarding emergency procedures:

i. Describe the actions to be taken in response to emergency situations, such as fires, explosions, or the unplanned releases of hazardous materials where hazards exist;

ii. Provide evacuation plans for the site, including procedures and routes; and

iii. Describe any arrangements agreed to with Ministry of Interior, hospitals, contractors, etc., and emergency response teams to coordinate emergency response services.

Table 5.12 provides a checklist for avoiding pollution, mitigating and controlling environmental incidents.

Table 5.12: Avoidance, Mitigation and Control Measures for Environmental Pollution incidents

Avoidance
Spillage Control – ensure appropriate storage of all liquids; Provision of spill kits and first aid kits within an easily accessible location, with contents checked on a frequent (e.g. daily) basis; Provision of training; and Ensure provision of oil spill kits on site, including: absorbent materials, sand for barriers, containers, shovels, rakes etc.
Control and Mitigation
Contractor to devise an Emergency Response Plan: Assess the risk of tackling the spill, if it is safe to do so; Inform relevant company official and relevant authorities; Identify the potential sources of pollution and stop flow immediately; Provide personnel with appropriate PPE; Attempt to contain the spill or prevent its spread; Dam the flow with absorbent material; If possible, maintain an upwind position, avoiding inhalation of potentially harmful fumes and vapours; Mark boundaries of incident or spill areas for future monitoring and clean-up operations if required; and Dispose of clean-up / waste materials properly.
On Land: Attempt to damn spill with absorbent material such as sand/earth; and Use absorbent material to soak-up spillage (do not wash-down or apply detergent products) and shovel contaminated material into suitable waste bags for disposal (6mm polyethylene). **In Water**: Contractor to install containment devices, as per specialist recommendations (e.g. skimmer) to attempt to recover the spill; Attempt to deflect any wildlife within close proximity; and Dispose of clean-up waste materials correctly.

5.12 SECURITY PLAN

Thorough planning is essential to ensure construction-site security. Security is important in controlling loss and prevention of theft of valuable construction materials and tools.

A detailed "Security Plan" should be provided within the Contractor's Method Statement, including the control measures to keep the site secure. Unauthorized access to the construction site should not be allowed and security is to be managed from the site access office.

It is important that the site be clearly marked (warning signage) and fenced off to ensure only authorized personnel and visitors are allowed entry. Additionally the following measures should be implemented:

i. Where possible, use high quality locks on gates;

ii. Employ experienced security guard(s);
iii. Avoid stacking materials against the site boundary/fence, as this can provide an opportunity for vandals and thieves to scale it;
iv. Within the site, ensure that materials that are potentially hazardous to the environment are well secured. It is important to lock fuel outlets when not in use;
v. Secure plant to prevent vandalism;
vi. Immobilize plant and equipment overnight;
vii. Install deterrents such as appropriate lights, warning notices, 24-hour security guards, etc.;
viii. Control the movement of people on and off the site: use site passes (or swipe cards);
ix. Position the site manager's office to give a good view of the site;
x. Good signage is required to warn passers-by of dangers (e.g. movement of vehicles); and
xi. Inform local police/coastguard about use of the site.

5.13 INFRASTRUCTURE PLAN

Contractor(s) should describe the measures taken to ensure protection of infrastructure (e.g. water systems, transmission lines) during the construction phase within their Contractor's specific CEMP.

Construction Environmental Management Plan (CEMP) Rev 00

6 MONITORING AND AUDITING

6.1 ENVIRONMENTAL PERFORMANCE MONITORING

Environmental performance will be monitored by undertaking daily inspection of the site (Contractor) alongside monthly environmental audits. Details are provided in the following sections.

6.1.1 Environmental Inspections

A standardised system of regular inspections should be agreed on to promote continuous improvement of site operations. These inspections are to be carried out by the Contractor'(s) EHS Officer. Daily site walkover and inspection is proposed to be implemented on a regular base during construction period.

The Contractor(s) EHS Officer is required to perform a Daily Site Walkover. During the Walkover the Officer will inspect the implementation of the environmental control measures and monitoring arrangements as stated within CEMP report, and record them using a standard checklist. All non-compliance will be investigated and resolved within the required timescales. It is the responsibility of the EHS Officer to ensure the remedial solutions are effectively implemented, and all deficiencies are reported to the EHS Manager. Major defective items or non-conformities not corrected or 'actioned' within the appropriate timescales will be raised and investigated within a Non-Conformance Report, presented to the Project Environmental Manager (see **Section 6.2**).

The daily inspection of the Contractor Site EHS Manager should focus on the following elements:

i. Inspection of workshop areas;
ii. Inspection of waste collection, hazardous material stores and storage areas; and
iii. Visual assessment of dust generation.

6.1.2 Environmental Audits

Environmental audits are an integral part of the CEMP implementation. Proposed audit arrangements should demonstrate whether the actual environmental performance and environmental impacts will be as predicted and can also provide the basis for appropriate and necessary actions.

In addition to routine monitoring, fortnightly environmental auditing is recommended through to the construction phase to ensure that the construction activities for the DAM Development are in compliance with environmental regulatory requirements and standards. Environmental auditing will confirm that the CEMP is being actively, adequately and effectively adopted.

Audits should be conducted with the following aims:

i. To check compliance with the CEMP;
ii. To identify specific issues of non-conformance and to give recommendations to meet them;
iii. To check the effectiveness of mitigation measures and corrective actions and to review the need for further mitigation measures; and
iv. Verify that any complaints are properly addressed and follow up procedures taken.

A Third Party Auditor should be appointed by DAM WLL to assess the Contractor's compliance with the CEMP and all other environmental requirements. It is suggested that site audits should be undertaken fortnightly by appointed consultant, and reported within monthly report submissions to be submitted to the Supreme Council of Environment (if required). From time to time, SCE may also carry out their own inspections and audits.

During the fortnightly audits, a more detailed inspection of the various control measures will be undertaken, ensuring any necessary environmental sampling is conducted, as per requirements identified within Contractor's Specific CEMP report. As with the Daily Site Walkovers, any non-compliance will be reported within a Non-Conformance Report and must be 'actioned' within the stated time scales mentioned in **Section 6.2**.

All non-conformances (major/minor) identified during the independent audits should be covered within this monthly CEMP monitoring report.

6.2 NON-CONFORMANCE CONTROL, CORRECTIVE AND PREVENTIVE ACTION

Non-conformances may arise during either internal inspections and audits conducted by the Contractor, or external inspections and audits conducted by the Third Party Auditor. All non-conformances raised will initiate corrective action, which will be overseen by the Contractor(s) Site EHS Officer and will be approved by the AECOM Project Manager.

Non-conformance can be:

Minor non-conformance – is a random or isolated incident that by itself, does not indicate a systemic problem with the CEMP. Minor non-conformances involve discrepancies within an element of the CEMP that do not significantly affect the implementation of the environmental management plan and commitment to conform to the Code of Good Practice.

Major Non-conformance – occurs when one of the elements in the CEMP has not been addressed or has not been addressed adequately. Major non-conformances can occur when a Contractor has documented a process or procedure, but has not implemented it or cannot demonstrate effective implementation. A major non-conformance can also occur if a number of minor non-conformances in a given activity or against a given element point to a systemic failure. Major non-conformances also exist if an element is being disregarded sufficiently during construction that it is having a noticeable effect on the Contractor's environmental compliance, environmental impacts, or the quality of the material being produced – there is a gap or problem that could lead to a systemic failure.

Corrective action should be undertaken immediately following notification of the non-conformance (with five days to one month close-out periods). All non-conformances and corrective actions will trigger investigation within one month into preventative action by appointed Environmental Manager. This may include environmental training and awareness or changing and updating the CEMP and associated procedures and communication to appropriate individuals for implementation as soon as practicable.

If a situation is not resolved within the appropriate time scales, depending upon criticality, the Client will rectify the situation and the cost will be borne by the Third Party Contractor (DAM might require a retention fee for environmental mitigation measures).

Construction Environmental Management Plan (CEMP) Rev 00

6.3 DOCUMENT CONTROL AND RECORDS

Daily inspections should be carried out by the Contractor(s) Site EHS Officer and recorded on a standard recording checklist and kept on file for audit by the Contractor EHS Manager and Environmental Consultant. Non-compliance recorded during the daily inspection shall be immediately reported to Contractor EHS Manager and Contractor(s) Project Manager. Corrective actions taken in response to the non-compliance should be documented on the inspection sheet and sent to the AECOM project Manager and DAM WLL Environmental Manager.

The Contractor(s) Site EHS Manager should prepare a monthly report for submission to the Project Environmental Consultant. This report should present the monitoring results, environmental issues encountered, recommendations for further actions where needed, corrective action taken, environmental incidents and complaints received. The Project Environmental Consultant will compile a monthly CEMP Monitoring Report for submission to SCE. This will include monitoring data, site inspection reports, all code blue, yellow and red incidents and their follow up investigations, implementation of corrective actions and close-out.

6.4 REPORTING REQUIREMENTS

All data will be made available to the SCE by the environmental consultant charged with conducting monitoring operations. A monthly CEMP monitoring report should be submitted to SCE by the Environmental Consultant. Additionally, should it be a requirement, a monthly meeting may be held with SCE. A suggested layout for the monthly CEMP monitoring report is provided within **Table 6.1**:

Table 6.1: Suggested Layout for Monthly CEMP Monitoring Report

Chapter	Content
Chapter 1	Executive Summary
Chapter 2	Introduction
	Project Description: Brief description of the Contractor's development.
	EIA Consultants: List of EIA experts involved in the monitoring of the EMP implementation and editing the monthly report.
Chapter 3	Management Team: List of contractor/developer personnel involved in supervising the implementation of the CEMP.
Chapter 4	Work Progress: Brief description of the progress in the construction activities undertaken during the last month.
Chapter 5	Monitoring of Implementation: Assessment of how far all mitigation measures addressed in the CEMP report have been effectively implemented. Results of dedicated monitoring programmes (e.g. noise and dust) will be presented.
Chapter 6	Complaints and Incidents: Any complaints received from disadvantaged parties should be elaborately addressed. Any environmental incidents happened and corrective action taken should be included.
Section 7	Conclusions and Recommendations: Environmental issues encountered, recommendations for further actions where needed.

If there is a requirement to include additional information in the form of:

i. Pre-operation compliance reports;
ii. Incident reports;
iii. Periodic or annual environmental progress reports;
iv. Non-compliance reports;

v. Corrective action reports;
vi. Complaints reports; and
vii. Any special reports required by government agencies.

These reports will be included as a part of a Monthly CEMP Monitoring Report.

6.4.1 Incident Reports

The Environmental Consultant must notify the SCE and other relevant authorities as soon as practicable on behalf of the Contractor(s) regarding any environmental incident with actual or potential significance for impacts on the environment. Should an incident occur, the Environmental Consultant must inform the SCE and other relevant authorities immediately and provide an incident report outlining the details within 3 days of the incident. Incident reports could include the following:

i. Fuel or chemical spills;
ii. System failures or malfunctions;
iii. Other emergencies (e.g., natural disasters); and
iv. Other events that led to non-compliance with environmental standards/requirements.

6.4.2 Periodic or Quarterly Performance Reports

A quarterly CEMP performance report should be submitted within three months of the date of approval of the CEMP. Thereafter, monthly environmental progress reports for the construction project should be provided to SCE. This report should accomplish the following:

i. Identify the standards, performance measures, and legal requirements that apply to the project construction;
ii. Assess the environmental performance of the project construction to determine whether it is complying with these standards, performance measures, and legal requirements;
iii. Identify any non-compliance with the conditions of this CEMP or any standards, performance measures, or legal requirements that apply to the project and occurred during the reporting period;
iv. If any non-compliance is identified, describe the actions and measures that will be performed to ensure compliance, clearly indicate who is or will be performing these actions and measures, when they will be conducted, and how the effectiveness of these measures will be monitored over time;
v. Include a copy of complaints for the quarter and a description of actions taken or being taken to address registered complaints; and
vi. Provide the results of all environmental monitoring required by the environmental permits, including interpretations and trends or exceptions in these results.

As per **Section 3.4.3**, the Environmental Consultant will be responsible for preparation, management of and submitting all documentation required by the SCE, including monitoring reports.

Construction Environmental Management Plan (CEMP) Rev 00

6.4.3 Monitoring Compliance Reports

As described in the "Environmental Impacts" **Chapter 4**, there are no nearby sensitive receptors to the DAM project site and the main concern will be impacts of dust and noise on construction workers, site staff, visitors and occupants once residential units start being occupied throughout the construction period. The proposed "Air Quality Control Plan" and "Noise and Vibration Control Plan" must be implemented to maintain the dust and noise levels within acceptable limits.

TSS monitoring should be carried out, should there be any dewatering discharges to the marine environment. Discharge point (s) for dewatering liquids and testing requirements should be agreed by the SCE.

The Monitoring Compliance Reports section of the Contractor(s) CEMP should include information regarding the following:

i. Establish a program to monitor environmental compliance of construction activities in accordance with the established procedures defined in the CEMP. These activities may include daily, weekly, or periodic inspections; and
ii. Provide procedures that establish corrective actions for non-compliance with established CEMP procedures and identify the root causes for the issue. These corrective actions should not only provide an immediate but also help ensure that similar non-compliance will not be repeated.

As within **Section 3.4.3**, the Environmental Consultant is responsible for conducting necessary site auditing and production of monitoring reports for submission to the SCE (if required).

6.4.4 Environmental Checklist

This CEMP report includes an Environmental, Health and Safety Checklist (**Appendix B**) adapted specifically for the Diyar Al Muharraq Project. The Contractor(s) CEMP can modify/upgrade this checklist as required.

7 REFERENCES

(1) Bahrain Census Summary Result 2010, Population, Housing, Buildings, Establishments and Agriculture Census; accessed 16th June on www.cio.gov.bh

(2) Diyar Al Muharraq, Environmental Statement (Volume 1 – Main Text), September 2006.

(3) http://www.unep.org/padelia/publications/VOLUME2T42.htm

(4) Swar, Mohamed Ali., 2002. MSc thesis (Arabian Gulf University, Bahrain) entitled "Groundwater Quantity and Quality Assessment of the Dammam Aquifer in the Kingdom of Bahrain, 1991 – 2001". Internal Reference Number: 20-034.

Construction Environmental Management Plan (CEMP) Rev 00

8 APPENDICES

A – Official Correspondence

KINGDOM OF BAHRAIN
Public Commission for the Protection of Marine Resources, Environment & Wildlife
General Directorate of
Environment & Wildlife Protection
Environmental Licensing Section

مملكـة البحـريـن
الهيئة العامة لحماية الثروة البحرية
والبيئة والحياة الفطرية
الإدارة العامة لحماية البيئة والحياة الفطرية
قسم التراخيص البيئية

EL/24/11/ 119 / SS-BM
29th Nov. 2011

Emily Morton
Environmental Scientist
Jennings O'Donovan **Fax:17587014**

Subject: Diyar Al Muharraq– phase 1 –Top Activities

Dear Morton,

This is with reference to letter no. 10001/219/EM dated 12th October 2011 regarding Diyar Al Muharraq Development – phase 1, After reviewing the relevant EA1 Environmental Assessment Screening Form the followings were concluded:

1. This type of projects require to have an Environmental Management Plan as per the attached EIA-12 Construction Environmental Management Plan (CEMP) Guidelines.
2. All the Utilities and major services and activities such as the proposed District Cooling Plant, Sewage Treatment Plant, or any future expected requirements for Fuelling Stations, Power Generation, Desalination Plants ... etc. are not covered by this application, and each of such requires to pass through Environmental Impact Assessment process separately.
3. Bridges and roads network should be in accordance to the layout originally permitted for the marine land reclamation phases and should adhere to that permission conditions.
4. The proposed Master Plan must comply with the Kingdom of Bahrain regulations and should consider all the requirements and conditions of related governmental bodies. Work done in this regard including any consultation with the concerned bodies must be clarified and included within or attached to the required CEMP.

Thank you for your kind cooperation.

Best regards,

Suhad Hussain Al Shehabi
Head of Environmental Licensing Section

JENNINGS O'DONOVAN
53 Jawhara Plaza, Road 2831, Seef
Date 29/11/11
Attention | Date | Action
DK
RG
PJH
PHer 29/11
EMV 29/11
File
RECORD No. ١٨٢٣٣ JOB No. 10001

مجمع البحرين – مملكة البحرين – تليفون: ٦٥٤/٣٨٦٦١٤ ١٧ (٩٧٣+) – فاكس: ٣٨٦٥٥٦ ١٧ (٩٧٣+)
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2030 البحرين BAHRAIN

EA - 1

إستمارة بيانات لتقويم الأثر البيني لمشاريع البنية الأساسية

Data Form for Environmental Screening of Infrastructure Projects

Type of Project: Primary Infrastructure and Development

(1) Project Name: Diyar Al Muharraq Development – Phase 1

(2) Project Location and Coordinates

The Diyar al Muharraq (DAM) Phase 1 site is an area of land reclamation located approximately 1000 metres (m) offshore from the northern coast of Muharraq Island, Kingdom of Bahrain, with approximate dimensions of 3 km (East / West) by 4 km (North / South) with an area of approximately 1,078 hectares (ha), as demonstrated in **Figure 1, Appendix A**.

A Phase 2 site is also planned (see **Section 6**) of similar size, located immediately adjacent to the North Western boundary of the Phase 1 site. The proposed Phase 2 site footprint is illustrated in **Figure 2, Appendix B**, the Concept Master Plan.

Currently, 82 % of the reclamation works required for Phase 1 have been completed. The proposed Primary Infrastructure of this land area is the focus of this EA-1 Data Form.

The DAM Phase 1 plot is situated approximately 1.6 km and 1.5 km north of the coastal villages of Al Dair and Samaheej at their closest points respectively, and 2 km North West of the village of Galali situated on the north eastern corner of the Muharraq coastline. The DAM development is also located 1.2 km North-North West of the reclaimed Amwaj Islands.

The boundary coordinates of the development and the coordinates for the access causeway are provided in **Table 1** below and illustrated in **Figure 1**, **Appendix A**.

Table 1 Boundary Coordinates of Diyar al Muharraq

Figure 1 Location Reference	Easting	Northing
A	465045.707	2912596.206
B	462885.153	2909231.713
C	466307.985	2911785.864
D	464147.900	2908421.079
E	463783.429	29134063.548
F	461623.171	2910041.875
G (Access Causeway Junction)	463915.960	2907630.170

Access Causeway Coordinate 'G' is the location of the junction between the mainland and the Diyar Al Muharraq access causeway (refer to **Section 3** below - Brief Description; Water Ways, Roads and Access).

(3) Brief Description

The Development

The developer's Master Plan for Phase 1 comprises of 7 islands, split into 21 zones, each differing in character through planned variation in buildings and landscaping, linked by open and public space. The Concept Master Plan is provided as **Figure 2, Appendix B.**

The plot is to provide predominantly residential mixed use, high density real estate development, with the remainder intended to provide public services primarily for the residential community; divided between retail, leisure, commercial, recreation and other uses (including utilities). The target residential population is currently estimated as 100,000 while the non-residential population is projected to be approximately 45,000.

The Client intends to provide the primary infrastructure, to sub-divide the land and to sell plots to third party developers. Please refer to **Table 2** for an outline of the development statistics.

Table 2 Proposed Land Use

Land Use		Unit (sqm /No.)	Percentage Cover (%)
Total Site Boundary Area		10,782,114	**100.0**
Infrastructure area		3,984,340	36.95
Built Property (Gross Floor Area)	**Total GFA**	7,808,668	72.42
	GFA Residential	5,073,364	47.05
	GFA Commercial	2,291,038	21.23
	GFA Other	444,266	4.12
Saleable Area	**Total Saleable Area**	6,797,774	63.05
	Saleable Residential	5,070,149	47.02
	Saleable Commercial	1,568,933	14.55
	Saleable Other	158,692	1.472
	Infrastructure Area	3,984,340	36.95
GFA by Type (No.)	Individual House	2,815,288	26.11
	Townhouses	344,343	3.19
	Apartment Towers	1,854,178	17.20
	Worker/Staff Housing	59,555	0.55
	Hotel	574,172	5.33
	Office	573,951	5.32
	Retail	148,224	1.37
	Commercial	240,529	2.23
	Mix Use	667,852	6.19
	Service & Logistics	86,309	0.80
	Misc. Use	444,266	4.12
	Service & Logistics	573,951	5.32
	Misc. Use	148,224	1.37

The Third Party Development will include leisure and retail facilities (including the Dragon shopping mall), community facilities (providing a school, healthcare centre, mosque and petrol station*), public spaces (marina front parks including the Parcel Park, Entry Park and Seefia Park, landscaped open spaces, promenades, walkways and cycle paths, playgrounds and beaches) and water ways (canals).

10001 – DIYAR AL MUHARRAQ –PRIMARY INFRASTRUCTURE

(*) The EIA for those utilities and facilities marked with an asterisk will be made and considered by Third Party Developers of the designated plots and are not considered directly within this EIA application.

Build out of the plot will be will be phased according to demand, initially beginning with the South East corner adjacent to the access corridor, extending North and Eastward as the development progresses.

Water Ways, Roads and Access

A network of waterways run throughout the DAM Phase 1 Plot, with a total of 15 % of the land area of the site has been designated for water related functions, canals and marine environments both within and surrounding the development. The canal network comprises of a main central canal crossing the site in an East – West direction with a narrower waterway cutting across the northern quarter of the development alongside 4 increasingly narrow canals running North - South through these Northerly sections, separating the land mass into 7 islands.

7 road bridges spanning the network of canals and pedestrian bridges are currently proposed for the site.

Currently, access to DAM consists of a causeway linking the South East corner of the site to the existing Dry-dock Highway.

The Master Plan indicates that access to DAM will be via three (3) primary roadway connections / causeways linking the site to the Muharraq Ring Road on Muharraq Island. The projected requirements indicate that up to 20 lanes will be required to serve traffic volumes when Phase 1 is completed to full build out.

The proposed road network consists of Arterial and Collector roads, primarily consisting of an arterial ring road "spine" carriageway, horizontal "rib" roads, a Central Boulevard and vertical bridge profiles provided for crossings across the loop road.

The primary arterial ring road ("spine") within the plot is proposed as a dual 4 lane carriageway (South – East and East locations; South – West location), and a dual 3 lane carriageway (North – East and West locations). It is anticipated that this highway will be built out sequentially, most likely as a dual single lane carriageway initially, expanded to dual two lane, then finally to a dual four lane as the traffic volumes increase and reach capacity.

The arterial horizontal "rib" roadways are proposed as a dual 3 lane carriageway while all other remaining "rib" roads and those in the Northern section of the central boulevard are Collector Roadways of dual 2 lane carriageway. The remainder of the road network, extending off the arterial "spine" and "rib" roads providing access to all remaining regions of the Plot are to be mainly single carriageways.

A Public Transport Strategy is currently being devised for *Diyar al Muharraq*, including central bus routes and a possibility navigable waterways providing access to the development along the currently unfinished *Muharraq* ring road.

(4) Total Area

The total area of Phase 1 of the DAM Development, is approximately 1000 Ha, or, 10,000,000 m^2, including 7 reclaimed islands.

(5) Proposed Starting Date

Commencement (of build-out of primary infrastructure): JUNE 2012
Completion: TBA

(6) Future Development / Expansion Proposed

A staged build out is proposed for the overall development. The time frame for the build out of Phase 1 is likely to extend over at least 15 years, whilst completion of Phase 2 will be reached at a later date. This EA-1 form is concerned with the Primary Infrastructure of Phase 1 of the *Diyar al Muharraq* development. The possibility of combining / sharing services with the Phase 1 plot where costs and environmental impacts could be reduced will be taken into consideration. Phase 2 Primary Infrastructure works will be subject of a separate EIA.

(7) Utilities Requirements

The proposed Combined Utility Layout Plan is illustrated in **Figure 3, Appendix C**.

The Developer intends to supply the necessary utilities through a mixture of Government supplies, supplemented by internal private infrastructure. Initial meetings and discussions have been held between the Developer and the Ministry of Works' Electricity and Water Authority (EWA) Planning and Studies Directorate (PSD), and the Sanitary, Operation and Maintenance Directorate to discuss the requirements and provision of services to Diyar al Muharraq.

The proposed utilities infrastructure will comprise the following components:

Water

The total daily consumption suggested to EWA will be used to determine the water storage requirements of the development. The total Preliminary Water Demand for Stage 1 of the DAM development has been calculated as 43.8 Ml / day. The Water Demand Value (litres/capita/day) of 350 lcpd was used to estimate water demand for residential areas and 300 lcpd for those residing in apartments. The water demand for commercial land uses is estimated at 100 lcpd for retail outlets, 80 lcpd for offices and businesses and 350 lcpd for hotels, while the water demand for community plots is expected to be 80 lcpd for schools and 60 lcpd for mosques and other public centers.

10001 – DIYAR AL MUHARRAQ –PRIMARY INFRASTRUCTURE

The following associated networks are to be included:

- 1 Waste Water Treatment Plant (Sewage Treatment Plant – STP)*;
- 1 District Cooling Plant (DCP)*;
- 1 Underground Storage Tank for Treated Sewage Effluent (TSE);
- Water Transmission and Bulk Water Facilities (Potable Water);
- Bulk Water Storage Facilities – including a Water Transfer Station (Ground Storage Tanks and Transmission Pumping Stations) and 2 Elevated Storage Reservoirs;
- Transmission network supplying DAM from the water supply source to the South East corner of the site boundary and any required pumping stations;
- Foul water drainage;
- Surface and storm water drainage;
- Irrigation/Treated Sewage Effluent (TSE);
- Fire protection (proposed to utilise the potable water network);
- All pipe work, pipe work ancillaries and fittings; and
- Associated mechanical and electrical plant and equipment.

Negotiations between EWA PSD and *Diyar al Muharraq* are currently ongoing regarding the interfaces between Government supplied and Client supplied infrastructure, an extract from the draft Memorandum of Understanding (MoU), currently awaiting signature by EWA which provides the provisional demand figures and supply figures, is presented in **Appendix E** alongside a letter from the Ministry acknowledging the requirement of the electricity and water networks for DAM Phase 1.

Electrical Transmission Networks

The total estimated Power Demand Load for Stage 1 of the DAM development is 1,210 MVA (to be reviewed).

Provision of the following infrastructure:

- Incoming 220 kV transmission cables form the National Grid ;
- 2 No Onsite Bulk Supply Points, transforming the 220 kV supply down to 66 kV ;
- 14 No Primary Substations, transforming the 66 kV supply down to 11 kV including the outgoing 11 kV circuit breakers;
- 66 kV cables from BSPs to the Primary Sub-stations (66 kV);
- 11 kV feeder cables from circuit breakers on the outlet from the Primary Sub-stations;
- 11 kV sub-stations;
- All associated substructure, superstructure and cable networks; and
- Power and street lighting networks.

Fuel

Not applicable.

Fuelling stations (both for land vehicles and marine craft) will be provided by Third Party Developers. Each will be responsible for the completion of the necessary environmental studies, commencing with the submission of EA-3 Data Forms for Environmental Screening of Petrol Filling Station Projects, in due course.

Sewerage

The sewage generation of Phase 1 of the DAM development is expected to be 32,850 m³/day. Foul sewage volumes have been assessed at 75 % of the Preliminary Water Demand of the DAM development which were derived from development parameters such as land use, population and Gross Floor Area, and assumptions considered reasonable by the Electricity and Water Authority.

Others

- Information, Communication and Telecommunications (ICT) network;
- Marina pontoons and fuelling station*.

This EA-1 Data form is concerned with the Primary Infrastructure required for the Diyar al Muharraq Development (Phase 1), excluding those utilities for consideration within a separate EA-2 Data Form for Environmental Screening of Industrial Projects; including the proposed STP and DCP. The requirements for the STP and DCP are currently under evaluation and will be refined as part of the design process, hence they will be dealt with separately. At this stage, it is possible that an extension to the proposed Deep Tunnel Sewer at Muharraq will be brought close to the DAM site, which would eliminate the long term need for an STP.

(8) The Factors which Determined the Project Location

The Governorate of Muharraq Island is the second largest in Bahrain, connected to the mainland by a causeway and two bridges, and is experiencing significant expansion in terms of population and development. As Muharraq is experiencing increased employment, investment opportunities and growth, the DAM site is ideally and conveniently located to reduce the burden of the associated traffic load on the broader road network and as a residential and community development, providing a varied range of housing and commercial and retail amenities catering to all social spectrums.

Numerous reclamation projects have been completed, are under construction and have been proposed adjacent to the DAM site. The surrounding major existing and proposed developments include the following; Amwaj Islands, Dilmunia Health Island; Investment Gateway Bahrain, The Seafront Harbour, expansion of West Hidd / Arad and West Busiteen and plans for major expansion of Bahrain International Airport immediately South-West of the DAM Phase 1 site.

The Diyar al Muharraq site is within a designated area allocated within the Ministry of Works' and the Government's National Planning Development Strategy (Bahrain, The National Plan, 2030; 2007), demonstrated in **Figure 4**, **Appendix D**, as an area of potential future development, proposed to contain residential developments (high, medium and low density) alongside some open areas (including green areas, parks and beaches), with some land allocated for utilities and public services and mixed use developments.

(9) Preliminary Studies Carried Out

Scott Wilson, Bahrain, conducted the EIAs for the dredging and reclamation activities for DAM. Environmental marine baseline surveys were undertaken for both the borrow areas and the DAM site alongside a water level assessment of the study area; hydrodynamic studies

10001 – DIYAR AL MUHARRAQ –PRIMARY INFRASTRUCTURE

including flow and flushing modelling works alongside marine surveys, oceanographic and ground investigations. An Environmental Management and a Compensation plan were also produced with environmental monitoring also conducted by Scott Wilson.

The list below provides a inventory of the EIA documentation produced to date for the DAM development:

- Environmental Statement for the Reclamation Phase, Scott Wilson, 2006
- DAM Marine Ecological Survey, Scott Wilson, 2006
- Baseline Marine Ecological Surveys for Borrow areas 1B and 2C, and 4 and 2 A, Scott Wilson, 2006;
- DAM, Benthic Macrofaunal Survey, Scott Wilson, 2006
- DAM, Dredging Dispersion Study, Scott Wilson, 2006.
- DAM, Hydrodynamics Report, Scott Wilson, 2006
- DAM, Marine Survey, Oceanography and Ground Investigation, Oceanographic Report, Scott Wilson, 2006.
- DAM, Environmental Management Plan, Scott Wilson, 2006
- Final Compensation Plan for Stage 1, Scott Wilson, 2007
- EER for Stage 2 Borrow Areas 2B, 3A, 3B & 4B and associated works, Scot Wilson, 2008
- Project, Marine Works, Option 8 Hydrodynamic Modelling Report, Scot Wilson, 2008
- Monthly TSS Monitoring Reports for the Reclamation Phase, Scott Wilson, 2008

Jennings O'Donovan are currently undertaking a Traffic Impact Assessment for the proposed development.

(10) Emissions to the Environment

It should be noted that, as discussed in **Section (7)**, the utilities requiring Industrial Processes are to be considered within a separate EA-2 Data Form.

(a) Emissions to the Air

The primary sources of emissions to the air during construction will be from, and are likely to be limited to:

- Primarily particulates in the form of dust originating from physical construction activities; alongside
- Vehicles, engines and plant.

During the operational phase of DAM Phase 1, emissions to the air may include those generated by traffic, light industry and operation of the STP (to be addressed within a separate EA-2 form when such information becomes available). The values of such emissions cannot be quantified at this stage, however, emissions modelling will be undertaken following the production of a revised TIA and according to finalised sewerage treatment processes which are currently unknown.

Environmental monitoring will be undertaken during the construction and operation in order to ensure adherence to the Air Quality Standards of the Kingdom of Bahrain's i.e. those identified within:

- Ministerial Order No. 10 of 1999 with Respect to Environmental Standards (Air and Water); and
- Ministerial Order No. 8 of 2002 with Respect to Standards of Pollutants and Emissions of Vehicles of their Exhaust Pipes and Inspection Thereof lists the 'Permitted Levels of Gaseous Pollutants Emitted by Exhaust Pipes of Petrol Powered Vehicles'.

Appropriate mitigation measures will be devised within the Environmental Management Plan (e.g. use of water bowsers and installation of catalytic converters).

Table 4 identifies the likely emissions to the air during the construction and operational phases of Diyar al Muharraq.

Table 4 Construction and Operation

Substance	Avg release rate mg/sec	Avg release conc. mg/m³	Max release conc. mg/m³	Stack height m	Stack diameter m	Gas exit temp °C	Gas exit velocity m/s	Water vapour velocity %
Particulates	u	u	See below*	n/a	n/a	n/a	n/a	n/a
	Construction Sources • Windblown dust from construction activities; • Windblown dust from stockpiles; • Windblown dust from heavy vehicles e.g. trucks transporting materials including rocks and sand to the site; and • Emissions of all construction vehicles and plant. **Operation** • Exhaust emissions from vehicle traffic (automobiles and boats); • Some windblown dust from heavy goods vehicles. * PM10 emissions are not to exceed 340 µg/m3 per hour							
CO	u	u	See below*	n/a	n/a	n/a	n/a	n/a
	• Contained in diesel engines emissions of construction vehicles and plant, particularly if engines are running inefficiently and exhaust emissions during operation of the development; and • Small quantities associated with exhaust emissions anticipated during the operation of the development. * CO emissions are not to exceed 45000 ppm (4.5 %)							
SO_2	u	u	See below*	n/a	n/a	n/a	n/a	n/a
	• Contributions from diesel engines emissions of construction vehicles and heavy plant; • Small amounts associated with exhaust emissions during operation of the development. *SO_2 emissions are not to exceed 350 µg/m³ per hour							
NO_2	u	u	See below*	n/a	n/a	n/a	n/a	n/a
	• Small quantities from engine emissions from vehicles associated with both the construction and operation of the site * NO_2 emissions are not to exceed 50 µg/m³ per hour							
H_2S	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
HCl	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Cl_2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Heavy metals	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Dioxins / Furans		n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hydrocarbons and smoke	u	u	See below*	n/a	n/a	n/a	n/a	n/a
	• Quantities and contributions associated with diesel engines emissions of vehicles and plan (particularly if engines are running inefficiently) and exhaust emissions during construction and operation of the development							
CO_2	• Quantities from engine emissions from vehicles associated with both the construction and operation of the site							

n/a –not applicable or none anticipated
u - unknown

(b) Liquid Effluent Properties - Emissions to Water

The potential primary sources of emissions to the water will be from, and limited to:

- Possible accidental spillages of oils and fuels from construction machinery and heavy plant;
- Surface and storm water drainage (pipes to be fitted with hydrocarbon interceptors – Oil Interceptor Tanks to mitigate); and
- Hydrocarbons associated with the Marine traffic.

Table 5 identifies the likely emissions to water during the construction and operational phases of DAM Phase 1.

These emissions will adhere to the Kingdom of Bahrain's Water Quality Standards for Industrial Effluent, i.e.:

- Ministerial Order No. 2 of 2001 and Ministerial Order No. 10 of 1999, with respect to Environmental Standards for Air and Water (which applies to effluents at the source before release into receiving water).

Table 5 Construction and Operation

	Units	Construction	Operation
Flow Rate	m^3/day	Storm water run-off ~ 77mm/year	
Floating Particles	m/m^2	n/a	n/a
pH	pH	n/a	n/a
Temperature	°C	n/a	n/a
Total Suspended Solids	mg/L	n/a	n/a
Turbidity (NTU)	mg/L	n/a	n/a
Ammonical Nitrogen (N)	mg/L	n/a	n/a
Dissolved oxygen	mg/L	n/a	n/a
Sulfide as (H2S)	mg/L	n/a	n/a
Chlorine Residual	mg/L	n/a	n/a
Cyanide (CN-)	mg/L	n/a	n/a
Chloride (Cl-)	mg/L	n/a	n/a
Nitrate (NO3-) -N-	mg/L	n/a	n/a
Nitrite (NO2-) -N-	mg/L	n/a	n/a
Phosphorous - Total	mg/L	n/a	n/a
M.B.A.S	mg/L	n/a	n/a
Fluoride (F-)	mg/L	n/a	n/a
Biological Oxygen Demand	mg/L	n/a	n/a
Chemical Oxygen Demand	mg/L	n/a	n/a
Total Kjeldahl Nitrogen	mg/L	n/a	n/a
Hydrocarbons (FLUOR or IR)	mg/L	n/a	n/a (storm water interceptors)
Oil & Grease (Hexane ex.)	mg/L	n/a	n/a (storm water interceptors)
Phenols	mg/L	n/a	n/a
Aluminium	mg/L	n/a	n/a
Arsenic	mg/L	n/a	n/a
Cadmium	mg/L	n/a	n/a
Chromium Total	mg/L	n/a	n/a
Copper	mg/L	n/a	n/a
Iron	mg/L	n/a	n/a

10001 – DIYAR AL MUHARRAQ –PRIMARY INFRASTRUCTURE

	Units	Construction	Operation
Lead	mg/L	n/a	n/a
Mercury	mg/L	n/a	n/a
Nickel	mg/L	n/a	n/a
Selenium	mg/L	n/a	n/a
Silver	mg/L	n/a	n/a
Zinc	mg/L	n/a	n/a
Total Coliforms	No/100	n/a	n/a
Others	mg/L	n/a	n/a

(12) Solid Wastes

A conventional waste collection system will be employed within the development, consisting of a series of bins of various sizes which will be emptied on a daily basis by a waste collection contractor.

Construction

It is anticipated that construction related wastes will be stored appropriately, collected and transported from the site to existing waste management and landfill facilities within the Kingdom of Bahrain. No waste will be disposed of into the marine environment.

Details regarding the anticipated waste produced during the construction phase of the Primary infrastructure development of DAM can be seen in **Table 6.**

Table 6 Anticipated Infrastructure Construction Waste

Description; Source of Wastes	Composition	Annual Quantity (T/y)	Disposal method
Inert waste & Excavated spoil materials	Excavated materials; construction waste, dirt, sand, rocks and debris	Currently unknown	Waste collection and removal by RCV from storage areas, stockpiles and bins
Building materials	Such as cement blocks and concrete		
Recyclable materials	paper, glass, bottles, cans, metals, plastics etc.		
Composite wastes	Fabrics and plastics		
Biodegradable wastes	Food and kitchen waste, green waste and paper etc. Created by those present during the construction period		
Sanitary waste	Sanitary waste from any temporary facilities which may be present during the construction period		Tankering & removal from site

Operation

It is currently anticipated that waste produced during the operation of the development will be collected and transported from the site to existing waste management or landfill facilities within the Kingdom of Bahrain and disposed of in accordance with local regulations.

Details regarding the anticipated operational waste and a summary of the breakdown of the forecast of the anticipated waste may be found in **Table 7**.

Table 7 Anticipated Operational Waste

Source of Wastes	Composition	Annual Quantity (T/y)	Disposal method
Commercial waste / light Industrial Services	All wastes from premises used wholly or mainly for the purposes of trade or business including sport, recreation, education and entertainment.	Currently unknown Approximately ~ 70 - 100 T/day	• Removal by RCVs (Refuse Collection Vehicles)
Residential Domestic waste	All municipal solid wastes; including: • *Biodegradable waste*: food, kitchen waste, green waste and paper • *Recyclable material*: paper, glass, bottles, cans, metals, plastics etc. • *Composite wastes*: waste clothing, tetra-packs, plastics • *Domestic hazardous waste*: toxic wastes, medications, paints, chemicals, light bulbs, spray cans, fertilizers and pesticides, batteries and shoe polish	Currently unknown Approximately ~120 - 160 T/day & 51,100 T/y during 100 % occupancy	• Removal by RCVs (Refuse Collection Vehicles)
Sanitary waste	*Sewage / waste water*	*EA-2 form*	

The developer is committed to implementing a Sustainability Strategy, which will consider resource re-use and waste management, wherever desirable and practical, and recycling facilities will be available throughout the development. Treated sewage effluent, for example, will be used for landscape irrigation and treated sewage sludge used as a fertilizer.

Separate storage facilities could be provided for recyclables and separate arrangements made for the collection of recyclables by a contractor.

10001 – DIYAR AL MUHARRAQ –PRIMARY INFRASTRUCTURE

(13) Project Owner

Name:	Diyar al Muharraq WLL
Address:	P.O. Box 75777, Manama, Kingdom of Bahrain
Contact Person:	Mr. Aaref Hejres
Position:	C.E.O., Diyar Al Muharraq WLL
Telephone:	77155555
Facsimile:	77055555

Project Managers

Name:	Hisham Abdulrahman Jaffer (HAJ)
Address:	P.O. Box 10507, Kingdom of Bahrain
Contact Person:	John Bateson
Position:	Project Director
Telephone:	17821222
Facsimile:	17822293
E-mail:	john.bateson@hajgulf.com.bh

(14) Applicant - Environmental Consultants

Name:	Jennings O' Donovan & Partners
Address:	Suite 53, Building No 2373, Road 2831, Block 428 Seef P.O. Box 76064, Manama, Kingdom of Bahrain
Contact Person:	Emily Morton
Position:	Environmental Scientist
Signature:	
Telephone:	17587574
Facsimile:	17587014
E-mail:	emilym@jodbahrain.com

Ref: DAM/CEO/L/0103/2015
Date: 15th April 2015

RECEIVED BY URS BAHRAIN 16 APR 2015

Copy to	Action by:	Reference
C/MANAGER		
MARINE		
INFRA		
TRANSPORT		
ACCTS		
HR		
IT		
SITE		

Aecom
Nr. Salam Bank,
Bhd la chocola,
Al Safar bldg, 2nd floor, Seef District
P.O.Box 640
Kingdom of Bahrain

Attn: **Craig Thackray**
Country Manager - Bahrain

Letter of Award governing Services in relation to Primary Infrastructure Design and Supervision Services at Diyar Al Muharraq

Dear Sirs,

1. Letter of Award

We refer to your tender submission dated 18th February 2015 and your subsequent response to Diyar's Tender Addendum 1 dated 16th March 2015 which together comprise (the **Tender**) relating to the provision of Design & Supervision Services for Primary Infrastructure Works (the **Services**) in relation to Diyar Al Muharraq (the **Project**). This letter (the **Letter**) shall be effective only upon you signing and returning to us the attached duplicate copy.

1.1 Except where stated otherwise all words and expressions used in this Letter shall have the same meanings as in the Appointment referred to below.

1.2 The Client's acceptance of the Tender in respect of the Services is subject to the following conditions:

a Agreement of all outstanding matters required to finalise the documents comprising the Consultant Appointment (referred to below) as listed in Appendix 3 (the **Outstanding Matters**);

b Execution of the Consultant Appointment in respect of the Services.

1.3 For the avoidance of doubt, this Letter does not constitute unconditional acceptance of the Tender in respect of the Services. It is conditional upon execution of the completed Consultant Appointment for the Services. Until such time as the Consultant Appointment is entered into, neither the Client nor the Consultant shall be bound in any way beyond the scope of this Letter.

1.4 Neither this Letter or any services carried out pursuant to the Letter (the **Initial Services**) or Services carried out by the Consultant, or payment made to the Consultant under this Letter shall be or shall be deemed to be a waiver by the Client of the requirement for the Consultant to enter into the Consultant Appointment.

ديار المحرق ذ.م.م، ص.ب ٧٥٧٧٧، المنامة، مملكة البحرين، هاتف ٧٧١٥٥٥٥٥ ٩٧٣+، فاكس ٧٧٠٥٥٥٥٥ ٩٧٣+
Diyar Al Muharraq W.L.L. P.O. Box 75777, Manama, Kingdom of Bahrain, Tel +973 77155555 Fax +973 77055555
www.diyar.bh

2 **Authority to proceed**

2.1 The Client confirms, subject to the terms of this Letter the conditional acceptance of the Tender in respect of the Services.

2.1 Any other activities undertaken by the Consultant which are not authorised by this Letter shall be unauthorised and entirely at the Consultant's risk.

3 **The Appointment**

3.1 The Initial Services shall be undertaken by the Consultant subject to and in accordance with the following documents, which together with all completed Outstanding Matters, will comprise the appointment in respect of the Services (the **Consultant Appointment**):

a This Letter;

b. The Request for Proposal and subsequent clarifications to tenderers.

c. The Consultant's submission dated 16th February 2015 and your subsequent response to Diyar's Tender Addendum 1 dated 16th March 2015.

4 **Appointment to supersede Letter**

4.1 In all matters the performance of the Initial Services shall be governed by Appointment as if they formed part of this Letter and as if for those purposes the term "the Services" in the Appointment was replaced by the term "the Initial Services" and in the event of any discrepancy this Letter shall take precedence over the Appointment until the execution of the Consultant Appointment in respect of the Services.

4.2 The Consultant shall execute and return to the Client the completed Consultant Appointment incorporating all of the finalised documents (as determined by the Client acting reasonably) comprising the Consultant Appointment within fourteen (14) days of the Client forwarding the same to the Consultant and any failure to do so shall be in breach of the terms of this Letter.

4.3 As from the date of execution of the Consultant Appointment, the terms of the Consultant Appointment shall supersede and replace this Letter as regards the Services. In that event, any Initial Services carried out by the Consultant pursuant to this Letter shall be deemed to have been carried out under the Consultant Appointment and any payments made by the Client pursuant to this Letter shall be deducted from the amount of the first interim payment due to the Consultant under the Consultant Appointment.

5 **Payment**

5.1 In consideration of the Consultant properly performing the Initial Services in accordance with the terms of this Letter, the Client shall pay to the Consultant the amounts set out in Appendix 2 (the **Prices**) in instalments and according to procedures equivalent to those set out in the Appointment. The Consultant shall not be entitled to any further payment in respect of the Initial Services other than in accordance with Appendix 2.

6 **General Terms and Conditions**

6.1 Within ten (10) days of the date of this Letter, the Consultant shall obtain and provide to the Client (more particularly described in clause 12.5 of the Appointment) the Direct Agreement(s) (more particularly described in clause 15.3 of the Appointment).

6.2 The Consultant shall treat this Letter, the Appointment and any other documents and information provided by the Client or the Client's representatives pursuant to this Letter, as private and confidential and, except where strictly necessary for the purposes of completing the Outstanding Matters, or as required by applicable Laws, shall not disclose the same to any third party without the prior consent of the Client.

6.3 The Consultant shall obtain the Client's written consent before entering into any Sub-Consultant appointments in connection with the Initial Services, which shall not be unreasonably delayed or withheld.

6.4 The Consultant shall ensure that any Sub-Consultant appointments and orders entered into by the Consultant contain a provision allowing the benefit of the Sub-Consultant appointments or order to be assigned to the Client (or to any replacement Consultant appointed by the Client) in the event that the Client terminates the appointment contained in this Letter for any reason.

6.5 The Consultant shall keep the Client fully and promptly informed of the progress of all Initial Services carried out by the Consultant pursuant to this Letter and shall report to the Client no less than fortnightly with supporting documentary evidence of all approved costs and commitments which the Consultant incurs pursuant to this Letter.

6.6 Within seven (7) days from the date of this Letter and as a pre-condition of payment pursuant to this Letter the Consultant shall provide the Client with certificates of verification of insurance cover confirming that all insurances which the Consultant is required to maintain under the Appointment are in place upon the required terms and at the required levels.

7 **Termination**

7.1 At the absolute discretion of the Client and with the Consultant having no right to challenge, the Client shall be entitled to terminate the Consultant's appointment under this Letter by not less than 1 (1) days' notice in writing at any time in which event:

a the Client shall pay the Consultant all Prices and other approved costs properly incurred in accordance with the terms of this Letter;

b the Consultant shall deliver to the Client all the documents and materials prepared by it or on its behalf in relation to the Initial Services in hard and soft copy;

c the Consultant shall within seven (7) days following receipt of notice from the Client assign to the Client or its nominee the benefit of any or all Sub-Consultant appointments and orders entered into by the Consultant with Sub-Consultants and suppliers authorised pursuant to this Letter;

d the Consultant shall immediately vacate the site of the Project; and

e the Consultant shall immediately cease all Initial Services with as little disruption as possible.

7.2 In the event of termination pursuant to paragraph 7 of this Letter, the Client shall not under any circumstances be liable to the Consultant for any loss of profit, loss of contracts or other costs, losses and/or expenses arising out of or in connection with any such termination or from failure to enter into the Contract.

8 **Governing Law**

8.1 This Letter shall be construed in accordance with the Laws of the Kingdom of Bahrain and any dispute or difference arising under or in connection with it shall be resolved in accordance with the Appointment.

9 **Entire Agreement**

9.1 This Letter supersedes any previous instructions, correspondence or other discussions between the Client and the Consultant in relation to any Initial Services and the Services and represents the entire agreement between them in relation to its subject matter.

Please confirm your agreement to the contents of this Letter by signing and returning the attached copy.

Yours sincerely,

Dr. Maher Al Shaer
Chief Executive Officer

I ..CRAIG JOHN THACKRAY.. for and on behalf of AECOM Middle East Limited hereby confirm our agreement to the terms of the Letter of which this is a duplicate copy.

Signed: .....

Date: ..16/4/15..

Appendix 1 to the Letter of Award

Initial Services – Priorities

The following table sets out some of the key priorities for the Consultant to focus on during the initial handing over period of twenty eight (28) days. It does not vary in any way the Consultants scope of services under the Consultancy Agreement.

Item	Description of Services and Deliverables
1	The Consultant shall note that he is replacing the previous Primary Infrastructure Consultant and is required to review, validate and take ownership of the current design information prepared by others. The RFP sets out the probable process that will be followed in this regard. ***Provide a work-plan aimed at achieving an orderly handover of responsibilities from the previous Primary Infrastructure Consultant. Such work plan to be submitted to the Client within 3 days of the date of award and shall include an information request. In addition to this the following urgent work scope will be required during the orderly hand over from the Previous Primary infrastructure Consultant to the Consultant :*** • Immediately commence supervision services for Priority Area temporary infrastructure Package 1A1 - electrical service, potable water service, temporary septic tanks and temporary storm water disposal. • Immediately conclude the design for the partially designed Priority Area temporary infrastructure Package 1A2 – roads and telecoms. • Supervision of infrastructure services for Sarat Village. • Supervision of the installation of the Mosque 11kV cable. • Liase with SEPPD and commence design of temporary sewage connection to the project including terminal lifting station and connecting pipeline between the terminal lifting station and a connection to be made to the Samsung DGS system at the junction of Dry Dock and Arad Highways (approximately 5.5 kms. • Update the Concept Design for the permanent Primary Infrastructure serving Project Habitat social housing PPP, in particular road designs, loading checks and design of utilities pick up points, interfacing with Messrs Mott MacDonald whom are responsible for secondary infrastructure design and supervision. • Complete the Detailed Design and approvals for the permanent Primary Infrastructure serving Project Habitat social housing PPP as part of phase 1 work described in (3) below. • Master-planning approvals via RPDD.
2	During a kick-off workshop meet with the Clients team and become familiar with the current status of the project, each team members responsibility and the projects key priorities.
3	Immediately following receipt of this LoA the Consultant shall prioritise the completion of the detailed design for of phase 1 (of 9) attached such that it is completed within 4 months of the date of award. Co-ordinate with the wider project team to prepare a detailed programme for all parts and stages of the Services and linked to the construction procurement process. ***Convene and chair a programme workshop and deliver an indicative level 1 design procurement program. Such program to be submitted to the Client within 3 days of the workshop.***
4	Coordinate with the project team and Government and statutory authorities regarding the uplift of the planning permissions and wayleaves required to enable the project to achieve its key milestone dates. **Provide a status report and work plan for obtaining the requisite approvals by the key dates. Such report and work plan to be submitted to the Client within 7 days of the date of award.**
5	Support the Client and the Client's Project Manager to obtain the Letters of Commitment from each of the Authorities as soon as possible.
6	Provide an updated organisation chart and resourcing for the Consultants Team together with CV's. Convince Diyar's TIO that the Consultants proposed Authorities Liaison resource is suitably experienced for this key role or propose a replacement.
7	With conjoint input from the Clients Project Manager submit for client approval a template format for monthly reporting.
8	Preliminary Design Initial Assessment Summary Report

Appendix 2 to the Letter of Award

Payment

The Consultant shall progress the works in accordance with the programme and pricing schedule in accordance with this Letter of Award and Appendix 4, to a value not exceeding BD300,000/- to be offset against the total fee payable under the Agreement for Consultancy Services referred to in this Letter of Award.

The Consultant shall invoice the Client on a monthly basis.

Appendix 3 to the Letter of Award

Outstanding Appointment Details

Each of the following shall be finalised in accordance with the terms of this Letter.

1. Final form of Consultancy Agreement – Both parties acknowledge that the final form of agreement will be substantially the same as the agreement included in the RFP, with the exception of any subsequent agreement reached between the parties in advance of the date of the Letter of Award.

2. Cash flow – Agreement needs to be reached on the payment schedule.

3. Interested Parties and Direct Agreements – The Client shall provide the Consultant with a list of interested parties and the nature of the proposed relationship in advance of signing the Agreement for Consultancy Services. The Direct Agreements are likely to include such things as an assignment of intellectual property rights to the project design drawings and specifications to the MoH, assignment of defects liability obligations to the MoH, assignment of any collateral warranties to the MoH, direct agreements with funders etc.

4. Provide an updated organisation chart and resourcing for the Consultants Team together with CV's. Provide evidence to Diyar's TIO that the Consultants proposed Authorities Liaison Resource is suitably experienced for this key role or propose a replacement.

5. Other matters that may arise from time to time during the term of the LoA and in particular relating to the final form of Development Agreement entered into between the Client and the Ministry of Housing (or such nominee as the Ministry may direct).

6. Resourcing Plan – The final form of resourcing plan (& Organisation Chart) is to be agreed between the parties. Such agreement will record that the supervision element will be completed on a cost reimbursable basis and in that regard actual resourcing and staff costs will need to be agreed.

7. Sharia Compliant Insurance – AECOM will advise on the cost to obtain Sharia compliant insurance.

8. AECOM will provide Diyar with a copy of AECOM Middle East Limited financial statements for the last three years and Diyar will confirm whether they are satisfactory or whether an alternate security is required.

9. The Agreement for Consultancy Services will be amended to incorporate the express undertaking from AECOM attached to this Letter of Award as Appendix 4

B – Environmental, Health and Safety Audit Checklist

Appendix 4 to the Letter of Award

Letter of Comfort

AECOM

Our Ref: OPP-330328/AECOM/2014/CJT/002

Your Ref:

13th April 2015

Diyar Al Muharraq
6th Floor, West Tower, Bahrain World Trade Centre,
P.O.Box 75777
Manama,
Kingdom of Bahrain

For the Attention of Mr Paul Gill

Re: **Diyar Al Muharraq – Tender for the Design and Supervision of Primary Infrastructure – Consultancy services**

Dear Sir,

Further to our telephone discussion today to we would like to provide the following clarifications to our tender submission:

1. AECOM have performed a high level review of the JOD Authority Approval drawings that we collected last Wednesday. We note from our review the JOD design basis/intent and infrastructure routing based on the Client approved Masterplan.

2. In order to validate the JOD designs to date we would have to fully engage our staff and run the models and design calculations. However please see 3 and 4 below.

3. Once we have completed the review and identified any differences in outputs between JOD and AECOM the findings would be presented in the Preliminary Design Initial Assessment Summary report which is as per our programme 4 weeks following Contract Award and mobilization.

4. We confirm that as part of the AECOM Design any differences and deficiencies identified in the JOD design under Item 1 above would be corrected by AECOM. There will be no additional costs for correcting the JOD designs as required to complete detailed design.

5. We confirm that any comments on the design as received by the Authorities on the JOD design (Asset 12A, 12B and 22A) would be incorporated by AECOM as required during the Detailed design process. There will be no additional costs for incorporating any comments into the next level of design.

Should you have any other queries please contact the undersigned.

Yours faithfully,

For AECOM

Craig Thackray
Country Manager
email: craig.thackray@aecom.com

Environment, Health and Safety Audit Checklist

Project:	**Date:**
Auditor:	**Contractor HSE Rep:**

Ref.	Objective and Action	Yes	No	Required Actions
1	**Environmental Awareness And Training**			
1a	Has all staff attended HSE Induction Training?			
1b	Are Tool Box Talks being held regularly?			
1c	Is specialist training being undertaken where needed?			
1d	Has the Contractor allowed for the provision of extra PPE to visitors?			
2	**Air Quality**			
2a	Are site roads dampened down regularly to control dust suspension?			
2b	Are stockpiles located, as far as practicable, in sheltered locations?			
2c	Are stockpiles limited to a minimum practicable height with gentle slopes?			
2d	Are all dust generating materials transported to and from site covered by tarpaulin?			
2e	Is construction traffic dispersing mud and sediment onto public roads?			
2f	Are engines switched off when not in use?			
3	**Chemical and Hazardous Materials**			
3a	Are all materials stored in accordance with the MSDS?			
3b	Is appropriate PPE available to all staff?			
3c	Are MSDSs clearly displayed with its corresponding chemical?			
4	**Hydrology, Spoils and Groundwater**			
4a	Are liquid fuels, oils and chemicals stored in drip trays for containers less than 200L and in fully bunded storage areas for containers in excess of 200L?			
4b	Is a spill contingency plan in place?			
4c	Are spill kits available at each work site and do workers know how to use them?			
4d	Any presence of contaminated soil?			
4e	If any contaminated soil is present, is it being dug out and stored in skips?			
4f	Is a drip tray provided during refueling activities to avoid spillage and soil contamination?			
5	**Noise and Vibration**			
5a	Is all equipment and plant maintained in good working order?			
5b	Are all covers and hatches on equipment properly secured?			
5c	Is unnecessary revving of engines avoided?			
6	**Traffic and Access**			

Environment, Health and Safety Audit Checklist

6a	Have measures to reduce construction related traffic been put in place?			
6b	Are speed limits and warning signs being respected on site?			
6c	Have haulage routes been selected away from sensitive areas where possible?			
6d	Are all traffic diversions well signposted and maintained?			
6e	Are flag men used to control traffic entering and exiting construction sites from busy roads?			
6f	Are all pedestrian areas clearly and safely marked?			
7	**Waste Management Control Plan**			
7a	Has the Contractor assigned a staff member responsible for waste management?			
7b	Are wastes segregated according to type?			
7c	Are skips clearly labelled to assist segregation?			
7d	Are records kept of where waste is disposed of/quantities and types disposed of?			
7e	Sight accurate records for all waste where possible			
7f	Are hazardous wastes stored separately from non-hazardous wastes?			
7g	Are hazardous wastes disposed of in accordance with SCE requirements			
7h	Are all skips covered to avoid litter becoming air borne?			
7i	Are all toilets fitted with septic tanks to contain all waste water?			
7j	Are septic tanks checked regularly?			
7k	Is wastewater effluent being removed by a licensed contractor?			
8	**Water Quality**			
8a	Has a TSS Monitoring Plan been developed by Contractor?			
8b	Is monitoring being undertaken in accordance with SCE requirements?			
8c	Are all dewatering operations being monitored on a fortnightly basis?			
8d	Are all TSS results within SCE limits?			
8e	Are chemicals and fuels being stored away from the water's edge?			
9	**Occupational Health and Safety**			
9a	Where appropriate, have masks been provided to site workers?			
9b	Is complete protection from noise impact provided to workers?			
9c	Have first aid boxes been provided on-site close to workers and within reach?			
9d	Is PPE provided and appropriately used on			

C– Environmental Incident Report

Environment, Health and Safety Audit Checklist

AECOM

	site?			
9e	Has drinking water been provided within easy reach of workers?			
9f	Have ablution and washing facilities been provided?			
9g	Have canopies for shade to protect workers from environmental factors been provided?			
9h	Is adequate fall protection and PPE in place where persons or material could fall more than 2 meters?			
9i	Have all areas been provided with adequate lighting to ensure safe access and egress?			
9j	Have secure barriers been erected around pits/holes/excavations to avoid tips and falls?			
9k	Are temperature related working regulations being adhered to?			
10	**Contingency Plan**			
10a	Has a Spill Contingency Plan been prepared?			
10b	Are spill kits available?			
10c	Are members of the team trained in spillage clean up? Has a drill taken place?			
10d	Is a spill report prepared after the event?			
11	**Security Plan**			
11a	Is the work site clearly marked and fenced off?			
11b	Are security personnel provided?			
11c	Is signage posted on all approach roads to ensure awareness of general public?			
12	**Housekeeping**			
12a	Is a tidy site scheme being implemented at all times?			
12b	Are emergency accesses/exists clear of debris?			
12c	Is all construction material safely segregated and stored away from working areas?			

Environmental Incident Report

Incident Description: Date and Time of Incident: _____ Location on Site: _____ Personnel/Subcontractor involved: _____ Was there any impact with threat to human life and/or the environment? Y/N Was there any off-site impact with threat to human life and/or the environment? Y/N
Department Notified: _____ Date/Time: _____/_____ Person Contacted: _____ Notes:
Description of corrective action taken: Measures taken to prevent re-occurrence of the incident:
Report Forwarded to: _____ _____ _____
Report Completed by (name/title): _____ Signature: _____ Date: _____

D– Complaint Report Format

Complaint Log Format

Date of Complaint: _____

Time of Complaint: _____

Complaint Description:

Name of Personnel Notified: _____

Name of Complainant: _____

Address: _____

_____

_____

Contact Number: _____

Person Contacted: _____

Department: _____

Date/Time: _____/_____

Notes:

Description of corrective action taken in response to the complaint:

Measures taken to prevent re-occurrence of the incident:

Confirm Follow-Up Response to Complainant _____

Sign off that the complaint has been satisfactorily resolved and corrective actions taken.

Report Completed by (name/title): _____

Report Forwarded to:_____

Signature: _____ Date: _____

E – Waste Log Format

Waste Log

Description of Waste:			
Waste Category:	**Recyclable**	**Non-Hazardous**	**Hazardous**
Process from which Waste Originated:			
Chemical Composition:			
Safety Data Sheet provided (if hazardous):			
Storage of Waste/Containment on Site:			
Quantity to be Transferred (tons):			
Personnel Handling Waste on Site:			
Company & Personnel Transferring Waste:			
Date of Transfer:			
Details of Spills during Transfer (if any):			
Action taken to Contain/Clean up Spill:			

Personnel Managing Waste On-Site

Name: _____

Signature: _____

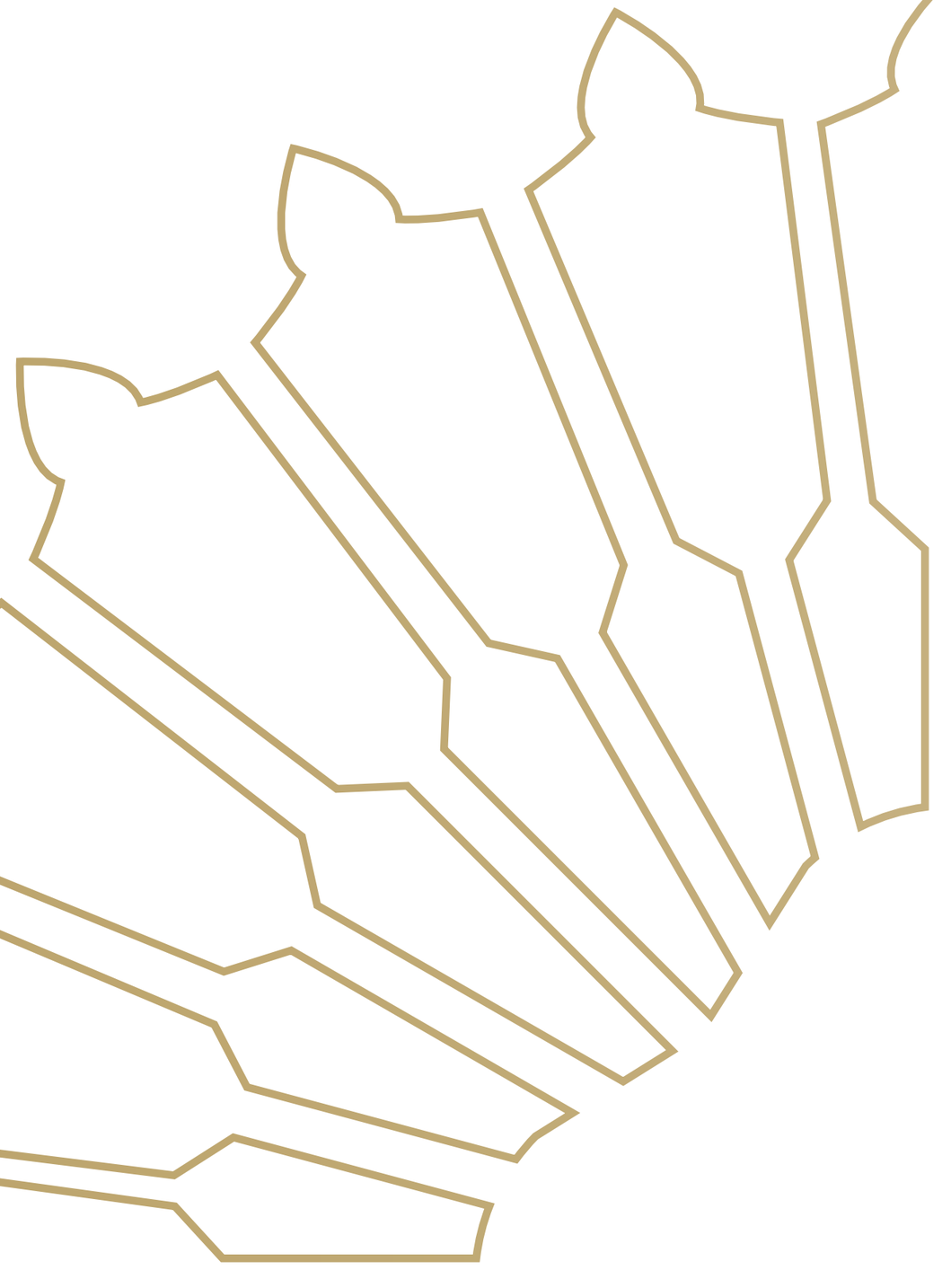
Date: _____

Personnel Receiving/Transferring Waste

Name: _____

Signature: _____

Date: _____



Diyar AL MUHARRAQ | Booklet 3

Construction Regulations

3.2 Construction Regulations

1 **Introduction**

The master developer, Diyar Al Muharraq (DAM) is selling plots / parcels of land to Third Party Developers (TPD) whereby the TPD agrees to develop the land in accordance with the Development Regulations and Guidelines (DRG).

The main objectives of DAM Construction Regulations, Booklet 3.2 of the DRG, are:

- To ensure that buildings are constructed in accordance with the approved designs and Requisite Consents.
- To ensure that construction and associated activities are controlled and coordinated so as to:
  - Minimise the impact on the residents and businesses of DAM.
  - Avoid any adverse impact on the construction activities of other projects or the infrastructure works.
- To protect the health and safety of the general public, and protect the environment.
- Facilitate construction around Diyar Al Muharraq.

A copy of these Construction Regulations can be found on the DAM website at www.diyar.bh. All DAM will attempt to keep this information current and complete; all such information should be verified independently before being used.

DAM reserves the right to change or modify this information at any time without notice.

2 **Responsibilities**

2.1 For the avoidance of doubt, it is the responsibility of the TPD, the TPD Consultant and TPD Contractor to comply with the laws of Bahrain, DAM DRG, and the requirements of all statutory bodies that may apply.

3 **TPD Consultant**

3.1 The TPD shall employ a Consultant to manage the TPD Contractor and administrates the building contract. The TIO shall communicate with the TPD's Consultant Only, unless it becomes necessary to do otherwise.

4 **Procuring a Contractor**

4.1 Only competent Contractors registered with the MOW shall be permitted to carry out works on the DAM Development.

4.2 Building Contract Terms shall include those stipulated in the Sale and Development Agreement; which are that in the contract:

4.2.1 Is in an internationally recognised standard form with such amendments as are reasonably required;

4.2.2 Includes a provision for the granting of a direct agreement to DAM on the written request of the TPD or DAM to the Contractor;

4.2.3 Includes step-in rights for DAM on written notice from DAM to the Contractor; and

4.3 The terms of the Building Contract shall include an obligation on the TPD's Contractor to comply with these Construction Regulations.

5 **Construction Programme**

5.1 The TPD Consultant shall issue, and obtain the TIO's approval on, a programme of the works which is in accordance with the timelines of the Sale and Development Agreement (if applicable).

5.2 The construction programme shall show, amongst the main activities of the project, the key approvals and inspection milestones to ensure clear coordination between the TIO and the TPD Consultant.

5.3 The TPD Consultant shall notify the TIO of changes to the programme as soon as practical after the TPD Consultant becomes aware thereof.

5.4 The TPD shall notify the TIO of changes of contacts of TPD Consultant and Contractor. TPD must complete and submit form 6 with all other required documents to the TIO.

6 **Setting out the site**

6.1 The TIO has established and maintains two surveying benchmarks on the site. The TPD/ TPD's surveyor shall contact the TIO for further information prior to setting out the site.

6.2 The Master Developer is responsible for demarcating the site. Site demarcation pegs shall be handed over to the TPD who shall then become responsible for maintaining them.

6.3 The TPD, his Consultants and Contractors may not disturb any pegs on the development without prior written permission from the TIO.

6.4 Once plot / parcel formation is completed, the TPD must submit a certificate from a certified surveyor to prove that level formation is according to road levels provided by TIO.

7 **Communication Protocols**

7.1 Any communications regarding the progress, safety, and compliance of construction work on site shall be between the TPD consultant and the TIO. This also includes conveying of violations and other notices, unless it becomes necessary to do otherwise.

8 **Commencement of the works**

8.1 The TPD's Contractor may not commence any construction work on site until the TPD's Consultant has obtained the TIO's approval to do so; this includes new construction, alterations, addition to existing building / villa, demolition, fencing, site formation, digging and other works. TPD Consultant must complete and submit form 3 with all other required documents to the TIO.

8.2 An introductory meeting between the TIO and the TPD's contractors is optional before commencing work on site in order to clarify tasks and responsibilities as per these Construction Regulations.

9 **Construction Work Schedule**

9.1 The TPD Contractor's is required to submit a Construction Management Plan which shall contain the following:

9.1.1 Programme, highlighting TIO required inspections

9.1.2 Manpower mobilisation plan

9.1.3 Highlight major traffic intensive works.

9.1.4 Laydown area

9.1.5 Temporary utilities plan

9.1.6 Construction traffic route within the Development

9.1.7 The Contractor's H&S plan

10 **Insurance of the Works**

10.1 The TPD will procure that at all times throughout the course of the construction the following insurances are kept in place in respect of the construction and (wherever commercially available on terms commensurate with conventional policies) with financially sound and reputable insurance companies:

10.1.1 Contractors All Risks to the full reinstatement cost;

10.1.2 Public Liability/Third Party Liability with a minimum level of cover of BD 1 million;

10.1.3 Professional Indemnity to a level of cover approved by the TIO;

10.1.4 Employers' Liability to a level of cover approved by the TIO.

10.2 The TPD will at all times ensure that the insurances it procures under these regulations specify the Master Developer as a named insured and include effective waivers by the insurer of all claims for insurance premiums or commissions or (if such policies provide for the payment thereof) additional premiums or assessments against the Master Developer.

10.3 If requested by Master Developer, the TPD will give the Master Developer a copy of the policy of insurance or such summary of terms and evidence of cover as may be issued by the insurers and produce evidence of its renewal including payments of premiums.

10.4 The TPD will cause all construction that is damaged or destroyed to be reinstated with due diligence and will apply the proceeds of any claim on the insurance towards such reinstatement. If the proceeds of the insurance claim are insufficient to effect reinstatement the TPD will make up the shortfall out of his own monies.

10.5 The TPD will ensure that nothing is done or omitted to be done which would prejudice or invalidate any insurance obtained by the Master Developer in respect of the Master Development.

11 **Construction Traffic and Site Access**

11.1 All contractors, suppliers, consultants and any parties associated with a project under construction (construction traffic) shall access the site via the construction access point and follow the access procedures.

11.2 Entering the site is not permitted to persons or vehicles without an appropriate authorisation of access.

11.3 Access passes are obtained from the TIO for restricted areas only. The TPD Consultant shall apply by submitting form 10, with all required documents, to the TIO.

11.4 All construction traffic shall travel from and to the plot (site) by the most direct path possible and using the designated construction routes as far as possible as shown in the logistic plan.

11.5 Labourers and workers must be collected and dropped off at the site.

11.6 All construction vehicles must leave the site immediately or parked within the hoarding or designated laydown areas.

11.7 Public areas such as the beach, parks, etc. are strictly off limits to construction personnel

11.8 Construction traffic will only be permitted on the development between the times of:

11.8.1 Seven days a week: 6am to 6pm

11.8.2 Fridays, Saturdays and Public Holidays in residential area:
8.00 am to 3.00pm

11.9 Exceptional access will only be allowed by prior arrangement and where circumstances demand. TPD Consultant must complete and submit form 5 with all other required documents to the TIO.

11.10 Construction vehicles and trucks into the site may be controlled at the gate to ensure that valid permit is available. This may involve some waiting time.

11.11 Film shooting on site is generally not permitted. TIO approval must be obtained. TPD Consultant or applicant must complete and submit form 5 with all other required documents to the TIO. Similarly, for advertising any projects o site, TPD Consultant or applicant must complete and submit form 5 with all other required documents to the TIO.

11.12 TIO must be informed prior to the demobilising and hauling away of materials and plant to and from site. TPD Consultant must complete and submits form 5 with all other required documents at TIO. All deliveries' to be made during normal working hours on the site. For special shipments and deliveries outside of normal working hours, TIO approval must be obtained. TPD Consultant must complete and submits form 5 with all other required documents at TIO.

11.13 Loads must be covered to control dust and improve safety. Transport, handling, and storage of the shipment must be carried out in an orderly and controlled manner to ensure the safety and protection of all persons and properties.

11.14 Public roads within the Development are subject to the control, rules and regulations of the Traffic Department in addition to these Construction Regulations.

11.15 TPD Contractors may explore alternate arrangements to reduce the levels of construction traffic or otherwise benefit their works and can discuss such arrangements with the TIO in order to obtain approval in advance. Examples include: delivery by barge, on-site ready-mix plant, piped delivery of sand, etc.

11.16 The speed limit for all construction vehicles on site shall not exceed 30 km/h. Violators will be issued a Notice of Violation in case of non-compliance.

12 **Laydown Areas**

12.1 All works associated with a plot or a parcel of land must be contained within the boundaries of that plot or parcel.

12.2 In exceptional circumstances, TPD's Consultants may apply at the TIO to use other land for laydown areas or any other purpose. Such an application may involve compensation to the owner of the alternate land (a rent), and would be subject to relocation without notice. TPD Consultant must complete and submit form 5 with all other required documents to the TIO.

13 **Temporary Tent Structures Permits**

Every tent application shall include the following:

1. Site plan showing:
- Tents location relative to property lines and all existing structures.
- Location of washroom facilities
- Location of cooking equipment, if applicable.

2. Floor plan layout showing:
- Location and size of exits on the perimeter of tent
- If the tent is enclosed with any sidewalls.

3. Sample of Fabric material and colour to be provided to TIO office for their approval.
4. All elevations of tent showing heights and roof design.

The applicant is required to submit Form 2 to the TIO with all required documents.

14 **Site Hoardings (Fencing) & Signage**

14.1 Before commencing any construction work on a plot or a parcel, a hording (temporary fencing) must be installed around the work.

14.2 The TPD may use its own discretion when deciding on the type of hoardings, provided it meets with the safety standards and requirements of the TIO.

14.3 No site hoarding to be commenced on site without the TIO approval. TPD Consultant must complete and submit form 3 with all other required documents to the TIO.

14.4 Site hoardings shall primarily serve to protect the public from the construction activities occurring on and around the site. Its secondary purpose is to maintain the image of the Project and the Development.

14.5 Site hoardings shall be at least 1.8m high (above outside ground level) and shall be designed such that there is no opening in or below the hoarding larger than 150mm.

14.6 Hoardings shall be augmented with additional height or screens should the nature of the works within demand it.

14.7 Hoardings and signage shall be maintained periodically. The TIO shall be the sole decider as to whether the condition of the hoarding is acceptable or not. Graphics may be installed on the hording based on TIO's approval.

14.8 Hoardings may need to be illuminated at night if the TIO requests this for safety reasons.

14.9 Each project shall be allowed a maximum of 1 project signboard as per Kingdom of Bahrain Building Regulations. The erection of information sign boards will not be allowed without the TIO approval.

14.10 The dimension of the Construction Signage board structure is to be maximum 6.5m high and 2.8m wide. The sign must contain the building permit Number, TPD Engineering/ Supervisor (if different) Consultant's and the Contractor's name. TPD Consultant must complete form 4 and submit with all other required documents at the TIO. No construction signage is permitted outside the site boundary.

14.11 "For Sale" or "Rent" signs may be placed on a privet property only. The dimension of each is to be maximum 0.8m high and 1m wide. The sign must be printed on a banner on plywood (White background with red text). Any signs placed in the public right-of-way will be removed by the TIO.

15 **Works outside of the site**

15.1 All works are to be restricted to within the confines of the hoarded site. The following exceptions may be considered by the TIO and the TPD's Contractor shall complete the necessary paperwork to seek approval:

15.1.1 Lifting/ deliveries outside the site boundaries or Road Occupation: TPD Consultant must complete and submit form 5 with all other required documents to the TIO.

15.1.2 Road Occupation: for any construction work requiring road occupation, the TPD Consultant must complete form 4 and submit this with all other required documents to the TIO prior to commencement.

15.1.3 Off-site Excavations: No off-site excavation shall be permitted without prior approval from TIO. TPD Consultant must complete and submit form 3 with all other required documents at the TIO.

15.2 The control of hazardous materials' transport, storage, and use must comply with the Bahrain Civil Defence roles and regulations. TPD Consultant must complete and submit form 5 with all other required documents at the TIO.

15.3 In exceptional circumstances, and subject to commercial agreement, the Master Developer may grant additional land to facilitate site logistics. Please approach the TIO in this regard.

16 **Working hours**

16.1 The permitted working hours are:

16.1.1 Sundays to Thursdays:

6.00 am to 6 pm

16.1.2 Fridays, Saturdays and Public Holidays in residential area:

8.00 am to 3.00pm

16.2 Any construction work required to be undertaken outside normal working hours shall be approved by the TIO. TPD Contractor must complete and submit form 5 with all other required documents at the TIO.

17 **Noise pollution**

17.1 The following maximum noise levels shall not be exceeded at any time:

Table 1 Bahrain Noise Standards

	Maximum Allowable Noise Limit L_{Aeq}, dB (A)		
	Daytime (07:00 - 16:00 hours)	**Evening (16:00 – 23:00 hours)**	**Night-time (23:00 – 07:00 hours)**
Residential Area	55	50	45
Residential Area with Some Commercial Activity	60	55	50
Commercial Area	70	70	70

18 **Air pollution**

18.1 The TPD Consultant shall take steps to control the emissions of smoke, smells and dust from the site or works therein.

18.2 The TIO shall be the sole decider as to whether the works are causing unacceptable levels of air pollution or not.

19 **Facilities**

19.1 Diyar Al Muharraq will not provide any common facilities for the use of TPD's Contractors. All facilities and welfare requirements (e.g. toilets, rest areas, canteen, medical facilities, roads, first aid, etc.) shall be provided by the TPD's Contractor within the site.

19.2 The TPD Contractors' proposed facilities shall be described in the Contractor's Health and Safety plan (H&S). TIO approval for erecting the site facilities will be granted upon applying to commence work on site.

19.3 TPD contractors must provide temporary sanitary facilities on site. It must be under cover, have a door with lock, be ventilated and provided with lights.

19.4 All sewage generated on the site must be stored safely (and without odour) and removed regularly by approved means.

19.5 All site facilities must be dismantled and removed from site upon completion of construction work. Temporary Foundations and roads must also be removed. TPD consultant must complete & submit form 5 with all other required documents to be granted approval for the removal of all site facilities off the site.

20 **Accommodation**

20.1 It is not permitted to accommodate workers on the site i.e. no persons (with the exception of a designated watchman) shall live on/ sleep overnight at the site.

21 **Temporary utilities**

21.1 The TPD's Contractor is wholly responsible for any utilities required for construction activities and must either obtain a temporary connection to mains utilities or provide suitable alternative arrangements.

21.2 Generators must comply with the following requirements:

21.2.1 Maximum allowable noise levels:

a 85 dBA as a normal level

b 90 dBA - no more than 8 hours per day

c 95 dBA - no more than 4 hours per day

d 100 dBA - no more than 2 hours per day

e 105 dBA - no more than 1 hour per day

21.2.2 Not to generate undue smoke.

21.2.3 Provide a drip tray to prevent contamination of the ground.

21.3 Storm water discharge shall be controlled so as not to cause erosion to surrounding land nor pollute the public roads or storm water network.

22 **Removal of Waste**

22.1 The TPD's Consultants and Contractors shall not, nor permit others to, dispose of any waste of any nature in Diyar Al Muharraq Development.

22.2 All forms of waste shall be removed regularly to waste containers and skips so as to increase the sanitation and safety of the site and the development.

22.3 No waste materials may be stored outside of the site hoarding for any period of time.

22.4 All waste materials shall be removed from the development completely within 24 hours of its being created, by approved means, and disposed of in a legal manner.

22.5 All construction sites must provide a skip for waste collection.

23 **Security**

23.1 The TPD Contractor is responsible for ensuring that the site is guarded and shall take sufficient precautions against theft and loss of property and damage. All thefts or unlawful damage to property must be reported to Diyar Al Muharraq security in writing.

24 **Accident Reports**

24.1 TPD Consultant must report all occupational site injuries and accidents immediately to the TIO. TPD Contractor must complete and submit form 7 with all other required documents at the TIO. Notifying the authorities will be the TPD contractor's responsibility.

25 **Health, Safety and Environment (HSE):**

25.1 DAM is concerned with the safety and wellbeing of all people and will actively seek to ensure that all TPD's Contractors on the site maintain reasonable standards of H&S. DAM H&S policy, which is also applied to all construction contractors employed by DAM directly, is attached as Appendix 1, for reference.

25.2 The TPD Contractor's H&S Plan shall contain, as a minimum, controls and standards relating to the following:

25.2.1 First aid and medical emergency plans

25.2.2 Working lighting

25.2.3 Fire safety

25.2.4 Welfare facilities

25.2.5 Site cleanliness

25.3 The TPD's Contractor shall provide copies of current safety approvals for all major, high-risk plant and equipment employed on the project such as tower cranes, mobile cranes and the like.

26 **Inspections**

26.1 The TPD Contractor shall allow the TIO inspectors to enter the site at any time provided that the inspectors follow reasonable site access procedures and it is during working hours.

26.2 The TIO will conduct intermittent, unplanned inspections in order to:

26.2.1 Check compliance with design regulations, sales agreement conditions, and construction regulations.

26.2.2 Check for unauthorised building work that has either not been approved or does not comply with the approved design drawings.

26.2.3 Dangerous or hazardous construction activities resulting in major defects or structural instability threatening workers and public safety.

26.3 The following inspections will be carried out by the TIO:

26.3.1 Pre-construction/Site Establishment inspections: these are carried out at the site establishment phase when fencing, site offices, accesses, and other site facilities are being installed or before commencing work on site on any alterations or addition to existing structure work starts.

26.3.2 Periodic inspections: these are carried throughout the construction phase of the project and will occur once a week.

26.3.3 Other special purpose inspections: these are follow-up inspections which are carried out as required in response to a violation of non-compliance or due to a complaint from another party.

26.3.4 Stage inspections: these are mandatory inspections and must be applied for by the TPD Consultant. One inspection must be carried out during the site preparation phase when excavation, grading, and foundation work are being undertaken before laying of foundation, and the second inspection must be carried out after the completion of 50% of the building work on site. For each inspection required, the TPD Consultant must complete and submit form 8 with all other required documents at the TIO.

26.3.5 Final inspection: this is a mandatory inspection and must be applied for by the TPD Consultant upon completion of building, civil and landscaping work on site in order to obtain a DAM completion certificate which is submitted at the concerned Municipality to obtain the final completion certificate. TPD Consultant must complete and submit form 8 with all other required documents at the TIO.

26.4 Upon completion of construction on site, An "Engineering Certificate" (certification of compliance with work approved) is required from the TPD Consultant at the conclusion of all building work confirming the project complies with the Bahrain Building Code. This certificate to be submitted by TPD consultant when applying for a completion certificate at the TIO.

26.5 Upon completion of any inspection, TIO will issue a formal notice of the inspection which will be sent to the TPD Consultant and a copy to the TPD. In the event of a violation being identified, TIO may informally discuss the matter with the TPD Contractor on site or the TPD Consultant. In case of non-compliant, maximum of three NOVs will be issued to the TPD's consultant or a Stop Work Notice (SWN)

27 **Compliance Enforcement**

27.1 TIO has the authority to take enforcement action to remedy breaches if and when they arise. To facilitate enforcement, the TIO will collect a Security Deposit for the TPD before commencing any construction work on site plot/parcel.

27.2 The Security Deposit will be held by the TIO and violation charges and other costs incurred shall be deducted therefrom. The TPD will be required to replenish the security deposit if it is exhausted during the construction period. The remaining balance will be refunded to the TPD on issuance of the Completion Certificate.

27.3 The security deposit amount is:

27.3.1 Villa Landscaping work: BD 50/-

27.3.2 Residential plots including alterations/addition/modification: BD 300/-

27.3.3 Commercial plots including alterations/addition/modification: BD 1000/-

27.3.4 All parcels including alterations/addition/modification: BD 2000/-

27.4 A violation fee will be charged to the TPD starting from the second violation issued. The amount of the violation will be as follows:

Type of Violation	Amount (BD)
Design Drawings / Skipped inspection request	100
Construction Regulations & HSE	100
Road Occupation / Signage	50
Garbage/Construction waste	50

27.5 In case of no corrective actions are taken after issuing three violations, a (SWN) will be issued, and contractors will be denied access to site. A (SWN) will also be issued where a major violation is noticed which has potential to considerably damage the environment, severely affects other projects or a significant no-compliance to approved design drawings.

27.6 If the TPD continues to carry out work contrary to the (SWN) or fails to comply or rectify the breach within the set time frame , formal enforcement action may be taken by TIO and any charges incurred to remove the rectify the violation will be billed to the TPD.

28 **Connections to permanent utilities**

28.1 Unless and until a completion certificate is issued by the concerned Municipality, it is unlawful for the development to be used or occupied by any person. TIO approved completion certificate must be submitted to the concerned Municipality with all other required documents in order to obtain the Municipality completion and occupation certificates. The Municipality completion certificate must be submitted to the concerned authorities to obtain the electricity, water, and sewerage connections.

Appendix 1

DAM Health, Safety, and Environment (HSE) Policy

DAM HEALTH, SAFETY, AND ENVIRONMENT (HSE) POLICY

Index

1.0	GENERAL RESPONSIBILITIES	16
2.0	WORKING CONDITIONS	18
3.0	HOUSEKEEPING	18
4.0	HAND TOOLS	19
5.0	EMERGENCIES	19
6.0	ELECTRICAL SAFETY	20
7.0	FALL PROTECTION, MOBILE SCAFFOLDS AND LADDERS	21
8.0	FIRE PREVENTION AND PROTECTION	22
9.0	HOT WORK	23
10.0	WELDING AND BURNING	23
11.0	EYE PROTECTION	23
12.0	WASTE SEGREGATION, DISPOSAL & ENVIRONMENTAL CARE	24
13.0	HYDRATION AND SOLAR PROTECTION	24

Core Values

DAM continually strives to maintain a sustainable health, safety and Environmental (HSE) program for its Projects, Joint Ventures, Contractors, Subcontractors, management and workers.

DAM believes that everyone has the right to go to work and be safe at work.

Diyar believes in the proper use of objective HSE processes, tools, policies and procedures but equally as important.

DAM encourages its Projects, Joint Ventures, Contractors, Subcontractors, management and workers to consider the legacy of a potential incident or accident beyond the event itself and asks the question "our management and supervision does not ask you to work un-safely so how may the action you're about to take affect the families and lives of loved ones if you do it?".

DAM recognizes that its Projects, Joint Ventures, Contractors and Subcontractors employ a broad range of people from a broad range of cultural backgrounds, some of whom do not speak or read English as a first language.

DAM believes therefore that its Projects, Joint Ventures, Contractors and Subcontractors must continue to provide personal training, mentoring, coaching and empowerment through programs designed to balance the process and the human aspects of HSE.

Zero injuries, whilst an admirable goal, is a statistic. DAM is intolerant of incident or injury to Contractors, Subcontractors, management and workers. It is a belief and is a core company value.

Diyar invests in and plays a hand on role in its projects in Bahrain. It also undertakes partnering and joint venturing with other like-minded companies, with similar values.

1. General Responsibilities

Contractors and their Subcontractors are required to comply with these basic procedures and practices and any revisions of them which may be made during the course of the work, and in particular to take the following actions:

- Establish, implement and maintain a health and safety program and plan which promote the use of safety working practices.
- Ensure that workers are provided with a safe and health place of work, including safe means of access to and egress from it.
- Provide training, where necessary, to workers to enable them to work safely and record details of training given, and in particular to explain the project procedures and practices as they affect them during induction training.
- Put emphasis on the "human" or subjective side of safety as well as providing training in procedures.
- Provide supervision of the safe conduct of the Work and provide supervisors that are competent in health and safety matters.
- Carry out inspections of the work areas and record the results of inspections.
- Communicate relevant information on health, safety and the environment to workers.
- Encourage feedback from workers concerning potentially hazardous working conditions.
- Report all occupational injuries and illnesses to the Engineer using incident reports followed by a detailed report of events and how the matter was closed out safely.
- Provide the TIO with copies of incident reports and other reports immediately following an incident on site.
- Comply with all project requirements on health, safety and environment matters which may be issued by the engineer from time to time.
- Ensure the attendance of management representatives at all meetings where health, safety and or environmental issues are to be discussed.

These actions shall be documented in a Contractor Health & Safety Plan, to be submitted as part of the Contractor's tender, which describes what specific activities are to be done.

- Contractors and Subcontractors shall make every effort to ensure that property is not damaged, and that site workers, other workers and third parties are not put at risk as a result of work operations.
- The Contractor warrants that all Subcontractors will have been notified of the requirements of this document and any of the engineer's requirements before executing a contract with DAM or DAM's Joint Ventures.
- The Contractor and its Subcontractors agree to co-operate at all times with the engineer and to rectify immediately any matters brought to their attention by the engineer.
- In addition to the engineer's requirements, all current and applicable National and Local Government Acts, Regulations and codes will be followed, including any requirements for the licensing or certification of workers, inspections and certification of plant and equipment.
- Partners, Joint Ventures, Contractors and Subcontractors shall report all near misses, incidents or injuries, to the engineer and TIO as soon as they are known. Where necessary and following consultation with the engineer and TIO, these will also be referred to the relevant authorities.
- Contractors and Subcontractors shall ensure that induction training is to be given to every worker (management and labour) in HSE before commencing work on site. This will cover as a minimum:
  - The Engineer's and DAM's / DAM's Joint Venture HSE program & induction.
  - Disciplinary rules which apply to the worker.
  - Common hazards on site including dangers of falls & electricity.
  - The control methods used by Contractors and Subcontractors to minimize risk.
  - The issue, use, replacement and maintenance of personal protective equipment "PPE".
  - The health, safety and Environmental role of supervisors.
  - Procedure to be followed in the event of incident or injury.
  - Fire and emergency procedures.
  - Location of all welfare facilities.
  - Emergency telephone numbers.
  - Arrangements for regular ongoing training & project briefing.

2. Working Conditions

- Access routes to the work face, walkways and stairs shall be kept clear to allow safe access. Where this cannot be achieved temporarily, alternative access routes shall be agreed with the Engineer.
- As regular exposure to high noise levels can cause deafness, Contractors and Subcontractors shall assess and control the exposure of workers. An evaluation of work noise levels and the controls to be used shall be included in the HSE plan.
- Where temporary lighting is required, site lighting levels shall be sufficient to permit all work to be done in safety. Contractors HSE plan will include details of the proposed supply of adequate lighting before work commences.
- Contractors and Subcontractors shall provide all necessary personal protective equipment to workers whether required by legislation or the Engineer's site safety policy. The equipment will be provided at no charge to the workers. The condition of the equipment will be regularly monitored and where there is any doubt as to the condition of the equipment, it will be retired and replaced.

3. Housekeeping

- The work areas and site will be kept and maintained in a clean and orderly condition, with emergency escape routes, fire and lifesaving equipment kept clear of obstructions. Oil, grease, construction waste, packing materials, litter and other debris caused by the work of Contractors and Subcontractors, shall be collected, segregated and removed to authorized segregation points as soon as possible for removal from site. Machinery and other equipment shall be kept in a clean condition.
- Materials shall be stored neatly in appropriate locations. Where substances which may be hazardous to health are involved (ie paint, welding gases, flammable materials, fuels etc.), Contractors and Subcontractors will obtain agreement from the Engineer for storage locations and this shall be reviewed at regular site meetings. Arrangements for the safe storage of such materials will be covered in the Contractor's and Subcontractors' HSE plan.
- Waste segregation and disposal shall be carried out daily, using properly designated containers according to the Engineer's applicable local waste disposal requirements.
- Areas under foot, be they floors of a building or the ground itself will be kept clean and free of projecting hazards such as nails, wire off-cuts and the like. All temporary electrical leads will be elevated up off the floor. Open ends of scaffold tubes, planking, strutting, access platforms and

the like will also be provided with hazard warning signage, and where necessary protective end caps.

4. Hand Tools

- Contractors and Subcontractors in addition to the Engineer's requirements shall comply with all local legislation controlling the use of powered tools and equipment. This includes the use of an approved "tagging" system.
- Tools shall only be used for the task they were designed to perform and shall be maintained in good condition. Defective tools shall not be used.
- All guards must be properly fitted and in good condition at all times.
- Abrasive wheels and cutting-off discs shall be checked for correct size relative to the machine before they are fitted. Fitting of these shall only be done by workers who are properly trained and competent to do so.
- Powered tools, whether hand-held or table or bench-mounted, shall be operated only by workers who are properly trained, competent and authorized by the Contractor's and Subcontractors' supervisors to do so.
- Only engineer approved, properly grounded electrical tools with three-pronged plugs, or double-insulated tools, shall be used. Switch lock-on devices are not permitted on any electrical or air-powered hand tools by Contractors and Subcontractors.

5. Emergencies

Before work begins, Partners, Joint Ventures, Contractors and Subcontractors will have undergone the engineer's safety induction courses and will have a suitable plan in place to handle emergency situations which may arise on site. This plan will be posted in the workplace, and will address the following as a minimum:

- Safe shutdown of all work activities, including emergency evacuation routes and assembly points
- Listing of the persons responsible for organizing the evacuation and controlling the emergency conditions.
- Listing of the marshals for each work area and floor who will be responsible for establishing that evacuation has been completed.
- Communication plan to ensure that all site personnel are aware of the correct response to an emergency, the correct telephone numbers etc.
- Nominee for the compilation of a Flash Report and whom this is to be issued to.
- Procedures for follow reporting and assessment of a safe return to the work place.
- In case of emergencies, please contact local authorities available at the following:

Police & Ambulance (Civil Defence & Fire Service)	999
Traffic Directorate	199
Samaheej Police Station	17334401
Bahrain Coast Guard	17700000
Emergency Hotline	80001112

Hospitals with close proximity and accident and emergency treatment facilities:

- King Hamad University Hospital, Busaiteen
- Samaheej Police Station

6. Electrical Safety

- Contractor's and Subcontractors' workers shall not work on or in proximity to energized circuits of any voltage unless adequate safety measures have been taken and the work operation has been reviewed and approved jointly by the Contractor's and Subcontractor's nominated manager responsible for safety jointly with the engineer. Only electricians or authorized workers shall be permitted to work on or repair electrical equipment, enter electrical enclosures or alter connections. Proper procedures for "approval to proceed" ticketing will be implemented.
- All electrical installations shall comply with the relevant local or national electrical codes.
- When portable or semi-portable equipment operates at voltages in excess of 110 volts, the supply shall be protected by an Earth Leakage Circuit Breaker "ELCB", regardless of any such device fitted to the equipment.
- Metal safety helmets are banned.
- Only workers who are trained and authorized to do so will be permitted to climb utility poles, subject to the approval of the utility company and the engineer.
- An established lockout-tag out procedure shall be followed before carrying out maintenance on any installations.
- Electric motors, equipment, cables, lines and plug connectors shall not be exposed to risk of contact with water. Temporary electrical cables are to be elevated up off the floor.
- During repairs to and maintenance of electrical systems, the Contractor and Subcontractors in consultation with the engineer will take adequate and suitable steps to warn workers in the area who may approach the area of the hazard, and prevent their possible exposure to harm.

- Electrical supply panels shall be protected by cabinets, and the doors of these shall be kept locked shut at all times except when access is required by an authorized electrician.
- Electrical equipment used in hazardous environments shall be classified as suitable for the environments.
- Temporary feeders shall be tagged at their source to indicate the Contractor and / or its Subcontractors using that feeder. Neither Contractors nor its Subcontractors shall use bare wire connections into power socket holes.
- Hand tools, machinery and other electrical equipment shall be grounded with an approved system and shall be inspected before use. Portable ELCB's shall be used in every case.
- Work on live electrical circuits and those above 110 volts shall only be done using a permit to work, issued by the engineer and implemented by the Contractor and its Subcontractors.
- Contractors and Subcontractors will ensure that all electrical systems under their control are maintained in a safe condition, and that cables and wires are properly routed to avoid becoming a hazard to others, or being damaged by traffic.
- All tungsten / halogen lamps shall be fitted with a glass guard to the element. These lamps shall be fixed at a high level.

7. Fall Protection, Mobile Scaffolds and Ladders

- Suitable and sufficient steps will be taken by the Contractor and its Subcontractors to prevent any person employed directly or by its Subcontractors from falling. It will provide training and briefing on trip hazards, penetration hazards, and hazards of working at heights and the correct use of PPE.
- Fall protection is required when workers are working more than 2m above grade and no handrails are present. Workers on suspended platforms, man-lifts, gondolas, baskets and chairs shall use approved safety lines attached to approve safety harnesses.
- Where falls of more than 2m can occur, the Contractor and its Subcontractors shall select a protected working platform as the first choice for protection against falls.
- Ladders must be in sound condition and of a size, strength suitable for the task and properly positioned. No access is to be allowed from ladders which puts the worker in an unstable or unsafe position. Ladders are for access to work platforms only, not as a work platform themselves.
- Where mobile scaffolds are fitted with wheels, these shall be equipped with efficient locking devices. It is strictly prohibited to move or attempt to move a scaffold tower with workers remaining on any part of it.
- Scaffolds providing access above 2 meters shall be fitted with bracing out riggers.

An approved scaffolding tagging system shall be discussed with the Engineer and adopted on site.

8. Fire Prevention and Protection

- All necessary precautions shall be taken to prevent fires.
- To prevent fires, the following minimum requirements must be observed:
  - Storage locations for any flammable and combustible material must be agreed by the engineer, and be isolated from ignition sources.
  - Report and eliminate all leaks and spills of these materials as appropriate
  - The work area must be kept clean
  - Remove all combustible materials away from hot equipment, flames and sparks.
  - Use oils and solvents only with the approval of the engineer.
  - Quantities of flammable and combustible substances exceeding that needed for one day's operation must be stored in a proper storage facility isolated from the actual work area.
- Smoking is not permitted on site. Designated smoking areas will be provided. Conspicuous signs stating 'NO SMOKING' shall be posted.
- The fuel tanks of gasoline engines must be filled away from work areas and only when the engines are turned off. Approved safety cans and proper grounding techniques must be used when the tank is not filled directly from the storage container or other source of supply.
- No combustible site offices are to be placed inside or within 10 meters of a site work area. Where temporary site office units are being used in these circumstances they must, to all practicable purposes, be constructed of non-combustible materials and have a half-hour fire rating inside to outside and outside to inside. Non-combustible assets inside the site accommodation shall be used where practicable.
- All temporary site offices and stores within are to be provided with zoned smoke detectors and fire alarms. Elsewhere individual smoke detectors and external warning lights are to be installed as necessary where work is being carried out inside buildings.
- Debris netting and weather protection sheeting are to be fire retardant.
- Suitable fire extinguishers will be made available throughout the work areas in quantities sufficient to provide first hand protection for all workers in that area. They shall be properly maintained and regularly tested, and their locations will be indicated by prominent safety signs.

9. Hot Works

- 'HOT WORK' shall be defined as any work which, in the particular circumstances, has the potential to generate a spark, heat or static electricity that could cause a fire or explosion. Some examples of this type of work include welding and grinding. A permit to work system shall be used to control HOT WORK for nominated activities as discussed at the Contractor and its Subcontractors' pre-commencement meeting and as defined by the engineer.
- Only workers trained, tested authorized by the Contractor and its Subcontractors to do so shall carry out HOT WORK. This means the Contractor and its Subcontractors must undertake a performance evaluation before being issued with a permit to work on such activities on site
- Before issuing the permit, The Contractor's Site Manager and Supervisor in charge shall be personally satisfied that the appropriate precautions are in place, which shall include:
- Isolation, shut down or protection of materials, pipes and drains which may be affected by the work or its consequences.
- Establish a fire watch to monitor the work and check on its safe completion after the hot work has ceased.
- The provision of appropriate fire extinguishing and protection equipment close to the work.

10. Welding and Burning

- Only competent and authorized workers issued with a permit to work by the Contractor and its Subcontractors shall be allowed to use welding equipment on DAM / DAM's Joint Venture projects.
- Suitable and sufficient precautions shall be taken to control the exposure of workers and third parties to excessive ultra-violet radiation, toxic gases, fumes and dusts where welding or cutting equipment is used. These precautions are to be reviewed and approved collaboratively with the engineer.
- Where necessary, welding screens and spark protection shall be used to protect other workers and third parties from falling sparks. The Contractor's nominated Safety Officer and Supervisor will ensure that this is checked regularly.
- A serviceable fire extinguisher shall be immediately available where welding and burning is being carried out.

11. Eye Protection

- Approved eye protection shall be worn at all times in conditions of high solar gain, in conditions of high atmospheric dust content, for all cutting, grinding and for all welding activities.

12. Waste Segregation Disposal & Environmental Care

- All waste materials and rubbish shall be segregated and removed from the site within 24 hours of its being created. The Contractor and its Subcontractors shall make positive plans for the removal of waste materials and rubbish from the work areas to nominated waste containers and skips. These plans shall form a part of the site-specific safety plan, and be agreed with the engineer. Special attention is to be paid to, the proper segregation of metal, wood, paper based, liquid and general waste segregation and any waste which has a potential to affect the environment. This includes, but is not restricted, toxic chemicals and other substances hazardous to health, non-degradable packaging material and fuels. No gases are to be released to atmosphere. Leakages are to be reported immediately.
- No material or liquid is to be allowed to spill down drains or into ground soils unless this has been reviewed and approved by the engineer. Method of clean-up of paint, tools & equipment to be agreed with engineer.

13. Hydration & Solar Protection

- The Contractor and its Subcontractors will provide an adequate supply of water for regular hydration intake by its workers on site.
- The Contractor and its Subcontractors will provide portable sun shade devices as and where necessary for the health and welfare of their workers.

Diyar AL MUHARRAQ | Booklet 3