Environmental and Social Impact Assessment of Construction and Operation of Syria Cement and Captive Power Plant and Associated Quarrying Activities, Syria

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Submitted to:

SYRIAN CEMENT COMPANY (SCC)
LAFRAGE GROUP

Date of Submission:
May, 2009

ELARD SYRIA		
SYRIAN CEMENT COMPANY	Document Type:	ESIA
	Project Ref::	
Environmental and Social Impact Assessment	No. of Pages:	268
Environmental and Social Impact Assessment of Construction and Operation of Syria Cement and Captive Power Plant and Associated Quarry Operations, Syria	Version	Final

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ANFO	Ammonium Nitrate Fuel Oil
a.s.l.	Above Sea Level
BAT	Best Available Techniques
BG	Below Ground
CBS	Circular Bridge Scraper
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanisms
CF	Continuous Flow
CPP	Captive Power Plant
CSI	Cement Sustainable Initiative
dB(A)	A-weighted decibels
DFEAs	Directorates for Environmental Affairs
EBS	Environmental Baseline Study
EE	Energy Efficiency
EHS	Environmental, Health and Safety
ELARD	Earth Link and Advanced Resources Development
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESP	Electrostatic Precipitator
EU	European Union
GCEA	General Commission for Environmental Affairs
GCT	Gas Conditioning Tower
GD	General Directorate
GHG	Greenhouse Gas
GIIP	Good International Industry Practice
GPS	Global Positioning System
GTZ	German Agency for Technical Cooperation
Ha	Hectare
HSE	Health, Safety and Environment
IFC	International Finance Corporation
ILO	International Labor Organization
IPPC	Integrated Pollution Prevention and Control
ISO	International Organization for Standardization
KWh	Kilowatt hour

LCP	Large Combustion Plant
MHC	Ministry of Housing and Construction
MOE	Ministry of State for Environmental Affairs
MOH	Ministry of Health
MOI	Ministry of Irrigation
MOLAE	Ministry of Local Administration and Environment
MOPMR	Ministry of Petroleum and Mineral Resources
NAQQS	National Ambient Air Quality Standards
OSHA	Occupational Health and Safety Administration
PPE	Personal Protective Equipment
Ppm	Parts Per Million
UNFCC	United Nations Framework Convention on Climate Change
USEPA	United States Environmental Protection Agency
RE	Renewable Energy
RDI	Research, Development and Innovation
SCC	Syrian Cement Company
SF	Smidth-Fuller
SOP	Standard Operating Procedure
SS	Side Scaper
tpa	tons per annum
TPH	Total Petroleum Hydrocarbon
WBCSD	World Business Council for Sustainable Development
WFD	Water Framework Directive
WS	Water Sample
WWF	World Wide Fund for Nature
WWTP	Wastewater Treatment Plant

NOMENCLATURE OF CHEMICAL COMPOUNDS

CO_2	Carbon Dioxide
CO	Carbon Monoxide
NO_x	Oxides of Nitrogen
PM	Particulate Matter
SO_2	Sulphur Dioxide
TSP	Total Suspended Particles
O_3	Ozone
PAH	Poly Aromatic Hydrocarbon

INTRODUCTION

The Syrian Cement Company (SCC), a Joint Stock Company formed between MAS Group of Syria and Lafarge Group of France. The project proponent, Lafarge Group, proposes to establish a Portland Cement Plant with its associated quarries and a coal fired captive power plant in the district of Aleppo, Syria. The proposed SCC plant will have an expected daily production capacity of clinker and cement of 7,500 and 9,090 tons, respectively. The annual Portland cement production capacity is estimated to be 3 million tons per year. The proposed plant capacity is primarily based on market demand and the availability of raw materials. Future plans to increase the production capacity through the introduction of a second production line of 7,500 t/day capacity will take place as part of the project phase 2 extension plans.

PROJECT DESCRIPTION

LOCATION AND SURROUNDING LAND USE

The total surface area of the project is around 14.6 km^2. The cement plant is located on a plot of 130 hectares (1.3 km^2) approximately 160 Km to the north-east of Aleppo city, 135 Km north-west of the Raqqah city and approximately 30 Km south of the Syrian-Turkish borderline (Figure 1). The site was selected due to its close proximity to a limestone deposit (675 ha) which is situated on the boundary of proposed cement plant and the basalt deposit (675 ha) 15 km to the north of the plant site. The quarry sites total the remaining 13.3 km^2 and are state-owned. The quarry sites will be leased from the Syrian Government.

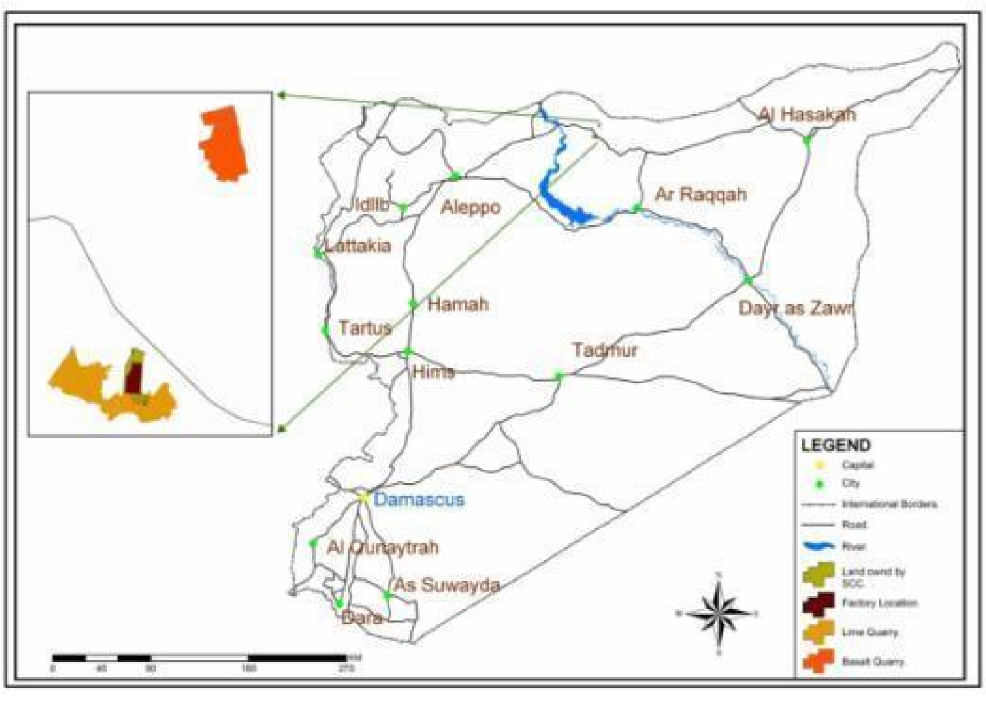


Figure 1-1: Location of the project site

The limestone quarry has an anticipated lifespan of 115 years if it serves a single line at the proposed cement plant. The basalt deposit will be further explored once the land has been acquired.

The area surrounding the site is dominated by agricultural production (wheat, barley and livestock) with more than 30 villages or clusters of homesteads interspersed. Other quarry activities can be found to the west of the project site and a Turkish cement factory has recently been established about 30 km to the North –east.

CONSTRUCTION ACTIVITIES

It is expected that it will take approximately 24 months from the commencement of the project to the time of full production. It is anticipated that the plant will be operational by mid-2010. Construction activities will comprise the following:

- **Equipment manufacturing**: Equipment will be manufactured elsewhere and transported to the site for assembly. It is likely that the equipment will be transported using the existing Aleppo-Al Hessakah Highway.
- **Site preparation:** The site will be leveled utilising excavators, trucks, bulldozers, graders and compactors. Due to the flat terrain, it is unlikely that additional material will be imported to the site. Excess material will be temporarily stockpiled on site and used as raw material (replacing basalt) in the production process.
- **Civil works:** Foundations will be excavated and reinforced concrete pads will be laid where required by process units or buildings. Buildings will be constructed from either blockwork or reinforced concrete.
- **Finishing:** As the main structures are erected mechanical and electrical assembly teams will install the required systems.

During construction water consumption will be approximately 600m^3/day. Water will be sourced from existing shallow wells adjacent to the plant site. Electricity will be provided by 24 diesel generators. The diesel required for the generators will be stored on-site in two tanks which have a secondary containment (bund) to prevent spread of spill and potential contamination.

A variety of solid wastes will be generated during the construction phase, including:

- Inert construction material (including excess soil, rubble etc.) will be used as fill;
- Other construction wastes are segregated and dealt with in four categories:
  - **Hazardous waste** (such as used oil and oil filters) are handed over to an approved contractor for recycling oil;
  - **Metal and wood scrap** is sold directly for off-site recycling;
  - **Domestic waste** is picked up by the Municipality and transported to the local Sareen landfill site 20 km from the plant site.

During peak construction, approximately 1,800 workers will be employed on site. The majority of these workers will be sourced from the local population and the rest housed in 3 construction camps able to accommodate a total of 760 workers, located next to the project site. The construction camp includes the following amenities and services:

- **Water and sewage:** Water will be sourced from a shallow well next to the site while sewage will be directed into a lined septic tank.
- **Electricity:** Electrical power is provided to the site by diesel generators which are supported with an appropriately bunded diesel tank.
- **Waste collection and disposal:** Waste is temporarily stored in a waste facility on site before collection and disposal at the Sareen landfill site 20 km from the plant site.

OPERATIONS/CEMENT MANUFACTURING PROCESS

The cement manufacturing process comprises seven critical stages, as follows:

1. Quarrying;
2. Crushing and pre-homogenisation of limestone and additives
3. Milling, homogenisation and storage of raw materials
4. Preheating and clinkerisation
5. Clinker cooling and storage
6. Clinker grinding
7. Cement storage, packing and distribution
8. Thermal Captive Power Plant

A variety of raw materials are required in the cement manufacturing process. The imported materials will be transported to site on tucks. The details of this process are provided in Table 1.

Table 1-1: Volumes of outsourced materials and distance from plant (per year)

RAW MATERIAL	ANNUAL QUANTITY (TONS)	SOURCE OF SUPPLY	DISTANCE FROM PLANT	NO OF TRUCK LOADS (50 TON TRUCKS)
Limestone	3,750,000	Koujak and Kharab Eshik Mountains	2 km	75,000
Basalt	768,240	Kortek Village-Gelabeya Area	15 km	15,364
Pozzolana	700,000	Manakhir Quarry	125 km	14,000
Sand	250,000	Karyateen – Homs Governorate	475 km	5,000
Gypsum	150,000	Gureen Quarry – Raqqah Governorate	170 km	3,000

The total number of monthly truck trips (at 3,113, excluding limestone) is significant, and the local highway will need to be upgraded at the exit point to the plant site to accommodate such loads, in addition the link road between the plant site and the basalt quarry will need to be upgraded and re-routed to bypass villages.

Electrical and water requirements of the plant will be met as follows:

- **Electricity:** In November 2007 the Syrian authorities cancelled their approval for supplying electrical power for all cement plants in the country hence the 45mW of power required to operate the project will be secured through an onsite thermal (coal-fired) captive power plant. The plant will consist of two 30MW generating units.
- **Water:** The total water requirement for the cement plant, power plant and the associated housing works is 7,000m^3/day, which will be met through water pumped from 5 shallow wells and 2 deep wells on the property. The water will be treated at an onsite water treatment plant, before being distributed.

The site will contain an on-site laboratory, fire fighting systems and workshops.

DECOMMISSIONING AND REHABILITATION

At the end of the project life, the plant and machinery is will be removed from the site and where possible re-deployed into new projects. Post-mining rehabilitation will be guided by the post-mining land-use stipulated by the local authorities. A mine rehabilitation plan will be developed according to these requirements.

SOCIAL AND ENVIRONMENTAL BASELINE CONDITIONS

LAND USE AND SOCIO-ECONOMIC SETTING

The study area's topography is a flat terrain lying at an elevation ranging between 420m - 500m a.s.l, and bounded in the south by mountainous hills. The southern area has small valleys or Oueds formed along ephemeral streams, flowing downstream in a northerly direction.

Thirty villages are scattered throughout the study area, and all share similar socio-economic characteristic. The study area comprises of mainly agricultural lands occupying a total area of 28, 272 ha, divided into 1,837 ha of irrigated lands and 26, 367 ha dry lands; with 69 ha of forest. Almost 60% of the agricultural lands are privately owned. Sixty percent of the population own on average 25ha and 40% own on average 2 ha. The total population in the study area is approximately 5,397 inhabitants, with an average of 7 members per household. A total of 769 houses are recorded with the majority (62%) constructed of mud. Five schools are found in the study area, two of which provide secondary level education. One health-care centre operates in the Jalabieh village requiring people to seek health services in other villages such as Ain Arab (north). An archaeological survey in the region of West Jazira, found that the closest mound to the study area lies in the village of Jalabieh located 5 km to the north of the cement plant location.

BIOPHYSICAL ENVIRONMENT

Climate

The average monthly temperatures range between a low of 0˚C to a high of 39˚C. The prevailing wind directions in winter are easterly, westerly and northerly. The mean annual precipitation is approximately 280 mm/year. Periods with high amounts of rainfall span form November to February, dry periods on the other hand extend from July to September. The average humidity in the study area is 77% during the winter period and 41% in dry periods. Maximum absolute humidity values may reach 100%, while the lowest humidity ever recorded in dry periods was 2%.

Air Quality

Limited air quality monitoring has been undertaken at four (4) locations (Tolak, Kharab Ishk, Damerjek Sharky and Kojak Met). Air pollutants monitored included CO, NO_2, SO_2 and PM_{10}. The ambient air quality reading for all pollutant types revealed that the ambient levels within the study area are very low (<0.5 ppm for CO_2, <0.001 ppm for SO_2, <0.02 ppm for NO_2 and <9.3 µg/m^3 for PM_{10}) and well within the permissible Syrian Ambient Air Quality Standards of 8.6 ppm, 0.1 ppm, 0.132 ppm and 100 µg/m^3 respectively.

Noise

Baseline ambient noise level monitoring survey was conducted at the same locations of the air monitoring locations. The readings revealed that the noise level within the study area were on average <40dB(A) and fall well within the national Syrian ambient noise level standards for rural areas.

Water

No permanent surface water resources exist within the study area. However, several small ephemeral streams exist flowing within small valleys/Oueds following a rain event. Three (3) aquifers are currently exploited in the study area. These are the Neogene, the Paleogene and the Cretaceous aquifers. A survey of the existing wells in the area revealed the presence of about 49 wells mostly tapping the Neogene and Paleogene aquifers. The depths of the wells vary between 65 and 190 m below ground (BG). Most of wells drilled in the Paleogene to the east of the plant site are dry. Water level contour maps for each of the tapped aquifers shows that ground water flow direction in the Paleogene and Neogene aquifers is in an east to west direction. The recharge area for the Paleogene aquifer consists of the Paleogene exposures located to the west and northwest to the site location. For all parameters and samples analyzed, results revealed contaminant levels are well below the Intervention Value of the Dutch groundwater standards.

Ecology

The vegetative cover in the study area consists mainly of semi-shrubs and herbs covering 35-45% of the wild patches. The study area has witnessed an accelerated change in natural vegetation to agricultural lands mainly induced by increased human pressure (agriculture, urbanization, etc). No protected areas were identified in the study area based on published documents or during the reconnaissance field survey. In general, the fauna in the study area belongs to the Mediterranean zoogeographic sub-region. Domestic animals are commonly found but some wild mammals have thrived despite the pressures of agricultural ecosystems. Apart from domestic birds such as chicken and turkey, wild species like rock dove, crested lark, and house sparrow were observed. The study area has low levels of biodiversity with a few amphibians and reptiles. Arthropod species such as dermipteras are inhabitants of the study area. These species serve as a source of food for other animals especially birds, reptiles, and amphibians.

Cultural Heritage and Archaeology

The closest mound to the Study Area lies in the village of Jalabieh located 5 km to the north of the cement plant location.

PUBLIC CONSULTATION

A public consultation process was undertaken in accordance with Syrian EIA Act, Annex 4 for "*Public Participation – Mechanisms and Procedures*", which called for a Public Hearing during the scoping phase of the project so as to introduce relevant stakeholders to the proposed project, its scope of work and inform the public about the anticipated impacts and the planned mitigation measures to be adopted for each impact (a copy of the presentation to stakeholders is attached).

The main concerns and views voiced during the public hearing (5 March 2009) were:

- Alteration of existing land use (i.e. shift from agricultural to industrial). This includes sharing of existing groundwater used for agricultural irrigation leading to resource depletion;
- Public health and safety risks induced from disease outbreaks, noise and vibration, industrial atmospheric emissions, fugitive dust emissions and waste management;
- Control measures to safeguard against pollution of agricultural resources;
- Proposed source of electricity and water ;
- Potential employment opportunities.

Following the public meeting all suggestions, comments and concerns from the different parties were documented, evaluated and addressed by the SCC representatives and EIA team.

DESCRIPTION OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

Table 1-3 and Table 1-4 highlight the key impacts associated with the project. The type, nature (positive, negative, direct, indirect), magnitude, timing (during design, operation), duration (short term/temporary, long term/permanent) and significance of impacts is assessed. The evaluation approach implemented in this study is a Receptor-Specific Analysis approach addressing the various sources of impacts from the project's different implementation phases including mobilization, site preparation, commissioning, drilling/quarrying operations, and site restoration. The impact significance was determined using the following basic assessment criteria (and discussed in more detail in the following section:

Table 1-2: Impact Assessment Management Matrix

		LIKELIHOOD RATING		
		A	B	C
CONSEQUENCE RATING	1	1A	1B	1C
	2	2A	2B	2C
	3	3A	3B	3C
	4	4A	4B	4C
	5	5A	5B	5C
	6	6	6	6

KEY

Consequences		Likelihood	Acceptability
1 - Negligible	4 - Significant	A - Low	Negligible with minor mitigation
2 - Minor	5 - Catastrophic	B - Medium	Minimize Impacts
3 - Moderate	6 - Beneficial	C - High	Unacceptable

Table 1-3: Comparison between Environmental Impact Severity Matrix – a) No Mitigation Measures Applied, b) Measures in Place

Consequence	Likelihood	Acceptability
1. Negligible	A. Low	Negligible with minor mitigations
2. Minor	B. Medium	Minimize impacts
3. Moderate	C. High	Significant / major mitigation
4. Significant		Beneficial
5. Catastrophic		
6. Beneficial		

ACTIVITY / SOURCE OF THE IMPACT	UNMITIGATED IMPACTS – RECEPTOR								MITIGATED IMPACTS – RECEPTOR							
	AIR QUALITY	LAND USE AND VISUAL IMPACT	WATER RESOURCES	BIODIVERSITY	NOISE & VIBRATIONS	INFRASTRUCTURE AND TRAFFIC	ARCHAEOLOGICAL	SOCIO-ECONOMIC & PUBLIC HEALTH	AIR QUALITY	LAND AND VISUAL	WATER RESOURCES	BIODIVERSITY	NOISE & VIBRATIONS	INFRASTRUCTURE AND TRAFFIC	ARCHAEOLOGICAL	SOCIO-ECONOMIC & PUBLIC HEALTH
CONSTRUCTION PHASE																
Plant Site	2C	3C	2B	3B	2C	4C	1A	4C	1C	2A	2B	1C	2A	3B	1A	3B
Roads	2C	3C	1A	1C	2C	4C	1A	4C	1C	2A	-	1C	2A	3B	1A	3B
OPERATIONS PHASE																
Plant Site																
Crushing and Pre-homogenisation	3C	4C	1A	3B	3C	1A	1A	2B	2A	2A	1A	2A	2A	1A	1A	B
Milling, Homogenisations & Storage of Raw Materials	3B	4C	1A	3B	3C	1A	1A	2B	2A	2A	1A	2A	2A	1A	1A	B
Pre-heating, Kilning and Heating	4C	3C	1A	3B	3C	1A	1A	4C	2A	2A	1A	2A	2A	1A	1A	1B
Cooling, Grinding, Storage and Packing	3B	4C	3C	3B	3C	1A	1A	2B	2A	2A	2B	2A	2A	1A	1A	B
Transport of Raw Materials and Final Product	2C	4C	2B	3B	3C	5C	1A	3B	2A	2A	1A	2A	2A	2B	1A	1B
Captive Power Plant	4C	3C	4C	3B	3C	1A	1A	B	2A	2A	2B	2A	2A	1A	1A	B
Office & Accommodation Facilities	1A	2C	2B	3B	1A	1A	1A	B	1A	2A	1A	2A	1A	1A	1A	B
Limestone Quarry																
Drilling and Blasting	4C	4C	1A	2C	4C	1A	1A	2B	2B	2B	1A	1A	2B	2B	1A	1B
Transport	3B	3B	1A	1A	3B	1A	1A	2B	1B	1B	1A	1A	1A	1A	1A	1B
Basalt Quarry																
Drilling and Blasting	4C	4C	1A	2C	4C	1A	1A	2B	2B	2A	1A	1A	2B	2B	1A	1B
Transport	3B	3B	1A	1A	3B	5C	2B	5C	1B	1B	1A	1A	2B	2B	1A	1B

Table 1-4*: Summary of impacts and mitigation measures for key receptors

Receptor	Impacts		Mitigation Measures		Final Rating	
	Construction	Operations	Construction	Operations	C	O
Air quality	• Health impacts associated with increased levels of pollutants; • Emissions of air pollutants, including - airborne particulates (dust) - fugitive emissions - exhaust and combustion emissions	• Health impacts associated with increased levels of pollutants; • Dust generation and nuisance/health impacts on the local community. • Emissions of Greenhouse Gasses (GHG's)causing global climate impacts • Diseases associated with high levels of air pollutants • Dust on agricultural lands	• Well maintained and operated equipments, using appropriate fuel mixtures, e.g. diesel fuel with low sulphur content (5% sulphur content) • Using environmentally friendly equipment with higher fuel efficiency or equipped with air pollution control devices to minimize exhaust emissions. • Avoiding equipment and vehicles left running unnecessarily; • Watering-down dusty work areas. • Efficient scheduling of deliveries to reduce traffic load • Maintaining stockpiles at minimum heights and forming long-term stockpiles into the optimum shape (i.e. stabilization) to reduce wind erosion. • Maintaining handling areas in a dust free state as far as practicable. • Establishing and enforcing appropriate speed limits over all unpaved surfaces. • Travelling on existing and paved tracks wherever possible. • Avoiding open burning of solid waste through segregation and recycling, and through disposal according to a solid waste management plan	• Install low emission burners • Product development with new clinker (BCAF) and enhanced (Portland) clinker reactivity & with concrete formulation (admixtures, granular optimization • Concentrate on interface between the cement plant flue gases & treatment plant (gas conditioning, scrubbing, liquefaction) • Using alternative materials and biomass • Energy consumption (reduce Specific Heat Consumption) • Reduce the Consumption of Power. • Upgrade its factories and improve its activities and operations on a continuous basis by using alternative power sources. • Dust control measure - wetting of roads, dust screens and equipment which generates low dust emissions • Efficient scheduling of deliveries to reduce traffic load • Maintaining stockpiles at minimum heights and forming long-term stockpiles into the optimum shape (i.e. stabilization) to reduce wind erosion. • Establishing and enforcing appropriate speed limits over all unpaved surfaces. • Travelling on existing and paved tracks wherever possible. • Avoiding open burning of solid waste through segregation and recycling, and through disposal according to a solid waste management plan • Well maintained and operated equipment, using appropriate fuel mixtures, e.g. diesel fuel with low sulphur content (5% sulphur content)	1C	2B

Receptor	Impacts		Mitigation Measures		Final Rating	
	Construction	Operations	Construction	Operations	C	O
Water Resource	• Stress on already heavily utilised local groundwater resources • Groundwater pollution • Accidental chemical or oil spill from the project's operations	• Stress on already heavily utilised local groundwater resources • Groundwater pollution • Accidental chemical or oil spill from the project's operations (e.g. refueling operations).	• Lined Septic tanks as part of the Waste Management Plan • Ensure that no sanitary or waste water is discharged onto the land • Using biological, mechanical or thermal control measures • Identify high risk spill areas- e.g. generators and fuel tanks – and have impervious surfaces and capture facilities in place • Clean up spills if any with an absorbent material such as cat litter. Chemicals spilled near wells can move directly and rapidly into groundwater. Chemicals spilled near ditches or streams can move rapidly into surface water. • Selecting properly the location of mixing areas; Mixing and loading of pesticides should be done on an impervious pad whenever areas show limestone, marl or conglomerates formations • If chemical pesticides are applied, concentrates need to be carefully measured before they are placed into the spray tank. • Casing should not present open spaces and should be tested for leaks prior to casing installation • Ensuring that the sealing grouting is properly installed, coupled with a continuous monitoring for cracks, or potential deterioration, • Using of chemically inert expandable material for grouting and drilling, to avoid physical deterioration upon contact with water All equipments shall be cleaned and decontaminated prior to passing through the aquiferous formations; • Ensure an appropriate storage of equipment, • Unfinished borehole should be temporary sealed with special caps • Use of water-based fluids including non-toxic chemicals;	• Development of a detailed monitoring plan to monitor the groundwater levels, and selected water quality parameters such as conductivity, and temperature • Domestic wastewater will be channeled through the waste treatment plant • Storm water runoff and wash water will be channeled to evaporation ponds before being used to irrigate and control dust • Reducing water consumption and increasing recycling operations in all production units. This will include, but not exclusively, collection of washing and cooling water, supervising water consumption and reusing treated wastewater (once wastewater treatment plant is operational) as part of its water saving measures • Exploitation of the limestone aquifer, to reduce the stress of the shallow aquifer. Installation of two production wells tapping the Cretaceous limestone aquifer. Routine inspection and maintenance of equipment to ensure that risk of leak/spill is minimized; • Promotion of good housekeeping during operation and maintenance; • Ensuring a supply of suitable absorbent materials is available at re-fuelling points for use in dealing with minor spills. If a leak or spill occurs during loading or offloading operations, the operations will be stopped and the spill will be contained, cleaned up and collected. • Spills from generators, chemicals or disposed waste onsite shall be reported readily in order to seek immediate remedial; • Drip trays will be installed underneath equipment such as diesel generators to contain leakage. The drip trays will be maintained and kept drained of rainwater;	2B	2B

Receptor	Impacts		Mitigation Measures		Final Rating	
	Construction	Operations	Construction	Operations	C	O
Biodiversity	• Loss of terrestrial habitat • Damage to vegetation • Land contamination	• Disturbance of normal breeding, migration etc patterns	• Routine checking of trenches (if any) and escape routes to minimize, if not prevent, entrapment of fauna; • Washing down of vehicles in place and prior to commencing work; • Preservation of excavated top-soil for future site restoration procedures particularly in highly disturbed areas; • Limiting vehicular transport to defined roads as to prevent unnecessary injury, habitat destruction and complying with safe driving procedures; • Reporting of any violation relating to hunting and trading activities; • Implementing good housekeeping practices on the field and implementing SCC's proposed Solid Waste Management plan in order to eliminate any source of hazard to the native fauna	• Limiting access to quarry sites and plant area via erection of concrete barriers and/or fencing so as to prevent accidental falls of fauna (and potentially herders, children, pedestrians). • Define refuge areas (for nesting, resting, feeding and breeding) – no-go for people, vehicles etc • Limiting vehicular transport to defined roads as to prevent unnecessary injury, habitat destruction and complying with safe driving procedures; • Reporting of any violation relating to hunting and trading activities; • Implementing good housekeeping practices on the field and implementing SCC's proposed Solid Waste Management plan in order to eliminate any source of hazard to the native fauna • Routine checking of trenches (if any) and escape routes to minimize, if not prevent, entrapment of fauna; • Washing down of vehicles in place and prior to commencing work	1C	1B
Land Use and Visual Impact	• Conflict with current land use for off-site facilities • Landscape changes	• Landscape changes	• Physical barriers such as walls and netting • Limiting the construction site (waste, roads etc) to the 130 ha will ensure that the area effected is limited to the plant site (130 ha) and does not spill over onto adjoining lands.	• Good design and effective landscaping • Plant green zones near impact receptors • Variation of color on the plant structures • Containing the quarry operations to the quarry sites this will ensure that the area affected is limited to the quarry and does not spill over onto adjoining grazing lands. • Quarries need to be fenced to ensure that local herders and their livestock do not enter the quarry site and run the risk of injury.	2A	2A
Noise & Vibrations	• Increase of ambient noise levels with the potential of disturbance to local	• Increase of ambient noise levels with the potential of disturbance to local	• Installation of temporary noise barriers and using appropriate equipment fitted with noise mufflers	• Select low noise equipment, install mufflers at air inlets and outlets of the fans and air compressors;	2A	2B

Receptor	Impacts		Mitigation Measures		Final Rating	
	Construction	Operations	Construction	Operations	C	O
	communities.	communities. • Damage to local structure due to vibrations	• Maintaining an active community consultation and positive relations with local residents will assist in alleviating concerns and resolve any potential noise complaints. • Provide adequate Personnel Protective Equipment (PPE) to construction workers at all noisy activities/locations that exceed permissible occupation noise level limits set in the Syrian Permissible threshold Occupational noise level standards in different work areas.	• Install sound insulation cover (room) for equipment with higher noise; • Place noisier sources farther away from sensitive receptors in the overall design; • Build sealed or semi-sealed workshops for noisier production processes; • Build 2 m high concrete wall around the cement plant premises; • Grow high-rise and thick trees around the plant and quarry premises. • Proper route planning, traffic planning • Install high noise warning boards which will be displayed in areas of noise levels and mandate ear protection the identified high risk area. • Noise level monitoring should be conducted regularly to ensure that noise levels during all times are within national noise exposure standards. • Additional noise level control measures and occupational/community health preventive measures will be considered following IFC EHS guidelines. • Timing between blast set to produce minimum vibrations • Blasting needs to be restricted to a limited part of the day. • Covering the detonating fuse with at least 150 mm thick cover of sand or drill cuttings • Supervision of drilling and blasting operations to ensure the designed blast geometry. • Avoid blasting when strong winds are blowing towards the residence. • Further based on the safe blasting limits it is recommended that the peak particle velocity (ppv) should be kept at 10 mm/sec.		
Infrastructure and Traffic	• Stress on local traffic infrastructure; • Public health risk from waste transport and	• Stress on local traffic infrastructure; • Public health risk from waste transport and	• A Traffic Management plan would need to be implemented	• In consultation with local inhabitants identify an alternative route for the road through an area that is less populated. This may require the need to purchase agricultural land from	3B	2B

Receptor	Impacts		Mitigation Measures		Final Rating	
	Construction	Operations	Construction	Operations	C	O
	disposal; • Traffic congestion; and • Public safety risk.	disposal; • Traffic congestion; and • Public safety risk. • Air, dust and noise pollution in villages, • Loss of livestock due to collisions on the roads •		local farmers in order to re-route the road • Construct/upgrade the road to the standard required to carry the load and volume of traffic required to deliver basalt to the plant • Enforce strict restrictions on the speed at which the trucks are allowed to travel and the hours of operations • Where necessary implement stop/go zones which will allow a single truck to pass at a time • Construction of a new intersection on the Aleppo- Al Hassakeh Highway at the entrance to the plant • Clear signage on the roads • Education of local communities, staff and transport contractor		
Archaeological	• Alteration of and/or damage to archaeological resources, from construction works which require the physical excavation (blasting, site clearance, trenching etc.)	• Visual intrusion on the setting and amenity of the above-ground archaeological mound during construction and operation and potential loss of access to the archaeological site;	• Proper and careful planning of any work carried out near mound so as to avoid any potential damage to the sensitivities and artifacts; • Prevent all theft attempts and postponing any damaging activities until further instructions from SCC	• Proper and careful planning of any work carried out near mound so as to avoid any potential damage to the sensitivities and artifacts; • Prohibiting all theft attempts and postponing any damaging activities until further instructions from SCC	1A	1A
Socio-Economic & Public Health	• Local spending and positive impact into the local economy • Creation of job opportunities for local residents; • Generation of employment for local workers • Public health risks from large scale use of immigrant workers and stress on local healthcare infrastructure and other social facilities	• Local spending and positive impact into the local economy • Creation of job opportunities for local residents; • Generation of employment for local workers • Public health risks from large scale use of immigrant workers and stress on local healthcare infrastructure and other social facilities	• Encouraging participation of locals at early planning stage • Consultation with potentially affected communities prior to building the construction camps; • Proper training of crew members on camp regulations, code of conduct, and local cultural behaviour and awareness training of the workforce on responsible community interactions; • Proper implementation of external security including adequate fencing and signage around the cement plant site as well as quarry sites, establishing tower guards to move away local pedestrians and livestock from the operation and all open pits so as to	• Encouraging participation of locals at early planning stage • Investigating the feasibility of SCC to conduct social assistant programs in the local area. • Having a Traffic Management Plan (TMP) and ensuring that the Contractor complies with TMP requirements at all times; • Allowing only certified and trained drivers to carry out transportation related activities; • Having an plan for Emergency Response Procedures in place • Maintaining and immediate repairing of any damages caused by the project operation on public or private structures (e.g. electric cables, water network supplies and irrigation	3B	1B

Receptor	Impacts		Mitigation Measures		Final Rating	
	Construction	Operations	Construction	Operations	C	O
		• Anti-social behavior of immigrant workers	prevent injury / entrapment or death to any person and/or grazing animals; • Communicating the availability of job opportunities to the local community in the project area; • Maintaining and immediate repairing of any damages caused by the project operation on public or private structures (e.g. electric cables, water network supplies and irrigation channels, etc.) • Investigating the feasibility of SCC to conduct social assistant programs in the local area. • Having a Traffic Management Plan (TMP) and ensuring that the Contractor complies with TMP requirements at all times; • Allowing only certified and trained drivers to carry out transportation related activities; • Having an plan for Emergency Response Procedures in place	channels, etc.) • Proper implementation of external security including adequate fencing and signage around the cement plant site as well as quarry sites, establishing tower guards to move away local pedestrians and livestock from the operation and all open pits so as to prevent injury / entrapment or death to any person and/or grazing animals;		

*The impacts and mitigation measure included in this table are not exhaustive but summarize the main issues

DISCUSSION OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

The impacts described in Table 1-3 and Table 1-4 are a reflection of the key aspects associated with the project. They can be further summarized in that the key impacts will be realized in the following environments:

- Ambient Air Quality;
- Land-use and Visual
- Water Resources (geology, groundwater and surface water);
- Biodiversity (fauna and flora);
- Noise and Vibration;
- Infrastructure and Traffic
- Archaeological;
- Socio-Economic and Cultural Heritage Environment;

Taking all of these factors into account, the following can be concluded:

1. **Degree of impact on public health and safety**
   - Public health and safety will be placed under the greatest risk through the effects of traffic and transportation, blasting and through dust impacts.
2. **Degree to which effect on the human environment is highly uncertain or involve unique or unknown risks;**
   - All risks are known and have been described (either quantitatively or qualitatively).
3. **Irreversibility of impact**
   - Most of the impacts described are reversible. Irreversible impacts (associated with landscape changes and habitat disturbance are manageable or considered to be of relatively low importance.
   - The significance of archaeological impacts is considered to be low.
4. **Action affects the functioning of life support systems, natural amenities, cultural resources etc**
   - The function of life support systems and/or natural amenities will be impacted by the project; however with appropriate mitigation measure these impacts can be limited to acceptable levels.
   - Key mitigation measures includes:
     - Exploiting the deep limestone aquifer to reduce stress on shallow aquifers
     - Lining of septic tanks and areas were oil and fuels are handled to prevent contamination of ground water
     - Re-routing road from basalt quarry to avoid villages and construction of intersection to facilitate exit and entry of trucks onto the highway
     - Implementation of various dust reducing techniques including the wetting of dry surfaces

5. Violation of the spirit of the law

- In review of performance against specified standards and guidelines, the project is not expected to exceed International and Syrian National Ambient Air Quality Standards for dust and NOx and SOx emissions.
  - The expected minimum and maximum total amounts of SO_2 emissions ranges between 990 and 14,850 tons/year; which are equivalent to stacks emissions between 861 mg/m3 and 1,888 mg/m3. The modelling of the SO_2 dispersion of the gases emitted by both sources (kiln + power plant), conclude a maximum yearly concentration at ground level of 6µg/m3 or 13µg/m3, depending on the sulphur retention scenario (95% or 99%). These concentrations are calculated for the most exposed villages in the dispersion pattern, namely, Kharab Eshek & Kharab Eshek Janoubi. The concentrations are compliant with European directives 80/779, 85/203 and amendments and they are representative of industrial areas in Europe
  - The expected minimum and maximum total amounts of NOx emissions ranges between 73 and 1097 mg/m3 with an emissions limit of 600 mg/m3 guaranteed by the supplier. The modelling of the NO_2 dispersion of the gases emitted by both sources (kiln + power plant) conclude a yearly concentration of between 3µg/m^3 & 6 µg/m^3 at ground level in the nearest village shown in the dispersion pattern. This is well within international standards for air quality. To put this in perspective a city like Paris, where air quality has improved over the years, 2008 registered concentrations of NO_2 between 34µg/m^3 & 43µg/m^3 depending on the air station location (district)
  - The daily expected minimum and maximum concentrations of dust emissions ranges between 2 to 73 mg/m^3 respectively
  - The expected amounts of CO_2 emission for the cement plant are 2,047,815 ton /year. The CPP will add an additional 429,720 ton of CO_2 / year.
- The project is expected to exceed ambient limits for noise levels and vibration, especially during blasting activities at the quarry sites. While unavoidable this can be mitigated as indicated in Table 1-4 above.
- The project is expected to extract large volumes of groundwater which may potentially impact on other resource users. However exploitation of the deep limestone aquifer, will help reduce the impact of the project on the shallower aquifers used by the local population, Preventative measure as outlined in Table 1-4 above will ensure impacts are prevented, while frequent monitoring of both water quality and quantity with allow immediate remedial action to be taken in the unlikely event that any impacts should emerge.

6. Limitations for future actions

- The project is unlikely to prevent further activities from taking place in the region. It is, in fact, likely that the project will generate additional opportunities for downstream industry.

7. Nature of cumulative effect

- Cumulative impacts have been assessed and are considered in the significance ratings summarised in Table 1-3

8. Social costs absorbed as private costs

- Private social costs are unlikely to accrue as a result of the project.

Therefore, while there are a number of environmental concerns associated with the project that need to be managed, none are considered to be of such significance that they cause concern for long-term risk and/or are of such importance that they should prevent the project from proceeding.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The ESMP addresses the main impacts identified in the ESIA, in particular:

- Mitigation measures to be implemented during the construction phases;
- Waste management and disposal methods;
- References to control guidelines and standards;
- Responsibilities for the implementation of the ESMP;
- Verification, monitoring, and training requirements; and
- Reporting requirements.

The ESMP has been based on the ISO14001 Environmental Management Systems standard. This is not to say that the programme will pursue certification, but simply that it will be based on a robust management philosophy. For this reason, the programme is structured to reflect a description of the overall approach; where after the individual elements of the management programme are presented in detail. It is also important to emphasise that the ESMP logically follows from the EIA and has been developed specifically in response to the mitigation measures stipulated.

The ESMP has been divided into the construction and operational phase, and key elements are depicted in Figure 1-2 and Figure 1-3 below.

Figure 1-2: Summary of Environmental requirements during Construction

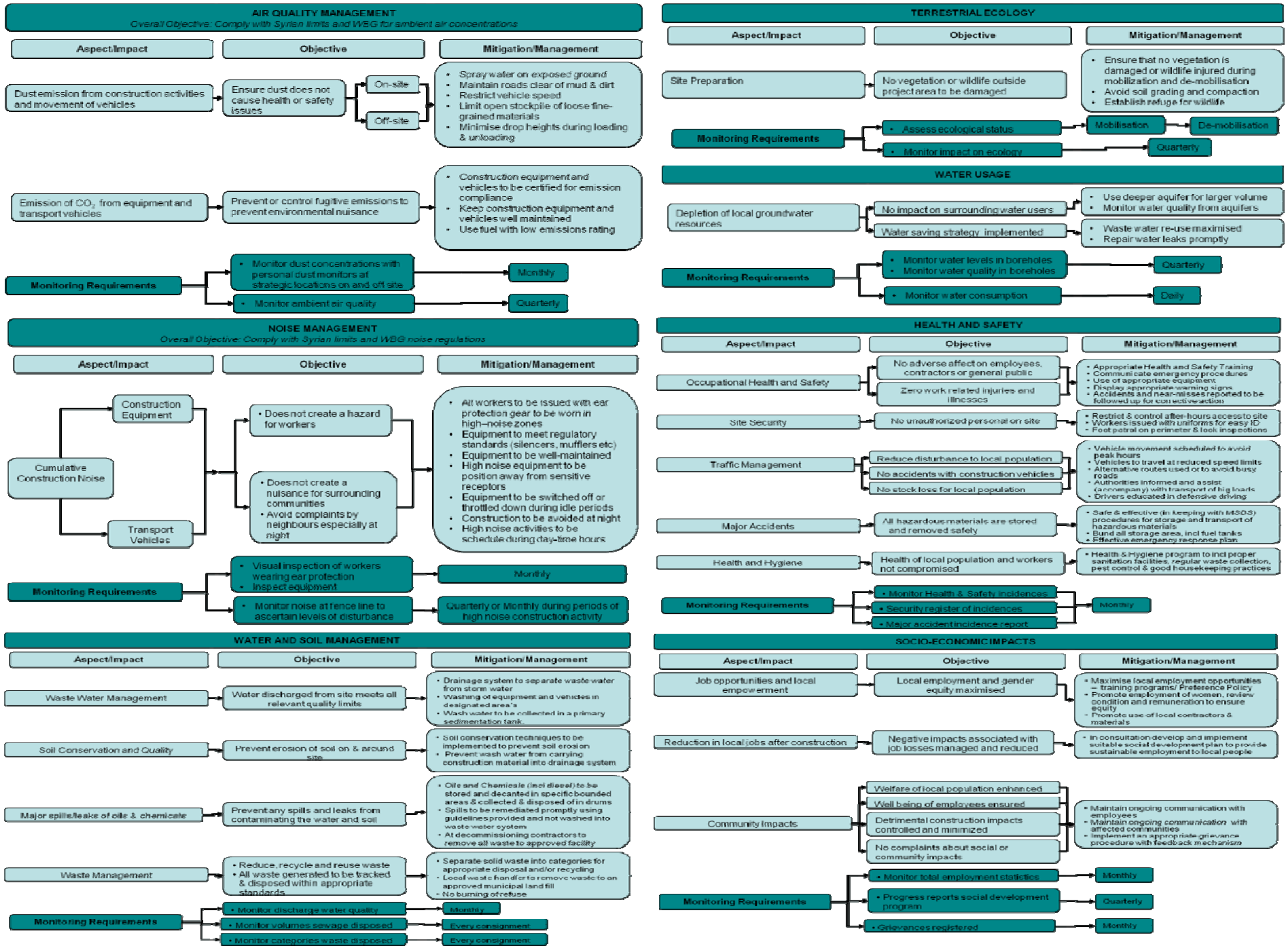


Figure 1-3: Operational Environmental and Social Management Plan

ENVIRONMENTAL MONITORING PLAN

Environmental Component	Parameters	Frequency
Ambient Air Quality	PM, SO_2, NO_x	Annual
Air Emissions	PM, SO_2, NO_x, GHG's	Continuous (GHG's annually)
Groundwater	pH, Oil and Grease, TSS, TDS, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Sulphates, Nitrates Chlorides, Heavy metals (Cd, Cu, Cr, Ni, Pb, Zn), Water levels	Biannual
Ambient Noise	Noise Levels in dB(A)	Annual
Resource Conservation	Steel and Cement	Monthly
	Operating hours for equipment and distance travelled of vehicles	Weekly
	Fuel Consumption and exhaust emissions	Quarterly
Solid Waste	Type, amount generated, reused, transported off-site, disposed (incl method of disposal)	Weekly
Material procurement	Material purchased, consumed and unaccounted for (with explanation)	Monthly
Water	Water consumption,	Weekly
	Effluent for pH, Oil and Grease, TSS, TDS, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Sulphates, Nitrates Chlorides, Heavy metals	Monthly
Oil consumption / used oil	Oil purchased, used, used oil generated and oily waste	Monthly
Safety	Training provided and its effectiveness	Monthly
Emergency procedures	Facilities for emergency preparedness and report on drill	Quarterly

CORRECTIVE ACTION/MITIGATION MEASURES FOR MAJOR IMPACTS

Major Impact		Corrective Action/Mitigation Measures
Air Quality	Emissions	Nature of design (eg ESP for the control of kiln exhaust) minimises emissions to the environment
	CO_2	• A complete inventory of CO_2 emissions, on a facility basis and for the corporation • An understanding of each facility's individual CO2 cost control curve • Development of trading, offset, and other management strategies • Integrating CO_2 costs into corporate financial decision-making using probabilistic modelling with a range of CO_2 prices.
	Dust	• Bag filters for crushing plant, blending silo, clinker storage, cement mill, all transfer points and conveyors • All raw materials covered were possible especially during transport including conveyor belts; • Retention of moisture in the raw material to the extent possible; • Green-belt development around the facility to act as buffer zone for mining and cement plant • Use of overburden to support green-belt development; • Surface internal roads to avoid dust generation; and watering of roads to suppress dust. • During drilling operations, dust extractors used for collection of dust from the source and depositing the same away from the work place. • Dust generated during unloading of limestone in crusher hopper suppressed by water spray.
Noise		• Equipment selection, engine selection and proper matching of equipment. • Operational practices including blasting practice, operator training, scheduling and site layout, and switching equipment off while not in use and driving at reduced speeds • Using long stemming columns in blast holes. • Using electric delayed detonators rather than detonating fuse as trunkline. • Covering the detonating fuse with at least 150 mm thick cover of sand or drill cuttings • Not blasting when strong winds are blowing towards the residence • Noise attenuating devices like ear plugs and ear muffs to workers exposed to high noise levels. • High noise warning boards displayed in areas of noise levels and ear protection made mandatory in this area. • High noise operations like blasting restricted to a limited part of the day. • Plant and machinery maintained properly and operated optimally at rated capacity.

MANAGEMENT PLANS

Management of Hazardous Substances

Waste Management Plan

- Emergency Response Plan – – – Spill Contingency Plan
- Health and Safety
  - Working at Heights
  - Mechanical Lifting
  - Transportation Safety
  - Safety and Welfare of Workers
  - Safety at Quarries
  - Power Plant safety
- Closure Plans *"Return site to a grazing/wilderness state"*
  - Surface Infrastructure
  - Site-vegetation
  - Spoils and Waste Dumps

CORRECTIVE ACTION/MITIGATION MEASURES FOR MAJOR IMPACTS

Major Impact	Corrective Action/Mitigation Measures
Vibration	• Use delay detonators. and decking wherever possible. • Supervise drilling and blasting operations to ensure the designed blast geometry. • Proper drilling of the face before blasting • Sub-drilling adequate to tear off the bench bottom and eliminate hole to hole propagation between charges. • No blasting when surface winds are strong.
Water Conservation	• Blowdown water and wash water be reused for material cooling, spraying • Domestic water treated in a biological treatment plant and reused within the plant for material cooling and or irrigation. • Wastewater from the colony needs to be treated and reused in manufacturing
Water Quality	• Workshop provided with a concrete surface to prevent seepage of any spillage into groundwater. • Changing of oil/fuel from construction vehicles to be undertaken in designated areas only. • Drip pans to be used when undertaking all such activities. • Maintain absorbent pads handy to absorb all leaks / accidental spills. • Dispose used pads as hazardous waste. • Drain and crush oil filters (and oil containers) before recycling or disposal. • Store crushed oil filters & empty lubricant containers in a leak proof container/receptacle. • Store mechanical parts and equipment that may yield even small quantities of contaminants (i.e. oil and grease) under cover. • Drain all fluids and remove batteries from salvage vehicles and equipment. • Recycle or properly dispose of greases, oils, antifreeze, brake fluid, cleaning solutions, hydraulic fluids, batteries, transmission fluids, and filters. • Clean up spills as they occur. • Constructing sediment basins/check dams, wherever necessary • Oil stored in barrels and sold to outside parties for further processing or reuse. • Domestic sewage from the plant and colony shall be treated in soak pits and in a sewage treatment plant and reused for irrigation
Traffic Management	• Vehicle movement scheduled to avoid peak hours • Vehicles to travel at reduced speed limits • Alternative routes used or to avoid busy roads • Authorities informed and assist (accompany) with transport of big loads • Drivers educated in defensive driving • By-pass routes to be constructed so as to avoid villages • Intersection to be constructed to facilitate exit and entry of vehicles onto highway

1 INTRODUCTION

1.1 BACKGROUND INFORMATION

This report represents the Environmental and Social Impact Assessment Report for Syrian Cement Company's (SCC's) proposed cement plant located to the north of Syria. The report was prepared after completion of public participation and technical studies in 2008 and 2009 and is in accordance with the requirements of the Syrian EIA Executive Procedures issued by the Ministerial Decision No. 222 in January 29, 2008 and the International Lending Community.

1.2 THE PROPOSED PROJECT

In 2006, Syria consumed 6.2 million tons of cement; of which 2 million tons were imported from nearby countries. In addition, the Syrian cement market is expected to witness around 8-10% annual growth in cement consumption over the next several years. In response, SCC was formed with the view of addressing this need. SCC is a Joint Venture Company whose ownership comprises the MAS Group of Syria (retaining 4% of the shareholding) and Lafarge Group of France (holding 96% of ownership). SCC is proposing to establish a three (3) million tons per annum (tpa) Portland Cement Production facility (including associated quarries – for limestone and basalt – and a captive thermal power plant) in the north of Syria.

The project aims to help alleviate the growing cement deficit in the domestic supply which currently imports in excess of 30% of the total cement consumed. In addition, local cement production will substitute imports, generate foreign exchange savings and significantly reduce cement prices. This will support the development of infrastructure and housing projects, which will encourage new business opportunities in other industrial and service sectors and lead to further job creation. The project will also contribute substantial transfers to the Syrian government through corporate and other taxes over the life of the project.

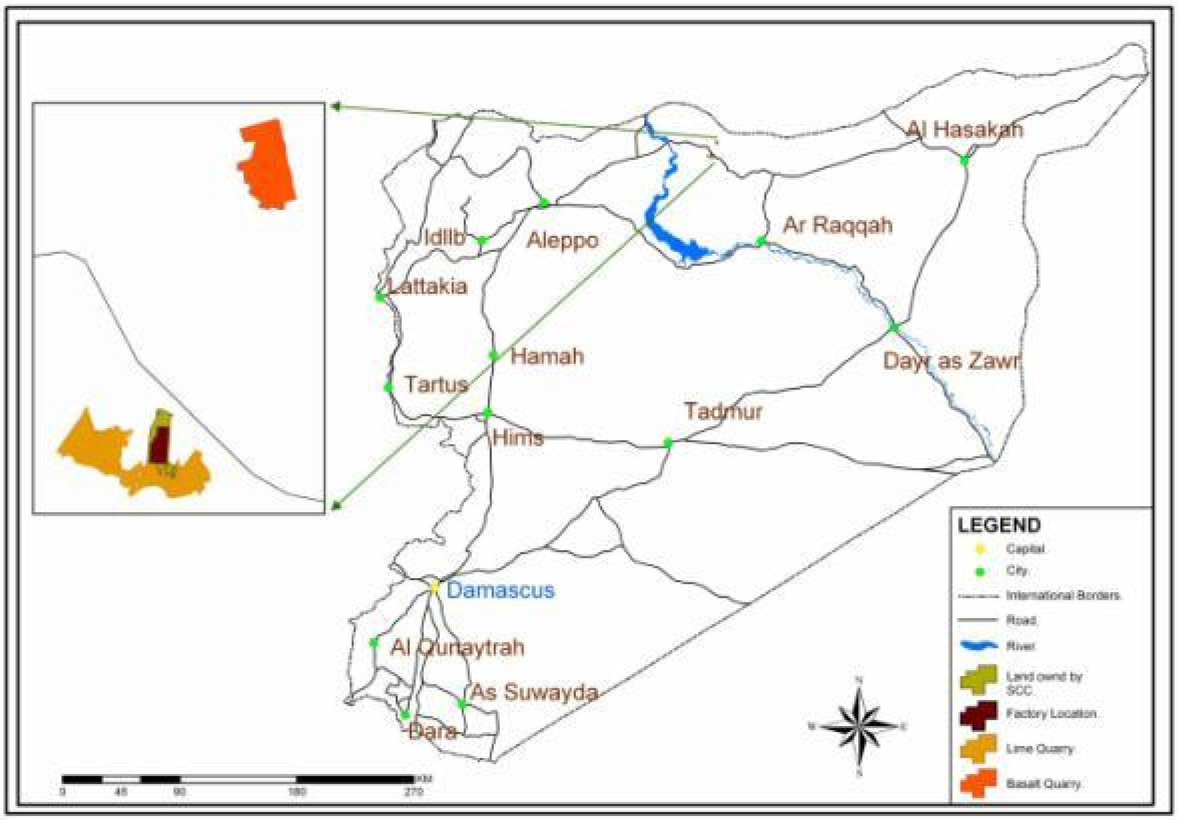
SCC's proposed development project involves:

- Construction and operation of Portland Cement Plant in the Aleppo District, Syria with a annual production capacity of 3 million tons;
- Mining operation of raw material from two quarries, Limestone and Basalt Quarries located near the cement plant;
- Construction and operation of a 60 MW coal fired thermal power plant to provide the necessary energy requirement for the Cement Plant operations. A further extension plan of the captive power plant will include an additional power supply of 30 MW.
- Well drilling of two deep water wells (800 m Below Ground (B.G.)) to supply the Project's facilities with the required water demand; and
- Accommodation units for approximately 760 employees with associated utilities and infrastructure (water, electricity, roads, wastewater treatment plant, etc.) during the Construction Phase.

Operation of the cement plant is expected to commence 24 months following the execution of construction works. The plant's maximum production capacity is anticipated within 5 months following operation. It is anticipated that the plant will be operational by mid-2010.

1.3 PROJECT LOCATION

The proposed project is located on the eastern bank of the Euphrates River approximately 160 km to the north-east of Aleppo, 135 km north-west of the Raqqah, and 20 to 30 km from the Syrian-Turkish border. The project occupies an area of approximately 14.6 km^2.



Map 1-1 General Map of the Study Area

1.4 PURPOSE OF ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

Due to the nature of this project and the EIA regulations of the Syrian Government and the International Lending Community, it is necessary to conduct an EIA on the proposed project. An EIA is a planning tool which helps to establish the social and environmental impact of a proposed project through public participation and independent specialist assessment. Its purpose is to provide the authorities with sufficient information on which to base a decision about whether a proposed project should or should not go ahead. Through the EIA, potential negative and positive impacts are identified. Recommendations are made for reducing or avoiding negative impacts, and enhancing positive impacts. The findings of an EIA are transferred into clear and measurable objectives that must be achieved during construction, commissioning, operation and closure of a proposed project. These objectives, and plans for achieving them, are captured in an Environmental Management Plan (EMP).

An EIA is a procedure required under the terms of the European Union Directives 85/337/EEC and 97/11/EC on assessment of the effects of public and private projects on the environment. It is also required under the Syrian EIA Executive Procedures issued by the Ministerial Decision No. 222 in January 29, 2008. These Executive Procedures specify the obligations of Article 4 of the Environmental Protection Law No. 50, 2002 regarding the rules of environmental safety and the protection of the environment from pollution.

The SCC proposed development project falls under “The production of cement clinker or cements with a production capacity of 1000 tons or more per day” and “Construction and operation of a quarry with a working area of 25 ha (250 000 m^2) or more” project categories that requires an EIA study in order to obtain a construction and operation permit from the Licensing Authority. The EIA process in Syria is similar to the EU EIA process.

To achieve this, the following objectives will be accomplished in the ESIA:

- Identify and review all Syrian applicable regulations and standards as well as all international agreements, EU and World Bank IFC standards and requirements;
- Provide a detailed description of all Project activities and work plans;
- Describe the existing baseline environmental conditions within the Project Area; covering the physical, biological, socio-economic, archeological and cultural elements likely to be affected by the Project’s operations and/or likely to cause adverse impacts upon the Project, including both natural and man-made environments;
- Identify the nature, extent and significance of any potential environmental, social and health impacts be they positive (beneficial) or negative (adverse), temporary or long term. This shall include routine, non-routine (planned) operations and unplanned (accidental) events.
- Identify any significant cumulative or trans-boundary impacts of the Project and recommend appropriate actions to mitigate or minimize these impacts during the project execution;
- Identify, assess and specify methods, measures and standards, to be included in the detailed design, operation and decommissioning of the Project which are necessary to mitigate these impacts and reduce them to acceptable levels;
- Design and specify appropriate mitigation and monitoring measures for these impacts; and
- Outline the management principles and controls that SCC and its Contractor will apply on the Project to address any residual impacts. And/or outline the Environmental and Social Management Plan (ESMP). This shall include a summary of the identified impacts and recommendations in

addition to an Environmental Compliance Status of SCC construction and operation procedures with local and international standards.

1.5 WHO IS THE SYRIAN CEMENT COMPANY?

The Syrian Cement Company (SCC) is a Joint Stock Company formed between the MAS Group of Syria and the Lafarge Group of France. The project proponent, Lafarge Group, has considerable experience in large-scale industrial projects both locally and internationally.

Lafarge Group, a world leader in building materials, is based in Paris, France. It employs more than 90,000 people in 76 countries and owns 166 cement production sites and 122 cement plants in 50 worldwide countries. The MAS Group was established in 1980 and that time focused primarily on agricultural food products. It has subsequently expanded to other industries such as real-estate development as well. It is renowned for being a supporter of social, cultural, athletic and humanitarian projects.

SCC, its contractors and sub-contractors will operate under Lafarge's Policies, Commitments, Standards and Requirements for environmental, health and safety compliance which are described below.

1.5.1 Statement of Environmental and Social Compliance

SCC is committed to ensuring that the proposed project complies with:

- Relevant Syrian Environmental legislations, regulations, standards and requirements;
- International treaties, conventions and agreements ratified by Syria;
- World Bank / IFC Environment, Health and Safety Guidelines for mining, cement manufacturing, and thermal power plants;
- World Business Council for Sustainable Development/Cement Sustainable Initiative (CSI) guidelines for environmental monitoring and CO_2 calculation and reporting in cement industry;
- Complies with European Investment Bank (EIB)'s environmental and social principles and standards including relevant EU Directives and best available techniques (BREFS) for the industry sectors covered by the integrated pollution prevention and control (IPPC) Directive 2008/1/EC; and
- Project Proposed Environmental and Social Management Plan (ESMP) for the construction and operation phases of the Project.

1.5.2 Health & Safety Policy

SCC have adopted and implemented Lafarge's Environment, Health and Safety management system which is updated as part of Lafarge's continuous improvement process. The objective is for Lafarge to manage its operations in accordance with leading global practice such as ISO 9001, ISO 14001 and OHSA's 18001 principles. Lafarge's commitments to Health and Safety are described in Box 1-1.

Box 1-1 Lafarge's Health and Safety Commitments

- *"Lafarge is committed to providing a safe and healthy work environment for its stakeholders and to conduction its various businesses in a safe manner. Health & Safety are core values that must be incorporated into all aspects of our business"* – Group H&S Policy

- *"Health and safety are absolute priorities for Lafarge. The Group has implemented a stringent safety policy for its employees. It also participates in public health programs that benefit both employees and local communities. Lafarge aims to become the safest company in its sector and encourage safe behavior"* – Health & Safety statement in group's website

1.6 ESIA PRACTITIONERS

SCC has commissioned Earth Link and Advanced Resources Development (ELARD), a local environmental consultancy firm based in Damascus, in cooperation with Golder Associates (Golder), a global leader in environmental and engineering services, to undertake the required ESIA. Both firms subscribe to best international practice in which independence is a critical requirement, as follows:

> *"that such EAP has no business, financial, personal or other interest in the activity, application or appeal in respect of which that EAP is appointed in terms of these Regulations other than fair remuneration for work performed in connection with that activity; or that there are no circumstances that may compromise the objectivity of that EAP in performing such work."*

1.6.1 ELARD

ELARD is a highly specialized consulting firm that employs professionals in the field of applied earth and environmental sciences, including solid waste management, water resources management and development, water and wastewater treatment, pollution containment and abatement, and environmental policy development and institutional strengthening. ELARD focuses on providing assistance to private developers, industries and public agencies in finding cost effective solutions for highly specialized and complex problems related to the management of earth resources, and the protection of the environment.

Founded in Beirut, Lebanon in 1996, the firm quickly expanded to become one of the leading environment and water resources management consulting firms in the region, offering its services in the Middle East, the Gulf, North Africa, and South Western Asia. With established offices in Lebanon, Syria, the Emirates, and USA, field offices are opened on an as-needed basis, as was the case in Pakistan for an extensive groundwater resource assessment project.

Established in 2005 in Damascus, Syria, ELARD project team has accumulated hands-on experience in carrying out geophysical investigations for hydrogeological and engineering purposes (Downhole geophysical logging) and in preparing Environmental Impact Assessments (EIAs) and Environmental Baseline Surveys (EBS) related to the oil and gas sector (onshore seismic, well exploration and drilling operations) as well as development and construction proposals for cement manufacturing plants (Al Badia Cement Manufacturing Factory, and Rajhi Cement Manufacturing Factory).

ELARD has been regularly solicited by international companies - Shell, Petro-Canada, Gulfsands, Total, Tatneft and IPA Water and Energy Consulting Ltd, the Euro-Arab Mashreq Gas Co-operation Center (EAMGCC) - to support in the preparation of EIA and EBS studies in the region.

1.6.2 Golder Associates

Golder Associates is a premier international company specializing in environmental and engineering sciences. Golder employs more than 8,000 people in over 150 offices around the world. Golder offers specialist services in the fields of environmental, geotechnical, civil and process engineering, waste and water engineering, geology, hydrology, geohydrology, environmental and social impact assessment, environmental and social auditing and management plans, relocation/resettlement action plans, sustainable development assessments and community development plans, agribusiness development, public participation, awareness creation, capacity building and stakeholder engagement, and planning for climate change.

The Golder Associates project team has extensive experience in preparing environmental evaluations for a variety of development proposals in different geographic settings. Golder has successfully conducted many thousands of environmental, social and consultation projects world-wide, several hundred of these in over 20 Middle Eastern and African countries. Golder has conducted more than 60 projects completed for EFI's, including the World Bank Group, European Bank for Reconstruction and Development, Asian Development Bank, and national development agencies. In addition, Golder has developed Equator Principle guidance for project lending for a number of leading financial institutions based in London, Sydney, New York, Paris, Johannesburg and the Middle East. Our organization subscribes to the Code of Ethics of the International Association for Impact Assessment and by inference is well-placed to apply principles of impartiality.

1.7 PURPOSE OF THIS REPORT AND SCOPE OF THE EIA

The purpose of the report is to provide the authorities and stakeholders with the findings of the EIA. It describes the public participation process and the results of the technical studies, undertaken during the EIA, and assesses the significance of potential impacts and recommended mitigation strategies.

This EIA covers the following components of the proposed SCC Project:

- The construction, commissioning and operation of Portland Cement Plant in the Aleppo District, Syria with a annual production capacity of 3 million tons;
- The construction, commissioning and operation of Limestone and Basalt Quarries located near the cement plant;
- The construction, commissioning and operation of a 60 MW coal fired thermal power plant to provide the necessary energy requirement for the Cement Plant operations; and
- Ancillary infrastructure, such as waste water treatment facilities, manpower camps etc. required for the effective construction and operation of the aforementioned project components.

1.8 ESIA REPORT STRUCTURE

The ESIA report is generally structured following the World Business Council for Sustainable Development/Cement Sustainable Initiative (CSI) Environmental and Social Impact Assessment guidelines as follows:

PART 1: INTRODUCTION AND CONTEXT

- **Chapter 1** is the introduction and gives an overview of the EIA process and the EIA practitioners.
- **Chapter 2** describes the proposed project and motivation for the project, covering the cement plant, the quarries and the captive power plant. Chapter 2 details the need and desirability of the proposed project.
- **Chapter 3** describes the study area. It presents a summary of knowledge about the existing physical, biological, social and cultural environment upon which the proposed project may impact.

PART 2: LEGAL AND PROCEDURAL

- **Chapter 4** outlines the EIA and public participation processes, indicating how stakeholders were notified of the opportunity to contribute to the EIA and the various technical studies that were undertaken.
- **Chapter 5** outlines the legislation that governs the EIA.

PART 3: POTENTIAL IMPACTS AND MITIGATION

- **Chapter 6** summarizes the potential impacts and associated mitigation measures for the project during construction and operation and contains the Environmental Impact Statement.
- **Chapters 7 & 8** describe the Environmental Management procedures that will be implemented to reduce environmental impacts

2 DESCRIPTION OF THE PROPOSED PROJECT

2.1 BACKGROUND INFORMATION

In 2006, the Syrian Arabic Republic consumed 6.2 million tons of cement; 2 million of which were imported from nearby countries. The Syrian cement market is expected to witness an estimated 8 - 10% annual growth in cement consumption in the coming years.

The proposed project aims at alleviating the growing cement deficit in the domestic market which currently imports in excess of 30% of the total cement consumed. Moreover, it is anticipated that local cement production will substitute imports, thereby generating foreign exchange savings and a significant reduction in the cement price. The increase in local production will help support the development of infrastructure and housing projects, which will encourage new business opportunities in other industrial and service sectors and lead to further job creation. The project will also contribute substantial transfers to the Syrian government through corporate and other taxes over its lifespan.

2.2 FACILITY LOCATION AND LAYOUT

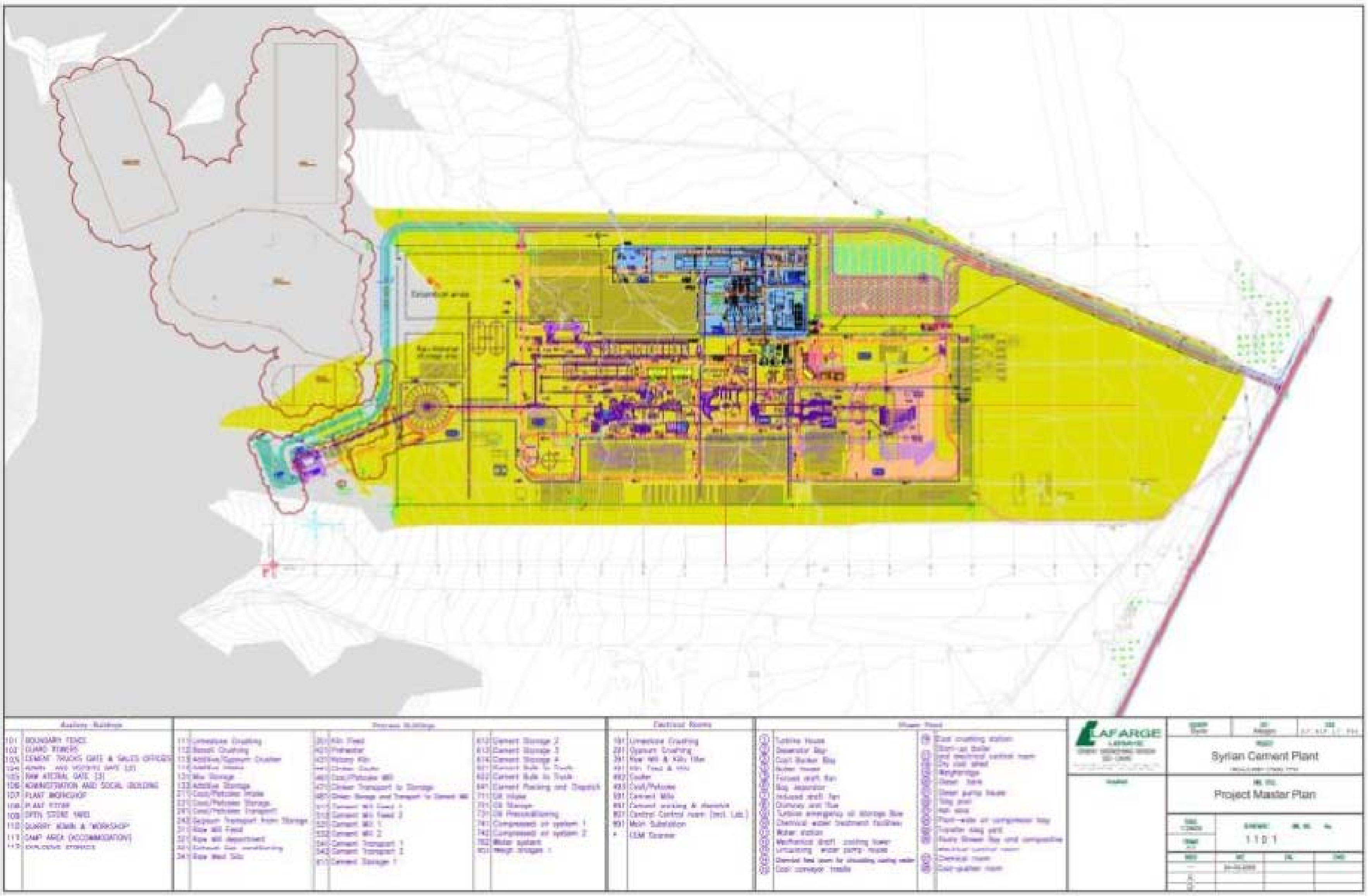
The proposed project is located on the eastern bank of the Euphrates River approximately 160 km to the north-east of Aleppo, 135 km north-west of the Raqqah, and 20 to 30 km from the Syrian-Turkish border. Table 2-1 presents the geographic coordinates delineating the boundaries of the project area including the captive power plant, cement plant site and associated quarry sites.

Table 2-1 Project Area Coordinates

POINTS	LATITUDE	LONGITUDE
1	36°32'10.68"N	38°34'58.83"E
2	36°32'36.60"N	38°035'0.84"E
3	36°32'36.39"N	38°035'4.85"E
4	36°32'42.87"N	38°035'5.36"E
5	36°32'42.67"N	38°035'9.37"E
6	36°32'55.63"N	38°35'10.38"E
7	36°32'54.71"N	38°35'28.44"E
8	36°32'09.36"N	38°35'24.92"E

The total surface area of the project is around 14.6 km^2 of which 1.3 km^2 is owned by the Syrian Cement Company and 13.3 km^2 is state-owned and will be leased from the Syrian Government. The leased land hosts the quarry sites. The SCC plant has been positioned in close proximity to the proposed quarries, with the limestone quarry adjacent to the southern border of the plant site (2 km south of the Aleppo- El Hassakeh Highway) and the Basalt quarry located 15 km to the north-east.

Figure 2-1: Syrian Cement Plant Layout



SCC requires 3,750,000 tons/year limestone and 768,240 tons/year basalt to support the proposed cement production capacity of three (3) million tons/year. The limestone and basalt quarrying activities will be undertaken by the SCC as part of a concession from the Syrian Government.

2.3 CONSTRUCTION DETAILS

The construction activities related to the quarry sites are limited to the preparation of access roads to enable movement of equipment for excavation.

In comparison, cement manufacture requires heavy construction activities spanning over several months. The discussion in this section therefore focuses on the construction activities related to the cement manufacturing plant.

2.3.1 Construction Activities

Generally, a 24 months construction period for the proposed SCC cement plant is estimated before commercial production begins. The detailed schedule indicating time-frame for civil works, electrical erection, and mechanical erection and commissioning engineering is presented in Table 2-2.

Table 2-2 Cement Plant Construction Time Schedule (Source: SCC)

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
Civil work construction	March 08	December 09
Steel structure transportation	July 08	October 09
Steel structure erection	August 08	June 09
SSS equipment transportation	July 08	May 09
CSD equipment transportation	May 08	April 09
Mechanical erection	November 08	July 10
Captive Power Plant	June 09	June 10
Electrical equipment transportation	March 08	March 09
Electrical erection	February 09	April 10
Cold run_ No load test	April 10	October 10
Commissioning on load test	April 10	November 10

2.3.2 Resources and Utilities

The main resources required for construction are cement, structural steel and wood. All these materials will be stored on site, and details on their source and the required quantities are presented in Table 2-3 below. Liquids such as paints, solvents and oils will be store in special containers which will ensure they do not contaminate the environment should leaks and spills occur.

Table 2-3 Construction Phase Resources

MATERIAL/RESOURCE	TOTAL QUANTITY	SUPPLY/SOURCE
Steel rebar	19,000 tons	Turkey and local Syrian market
Structural steel	13,640 tons	
Concrete aggregate	88,000 m^3	Hassae-Homs, Syria
Sand aggregate	50, 000m^3	Hassae-Homs, Syria (and Banks of Euphrates River)
Cement	63,000 tons	Turkey
Wood	7,500 m^3	Local supplier who imports from Finland
Paint, solvents and oils		Local Supplier

The sole source of power during the construction phase will be from diesel-fuelled generators. It is estimated that 24 units of varying output capacity (refer to Table 2-4) will be required and consume approximately 3,500 tons of diesel.

Table 2-4 Onsite Power Generators during the Construction Phase

GENERATOR NUMBER	POWER (KVA)
2	132
3	150
2	170
8	200
1	225
4	250
3	350
1	400
TOTAL 24	**1877**

2.3.3 Transport Routes for Construction Materials

All construction materials and tools will be transported to the construction site by road via trucks along Aleppo-Hassakeh highway.

2.3.4 Construction Waste

Large quantities of solid and liquid waste will be generated during the construction phase. Table 2-5 below lists the main waste streams, their method of collection and final fate.

Table 2-5 Waste Management during Construction Phase (Source: SCC)

CONSTRUCTION WASTE MATERIALS	ESTIMATED QUANTITY	SOURCE	COLLECTION METHOD	DISPOSAL METHOD
Excavated material	900,000 m^3	Land excavation	Stored as 2 piles in the project site	To be used as raw material during plant operation
Metal Scrap	1,500 tons	Steel use	Stored in designated area in the project site	To be sold
Wood trash	300 tons		Stored in designated area in the project site	To be sold
Used oil & Grease	120 tons	Lubricants	Stored in designated area for Hazardous Waste	To be sold for local oil recycling industry
Garbage	3000 tons	Domestic use	Collected in bins and containers	Disposed in the Sereen" licensed dumpsite
Used Batteries	600 kg	Mobile equipment	Stored in designated area for Hazardous Waste	To be sold for local oil recycling industry
Used Tires	5-7 tons	Mobile equipment	Stored	To be sold for local oil recycling industry
Domestic wastewater	150-175 m^3/day	Worker base camp	Underground pipeline to lined septic system	Emptied regularly and disposed in licensed sewer network

2.3.5 Construction Manpower and Camp Location

During peak construction, an estimated 1,800 workers will be required on site. The workers will be sourced from nearby villages and local residents and will be provided by a secondary contractor. The construction phase will accommodate for three camp sites:

- FLS camp (25 to 30 people);

- Orascom camp (330 people) ,and
- Chinese camp for power plant (400 people).

2.4 RAW MATERIALS AND FUELS

2.4.1 *Sourcing for Limestone and Basalt*

Two quarry sites, Limestone and Basalt, will be explored during the project lifetime. The total surface area for the limestone and basalt quarries is estimated at around 650 ha and 630 ha respectively. The quarries will provide a continuous and steady flow of raw material needed for the manufacturing of the cement.

The Koujak Mountain (Jabal Koujak) and Kharab Eshik Mountain limestone occupy practically the entire lease area and is exposed everywhere. The area is practically devoid of any overburden. The rock is medium to coarse-grained and white. It is well bedded, hard and consolidated.

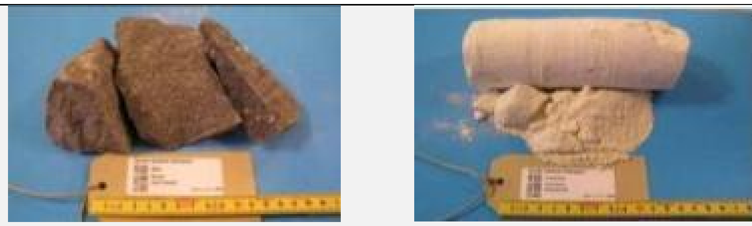
The surface outcrops of Koujak Mountain limestone in the proposed mining block and the core logs from the borehole show that the limestone bed is uniform both in quantity and quality. The proven reserve for the limestone mine area is calculated at 149 million m^3 (at > 430m above sea level (a.s.l.)) with an anticipated mine life span of 115 years to serve a single line at the proposed cement facility.

A detailed exploration drilling campaign for the entire basalt deposit as well as a block modelling will be carried out once the land has been acquired. However, physical and chemical analysis of the sediment basalt has shown the basalt to be suitable for cement production. The rock is dark black to greenish black, fine grained, very hard, weathered in top surface and joined boundaries.

Table 2-6 presents the results of the analysis conducted on core samples taken from the proposed limestone and Basalt quarry areas. Limestone is considered of high grade with a CaO making up on average 54.23%. Photographical illustrations of the raw materials are presented in Figure 2-2 below.

Table 2-6 Chemical Analysis of Samples taken from the Limestone and Basalt Mining Areas

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	SO_3	Cl	LOI
Limestone	0.59	0.07	0.06	54.23	0.57	0.01	0.00	0.044	0.001	43.26
Basalt	47.70	13.78	12.18	10.90	7.79	0.60	2.08	0.04	0.003	1.60



Basalt **Limestone**

Figure 2-2 Raw Material

2.4.2 Corrective Materials & Cement Additives

Sand is to be used as a corrective material in the mix design, making up about 5.5% of the raw meal. The chemical analysis of sand samples collected is presented in Table 2-7.

Table 2-7 Chemical Analysis of Sand Samples

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	TiO_2	LOI
Min	95.5	0.60	0.05	0.40	0.10	0.02	0.04	0.01	0.15
Max	98.5	1.20	0.15	0.85	0.50	0.07	0.09	0.02	0.85

Cement additives, Gypsum and Pozzolana will be used by SCC at 5% and 20-25% respectively. The chemical analysis of the collected Pozzolana and Gypsum samples is presented in Table 2-8.

Table 2-8 Chemical Analysis of Pozzolana and Gypsum Samples

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	SO_3	Cl	LOI
Pozzolana	39.91	9.78	13.40	12.63	16.64	1.42	1.900	0.12	0.020	1.41
Gypsum	1.46	0.01	0.24	32.66	1.94	0.06	0.020	42.72	0.004	22.86

The required annual quantities of raw materials needed to produce the 3 million tons per year of cement at the SCC plant are presented in Table 2-9 below.

Table 2-9 Annual Supply of Raw & Corrective Materials and Cement Additives for Cement Manufacturing at SCC Plant

RAW MATERIAL	ANNUAL QUANTITY (TONS)	SOURCE OF SUPPLY	DISTANCE FROM PLANT
Limestone	3,750,000	Koujak and Kharab Eshik Mountains	2 km
Basalt	768,240	Kortek Village-Gelabeya Area	15 km
Pozzolana	700,000	Manakhir Quarry	125 km
Sand	250,000	Karyateen – Homs Governorate	475 km
Gypsum	150,000	Gureen Quarry – Raqqah Governorate	170 km

Table 2-10 Operation Phase Resources

MATERIAL/RESOURCES	TOTAL QUANTITY	SUPPLY/SOURCE
Solvents and Oils	-	Local supplier
Fuel (diesel)	3,500 tons	Local supplier
Explosives	550 tons/month	Abo' Za'bal
Coal (incl CPP)	679,725 tons	South Africa/Turkey
Water	7,000m^3/year	Boreholes

2.4.3 Fuel Type and Source

The main fuel source for the cement plant's Kiln and Calciner operation is a mixture of low sulphur (low volatile) bitumen coal and petcoke. The Bitumen coal characteristics are presented in Table 2-11.

The cement plant has been designed to burn coal or heavy fuel oil (HFO). The coal which is specified for the performance guarantees has the following characteristics:

Table 2-11: Characteristics of Fuels

	CHARACTERISTICS OF COAL	CHARACTERISTICS OF HFO
Ash Content	15% (max)	-
Volatile matters	30% (max)	-
LHV	6430 kcal/kg (min)	9500 kcal/kg (min)
Sulphur Content	1% (max)	4.5 % (max)
Viscosity	-	2 deg Engler (11cSt) @ 130°C (max)

As there is no coal mine in Syria, the coal will be imported either through a Turkish port (Toros or Iskenderun) or through Tartous port in Syria. Due to the size of vessels which can be handled (up to 60 Kt) the preferred option is from Turkey. The origin of the coal will depend on the market conditions. It may come from South Africa or Ukraine as a first assumption. The coal will come from Turkey by truck as there is no railway station close to the plant, while rail will be explored as a future option if Syrian plans for new railway stations materialises.

The price of coal has been assessed in the business plan at 165 USD/T with the following breakdown:

- 100 USD/T C&F Toros
- 60 USD/T for transportation costs inclusive customs clearance and border fees
- 5 USD/T grinding

While not included in the business plan the use petcoke either domestic or imported will be considered once the plant has stabilized. The domestic petcoke is only produced in the Homs refinery (170 kt per year) and discussions have been initiated with Ministry of Petroleum to secure a portion.
The imported petcoke would come from US Gulf, Venezuela or India and would be handled like the coal, from Turkey. When new refineries come on stream in Syria, there would be more than enough domestic petcoke. The percentage of petcoke that will be blended with coal will be adjusted based on the process, environment and quality constraints. Coal and petcoke will be grinded and mixed in the coal grinding system

It is planned to use the same coal in the captive power plant as the one for the cement plant to simplify the logistics issues. At this stage, it is not planned to use petcoke as fuel for the CPP.

It is estimated that the daily requirement of low sulphur coal for the cement plant is about 1200 tons, (400,000 tons per year) and 279,725 tons per year for the captive power plant, amounting to a total of about 679,725 tons per year.

Table 2-12 Low Sulphur Bitumen Coal Analysis

ELEMENT	PERCENTAGE
C	60.3
H_2	2.14
O_2	11.44
N_2	1.5
S	0.95
Ash	15.17
Humidity (at receiving)	8.5
Humidity (in dry air)	3.5
Evaporate Elements	37.27
Minimal thermal Capacity	21303
Gridding capability factor	<100

2.5 SCC CEMENT MANUFACTURING PROCESS

Two cement production methods exist worldwide, the dry process and the wet process. In the latter, raw materials are mixed and ground with water to form “raw slurry”, while in the “dry process”, the raw materials are dried and ground together in defined and well-controlled proportions to produce a “raw meal”. The main differences between the two processes is in the water content of the raw materials (ranging from 3% for hard limestone to over 20% for soft limestone such as chalk), energy and power consumption rates, and length of the kiln system.

On average, wet process operations use 34 percent more energy per ton of production than dry process operations (US EPA, 2007). Fuel consumption is higher in the wet process, ranging between 1300-1600 Kcal/kg of clinker compared to 750 - 950 Kcal/Kg of clinker in the dry process. Power consumption however, is lower in the wet process, with 110 -115 KWh of energy consumed per ton of cement compared with 120-125 KWh/ton of cement in the dry process.

The “dry process” for cement production is proposed at the SCC plant due to its favorable environmental performance particularly with regards to its lower water consumption. As a further refinement and development of the adopted dry process, SCC will fit air suspension preheaters with precalciners which ensure complete calcining of the raw mix before it enters the kiln. A detailed description of the cement manufacturing processes is provided in the following sections.

The processes mainly consist of:

1. Quarrying (Drilling and Blasting);
2. Crushing and Pre-Homogenisation of Limestone and Additives;
3. Milling, Homogenisation and Storage of Raw Materials;
4. Preheating, Kilning and Heating System;
5. Clinker Cooling, Transport and Storage;
6. Cement Grinding; and
7. Cement Storage, Packing and Dispatch.

2.5.1 Quarrying

The proposed mining method for exploiting the limestone and basalt is quarry mining with fully mechanized operations comprising of drilling, blasting, loading and transportation by road to the main crusher to supply about 9,500 tons/day of limestone and 2,300 tons/day of basalt.

The excavated limestone will be transported from the mine face to the crusher by off-road dump trucks. Crushed limestone will then be transported via conveyor belts to the cement factory. Conveyor belts will be covered to reduce fugitive dust emissions during transportation. .

Excavated basalt rocks will be transported approximately 15 km using on-road dump trucks with rock-type boxes to the basalt crusher at the plant site.

2.5.1.1 Quarry Opening

Phase one of the limestone quarry will start with Kojack Mountain, south of the crusher (refer to Figure 2-3). The lower bench will be at the same level as the crusher (445 m a.s.l.), and develop in a southern direction with a bench height of 15m. The usable quantity of limestone to be extracted from Kojack Mountain is calculated at approximately 60 million tons, which is enough to serve a single line for about 20 years. The detailed planning for the basalt quarry is under preparation.

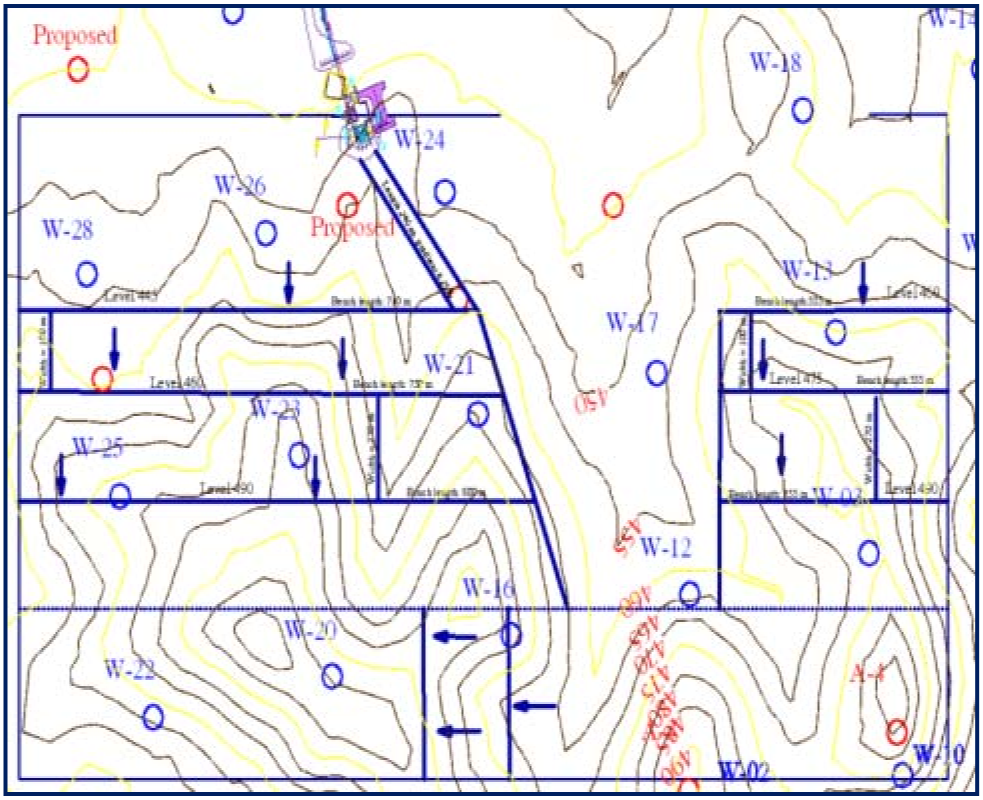


Figure 2-3 Opening of Kojak Mountain (Retrieved from SCC)

2.5.1.2 *Drilling & Blasting Operations*

Drilling is carried out using compressed-air powered drills. Explosives are set in predetermined amounts in holes drilled to a maximum depth of 15m into the rock. The diameters of the holes vary between 105 to 150 mm deviated by 75 degrees from the horizontal, with hole intervals of 5.5 m and row intervals of 4 m.

Blasting will be carried out once a week (twice/week at most) and will require 550 tons of explosive per month. SCC intends to use Ammonium Nitrate mixed with diesel fuel (95%); hereafter referred to as ANFO, and Nitroglycerine (5%). ANFO will serve as the main column charge for economic and safety reasons.

When the location of the holes to be drilled have been defined, the quarry engineers will determine the quantity of explosives needed, according to the prevailing local conditions, to ensure maximum efficiency of the blasting operation and to minimize any risk of accidents and/or losses.

As part of its safety plan and vibration control measures, SCC will:

- Adopt a single line drilling technique to help reduce the vibration waves;
- Limit the depth of the holes drilled to 15m;
- Optimize and monitor powder ratio (explosive/rocks) to obtain maximum fragmentation without using excess explosive energy; and
- Use non-electrical (NONEL) delay detonators to carry out blasting operations in a defind sequence with a delay of 25 milliseconds (ms)

As for controlling fly rock, SCC will:

- Reduce the explosive charge used by fine-tuning the spacing of the holes drilled, cavities as well as fractures;
- Incline the holes drilled at 10-15 degrees from the vertical so as to force fly rocks to land behind the quarry face where the area is devoid of workers and equipment; and
- Ensure good stemming of holes drilled above the detonating charge from cuttings produced during the drilling operation.

In view of road safety, SCC will 1) Ensure regular maintenance of access roads by levelling the road surface and clearing any physical obstacles, 2) Design the camber of the road so as not to exceed 6% in order to prevent slipping of mobile equipment particularly during the rainy seasons and 3) Install retaining walls and/or large stone lumps at the side of roads in a clear and visible way to prevent mobile equipment from leaving the road.

SCC will commission a local contractor, through a tender process, to procure equipment for quarrying and associated activities (loading, transportation, etc). However, SCC is committed to procure only reliable and professional heavy duty brand models so as to guarantee the reliability of mobile equipment as well as the occupational safety of the operators (e.g. shield protection for cabin crew)

Typical equipment used in quarry mining includes:

- Excavator and hammer
- Dump trucks
- Drill machine
- Compressors
- Dozers
- Wheel loaders
- Fuel tank trucks
- Water tanks

The SCC reports that blasting operations are expected to be carried out 6 months ahead of the crushing period. The mine area will not account for an explosives magazine since the explosive material will not be stored on-site. The supply of explosives will be secured by the Syrian Security Authorities which shall control, monitor and execute blasting operations.

The number of workers at the quarry sites will vary between 30 - 40 workers per site. The daily work will be based on a single eight hours/day shift and six days/week. No labour camp is expected to be constructed at the quarry areas.

2.5.2 Crushing and Pre-homogenisation of Limestone and Additives

To feed the kiln operation (7,500 tons/day clinker) the total daily tonnage of raw materials required is calculated at 12,000 tons. This includes approximately 66,500 tons/week of limestone and 16,800 tons/week of basalt. Table 2-13 lists the main crushers types associated the different feed sizes.

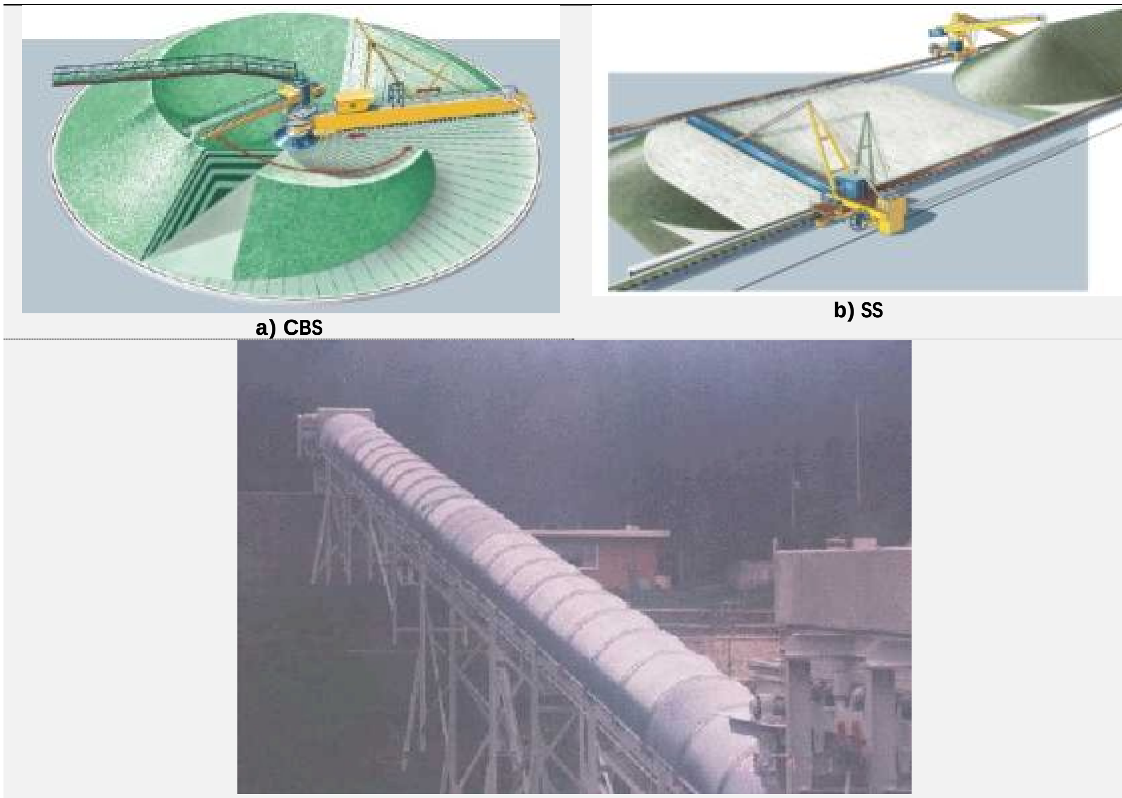
The crushed limestone will be transported to the cement factory via conveyor belts while crushed basalt will be hauled by means of dump trucks to the plant site.

Table 2-13 Crushing Operations and Expected Yield

RAW MATERIAL	CRUSHER TYPE	CAPACITY (TONS/HOUR)	FEED SIZE (MM)	PRODUCT SIZE (MM)	YIELD (TONS/DAY)
Limestone	Hammer Crusher	2000	2000	120	9,500
Basalt	Jaw Crusher	350	350	120	2,300
Gypsum	(HG limestone) Hammer Crusher	650	1000	<80	850

For the pre-homogenizing and storage of raw materials, a circular bridge scraper (CBS) store is proposed and designed for continuous Chevron stacking in a ring shaped pile. The material enters the store on a rubber belt conveyor and is discharged into a centrally positioned inlet hopper on the stacker jib. The belt conveyor will be covered as part of SCC's commitment to adopting Best Management Practices for Fugitive Dust Abatement (refer to Figure 2-4).

A Side Scraper (SS) store is proposed for the storage of corrective materials and additives (sand, gypsum and Pozzolana). The SS store operates according to the Chevron or Cone shell method. This type of store is used for free flowing, non-sticky materials which do not necessitate homogenizing. Photographical illustrations of the CBS and SS stores are presented in Figure 2-4 below.



a) CBS

b) SS

c) Covered Conveyor Belt

Figure 2-4 Illustrations of Circular Bridge Scraper Store (CBS), Side Scraper (SS) and Covered Conveyor Belt

2.5.3 Milling, Homogenisation and Storage of Raw Materials

For the grinding of raw materials an ATOX vertical roller mill with a production rate of 550 tons/hour (refer to Figure 2-5) is proposed. Grinding takes place inside the mill between the rotating table and the three cylindrical rollers connected by a centre yoke. The former is surrounded by a nozzle ring, through which hot gas enters for drying purposes. Replaceable wear segments cover both the table and the three rollers. The grinding force is applied through three pull rods by a hydraulic pump station controlling the grinding force.

The airflow through the mill will carry the ground raw meal up to the RAR-LVT separator for separation. Coarse material collected from the separator is returned to the grinding table for further grinding, while finished raw meal leaves the mill along with the exhaust gases and is then fed to the Raw Meal Silo Continuous Flow (CF) of 20 m diameter and 54 m section height and a capacity of 21,000 tons. The CF silo operates following a multi-plug flow. Blending of raw meal is achieved by extracting from three different outlets at a time and which are changed at regular intervals. This method of controlling the extraction helps achieve a well balanced and homogenized raw meal by allowing the latter to mix with the different "layers" in the silo. Further blending occurs in a mixing tank located below the silo which subject to strong aeration hence fluidizing the raw meal to enhance the mixing. The raw meal is then transported to the preheater top by an elevator.

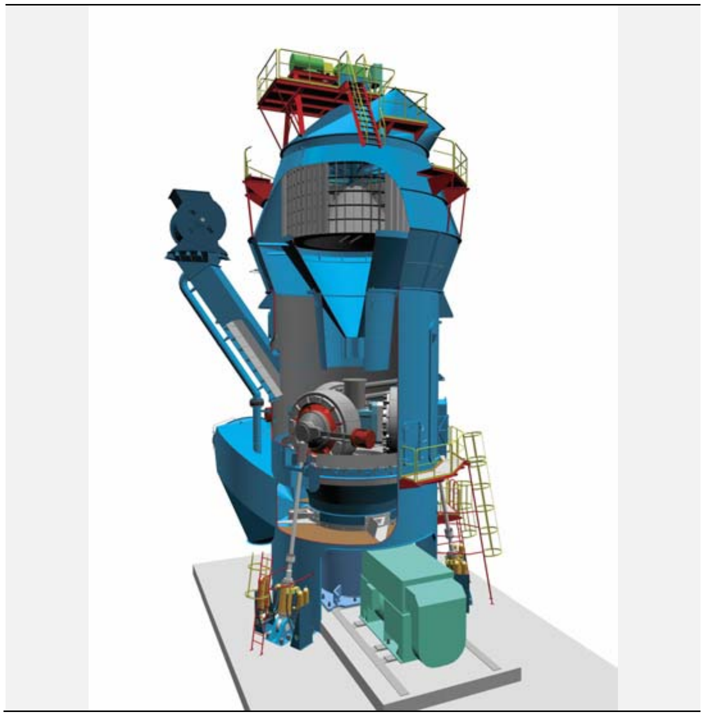


Figure 2-5 ATOX Vertical Roller Mill

The raw meal preparation of the proposed SCC Cement Plant's production capacity, encompasses the blending and grinding of 200-2000 t/h of limestone, 70-700 t/h of Basalt, 280-845 t/h of High Grade (HG) Limestone/Gypsum, and 67-200 t/h of Sand/Pozzolan.

A mass flow diagram describing the abovementioned steps for raw meal preparation up to the preheating stage is presented in Figure 2-8.

2.5.4 Preheating, Kilning and Heating System

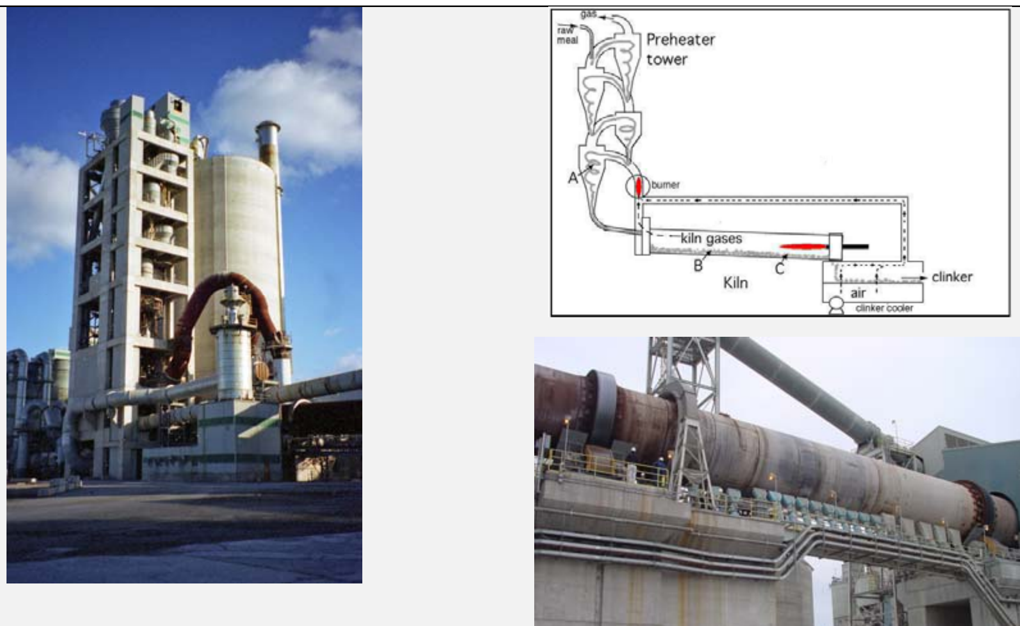
For clinkerisation, the pre-calcining burning system, consisting of a double string 5-stage cyclone preheater (80˚C–1000˚C) with precalciner is planned. A rotary kiln with a daily output of 7,500 tons of clinker will be installed. The heat consumption for making clinker will be about 730kCal/kg clinker. The excess heat from the system will be used to dry raw meals as part of SCC's strategy to minimize fuel consumption.

In the pre-calciner, calcining i.e. decarbonation of calcium carbonate of the raw meal is carried out in seconds with a decomposition rate of CaCO3 exceeding 92%. A number of phases (Alite, Belite, Aluminate, and Ferrite) are formed in the clinker feed before the proper burning zone is reached. However, these intermediate phases are not found in the final clinker minerals due to their dissociation in the burning zone.

Kilning is considered the last stage in converting the raw mixture into Clinker. During this stage, the raw mixture is heated from 1000 to 1450 degree Celsius, breaking the bonds of the raw elements and calcium enters a chemical reaction with Aluminum, Silica and Iron Oxides.

All exhaust gas released from the raw mill and kiln circuit is handled by the Gas Conditioning Tower (GCT) and Electro-Static Precipitators (ESP) in charge of de-dusting operations. Upon filtering, dust emissions would be reduced to a maximum of 50 mg/Nm³.

Photographs of the abovementioned components of the pyrosystem are presented in Figure 2-6.



Pre-heater Process

Kiln

Figure 2-6 Components of Pyro System

2.5.5 Clinker Cooling, Transport and Storage

For clinker cooling, the well proven Smidth- Fuller (SF) cross bar cooler is proposed. Clinker directly from the cooler will be at maximum of 80˚C. The cooler ensures a uniform distribution of the hot clinker on the bed. Good penetrability of the bed provides thorough gas/solid heat exchange, raises the tertiary air temperature, and improves heat recovery.

The cooler is provided with a hammer crusher in the outlet and excess air is de-dusted in an ESP. In order to protect the electrostatic precipitator against excessive temperatures during upset conditions the cooler is provided with a water injection system. Hot abrasive clinker is conveyed by deep-drawn pan conveyors to the top of clinker storage.

A silo of 40×46m is proposed for clinker storage, with a capacity of 55,000 tons and a storage period of 7 days. An off-standard clinker silo of 13×25m store capacity of 3,500 tons will be provided for better control on initial production.

Clinker is extracted from the bottom of the storage, by discharge gates and transported to the cement mill department by heat resistant rubber belt conveyors.

2.5.6 Cement Grinding

Cement grinding is carried out in an OK vertical roller mill with a production capacity of 230 tons/hour. In order to achieve the desired setting qualities in the finished product, 5% of gypsum is added to the clinker and the mixture is finely ground to form the finished cement powder. The milling process is operated in a sealed system whereby sorting of cement grains is carried out according to their sizes using air. Materials that are not milled to the desirable size are transported back to the mill feed. The finished product is collected in bag filters and transported to the cement silos.

2.5.7 Cement Storage, Packing and Dispatch

The proposed plant is designed to accommodate 4 Continuous Flow Storage (CFI) cement silos (refer to Figure 2-7) allowing the simultaneous filling and extracting with a 15,000 tons capacity each.

The packing plant shall encompass four (4) packing lines with individual capacities of 120 tons/hour. The cement is to be transported via a bucket elevator to a vibration screen above the packing machine. The latter is a rotary type with 8 spouts. Each filling spout is equipped with its own vertical shaft impeller and an individual electronic weighing control system. The packing machine is equipped with dust collecting hoppers, screens and a discharge belt conveyor, and a bag filter for de-dusting the packing line.

Figure 2-7 a) Cement Silos and b) Packing Plant under Construction at Plant Site

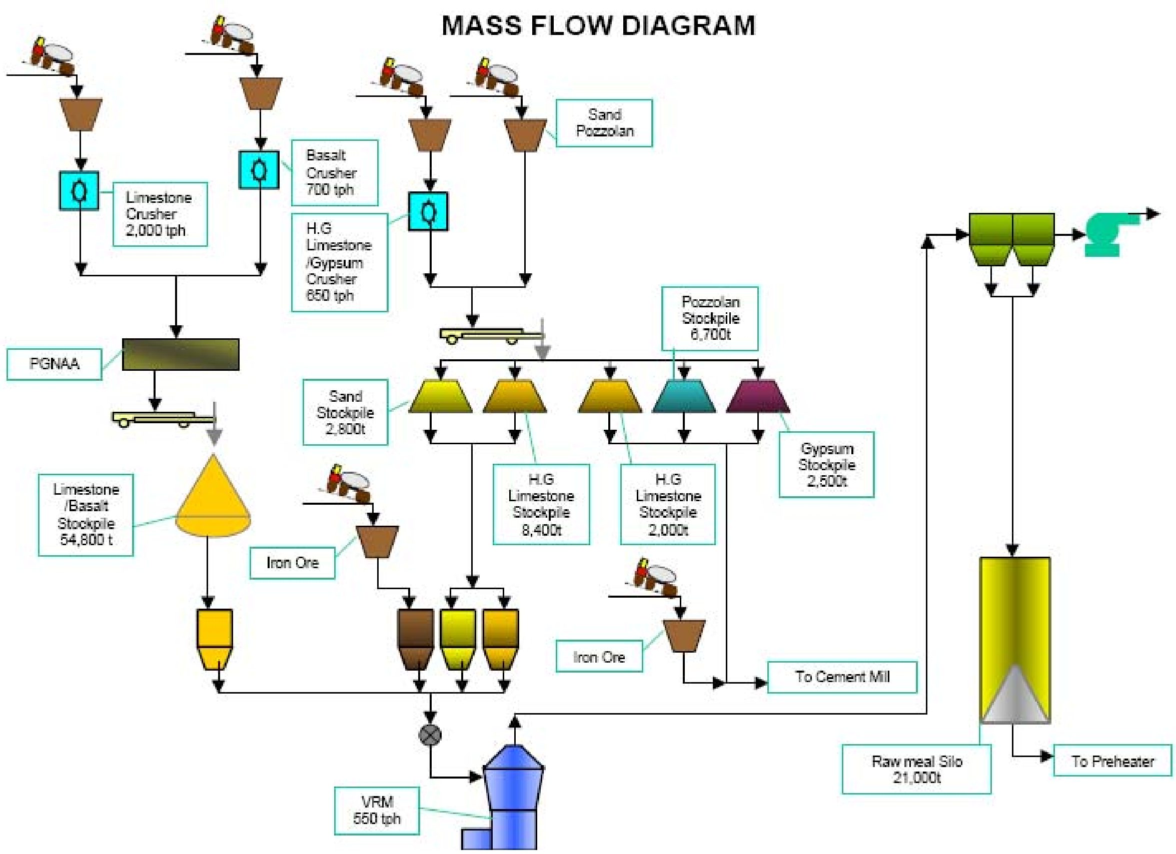


Figure 2-8 Mass Flow Diagram of Raw Meal Preparation

2.6 60 MW THERMAL (COAL-FIRED) CAPTIVE POWER PLANT

2.6.1 Background Information

The energy required to operate the cement plant during phase 1 is around 45 MW/day. The production capacity of the SCC plant will be increased in the future as part of phase 2 extension plans through the introduction of a second production line of 7,500 t/day capacity.

The electrical power needed for the proposed SCC project was originally agreed on with the Syrian electrical authority to be supplied through the Syrian national grid at 220 KV level (March 2007). However, on November 2007, the Syrian authorities cancelled their approval for supplying electrical power for all cement projects in the country.

In light of this, SCC conducted a feasibility study to evaluate alternative options for supplying the project with electrical power. Three scenarios were investigated including (1) purchasing energy from a third party, (2) constructing a diesel based power plant, and (3) constructing a coal fired captive power plant. The main findings show that:

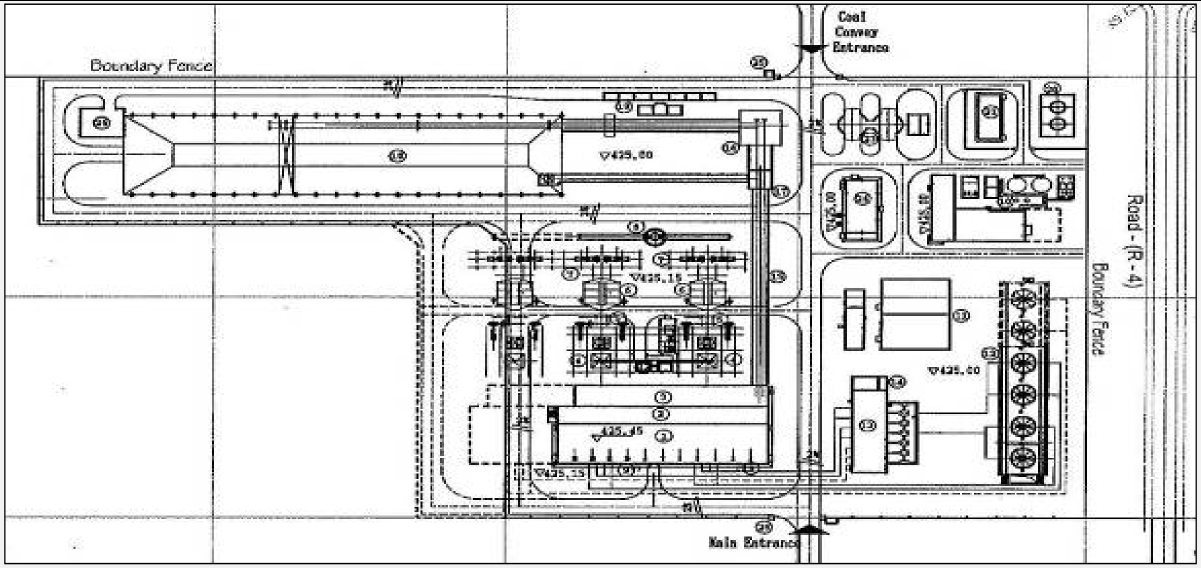
- Purchasing energy from a third party is very risky, unreliable and very costly.
- The construction of diesel power plant option was to be excluded due to:
    - Economical reasons (the current price of oil fuels is very high in Syria, fuel prices are expected to increase steadily over the next few years, fuel transportation cost are high, KWh production cost are high, etc.) and;
    - Embargo rules on Syria and its impact on finding a reliable manufacturer to execute the project.

Hence, the 45 MW power demand required to operate the SCC project during phase 1 will be secured through a newly constructed Thermal (coal fired) Captive Power Plant (CPP).Table 2-14 provides a brief description of the proposed SCC power plant.

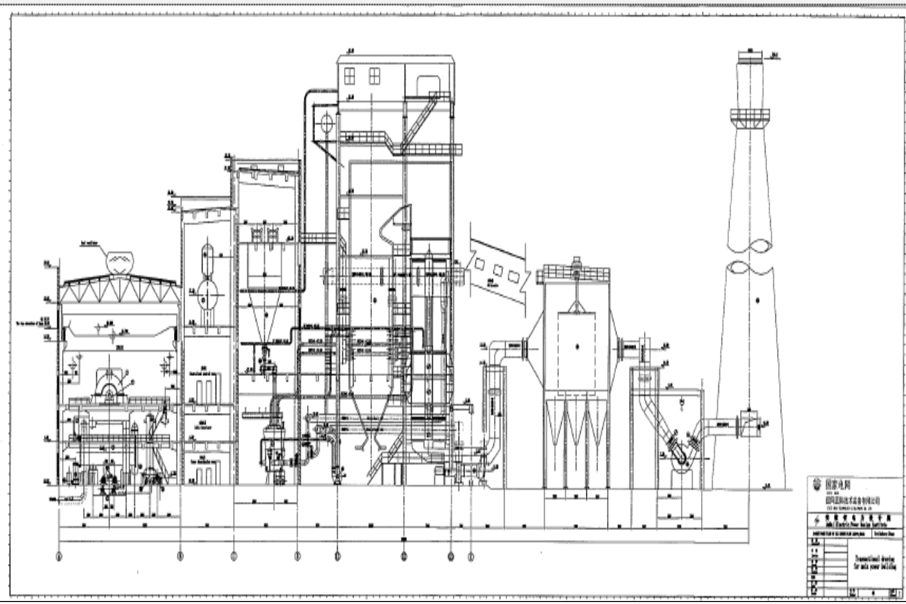
Table 2-14 Main Design and Operational Data of CPP

ITEM	DATA
Plant Location	At north-western corner of the cement plant site
Total Surface Area	55,000 m^2 (increase up to 60,000 m^2 upon expansion)
Plant Concept	
Technology	Conventional Pulverized coal fired steam plant
No. of pulverized coal-fired boilers	2
No. of steam turbines	2
No. of stacks	1
(BAT)	Low NOx burner
Stack Characteristics	
Height	120 m
Outlet Inner Diameter	3.5 m
Net Power Generating Capacity	30 MW/unit
Water Supply	
Source of Supply	SCC Wells (deep and shallow)
Demand	5,000 m^3/day
Type of Fuel	
Main Fuel	High quality butimous coal (sulphur content 0.7% -0.9 %)
Start up Fuel	Diesel oil-(2x)oil tanks with 50 m^3 capacity
Coal Storage Yard	36m x 133m
Cooling water temperature	Designed 20˚C (Maximum 30˚C)
Ash Silos	
No. of silos	2
Capacity	500m^3/silo

The proposed fuel type (i.e. coal) for the power plant is already used in the SCC cement plant cutting down the logistics and transportation cost of coal on the project as a whole. The cost of producing one KWh therefore becomes more attractive especially when the low running cost and high availability of the generation plant are taken into consideration. Figure 2-9 illustrates the layout plan of the proposed power station.



Top View Plan



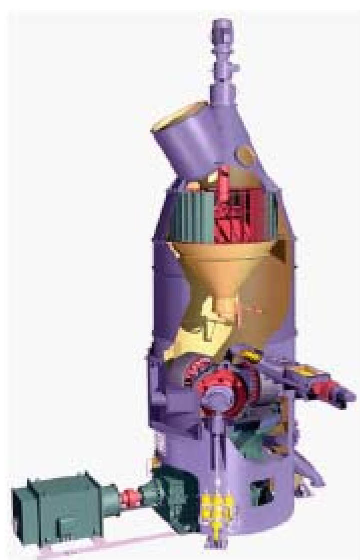
Side View Plan

Figure 2-9 CPP Layout Plan

2.6.2 Coal Grinding System

Given the project's need for coal as the main fuel for electricity generation, additional procedures are warranted prior to feeding the cement plant including 1) coal grinding/milling and 2) coal firing/burning.

The supplied coal and petcoke will be conveyed by trucks to an onsite coal storage yard with a surface area of 4,800 m^2. The raw coal is transported to a feed bin via belt conveyors equipped with a magnetic separator and a metal detector to prevent entry of metallic objects into the mill, an ATOX vertical roller mill (refer to Figure 2-10). The latter has a grinding capacity of 75 tons/hour and 50 tons/hour for coal and petcoke respectively. The coal grinding system follows that of the raw material described in section **2.5.3** above. Upon grinding, the air flowing through the mill will carry the ground coal meal suspended in the gas to a separator. Coarse material collected from the separator is returned to the grinding table for further grinding, while finished coal meal leaves the mill along with the exhaust gases and is collected in a bag filter and transported to a silo. Bag house filters in charge of de-dusting operations will ensure that dust emissions are reduced to a maximum of 30 mg/Nm³. Additional measures for controlling operation and process air releases such as fly ash are discussed in section 2.6.5 below.



ATOX coal mill

Figure 2-10 ATOX Coal Mill

2.6.3 Main Unit Operations

An estimated 279,725 tons per year of low sulphur Bitumen coal will be consumed as fuel by the SCC power station. The plant shall consist mainly of boilers, turbines, water consumption system and other supplementary parts.

At this stage of the project, two high-pressure and high-temperature boilers, each of 130 tons/hour capacity, are proposed for the operation of the CPP. A calculated 17.23 tons/hour of coal are consumed by each boiler. Two-diesel oil tanks with a total capacity of 1000 m^3 are readily available for boiler ignition. Pulverized coal is air-blown into the boiler from fuel nozzles rapidly burning to form a large fireball at the center. The thermal radiation released by the fireball heats up water circulating through the boiler tubes eventually circulating water absorbs the heat and converts into steam. Steam generated by the boiler from the superheater is sent to the steam turbine generator for operation. The steam is cooled and condensed back into water and returned to the boiler to start the process over again.

2.6.4 Water Supply and Chemical Water Treatment System

The estimated water demand for the operation of the CPP is 5,000m^3/day. Water will be supplied from the two newly drilled deep water wells. Upon pumping, water will be discharged into two (2) raw water tanks (total capacity of 1000m^3). The collected water is expected to undergo a chemical treatment process consisting of a “primary demineralization and mixed bed” system.

The purpose of the chemical water treatment process is to reduce the levels of electrical conductivity (EC), hardness and silica (SiO_2) to 0.2μS/cm or less, 0μmol/l and 2μg/l respectively as required of the water quality feeding the boiler. At this stage of the study, the water treatment plant is under design.

2.6.5 Fly Ash and Slag Handling System

The captive power plant is designed to accommodate two separate systems for the management of fly ash and slag formed as a result of boiler operations. Table 2-15 below displays the expected amounts of fly ash and slag discharged by one boiler.

Table 2-15 Breakdown Quantities of Fly Ash and Slag Discharged per Boiler

		DESIGN COAL		
		TON/HOUR	TON/DAY	TON/YEAR
1 X 30MW	Ash	2.3	45.91	1.26×10^4
	Slag	0.57	11.48	0.32×10^4
	Total	2.87	57.39	1.58×10^4

As such, with 24 running hours, the SCC captive power plant is expected to generate an estimated daily amount of 91.82 tons of fly ash and 22.96 tons of slag.

The process design integrates a pneumatic ash handling system as well as a hydraulic slag handling system. The fly ash collected by bag filters will be conveyed into the ash silos of 500 m^3 storage capacity (equivalent to 10 days storage capacity) prior to its reuse in the cement manufacturing process.

With regards to slag management, two settling pools and two filter pools will be built. The slag discharged from the boilers will be cooled and transported to the pools by the sluiceway. The slag-water slurry from sluiceway will enter primarily the settling pool and then conveyed to the filtering pool. The latter consists of three filtering layers (sand, cobble and grizzly screens) for the removal of slag. Filtered water will be discharged into a clean water pool. Boiler Slag will also be reused in the cement manufacturing process.

2.6.6 CPP Support Units

The CPP camp site is expected to accommodate for an estimated 300 – 400 workers during the construction phase.

2.7 RESOURCES, UTILITIES AND INFRASTRUCTURE

2.7.1 Land

The identified site for the project is 1.3 km^2 for the cement plant. With regards to quarry sites, the total allocated area for limestone and basalt quarry is approximately 675 ha each.

2.7.2 Electricity

As previously mentioned, two main power sources will be used during the life of the project. During the construction phase, a total of 24 diesel generators will supply electricity to the plant site and associated facilities/units. Upon operation, the cement plant will require a power demand of 45 MW which will be supplied by the planned 60MW thermal captive power plant.

2.7.3 Water

The total water demand for the entire project is estimated to be 7,000 m^3 per day. The largest water consumption division of the project will be at the power station with an estimated daily consumption of 5,000 m^3 whereas around 2,000m^3/day will be consumed in the cement production and for daily domestic water usage. A descriptive summary of the water demand required during each phase of the Project is presented in Table 2-16 below.

SCC envisages the use of five existing shallow water wells drilled in the Paleogenic aquifer in addition to two newly drilled water wells tapping the Cretaceous aquifer (800 m below ground). Water permits from the water authority were acquired prior to the drilling campaign in accordance with the Syrian water law no. 31/2005.

Since saving natural resources such as water is a vital part of Lafarge Co. policy, SCC will set a goal for preserving this scarce natural resource by reducing water consumption and increasing recycling operations in all production units. This will include, but not exclusively, collection of washing and cooling water, supervising water consumption and reusing treated wastewater.

Table 2-16 Anticipated Water Demand and Distribution during Project's Construction and Operation Phase

PHASE	FACILITY	DESCRIPTION OF WATER REQUIREMENTS	DAILY CONSUMPTION RATE
Construction	Quarries (Basalt and Limestone)	No anticipated quarrying operations	None
	Cement plant and Power plant	**Domestic Purposes** Water supply for construction workers with an average number of 500 workers. Upon construction of power plant, the peak number of workers will be about 1,800 workers (over a period not exceeding 12 months)	50 m^3/day to 180 m^3/day (Average 100 m^3/day)
		Construction Purposes Cement mixing, dust suppression and vehicle wash down	200 m^3/day to 400 m^3/day (Average 300 m^3/day)
Operation	Quarries (Basalt and Limestone)	**Domestic Purposes** Water supply for local workers (40 workers/quarry site) working an 8 hours/shift/day with no base camp envisaged for quarrying operations	<50 m^3/day
		Operation Purposes Operations such as water spraying for dust control, and rock crushing activities	350 m^3/day
	Cement plant and Power plant	**Domestic Purposes** Water supply for workers with an average number of 500 workers in cement manufacturing, 85% of which are	150 m^3/day

PHASE	FACILITY	DESCRIPTION OF WATER REQUIREMENTS	DAILY CONSUMPTION RATE
		nationals i.e. base camp to accommodate for a maximum of 100 workers Power plant base camp expected to accommodate 30 – 40 workers (non-nationals)	
		Cement Plant Processes Cooling purposes	2,000 m^3/day
		Power Plant Processes Steam turbines	5,000 m^3/day

2.7.4 Laboratory

A laboratory will be operated for testing of raw material, clinker and cement for physical and chemical parameters. The test will be mainly dry tests using modern equipment and therefore requiring minimal use of chemicals.

2.7.5 Workshop

The following workshops will be established for the plant and mine sites.

- Mine/Quarry workshop
- Raw material workshop
- Manufacturing workshop (Electrical and mechanical)
- Auxiliary workshop

Plant and mine equipment will be serviced and maintained in the workshop.

2.7.6 Clinic

A Health Centre staffed by a Doctor, a Nurse, Laboratory technician, pharmacist and other supporting staff will be set up within the plant which will serve the employees of SCC. Medical staff will extend close cooperation and help in periodic health surveys and during occurrence of any accidents, calamities, etc. Diseases of high concern that will be regularly monitored by the medical staff due to labour mobility are sexually transmitted diseases (STDs) such as HIV/ AIDS.

2.7.7 Parking

Provision for parking of trucks has been made at the West and South ends of the Plant Site. A total surface area 22,500 m^2 has been allowed for parking, with an additional space of 2,060 m^2. The parking can accommodate 128 trucks. Parking for the administration staff is currently under design as a separate parking lot.

2.7.8 Fire Fighting and Emergency Systems

The plant will be fitted with an adequate fire fighting system consisting of:

- High pressure pipes system, includes enough taps;
- Independent network to provide fire taps with water;
- Heavy powder extinguishers ABC, they will be put in important places such as Electrical instrumentations places;
- Light portable CO_2 extinguishers; and
- Automatic extinguishing system.
- Fire Alarm including smoke sensors and manual switches wired to a central display panel.

2.8 PROCESS EMISSIONS

2.8.1 Air Emissions

Elector-Static Precipitators will be used for dust control of kiln gases. High efficiency bag filters (99.99%) will be used for the control of dust for all point sources and transfer points.

A five-stage pre-Calciner and low NO_x burners (DUOFLEX low NO_x burner) and automated kiln air control system will be installed to reduce NOx emissions. The latter is also designed to allow formation of a good flame profile in the kiln, thereby allowing operation with very little access air and without formation of Carbon Monoxide (CO).

Carbon Dioxide (CO_2) is major greenhouse gas generated during cement production. CO_2 is evolved from both burning fuel, and from the chemical reactions converting limestone into clinker. However, both sources are inherent to the process therefore these emissions are inevitable. About one ton of CO_2 is produced per ton of clinker.

By year 2010, Lafarge Company is committed to reduce the total emissions of its activities, CO_2 emissions, down to 20% for one ton of cement worldwide, which corresponds to the Kyoto protocol treaty. By this, Lafarge Company is committed to the following:

- Reduce the Consumption of Power.

- Upgrade its factories and improve its activities and operations on a continuous basis by using alternative power sources.
- Using Industrial wastes such as Ash to produce cement.
- Some additions can totally or partially replace the Limestone, such as materials that were burned before, besides the reduction of burned Calcium; this can reduce the emissions of CO_2.

Lafarge has also conducted three projects that target Clean Growth techniques, within the framework of the Kyoto protocol; within three years, those techniques reduce 160,000 tons annually of CO_2 emissions, which is an environmental gain that equals planting 10.6 million trees per year.

Apart from the point sources of air pollution, the generation of fugitive dust during material handling is another potential impact. Quarrying operations, conveyors, stored materials, movement of vehicles on plant roads will also lead to air pollution, which however can be controlled by spraying recycled water. Installing rubber curtains for loading and unloading operations and covering of materials during storage or transport by trucks or conveyors is known to reduce dust load. In addition, maintaining right amount of moisture is expected to suppress the dust generation. Plant roads need to be maintained clean by frequent sweeping to minimize possibility of dust generation.

The combustion of the low sulphur Bitumen Coal at the power station will result in the emissions of air pollutants. Given the low sulphur content of coal (0.7% - 0.9%), emissions of SO2 are expected to reach a maximum of 1888 mg/m3 which are within permissible limits set by the IFC Guidelines.

2.8.2 Liquid Effluents

Usually the sewerage system is designed as either a separate or combined system. A separate system (i.e. two separate networks one for storm water and the second for domestic wastewater) was chosen for the current project to reduce the hydraulic load on the wastewater treatment plant. The sewerage system will rely on manholes and buried sewers whereas the storm water will be collected in open ditches/channels. SCC envisages that collected storm water will be conveyed to 3 -4 evaporation ponds, however, at the time of writing up this study, the storm water network was still under design.

At this stage of the study, SCC proposes the use of septic tanks for the collection of domestic wastewater generated from the facilities and accommodation units.

Due to the absence of any waste water infrastructure or treatment services within the study area, SCC will construct an onsite wastewater treatment plant (WWTP) for treatment of sewage waste. The plant will be located to the north of the cement facility. At this point, the detailed design of the WWTP is still under investigation. 450 staff will be employed and 20 m^3/day of domestic wastewater will be generated from staff quarters, which will be treated in a biological treatment plant followed by settlement and polishing.

The treated wastewater will be reused for irrigation. The characteristics of the domestic wastewater or sewage are considered to be typical of municipal wastewater. The treatment of sewage has been standardized and thus no analysis has been considered necessary. However, it is anticipated that the planned WWTP will be designed based on a secondary treatment level technology since the treated wastewater will be reused for irrigation of green areas. SCC will comply with the Syrian national Norm no. 2752 dated 2003 (decision No. 72) on the re-use of treated wastewater for irrigation purposes.

2.8.2.1 Industrial Water

Wastewater from the cooling tower blow-down and truck washing will be of industrial origin but not expected to contain any organic pollutant. The quantity of these streams is 260 m^3 / day. In view of water scarcity in the region, wastewater from these sources will be reused, without any treatment, within the plant for road cleaning, spraying for dust suppression. These activities will not generate any wastewater, as the water will be lost due to evaporation. Thus, industrial wastewater will be reused and there will be no disposal of wastewater. This will also limit the intake of fresh water to 1000 –1500 m^3 of water per day.

2.8.3 Noise and Vibration

Potential sources of noise from the cement plant are the crusher, kiln, cement mill, compressors and workshops. Noise levels from these sources will be in the range of 85-100 dB(A). In order to control the noise, the project is designed to:

- Select low noise equipment.
- Install mufflers at air inlets and outlets of the fans and air compressors.
- Install sound insulation cover (room) for equipment with higher noise.
- Place noisier sources farther away from sensitive receptors in the overall design.
- Build sealed or semi-sealed workshops for noisier production processes.

High noise levels are inherent to blasting operations (100-120 dB(A) near the source). However, these are limited to very short duration and therefore are not expected to have any adverse impact on the ambient noise levels. Explosives, in large quantity will be used for fragmentation of rocks in the quarries but only a part of the explosive energy is used in doing the useful work, the rest is spent in undesirable phenomena such as ground vibrations and noise. The non-electrical delay detonators, where blasting is carried out in definite sequence with delay time (25 m sec.) will be employed to minimize vibrations. The details on the vibration and noise control are provided in section **2.5.1.2**.

Mechanized mining involves the use of various equipments like pressure drills, excavators, loaders and dumpers. All these equipments generate noise levels typically of about 90 to 95 dB(A) (measured at 1-2 meters from source). The process of grinding raw material and clinker generates high levels of noise. The potential sources of noise (at 1 m distance) are presented in Table 2-17.

Table 2-17 Identified Sources of Noise and Associated Noise Levels

OPERATION	SOUND LEVEL DB(A)
Mining operations	90-95
Crushers	95-100
Drilling operations	85-95
Compressor	85-95
Vertical mills	95-100
Kilns	80-85
Cement mills	95-100

2.8.4 Solid Waste

SCC will adhere to the requirements of Syrian Law 49/2004 “Cleanliness Law” which provides regulations for the management, monitoring and documentation of all waste streams generated by an industrial establishment.

SCC will follow Lafarge’s policies and principles that support the five R’s principle related to local environmental health, and providing healthy places to dispose of wastes. The five R’s includes:

- Reduction of produced wastes in their original forms.
- Reuse of materials in their original forms.
- Recycling the wastes into usable forms (e.g. cement that was corrupted in the kiln)
- Recovering materials or power from other wastes.
- Residues and using healthy methods to dispose of useless wastes.

For this purpose, domestic non-recyclable solid waste generated from the project will be collected by a licensed third party contractor to be disposed of safely in a licensed dumpsite. “Sereen dumpsite” is located 20 km from the plant site.

Recyclable waste streams will be separated, stored and sold to local recycling industry in the area. Hazardous waste streams will be handled and stored separately from all waste streams to be re-used or disposed in accordance with local regulations and IFC Hazardous Material and Waste Management EHS guidelines.

Solid waste management is discussed in more detail in Chapter 7

2.8.5 Total Emissions Summary

This section summarizes the total emissions expected from all activities related to the construction and operation activities of the proposed SCC project. The waste generation is calculated based on manpower, construction material requirements, and total working days (when possible). Other types of wastes which cannot be estimated based on known standards (referred to as N/A) and are expected to be recorded constantly on-site for continuous follow up.

Table 2-18 Estimated Cumulative Emissions/Discharges from Construction and Operation Activities

PHASE	SOURCE	TYPE OF WASTE	QUANTITY
Construction Phase	Civil and construction works/ site clearance	Inert soil / green waste	900,000 m^3
		Scrap metal	2,000 tons
		Wood material	300 tons
		Used batteries	600 kg
		Used tires	5 -7 tons
		Paints, solvents, lubricants	N/A
	Base camp (average 500 workers – peak time 1,800 workers)	Domestic solid waste*	250kg/day – 900kg/day (peak period) = 3000 tons during entire construction phase
		Sanitary wastewater**	100 m^3/day
	Diesel generators (# 24)	Atmospheric Emissions mainly CO_2, NO_X and CO	Refer to **Table** 2-19
	Transport sector/vehicular exhaust	Atmospheric Emissions mainly from trucks, vehicles... Fugitive Emissions mainly dust	N/A
	Clinic/Health Care Unit	Medical waste	N/A
Operation Phase	Quarrying activities	Fugitive Dust Emissions	N/A
	Cement plant/kiln stack	**Atmospheric Emissions** Sulphur Dioxide (SO_2) Oxides of Nitrogen (NO_X) Carbon Dioxide (CO_2) Dust	 1,283 mg/m^3 73 – 1,097 mg/m^3 2,047,815 tons/year 50 mg/m^3
	Process liquid effluent	Loss as back wash filter	75m^3 every 2 weeks
	Power plant	**Atmospheric Emissions** Sulphur Dioxide (SO_2)	 605 mg/m^3

PHASE	SOURCE	TYPE OF WASTE	QUANTITY
		Oxides of Nitrogen (NO_x) Carbon Dioxide (CO_2) Dust Volatile Organic Compounds (VOCs) Acid gases (HF/HCl) Trace metals	73 – 1,097 mg/m³ 429,720 tons / year 50 mg/m3 N/A N/A N/A
	Process solid waste	Fly ash Slag	91.82 tons/day fly ash 22.96 tons/day slag
	***Base camp (140 workers)	Domestic solid waste	270 kg/day
		Sanitary wastewater	135m³/day
	Laboratory	Chemical waste and others	N/A
	Clinic/Health Care Unit	Medical waste	N/A

*Estimated domestic solid waste based on 0.5kg/capita/day
**Estimated wastewater quantity (90m³/day) based on water demand for domestic purposes equivalent to100m³/day (Quantities generated during peak period are included)
*** A maximum total of 140 workers are assumed given that: Base camp for cement plant (500 workers only a maximum of 100 workers will reside in it since 85% are nationals)/Base camp for power plant (30-40 workers, non-nationals). Estimated domestic solid waste based on 0.5kg/capita/day. Estimated wastewater quantity (135m³/day) based on water demand for domestic purposes equivalent to150m³/day

Based on OGP emission factors for the burning of diesel fuel, the power generation activities during the construction phase (i.e. 24 diesel generators), comprising the combustion of an estimated 3,500 tons of diesel, shall emit the pollutant levels presented in the Table 2-19.

Table 2-19 Estimated Atmospheric Emissions from Combustion Sources

POLLUTANT	EMISSION FACTOR* (TONNE EMISSION/TONNE DIESEL)	EMISSION LEVELS (TONS)
CO_2	3.2	11,200
CO	0.019	66.5
NO_x	0.07	245
SO_x	0.008	28
CH_4	0.00014	0.49
VOC	0.0019	6.65

*Draft OGP Tier II Emission Factors for Diesel Combustion

2.9 PROJECT CLOSURE AND THE REHABILITATION OF THE QUARRY SITES

At the expiration of the useful life of the project, adequate arrangements will be made to remove all movable assets. These may be sold or moved to another factory. Almost all the equipment and machinery shall be re-used for other industrial purposes. All plant facilities and machinery that are not deemed to be of further use will be sold off as scrap or recycled at metal depots/rolling mills.

SCC is committed to rehabilitate both the Limestone and Basalt quarries in accordance with Lafarge rehabilitation of decommissioned quarries policies and in compliance with the Syrian authority requirements for rehabilitation of exploited quarries. The Syrian quarry rehabilitation program serves to attain the following:

- Restoring the quarry site for agricultural use;
- Transforming the quarry site to a leisure zone or nature reserve; and
- Leveling the depressed areas.

For this purpose, SCC will follow Lafarge quarry rehabilitation process, developed in partnership with W.W.F. (World Wide Fund for Nature) in 2001 which aims at limiting the traces of extraction and bringing life back to the quarry area at the end of its life span. Financial mechanisms for funding the future rehabilitation works will be addressed in the future in agreement between project proponent and local authority.

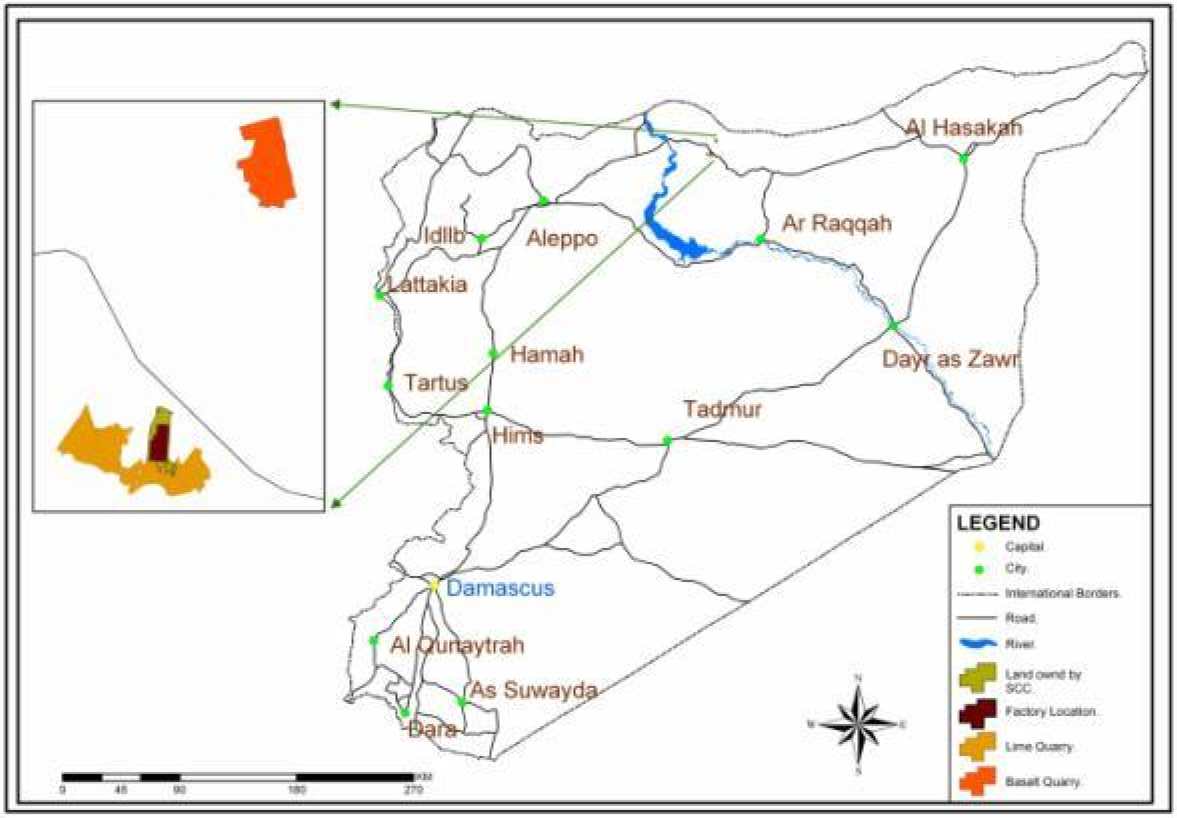
Additional details for closure are outlined in Chapter 7.

3 BASELINE DESCRIPTION OF THE STUDY AREA

3.1 DEFINITION OF THE STUDY AREA

The project area under study is located on the eastern bank of the Euphrates River, approximately 160 km north east of Aleppo, 135 km north-west of the Raqqah (i.e. to the south of Ain Arab village) and 35 km from the Syrian - Turkish border. The study area occupies an area of 14.6 km^2 and encompasses the geographic region (refer to Map 3-1) within and around the:

- Basalt Quarry site,
- Limestone Quarry site;
- Cement Plant Site; and
- Surrounding villages and populated clusters.



Map 3-1 General Map of the Study Area

3.2 SCOPE AND METHODOLOGY

The ELARD survey team consisted of six experts in the fields of biodiversity, geology and water resources, archaeology, socio-economic and environment. The survey program incorporated a drive/walk-over survey through the abovementioned the sites.

The environmental baseline description was based on two inter-dependant activities:

- An extensive desk review of existing data records consisting of the analysis of satellite imagery, review of previous studies and publications on the area, interviews with local inhabitants and public officials; and
- Field investigation of the study area consisting of a series of site visits (19 – 20 February, 9 - 30 March and 21 September), visual documentation and field measurements. The field survey confirmed findings from the desk review based studies and allowed the team to visually identify areas of a sensitive nature and investigate the soils and surface geology, hydrological features, groundwater resources (wells and springs), general terrain, flora and fauna, geomorphology, archaeology,

habitat types and any evidence of human activity (e.g. land use and agriculture), as well as overall socio-economic conditions in areas along the proposed project site.

- All observations by team members were documented (photos and notes taken) and recorded on proforma with position fixing by using a hand held Global Positioning System (GPS). All coordinates quoted in this report are in geographic coordinate system following the WGS84.
- Two sampling campaigns, soil and groundwater, were performed following the New Jersey Field Sampling Standard Operating Procedure (SOP, 2005).
- An assessment of the ambient air quality and background noise level was conducted as well during the field survey.

The scope and methodology for each of the performed technical studies are described in more details in the following sections.

3.3 BASELINE SCOPE AND METHODOLOGY

The scope and methodology of the project area's soil and groundwater profiles are discussed separately in sections 3.3.1 and 3.3.2 below.

3.3.1 Soil Sampling Methodology

Sampling for soil parameters is an integral part in this EIA study which serves as a profiling tool of the soil quality in the study area. Soil sampling is performed in order to be able to:

- Assess the baseline soil contamination,
- Identify the horizontal and vertical extent of contamination, and
- Investigate the relationship between soil and ground water contamination.
- The sampling results will serve as a means for comparative assessment to evaluate potential alterations /change to the soil quality and profile resulting from the various project activities. The findings would also be of use in the impact assessment section of the report and help propose adequate mitigation measures with respect to the project related activities so as to preserve as much as possible the existing soil conditions.

Three (3) surface soil samples (refer to Map 3-2) were collected during the site visit on March 30th, 2008. The collected samples are representative of grab samples of dry sludge taken at one point in time. Soil sampling locations were selected according to SCC's proposed construction and operation sites (wastewater treatment plant outlet, storage site of fuel tank, 1 km east of the cement stacks in the vicinity of the limestone quarry). These areas are selected based on anticipated pollution hotspots such as areas located downwind of the proposed site and areas prone to water erosion (e.g. wadis) in order to complete the baseline survey related to soil conditions and quality prior to commencement of project activities.

For record keeping sake, the coordinates and location of each sample (coordinates) are documented in Table 3-1 below.

Table 3-1 Soil Sampling Locations within the Study Area

SAMPLE ID	DESCRIPTION	LATITUDE			LONGITUDE		
		DEG	MIN	SEC	DEG	MIN	SEC
S1	Location of the wastewater treatment plant	36	32	53.8	38	35	18.0
S2	Location of the fuel tank	36	32	21.7	38	35	22.4
S3	1 km to the east of the plant	36	32	22.3	38	36	2.0

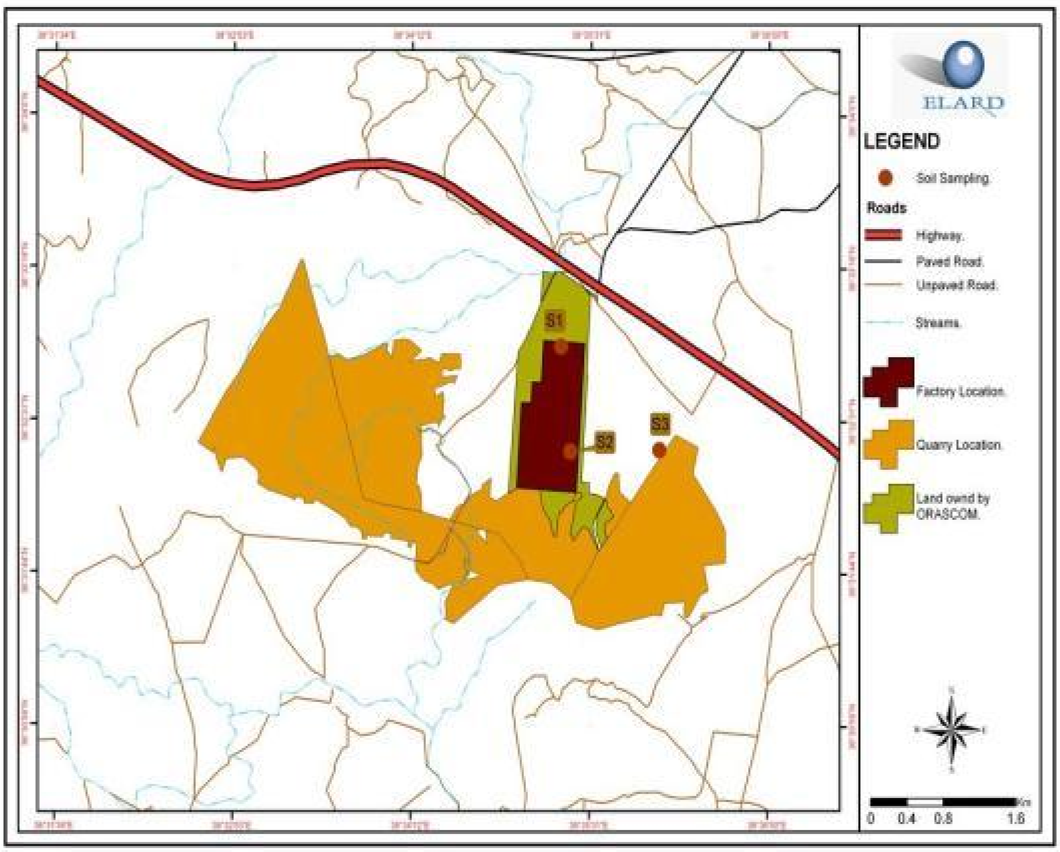
To avoid cross contamination, it was ensured that the decontaminated sampling equipment was always handled using disposable sterilized gloves, prior to and during sample collection. Sampling equipment was kept away from solvents, gasoline, exhaust emissions, or other equipment and/or materials that may impact the integrity of prepared sampling instruments. A record was kept of the date and time and labeled on the sampling device and containers.

- The samples were collected using stainless steel scoops. It was ensured that the implement and the sampling bucket/ recipient were decontaminated prior to sampling.
- The sample collection procedure consisted in the following:
  - Prior to sampling, all inconsequential surface debris such as rocks and excess plant residues were removed from the surface. Disposable gloves are changed between each sample location while minimizing contact of gloves with the soil.
  - It was ensured that samples are relatively homogenous, representing the dominant type of soil or fill at each depth and location.
  - Surface samples were collected from a maximum depth of 0.5 m below the surface and at consistent depth intervals.
  - When using a shovel a V-shaped hole was created. A slice 2 - 3 cm thick down to a depth of 15 - 20 cm was produced. Then the slice was trimmed on either side to form a 2 - 3 cm wide core. This core placed in a bucket constituted an individual sample that was used to create the final composite sample.
  - Upon collection of all the individual samples, lumps and stones are broken up and removed. This is followed by a mixing of soil and a removal of about 500 grams. The final composite soil sample was then placed in decontaminated soil sample box / bag. The sample container was then sealed and labeled with the appropriate information such as location, name, date, type, project name, sampler etc…
- The collected samples were kept in a cooler at 4^{o}C to secure appropriate preservation during shipping and storage.

The samples were delivered to the local laboratory in the Petro-Chemical Engineering Faculty in Al Ba'th University, Homs within 2 days of sample collection. The laboratory is certified by the General Commission for Environmental Affairs (GCEA) in Syria. The soil parameters analyzed in the collected soil samples are listed in Table 3-2 below.

Table 3-2 Parameters Selected for Soil Quality Analysis

SOIL QUALITY PARAMETERS		
Soil pH % Clay Content % Organic Matter Content	Heavy Metals (Arsenic, Barium, Cadmium, Chromium (VI), Copper, Mercury, Nickel, Lead, and Zinc),	Mineral Oil



Map 3-2 Geographic Location of Soil Sampling Points

3.3.2 Groundwater Sampling Methodology

Sampling for water parameters is a fundamental part as well in this EIA study which serves a profiling tool of the water quality in the study area. Groundwater sampling procedures are performed for a number of reasons including:

- Determination of spatial changes in major constituents, nutrients and organic compounds that exist across the study area.
- Provision of a timely warning of serious increases in contaminant levels that can impact end-users of water especially for drinking purposes.
- Identifying the horizontal and vertical extent of contamination; and
- Investigating the relationship between soil and groundwater contamination.

The sampling results will also serve as a basis for comparative assessment to evaluate potential repercussions to the water quality and profile resulting from the various project activities. The findings would also be of use in the impact assessment section of the report and help propose adequate mitigation measures with respect to the project related activities so as to preserve as much as possible the existing water characteristics.

Two (2) groundwater samples (refer to Map 3-3) were collected during the site visit on March 30th, 2008. It should be mentioned that the collected samples are representative of grab samples taken at one point in time. Water sampling locations are selected based on the hydrogeology of the area, i.e. mainly the underlying aquifers that might be impacted by the project and the location of accessible wells.

For record keeping sake, the coordinates of each sample location are listed in Table 3-3 below. Standard operating procedures were adopted from the New Jersey Field Sampling Procedures Manual.

Table 3-3 Groundwater Sampling Locations along the Study Area

WATER SAMPLE NO.	LATITUDE			LONGITUDE		
	DEG	MIN	SEC	DEG	MIN	SEC
WS 1	36	32	27.1	38	34	33.1
WS 2	36	33	12.8	38	35	15.1

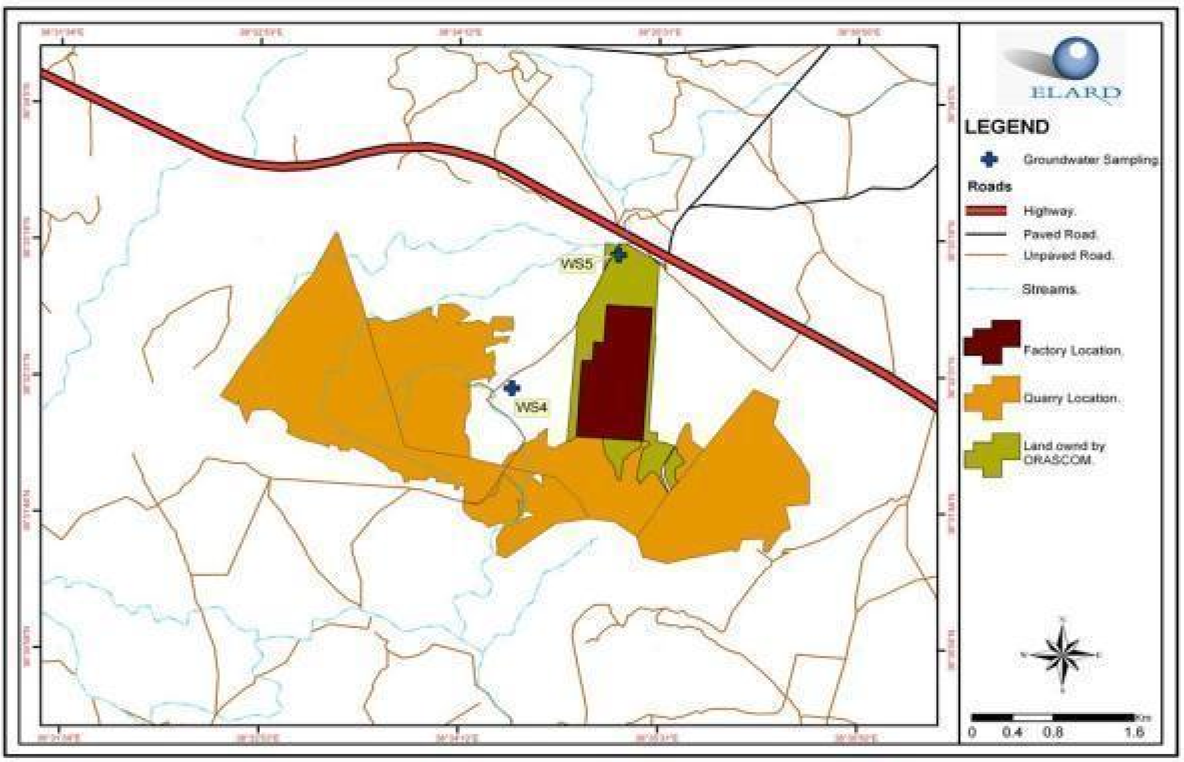
To reduce the possibility of contamination all equipment was handled as little as possible prior to use with disposable gloves worn at all times when handled. It was ensured that sampling equipment was stored away from solvents, gasoline, exhaust emissions, or other equipment and/or materials that may impact the integrity of prepared sampling instruments. A record was kept of the date and time and labeled on the sampling device and containers.

Prior to collection of groundwater samples, the well is purged (5 well volumes of water) to remove any stagnant water in the well casing and to ensure that at least 95% of the water sample originates from the aquifer formation being sampled. Water is then collected from the rising pipe and labeled and preserved at 4°C to secure appropriate preservation during shipping and storage. The samples were delivered to the

GCEA certified laboratory in the Petro-Chemical Engineering Faculty in Al Ba'th University, Homs within 2 days of sample collection. The concerned water parameters for groundwater are listed in Table 3-4 below.

Table 3-4 Parameters Selected for Water Quality Analysis

TESTED GROUNDWATER PARAMETERS
pH (In situ sampling)
Heavy Metal (Cadmium (Cd) Chromium (Cr) Copper (Cu) Mercury (Hg) Nickel (Ni) Lead (Pb) Zinc (Zn) Barium (Ba) and Arsenic (As)
Total Dissolved Solids, Ammonium (NH_3), Sulphide free (as H_2S)



Map 3-3 Geographic Location of Water Sampling Points

3.3.3 Air Monitoring Methodology

With regards to the proposed cement plant, the main anticipated atmospheric releases include Oxides of Nitrogen (NO_x), Sulphur Dioxide (SO_2), and dust/particulate matter (PM_{10}) released from the pyroprocessing stage of Portland cement manufacturing (i.e. rotary kiln system) and coal-fired thermal power plants. Such atmospheric discharges are expected to be continuously discharged during the plant's operational phase. This fact could give rise to public health concerns and air quality degradation due to the persistence of these pollutants. Therefore, in order to assess the current status of the ambient air quality, four (4) sampling points were investigated. These points were chosen according to the climatic data (wind speed, direction), humidity, temperature) provided by "Tal Abyad" Weather Station and to SCC's planned construction and operation sites (refer to Map 3-4).

Air sampling was carried out using the "NOVA 600" Air Quality Monitor System in line with EU specifications. The instrument was configured with a set of gas sensor modules and various weather sensors. All gas modules in the unit were calibrated (zero and span) by applying certified gas to its inlet. The instrument was mounted at the different sampling locations using metal brackets and set for logging at 2 minutes interval.

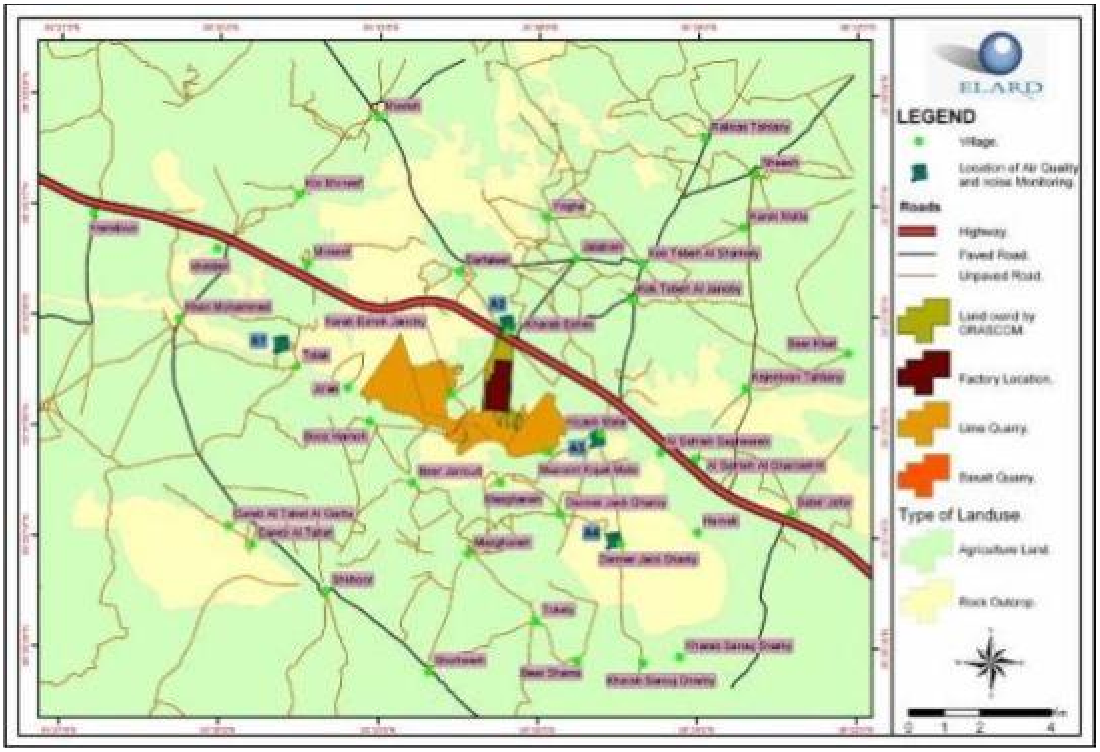
Recorded concentrations are assessed based on permissible Syrian national air quality standards. Table 3-5 presents the sampling locations in relation to the proposed project site.

Table 3-5 Coordinates of the Air Monitoring Points

SYMBOL	LATITUDE	LONGITUDE	DESCRIPTION
A1	36°33'09.83"N	38°31'09.08"E	8 km northwest of plant site
A2	36°33'29.02"N	38°35'23.96"E	1 km north of plant site
A3	36°30'11.88"N	38°37'25.64"E	2 km southeast of plant site
A4	36°31'44.47"N	38°37'06.78"E	4 km south of plant site

3.3.4 Noise Monitoring Methodology

Noise level related to different project activities might be of concern for the study area's noise-sensitive receptors (population clusters in particular). Different noise monitoring points were chosen to reflect on the general background noise level of the project area expected to be reflective of a rural setting. Noise monitoring was performed using the CIRRUS - Model CR: 811C noise meter at the limestone quarry site, 1 and 1 km downwind to the latter as well as at increasing distances to the cement plant site (2 -4 km south of site). Recorded noise levels were assessed based on Syrian permissible noise levels for rural areas.



Map 3-4 Air and Noise Sampling Locations

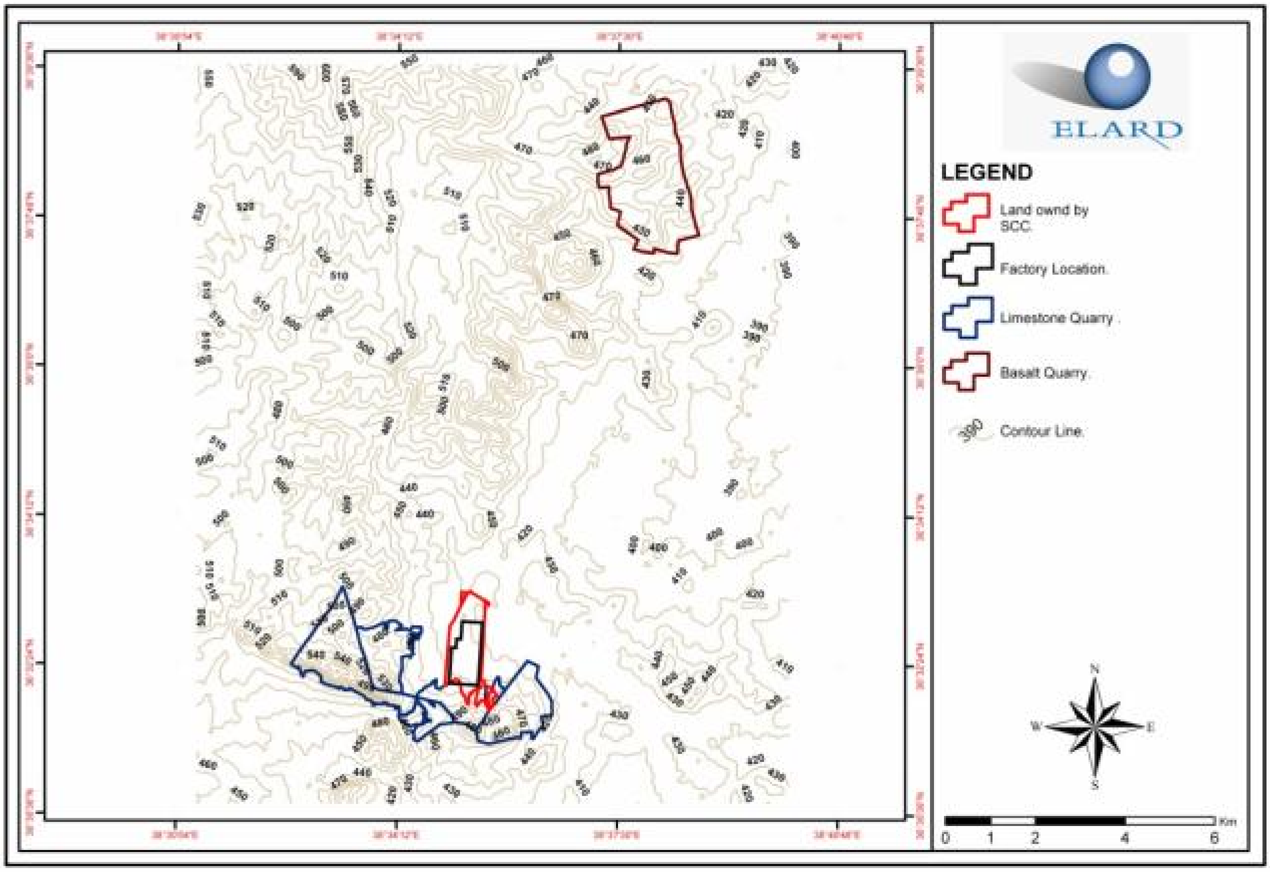
3.4 PHYSICAL ENVIRONMENT

3.4.1 Geography and Topographic Setting

The study area's topography is defined in some part as a flat terrain (i.e. proposed plant site) and in another as an undulated area (i.e. basalt and limestone quarry sites).

The area under study extends at an elevation ranging between 420 - 500 m above sea level (a.s.l), and bounded to the south by Jabal Khrab and Koujak Mountainous hills. Despite the plain nature of the area, the southern parts witness small valleys or Oueds formed along ephemeral streams, trending downstream in the north direction. The major mountains overlooking the site from the south are: Koujak Meet South (439 m a.s.l.), Koujak Mountain (499 m a.s.l.), Kharab Ichk Mountain range (548 m a.s.l.), and Toulak Mountain (557.5 m a.s.l.).

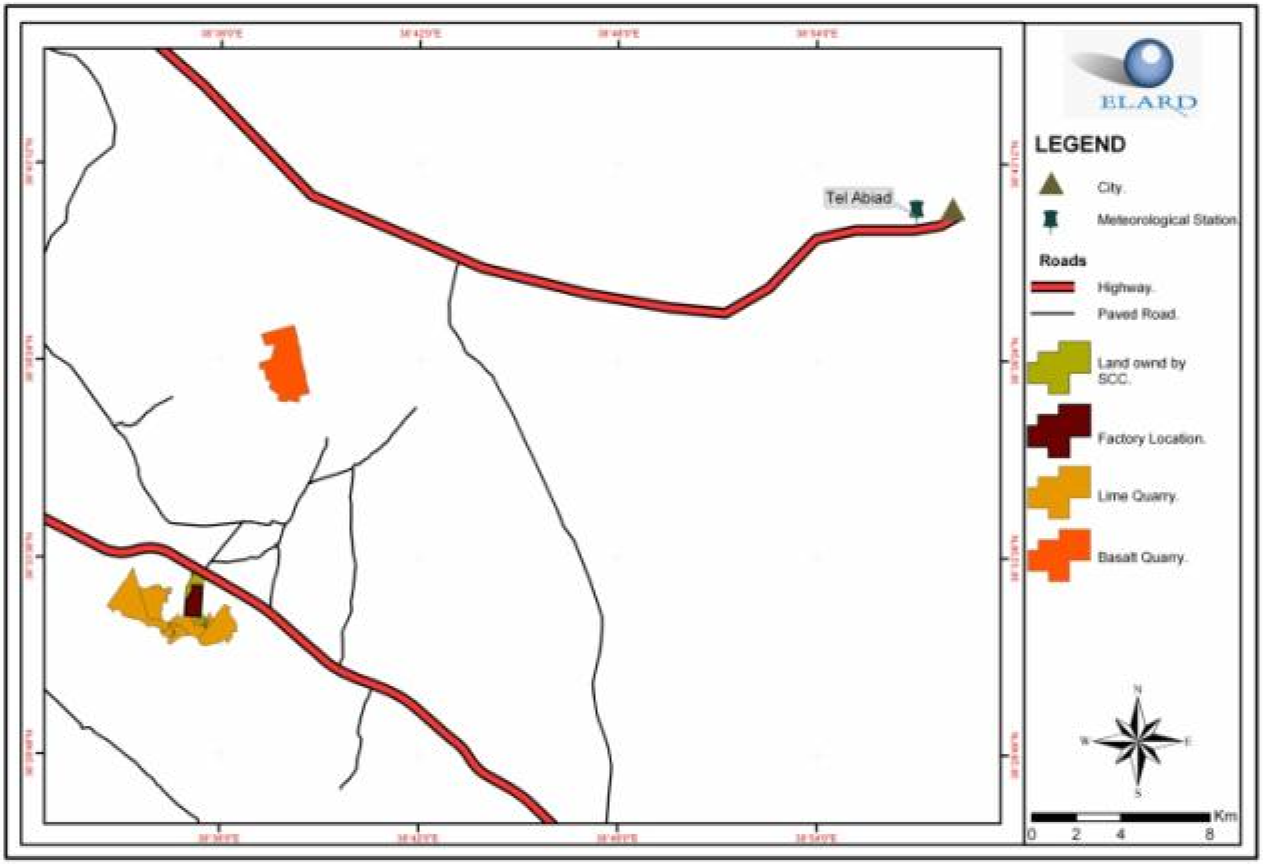
Elevations of the basalt and limestone quarry sites range between 400 to 440 m and 440 to 560 m respectively. A topographic map of the study area is given in Map 3-5 below.



Map 3-5 Topography of the Project Area

3.4.2 Climate

The climatic conditions of the study area were gathered from the "Tal Abyad" Meteorological Station, located 36 km north-east. Map 3-6 illustrates the location of the weather station in relation to the proposed project Site.



Map 3-6 Location of "Tal Abyad" Weather Station

3.4.2.1 Precipitation

According to the general precipitation map of Syria, the study area falls within Syria's fourth Rainfall Zone (i.e. marginal land), with an annual rainfall ranging between 200-250mm, and not less than 200 mm in 50% of the monitoring years.

Based on the recorded precipitation level between 1967 and 2004, the monthly rainfall levels range between 0 - 50mm. The annual average precipitation of 280 mm is the sum of the "Mean of Total Precipitation" calculated over a year. Periods with high amounts of rainfall span from November to February, while dry periods extend from the months of July to September (refer to Figure 3-1).

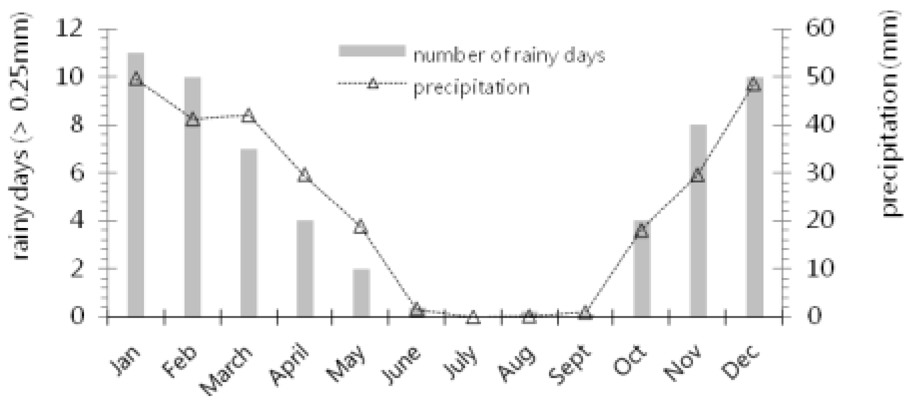


Figure 3-1 Monthly Precipitation Levels

3.4.2.2 Temperature

The study area is characterized by a dry to semi-dry Mediterranean climate. As shown in Figure 3-2, the average monthly temperatures range between a low of 0˚C to a high of 39˚C. Extreme temperatures recorded in the Governorate of Aleppo are -13˚C and 47˚C during the months of January and June, respectively.

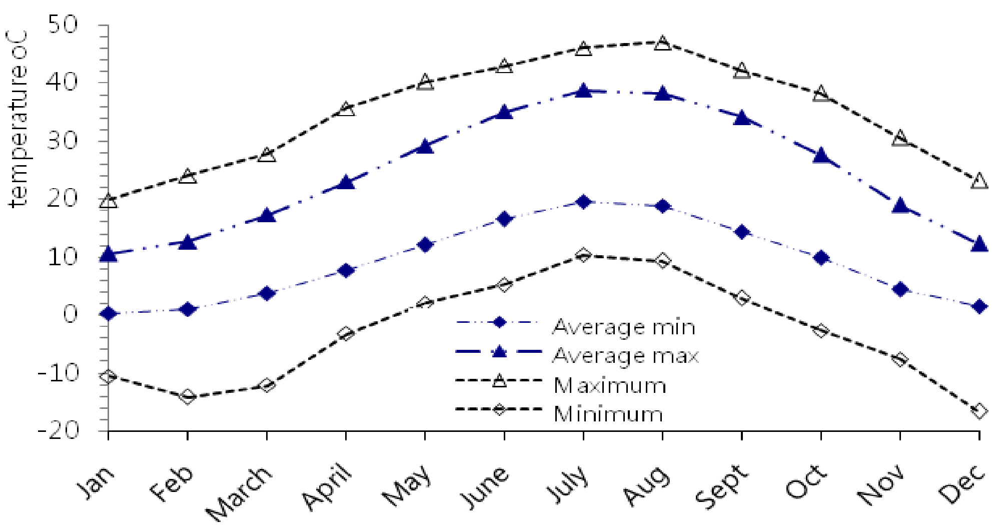


Figure 3-2 Average and Aboslute Maximum & Minimum Temperatures at "Tal Abyad" Weather Station

3.4.2.3 Wind

In general, Syria is subject to easterly, westerly and northerly winds in the winter season. The prevailing summer winds blow either from the north or from the west (MoD, 1977). Wind speed varies from 3 m/s in June to 1.2m/s during the month of November. Figure 3-4 illustrates the maximum and mean monthly wind speed data collected from the Tal Abyad weather station.

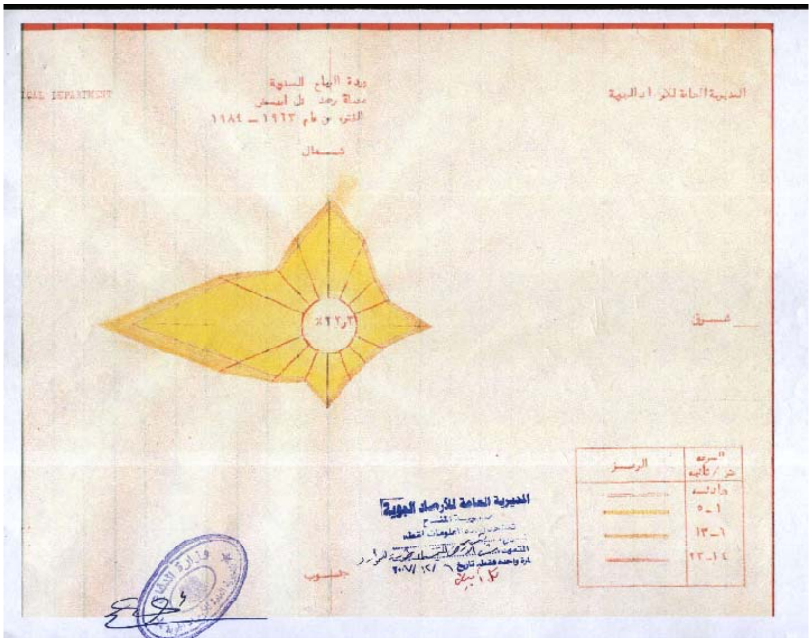


Figure 3-3-3 Wind Rose of Tal Abyad Station

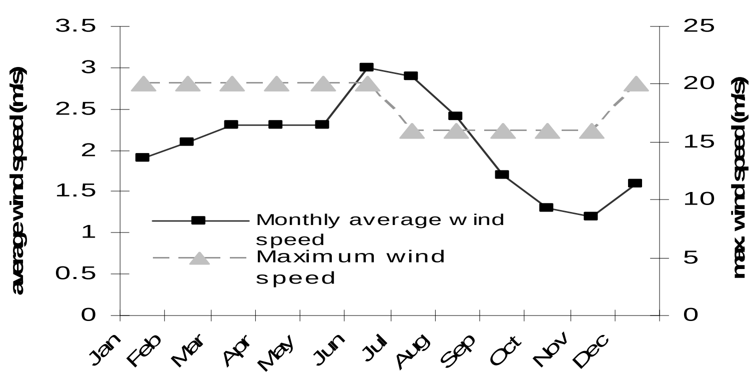


Figure 3-4 Maximum and Minimum Monthly Wind Speed Data from Tal Abyad Weather Station (1963-2004)

3.4.2.4 Humidity

The average humidity recorded in the study area is about 77% during the winter period and 41% in dry periods. Maximum absolute humidity values may reach 100%, while the lowest humidity in dry periods were recorded around 2% (refer to Figure 3-5).

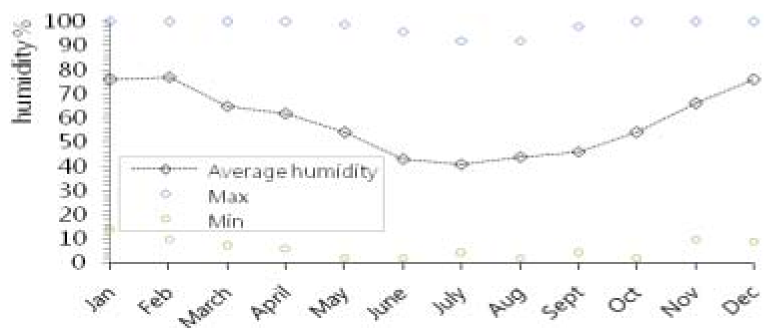


Figure 3-5 Maximum, Minimum, and Average Humidity Levels

3.4.3 Soils

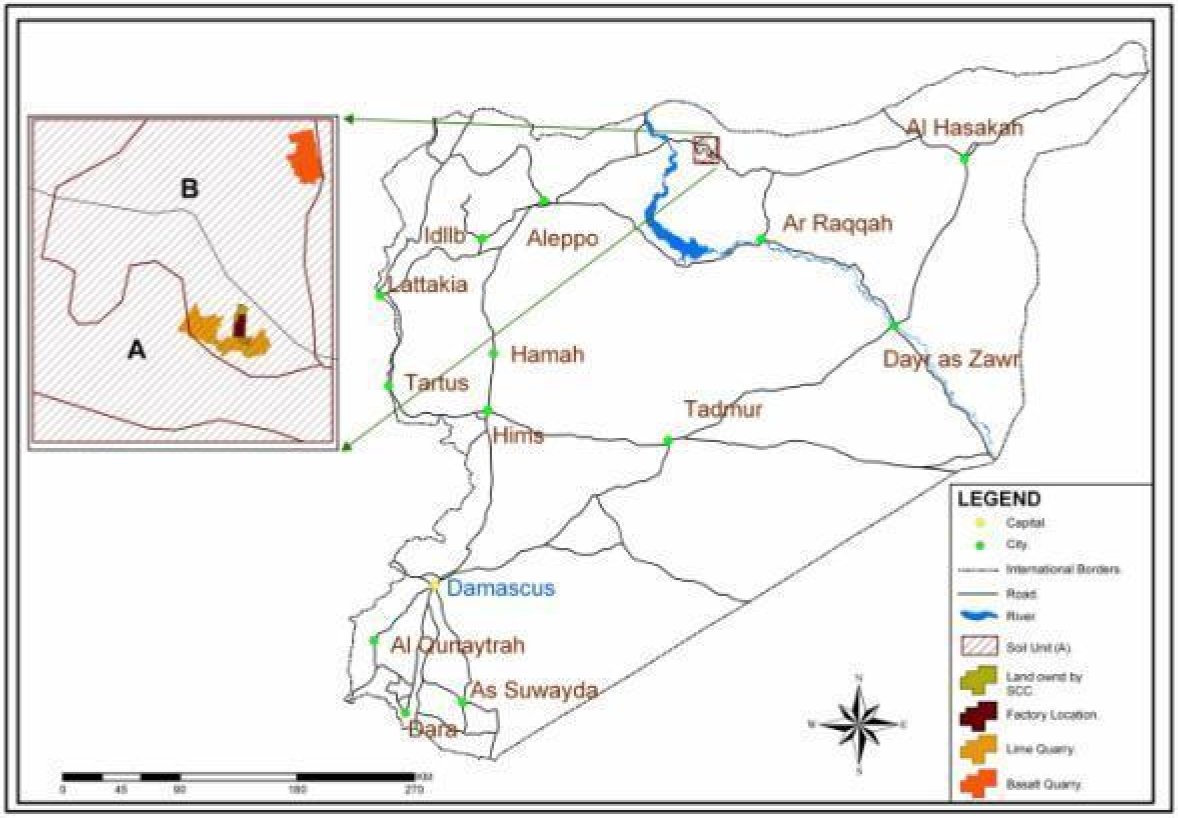
The study area is situated in a dry to semi dry setting and includes two different soil groups. The two soil units are labeled A and B (refer to Map 3-7).

3.4.3.1 Unit Material, Parent Rock and Soil Composition

The occurrence of the units is mainly dominated by and follows the type of geological outcrops, which are tackled in Table 3-6 below.

Table 3-6 Characterization of Soil Groups

GROUP	LOCATION LANDSCAPE AND PARENT MATERIAL	SOIL COMPOSITIONS
A	• Extends from the Euphrates dam in the south up to the Turkish borders up north • Surface area: 1,890 km^2 • The surface of the plateau is gently undulated with an elevation ranging between 400 – 500 m a.s.l. • Soils were formed in sediments mainly derived from Helvetian limestone and to a lesser extent from Oligocene limestone and sandstones.	• Xerollic Calciorthids dominating the southern largest part of this unti at lower rainfalls. • Calcixerollic Xerochrepts soils prevail mostly in the northern part
B	• Located in the north western part of the Mesopotamian plain, between the Euphrates and Balikh Rivers. • Surface area: 960 km^2 • The surface of the plateau is gently undulated with an elevation ranging between 450 – 550 m a.s.l. • Basaltic soils dominate the entire unit.	• Calcixerollic Xerochrepts occupying almost 40% of unit (B), • Lithic Xerorthents occupy 30% of this unit. • Majority of the heights are occupied by rock outcrops, along with Lithic Xerorthents on the upper slopes. Other major soils are Calcixerollic-Lithic Xerochrepts occurring mainly in the lower parts of the slopes.



Map 3-7 Soil Groups in the Study Area

3.4.3.2 Soil Quality

As previously mentioned in section **3.3.1**, a soil sampling campaign was carried out in order to assess the existing soil quality of the study area prior to commencement of the proposed project. It should be noted that due to the lack of standards for soil quality in Syrian regulation, sampling results were assessed according to the "Dutch Soil Target and Intervention Values" which are in line with EU Standards. Though Dutch Intervention Values are not directly applicable to Syrian soils; due to the 10% organic matter and 25% clay of Dutch soils, these values however do give an idea of the potential risk of contamination. The soil sampling results show background concentrations of the different soil parameters to be well within, if not below, the target and intervention values. The soil sampling results are presented in Appendix A

3.4.4 Geology

Data for this section was gathered according to the geological map of Syria as well as lithological logs of exploration wells drilled in the study area.

3.4.4.1 Stratigraphy

The expected stratigraphic setting in the study area consists mainly of formations ranging from the Cretaceous, Paleogene, Neogene and Quaternary Periods. The various sequences of formations within the study area are presented from younger to older as follows:

- **Quaternary**

The Quaternary deposits which are mainly composed of a clayey soil cover with variable thickness. Maximum soil thickness is witnessed in the plain area of the proposed plant site, located downhill from the mountain cliffs. Pebbles and boulders are also prominent along the Euphrates River's main stream.

- **Neogene**

The Neogene rock sequence is exposed in the subsurface of the study area and is restricted to the Lower Neogene age, of the Middle Miocene age (Helvetian, N1h; Tortonian N1t). These formations are a result of erosion/non-deposition episodes that took place in the post Oligocene and upper Miocene times.

These rock formations consist mainly of limestone, dolomitized limestone, and sandstones, with conglomerates and sands prevalent at their base. The thickness of the Helvetian ranges between 13 to 80 m. The Neogene is exposed in the northern and south eastern parts of the study area.

- **Paleogene**

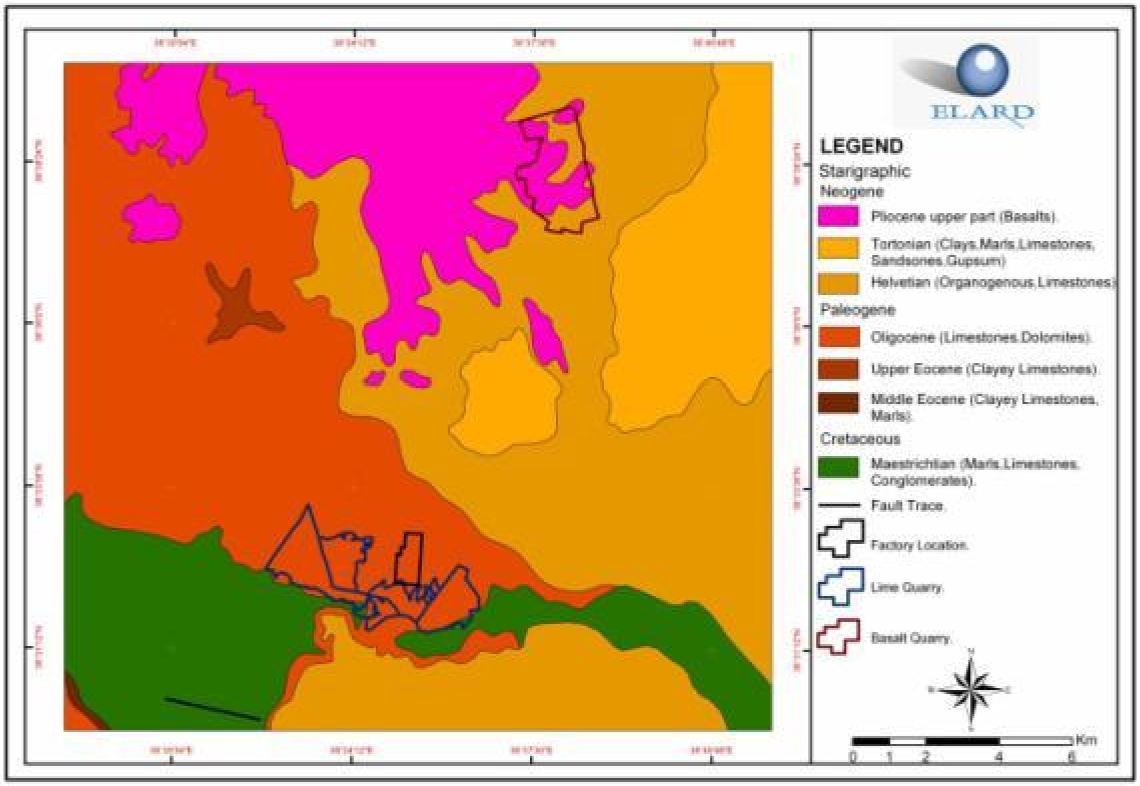
As stated previously, the base of the overlying formation is composed of conglomerates and sand lying over Oligocene rock sequences. The contact between both strata is an unconformity resulting from post Oligocene erosion. The Paleogene rock sequence is composed, from younger to older; of the Oligocene (Pg3), Eocene (Pg2), and at the base, Paleogene (Pg1) strata. The Paleogene sequence that is exposed at the proposed site location is the Upper Paleogene (Oligocene) sequence.

- The Oligocene (Pg3) consists of limestone beds intercalated with marl layers. It has a variable thickness in the study area.
- At the base, the Eocene (Pg2) is composed of limestone beds intercalated with marl beds. The Upper Eocene sequence consists of massive limestone, whereas the lower parts consist of marly limestone.
- The Oligocene and Upper Eocene layers present in the study area have a thickness of about 300m.
- If present, the lower Paleogene (Pg1) consists of marly limestone with thickness ranging between 3 to 7m. The absence of the basal Paleogene is due to episodes of erosion/non-deposition having occurred in the late Cretaceous period.

- **Cretaceous**

The Cretaceous sequence that is of interest for the purpose of this study is the Upper and Middle cretaceous strata.

- The Upper cretaceous of the Maastrichtian age (cr2m) is composed of limestone marls and chalks. The upper cretaceous rocks are exposed to the south of the study area on an elevated terrain. The thickness of this layer can reach up to 100m.
- The Middle Cretaceous of the Cenomanian - Turonian age is composed of massive limestone. This layer is not exposed in the vicinity of the study area. Information about this sequence is interpolated from the general geology of Syria.



Map 3-8 Geologic Map of the Study Area (Modified from the geological map of Syria 1:200000)

3.4.5 Seismicity and Tectonism

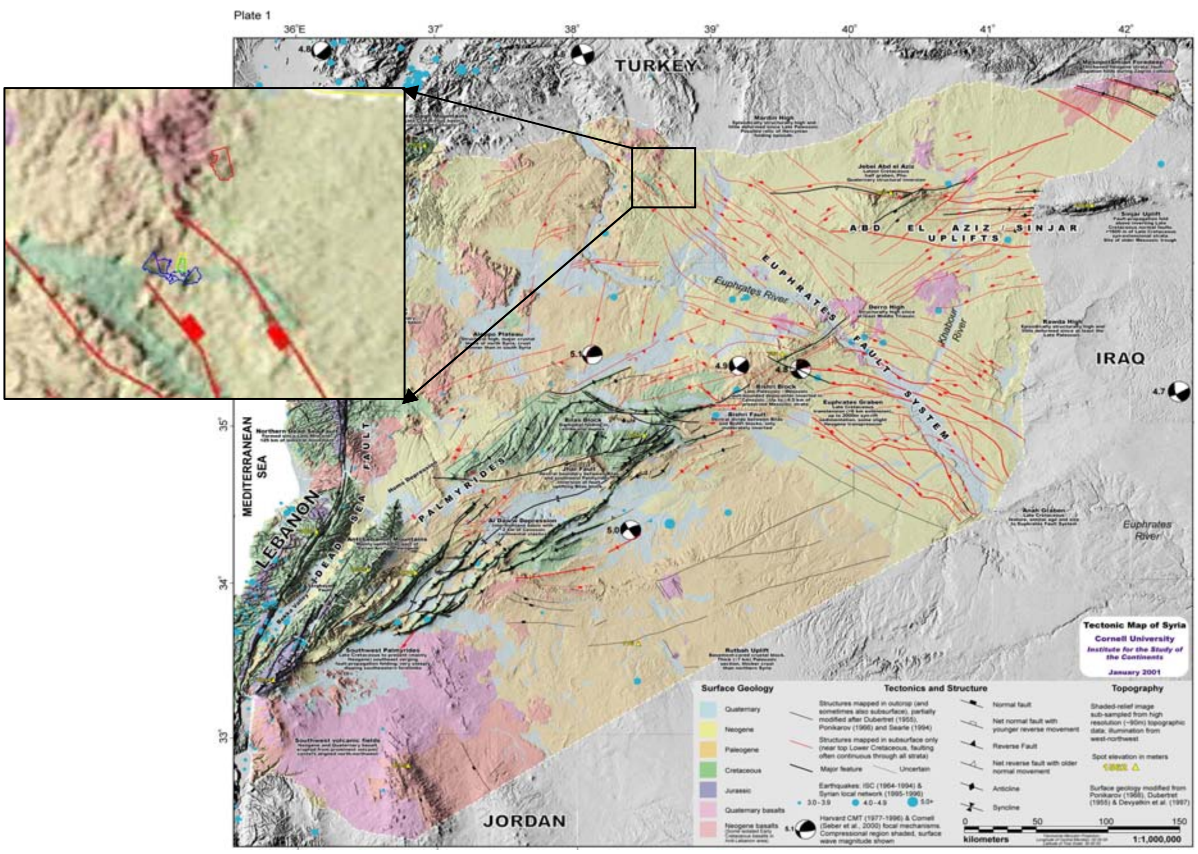
In reference to tectonic sequences in Syria, they are divided into two parts; the northern part considered relatively movable and the southern part regarded fairly stable. The limit between the two parts is the Palmyrine Mountain series. The Study Area is located in the northern movable part however during the period extending between 1964 and 1996; only weak seismic activities (not exceeding 3.9 on Richter Scale) were recorded at 21 km to the southwest of the Project Area (refer to Map 3-9).

The Study Area was subject to various folding and faulting episodes. A series of alternating northwest trending synclines and anticlines exist to the east of the Study Area. These folding structures allowed the exposure of the cretaceous strata of the Maastrichtian age to the south of the Study Area.

Faults trending in the northwest southeast and north-northwest south-southeast directions predominate in the Study Area.

Southeast of the Study Area, two faults trending in a northwest southeast direction form a graben like structure where Neogene rocks are lowered to levels of older Neogene and Paleocene Strata. Bedding attitudes vary according to structural disturbances.

A major northeast southwest trending fault passes from south to north through the tip of Kharab Ichk Mountain, Kharab Ichk, and Haliba villages lying to the east of the Study Area



Map 3-9 Tectonic Map of Syria and Study Area

3.4.6 Hydrogeology and Hydrology

3.4.6.1 Hydrogeology

Three (3) aquifers are currently exploited in the study area. These are the Neogene, the Paleogene and the Cretaceous groups. The study area's hydrostraticgraphic units are illustrated in Map 3-10.

- The **Neogene Group** of Middle Miocene age is considered an aquiferous formation in the study area. The recharge area for the Neogene is located north of the study area. Water in this aquifer circulates in secondary porosity in fractures and fissures.
- The **Paleogene Group** namely the Oligocene and middle Eocene groups constitute a karstic aquifer with an approximate thickness of 270m. This aquifer is, like the Neogene, a karst aquifer, where water circulates in fractured limestone. The marly and marly limestone units overlying and underlying the Paleogene system relatively reduce the hydraulic exchange between the Paleogene and the overlying and underlying units. This aquifer hosts marly impervious lenses, which may hinder local groundwater flow.
- The **Cretaceous Group** is poorly exploited in the study area. Water also flows in fractures and dissolution conduits. It is expected that the top of this aquifer is about 400 to 450m deep in the study area.

3.4.6.2 Well and Spring Survey

A survey for the existing wells in the area of investigation conducted between February 18th and 22nd 2008 revealed the presence of about 49 wells mostly tapping the Neogene and Paleogene aquifers (refer to Figure 3-6). The depth of the wells varies between 65 m and 190 m below ground (B.G.). Discharge rates vary between 18 and 2,160 m^3/day. The wells are mostly used for domestic and agricultural purposes.

Depth to water level in most of the Neogene wells vary between 60 m and 90 m B.G., which corresponds to an absolute static water level of about 330 to 400 m a.s.l. Wells drilled in the outcrops of the Neogene group are found north to the study area.

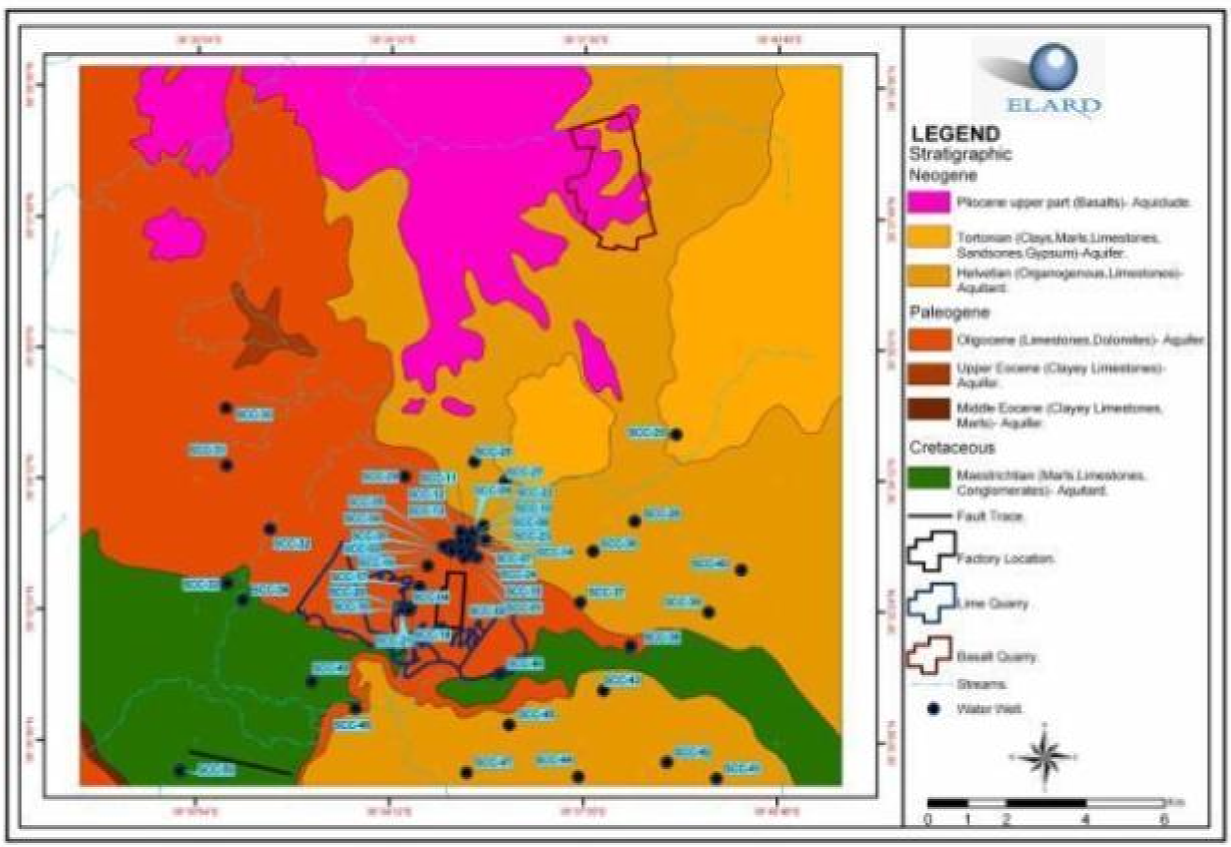
In wells tapping the Paleogene formations, seldom down to depths of 130 - 160m B.G., static water level varies between 30 m and 110 m below ground level, which is equivalent to an absolute level of 320 m to 440 m a.s.l. Water starts to appear at about 110 m-120 m BG in wells drilled in the Paleogene unit.

Finally, wells tapping the Cretaceous strata of Maastrichtian age are characterized by static water levels varying between 40 m and 100 m B.G., which corresponds to an absolute water level of about 330 m to 440 m a.s.l.

Based on field surveys, most of wells drilled in the Paleogene to the east of the plant site are dry. Based on generated water level contour maps for each of the tapped aquifers, namely the Neogene, Paleogene, and Cretaceous aquifers, the groundwater flow direction in the Paleogene and Neogene aquifers is in an eastern to western direction. There is a groundwater divide which extends along the crest of Jabal Koujak, and Jabal Kharab Ichk.

The recharge area for the Paleogene aquifer consists of the Paleogene exposures located to the west and northwest to the site location. As water flows in an east- southeast direction, the cement plant area (mainly the zone of wells SCC-02- SCC-03) becomes a sink zone where water accumulates, as a result of the presence of a water divide to the south and a fault to the east. The recharge area could be estimated at about 148 km^2 extending northwest to the Euphrates. Since the study area is restrained to the zone surrounding the SCC proposed site, an accurate water balance cannot be performed, mainly because of the inexistent information about wells in the entire recharge area.

Figure 3-6 Groundwater Wells identified in the Study Area



Map 3-10 Hydrogeological Map of the Project Area and Well Distribution

3.4.6.3 Groundwater Quality

As previously noted in section **3.3.2**, the sampling results will help assess the existing quality of the groundwater and serve as a basis for comparative assessment to evaluate potential repercussions to the water quality that might arise from the various construction and/or operation activities of the proposed project.

Due to the absence of standards for groundwater quality in Syrian regulations, the sampling results were also evaluated based on the Dutch Target and Intervention Values. For all the parameters and samples analyzed, results revealed contaminant levels to be well below the Intervention Value of the Dutch standards. The pH values recorded at location (i.e. in-situ) “WS1” and “WS2” were 7.6 and 7.1, respectively. The results of the water analysis are presented inAppendix A.

3.4.6.4 Hydrology

No permanent surface water resource flows within the study area. However, several small ephemeral streams exist flowing within small valleys/Oueds following a rain event. These streams were found to be trending in a SSW-NNE and SE-NW direction thus contributing to recharge of local groundwater.

Two major streams (wadis) were observed close to the project area which are; Wadi Al Areed (2 Km south west the limestone quarry) and Wadi Ajak (0.5 Km west the basalt quarry).

3.4.7 Noise

3.4.7.1 Ambient Noise Level

It is evident that at any setting, both the frequency and magnitude of environmental noise may vary considerably over the course of the day. In the case of the proposed SCC cement plant located at 160 km north-east of Aleppo, the project would occur primarily along a rural range and agricultural areas. This implies that noise sources are predominantly natural including wind, cattle, birds and weather. Findings show that typical background noise levels in rural and underdeveloped areas typically range between 35 and 45 dB(A) (EPA, 1978).

For the proposed project, baseline noise levels were measured using a noise meter at different locations around the site. The existing ambient noise levels recorded in the project area were non-intrusive and well within the Environmental Protection Agency (EPA) standards ranging from 34 to 40.5 dB(A). It should be noted that these recordings are reflective of the daytime and that noise levels during nighttime are expected to decrease considerably.

3.4.7.2 Noise-Sensitive Receptors

Noise sensitive receptors near the proposed project site include mainly the population clusters and dwellings located at 1km north of the cement plant, in addition to those residing around the basalt quarry site.

It is anticipated that the project would increase significantly the background noise levels mainly due to the blasting activities, heavy traffic movement (haulers and truck movement for material transportation), and equipment handling (drilling, crushing…).

3.4.8 Ambient Air Quality

Given the rural setting of the study area and the minor industrial development identified within the region, concentrations of the primary pollutants such as NO_2, SO_2, CO and dust in the ambient air are expected to be minimal, if not negligible. The results of the air quality monitoring survey are presented in Table 3-7.

Table 3-7 Air Quality Monitoring Results

		AIR QUALITY			
SAMPLING POINT	**WIND DIRECTION**	**CO (ppm) (8 hours)**	**NO_2 (ppm)**	**SO_2 (ppm)**	**PM_{10} (µg/m³)**
A1	west	< 0.5	< 0.001	< 0.02	3.9
A2	west	< 0.5	< 0.001	< 0.02	4.8
A3	west	< 0.5	< 0.001	< 0.02	6.3
A4	west	< 0.5	< 0.001	< 0.02	9.1
Syrian Standards		**8.6**	**0.105**	**0.047**	**100**
IFC Standards		**10**	**0.039**	**0.01146**	**100**

However, emission concentrations especially for these pollutants are anticipated to increase considerably during the construction phase of the project which entails quarrying operations, and heavy traffic movement (haulers and truck movement). The operational phase of the project is also considered a point source for these atmospheric discharges generating combustion emissions from the cement rotary kiln stacks and thermal power plant.

3.5 BIOLOGICAL ENVIRONMENT

3.5.1 Methodology of the Ecological Survey

An ecological investigation represents a major part of the field survey. One of the aims of the field survey conducted on 30th of March 2008 was to assess the biodiversity of the existing fauna and flora in the project area and identify any endangered or protected species

Several limitations were associated with the biodiversity survey including:

- The field survey identified flora and fauna as a 'snapshot' in time (could not assess the biodiversity all year round).

- The visit was undertaken during daylight hours for security, health and safety purposes. Consequently, the abundance and diversity of species during nocturnal hours could not be assessed.

Therefore, this survey must not be considered inclusive. The following sections will present the typical fauna and flora cited during the field survey.

3.5.2 Background on Land-Use and Biodiversity in Syria

The Syrian territories have been divided into five agricultural settlement zones according to the annual rainfall average:

- The first zone (14.6% of total Syria's territories): the annual rainfall averages more than 350mm but not less than 350 in 65% of the monitoring years.
- The second zone (13.3%): the annual rainfall ranges between 350-250mm and not less than 250 mm in 65% of the monitoring years.
- The third zone (7.1%): with annual rainfall over 250 mm and not less than 250 mm in 50% of the monitoring years.
- The fourth zone (the marginal lands 9.9%): the annual rainfall ranges between 200-250mm and not less than 200 mm in 50% of the monitoring years.
- The fifth zone (the steppe lands): the rest of the territories.

It should be stated that the study area stretches along the fourth agricultural settlement zone which presents relatively one of the lowest recorded annual rainfall.

3.5.3 Project Area Flora

The vegetative cover in the study area consists mainly of semi-shrubs and herbs covering 35 - 45% of the wild patches. There exists approximately 10 - 25 species per surface unit (500m^2).

The study area is characterized by the cultivation of rainfed crops such as barley, wheat, and cotton (refer to Figure 3-7). Fields of olive trees, beans, and cumin were also observed. Additionally, the last thirty years have witnessed the introduction of summer crops due to the irrigation networks project and the land reclamation policy.

The Mediterranean climate supports the growth of wild species like Quercus (Oak), Crataegus (Hawthorn), Amygdalus (Almond) and Eucalyptus (Eucalyptus camali); however, their absence from the study area was well noted. The loss of the vegetative cover is accredited to land use practices, mainly intensive agricultural rotation, leaving only small patches of vegetation in the neglected corridors between the cultivated lands.

Barley Field

Olive Plantlet

Figure 3-7 Rainfed Crops in the Study Area

Some fruit trees identified in the villages surrounding the plant site include: *Prunus avium* (كرز); *Prunus cerasifera* (الجانرك); *Prunus armeniaca* (مشمش); and Almond.

Previous studies carried out in the area documented the presence of climax vegetation- such as perennial shrubs and woody species. Table 3-8 presents the main floral species reported in the literature within the study area (Sankary, 1978).

Table 3-8 Main Floral Species in the study area (Sankary, 1978)

GROUP NO.	SPECIES NAME
Group 3	*Atriplex leucoclada*, *Salsola vermiculata*, *Haloxylon articulatum*, *Phalaris paradoxa*, *Phalaris minor*, *Phalaris brachystachys*, *Astragalus hamosus*, *Avena barbata*, *Sisymbrium bilobum*, *Malva parviflora*, *Anthemis spp*, *Hypecoum spp*, *Hordeum glaucum*, *Tamarix spp* (could be found in few spots)
Group 2	*Pistachia atlantica*, *Rhamnus palaeatina*, *Prunus app*, *Agropyron libanoticum (above 1000 m)*, *Atriplex leucoclada*(below 1000 m), *Postia lanuginose*, *Argyolobium crotolarioides* , *Stipa lagascae*, *Stipa barbata*, *Stipa parviflora*

Currently, annual species with degradation indicators were observed (such as *Peganum harmala*). During the past years, the study area has witnessed an accelerated change in natural vegetation mainly induced by increased human pressure. The varying demand of the agricultural market, road construction, and settlement growth in agricultural terraces are at the heart of this change. Additionally, privately-owned parcels are being invested for construction purposes (houses, shops, etc.); further eradicating the natural vegetation.

With regards to protected areas in Syria, they are either forest/forest-like ecosystems or rangeland areas. Given that the study area lies in the fourth marginal zone of Syria, i.e. in a transition zone between the forest areas (1st and 2nd stabilization zones) and the steppe dry area (5th zone), this implies the absence of sensitive ecosystems requiring protection. As such, no protected areas could be identified in the study area based on published documents or during the reconnaissance field survey. The most common documented floral species (refer to Figure 3-8) in the study area are listed in Table 3-9.

Table 3-9 List of Identified Floral Species

SPECIES NAME	HABITAT DESCRIPTION	FLOWERING PERIOD
Achillea conferta	Perennial plant, grows on sandy, gravelly soils in orchards and waste places.	April to June.
Chrysanthemum coronarium	Grows on rich, loamy soils in waste places and road sides	February to June
Vicia sativa	Grows on loamy soils as a weed escaping from cultivation in the vegetable fields	Early March till May
Phalaris brachystachys	Grows as a weed in barley and wheat fields	March to May
Trifolium sp.	Grows as a weed in vetch and barley fields	Spring

Peganum harmala

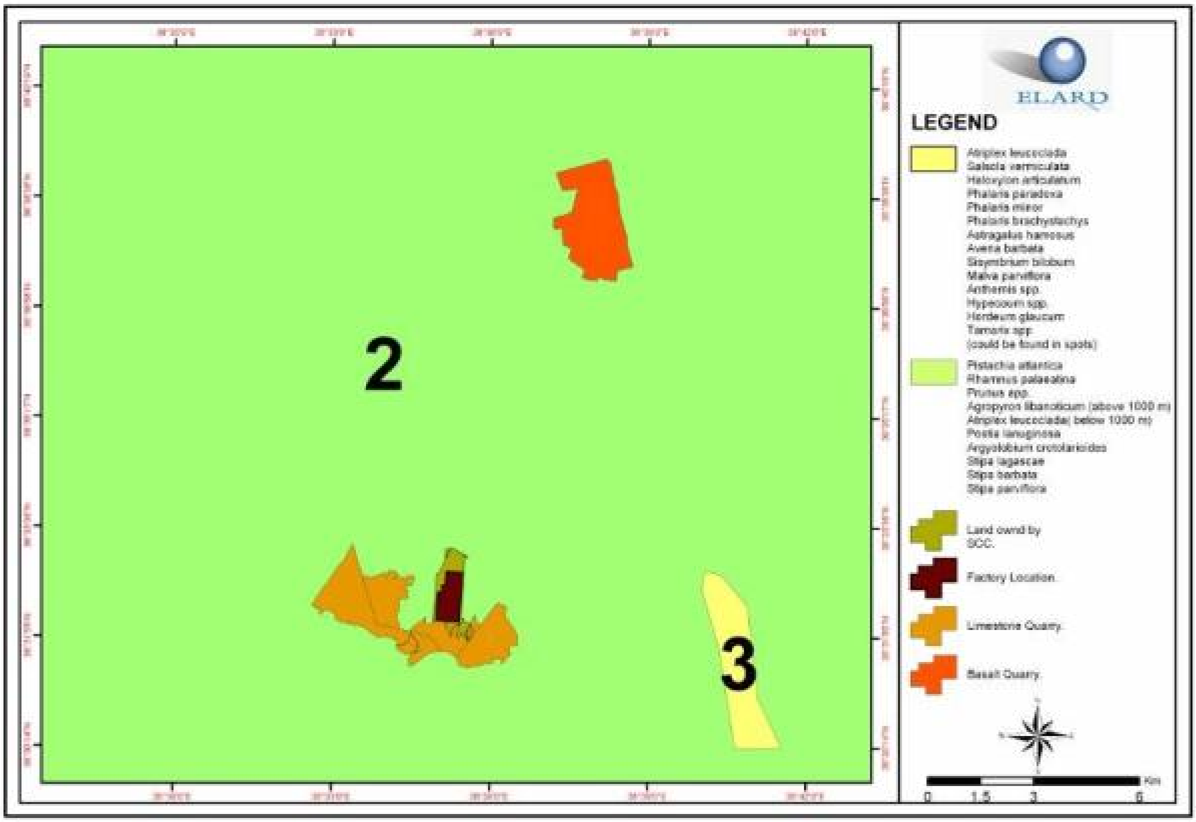
Vicia sativa

Achillea Conferta

Trifolium sp.

Figure 3-8 Project Area Floral Species

Map 3-11 illustrates the distribution of the floral species identified in the literature as well as during the ecological survey.



Map 3-11 Distribution of Main Floral Species within the Study Area

3.5.4 Project Area Fauna

According to the scheme of zoogeographic zoning, the region under consideration belongs to the Turanian district of the Irano-Turanian Province of the Mediterranean zoogeographic sub-region. Therefore it is expected to find both Paleoarctic and Mediterranean species.

During the field survey, several species such as mammals, bird, arthropods species, etc. were identified.

3.5.4.1 Mammals

Domestic animals are common in the study area; some wild mammals have thrived to survive in the area despite the pressures of agricultural ecosystems. The domestic and wild species present in the study area are presented in Table 3-10. Photographical illustrations are presented in Figure 3-9 below.

Table 3-10 Mammalian Species identified in the Study Area

COMMON NAME	LATIN NAME	STATUS*
Cattle	Bos taurus	N.A.
Awassi sheep	Ovis aries	N.A.
Goat	Capra hircus	N.A.
Watchdogs	Canis	N.A.
Wolf	Canis lupus	LC
Fox	Vulpes vulpes syriacus	LC
Jackal	Canis aureus	LC
Brown hare	Lepus capensis	LR/lc
Long-eared hedgehog	Hemiechinus auritus	LR/lc
Mole rat	Spalax leucodon	D
Striped hyena	Hyanea hyanea	LR/nt

* Status is explained in Annex 2 -Citation for the IUCN Red List Categories and Criteria


Awassi sheep


Watchdogs


Cow

Figure 3-9 Domestic Animals in the study area

Mammals documented in Al-Jaboul area include: wolf (*Canis lupus*) , fox (*Vulpes vulpes*), hyena (*Hyaena syriaca*), Indian crested porcupine (*Hystrix indica*), cape hare (*Lepus capensis*) ,hedgehogs (*Erinacus europaeus*) , blind mole-rats (*Spalax leucodon*), etc. Nowadays, most of these species have become rare as a result of hunting activities and habitat destruction.

3.5.4.2 Birds

Apart from domestic birds such as chicken and turkey, wild species like rock dove, crested lark, and house sparrow were observed in the study area. The main bird species identified in the study area are presented in Table 3-11 and Figure 3-10.

Table 3-11 Bird Species identified within the Study Area

COMMON NAME	LATIN NAME	STATUS*
Rock dove	Columba livia	LC
Crested lark	Galerida cristat	LC
Common swift	Apus apus	LC
House sparrow	Passer domesticus	LC
Chicken		NA
Turkey		NA
Duck		NA

* Status is explained in Annex 2 -Citation for the IUCN Red List Categories and Criteria


Chicken


Turkey

Figure 3-10 Documented Birds in the Study Area

3.5.4.3 *Amphibians and Reptiles*

The study area is not widely rich in amphibians and reptiles, as it has minor marginal lands. Table 3-12 presents a summary of reptiles and amphibian species identified in the study area.

Table 3-12 Reptile & Amphibian Species in the Study Area

COMMON NAME	LATIN NAME	STATUS*
Green Toad	Bufo viridis	LC
	Rana ridibunda	LC
Common Tortoise	Testudo graeca terrestris	N.A.
Mediterranean Gecko	Hemidactylus turcicus	N.A.
Starred Agama	Laudakia stellio	N.A.
Water Snake	Natrix tesellata	C

* Status is explained in Annex 2 -Citation for the IUCN Red List Categories and Criteria

3.5.4.4 *Arthropods*

Arthropod species such as dermipteras are inhabitants of the study area. These species serve as a healthy meal for other animals especially birds, reptiles, and amphibians.

3.5.4.5 *Pressures on the Fauna Species*

Wild animals that have survived in the area have adapted to several man-made pressures in addition to natural pressures defined as minimal vegetative cover and low precipitation levels. The presence of quarrying activities, along with other factors, has put the ecosystem in the study area under a lot of pressure. This has halted the evolution of biodiversity, leaving only a few wildlife species that have thrived to survive the harsh conditions. Some of the observed factors that might impact the ecosystem are summarized as follows:

- Agricultural activities (use of pesticide, herbicide…);
- Air pollution (Airborne particulates from quarries);
- Hunting;
- Grazing;
- Noise (quarrying and traffic); and
- Vehicular operation (along road network within the study area).

3.5.4.6 Protected and Sensitive Areas

The closest sensitive feature to the study area is the water body formed by the Teshreen dam located approximately 35 km to the west of the proposed project site. It has a total surface area of 155 km^2 and a maximum storage capacity of 1,900,000 million cubic meters. The dam forms a habitat for water birds and is used as an aquaculture farm (Refer to Figure 3-11).

Duck

Bird populations

Figure 3-11 Faunal Species inside Teshreen Dam

3.6 SOCIO-ECONOMIC BASELINE

This section provides an overview of the demographic, social and economic characteristics of the study area that are relevant to the project and its impacts, within the local context. Its purpose is to present a basis against which social and economic impacts can be assessed, and against which comparisons can be made in future assessments of the project impacts.

3.6.1 Methodology of the Socio-Economic Survey

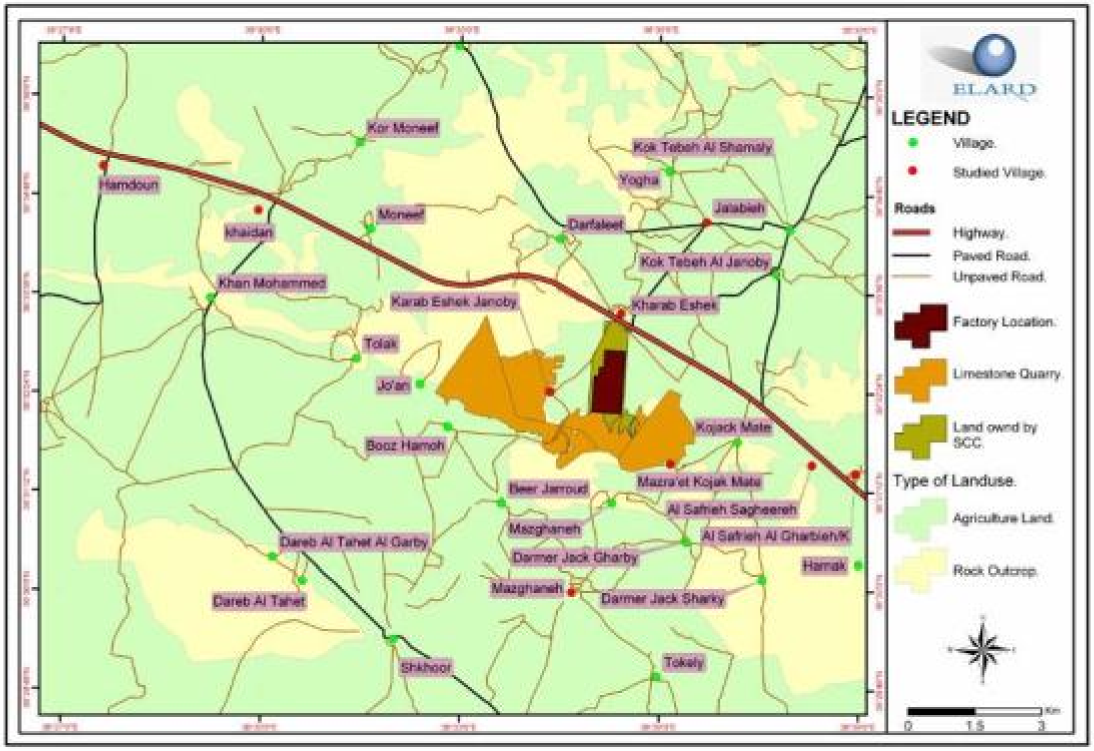
Information for this section was gathered through a survey conducted in the study area. The survey covered questions about age and gender distributions, family structure (nuclear/extended), availability of institutions (schools, level of education), current ethnicities and tribes, land ownership, land use, availability and accessibility to healthcare centers (primary health care units, pharmacies), socio-cultural practices, political structure and administration, economic generating activities (agricultural sector, animal husbandry), infrastructures, resources and services (water supply, electricity, telecommunication, roads, sewage disposal practices), livelihoods (skill levels, sources of income, employment status, development needs and priorities (poverty, unemployment, sanitation).

It should be noted that there is a lack of formal, comprehensive and consistent data collecting and record keeping processes about these rural areas at a local and national level in Syria. Therefore, data was also collected through visual documentation and consultation with mayors; i.e. "Mukhtars" of certain settlements.

For the abovementioned reasons, any figures contained within this socio-economic baseline section should be regarded as estimates at this stage.

3.6.2 Demographics and Population

A number of settlements are identified within the vicinity of the study area. The latter encompasses 33 villages; out of which 6 villages are located around the Basalt quarry. All identified villages share similar socio-economic characteristic. As such, this study has focused on 9 of these villages which are: Mazra'et Kojak Mate, Al Safrieh Sagheereh, Al Safrieh Al Gharbieh, Jalabieh Kharab Eshek janoby, Kharab Eshek, Khaidan, Hamdoun, and Mazganeh. Map 3-12 shows the distribution of population clusters and the types of land use in the study area and surrounding villages.



Map 3-12 Population Clusters in the Project Area

Identified villages were recorded in terms of distance to the quarry sites (basalt and limestone) and the proposed cement plant site so as to assess potential vulnerabilities and sensitivities located at close proximity to the proposed activities (eg mining/quarring. As shown in Table 3-13, the villages were geo-referenced using a hand held GPS equipment and documented during the site visit (on 9th of March 2008) for a better evaluation of the current status.

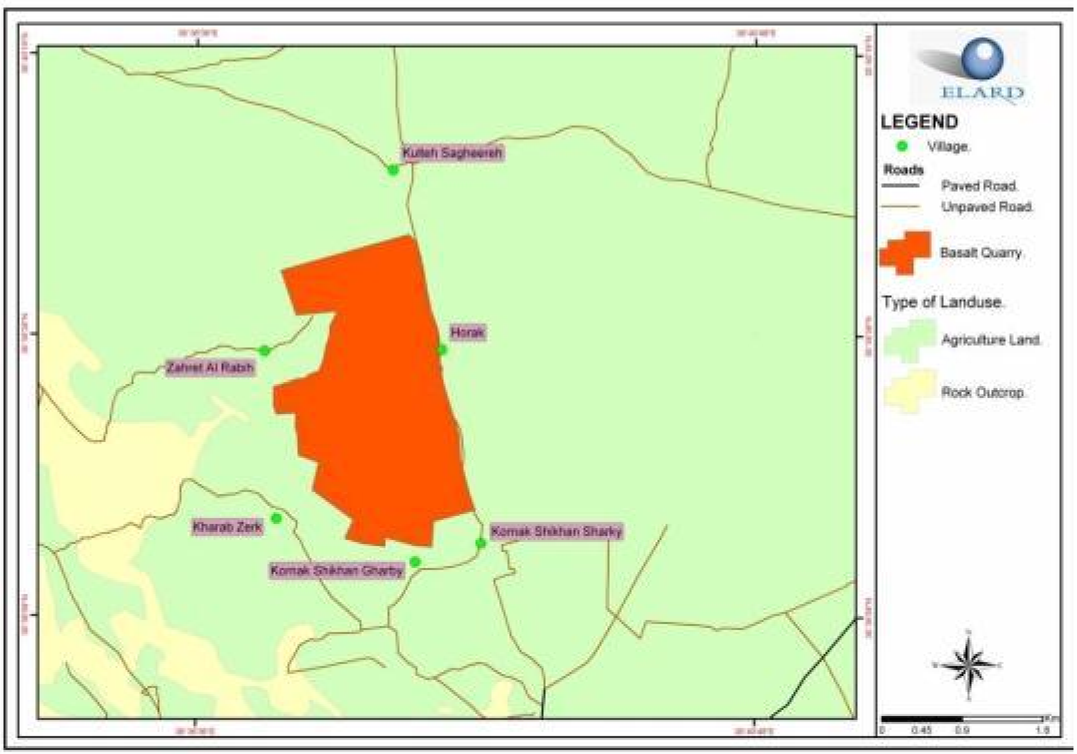
Table 3-13 Identified Population Clusters

	VILLAGE NAME	LAT	LONG	DISTANCE TO THE FACTORY (KM)	DIRECTION	DISTANCE TO THE QUARRY (KM)	DIRECTION
VILLAGES AROUND THE FACTORY AND QUARRY LOCATION	Beer Jarroud	36.51773	38.56038	2.89	South West	1.47	South West
	Booz Hamoh	36.53315	38.54688	3.25	West	0.52	West
	Dareb Al Tahet	36.50196	38.5105	7.51	South West	5.45	South West
	Dareb Al Tahet Al Garby	36.50672	38.50294	7.9	South West	5.43	South West
	Darfaleet	36.57128	38.57493	2.68	North West	2.40	North West
	Darmer Jack Gharby	36.50997	38.60678	3.23	South East	1.85	South East
	Darmer Jack Sharky	36.50234	38.62588	4.9	South East	3.20	South East
	Jo'an	36.54174	38.53986	3.88	West	0.39	West
	Khan Mohammed	36.55907	38.48715	8.93	West	5.48	West
	Kharab Eshek Al Shamalieh	36.55602	38.58945	700m	North	1.53	North
	Kojack Mate	36.53018	38.61952	2.71	East	0.96	East
	Kok Tebeh Al Janoby	36.56421	38.62911	3.81	North East	3.52	North East
	Mazar Khan Mohammed	36.55405	38.48533	8.8	West	5.45	West
	Mazghaneh farm	36.49983	38.57805	4.04	South	0.88	South
	Moneef	36.57313	38.52722	6.02	North West	3.25	North West
	Shkhoor	36.49018	38.53329	6.81	South West	5.46	South West
	Tolak	36.54694	38.52384	5.35	West	1.93	West
	Yogha	36.58496	38.60231	4.15	North	4.99	North
VISITED VILLAGES	Al Safrieh Al Gharbieh	36.52382	38.64918	5.44	East	3.59	East
	Al Safrieh Sagheereh	36.52552	38.63823	3.9	East	2.59	East
	Hamdoun	36.58565	38.46007	12	North West	9	North West
	Jalabieh	36.57473	38.61164	3.42	North East	4.69	North East
	Karab Eshek Janoby	36.54024	38.57239	0.83	West	0.07	West
	khaidan	36.57689	38.49905	8.2	North West	5.60	North West
	Kharab Eshek	36.55612	38.59022	0.83	North	1.33	North
	Mazghaneh	36.51781	38.58807	2	South	2.67	South
	Mazra'et Kojak Mate	36.52573	38.60265	1.6	South East	0.10	South East

Table 3-14 presents the distances between each village and the Basalt quarry (refer to Map 3-13).

Table 3-14 Identified Villages around Basalt Quarry

VILLAGE NAME	LAT	LONG	DISTANCE TO THE QUARRY (KM)	DIRECTION
Horak	36.64258	38.64075	On the quarry border	East
Kornak Shikhan Sharky	36.62333	38.64573	On the quarry border	South
Kulteh Sagheereh	36.66047	38.63458	0.52	North
Zahret Al Rabih	36.64238	38.61855	0.25	West
Kharab Zerk	36.62575	38.62007	0.37	South West
Kornak Shikhan Gharby	36.62144	38.63751	0.1	South



Map 3-13 Documented Villages around Basalt Quarry Site

The total population in the study area and the surrounding villages is approximately 5,397 inhabitants. With an average of 7 members per household, a total of 769 houses are recorded. About 62% of the houses in the area are mostly mud-based, while only 35% are made from cement and the remaining 2% from stone.

3.6.2.1 Bedouin

The traditional homeland of the Bedouin Arab is the Arabian Desert; however, some groups have migrated north. Syria was one of the first lands to be inhabited by the Bedouin, and today, there are over a million still living in the northern Syrian Desert. Most of these Bedouin are herders of sheep and goats. The Al-Raqqah province which neighbors the project area tops the list in Syria for the number of Bedouin tents and mobile caravans. They move into the desert during the rainy winter seasons and back to the desert's edge during the hot, dry summers.

The Bedouin Arab has a relatively harsh existence. The nomads have no permanent homes, but live in portable, black tents made from woven, goat hair (refer to Figure 3-12). The women do most of the work, while the men socialize and make plans for the group. The material culture of the Bedouin is limited. Their tents are their main possessions, and animals are very important for their nomadic lifestyle. Sheep and goats are bought and sold. Dairy products are the main food source milk from goats is made into yogurt and butter. Most of their meals consist of a bowl of milk, yogurt, or rice. Round loaves of unleavened bread are served when available. Meat is only served on special occasions such as marriage feasts, ceremonial events, or when guests are present.

The recent drought (2008) experienced in Syria has forced the Bedouin to move out of the desert and further into the steppe lands and plains in search of grazing. These nomadic groups congregate on the fringes of construction sites and developments where they salvage scraps of wood etc for fuel.

Bedouin women collecting wood for fuel at the Limestone Quarry

Bedouin camped behind the Limestone Quarry

Figure 3-12 Identified Bedouin Communities

3.6.3 Education Level and Status

A total of 5 schools exist in the aforementioned villages, only two of which provide secondary level education. Almost 60% of the population has acquired basic reading and writing skills, 33% of which completed secondary education, and only 9% hold a university degree (2% of which are females).

3.6.4 Lifestyle and Income Generating Activities

On average, a typical household in the study area is constituted of 7 members. The families lead a stable and simple lifestyle. The social classes of the population are divided among two categories: middle and lower middle classes, with the former taking the edge at 65%. Almost 80% of the identified population depends on agricultural practices for sustaining their livelihoods, 10% rely on herding, 8% have professions such as carpentry, and the remaining 2% are government employees. Indoor economic activities are limited to the production of dairy products (e.g. milk, yogurt, cheese).

3.6.5 Health Care Services

Only one health-care centre exists in the Jalabieh village thus coercing people to seek health services in other villages such as Ain Arab (north of the study area). The most commonly reported illnesses among children are asthma and inflammation while adults mainly reported urinary infection, kidney inflammation, and diarrhea.

3.6.6 Existing Infrastructure

Main roads servicing the study area include the Aleppo-Hassakeh highway traversing the villages as well as other roads linking the villages to the city roads. Unpaved roads network also exists in the area. The lack of an internal public transport system linking the villages poses transportation difficulties for the local communities except for Jalabieh village.

The area lacks a telephone network, while hosting mobile coverage and a high voltage electricity grid supplying all the villages. Television channels and receivers are owned by almost 90% of the population. There are no public water systems, no sanitation networks, and the solid wastes generated are either burned, buried, or used in agricultural lands.

Most people use gas for cooking. Diesel is used for heating purposes and for operating engines, tractors, and wells with an electric motor. There is only one well in the study area equipped with electric pump which is present in Chalabiya village, and the remaining wells all manually-driven (refer to Map 3-14).

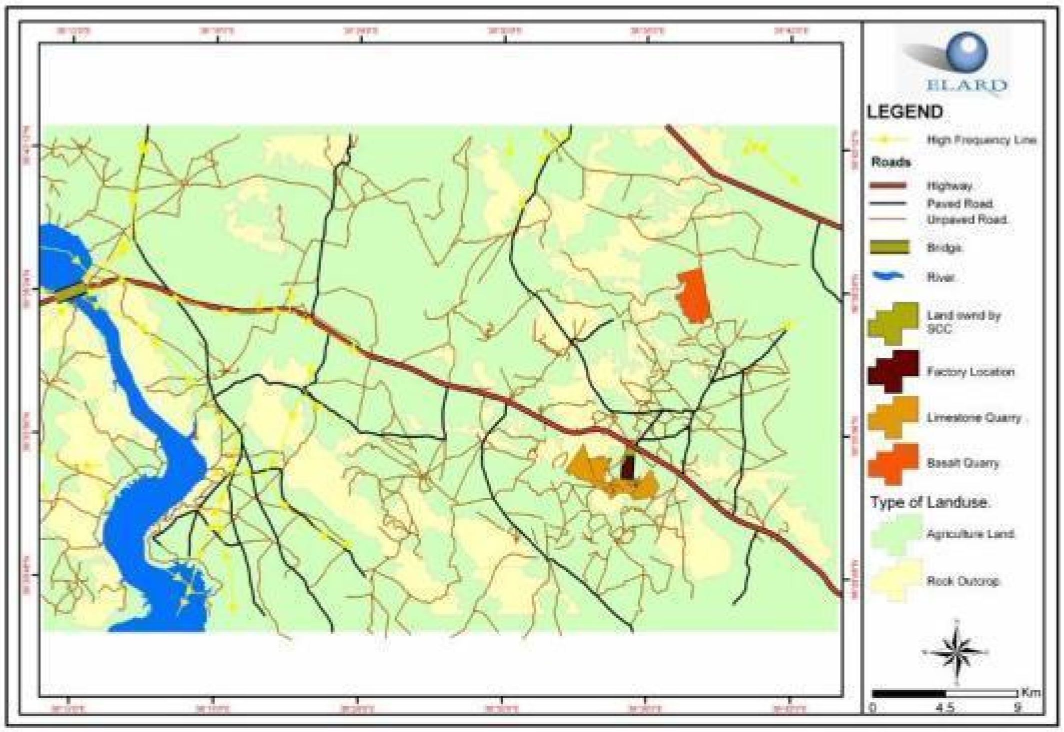
3.6.7 Water Supply and Resources

The villages lack a public water supply network. Accordingly, water for drinking and agricultural purposes is supplied from the scattered wells located in the area. Since the area lacks any sanitary network, most population centers rely on cesspools, while few others lack any sort of sanitation controls.

3.6.8 Existing Land Use

The study area and surrounding villages are mainly agricultural lands occupying a total area of 28, 272 Ha, divided as follows: 1,837 Ha irrigated lands , 26, 367 Ha dry land; and 69 Ha forested.

Almost 60% of the agricultural lands are privatized. The average area of the land owned by 60% of the population is 25 Ha. The remaining 40% own only 2 Ha. The cultivation of rainfed crops such as wheat, barley, cotton, and a variety of beans and vegetables is common. Herding of sheep, goats, and cows is also practiced, though to a lesser extent. The total head count of sheep in the villages under study is 15, 231. Chicken farming is also abundant in the area for domestic uses.



Map 3-14 Existing Infrastructure in the Project Area

3.6.9 Development Needs and Priorities

This section aims to highlight the needs and complaints on behalf of the settlements encountered during the site visit. A major and common complaint reported by the surveyed population is the high rate of unemployment and poverty.

The information stated above could be helpful in assessing the positive impacts of the proposed project with respect to the socio-economic concerns.

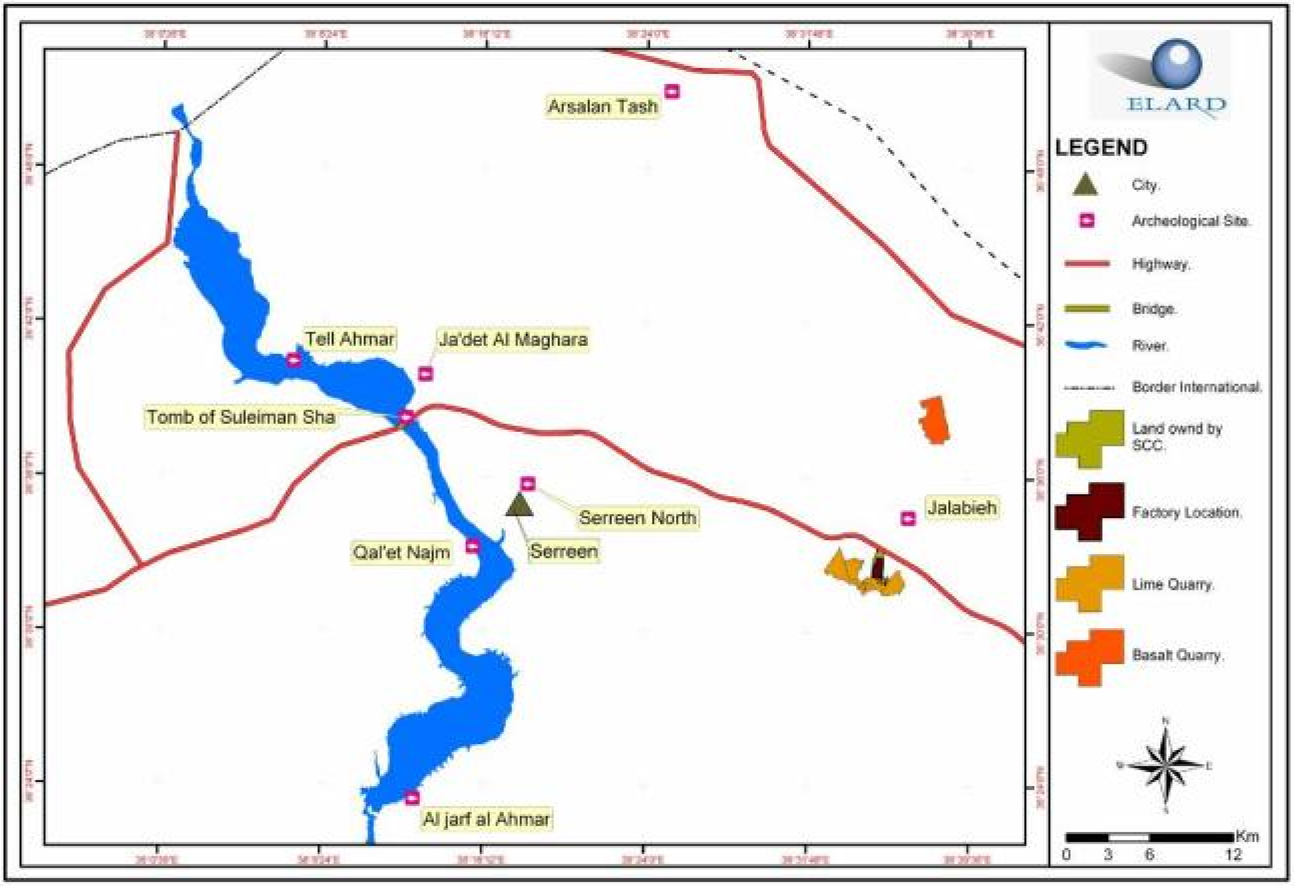
3.7 ARCHAEOLOGY AND CULTURAL HERITAGE

An archaeological survey in the region of West Jazira reported 47 mounds and sites from the Iron Age concentrated along the Euphrates and Balikh rivers. However, the closest mound to the study area lies in the village of Jalabieh located 5 km to the north of the cement plant location. Historical mounds are located at hills on the northern part of the village (Einwig, 2000). However, potential buried antiquities could be present. As such, caution must be taken during the execution of the project. Some of the identified archaeological sites scattered to the west of the cement and quarry sites at varying distances are presented in Map 3-15. A brief description on some of these archaeological sites is presented in Table 3-15.

Table 3-15 Brief Description of Selected Archaeological Sites

SITE	DESCRIPTION
Jalabieh Village	Jalabieh village is located 5km to the north of the proposed plant location. Historical mounds are identified on the Northern hills of the vilage.
Qal'at Najm	Qal'at Najm lies 30km south east of Menbeg. It is an Arabic castle built by Najm Al Safawi in the 8th century. It has an entrance resembling that of Aleppo citadel, an Ayyoubid palace, and a mosque with inscription mentioning the name of al Zaher Ghazi son of Salah ad Din. It was built to serve as headquarter for Hulagu in Mongol in 1260. The Ottoman troops destroyed the castle in the 19th century while chasing a tribe which had refugees in the castle. The castle was subject to restoration activities executed by the Antiquities Authority.
The Tomb of Suleiman Shah	It is situated to the north of Qara Qozaq Bridge after crossing the Euphrates River. It contains the tomb of Suleiman Shah, the grandfather of the Ottoman tribe, who drowned in 1231near Qal'at Ja'bar while crossing the Euphrates River. His body was not found so they built a tomb for him close to Qal'at Ja'bar, made later as mausoleum during the reign of Sultan Selim of Turkey after conquering Syria in 1516. The tomb was moved to Qara Qozaq after the construction of the dam in Tabqa.
Ja'det al Maghara	It is situated about 10km to the north of Qara Qozaq Bridge on the eastern bank of the Euphrates. A French archaeological expedition found in the site a settlement from the 9th millennium B.C. (PPNA Pre Pottery Neolithic A) with a painted wall dating back to that period.
Tell Ahmar (Tell Bersib)	It is a huge mound located 11km to the north of Qara Qozaq Bridges. A French expedition dug in it in 1930 and found steles of Assyrian king Assarhadon, big statues, and painted walls from the 1st millennium B.C. A Belgian expedition who started off a dig in 1988, found a statue for God Tishub and a mosaic pavement with squares filled with black, white, and blue gravels. Small human figures made from ivory dating back to the 9th century B.C. were also found.
Sirrin North	Sirrin North, the center of Sirrin County, lies about 10km south east of Qara Qozaq Bridges. To the east of the village, there exists a tour tomb -used also as a watch tower- with Aramaic inscriptions dating from 75 A.D. In 1983, a beautiful mosaic pavement formerly part of a big hall was found in Sirrin and was then translocated to the museum of Aleppo for restoration. It is composed of legend scenes representing Dionesius, Hercules, The kidnapped Europe and Hunting carvings of diverse animals. It is hypothesized that the pavement dates back to the 5-6th century. A statue of a human figure from the 8th century B.C, taken from the mound of Sirrin, is found in the interior garden of Aleppo National Museum
Al Jarf al Ahmar	It is located in the eastern side of the Euphrates River, close to Tishrin dam. An archeological expedition discovered an old settlement, dated to the 9th millennium B.C., with round houses and eagle shaped carvings on small stones.

Arslan Tash	Lying 1km south from Ain Arab, it beholds basaltic lions and some ivory scenes with Egyptian motives dating from the 9th century B.C. These mounds have been relocated to Aleppo National Museum.



Map 3-15 Archaeological Sites Surrounding the Study Area

4 EIA PROCESS

4.1 LEGISLATIVE REQUIREMENTS

In March 2006, a project between The German Agency for Technical Cooperation (GTZ) and the Ministry of Local Administration and Environment (MOLAE) commenced to issue an act that contains the descriptive definitions (implementation guidelines) for Article 4, paragraph 5 of Law 50, 2002 and which lays out the responsibilities of the General Commission for Environmental Affairs in "Prepare the specifications and standard criteria for environment elements and set principles and measures necessary to assess the environmental impact".

Under Ministerial Decision No. 222 in January 29, 2008, the EIA Executive Procedures were issued. This Executive Procedures specifies the obligations of Article 4 of Law No. 50, dated 2002 regarding the rules of environmental safety and the protection of the environment from pollution. It clarifies the mechanism necessary to execute an EIA in Syria.

The main steps required in the EIA process in Syria for licensing a project, by the environment authority are illustrated by a schematic diagram presented in Figure 4-1.

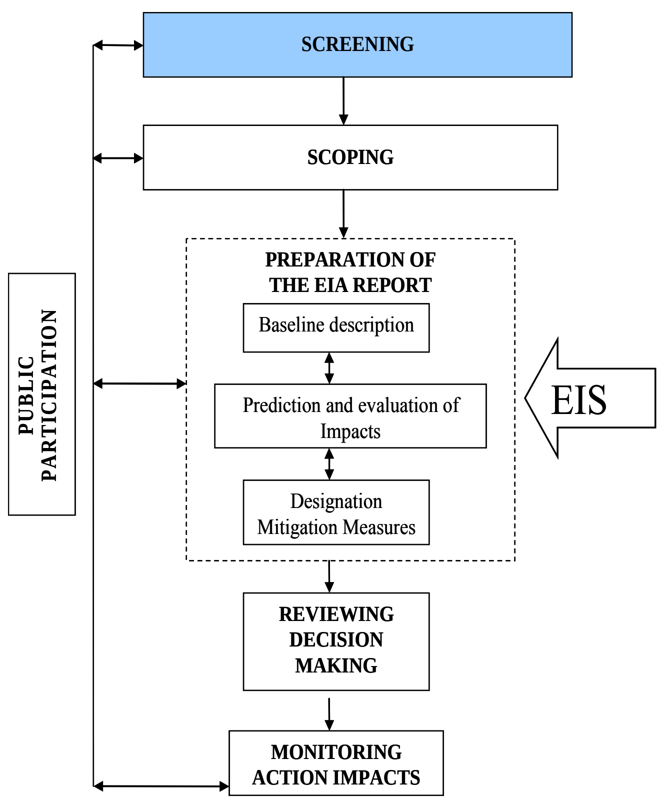


Figure 4-1 Schematic Diagram of the EIA Licensing Procedure

In addition, detailed description for each step of the EIA procedures is presented in the Executive Procedures articles and annexes. Level of required screening and a general screening level were also identified as mentioned in Paragraph 1 of Article 4 of the executive procedures.

According to Article 3 and 4 in the EIA Executive Procedures, an EIA shall be preformed if, in the opinion of the Licensing Authority, the Project is capable of having significant environmental impacts. A list of all prospect projects were presented in Annex 2a that fall within the scope and environmental protection criteria of this Act. The list of prospect projects where categorized per project type, projects that requires an EIA and the level of screening required, with general screening level required as stated in the new Act's Article 4 paragraph 1 or site-related screening level required as stated in Article 4 paragraphs 1 and 2.

According to the list of projects requiring an EIA presented in Annex 2a, the SCC Project falls under the category of "Non-metallic minerals, Glass, Ceramics, and building materials". Projects, within this category, that require an EIA are numbered 2-2-1 and are titled: "The production of cement clinker or cements with a production capacity of 1000 tons or more per day". The SCC cement plant, with an estimated production capacity of 7,500 tons of clinker and 9, 090 tons of cement per day, requires an EIA to obtain a construction and operation permit from the Licensing Authority.

Under the same category, project number 2-1-1 titled: "Construction and operation of a quarry with a working area of 25 ha (250 000 m^2) or more" also require conducting an EIA study. As the limestone and basalt quarries for the SCC Project has an estimated cumulative total surface area of 12.7 million square meters, a permit shall be obtained from the Licensing Authority to allow for commencement of activities in the designated quarry areas.

As such, this EIA study is an obligatory requirement by the Syrian Licensing Authority for the construction and operation of SCC cement plant and associated quarry in the region of West Jazira, Aleppo.

Table 4-1 below describes the general procedures undertaken by the developer, environmental authority and GCEA during each of the main steps of the licensing process.

Table 4-1 Description of the EIA Licensing Procedure

STEP		DESCRIPTION
1	Scoping	The developer shall propose a scoping document to the Licensing Authority as early as possible in the preparatory stage of the project. In this proposal, the developer shall describe the project, the project site and alternatives which could be considered and provide information on the planning of the project site and how the project will comply with national development plans. The scoping document shall also propose which aspects of the project and of the environment should be emphasized, describe what data is already available and have a plan for making information available and for public consultation.
2	Environmental Impact Statement (EIS)	The developer is responsible to prepare an Environmental Impact Statement (EIS) which: 1) describes the activity, its purpose, scope and site, the status of the environment at the site, and the potential consequences of the activities, e.g. water, soil and air pollution, noise, vibration, light, heat and radiation;

STEP		DESCRIPTION
		2) determines the scope of the potential environmental impact on the status of the environment, human health, property, flora, fauna, soil, the landscape, climate, protected natural objects and objects protected under heritage conservation; 3) assesses the effects of the likely environmental impact of the activities and describes the measures envisaged in order to avoid or mitigate the potential danger; 4) assesses the efficiency of the use of natural resources; 5) makes proposals for the conduct of environmental monitoring and environmental auditing; 6) contains the approved scoping document; 7) contains proposals from the granters of consent and the reasons why they were taken into account or disregarded; and 8) contains a short summary of the assessment results. Once the developer has sent the EIS to the Licensing Authority, the authority must, within four weeks of receipt, assess in cooperation with the GCEA whether the statement fulfils the requirements and is in accordance with the scoping document; If the statement does not fulfil the requirements, the developer shall be informed by the Licensing Authority.
3	Public Consultation	After announcement of a project and completion of a scoping document, the developer shall organize public consultation in cooperation with the Licensing Authority in order to inform the public of the activities proposed by the developer. The publication period shall be one month maximum. Between publication of the project and the beginning of the period of accessibility to the project documents a minimum time span of two week is required. Note that Public consultation is planned during the month of may, whereby the EIA process for the Project will be presented to all the Project stakeholders.
4	Monitoring	GCEA is responsible for carrying through monitoring measures during the construction and operation phase. The licensing authority shall submit the EIA report to GCEA.

4.2 SCOPING THE ISSUES

4.2.1 Scope and Methodology of the Field Reconnaissance Study

The field reconnaissance study was mainly based on two inter-dependant means:

- An extensive desk review of existing data records consisting of the analysis of satellite imagery, review of previous studies and publications on the area, interviews with local inhabitants and public officials; and
- Field investigation of the Study Area consisting of a series of site visits, visual documentation and field measurements. Table 4-2 lists the dates of the different surveys carried out during the Scoping Phase.

Table 4-2 Date and Type of Reconnaissance Survey

SURVEY DATE	NO. OF DAYS	SURVEY TYPE
February 19th 2008	1	Assessment of the Physical Environment including background noise level, potential noise-sensitive receptors, ambient air quality, potentially existing point sources of pollution(existing industries, traffic flow/load) and current infrastructure, resources and public services (water distribution network, sewerage network, electricity, road network in particular unpaved located within certain settlement areas). Climatic conditions (temperature, precipitation, humidity, wind) were retrieved from the Tel Abiad Weather Station located 36 km north east of the Study Area.
February 20th 2008	1	Archeological Survey to explore potentially existing and sensitive archeological/historic features (existing Mounds/Tells) and areas of cultural significance such as holy sites (if any). Socio-Economic Survey to identify current land use and patterns and project area livelihoods (i.e. income generating activities) and assess the Project Area population's development needs and priorities. Identified population clusters (fixed and of mobile nature) were geo-referenced using a hand-held GPS equipment.
March 9th 2008	1	Ecological Survey – Assessment of floral species distribution and significance with regards to national registries and protected areas (if any).
March 30th 2008	1	Ecological Survey – Assessment of existing faunal species and significance with regards to national registries and international (i.e. IUCN) classification.
September 21st 2008	4	Geological, Hydrogeological and hydrological Survey- Assessment of the surface geology and geomorphology of the Study Area to identify topographic and landscape conditions, soil characteristics, existing surface water bodies (i.e. wadis, streams...) surrounding the proposed plant site. A well and spring survey was carried out to assess the present conditions of the groundwater resources (static water level, mineralization level, discharge rates, recharge area...) and the existing uses of these wells (irrigation, domestic, drinking purposes).

4.2.2 Findings of Reconnaissance Survey

The Field Reconnaissance Campaign confirmed findings from the desk review based studies and allowed the team to visually identify areas of a sensitive nature, areas of concern and project affected people. The below section summarizes the main baseline findings as follows:

- The Study Area does not host any protected natural reserves. Further, no rare, endangered or protected faunal and floral species were identified in the Study Area. Anticipated impacts are associated with the temporary disturbance to domestic birds and other animals from noise, personnel, vehicles, dust, and spillages mostly during construction.
- No archaeological resources and artefacts were documented. The closest mound/Tell lies in the northern hills of the Jabalieh village in the northern hills located 5 km to the north of the proposed cement plant location. Additional identified mounds are documented west to the Project at greater distances (>10 km away from proposed project site);
- Fixed population clusters (estimated 40 villages) surrounding the proposed Project Area of which the identified affected settlements amount to 9 villages and are mainly concentrated north of the project site in the vicinity of the basalt quarry which is intended for future mining and raw material extraction. Concerns relate to the following anticipated impacts:
  - Increase in background noise level and ambient air quality mainly due to blasting activities, heavy traffic movement (haulers and truck movement), equipment handling and cement plant stack and power plant kiln off-site emissions in addition to those released by vehicular exhaust;
  - Increased risk on local community health and safety mostly due to accidental physical injuries (potential vehicle collision, fly rocks…); and contamination
  - Alteration/loss of existing land-use (agricultural) from the project's footprint potentially leading to dispute, grievance and loss of livelihoods in addition to disturbance to visual amenity and land aesthetics from newly established industrial operations.
  - Groundwater resource depletion (due to water needs for construction camp and operation of facilities (power plant, cement plant…) as well as deterioration of groundwater quality and recharge characteristics due to fuels, lubricating oils, cement, etc.; during transportation or accidental spills from vehicles and heavy equipments.

    Impacts are regarded significant particularly at wadi crossings, considered as surface water bodies for aquifer recharge, due to sedimentation of wadi beds and/or discharge of liquid waste.
  - Improper management of the different waste streams - solid (construction waste, domestic waste, industrial waste...), liquid (wastewater, wash water...), hazardous and non-hazardous during handling, transportation and disposal operations.

Potential positive impacts relate to the creation of temporary job opportunities for local settlers particularly during the construction phase of the project and promoting small scale (i.e. household) economic activities (dairy production).

4.3 PUBLIC PARTICIPATION

A public consultation meeting was conducted in March 2009 at the municipality of Serreen's Arabic Cultural Centre, near the proposed project location. The meeting was attended by representatives of each environmental directorate in the district of Aleppo (Directorate of Irrigation, Health, Water Resources, Transport, Industry...), representatives from SCC and the EIA consultant group (i.e. ELARD), together with local people representing the inhabitants of the neighbouring settlements, as well as a representative of the Peasant Association, the heads of Administrative Units in Serreen, and a representative of the local political divisions. The objective was to introduce the proposed SCC project and to obtain feedbacks and concerns relating to this project and which are to be addressed in more details in the EIA study.

4.3.1 Methodology

In accordance with the Syrian EIA Act, Annex 4 for "*Public Participation – Mechanisms and Procedures*", the Project Proponent (SCC) prepared a letter to the Environmental Directorate of Aleppo, describing the project, its geographical and temporal scope along with the proposed planning of the site and how the former will comply with national development plans and informing the Directorate of the EIA study and scoping report.

Upon approval of the request for a public participation, an official announcement for a public hearing was issued on the 25th of February 2009 in the official newspaper "Al Thawra" (refer to Figure 4-2). It should be stated that the announcement was also distributed to the Head of municipalities of the neighbouring villages located in the vicinity of the proposed project site. This was carried out on behalf of ELARD in co-operation with the Environmental Directorate of Aleppo to ensure public transparency and full coverage of the potentially affected communities.

Following the public hearing, a second official announcement was issued on the 15th of March 2009 in the local newspaper requesting all additional complaints, objections and views (if any) to be submitted to the Directorate in the following 15 days. As per Annex 4 of the EIA Act, in case of non-compliance with the deadline and/or lack of further objections, the Directorate has the right to cancel the request for a second public hearing.

4.3.2 Summary of Meetings

Table 4-3 summarizes the development of the public hearing. The documented minutes of meeting are presented in Appendix B

Table 4-3 Summary of Meetings

DATE OF PUBLIC HEARING	Wednesday 5th of March 2009
START TIME	11:10 am
END TIME	13:30 pm
SPEAKERS	Eliyah Wasel – Public Hearing General Coordinator/ Environmental Directorate of Aleppo Mustafa Hendi –SCC Project Manager Dr. Mwaffak Chikhali – ELARD General Manager

Figure 4-2 Publication/Announcement of SCC Proposed Project in Local Newspaper

4.3.3 Summary of Concerns/Issues raised by the Stakeholders

Following the public notification of the SCC project application and description, all suggestions, comments and concerns from the different parties were documented, evaluated and addressed by each of the SCC representatives and EIA team. The documented stakeholders' objections and views are summarized in Table 4-4 below.

It is evident that these objections and views shall also be integrated in the final EIA study report. The EIA team will play a key role in defining the objectives and direction of the consultation meetings to make sure that their demands and needs are clearly addressed.

Table 4-4 Summary of Comments/Views generated by the Participants

COMMENT NO.	PARTICIPANT/COMMENT	SPEAKER/RESPONSE
1	(Local from Kharab Eshk) What are the control measures to be implemented with regards to pollution of the agricultural lands of 150Ha located east of the plant?	(Mustafa Hendi) The anticipated impact is dust emissions along the travelled roads and during excavation and site levelling which will be mitigated by damping down the area, proper stockpiling of excavated topsoil. And during the operation of the project, filters shall be installed to capture dust emissions and smoke. In addition, regular maintenance of the filters will be carried out to preserve as much as possible the ambient air quality. Continuous monitoring for air emissions will also be conducted by the Environmental Directorate of Aleppo.
2	(Mohamad Hobar –Product Company) It is known that filters have a certain lifespan. Is there any regular maintenance program to assess efficiency of filters and routine checking for changing air filters? Who is responsible for that?	(Mustafa Hendi) As I mentioned earlier, there is going to be a regular maintenance program. The program is part of Lafarge's internal policies. He also added that best available techniques (BAT) are planned on being used for the point sources of air emissions addressing the stacks and kilns.
3	Abd Khalil (Ain Arab) What is the impact of the cement facility? And as you have previously mentioned concerning the increase in job opportunities, will it still be the case following the construction phase?	(Mustafa Hendi) Domestic wastewater will not be discharged haphazardly. Wastewater and industrial liquid waste shall be handled separately. We intend to treat the wastewater in our waste water treatment plant. Water quality will comply with Syrian national standards for reuse in irrigation which will be used to water the green area surrounding the facility and not the agricultural lands. Upon operation, the positive economic impacts are anticipated on a national scale likely to benefit the Syrian market.
4	(Fadel Sheikh Ali –Seneen	(Mustafa Hendi) Given the electricity shortage in Syria's

COMMENT NO.	PARTICIPANT/COMMENT	SPEAKER/RESPONSE
	Electricity) With regards to power supply of the facility, is the source of fuel traditional or new? And what are the sources of water supply used in the facility?	electrical supply, we investigated the feasibility of constructing a thermal power plant (60MW) to supply our cement plant with its power requirements. It is of modern technology allowing us to reuse by-products/effluents such as fly ash in cement manufacturing. With regards to water sourcing, there are four existing water well with existing water permits within the proposed project site and currently a drilling campaign is carried out to drill new deeper wells to prevent water losses/depletion from the shallow wells already in use for land irrigation by the local community. Furthermore, water abstraction from the Euphrates River is currently under design and will be used in later stages of the project. (Sherif Ghaly- SCC Environmental and Safety officer) Modern technology exists in Egypt to monitor emissions from the plant's stacks and include an automated shut-off system in case of unexpected events. We are hoping to procure the same technology in Syria.
5	(Mohamad Ali -Sereen School Advisor) What are the Health and Agriculture Directorates' proposed plans in case of disease outbreak(s) affecting public health and crop plantations respectively upon project operation? What about the project's revenues? Employment status? Date of project operation? Production capacity?	(Eliyah Wasel – Public Hearing General Coordinator/ Environmental Directorate of Aleppo) It is anticipated that such adverse health impacts on both receptors will not present themselves which is why we are carrying out the EIA study and addressing the proper environmental control and mitigation measures. In the event of that happening, the penalty law mentioned in the executive procedures of the Environmental Protection Law No.50 dated 2002. (Dr. Mwaffak Chikhali and Mustafa Hendi) All answers to your questions have been addressed earlier during the project presentation.
6	(Head of Sereen Municipality) What is the waste management plan for solid waste, and domestic wastewater? Will there be any open discharge to wadi beds and streams and will there be an impact on the River?	(Sherif Ghaly) The waste management plan shall integrate the principles of, reusing, sorting and selling to local end-users. With regards to wastewater, it will be treated in the wastewater treatment plant making sure that effluent will comply with Syrian national standards and will not impact the land or rivers.

4.4 TECHNICAL STUDIES

In light of the public participation outcomes and issues raised during the field reconnaissance study, a list of the Project Area's potentially affected environmental and social resources was complied (refer to Table 4-5) in order to assess each receptor's vulnerability to the various project operations.

Table 4-5 Identified Receptors of Concern

RESOURCE/RECEPTOR	DESCRIPTION OF IMPACT
Ambient air quality	Deterioration of local air quality from dust emissions and atmospheric releases from facility operations (stacks, chimneys...)
Surface water and Groundwater availability	Depletion of groundwater resources due to excessive water abstraction/consumption and competing water demands (i.e. for land irrigation and SCC industrial uses)
Groundwater quality	Liquid waste (i.e. domestic wastewater/industrial liquid effluents) discharge into receiving water bodies (streams, wadi beds, river...)
Land use/pattern, livelihood, visual amenity	Damage to surrounding agricultural land and crops

As a result, a series of specialist studies including sampling and monitoring surveys were conducted during the field survey partially to assess the existing environmental baseline conditions (background noise level and ambient air quality, groundwater quality) and to certain extent predict the geographical scope of some of the anticipated impacts in particular for off-site atmospheric emissions and groundwater availability.

Table 4-6 describes the scope and methodology adopted for each of the technical studies carried out by the EIA consultants.

Table 4-6 Overview of Technical Studies carried out by ELARD

RESOURCE/RECEPTOR	TECHNICAL STUDY
Ambient air quality	<u>Air Sampling</u> In order to assess the current status of the ambient air quality, 4 sampling points were investigated. Points were chosen according to SCC's planned construction and operation sites (the cement plant site, Limestone quarry site, 1km downwind from the quarry site and another 1km from the cement plant stacks). Climatic data (temperature, humidity, wind direction and wind speed) was retrieved from Local Weather Station (Tal Abyad). Monitored air pollutants include Dust (PM_{10}), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_X) and Carbon Monoxide (CO). Pollutants were chosen according to commonly identified atmospheric emissions generated from cement kiln

RESOURCE/RECEPTOR	TECHNICAL STUDY
	stacks and coal-fired thermal power plant. Equipment used: "NOVA 600" Air Quality Monitor System compliant with EU specifications. Concentrations are evaluated based on permissible Syrian national air quality standards
	Air Modelling Computer software: ISC-AERMOD, produced by Lakes Environmental (US EPA approved). The purpose of the air modelling study is to assess the geographical scope of these process emissions (on-site and off-site deposition) by simulating the dispersion of air pollutants from the SCC facilities and to predict the concentration isopleths (i.e., contours) of air pollutants in the surrounding areas. Concentrations are evaluated based on permissible standards adopted by the World Bank IFC guidelines for emissions performance of cement stacks and thermal power plants following daily (24 hr) and annual averaging periods.
Ambient Noise Level	Noise Monitoring Background noise levels were assessed at 4 sampling points. Points were also chosen according to SCC's proposed construction and operation sites (the cement plant site, Limestone quarry site, 1km downwind from the quarry site and another 1km from the cement plant site). Equipment: CIRRUS - Model CR:811C (compliant with EU EMC Detective) Noise Modelling Noise modelling was conducted using the Roadway Construction Noise Model (RCNM). The RCNM is the USA Federal Highway Administration's (FHWA) national model for the prediction of construction noise
Groundwater availability	Hydrological Study A feasibility study including a hydrogeological survey, geophysical survey, and aquifer testing was carried out to assess the viability of abstracting groundwater from the existing shallow wells to supply the proposed project with its water demand. A series of test include a Capacity test, Step test, Step Drawdown test, Long-term Pumping test. The latter helps determine the hydraulic properties of the aquifers present in the Study Area and define the characteristics of a well, as well as its efficiency, and groundwater flow behavior. Testing aimed particularly at characterizing the Paleogene aquifer, which is currently exploited.
Groundwater quality	Groundwater Sampling 2 groundwater samples were collected from the existing tapped shallow aquifers located in the vicinity of the proposed sites in order to assess quality of the exploited water wells used for irrigation. Equipment decontamination, sample collection, labelling, storage and shipping were conducted following the New Jersey Field Sampling Standard Operating

RESOURCE/RECEPTOR	TECHNICAL STUDY
	Procedure (SOP, 2005). Due to the lack of standards for groundwater quality in Syria regulation, sampling results were assessed according to the "Dutch Groundwater Target and Intervention Values" which are in line with EU Standards.
Soil Quality	Soil Sampling Campaign 3 soil sampling locations were determined according to SCC's proposed construction and operation sites (wastewater treatment plant, storage site of fuel tank, 1 km east of the cement stacks in the vicinity of the limestone quarry) in order to complete the baseline survey related to soil conditions and quality prior to commencement of Project activities. Parameters tested for include heavy metals and mineral oil among others. Equipment decontamination, sample collection, labelling, storage and shipping were conducted following the New Jersey Field Sampling Standard Operating Procedure (SOP, 2005). Due to the lack of standards for soil quality in Syria regulation, sampling results were assessed according to the "Dutch Soil Target and Intervention Values" which are in line with EU Standards. **Note**: Though Dutch Intervention Values are not directly applicable to Syrian soils; due to the 10% organic matter and 25% clay of Dutch soils, these values however do give an idea of the potential risk of contamination.

4.5 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

The outcomes of the Technical studies have been captured into the Environmental and Social Impact Assessment Report (this document). An earlier version of the report was discussed with the Syrian authorities for their approval. The application is under review.

5 POLICY, LEGAL AND ADMINISTRATIVE REQUIREMENTS

5.1 NATIONAL ENVIRONMENTAL REGULATIONS

This section presents an overview of the Syrian environmental legislation and institutional framework highlighting the most relevant regulations, standards and key stakeholder's roles and responsibilities.

The objective is to provide the basis for implementing environmental regulatory compliance in the design, execution and operation of the proposed Project and to ensure that the future Project operation complies with both the Syrian environmental laws and regulations and relevant international agreements, standards and guidelines of which Syria is signatory and to observe non-statutory corporate standards and good practice guidance.

5.2 INSTITUTIONAL FRAMEWORK

5.2.1 Environmental Protection

The Ministry of State for Environmental Affairs (MOE) was established in the beginning of 1990 by Presidential Decree, which described the functions and roles of the Ministry as well as the establishment of the General Commission for Environmental Affairs (GCEA). This was formalized in 2002 when the Law of Environmental Protection (Law No. 50/2002) was issued through the Presidential Decree. The Law of the Environmental Protection provided GCEA with the legal mandate to execute environmental protection and issue bylaws and regulations to guide its implementation. In 2003 the MOE was merged with the Ministry of Local Administration to become the Ministry of Local Administration and Environment (MOLAE). In this regard the role of GCEA and its Directorates for Environmental Affairs (DFEAs), which are GCEA's branch organizations located in the respective Governorates of Syria (refer to Figure 5-1) were increased to ensure better control over environmental protection.

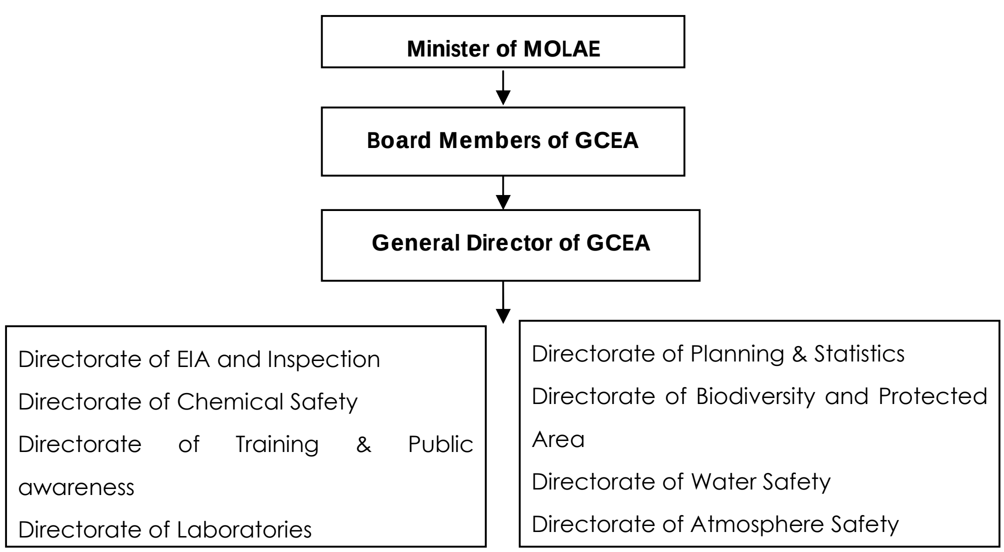


Figure 5-1 Organizational Structure of MOLAE and GCEA

In 2003 government reshuffled and MOLAE was made responsible for the execution of policy and control over the implementation of environmental legislation, while line function ministries were made responsible for the environmental management of resources under their jurisdiction. Table 5-1 presents the general role of the different Ministries relevant to the Project.

Table 5-1 Role of Government Institutions in Environmental Protection

PUBLIC AUTHORITY	ROLE/RESPONSIBILITY
Ministry of Local Administration and Environment (MOLAE)	MOLAE is the key government organization involved in Environment management on a day to day basis which was set up to play a major role in environmental protection and prevention of pollution. It is responsible for environmental legislation and policy. The General Commission for Environmental Affaires (GCEA) is the technical arm of the Ministry, where a directorate at governorate level executes the policy and controls the implementation of environmental legislation within the administrative borders of the governorate. Also, the GCEA is responsible for monitoring activities of public and private bodies that have environmental impact and for verifying the extent of compliance with standard environmental specifications and accredited criteria.
Ministry of Irrigation (MOI)	The Ministry of Irrigation is the major organization responsible for water resources development and management in Syria. It was established by Law No. 16/1982 and is formally responsible for the management of water, specifically: a) policy formulation and research / studies regarding water resources development including water quantity and quality and allocation among sectors, b) issuing water permits both for surface and groundwater, and c) planning, construction, and operations &maintenance (O&M) of most hydraulic facilities, such as dams, canals and pumping stations.
Ministry of Housing and Construction (MHC)	Established in 2003 by Presidential Decree No. 70/2003, through the merger between the Ministry of Housing and Utilities and the Ministry of Construction, MHC has replaced and undertaken all responsibilities of both ministries. The Water Supply and Sewerage Authorities were created in each governorate in 1984 according to the Legislative Decree No. 14. These are overseen by the MHC and are mainly involved in the planning, design and execution of water supply and sewerage projects. They are also responsible for operation and maintenance of these projects.
Ministry of Health	MoH is responsible for all the health issues in Syria, such as vaccination companies to schools in all over Syria, and have important role in the matters related to the pollution results from the industrial activities.
Governorate Councils, Town and Villages Councils or Municipalities	The Law of Local Administration (11.05.1971) identified the tasks and responsibilities of the councils and executive offices including implicit provisions for solid waste management. The executive regulations of this law (Chapter 2-article 11) stated that the city council shall be involved in different tasks, among which is executing drinking water and wastewater projects and improving the environment. Chapter 4, article 21 stated that city and town councils shall be involved, among others, in the provision of cleaning and improving the environment. The same applies to village councils.

5.2.2 Cement Industry

Since its establishment in 1974 following separation from the Ministry of Electricity, the Ministry of Petroleum and Mineral Resources (MOPMR) has been in charge of the exploration, production and export of oil and mineral resources in Syria. The most important legislative acts relevant to its authority are:

- Law No. 7/ 1954 pertaining to mineral resources, which establishes public ownership of all mineral resources.
- Law No. 67 / 2006 pertaining to the investment of quarries in the territory of the Syrian Arab Republic

- Decree No. 133 /1964 pertaining to the exploitation of mineral resources and petroleum in the territory of the Syrian Arab Republic.

5.3 NATIONAL LAWS AND MINISTERIAL ORDERS

5.3.1 Overview of the Legal Framework for Environmental Management

The existing environmental regulations of the Syrian Arab Republic are generally limited in quantity with some dating back to the beginning of the last century. Table 5-2 presents an overview of the main relevant environmental, water use and pollution control laws and decrees found in Syria.

Table 5-2 List of Relevant Syrian Environmental Laws and Decrees

YEAR	LAW / DECREE	RELEVANT PROVISIONS
2009	Law No. 3	"Energy conservation Law" Promoting Energy Efficiency and Conservation
2008	Decision No. 222	"EIA executive Procedure" Issued under the Framework of Environmental Law. It stipulates the EIA procedure and regulations related to all development projects with potential impacts on the environment.
2006	Law No. 62	Badia / Steppe law for protection of soil and vegetative cover
2005	Law No. 31	Water resources management and protection
2004	Decree No. 2883	National Standards for Ambient Air Quality
2004	Law No. 49	Cleanliness law. The law provided industries with solid waste management guidelines.
2002	Law No. 50	Framework Environmental Law
2001	Memorandum No. 1	Prohibits issuing licenses without conducting an Ecological Impact Assessment.
1999	Antiquity Law No.1	Protection and conservation of archaeological sites and antiquities
1991	Decree No 11	It stipulates the establishment of a General Commission for Environmental Affairs (GCEA) and defined its goals and responsibilities.
1991	Law No. 21	Related to Law No. 19 of 1974; the provisions of this law focus on a number of issues, including vehicle emissions and noise pollution from different vehicle types.
1982	Law No. 16	It calls upon the Ministry of Irrigation (MOI) to: 1) Protect the Syrian water resources from pollution; 2) define illicit water resources; 3) organize well excavation locations to protect deep subsurface water from contamination; and 4) establish a special directorate to combat public water contamination.
1974	Law No. 19	The provisions of this law focus on a number of issues, including vehicle emissions and noise pollution from different vehicle types.
1972	Law No. 10	It prevents discharging of industrial and laboratory wastewater into watercourses.
1971	Decree No. 2145	It stipulated the establishment of the Public Water Pollution Prevention Directorate at MOI to be in charge of protecting public water resources against pollution.
1964	Law No. 25	The provision of this law prohibits residue leakage from industrial establishments, which endanger aquatic forms of life. It also stresses the necessary measures to protect public waters.
1964	Law No. 30	Water pollution control law. It prohibited the disposal of plants and laboratory wastes that might be harmful to aquatic life into public water. It also stated that all necessary measures should be taken to prevent the leakage of harmful chemical, and petrol materials from sewerage and ships into public water. As a result of this law all industries and laboratories were forced to obtain permits from MOI in which all the procedures that should be provided to prevent polluting the public waters are identified.
1958	Law No. 65	Related to extracting from public water resources. This law set the regulatory requirement for water extraction permits that define the quantity of water to be extracted, the location of the extraction well, and the method of extraction.

The most relevant national environmental regulations to the Project are presented in Table 5-3, along with a summarized description of each.

Table 5-3 Most Relevant Syrian Laws and Regulations

LEGISLATION	OBJECTIVES	SUMMARY	RELEVANCE TO THE PROJECT (RF TO ADD)
Environmental Protection Law No. 50 / 2002	The law presents the framework for requirements and procedures of EIA.	Law No 50 on Environmental Protection is the main piece of Syrian environmental legislation. It aims to achieve sustainable development of environmental resources and to optimize the utilization of natural resources (Article 2). It requires all companies and public bodies to refrain from polluting the environment (Article 22). It also stipulates measures to protect the atmosphere (Article 27) and the general environment (Articles 24) from pollution. The Law on Environmental Protection assigns a wide range of environmental responsibilities to the General Commission for Environmental Affairs (GCEA).	EIA Executive Procedure No 222, issued under the Framework of Environmental Law, clarifies the mechanism necessary to execute an EIA in Syria. Laying out the responsibilities of the General Commission for Environmental Affairs in "Preparing the specifications and standard criteria for environment elements and set principles and measures necessary to assess the environmental impact", along with the rules of environmental safety and the protection of the environment from pollution.
Energy conservation Law No. 3, 2009	Conservation of energy and reduction in fossil fuel consumption	Law 3/2009 aims to protect its reserves of fossil fuels, while reducing the environmental impacts and negative effects associated with the use of conventional power resources required to meet continued economic and social development in Syria.	The project is to generate its own power using a coal driven power unit. The environmental and social impact need to be addressed as per the law
Water Law No. 31, 2003	Water resource management and Conservation	Defines acquired rights to public water, Well drilling licenses, Public water network, water exploration, water association, as well as law enforcements and penalties.	Water for construction is to be sourced from 4 shallow wells, while water for the operational phase will be sourced from 2 deep wells. Licenses to be accessed as per law.
Cleanliness Law No. 49/ 2004	The law provides industrial companies with waste management guidelines.	Law 49/2004 on Cleanliness provides guidelines for the management of municipal, industrial, hazardous and medical wastes. Under this law, companies are responsible for the management and disposal of the industrial wastes produced, and for any impact on the environment resulting from their wastes. The quantities and types of wastes generated must be recorded, and industrial waste separated from municipal and other waste types. Companies must also determine the chemical composition of the waste generated and determine their potential impact on human health and on the environment. Industrial wastes should be treated, and disposed of in specialized locations.	Industrial and domestic waste will be generated during the construction and operational phases of the project; disposal of this waste needs to be in accordance with the Cleanliness Law. An onsite water treatment plant and sewage works is to be constructed
Antiquity Law 1/1963, modified in 1/1999	The law for antiquity protection	Law 222/1999 presents the definition of the different antiquity types (stable vs. movable), defines the role of the "Archaeological Authority" i.e. the "The Public Directorate of Antiquities and Museums" in the recognition, conservation, protection and maintenance of the archaeological sites and stipulates the juridical sanctions and penalties for unauthorized activities.	Jalabieh village is located 5km to the north of the proposed plant location between the cement factory and basalt quarry. Historical mounds have been identified on the Northern hills of the village, caution must be taken during the execution of the project.
Decree No. 2883/ 2004	National Standards for Ambient Air Quality	Defines the ambient air quality and permissible threshold concentration level standards for areas surrounding industrial activities and any other areas. The objective of this standard is to protect the human population, plants and animals from the potential hazardous impacts of air pollution. The preliminary list of air pollutant parameters includes: Sulfur Dioxide (SO2), Nitrogen Oxides (NO & NO2), Carbon Monoxide (CO), Ozone (O3), Lead (Pb), Total Suspended Particles (TSP), Respirable Suspended Particles (PM10), Benzene (C6H6) and Poly-Aromatic Hydrocarbons (PAH) presented by Benzo[a]pyrene.	Emissions guidelines define the permissible concentration level for variety of air pollutant parameters emitted from point sources such as stacks and exhaust Both the cement and power plant produce emissions which need to be controlled as per the pollution parameters contained in the law or as per international standards whichever is the most stringent.

5.3.2 International Conventions and Protocols

Syria is has signed or ratified a number of international conventions and agreements, these include provisions relevant to production operations and are listed in Table 5-4 below.

Table 5-4 Ratified or Signed International Agreements

AGREEMENT	OBJECTIVE	RELEVANCE TO PROJECT
The Framework Convention on Climate Change, or Global Warming Convention (UNFCC)– 1994 Ratified by Syria in 1996	To achieve stabilization of greenhouse gas concentrations in the atmosphere to prevent dangerous anthropogenic interference with climate system	Reduce greenhouse gas emissions from operations
Convention of Climate Change- Kyoto Protocol , 1997	To reduce greenhouse gas emissions responsible for global warming	The proposed cement plant will have significant emissions of CO_2, a primary greenhouse gas.
Convention to Combat Desertification - 1997 Ratified by Syria in 1997	To combat desertification and mitigate the effects of drought	Control land clearance, excavation, drilling, off-road driving and base footprint size
The Convention on Biological Diversity - 1992 Rio declaration Ratified by Syria in 1995	To protect biodiversity (the so called agenda 21) Sustainable use of components Fair and equitable sharing	Project site located near sensitive area could be declared as protected area
Vienna Convention for the Protection of the Ozone Layer – 1985 Montreal protocol on ozone-depleting substances - 1987 Ratified by Syria in 1989	To protect human health and environment from any activity that modifies the ozone layer Adopt measures to control human activities found to have adverse impact on ozone layer	Regulates the use of ODS (ozone depleting substances) methane
Stockholm Convention on Persistent Organic Pollutants (POPs) - 2001 Signed by Syria in 2002	To reduce intentional and unintentional production of POPs Develop country-specific implementation plans for this purpose	Regulates the emissions of POPs from waste burning
International Labour Convention No. 139, 120 and 136 Syria joined and declared Legislative Decrees No. 1745 and 8	To prevent vocational risks ensuing from cancer causing materials and tools Deals with sanitation in offices To protect workers against the risks of intoxication ensuing from benzene	Protects workers health and ensures proper sanitation and hygiene for base camps, work environment and offices

5.4 INTERNATIONAL LENDING REQUIREMENTS

5.4.1 European Union Requirements

5.4.1.1 EU Directives

A review of the most relevant EU Directives regarding environmental sectors, cement industry, mining industry and energy industry are presented below as follows:

Directive 2003/87 established the EU emissions trading scheme (the EU ETS), the first international carbon trading system. Phase I of trading under the EU ETS commenced on 1 January 2005 and ended on 31 December 2007. The second phase corresponds with the first commitment period set by the Kyoto Protocol of 1 January 2008 until the 31 December 2012. Relevant activities covered by the EU ETS Phase II include (1) Combustion installations with a rated thermal input exceeding 20 MW and (2) Installations for the production of cement clinker in rotary kilns with a production capacity exceeding 500 tons per day:

- IPPC Directive 2008/1/EC of 15 January 2008 including all previous amendments to the Directive 96/61/EC concerning Integrated Pollution Prevention and Control (IPPC). The purpose of this Directive is to achieve integrated prevention and control of pollution arising from the activities listed in the Directive Annex 1 including:

    - Combustion installations with a rated thermal input exceeding 50 MW (1)
    - Coal gasification and liquefaction plants.
    - Installations for the production of cement clinker in rotary kilns with a production capacity exceeding 500 tons per day or lime in rotary kilns with a production capacity exceeding 50 tons per day or in other furnaces with a production capacity exceeding 50 tons per day

- The IPPC Directive also lays down that pollution must be prevented or reduced through the use of best available techniques (BAT) as provided in the Reference BAT documents for each industrial sector. The main purpose of the BAT is to provide guidance to regulators, the industry and others on best practices. The most relevant BAT documents for the SCC proposed project include:

    - Reference Document on Best Available Techniques in the Cement and Lime Manufacturing Industries, December 2001.
    - Reference Document on the General Principles of Monitoring, July 2003.
    - Reference Document on Best Available Techniques for Large Combustion Plants, July 2006.
    - Reference Document on Best Available Techniques for Management of Tailings and Waste Rock in Mining Activities, July 2004.
    - Reference Document on Best Available Techniques for Cement, Lime and Magnesium Oxide Manufacturing Industries, February 2009.

- The Water Framework Directive 2000/60/EC (WFD) establish a framework for the action of the EU in the field of water policy, and aims to secure the ecological, quantitative and qualitative functions of water. It requires that all impacts on water will have to be analysed and actions will have to be taken within River Basin management plans. The operations of the extractive industry also be covered by the directive.

- Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants.
- Council Directive 75/439/EEC of 16 June 1975 on the disposal of waste oils.
- Council Directive 91/689/EEC of 12 December 1991 on hazardous waste.
- Directive 91/271/EEC on urban wastewater treatment
- Directive 86/278/EEC on disposal of sewage sludge
- The emissions to air from large combustion (rated thermal input above 50MW) plants are mainly regulated by Directive 2001/80/EC(commonly known as the Large Combustion Plant (LCP) Directive) and by Directive 2008/1/EC on IPPC. Best available techniques (BAT) for reducing emissions from combustion plants are described in the BAT Reference Document (BREF) for Large Combustion Plants developed pursuant to Directive 2008/1/EC. Combustion plants above 20 MW are also subject to the EU Emission Trading Scheme established by Directive 2003/87/EC
- The Seveso II Directive 96/82/EC on the control of major-accident hazards was amended by Directive 2003/105/EC of 16 December 2003, extending its scope to cover risks arising from storage and processing activities in mining, among others.
- Directive 2006/21/EC on the management of waste from extractive industries and amending Directive 2004/35/EC. The Directive cover the management of waste from land-based extractive industries, that is to say, the waste arising from the prospecting, extraction (including the pre-production development stage), treatment and storage of mineral resources and from the working of quarries. Measures to be taken are to be based on best available techniques as outlined in the BAT Document.
- The Directive 2004/35/CE on environmental liability with regard to the prevention and remedying of environmental damage as amended by the Directive 2006/21/EC on the management of waste from extractive industries.
- Waste resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries is covered by Directive 75/442/EEC on waste, as amended by Directive 91/156/EEC.
- The deposit of waste from the processing of minerals (tailings) in a pond is covered by Directive 99/31/EC on the landfill of waste, which lays down requirements concerning the authorisation and construction of landfills, the types of waste acceptable at landfills and the monitoring procedures.
- Electromagnetic Compatibility (EMC) Directive 2004/108/EC that governs the electromagnetic emissions of electrical and electronic equipment and their immunity to interference.
- German Norm (DIN 4150). Structural vibration in buildings - effects on structures. 1999.
- British Standard BS 7385: Part 2: 1993: Guide to damage levels from ground-borne vibration.

- British Standard BS 6472 – 1992: Evaluation of Human Exposure to vibration in Buildings (1 Hz to 80 Hz).

5.4.2 EIB Environmental and Social Principles and Standards

The European Investment Bank (EIB) refers to EU environmental law as the primary source of its environmental principles, and is a signatory to the European Principles for the Environment (EPE). EIB-financed projects should include measures to prevent, reduce or eliminate pollution that arises directly or indirectly from their activities. The Bank requires its promoters to apply point source-specific emission standards according to the IPPC Directive and sector-specific Directives, e.g. the Water Framework Directive. The IPPC approach is based on "best available technology" (BAT), which among other things requires a rational approach to resource use, including best practice measures in the field of energy efficiency.

For projects in all other regions of EIB activity, the Bank requires that all projects comply with national legislation, including international conventions ratified by the host country (i.e. Syria in this case), as well as EU standards. Where EU standards are more stringent than national standards, the higher EU standards are required, if practical and feasible. The relevant standards are identified in discussions between the Bank and the promoter during project preparation, appraisal and negotiation and are applied by the promoter during project implementation and operation.

In compliance with the EU energy and climate change policy (commitment to 20% reduction in green house gases by 2020), the EIB proposes measures to reinforce its contribution to achieve the target. These measures complement the current EIB energy policy adopted as part of the Corporate Operational Plan (COP) 2007-2009, which focuses on five priority lending areas:

- Renewable energy (RE),
- Energy efficiency (EE),
- Research, development and innovation (RDI) in energy,
- Security and diversification of internal supply, and
- External energy security and economic development (Neighbour and Partner Countries including Syria).

The new EU energy policy requires the EIB to review its approach and be more selective when financing electricity generation based on fossil fuel, notably coal or lignite, while taking into consideration the security of energy supply. The concern arises because of the relatively high carbon intensity of this fuel. The following conditions could be considered as necessary for EIB financing of new coal/lignite power stations:

- They should use best available technology and be "carbon capture ready".

- They should also be cost effective taking into account CO_2 externalities, i.e. be able to exploit CCS once that technology becomes commercially available.
- They should replace existing coal/lignite plants and involve a decrease of at least 20% in the carbon intensity of power generation.
- The EIB is also ready to finance CCS demonstration plants and other experimental clean coal technologies as RDI projects.

All mining projects with a significant impact on the environment financed by EIB require an EIA. Mine closure plans, including the elaboration of financial requirements, also form one of the requirements of the EIB (at the early project appraisal stage these can only be preliminary). As to guidelines on tailing, waste disposal and use of chemicals, EIB appraisal includes verification that the relevant environmental issues have been properly addressed by the promoter and mitigating measures incorporated into the project design, or are foreseen according to best industry practice.

EIB also pays strong attention to the social & governance acceptability of projects based among other things on the EIB guidelines on vulnerable groups, occupational and community health and safety and labour rights.

5.4.3 The Equator Principles

The Equator Principles are used by lenders as a means of ensuring that the projects they finance are socially and environmentally responsible and sound. As such, they serve to establish a common baseline and framework for the implementation of environmental and social procedures and standards for financing activities across all industry sectors globally in which finance is sought. The Principles apply to all new project financings globally with total project capital costs of US$10 million or more, and across all industry sectors. In addition, while the Principles are not intended to be applied retroactively, we will apply them to all project financings covering expansion or upgrade of an existing facility where changes in scale or scope may create significant environmental and/or social impacts, or significantly change the nature or degree of an existing impact.

Equator Principle Finance Institutions (EPFI) will only provide loans to projects that conform to Principles 1-9

In addition, the Equator Principles are augmented with four distinct “exhibits”:

- Environmental and social screening (Exhibit I);
- Illustrative list of issues to be included in an Environmental and social Impact Assessment (Exhibit II);
- IFC Performance Standards (Exhibit III); and
- Industry Specific EHS Guidelines (Exhibit IV).

These are outlined detail below and reflected in Table 5-5 below.

- Principle 1: Review and Categorization
- Principle 2: Social and Environmental Assessment
- Principle 3: Applicable Social and Environmental Standards
- Principle 4: Action Plan and Management System
- Principle 5: Consultation and Disclosure
- Principle 6: Grievance Mechanism
- Principle 7: Independent Review
- Principle 8: Covenants
- Principle 9: Independent Monitoring and Reporting

Table 5-5 Detailed Description of the Equator Principles

EQUATOR PRINCIPLE	EXPLANATION
Principle 1: Review and Categorization	When a project is proposed for financing, the EPFI will, as part of its internal social and environmental review and due diligence, categorise such project based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC).
Principle 2: Social and Environmental Assessment	For each project assessed as being either Category A or Category B, the borrower has conducted a Social and Environmental Assessment ("Assessment") process to address, as appropriate and to the EPFI's satisfaction, the relevant social and environmental impacts and risks of the proposed project The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.
Principle 3: Applicable Social and Environmental Standards	For projects located in non-OECD countries, and those located in OECD countries not designated as High-Income, as defined by the World Bank Development Indicators Database, the Assessment will refer to the then applicable IFC Performance Standards and the then applicable Industry Specific EHS Guidelines ("EHS Guidelines") (Exhibit IV). The Assessment will establish to a participating EPFI's satisfaction the project's overall compliance with, or justified deviation from, the respective Performance Standards and EHS Guidelines. The regulatory, permitting and public comment process requirements in High-Income OECD Countries, as defined by the World Bank Development Indicators Database, generally meet or exceed the requirements of the IFC Performance Standards and EHS Guidelines. Consequently, to avoid duplication and streamline EPFI's review of these projects, successful completion of an Assessment (or its equivalent) process under and in compliance with local or national law in High-Income OECD Countries is considered to be an acceptable substitute for the IFC Performance Standards, EHS Guidelines and further requirements as detailed in Principles 4, 5 and 6 below. For these projects, however, the EPFI still categorises and reviews the project in accordance with Principles 1 and 2 above. The Assessment process in both cases should address compliance with relevant host country laws, regulations and permits that pertain to social and environmental matters.
Principle 4: Action Plan and Management System	For all Category A and Category B projects located in non-OECD countries, and those located in OECD countries not designated as High-Income, as defined by the World Bank Development Indicators Database, the borrower has prepared an Action Plan (AP) which addresses the relevant findings, and draws on the conclusions of the Assessment. The AP will describe and prioritise the actions needed to implement mitigation measures, corrective actions and monitoring measures necessary to manage the impacts and risks identified in the Assessment. Borrowers will build on, maintain or establish a Social and Environmental Management System that addresses the management of these impacts, risks, and corrective actions required to comply with applicable host country social and environmental laws and regulations, and requirements of the applicable Performance Standards and EHS Guidelines, as defined in the AP. For projects located in High-Income OECD countries, EPFIs may require development of an Action Plan based on relevant permitting and regulatory requirements, and as defined by host-country law.
Principle 5: Consultation and Disclosure	For all Category A and, as appropriate, Category B projects located in non-OECD countries, and those located in OECD countries not

EQUATOR PRINCIPLE	EXPLANATION
	designated as High-Income, as defined by the World Bank Development Indicators Database, the government, borrower or third party expert has consulted with project affected communities in a structured and culturally appropriate manner. For projects with significant adverse impacts on affected communities, the process will ensure their free, prior and informed consultation and facilitate their informed participation as a means to establish, to the satisfaction of the EPFI, whether a project has adequately incorporated affected communities' concerns. In order to accomplish this, the Assessment documentation and AP, or non-technical summaries thereof, will be made available to the public by the borrower for a reasonable minimum period in the relevant local language and in a culturally appropriate manner. The borrower will take account of and document the process and results of the consultation, including any actions agreed resulting from the consultation. For projects with adverse social or environmental impacts, disclosure should occur early in the Assessment process and in any event before the project construction commences, and on an ongoing basis.
Principle 6: Grievance Mechanism	For all Category A and, as appropriate, Category B projects located in non-OECD countries, and those located in OECD countries not designated as High-Income, as defined by the World Bank Development Indicators Database, to ensure that consultation, disclosure and community engagement continues throughout construction and operation of the project, the borrower will, scaled to the risks and adverse impacts of the project, establish a grievance mechanism as part of the management system. This will allow the borrower to receive and facilitate resolution of concerns and grievances about the project's social and environmental performance raised by individuals or groups from among project-affected communities. The borrower will inform the affected communities about the mechanism in the course of its community engagement process and ensure that the mechanism addresses concerns promptly and transparently, in a culturally appropriate manner, and is readily accessible to all segments of the affected communities.
Principle 7: Independent Review	For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower will review the Assessment, AP and consultation process documentation in order to assist EPFI's due diligence, and assess Equator Principles compliance.
Principle 8: Covenants	An important strength of the Principles is the incorporation of covenants linked to compliance. For Category A and B projects, the borrower will covenant in financing documentation: a) to comply with all relevant host country social and environmental laws, regulations and permits in all material respects; b) to comply with the AP (where applicable) during the construction and operation of the project in all material respects; c) to provide periodic reports in a format agreed with EPFIs (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third party experts, that i) document compliance with the AP (where applicable), and ii) provide representation of compliance with relevant local, state and host country social and environmental laws, regulations and permits; and d) to decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.

EQUATOR PRINCIPLE	EXPLANATION
	Where a borrower is not in compliance with its social and environmental covenants, EPFIs will work with the borrower to bring it back into compliance to the extent feasible, and if the borrower fails to re-establish compliance within an agreed grace period, EPFIs reserve the right to exercise remedies, as they consider appropriate.
Principle 9: Independent Monitoring and Reporting	To ensure ongoing monitoring and reporting over the life of the loan, EPFIs will, for all Category A projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFIs.
Principle 10: EPFI Reporting	Each EPFI adopting the Equator Principles commits to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations.

In addition, the Equator Principles (outlined below) .are augmented with four distinct "exhibits":

- Environmental and social screening (Exhibit I);
- Illustrative list of issues to be included in an Environmental and social Impact Assessment (Exhibit II);
- IFC Performance Standards (Exhibit III); and
- Industry Specific EHS Guidelines (Exhibit IV).

5.4.4 Exhibit I: Environmental and Social Screening Process

The environmental and social review procedure outlines the process by which Lender agencies determine the adequacy of an environmental assessment for a proposed project and ensure that the project complies with applicable environmental and social policies in order to meet the applicable guidelines as developed by the IFC. Projects are categorised as either A, B or C. A detailed description of each category is provided in Box 5-1. Table 5-6 provides a summary of the key characteristics associated with each category.

Box 5-1 Description of Project Categories

Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. A potential impact is considered "sensitive" if it may be irreversible (e.g., lead to loss of a major natural habitat) or affect vulnerable groups or ethnic minorities, involve involuntary displacement or resettlement, or affect significant cultural heritage sites. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including, the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. A full environmental assessment is required which is normally an Environmental Impact Assessment (EIA).

Category B: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas-including wetlands, forests, grasslands, and other natural habitats-are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A EA. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

Table 5-6 Summary of key Characteristics of IFC Project Categories

CATEGORY A	CATEGORY B	CATEGORY C
Likely to have significant environmental impacts which are irreversible	Potential adverse impacts on human populations and environmentally important areas- less adverse than category A	Likely to minimal or no adverse environmental impacts
Affects vulnerable population groups	Impacts are site specific	Screening required
Involuntary resettlement is required	Few or no irreversible impacts	No EA required
Affect cultural heritage	Mitigation measures can be designed to abate most negative impacts	
Affected areas extend broader than site boundary	EA is narrower than category A assessment	
ESIA must examine positive and negative impacts as well as evaluate "no-go" scenario	EA must recommend all measures needed to prevent, minimise, mitigate or compensate for adverse impacts.	
ESIA must recommend all measures needed to prevent, minimise, mitigate or compensate for adverse impacts.	EA must recommend methods for improved performance	
ESIA must recommend methods for improved performance	Project sponsor is required to provide full environmental and social information	
Project Sponsor is responsible for preparing full Environmental Impact Assessment and and Environmental Action Plan	EA may be curtailed in scope and determined on a project by project basis	

The categorization of the project has proven problematic, since the project could readily be defined as a Large scale industrial plant (Category A project) or a development aimed at the Manufacture of Construction Materials (Category B project) depending on the view of the reader. The process of project categorization is largely subjective. The following factors were taken into consideration in project categorization:

- The impacts associated with the project will have limited adverse effects on human populations and environmentally important areas; and

- Are largely limited to the specific site and that mitigation measures can be designed to abate most negative impacts.

On this basis, the SCC project is categorized as a Category B project with the incumbent Environmental Assessment requirements. Despite this categorization, it is felt that the critical impacts (air quality, noise, traffic and transportation and archaeology) should be addressed in sufficient detail so as to ensure that the management response is appropriate.

5.4.5 Exhibit II: Illustrative list of issues to be included in an Environmental and Social Impact Assessment

A significant number if social and environmental issues need to be addressed in an ESIA conducted according to the requirements of the Equator Principles Box 5-2. The list is for illustrative purposes only and needs to be carefully considered within the context of each project.

Box 5-2 Illustrative List of Issues to be included in an Environmental and Social Impact Assessment

(a) Assessment of the baseline social and environmental conditions
(b) Consideration of feasible environmentally and socially preferable alternatives
(c) Requirements under host country laws and regulations, applicable international treaties and agreements
(d) Protection of human rights and community health, safety and security (including risks, impacts and management of project's use of security personnel)
(e) Protection of cultural property and heritage
(f) Protection and conservation of biodiversity, including endangered species and sensitive ecosystems in modified, natural and critical habitats, and identification of legally protected areas
(g) Sustainable management and use of renewable natural resources (including sustainable resource management through appropriate independent certification systems)
(h) Use and management of dangerous substances
(i) Major hazards assessment and management
(j) Labour issues (including the four core labour standards), and occupational health and safety
(k) Fire prevention and life safety
(l) Socio-economic impacts
(m) Land acquisition and involuntary resettlement
(n) Impacts on affected communities, and disadvantaged or vulnerable groups
(o) Impacts on indigenous peoples, and their unique cultural systems and values
(p) Cumulative impacts of existing projects, the proposed project, and anticipated future projects
(q) Consultation and participation of affected parties in the design, review and implementation of the project

(r) Efficient production, delivery and use of energy

(s) Pollution prevention and waste minimisation, pollution controls (liquid effluents and air emissions) and solid and chemical waste management

5.4.6 *Exhibit III: IFC Performance Standards*

The IFC has published a set of "Performance Standards" for Social and Environmental sustainability. The Performance Standards are listed in Table 5-7, which includes a brief summary of the important aspects of each policy as well as the implications for the Project.

5.4.7 *Exhibit IV: Industry Specific EHS Guidelines*

Industry specific EHS guidelines have been developed by the World Bank Group and the IFC. The World Bank's Pollution Prevention and Abatement Handbook (PPAH) applies to all projects to be funded by the World Bank. The handbook covers over 41 production processes for various industrial applications and projects – including Cement Manufacturing. In addition, the World Bank has developed guidelines for Open Pit Mining and Milling which are not included in the PPAH.

The direct limits arising from the guidelines above that are relevant to the Project are summarized in section 2.3.

5.4.8 *Good Practice Guides*

The IFC has also produced a series of good practice publications and notes, some of which are relevant to the Project (e.g. Good Practice Note: Addressing the Social Dimensions of Private Sector Projects) and consults a number of other reference materials in reviewing projects:

- Techniques for Assessing Industrial Hazards: A Manual. World Bank Technical Paper No. 55, 1988
- The Safe Disposal of Hazardous Wastes: Volumes I, II and III, World Bank Technical Paper No. 93, 1989.
- Environmental Assessment Sourcebook, Volumes I, II and III, World Bank Technical Paper No. 139, 1991.
- Resettlement as Development: A World Bank Sourcebook for Good Practice, World Bank;
- Doing Better Business Through Effective Public Consultation and Disclosure: A Good Practice Manual, International Finance Corporation.

Table 5-7 IFC Environmental Performance Standards

PERFORMANCE STANDARD	DESCRIPTION/OBJECTIVES	IMPLICATIONS FOR SCC
Performance Standard 1: Social & Environmental Assessment & Management System	Outlines the requirements for Social and Environmental Impact Assessment and Management, including: • Preparation of Environmental Management Plans and Systems, such as: (i) Management Programme; (ii) Organisational Capacity; (iii) Training; and (iv) Community Engagement • Social and Environmental Impact Assessment, outlining: (i) Scope of Assessment to cover all project related risks and impacts in a cumulative sense; (ii) Project life-cycle issues; and (iii) Focus on critical and key issues in a scientifically defensible, qualitative assessment.	A full Environmental and Social Impact Assessment (ESIA) and a comprehensive Environmental and Social Action Plan (ESAP) are required.
Performance Standard 2: Labour and Working Conditions	Sets out conditions for the protection of the basic rights of workers, including: • Maintaining worker-management relationships; • Fair treatment of workers including provision for: (i) non-discrimination; (ii) equal opportunities; (iii) labour and employment laws; and (iv) child and forced labour prevention; • Promotion of safe working conditions (Occupational Health and Safety)	
Performance Standard 3: Pollution Prevention and Abatement	Outlines approaches for the minimisation and prevention of emission, effluent and wastes, including: • The avoidance or minimisation of impacts on human health and the environment through pollution prevention or abatement; and • Reducing the emissions that contribute to climate change. These actions should be read in conjunction with Performance Standard 1 and the Industry Specific EHS guidelines. The Standard takes account of both emissions and ambient environmental considerations.	Best environmental practice technology should be employed wherever possible so as to reduce emissions to meet international quality standards.
Performance Standard 4: Community Health, Safety and Security	Aims to reduce the risks (health and safety) to communities as a result of the project and sets out guidelines so as to reduce risks wherever possible. The standard includes requirements for:	Community health and safety are key to the assessment of impacts and need to be included into the social and environmental management plan.

PERFORMANCE STANDARD	DESCRIPTION/OBJECTIVES	IMPLICATIONS FOR SCC
	• Infrastructure and Equipment safety; • Hazardous materials; • Community exposure to disease; and • Emergency preparedness and response.	
Performance Standard 5: Land Acquisition and Involuntary Resettlement	This standard is applied wherever land, housing or other resources are taken involuntarily from people and outlines approaches for the assessment and management of the resettlement process – including the avoidance thereof.	Not applicable.
Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management	Sets out guidelines for the protection and conservation of biological diversity. In doing so, the standard outlines: • The protection of habitats; and • The management and use of renewable natural resources.	The potential impacts on natural habitats should be assessed by the specialist studies undertaken as part of the social and environmental impact assessment. In the case of habitat destruction appropriate mitigation/rehabilitation measures should be incorporated into the social and environmental management plan.
Performance Standard 7: Indigenous Peoples	The standard sets out to: • Ensure that the development respects the culture and rights of local peoples; • Minimise impacts on local communities and their way of life; and • Establish mechanisms for local community engagement and good faith negotiation on issues of grievance.	Local people must be actively engaged with through the public consultation and disclosure processes. The social and environmental impact assessment should indicate all relevant social programmes and highlight both positive and negative social impacts.
Performance Standard 8: Cultural Heritage	Aims to protect culture heritage and ensure that its use (where appropriate) equitably shared.	The social and environmental impact assessment should: (a) Determine what is known about the cultural aspects of the proposed project site; and, if necessary, (b) Conduct a brief reconnaissance survey of the proposed project area.

5.4.9 World Business Council for Sustainable Development – Cement Sustainability Initiative

The World Business Council for Sustainable Development (WBCSD) Cement Sustainability Initiative (CSI) has initiated a task force (one of six) to address the local impacts of the cement industry on environment and communities. The CSI Task Forces has issued:

- Concise guidelines for an ESIA process for the cement industry to enable cement companies and local communities to identify and address some of the critical issues during each phase of a cement facility's development, operation and eventual closure.
- The Cement CO_2 Protocol which is intended as a tool for cement companies worldwide for calculating and reporting CO_2 emissions. It provides a harmonized methodology for calculating CO_2 emissions, with a view to reporting these emissions for various purposes. It addresses all direct and the main indirect sources of CO_2 emissions related to the cement manufacturing process in absolute as well as specific or unit-based terms.
- Established an emissions measurement and reporting protocol which would provide a common framework for all cement facilities. The protocol focuses on the practical task of monitoring and reporting emissions from cement production. Based on these data individual companies have agreed to set their own emissions targets and to track their progress in emissions reduction using the agreed key performance indicators (KPIs).

5.5 ENVIRONMENTAL STANDARDS AND GUIDELINES

A number of National and International Environmental standards apply to the project. These are detailed in Table 5-8.

Table 5-8 Environmental quality standards and guidelines

ASPECT	PARAMETER	LIMIT			
Air					
Emission standards (mg/Nm^3)		Syrian Legislation		PPAH	
	Total Suspended Particles	50-200		50	
	SO_2	1000-3000		400	
	NO_x	300-3000		600	
Ambient Air Quality Standards (µg/m3 unless otherwise stated)		Syrian Legislation (PPAH, 1998 standards are in brackets)			
		1-hour	8-hours	24-hours	Annual
	PM_{10}	-	-	150 (500)	- (100)
	TSP	-	-	230	90
	SO_2	350		150 (500)	60 (100)
	CO (mg/m^3)	30	10	-	-
	NO_x	400	-	150 (200)	- (100)
	O_3	200	120	-	-
	Lead	3	-		0.5-1.5

Power plant emissions (mg/Nm³ unless otherwise stated)		Syrian Legislation	PPAH Guidelines for Thermal Power Plants (1998)
	Particulate matter		50
	SO_2		2,000 (with 500tpd)
	NO_x		750
Water			
		Syrian Legislation – Max limit discharging into sewer Norm No 2580/2008	Effluent at point of release into the environment (PPAH)
	pH	6.5-9.5	6-9
	Temperature	35° C	<3° C above average receiving water temperature
	Suspended solids	500mg/l	50 mg/l
	Biological Oxygen demand	800mg/l	50 mg/l
	Oil and grease	10mg/l	10 mg/l
	Total Nitrogen	-	
Effluent Levels			
mg/l except pH and temperature			PPAH Guidelines for Thermal Power Plants (1998)
	pH		6-9
	TSS		50
	Oil and grease		10
	Total residual chlorine		0.2
	Chrome		0.5
	Copper		0.5
	Iron		1
	Zinc		1
	Cadmium		0.1
	Mercury (Hg)		0.005
	Arsenic (As)		0.5
	Temperature increase °C		<3
Noise			
		Maximum allowable noise in dB(A) - Federal Law 11 of 2006 (PPAH)	
	Area	Day (07:00 – 20:00)	Night (20:00 – 07:00)
	Residential areas with light traffic	40-50 (55)	30-40 (45)
	Residential areas in downtown	45-55	35-45
	Commercial areas and downtown	55-65	45-55
	Heavy industrial areas	60-70 (70)	50-60 (70)
Vibration (in the workplace)			
	Daily exposure limit value standardized to an 8-hours reference period	5 m/s² - Hand-arm Vibration 1.15 m/s² Whole-body Vibration	

6 IMPACT IDENTIFICATION AND ASSESSMENT

6.1 INTRODUCTION

The construction and operation of a "Portland Cement" Manufacturing Facility as the one proposed by the Syrian Cement Company (SCC) have the potential to create a range of impacts on the environment. As previously mentioned, the proposed development project is expected to extend over a 24 months construction period and will involve, in addition to the construction of the cement plant, mining operations of raw material from two quarries (limestone and basalt Quarries); and the construction and operation of a 60 MW coal-fired thermal power plant to provide the necessary energy requirement for the plant's operations.

These potential impacts can be both positive (beneficial) and negative (adverse) depending on the resources and receptors involved along with other parameters such as geographical scope (magnitude and extent), temporal scope (duration) and reversibility. It is anticipated that this project will have positive impacts on sectors such as the economy, employment and foreign exchange earnings among others. Moreover, the project is expected to result in negative impacts of short-term duration and transient in nature.

The objective of this chapter is to assess the likelihood of those social and environmental impacts as far as possible and to propose measures which will be incorporated in the project design, construction and operation, to, if not eliminate, at least mitigate these impacts to as low as reasonable practicable (ALARP) and to meet national Syrian standards and regulations, international industry standards, and quality standards requirements.

6.2 METHODOLOGY OF IMPACT EVALUATION

6.2.1 General Approach

The type, nature (positive, negative, direct, indirect), magnitude, timing (during design, operation), duration (short term/temporary, long term/permanent) and significance of impacts will be assessed in this section. The evaluation approach implemented in this study is a **Receptor-Specific Analysis** approach addressing the various sources of impacts from the project's different implementation phases including mobilization, site preparation, commissioning, drilling/quarrying operations, and site restoration.
The analysis covers all potential fields of impacts and/ potential receptors:

- Ambient Air Quality;
- Geology and Water Resources (groundwater and surface water);
- Noise and Vibration;
- Land-use
- Biodiversity (fauna and flora);
- Visual and Aesthetics;

- Socio-Economic Environment;
- Archaeology and Cultural Heritage; and

The general evaluation process will include the following stages:

- **Step 1:** Identification of project related activities (sources) and environmental aspects;
- **Step 2:** Identification of potential impacts to the environment (physical, biological, human, cultural);
- **Step 3:** Evaluation and assessment of the related unmitigated impact significance;
- **Step 4:** Identification of Best Practicable Environmental Options (BPEO); and
- **Step 5:** Re-evaluation and assessment of the mitigated impact significance.

6.2.2 Impact Evaluation Pre-Screening Level

The screening methodology that is adopted for the purpose of this ESIA study comprises a preliminary screening process followed by a more delicate and detailed secondary screening process.

The pre-screening process includes an intensive literature research and review of cement manufacturing industry projects implemented in other parts of the world as well as in Syria. The pre-screening highlighted some of the major impacts that might be associated with normal operations based on the literature research and the nature of the surrounding environment.

The key issues identified were further investigated and evaluated based on planned project operations including proposed SCC activities, time duration, national Syrian regulations, Lafarge HSE policies and commitment, and the environmental baseline conditions. Given the data gathered by ELARD team from the ground and those provided by SCC, the results were channeled to a secondary screening process.

6.2.3 Impact Evaluation Secondary Screening Level

A secondary screening level systematically screens the wide range of possible sources and potential previously highlighted impacts. This screening level also assesses the impacts in terms of their significance, duration, reversibility, likelihood of occurrence and geographical extent.

In the secondary screening level, consequence criteria were ranked into six levels of significance listed in Table 6-1. Then, the likelihood of the occurrence of the impact was rated according to the criteria outlined in Table 6-2. Based on the level of significance, and likelihood of occurrence, the impact severities (risk) are determined.

The assigned impact severity assessment was first undertaken in accordance to SCC's currently planned project design and mitigation measures incorporated. The assessment was conducted to identify the potential unmitigated impacts and the residual impacts under current project designs and SCC's control measures.

Having identified and characterized the potential significant impacts during each phase using the screening procedure identified above, an Environmental Impact Severity Matrix (EISM) was developed to summarize all identified impacts during each phase of the project (refer to Table 6-34).

The assigned impact severity was derived from:

- Round table scoring exercise by all team experts,
- Results from analysis and calculations, and
- Scientific predictions based on experience of every team member in the field of his/her expertise and from outcomes from similar projects conducted abroad or locally.

Table 6-1 Secondary Screening Consequence Level Criteria

CRITERIA	CONSEQUENCE
Massive impact over a large area resulting in extensive, potentially irreparable damage to a VEC*. Has a measurable effect on the livelihood of those using a resource over a period of years. Massive impact over a large area resulting in extensive, potentially irreparable damage to a site of social and/or cultural importance.	5. Catastrophic
Long term or continuous impact resulting in substantial adverse changes in a VEC, well outside the range of natural variation. Unassisted recovery could be protracted. Area of effect is extensive and/or encompasses an area that supports a statistically significant proportion of a VEC population or ecosystem. Has a measurable effect on the livelihood of those using a resource over a period of months. Significant damage / impact to a site of social and/or cultural importance.	4. Significant
Moderate adverse changes in a VEC or area that supports a VEC population. Changes may exceed the range of natural variation though potential for recovery within a few years without intervention is good. Area of effect encompasses an area that supports either a moderate or minor proportion of a VEC population or ecosystem. Long term (> 5 yrs) changes over an area which is not considered to be a VEC. Has a measurable effect on the livelihood of those using a resource over a period of weeks. Moderate damage to a site of social and/or cultural importance.	3. Moderate
Minor adverse changes in a VEC. Changes will be noticeable but fall within the range of normal variation and be typically short-lived, with unassisted recovery possible in the near term. However, it is recognized that a low level of impact may remain. Medium term impact (1-5 yrs) in an area that does not encompass a VEC or whose impact is highly localized within a VEC. Long term impact over a discrete, small area which does not support a VEC. May be noticed but does not affect the livelihood of those utilizing a resource. Minor impact to a site of social and/or cultural importance.	2. Minor
Short term changes in an ecosystem that are unlikely to be noticeable (i.e. fall within the scope of natural variation). Area of effect is restricted to the immediate vicinity of the source. Has no discernible effect on the environmental resource as a whole and is likely to go unnoticed by those who already use it. Negligible impact to a site of social and/or cultural importance.	1. Negligible
Changes that result in a net positive impact to an ecosystem, environment or population.	Beneficial

* VEC means Valuable Ecosystem Component, used to refer to components of the environment that are considered to be of commercial and/or ecological importance.

Table 6-2 Likelihood Evaluation Criteria

LIKELIHOOD TO OCCUR	CATEGORY	SCORE
Impact is highly likely or certain to occur under normal operating/ construction conditions	**High**	**C**
Impact may possibly occur under normal operating/construction conditions.	**Medium**	**B**
Impact is unlikely to occur under normal operating/construction conditions but may occur in exceptional circumstances.	**Low**	**A**

Table 6-3 Impact Assessment Management Matrix

		LIKELIHOOD RATING		
		A	B	C
CONSEQUENCE RATING	1	1A	1B	1C
	2	2A	2B	2C
	3	3A	3B	3C
	4	4A	4B	4C
	5	5A	5B	5C
	6	6	6	6

KEY

Consequences		Likelihood	Acceptability	
1 - Negligible	4 - Significant	A - Low	(blue)	Negligible with minor mitigation
2 - Minor	5 - Catastrophic	B - Medium	(yellow)	Minimize Impacts
3 - Moderate	6 - Beneficial	C - High	(orange)	Unacceptable

6.3 PRE-SCREENING OF ENVIRONMENTAL IMPACTS AND PATHWAYS

Based on the methodology described in section 6.2.2, the various impacts of the project were pre-screened according to the project's construction and operations phases as well as the pathway of the impact.

Table 6-4 lists the potential adverse and beneficial environmental, social and economic impacts that could result from the project.

Table 6-4 Summary of Potential Environmental and Socio-Economic Impacts

PHASE	SOURCE/ACTIVITY	TYPES OF EMISSIONS/ RESULTANTS	TYPE OF IMPACT
Mobilization and Construction	Site preparation, land clearance (project foot print), movement of heavy machinery/equipment, road grading and excavation/construction works	Emissions to atmosphere (CO, NO_x, SO_x, Particulate matter) Leakage diesel/oil spills Solid waste generation (inert; soil, vegetation, domestic, hazardous), spare damaged equipments Noise generation	Vegetation clearance Top soil removal and alteration of surface soils profile Degradation of local air quality Disturbance to local population Habitat alteration and destruction Potential land-use conflict and resettlement Visual intrusion from high rise structures and night lights disturbance and interference to local population and Bedouins Damage to surface and underground physical infrastructure (roads...)
	Influx of labour and workforce	Increased water consumption rates and waste generation (liquid and solid effluents) Increased background noise	Employment prospects in development area for skilled and unskilled workers and service providers **(beneficial)**

PHASE	SOURCE/ACTIVITY	TYPES OF EMISSIONS/ RESULTANTS	TYPE OF IMPACT
		level Heavy traffic movement	Increase in commercial trade with nearby communities **(beneficial)** Traffic congestion/risk of collision Depletion of natural water resources (groundwater and surface water if any) Increased risk of social conflicts/disputes Increased risk on health and safety of occupational workers and public community
	Transportation for logistics support, material/goods & services	Fine particle suspension especially in desert area, Emissions to atmosphere (CO, NO_x, SO_x), Leakage diesel/oil spills, Solid waste (raw material...), Noise generation	Enhance local trading and commerce **(beneficial)** Increased road traffic and accidents Soil compaction and quality deterioration Behavioural change of native faunal species. Increased risk for occupational injuries (stress, fatigue...)
Operation & maintenance	Camp Operation/labour lodging	Noise and light generation Solid waste disposal Sewage/camp grey water; Waste burning Visual impacts	Increased BOD, faecal coliforms, Contamination of soil, and consequently shallow aquifers Behavioural changes of local fauna Risk of diseases outbreak Increased risk for socio-cultural and land-use conflicts
	Quarrying/Drilling/blasting	Waste discharge Noise and vibration Water consumption Drainage / run-offs/ wash water Water consumption Emissions from raw material and manpower transportation and onsite equipment (crusher...) including mainly dust Explosive and chemicals handling/use	Employment opportunities for skilled and unskilled labour **(beneficial)** Loss of flora, fauna, archaeological artefacts (if any) Scaring of existing land and compromised visual aesthetics Medical waste generation Contamination of soil by heavy metals, salts, hydrocarbons, etc. Contamination of groundwater aquifers Occupational health and Safety risk hazard due to risk of abnormal operations (blasting, emergencies, fire, etc) Nuisance to local population (particularly those suffering with respiratory morbidities)
	Maintenance	Spare damaged equipments Waste discharge Spent chemicals/oil/grease	Hydrocarbon contaminated waste Heavy metals generation
	Process Operations (cement	Atmospheric Emissions mainly	Degradation of air quality

PHASE	SOURCE/ACTIVITY	TYPES OF EMISSIONS/ RESULTANTS	TYPE OF IMPACT
	plant/power plant stack emissions) Hauling, loading and unloading of raw material as well as finished product	SO_2, NO_X, CO_2, particulate matter/TSP Fugitive dust emissions Vehicular exhaust Solid waste generation (slag, fly ash) and liquid industrial effluents (blow down, wash water) Increased vehicular movement and risk of vehicle collision	Disturbance to land aesthetics, and local biodiversity Traffic congestion Occupational health and safety risks Nuisance to local population (particularly those suffering with respiratory morbidities)
Accidental events	Collision of trucks / vehicle accidents Fire / Explosion and process failure	Leakage diesel spills, Noise generation Emissions to atmosphere (CO, NO_x, SO_x) - Fine particle suspension especially in desert-like area	Contaminant dispersion (Groundwater, surface water, soil) Increased risk for occupational injuries (stress, fatigue...) Loss of flora, fauna, archaeological artefacts (if any), visual impacts Increased risk for occupational injuries (stress, fatigue...)
Site restoration/quarry rehabilitation	Restoration activities (green area plantation)	Nil	Restoration of site and landscape **(beneficial)**

6.4 POTENTIAL IMPACTS ON AMBIENT AIR QUALITY

6.4.1 Introduction

Air emissions may originate from different points in cement production processes, depending on the raw materials, preparation procedures, kiln type and emissions control systems used. The main manufacturing steps where dust, particles and gaseous pollutants can be generated include:

- Quarrying and preparation of raw material (including crushing and grinding),
- Loading and unloading of materials,
- Burning of fuels (power generation),
- Clinker production,
- Finish grinding,
- Blending,
- Packaging,
- Storage, and
- Transport.

The largest volume of substances emitted during the production of cement are carbon dioxide (CO_2), particulate matter (dust), oxides of nitrogen (NO_x), and sulphur dioxide (SO_2). Trace quantities of volatile organic compounds (VOCs), acid gases (HCL and HF), and some trace metals may also be emitted. The different sources of emissions and their implications on human health are described in the following tables.

6.4.2 *Legislative Requirements*

The Syrian National Ambient Air Quality Standard (NAAQS) addresses criteria air quality pollutants (namely; SO_2, CO, NO_2, O_3, TSP, PM_{10}, Pb, Benzene and Benzo[a]Pyrene). NAAQS were adopted by the Council for Protection of the Environment & Sustainable Development and were issued in 2004 by the Syrian Organization for Metrology and Standardization as the Syrian National Standard (SNS No.: 2883/2004).

As shown in the table below, the NAAQS address the exposure averaging period, the allowable limit values, allowable number of exceedance per year and the margin of tolerance. Limit values in the Syrian NAAQS aims at protecting human health and the environment and were adapted from the air quality guideline values set by the World Health Organization (WHO, 2000) and the EC-Directive.

A national emission standard for air pollutants is not available yet in Syria, however, a list of Maximum Allowable Emission Limits at Source was adopted by the highest environmental authority in Syria (i.e., the Council for Protection of the Environment & Sustainable Development). A number of National and International air quality standards apply to the project. These are summarised in Table 6-5.

Table 6-5 Summary of National and International Air Quality Standards and Guidelines

ASPECT	PARAMETER	LIMIT			
Emission standards (mg/Nm³)		Syrian Legislation		PPAH (1998)	
	Total Suspended Particles	50-200		50	
	SO_2	1000-3000		400	
	NO_x	300-3000		600	
Ambient Air Quality Standards (µg/m3 unless otherwise stated)		Syrian Legislation (PPAH, 1998 standards in brackets)			
		1-hour	8-hours	24-hours	Annual
	PM_{10}	-	-	150 (500)	- (100)
	TSP	-	-	230	90
	SO_2	350		150 (500)	60 (100)
	CO (mg/m³)	30	10	-	-
	NO_x	400	-	150 (200)	- (100)
	O_3	200	120	-	-
	Lead	3	-		0.5-1.5
Power plant emissions (mg/Nm³ unless otherwise stated)		Syrian Legislation		PPAH Guidelines for Thermal Power Plants (1998)	
	Particulate matter			50	
	SO_2			2,000 (with 500 tpd)	
	NO_x			750	

Additional national legislation includes:

- "General Syrian Guidelines for Cement Industry and Quarries" associated with the stages of quarrying, raw material grinding and cement production line to mitigate impacts from noise and fugitive emissions;
- **Decree No. 1745 and 8**, issued following Syria's ratification of the "International Labor Convention No. 139, 120 and 136", which prevents vocational risks ensuing from cancer causing materials and tools, protects workers health and ensures proper sanitation and hygiene for base camps, work environment and offices; and

6.4.3 Approach and Methodology

Given the lack of previous data or measurement campaigns on ambient air quality at the SCC proposed site in Tal-Abyad, the air quality specialist study methodology included:

- **An assessment of the current ambient air quality status**- performed based on a one-week air quality monitoring campaign undertaken during July 2008 to obtain some baseline concentrations of the primary air pollutants (CO, SO_2, NO_x, and Particulate Matter) at four sites representing villages in the four directions of SCC site.
- **Development of an inventory of emissions resulting from SCC operations-** identifying the main sources of atmospheric emissions, where dust or combustion gases might be emitted to the surrounding environment (refer to table below);
- **Estimation of anticipated emissions -** for Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_x), Dust and Carbon Dioxide (CO_2) Emissions.
- **Estimation of the ambient concentrations using dispersion modelling -** The US EPA approved air dispersion model (AERMOD-ISC, developed by Lakes Environmental) was used to estimate ambient concentrations of major air pollutants (SO_2, NO_x, and dust) that will result from the accumulated emissions from the operation of SCC cement plant. This computer software utilizes the US Environment Protection Agency (USEPA) Regulatory Model (AERMOD) and the Industrial Source Complex (ISC) to predict the concentrations of pollutants downwind from a variety of sources associated with an industrial complex. The model is used to assess the transportation of pollutants and the impacts on surrounding land-uses taking into account the complex meteorological conditions. The key input requirements include site representative meteorology from Tal-Abyad meteorological station and the accurate characterization of the SCC emission sources.

6.4.4 Findings

The air quality monitoring campaign revealed that all measured baseline concentrations (at the four locations) are well below the national ambient air quality standards (NAAQS).

With regards to the estimation of the anticipated emissions from SCC operations, the following was calculated:

- The expected minimum and maximum total amounts of SO2 emissions ranges between 990 and 14,850 tons/year; which are equivalent to stacks emissions between 861 mg/m3 and 1,888 mg/m3. The modelling of the SO2 dispersion of the gases emitted by both sources (kiln + power plant), conclude a maximum yearly concentration at ground level of 6µg/m3 or 13µg/m3, depending on the sulphur retention scenario (95% or 99%). These concentrations are calculated for the most exposed villages in the dispersion pattern, namely, Kharab Eshek & Kharab Eshek Janoubi . These concentrations are compliant with WHO standards & are representatives of industrial areas in Europe.
- The expected minimum and maximum total amounts of NO_x emissions ranges between 73 to 1097 mg/m^3 with an emissions limit of 600 mg/m^3 guaranteed by the supplier. The modelling of the NO_2 dispersion of the gases emitted by both sources (kiln + power plant) conclude a yearly concentration of between 3µg/m3 & 6 µg/m3 at ground level in the nearest village shown in the dispersion pattern. This is well within international standards for air quality. To put this in perspective a city like Paris, where air quality has improved over the years, 2008 registered concentrations of NO_2 between 34µg/m3 & 43µg/m3 depending on the air station location (district).
- The daily expected minimum and maximum concentrations of Dust emissions ranges between 2 to 73 m_g/m^3 respectively; and
- The expected amount of CO2 emissions for the cement plant is 2,047,815 tone /year. The CPP will add an additional 429,720 tone of CO_2 / year.

6.4.5 Assessment of Impacts

6.4.5.1 Potential Impacts during Construction Phase

Emissions of air pollutants from the project's construction phase are mainly associated to transportation i.e. vehicle movement and site clearance activities. The primary sources include:

- Combustion and exhaust emissions from diesel-fueled equipments, generators and transport vehicles;
- Airborne particulates (dust) from soil disturbance and transportation to and from the plant and quarry sites;
- Fugitive emissions from loading/unloading operations of raw construction materials and process equipment (leaking valves, tanks, etc.); and
- Combustion emissions from open-burning of generated solid waste (carbon dioxide, carbon monoxide, metal fumes…) if any.

Impacts from Combustion and Exhaust Emissions

The construction phase of the project is likely to involve combustion and exhaust emissions generating from activities such as ground excavation, site clearance, material handling and vehicle/equipment movements. These emissions can be estimated from established methodologies that depend on the number and type of construction equipment/vehicles which will be used during the site preparation phase.

The largest source of air pollution is the operation of the internal combustion engines (i.e. 24 diesel generators) used to supply the construction phase with the electricity needed to run the project (e.g, base camp utilities, offices). The generators will operate simultaneously over a 24 hrs period during construction and operation.

Diesel emissions count about 40 hazardous air pollutants (HAP) as reported by the US EPA (2002). However, the main air pollutants likely to be associated with these emission sources include: Oxides of Nitrogen (NO_x), Sulfur Dioxide (SO_2), Carbon Dioxide (CO_2), Carbon Monoxide (CO), and Particulate Matter (PM). The primary environmental consequences of air pollutants are respiratory difficulties in humans and animals, damage to vegetation, and soil acidification. The impacts associated with the above air emissions are illustrated in **section 6.4.1.**

Based on OGP emission factors for the burning of diesel fuel, the power generation activities at the plant site (i.e. 24 diesel generators), comprising the combustion of an estimated 3,500 tons of diesel, shall emit the pollutant levels presented in Table 6-6.

Table 6-6 Estimated Atmospheric Emissions from Combustion Sources

POLLUTANT	EMISSION FACTOR* (TONNE EMISSION/TONNE DIESEL)	EMISSION LEVELS (TONS)
CO_2	3.2	11,200
CO	0.019	66.5
NO_x	0.07	245
SO_x	0.008	28
CH_4	0.00014	0.49
VOC	0.0019	6.65

*Draft OGP Tier II Emission Factors for Diesel Combustion

No estimated atmospheric emissions from combustion sources were provided by SCC at this stage of the study. It should be mentioned that Exhaust emissions are inevitable during normal operation of combustion sources. However, lack of maintenance, poor quality fuel, unnecessary idling periods, long operation period (especially power generators) and absence of exhaust emission control units will result in the increase of pollutants concentration emissions. Emissions concentration of sulphur dioxides and hydrogen sulphide depend upon the sulphur content of the diesel fuel used, particularly when used as a power source. The lower the sulphur content, the lesser the concentration emitted. Similarly, partially burned hydrocarbons are emitted during combustion when the engine's fuel/air mixture is incorrect. However, little can be done to lower NO_x emission, other than to purchase low NO_x generating equipment.

Generally speaking, the emissions associated with the construction activities, and vehicular exhaust will be of a **Moderate** effect. This impact is of a **high** likelihood, yet of a medium to short-term duration and reversible nature. Accordingly, with no mitigation measures in place, this activity is likely to have a **Moderate impact (3C)** on the overall air quality within the project area.

However it is recommended that various mitigation measures be adopted, including:

- Using continually well designed, maintained and operated equipments / vehicles by the contractor. Precautionary control measures for atmospheric emissions reduction could include proper engine fuel mixtures, regularly serviced exhaust emission systems, suitable engine tuning, and purchase of diesel fuel with low sulfur content (5% sulfur content).
- Investigating the environmental benefits of employing environmentally friendly equipment by the contractor such as machinery with higher fuel efficiency or those equipped with air pollution control devices to minimize exhaust emissions. Examples include vehicles equipped with 2 or 3 way catalytic converters;
- Avoiding idling vehicles and equipment engines that are left running unnecessarily;
- Reporting monthly fuel consumption records;

An implementation of the abovementioned mitigation measures is likely to reduce the effect of exhaust and combustion emissions during site preparation and transport to **Minor (2A)** on the overall air quality within the project area.

Impacts from Dust Generation

The primary sources of dust generation would be related to construction activities. These sources include a combination of on-site excavation and civil works such as compaction and trenching activities, contact of construction machinery with uncovered soil and exposure of bare soil and soil piles to wind. These activities are expected to result in the disturbance of surface soil hence increasing the atmospheric dust levels.

Estimation of the quantity of dust generated is closely related to the type of equipment used, and the duration and nature of the civil works. USEPA reports the typical emissions factors for various construction activities which are presented in Table 6-7. These are illustrated for indicative purposes.

Table 6-7 Uncontrolled Particulate Emission Factors for Open Dust Sources (USEPA, AP-42)

SOURCES	TSP EMISSION FACTOR*	UNIT
Topsoil removal by scrapper	0.029	Kg/Mg
Truck loading by power shovel	0.018	Kg/Mg
Bottom dump truck unloading	0.001	Kg/Mg
Scrapper unloading	0.02	Kg/Mg
Wind erosion of exposed areas	0.38	Ton/acre/year

Further increase in atmospheric dust levels are anticipated by the movement of trucks and vehicles transporting people, material and equipment to the work sites. The amount of dust generated by the activity is difficult to estimate at this stage, however the occurrence and significance of the dust generation depend upon meteorological and ground conditions at the time and location of the civil works activities. However, under normal meteorological conditions, dust impacts should be limited to within several hundred meters of the activity areas.

The main environmental concerns associated with dust generation are likely to be limited to occupational health risk (visual intrusion due to dust clouds) and irritation to humans (i.e. construction workers and nearby local community).

The likelihood for dust generation during site preparation and excavation activities is **high**. This impact is long-term **given the 24 months construction period followed by the on-going vehicle movement during the operation phase** and therefore considered **Significant (4C)** when no mitigation levels are in effect**,** particularly for dwellings located at close proximity of the paved roads.

Techniques for minimizing and preventing fugitive dust emissions during the construction activities can be accomplished through dust suppression measures. The main dust control measures, as proposed by SCC and which are recommended to be considered, include the following:

- Watering-down work area/s.
- Efficient scheduling of deliveries.
- Maintaining stockpiles at minimum heights and forming long-term stockpiles into the optimum shape (i.e. stabilization) to reduce wind erosion.
- Maintaining handling areas in a dust free state as far as practicable.
- Establishing and enforcing appropriate speed limits over all unpaved surfaces.
- Traveling on existing and paved tracks wherever possible.
- Avoiding open burning of solid waste through segregation and recycling, and through disposal according to a solid waste management plan.

When the mitigation measures recommended above are adopted, the impacts due to dust generation from site preparation and civil works become **Minor (2C).**

Impacts from Open-Burning Activities

Open incineration of un-segregated waste will result in incomplete combustion and generation of emissions including CO_2, NO_x, SO_2, gaseous acids (e.g. HCL), PM and toxic by-products such as polycyclic aromatic hydrocarbons (PAHs), benzene and carbon monoxide (CO).

The burning of waste containing Polyvinyl Chlorides or PVC material (plastic food containers, bottled water containers, safety boots, electronic devices…) can lead to the generation of Persistent Organic Pollutants (POPs) such as polychlorinated dioxins which are highly toxic to humans and environment even at very low concentrations. These are highly toxic to humans and the environment even at very low concentrations. In addition to cancer, exposure to dioxins and furans can cause severe reproductive and developmental problems, damage the immune system and interfere with hormonal systems (WHO, 2004). Heavy metals residues (cadmium, mercury, lead and chromium) are also considered a concern when burning un-segregated waste including items such as dry cell batteries or damaged electronic devices. Mercury vapors are considered a potent neurotoxin that can affect the brain, kidneys and liver.

Though waste management is covered under SCC's solid waste management plan, which envisages the adoption and implementation of the 4Rs' procedure (Reduce, Reuse, Recycle, Recover, Treatment /Disposal) and "good housekeeping" practices, the likelihood of uncontrolled incineration occurrence is **High** of **Moderate Effect (3C)** particularly in the absence of a personnel supervision and proper implementation of the waste management plan and local infrastructure (i.e. waste management facilities).

Mitigation measures to reduce on the incidence of open incineration activities include:

- Careful monitoring should be carried out especially during the peak construction period which intends to accommodate for 1,800 workers;
- Prohibition of burning of industrial or hazardous waste (e.g. oil, medical waste…);
- Sorting and segregation of waste streams into combustible (paper, food, cardboard, wood) and non combustible waste and recyclables; and
- In case of incineration, it should be conducted at a location at appropriate distance from the base camp and at least 1000 meters from any local settlers so as to prevent any hazard to operations, personnel or local inhabitants. Incineration shall be supervised and should be performed either using a dedicated waste incinerator or within a specially constructed wire meshed burn basket raised from the ground level, allowing air to reach all six sides and ensuring full and complete combustion. Once combustion is completed, residual ash should be buried in a locally opened pit.

Consequently, by adopting SCC's proposed waste management plan and the outlined mitigation measures, it is concluded that the air emission impacts associated with the waste disposal will be **Negligible (1A)**.

6.4.5.2 Potential Impacts from Operation Phase

Emissions of air pollutants from the project's operation phase are mainly associated with the industrial process emissions (i.e. offset emissions) released from cement manufacturing and electric power generation. Additional sources of atmospheric and fugitive emissions comprise of vehicular transportation of raw materials (basalt, gypsum, coal...), finished product (i.e. cement) and quarrying operations (mainly dust).

Impact from Dust Emissions on Surrounding Environment

In reference to cement manufacturing, the cement kiln is regarded as a major point source of dust predominantly particulate matter emissions, since they are inherent to the cement manufacturing process. However, dust emission from cement kiln stacks has been reduced dramatically over the last two to three decades due to regular improvements in design and operation, including increased use of modern de-dusting equipment.

Additional sources of dust include the near-ground fugitive releases originating in most cases from crushing, grinding operations, transportation of material by truck or conveyor belts, storage conditions of clinker and/or cement, bagging activities.

As previously mentioned, the main environmental concerns associated with dust emissions are centered on occupational health risk and irritation to human health. Dust (i.e. PM_{10}, particulate matter with a diameter of less than 10 μm) is able to penetrate deeply into the lungs and is known to impact the upper respiratory tract and cause irritation and infection; exacerbation of and increased mortality from cardiorespiratory diseases. In addition to it being a health hazard, dust is also regarded as environmental nuisance due to its capacity to restrict vision particularly in the project area characterized by low annual rainfall and dry climate, increased risk from dust is related to compromised visual amenity on the roads which could potentially cause an increase in mortality incidence rates for both public community and occupational workers.

Given the dry setting of the study area and the distribution of the population clusters, impacts from dust on the local air quality and human health are **highly** likely to occur and are expected to be of **Significant Effect (4C)** when no mitigation measures are in place to control local (i.e. inside plant working area) emissions, and offset emissions from industrial stacks.

Dust emissions during operations are expected to be between 2-73 mg/m3, with a typical emission level of 37mg/m^3. As part of SCC's best available technique (BAT) and environmental commitment, all exhaust gas released from the raw mill and kiln circuit is handled by the Gas Conditioning Tower (GCT) and Electro-Static Precipitators (ESP) in charge of de-dusting operations. Upon filtering, dust emissions would be reduced to a maximum of 50 mg/Nm^3 compliant with national and international standards.

Additional mitigation measures proposed to reduce, if not prevent, dust emissions tackle the handling of raw and finished material and include the use of sealed conveyor belts, silos for storage of raw and finished materials, vehicle and road wash-down procedures. In the case of truck hauling of raw material (such as the case for basalt and coal) to the plant, SCC will ensure that hauled material is adequately contained in the trucks while using rubber film/sheet to cover trucks so as to reduce risk of releases and appropriate speed limits are maintained and vehicles travel on existing roads.

Subsequently, impacts from dust emissions on the local air quality are reduced to a **Minor (2C) Effect** with a reduced risk on human and occupational health implications.

Impact from Sulphur Dioxide Emissions on Surrounding Environment

SO_X emissions are generally formed from the combustion of sulphur (S) in the fuel (coal in this case) and from the oxidation of sulphur present in the raw materials and are predominantly (99%) released as Sulphur Dioxide (SO_2). The main sources of SO_2 emissions during the operation of SCC would be from:

- The pyritic sulphur in the kiln feed; and
- The combustion of sulphur present in coal fed to the cement kiln and the power generation plant

The cement kiln is known to be an excellent scrubber for acid gases, due to the presence of alkalis & free lime generated by the raw materials. This is especially the case for modern kiln technologies and for situations with no pyretic sulphur in raw materials. In keeping with Lafarge's standards, all quarries have to be screened for pyretic sulphur content. This was done at an early stage for the SCC project and the analysis showed the absence of any pyretic sulphur in the quarries. In addition a low sulphur coal for the power plant (0,9 %) has been adopted. Under these conditions a SO_2 retention of 99,8 % for modern kilns, as the one built at SCC, is suggested. To simulate the worst conditions, an assessment a range of [95%-99%] for the sulphur retention in the kiln was assumed. SO_2 emissions were calculated at between 861 mg/m^3 (99% absorption) and 1,888 mg/m^3 (95% absorption) well below the PPAH (1998) standards maximum level of 21,926 mg/m^3.

SO_2 is known to contribute to acid deposition (dry and wet) resulting in subsequent damages to ecosystem while in reference to human health impacts from exposure to sulphur dioxide concentrations, the main impact relates to repercussions induced on the respiratory system through inhalation since it does not accumulate in the body. Sulphur dioxide in ambient air mostly affects the elderly, children, and people with bronchial and asthmatic disorders (i.e. the most sensitive and vulnerable groups in the community).

According to the WHO Air Quality Guidelines (AQG) for Europe (2000), it is noted that the lowest observed-adverse-effect levels of SO_2 for which effects on the most sensitive population groups (people suffering from asthma) were:

- 1,000 µg/m^3 (10 minutes) for changes in lung function in asthmatics; and
- 250 µg/m^3 (24-hr) and 100 µg/m^3 (annual) for exacerbation of respiratory symptoms.

Due to the highly alkaline conditions in the kiln (limestone and clinker), SO_2 absorption from the flue gas ranges from between 99% and 95% accordingly air dispersion modeling was carried out taking into account the minimum and maximum expected ground level concentrations SO_2 emissions.

The modelling of the SO2 dispersion of the gases emitted by both sources (kiln + power plant), conclude a maximum yearly concentration at ground level of 6µg/m3 or 13µg/m3, depending on the sulphur retention scenario (95% or 99%). These concentrations are calculated for the most exposed villages in the dispersion pattern, namely, Kharab Eshek & Kharab Eshek Janoubi . These concentrations are compliant with WHO standards & are representatives of industrial areas in Europe.

Though SO_2 emissions are **highly** anticipated throughout the project's operation given coal is used in the kiln, modeling contour results show a maximum yearly concentration at ground level of 6µg/m3 or 13µg/m3, depending on the sulphur retention scenario (95% or 99%). The most exposed villages in the dispersion pattern, namely, Kharab Eshek & Kharab Eshek Janoubi will not be subject to exceeding levels hence impacts from SO_2 process emissions are considered of **Minor Effect (2C)** on the surrounding environment.

It should also be reminded that the proposed SCC plant intends to reuse solid by-products from power generation (i.e. fly ash and slag) for cement manufacturing. This common practice is expected to reduce on reliance on coal hence leading to a decrease in SO_2 emissions.

Hence impacts from industrial SO_x emissions would be reduced to a **Negligible effect (1C)** on the local (plant boundary) and surrounding environment.

Impact from Oxides of Nitrogen Emissions on Surrounding Environment

NO_X emissions are formed by the reaction of nitrogen (N_2) in air with oxygen (O_2) at the high temperatures reached during the clinker production process. Oxides of nitrogen (NO_x) can be formed from the oxidation of organic nitrogen present in the fuel. With regards to the power plant, NO_X emissions are mainly influenced by the efficiency of NO_X burners as well as the flue gas treatment.

NO_2 is a toxic gas, even at relatively low concentrations contributing as well to the formation of acidic species, which can be deposited by wet and dry processes. NO_X can also increase the formation of ozone at ground level when mixed with VOCs in the sunlight atmosphere. NO is a relatively innocuous species, but is of interest as a precursor for NO_2. The main adverse health effect caused by exposure to nitrogen dioxide (NO_2) is damage to the respiratory system. Inhalation of nitrogen dioxide increases a child's risk of respiratory infection, and may lead to reduced pulmonary function later in life.

Following the air modeling results, the predicted NO_X annual mean concentration contours in the study area are expected to be well below the recommended values while adopting the worst-case scenario (10 µg/m^3).

NO_x emissions are also **highly** anticipated from the project's process operations however impacts on human health and air quality are expected to be **Negligible (1B).** SCC is currently investigating higher efficiency boilers/furnaces so as to reduce to As Low As reasonable Practicable (ALARP) on NO_X concentrations.

Impact from Offset Emissions on Local Vegetation and Native Fauna

Following the air dispersion modeling results, the estimated off-site emissions of the maximum annual NO_X concentrations are calculated at a maximum of 6µg/m^3 at a distance of 0.5 km to the plant site. With increasing distance from the site (from 1 km up to 4 km), NO_X concentrations drop to a value of 3 µg/m^3.

Therefore, NO_X levels that could potentially affect natural vegetation will not be reached in the cultivated areas located surrounding the plant site. Impacts from NO_X emissions on vegetation will be **Negligible (1C)**.

With regards to SO_2 maximum annual concentrations, the mean levels are estimated at 13 µg/m^3 which ensures protection of the agricultural crops given the maximum permissible level of 30 µg/m^3 as set by the United Nations Economic Commission for Europe (UNECE).

Consequently, impact from perturbation of natural vegetation due to SO_2 process emissions are also **Negligible (1C).**

In addition to the abovementioned emissions, particulate matter/dust is also a common atmospheric process pollutant. The main impact from suspended and deposited dust particles on the vegetation is the decrease in absorbed light intensity due to the coverage of leaves as well as impediment of the pollination progression which could lead to plant growth disruption and loss of integrity. The annual maximum concentrations of Total Suspended Solids (TSP) in the Study Area are calculated at 41µg/m^3, well below the National Ambient Air Quality Standards (NAAQS) of 150 µg/m^3.

Generally, the study area is adapted to desert-like conditions (i.e. 200-250 mm of annual rainfall) whereby plants are regularly exposed to dust and sandstorms (particularly from the months of May till October). This suggests that environmental impacts on the floral cover from TSP emissions are considered **Negligible (1C)** as well.

6.4.6 Summary of Impacts and Ratings

Table 6-8 Impacts on Ambient Air Quality and Surrounding Environment Before and After Mitigation Measures

IMPACT	RATING BEFORE MITIGATION	RATING AFTER MITIGATION
Impacts from Combustion and Exhaust emissions during construction phase	3C	2A
Impacts from fugitive dust emissions during the construction phase	4C	2C
Impacts from open-burning activities from crew members and base camp operations	3C	1A
Impacts from process dust emissions on surrounding environment	4C	2C
Impacts from process SO_2 emissions on surrounding environment	2C	1C
Impacts from process NO_x emissions on surrounding environment	1B	1B
Impacts from offset process emissions on local vegetation	1C	1C

6.4.7 Conclusions

The risk of adverse impacts on community health in the surrounding areas caused by emissions from the proposed cement plant and power plant are negligible given SCC's proposed use of best available technology (BAT). However, particular attention should be paid to dust control measures given the dry climate residing over the area and the nuisance to the local human and physical receptors.

As previously mentioned, Carbon Dioxide (CO_2) is a major greenhouse gas generated during cement production evolving from both burning fuel, and from the chemical reactions converting limestone into clinker. However, both sources are inherent to the process therefore these emissions are inevitable. It should be reminded though that as per Lafarge's commitment to reduce the total CO_2 emissions of its activities, SCC will adopt mitigation and control measures as part of its environmental policy and compliance to Lafarge procedures. SCC is committed to:

- Product development with new clinker (BCAF) and enhanced (Portland) clinker reactivity & with concrete formulation (admixtures, granular optimization, additions,…)
- To concentrate on interface between the cement plant flue gases & treatment plant (gas conditioning, scrubbing, liquefaction,…)
- To understand global chain from capture to sequestration (technology, specifications & costs,…)
- Using alternative materials and biomass
- Energy consumption (reduce Specific Heat Consumption) Reduce the Consumption of Power.
- Upgrade its factories and improve its activities and operations on a continuous basis by using alternative power sources.
- Using Industrial wastes such as ash and sludge to produce cement.
- Some additions can totally or partially replace the Limestone, such as materials that were burned before, besides the reduction of burned Calcium; this can reduce the emissions of CO_2.

6.5 POTENTIAL IMPACTS ON WATER ENVIRONMENT

6.5.1 Introduction

The construction and operation of the SCC cement plant factory and associated facilities (mainly thermal power plant) may potentially have an impact on the local water resources, with respect to quantity and quality due to its high water consumption requirements and potential groundwater contamination that may result from the various construction and operation activities, such as potential leaks, improper management of solid wastes and liquid effluents as well petroleum hydrocarbon storage facilities.

Given that the regional water authority is not capable of meeting the water supply requirements of the cement plant, due to the absence of water infrastructure and the high water demand, the plant has to secure its own water sources, from the available groundwater resources. Surface water bodies are not available within the area or its close proximity.

An estimation of the water consumption during the project construction phase and the project operation phase is provided below on Table 6-9. During Construction Phase the average water demand is about 400 m3/day, with a peak in demand not exceeding 600 m3/day, when construction activities will be at its peak requiring more workers. The main water consumption (about 75%) will be for construction purposes; whereas the remaining 25 % would be to for domestic purpose.

During the operation phase, the total water demand will be about 7000 m^3/day, most of which will be used for industrial purposes mainly cooling for the cement and the power plants (6500 m^3/day), and to a lesser extent for the operation of the Quarries (about 350 m^3). Water consumption for domestic purposes, would not exceed 150 m^3/day.

Table 6-9: Anticipated Water Demand during Construction and Operations

Phase	Facility	Description of Water Requirements	Daily Consumption Rate
Construction Phase	Quarries	No Activities	-
	Cement and Power Plant	***Domestic Purposes:*** water supply for Construction Workers. The average number of worker is about 500. The Peak number of workers will be about 1800 workers for over a period not exceeding 12 months	50 m^3/day to 180 m^3/day (Average 100 m^3/day)
		Construction Purposes: such as water spraying for dust control, and cement mixing,	200 m^3/day to 400 m^3/day (Average 300 m^3/day)
Operation Phase	Quarries	***Domestic Purposes:*** Water Supply for local workers (no base Camp), during working hrs. The number of workers is about 40 for each Quarry.	<50 m^3/day
		Operation Purposes: such as water spraying for dust control, and rock crushing activities	350 m^3/day
	Cement and Power Plant	***Domestic Purposes:*** water for local workers (about 50 workers) and cleaning/washing purposes	100 m^3/day
		Industrial Purposes: Cement: Water mainly for cooling purpose Power Plant: Water mainly for cooling purpose	 1500 m^3/da 5000 m^3/day

6.5.2 Legislative Requirements

The use of groundwater or surface water for industrial purposes requires an exploration and exploitation permit to be requested from the concerned authorities. This type of activity falls under the jurisdiction of the Ministry of Industry, the Ministry of irrigation/General Commission for water resources and their extensions at the governorate level.

Generally, any private industry that is licensed by Investment law No 10, is granted the rights for public water use and abstraction, but has to abide by the laws related to groundwater and surface water, as per the following:

- **Water Law No. 31** dated 2005, which considers the acquired rights to public water usage, well drilling license, public water network usage, water exploration (e.g. equipping well with flow meters for discharge and abstraction control) in addition to penalties for non-compliance (Conflicts over water use are solved in court);
    - **Law No.10** dated 1972 which prohibits factories and laboratories from evacuating wastewater in open water bodies;
    - **Legislative Decree No. 111** dated 1966 issued by the Ministry of Health mandating the monitoring of water quality; and
- **Investment Law No. 10** dated 2003 which entails the prohibition of well drilling in areas with scarce water resources and control of drilling rigs by the government.

6.5.3 Approach and Methodology

A Hydrogeological study was conducted to evaluate the groundwater resources of the area, and provide recommendations for a pumping scheme to meet the water demand during the plant operation, which was previously set at about 2000 m3/day. The initial plan did not include an electric power plant, given that the Syrian government was supposed to secure the required electric power. With the addition of the power plant the water demand during project operation has increased to about 7000 m3/ day.

The results of the study is used to develop a pumping strategy to meet the new water demand, and assess its impact with respect to quantity, by making projection of the lowering of the water table within the area.

The results of the study have revealed the presence of ***two main aquifers*** in the area: the Paleogene shallow aquifers which are currently being exploited in the region; and the Limestone aquifer of middle cretaceous, which is practically not being used.

The Paleogene aquifer within the site boundary appears to have a relatively high transmissivity. Efficient wells tapping this aquifer can easily yield more than 2000 m^3/day (each). Projection of maximum water level drops, as a result of pumping for a period of 50 years at a rate of 4500 m^3/day, and 7000 m^3/day, assuming that there is no recharge, would not exceed 3 m, and 5 m, respectively. These drops would be in the production wells, however the average drop within the water table is not anticipated to exceed 1 to 2 meter.

Four old wells are believed to be present. These wells used to be used for irrigation. It was reported that these wells used to have a sustainable yield exceeding 1000 m^3/day (each). These wells will be rehabilitated, and pump tested to estimate their production capacity.

The recharge basin was estimated to extend over an area of 148 km^2, however the water balance could not be estimated since the study did not extend over the entire basin. Assuming that the recharge is only from water infiltration as a result of rainfall within the property boundary, that covers an area of about 14 km2, the average recharge is estimated at about 784,000 m^3/year (about 2,150 m^3/day). This is value is most probably very conservative; the recharge may most likely be significantly higher, but still below the water demand during the plant operation. Groundwater extraction of 400 m^3/day to 600 m^3/day, during the construction phase would not have a significant impact on the shallow aquifer. However, groundwater extraction of about 7000 m^3/day during the operation of the plant may potentially have a moderate impact on the shallow aquifer, due to its over-exploitation. Thus the need arises, for a supplemental source of water to mitigate the impact on the shallow Paleogene aquifer.

The deep aquifer of Middle Cretaceous may likely be the supplemental source of water. This aquifer is one of the main aquifer in Syria. It is considered a very productive aquifer. Wells tapping this aquifer can easily yield more than 2000 m^3/day. The mountain chain of South Eastern Turkey is believed to be one of the main sources of recharge water. It is recommended to tap into this aquifer by installing a series of deep wells. The installation of two exploratory wells of about 800 to 850 m depth was just completed. Based on the results of the pumping tests conducted on the two wells, each of these wells can easily sustain a yield of more which exceeds 2000 m^3/day. Thus water demand during the operation phase would be supplied from the two aquifers. Initially, the daily extraction volume would be higher from the shallow aquifer than that of the Cretaceous aquifer. . However the factory should extract from the deep aquifer to eliminate the risk of running out of water.

The initial rate would be set upon completion of rehabilitation and pump test activities of the four existing shallow wells. The pumping test program would include pumping from all the proposed shallow wells for a period of about 1 month to estimate the combine pumping capacity and to make more reliable projection of the water level drop in the aquifer through time.

During the plant operation, the extraction rates from the two aquifers would be gradually adjusted based on the results of a monitoring program to be designed and implemented, which consists of monitoring the groundwater levels and water quality parameters such as temperature and conductivity, specifically in the shallow aquifer. It is proposed to install 4 monitoring wells and install a probe that is equipped with a water level, temperature, and electric conductivity sensors, as well as a built-in data logger for continuous measurements of the parameters. Similar probes are also recommended to be installed in all the production wells that should also be equipped with a flowmeter, for continuous monitoring of the discharge flow.

6.5.4 Findings

The sampling campaign, hydrogeological study and geophysical survey revealed the following:

- The sample collected from the shallow well (SCC-03) is typical of a carbonate aquifer displaying higher end calcium and bicarbonates; Total dissolved solids of 185 mg/l, along with a conductivity measured during pumping show that water is characterized by a relative normal mineralization. Concentrations of nitrates are below acceptable maximum standard limit (< 50 mg/l). However the presence of nitrite denote of a prevailing process of denitrification (i.e. reduction of nitrate into nitrite). The nitrite content falls beyond allowable maximum limits. The nitrite and nitrate are resulting from agricultural contamination.. This seems to indicate that there is surface to aquifer contamination – implying the need for careful site management

- The well and spring survey revealed the presence of about 49 wells mostly tapping the Paleogene aquifer. The depth of the wells varies between 65 and 190 m below ground (BG). Discharge rates vary between 0.2 and 25 l/s, i.e. 18 to 2,160m^3/day. The wells are the only source of domestic and agriculture water;

- The study area's water bearing layers include respectively the Neogene/Paleogene, and the deep Cretaceous strata. The results of the study have revealed the presence of two main aquifers in the area: the Paleogene shallow aquifers which are currently being exploited in the region; and the Limestone aquifer of middle Cretaceous, which is practically not being used.

  - Based on field surveys, most of wells drilled in the Paleogene to the east to the factory site are dry. The Palegoene appears to be characterized by significant recharge and considerable yields based on the pumping tests results, however, it may not consist of a sustainable source mainly because of seasonal fluctuations of the direct recharge, spatial heterogeneity of the aquifer, increasing overexploitation for irrigation purposes by local communities;

  - A major northeast-southwest trending fault passes through the tip of Jabal Kharab Ichk, Kharab Ichk, and Haliba villages to the east of the study area, resulting in a water divide extending along the crest of Jabal Koujouk and Jabal Kharab Ichk. The east-south east flow of ground water is deflected by the water divide to the south of the project area resulting in a sink zone where ground water accumulates under the project site.

  - The Cretaceous aquifer lies at a depth of 700-800 m in the area of the cement factory and is considered as a potentially important water bearing layer having significant yields.

6.5.5 Assessment of Impacts

As previously mentioned, due to the lack of surface water resources as well as local physical infrastructure (i.e. public water distribution network) in the study area, SCC's proposed plan is to use local groundwater resources to meet its high water requirement. Consequently, the assessment of impacts on the water environment is limited to evaluating:

- Impacts on groundwater availability and accessibility with respect to the currently exploited wells in the study area as well as the project's water needs during the construction and operation phases; and
- Impact on groundwater quality as a result of construction activities and drilling operations.

6.5.5.1 Potential Impacts during Construction Phase

Impacts from Water Consumption

During the project's construction phase, the average water demand is calculated at 400m^3/day. Considering the peak period requiring an estimated 1,800 workers, the maximum demand is estimated at 600m^3/day. It is estimated that the main water consumption will be used for construction purposes (75%) and associated operations; whereas the remaining 25 % would serve for domestic purposes. Table 6-10 describes the main water consuming activities during the construction phase.

Table 6-10 Anticipated Water Demand and Distribution during Construction

PHASE	FACILITY	DESCRIPTION OF WATER REQUIREMENTS	DAILY CONSUMPTION RATE
Construction	Quarries (Basalt and Limestone)	No anticipated quarrying operations	None
	Cement plant and Power plant	**Domestic Purposes** Water supply for construction workers with an average number of 500 workers. Upon construction of power plant, the peak number of workers will be about 1,800 workers (over a period not exceeding 12 months)	50 m^3/day to 180 m^3/day (Average 100 m^3/day)
		Construction Purposes Cement mixing, dust suppression and vehicle wash down	200 m^3/day to 400 m^3/day (Average 300 m^3/day)

The project's construction phase is expected to secure its water requirements from the two existing shallow wells tapping the Paleogene aquifer (referred to as SCC-03 & SCC-04). The Paleogene aquifer within the site boundary appears to have a relatively high transmissivity. Each of these two existing wells tapping this aquifer can easily yield more than 2000 m^3/day.

The projected maximum water level drops, as a result of pumping for a period of 50 years at a rate of 4500 m^3/day and 7000 m^3/day and assuming no recharge, is note expected to exceed 3 m and 5 m respectively. These drops would take place in the production wells however the average drop within the water table is not anticipated to exceed 1 to 2 meters.

The recharge basin was estimated to extend over an area of 148 km^2 however the water balance could not be estimated since the study did not extend over the entire basin. As such, assuming that the groundwater recharge is induced only by water infiltration as a result of rainfall within the property boundary which covers an area of about 14 km^2, the average recharge is estimated at about 784,000 m^3/year (i.e. around 2,150 m^3/day). This value is most probably very conservative; the recharge may most likely be significantly higher, but still below the water demand during the plant's operation, but above that during the construction phase.

Since saving natural resources such as water is a vital part of Lafarge Co. policy, SCC will set a goal for preserving this scarce natural resource by:

- Reducing water consumption and increasing recycling operations in all production units. This will include, but not exclusively, collection of washing and cooling water, supervising water consumption and reusing treated wastewater (once wastewater treatment plant is operational) as part of its water saving measures
- Exploitation of the limestone aquifer, to reduce the stress of the shallow aquifer. Installation of two production wells tapping the Cretaceous limestone aquifer.
- Development of a detailed monitoring plan. A network of 4 -5 monitoring wells will be established within the boundaries of the proposed plant site. The wells will be tapping the shallow Paleogene aquifer and equipped with sensors with built-in data logger installed in each monitoring well for continuous measurement of water levels and fluid conductivity.

Therefore, impacts on the shallow aquifers from daily groundwater extraction of 400m^3 to 600m^3 during the construction phase are considered of **Minor** effect with a **Medium** likelihood of occurrence **(2B)**. Additionally, impacts from water consumption can further be reduced to as low as reasonable practicable (ALARP) by adopting water control and saving measures as proposed by SCC (e.g. reuse of water in de-dusting operations…).

Impact on Groundwater Quality

The degree of vulnerability of these groundwater resources is assessed according to:

- Geology of the study area: The risk of contamination is assessed based on the depth of the water table and permeability of the geological layers between the surface soil and groundwater. Rock formations help understand the rate of infiltration and permeability level (hydraulic conductivity);
- Soil and field characteristics: The susceptibility of the soil or field site to leaching or runoff should be determined. Soil texture and organic matter content particularly influence chemical movement into groundwater whereas the slope of the field influences surface runoff.
- The type of contaminant: solubility, stability, leaching capacity, biodegradability etc…
- The current use of the water wells: Direct human consumption, crop irrigation, etc…

In general depending on the contaminant, soil contamination eventually finds its way to groundwater unless an impermeable layer blocks its infiltration, or if the soil is remediated in time.

Potential sources impacting groundwater quality are likely to include:

- Construction and site clearance activities;
- Wastewater Discharge;
- Well Drilling operations; and
- Accidental chemical or oil spill from the project's operations (e.g. refuelling operations).

Impact from Construction Activities

Civil works mainly site clearance activities include the removal of vegetation, land cover, tree stumps and roots creating a suitably flat working terrain and corridor for succeeding crews. The main concern related to groundwater resources is the use of chemical pesticides while controlling the area's vegetation. Herbicides that are highly soluble, relatively stable and not readily adsorbed to soil tend to have a greater potential to leach hence spreading the contamination into groundwater reservoirs and contaminating the local communities' water supply (used for domestic and irrigation purposes).

Impacts arising from site clearing activities while using chemical control measures are considered **Significant** with a **High** likelihood of occurrence given the large amount of land cover and vegetation to be cleared and the existing use of these wells. With no mitigation and control measures in place, the impact is expected to be long-term and irreversible **(4C).**

In order to reduce, if not eliminate, such impacts, it is recommended to:

- Using biological, mechanical or thermal control measures;

- Restricting, if not completely avoiding, the use of chemical herbicides while controlling the area's vegetation;

- Clean up spills if any with an absorbent material such as cat litter. Chemicals spilled near wells can move directly and rapidly into groundwater. Chemicals spilled near ditches or streams can move rapidly into surface water.

- Selecting properly the location of mixing areas; Mixing and loading of pesticides should be done on an impervious pad whenever areas show limestone, marl or conglomerates formations. If mixing is done in the field, it is recommended to change the location of the mixing area regularly and whenever possible choose areas with clayey or basaltic soils.

- If chemical pesticides are applied, concentrates need to be carefully measured before they are placed into the spray tank. Do not "add a little extra" to ensure the herbicide will do a better job. Such practices only increase the likelihood of injury to the treated crop, the cost of pest control, and the risk of groundwater contamination.

By adopting the proposed control measures, the impacts on groundwater contamination from pesticide use would be **Negligible (1C).**

Impact from Wastewater Discharge

The quantities of mixed sanitary and domestic wastewater (black and grey) that will be generated from camp site operation during project lifetime are estimated at 90m^3/day during from the construction base camps and 135m^3/day from the operation base camps. Improper disposal of generated wastewater could result in groundwater contamination with chemical as well as biological contaminants. Also, secondary impacts from mixed wastewater discharge and storage can include odor generation, and attraction of flies and incidence of associated vector diseases.

If no mitigation and control measures are in place, the potential effects of the small volume of discharge are anticipated to be **Significant** and its occurrence **High (4C).**

As part of SCC's proposed Waste Management Plan, septic tanks will be designed to handle wastewater generated from the existing facilities/base camps therefore no untreated sanitary wastes or wastewaters will be discharged to the land or to the permanent surface water bodies (such as wadis, irrigation canal...) from the different sources (base camps, civil works, etc.). Additionally, storage of mixed wastewater shall be done in closed lined septic tank excavated on site.

Measures to be integrated in the design of septic tanks and in the management of wastewater include:

- Providing the septic tanks with an overflow to an open pit where evaporation will take place. **Pit Design:** A liner should be installed so that the bottom and sides of the pit have a coefficient of permeability of no greater than 1 x 10^{-7} centimeters per second (cm/sec); The pit should be constructed to a depth of typically no less than 5 m above the seasonal high water table; Measures such as careful siting, or installation of berms should be adopted to prevent natural surface drainage from entering the pit or breaching during heavy storms. It is recommended to install a perimeter fence or screen around the pit to prevent access by people, livestock and wildlife.

- Waste water pit shall be constantly monitored by site camp responsible. Wastewater shall be evacuated from pit by a local subcontractor with sealed lined steel containers mounted on trucks when septic pit is filled to avoid wastewater overflow.

With the proper application on the wastewater management plant, impact on groundwater quality from wastewater storage in septic tanks is expected to be **Minor** and its occurrence **Low** and the proper application of the above listed mitigation measures **(2A)**.

Impact from Groundwater Quality from Drilling Activities

With regards to the proposed drilling campaign of the two new wells tapping the deeper Cretaceous aquifer, the anticipated wells will penetrate aquiferous formations, namely the Neogene aquifer, Paleogene aquifer (currently exploited), and Cretaceous aquifers. Upon drilling, the contact of drilling fluids, and any other substance present on the drilling tool might interact with the local host formation. Additionally, exchange among the borehole, and all the penetrated formations may occur, which leads to water mixing, groundwater contamination and cross contamination. Subsequently, the potential impacts include:

- Contamination from pollutants in contact with the water bearing layer and travel horizontally or vertically, upon drilling with contaminated bits in water bearing formations;

- Contamination due to improper casing installation, leakages in the annular spacing, infiltration of surface contaminated water, improper grouting, improper material for grouting, cracks or deteriorated casing, use of shrinkable grouting material; and

- Infiltration of oils and pollutants into the well through the annular spacing or directly in the well.

The impacts from drilling operations are generally local, short-termed (if no contamination occurs) but of a **Significant** effect and **high** likelihood of occurrence particularly concerning the Paleogene aquifer **(4C)** due its current usage by local communities.

In order to prevent cross contaminations and pollutants, drilling fluids, from penetrating into surrounding aquifers, spread into uncontaminated deeper hydrogeological units, especially in water bearing formations, measures should be as follows:

- Identification and reporting of water bearing formations and water losses;
- Sampling of water (if necessary);
- Proper sealing of the non exploited formations with casings and grouting (to achieve an optimal annular space seal) ;
- Casing should not present open spaces and should be tested for leaks prior to casing installation;
- Ensuring that the sealing grouting is properly installed, coupled with a continuous monitoring for cracks, or potential deterioration,
- All equipments shall be cleaned and decontaminated prior to passing through the aquiferous formations;
- Ensure an appropriate storage of well equipment,
- Using of chemically inert expandable material for grouting and drilling, to avoid physical deterioration upon contact with water,
- Unfinished borehole should be temporary sealed with special caps
- Use of water-based fluids including non-toxic chemicals;

By adopting the following measures, the impacts from well drilling activities could be reduced to **Minor (2B)** of **Medium** likelihood of occurrence.

Impacts from Accidental Hydrocarbon/Chemical Spills

The major potential sources of accidental spills include mainly improperly constructed or positioned dump pits, and diesel supplies for power generation. Other minor sources include hydraulic oil, fuels and lubricating oil as part of routine rig operations and vehicular maintenance.

- Pollutants like light Alkaline and monocyclic aromatic hydrocarbons (benzene, toluene, ethylbenzene etc…) tend to evaporate from surface spill and/or biodegrade readily;
- Pollutants like heavy metals and Poly aromatic hydrocarbons (PAH) do not evaporate, they accumulate in sediments, or might, with a decreasing viscosity and surface tension, penetrate to the subsurface formations and remain entrapped into voids and pores, and/or travel large distances;

Additionally, one of the major adverse impacts on soil caused by TPH contamination (particularly oil and grease) is the alteration of the soil's hydraulic properties, such as hydraulic conductivity. Hydraulic properties of soil are affected by soil physical properties such as soil texture. As the latter changes so does the soil-water holding properties. The introduction of a relatively low amount of oil contamination inhibits the movement of water hence prohibiting future water infiltration and soil aeration.

Given the soil profile, it should be noted that the major soil cover (clayey and basaltic soils) in the area has a relatively high thickness and a capacity of retention, which renders the soils adept at dealing with the diesel spills and heavy metal releases. However, in areas were limestone sediments predominate, spills may reside in soil layers and adsorb to soil grains. If conveyed to subsurface formations they might remain for long time in remote isolated fractures, small traps, and pools, especially in limestone formations.

Though spills and accidental events have a **high** likelihood of occurrence, impacts on the groundwater quality from spills are considered **Negligible (1C)** given the relative depth of the underlying Neogene and Paleogene aquifers (130 – 160 m below ground (B.G.)), depth of static water level (30 m and 110m B.G.).

General mitigation measures to avoid accidental leaks and spills and control procedures (in case of leak) include:

- Routine inspection and maintenance of equipment to ensure that risk of leak/spill is minimized;
- Promotion of good housekeeping during operation and maintenance;
- Availability of Tier One spill response kits on the drilling location and at the camp sites to mop up small spills.
- Ensuring a supply of suitable absorbent materials is available at re-fuelling points for use in dealing with minor spills. If a leak or spill occurs during loading or offloading operations, the operations will be stopped and the spill will be contained, cleaned up and collected.
- Spills from generators, chemicals or disposed waste onsite shall be reported readily in order to seek immediate remedial;
- Drip trays will be installed underneath equipment such as diesel generators to contain leakage. The drip trays will be maintained and kept drained of rainwater;
- Control and supervision of refueling at all times by appropriate personnel: Checks to fill hoses, valves and nozzles for signs of wear and tear prior to operation;

6.5.5.2 Potential Impacts during Operation Phase

During the project's operation phase, the total water demand will be about 7000m^3/day, most of which will be used for industrial purposes mainly cooling for the cement plant processes and the power plant's steam turbines and to a lesser extent for the operation of the quarries. Water consumption for domestic purposes is not expected to exceed 200m³/day. The main water consuming activities during the operation phase are described in Table 6-11 below.

Table 6-11 Anticipated Water Demand and Distribution during Operations

PHASE	FACILITY	DESCRIPTION OF WATER REQUIREMENTS	DAILY CONSUMPTION RATE
Operation	Quarries (Basalt and Limestone)	**Domestic Purposes** Water supply for local workers (40 workers/quarry site) working an 8 hours/shift/day with no base camp envisaged for quarrying operations	<50 m³/day
		Operation Purposes Operations such as water spraying for dust control, and rock crushing activities	350 m³/day
	Cement plant and Power plant	**Domestic Purposes** Water supply for workers with an average number of 500 workers in cement manufacturing, 85% of which are nationals i.e. base camp to accommodate for a maximum of 100 workers Power plant base camp expected to accommodate 30 – 40 workers (non-nationals)	150 m³/day
		Cement Plant Processes Cooling purposes	2,000 m³/day
		Power Plant Processes Steam turbines	5,000 m³/day

Impact from Water Consumption from Aquifers

As previously mentioned, the hydrogeological study was conducted to evaluate the groundwater resources of the area. The study also served to provide recommendations for a pumping scheme to meet the water demand during the plant's operation, which was previously set at about 2000 m³/day. This initial plan did not accommodate for the construction and operation of a coal-fired captive power plant (CPP), given that the Syrian government was supposed to secure the proposed cement plant with its electric power needs. Consequently, the water demand during the project's operation phase has increased to about 7000 m^3/ day.

With regards to groundwater extraction of about 7000 m^3/day from the abovementioned shallow wells to sustain the project's operational phase (i.e. cement manufacturing and electricity generation), could potentially cause water shortage/reduction for the other existing users (i.e. land farm and crop irrigation).

Such impacts on water availability have a **High** likelihood of occurrence due to over-exploitation of the shared Paleogene aquifer and are considered of **Significant** effect **(4C)** particularly when local livelihoods are compromised.

As part of the proposed mitigation measures to reduce on these anticipated socio-economic impacts as well as on the aquifer itself (i.e. to prevent lowering the water table within the area), in addition to securing the water requirement for sustaining the project's operation phase, a supplemental source of water was investigated.

The deep aquifer of Middle Cretaceous may likely be the supplemental source of water. This aquifer is one of the main aquifers in Syria regarded as a very productive aquifer. Wells tapping this aquifer can easily yield more than 2000 m^3/day. The mountain chain of South Eastern Turkey is believed to be one of the main sources of recharge water. It is recommended to tap into this aquifer by installing a series of deep wells. Currently, two exploratory wells of about 800 to 850 m depth are in the process of being installed. Preliminary results of the first well confirm its high sustainable yield which exceeds 2000 m^3/day (about 2,500m^3/day). Thus water demand during the operation phase would be supplied from the two aquifers.

As aforementioned, the wells drilled in the study area are mainly tapping the shallower Neogene/Paleogene aquifers. Water abstracted from these wells is used for domestic and irrigation purposes. Therefore, impacts from drilling and exploiting the deeper Cretaceous aquifer on the current users (i.e. local settlers) and groundwater availability are **unlikely to occur** and as such are considered of **Negligible** effect **(1A)**.

As aforementioned, the wells drilled in the study area are mainly tapping the shallower Neogene and Paleogene aquifers (depth of wells 60m - 190m). Water abstracted from these wells is used for domestic and irrigation purposes. Therefore, impacts from drilling and exploiting the deeper Cretaceous aquifer (800 m B.G.) on the current users (i.e. local settlers) and groundwater availability are **unlikely to occur** and as such are considered of **Negligible** effect **(1A)**.

Impact from Wastewater Generation

The wastewater streams typical generated from cement plant and coal fired thermal power plant mainly generated from utility operations for cooling purposes in different phases of the process (e.g. bearings, kiln rings, cooling tower blowdown). Cooling tower blowdown from power stations tends to be very high in total dissolved solids but is generally classified as non-contact cooling water and, as such is typically subject to limits for pH, residual chlorine, and toxic chemicals that may be present in cooling tower additives. Machinery and vehicle washing water will be contaminated with residual oil and fuel along with predicted high TSS levels. Stormwater flowing through pet–coke, coal, and waste material stockpiles exposed to the open air may also become contaminated. Domestic wastewater will be generated from the manpower camps and office facilities.

Impacts from wastewater generation from the SCC project are expected to have moderate impact (3B) on the study area environment, due to the lack of public facilities to accommodate these waste streams.

SCC have designed the plant so as to recycle wastewater as much as possible. Cooling water shall be recycled, but prior to recycling; it shall be cooled in a cooling tower before discharge into a retention pond (physical settling) from where it will be reused for dust control and general cleaning purposes. Process wastewater will be preliminarily treated in sedimentation for suspended solids reduction using settling basins. Treated wastewater will be used for dust control and general cleaning purposes. SCC shall adhere with IFC wastewater disposal guidelines for "Cement Manufacturing" and "Thermal Power Plants" in addition to the Syrian Maximum Limits for Wastewater Discharge into Land (2580/2008). Domestic wastewater generated from workers accommodation units and general cleaning areas will be treated in a secondary wastewater treatment plant. The treated wastewater will be reused for irrigation of green areas around the cement plant. SCC shall adhere to national Syrian standard 2752 dated 2003 (decision No. 72) set the limits for re-use of treated wastewater for irrigation purposes. All washing water will be diverted to a settling tank fitted with oil traps before reuse or final disposal. Stormwater will be prevented from contacting stockpiles by covering or enclosing stockpiles and by installing run-on controls. Recommended pollution prevention techniques, listed in IFC EHS guidelines for cement manufacturing, for dust emissions from stockpiles of raw materials, clinker, coal, and waste will also be adopted by SCC to minimize contamination of stormwater

With recycling inherent in the design of the plant facility the impacts from wastewater generation from the SCC project is expected to have minor impact (2A) on the study area. Positive environmental impacts are anticipated due to the proposed water conservation measures through the proposed wastewater reuse schemes.

6.5.6 Summary of Impacts and Ratings

Table 6-12 Impacts on Water Environment Before and After Mitigation Measures

IMPACT	RATING BEFORE MITIGATION	RATING AFTER MITIGATION
Impact from water consumption of shallow aquifers during construction phase	2B	2B
Impact from Construction Activities/Site clearance	4C	1C
Impact from Wastewater discharge during construction	4C	2A
Impact from drilling operations of new wells	4C	2B
Impact from Accidental hydrocarbon/chemical spills	1C	1C
Impact from water consumption during operation phase	4C	2B
Impact if waste water discharge during operations	4B	2A

6.5.7 Conclusions

Generally, the project's construction phase is expected to secure its water requirement sustainably taking into account its peak period with an estimated daily requirement of 600 m^3 without potential repercussions on the already exploited Paleogene aquifer or even land farmers.

A supplemental source of water is suggested to help alleviate the stress on the shallow Paleogene aquifer as well as to mitigate, if not prevent, potential implications on the current users while supplying at the same time the project's operations with water requirement.

It is expected that initially, the daily extraction volume would be higher from the shallow Paleogene aquifer than that of the Cretaceous aquifer. The extraction rates from the two aquifers would be gradually adjusted based on the results of a monitoring program to be design and implemented, which consists of monitoring the groundwater levels and water quality parameters such as temperature and conductivity.

As for groundwater quality, spills and discharges from drilling operations and construction activities are highly likely to occur yet of minor effect given the soil characteristics of the study area as well as dept of the underlying aquifers. Impacts can be reduced to Negligible when appropriate emergency response procedures and good housekeeping practices are in place.

6.6 POTENTIAL IMPACT ON NOISE QUALITY AND VIBRATION

6.6.1 Introduction

The study Area is predominantly rural in nature and not generally exposed to high levels of noise or vibration levels as determined from the baseline survey. Any excessive noise will have a detrimental effect on peoples' health and may increase annoyance and raise complaints. Similarly, any excessive vibration levels will have detrimental impacts on the integrity of the building structures of nearby communities which is mostly constructed from mud.

The construction and operation of the proposed SCC project will likely generate noise and vibration levels that could potentially elevate the baseline condition possibly causing disturbance or damage to nearby surrounding communities.

This section addresses the potential noise and vibration impacts during both phases through identification of sensitive receptors, determining primary sources of noise and vibration generation, assessment of the potential impacts and their significance and finally proposing mitigation measures following Best Available Techniques (BAT).

6.6.2 Legislative Requirements

6.6.2.1 Applicable Noise Level Standards

The Syrian ambient noise quality standards (Environmental Law No. 50 - article 26 paragraph 1 (13th of October, 2002) are presented below.

Table 6-13 Permissible threshold ambient noise level standards in different areas (Dated 13/10/2002)

TYPE OF AREA	PERMISSIBLE THRESHOLD NOISE LEVEL STANDARDS IN DIFFERENT AREAS		
	DAY (7:00 AM → 6: 00 PM)	EVENING (6:00 PM → 10:00 PM)	NIGHT (10:00 PM → 7:00 AM)
Commercial, administrative and downtown area	55-65	50-60	45-55
Residential area with some workshops, commercial businesses or at a main road	50-60	45-55	40-50
Residential area inside the city	45-55	40-50	35-45
Residential suburban area with weak traffic flow	40-50	35-45	30-40
Residential rural areas, hospitals and public parks	35-45	30-40	25-35
Industrial areas (heavy industry)	60-70	55-65	50-60

National limit for the exposure to work-place noise have been defined for the maximum number of hours of exposure for a given noise level as tabulated in Table 6-14.

Table 6-14 Permissible threshold Occupational noise level standards in different areas (Dated 13/10/2002)

TYPE OF LOCATION AND ACTIVITY	PERMISSIBLE THRESHOLD NOISE LEVEL (DB(A))
Work place with 8hr shift and for the purpose of minimizing hearing loss risks from noise pollution	90
Work place that requires both verbal and audio communication	80
Work plan that includes monitoring, measuring, operation control and high demand activities	65
Work place that includes working on computer, typing machine or similar devices	70
Working place that requires routine mental focusing activity	60

National limits states that Instant noise level must not exceed 135 dB(A). Similarly, noise level exposure during an 8 hr working shift must not exceed 90 dB(A). In case noise level exceeds the 90 dB(A), the exposure duration must be reduced according to Table 6-15.

Table 6-15 Noise Reduction Rates

NOISE LEVEL DB(A)	95	100	105	110	115
EXPOSURE TIME (HRS)	4	2	1	1/2	1/4

6.6.2.2 *Applicable Vibration Limits*

Explosives will be used during quarrying activity (for fragmentation of rocks) but only a part of the explosive energy is used in doing the useful work, the rest is dissipated as ground vibrations and noise. In the absence of vibration limits in the Syrian legislations, the following safe blast vibrations limits of various countries are recommended below.

Table 6-16 Blast Vibration Limits of Various Countries

COUNTRY	Ppv (mm/s)	FREQUENCY (HZ)	*TYPE OF STRUCTURE*
Germany	3	<10	*Sensitive structure*
	3-8	10-15	*Domestic house*
	8-10	50-100	*Industrial structure*
U.S.A	13	<40	*Older houses*
	19	40	*Modern houses*
	50	>40	*Al structures*
Australia	2	-	*Historic buildings & monuments*
	10	-	*Houses & low rise buildings*
	25	-	*Commercial and industrial buildings or structure of reinforced concrete or steel construction*

6.6.3 Approach and Methodology

The methodology for the noise and vibration assessment included:

- A field assessment of the EIA study Area was undertaken on 9th of March 2008 to establish baseline noise level and record the type and location of sensitive receivers.
- Ambient noise measurements were taken during the day time. Noise monitoring was performed using the CIRRUS - Model CR: 811C integrated noise meter at four locations surrounding the SCC project site. Recorded noise levels were assessed in accordance with Syrian permissible ambient noise levels for rural areas.
- Inventories of potential sensitive receptors and land use were recorded based on field visits and aerial photos. The identified receptors were geo-referenced using hand held GPS equipment during the site visit. Distance and direction from planned project activity sites were determined.
- An inventory of the primary noise sources were identified and noise levels were determined for each phase of the project, i.e. construction and operation, and for each location, i.e. (1) Basalt quarry site; (2) Limestone quarry site; and (3) cement plant. The noise levels were estimated based on available literature and from the noise model database.
- Noise control measures planned at each site within the SCC project were determined based on the planned project design, operation activities and field visit to the study Area. General observation of land topography, vegetation cover and other natural noise barriers were recorded during the field visit. The cumulative noise reduction level between the sources and receivers was estimated from available literature.
- Noise modelling was conducted using the Roadway Construction Noise Model (RCNM). The RCNM is the USA Federal Highway Administration's (FHWA) national model for the prediction of construction noise. The RCNM provides a construction noise screening tool to easily predict noise levels and determine compliance with noise limits for a variety of projects of varying complexity. The use of the RCNM was further extended to predict the noise levels at each receiver during operation phase.
- Noise limit criteria were defined based on the most stringent Syrian ambient noise limit standards for rural area. Criteria for impact significance were defined based on human perception to noise level increase.
- The results of the noise modeling were assessed in accordance with the defined noise limit criteria.

6.6.3.1 Noise Modelling Methodology

Common Methodology

- Construction noise modelling conducted only for day-time period (construction limited to day-time).
- Quarry operation noise modelling conducted for day-time only as daily work will be based on a single eight hours/day shift and six days/week.
- Cement plant operation noise modelling conducted for 24 hrs period (day – evening – night-time).
- Linear distance between source and receiver estimated from aerial photos and maps.
- Assumptions were made regarding the minimum type of noisy machinery and equipment to be used during the construction/operation phases.
- Conservative sound powers – as per piece of equipment presented in the RCNM model database and available literature.
- Noise shielding effects estimated based on land topography, barriers erected and vegetation cover between sources and receptor.
- The most stringent Syrian noise level limits for residential areas in a rural setting will be adopted as the limit criteria for assessment.
- Noise impact severity on receptors assessed following the semantic scale presented in Table 6-17 below.

Table 6-17 Noise Impact Severity Rating

CRITERIA NOISE LIMIT EXCEEDANCE	*SCALE RATING*
0 to < 3 dB(A)	*Not significant*
3 to 5 dB(A)	*Minor level*
6 to 10 dB(A)	*Moderate level*
> 10 dB(A)	*Significant level*

Specific Approach for Noise Modelling from Quarry Operation

- Linear distances from source to receptor measured from two locations (1) at the boundary premises and (2) from centre of each quarry site.
- Modelling for quarry operation scenarios:
    - *Worst Case Scenario:* (1) Mining taking place at the quarry surface, (2) Mining taking place at the boundary of the licensed quarry area at shortest distance with the noise receivers, and (3) all noisy equipment are operated continuously and simultaneously.
    - *Best Case Scenario:* (1) Mining progressing underground and (2) progressing further from receivers towards centre of licensed quarry area; and (3) all noisy equipment are operated continuously and simultaneously.

- Noise emissions from blasting activity not included in modelling for both scenarios.
- Conservative noise shielding effect due to land topography and noise barriers (concrete walls, hills, valleys, vegetation cover, etc.) estimated to have cumulative noise reduction of around 10 dB(A) between the sources and receptors.

Specific Approach for Noise Modelling from Cement plant Construction and Operation

- Construction noise modelling: Distances measured from the cement plant boundary to receptors
- No noise shielding effect used in the construction noise modelling.
- Operation noise modelling: Distances measured from the center of cement plant (at cement production line) to receptors
- Assuming steady state operation during 24 hrs during noise operation modelling.
- Conservative noise shielding effect estimated to be around 10 dB(A) during operation modelling.

6.6.4 Findings

6.6.4.1 Current Status of Ambient Noise Level

It is evident that at any setting, both the frequency and magnitude of environmental noise may vary considerably over the course of the day and even on an hourly basis. In the case of the proposed SCC project, the project site is primarily located along a rural range and agricultural areas with no industrial or commercial activities with very sparse low populated centres. This implies that noise sources are predominantly natural (e.g. wind).

The existing ambient noise levels recorded during daytime in the project area were non-intrusive ranging between 28 to 40 dB(A), as anticipated, and well within the Syrian ambient noise level standards for rural area (45 dB(A)). It should be noted that these recordings are reflective of the daytime and that noise levels during night time are expected to decrease considerably.

Table 6-18 Ambient Noise Levels recorded on site

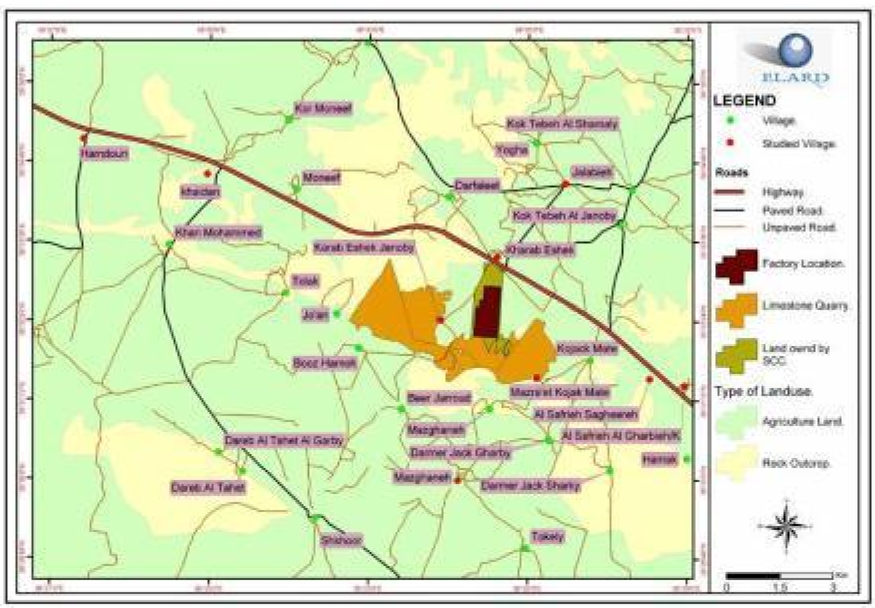
				NOISE LEVEL DB(A)		
SYMBOL	LATITUDE	LONGITUDE	DIRECTION FROM SCC SITE	MINIMUM	MAXIMUM	AVERAGE
A1	36°33'09.83"N	38°31'09.08"E	West	17.4	65.7	34.1
A2	36°33'29.02"N	38°35'23.96"E	North	17.8	76.9	40.3
A3	36°30'11.88"N	38°37'25.64"E	East	18.4	71.3	40.1
A4	36°31'44.47"N	38°37'06.78"E	South-East	18.6	55.7	28.7

6.6.4.2 Inventory of Potential Sensitive Receptors

A number of settlements were identified within the study area. The latter encompasses 33 villages; out of which 6 villages are located around the Basalt quarry. All identified villages share similar socio-economic and urban characteristics.

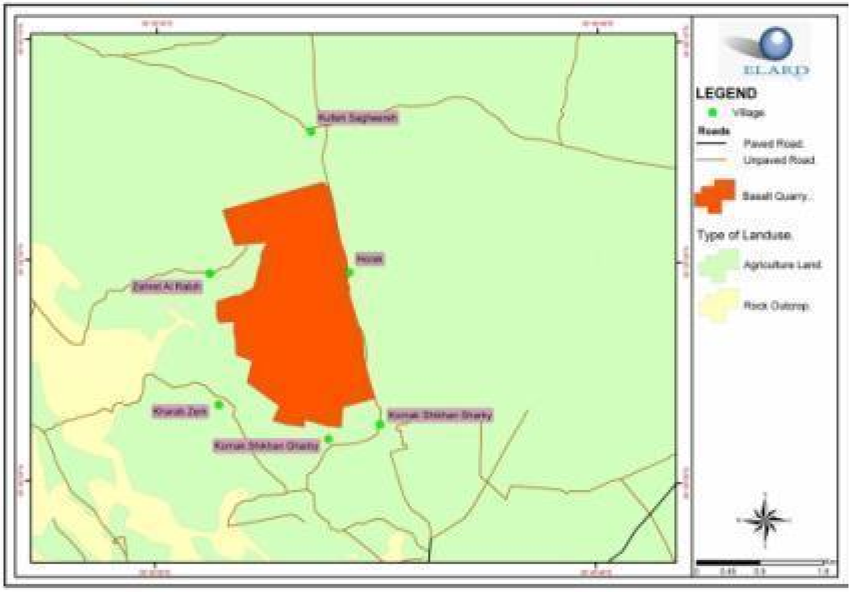
In general, the total population in the study area and the surrounding villages is approximately 5,397 inhabitants. With an average of 7 members per household, a total of 769 houses are recorded. About 62% of the houses in the area are mostly mud-based, while only 35% are made from cement and the remaining 2% from stone. The distribution of population clusters and the types of land use around the limestone and cement plant site are presented in the following map.

The study area's topography is defined in some part as a flat terrain (mostly to the north of the cement plant) and in another as an undulated area with several hills and small valleys (mainly around the quarry sites). Elevations of the basalt and limestone quarry sites range between 400 to 440 m and 440 to 560 m respectively. The land-use in the study area is dominantly agricultural lands.



Map 6-1 Population Clusters and Land-Use surrounding the Limestone Quarry and SCC Plant Site

Map 6-2 presented below also shows the distribution of population clusters and the types of land use around the Basalt quarry site.



Map 6-2 Population Clusters and Land-Use surrounding the Basalt Quarry Site

Table 6-19 and Table 6-20 list the name, geographic coordinates, distance and direction of each receptor from each project site location.

Table 6-19 Identified Villages around Limestone Quarry and SCC proposed Cement Plant

VILLAGE NAME	LAT	LONG	DIRECTION	DISTANCE FROM CEMENT PLANT BOUNDARY (KM)[1]	DISTANCE FROM LIMESTONE QUARRY BOUNDARY (KM)
Beer Jarroud	38.56038	36.51773	South West	2.89	1.47
Booz Hamoh	38.54688	36.53315	West	3.25	0.52
Dareb Al Tahet	38.5105	36.50196	South West	7.51	5.45
Dareb Al Tahet Al Garby	38.50294	36.50672	South West	7.9	5.43
Darfaleet	38.57493	36.57128	North West	2.68	2.40
Darmer Jack Gharby	38.60678	36.50997	South East	3.23	1.85
Darmer Jack Sharky	38.62588	36.50234	South East	4.9	3.20
Jo'an	38.53986	36.54174	West	3.88	0.39
Khan Mohammed	38.48715	36.55907	West	8.93	5.48
Kharab Eshek Al Shamalieh	38.58945	36.55602	North	0.7	1.53
Kojack Mate	38.61952	36.53018	East	2.71	0.96
Kok Tebeh Al Janoby	38.62911	36.56421	North East	3.81	3.52
Mazar Khan Mohammed	38.48533	36.55405	West	8.8	5.45
Mazghaneh farm	38.57805	36.49983	South	4.04	0.88
Moneef	38.52722	36.57313	North West	6.02	3.25
Shkhoor	38.53329	36.49018	South West	6.81	5.46
Tolak	38.52384	36.54694	West	5.35	1.93
Yogha	38.60231	36.58496	North	4.15	4.99
Al Safrieh Al Gharbieh	38.64918	36.52382	East	5.44	3.59
Al Safrieh Sagheereh	38.63823	36.52552	East	3.9	2.59
Hamdoun	38.46007	36.58565	North West	12	9

Jalabieh	38.61164	36.57473	North East	3.42	4.69
Karab Eshek Janoby	38.57239	36.54024	West	0.83	0.07
Khaidan	38.49905	36.57689	North West	8.2	5.60
Kharab Eshek	38.59022	36.55612	North	0.83	1.33
Mazghaneh	38.58807	36.51781	South	2	2.67
Mazra'et Kojak Mate	38.60265	36.52573	South East	1.6	0.10

[1] On average an additional 1000m to be added for distance between centre of plant and receptor

Table 6-20 Identified Villages around Basalt Quarry

VILLAGE NAME	LAT	LONG	DISTANCE TO THE BASALT QUARRY BOUNDARY (M)[1]	DIRECTION
Horak	36.64258	38.64075	On the quarry border (<50 m)	East
Kornak Shikhan Sharky	36.62333	38.64573	On the quarry border (<50 m)	South
Kulteh Sagheereh	36.66047	38.63458	520	North
Zahret Al Rabih	36.64238	38.61855	250	West
Kharab Zerk	36.62575	38.62007	370	South West
Kornak Shikhan Gharby	36.62144	38.63751	100	South

[1] On average an additional 1000m to be added for distance between centre of quarry and receiver

6.6.4.3 *Inventory of Primary Sources of Noise Emissions*

Noise emissions will be generated from a number of activities that will take place, including:

- Construction activities at the cement plant site;
- Mining activities at the basalt and limestone quarry sites;
- Cement plant operation; and
- Traffic flow for transportation of raw material and final product.

Construction Activities

The planned construction program of the SCC plant will only take place during daytime period (i.e. 6:00 am till 6:00 pm). Noise levels from different activities can vary between 50 -100 dB(A) based on the typical noise levels of machinery specified in the British Standards for Noise and Vibration Control on Construction and Operation sites (BS5228:1997). The primary sources of noise generation during construction include:

- Land clearance, compaction and excavation works;
- Construction of above ground reinforced concrete structures including slabs, foundations and walls;
- General movement of heavy vehicles such as delivery trucks, dozers, concrete delivery vehicles, cranes, front end loader, excavators, pumps, and mechanical dumpers; and
- Handheld and table tools such as saws, grinders, etc.

Construction equipment likely to be used is listed in the table below. Selected noise levels at 15 m for the noisiest of these types of equipment are shown below the values quoted are from the RCNM database.

Table 6-21 Selected Construction Equipment Noise Levels (RCNM Database)

NO.	CONSTRUCTION EQUIPMENT	L MAX DB(A)
1	Compactor (ground)	83.2
2	Compressor (air)	77.7
3	Concrete Mixer Truck	78.8
4	Concrete Pump Truck	81.4
5	Bulldozer	81.7
6	Dump Truck	76.5
7	Excavator	80.7
8	Front End Loader	79.1
9	Generator	80.6
10	Crane	80.6

Mining Activities

The mining activity proposed at the SCC quarries involves the use of both blasting and mechanical excavation works. The blasting is planned to take place once or twice per week and restricted to day time only. A single crusher unit will be employed at the Basalt quarry site and another unit will be employed at the limestone quarry to be located at the southern border of the cement plant site. Primary sources of noise generation associated with quarry activities include noise from:

- Blasting activities,
- Mechanical excavation activities involving the use of various equipments like pressure drills, excavators, compressors, loaders and dumpers;
- Crusher;
- Power generation;
- Onsite traffic (including Backing-up alarm signal of wheel loaders and dumpers).

High noise levels are inherent to blasting operations (100-120 dB(A) near the source). Machinery and equipments generally employed for mining activity generate noise levels typically of about 90 to 95 dB(A) (measured at 1-2 meters from source). The process of raw material crushing also generates high levels of noise (95 - 100 dB(A)). The noise levels (near source) for potential sources of noise are presented in Table 6-22 .

Table 6-22 Principle Sources of Noise and Associated Noise Levels at Quarry Sites

OPERATION	SOUND LEVEL DB(A)
Blasting	100-120
Mining operations	90-95
Crushers	95-100
Drilling operations	85-95
Compressor	85-95
Warning horns	85

Cement Manufacturing

Cement manufacturing includes raw material grinding, mixing and storage; intermediate and final product handling and transportation; and operation of exhaust fans. Noise levels from primary noise sources at the cement plant will be in the range of 73 -100 dB(A) as presented in Table 6-23 below.

Table 6-23 Principle Sources of Noise and Associated Noise Levels at Cement Plant

OPERATION	SOUND LEVEL DB(A)
Vertical mills	95-100
Kilns	80-85
Cement mills	95-100
Ventilation fans	85
Pumps	73
Compressor	85-95
Cooler	85

In order to control the noise, the SCC project is designed to:

- Select low noise equipment;
- Install mufflers at air inlets and outlets of the fans and air compressors;
- Install sound insulation cover (room) for equipment with higher noise;
- Place noisier sources farther away from sensitive receptors in the overall design;
- Build sealed or semi-sealed workshops for noisier production processes;
- Build 2 m high concrete wall around the cement plant premises; and
- Grow high-rise and thick trees around the plant premises.

Offsite Traffic

Offsite noise impacts are most likely to occur along the road networks that will be used for the transportation of construction material, machinery, raw material, manpower and final product to end users.

The significance of the impact is related to the anticipated high traffic volume (hundreds of round trips) and nature of vehicles (mostly heavy trucks) entering and existing the cement plant site during the project lifetime.

6.6.4.4 Vibration from Blasting Activity

Vibration will mainly result from blasting during mining activity at both the Basalt and Limestone quarries. Blasting induces both ground vibration and air blast overpressure in the form of noise wave. Geological condition, atmospheric conditions, the terrain and the vegetation affect the wave propagation from the blast.

6.6.5 Assessment of Impacts

This section describes the predicted modelled noise levels that are likely to be experienced at the surrounding identified sensitive receptors, the risk of these emissions on human health, the potential cumulative and secondary impacts, the worst case scenario of surface mining at the extreme boundary of the quarry sites and its impacts of nearby receptors. This information provides a basis to assess the significance of the impacts on human health and the surrounding environment.

6.6.5.1 Noise Impacts during Construction Activities

Table 6-24 presents a general summary of the predicted noise levels at each noise-sensitive receptor.

Table 6-24 Predicted Construction Noise Levels without Noise Shielding Effect at Steady State Operation

RECEPTOR (VILLAGE NAME)	DIRECTION	DISTANCE FROM CEMENT PLANT BORDER (METER)	CALCULATED L MAX DB(A)	NOISE LIMITS L MAX (DBA) DAY TIME	NOISE LIMIT EXCEEDANCE DB(A) DAY TIME	SIGNIFICANCE CRITERIA
All villages	All	>1600	28→42.8	45	Complies	NA
Kharab Eshek Al Shamalieh	North	700	50	45	5 dB(A)	Minor
Karab Eshek Janoby	West	830	48.5	45	3.5 dB(A)	Minor
Kharab Eshek	North	830	48.5	45	3.5 dB(A)	Minor

Based on the RCNM noise model results, the noise levels at the majority of the sensitive receivers surrounding the cement plant construction site complies with the stringent day time criteria of 45 dB(A) under worst case scenario (all equipment operating simultaneously without accounting for any noise shielding effect). The only exception is the predicted noise level at the Karab Eshek Janoby, Kharab Eshek Al Shamalieh and Kharab Eshek villages located less than 1 km from the construction site were noise levels are expected to exceed ambient noise level limits by less than 5 dB(A). This increase has been assessed to be of **Minor** significance level of **short-term** and **reversible** nature.

Construction noise emissions are generally intermittent and not expected to be continuously operational during the entire construction period. In addition, noise shielding effect due to land topography and vegetation cover, which are not included in the modelling, could further reduce the noise levels by 3 to 5 dB(A) at the receptor. Overall, construction noise impacts have a **high** likelihood of occurrence yet are considered to be of **Minor Effect (2C)** of temporary and reversible nature as they cease to exist once the construction activities are terminated.

Additional noise mitigation measures at the source include:

- Selecting adequate equipment (fit with noise mufflers) and minimizing machinery or equipment idling conditions;
- Erecting temporary noise barriers facing receptors (mainly towards north and west direction); and
- Maintaining an active community consultation and positive relations with local residents will assist in alleviating concerns and resolve any potential noise complaints.

With proper implementation of the mitigation measures, impacts on the surrounding environment could be reduced to **Minor (2A).**

6.6.5.2 Noise Impacts from Basalt Quarry Operation

Table 6-25 presents a general summary of the predicted noise levels at each noise-sensitive receptor from the basalt quarry's operational phase.

Table 6-25 Predicted Operation Noise Levels from Basalt Quarry Boundary

NOISE RECEPTOR	DIRECTION	DISTANCE FROM BOUNDARY (M)	CALCULATED NOISE DB(A)	NOISE LIMITS DB(A)	NOISE LIMIT EXCEEDANCE DB(A) DAYTIME	SIGNIFICANCE CRITERIA
Horak	East	50	77.2	45	32.2	Significant
Kornak Shikhan Sharky	South	100	74.7	45	29.7	Significant
Kulteh Sagheereh	North	520	68.7	45	23.7	Significant
Zahret Al Rabih	West	250	54.3	45	9.3	Significant
Kharab Zerk	South West	370	60.7	45	15.7	Significant
Kornak Shikhan Gharby	South	100	57.3	45	12.3	Significant

Based on the RCNM results, the noise levels at all sensitive receptors surrounding the Basalt quarry site, assuming Worst case scenario, will not comply with noise limits with potential **Significant** impacts of long-term nature and are **highly** likely to occur **(4C).**

However, as mining activity progresses vertically deeper underground, the noise shielding effect from the quarry walls will increase significantly reducing the noise level. Further, the mining at the surface will be limited to short period resulting in reduction of the noise impact duration.

To minimize the noise impacts, an adequate buffer zone need be maintained between the mining activity location and noise-sensitive receptors to assure proper noise attenuation with distance. Additional noise barriers such as trees and soil stockpiles could further minimize the noise level by 3 to 5 dB(A).

As the mining activity progresses towards the center of the license area, the distance from mines to receptors will increase thereby reducing the noise levels (noise attenuation). The predicted noise levels from the center of the quarry assuming mining activities at the surface of the quarry site are presented in Table 6-26.

Table 6-26 Predicted Operation Noise Levels from Center of Basalt Quarry

NOISE RECEPTOR	DIRECTION	DISTANCE FROM QUARRY CENTRE (M)	CALCULATED NOISE DB(A)	NOISE LIMITS DB(A)	NOISE LIMIT EXCEEDANCE DB(A) DAYTIME	SIGNIFICANCE CRITERIA
Horak	East	1050	48.2	45	3.2	Minor
Kornak Shikhan Sharky	South	1100	47.8	45	2.8	Not significant
Kulteh Sagheereh	North	1520	45	45	Complies	NA
Zahret Al Rabih	West	1250	46.7	45	1.7	Not significant
Kharab Zerk	South West	1370	45.9	45	0.9	Not significant
Kornak Shikhan Gharby	South	1100	47.8	45	2.8	Not significant

As anticipated, the predicted noise levels will drop significantly compared to those at the quarry boundary. However, noise levels will still exceed the noise limits with only minor impacts for daytime limit criteria at the Horak village. Nevertheless, as mining progress vertically underground, the noise shielding effect will increase significantly due to the rise of the quarry walls (acting as noise barriers) most likely reducing noise levels by additional 3 to 5 dB(A) achieving permissible daytime noise limits at all receptors.

Hence, noise impacts from quarry operation, as it progresses vertically downwards, most likely will have **Minor Effects (2A)** during the daytime.

6.6.5.3 Noise Impacts from Limestone Quarry Operation

A general summary of predicted noise levels at each noise-sensitive receptor from Limestone operation phase is given in Table 6-27.

Table 6-27 Predicted Operation Noise Levels from Limestone Quarry Boundary

NOISE RECEPTOR	DIRECTION	DISTANCE FROM BOUNDARY (M)	CALCULATED NOISE DB(A)	NOISE LIMITS DB(A)	NOISE LIMIT EXCEEDANCE DB(A) DAYTIME	SIGNIFICANCE CRITERIA
All villages	All	>1530	29.6→43.3	45	Complies	NA
Beer Jarroud	South West	1470	45.3	45	0.3	Not Significant
Booz Hamoh	West	520	54.3	45	9.3	Moderate
Jo'an	West	390	56.8	45	11.8	Significant
Kojack Mate	East	960	49	45	4	Minor
Mazghaneh farm	South	880	49.8	45	4.8	Minor
Kharab Eshek Janoby	West	70	71.8	45	26.8	Significant
Kharab Eshek	North	1330	46.2	45	1.2	Not Significant
Mazra'et Kojak Mate	South East	100	68.7	45	23.7	Significant

Based on the RCNM results, the noise levels at all sensitive receptors surrounding the Limestone quarry site, assuming a worst case scenario, will not comply with permissible noise limits.

As such impacts are expected to be **Significant** of **High** likelihood of occurrence and of long-term nature mainly at the Booz Hamoh, Jo'an, Kharab Eshek Janoby and Mazra'et Kojak Mate villages located at proximity from the quarry license area boundary **(4C)**.

As aforementioned, the projected noise level, as the mining activity progresses vertically deeper underground, is anticipated to decrease considerably due to the noise shielding effect from the quarry walls. Similar mitigation measures are proposed to attenuate noise level by 3 to 5 dB(A).

As the mining activity progresses towards the centre of the license area, the distance from mines to receptors will increase thereby reducing the noise levels.

Table 6-28 presents the predicted noise levels from the centre of the quarry assuming mining activities at the surface of the quarry site.

Table 6-28 Predicted Operation Noise Levels from Center of Limestone Quarry

NOISE RECEPTOR	DIRECTION	DISTANCE FROM CENTER (M)	CALCULATED NOISE DB(A)	NOISE LIMITS DB(A)	NOISE LIMIT EXCEEDANCE DB(A) DAYTIME	SIGNIFICANCE CRITERIA
All villages	All	>2530	<45	45	Complies	NA
Beer Jarroud	South West	2000	<45	45	Complies	NA
Booz Hamoh	West	1100	47.8	45	2.8	Not Significant
Jo'an	West	1390	45.8	45	0.8	Not Significant
Kojack Mate	East	1460	45.4	45	0.4	Not Significant
Mazghaneh farm	South	1000	47.1	45	2.1	Not significant
Kharab Eshek Janoby	West	1070	48.7	45	3.7	Minor
Kharab Eshek	North	2330	43.4	45	Complies	NA
Mazra'et Kojak Mate	South East	600	53.1	45	8.1	Moderate

As anticipated, the predicted noise levels will drop significantly compared to those at the quarry boundary. However, noise levels will still exceed the noise limits but with only minor impacts for daytime limit criteria at the Kharab Eshek Janoby village but with **Moderate significance (3C)** at the Mazra'et Kojak Mate village.

Nevertheless, as mining progress vertically underground, the noise shielding effect will increase significantly due to the rise of the quarry walls (acting as noise barriers) most likely reducing noise levels to permissible daytime noise limits at all receptors. Hence, noise impacts from the quarry operation, as it progresses vertically downwards and further from the boundary, will have a **Low** likelihood of occurrence and are expected to be reduced to even **Minor Effect (2A)** during day time.

6.6.5.4 Noise Impacts from Cement Plant Operation

The following table below presents a general summary of predicted noise levels at each noise-sensitive receptor from the cement plant's operational phase.

Table 6-29 Predicted Noise Levels from Cement Plant Operation

RECEPTOR (VILLAGES)	DIRECTION	DISTANCE FROM CENTER OF CEMENT PLANT (M)	CALCULATED NOISE DB(A)	NOISE LIMITS DB(A)	NOISE LIMIT EXCEEDANCE DB(A)	SIGNIFICANCE CRITERIA
All Villages	All	> 2600	27.1→ 44.6	Day: 45 dBA	Complies	NA
				Evening: 40 dBA	Complies	NA
				Night: 35 dBA	0.4 →1.1	Not Significant
Kharab Eshek Al Shamalieh	North	1700	44.1	Day: 45 dBA	Complies	NA
				Evening: 40 dBA	4.1	Minor
				Night: 35 dBA	9.1	Moderate
Karab Eshek Janoby	West	1830	43.4	Day: 45 dBA	Complies	NA
				Evening: 40 dBA	3.4	Minor
				Night: 35 dBA	8.4	Moderate
Kharab Eshek	North	1830	43.4	Day: 45 dBA	Complies	NA
				Evening: 40 dBA	3.4	Minor
				Night: 35 dBA	8.4	Moderate

Based on the RCNM results, the noise levels at all sensitive receptors surrounding the cement plant site will comply with noise limits for daytime period. Hence no noise impact during day time is expected.

However, noise limits will be exceeded at all nearby receptors (except those located beyond 2600 m radius) by 3 to 9 dB(A) for evening and night time. This noise limit exceedance is considered to have minor impacts (for evening time) to **Moderate impacts** (for night time) of long term nature (during project lifetime) **(3C).**

However, considering that we are using the most stringent noise limits in the Syrian standards and given that the highest predicted noise levels at night are less than 45 dB(A), the noise impacts are expected to be tolerable by the residents of these communities as higher noise limits for night time (45 to 50 dB(A) are set in the Syrian standards for residential areas in the city or near main roads.

Further mitigation measures could be adopted to reduce noise limits to permissible noise levels including:

- Use of properly tuned engines, proper mountings and muffling of equipment and equipment fitted with silencers;
- Providing permanent enclosures around the heavy noise producing equipment;
- Ensuring good maintenance and repair of the heavy equipment;
- All equipment shall be switched off when not in use.

- Equipment and trucks used shall use the best available noise control techniques (e.g., improved mufflers; equipment redesign; use of intake silencers, ducts, engine enclosures and/or acoustically-attenuating shields or shrouds) wherever feasible and necessary.
- Stationary noise sources shall be located as far from sensitive receptors as possible. If they must be located near sensitive receptors, they shall be muffled to the extent feasible and enclosed within temporary shed.
- Buffer zone of green areas consisting of tall and thick bushes and trees will act as an effective noise barrier.

Adopting the proposed mitigation measures would most likely reduce the noise impacts generated from cement plant operation during evening and night-time period to a **Minor Effect (2A)**.

6.6.5.5 *Offsite Traffic Noise Impact*

Offsite noise impacts may arise from transport of raw material along the road linking the Basalt quarry and the cement plant crossing nearby communities. Typical noise levels from trucks could range between 80 and 95 dB(A) based on vehicle condition and speed. The flow of large volume of trucks at close proximity from communities will be a major source of noise pollution in addition to high safety risk to pedestrians and motorists.

With no mitigation measures in place to reduce on the impacts on the health and safety of public community/local settlers situated along the road, repercussions **highly** likely to occur and are anticipated to be **Significant** and of long-term nature **(4C)**.

SCC shall properly plan the transportation routes between the basalt quarry and the cement plant to optimize the distance covered, increase the buffer zone between road and nearest communities and enhance traffic flow and speed; all which will contribute to reduction of noise pollution. SCC shall also develop a detailed traffic management plan for organizing truck movement inside the plant, traffic flow, parking spaces, warning signs, timing, directions, measures to prevent traffic related accidents or injuries to workers and motorist driving along the highway and at the facility main entrance/exit gate.

The adoption of the propose mitigation measure will reduce the impacts from offsite noise pollution to acceptable **Minor** level **(2B)**.

6.6.5.6 *Occupational Impacts*

Noise impacts are likely to be a matter of concern from an occupational health and safety point of view for both construction crew workers and SCC quarry and cement staff. As indicated, some of the machinery and equipment will generate noise levels exceeding permissible exposure noise limits of 90 dB(A) for an 8 hr working shift.

Impacts on occupational workers from exposure to increased noise level are **highly** anticipated and of **Significant Effect (4C)** potentially causing stress and hearing impairment particularly in the absence of Personal Protective Equipment (ear plugs…) given the long-term exposure to the different sources of noise.

In order to mitigate such impacts on the occupational health, SCC and its contractors shall:

- Provide adequate Personnel Protective Equipment (PPE) to construction workers at all noisy activities/locations that exceed permissible occupation noise level limits set in the Syrian Permissible threshold Occupational noise level standards in different work areas.
- Install high noise warning boards which will be displayed in areas of noise levels and mandate ear protection the identified high risk area.
- Noise level monitoring should be conducted regularly to ensure that noise levels during all times are within national noise exposure standards.
- Additional noise level control measures and occupational/community health preventive measures will be considered following IFC EHS guidelines.

With the adequate noise control measures in place and compliance of workers with the provided recommendations, impacts on occupational health and safety would be reduced to a **Minor Effect (2B).**

6.6.5.7 Vibration Impact from Mining Activity

Blasting is certainly an issue of concern for local residents. Exceeding vibration limits for both human comfort and structural damage will result in significant public opposition. With the majority of residential units in nearby communities constructed from mud, the vibration impacts on structural integrity could be higher. The limit values for ground vibration applied to European quarries range from 2 to 50 mm/s (PPV), with an average of around 15-20 mm/s, and 90-140 dBL (OP) for the air overpressure. For ground vibration, these limits are adapted to the frequency of the vibration and to the type of nearby building. However, public complaints are not always the result of actual structural damage, but could be due to adverse human responses and fears of structural damage from blasting activities.

The proximity and density of the population surrounding the quarry sites and the transportation routes are obviously a key factor. Both quarry sites are surrounded by a dispersed number of small villages. On average, the majority of the villages around the limestone quarry are located few hundreds to few kilometres from its border, with the exception of few villages located at very close proximity to the border such as the Karab Eshek Janoby village at the limestone quarry or the Hourk village at the basalt quarry site.

Impacts from vibration on human health as well as local infrastructure are of **Significant Effect (4C)** when no control measures are in place. Particular concern is centred on the blasting operations and induced vibration resultants given the frequency and need of such activities during the project lifetime.

In general, vibration (as well as noise) level decreases with the increase of distance of measurement and it is proportional to the quantity of explosives detonated. Air over pressure, noise and vibration can be effectively contained within limits by adopting SCC's proposed techniques (refer to project Description Chapter) in addition to those stated below:

1. The frequency of blasting shall be determined and amount of explosives used per round of blasting shall be properly calculated.
2. Blasting needs to be restricted to a limited part of the day.
3. Covering the detonating fuse with at least 150 mm thick cover of sand or drill cuttings
4. Supervision of drilling and blasting operations to ensure the designed blast geometry.
5. Avoid blasting when strong winds are blowing towards the residence.
6. Further based on the safe blasting limits it is recommended that the peak particle velocity (ppv) should be kept at 10 mm/sec.

By adopting the above listed measures, vibration impacts due to blasting operations would be reduced to **Minor** levels **(2C)**.

6.6.6 *Summary of Impacts and Ratings*

Table 6-30 Impacts on Noise and Vibration Before and After Mitigation Measures

IMPACT	RATING BEFORE MITIGATION	RATING AFTER MITIGATION
Construction Noise	2C	2A
Basalt quarry operation	4C	3C
Limestone quarry operation	4C	3C
Noise from cement plant operation	3C	2A
Off-site traffic	4C	2B
Occupational impacts	4C	2B
Vibration Impact from Mining operations	4C	2C

6.6.7 Conclusions

The noise generated at some locations and near certain equipment within the cement plant could be in excess of noise exposure limits. Noise level in mining area, though high especially during blasting, will be only for short duration. High noise warning signs shall be displayed in areas of noise levels and ear protection will be made mandatory in those areas.

Majority of the sensitive receptors surrounding the cement plant during construction will comply with daytime limit criteria of 45 dB(A) except at the Kharab Eshek Janoby, Kharab Eshek Al Shamalieh and Kharab Eshek villages (<5 dB(A) exceedance) which have been assessed to be of Minor significance, short-term and reversible nature. Adoption of proposed noise mitigation measures shall minimize noise to permissible levels.

Noise levels from operation at the Basalt quarry site (at all receivers) and Limestone quarry site (at Booz Hamoh, Jo'an, Kharab Eshek Janoby and Mazra'et Kojak Mate villages), under worst case scenario, will not comply with noise limits having potential Moderate to Significant impacts of long-term nature. Prohibiting mining activity near receptors at close proximity, securing an adequate horizontal buffer zone (noise attenuation), progressing in vertical underground displacement of mining activity (increase of quarry wall height), and adoption of additional noise barriers will significantly increase the noise shielding effect which will further minimize the noise level at receptors. Noise modelling results validates the predicted reduction at targeted receptors with the noise impacts assessed to have Minor significance to no impacts.

Noise levels at all sensitive receptors surrounding the cement plant site during operation will comply with noise limits for daytime period. Hence no noise impact during daytime is expected.

Noise levels at all sensitive receptors surrounding the cement plant site during operation will be exceeded at distances (<2600 m radius) by 3 to 9 dB(A) for evening and night-time limit criteria which are assessed to have Minor to Moderate impacts of long-term nature (during project lifetime). Considering that we are using the most stringent noise limits in the Syrian standards and given that the highest predicted noise levels at night are less than 45 dB(A), the noise impacts are expected to be tolerable by the residents of these communities as higher noise limits for night-time (45 to 50 dB(A)) are set in the Syrian standards for residential areas in the city or near main roads.

The flow of large volume of trucks at close proximity from communities will be a major source of noise pollution in addition to high safety risk to pedestrians and motorists especially the proposed road link between the Basalt quarry and the plant. Impacts have been assessed to have Significant Effects and of long-term nature. Proper route planning, traffic planning and compliance with regulations will reduce the impacts from offsite noise pollution to acceptable Minor level.

Exceeding vibration limits for both human comfort and structural damage will result in significant public opposition. With the majority of residential units in nearby communities constructed from mud, the vibration impacts on structural integrity are likely to be more Significant. The adoption of good blasting practices, potential vibration impacts will be reduced to acceptable levels.

6.7 POTENTIAL IMPACT ON LAND AND INFRASTRUCTURE ENVIRONMENT

6.7.1 Impact on Land and Infrastructure Environment

6.7.1.1 Introduction

The study area receives an average annual rainfall of about 280 mm, and is dominated by agricultural lands occupying a total area of 28, 272 ha, of which 1,837 ha are irrigated from wells and 26, 367 ha are cultivated under rainfed conditions. Sixty percent of the population own on average 25 ha of land, while the remaining 40% own less than 2 ha. The cultivation of rainfed crops such as wheat, barley, cotton, and a variety of beans and vegetables is common. Herding of sheep, goats dominated the uncultivated land, with the herding of cows practiced to a lesser extent. Livestock provide an important secondary source of income for most households.

Thirty-three villages (6 of them around the Basalt quarry) are scattered throughout the study area. The villages lack a public water supply network. Accordingly, water for drinking and agricultural purposes is supplied from the scattered wells located in the area. Since the area lacks any sanitary network, most population centres rely on septic tanks, while few others lack any sort of sanitation controls. Main roads service the study area, such as the Aleppo-Hassakeh highway traversing the villages as well as secondary roads linking the villages to the city roads. An unpaved road network also exists in the area.

6.7.2 Legislative Requirements

A number of environmental and social Syrian legislation could be identified with regards to the potential repercussions on the Land environment namely:

- **Acquisition Law No. 20** dated 1983 which considers the rights of the State, the public sector, governmental and administrative organizations for land acquisition for purposes of development, settlement or security. The law also integrates articles relevant to farmers and land-owners' right to objection and compensation. Noteworthy articles relevant to the project are summarized below:
    - **Article 14:** The collector shall proceed to enquire into measurements, values and claims of the Real Estate. Compensation estimates are based on current land value and land uses under Law No. 3/1986 and its amendments.
    - **Article 15:** Where the acquired property was used for agriculture and was the main source of livelihood of its owner and concerned farmer, the Development Authority shall, on his

demand, offer him other property, either for ownership or for lease, as full or partial compensation. In the case of a full compensation, the Development Authority shall pay the land-owner and his farmer respectively 70% and 30 % of the total settlement value.

- Under the **Decree No. 347**, Article 2 of Law No. 3/ 1986 puts forth a table of estimations of tree values. The table shows the value of each tree according to species, age, cultivation expenses (soil preparation, etc.) and expected benefits;

6.7.3 Approach and Methodology

A review of specialist reports (hydrological, socio-economic and biodiversity) were studied for a general description of the prevailing topography and land-use practices. This was supplemented by an internet search and site visit.

6.7.4 Findings

The plant site consists of 130 ha of privately owned land which was purchased by the SCC and a further 1,350ha (Limestone and Basalt quarries) of Government land which is to be rented by the SCC for the lifespan of the quarries.

Figure 6-1 View of Plant Site (130ha) from Jabal Koujak

a) Sheep grazing on limestone quarry site

b) Local inhabitants harvesting barley for subsistence use

Figure 6-2 Existing Land-Use

The SCC is expected to impact directly on 130 ha of agricultural lands to accommodate the plant site and 1,350 ha of grazing lands at the quarry sites, by permanently excluding these areas from further cereal production and grazing (refer to Figure 6-2 above).

Agricultural and grazing land borders all project sites (plant and quarries) these lands may be further impacted by dust generated at the plant site, but most especially at the quarry sites. Dust settling on the cereal plants reduces the ability of the plants to photosynthesise thereby reducing their yields. In addition the presence of different toxic pollutants in cement dust has been shown to impact negatively on plant growth and therefore yield. While the spread of dust at the plant site can be managed, dust from the quarry sites may prove to be more problematic. The effect of dust if not controlled could decrease the agricultural potential of lands surrounding the plant and quarry sites, as well as those lands downwind of the quarries.

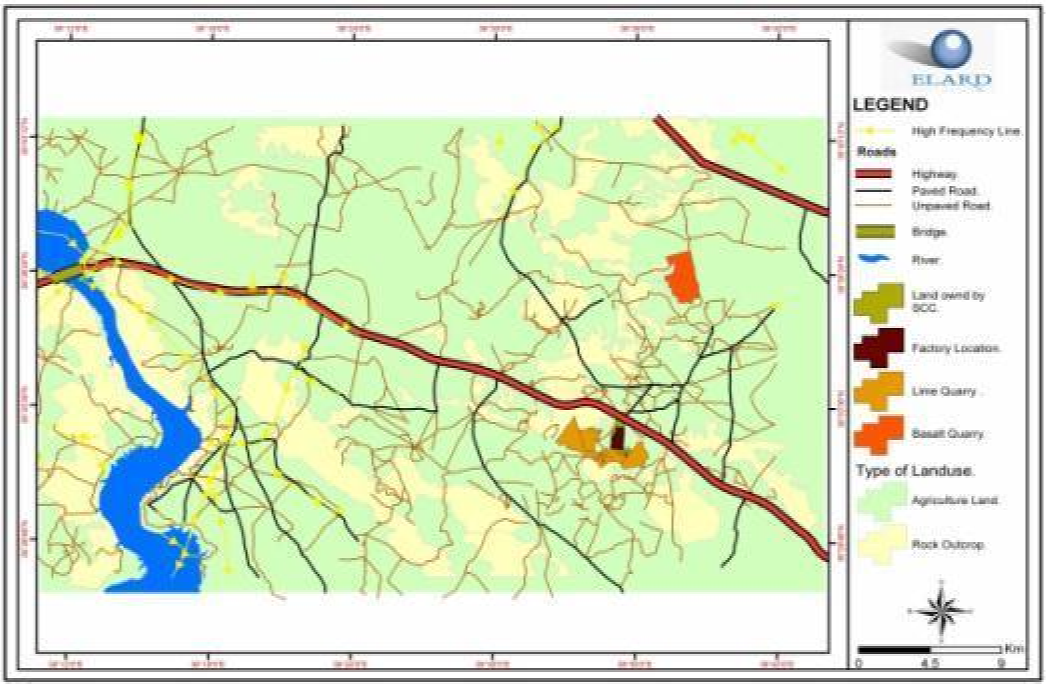
The plant site and limestone quarry is visible from the Aleppo-Hassakeh highway, while the basalt quarry is 15 km to the north. While the basalt quarry would not be visible from the highway it would be visible to the 6 villages which surround its perimeter.

The road from the plant site to the basalt quarry meanders through 3 villages. The road is tarred for approximately 10 km with the final 5 km a good gravel road. At present the road is about 4-5 m in width (refer to Figure 6-3), which comfortably allows light motor vehicles and small trucks (4 ton) to pass each other. Residences and storage buildings in the villages are built close to the edge of the road, with public facilities such as a school and cemetery having been establish in close proximity (<10m) to the road. Traffic calculations indicate that approximately 70 30-ton truck loads are required daily to deliver the 2,300 tons of basalt to the plant. This translates into a truck every 5 minutes.

Cemetery and Local Children **Road through Village** **Proximity of Buildings to Road**

Figure 6-3 Basalt Quarry Road passing through villages

In addition to the trucks bringing basalt from the quarry, other raw materials (coal, sand, iron) are also trucked to the plant site, while cement will be trucked away to market. It is estimated that 700 trucks will enter and leave the plant site per day. This translates into 1.5 trucks/min. The current Aleppo-Hassakeh highway cannot accommodate this volume of traffic entering or leaving the highway at the plant site. The road network of the study area is illustrated in Map 6-3.



Map 6-3 Road Network in the study Area

6.7.5 Assessment of Impacts

6.7.5.1 Potential Impacts during Construction Phase

Loss of Agricultural Land at Quarry and Plant Sites

The 130 ha of agricultural land lost to the plant site represents less than 0.01% of the 10-year national average for barley production. The land was purchased from a private land owner and does not impact on subsistence producers who own less than 2ha/household.

The loss of 130h ha of agricultural land for the plant site will be of a Negligible Effect. This impact is of a high likelihood, but will not affect the livelihoods of other farmers. Accordingly, with no mitigation measures in place, this activity is likely to have a Negligible Impact (1C) on the overall production of cereal crops in the project area.

Limiting the construction site (waste, roads etc) to the 130ha will ensure that the area effected is limited to the plant site (130 ha) and does not spill over onto adjoining lands.

No mitigation measures are proposed as this is an unavoidable impact with a very localised effect. The rating therefore remains that of having a Negligible Effect (1C).

Loss of Grazing Land at Quarry and Plant Sites

Livestock are the most important source of income for poor households and a second source of income to most other households. Sheep production is dominated by small-scale herders 47% of whom own less than 100 sheep and 80% less than 200 sheep. These families are extremely vulnerable to any sudden decrease in their flocks. These small and medium sized herders are unable to buy fodder and concentrate feed for their animals and rely on the natural grazing to feed their flocks. Although the 1,350 ha of grazing land lost to the limestone and basalt quarries represents less than 0.02% of the total available grazing area in the province, it does impact on the households close to the quarries who will continue to use the grazing land around the quarry or travel greater distances to find suitable grazing. The grazing of livestock around the quarry will increase the risk of injury to livestock and herders.

The loss of 1,350h ha of grazing land for the quarry sites will be of a **Moderate Effect as it represents a safety risk to livestock and herders as well as a loss of grazing land for which herders will need to travel further to replace**. This impact is of a **high** likelihood, and will have a limited impact on the livelihoods of local inhabitants. Accordingly, with no mitigation measures in place, this activity is likely to have a Moderate Impact **(3C)** on livelihoods of villagers close to the quarry sites.

The following mitigation measure can be implemented to limit the impact of the quarries on grazing resources:

- Containing the quarry operations to the quarry sites this will ensure that the area effected is limited to the quarry and does not spill over onto adjoining grazing lands.
- Quarries need to be fenced to ensure that local herders and their livestock do not enter the quarry site and run the risk of injury.

The implementation of the above mentioned mitigation measures are likely to reduce the effect of the quarry operations to Minor (2A) on the overall grazing land within the project area.

Existing Infrastructure

Given the rural and agricultural nature of the study area as well as its remote location (160 km northeast of Aleppo City), the number of surface and underground infrastructures is limited to a public electricity grid with full coverage of villages, and one (1) main tarmac road (Aleppo-Hassakeh highway) and one (1) minor leading to the basalt quarry site (15 km north of the proposed cement plant site). The area under study lacks:

- Public telephone network - however the area hosts mobile coverage;

- Waste management facilities for the management of construction waste and solid waste (hazardous and non-hazardous) - with the exception of Sereen's municipal dumpsite located at 20 km from the plant site. Additional reported practices at the household level include burial and open-burning of domestic waste.
- Sewage network - domestic wastewater is discharged in cesspools/pits located within the vicinity of each dwelling; and
- Public water distribution system- water for irrigation, domestic and drinking purposes is supplied from existing nearby shallow wells (65 m to 190 m below ground).

With the exception of road transportation, the impacts on existing physical infrastructures are considered **Negligible (1A)** during the construction and operation phases of the proposed project. **No impact** on the electricity grid is expected since the construction phase will rely on 24 generators for power supply and the proposed cement plant envisages having its own power plant (60MW) to sustain its electricity demand (45MW) upon operation.

In reference to the management of construction waste, a storage area is designed within the plant site receiving mainly steel, wood and cemented as waste materials. Cement is intended to be re-used for construction purposes while steel and wood wastes are sold to local recycling facilities. The Waste Management Plan adopted during the operation phase of the project follows that of a "Zero Waste" Plan handling both solid and liquid effluents focusing on in-situ handling of waste. The final fate of the different waste streams is discussed in the *"project Description Chapter"* and includes mainly re-use in the process for cement manufacturing, incineration in the kiln system, treatment for secondary reuse (e.g. wastewater for irrigation) in addition to recycling. As such, impacts from waste management on the existing and surrounding waste management facilities (i.e. Sereen dumpsite or others if any) are considered **unlikely to occur** given SCC's proposed Waste Management Plan for its construction and operation phases.

6.7.5.2 *Potential Impacts during Operation Phase*

Impact of Dust on Agricultural and Grazing Land

Dust from the plant and quarry sites have the potential to impact on the cereal crops planted adjacent and downwind of the plant and quarry sites. In general, plants show a decrease in plant growth due to dust as a result of stomatal clogging, reduced photosynthesis, and changes in soil pH. Dust on grazing lands makes the fodder unpalatable for livestock. Without mitigation measures dust particles are expected to drift in a predominately easterly direction with some dispersal to the west. This dispersion can carry up to 800m.

Dust emissions from cement kilns have been reduced dramatically over the last two to three decades due to regular improvements in design and operation, including increased use of modern de-dusting equipment. Near-ground fugitive releases of dust originating from grinding operations, truck traffic, wind, and other natural sources are difficult to measure and impact mainly on the local environment.

At quarries, drilling, blasting, primary crushing at tips, screening and tipping onto stockpiles are the major sources of airborne dust. Operation of heavy equipment such as loaders, shovels, dozers, draglines and haul trucks also produces dust. Dust on roadways and around stockpiles and loading operations is often a problem.

The loss of agricultural and grazing land surrounding the plant and quarry sites as a result of dust will be of a **Significant Effect as it represents a long-term, continuous impact resulting in adverse change to key economic drivers in the area.** This impact is of a **high** likelihood, and will have an impact on the livelihoods f local inhabitants. Accordingly, with no mitigation measures in place, this activity is likely to have a Significant Impact **(4C)** on the livelihoods of villagers surrounding the plant and quarry sites.

The following mitigation measure can be implemented to limit the impact of dust at the quarries and plant site:

- Implementation of modern de-dusting equipment in the plant.
- Tarring of heavily used roads.
- Wetting (fog or mist) of gravel roads and other surfaces which release dust.
- Planting of trees around the plant and quarry sites to act as a net for dust particles.
- Use of water and foam based suppression methods at the quarries

The implementation of the above mentioned mitigation measures are likely to reduce the effect of the dust at the plant and quarry operations to **Minor (2A)** on the overall agricultural and grazing land within the project area.

Visual Impact of Plant and Quarry Sites

The plant and limestone quarry sites will have a negative influence on the visual environment; both are visible from the Aleppo-Hassakeh highway, and surrounding villages due to the flat topography of the area. The basalt quarry is clearly visible to the 6 villages surrounding the site. The lack of vegetation on the sites leaves them visually exposed.

The negative influence on the visual environment will have a **Moderate Effect as it represents a long-term, continuous impact resulting in adverse change outside the range of natural variation.** This impact is of a **high** likelihood. Accordingly, with no mitigation measures in place, this activity is likely to have a Moderate Impact **(3C)** on the visual environment.

It will be difficult to mitigate the visual impact on site, due to the elevation and extent of the impact. Planting of vegetation will need to be close to the impacted community/road to maximise the angle at which the vegetation obscure the sites. The following mitigation measures can be implemented to limit the impact:

- Planting of tall and dense vegetation between the site, along the highway
- A variation of colour on the plant structures so as to blend into the environment (green and grey hues)
- Consultation with villages to address their particular impacts. Possible interventions include the planting of tall and dense vegetation around the villages

The implementation of the above mentioned mitigation measures are likely to reduce the negative visual impact to a **Minor (2A) rating**.

Basalt Quarry Road

The basalt quarry road has not been designed to carry the increased load and frequency of vehicles required to deliver the basalt to the plant. The road is not wide enough to allow two 30-ton trucks to safely pass each other in opposite directions, while the proximity of buildings and public facilities to the road will make widening the road problematic

The proximity of structures and public facilities to the road also increases the risk of damage to property should the trucks go off the road, as well as increasing the risk of injury to local inhabitants who make use of the road to walk between the villages, crop fields and to school etc.

The inability of the basalt road to meet the needs of the project will have a **Catastrophic Effect as it represents a long-term, continuous impact resulting in adverse effects on the local inhabitants.** This impact is of a **high** likelihood. Accordingly, with no mitigation measures in place, this activity is likely to have a Significant Impact **(5C)** on the local population.

The following mitigation measures can be implemented to limit the impact:

- In consultation with local inhabitants identify an alternative route for the road through an area that is less populated. This may require the need to purchase agricultural land from local farmers in order to re-route the road
- Construct/upgrade the road to the standard required to carry the load and volume of traffic required to deliver basalt to the plant
- Enforce strict restrictions on the speed at which the trucks are allowed to travel and the hours of operations
- Where necessary implement stop/go zones which will allow a single truck to pass at a time

The implementation of the above mentioned mitigation measures are likely to reduce the negative impact to a **Moderate (2A) rating**.

Aleppo-Hassakeh highway

The Aleppo-Hassakey highway is the main highway from Aleppo to Iraq. The highway consists of a single-lane in either direction; no provision is made at the entrance to the plant site for trucks to turn off or onto the existing road. At the anticipated traffic volume of 1.5 trucks/min this will cause a major traffic congestion, with a high risk of collisions exacerbate by the frustration caused at being delayed due to vehicles exiting or entering the highway. Homesteads have also been established alongside the highway and new shops/trading stores have started to emerge in anticipation of increased trade.

The lack of infrastructure on the Aleppo-Hassakey highway to facilitate the smooth exit and entry of truck from the cement Plant a **Significant Effect as it represents a long-term, continuous impact resulting in adverse effects on the local inhabitants and transient travelers.** This impact is of a **high** likelihood. Accordingly, with no mitigation measures in place, this activity is likely to have a Significant Impact **(4C)**.

The SCC has identified this impact and are currently investigation two options, the preliminary approvals of the concerned authorities is currently a precondition for further studies as the options will involve land acquisition and potential modification of existing infrastructure.

The two proposals are:

- **Direct intersection**

  The direct Intersection option looks at widening the Aleppo-Hassakey highway by about 7.5m for a 500m long section at the plant exit. This adds approximately 3.75m in both directions. The proposal includes a curb stone separator for traffic regulation and clearly marked traffic signs. However the avoidance of accidents is dependent on driver habits and respecting the traffic signs. The intersection has 3 high risk areas where direction flows intersect each other.

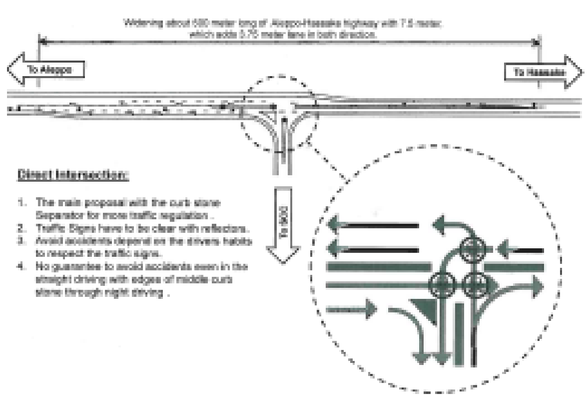


Figure 6-4 Direct Intersection (Proposal 1)

- **Free intersection**

The free intersection proposal includes a bridge (minimum height of 5.5m) of the clover leaf type (one leaf double function with ramp and loop). A triangular curb under the bridge prevents illegal turning. The intersection with be marked with traffic boards on steel frame as well white arrows on the asphalt to indicate direction.

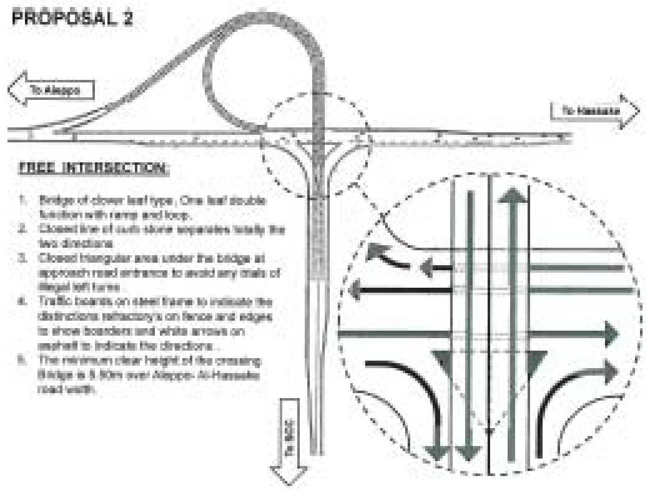


Figure 6-5 Free Intersection (Proposal 2)

Both proposals would significantly impact on the community living next to the road at the intersection.

The implementation of the above mentioned mitigation measures are likely to reduce the negative impact of traffic congestions in two ways. Proposal 1 because of the risk of accidents at key intersections would reduce the traffic impact rating a **Minor (2B) rating,** while Proposal 2 would reduce the traffic impact rating to **Negligible (1A).**

6.7.6 Summary of Impacts and Ratings

Table 6-31 Impacts on Land Environment Before and After Mitigation Measures

IMPACT	RATING BEFORE MITIGATION	RATING AFTER MITIGATION
Loss of Agricultural Land at Quarry and Plant Sites	1C	1C
Loss of Grazing Land at Quarry and Plant Sites	3C	2A
Visual Impact of Plant and Quarry Sites	3C	2A
Impact of Dust on Agricultural and Grazing Land	4C	2A
Basalt Quarry Road	4C	2A
Aleppo-Hassakeh highway	4C	2B

6.7.7 Conclusions

The development of the plant site and associated limestone and basalt quarries has significant impact on current land usage and infrastructure in the project area if mitigation measures are not implemented. The most important from a land-use perspective is the impact of dust on the surrounding crop and grazing lands, however with suitable mitigation measures this impact is reduce to a minor impact which is only expected to occur in exceptional circumstances. The biggest impact on the existing infrastructure is the impact of traffic volumes on the current road network. SCC has identified these impacts and is currently working with government to finalise mitigation measures. Once these measures have been implemented the impact is expected to be minor with a likelihood of occurring under exceptional circumstances.

6.8 POTENTIAL IMPACT ON BIOLOGICAL ENVIRONMENT

6.8.1 Introduction

Since the project area belongs geographically to the fourth Settlement Zone (as per the national Syrian classification), which is regarded as a transition zone between the forested areas (1st and 2nd stabilization zones) and the steppe dry area (5th zone), it could be assumed that the area under study is characterized by the absence of sensitive ecosystems requiring protection.

In this section, the biological environment refers to the study area's biodiversity including floral as well as faunal species.

6.8.2 Legislative Requirements

This section lists the national as well as international agreement(s) relevant to the proposed project. It should be reminded that given the study area's extension along the fourth agricultural settlement zone, the project is not governed by the Badia/Steppe Protection Law (**Law No. 62** dated 2006). In addition, due to the absence of forested areas, the Forestry Law (**Law No. 7** dated 1994) does not reside over the project as well. The relevant legislations include:

- **Decree No. 152** dated 1970 which considers organization of wild hunting by specifying hunting means and times, permit requirements. It sets as well penalties for violation occurrences; and
- **The Convention on Biological Diversity - 1992 Rio** (declaration ratified by Syria in 1995), for the protection and conservation of biodiversity covering all ecosystems, species and genetic resources;

6.8.3 Approach and Methodology

The methodology for the ecological assessment included:

- **Desk review study:** An extensive desk review of existing data records consisting of the analysis of satellite imagery and cartography, previous studies and publications on the study area;
- **Ecological survey:** The survey documented flora and fauna as a 'snapshot' in time. An all year round biodiversity assessment was not carried out due to time constraint. The ecological assessment was carried out to identify local species distribution and significance (common, protected and/or endangered if any) with regards to national and international registries (IUCN) as well as areas of a sensitive nature.

6.8.4 Findings

The desk review and ecological survey revealed a large vegetative and agricultural cover with an estimated surface area of 28, 272 Ha. These lands are mainly planted with rainfed crops such as wheat, barley, cotton, and a variety of beans and vegetables. The documented aspects of the ecological survey include:

- Intensive agricultural practices and crop rotation leading to the loss of vegetative cover particularly the growth of wild species like Quercus (Oak), Crataegus (Hawthorn), Amygdalus (Almond) and Eucalyptus (Eucalyptus Camali); as such flora is mainly limited to low number of species;
- The study area does not host any protected natural reserves or areas of a sensitive nature. Further, no rare, endangered or protected faunal and floral species were identified in the study area. The closest sensitive feature to the study area is the water body formed by the Teshreen dam located approximately 35 km to the west of the proposed project site having a total surface area of 155 km^2. The dam forms a habitat for water birds and is used as an aquaculture farm;
- Natural (e.g. low precipitation levels) and anthropogenic (hunting, quarrying, use of pesticide…) activities have put the ecosystem in the study area and its vicinity under a lot of pressure, halting the evolution of biodiversity; and
- Identified faunal species are mobile in nature and are limited to domestic animals (sheep, turkey, cows…).

6.8.5 Assessment of Impacts

Civil works and process emissions are the major sources of potential impacts on the study area's floral biodiversity and vegetation cover. Impacts on the general fauna can be categorized as direct and indirect. The former impacts are related to physical injuries from accidents and risk of entrapment whereas the latter impacts are related to loss of feeding habitation due to damage of vegetation cover, accidental spills, etc.

6.8.5.1 *Potential Impacts during Construction Phase*

Impact from Physical Disturbance on Terrestrial and Avian Fauna

Site clearance activities entail the excavation and removal of hundreds of hectares of vegetation to accommodate for the proposed plant site and associated working areas consequently causing the loss of habitat for some terrestrial and avian faunal species. In this area, terrestrial fauna refers mainly to small mammals (awassi sheep, dogs, cows), birds (chicken, turkey, crested lark), and reptiles, as there is essentially no large fauna in the area. It should be stated again that the project area is not widely rich in faunal species with most domestic animals pertaining to local settlers.

Typically the elevated background noise levels emitted by the civil works, quarrying/blasting operations and vehicular movement may compel the native fauna to vacate the immediate vicinity. Additional sources of noise include the high number of generators (i.e. 24 generators) which will be used to supply the facility with its power demand during the entire construction period. It is noted that the faunal species of the surrounding area is generally mobile hence no particular territorial needs will be affected by the works. However, noise may disturb animal breeding, feeding and migration patterns.

The light (night-time guard watch) and noise impacts experienced by local species is expected to be of long-term duration given the expected 24 months construction phase followed by the on-going operation procedures required for cement manufacturing and power generation (i.e. continuous quarrying activities, and transportation of manpower and raw material in and out of the facilities). The impact of dust caused by site equipment and vehicles is considered of **Moderate** effect, given the duration of the work (limited working hours), the restricted perimeter of the construction as well as the dust suppression and control measures to be implemented by SCC throughout the project lifetime including internal process de-dusting operations (electro-static precipitators/bag filters), vehicle wash-downs and damping of roads.

Impact effects from uncontrolled physical and noise disturbance on terrestrial habitats are expected to have a **High** likelihood of occurrence with particular reference to the natural vegetation in the area. The impact is of **Moderate (3C) effect given the expected project footprint size which includes the area of the proposed plant site as well as the two quarry sites to be mined**.

Impacts from Crew Members and Base Camp Operations

With regards to crew members, impacts from solid waste littering and illicit activities are of concern. Improper disposal of solid waste including water bottles, cigarette butts, broken glass, packaging material, etc. could pose a hazardous risk on fauna and especially on livestock. It is expected that roaming herds will intake plastic bags and inedible materials while grazing on natural forages and grass. This may result in economic losses and social conflicts with the local settlers and Bedouin communities. Moreover, scattered sharp solid waste or left over nets or wiring could physically harm the local fauna or result in accidental entrapment.

Hunting, nest robbing and poisoning (from accidental spills) might have adverse impacts on wild animals in the area. Illicit activities such as hunting are prohibited by the national authority **(under Environmental Law No. 50, Article 29)** and any violation will subject the violator to legal pursuit and penalty. Trading of wild animals with locals should be prohibited as it encourages illegal hunting.

The potential impacts anticipated from SCC's solid waste generation (construction, domestic...) are **unlikely** to occur and therefore are not considered significant given SCC's proposed waste management plan during the project's lifetime which excludes off-site handling, storage and dumping/disposal. However, individual practices performed by crew members such as waste littering and illicit activities are considered to have a **High** likelihood of occurrence with adverse repercussions on the native fauna particularly in the absence of good housekeeping practices and an ethical code of conduct. Impacts from crew members and base camp operations are considered of **Moderate** effect **(3C)**.

Impact on Vegetation

The plant's construction activities are the major source of potential impacts on the study area's floral biodiversity and vegetation cover. Site clearance activities, grading and transport of heavy machinery and vehicles would most likely result in physical damage of the land cover. The site flora may also be impacted by solid waste littering by the construction crew members, and accidental leaks or spills. It is anticipated that the vegetative cover along the proposed footprint, access routes (as well as newly upgraded roads) and base camp stations will be completely damaged and lost following the civil works during the construction phase of the project.

The floral species identified in the study area as well as the floral community listed in the existing literature are regarded as common species suggesting a low environmental value. However, the degree of land disturbance is high and permanent loss of the vegetative cover is **highly** likely to occur in the designed working areas (quarry sites) and regarded of **Significant** effect in terms of visual contrast and aesthetics of the receiving area **(4C)**.

In addition to the SCC's proposed control measures for noise and vibration minimization and fly rock management, mitigation measures to minimize further potential impacts on the project area's fauna and flora include:

- Routine checking of trenches (if any) and escape routes to minimize, if not prevent, entrapment of fauna;
- Washing down of vehicles in place and prior to commencing work;
- Preservation of excavated top-soil for future site restoration procedures particularly in highly disturbed areas;

- Limiting vehicular transport to defined roads as to prevent unnecessary injury, habitat destruction and complying with safe driving procedures;
- Reporting of any violation relating to hunting and trading activities;
- Implementing good housekeeping practices on the field and implementing SCC's proposed Solid Waste Management plan in order to eliminate any source of hazard to the native fauna; and
- Limiting access to quarry sites and plant area via erection of concrete barriers and/or fencing so as to prevent accidental falls of fauna (and potentially herders, children, pedestrians).

With the proposed mitigation measures in place, the likelihood of the impact will be reduced to **Low** and its effect to **Minor (2A)**.

6.8.5.2 *Potential Impacts during Operation Phase*

Impacts on local vegetation and fauna from the operation phase are mainly linked to off-site atmospheric emissions (sulphur dioxide, carbon dioxide, oxides of nitrogen…) released from the processes of cement manufacturing (kiln stacks) and electricity generation (power plant stack) and are discussed in the "*Impact on Air Quality*" section. Following the air dispersion modeling results, the estimated off-site emissions of the maximum annual NO_X concentrations are calculated at a maximum of 6µg/m^3 at a distance of 0.5 km to the plant site. With increasing distance from the site (from 1 km up to 4 km), NO_X concentrations drop to a value of 3 µg/m^3.

Therefore, NO_X levels that could potentially affect natural vegetation will not be reached in the cultivated areas located surrounding the plant site. Impacts from NO_X emissions on vegetation will be **Negligible (1C)**.

With regards to SO_2 maximum annual concentrations, the mean levels are estimated at 13 µg/m^3 which ensures protection of the agricultural crops given the maximum permissible level of 30 µg/m^3 as set by the United Nations Economic Commission for Europe (UNECE).

Consequently, impact from perturbation of natural vegetation due to SO_2 process emissions are also **Negligible (1C)**.

In addition to the abovementioned emissions, particulate matter/dust is also a common atmospheric process pollutant. The main impact from suspended and deposited dust particles on the vegetation is the decrease in absorbed light intensity due to the coverage of leaves as well as impediment of the pollination progression which could lead to plant growth disruption and loss of integrity. The annual maximum concentrations of Total Suspended Solids (TSP) in the study area are calculated at 41µg/m^3, well below the National Ambient Air Quality Standards (NAAQS) of 150 µg/m^3.

Generally, the study area is adapted to desert-like conditions (i.e. 200-250 mm of annual rainfall) whereby plants are regularly exposed to dust and sandstorms (particularly from the months of May till October). This suggests that environmental impacts on the floral cover from TSP emissions are considered **Negligible (1C)** as well.

6.8.6 Summary of Impacts and Ratings

Table 6-32 Impacts on Biological Environment Before and After Mitigation Measures

IMPACT	RATING BEFORE MITIGATION	RATING AFTER MITIGATION
Impacts from site clearance activities and associated noise/light generation on terrestrial and avian fauna	3C	2A
Impact from crew members and base camp operations on fauna species	3C	2A
Impact on local vegetation	4C	2A
Impacts from process emissions (NO_X, TSP, SO_2) on agricultural crops	1C	1C

6.8.7 Conclusion

The construction phase of the proposed project is highly likely to induce physical damage to a portion of the agricultural land (1.3 km^2) due to excavation and site clearance activities. Additional impacted receptors from construction works include the native faunal species. Though the study area does not host any threatened species or protected natural areas, several behavioral changes in local fauna have a high possibility of taking place such as breeding, feeding and migration patterns. Protection and preservation efforts from SCC's manpower as well as from the local settlers are required in order to prevent, if not mitigate, the anticipated adverse impacts on the site's biodiversity.

Generally, process emissions represent the main concern to vegetation during the operation phase. However, in the case of the project area, the mean annual maximum emissions of NO_X, SO_2 and TSP are not expected to pose any threat to the vegetative cover given the low levels obtained in the air dispersion modeling results.

6.9 POTENTIAL IMPACTS ON SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

6.9.1 Introduction

The project is likely to induce economic, social and cultural alterations at both the local and national scales. The extent of these changes varies in importance among local groups (settlers) and the Syrian economic sector. The type and nature of the anticipated impacts are also subject to change following the different phases (i.e. construction and operation) of the proposed project. This section will focus on the anticipated impacts induced from the project on the surrounding affected population (i.e. local community) as the main receptor in addition to existing infrastructure (roads, electricity...) and archaeological sensitivities. Further projected economic impacts at the national level will be discussed briefly.

6.9.2 Legislative Requirements

Given the physical footprint (cement plant area and quarry sites), the geographical extent and temporal scope (construction & operation activities) of the proposed project, a number of environmental and social Syrian legislation could be identified with regards to the potential repercussions on the socio-economic environment namely:

- **Acquisition Law No. 20** dated 1983 which considers the rights of the State, the public sector, governmental and administrative organizations for land acquisition for purposes of development, settlement or security. The law also integrates articles relevant to farmers and land-owners' right to objection and compensation. Noteworthy articles relevant to the project are summarized below:
- **Antiquities Law** issued by Legislative **Decree No. 222** dated 1968, and then modified some of its articles by the **law No. 1/1999** entailing the preservation and protection of archeological ruins/findings (stable and movable) during development projects and associated excavation works. The law also considers the penalties and sanctions in case of non-compliance;
- Standards for permissible threshold levels for ambient noise standards in rural areas and safe exposure (dated 2002) established by the Syrian Environmental Protection Council in 2002;
- **Decree No. 2883** dated 2004 under which are issued the "National Ambient Air Quality Standards" defining the ambient air quality and permissible threshold concentration level standards for areas surrounding industrial activities and any other areas. The objective of this standard is to protect the human population, plants and animals from the potential hazardous impacts of air pollution;
- "General Syrian Guidelines for Cement Industry and Quarries" associated with the stages of quarrying, raw material grinding and cement production line to mitigate impacts from noise and fugitive emissions;
- **Decree No. 1745 and 8**, issued following Syria's ratification of the "International Labor Convention No. 139, 120 and 136", which prevents vocational risks ensuing from cancer causing materials and tools, protects workers health and ensures proper sanitation and hygiene for base camps, work environment and offices; and
- **Cleanliness Law No. 49** dated 2004 providing Developers with solid waste management guidelines for the handling of municipal, industrial, hazardous and medical wastes as well treatment of industrial gaseous emissions. The law entails compliance with record keeping, documentation and waste treatment for the protection of environmental and social receptors.

6.9.3 Approach and Methodology

The methodology for the socio-economic assessment included:

- **Desk review study:** An extensive desk review of existing data records consisting of the analysis of satellite imagery and cartography, previous studies and publications on the study area;
- **Field survey:** Data was also collected through visual documentation and consultation with local communities and Mayors; i.e. "Moukhtar" or Head of Municipality of certain settlements (when available). The survey covered information pertaining to age and gender distributions, family structure, availability of institutions (schools, level of education), current ethnicities and tribes, land ownership, land use, availability and accessibility to healthcare centers (primary health care units, pharmacies), socio-cultural practices, political structure and administration, economic generating activities (agricultural sector, animal husbandry), infrastructures, resources and services (water supply, electricity, telecommunication, roads, sewage disposal practices), livelihoods (skill levels, sources of income, employment status, development needs and priorities (poverty, unemployment, sanitation); and
- **Public Participation Meeting:** As per **Annex 4** of the Syrian **EIA Act** dated 2008, which called for a Public Hearing during the scoping phase of the project so as to introduce relevant stakeholders to the proposed project, its scope of work and inform the public about the anticipated impacts and the planned mitigation measures to be adopted for each impact. The outcome of the public consultation meeting (i.e. public's objections, views, and concerns) will help in the assessment of the anticipated impacts.

6.9.4 Findings

The desk review and field survey revealed the presence of thirty-three (33) villages surrounding the study area (cement plant site and quarry areas), all sharing similar socio-economic characteristic. The main sources of livelihood include land farming, animal grazing as well agricultural activities. Almost 60% of the agricultural lands are privately owned. These lands are mainly planted with rainfed crops such as wheat, barley, cotton, and a variety of beans and vegetables.

The documented sensitivities/aspects of the surveyed population clusters include:

- Proximity of one (1) village (Kharab Eshek Al Shamalieh) to the proposed cement site located at 0.7 km north of the site;
- Proximity of one (1) village (Kharab Eshek Janoby) to the limestone quarry site located at 0.07 km south of the site;
- Proximity of six (6) villages surrounding the basalt quarry site with some dwellings bordering the quarry site and others located at a maximum of 0.52 km (refer to baseline chapter). Dwellings

(such as Kornak Shikhan, and Horak) are also noted at few meters of the paved road leading to the basalt quarry site;

- Proximity of one (1) archeological mound to the basalt quarry site in the Jalabieh village;
- The large agricultural cover estimated at 28, 272 Ha; and
- Poverty and high unemployment rates.

Concerns and views disclosed during the public hearing related to:

- Alteration to existing land use (i.e. shift from agricultural to industrial). This includes as well sharing of existing groundwater used for agricultural irrigation leading to resource depletion;
- Public health and safety risks induced from noise and vibration, industrial atmospheric emissions, fugitive dust emissions and waste management;
- Land compensation plan;
- Potential employment opportunities

6.9.5 Assessment of Impacts

Impacts, adverse and beneficial, are expected to vary according to the phase of the proposed project. As such, impacts from two main phases are assessed in terms of type/nature, magnitude and significance.

6.9.5.1 Potential Impacts during Construction Phase

Social and Health Impacts

The major negative impacts on the social and public health characteristics of the area arising from the project's construction phase include:

- Potential cultural misunderstanding between the workers and indigenous/local settlers and increased risk of spreading communicable diseases such as HIV/AIDS…typically associated with poor sanitation and living conditions, sexual transmission and vector-borne infections;
- Accidental events/physical injuries due to heavy vehicular movement from and to the basalt quarry site and along the main Aleppo-Hassakeh highway; where local road users are not accustomed to have significant amount of heavy vehicular movement associated with the civil works, construction and preparation of the plant site; and inadvertent or intentional trespassing to construction sites, including potential contact with hazardous/contaminated materials or excavations and structures which may pose falling and entrapment hazards; (refer to section on *"Impact on Health and Safety*);
- Changes in land-use patterns, such as agriculture and sheep grazing due to acquisition of private properties and construction of access roads; (refer to section on *"Impact on the Land Environment"*);

- Temporary nuisance from noise and vibration generated from construction and blasting operations, vehicular movement, visual intrusion and dust emissions; (refer to section on "*Impact on Noise Quality and Vibration*");
- Aesthetic impacts due to unsightly operations and base camps; (refer to section on "*Impact on the Visual Environment*).

Without proper mitigation measures in place and compensation plans, the impacts resulting from the construction phase on the livelihood of the local population as well community's health and safety are considered **Significant** with a **high** likelihood of occurrence **(4C).** Impacts could range from temporary / reversible (nuisance from noise and emissions) to permanent/ irreversible (loss of land, livestock, fatalities, etc…).

Recommended mitigation measures to enhance the beneficial economic impacts and minimize the few adverse social and health impacts include the following:

- Compensation to local farmers who temporarily lost their agricultural lands (loss of livelihood);
- Consultation with potentially affected communities prior to building the construction camps;
- Proper training of crew members on camp regulations, code of conduct, and local cultural behavior and Awareness training of the workforce on responsible community interactions;
- Proper implementation of external security including adequate fencing and signage around the cement plant site as well as quarry sites, establishing tower guards to move away local pedestrians and livestock from the operation and all open pits so as to prevent injury / entrapment or death to any person and/or grazing animals;
- Avoiding cultural misunderstanding with indigenous and local settlers;
- Ensuring that noise levels near sensitivities meet local and company requirements;
- Communicating the availability of job opportunities to the local community in the projectarea;
- Maintaining and immediate repairing of any damages caused by the project operation on public or private structures (e.g. electric cables, water network supplies and irrigation channels, etc.); and
- Investigating the feasibility of SCC to conduct social assistant programs in the local area.
- Having a Traffic Management Plan (TMP) and ensuring that the Contractor complies with TMP requirements at all times;
- Allowing only certified and trained drivers to carry out transportation related activities;
- Having an plan for Emergency Response Procedures in place; and

By applying the above recommended measures, the impacts are reduced to a **Medium** likelihood of **Moderate** effect **(3B)**.

Further social impacts which are likely to be experienced by local or regional communities as a result of changes induced by development of the study area include workforce accommodation and accessibility to health care units/services facilities.

It should be reminded that the majority of the workforce will be comprised of Syrian manpower most of which are residing in the neighboring villages of the study area. Therefore, it is expected that the workforce will commute from their local residencies. The migrant workforce however (i.e. Chinese, French and Egyptian labor forces) will likely reside in the base camps inside the proposed plant site. Such will also be the case as the activities reach their peak in the construction phase. One (1) on-site health facility/ clinic will be provided for the workers during both construction and operation phases. The main concern is related to the availability of and potential dependency on existing nearby facilities.

Economic Benefit

The **key economic benefit** induced from the construction phase would relate to an increase in income and livelihood of local population clusters. This is promoted via the creation of new and temporary job opportunities for over 500 personnel in construction and civil works (estimated to extend over 24 months) in addition to the purchasing of supplies and commodities from local settlers and neighbouring businesses (grocery shop...) to serve the camp and logistic support. At the peak of the construction phase, nearly 1,800 persons will be employed for the SCC proposed project, a major portion of which will be comprised of nationals (i.e. of Syrian origin).

By creating job opportunities in these rural areas from hiring locals during civil works, providing rental lodgings for laborers and catering services (selling of local products), anticipated impacts would be considered short-term yet **Beneficial.**

6.9.5.2 *Potential Impacts during Operation Phase*

Cumulative Social-Economic Impacts

Given the lower labour intensity requirement during the operational phase, the study area will witness a decrease in labour force influx implying less demand for employment particularly for unskilled manpower. However, at a national scale, the project is expected to contribute beneficially to the Syrian economy by supporting development and growth in the region via creation of opportunities for local businesses in the supply of goods and services and promotion of the local cement market (thus decreasing the national demand for importation).

Archaeological and Cultural Heritage

With respect to cultural heritage, the baseline survey revealed the presence of several mounds, also known as "Tells", scattered to the west of the cement and quarry sites at varying distances (> 10km). In general, the proposed project is not expected to have any impacts on the local archeology throughout its construction and operation programs. However, the field investigation identified an archeological mound in the Jalabieh village located 5 km north of the proposed plant site. This also suggests the potential existence of buried artefacts which might be discovered during excavation activities.

Direct and indirect impacts during the construction phase particularly with the opening of the basalt quarry and associated quarrying/blasting and hauling operations on the cultural heritage include:

- Alteration of and/or damage to archaeological resources, whether on surface or below-ground from construction works which require the physical excavation (blasting, site clearance, trenching etc.) cause the
- Visual intrusion on the setting and amenity of the above-ground archeological mound during construction and operation and potential loss of access to the archaeological site;

Additional impacts are related to illegal activities such as robbing and trading of archaeological artefacts between crew members and local community. Additional concerns are related to conflicts that might arise due to such illicit activities. It should be noted that illicit activities such as smuggling and trading of artefacts are prohibited by the national authority (under the legislative **Decree No. 222/1968, Articles 56 & 57**) and any violation will subject the violator to legal pursuit and penalty.

Without proper implementation of control measures for the preservation and protection of archeological ruins, the impacts resulting from the operation phase on the cultural heritage are considered **Significant** with a **high** likelihood of occurrence **(4C) due to its close proximity to the basalt quarry site.**

Mitigation measures to be undertaken as to preserve the integrity of historical ruins and the existing mound rely on:

- Proper and careful planning of any work carried out near the mound so as to avoid any potential damage to the sensitivities and artifacts;
- Availability of an archeological expert at all times during the excavation phases at all sites;
- Proper documentation and reporting of historic sites for better assessment and rerouting (alternative routes); and developing an appropriate archeological guidance brochure and distributing it among the contractor crews as to show them some indications of how to distinguish the artifacts in the field. The brochure could include photographs and illustrations, handling procedures and a reporting system. It should be presented in both Arabic and English;
- Direct reporting to Aleppo's Directorate General of Archeology and Cultural Heritage in case of new findings during the quarrying operations (and any other relevant authority); and

- Prohibiting all theft attempts and postponing any damaging activities until further instructions from SCC or the on-site archeological expert.

- Based on the recommendation of the ELARD senior archeologist, a minimum buffer zone of a 500 m radius is suggested around the affected above ground archeological sites. The buffer zone is subject to change according to findings during civil works. It should be mentioned that direct reporting to relevant directorates and authorities should be carried out upon new finds.

Following implementation of the above recommended measures, the impacts are reduced to a **Medium** likelihood of **Moderate** effect **(3B)**.

Other impacts resulting from the project are anticipated to be **beneficial** and include 1) Increased knowledge resulting from the recording and analysis of archaeological sites carried out as part of the mitigation strategy; 2) Potential improvements to the setting and coherence of archaeological resources; and 3) Opportunity to involve and inform local business and residential communities about local archaeological resources.

6.9.6 Summary of Impacts and Ratings

Table 6-33 Impacts on Biological Environment Before and After Mitigation Measures

IMPACT	RATING BEFORE MITIGATION	RATING AFTER MITIGATION	
Existing Infrastructure	4C	3C	
Social and Health Impact	4C	3C	
Economic Impact (local and national scales)	Beneficial	Beneficial	
Archeological and Cultural Heritage	4C	3B	Beneficial

6.9.7 Conclusions

With regards to the socio-economic profile of the study area, it is expected to witness a temporary increase in income livelihoods throughout the construction phase. The economic benefits are anticipated to be felt at a national scale by strengthening local markets and businesses for cement manufacturing and trade.

Adverse socio-economic particularly public health impacts are regarded as significant and are highly likely to arise during the different stages of the project in the absence of the abovementioned mitigation measures. As such, it is highly recommended to ensure proper liaising with community and government by a dedicated resource in the field throughout the duration of the project (i.e. establishing a complaint register to document potential public complaints. The register should include 1) A description of the complaint; 2) Time and date; 3) Name, address and contact details of the person complained and 4) Actions taken to address the complaint with assigned timeframe for completion

6.10 CONSOLIDATED MATRIX OF ENVIRONMENTAL IMPACT ASSESSMENT

Table 6-34 Comparison between Environmental Impact Severity Matrix – a) No Mitigation Measures Applied, b) Measures in Place

ACTIVITY / SOURCE OF THE IMPACT		
Consequence	**Likelihood**	**Acceptability**
7. Negligible	A. Low	Negligible with minor mitigations
8. Minor	B. Medium	Minimize impacts
9. Moderate	C. High	Significant / major mitigation
10. Significant		Beneficial
11. Catastrophic		
12. Beneficial		

ACTIVITY / SOURCE OF THE IMPACT	UNMITIGATED IMPACTS – RECEPTOR: AIR QUALITY	LAND USE AND VISUAL IMPACT	WATER RESOURCES	BIODIVERSITY	NOISE & VIBRATIONS	INFRASTRUCTURE AND TRAFFIC	ARCHAEOLOGICAL	SOCIO-ECONOMIC & PUBLIC HEALTH	MITIGATED IMPACTS – RECEPTOR: AIR QUALITY	LAND AND VISUAL	WATER RESOURCES	BIODIVERSITY	NOISE & VIBRATIONS	INFRASTRUCTURE AND TRAFFIC	ARCHAEOLOGICAL	SOCIO-ECONOMIC & PUBLIC HEALTH
CONSTRUCTION PHASE																
Plant Site	2C	3C	2B	3B	2C	4C	1A	4C	1C	2A	2B	1C	2A	3B	1A	3B
Roads	2C	3C	1A	1C	2C	4C	1A	4C	1C	2A	-	1C	2A	3B	1A	3B
OPERATIONS PHASE																
Plant Site																
Crushing and Pre-homogenisation	3C	4C	1A	3B	3C	1A	1A	2B	2A	2A	1A	2A	2A	1A	1A	B
Milling, Homogenisations & Storage of Raw Materials	3B	4C	1A	3B	3C	1A	1A	2B	2A	2A	1A	2A	2A	1A	1A	B
Pre-heating, Kilning and Heating	4C	3C	1A	3B	3C	1A	1A	4C	2A	2A	1A	2A	2A	1A	1A	1B
Cooling, Grinding, Storage and Packing	3B	4C	3C	3B	3C	1A	1A	2B	2A	2A	2B	2A	2A	1A	1A	B
Transport of Raw Materials and Final Product	2C	4C	2B	3B	3C	5C	1A	3B	2A	2A	1A	2A	2A	2B	1A	1B
Captive Power Plant	4C	3C	4C	3B	3C	1A	1A	B	2A	2A	2B	2A	2A	1A	1A	B
Office & Accommodation Facilities	1A	2C	2B	3B	1A	1A	1A	B	1A	2A	1A	2A	1A	1A	1A	B
Limestone Quarry																
Drilling and Blasting	4C	4C	1A	2C	4C	1A	1A	2B	2B	2B	1A	1A	2B	2B	1A	1B
Transport	3B	3B	1A	1A	3B	1A	1A	2B	1B	1B	1A	1A	1A	1A	1A	1B
Basalt Quarry																
Drilling and Blasting	4C	4C	1A	2C	4C	1A	1A	2B	2B	2A	1A	1A	2B	2B	1A	1B
Transport	3B	3B	1A	1A	3B	5C	2B	5C	2B	1B	1A	1A	2B	2B	1A	1B

6.11 ENVIRONMENTAL IMPACT STATEMENT

The proposed SCC plant is designed to produce 3 million tons of cement a year. The project consists of:

- A cement plant equipped with crushers, mills, kilns, coolers, grinders and storage facilities
- A captive power plant capable of producing 60MW of power
- A limestone quarry capable of delivering 3,750,00 tons per annum
- A basalt quarry which will deliver 768,240 tons per annum

This chapter summarises the findings of the EIA and provides a comparative assessment of the positive and negative implications of the proposed SCC plant.

A summary of the need for and desirability of the project is presented, followed by a summary of the findings for the physical, soci-economic and cultural environments.

6.11.1 Need and Desirability of the proposed project

The need and desirability of the project is outlined in Chapter 1 based on the high percentage of cement imported into the country support by a growing demand for cement which is driving price up. The economic benefits of the project will be realised in the support of other sectors growth through lower cement prices, stimulation of business opportunities, job creation and the generating of government revenue.

6.11.2 Physical Environment

6.11.2.1 Negative Impacts

Air Quality

Construction Phase

Impacts on air quality during the construction phase of the project are minor and limited to the near-ground fugitive releases of dust from trucks delivering equipment and construction activities such as excavation. The impacts are short-lived and can be reduced by wetting roads to prevent excessive dust and the erection of dust shields around construction sites.

Operations Phase

Modern equipment available to control air pollution (i.e., electrostatic precipitators, pulse-jet fabric filters, low NOx burners, closed materials conveyers, etc…) can result in negligible concentrations of major air pollutants being emitted into the atmosphere. The impact of the cement plant on air quality is minor as the predicted annual means for major air pollutants fall within the national ambient air quality standards (SNS No. 2338/2004).

The modelling of the SO2 dispersion of the gases emitted by both sources (kiln + power plant), conclude a maximum yearly concentration at ground level of 6µg/m3 or 13µg/m3, depending on the sulphur retention scenario (95% or 99%). These concentrations are calculated for the most exposed villages in the dispersion pattern, namely, Kharab Eshek & Kharab Eshek Janoubi . These concentrations are compliant with WHO standards and are representatives of industrial areas in Europe.As for NOx the annual mean concentration in the study area of 40 µg/m3 remain below recommended standard values provided a low NOx burner is installed at the captive power plant. Annual emissions of the green-house gas CO2 from the operation of SCC plant is calculated at 2,047,815 tons/year for the cement plant and 429,720 tons/year for the power plant.

Dust emissions from cement kilns have been reduced dramatically over the last two to three decades due to regular improvements in design and operation, including increased use of modern de-dusting equipment. Near-ground fugitive releases of dust originating from grinding operations, truck traffic, wind, and other natural sources are difficult to measure and impact mainly on the local environment. The annual mean concentration of Dust (TSP) emissions (150 µg/m3) are below the recommended standard values so no adverse impacts on the ambient air quality are expected.

Water Quantity and Quality

Construction Phase

The main water demand during the construction phase is for domestic (25%) and construction (75%) purposes. The 600m3 /day of water required is comfortable supplied by the shallow wells on the property which can easily yield more than 2,000m3/day. The low volume of water required will have a negligible effect on the groundwater aquifers. Septic tanks are to be designed as part of the Waste Management Plan ensuring that no sanitary or waste water is discharged onto the land or surface water bodies.

Operations Phase

Water consumption for the cement plant is estimated at 2,000m3/day, while the captive power plant will require 5,000m3/day. The total water requirement for the cement plant of 7,000m3 is to be extracted from a series of 5 shallow wells around the cement plant and could potentially cause a water shortage/reduction for the other existing users. SCC will need to supplement their water requirements from 2 deep wells. Water from the deep and shallow wells are to be mixed to deliver an acceptable quality of water to the water treatment plant which is still to be designed. The water table at wells around the project site will be monitored to ensure the shallow aquifers are not depleted, thereby negative impacting on the availability of drinking and irrigation water for the surrounding communities. The quality of the water will also be monitored to ensure the recharge of the shallow aquifers does not reduce the quality of the water accessed by the communities. The impact of water requirements for the cement plant is minor provided the shallow aquifers are regularly monitored and corrective action taken (i.e. shifting to the deep wells) should they show signs of significant drawdown.

Domestic wastewater will be channeled through the waste treatment plant currently under design, before being used to irrigate lawns and wet surfaces to control dust. Similarly stormwater runoff and wash water will be channeled to evaporation ponds before being used to irrigate and control dust. With recycling inherent in the design of the plant facility the impacts from wastewater generation from the SCC project is expected to have minor impact (2A) on the study area. Minimal environmental impacts are anticipated due to the proposed water conservation measures through the proposed wastewater reuse schemes.

Noise and Vibrations

Construction Phase

All construction activities falls within the stringent day time criteria of 45 dB(A). However, the noise generated at some locations and near certain equipment within the cement plant could be in excess of noise exposure limits. High noise warning signs shall be displayed in areas of noise levels and ear protection will be made mandatory in those areas. With noise levels in villages located less than 1 km from the construction site, expected to exceed ambient noise level limits by less than 5 dB(A), management through the installation of temporary noise barriers and using appropriate equipment fitted with noise mufflers is required. Given the mitigation measure available, noise during construction is expected to have **minor** impacts.

Operations Phase

Noise levels at all sensitive receivers surrounding the cement plant site during operation will comply with noise limits for the day time period. Hence no noise impact during day time is expected. Noise levels at all sensitive receivers surrounding the cement plant site will exceed evening and night time limits by 3 to 9 dBA during operation. This is assessed to be a minor impact of a long term nature and would require adequate noise attenuation zones and noise barriers to be implemented. Noise level in quarry area, though high especially during blasting, will be only for short durations. Adequate noise attenuation zones, an increase of the quarry wall height, and adoption of additional noise barriers will need to be implemented to significantly increase the noise shielding effect, minimizing the noise level at receivers. The flow of large volume of trucks at close proximity to communities will be a major source of noise pollution especially along the proposed road link between the basalt quarry and the plant. Impacts have been assessed to have significant impact and of long-term nature. Proper route planning, traffic planning and compliance with regulations will reduce the impacts of offsite noise pollution to acceptable minor levels.

Vibration levels are expected to exceed limits for both human comfort and structural damage will result in significant public opposition. The adoption of good blasting practices will reduce the potential vibration impacts to acceptable levels. However with the majority of residential units in nearby communities constructed from mud, the vibration impacts on structural integrity are more likely to be more significant.

Adopting listed mitigation measures, noise and vibration impacts are expected to become a Minor level of Long-term (during project lifetime) but of reversible nature.

Biological Environment

Construction Phase

The construction phase of the proposed project will have a permanent effect due to physical damage to a limited portion (1.3 km2) of the agricultural land from excavation and site clearance activities. The impact is negligible as this represents 0.01% of the total agricultural land in the study area.

Operations Phase

The impact on receptors during operations will be minor as the study area does not host any threatened species or protected natural areas. However, several behavioral changes in local fauna are likely to take place such as breeding, feeding and migration patterns. Protection and preservation efforts from SCC's manpower as well as from the local settlers are required in order to prevent, if not mitigate, the anticipated adverse impacts on the site's biodiversity.

As anticipated, the predicted noise levels will drop significantly compared to those at the quarry boundary. However, noise levels will still exceed the noise limits with only minor impacts for daytime limit criteria at the Horak village. Nevertheless, as mining progress vertically underground, the noise shielding effect will increase significantly due to the rise of the quarry walls (acting as noise barriers) most likely reducing noise levels by additional 3 to 5 dB(A) achieving permissible daytime noise limits at all receptors

Infrastructure

Construction Phase

With the exception of road transportation, the impacts on existing physical infrastructures are considered Negligible during the construction phases of the proposed project. A Traffic Management plan would need to be implemented to control the trucks delivering equipment and supplies.

Operations Phase

No impact on the electricity grid is expected since the construction phase will rely on 24 generators for power supply and the proposed cement plant envisages having its own power plant (60MW) to sustain its electricity demand (45MW) upon operation. SCC are currently investigating an alternative routes and upgrade option for the basalt link road, these mitigation measure will limit the negative impacts to those of minor consequence which can be managed during the course of operations. The high volumes of traffic generated by the SCC will be mitigated through the upgrading and diverting of the Basalt Link Road, and the construction of a new intersection on the Aleppo- Al Hassakeh Highway at the entrance to the plant. High volumes of traffic will however increase the risk of accidents and traffic related incidence. This will need to be managed through clear signage on the roads and the education of local communities, staff and transport contractors.

Land and Visual Environment

Construction Phase

The visual impact during construction is limited to the plant site. Few mitigation options are available including physical barriers such as walls and netting. The impact is however of a limited duration.

Operations Phase

Visual impacts are typical concern in quarry projects. However, both quarry sites are adopting open pit quarrying method and are generally located in remote areas with almost flat topography that helps reduces visual intrusion on nearby communities. Good design and effective landscaping would further minimize any potential visual impacts. Vegetation planted close to the impacted community/road will maximize the angle at which the vegetation obscure the sites, and a variation of color on the plant structures will also helps blend the plant into the environment (green and grey hues).

6.11.3 Socio-economic and Cultural Environment

6.11.3.1 Negative Effects

Agricultural

Construction Phase

The construction of the roads and plant will transform the land-use of 13km^2 agricultural and grazing land. This however only represents 0.01% of the land already used for these activities and there has a negligible impact. The land for the plant site was purchased from a private owner as will land for the basalt link road. The quarry sites are being leased from the Government.

Operations Phase

Impacts on agriculture during the operational phase of the project are predominantly from dust (TSP) emission and air quality impacts. The air quality study show that based on the plant design emissions are within acceptable standards and no adverse impact is anticipated on surrounding activities such as agriculture.

Social and-Economic Impacts

Construction Phase

The likelihood of negative impacts on the social and economic texture of the study area is Low especially that SCC will recruit most of its workforce from nearby communities providing jobs and enhancing their skills and livelihoods. SCC shall develop a compensation mechanism in accordance with local regulations in case of any damage or acquisition of privately owned lands. Negative impacts associated with trespassing to construction sites, including potential contact with hazardous/contaminated materials or excavations and structures which may pose falling and entrapment hazards; traffic related injuries and fatalities among residents, other motorist and road users due to the increased traffic load and social discourse and disease linked to an influx of strangers into the areas are the main areas of concern. Most of these negative impacts could be minimized or even prevented by diffusing an environment of respect and dialog with the locals, encouraging participation of locals at early planning stage to manage issues like access, water supply and traffic in compliance with local regulation and IFC EHS guidelines.

Operations Phase

The project is likely to result in economic, cultural, and social alterations in the study area. The major socio-economic impacts on the area are around changes in land-use patterns, such as agriculture and grazing practices and the fluctuation of the local population through construction and into the operations phase of the project. Given that the land on which the plant will be constructed is privately owned by Lafarge and the quarry is situated on public land owned by the government of Syrian Arab Republic with the nearest receptor located few 100 meters from the nearest activity site, it is highly unlikely that any conflicts or direct impacts on locals will occur. Adopting recommended mitigation measures would further eliminate any potential impacts while enhancing the positive impacts of the Project on both the local and national level

6.11.3.2 Positive Effects

Construction Phase

Several potential positive impacts will arise during the construction phase which are primarily socioeconomic in nature and may include:

- Job creation;
- Local skills development;
- Increase in living standards;
- Increase in expenditure within local economies (purchase of commodities, services, etc,);
- Possible development and improvement of local physical and socio-economic infrastructure with the possibility of attracting future governmental funding to support infrastructure projects (e.g. roads, water networks, municipal landfills, etc.) and municipal services (e.g. communication, public transport services, etc.) in the area.

Operations Phase

The project is envisaged to have significant positive socio-economic impacts both on the local level in term of: skill development, long-term employment opportunities improve infrastructure, increase spending for purchasing of raw materials and commodities to serve the camp from the local market will boost the country's economy, etc. In addition, the project will have significant positive impacts on the national level through increasing Syrian's cement production exports, generating income and compensating for deficiency in local market demand for cement to accommodate the rapid urban development in the country.

6.12 CONCLUSION

The SCC project is of strategic importance to Syria to meet the growing deficient in its cement industry, which supports growth in other sectors. The EIA has found that within the limits of data availability and subject to the implementation of management and mitigation measures, the activity will result in impacts of low to moderate significance and a sizeable benefit to the cement industry in Syria

7 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

7.1 INTRODUCTION

In Chapter 6, different mitigation measures to reduce impacts or to optimize integration of the Syrian Cement project into the environment were proposed. Chapter 7 presents the proposed Environmental and Social Management Plan (ESMP) for the execution and operation of the proposed project.

"*Environmental Management is a tool for an organisation to keep aware of the interactions that its products and activities have with the environment and to achieve and continuously improve the desired level of environmental performance.*" **(Fredericks, *et. al*, 1995)**

Every EMP is designed for a particular operation and organisation and there is no single model that would apply to all types of industrial, commercial or institutional development. The ISO 14001 standard has developed some guidelines that organisations can use to help companies to develop appropriate environmental management practices, and where appropriate seek registration with a certification entity.

The following outline is based on the general requirements of an environmental management plan that would satisfy the requirement of the ISO 14001 standard.

Environmental policy
Planning
Environmental aspects
Legal and other requirements
Objectives and targets
Environmental management programme(s)
Implementation and operation
Structure and responsibility
Training, awareness and competence
Communication
Environment management system documentation
Document control
Operational control
Emergency preparedness and response
Checking and corrective action
Monitoring and measurement
Records
Environmental management system audit
Management review

The ESMP addresses the main impacts identified in the ESIA, in particular:

- Mitigation measures to be implemented during the construction phases;
- Waste management and disposal methods;
- References to control guidelines and standards;
- Responsibilities for the implementation of the ESMP;

- Verification, monitoring, and training requirements; and
- Reporting requirements.

SCC, its contractors and sub-contractor's commitment to comply with the proposed ESMP and relevant national and international regulations, standards and guidelines will guarantee that the project will operate in an environmentally and socially sustainable manner.

The ESMP has been based on the ISO14001 Environmental Management Systems standard. This is not to say that the programme will pursue certification, but simply that it will be based on a robust management philosophy. For this reason, the programme is structured to reflect a description of the overall approach; where after the individual elements of the management programme are presented in detail. It is also important to emphasise that the ESMP logically follows from the EIA and has been developed specifically in response to the mitigation measures stipulated in Chapter 6.

7.2 ENVIRONMENTAL AND SOCIAL POLICY

SCC is dedicated to constructing and operating their cement plant, quarry and associated infrastructure in an environmentally and socially responsible manner and in compliance with applicable environmental laws, regulations, and guidelines. The company considers meeting or exceeding safety and environmental standards a top priority. The SCC team will be committed to minimizing the environmental risks associated with construction activities. The planning execution of all the work-related activities will be completed in such a way that adverse effects on the environment are minimized. The LaFarge environmental and social policy (Figure 7-1) provides the overarching decision-making framework during design and construction after which it will be revisited and possibly revised as the project moves towards commissioning and full operations.

LAFARGE

June 2003

Lafarge Group Environmental Policy

We believe that Lafarge will succeed in the long term only if our actions respect the common interest. This means we must not only comply with the laws but also conduct our businesses consistent with sustainable development principles. At the same time, we must take into account the views and opinions of our local and global stakeholders. We are committed to the protection of the environment, human health and well being, to the mitigation of climate change and the conservation of nature. Our objective is to ensure the continued improvement of our environmental performance. We aim to use energy and natural resources more efficiently, minimize the production of waste, harmful air emissions, and water discharges while seeking ways to preserve heritage, landscape and biological diversity. In order to implement this policy, Lafarge commits to:

Commitments

Operations:
- operate our facilities in a manner that meets local laws, standards and regulations and state of the art environmental management systems requirements.
- minimize the exposure of our employees and the communities we work in to environmental, health and safety risks by employing safe technologies and operating procedures.
- minimize the use of non-renewable resources and, where feasible and safe, replace them with substitute raw materials, alternative fuels or biomass.
- minimize the generation of hazardous and other wastes, reuse and recycle materials where feasible and dispose of wastes using safe and responsible methods.
- implement programs to prevent accidental releases; have emergency response action programs in place at all sites.
- conduct environmental audits for all facilities on a routine schedule and in connection with all acquisitions and divestments.
- develop a rehabilitation plan for all quarry sites that takes account of the needs and expectations of our stakeholders and, where feasible, fosters wildlife habitat creation and contributes to the conservation of endangered species.

Greenfield Site Development and Major Modification Projects
- carry out an environmental impacts study when selecting greenfield sites for development or developing major modification projects, and meet the requirements resulting from being in close proximity to protected areas or habitats.
- design and build our facilities in a manner that meets local laws, standards and regulations as well as Lafarge's worldwide environmental standards.
- facilitate the conservation of historic remains discovered during site development and quarry operations.

Resources, Training, Research:
- provide adequate financial and human resources, employee training and awareness raising to facilitate continuous improvement in environmental performance.
- take the necessary steps, including sponsoring research, to improve our knowledge of the environmental impacts of our processes and products.

Procurement
- evaluate the environmental values and policies of subcontractor and supplier candidates as part of the selection process.
- require our subcontractors and suppliers to respect our environmental, health and safety values and comply with our policies and procedures when present on our premises.

Product Stewardship
- implement sustainability and product stewardship practices in the design, manufacturing, distribution and application of our products to enhance their contribution to sustainable construction, minimize their impact on human health and the environment, and limit the amount of wastes generated and disposed of.

Stakeholder relations
- provide our stakeholders routinely with environmental information about our operations and products in an open manner. We will solicit their feedback and encourage a candid dialogue. We will hold ourselves accountable to our stakeholders for our actions.
- cooperate pro-actively with legislators and regulators to evaluate the feasibility, impact, and cost/benefit of proposed laws, regulations and standards.

Figure 7-1 Lafarge Group Environmental Policy

7.3 ASSESSING ENVIRONMENTAL EFFECTS (ENVIRONMENTAL ASPECTS)

This Environmental and Social Impact Assessment report constitutes the environmental assessments that has been carried out in relation to construction and operational activities, and includes an assessment of:

- Air emissions;
- Water intake and discharge;
- Waste characterization and inventory;
- Consumption of chemicals, and other raw materials; and
- Labour and social issues.
- Please refer to Section 6 of this ESIA Report for further details on specific impacts.

7.4 COMPLIANCE WITH LAWS/REGULATIONS

Approvals / permits / consents / licenses relating to the environment will be in place prior to construction and operational activities and will be stored in a location which is easily accessible to appropriate staff. The approvals / permits / licenses will include – but not limited to – the following:

- Planning permission;
- Environmental approvals (discharge to air, transport of waste, etc.)
- Water intake permits; and
- Contract with special and approved for transport of hazardous material.

Should any other approvals or permits be required for new activities, these will be obtained prior to the commencement of the activities. The facility shall comply with relevant legislation, as presented in Section 5 of the ESIA.

7.5 OBJECTIVES

The objectives in implementing the Environmental and Social Management Plans are:

- To establish environmental management standards meeting or surpassing statutory, industry, community and client requirements;
- To continually review and, where appropriate, amend the environmental standards to reflect developments in technology, statutory requirements, industry practice and community standards;
- To develop and implement contingency plans for the control and correction of all environmental incidents;
- To inform all the Project's personnel and the contractor's personnel of their responsibilities with respect to environmental issues and to monitor the manner in which their responsibilities are discharged;
- Strive for an injury-free work force and minimize environmental impact through implementation of programmes in its project area that reduce risks to employees and the environment;
- Encourage and promote waste minimization, the sustainable use of natural resources, recycling, energy efficiency, resource conservation and resource recovery;
- The implementation of the Company Environmental Policy is accomplished through organized environmental management systems;
- To regularly audit the business activities and working procedures to ensure that the objectives stated above are being met.

7.6 LABOUR AND WORKING CONDITIONS

SCC intends to follow internationally-recognized best practices (consistent with IFC Performance Standards on Labour and Working Conditions [1] for labour and working conditions at the project.

SCC will provide a grievance mechanism for workers (and their organizations, where they exist) to raise workplace concerns. SCC will inform the workers of the grievance mechanism upon being hired, and will ensure that it is easily accessible to all. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides feedback to those concerned, without any retribution. The mechanism should not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

With respect to contractors or other intermediaries procuring non-SCC employee workers, SCC will:

- ascertain that these contractors or intermediaries are reputable and legitimate enterprises; and
- require that these contractors or intermediaries duly apply the requirements of the labour law.

The following actions will be taken to ensure good working and living conditions for the workers:

- Hiring of reputed contractors, preferably those who directly hire their workforce without intermediaries or recruitment agencies;
- Ensure regular and timely payment of salaries/wages;
- Design organization to ensure safe construction at a high performance standard;
- Enforce a health and safety plan, including personal protection equipment;
- Regularly (and without notice) audit the living conditions in the labour camps. Contractors unable to maintain good living conditions for workers will be banned from the project; and
- Require worker participation in weekly EHS meetings for safe working practices, finding solutions and solving problems (as the need arises). Employees who voice their concerns and suggestions will be rewarded.

7.7 COMMUNITY ENGAGEMENT PLAN (CEP)

Good relations with the community will be promoted by implementing an action plan that aims to provide a timely response to any enquiries, concerns or complaints about construction or operation activities.

SCC contractor will have a role in the consultation and disclosure process during construction, particularly regarding disclosure of information related to construction scheduling, hiring and procurement; traffic management; public health and safety; and reporting results of environmental monitoring.

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1 http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards

SCC will continue to remain in contact with project stakeholders during construction and the initial period of operation, for as long as it is an effective two-way channel for communication. In time, as a long-term presence in the region, SCC will develop additional formal contacts. With time, SCC may develop other local relationships and channels of communication that could benefit the local area.

Ongoing stakeholder consultation will allow SCC to receive and respond to community concerns on an ongoing basis. The goal of the CEP is to further SCC's "good neighbour" strategy of being good corporate citizens, protecting the environment, and enhancing the quality of life in their host).

The Community Engagement Plan (CEP) will be designed on the following principles:

- A Community Liaison Officer is appointed (preferably an SCC employee);
- The Community Liaison Officer will initiate the CEP through consultation with key stakeholders identified during community consultation;
- A formal CEP is produced and documented in consultation with all key stakeholders and the support of a specialized socio-economic consultant;
- The development of a communication strategy for the CEP with the support of a public relations firm or the support of a specialized socio-economic consultant;
- All stakeholders sign the CEP and receive a copy, thus ensuring full ownership;
- The CEP is monitored and evaluated by independent consultants alongside specified milestones;
- Professional monitoring and evaluation will contribute to maintaining the CEP as a dynamic and community-based engagement plan, and will ensure it is reviewed and amended as the project evolves through its cycle.

Box 7-1 Key CEP Components

- The CEP will be supported by an action plan defining activities, milestones, timeframes and responsibilities.
- The CEP will have documented procedures and processes circulated to all stakeholders ensuring that they have a full understanding and participation within the plan.
- Allocated budgetary support from the project sponsor for all activities within the action plan.
- Allocated budgetary support from the project sponsor for monitoring and evaluation by independent consultants.
- Provision of support resources such as meeting rooms, secretarial support (including translating facilities) and communication materials.

Through the Community Liaison Officer, SCC will implement a community grievance mechanism allowing community members to raise their concerns about any environmental or social concerns that they may have with regard to the project.

It is likely that SCC's Human Resources Department will take responsibility for the implementation of the ongoing CEP.

7.8 CONSTRUCTION PHASE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

7.8.1 Roles and responsibilities

7.8.1.1 E&S Organization

An Environmental and Social (E&S) Manager will be appointed to the project. The E&S function will be structured to include a range of responsibilities that will address the various requirements detailed in this ESMP. The ESM (will be responsible for ensuring that all requirements that have been identified in this ESIA, as well as others that may become apparent during project implementation are effectively met.

7.8.1.2 Contractor

Site environmental control officer – to support the ESM, it will be necessary to have at least one full time site environmental control officer. The site environmental control officer will be responsible for the coordination of the various environmental management requirements that need to be met by the project as well as the various other contractors that will be operating on the site. This function will include regular inspections, coordination of reporting, and site wide environmental monitoring.

Site community liaison officer – to support the E&S Manager it will be necessary to have a full time site community liaison officer. The site community liaison officer will be responsible for all contractor-related community liaisons including the dissemination of information, complaints management, and regular interaction with the various communities in the area.

Health and safety advisors – to support the E&S Manager it will be necessary to have full time health and safety advisors (number to be determined). The health and safety advisors will ensure an ongoing site presence to proactively identify potential, health and safety risks and timeous intervention to prevent accidents.

In addition the following line functions will need to have specific environmental and social management responsibilities included in their job descriptions and performance expectations.

Construction manager – the construction manager will be accountable for environmental and social management during the construction phase. Specific responsibilities will include:

- The effective implementation of the E&S
- Regular (monthly) performance reviews
- Corrective and/or remedial action where this may be required.

Engineering manager – the engineering manager will be accountable for ensuring that all environmental and social management infrastructure that will be required during operations of the proposed smelter is included in the design. This includes:

- The identification and inclusion of general site wide infrastructure (e.g. stormwater management, spill control etc.) as well as requirements for specific facilities (e.g. dust control equipment);
- The specification of design requirements and criteria (performance) for each engineering package.

7.8.1.3 Sub-Contractors

E&S representatives – each sub- contractor will need to appoint and have available on site on a a Health, Safety, Environment and Community (E&S) representative who can facilitate the implementation of the various environmental and social management requirements as they are relevant to the contractor's activities. Note that this function will need to extend to all sub-contractors that are used by the principal contractor.

7.8.1.4 Communications

A proper communication system will be established between personnel involved in the overall direction of operations as to facilitate communication. Any physical, organizational, personnel or work practice changes occurring on the rig will be controlled by the rig management system. Communications with the rig will be in accordance with the Emergency Response Plan Interface Document

7.8.2 Training

7.8.2.1 Formal E&S Management Training

As part of the development of the E&S Management system, specific training needs will be identified together with the mechanisms needed to respond to those training needs (in-house training, external training courses and so forth). The purpose of the training is to ensure that all personnel performing activities related to environmental and social management practices are trained, qualified and competent. Several in-house training programmes will also be developed for especially non-E&S specific personnel (particularly management) and these will be rolled out widely during the project. This training will include modern environmental and social management principles, integrated E&S management systems, as well as dedicated, task specific training such as monitoring and analysis.

7.8.2.2 E&S Awareness Training

Broad level E&S awareness courses will also be developed for all levels of worker on the project. E&S awareness training will focus on the following topics:

- What is E&S?
- Why do these items need to be managed/conserved/protected?
- What are the E&S aspects
- What can individuals do?
- E&S management principles.

7.8.2.3 Supplementary Initiatives

All of the above can also be supplemented through the following:

- Toolbox talks
- Crew talks
- Site directives
- Newspaper/newsletter
- Site induction programme
- Videos
- E&S Handbook

7.8.3 Checking and Corrective Action

7.8.3.1 Monitoring

A series of environmental variables that are to be monitored ARE listed below. Monitoring results will be presented monthly at the ECC, and compared to the objectives and targets stated in the EMP. Where the target values are not being met, further mitigatory action will be pursued:

- Effluent quality and water consumption
- Ambient air quality
- Surface water quality
- Groundwater quality (background)
- Noise
- Health and safety incidents

7.8.3.2 Inspections

Due to the transient nature of the Project phase, the greatest source of information is that sourced through ongoing visual inspection. HSE advisors will spend the bulk of their time on site looking for unsafe acts and activities that transgress the requirements specified in the EMP. At the same time some potential impacts are difficult to monitor quantitatively, such as soil erosion and waste management. The ongoing inspections by the HSE advisors provide valuable qualitative information on effects such as these so that action can be taken to mitigate against further potential effects.

7.8.3.3 Internal Audits

Where the monitoring data and the inspection reports highlight problems, an internal audit will be initiated. The purpose of the audit is to ascertain the source of the problem and to define what action must be taken to prevent its recurrence. The Contractor's EMPs will be audited routinely anyway, but if there are repeated reports of transgressions by a particular contractor, then that Contractor will be targeted for an audit. HOT will be notified of these audits and invited to participate. It is also expected that HOT will conduct their own internal audits on the Project on an ongoing basis.

7.8.3.4 Environmental Management Plan Documentation

The environmental procedures that are operated under the EMP must be carefully recorded in paper or electronic format so that they can be communicated effectively and clearly to employees and subcontractors.

The Environmental officer will regularly submit reports concerning environmental/social incidents, wastes and their disposal, monitoring results, audits findings and performance against Key Performance Indicators environmental coordination committee (ECC) (the composition of the ECC is described below). The ECC will review the consolidated monthly report and decide on an appropriate corrective action where this is deemed necessary (as outlined in table 7-1

Table 7-1 Environmental Reports

Reporting Parameter	Frequency	Nature of Report
Environmental and Social Incidents	Monthly (immediately if severe)	Entered into Action Tracking Database
Waste Volumes and Disposal Routes	Monthly	Internal reporting
Monitoring Results	Quarterly	Internal reporting
Audits Findings	Once per year (or according to the audit programme)	Internal reporting
Performance Against KPIs	Annually	Internal HSE reporting

7.8.3.5 Document Control

SCC will establish and maintain procedures for controlling EMP documents relating to the proposed activities. This involves developing a system that allows for the EMP and associated supporting text to be easily located and for the information provided in the EMP to be periodically reviewed, revised as necessary and approved by authorising personnel. Moreover the document control system should ensure that obsolete documents are removed from all points of issue and points of use, but are retained for legal and knowledge preservation purposes.

7.8.3.6 Environmental Co-ordination Committee (ECC)

The role of the Environmental Co-ordination Committee is to review on a monthly basis the environmental management performance of the Project and to specify suitable corrective action where required. Although the exact format of the meetings can be refined and modified as the project unfolds, at least the following should be addressed:

- Monthly monitoring results. It is proposed that these be tabled as a monthly report.
- Non-conformance issues and response.
- Feedback reporting to local and provincial authorities and stakeholders.

7.8.3.7 Records

As part of the EMP, it will be important to establish a records system for the identification, maintenance and dissemination of environmental records. Environmental records should be legible, identifiable and traceable to the activity involved. Records should be stored in such a way that they are readily retrievable and protected against damage, deterioration and loss. This system should contain the following components, if applicable:

- Permits, licenses, consents, certificates, registrations and other authorizations for waste and hazardous material handling;
- Appropriate plans, such as a spill response plan or ERP and the facility health and safety procedures;
- Inspection documentation;
- Training documentation (where appropriate); and
- Waste management documentation, including manifests and receipts. A hazardous waste register should be retained that must include the following:
- Name and address of the establishment;
- Name of person responsible for filling out the Register and his position;
- Period covered by the current data;
- Any special conditions issued by the Syrian Environmental Authorities;

- A list of the types and quantities of hazardous/dangerous waste resulting from the activity of the establishment;
- Method of disposal;
- Parties contracted to receive the hazardous waste;
- Date on which the form is filled; and
- Signature of person in charge.
- Access to sensitive documents may need to be controlled.

7.8.3.8 *Corrective Action*

There are several levels at which corrective action can be effected. These are listed and described below:

7.8.3.9 *Verbal Instruction*

Verbal instructions are likely to be the most frequently used form of corrective action and are given in response to minor transgressions that are evident during routine site inspections. Verbal instructions are also used to create further awareness amongst Contractors as often the transgressions are a function of ignorance rather than vindictiveness.

Maximum allowable response time: 2 working days

7.8.3.10 *Written Instructions*

Written instructions will be given following an audit. The written instructions will indicate the source or sources of the problems and proposed solutions to those problems. The implementation of these solutions will be assessed in a follow-up audit and further written instructions issued if required.
Maximum allowable response time: 4 working days

7.8.3.11 *Contract Notice*

A contract notice is a more extreme form of written notice because it reflects the transgressions as a potential breach of contract. If there is not an adequate response to a contract notice then the next step can be to have the contractor removed from the site and the contract cancelled.
Maximum allowable response time: 6 working days

7.8.4 *Management Review*

In keeping with the ISO14001 requirements, a formal management review will need to be conducted regularly. The purpose of the review will be to critically examine what is working and what is not in respect of the ESMP and its implementation and to decide on modifications as necessary.

The process of management review is in keeping with the principle of continuous improvement which is the commitment expressed here. Given the period of construction it is envisaged that a management review will take place at least at 3-monthly intervals.

7.8.5 Mitigation Measures

This section includes a priority list of the most important measures that SCC should adopt to ensure a practical, cost-effective and appropriate approach to impact mitigation.

Proposed mitigation for construction impacts is provided in **Error! Reference source not found.**, to ensure that the residual adverse impacts resulting from the works will be reduced to an acceptable level, whilst maximizing the benefits of the project. In addition, the CESMP will identify additional measures to be implemented during the construction phase.

Table 7-2 Summary of Environmental Management Requirements for SCC Project during Construction Activities

ASPECT/IMPACT	OBJECTIVES	MITIGATION/MANAGEMENT	MONITORING REQUIREMENTS
AIR QUALITY MANAGEMENT			
- Soil grading and compaction during site preparation Movement of transport vehicles - Engine emissions from construction equipment and transport vehicles	- Comply with Syrian limits and WBG for ambient air concentrations - Dust does not cause health or safety issues on site or beyond the boundaries of the site. - Fugitive emissions, including odours, dust, smoke and fumes, are either prevented or controlled so that they do not cause an environmental nuisance.	- Spray water on exposed earth and graded roads for dust suppression during dry weather conditions - Clean vehicles periodically to minimize dust generation. - Restricted speed of vehicles - Erect sign posts displaying the safe maximum speed limit. - Water sprinkling in dry weather, cover cut and embankment sections of earthwork. - Open stockpiles of loose, fine-grained materials should be avoided where possible. Maintenance of all roads clear of mud and dirt from the site. - Maintenance of vehicles and tyre roads clear of mud and dirt from the site. - Loading and unloading should be carried out carefully with minimal drop heights to minimize dust generation. - Ensure that all construction equipment and transport vehicles are well maintained and certified for emission compliance.	- *Monitor workplace concentrations with personal dust monitors at several locations within worksites and outside of the working area to ensure compliance with standards; Frequency – monthly / quarterly;* - Periodically monitor ambient air quality quarterly to ensure compliance with standards.
NOISE MANAGEMENT			
- Construction equipment noise Movement of transport vehicles Cumulative construction noise	- Noise does not create a nuisance to surrounding communities or a health hazard to workers - Compliance with relevant Syrian/WBG noise regulations. - Complaints related to noise nuisances by neighbors, especially during night time (from 10 pm to 7 am), are avoided.	- Use and allow only well-maintained construction equipment which meet regulatory standards for source noise levels; - Position equipment which emit noise in one direction away from noise sensitive receivers; Use silencers or mufflers on construction equipment; - Maintain silencers and mufflers; - Site mobile equipment as far as possible from noise sensitive receivers; - Shut or throttle down to a minimum machines and transport equipment that are used intermittently during idle periods; - Construction should be avoided during night times, except when essential. The contractors will be required to use best practicable means to minimize noise during the construction period. Schedule high noise generating activities such as piling and drilling for day time only.	- Quarterly monitoring of noise at fenceline to ascertain levels of disturbance

ASPECT/IMPACT	OBJECTIVES	MITIGATION/MANAGEMENT	MONITORING REQUIREMENTS
		- Ensure that vehicles are well maintained. - Personnel working with equipment generating high noise levels shall be provided with ear plugs/muffs.	
WATER AND SOIL QUALITY MANAGEMENT			
- Waste water management - Major spills / leaks of oils and chemicals	- Water discharged from site meets all relevant quality limits. - Soil erosion is controlled and minimized. - Transport of sediment off-site by wind or storm water run-of is controlled and minimized.	- Erosion of the construction site is controlled and minimized. - Drainage system must segregate storm water run-off from wastewater streams; - Prevent wash water from carrying construction material into the drainage system; - Wash construction equipment and transport vehicles in designated areas only. Wash water must be collected in a primary sedimentation tank. - In case of accidental spills or leaks on soil, ensure that contaminated sites are remediated promptly.	- There is comprehensive monitoring of discharge water quality - Determine volume of sewage disposed from work sites and labour camps, based on volume calculated for tanker capacity and waste consignment notes issued for transfers; Frequency – every consignment
- Waste management	- All waste generated during the construction phase is tracked in terms of quantities, hazard rating and final disposal.	- Every effort shall be made to recycle waste. - Segregate waste into four main categories, viz. non-hazardous and recyclable' on-hazardous and non-recyclable' hazardous and recyclable and hazardous and non-recyclable; - Used oil and oily waste shall be collected in drums and stored in a dedicated impervious area on site for off-site disposal. - Any polluted water, oil spills and such hazardous liquids shall be confined in impermeable containers and disposed appropriately - At the time of demobilization, the contractor must remove accumulated waste to an approved off-site facility; - Employ a local waste handler to remove non-hazardous construction waste from the site on a regular basis to an approved municipal landfill sites; - Prohibit burning of refuse on site.	- Determine the quantity of each category of solid waste disposed from work site and labour camps, based on volume / weight calculated for tanker capacity and waste consignment notes issued with each transfer; Frequency – every consignment.
TERRESTRIAL ECOLOGY			
- Site preparation	- No vegetation outside the project area is damaged during the construction of the project.	- Ensure that no vegetation outside the project area is damaged during the mobilization and demobilization of construction equipment - Soil grading and compaction	- At the time of demobilization, the contractor must assess the vegetation surrounding the

ASPECT/IMPACT	OBJECTIVES	MITIGATION/MANAGEMENT	MONITORING REQUIREMENTS
			site.
WATER USEAGE			
- Depletion of local groundwater resources	- Meaningful reductions in water use across the site are achieved and waste water re-use is maximized	- Identify water supply wells that support sustainable water extraction without affecting existing users. Source water from these wells only if required in addition to supply from the temporary desalination plant. - Minimize water consumption by reusing treated sewage/wastewater for non-critical purposes such as dust suppression.	- Monitor daily water consumption and conduct quarterly water audits to identify opportunities for water conservation. No impacts on existing users of groundwater and maximum re-use of waste water
HEATH AND SAFETY			
- Occupational Health and Safety	- Ensure that the project does not adversely affect the health of the employees, contractors or the general public. - Zero reportable injuries and work-related illnesses.	- All the construction employees are to be provided with appropriate safety training that covers key issues like hazards associated with the job, precautionary measures including necessary personal protective equipment and importance of safety on the work place. - All the employees shall be aware of potential emergency conditions at the site, actions to be taken in case of emergency and facilities provided to combat emergency situations. The effectiveness of the emergency preparedness shall be tested by conducting periodic drills. - Appropriate warning shall be displayed indicating hazard in the area and the personal protection to be used while working in the area. - The employees shall be encouraged and rewarded for pointing near-miss cases. - All unusual instances including accident and near-miss shall be recorded and investigated for knowing corrective and preventive actions. - Contractor will designate health, safety and environmental officer or manager in charge responsible to track and document safety statistics and set targets for continuous improvement. - A safety and information bulletin board will be posted at sites where workers enter and leave the site or rest to encourage good communications.	- Monitor the monthly health and safety incidences

ASPECT/IMPACT	OBJECTIVES	MITIGATION/MANAGEMENT	MONITORING REQUIREMENTS
		- Material handling, in particular, loading and unloading activities can be prone to cause accidents. Use of suitable equipment, proper supervision and sound site management practices are recommended to minimise the possibility of the accident.	
- Site security	- No unauthorized personnel on-site	- Restrict access to site and control access gates during off-hours for 7 days a week, including public holidays; - Security personnel conduct regular foot patrols, permanent patrols and lock inspections; - Workers to be issued with uniforms or identity badges	-
- Traffic management	- Reduce the potential for disturbance to local road users - No road accidents as a result of construction vehicles. - The number of vehicles using public road will be ascertained to judge the extent of traffic disruption.	- The route of the vehicles will follow the less busy roads to the extent possible. - The vehicle movement shall be scheduled with a view to avoid traffic peak hours of the public roads. - The transport authority shall be informed about the vehicle movement so that - Appropriate traffic management strategies like diversion can be adopted. - All the drivers of the vehicles using public roads will be trained in defensive driving with a view to minimize traffic jams. - Traffic diversion, if required, shall be planned in co-ordination with traffic police.	- Maintain register of drivers trained in defensive driving techniques - Maintain register of road accidents.
- Major accidents associated with transport, storage and of hazardous substances	- All hazardous materials that are used on site are safely stored, used and removed.	- Develop and implement safe and effective procedures for transportation, storage and handling of hazardous materials according to the requirements of MSDS; - Bund all fuel tanks and acid/alkali storage areas to prevent spilled fuel oil from reaching water systems or running into drainage systems; - Keep welding gas cylinders in secure, cool, covered and ventilated areas; - Keep radioactive material, used for radiographic testing of process vessels, in secured designated areas under custody of authorized personnel. Storage areas and conditions must comply with local regulations. - Develop an effective emergency response plan in association with local authorities.	- All waste generated during the construction phase is tracked in terms of quantities, hazard rating and final disposal.
- Hygiene management	- The health of workers and	- Implement a health and hygiene management	

ASPECT/IMPACT	OBJECTIVES	MITIGATION/MANAGEMENT	MONITORING REQUIREMENTS
	surrounding communities is not reduced in any way and is enhanced wherever possible	programme, consisting of the following: - Proper sanitation and drainage facilities - Routine pest control measures such as spraying of insecticides and pesticides - Regular waste collection and proper storage - Regular inspections for any health problems of workers - Good housekeeping practices	
SOCIO-ECONOMIC IMPACTS			
- Job opportunities - Local empowerment	- Local employment and gender equity is maximized.	- Maximize local employment opportunities and provide supporting training to maximize the number of locals that can be employed; - Develop and implement a local labour preference policy and maximize the hiring of qualified local Syrian workers. - Promote the employment of women; - Review conditions of employment and remuneration to promote equity between expatriate and local personnel, whilst still remaining attractive to essential expatriate skilled staff. - Identify and consider opportunities for maximizing the use of local contractors and workforce, locally available materials and consumables even if such measures involve upfront investment/effort in training and upgrading services/materials to specifications and quality for meeting requirements – in doing so, start extending benefits to the local communities from the early stages of site work throughout the construction period	- Monitor the total employment of local labour at the completion of the construction process.
- Reduction of local job opportunities at the end of construction	- Negative impacts associated with the loss of jobs at the end of the construction phase are managed and reduced -	- Coordinate with local authorities and other project officials in developing and implementing a suitable social investment plan to provide sustainable employment to local people.	-
- Community impacts	- The welfare of local communities is not reduced in any way and is enhanced wherever possible. - The well-being and the security of all employees is ensured and conditions created for a working environment, respectful of the different ethnic groups living on site.	- Maintain ongoing communication with potentially affected communities.	- Monitor the effectiveness of managing community expectations and addressing their concerns during construction phase.

ASPECT/IMPACT	OBJECTIVES	MITIGATION/MANAGEMENT	MONITORING REQUIREMENTS
	- Detrimental social and/or community impacts from construction workforce are controlled and minimized - Opportunities for local population are maximized during the construction period. - No complaints about social or community impacts are received.		

7.9 OPERATIONAL ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (OESMP)

7.9.1 Roles and Responsibilities

In order to ensure that this EMP is implemented, the following staff resources shall be made available:

- The SCC site manager will assume responsibility for ensuring that the environmental management measures contained in this document are implemented during the operation of the project.
- An Environmental Coordinator will be designated from the Quality Department to ensure the day-to-day implementation of the requirements of the OESMP

7.9.2 Specific duties of the Environmental Co-ordinator

The Environmental coordinator must:

- Implement the requirements of the ESMP;
- Know the background to the project and monitor the implementation of the EMP.
- Ensure regular in-house auditing of the project for adherence to the EMP, identify problem areas and provide action plans to avoid costly stoppages and / or further environmental damage.
- Ensure that open communication lines exist for the reporting of any significant environmental incidents and ensure that open communication lines exist for the reporting of any environmental incidents or environmental threats (for example, a leaking pipe) from workers at the site to the plant management or supervisor.
- Update the EMP as and when required.

7.9.3 Training

The Environmental Coordinator shall ensure that adequate environmental training of all employees and contractors takes place. All employees / contractors shall have an induction presentation on environmental awareness (see below). Where possible, the presentation needs to be conducted in the language of the employees / contractors. The environmental training shall, as a minimum, include the following:

- Sensitive and no-go areas on site.
- The importance of conformance with the EMP.
- The significant environmental impacts, actual or potential, of their work activities.
- The environmental benefits of improved personal performance.
- Their roles and responsibilities in achieving conformance with the EMP, including emergency preparedness and response requirements.
- The potential consequences of departure from specified operating procedures, including actions that may be taken by the regulating authorities against transgressors.

- The mitigation measures required to be implemented when carrying out their work activities.

7.9.4 Checking and Corrective Action

7.9.4.1 Monitoring

The operation phase monitoring program will include monitoring at the source within the plant site as well as monitoring in the external environment. The Monitoring Plan is presented in Table 7-1 Environmental Monitoring Plan during Operations

Table 7-1 Environmental Monitoring Plan during Operations

ENVIRONMENTAL COMPONENT	PARAMETERS	FREQUENCY
Ambient Air Quality	PM, - max of 50 mg/m^3 SO_2, - max of 13 µg/m^3 7.10 NO_x - max 6 µg/m^3	Annual
Air emissions	PM, - max of 50 mg/m^3 SO_2, max of 1888 mg/m^3 NO_x, max of 600 mg/m^3 GHG's	Continuous (with the exception of annual GHG monitoring)
Groundwater	pH, Oil and Grease, TSS, TDS, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Sulphates, Nitrates Chlorides, Heavy metals (Cd, Cu, Cr, Ni, Pb, Zn) Water levels	Biannually
Ambient Noise	Noise Levels in dB(A)	Annual
Resource conservation	Cement Steel Construction equipment: • Operating hours / distance travelled • Fuel consumption • Exhaust emissions	Monthly Monthly Weekly Quarterly Quarterly
Solid waste	Waste type Waste generated Waste reused Waste transported for offsite reuse/recycle Waste disposed Method of disposal	Weekly
Material procurement	Material purchased Material consumed Un-accounted material with explanation	Monthly
Water	Water consumption Effluent for pH, Oil and Grease, TSS, TDS, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Sulphates, Nitrates Chlorides, Heavy metals (Cd, Cu, Cr, Ni, Pb, Zn)	Weekly Quarterly
Oil consumption / used oil	Lubricant oil purchased Lubricant oil used Used lubricant oil generated Oily waste	Monthly
Safety	Safety training provided Effectiveness of training	Monthly
Emergency preparedness	Facilities for emergency preparedness Report of emergency preparedness drill	Quarterly

7.10.1.1 *Audits*

Where the monitoring data and the inspection reports highlight problems, an internal audit will be initiated. The purpose of the audit is to ascertain the source of the problem and to define what action must be taken to prevent its recurrence.

SCC will undertake an annual external audit of for the purposes of compliance with the requirements of the Lenders.

7.10.1.2 *Reporting*

A suitable reporting structure must be defined – it is proposed here that a monthly report be developed that can be tabled at an environmental coordination committee (ECC) (the composition of the ECC is described below). The ECC will review the consolidated monthly report and decide on an appropriate corrective action where this is deemed necessary.

It is important to note that corrective action can also be effected immediately without necessarily going the route of reporting to the ECC. Corrective action can be instructed immediately where this is deemed necessary and formalised through a site directive issued by the Environmental Co-ordinator Manager should that be required.

7.10.1.3 *Environmental Management Plan Documentation*

The environmental procedures that are operated under the EMP must be carefully recorded in paper or electronic format so that they can be communicated effectively and clearly to employees and subcontractors.

The Environmental officer will regularly submit reports concerning environmental/social incidents, wastes and their disposal, monitoring results, audits findings and performance against Key Performance Indicators environmental coordination committee (ECC) (the composition of the ECC is described below). The ECC will review the consolidated monthly report and decide on an appropriate corrective action where this is deemed necessary (as outlined in table 7-1

Table 7-1 Environmental Reports

Reporting Parameter	Frequency	Nature of Report
Environmental and Social Incidents	Monthly (immediately if severe)	Entered into Action Tracking Database
Waste Volumes and Disposal Routes	Monthly	Internal reporting
Monitoring Results	Quarterly	Internal reporting
Audits Findings	Once per year (or according	Internal reporting

Reporting Parameter	Frequency	Nature of Report
	to the audit programme)	
Performance Against KPIs	Annually	Internal HSE reporting

7.10.1.4 Document Control

SCC will establish and maintain procedures for controlling EMP documents relating to the proposed activities. This involves developing a system that allows for the EMP and associated supporting text to be easily located and for the information provided in the EMP to be periodically reviewed, revised as necessary and approved by authorising personnel. Moreover the document control system should ensure that obsolete documents are removed from all points of issue and points of use, but are retained for legal and knowledge preservation purposes.

7.10.1.5 Records

As part of the EMP, it will be important to establish a records system for the identification, maintenance and dissemination of environmental records. Environmental records should be legible, identifiable and traceable to the activity involved. Records should be stored in such a way that they are readily retrievable and protected against damage, deterioration and loss. This system should contain the following components, if applicable:

- Permits, licenses, consents, certificates, registrations and other authorizations for waste and hazardous material handling;
- Appropriate plans, such as a spill response plan or ERP and the facility health and safety procedures;
- Inspection documentation;
- Training documentation (where appropriate); and
- Waste management documentation, including manifests and receipts. A hazardous waste register should be retained that must include the following:
- Name and address of the establishment;
- Name of person responsible for filling out the Register and his position;
- Period covered by the current data;
- Any special conditions issued by the Syrian Environmental Authorities;
- A list of the types and quantities of hazardous/dangerous waste resulting from the activity of the establishment;
- Method of disposal;
- Parties contracted to receive the hazardous waste;
- Date on which the form is filled; and
- Signature of person in charge.
- Access to sensitive documents may need to be controlled.

7.10.1.6 *Environmental Co-ordination Committee (ECC)*

The role of the Environmental Co-ordination Committee is to review on a monthly basis the environmental management performance of the Project and to specify suitable corrective action where required. Although the exact format of the meetings can be refined and modified as the project unfolds, at least the following should be addressed:

- Monthly monitoring results. It is proposed that these be tabled as a monthly report.
- Non-conformance issues and response.
- Feedback reporting to local and provincial authorities and stakeholders.

7.10.1.7 *Mitigation Measures*

Air Quality

The proposed plant is designed to the state-of-the-art technology and all environmental protection measures are built in the plant design. By nature of design (like ESP for the control of kiln exhaust) emissions to the environment are minimised. Air emissions should be monitored once the plant is commissioned to ensure that the emissions used in the modeling exercise are complied with.

Bag filters shall be provided for crushing plant, blending silo, clinker storage, cement milland all transfer points and conveyors.

Notwithstanding the fact that dust emissions in proposed facilities for mining and cement manufacture depend on spread of dust, following control measures are proposed:

- Covering of all the raw materials to the extent possible in particular during transport including conveyor belts;
- Retention of moisture in the raw material to the extent possible;
- Green-belt development around the facility to act as buffer zone for mining and cement plant
- Use of overburden to support green-belt development;
- Surface internal roads to avoid dust generation; and
- Watering of roads to suppress dust.

In order to mitigate the air pollution caused during drilling operations, dust extractors shall be used for collection of dust from the source and depositing the same away from the work place. Dust generated during the unloading of limestone in the crusher hopper shall be suppressed by water spray.

Control of carbon emissions though important it is challenging for cement industry, as CO_2 generation is inherent to the process. Cement industry produces equal weight of CO_2 and clinker; any cost associated with CO_2 management is feared to have significant impacts on the financial performance. The control of CO_2 emissions has been, therefore, identified as a critical issue by the cement industry and it is rightly believed that companies or a group of companies cannot solve this problem in isolation. Cement

Sustainability Initiative, Sustainable Development Initiative of cement manufacturing industry have identified emission control as a priority item and key factors for success of climate change management are delineated as follows:

- A complete inventory of CO2 emissions, on a facility basis and for the corporation
- An understanding of each facility's individual CO2 cost control curve
- Development of trading, ofset, and other management strategies
- Integrating CO2 costs into corporate financial decision-making using probabilistic modelling with a range of CO2 prices.

CSI has issued a protocol titled, "CO_2 Accounting and Reporting Standard for the Cement Industry - June 2005" as a tool for cement companies worldwide to monitor inventory. It provides a harmonised methodology for calculating CO_2 emissions, with a view to reporting these emissions for various purposes. It addresses all direct and the main indirect sources of CO_2 emissions related to the cement manufacturing process in absolute as well as specific or unit-based terms.

Noise and Vibration

Noise

The methods to be adopted to minimize noise pollution include equipment practices and equipment quieting. The equipment practice covers equipment selection, engine selection and proper matching of equipment. The operational practices include blasting practice, operator training, scheduling and site layout, and switching equipment while not in use and driving and reduced speed (20-40 kmph). The equipment quieting includes new equipment noise control and retrofit noise control.

Further it should be noted that noise level decreases with the increase of distance of measurement and it is proportional to the quantity of explosives detonated. Air over pressure and noise can be effectively contained within limits by adopting the techniques stated below:

- Using long stemming columns in blast holes.
- Using electric delayed detonators rather than detonating fuse as trunkline.
- Covering the detonating fuse with at least 150 mm thick cover of sand or drill cuttings
- Not blasting when strong winds are blowing towards the residence.

It is also recommended to provide noise attenuating devices like ear plugs and ear muffs to workers exposed to high noise levels. Also, high noise warning boards shall be displayed in areas of noise levels and ear protection will be made mandatory in this area.

The high noise operations like blasting need to be restricted to a limited part of the day. All plant and machinery will be maintained properly as prescribed and operated optimally at rated capacity.

Vibration

The measures to be adopted for abatement of ground vibrations air blast and flyrock include:

- Reduce weight using total charge weight per delay using delay detonators.
- Use decking wherever possible.
- Supervision of drilling and blasting operations to ensure the designed blast geometry.
- Sub-drilling may be kept just adequate to tear off the bench bottom.
- Eliminate hole to hole propagation between charges.
- Proper drilling of the face before blasting.
- Use warning signals.
- No blasting when surface winds are strong.

Water Environment

Water Conservation

All efforts shall be made to conserve and ruse the water within the project. It is therefore recommended that all blowdown water and wash water be reused for material cooling, spraying, etc. Domestic water shall be treated in a biological treatment plant and reused within the plant for material cooling and or irrigation.

The fire-fighting exercises require significant amount of water whenever a drill is conducted. Necessary containment and treatment measures need to be established to enable maximum reuse. The wastewater from the colony needs to be treated and reused in manufacturing.

Water Quality

The proposed mine workings are located above the general ground level and the water table is significantly below the ground surface. Therefore no water seepage is anticipated in the mining area. Any spillage of waste oil from workshops will have an adverse impact on the groundwater.

- Measures to mitigate this impact are discussed below:
- The workshop shall be provided with a concrete surface to prevent seepage of any spillage into the groundwater.
- Changing of oil/fuel from construction vehicles shall be undertaken in designated areas only.
- Use drip pans while undertaking all such activities.
- Maintain absorbent pads handy to absorb all leaks / accidental spills. Dispose used pads as hazardous waste.
- Drain and crush oil filters (and oil containers) before recycling or disposal.
- Store crushed oil filters and empty lubricant containers in a leakproof container/receptacle.
- Store mechanical parts and equipment that may yield even small quantities of contaminants (i.e. oil and grease) under cover.

- Drain all fluids and remove batteries from salvage vehicles and equipment.
- Recycle or properly dispose of the following: greases, oils, antifreeze, brake fluid, cleaning solutions, hydraulic fluids, batteries, transmission fluids, and filters.
- Clean up spills as they occur.

Fouling of groundwater sources located in the vicinity of any mining area during the rains may generally be caused due to the following reasons:

- Sediments in suspension of the mine drainage; and
- Sediment carried away from the unconsolidated waste dumps.

It is accepted that for the proposed mining, the extent of fouling of groundwater sources will be minimal as there is no regular drainage. However, the sediment flow during the rainy season can be checked prior to its flowing in the nearby groundwater sources by constructing sediment basins/check darns, wherever necessary. The operation of various equipment like excavators, dumpers, loaders, etc. results in generation of liquid waste in form of used oil. This oil shall be filled in barrels and sold to outside parties for further processing and or reuse.

Domestic sewage from the plant shall be treated in soak pits and from colony shall be treated in a sewage treatment plant and reused for irrigation.

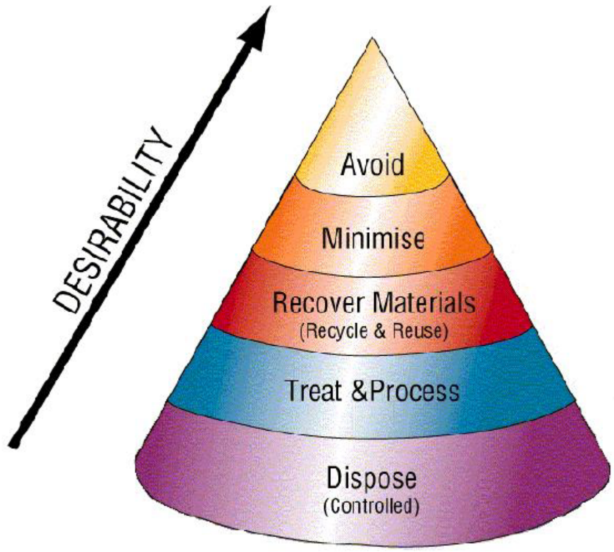
7.10.2 Waste Management Plan

The operational waste management plan will keep waste to a minimum and emphasize the 4RVE waste management hierarchy of reduce, reuse, recover, valorize, and eliminate (for non-hazardous materials). Each type of waste (solid or hazardous) has to be managed according to its nature, the current legislation and its recycling or recovery potential.

The individual management methods for each waste will be developed on a case-specific basis to determine the appropriate management option. The management method selection will be based on analysis of the following:

- Detailed characterization of the waste;
- Temporary storage methods;
- Handling and transport methods;
- Method of treatment or destruction;
- Final products and residues;
- Environmental impact of this management strategy;
- Cost.

Figure 7-2 Lafarge Waste Management Hierarchy



Waste management options include:

- Recycling in the process;
- Off-site recovery;
- Off-site elimination/disposal.

Employees will be provided with waste management training and encouraged to implement waste management practices. Waste Management controls are described in **Error! Reference source not found.**.

Table 7-2 Summary of Waste Management Requirements for the SCC Project during Operations Activities

Environmental pollution and potential health risks from solid waste	- Solid waste shall be stored in an approved area in covered, tip-proof metal drums, preferably skip containers, for collection and disposal.
	- The waste collection point shall be fenced off with diamond mesh wire with a minimum height of 1,8 meters. This fence should preferably be electrified. The fence needs to keep out people and animals, above and below ground level.
	- A refuse control system shall be established for the collection and removal of refuse to the satisfaction of the MD.
	- Disposal of solid waste shall be at an appropriately licensed landfill site.
	- No waste shall be burned at the site offices or anywhere else on the site, nor at the approved solid waste disposal site.
	- All building rubble shall be a) removed from the site and disposed of at an appropriate dumping site, or b) temporarily stored in a clearly demarcated area on site for future use.
Litter	- No littering by workers shall be allowed. During the operations period, the facilities shall be maintained in a neat and tidy condition and the site shall be kept free of litter.

	- The contractor shall provide enough rubbish bins / skips for later safe disposal at approved sites.
	- Littering, discarding or burying of any materials shall not be allowed on site.
Hazardous waste	- Hazardous waste such as tar and oil shall be disposed of at an appropriately licensed hazardous waste site, or through a registered hazardous waste management company. Special care shall be taken to avoid spillage of hazardous products.
	- Used oil, lubricants and cleaning materials from the maintenance of vehicles and machinery shall be collected in a holding tank and returned to the supplier. Water and oil shall be separated in an oil trap. Oils collected in this manner shall be retained in a safe holding tank and removed from site by a specialist oil recycling company for disposal at an approved hazardous waste disposal site.
	- Hazardous waste shall be removed from the site and adequately disposed of.
Recycling	- Wherever possible, materials used or generated by construction shall be recycled or reused.
	- Where possible and practical, such as at stores and offices, waste shall be sorted for recycling purposes, into the following categories: paper, aluminium, metals (other than aluminium), organic waste and glass.
	- Separate containers for glass, paper, metals and plastics shall be provided. Office areas are particularly suited to this form of recycling process.

7.10.3 Management of Hazardous Substances

A procedure will be developed for safe handling, storage and use of hazardous substances, to protect employees and the environment from related risks. As a rule, the selection and use should always be of the least hazardous substances. If substitutions are not available, the following actions should be taken:

- Assessment of the risks in terms of EHS;
- Limitation of the number of people directly exposed to the substance;
- Any hazardous waste must be stored in solid, non-porous, leak-proof sealed containers (i.e., steel drums/skips with securely closed covers) that are in good condition with no visible defects, and accompanied with Material Safety Data Sheets (MSDS). Containers must be kept at the upright position and must be labelled with the content of the container and warning about the danger associated with the material.
- Signs and labels must be posted and clearly written in Arabic and English indicating "Warning – Hazardous Waste" at the storage area. The storage area must be located away from existing drainage paths to prevent accidental spills from reaching sensitive areas, and away from offices and operation area for safety.
- Equipment and vehicles must also be kept away from hazardous waste storage area;
- The Storage area must be equipped with secondary containment; and
- Sufficient space must be kept between drums to permit the required visual inspection and to allow access in emergency situations.
- Reduction of the exposure levels

Each area using a hazardous substance should:

- Ensure that updated information on the potential harm caused by the substance (e.g., MSDS) is available to all personnel;
- Define training needs;
- Ensure appropriate labeling of containers;
- Implement prevention/protection measures recommended by the emergency measure plan and/or the suppliers.

7.10.4 Emergency Response Plan

During pre-operational mobilization, SCC will develop a site specific Emergency Response Plan for the operational activities. This plan will include a Spill Contingency Plan (chemical and petroleum handling storage and spill management).
The purpose of the spill contingency plan is to describe the methods and procedures necessary to prevent the release of potentially harmful substances into the environment. The spill contingency plan will include procedures and information on:

- Spill prevention planning and preparedness;
- Training of personnel;
- Security;
- Material handling;
- Storage tanks;
- Unloading areas;
- Emergency station, community and agency notification and updates;
- Spill containment and clean-up procedures;
- Spill report preparation.

With clear, concise definitions of the appropriate agency contacts and their roles and responsibilities, the Emergency Response Plan will ensure that the effect of any emergency will be minimized. Regular employee training and emergency drills will serve to ensure that all personnel is prepared in the case of emergency and that the response team is prepared to quickly respond to any potential emergency (e.g., fire, power disruptions, etc.).

7.10.5 Formalised Environmental Management system

SCC is recommended to develop and implement a formalized Environmental Management System (EMS) to ensure compliance with national environmental legislation and its own Policy Statement during the Project life time. The EMS should comprise:

- Published environmental policy statement;

- Published set of objectives for fulfilling the environmental policy;
- Register of the relevant environmental legislation, action plans, undertakings and assurances;
- Environmental management program for achieving the objectives including targets, timescales, training needs, budgets and who is responsible for each item in the program;
- Instructions, where required, to ensure that all staff understand that what they do or how they do it plays a part in fulfilling the environmental policy;
- Day to day monitoring and control procedures;
- Regular reports on compliance and progress towards objectives;
- Audit program to provide an independent check on compliance and progress towards objectives;
- Procedures to ensure compliance with the above; and
- Annual managerial review of the EMS.

7.11 HEALTH AND SAFETY

The measures to protect the Health and Safety of workers during construction and operations are outlined below.

7.11.1.1 *Working at Height*

- All work in site is risk assessed, with a special attention to working at height.
- Any working at height has to have a Permit to work.
- All workers are trained through various tool-box talks and safety meetings for harness use and importance
- All Contractor engineers and foremen have gone through a local training on Lafarge W@H standard requirements.
- Hierarchy of controls is always addressed by preferring handrails and proper designs (engineering controls) to harnesses (PPE) decreasing the dependency on human errors and unsafe behaviors.
- Disciplinary actions (punching system) & Awards.
- Constant talks with the employees that going home to their families is as important to us as going home to ours.

7.11.1.2 *Working at Heights - Scaffolds*

- A team from is dedicated to erecting scaffolds & communicated to everyone.
- Green and red tags are used on all scaffolds, communicated to all workers with disciplinary actions
- Inspections are done by Contractor and Project team
- Some dedicated scaffolds are specially designed for a specific task to minimize risk, e.g.: Chimney internal work

7.11.1.3 *Mechanical Lifting*

- All lifting equipment was inspected by a 3rd party inspection company (Petrolift, local agent of Crosby Group).
- All operators were tested and were issued a local license to operate equipment in order to identify who drives what.
- All lifts are performed through a Lift Plan & PTW.
- All certifications and monthly maintenance/inspection records are submitted to PMT.

7.11.1.4 *Transportation Safety – Mobile Equipment*

- All drivers and equipment operators are tested and are issued a local on-site driving license
- All vehicles are inspected with logs created
- Roads have been leveled
- Speed limits defined and enforces

As indicated in Section 6, traffic could potentiall create issues of concern for local residents, therefore, a traffic management plan should be implemented that includes:

- In consultation with local inhabitants identify an alternative route for the road through an area that is less populated. This may require the need to purchase agricultural land from local farmers in order to re-route the road
- Construct/upgrade the road to the standard required to carry the load and volume of traffic required to deliver basalt to the plant
- Enforce strict restrictions on the speed at which the trucks are allowed to travel and the hours of operations
- Where necessary implement stop/go zones which will allow a single truck to pass at a time
- Construction of a new intersection on the Aleppo- Al Hassakeh Highway at the entrance to the plant
- Clear signage on the roads
- Education of local communities, staff and transport contractor

7.11.1.5 *Safety and Welfare of Workers*

- Full time -24/7- doctor on site
- Day and night shifts for Nurses
- 24/7 Ambulance for emergencies
- 24/7 fire trucks
- Medical insurance for workers on site
- Encouraging the “Safety is a 24/7 culture”

- Stressing full PPE on all the workers with replacement schedule.

7.11.1.6 *Safety of Quarrying Activity*

Safety of work staff and surroundings is our main objective while doing the job, we are seriously following restrict safety management plan that ensure harmless working conditions.

Mining activity is a risky type of jobs, where a lot of precaution must be taken into consideration, and our mining plan for Syrian Cement Company raw material exploitation will follow up the following items:

Roads Safety:

- Access roads will be regularly maintained to clear any obstacles and adjust roughness and/or slippery fine material.
- Inclination does will not exceed 6% to prevent slipping of wheel equipments specially if roads are wet during rain.
- Retaining walls or large stone lumps arranged at the side of roads in clear and visible way to prevent fall of equipments in case of any unexpected trouble.

7.11.1.7 *Power Plant Safety*

- Fire proof wall between Boilers & Turbine House
- Fire alarm and firefighting networks with Diesel driven pump as stand by
- Expert control software for safe and optimized operation of boilers and Turbines
- Wash points in coal transport galleries to avoid accumulation of dust
- Sprinkler system in coal shed to suppress coal dust clouds
- Plant grounding system with low resistance, below one ohm for human safety
- Buildings provided with Lightning protections
- Power distribution system to have micro processor based protection devices with fast fault clearing feature.
- Loading of Electrical drives and Transformers designed to operate at load factor below 90%
- Bag Filter for deducting system for the Coal Mills
- Using a fire retarding material for MV cables

7.12 CLOSURE PLANS

Although early in the project cycle, a preliminary closure plan is described below. It is probable that the plan will be updated as the project progresses.

7.12.1 *Overall closure objective*

The overall closure objective is to return the current site to a grazing/wilderness state that is consistent with surrounding agricultural land that would be suitable for sheep grazing.

The closure objective would be achieved by means of the following:

- Rehabilitation and vegetation of disturbed areas
- Shaping of historical spoil piles into stable dumps
- Retaining and transferring of surface infrastructure that could beneficially be re-used to a third party.

7.12.2 Surface Infrastructure

7.12.2.1 Closure Objective

To retain surface infrastructure that could be beneficially re-used and the transfer of this infrastructure to a third party.

7.12.2.2 Closure Measures

- Compile an inventory of surface infrastructure that would be available for reuse at mine closure.
- Determine whether the landowner that takes control of the closed mine site is willing to accept the identified surface infrastructure for reuse and formalise the transfer by means of agreements.
- Demolish surface infrastructure that have not been identified or accepted for reuse. Dispose of the inert building rubble at the bottom of the opencast pit and cover this with spoils material.
- Rehabilitate and vegetate disturbed areas from which surface infrastructure has been removed.

7.12.3 Site Re-vegetation

7.12.3.1 Closure Objective

To reinstate native vegetation species to:

- Stabilize disturbed areas against surface erosion and sediment mobilization
- Re-establish local grassland/woodland communities reflecting the surrounding "undisturbed" areas.

7.12.3.2 Closure Measures

Broadcast hand harvested grass seeds over rehabilitated disturbed areas. The seed will be hand harvested from adjacent areas when grasses are in seed and immediately broadcast onto the areas prepared for seeding. If the use of hand harvest local seed prove not to be successful (inadequate seed availability, or poor establishment), locally available pasture grass seed would be seeded under the supervision of a specialist.

Note: *The topsoil held in stockpile for the duration of the mining period is likely to contain a low portion of viable seed. Hence, the initial vegetation cover that could result from distribution of stockpiled seed would be sparse and would require to be supplemented by the seeding of grass species.*

7.12.4 Spoils and Waste Dumps

7.12.4.1 Closure Objective

To render the spoils and waste dumps that remain on surface at mine closure to be stable over the long term.

7.12.4.2 Closure Measures

- Shape the outer slopes of the remaining spoils and waste dumps to a uniform slope of 1:4(14°).
- Shape the upper surfaces of these dumps to a minimum slope of 1:200 and integrate with the shaped outer slopes (whaleback).
- Ameliorate (as indicated by soil sampling and analysis) the shaped upper surfaces and outer slopes to be suitable to sustain vegetation.
- Shallow rip the shaped slopes and upper surface along the contour to further enhance the potential to sustain vegetation as well as to limit the prohibiting for soil erosion during the initial period until the vegetation has established.
- Re-vegetate the ripped surface as above.

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