



Building Sustainably

GSAS CONSTRUCTION MANAGEMENT GUIDELINES MANUAL

FOR BUILDINGS AND INFRASTRUCTURE



Dr. Yousef Alhorr, Founding Chairman

4th Edition



GSAS

PUBLICATIONS SERIES

GSAS CONSTRUCTION MANAGEMENT: GUIDELINES MANUAL FOR BUILDINGS AND INFRASTRUCTURE

4th Edition

Dr. Yousef Mohammed Alhorr
Founding Chairman

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Founding Chairman



The UN Urbanization Prospects Report 2014 states that 54 percent of the world's population is residing in urban areas, and by 2050, 66 percent is predicted to be urbanized. Continued population growth and urbanization are projected to add a further 2.5 billion people to the urban population of the world by 2050.

To put this urbanization issue into a GCC context, close to 90% of the population in Gulf countries will be in cities by 2050.

Cities are the hub of human life. It is critical to ensure that while we focus on the comforts of living, the cities remain sustainable, resilient and low-carbon. Sustainability is a way of life, which apart from reducing the environmental, social and economic burden, it also determines the quality of life and how human wellbeing is taken care of. As most of our time is spent in buildings and using associated infrastructure, they are the most common denominators that determine how sustainable the cities are and can be. Worldwide regional and international organizations are tirelessly working and cooperating to make cities better places to live with a special focus on the built environment.

Out of a deep concern on unsustainable urban living—especially in the Central and Western Asian continent, in 2007 GORD developed and implemented the green building and infrastructure certification system. This recognizes the pioneering efforts of the developers, contractors, practitioners and entire construction community that has assumed responsibility to care for the cause of sustainability. GORD has come a long way since stewarding the Global Sustainability Assessment System (GSAS), formerly known as (QSAS), the Middle East's first integrated and performance-based assessment system. Our mission is to encourage the development and implementation of sustainability principles and imperatives which stems from our vision on sustainable development of the region as well as globally. Over the last few years we have established a clear link of what we are doing in GSAS with the achievement on multiple Sustainable Development Goals of the United Nations. GSAS draws from top tier global sustainability systems and adds new facets and dimensions to the current practices in assessing the sustainability of the built environment. Over the years, GSAS has become one of the most comprehensive systems to date, that addresses the built environment from a macro level to a micro level targeting a wide range of building typologies and infrastructure projects.

GSAS Certifications now cover all the dimensions to assess and certify the sustainability of the built environment, be it design, construction or operation of projects. This performance based dynamic system, equipped with continually reviewed benchmarks and best practices, is a great tool in the hands of the building community to continually improve the sustainability standards of the built environment.

I would like to acknowledge the efforts and contributions from the State of Qatar, all our members, international partners and the associated consultants who helped in establishing the system and take it into new dimensions. Finally, the continuous support from Qatari Diar Real Estate Company (QD) and the Supreme Committee for Delivery and Legacy (SC) are highly appreciated, and without their support, GSAS would not be able to achieve what it has done in such a short space of time.

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PREFACE

Global Sustainability Assessment System (GSAS) is the first performance-based system in the Middle East and North Africa (MENA) region, developed for assessing and rating the buildings and infrastructures for their sustainability impacts. The primary objective of GSAS is to create a sustainable built environment that minimizes ecological impact and reduces resources consumption while addressing the local needs and environmental conditions specific to the region. GSAS adopts an integrated lifecycle approach for the assessment of the built environment including design, construction and operation phases.

The 4th Edition of GSAS launched in 2019 has capitalized on 10 years of experience and 'hands on' implementation of GSAS, richness and capacity gained from the assessment of numerous and various building typologies totaling more than 217,000,000 square feet of built-up area and more than 1,872,000,000 square feet of district master planning, and multi-disciplinary research projects conducted in collaboration with renowned world-class institutes on various aspects of sustainability in the built environment.

GSAS supports the project stakeholders with manuals and tools to aid projects in the implementation of the certification processes throughout the various phases of project development from predesign to post-occupancy.

The objective of GSAS Construction Management (GSAS-CM) is to evaluate the sustainability impact of building or infrastructure project over the course of the construction phase. It assesses the aspects of the construction processes and on-site practices that have a lasting sustainability impact and provides a framework to perform measurements in line with normative standards and accepted practices to consider those impacts the project can mitigate.

GSAS-CM is used to assess the processes and practices of contractors in the construction of buildings, mixed use developments and districts & infrastructure and irrespective of whether GSAS Design and Build certification is pursued for these projects or not. GSAS-CM benefits from best practices employed by the construction industry taking into consideration the specific ecological and environmental context of the region.

Although GSAS-CM can be used for different types of projects using the same processes and measurement principles, there may be differences among the project types depending upon different applicability of criteria at each construction stage (enabling / foundation stage; superstructure stage; and, finishing stage), types of measurements required within a particular criterion, and specific reference values or scoring thresholds. Since the assessment involves audits at each construction stage, the nature of observations in Audit Advisory Notice (AAN) issued at each stage will also differ from criterion to criterion.

GSAS-CM framework is based on eight categories including: Urban Considerations [UC], Site [S], Energy [E], Water [W], Materials [M], Outdoor Environment [OE], Socio-Cultural Dimension [SD] and Management & Operations [MO]. The categories are then broken down into specific criteria that measure and define individual issues related to environmental aspects. Each criterion has

associated guidelines to provide projects with descriptive information for consideration to help attain the targeted level. These suggestions are in the form of recommended methods and measures. Projects should consider and assess the potential advantages and benefits of the recommended methods and measures in relationship to the specific goals, requirements, and conditions of the project.

For a project, it is possible to target selected categories and criteria to achieve desired GSAS Class Rating. In order to incorporate the targeted GSAS-CM framework categories and criteria and to outline how a construction project will plan human, organizational, and communication resources and processes to meet the requirements of targeted GSAS-CM criteria, a GSAS Construction Management Plan (GSAS-CMP), shall be developed by contractor and assessed by GSAS-Trust. Appropriate submittals shall be made for assessment of evidence of compliance against each targeted GSAS-CM criterion as guided by the GSAS-CMP.

The guidelines are not intended to provide specific or explicit instruction on how to manage construction activities sustainably, but rather to provide guidance and recommendations on how to approach the sustainability issues within each criterion. Furthermore, these guidelines are by no means inclusive of all possible recommendations. Thus, all projects are ultimately expected to perform the required research and analysis necessary for their specific conditions and goals to meet the sustainability requirements of GSAS.

This manual should be read in conjunction with all other relevant GSAS manuals and publications.

CRITERIA SUMMARY

The table below summarizes the categories, criteria and the associated weights for GSAS-CM certification:

NO.	CATEGORY / CRITERION	LEVELS		WEIGHTS	INCENTIVE WEIGHTS
		Min	Max		
[UC]	URBAN CONSIDERATIONS				
UC.1	Traffic Management	0	3	3.00%	-
UC.2	Drain & Stormwater Contamination	0	3	3.00%	-
UC.3	Waterbody Contamination	0	3	2.00%	-
Total				8.00%	
[S]	SITE				
S.1	Land Preservation	0	3	3.00%	-
S.2	Biodiversity Preservation	0	3	2.00%	-
S.3	Erosion & Sediment Control	0	3	2.00%	-
S.4	Earthworks Control	0	3	3.00%	-
S.5	Dewatering Control	0	3	5.00%	-
Total				15.00%	
[E]	ENERGY				
E.1	Energy Use – Temporary Buildings	0	3	9.00%	1.50%
E.2	Energy Use – Plant & Equipment	0	3	3.00%	1.50%
Total				12.00%	3.00%
[W]	WATER				
W.1	Domestic Water Use	0	3	6.00%	1.00%
W.2	Non-Domestic Water Use	0	3	4.00%	1.00%
Total				10.00%	2.00%

NO.	CATEGORY / CRITERION	LEVELS		WEIGHTS	INCENTIVE WEIGHTS
		Min	Max		
[M]	MATERIALS				
M.1	Materials Diversion from Landfill	0	3	3.00%	-
M.2	Materials Eco-Labeling	0	3	4.00%	2.00%
M.3	Cut & Fill Optimization	0	3	3.00%	-
Total				10.00%	2.00%
[OE]	OUTDOOR ENVIRONMENT				
OE.1	Dust Control	0	3	8.00%	2.00%
OE.2	Noise & Vibration Control	0	3	6.00%	-
OE.3	Light Pollution & Visual Impact Control	0	3	3.00%	-
OE.4	Odor & VOC Emissions Control	0	3	2.00%	-
Total				19.00%	2.00%
[SD]	SOCIO-CULTURAL DIMENSION				
SD.1	Protection of Archaeological Remains	0	3	2.00%	-
SD.2	Socio-Cultural Interaction	0	3	3.00%	-
Total				5.00%	
[MO]	MANAGEMENT & OPERATIONS				
MO.1	Waste Management	0	3	7.00%	-
MO.2	Welfare Facilities	0	3	5.00%	-
MO.3	Construction Health & Safety	0	3	6.00%	3.00%
MO.4	Workers Accommodation	0	3	3.00%	4.00%
Total				21.00%	7.00%

1.0 [UC] URBAN CONSIDERATIONS

The Urban Considerations category considers aspects related to traffic management, drain, stormwater and waterbody contamination.

IMPACTS

Environmental impacts resulting from unsustainable urban practices include:

- Land Use & Contamination,
- Water Pollution,
- Air Pollution,
- Human Health & Comfort.

MITIGATE IMPACT

Measures that could mitigate environmental impact include:

- Controlling the impacts of traffic on-site and neighboring sites,
- Preventing any risks or pollution to drain, stormwater and waterbodies,
- Maintaining the water quality of existing waterbodies.

CRITERIA IN THIS CATEGORY

UC.1 Traffic Management

UC.2 Drain & Stormwater Contamination

UC.3 Waterbody Contamination

1.1 [UC.1] TRAFFIC MANAGEMENT

1.1.1 PURPOSE

To manage on-site and off-site traffic and minimize disruption of the local transportation network and pattern.

1.1.2 CONTEXT

Construction traffic and transportation management is of significant importance to ensure the safety and convenience of commuters and public road users during the construction phase of new developments.

Construction activities that can impact the off-site traffic include, but are not limited to road closures, temporary traffic diversions and heavy vehicle traffic. On-site traffic conditions should be properly managed to avoid safety risks to workers, visitors and properties on site, dust generation, noise and vibration.

Construction activities can affect the adjacent roads and road users' safety and comfort, and the socio-economic state of the neighboring communities. In addition, the increased traffic congestion on adjacent roads, results in increased CO₂ emissions.

A Traffic & Transportation Management Plan (T&TM Plan) for on-site and off-site traffic networks takes into consideration the requirements of the relevant local and municipal authorities in addition to meeting commuter needs and convenience.

1.1.3 GUIDELINES

A. Off-Site Traffic Management

Methods and measures that can be implemented to ensure appropriate off-site traffic and transportation management, include:

- Avoid road closures whenever possible. When this is not possible, roads are re-instated, or alternatives provided to restore traffic access. If any road closure is required, it is carefully planned to minimize impacts on traffic on the local road network associated with diversions and subsequent congestion.
- Minimize disruption of access for local residents and businesses and provide alternative access points, whenever possible.
- Ensure adjacent residential areas are not disturbed by construction traffic routes as applicable.
- Provide appropriate traffic safety signage to warn the public of construction traffic where traffic merges with normal road traffic.

- Schedule, where possible, construction traffic in off-peak traffic times and on well-maintained routes.
- Maintain adjacent roads and pavements in good condition and avoid damage due to heavy load transportation.

B. On-Site Traffic Management

Methods and measures that can be implemented to ensure appropriate on-site traffic and transportation management, include:

- Minimize movement of plant, vehicles and the removal of materials and waste by road.
- Provide adequate temporary traffic control measures and road signage.
- Provide appropriate interfaces with public/private roads or pedestrian walkways.
- Ensure provision of appropriate temporary road/haulage road layouts.
- Provide adequate permanent and temporary access to the construction site used by workers and visitors.
- Construct stabilized entrance/exits onto public paved surfaces (where required).
- Install speed control measures and monitoring.

FURTHER RESOURCES

Publications

1. *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*. Department for Environment, Food and Rural Affairs, United Kingdom, 2009.
2. *Construction Site Best Management Practice (BMP) Field Manual and Troubleshooting Guide*. Department of Transportation, State of California, 2013.
3. *Environmental Best Practice Specifications: Construction*. Department of Water Affairs and Forestry, Republic of South Africa, 2005.
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11. Pires dos Santos, Camilla, et al. "Water Consumption in Construction Sites in the City of Recife/ PE." *The Electronic Journal of Geotechnical Engineering*, vol. 20, 2015, pp. 1711–26.
12. *Sustainable Construction: Simple Ways to Make It Happen*. bre, 2008.
13. *Technical Guidance Document for Construction Environmental Management Plan (CEMP)*. Environment Agency, Abu Dhabi, 2010.

1.2 [UC.2] DRAIN & STORMWATER CONTAMINATION

1.2.1 PURPOSE

To prevent contamination of drain and stormwater due to construction activities.

1.2.2 CONTEXT

Storm water resulting from a significant rainfall event during construction has the potential of being contaminated by on-site toxic and hazardous materials, as construction activities can generate various types of contaminants including solids, sludge, sediment, floating debris, oil, detergents, chemicals, pesticides, and scum.

These contaminants may reach public utilities and/or surrounding communities, posing a serious risk to human health, and a burden on public water treatment facilities.

Practices to prevent contamination should include pollution prevention in addition to treatment methods on the construction site in order to reduce the adverse environmental and health impacts. The degree and type of treatment method may vary dependent on the specific contaminant conditions.

1.2.3 GUIDELINES

A. Stormwater Contamination Control

Methods and measures that can be implemented to control storm water and run-off, include:

- Ensure oil spillages are prevented on the site and the contaminated site is immediately cleaned up.
- Ensure concrete washouts are designed to prevent water and ground contamination.
- Check the quality of discharged water for its adherence to local standards by conducting regular physical and chemical testing on selected samples at an qualified approved laboratory, collected from different discharge points on the construction site.
- Use individual or centralized pollution controls upstream of the stormwater discharge/ collection points to capture gross pollutants and sediments picked up in stormwater run-off prior to discharge from the project site. Use the following controls as applicable:
 - Sump pits or Gross Pollutant Traps (GPT's) that require adequate access points and regular cleaning to collect and suitably dispose of the matter collected.
 - An oil-bypass interceptor tank to remove any suspended contaminants.
 - Sedimentation tank to allow particles to settle out of water as it flows through the tank.

- Prevent wastewater discharged to the storm drains on all sites unless a proper wastewater treatment is undertaken where applicable.
- Avoid scheduling construction activities if there is significant potential for heavy rainfall.
- Undertake backfilling activities in horizontal layers with dampened soil.
- Undertake in-situ soil compaction immediately.

B. Sewer Contamination Control

Methods and measures that can be implemented to minimize or eliminate sewer contamination, include:

- Ensure the extent of filtration, separation, or treatment that can occur before the connection of plumbing lines to off-site treatment facilities are determined to ensure compatibility with relevant regulations of the local authority.
- Provide moveable chemical toilets in different locations on the site if no connection to a sewer is available and no septic tanks are provided.
- Provide appropriate training course(s) for all employees on determination, collection, storage, and safe disposal of liquid wastes.
- Check the quality of discharged sewage for adherence to local standards by conducting regular physical and chemical testing on selected samples, at an qualified approved laboratory, collected from different discharge points on the construction site.

FURTHER RESOURCES

Websites

1. "Water Pollution." *Natural Resources Defense Council (NRDC)*, 2019, <https://www.nrdc.org/issues/water-pollution>.

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10. *Pollution Prevention Pays: Getting Your Site Right*. Environment Agency, United Kingdom, 2004.
11. *Source Water Protection Practices Bulletin: Managing Stormwater Runoff to Prevent Contamination of Drinking Water*. Office of Water, U.S. Environmental Protection Agency, 2001.
12. *Use and Design of Oil Separators in Surface Water Drainage Systems: PPG3*. Environment Agency, United Kingdom, 2006.

1.3 [UC.3] WATERBODY CONTAMINATION

1.3.1 PURPOSE

To maintain the water quality of existing waterbodies from the impact of construction activities.

1.3.2 CONTEXT

Water bodies including the sea, gulfs, lakes, and rivers are home to a wide variety of flora and fauna.

Coastline development does not only affect the quality of nearby water bodies, but also the overall ecological health of the habitats dependent on them.

Considering the above, construction sites should be managed in a way to protect all-natural water bodies on and around the site, including coastlines to prevent degradation. In addition, reclamation and dredging construction activities that have the potential to harm the ecological diversity of water bodies should be properly managed, and the associated risks identified and resolved.

1.3.3 GUIDELINES

A. General Controls

Methods and measures that can be implemented to minimize any potential adverse impacts of reclamation and dredging and other construction activities affecting water bodies, include:

- Schedule relevant works to:
 - Avoid seasonal weather impacts and plume migration near sensitive areas.
 - Avoid disruption of major public maritime activities, for example - sailing regattas, speed boat races and ferry operations.
 - Avoid work during the turtle hatching period, coral spawning period, or migratory bird roosting grounds at relevant times.
 - Maximize opportunities for plume containment with respect to breakwater construction.
- Implement the following, or equivalent as applicable, for diversion of overland flow around work areas / construction sites:
 - For sites closer to water bodies maintain a ditch along the side of the water bodies as a minimum control measure to catch any run-off from reaching the water bodies.
 - Provide storm water collection drains all along the stockpiles such that drained water can pass through a sump pit to collect the silt and gross pollutants prior to disposing the storm water into the water bodies and/or flooded areas.
 - Install storm water run-off controls (bunds) around soil stockpiles near the shoreline of water bodies.

- Ensure that pipeline sections are quick and easy to assemble, maintain and dismantle, as it may be necessary to periodically halt dredging operations to add or remove sections of the pipeline to repair leaks or reroute the line.
- Test transport equipment for leaks and breaks prior to material transportation and frequently monitor for leaks and blockages during operation.
- Inspect barge hulls regularly to ensure they are completely sealed.
- Prevent spillage while in tow by placing removable covers over the barge coaming.

B. Silt Curtains

Silt curtains are a type of containment barrier used to control suspended sediments in the water column that may be generated by dredging and reclamation. Silt curtains reduce water movement in the area contained by the curtain, allowing suspended sediment within the contained area to settle out of suspension, before the water disperses more broadly.

Methods and measures that can be implemented to ensure the effectiveness of silt curtains, include:

- Ensure that silt curtains are approved by the local authority representative as being installed correctly prior to works starting adjacent to or within the water.
- Ensure the silt screen is complete with a scum boom and the size and gauge of the silt curtain is appropriate. It is not acceptable to have the floating solid silt screen with a screen that does not reach the sea floor at all times, as the sediment-laden water can pass beneath it, thus negating the purpose of a silt curtain.
- Remove any scum that develops within the fenced off area with a net or similar and stored on land within a contained area to dry out prior to disposal.
- Add adequate weights to the bottom of the silt screen from the outset, as this will prevent the screen from floating.

FURTHER RESOURCES

Publications

1. *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*. Department for Environment, Food and Rural Affairs, United Kingdom, 2009.
2. *Construction Site Best Management Practice (BMP) Field Manual and Troubleshooting Guide*. Department of Transportation, State of California, 2013.
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2.0 [S] SITE

The Site category considers aspects related to land preservation, biodiversity preservation, erosion and sediment control, earthworks control and dewatering control.

IMPACTS

Environmental impacts resulting from unsustainable site practices include:

- Land Contamination and Ecological Value Deterioration;
- Biodiversity Deterioration,
- Water Pollution,
- Air Pollution,

MITIGATE IMPACT

Factors that could mitigate environmental impact include:

- Preserving or enhancing land quality,
- Preserving biodiversity of the site,
- Controlling erosion and prevent off-site sedimentation,
- Minimizing negative impacts of earthworks activities,
- Minimizing negative impacts of dewatering activities.

CRITERIA IN THIS CATEGORY

S.1 Land Preservation

S.2 Biodiversity Preservation

S.3 Erosion & Sediment Control

S.4 Earthworks Control

S.5 Dewatering Control

2.1 [S.1] LAND PRESERVATION

2.1.1 PURPOSE

To preserve or enhance the land through remediation, conservation, and/or restoration.

2.1.2 CONTEXT

During construction the existing topography, soil, trees, plants, groundcover, water features and wildlife habitats should be taken into consideration for the conservation of the natural state of the site. It is important that the ecological value of the land will not be impacted by the construction activities beyond the limitations set by the design.

Excessive soil disturbance can take place due to excavation for the construction of buildings, landscaping, development of infrastructure, man-made water bodies, dredging for new coastline, or infilling for man-made islands.

Excavation or fill required on-site will not only decrease the ecological value of the site, but also increase the need for transport and contribute to the depletion of fossil fuels. Soil disturbance may also release natural Volatile Organic Compounds (VOC's), which lead to air pollution.

Therefore, reduction of unnecessary disturbance of soil is vital for conserving the natural resources of the site, whereas, healthy soils can effectively cycle nutrients, store carbon as organic matter, maximize water holding capacity, and provide a healthy rooting environment and habitat to a wide range of organisms.

2.1.3 GUIDELINES

A. Preservation of Soil Condition

Methods and measures that can be implemented to ensure land preservation, include:

- Import, when necessary, higher quality topsoil to mix with existing soil or to replace soil of lower quality. Enhancing the soil with organic material improves water holding capacity.
- Leave existing trees, vegetation and soil undisturbed to the greatest extent possible.
- Minimize soil compaction by identifying pathways and areas during construction for heavier equipment, in order to localize affected areas.
- Minimize the length of time soil remains barren or uncovered to avoid erosion due to wind. Use groundcover in landscaped areas to prevent soil movement.

B. Use of Contaminated Land

Methods and measures that can be implemented to ensure the proper use of contaminated lands, include:

- Conduct an investigation to test for hazardous levels of pollutants on the site with contaminated land during the construction phase.
- Determine, if required, strategies to remediate contaminated areas in order to prevent further risks to the environment and human health.
- Determine, if required, strategies for remediation by the type and degree of contamination, natural site features, level of short- and long-term effectiveness, and available funds and timeframe for completion.
- Ensure that all remediation strategies shall have minimal disruption to the site, including underground features. Continue the monitoring of land after remediation takes place to ensure that all hazardous substances have been completely cleared from the site.
- Remediate contaminated groundwater using pump-and-treat technologies, where the water is pumped to the surface and treated using physical or chemical processes.
- Remediate the contaminated soils through several methods including in-situ applications, off-site disposal, the use of bioreactors and solar detoxification technologies.
- Minimize negative environmental impacts while selecting and implementing remediation strategies/methods.

FURTHER RESOURCES

Websites

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2. "Chartered Institute of Ecology and Environmental Management." *Chartered Institute of Ecology and Environmental Management*, 2019, <https://cieem.net/>.
3. "Implementation of Green Roof Sustainability in Arid Conditions." *US Environmental Protection Agency - Science Inventory*, 2009, https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=NCER&dirEntryID=200851.

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2. *BS ISO 10381-1 Soil Quality - Sampling - Guidance on the Design of Sampling Programmes*. British Standards Institution, 2002.
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11. Tehachapi Resource Conservation District. *Erosion Control Guide for Desert and Mountain Areas*. Southern California Edison Corporate, 2010.

2.2 [S.2] BIODIVERSITY PRESERVATION

2.2.1 PURPOSE

To preserve the natural biodiversity of the site.

2.2.2 CONTEXT

The increasing number of construction sites is placing a significant stress on the richness of our biodiversity. Lands with habitats for wildlife species are converted into residential, commercial developments, infrastructure and other uses. The fast-paced development of land destroys and fragments the habitat at site, impacting the quantity and quality.

Construction activities can eliminate and significantly change many important habitat features, thereby altering the habitat value of the site. Furthermore, when habitats of ecologically sensitive species are separated by distances, movement from one area to another can become impossible, affecting health and the ability to reproduce resulting in fewer species.

Landscape disturbance caused by construction activities can also serve to introduce invasive species into natural habitats, further degrading the quality of the remaining habitat areas.

Although construction can have many adverse impacts on biodiversity, construction is still essential for the improvement of social and economic well-being. Therefore, proper implementation of a Habitat Preservation Plan during the construction stage should be imposed to protect and preserve the habitat without compromising the quality of development.

2.2.3 GUIDELINES

Methods and measures that can be implemented to ensure biodiversity preservation, include:

- Conduct a site assessment and employ construction processes and practices that protect all habitats, natural vegetation, and wildlife on the site to prevent degradation of biodiversity.
- Consult with an ecologist to create a Biodiversity Preservation Plan that maintains habitats and ecosystems present on the site. The plan catalogs all species on-site before and after construction to preserve the biodiversity and encourages the use of native plants.
- Adequately protect all the existing features of ecological value surrounding the construction zone and site boundary area from damage during clearance, site preparation and construction activities as identified in the Site Assessment Report.
- Designate an ecological zone to protect habitats from the impact of construction activities. Where habitats are to be disturbed during construction, develop a plan to restore the native ecology by replanting the disturbed vegetation and reintroducing the same species and habitats after construction is complete.

- Train the site workforce on the protection of the ecology during the project. Organize specific training for the entire site workforce to ensure they are aware of how to avoid damaging the site ecology.
- Encourage provision and implementation of effective tree preservation and protection measures. Retain, preserve, and protect all the identified and designated healthy trees within the site or transfer them to another site for replanting. Impose the implementation and monitoring of tree protection measures on site to minimize the adverse impact to the preserved trees due to construction activities. Establish specific tree preservation and transplantation measures for larger trees with high amenity value. Further, ensure that on-site trees and undergrowth integrated into the landscape plan are adaptive or native to the ecosystem.

FURTHER RESOURCES

Websites

1. "Australian Research Centre for Urban Ecology (ARCUE)." *Royal Botanic Gardens Melbourne*, 2015, <https://www.rbg.vic.gov.au/science/arcue>.
2. "Chartered Institute of Ecology and Environmental Management." *Chartered Institute of Ecology and Environmental Management*, 2019, <https://cieem.net/>.

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4. *Guidelines for Ecological Impact Assessment in the United Kingdom*. Institute of Ecology and Environmental Management (IEEM), 2006.
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2.3 [S.3] EROSION & SEDIMENT CONTROL

2.3.1 PURPOSE

To minimize the risk of soil erosion and sedimentation due to construction activities.

2.3.2 CONTEXT

The most environmentally dangerous period of any development with respect to soil erosion and off-site sedimentation is the initial construction phase when land is cleared of vegetation and the topography is graded to create the necessary surface for construction. The removal of natural vegetation and topsoil makes the exposed area susceptible to erosion, leading to the degradation of soil quality and the structure and texture of the soil.

Erosion may cause instability of both above and below grade structural features, including earthen embankments, built structures and roadways and even change the texture due to the breakdown of aggregates and the removal of smaller particles or the entire layer of soil or organic matter. These textural changes can alter the water holding capacity of the soil, increasing the susceptibility of the site to extreme conditions and possibly drought.

Moreover, offsite sedimentation can cause degradation of downstream water quality and damage marine habitats. Sediment that reaches streams or watercourses can accelerate bank erosion and obstruct stream and drainage channels. Sediment control is a practice to keep eroded soil on the construction site and is the second line of defense if the erosion control measures are not fully functioning.

2.3.3 GUIDELINES

A. Erosion Control

Methods and measures that can be implemented to ensure erosion control effectiveness, include:

- Develop a Soil Erosion Control Plan to implement erosion control practices, including the preservation of natural vegetation where possible, directing the run-off away from exposed soils, planting temporary groundcover, and permanent revegetation of areas at risk of erosion damage. The plan shall include information on the soils present on the site and the area of disturbance and summarizes design requirements that include the amount, frequency, intensity, and duration of precipitation. It shall identify the stormwater run-off and run-on at the site, including expected flow and any controls to minimize peak and total stormwater volume. It shall also describe the stormwater discharge areas to maximize infiltration and increase sediment removal. The plan shall consider erosion prevention and sediment control to the areas where soil is already disturbed.
- Avoid soil disturbance as far as possible to minimize soil erosion.
- Plant/replant non-vegetated areas prone to erosion with native species to prevent further

damage. Vegetation/revegetation helps to prevent erosion by slowing down run-off drainage on hillsides and protecting soil from wind erosion. The roots of plants serve to stabilize soils, and revegetation enhances water infiltration in the soil, reduces run-off, and traps sediment.

- Restrict activities in areas with erosive potential by creating undisturbed areas.
- Preserve natural vegetation as it is the most efficient and inexpensive form of erosion control, greatly reducing the need for revegetation. Erosion rates are directly proportional to the type and density of groundcover on the site.
- Develop a plan for erosion control maintenance during construction including inspection and repair schedules.

B. Sediment Control

Methods and measures that can be implemented to ensure sediment control effectiveness, include:

- Control the run-off and contain the sediment by implementing, as applicable, any of the following:
 - Make diversion ditches,
 - Install buffer zone or vegetated filter strip to catch sediment and decrease velocity of run-off,
 - Make earth dykes,
 - Install temporary sediment trapping basins.
- Install a silt fence, which is a temporary sediment control device used on construction sites to protect water quality in nearby streams, rivers, lakes and seas from sediment (loose soil) in stormwater run-off. Silt fences are perimeter controls, typically used in combination with sediment basins and sediment traps, and erosion controls, which are designed to retain sediment in places where soil is being disturbed by construction processes (i.e., land grading, reclamation and other earthworks). Consider the following in silt fence installation:
 - Install a silt fence along the perimeter of the area to be cleared and graded before any grading that takes place.
 - The silt fence is to be properly installed by being trenched and buried into the soil to stop the fence floating free when a strong current or flow strikes it.
 - Sediment is captured by silt fences primarily through ponding of water and settling, rather than filtration by the fabric. Sand and silt tend to clog the fabric, and then the sediments settle in the temporary pond.
- Install linear sediment barriers (for example: silt fence, sandbag barrier, and straw bale barrier), which are typically placed below the toe of exposed and erodible slopes, on the downslope of exposed soil areas, and at other appropriate locations along the site perimeter.
- Develop a plan for sediment control maintenance during construction including inspection and repair schedules.

FURTHER RESOURCES

Websites

1. "Australian Research Centre for Urban Ecology (ARCUE)." *Royal Botanic Gardens Melbourne*, 2015, <https://www.rbg.vic.gov.au/science/arcue>.
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8. Tehachapi Resource Conservation District. *Erosion Control Guide for Desert and Mountain Areas*. Southern California Edison Corporate, 2010.

2.4 [S.4] EARTHWORKS CONTROL

2.4.1 PURPOSE

To minimize the impact of earthworks activities on the construction site.

2.4.2 CONTEXT

Earthworks activities are one of the main contributors to environmental impacts in construction, especially in large projects, which can usually necessitate the disturbance of a considerable quantity of soil.

Excavation and stockpiling make the soil vulnerable to erosion. Wind may carry the small particles away causing air pollution and impacting human health. Rain may carry loose soil into waterways causing water pollution and impacting natural marine life.

In addition, earthworks often require noisy heavy equipment and trucks which can impact the comfort and wellbeing of neighboring communities.

It is of great importance that projects manage earthworks in a sustainable manner by protecting the stockpiles and disturbed areas from erosion and implementing measures to prevent the sediments from exiting the site.

2.4.3 GUIDELINES

Methods and measures that can be implemented to ensure the effectiveness of earthworks management, include:

- Implement the following general earthworks control measures in order to minimize/mitigate potential soil and water contamination during earthwork activities:
 - Stockpile the excavated materials for as short a time as possible.
 - Minimize handling of excavated materials and the distances from the excavation site to the fill site.
 - Implement Horizontal Directional Drilling and Piling (HDD) techniques where possible. This technique is a steerable trenchless method of installing underground infrastructure when trenching or excavating is not practical, especially in urban areas for developing subsurface utilities. Ensure no spillage of drilling fluid slurry occurs by installing the appropriate barriers for example berms around the giving and receiving pits.
- Prevent the erosion of soil stockpiles by implementing any of the following measures as applicable, or a combination of them:
 - Cover the stockpiles with netting or similar material to minimize wind erosion and storm water ingress into the material where access to stockpiles is not required for a long period.

- Water down (either by hand or temporary sprinklers) unstabilized stockpiles (and those being regularly worked) to suppress dust.
- Place stockpiles in sheltered or covered areas, with temporary wind screens erected around stockpiles exposed to the effects of wind where necessary.
- Locate stockpiles on flat areas, away from stormwater or dewatering drainage flow paths, with diversion (through ditches or bunds) of all up-gradient flows around stockpiled material to prevent erosion caused by storm water.
- Take stabilization measures to protect the stockpile from rain and wind erosion including hydro-seeding, mulching, plastic sheeting, or similar measures.
- Prevent the eroded soil particulate and sediment being carried off-site by implementing any of the following measures on the stockpile as applicable, or a combination of them:
 - Install berms or ditches around long-term stockpiles to prevent run-off.
 - Install buffer zones or vegetated filter strips around the long-term stockpiles to decrease velocity of run-off and eventually catch sediment.
 - Install silt fences around long-term stockpiles close to water bodies.

FURTHER RESOURCES

Publications

1. *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*. Department for Environment, Food and Rural Affairs, United Kingdom, 2009.
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2.5 [S.5] DEWATERING CONTROL

2.5.1 PURPOSE

To minimize the impact of dewatering activities on the construction site.

2.5.2 CONTEXT

Dewatering is the process of removal of any water that accumulates in earthwork excavations or below ground structures, as a result of, for example: intersecting aquifers or water table, and seepage of soil water/groundwater. The water removed during dewatering activities is recognized herein as discharged groundwater.

Underground water may be contaminated by a wide range of pollutants, for example groundwater with elevated turbidity or suspended solids. Dewatering this contaminated water and then discharging it to surface water, stormwater system or marine water may result in water pollution, impacts on flora and fauna, and risks to human health.

Therefore, prior to any dewatering activities, a desktop risk assessment should be undertaken to highlight potential environmental risks which will form a basis for development of a construction site specific management strategy to mitigate any identified risks.

2.5.3 GUIDELINES

Methods and measures that can be implemented to mitigate any adverse consequences as a result of dewatering and discharge activities, include:

A. General Dewatering Requirements

- Limit, when possible, the duration of dewatering.
- Select the discharging point following the hierarchy below, subject to local authority approval and water quality test results:
 - Land, in a constructed lagoon/basin or large tank.
 - Stormwater network.
 - A waterbody (for example the sea).

B. Discharge of Groundwater

A permit from the regulatory authority is required for all discharges of groundwater and other water from construction activities. This is regardless of the receiving medium, whether land, sea or other water bodies.

- Discharge of groundwater to evaporation lake

Use temporary lakes to store water and permit evaporation. Comply with the following requirements:

- Develop a plan identifying the area intended to receive the discharge water. Clearly mark the land use of this area and surrounding areas, noting any environmentally sensitive areas including wetlands, lakes, schools or residences.
 - Carry out a water balance to determine discharge inflow plus other potential inflows (rainfall, stormwater) against outflows (evaporation and infiltration) and storage volume.
 - Implement drainage control measures to prevent dewatering material from entering low lying areas, which may cause flooding of adjoining land and vegetation.
 - Ensure that dewatering discharge does not cause soil erosion or sediment accumulation problems. The contractor is responsible for putting in place control measures, including retention basins/tanks.
 - People and native animals can drown in temporary lakes, particularly with steep sides. Provide a chain-mesh fence to all dewatering ponds and lakes which is at least 1.6 meters high with adequate signage providing a warning of the maximum water depth and that the water is not suitable for human consumption.
 - Provide a stepped or terraced slope up to the water surface of temporary lakes, to allow people or animals to easily climb out should they fall in.
 - Take measures to prevent mosquitoes and other insect pests from occurring due to standing water (e.g. lakes, ponds).
- Discharge of groundwater to storm water network
 - Do not discharge to the storm water network in a way that compromises the effectiveness of the existing stormwater system.
 - Ensure that hoses typically discharge through manholes into the stormwater system.
 - Ensure that alternative sources of discharge location are available during heavy rain events which may overwhelm the stormwater system.
 - Ensure water treatment is carried out before it is discharged to the networking sedimentation tanks, temporary lagoons or similar.
 - Discharge of groundwater to marine or other water body
 - Ensure that groundwater is discharged more than 50 meters from the shoreline, into the deepest part of the channel/water body (usually the center), or in accordance with the requirements of the local authority for discharging dewatering effluent.

- Keep discharge location of groundwater at least 1 meter below the lowest low tide level if discharged to the marine environment, to allow adequate mixing of the discharged water with the seawater.
- Reduce, as applicable, the discharge flows to prevent scour and, where necessary, employ edge protection measures.
- Indicate the location of the discharge pipe outlet using a marker buoy.
- Ensure water treatment is carried out before it is discharged to the network, by using sedimentation tanks, temporary lagoons or similar.
- Injection into the ground
 - Obtain a permit for injection from the relevant local authority.
 - Develop a site-specific injection methodology outlining the permitted quantity and rate of water to be injected.
 - Continuously monitor the quantity of injected water and water levels in all relevant deep wells.
 - Regularly conduct physical and chemical tests to verify the quality of injected water. The tests should be conducted by a licensed laboratory.

C. Monitoring Requirements

On a regular basis, test the discharged water at an accredited laboratory, following national standards, for all required parameters and to minimum detection limits to allow adherence to the regulatory authority limits:

- Obtain a permit from the local authorities before dewatering.
- Provide reports on the amount and quality of discharged water at the discharge point at least to meet the local regulatory requirements. The report shall contain the necessary information on the water to be tested, sampling collection, sampling and delivery dates, intended laboratory and QA/QC testing procedures.

FURTHER RESOURCES

Publications

1. *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*. Department for Environment, Food and Rural Affairs, United Kingdom, 2009.
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3.0 [E] ENERGY

The Energy category considers aspects related to energy management and the contractors use of energy during construction.

IMPACTS

Negative impacts resulting from unsustainable energy use include:

- Climate Change,
- Fossil Fuel Depletion,
- Air Pollution.

MITIGATE IMPACT

Measures that could mitigate environmental impacts due to unsustainable energy use include:

- Selecting efficient materials and systems for temporary buildings,
- Selecting energy efficient construction equipment and machinery,
- Using renewable and/or low-carbon energy sources.

CRITERIA IN THIS CATEGORY

[E.1] Energy Use – Temporary Buildings

[E.2] Energy Use – Plant & Equipment

3.1 [E.1] ENERGY USE - TEMPORARY BUILDINGS

3.1.1 PURPOSE

To minimize the energy consumption of temporary buildings.

3.1.2 CONTEXT

This criterion considers energy consumption and management in temporary buildings only. This includes energy consumption associated with site offices, canteens, workers accommodation (if attached to the construction site) and any temporary office/accommodation facilities on the construction site.

Construction operations require considerable logistic support in the form of temporary offices and welfare facilities for the employees, construction workers and visitors. These temporary buildings consume a significant amount of electricity during the construction phase, usually sourced from diesel generators. This causes CO₂ NO_x and Sox emissions which have an adverse impact on climate change.

The contractor is encouraged to reduce building energy consumption under this criterion to achieve a higher level. This is based on a comparison of the energy consumption of temporary buildings with the reference value.

Considering the building type and the local climate conditions, the major sources of energy consumption are cooling, heating, lighting, and the power consumed by the systems that support the building operation. The expected operational energy consumption is determined mostly through the design of an energy efficient building envelope and the procurement of efficient electrical equipment. However, the energy consumption can still be optimized during the operation of the buildings by responsible occupant behavior, retrofits/refurbishment and efficient facility management.

Energy efficiency for buildings can be achieved through various approaches for reducing energy consumption without affecting the comfort level of the occupants. Key areas to be addressed include:

- Occupancy and the operational profile,
- Internal and external heat gains.
- HVAC Systems.
- Lighting systems.
- Auxiliaries and equipment.
- Domestic hot water heating system.
- Use of renewable energy.
- Education and awareness of users.

The above building systems are assessed using GSAS Energia Suite™. The energy use outcomes are based on normative, standardized calculations.

3.1.3 GUIDELINES

Methods and measures that can be implemented to minimize energy consumption associated with contractors' facilities, include:

A. Building Envelope

Temporary buildings on construction sites are typically prefabricated, although projects may also decide to construct some of the temporary buildings, depending on the nature and duration of the project. Projects should ensure temporary buildings have an energy efficient envelope by implementing the following methods and measures:

- Select envelope elements with low Overall Heat Transfer Coefficients or U-Values (high R-Values) to reduce both solar and conductive heat gains and losses.
- Specify all windows and skylights with low solar transmittance to control solar gain and reduce cooling load.
- Increase roof surface reflectance using reflective materials, paints or coatings.
- Minimize air leakages occurring between the pipe/duct exterior and the penetration opening.
- Use hybrid ventilation strategies, including operable windows, where possible.
- Install external shading devices to protect the building against excessive solar gains during the summer.

B. Building Internal Loads

- Select more efficient interior lighting. The widespread availability of compact fluorescent lamps, and LED (light-emitting-diode) lighting options can reduce lighting electricity consumption and heat gains in air-conditioned areas and reduce the energy consumption for air conditioning.
- Control the external solar shading, internal shading, and electric lighting in a holistic manner.
- Select more energy efficient electrical equipment which are Energy Star labelled by an accredited organization (e.g. computers, printers, etc.) to reduce the electricity requirements of plug loads and reduce heat gains in air-conditioned areas from the use of appliances, office equipment, and other devices plugged into electrical outlets.

C. HVAC Systems

- Select equipment to meet the design and bring the operational performance close to maximum efficiency performance levels based on manufacturers data.
- Use direct digital control systems to optimize start-up or shut down of the HVAC systems.
- Avoid using temperature sensors that can be adjusted and tampered with locally.
- Select HVAC room air conditioners which are minimum 5-Star energy labelled from an accredited organization.

FURTHER RESOURCES

Publications

1. *Buildings and Climate Change: Status, Challenges, and Opportunities*. United Nations Environment Programme (UNEP), 2007.
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11. *PrEN 15193 Energy Performance of Buildings - Energy Requirements for Lighting*. European Committee for Standardization (CEN), 2006.
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3.2 [E.2] ENERGY USE – PLANT & EQUIPMENT

3.2.1 PURPOSE

To minimize the energy consumption of plant and equipment during construction.

3.2.2 CONTEXT

This criterion is dedicated to energy consumption and management of the plant and equipment utilized for construction activities. This includes energy use in stationary and mobile site equipment fed by on-site electricity generators including batching plants, tower cranes, air compressors, pumps, fans, lifts, lighting, concrete mixers, etc.

Construction operations require a wide variety of plant and equipment, many of them run off electricity typically delivered by diesel generators. This causes CO₂, Nox and Sox emissions which have an impact on climate change.

It is important to mitigate these impacts by reducing plant and equipment energy consumption.

The expected plant and equipment operational energy consumption is determined, primarily through:

- Efficiency of the generators.
- Efficiency of the plant and equipment utilized on-site.
- Responsible use by the operators.

3.2.3 GUIDELINES

Methods and measures that can be implemented to minimize the energy use of plant and equipment include:

A. Electrical Installations

- Connect to the grid wherever possible.
- Ensure generators are not oversized and run at low load conditions.
- Ensure generator air intake path is clear of any obstruction.
- Monitor the overall electricity consumption from the generators.

B. External Lighting

- Use more efficient lighting fixtures including compact fluorescent or LED lights.
- Ensure light fixtures are properly oriented to illuminate the required work area/pathways.

- Ensure light fixtures are zoned or are not on a single wiring circuit to control lighting more efficiently allowing light fixtures to be switched off when not required, for example when day light is available, or work is not scheduled in that area.
- Ensure light fixtures are clean and maintained properly such that the light output is as close as possible to the manufacturer's specifications.
- Ensure flickering or damaged lights present on site are replaced.
- Consider renewable energy sources for whole or part of site lighting.

C. Pumps and Fans

- Ensure the dewatering pump flow rate and horsepower are suitable for the required piping length and discharge flow.
- Utilize high efficiency pumps.
- Ensure fans are off when not required for occupational or health reasons.
- Utilize high efficiency fans.

D. External Construction Equipment

- Select electrically operated tower cranes with power optimization and control features. A frequency converter regulating all drives and variable speed hoisting winch make cranes more energy efficient than conventional cranes.
- Ensure air compressors and compressed air hoses are free of leaks to avoid longer run times for the compressor. An air compressor motor with a high efficiency rating will conserve additional energy.
- Use high efficiency rating motors for air compressors.
- Use high efficiency rating water coolers.

E. Training and Awareness

- Ensure operators are trained in energy saving practices.

FURTHER RESOURCES

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1. *Buildings and Climate Change: Status, Challenges, and Opportunities*. United Nations Environment Programme (UNEP), 2007.
2. *CEN EN 15603 Energy Performance of Buildings - Overall Energy Use and Definition of Energy Ratings*. European Committee for Standardization (CEN), 2008.
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4.0 [W] WATER

The Water category considers aspects related to water consumption and management for domestic and non-domestic applications.

IMPACTS

Impacts resulting from unsustainable water consumption include:

- Water depletion,
- Human Comfort & Health,
- Water pollution and contamination.

MITIGATE IMPACT

Measures that could mitigate environmental impacts and lower demand on water include:

- Implementing water conservation practices,
- Selecting efficient water-consuming fixtures,
- Creating a system for collection and reuse,
- Treating water on-site.

CRITERIA IN THIS CATEGORY

[W.1] Domestic Water Use

[W.2] Non-Domestic Water Use

4.1 [W.1] DOMESTIC WATER USE

4.1.1 PURPOSE

To minimize the domestic water consumption in temporary buildings.

4.1.2 CONTEXT

This criterion is dedicated to water consumption and management for personal needs by site personnel. The facilities where this type of water consumption occurs are sanitary, dining, laundry and kitchen facilities. This includes the water consumption in workers accommodation only when they are attached to construction sites.

The natural water cycle is a system in which water resources are continuously exchanged between the atmosphere, soil water, surface water, ground water, and plants. This cycle treats and recharges freshwater supplies. Human consumption of fresh water outpaces the natural cycle and under these circumstances, water cannot be considered as a renewable resource.

Domestic water use at construction sites by site personnel is protected in accordance with local labor laws. The quantity of water used for this purpose amounts to a significant proportion of the total water consumption as it exists throughout the construction process. Therefore, special consideration should be given to monitor the sufficiency as well as efficiency of this usage.

Water conservation is becoming a viable alternative and is complementary to developing new water supplies. It involves a combination of retrofits, an upgrade of water related equipment and fixtures, the maintenance of infrastructure, and a collective water conservation ethic focused on resource use, allocation, and protection. There are ample opportunities in all types of buildings, offices and other facilities on construction sites to achieve significant water savings, indoors and outdoors, by making improvements in several operational areas.

The contractor is encouraged to optimize the use of water consumption under this criterion to achieve a higher score. This is based on the comparison of the building water consumption to the reference value.

Water saving in buildings on construction sites can be achieved through various approaches, while maintaining the level of comfort for the occupants in offices and accommodation. Key areas to be addressed include:

- Monitoring of water use and leak detection.
- Efficient sanitary fixtures and equipment.
- Education and awareness of users.

The building systems are assessed using GSAS water Suite™ based on normative, standardized calculations.

4.1.3 GUIDELINES

Methods and measures that can be implemented to minimize domestic water consumption associated with the contractors' facilities, include:

- Develop a Domestic Water Management Plan demonstrating how to conserve water during the construction phase for domestic use. Include all temporary facilities (facilities within the construction site or its boundaries) to determine the cumulative domestic water consumption.
- Do not use clean drinking water for activities which can be done using recycled water, for example, for flushing etc.
- Install water efficient fixtures including low flush toilets, vacuum toilet flush systems, dual flush toilets, water- saving valves and fixtures on faucets and showerheads, low flush urinals and occupant sensors.
- Install automatic water flow shut-offs, flow-controllers and regulators, electronic sensors, and lever taps on faucets.
- Install dry fixtures, for example composting toilets and waterless urinals.
- Use low-flow appliances instead of conventional appliances to reduce water consumption.
- Install leak detection systems to quickly and efficiently identify and locate the source of water leaks.
- Control and monitor the water use at construction facilities. Periodic readings should be taken from all meters and sub-meters (monthly is recommended in most instances). Regular out-of-hours meter readings might also help to detect any leaks or other unwarranted consumption.
- Provide training to employees and construction workers on water conservation practices.

FURTHER RESOURCES

Publications

1. *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*. Department for Environment, Food and Rural Affairs, United Kingdom, 2009.
2. *Construction Site Best Management Practice (BMP) Field Manual and Troubleshooting Guide*. Department of Transportation, State of California, 2013.
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4. *Field Guide for Sustainable Construction, Partnership for Achieving Construction Excellence*. The Pennsylvania State University, PA & Pentagon Renovation and Construction Program Office, 2004.
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4.2 [W.2] NON-DOMESTIC WATER USE

4.2.1 PURPOSE

To minimize the non-domestic water consumption associated with construction activities.

4.2.2 CONTEXT

Water conservation is becoming a viable alternative. There are ample opportunities in all types of construction sites to achieve significant water savings in the outdoor environment, by making improvements in several operational areas.

Non-domestic water use includes water consumption associated with various activities including dust suppression, concrete curing, testing and commissioning, washing and cleaning and any other construction related activities.

The contractor is encouraged to enable various water saving measures and methods in construction activities under this criterion to achieve a higher score.

Non-domestic water savings can be achieved through various construction methodologies applied to the main water consuming activities on site while maintaining the level of quality required by the applicable standards.

4.2.3 GUIDELINES

Methods and measures that can be implemented to minimize non-domestic water consumption, include:

A. General

- Install meters to control and monitor non-domestic water consumption and detect potential water leaks.
- For concrete curing utilize chemicals where possible to avoid the use of water.
- Ensure all water sources are accurately quantified including water supplied by tankers.
- For concrete curing, ensure the evaporation of water is minimized with practices including placing sponge or jute cloth on exposed slabs to help retain water for longer periods.

B. Dust Suppression

- Utilize non-potable water, for example TSE and discharged water from dewatering activities, for dust suppression.
- Utilize misting/atomizing systems which use less water and are more effective.
- Utilize suitable chemical additives to assist in reducing the volume of water required for dust suppression.

- Cover stockpiles with mesh or similar, to reduce the amount of water required for dust suppression.
- Stabilize on-site roads and laydown areas to reduce the amount of water required for dust suppression.

C. Washing and Cleaning

- Avoid the installation of drive through wheel washers that do not recirculate water.
- Install waterless wheel cleaning systems that use angled steel grids or similar, to clean debris from wheels.
- Avoid washing staff vehicles on site.

D. Commissioning Activities

- Consider appropriate flushing velocities based on the maximum sizes of debris expected in the piping network to avoid using large volumes of water.
- Provide specific water efficiency training and awareness to the commissioning staff.

E. Training and Awareness

- Ensure equipment operators are trained in water saving practices.

FURTHER RESOURCES

Publications

1. *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*. Department for Environment, Food and Rural Affairs, United Kingdom, 2009.
2. *Construction Site Best Management Practice (BMP) Field Manual and Troubleshooting Guide*. Department of Transportation, State of California, 2013.
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5.0 [M] MATERIALS

The Materials category considers aspects related to conservation of natural resources, minimizing soil disposal, and the use of certified materials with enhanced environmental, health and resources conservation attributes for temporary works.

IMPACTS

Environmental impacts resulting from unsustainable material use include:

- Materials depletion,
- Climate change,
- Fossil fuel depletion,
- Air, water and land pollution.

MITIGATE IMPACT

Measures that could mitigate environmental impact due to unsustainable use of materials include:

- Diverting existing waste materials from landfill or incineration,
- Using certified products and materials with enhanced environmental, health and resources conservation attributes,
- Minimize transportation and disposal of soil through reuse and optimization of cut and fill balance.

CRITERIA IN THIS CATEGORY

- M.1 Materials Diversion from Landfill
- M.2 Materials Eco-Labeling
- M.3 Cut & Fill Optimization

5.1 [M.1] MATERIALS DIVERSION FROM LANDFILL

5.1.1 PURPOSE

To maximize the quantity of existing on-site waste material diverted from landfill or incineration.

5.1.2 CONTEXT

A significant amount of waste generated by the construction sector comes from the demolition of existing buildings and infrastructures. In developing countries, where the construction sector is strong, most of the waste generated is from construction activities. The present recovery rates in the region are much lower than international norms.

Construction and demolition (C&D) waste is typically taken to landfill, causing environmental impacts on land use, air pollution, soil contamination, water contamination, biodiversity, human health and visual impact.

Materials recovery practices divert waste from landfill and incineration resulting in both environmental and economic benefits.

The scope of this criterion comprises salvaging existing materials found on-site and suitable for further reuse, either directly or after a recycling process (see Figure M.1.1).



Figure M.1.1 Scope of M.1 Materials Diversion from Landfill

5.1.3 GUIDELINES

Methods and measures that can be implemented to encourage the recovery of existing building materials to divert them from landfill or incineration, include:

- Identify existing materials found on-site and suitable for further reuse either directly or after a recycling process.
- Identify recovery outlets capable of handling recovered materials. Summary of potential materials for waste streams recovery include:
 - Concrete: crushed and used as aggregate, backfill material, road base, etc.
 - Masonry blocks and bricks: crushed and used as backfill material, aggregate and material for drainage.
 - Asphalt: milled and used for bituminous mixes, backfill material and road sub-base.
 - Glass: used in manufacturing of industrial abrasives; glass wool products; construction aggregate; filtration media; landscaping; Portland cement; epoxy binders and ceramic glazes.
 - Textiles: used in manufacturing of yarn and fleece; production of synthetic materials; textile hardboards and carpet products.
 - Ferrous Metals: sold to merchants and recycled in mills for ferrous manufacture.
 - Paper: used in manufacturing of molded fiber packaging; insulation; building board and furniture; paper mills.
 - Cardboard: recycled in mills for cardboard manufacture.
 - Plastic: used in manufacturing of several products used in road safety, home gardening, horticulture, building, domestic, entertainment, agriculture, furniture, marine engineering, plumbing and drainage, education, sports, waste industry, transport, office etc.
 - Non-Ferrous Metals: including aluminum sold to merchants and recycled in foundries and smelters.
 - Wood: used in manufacturing of wood-fiber-plastic products; inorganic bonded wood composites; pulp and paper manufacture; etc.
 - Bulk items for example pieces of furniture, equipment and decorative objects: sold to antique dealers, second-hand market or donated to schools or charity organizations.
- Identify salvaged materials matching the project design specifications for reuse on-site.
- Arrange for the transfer and transportation of recovered materials consignments with a licensed/recognized Waste Management Contractor (WMC).

- Arrange for appropriate waste storage areas, depending on the type of waste being stored, with a sufficient number of skips/storage areas for the different types of recovered materials.
- Develop a waste tracking system using a Waste Transfer Note (WTN) or similar; to confirm the amount of waste recovered.
- Maintain a register of all recovered materials and transfer methods. The record of waste being transferred shall include date, time, packing, labeling, type of waste and volume or weight of waste.
- Transport recovered materials to an approved facility for reuse, storage, or recycling purposes.

FURTHER RESOURCES

Websites

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8. *Sourcing Reclaimed Material for Use in FSC Product Groups or FSC Certified Projects*. Forest Stewardship Council, 2011.
9. *The State of the Practice of Construction and Demolition Material Recovery*. Office of Research and Development, U.S. Environmental Protection Agency, 2017.

5.2 [M.2] MATERIALS ECO-LABELING

5.2.1 PURPOSE

To use certified products and materials with enhanced environmental, health and resources conservation attributes for temporary construction activities.

5.2.2 CONTEXT

Environmental labels or eco-labeling has emerged as a useful tool for society and offers a valuable contribution to the development and implementation of sustainable procurement practices. There are several objectives for pursuing eco-labeling including:

- Protecting the environment,
- Encouraging environmentally considered construction innovation and leadership,
- Developing awareness of environmental issues,
- Linking eco-labelled materials with life cycle environmental assessment embodied energy.

There are three main types of widely adopted eco-labeling programs, guided by internationally recognized standards and each serves a different purpose and addresses different attributes:

A. Single-Attribute Labels

A single-attribute label identifies an individual environmental attribute associated with the product. An example of a single attribute label is the representation of recycled content or the energy efficiency performance of the product.

B. Multi-Attribute Labels

In contrast to single attribute labels, multi-attribute labels/standards represent collective characteristics of the product with an aim to set criteria for the range of environmental impacts that the product category should minimize or avoid. This is typically achieved by focusing on life cycle environmental impacts of the product categories e.g. energy saving, carbon footprint reduction, recycling or reuse of the material or product and the impact on the ecosystem and public health. These labels are good indicators of the “greenness” of the product category and are awarded when all the criteria of the standard are met by the product category.

C. Environmental Product Declarations

Environmental Product Declaration (EPD) labels are awarded to a product for declaring the environmental impacts over the life cycle of the product. The award of the label requires a thorough life cycle assessment study, which enables a comparison of the product with other products in the same category in terms of their life cycle environmental footprints. The EPD label helps users to compare the relevant data among products and make an informed decision.

5.2.3 GUIDELINES

Methods and measures that can be implemented to encourage the use of eco-labelled temporary materials and products required during construction, include:

- Procure eco-labelled materials and products which have enhanced environmental attributes.
- Investigate the availability of eco-labelled materials and products for temporary use and develop a materials logistic plan to identify suppliers and manufacturers.
- Develop a procurement program to ensure the availability of eco-labelled temporary materials and products according to the construction phase timeline. These considerations should take place early in the pre-construction process to assess which eco-labelled materials and products will be most appropriate.
- Ensure the appropriateness and validity of material and product information and certification.
- Develop a matrix to identify the potential environmental impacts of materials and products to inform the decision-making process and specify alternative eco-labelled materials and products whenever possible.

FURTHER RESOURCES

Publications

1. *A Guide to Environmental Labels -for Procurement Practitioners of the United Nations System*. UNOPS, 2009.
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5.3 [M.3] CUT & FILL OPTIMIZATION

5.3.1 PURPOSE

To minimize transportation and disposal of soil through reuse and optimization of cut and fill balance.

5.3.2 CONTEXT

The term “cut and fill” is used to describe the process of profiling the landform for the project; earthwork excavation (cut) in some parts, and earthwork embankment (fill) in other parts.

Earthworks construction activities have a significant environmental impact associated with the excavation and backfill activities and the transportation of soil. The machinery involved in the excavation and backfilling works is usually run by fossil fuels, producing large quantities of CO₂ emissions. The movement of high volumes of soil involves heavy vehicles running on fossil fuels and emitting significant quantities of CO₂. Soil represents a great percentage of the construction and demolition waste taken to landfill, which requires vast areas for disposal and poses a health risk to the population.

Mitigation measures to minimize these impacts can be implemented to reduce the earthworks volume, balancing the “cut and fill”, and the reuse of surplus soil either on-site or off-site.

5.3.3 GUIDELINES

Methods and measures that can be implemented to mitigate the impacts related to earthworks, include:

- Reduce the earthworks volume by adjusting the project design to the actual land topography and conditions on-site. This requires a comprehensive survey study to be conducted prior to the commencement of the construction works.
- Optimize the “cut and fill” balance by adjusting the project design to the actual land topography and conditions on-site. Redesign landscaping works to accommodate surplus soil whenever possible.
- Reuse as much excavated soil as possible on site. This requires testing of the excavated material to ensure it meets the physical and chemical requirement of the backfill material for the project. If needed, treat the excavated soil to modify its features to match the project backfill material specifications. This can be achieved by crushing, sieving, and adding sand and/or aggregates as required.
- Reuse surplus suitable excavated soil on another project or facility off-site. If there are no available destinations for immediate reuse, projects may stockpile the soil in temporary facilities for further reuse. Some clients may have dedicated plots for this purpose.
- Reuse material from other development sites rather than extracting material from a quarry.
- Utilize trenchless technologies for pipelines when technically feasible.

FURTHER RESOURCES

Publications

1. Capachi, Nick, and John Capachi. *Excavation & Grading Handbook*. Craftsman Book Company, 1987.
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6.0 [OE] OUTDOOR ENVIRONMENT

The Outdoor Environment category considers aspects related to dust control, noise and vibration control, light pollution/visual impact control and odor and VOC's control.

IMPACTS

Impacts resulting from ineffective control and design of the outdoor environment include:

- Air pollution,
- Human Comfort and Health Degradation.

MITIGATE IMPACT

Measures that could improve outdoor environmental quality during the construction process include:

- Minimizing the level of dust and fine particulates produced on-site,
- Minimizing the amount of noise generated due to construction activities,
- Reducing the vibration impacts from different construction equipment,
- Minimizing light pollution and negative visual impacts,
- Minimizing odor and reducing level of VOC emissions in the air.

CRITERIA IN THIS CATEGORY

OE.1 Dust Control

OE.2 Noise & Vibration Control

OE.3 Light Pollution & Visual Impact Control

OE.4 Odor & VOC Emissions Control

6.1 [OE.1] DUST CONTROL

6.1.1 PURPOSE

To minimize levels of dust and airborne particulates generated by construction activities.

6.1.2 CONTEXT

The outdoor air quality at the construction site and the surrounding areas is susceptible to pollutants due to dust and other hazardous fine particulates generated by construction activities travelling through the air, across the construction site and beyond.

Several sources of air pollutants can be found on the construction site associated with construction activities including, but not limited to: enabling works; excavation activities, truck and vehicle movement; digging and drilling; stockpiling and backfilling.

Prolonged exposure to polluted air poses risks to human health and well-being. The health risks associated can cause distinct and acute allergies and respiratory diseases including asthma, and impact workers productivity.

It is important to have an efficient and properly functioning system on the construction site to mitigate dust generation and minimize transfer beyond the construction site boundary.

6.1.3 GUIDELINES

Methods and measures that can be implemented to contain dust particles, include:

A. Construction Sites Watering

- Spray water on areas of the construction site that produce dust on a regular basis using water tanks and/or any other water delivery method.
- Spray water on construction paths and gravel roads to reduce the amount of dust generated due to the movement of construction equipment and vehicles.
- Ensure sustainable approaches have been considered to reduce the amount of potable water used for watering, including the use of treated sewage effluent (TSE).
- Ensure any water collected, filtered or recycled on site is used for watering purposes where possible.
- Ensure an adequate number of mobile watering units and necessary equipment are available on the construction site.

B. Dust-Producing Activities Control

- Determine the location of the on-site concrete batching plant based on the prevailing wind direction and speed. Provide a considerable buffer distance from sensitive receptors of dust.

- Locate dust-producing activities away from the site boundary, especially from sensitive receptors, whenever possible.
- Isolate the construction activity that is likely to produce significant levels of dust either by distance or using temporary barriers, for example, fencing lined with cloth or fabric.
- Minimize construction activities that will potentially produce large quantities of dust (including excavation and transfer of surface materials) when wind speeds are high, particularly when blowing in the direction of sensitive receptors.

C. Source Control

- Stabilize construction roads with gravel, asphalt (or similar) immediately after grading.
- Provide training to staff and workers involved in dust-generating activities.
- Provide road sweeping equipment to clean up any public roadways affected by dust and mud from construction works, and from paved on-site roads.
- Provide a de-dusting system in indoor areas with poor natural ventilation.
- Control dust generated from the concrete batching plant by installing filter bags at the vents of the silos and provide conveyors and discharge ends with dust-tight covers.

D. Movement Control

- Ensure trucks transporting bulk materials (e.g. dry earth) to/ from/within the project site are not overloaded. Cover loads with a suitable tarpaulin or similar.
- Restrict the movement of equipment to reduce the frequency of equipment travel.

E. Dust Monitoring

- Implement dust monitoring on the construction site using appropriate monitoring equipment to measure dust concentration levels (PM10 and PM2.5) as per GSAS-CM Dust Monitoring Methods.

FURTHER RESOURCES

Websites

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Publications

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6.2 [OE.2] NOISE & VIBRATION CONTROL

6.2.1 PURPOSE

To minimize the levels of noise and vibration generated by construction activities, plant and equipment.

6.2.2 CONTEXT

Noise disturbance is an increasing issue in daily life resulting from industrialization and urbanization.

Noise is inherent and generally some noise is unavoidable when undertaking most construction activities, with the most prominent noise emissions typically produced by heavy equipment, earthworks, piling, vehicles, generators and demolition.

Noise pollution generated from construction activities affects the surroundings, including wildlife habitats and neighbors, contributing to hearing impairment, sleep disturbance, ear pain or discomfort, and other psychological effects. Wider effects can include economic impacts including decreased productivity, lowered property values and social impacts.

It is important to have an efficient and properly functioning system on the construction site to mitigate noise generation and minimize the impact on the construction site and surrounding environment.

Operation of construction equipment causes varying degrees of ground vibration. It can spread through the ground and diminish in strength with distance depending on the equipment and methods employed. In a construction environment, vibrations usually occur from the movement of vehicles (e.g. heavy trucks, trains, plant) or from construction activities including demolition or compaction of the soil by depth vibrators (vibro-compaction) during earthworks.

Ground vibrations from construction activities may impact buildings located on adjoining properties. Depending on the level of vibration, neighboring buildings are affected, and serious damage may occur at the highest vibration levels. In addition, ground vibrations could impact the comfort and wellbeing of neighboring residents.

6.2.3 GUIDELINES

Methods and measures that can be implemented to minimize noise pollution and reduce vibration impacts from construction machinery, plant and vehicles, include:

A. Noise Minimization at Source

- Ensure, whenever possible, that inherently quiet and/or properly silenced equipment are utilized for construction activities. All generator sets and compressors shall be housed in an acoustically designed housing, which shall be closed when in use.

- Provide adequate guidance and training to the operators of construction equipment. Careless or improper operation or inappropriate use of equipment for example, poor loading, unloading, excavation and hauling techniques can increase noise levels.
- Ensure that construction equipment is regularly maintained for noise mitigation and the silencers of machines and equipment are working properly.

B. Noise Control

- Ensure long-term noise generating equipment including concrete batch plants, electricity generators, and water pumps are properly located and oriented carefully such that noise is suitable directed away from sensitive receptors.
- Use, whenever possible, noise controls at-source, such that any noise generating equipment is suitably enclosed with an acoustic barrier or buffers, for example, fencing, material stockpiles, site accommodation, building walls or a stand of trees or other suitable vegetation.
- Restrict noise generating activities to daytime and limited evening periods only, with no overnight working permitted unless approval has been granted by the regulatory authority (e.g. 24-hour concrete pours).
- Schedule, when practical, the noise generating activities in a manner that will not negatively impact sensitive receptors.

C. Vibration Control

- Locate, when reasonably practicable, vibrating equipment as far from sensitive receptors as possible.
- Minimize the unnecessary operation of construction machinery which cause vibrations through improved efficiency of trips, and reduction of double handling through appropriate placement of stockpiles, haul roads, works depots and work areas.
- Reduce transmitted vibration by cutting a structure to separate construction work from sensitive receptors. Note: Clearly, it is important to take account of safety and structural issues before carrying out any work of this nature.
- Replace or repair immediately any equipment or vehicles seen to have an excessive amount of vibration.

D. Noise Monitoring

Noise affecting workers on the project site and adjacent sensitive receptors should be monitored. The noise monitoring will incorporate the use of appropriate noise monitoring equipment to monitor:

- Noise affecting the neighborhood.
- Noise from construction related plant and equipment.

FURTHER RESOURCES

Publications

1. *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites*. Noise. British Standards Institution, 2014.
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6.3 [OE.3] LIGHT POLLUTION & VISUAL IMPACT CONTROL

6.3.1 PURPOSE

To minimize light pollution and reduce the visual impact associated with construction activities.

6.3.2 CONTEXT

Light pollution refers to the impact caused by inefficient, excess or obtrusive use of artificial light.

The major sources of artificial light generated on the construction site include boundary lighting, security lamps, vehicle head lamps, floodlights and temporary building illumination.

Light pollution generated by construction sites impacts urban residents' comfort, road traffic safety, and like any other form of pollution, disrupts ecosystems.

It is important that the construction site is served with appropriate artificial lighting to enable construction work to continue safely and effectively in periods of insufficient natural light. Lighting design of a construction site should be based on the specific construction needs, functions and site conditions, with the intention of reducing the effects of light pollution. To achieve this objective, a lighting plan for a construction site should be developed.

Visual impact refers to a change in the view, or appearance, of the surrounding built environment, urban areas and natural landscape due to the construction of new developments. The appearance of a construction site is an important issue for the surrounding environment and local community.

Visual impacts resulting from a construction site are associated with landscape alteration, stockpiles, site fencing and vehicular/machinery use.

Environmental mitigation measures should be implemented to reduce the visual impact of construction projects. These measures should cover the landscape coherence, demolition areas, site boundary, change to geological terrain, and any other obstacle including structures or buildings that limit the natural view.

6.3.3 GUIDELINES

A. Light Pollution

Methods and measures that can be implemented to minimize light pollution, include:

- Position lighting (especially construction floodlights) properly and directing light more efficiently and effectively towards where it is actually required.
- Turn lights off using a timer, occupancy sensor or manually when not required.
- Use the most appropriate lighting type for the given task. Several different types of light sources exist, each having different properties that affect their appropriateness for certain tasks, particularly efficiency and spectral power distribution.

- Use flat lens (full cut-off) fixtures to ensure that light is only directed below the horizontal, which means less light is wasted outwards and upwards. For instance, on advertising hoardings use top-mounted rather than ground-mounted floodlights.

B. Visual Impact

Methods and measures that can be implemented to minimize visual impacts, include:

- Ensure that vehicles leaving the site do not spread mud, soil or dirt onto public roads. Any mud, soil or dirt which has been spread onto public roads should be removed and cleaned promptly.
- Ensure the choice of materials for boundary fencing considers the surrounding land use. Use a solid fence providing security, safety, visual barrier, and partial acoustic attenuation for sites in or directly adjacent to residential areas. A chain link or similar fencing is sufficient for construction sites in more remote areas away from residential areas or adjacent to other construction sites.
- Minimize solid waste piles on-site. Where existing, cover them with netting or tarpaulin and enclosed with hoardings.
- Minimize ground disturbance and vegetation removal that could result in visual impacts that produce contrasts of color, form, texture, and line. Designate a "No-intrusion Zone" to maximize protection to existing trees and ground vegetation.
- Plan and develop temporary tree nurseries, when possible, for the transplanted and proposed trees at an early stage to allow small trees to grow during the construction period. This will serve as a visual impact mitigation measure during the construction period.

FURTHER RESOURCES

Websites

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6.4 [OE.4] ODOR & VOC EMISSIONS CONTROL

6.4.1 PURPOSE

To minimize odors and VOC emissions arising from construction activities.

6.4.2 CONTEXT

Unpleasant odors can arise from specific processes, adversely affecting workers and residents in the surrounding area downwind of the construction site.

Odors from construction site activities potentially include several sources, for example: inadequately maintained septic tanks or sewage networks; exhaust emissions from vehicles or equipment; and poor waste management including dumped food waste, causing discomfort to workers and neighbors.

Strong toxic odors can also originate from volatile organic compounds (VOC) emissions, which are chemical additives that readily vaporize, becoming volatile with a low evaporation point, at typical indoor temperatures and pressure conditions. Common VOC's include formaldehyde, benzene, flammable alcohols, cleaning solvents, etc. Typically, VOC's are contained in chemical products used in construction works including floor coverings, paints, adhesives, fillers, shellacs, insulation, sealants, and other materials used especially in finishes. Volatile emissions are also connected to refueling and maintenance activities.

VOC's can pose risks to human health and have negative effects on the environment. Research shows that high concentrations of VOC's are linked to an increase in allergies, asthma and other respiratory diseases. These emissions contribute to the formation of ground-level ozone and fine particulate matter, which form smog. Smog has detrimental effects on humans, plants and animals and can cause property damage through acid rain.

6.4.3 GUIDELINES

A. Odor Control

Methods and measures that can be implemented to reduce air quality impacts from odors, include:

- Provide a metal or hard plastic lid on organic waste (food) containers to ensure odors do not emanate from decaying organic waste. Empty the bins regularly and keep them clean.
- Do not permit long-term storage of waste on-site and do not allow short-term storage outside designated areas.
- Keep septic tank lids tightly in place at all times to stop emission of odors and to prevent rubbish collecting in the septic tanks. Avoid any overflow or leakage during the emptying of septic tanks.

- Supply the appropriate personal protective equipment (PPE), for example, respiratory equipment, to workers when they work in an environment with odors and volatile emissions.
- Maintain adequate separation distances between potential odor sources and potential receivers.
- Monitor pipe networks that carry wastewater for any leaks that could cause water with foul odors to escape and build up a stagnant wastewater pond.
- Prohibit smoke generated by bonfires (often when burning waste).

B. VOC Emissions

Methods and measures that can be implemented to control volatile emissions, include:

- Ensure that fuels are stored safely in sealed containers.
- Ensure proper on-site storage of volatile chemicals in appropriately sealed containers, e.g. Containers for Control of Substances Hazardous to Health (COSHH Containers), in cool, covered areas with adequate ventilation.
- Control leakage of gases from gas bottles by complying with the instructions for the storage of dangerous goods.
- Maintain an up to date full list of all volatile materials and chemicals stored on site. Keep Material Safety Data Sheets (MSDS) available at the chemical storage areas.
- Store and handle chemicals in accordance with the manufacturers Material Safety Data Sheets (MSDS).
- Control volatile emissions by minimizing leaks and spills of fuel driven engines.
- Avoid, if possible, long-term on-site storage of highly volatile fuels including petrol and volatile chemicals, for example, solvents and oil-based paints.
- Ensure training is provided to workers regarding odors and VOC emissions control.

FURTHER RESOURCES

Publications

1. *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*. Department for Environment, Food and Rural Affairs, United Kingdom, 2009.
2. *Construction Site Best Management Practice (BMP) Field Manual and Troubleshooting Guide*. Department of Transportation, State of California, 2013.
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10. *Overall Construction Environment Management Plan*. Lusail Real Estate Development Company, 2012.
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13. *Technical Guidance Document for Construction Environmental Management Plan (CEMP)*. Environment Agency, Abu Dhabi, 2010.

7.0 [SD] SOCIO-CULTURAL DIMENSIONS

The Socio-Cultural Dimensions category considers aspects related to cultural conservation, protection of archeological remains and heritage sites, society engagement and effective control and design of Socio-Cultural Interactions. This category is applicable if any archeological or heritage elements are discovered during the construction works.

IMPACTS

Impacts resulting from the non-protection of archeological remains or heritage sites, and ineffective control and design of the Socio-Cultural Interactions include:

- Loss of cultural heritage,
- Loss of society wellbeing,
- Missed opportunities to build mutual trust between society and the needs of construction practices.

MITIGATE IMPACT

Factors that could mitigate the impact include:

- Identifying archeological sites to prevent damage by excavation,
- Identifying heritage items or relics for protection against site activities,
- Implementing an effective control and design of Socio-Cultural Interactions.

CRITERIA IN THIS CATEGORY

SD.1 Protection of Archeological Remains

SD.2 Socio-Cultural Interaction

7.1 [SD.1] PROTECTION OF ARCHAEOLOGICAL REMAINS

7.1.1 PURPOSE

To protect archeological remains present on the construction site.

7.1.2 CONTEXT

Archeological sites are non-renewable resources; they serve as links to the people and civilizations that flourished in the distant past.

Potential heritage items or relics on archeological sites can include:

- Evidence of historical occupation including aged building remains, fishing or pearling artifacts, shipwrecks, pottery, flint and other tools.
- Evidence of early industrial heritage.
- Articles of value associated with religious heritage.
- Items or places of importance to the early Bedouin people.

New construction developments can potentially damage archeological sites. Nonetheless, development should not be stopped simply to protect and preserve archeological sites.

Understanding the impact before development takes place can help protect such sites. Several techniques of restoration, reconstruction, recreation/renovation, and relocation can be used to prevent damage and reinstate the cultural significance of an archeological site. Protection of archeological sites will be ensured prior to and during the construction process, taking into consideration the applicable requirements of governmental and other relevant authorities.

7.1.3 GUIDELINES

Methods and measures that can be implemented to protect archeological sites, include:

- Implement procedures for the early detection of archeological constraints before the construction activities start.
- Create an exclusion zone clearly marked with temporary flagging or fencing around the heritage items identified on or near the work site prior to the commencement of works.
- Report the discovery of any potential heritage items immediately to the relevant local authority.
- Implement the specific measures related to the protection of cultural heritage items from the Environmental Impact Assessment and Environmental Baseline Study, as required.
- Communicate to all staff, including machinery operators, the possibility of or confirmed existence of heritage objects or places, and the responsibility to report any suspected heritage discoveries.

FURTHER RESOURCES

Publications

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7.2 [SD.2] SOCIO-CULTURAL INTERACTION

7.2.1 PURPOSE

To establish communication and interaction protocols with the local community and stakeholders for addressing public concerns and feedback.

7.2.2 CONTEXT

Effective communication including a consistent interface with local communities and major stockholders is a key to the success of construction projects.

Poor communication can cause numerous issues including compromising stakeholders needs and requirements, client dissatisfaction, and rising community concerns.

Stakeholders, those who will be affected by the project and those who will benefit from the project, should be identified during the pre-construction stage.

A proper communication channel must be implemented with every stakeholder, which can be:

- Written channels including, emails, letters, etc.,
- Verbal channels including meetings and call centers,
- Media releases in newspapers or on social media platforms.

The feedback obtained by the Project must trigger action plans to mitigate the impacts of the construction activities on the community.

7.2.3 GUIDELINES

Methods and measures that can be implemented to ensure proper socio-cultural interaction, include:

- Notify local residents and other stakeholders who may be affected by the works prior to the commencement of the main construction activities in the area. The communication is required for activities that are likely to result in disruption or disturbance, for example, traffic diversions, blocking of access to properties, piling and tunneling near sensitive receptors. Provide local residents and other stakeholders with a contact name, telephone number and address for directing any enquiries or complaints.
- Ensure all necessary insurance policies are in place to cover any event of physical or property damage to third parties.
- Set up and co-ordinate a series of communication meetings with major stakeholders and local communities. Collect public views through various engagement processes that will refine the mitigating measures proposed during construction works.
- Establish and implement a robust action plan with clear roles and responsibilities and timelines in line with the public feedback meetings and complaints raised.

FURTHER RESOURCES

Publications

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8.0 [MO] MANAGEMENT & OPERATIONS

The Management & Operations category considers aspects related to waste management, welfare facilities, construction health & safety and workers accommodation.

IMPACTS

Environmental impacts resulting from ineffective construction site management and operations include:

- Materials Depletion,
- Land Use and Contamination,
- Human Health & Safety Risks,
- Reduced comfort and wellbeing.

MITIGATE IMPACT

Factors that could mitigate environmental impact include:

- Planning and implementing sustainable management of waste,
- Providing appropriate facilities for the welfare of workers and staff on-site,
- Ensuring health and safety of workforce by providing necessary facilities, developing plans and management systems,
- Use GSAS certified workers accommodation.

CRITERIA IN THIS CATEGORY

MO.1 Waste Management

MO.2 Welfare Facilities

MO.3 Construction Health & Safety

MO.4 Workers Accommodation

8.1 [MO.1] WASTE MANAGEMENT

8.1.1 PURPOSE

To minimize waste arising from on-site construction activities taken to landfill or incineration.

8.1.2 CONTEXT

Responsible management of waste is an essential aspect of sustainable construction practice. In developing regions including the GCC, the amount of waste generated from construction is much higher than the amount of waste generated by other sectors.

Construction waste is primarily generated from the packaging of materials, surplus materials, demolition works, construction materials subject to wear and tear, for example shuttering for concrete works. The types of waste can include, but are not limited to: metals, wood, plastic, paper and cardboard, glass, concrete, organic and hazardous waste.

Environmental impacts resulting from ineffective construction waste management include material depletion, land and water contamination, human discomfort and health risks. Particular attention is required for hazardous waste management as it poses major risks to human health and habitats.

Project can reduce the amount of waste taken either to landfill or incineration by adopting the following waste management hierarchy:

- Reduce.
- Reuse.
- Recycle/compost organic waste.
- Disposal, when none of the other options are feasible.

In the case of hazardous waste, deviation from landfill is mandatory to avoid major health and environmental impacts.

8.1.3 GUIDELINES

A. Waste Reduction

Methods and measures that can be implemented to encourage waste reduction, include:

- Maintain an orderly and tidy site by implementing good housekeeping, which can reduce waste generation.
- Establish and maintain proper material storage facilities and practices. Order materials in bulk, where possible, to reduce packaging; alternatively purchase materials with the minimum of packaging waste to dispose of.

- Reuse as much material on site as possible by implementing the following practices, as applicable, plus others deemed suitable for the project:
 - Reuse worn-out plywood, no longer suitable for shuttering, to assemble temporary furniture (tables, benches, shelves, etc.), to set up noise barriers, to assemble traffic signs, etc.
 - Reuse surplus concrete for temporary paving, footings for hoarding and signs, etc.
 - Reuse waste rebar as surveying stakes, to erect fencing, etc.
- Implement training programs for workers on waste management.

B. Waste Segregation and Storage

Methods and measures that can be implemented for proper waste segregation and storage, include:

- Transfer, as applicable, waste from high level construction work to ground level through chutes:
 - Provide enclosed chutes where materials are dropped from height.
 - Provide suitable enclosed protection barriers and warning signs of the hazard of falling materials into the area on which the material is dropped.
 - Ensure waste chutes deposit the waste directly into waste skips and do not deposit them on to the ground where waste is uncontrolled.
 - Place dust netting or similar around the skip and along the length of the chute to contain any dust clouds upon impact and to stop any loose waste escaping.
- Pile the waste for as short a period as possible:
 - Do not allow construction debris and demolition material to accumulate such that it presents an environmental, health and/or safety hazard. All such materials are to be disposed off-site on a regular basis.
 - Do not pile food waste or hazardous waste.
 - Cover the waste pile containing plastic, paper or other lightweight materials with a net/tarpaulin or similar to stop waste from being blown around.
- Collect liquid waste, for example greywater, sewage, slurry and other wastewater from source in tanks by a licensed waste collector and remove off-site for disposal at an approved regulatory authority facility.
- Segregate waste generated at source to enable recycling. Store toxic and hazardous waste separately.

- Identify which waste should go into which skip, either with signs/pictures or by color-coding the skips.
- Place adequate numbers and sizes of containers (skips, bins or similar) throughout the construction areas and temporary facilities.
- Collect on a regular basis the waste from different construction areas and transfer them to the main on-site waste storage area.
- Inspect containers on a regular basis. Keep waste receptacles securely closed during accumulation (except for open-topped trash skips) and store and seal them tightly prior to transportation from the construction area.
- Store all food waste properly in containers with closed metal or hard plastic lids to minimize the possibility of vermin infestation and to prevent odors.
- Place a bucket with sand at designated smoking areas for the safe disposal of cigarette butts.
- Ensure no waste is burnt on site.
- Keep flammable waste away from any sources of ignition.
- Avoid stockpiling of used tires. Tires represent a fire hazard and should be taken regularly to a recycling facility or approved landfill for proper disposal.
- Contain the full waste including wastewater generated during marine activities, keep such waste on board and dispose appropriately once ashore. No waste is to be disposed overboard.
- Prohibit discharging bilge or ballast water into marine waters. Bilge and ballast waters are contaminated with oil, grease, sewage and other chemicals, and are harmful to the marine environment. Bilge and ballast water are to be stored securely on board the vessel, and then discharged into a port/marina treatment facility.

C. Waste Collection and Disposal

Methods and measures that can be implemented for proper waste collection and disposal, include:

- Arrange for the transportation of waste with a licensed Waste Management Contractor (WMC).
- Transport waste to a disposal facility approved by the relevant local authority.
- Cover the waste transportation vehicles when necessary, to prevent dropping, leaking, or blowing of waste.

D. Hazardous Waste Management

Methods and measures that can be implemented for proper hazardous waste management, include:

- Provide fire prevention systems and pollution control equipment for waste storage facilities where necessary, to prevent fires or the release of hazardous materials to the environment. Locate the storage facility away from any sources of ignition.
- Store and handle hazardous waste in accordance with the manufacturers Material Safety Data Sheet (MSDS).
- Mark the hazardous waste containers with appropriate warning labels to accurately describe their contents and with detailed safety precautions. Ensure that labels are waterproof, securely attached, and written in English and other languages when necessary.
- Do not use containers intended for hazardous waste disposal for other purposes unless they are specifically labeled for the intended purpose.
- Store different types of hazardous waste separately to avoid adverse chemical reactions leading to accidents.
- Drain used oil or fuel filters of the residual liquids by placing them on a mesh rack in a tray or drum. Dispose of the drained filter as scrap metal. Arrange for the collection of drained oil or fuel by a licensed oil waste management contractor.
- Do not dispose unused liquid paints with general waste. Dispose only of completely dried-out paint residue tins/drums with solid waste.
- Store used batteries on a concreted surface or metal/hard plastic tray due to the acid content. Send used batteries for recycling.
- Ensure bentonite fluid mixtures used during piling and other site works are contained. Implement appropriate measures to prevent the slurry mixtures spreading to other parts of the site or adjacent works. This can be achieved with adequate temporary containment barriers placed around the piling bores to prevent lateral spreading of bentonite/cement fluids.
- Store hazardous waste in tightly closed, leak-proof containers made of or lined with, materials that are compatible with the hazardous waste to be stored. Wherever possible, chemicals should be kept in their original container.
- Adhere to the relevant spill prevention measures in accordance with applicable good practices.

E. Waste Tracking System

To ensure that waste, including hazardous waste generated throughout the project, is disposed of appropriately, a proper waste tracking system should be implemented, which include:

- Proof that each type of waste is collected from site including:
 - Waste Transfer Note (WTN) or equivalent between project and Waste Management Contractor (WMC).
 - Approved monthly logs, including the amount of waste collected, issued by the Waste Management Contractor (WMC).
- Proof that waste is transported and disposed at an approved disposal facility.
 - Waste Transfer Note (WTN) or equivalent between Waste Management Contractor (WMC) and disposal facility.
 - Approved monthly logs or invoices, including the amount of disposed waste, issued by the disposal facility.
- Ensure waste records are audited on a regular basis to monitor the quantity and type of waste being produced to analyze where improvements can be made in either reducing the quantity of waste being produced or increasing the diversion of waste from landfill towards reuse or recycling.

FURTHER RESOURCES

Publications

1. *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*. Department for Environment, Food and Rural Affairs, United Kingdom, 2009.
2. *Construction Site Best Management Practice (BMP) Field Manual and Troubleshooting Guide*. Department of Transportation, State of California, 2013.
3. *Environmental Best Practice Specifications: Construction*. Department of Water Affairs and Forestry, Republic of South Africa, 2005.
4. *Field Guide for Sustainable Construction, Partnership for Achieving Construction Excellence*. The Pennsylvania State University, PA & Pentagon Renovation and Construction Program Office, 2004.
5. Fleming, Tim, et al. *Guide to Best Practice for Safer Construction: Principles*. Cooperative Research Centre for Construction Innovation, 2007.
6. McNab, Derek, et al. *Auditing of Water Use on Construction Sites - Phase I*. Mabbett & Associates Ltd., 2011.
7. National Academies of Sciences, Engineering and Medicine. *Guidebook for Construction Management Practices for Rural Projects*. Edited by Matthew Hallowell et al., The National Academies Press, 2013, <https://www.nap.edu/catalog/22633/guidebook-for-construction-management-practices-for-rural-projects>.
8. *National Code of Practice for the Construction Industry: Towards Best Practice Guidelines*. Australian Procurement and Construction Council, 1999.
9. Ndayiragije, Adolphe. *Modelling Study of Energy Use on a Construction Site*. Strathclyde University, Department of Mechanical Engineering, 2006.
10. *Overall Construction Environment Management Plan*. Lusail Real Estate Development Company, 2012.
11. Pires dos Santos, Camilla, et al. "Water Consumption in Construction Sites in the City of Recife/ PE." *The Electronic Journal of Geotechnical Engineering*, vol. 20, 2015, pp. 1711–26.
12. *Sustainable Construction: Simple Ways to Make It Happen*. bre, 2008.
13. *Technical Guidance Document for Construction Environmental Management Plan (CEMP)*. Environment Agency, Abu Dhabi, 2010.

8.2 [MO.2] WELFARE FACILITIES

8.2.1 PURPOSE

To provide satisfactory on-site welfare facilities for employees, construction workers and visitors.

8.2.2 CONTEXT

Welfare facilities are a fundamental and basic necessity for construction workers, staff and visitors.

Welfare facilities include sanitary, washing, drinking, dining, medical assistance, rest shelters, comfortable indoor spaces, and transportation to ensure comfort and safe environment for all people on the construction site.

Poor welfare facilities can have detrimental impacts on workers, staff and visitors, for example health and safety risks, discomfort, low productivity and performance, lack of motivation.

Providing the right welfare facilities can set the tone for a project and demonstrate a commitment to meeting Workers needs. Due to the harsh climate conditions of the region, special attention should be given to air conditioning, praying facilities, drinking and rest facilities

The type and number of facilities the project needs depend on manpower size and the type of construction work.

8.2.3 GUIDELINES

Methods and measures that can be implemented to ensure proper welfare to workers and staff, include:

A. Indoor Environment

- Provide a thermally comfortable environment to ensure the comfort and health of building occupants (air conditioning/heating) for all habitable buildings including offices, prayer halls and dining areas.
- Provide sufficient measures to maintain an adequate acoustic quality within various buildings on the construction site.
- Ensure light levels provided in all areas of the construction site are in line with best practices for visual performance, comfort and safety.
- Optimize the exposure to daylight for interior spaces to improve light quality for building occupants.
- Minimize direct or reflected glare within occupied spaces to improve visual comfort for occupants.
- Provide proper housekeeping to all habitable buildings.

B. Drinking Water & Washing Facilities

- Provide cooled drinking water in site offices, dining areas, field rest shelters and at other suitable points and ensure convenient walking distances for workers from a water station. Label drinking water in English and other applicable languages for the construction community.
- Ensure water is of a 'wholesome' quality and free of all contaminants by installing water filters, chlorinators and disinfection units and ensure water storage tanks are cleaned and maintained.
- Ensure every working area within the construction site has adequate washing facilities accessible to staff and workers.
- Remove foul air and moisture from rooms containing washing facilities by providing an adequate exhaust ventilation.

C. Sanitary Facilities & Pest Control

- Ensure every working area within the construction site where workers work for longer durations (say 4 hours) have adequate sanitary facilities.
- Ensure an adequate exhaust ventilation in rooms containing sanitary facilities to remove foul air and moisture.
- Arrange septic tanks and schedule emptying on a regular basis to prevent overflowing. Ensure septic tanks are of sufficient size/capacity to cope with the peak load.
- Ensure suitable cleaning/disinfecting procedures are implemented in all sanitary facilities, with a dedicated cleaning team.
- Implement pest control measures in all site offices, dining areas, washing and sanitary facilities. Ensure pest control measures are appropriate to the known/likely pests and undertaken by competent persons.

D. Workers Transportation

- Ensure transport vehicles, either owned or hired by the contractor are thermally comfortable.
- Ensure the transportation time schedule and capacity and number of vehicles are appropriate to avoid unnecessary discomfort to workers waiting for the transportation.
- Ensure transport vehicles, either owned or hired by the contractor are clean with comfortable seating.

E. Dining Areas

- Ensure dining areas are sufficiently sized and furnished with adequate seating provision and tables for all workers.
- Ensure, whenever possible, dining areas are located within a suitable distance from working areas.
- Ensure suitable cleaning/disinfecting procedures are implemented in all dining areas.
- Ensure an appropriate quantity and quality of food provided to workers. As necessary, different types of food should be served in line with the nationality of workers.
- Ensure catering points and serving time schedules are appropriate to avoid long waiting queues.

F. Medical Facilities

- Provide adequate and appropriate medical services (first aid boxes, defibrillator kits, qualified nurse(s) and doctor(s)) based on the number and distribution of workers in accordance with applicable local regulations.
- Ensure all workers have reasonably rapid access to first aid. Provide adequate first aid cover for all locations when workers are dispersed over a wide area.
- Ensure first aid staff have completed an appropriate approved course of training, from a recognized nationally or internationally approved organization/trainer.
- Ensure the locations of first aid boxes and defibrillator kits are clearly signed.

FURTHER RESOURCES

Websites

1. "Construction - Site Health and Welfare Requirements." *Builder's Engineer*, 21 Dec. 2013, <http://www.buildersengineer.info/2013/12/construction-site-health-and-welfare.html>.
2. "Construction: Managing Occupational Health Risks: Welfare." *Health and Safety Executive*, <http://www.hse.gov.uk/construction/healthrisks/welfare/index.htm>. Accessed 28 Aug. 2019.
3. "Organising Site Welfare." *Fit For Work*, https://support.fitforwork.org/app/answers/detail/a_id/573/~/organising-site-welfare. Accessed 28 Aug. 2019.

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1. *Construction Site Best Management Practice (BMP) Field Manual and Troubleshooting Guide*. Department of Transportation, State of California, 2013.
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7. *National Code of Practice for the Construction Industry: Towards Best Practice Guidelines*. Australian Procurement and Construction Council, 1999.
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11. *Sustainable Construction: Simple Ways to Make It Happen*. bre, 2008.
12. *Technical Guidance Document for Construction Environmental Management Plan (CEMP)*. Environment Agency, Abu Dhabi, 2010.

8.3 [MO.3] CONSTRUCTION HEALTH & SAFETY

8.3.1 PURPOSE

To implement health and safety requirements for site personnel, employees and visitors throughout the construction program.

8.3.2 CONTEXT

A construction site poses significant health and safety risks to construction workers and visitors to the site. It is critical for a project to address the management of health and safety issues to provide a safe and healthy environment and avoid accidents and injuries.

Construction nowadays is labor-intensive. The construction industry is highly prone to hazards related to site activities and construction projects engage large numbers of workers.

During construction, workers are exposed to various risks involved in construction works and other occupational diseases and health hazards which can cause injuries and illnesses. As a result, construction projects must address the health and safety and legal issues that can arise.

Workers come from varied trades and backgrounds, many of them do not have proper training in construction health and safety and are not suitably literate to forecast the unknown dangers. Therefore, proper training for workers and maintaining health and safety specialist personnel at the job site are of significant importance.

8.3.3 GUIDELINES

The contractor shall develop and implement a health and safety plan with consideration to:

- International or national health and safety standards relevant to the construction site.
- In-house Health & Safety program.
- Both of the above, considering the most appropriate elements from each of them.

In so doing, the contractor shall also fully abide by the applicable legal requirements.

A comprehensive Heat Stress Control Plan must be included in the Health and Safety Plan. The contractor will implement a Heat Stress Monitoring Program for on-site continuous measurements and data collection. The contractor may use the data to alter work schedules during periods of increased heat. Special timing must be observed during summer to prevent the effects of direct sun, when mandated by the relevant local authorities.

In addition, the contractor shall consider the implementation of methods and measures related to the following aspects to ensure health and safety on site:

A. General

- Provide a training and induction program to educate workers and visitors about the potential hazards on the construction site.
- Develop an Emergency Response Plan including an Earthquake Emergency Management Plan, and conduct emergency drills on site to train personnel on emergency procedures and test the adequacy of the emergency management measures implemented on site.
- Designate a safety team whose sole responsibility is to identify, correct, and manage safety issues across the entire construction site.
- Provide first aid equipment and clinic of sufficient capacity to serve the manpower on site.
- Provide fire precaution and prevention measures including the safe storage of combustible fuels and install extinguishers in locations of fire risk.
- Provide appropriate and necessary personal protective equipment (PPE) for construction workers and visitors on site.
- Provide safety equipment for the protection of the personnel on site including barricading, warning tape, safety nets and sufficient lighting to ensure a safe working environment in areas where daylight is not available.

B. Special Safety Requirements and Precautions

- Implement a permit-to-work system when undertaking any work on an existing utility, service, item of equipment or structure and confined spaces.
- Comply with the requirements of the public works authority when working on or adjacent to any pipeline or at a sewage treatment plant.
- Ensure the safe operation of plant and equipment on site including the implementation of measures including utilizing third-party certified equipment, providing adequate maintenance and hiring licensed operators.
- Identify existing utilities prior to commencement of the works and protect them to prevent any damage.
- Ensure safety on and near excavations including the implementation of measures including installing safety barriers to prevent workers and objects falling from the edge.
- Install warning signs on site to alert workers and visitors of potential hazards including excavations, electrical equipment and falls from height, and indicating safety equipment and measures including pedestrian pathways, emergency exits and fire extinguishers. Label signs in English and other applicable languages for the construction community and use internationally recognized symbols.

- Ensure safety in confined spaces including the implementation of measures to provide adequate ventilation and checking of the internal atmosphere before granting access to personnel.
- Ensure safety of lifting operations including the implementation of measures including barricading the lifting area, stopping works when the wind speed is high and checking the lifting gear is in good condition.
- Ensure all scaffolding is sturdy and safe for workers.
- Implement methods and measure to prevent fire and electric shock hazards from hot work and welding.
- Ensure safe transportation, storage and operation of compressed gas cylinders.
- Provide safety measures for working at height to prevent falls of both personnel and objects.
- Provide a safe electrical installation undertaken by competent qualified electricians including fencing of generators and adequate protection of cables.
- Ensure safety of the public by providing protective measures including fencing of the works, sufficient lighting and suitable pedestrian pathways.

FURTHER RESOURCES

Websites

1. "Globally Recognised Health, Safety & Environmental Qualifications." *NEBOSH - The National Examination Board in Occupational Safety and Health*, <https://www.nebosh.org.uk>. Accessed 28 Aug. 2019.

Publications

1. Coble, Richard, et al., editors. *The Management of Construction Safety and Health*. CRC Press, 2000.
2. *Environmental Best Practice Specifications: Construction*. Department of Water Affairs and Forestry, Republic of South Africa, 2005.
3. *Field Guide for Sustainable Construction, Partnership for Achieving Construction Excellence*. The Pennsylvania State University, PA & Pentagon Renovation and Construction Program Office, 2004.
4. Glavinich, Thomas E. *Contractor's Guide to Green Building Construction*. John Wiley & Sons, 2008.
5. Mehra, Chandan, et al. "Importance of Safety in Indian Construction." *A Proceedings*, Conference World, 2016, pp. 461–68.
6. Peterson, Mark, editor. *The ABC's of Construction Site Safety*. Oregon OSHA.
7. *Qatar Construction Standards, Section 11: Health and Safety*. Qatar General Organization for Standards and Metrology (QGOSM), 2014.
8. Reese, Charles D. *Handbook of OSHA Construction Safety and Health*. 2nd ed., CRC Press / Taylor & Francis, 2006.

8.4 [MO.4] WORKERS ACCOMMODATION

8.4.1 PURPOSE

To use GSAS certified Workers Accommodation scheme for the duration of the construction program.

8.4.2 CONTEXT

In some regions, workers are accommodated by their employers when the number or the type of workers required cannot be sourced from or accommodated within local communities. The provision of workers accommodation during the construction phase for example providing an exploration or construction camp is often associated with the importation of an external workforce into an area.

Due to the increased number of construction projects in the region, the number of workers accommodation facilities has also increased, and the potential impact on the environment is significant. Depending on the type of accommodation, there are a range of considerations relating to both the living conditions of the workers themselves, and the impact that workers accommodation facilities may have on surrounding communities, and the environment.

8.4.3 GUIDELINES

The Project will ensure the accommodation provided for construction site workers has all the facilities for a comfortable stay and is built following sustainability principles. The accommodation should be certified under the GSAS-Design & Build, Workers Accommodation Scheme or under GSAS Operation.

Case A: GSAS-D&B Certified Project

Under this certification, the following categories are assessed:

[UC] Urban Connectivity

Under this category GSAS assesses factors including zoning, proximity to existing infrastructures, public transportation and amenities and the impact of the development on traffic congestion.

[S] Site

Under this category GSAS assesses factors associated with the land use of the Workers accommodation plot and the impact on the environment are assessed under this category, including:

- Preservation of land, water bodies and biodiversity.
- Uses of the land - vegetation, parking footprint, shading, pathways and visual comfort.
- Impact of the development on the surroundings - rainwater run-off, heat island effect, noise pollution, light pollution, and construction management practices.

[E] Energy

Under this category, GSAS assesses factors associated with the energy demand of the accommodation, the efficiency of energy delivery, and the use of fossil energy sources that result in harmful emissions and pollution.

[W] Water

Under this category, GSAS assesses factors associated with water consumption in the accommodation and the associated burden on municipal supply and treatment systems.

[M] Materials

Under this category GSAS assesses factors associated with materials extraction, processing, manufacturing, distribution, use/ reuse, recycling and disposal.

[IE] Indoor Environment

Under this category, GSAS assesses factors associated with indoor environmental quality of the Workers accommodation including thermal comfort, air quality, acoustic quality, and illumination quality.

[CE] Cultural & Economic Value

Under this category GSAS Assesses factors associated with cultural conservation and support of the local economy.

[MO] Management & Operations

Under this category, GSAS assesses factors associated with the Workers accommodation design related to the management and operations of waste, commissioning, leak detection, energy and water sub-metering, education and awareness of the workers, health and safety, and Workers welfare.

Case B: GSAS-OP Certified Project

Under this certification, the following categories are assessed:

[E] Energy

Under this category, GSAS assesses factors associated with the total energy use of a facility that results in harmful emissions and climate change.

[W] Water

Under this category, GSAS assesses factors associated with water consumption and reuse in order to mitigate the impact on available water resources.

[IE] Indoor Environment

Under this category, GSAS assesses factors associated with indoor environmental quality to ensure human health, comfort and well-being.

[WM] Waste Management

Under this category, GSAS assesses factors associated with building operational practice for waste reduction, reuse and recycling to mitigate the environmental impacts on landfills.

[FM] Facility Management

Under this category, GSAS assesses factors associated with practices and strategies implemented to ensure that facilities are operated and maintained in a sustainable manner.

[SA] Sustainability Awareness

Under this category, GSAS assesses factors associated with the initiatives of the facility to promote and create awareness on the sustainability programs implemented for managing the assets and operations of the building.

FURTHER RESOURCES**Publications**

1. *GSAS Technical Guide 2019*. Gulf Organisation for Research and Development (GORD), 2019.
2. *GSAS-Design & Build-Workers' Accommodation Scheme*. Gulf Organisation for Research and Development (GORD), 2013.
3. *Qatar Construction Standards*. Qatar General Organization for Standards and Metrology (QGOSM), 2014.
4. *Workers' Accommodation: Processes and Standards A Guidance Note by IFC and the EBRD*. European Bank for Reconstruction and Development and International Finance Corporation, 2009.

9.0 GSAS CONSTRUCTION MANAGEMENT PLAN (GSAS-CMP)

9.1 OVERVIEW

The GSAS Construction Management Plan (GSAS-CMP) is a project specific plan developed by the Project to incorporate the targeted GSAS-CM categories and criteria and the targeted final GSAS-CM rating, to ensure human, organizational, and communication resources and procedures are prepared and capable of meeting the requirements of the construction project and GSAS-CM targets.

The scale, complexity and local environment of different projects may alter the coverage of issues and level of details required in the GSAS-CMP. However, the content of each GSAS-CMP shall include all the sections listed below.

9.2 ROLES AND RESPONSIBILITIES OF THE CONTRACTOR

The roles and responsibilities of the contractor in relation to the development of GSAS-CMP include:

- Developing a GSAS-CMP in consultation with staff and sub-contractors' teams.
- Managing the delivery of GSAS-CMP submissions.
- Updating the GSAS-CMP if the targeted categories/criteria change and/or plans for resources/ processes change.
- Providing complete and accurate information in the GSAS-CMP.
- Communicating the GSAS-CMP to all staff and sub-contractors that play key roles in the successful delivery of the plan.
- Upholding the commitments of the GSAS-CMP with the utmost importance throughout the entire duration of the construction works.

9.3 CONTENTS OF GSAS-CMP

This section describes the titles and contents of each section of the GSAS-CMP.

9.3.1 Introduction

This section is important to understand the intention and purpose to target GSAS certification and the commitment to sustainability.

In this section, identify:

- The purpose of GSAS Construction Management certification and intended GSAS targeted rating,
- Identify all previously performed assessments including Environmental Impact Assessment (EIA) or GSAS Design & Build-LOC,
- Key participants - the parties that prepared the GSAS-CMP and will be responsible for implementing and updating it.

9.3.2 Project Description

This section will provide an overview of the project activity and location, the context of GSAS certification and a broad evaluation of the additional value of GSAS in terms of sustainable development.

In this section, identify:

- Project background – briefly describe the building/infrastructure project that this particular construction activity relates to, including the major elements to be delivered.
- Project location – describe the location and include a site plan identifying the major activities/facilities/compounds proposed.
- Construction Activities - a description of the works including:
 - A brief description of the major construction processes to be used.
 - Working hours.
- Scheduling - include a high-level program showing the main construction activities. The level of detail should be sufficient to identify the anticipated three construction stages: enabling/foundation, superstructure and finishing works.
- Construction Stages - propose dates for the three construction stages, that will serve as GSAS-CM periods of assessment.

9.3.3 GSAS-CMP Scope

This section should be written after careful evaluation of which GSAS-CM categories and criteria will be targeted based on broad evaluation of the sustainability impacts of practices and processes at the construction site. This represents a valuable starting point to seriously consider the capacity and capabilities of the contractor to mitigate sustainability impacts associated with site-specific activities pertaining to the targeted criteria.

In this section, identify:

- The boundaries of GSAS-CM Certification scope. A justification is required if any specific area(s) within the construction site will be excluded from GSAS-CM certification.
- GSAS-CM categories and criteria and final GSAS-CM rating targeted by the contractor. The scoring sheet should be used for this purpose.
- The targeted GSAS-CM criteria, and those levels that may be affected due to previous GSAS Design & Build-LOC (if applicable).
- Outline per criterion the main strategies to be implemented on site to comply with the GSAS-CM requirements. A brief description of the strategies, specific for the construction site, should be provided.

9.3.4 Human Resources Roles and Responsibilities

A thorough assessment of GSAS-CM categories and criteria will provide sufficient inputs to the contractor of the skills and experience of the human resources requirements. The inputs will assist in developing this section of GSAS-CMP.

In this section, provide:

- Human resources details (names and positions) for the sustainability management of the project in accordance with targeted GSAS categories, criteria and rating.
- Descriptions of the different roles and responsibilities undertaken by those personnel, pertaining to GSAS-CM implementation and monitoring throughout the construction phase.
- Descriptions of the roles and responsibilities as they apply for the main sub-contractors pertaining to GSAS-CM implementation and monitoring throughout the construction phase.

9.3.5 Training, Awareness and Competency

This section is important to analyze and improve the awareness, skills and competencies required at different levels in the team dedicated to GSAS-CM implementation and monitoring.

Imparting training and raising awareness is particularly important for several GSAS criteria where human intervention and performance are of very high significance from a sustainability point of view.

These criteria include:

- Drainage & Stormwater Contamination.
- Biodiversity Preservation.
- Energy Use – Temporary Buildings.
- Energy Use – Plant & Equipment.
- Domestic Water Use.
- Non-domestic Water Use.
- Materials Diversion from Landfill.
- Dust Control.
- Noise & Vibration Control.
- Protection of Archaeological Remains.
- Waste Management.
- Construction Health & Safety.

However, GSAS-CM scheme-wide topics need to be identified and awareness building and skill-based training should be encouraged.

Through a project-wide awareness campaign, a behavioral change should be brought about in staff by creating a culture that instills a sense of ownership and responsibility. For example, staff should be aware and proactive in implementing best practices including good housekeeping, optimum resource consumption, waste management, and prevention and control measures in relation to the different criteria indicated above. Specialized skill-based training needs for key personnel should also be identified promptly, and appropriate training should be provided accordingly.

In this section, identify:

- The training required for developing skills, competencies and awareness that personnel working on site will receive pertaining to environmental issues associated with the targeted GSAS-CM criteria.
- Modes of training, including inductions, courses or toolbox talks.
- Frequency of training.
- What personnel the different training is aimed at.
- The personnel responsible for delivering the training.
- The forms and formats to maintain records which, at a later stage, will provide evidence on who underwent training events, on what dates and who conducted the training.

9.3.6 Communication

This section is important from the aspect of managing internal and external communication on sustainability aspects pertaining to GSAS-CM.

In this section, identify and expand upon aspects of the contractors' corporate communication strategy relevant to GSAS certification:

- Internal communications.
- Toolbox meetings.
- Handling of external communications (including community liaison).
- Public complaints.

In all cases, identify the personnel responsible for coordinating inputs, outcomes and actions arising from these communications.

9.3.7 Review and Reporting

This section is important to describe the management framework including the plans and controls in place to ensure that GSAS-CM implementation is effective and efficient.

In this section, describe how the GSAS-CMP will be reviewed depending upon the change in plan or any deviation from targets. Any proposed change to the nature, extent or scope of activities included in the project will initiate a GSAS-CMP review and update. This section must take into consideration the following.

- Reviews must be undertaken if:
 - There is a significant change in the project scope.
 - An environmental incident occurs potentially affecting certification outcomes.
 - An improvement is identified through either on-site experience, or observation reported through site audits at different stages (enabling / foundation stage; superstructure stage; and, finishing stage).
 - An improvement is identified through a change in industry best practice or statutory legislation.
- Periodic reports should be prepared, covering compliance of construction activities with the established environmental plans for targeted GSAS-CM criteria.

Changes required to GSAS-CMPs must be communicated to GSAS Trust prior to scheduled audit visits. During a review of each GSAS-CMP, GSAS Trust will evaluate the compliance of the GSAS-CMP provided by the contractor. The evaluation intends to ensure that the GSAS-CMP adheres to this guideline document and provides sufficient detail.



Building Sustainably