

FORM IA
**REVISION OF RAJIV GANDHI
INTERNATIONAL CRICKET STADIUM &
SPORTS COMPLEX**

At
*VILLAGE RAIPUR, PARGANA PARVADOON, DISTT.
DEHRADUN,
UTTARAKHAND*

For

*RAJIV GANDHI INTERNATIONAL CRICKET STADIUM
& SPORTS COMPLEX*



QCI Certificate no. NABET/EIA/1619/RA 0064



PREPARED BY

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FORM IA

CHECK LIST OF ENVIRONMENTAL IMPACTS

(Project proponents are required to provide full information and wherever necessary attach explanatory notes with the Form and submit along with proposed environmental management plan & monitoring program)

SECTION 1- LAND ENVIRONMENT

1.1 Was the existing land use get significantly altered from the project that is consistent with the surroundings? (Proposed land use must conform to the approved Master Plan/Development Plan of the area. Change of land use, if any and the statutory approval from the competent authority are submitted). Attach Maps of (i) site location, (ii) surrounding features of the proposed site (within 500 meters) and (iii) the site (indicating levels & contours) to appropriate scales. If not available attach only conceptual plans.

➤ **No**

The construction at project site has been completed and construction activities of the project did not have an adverse effect on the land use activities in the project area. The site is earmarked for recreational purpose as per the Dehradun Master Plan- 2025. This project provides facility to conduct National as well as International Cricket Matches & other sports which enhance the surrounding quality of life and also sets standard for future developments in the area.

The project site is well connected through proposed 30 m wide Raipur - Thano Road. The nearest highway is NH-72 which is 3.75 km (SW) away from project site. The nearest railway station being Harrawala Railway Station, about 3.64 km (S) away from the project site. The nearest airport is Jolly Grant Airport, at 14.08 km (SE) from the project site. Google Earth Image & Toposheet showing project site & surroundings within 500 m and 10 & 15 km are attached as **Annexure I.**

1.2 List out all the major project requirements in terms of the land area, built up area, water consumption, power requirement, connectivity, community facilities, parking needs etc.

➤ **LAND REQUIREMENT**

Table 1: Area Statement

Sl. No.	PARTICULARS	AREA (in m ²)
1.	Plot Area	89,030.16
2.	Ground Coverage	18,085.35
3.	Proposed FAR	37,709.36
	• Stadium FAR	36,851.73
	❖ North Pavilion	19,640.14
	❖ South Pavilion	10,685.35
	❖ East Stand	3,311.59
	❖ West Stand	3,214.65
	• Other Blocks FAR	857.63
	❖ Electrical Service Station	280.42
	❖ HVAC Plant Room	285.62
	❖ Guard & Ticketing	291.59
4.	Other Services (Non-FAR)	3,770.936
5.	Built Up Area	41,480.296
6.	Landscape Area (@ 22.58% of the Plot Area)	20,106.86
	• Cricket Field Area	18,337.47
	• Green Belt	1,769.39

*FAR = Floor Area Ratio

Table 2: Floor wise Area Breakup

	A - STADIUM
PAVILIONS/STANDS	FLOORS

	GROUND	FIRST	SECOND	THIRD	FOURTH	TOTAL (SQ.M)
NORTH PAVILION	5,456.27	4,046.33	3,751.49	3,765.46	2,620.59	19,640.14
SOUTH PAVILION	5,852.86	2,283.55	2,548.94	-	-	10,685.35
EAST STAND	3,006.56	305.03	-	-	-	3,311.59
WEST STAND	3,043.07	171.58	-	-	-	3,214.65
TOTAL	17,358.76	6,806.49	6,300.43	3,765.46	2,620.59	36,851.73
B - OTHER BLOCKS						
BLOCKS	FLOORS					
	GROUND	FIRST	SECOND	THIRD	FOURTH	TOTAL (SQ.M)
ELECTRIC SERVICE STATION	149.38	131.04	-	-	-	280.42
HVAC PLANT ROOM	285.62	-	-	-	-	285.62
GUARD AND TICKETING	291.59	-	-	-	-	291.59
TOTAL	726.59	131.04	0	0	0	857.63

➤ **WATER REQUIREMENT**

During construction phase, water requirement was 208 ML which was provided by private water tanker. During ongoing operation phase, water supply is provided through the bore wells. During non match day, 1,000 persons was be engaged for the maintenance of the stadium. The total water requirement during non match day was be approx. 65 KLD i.e. 45 KLD for drinking purposes while, 20 KLD for horticulture purposes.

The total water requirement during match day was be approx. 247 KLD, out of which total domestic water requirement is 175 KLD. (The fresh water requirement is approx. 147.53 KLD and 27.225 KLD is for flushing purpose).

The daily water requirement calculation during Match Day is given below in **Table 3**:

Table 3: Calculations for Daily Water Demand (During Match Day)

S. No.	Description	Area (in m ²)	Total Occupancy	Rate of water demand (lpcd)		Total Water Requirement (KLD)	
				Domes tic	Flushin g	Domes tic	Flushin g
A.	Domestic Water						
	A) Spectators						
	• General Public Occupancies		21,500	5	0	107.5	0
	• VVIP Member Occupancies		60	5	0	0.3	0
	• VIP Members Occupancies		3,000	5	0	15	0
	• Disable + Companion Seating (0.5%)		215	5	0	1.075	0
	• Corporate Suite Seating		375	5	0	1.875	0
Sub Total (A)						125.75	
	B) Staff Occupancies		1,089	20	25	21.78	27.225
Sub Total (B)						147.53	27.225
Total domestic water demand (A+B)				= 174.755 Say 175 KLD			
B.	Horticulture and Landscape development	20,106.86 m ²		1 lt./sqm/day		20.11	
C.	HVAC Cooling (650 TR)**			10 lit/hr/TR		52	
Grand Total (A+B+C) = 246.865 KLD Say 247KLD							

** Considering 8 hours of HVAC during operation.

➤ **POWER REQUIREMENT**

The power supply is being supplied by Uttarakhand Power Corporation Ltd. (UPCL). The demand load for the stadium Project was be approx. 1,033 KVA (during Non-match day/ Match

day (day time)) and 2,172 KVA (During Match Day (Night time)) which is supplied by 1 transformer of 2,000 KVA.

➤ **POWER BACK UP**

There are 4 no. of DG sets of 1000 KVA capacity each for power back up in the stadium Project all DG sets was be kept standby. The DG sets are equipped with acoustic enclosure to minimize noise generation and adequate stack height for proper dispersion.

➤ **CONNECTIVITY**

The project site is well connected through proposed 30 m wide Raipur - Thano Road. The nearest highway is NH-72 which is 3.75 km (SW) away from project site. The nearest railway station being Harrawala Railway Station, about 3.64 km (S) away from the project site. The nearest airport is Jolly Grant Airport, at 14.08 km (SE) from the project site.

➤ **PARKING FACILITIES**

Adequate parking (1,622 ECS) provision provided for vehicles parking in the project. Besides this, internal road of adequate width within the project was facilitate smooth traffic movement.

1.3 What are the likely impacts of the proposed activity on the existing facilities adjacent to the proposed site? (Such as open spaces, community facilities, details of the existing land use and disturbance to the local ecology).

The project being a well planned activity resulted in organized open spaces and green areas. About 20,106.86 m² of the area is earmarked for landscaping. The project have an overall positive impact on the existing land use and is not causing any disturbance to the local ecology. Proposed activity does not have impact on surroundings.

1.4 Was there be any significant land disturbance resulting in erosion, subsidence & instability? (Detail of soil type slope analysis, vulnerability to subsidence, seismicity etc may be given).

There is no land disturbance resulting in erosion, subsidence and instability as it is a flat land. The site falls under the zone IV as per the seismic zone map of India and indicating high damage risk zone. The project was be earthquake resistant taking into account the latest provisions of Indian Standards Codes.

The soil type of project area is Sandy Loam and details of analysis are shown in Table 4.

Table 4: Physiochemical characteristics of soil

Rajiv Gandhi international Stadium & sport complex, raipur, Dehradun(Uttarakhand)			
Soil Quality Data Dec.-2018			
S.No	Parameters	Unit	SQ-1
1	Texture	-	Sandy Loam
	Sand	%	68.6
	Silt	%	13.2
	clay	%	18.2
2	pH (1:2)	-	7.78
3	Electrical Conductivity (1:2)	µmhos/cm	406
4	Cation exchange capacity	meq/100 gm	15.2
5	Exchangeable Potassium	mg/kg	93
6	Exchangeable Sodium	mg/kg	132
7	Exchangeable Calcium	mg/kg	2200
8	Exchangeable Magnesium	mg/kg	410
9	Sodium Absorption Ratio	-	0.68
10	Water Holding Capacity	%	26.3
11	Porosity	%	39.4

1.5 Was the proposal involve alteration of natural drainage system? (Give details on a contour map showing the natural drainage near the project site).

The project does not intersect any natural drainage route. No perennial or non-perennial drainage system is found to exist in the project area or being obstructed by the project. The surroundings comprise an urbanized stretch. A well planned storm water drainage has been designed to take care of internal storm water drainage. Thus, no impact on the natural drainage system is anticipated.

1.6 What are the quantities of earthwork involved in the construction activity-cutting, filling, reclamation etc. (Give details of the quantities of earthwork involved, transport of fill materials from outside the site etc?)

The earthwork includes soil excavation and cutting 54,256.05 m³ of the earth was moved. The cut and fill material in the project site is nearly at par and hence the need for movement of soil to and from the site is not anticipated.

1.7 Give details regarding water supply, waste handling etc. during the construction period.

Water requirement during construction phase was met from private water tanker. Waste water generated during the construction phase was 9 KLD and waste water was disposed off through soak pits. Waste handling during the construction phase was done by the site contractor whose responsibility lies with collection and storage of construction and demolition waste generated on the site. All construction wastes generated during construction was used within the site itself for filling the floors, roads, aggregate for mortar etc. to the extent feasible. Remaining was sent to the agency for proper disposal.

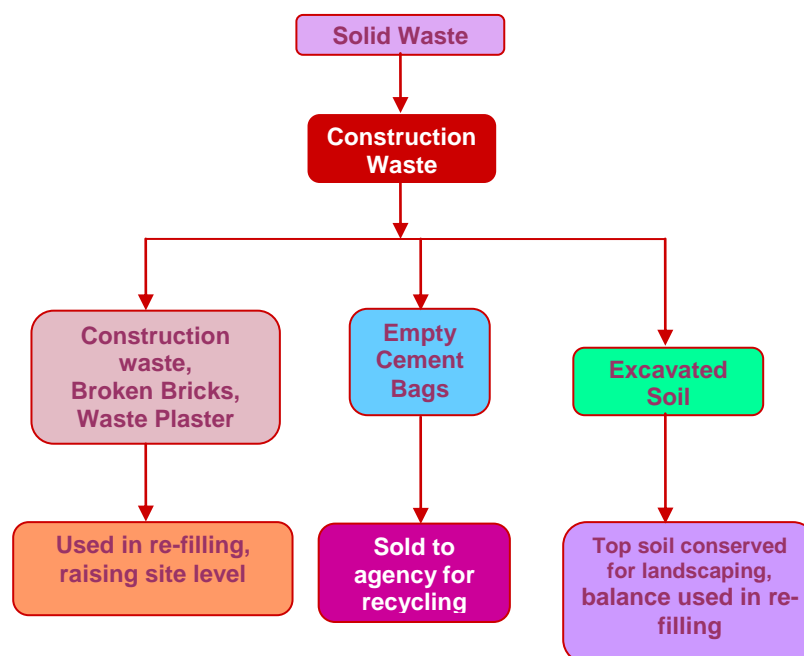


Figure 1: Waste Management Plan for the Construction Phase

1.8 Was the low lying areas & wetlands get altered? (Provide details of how low lying and wetlands are getting modified from the proposed activity).

No. The site area is a flat land and the surroundings are characterized by an urbanized stretch. No low lying areas or wetlands are found in the region.

1.9 Whether construction debris & waste during construction cause health hazard? (Give quantities of various types of wastes generated during construction including the construction labor and the means of disposal).

No health hazards were expected during the construction phase. The laborers were provided with face masks to minimize dust inhalation.

A significant portion of the construction waste and wood scrap generated was used on the site. The remaining waste was transported to a government approved dumping site.

The quantity of domestic waste generated was very little, as mostly local laborers were employed. However, the wastes generated was collected and disposed by an authorized agency.

SECTION 2- WATER ENVIRONMENT

2.1 Give the total quantity of water requirement for the project with the breakup of requirements for various uses. How is the water requirement be met? State the sources & quantities and furnish a water balance statement.

The water supply is provided through the Bore Wells. During non match day, 1,000 persons was be engaged for the maintenance of the stadium. The total water requirement during non match day is approx. 65 KLD i.e. 45 KLD for drinking purposes while, 20 KLD for horticulture purposes.

The total water requirement during match day is approx. 247 KLD, out of which total domestic water requirement is 175 KLD. (The fresh water requirement is approx. 147.53 KLD and 27.225 KLD is for flushing purpose).

The daily water requirement calculation is given below in Table 5:

Table 5: Calculations for Daily Water Demand (During Match Day)

S. No.	Description	Area (in m ²)	Total Occupancy	Rate of water demand (lpcd)		Total Water Requirement (KLD)	
				Domes tic	Flushin g	Domes tic	Flushin g
A.	Domestic Water						
	A) Spectators						
	• General Public Occupancies		21,500	5	0	107.5	0
	• VVIP Member Occupancies		60	5	0	0.3	0
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	• Disable + Companion Seating (0.5%)		215	5	0	1.075	0
	• Corporate Suite Seating		375	5	0	1.875	0
Sub Total (A)						125.75	
	B) Staff Occupancies		1,089	20	25	21.78	27.225
Sub Total (B)						147.53	27.225
Total domestic water demand (A+B)				= 174.755 Say 175 KLD			
B.	Horticulture and Landscape development	20,106.86 m ²		1 lt./sqm/day		20.11	
C.	HVAC Cooling (650 TR)**			10 lit/hr/TR		52	
Grand Total (A+B+C) = 246.865 KLD Say 247 KLD							

** Considering 8 hours of HVAC during operation.

Table 6: Waste Water Calculations (During Match Day)

Total Water Requirement	247 KLD
Domestic Water Requirement	147.53 KLD

Flushing Water Requirement	27.225 KLD
Waste Water Generated (@ 90% Domestic + 100% flushing)	132.77 + 27.225 = 159.5 KLD Say 160 KLD
STP CAPACITY	200 KLD

Water Treatment System & Disposal System

Appropriate provision is been made for treatment of waste water by installing a sewage collection system and sewage treatment plant of 200 KLD (20% higher than the waste water generated).

The water balance diagram for match day during rainy and non-rainy season are shown below in Figure 2 & 3:

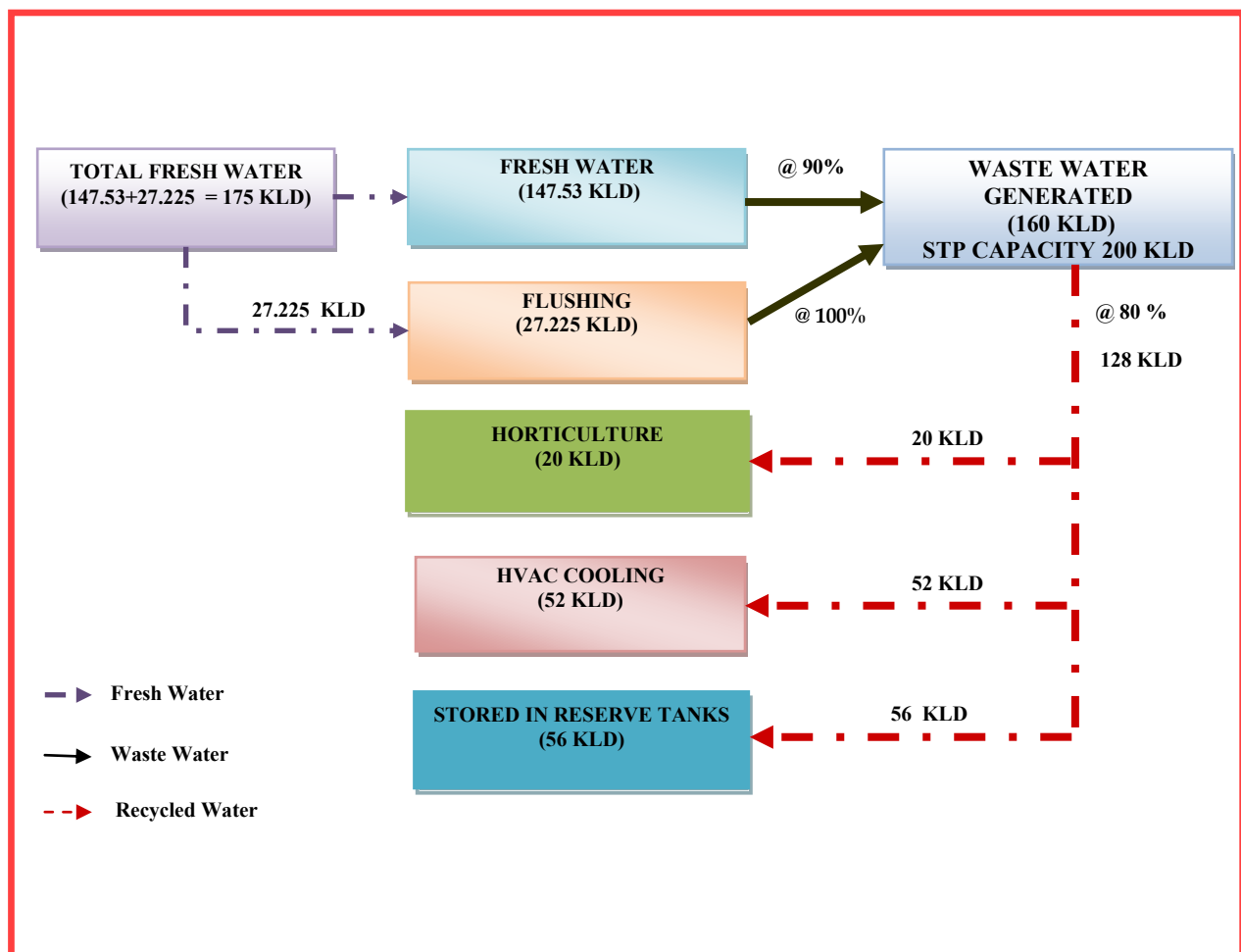


Figure 2: Water Balance Diagram during Match Day (Non- Rainy)

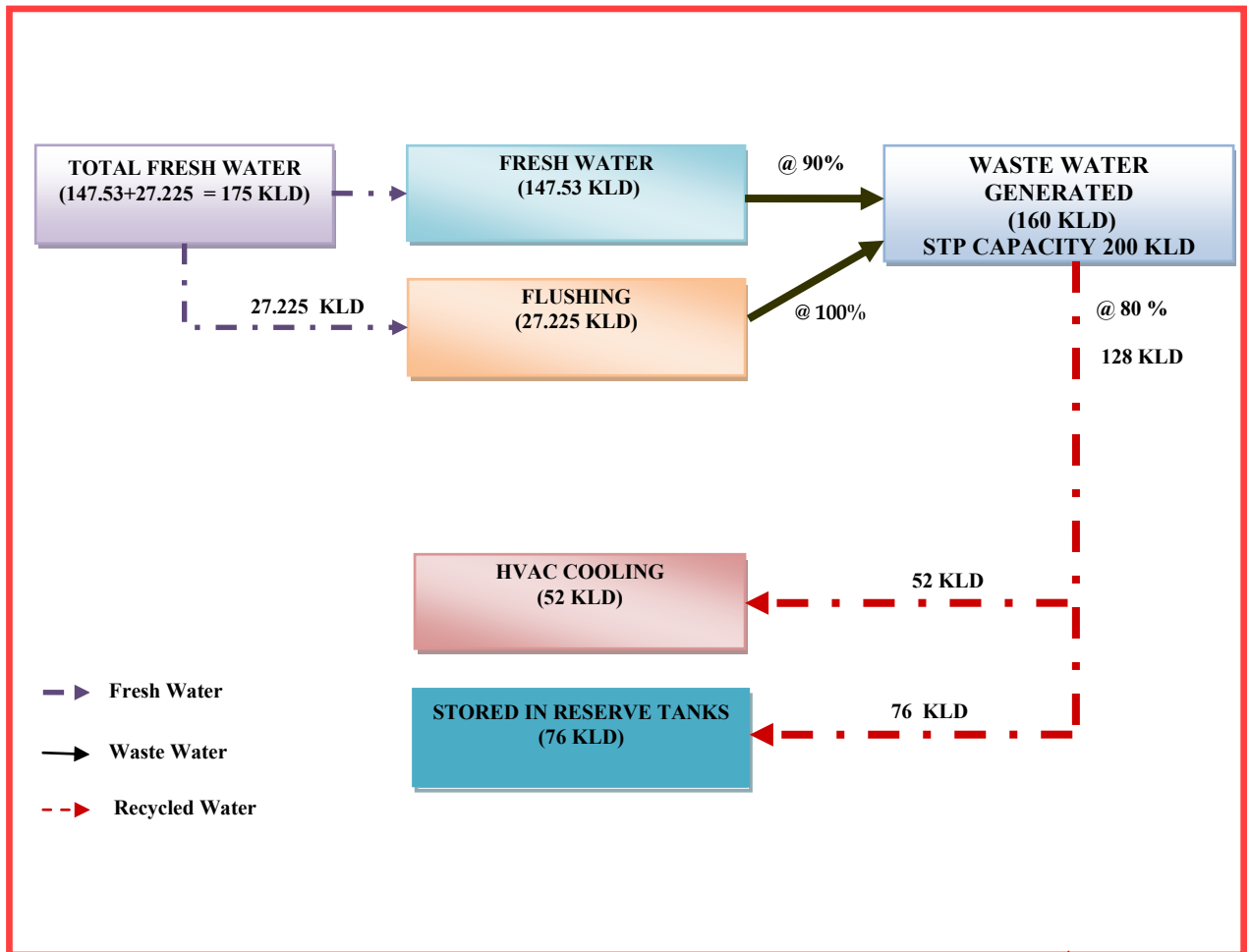


Figure 3: Water Balance Diagram during Match Day (Rainy Season)

2.2 What is the quality of water required, in case, the supply is not from a municipal source? (Provide physical, chemical, Biological characteristics with class of water quality).

The total water requirement for the project is 247 KLD. However, the freshwater requirement is 147.53 KLD that is sourced from Bore Wells. However, monitoring of ground water at site has been done. The quality of water is good conforms to the desirable drinking water standards as per IS 10500.

Table 7: Physico-chemical Characteristics of the ground water

Rajiv Gandhi international Stadium & sport complex, raipur, Dehradun(Uttarakhand)			
Ground water Quality Dec.- 2018			
S.No	Parameter	Limit (as per IS:10500:2012)	Project

REVISION IN RAJIV GANDHI INTERNATIONAL CRICKET STADIUM & SPORTS COMPLEX
 VILLAGE RAIPUR,
 PARGANA PARVADOON,
 DIST. DEHRADUN,
 UTTARAKHAND

FORM IA

		Desirable Limit	Permissible Limit	Unit	Site Results
1	Colour	5	15	Hazen	<5
2	Odour	Agreeable	Agreeable	-	Agreeable
3	Taste	Agreeable	Agreeable	-	Agreeable
4	Turbidity	1	5	NTU	<1
5	pH	6.5-8.5	No Relaxation	-	7.32
6	Total Hardness (as CaCO ₃)	200	600	mg/l	156
7	Iron (as Fe)	1	No Relaxation	mg/l	0.2
8	Chlorides (as Cl)	250	1000	mg/l	45
9	Fluoride (as F)	1	1.5	mg/l	0.6
10	TDS	500	2000	mg/l	265
11	Calcium(as Ca ²⁺)	75	200	mg/l	37
12	Magnesium (as Mg ²⁺)	30	100	mg/l	15
13	Copper (as Cu)	0.05	1.5	mg/l	<0.01
14	Manganese(as Mn)	0.1	0.3	mg/l	0.05
15	Sulphate (as SO ₄)	200	400	mg/l	28
16	Nitrate(as NO ₃)	45	No Relaxation	mg/l	1.2
17	Phenolic Compounds (as C ₆ H ₅ OH)	0.001	0.002	mg/l	<0.001
18	Mercury (as Hg)	0.001	No Relaxation	mg/l	<0.001
19	Cadmium (as Cd)	0.003	No Relaxation	mg/l	<0.001
20	Selenium (as Se)	0.01	No Relaxation	mg/l	<0.01
21	Arsenic (as As)	0.01	No Relaxation	mg/l	<0.01
22	Cyanide (as CN)	0.05	No Relaxation	mg/l	<0.01
23	Lead (as Pb)	0.01	No Relaxation	mg/l	<0.01
24	Zinc (as Zn)	5	15	mg/l	0.06
25	Anionic Detergent (as MBAS)	0.2	1	mg/l	<0.01
26	Chromium (as Cr ⁶⁺)	0.05	No Relaxation	mg/l	<0.01
27	Mineral oil	0.5	No Relaxation	mg/l	<0.1
28	Alkalinity (as CaCO ₃)	200	600	mg/l	127
29	Aluminum (as Al)	0.03	0.2	mg/l	<0.02
30	Boron (as B)	0.5	1	mg/l	0.1
Bacteriological Parameter					
1	Total Coliform	Shall not be detectable		MPN/100ml	ND (<2)
2	E.coli	Shall not be		E.coli	Absent

		detectable		/100ml	
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2.3 How much of water requirement can be met from the recycling of treated wastewater? (Give the details of quantities, sources and usage)

It is expected that the project was generate approx. 160 KLD of wastewater. The wastewater was be treated in the STP provided within the complex generating 200 KLD of recoverable water from STP which was be recycled within the project and surplus water was be stored in the treated water tank and reuse for horticulture during non-match day. For the treatment of sewerage water, a modular STP of MBBR technology was be provided.

2.4 Was there be diversion of water from other users? (Please assess the impacts of the project on other existing uses and quantities of consumption).

No. There was not be any diversion of water from other users. Rise in water demand is a local phenomenon but the project would only involve spatial shifting of water demand within a region.

2.5 What is the incremental pollution load from wastewater generated from the proposed activity? (Give details of the quantities and composition of wastewater generated from the proposed activity)

Approximately, 160 KLD of wastewater is generated during the operational phase from domestic use and other commercial uses. This wastewater generated was be treated in well designed sewage treatment plant based on MBBR technology.

The following are the input characteristics of the waste water:

a. Waste water Details

- (a) Daily load : 160 KLD
- (b) Temperature : Maximum 32°C
- (c) pH : 7 to 8.5
- (d) Colour : Mild
- (e) T.S.S. (mg/l) : 200-400 mg/l

-
- | | | | |
|-----|-------------------------|---|--------------|
| (f) | BOD ₅ (mg/l) | : | 200-250 mg/l |
| (g) | COD (mg/l) | : | 400-600 mg/l |

b. Final discharge characteristics

- | | | | |
|-----|------------------------|---|----------|
| (a) | pH | : | 6 to 8.5 |
| (b) | B.O.D. | : | 10 mg/l |
| (c) | C.O.D. | : | 60 mg/l |
| (d) | Total Suspended Solids | : | 10 mg/l |

Treatment Technology

Moving bed biofilm reactor technology is based on the principle of attached growth process. Raw sewage was be collected under gravity into the equalization tank after allowing to pass through the bar screen. Screens was be provided in screen chambers and it was be manually cleaned by going down to a platform. The bar screen, by removing coarse solids from the sewage help in protecting the raw sewage pump.

Fully submersible centrifugal non clog sewage handling pump was be provided in the collection cum equalization tank to pump the collected sullage to the next MBBR tanks. Automatic level controller was be provided in the tank to turn the pump off at the low water level in the tank and to start the pump when water level is high automatically. Air was be introduced in this tank to prevent any potential foul smell problem & to provide the mixing of sullage to avoid the sedimentation of solids in this tank. Air Grid used for aeration purpose shall be non-clog.

The sewage collected in equalization tank is pumped the moving bed bioreactor. There shall be two nos. of bioreactors in series for the efficient working and removal of BODs for the required retention time. The process inside the moving bed bioreactors consists of adding small cylindrical-shaped polyethylene/polypropylene carrier elements in aerated basins to support biofilm growth. The small cylinders are provided with a cross inside the cylinder and longitudinal fins on the outside. The biofilm carriers are maintained in the reactor by the use of a perforated plate with appropriate slot at the tank outlet. Air agitation or mixers are applied

in a manner to continuously circulate the packing. The packing may fill 25 to 50 percent of the tank volume. Specific surface area of the packing is about 450-500m²/m³ of bulk packing volume. The sullage from first bioreactor flows by gravity through the perforated plate/mesh to the next bioreactor kept in series. Inside the bioreactors, aerobic bacteria grow in an attached growth from around the moving plastic media inside the reactors. The bacteria have to reduce BOD & COD of sullage in the presence of oxygen provided through the air grids located at the bottom of the reactors. The Process does not require any return activated sludge flow or backwashing.

From the bio-reactors, the effluent passes by gravity into the clarifier (Tube Settling Tank). Clarifier was be a hopper bottom sedimentation tank provided with appropriate size PVC tube deck media. The suspended solids was settle at the bottom of the tank & clear supernatant was overflow to filter feed tank through outlet launder. The collected sludge at bottom isbe transferred through pumps to sludge holding tank.

The clear supernatant after clarifier was be collected in to filter feed tank. This tank was act as housing tank for filter feed pumps. The clarified & dis-infected water was be then fed to filtration unit.

Filtration unit consisting of Dual Media sand filter, activated carbon filter and ultra filtration system (optional) was remove the residual impurities such as odor/color, suspended solids, BOD/COD. The treated water after the filtration unit was be collected in Irrigation cum Flushing water storage tank from where it is transferred to flushing water tank at terrace & Irrigation System.

Excess sludge from the bottom of the settling tank was be removed and transferred to sludge holding tank. Air grid is be provided in this tank to avoid conversion into anaerobic conditions, thickening of sludge and keep sludge in homogenous condition. The digested & thickened sludge is be further thickened through Sludge Dewatering System (Filter press with screw pump) and disposed off periodically through closed tanker or can be reused as manure.

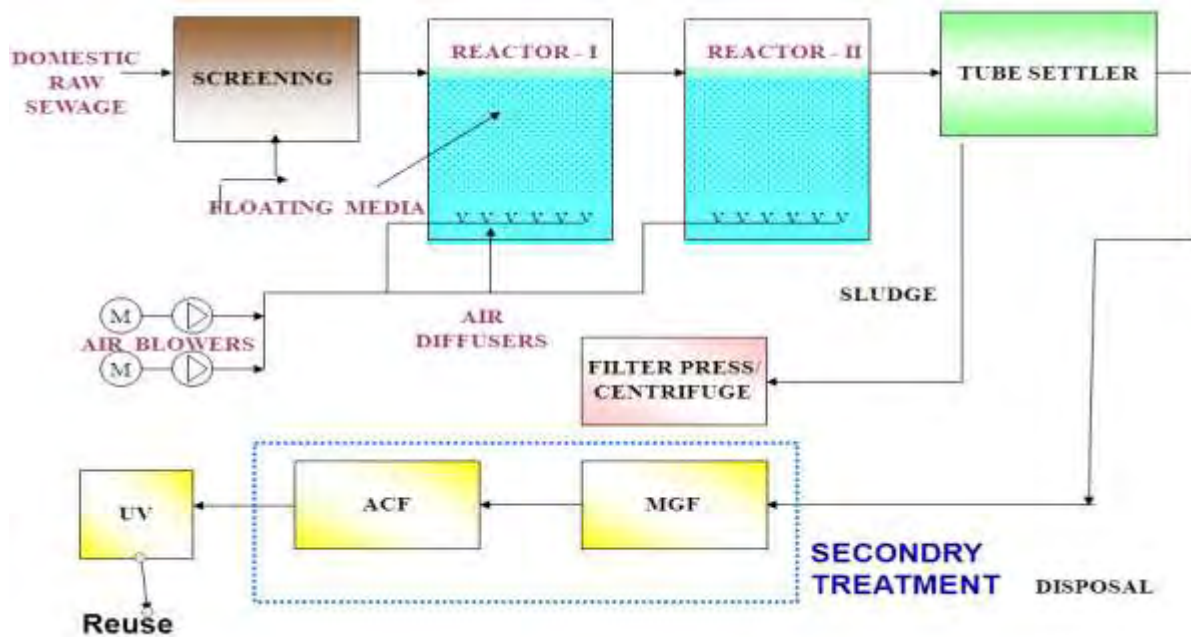


Figure 4: Schematic Diagram of MBBR STP

2.6 Give details of the water requirements met from water harvesting? Furnish details of the facilities created.

Rainwater harvesting in the project as a water conservation tool. 20 rain water harvesting pits along with two rain water harvesting tanks is provided for the purpose. The main emphasis given in the planning of the storm water drainage system is on recharging the underground aquifer of the area while having the safe disposal of storm water without flooding the campus. A network of storm water disposal drains is planned which finally dispose off into a percolation well for direct injection of collected storm water into the ground water. Bar screens and silt traps was be incorporated before the percolation wells to remove the silt, heavier particles and other objectionable materials which can cause the choking of percolation wells. The type of percolation wells etc.is decided after detailed hydrological and geological survey analysis results are obtained and/ or as per recommendations of the Central Ground Water Board.

The storm water drainage network led to various percolation wells catering to different parts of the catchments area. Silt traps was be provided at the inlet of each percolation well. The

overflow from percolation wells was either be interconnected or pumped to the existing storm water disposal line. In general, the rain water from terraces and other open areas is collected through rain water down-take pipes and let off at surface. This water is be allowed to flow through sloping channels in external areas for rainwater harvesting.

Calculations for storm water load

$$\begin{aligned}\text{Roof-top area} &= 3,430 \text{ m}^2 \\ \text{Green Area} &= 20,106.86 \text{ m}^2 \\ \text{Paved Area} &= \text{Total Plot Area} - (\text{Ground coverage} + \text{Green Area}) \\ &= 89,030.16 - (18,085.35 + 20,106.86) \\ &= 50,837.95 \text{ m}^2\end{aligned}$$

Runoff Load

$$\begin{aligned}\text{Roof-top Area} &= 3,430 \times 0.08 \times 0.95. \\ &= 260.68 \text{ m}^3/\text{hr}\end{aligned}$$

$$\begin{aligned}\text{Taking 15 minutes Retention Time, Total volume of storm water (Roof-top Area)} &= 260.68/4 \\ &= 65.17 \text{ m}^3\end{aligned}$$

$$\begin{aligned}\text{Green Area} &= 20,106.86 \times 0.08 \times 0.2. \\ &= 321.71 \text{ m}^3/\text{hr}\end{aligned}$$

$$\begin{aligned}\text{Paved Area} &= 50,837.95 \times 0.08 \times 0.7. \\ &= 2,846.92 \text{ m}^3/\text{hr}\end{aligned}$$

$$\begin{aligned}\text{Total Runoff Load} &= 321.71 + 2,846.92 \text{ m}^3/\text{hr} \\ &= 3,168.63 \text{ m}^3/\text{hr}\end{aligned}$$

$$\begin{aligned}\text{Taking 15 minutes Retention Time, Total volume of storm water} &= 3,168.63/4 \\ &= 792.16 \text{ m}^3\end{aligned}$$

Taking the effective dia and depth of a Recharge pit 3.25 m and 5 m respectively, Volume of a single Recharge pit = $\pi d^2h/4 = 3.14 \times 3.25 \times 3.25 \times 5 / 4 = 41.46 \text{ m}^3$

Hence No. of pits required = $792.16/41.46 = 19.10$ Pits Say 20 Pits.

Total of 20 Rain Water Harvesting pits are for artificial rain water recharge for green area and paved area where as for the collection and while for roof-top run-off, 2 no. Rain water harvesting tanks of 55.125 m³ each (4.5 m X 3.5m X 3.5 m) are being proposed within the stadium.

2.7 What would be the impact of the land use changes occurring due to the project on the runoff characteristics (quantitative as well as qualitative) of the area in the post construction phase on a long term basis? Would it aggravate the problems of flooding or water logging in any way?

The project includes paved areas and thus the runoff from the plot is expected to increase due to reduced infiltration. However, the increased runoff does not cause flooding or water logging as a well designed storm water drainage was be provided. The runoff collected into rainwater harvesting pits for groundwater recharging and also stored in the tanks. The quality of the runoff is expected to improve due to paved areas.

2.8 What are the impacts of the proposal on the ground water? (was there be tapping of ground water; give the details of ground water table, recharging capacity and approvals obtained from competent authority, if any)

Water demand is fulfilled by bore wells. No adverse impact is expected on this account as extensive rainwater harvesting implemented across the project site. To reduce the freshwater demand and hence the groundwater stress, treated wastewater is used for horticulture and HVAC cooling and remaining surplus water is stored in the reserve tank and reused for horticulture during non-match day.

2.9 What precautions/ measures have been proposed to check the surface run-off, as well as uncontrolled flow of water into any water body?

The following management measures are suggested to protect the water quality are:

- Avoid excavation during monsoon season.
- Care would be taken to avoid soil erosion.

- Community toilets were constructed on the site during construction phase and the wastewater was channelized to the septic tank in order to prevent wastewater from entering the water bodies.
- Any area with loose debris/soil within the site was fully planted by local plant species.
- To prevent surface and ground water contamination by oil/grease, leak proof containers would be used for storage and transportation of oil/grease. The floors of oil/grease handling area would be kept effectively impervious.
- Collection and settling in the storm water, prohibition of equipment wash downs, and prevention of soil loss and toxic release from the construction site was be adhered to minimize water pollution.

2.10 How is the storm water from within the site managed? (State the provisions made to avoid flooding of the area, details of the drainage facilities provided along with a site layout indication contour levels).

Most of the storm water produced on site was be harvested for ground water recharge. Thus proper management of this resource is a must to ensure that it is free of contamination. A detailed Storm Water Management Plan was be developed which was consider the sources of storm water. The plan was incorporate best management practices which was include the following:

- Regular inspection and cleaning of storm drains.
- Installation of clarifiers or Oil/Water separators/traps system of adequate capacity around parking areas and garages as per requirement.
- Avoid application of pesticides and herbicides before wet season.
- Conducting routine inspections to ensure cleanliness.
- Preparation of spill response plans, particularly for fuel and oil storage areas.
- Provision of silt traps in storm water drains.
- Good housekeeping in the above areas.

2.11 Was the deployment of construction laborers particularly in the peak period lead to unsanitary conditions around the project site (Justify with proper explanation).

No, mostly local laborers was be employed during the construction phase and thus negligible quantities of wastes was be generated. Mobile toilets was be provided and the wastewater generated was be collected in septic tanks.

2.12 What on-site facilities are provided for the collection, treatment & safe disposal of sewage? (Give details of the quantities of wastewater generation, treatment capacities with technology & facilities for recycling and disposal).

It is expected that the project was generate approx.160 KLD of wastewater. The wastewater was be treated in the STP provided within the complex generating 128 KLD of recoverable water from STP which was be recycled within the project and surplus water was be stored in the treated water tank and reuse for horticulture during non-match day. For the treatment of sewerage water, a modular STP of MBBR technology was be provided.

2.13 Give details of dual plumbing system if treated waste used for flushing of toilets or any other use.

Dual plumbing system that utilizes separate piping systems for freshwater and recycled wastewater was be adopted for the project. Treated water from the on-site STP is estimated at 200 KLD. The recycled water system utilize this treated waste water and serve for non-contact uses such as horticulture and HVAC cooling and remaining surplus water was be stored in the reserve tank and the water was be reuse for horticulture during non-match day.

SECTION 3- VEGETATION

3.1 Is there any threat of the project to the biodiversity? (Give a description of the local ecosystem with its unique features, if any).

No ecologically sensitive area falls within the project site. Hence, no ecological/ biological threat has been anticipated.

3.2 Was the construction involve extensive clearing or modification of vegetation? (Provide a detailed account of the trees & vegetation affected by the project)

The project does not support any significant vegetation. It is proposed to develop a multilayered peripheral greenbelt of native plant species to enhance the aesthetic value of the region and also provide an excellent habitat for various faunal groups. Evergreen tall and ornamental trees like and ornamental shrubs like *Grevillea robusta*, *Embellica officinalis*, *Morus alba*, *Azadirachta indica*, *Dalbergia latifolia*, *Acacia catechu*, *Bauhinia acuminata*, *Dalbergia latifolia*, *Terminalia arjuna*, *Cassia pumila* have been proposed to be planted inside the premises.

3.3 What are the measures proposed to be taken to minimize the likely impacts on important site – features (Give details of proposal for tree plantation, landscaping creation of water bodies etc along with a layout plan to an appropriate scale?)

Green belt was be developed along the periphery of the project premises along with the internal parks and lawns. 20,106.86 m² i.e. 22.58% of the project area was be developed as green belt and organized green spaces.

SECTION 4- FAUNA

4.1 Is there likely to be any displacement of fauna both terrestrial and aquatic or creation of barriers for their movement? Provide the details.

No. The existing land use around the site is urban and does not provide a habitat for wild species. The peripheral greenbelt was provide an excellent habitat for the native fauna.

4.2 Any direct or indirect impacts on the avifauna of the area? Provide details.

The project was not have any direct or indirect impacts on the avifauna of the area. However, planting of fruit bearing trees in the proposed greenbelt was be an attraction to the local bird population.

4.3 Prescribe measures such as corridors, fish ladders etc. to mitigate adverse impacts on fauna.

Not applicable

SECTION 5- AIR ENVIRONMENT

5.1 Was the project increase atmospheric concentration of gases & result in heat islands? (Give details of background air quality levels with predicted values based on dispersion models taking into account the increased traffic generation as a result of the proposed construction).

Ambient air monitoring was carried out at the project site during the environmental assessment.

Table 8: Ambient Air Quality Data

Rajiv Gandhi international Stadium & sport complex, raipur, Dehradun(Uttrakhand)						
Ambient Air Quality Data Dec.- 2018				Location: (Project site)		
S.No.	Date	PM2.5,µg/m3	PM10,µg/m3	SO₂ µg/m3 ,	NO₂,µg/m3	CO, µg/m3
		Gravimetric	IS:5182:Pt-23	IS:5182:Pt-2	IS:5182:Pt-6	IS:5182:Pt-10
1	05.12.2018	42.2	72.4	5.4	21.6	750
2	08.12.2018	45.3	88.8	4.9	18.6	640
3	11.12.2018	48.3	82.5	5.7	20.2	760
4	14.12.2018	54.4	94.0	5.3	23.9	910
5	17.12.2018	47.4	97.2	4.7	23.4	950
6	20.12.2018	43.6	95.4	5.9	20.5	790
7	23.12.2018	47.2	90.3	6.2	19.6	630
8	26.12.2018	44.3	86.2	5.3	17.4	470
	Min	42.2	72.4	4.7	17.4	470
	Max	54.4	97.2	6.2	23.9	950
	Average	46.6	88.4	5.4	20.7	738
	98 Percentile	53.5	96.9	6.2	23.8	944.4
	NAAQS (For 24 hrly monitoring except CO)CO For one Hr	60	100	80	80	4000

During the post construction phase cars, scooter/motorcycle of the occupants/spectators of the stadium was be the major source of air pollution in addition to DG set. Quantum and dispersion of pollutants form vehicular emission was depend upon the following:

- Volume of traffic on the roads,
- Meteorological conditions.
- Emission sources from D.G. Sets.

From vehicular emissions, PM, NO_x and CO are pollutants of primary concern. The dispersion of vehicular emissions would be confined within 100 m from the road and concentration was decrease with the increase in distance from road. It is anticipated that the contribution of vehicular emissions in ambient air quality was be marginal but well within the stipulated National Ambient. At higher wind speed dispersion was be faster.

Mitigation Measures: The Stadium was develop a green belt inside the premises of the project site and along the internal road, which was work as barrier for the movement of pollutants and help in pollution control.

Table 9: Noise Quality Data

Rajiv Gandhi International Stadium & Sports Complex Dehradun						
Noise Quality data Dec -2018						
S.No.	PROJECT SITE	ZONE	LIMIT (as per CPCB Guidelines), Leq (dBA)		Observed value, Leq, (dBA)	
			DAY*	NIGHT*	DAY*	NIGHT*
1	PROJECT SITE (NQ-1)	Commercial Zone	65	55	55.2	43.5
*	Day time	Leq(6.00AM TO 10.00PM)				
	Night time	Leq(10.00PM TO 6.00AM)				

5.2 What are the impacts on generation of dust, smoke, odorous fumes or other hazardous gases? Give details in relation to all the meteorological parameters.

Source of pollution:-

- DG set running
- Vehicular movement

Impacts on Air Quality due to DG Sets and vehicular emissions:

- Impacts on ambient air during operation phase would be due to emissions from the stacks attached to backup DG sets only during grid power failure.
- Increase of CO level in the basement.

Mitigation Measures for Impacts of DG Sets and other vehicular emissions on Ambient Air Quality:

- Back up DG sets was comply with the applicable emission norms.
- Adequate stack height for DG sets was be provided as per norms.
- Back up DG sets was be used only during power failure.
- Monitoring of emissions from DG sets and ambient air quality was be carried out as per norms.

Being a small construction project, it comes under 8a schedule of EIA notification 2006, so emissions was be negligible and under prescribed limits.

5.3 Was the proposal create shortage of parking space for vehicles? Furnish details of the present level of transport infrastructure and measures proposed for improvement including the traffic management at the entry and exit to the project site.

Adequate provision is kept for car/vehicles parking at the project. There is also be adequate provision for visitors parking so as not to disturb the traffic and allow smooth movement at the site.

Parking Required:

As per MoEF Norms and Dehradun Bye Laws:

For Stadium facilities = 1 ECS/20 seats
= 25,150/20
= 1,257.5 ECS Say 1,258 ECS

Total parking required as per MoEF norms and Dehradun Bye Laws = **1,258 ECS**

Parking Proposed:

Area proposed for Open parking = 37,307.54 m²

Area required for 1 ECS of open parking	= 23 m ²
Parking proposed for open parking	= 1,622 ECS
Total Parking proposed	= 1,622 ECS

Therefore, 1,622 ECS parking spaces have been proposed for the spectators of the cricket stadium.

5.4 Provide details of the movement patterns with internal roads, bicycle tracks, pedestrian pathways, footpaths etc, with areas under each category.

Internal roads of adequate width, footpaths/pedestrian pathways have been well planned for the project.

5.5 Was there be significant increase in traffic noise & vibrations? Give details of the sources and the measures proposed for mitigation of the above.

No significant impact of noise has been anticipated within and outside of the project site due to provision of wide roads for smooth flow of traffic and greenbelt along the roads. Noise, due to the traffic, within site, was result in a marginal increase in the noise levels because noise control measures are provided in vehicles & DG sets as mentioned below, which was cause slight increase in noise level.

5.6 What was be the impact of D.G. sets and other equipment on noise levels and vibration in ambient air quality around the project site? Provide details.

During match day, vehicular movement and operation of DG sets are the major sources of noise pollution. But both these activities- DG set and vehicular movement was not have any significant impact on the spectators in the area. Since DG set was not be operational continuously and moreover it was be placed away from spectators and was be enclosed with suitable enclosures, hence no or minimal impact was be anticipated. It is envisaged that the movement of the motor vehicles was be restricted to designated carriageways only.

Impacts on Air Quality due to DG Sets:

- Impacts on ambient air during operation phase would be due to emissions from the stacks attached to backup DG sets only during grid power failure.

Mitigation Measures for Impacts of DG Sets on Ambient Air Quality:

- Back up DG sets was comply with the applicable emission norms.
- Adequate stack height for DG sets was be provided as per norms.
- Back up DG sets was be used only during power failure.
- Monitoring of emissions from DG sets and ambient air quality was be carried out as per norms.

Noise Control Measures for DG sets:

- The DG set room was be provided with acoustic enclosure to have minimum 25 dB(A) insertion loss or for meeting the ambient noise standard whichever is on higher side as per E (P) Act, GSR 371 (E) and its amendments.
- Adequate exhaust mufflers was be provided as per norms to limit the noise.

SECTION 6- AESTHETICS

6.1 Was the proposed construction in any way result in the obstruction of a view, scenic amenity or landscapes? Are these considerations taken into account by the proponents?

The site lies in an urbanized settlement and is well planned. Thus, no obstruction of view or scenic beauty or landscape is anticipated. Furthermore, the construction was be planned in such a way that the organized open spaces and landscaped areas was render the plot aesthetically appealing.

6.2 Was there be any adverse impacts from new constructions on the existing structures? What are the considerations taken into account?

No impacts anticipated.

6.3. Whether there are any local considerations of urban form & urban design influencing the design criteria? They may be explicitly spelt out.

The project was strictly follow the Area Building Regulation of NBC. All norms on Ground Coverage, FAR, Height, Setbacks, Fire Safety Requirements, Structural Design and other parameters was be strictly adhered to.

6.4 Are there any anthropological or archaeological sites or artifacts nearby? State if any other significant features in the vicinity of the site have been considered?

No anthropological or archaeological sites or artifacts are found near the site area.

SECTION 7- SOCIO-ECONOMIC ASPECTS

7.1 Was the proposal result in any changes to the demographic structure of local population? Provide the details.

No such changes anticipated.

Construction phase: Since local labourers was be engaged during construction phase, alteration to the existing demographic profile of the area is not anticipated.

Operation phase: The changing demography in the area is another impact that needs attention. The project was mainly lead to spatial redistribution of local population and hence no considerable influx of population is envisaged owing to the project.

7.2 Give details of the existing social infrastructure around the project.

The area around the project is surrounded by local land area. Areas occupied by sensitive man-made land uses like hospitals, schools, places of worship, community facilities include Shri Mahant Indresh Hospital, Doon International School, Durga Mandir etc.

7.3 Was the project cause adverse effects on local communities, disturbance to sacred sites or other cultural values? What are the safeguards proposed?

Construction phase: There are no religious sites or archeological monuments of historical significance in or near the project site. Hence, no adverse impact in this regard is anticipated. Rather, this phase was generate jobs that relate to unskilled, semi skilled as well as skilled labour

category. Few supervisory positions was also open up, for which local candidates was be considered based on merit.

Operation phase: This project was provide facility to conduct National as well as International cricket match which enhance the surrounding quality of life and was also set a standard for future developments in the area. A stadium project of such scale was also boost the local economy.

SECTION 8- BUILDING MATERIALS

8.1 May involve the use of building materials with high embodied energy. Are the construction materials produced with energy efficient processes? (Give details of energy conservation measures in the selection of building materials and their energy efficiency)

For the purpose of paved path, sun dried pavers was be used instead of baked pavers as they are manufactured through energy efficient processes.

8.2 Transport and handling of materials during construction may results in pollution, noise and public nuisance. What measures are taken to minimize the impacts?

Mitigation Measures for Air Pollution during Construction Stage:

- Construction materials was be suitably covered with tarpaulin cover etc during transportation.
- Water sprinkling is being done on roads where dust generation is anticipated.
- Raw material storage and handling yard was be enclosed from all sides.
- To minimize the occupational health hazard, proper personal protective gears i.e. mask were be provided to the workers working in the dust prone areas.

Mitigation Measures for Noise Pollution during Construction Stage:

- Administrative as well as engineering control of noise was be implemented.
- Isolation of noise generation sources and temporal differentiation of noise generating activities was ensure minimum noise at receiver's end.
- To prevent any occupational hazard, earmuff / earplug were given to the workers working around construction plant & machinery emitting high noise levels.

- Use of such plant or machinery was not be allowed during night time. Careful planning of machinery operation and scheduling of operations was done to minimise such impact.

8.3 Are recycled materials used in roads and structures? State the extent of savings achieved?

Yes, for road construction fly-ash was be utilized. Recycled materials was be bought from outside sources and was be used as fillers in base and sub-base of the carriageway, footpaths pavements or pedestrian way, as needed.

8.4 Give detail of the methods of collection, segregation & disposal of the garbage generated during the operation phases of the project.

The solid waste of the project was be segregated into biodegradable waste and non-biodegradable. Biodegradable waste and non biodegradable waste was be disposed through Govt. approved agency. Proper guidelines for segregation, collection and storage was be prepared as per Municipal Solid Wastes (Management and Handling) Rules, 2016.

SECTION 9- ENERGY CONSERVATION

9.1 Give details of the power requirements, source and supply, backup source etc. What is the energy consumption assumed per square foot of built-up area? How have you tried to minimize energy consumption?

The power supply is being supplied by Uttarakhand Power Corporation Ltd. (UPCL). The demand load for the stadium Project was be approx. 1,033 KVA (during Non-match day/ Match day (day time)) and 2,172 KVA (During Match Day (Night time)) which is being supplied by 1 transformer of 2,000 KVA.

Back-up energy for power failure is provided by 4 number of DG sets of total capacity 4,000 KVA (i.e. 4 × 1,000 KVA capacity) and all DG sets was be kept standby.

Effective measures have been incorporated to minimize the energy consumption in following manners:

- Solar street lights.
- Solar blinkers.
- Roof top SPV (Solar Photo voltaic) systems with or without grid interaction.
- All external lighting are BEE star rated.
- All internal lighting are BEE star rated and solar lit, at least to an extent of 25%.
- All common spaces including street lights (where there is no use of light for reading purposes), are “LED”.
- Solar street light controllers was be used for automatic dusk to dawn operation of street lights.
- Traffic light, blinkers, direction signage, based on LEDs is powered by solar.
- Integration of automated system to operate electrical equipment as per load requirement to save energy

9.2 What type and capacity of power backup do you plan to provide?

Backup power units was be provided by 4 Nos. of DG sets of total capacity 4,000 KVA (i.e. 4 × 1,000 KVA capacity). The DG sets was be operated only during power failure.

9.3 What are the characteristics of the glass you plan to use? Provide specifications of its characteristics related to both short wave and long wave radiation?

The project, being Stadium Project, was involve uses of clear & tinted glass having U-value of 5.40 to 5.49.

9.4 What passive solar architectural features are being used in the building? Illustrate the applications made in the project.

Passive solar design refers to use of the sun’s energy for the heating and cooling of living spaces. Pergolas, projections, façade elements, metal louvers was be provided for sun shading to reduce the heat influx into the building and thus reduce the air conditioning loads.

9.5 Does the layout of street & building maximize the potential for solar energy devices? Have you considered the use of street lighting, emergency lighting and solar hot water systems for use in the building complex? Substantiate with details.

Layout of stadium i.e. location of pavilion/stands has been done as per the sun path analysis so that the design cuts off direct radiations of critical hours which are specific to the orientation. Solar energy was be harnessed to meet various energy requirements of the project such as:

- Solar street lights.
- Solar blinkers.
- Roof top SPV (Solar Photo voltaic) systems with or without grid interaction.

9.6 Is the shading effectively used to reduce cooling/heating loads? What principles have been used to maximize the shading of walls on the East and the West and the Roof? How much energy saving has been effected?

Pergolas, projection, façade elements, metal louvers was be provided to reduce cooling loads. Green area and open areas was being so spaced that a reduction in temperature is achieved.

9.7 Do the structures use energy-efficient space conditioning, lightening and mechanical systems? Provide technical details. Provide details of the transformers and motor efficiencies, lightening intensity and air conditioning load assumption? Are you using CFC and HCFC free chillers? Provide specifications.

Yes. The walls was be insulated such that air conditioning load is reduced. Well designed building structures was allow natural light to enter. Measures prescribed in Energy Conservation Building Code 2007 was be adopted to reduce the heat influx by walls, roofs and openings. Only prescribed quality of glasses was be used.

9.8 What are the likely effects of the building activity in altering the micro-climates? Provide a self assessment on likely impacts of the proposed construction on creation of heat island & inversion effects?

Heat emissions from the construction may be from the following sources:

- Heat absorbed from the paved and concrete structures
- Heat generated from equipment/appliances
- Heat increase due to population increase in the stadium project.

However, the heat generated was not be significant and was be dissipated in the greens and open areas provided within the project area.

9.9 What are the thermal characteristics of the building envelope? (a) Roof (b) external walls and (c) fenestration? Give details of the material used and the U value or the R values of the individual components.

The roof tops of the buildings was be planned with puffing/bricks bat coba for water proofing and reflective tiles. Roof tops was also have partly landscaped area/gardens.

External wall-external opening was have regular door windows with slightly tinted glass. Regular walls have some cladding/fixture paints.

9.10 What precautions & safety measures are proposed against fire hazards? Furnish details of emergency plans.

Firefighting measures are adopted as per the guidelines of NBC. External yard hydrants installed around all buildings in the complex and galvanized steel fire hose boxes/cabinet (weather proof). All external yard hydrants are at one meter height from finished ground level as per NBC at a distance of 45 m along the road. External fire hydrants are located such that no portion of any building is more than 45 m from a hydrant and the external hydrants are not vulnerable to mechanical or vehicular damage.

Fire hydrant system was be provided within the buildings, fire escape staircases and refuge areas was be provided and the building structures was be planned as per NBC. In addition, 10 kg fire extinguishers was be provided for class A, B, and C fires. CO₂ extinguishers was also be provided.

Disaster Management Plan

PRECAUTION & MITIGATORY METHODS TO PREVENT DISASTERS:

- Complex is planned to reduce the impact of disasters and to encourage recovery.
- A disaster management cell would be established which was take care of post disaster scenario.
- It would be a volunteer kind of set-up and professionals can also be hired in case of eventuality.
- Complex management and maintenance agency was prepare an integrated, comprehensive management plan.

PRECAUTION & MITIGATORY METHODS TO PREVENT DISASTERS:

(Earthquake Management)

- At the time of designing and constructing the building due care would be taken to have earthquake resistant structures which was conform to IS 1983.
- New systems and devices using non-conventional civil engineering materials would be developed to reduce the earthquake forces acting on structure.

PRECAUTION & MITIGATORY METHODS TO PREVENT DISASTERS:

(Fire Hazard)

- Fire safety would be taken into account and would follow all the safety norms and regulations as per the NBC and other related Indian Standards.
- All electrical cables would be underground and sophisticated modern electrical distribution system to reduce risk of fire.
- Special fire fighting equipments like Automatic Fire Detection and alarm system, automatic Sprinkler System etc. would be installed as per the NBC standards.
- Risk assessment with on site disaster management plan was be specified to fire, smoke and other emergency conditions.

9.11 If you are using glass as wall materials, provide details and specifications including emissivity and thermal characteristics.

The project being a stadium project was involve use of glass in fenestration with U-factors, SHGC, or visible light transmittance determined, certified and labeled in accordance ISO 15099 is adopted.

9.12 What is the rate of air infiltration in to the building? Provide details of how you are mitigating the effects of infiltration.

The project was not be centrally air conditioned and hence there was be provision for ample natural ventilation.

9.13 To what extent the non-conventional energy technologies are utilized in the overall energy consumption? Provide details of the renewable energy technologies used.

Solar energy was be variedly used as:

- Solar street lights.
- Solar blinkers.
- Roof top SPV (Solar Photo voltaic) systems with or without grid interaction.
- Green CFLs was be used in buildings to minimize the energy consumption.
- Green area is provided along with tree plantation which was result in natural air cooling and was reduce the load on conventional energy sources.

10. ENVIRONMENT MANAGEMENT PLAN

The Environment Management Plan (EMP) would consist of all mitigation measures for each component of the environment due to the activities increased during the construction, operation and the entire life cycle to minimize adverse environmental impacts resulting from the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It was state the steps to be taken in case of emergency such as accidents at the sites including fire. The detailed EMP for the project is given below.

10.1 Environmental Management Plan

The Environment Management Plan (EMP) is a site specific plan developed to ensure that the project is implemented in an environmental sustainable manner where all contractors and subcontractors, including consultants, understand the potential environmental risks arising from

the project and take appropriate actions to properly manage that risk. EMP also ensures that the project implementation is carried out in accordance with the design by taking appropriate mitigation actions to reduce adverse environmental impacts during its life cycle. The plan outlines existing and potential problems that may adversely impact the environment and recommends corrective measures where required. Also, the plan outlines roles and responsibility of the key personnel and contractors who was be in-charge of the responsibilities to manage the project site.

10.1.1 The EMP is generally

- Prepared in accordance with rules and requirements of the MoEF and CPCB/ SPCB
- To ensure that the component of facility are operated in accordance with the design
- A process that confirms proper operation through supervision and monitoring
- A system that addresses public complaints during construction and operation of the facilities
- A plan that ensures remedial measures is implemented immediately.

The key benefits of the EMP are that it offers means of managing its environmental performance thereby allowing it to contribute to improved environmental quality. The other benefits include cost control and improved relations with the stakeholders.

EMP includes four major elements:

- Commitment & Policy: The management was strive to provide and implement the Environmental Management Plan that incorporates all issues related to air, water, land and noise.
- Planning: This includes identification of environmental impacts, legal requirements and setting environmental objectives.
- Implementation: This comprises of resources available to the developers, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken.
- Measurement & Evaluation: This includes monitoring, counteractive actions and record keeping.

It is suggested that as part of the EMP, a monitoring committee would be formed by Rajiv Gandhi International Cricket Stadium & Sports Complex comprising of the site in-charge/coordinator, environmental group representative and project implementation team representative. The committee's role would be to ensure proper operation and management of the EMP including the regulatory compliance.

The components of the environmental management plan, potential impacts arising, out of the project and remediation measures are summarized below in Table 10.

TABLE 10: SUMMARY OF POTENTIAL IMPACTS AND REMEDIAL MEASURES

S. No.	Environmental components	Potential Impacts	Potential Source of Impact	Controls Through EMP & Design	Impact Evaluation	Remedial Measures
1.	Ground Water Quality	Ground Water Contamination	<u>Construction Phase</u> • Waste water generated from temporary labor tents.	• No surface accumulation was be allowed.	No significant impact as majority of labors would be locally deployed	
			<u>Operation Phase</u> • Discharge from the project	• Rajiv Gandhi International Cricket Stadium & Sports Complex provides the STP to treat the discharge of the stadium.	No negative impact on ground water quality envisaged. Not significant.	
2.	Ground Water	Ground Water	<u>Construction Phase</u>	• Private water	No significant	

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	Quantity	Depletion	<ul style="list-style-type: none"> No ground water was be used for the construction activity. 	tanker was be used for the supply of water during construction phase.	impact on ground water quantity envisaged.	
			<u>Operation Phase</u> <ul style="list-style-type: none"> The source of water during operation phase is bore-wells. 	<ul style="list-style-type: none"> Rain water harvesting scheme. Black and Grey water treatment and reuse. Storm water collection for water harvesting. 	No significant impact on surface/ground water quantity envisaged.	In an unlikely event of non-availability of water supply, water was be brought using tankers.

				<ul style="list-style-type: none"> • Percolation well to be introduced in landscape plan. • Awareness Campaign to reduce the water consumption 		
3.	Surface Water Quality	Surface water contamination	<u>Construction Phase</u> <ul style="list-style-type: none"> • Surface runoff from site during construction activity. 	<ul style="list-style-type: none"> • Silt traps and other measures such as additional on site diversion ditches was be constructed to control surface run-off during site 	No off-site impact envisaged as no surface water receiving body is present in the core zone.	

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				development		
			<u>Operation Phase</u> <ul style="list-style-type: none"> Discharge of domestic wastewater to STP. 	<ul style="list-style-type: none"> Domestic water was be treated in STP 	No off-site impact envisaged	Excess of water was be used for horticulture and HVAC cooling and remaining water was be stored in the reserve tank and used for the irrigation during non-match day. CPCB standards for usage of treated waste water for irrigation purposes was be followed.
4.	Air Quality	Dust Emissions	<u>Construction Phase</u> <ul style="list-style-type: none"> All heavy construction activities 	<ul style="list-style-type: none"> Suitable control measures was be adopted for mitigating the PM level in the air as per air pollution 	Not significant because dust generation was being temporary and was settle fast due to dust suppression techniques.	During construction phase the contractors are advised to facilitate masks for the labors. Water sprinklers were used for suppression of dust during construction phase.

				control plan.		
		Emissions of PM, SO ₂ , NO _x and CO	<u>Construction Phase</u> <ul style="list-style-type: none"> • Operation of construction equipment and vehicles during site development. • Running D.G. set (back up) 	<ul style="list-style-type: none"> • Rapid on-site construction and improved maintenance of equipment 	Not significant.	Regular monitoring of emissions and control measures was be taken to reduce the emission levels. Use of Personal Protective Equipment (PPE) like earmuffs and earplugs during construction activities
			<u>Operation Phase</u> <ul style="list-style-type: none"> • Power generation by DG Set during power failure • Emission from vehicular traffic in use 	<ul style="list-style-type: none"> • Use of low sulphur diesel if available • Providing Footpath and pedestrian ways within the site for the residents • Green belt 	Not significant. DG set would be used as power back-up (approx 6 hours)	<ul style="list-style-type: none"> • Stack height of DG set above the tallest building as per CPCB standards No significant increase in ambient air quality level is

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				<p>was be expected from developed with the project's specific species activities.</p> <p>to help to There are no reduce PM sensitive level receptors</p> <ul style="list-style-type: none"> • Use of located within equipment the vicinity of fitted with site. silencers • Proper maintenance of equipment 	
5.	Noise Environment		Construction phase	<ul style="list-style-type: none"> • Provision of noise shields near the heavy construction operations and acoustic enclosures for 	

				DG set. <ul style="list-style-type: none"> • Constr uction activity was be limited to day time hours only 		
			<u>Operation Phase</u> <ul style="list-style-type: none"> • Noise from vehicular movement • Noise from DG set operation 	<ul style="list-style-type: none"> • Green Belt Development • Devel opment of silence zones to check the traffic movement • DG set rooms was be equipped with acoustic enclosures 	No significant impact due to suitable width of Greenbelt.	

FORM IA

6.	Land Environment	Soil contamination	<u>Construction Phase</u> <ul style="list-style-type: none"> Disposal of construction debris 	Construction debris was be collected and suitably used on site as per the solid waste management plan for construction phase	No significant impact. Impact was be local, as waste generated was be reused for filling of low lying areas etc.	
			<u>Operation Phase</u> <ul style="list-style-type: none"> Generation of municipal solid waste Used oil generated from D.G. set 	<ul style="list-style-type: none"> It is proposed that the solid waste generated was managed as per MSW Rules, 2016 and amended 	Since solid waste is handled by the authorized agency, waste dumping is not going to be allowed. Not significant.	

FORM IA

				Rules, 2008. <ul style="list-style-type: none"> • Collec tion, segregation, transportation and disposal was done as per MSW Management Rules, 2016 by the authorized agency • Used oil generated was sold to authorized recyclers 	Negligible impact.	
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FORM IA

7.	Biological Environment (Flora and Fauna)	Displacement of Flora and Fauna on site	<u>Construction Phase</u> <ul style="list-style-type: none"> Site Development during construction 	<ul style="list-style-type: none"> Import ant species of trees, if any, was identified and marked and was merged with landscape plan 	The site has shrubs as vegetation	
			<u>Operation Phase</u> <ul style="list-style-type: none"> Increase in green covered area 	<ul style="list-style-type: none"> Suitable green belts was developed as per landscaping plan in and around the site using 	Beneficial impact.	

				local flora		
8.	Socio- Economic Environment	Population displacement and loss of income	<u>Construction Phase</u> • Construction activities leading to relocation	<ul style="list-style-type: none"> • Recrea tional zone as per the Dehradun Master Plan- 2025. • Project will provide employment opportunities to the local people in terms of labor. 	No negative impact.	
			<u>Operation Phase</u> • Site operation	• Project	Beneficial	

REVISION IN RAJIV GANDHI INTERNATIONAL CRICKET STADIUM & SPORTS COMPLEX
 VILLAGE RAIPUR,
 PARGANA PARVADOON,
 DISST. DEHRADUN,
 UTTARAKHAND

FORM IA

				will provide employment opportunities to the local people in terms of service personnel (guards, securities, gardeners etc)	impact	
				<ul style="list-style-type: none"> • Providing quality-Integrated infrastructure. 		

FORM IA

9.	Traffic Pattern	Increase of vehicular traffic	<u>Construction Phase</u> <ul style="list-style-type: none"> Heavy Vehicular movement during construction 	<ul style="list-style-type: none"> Heavy Vehicular movement was restricted to daytime only and adequate parking facility was provided 	No negative impact	
			<u>Operation Phase</u> <ul style="list-style-type: none"> Traffic due to spectators once the project is operational 	<ul style="list-style-type: none"> Vehicular movement was regulated inside the project with adequate roads and parking lots in the colony. 	No major significant impact as green belt was developed which was help in minimizing the impact on environment.	

10.2 ENVIRONMENT MANAGEMENT PLAN

An Environmental Management Plan (EMP) was required to mitigate the predicted adverse environmental impacts during construction and operation phase of the project and these are discussed in later subsections.

10.2.1 EMP for Air Environment

Construction Phase

To mitigate the impacts of PM during the construction phase of the project, the following measures are recommended for implementation:

- A dust control plan
- Procedural changes to construction activities

Dust Control Plan

The most cost-effective dust suppressant is water because water is easily available on construction site. Water can be applied using water trucks, handled sprayers and automatic sprinkler systems. Furthermore, incoming loads could be covered to avoid loss of material in transport, especially if material is transported off-site.

Procedural Changes to Construction Activities

Idle time reduction: Construction equipment is commonly left idle while the operators are on break or waiting for the completion of another task. Emission from idle equipment tends to be high, since catalytic converters cool down, thus reducing the efficiency of hydrocarbon and carbon monoxide oxidation. Existing idle control technologies comprises of power saving mode, which automatically off the engine at preset time and reduces emissions, without intervention from the operators.

Improved Maintenance: Significant emission reductions can be achieved through regular equipment maintenance. Contractors were asked to provide maintenance records for their fleet as part of the contract bid, and at regular intervals throughout the life of the contract. Incentive

provisions were established to encourage contractors to comply with regular maintenance requirements.

Reduction of On-Site Construction Time: Rapid on-site construction would reduce the duration of traffic interference and therefore, was reduce emissions from traffic delay.

Operation Phase

To mitigate the impacts of pollutants from DG set and vehicular traffic during the operational phase of the Colony, following measures are recommended for implementation:

- DG set emission control measures
- Vehicular emission controls and alternatives
- Greenbelt development

Diesel Generator Set Emission Control Measures

Adequate stack height was be maintained to disperse the air pollutants generated from the operation of DG set to dilute the pollutants concentration within the immediate vicinity. Hence no additional emission control measures have been suggested.

Vehicle Emission Controls and Alternatives

During construction, vehicles was properly maintained to reduce emission. Vehicles was generally having “PUC” certificate.

Footpaths and Pedestrian ways: Adequate footpaths and pedestrian ways would be provided at the site to encourage non-polluting methods of transportation.

Greenbelt Development

Increased vegetation in the form of greenbelt is one of the preferred methods to mitigate air and noise pollution. Plants serve as a sink for pollutants, act as a barrier to break the wind speed as well as allow the dust and other particulates to settle on the leaves. It also helps to reduce the

noise level at large extent. The following table indicates various species of the greenbelt that can be used to act as a barrier.

Table 11: Trees to be planted in the premises of the project

S. No.	Local name	Botanical name
1	Silver oak	<i>Grevillea robusta</i>
2	Awala	<i>Embellica officinalis</i>
3	Mulberry	<i>Morus alba</i>
4	Neem	<i>Azadirachta indica</i>
5	Shisam	<i>Dalbergia latifolia</i>
6	Khair	<i>Acacia catechu</i>
7	Kanchan	<i>Bauhinia acuminata</i>
8	Shisam	<i>Dalbergia latifolia</i>
9	Arjuna	<i>Terminalia arjuna</i>
10	Yellow cassia	<i>Cassia pumila</i>

(Source: Guidelines for developing Green Belts by CPCB, 2000)

10.2.2 EMP FOR NOISE ENVIRONMENT

Construction Phase

To mitigate the impacts of noise from construction equipment during the construction phase on the site, the following measures are recommended for implementation.

Time of Operation: Noisy construction equipment would not be allowed to use at night time.

Job Rotation and Hearing Protection: Workers employed in high noise areas were employed on shift basis. Hearing protection such as earplugs/muffs was provided to those working very close to the noise generating machinery.

Operation Phase

To mitigate the impacts of noise from diesel generator set during operational phase, the following measures are recommended:

- Adoption of Noise emission control technologies
- Greenbelt development

Noise Emission Control Technologies

The DG set room was provided with acoustic enclosure to have minimum 25 dB(A) insertion loss or for meeting the ambient noise standard whichever is on higher side as per E (P) Act, GSR 371 (E) and its amendments. It would be ensured that the manufacturer provides acoustic enclosure as an integral part along with the diesel generators set. Further, enclosure of the services area with 4 m high wall was reduce noise levels and ensure that noise is at a permissible limit for resident of the site and surrounding receptors.

Greenbelt Development

The following species can be used, as in a greenbelt, to serve as noise breakers:

- *Grevillea robusta*
- *Embellica officinalis*
- *Azadirachta indica*
- *Dalbergia latifolia*
- *Terminalia arjuna*

10.2.3 EMP FOR WATER ENVIRONMENT

Construction Phase

To prevent degradation and to maintain the quality of the water source, adequate control measures have been proposed. To check the surface run-off as well as uncontrolled flow of water into any water body check dams with silt basins are proposed. The following management measures are suggested to protect the water source being polluted during the construction phase:

- Avoid excavation during monsoon season
- Care would be taken to avoid soil erosion
- Common toilets was constructed on site during construction phase and the waste water would be channelized to the septic tanks in order to prevent waste water to enter into the water bodies
- Any area with loose debris within the site are re-planted
- To prevent surface and ground water contamination by oil and grease, leak-proof containers would be used for storage and transportation of oil and grease. The floors of oil and grease handling area would be kept effectively impervious. Any wash off from the oil and grease handling area or workshop are drained through imperious drains
- Collection and settling of storm water, prohibition of equipment wash downs and prevention of soil loss and toxic release from the construction site are necessary measure to be taken to minimize water pollution
- All stacking and loading area was provided with proper garland drains, equipped with baffles, to prevent run off from the site, to enter into any water body.

Operation Phase

In the operation phase of the project, water conservation and development measures was taken, including all possible potential for rain water harvesting. Following measures was adopted:

- Water source development.
- Minimizing water consumption.
- Promoting reuse of water after treatment and development of closed loop systems for different water streams.

Water Source Development

Water source development is being practiced by installation of scientifically designed Rain Water Harvesting system. Rainwater harvesting promotes self-sufficiency and fosters an appreciation for water as a resource.

Minimizing Water Consumption

Consumption of fresh water was minimized by combination of water saving devices and other domestic water conservation measures. The following section discusses the specific measures, which are implemented:

Domestic and Commercial Usage

- Use of water efficient plumbing fixtures (ultra low flow toilets, low flow sinks, water efficient dishwashers). Water efficient plumbing fixtures uses less water with no marked reduction in quality and service
- Leak detection and repair techniques.
- Sweep with a broom and pan where possible, rather than hose down for external areas.
- Meter water usage: Implies measurement and verification methods.

Monitoring of water uses is a precursor for management.

Horticulture

- Drip irrigation system is used for the lawns and other green area. Drip irrigation can save 15-40% of the water, compared with other watering techniques.
- Plants with similar water requirements is grouped on common zones to match precipitation heads and emitters.
- Use of low-angle sprinklers for cricket ground.
- Select controllers with adjustable watering schedules and moisture sensors to account for seasonal variations and calibrate them during commissioning.
- Place 3 to 5 inches of mulch on planting beds to minimize evaporation.

Promoting Reuse of Water after Treatment and Development of Closed Loop Systems

To promote reuse of waste water and development of closed loop system for waste water segregation. Two wastewater schemes are suggested, namely:

- 1) Storm Water Harvest
- 2) Waste water recycling.

Storm water harvest as discussed in earlier, was be utilized for artificial recharge of ground water sources; and waste water was reused on site after treatment.

Treated waste water was used for landscaping and HVAC cooling and remaining water was stored and reuse for horticulture for non-match day. Following section discuss the scheme of waste water treatment.

Waste Water Treatment Scheme

Proponent was treat the waste water of the stadium in well designed sewage treatment plant of capacity 200 KLD based on MBBR technology.

Storm Water Management

Most of the storm water produced on site was harvested for ground water recharge. Thus proper management of this resource is a must to ensure that it is free from contamination.

Contamination of Storm Water is possible from the following sources:

- Diesel and oil spills in the diesel power generator and fuel storage area
- Waste spills in the solid / hazardous waste storage area
- Oil spills and leaks in vehicle parking lots
- Silts from soil erosion in gardens
- Spillage of sludge from sludge drying area of sewage treatment plant

A detailed storm water management plan was developed which was consider the possible impacts from above sources. The plan was incorporate best management practices which was include following:

- Regular inspection and cleaning of storm drains
- Clarifiers or oil/separators were installed in all the parking areas. Oil / grease separators installed around parking areas and garages were sized according to peak flow guidelines. Both clarifiers and oil/water separators was periodically pumped in order to keep discharges within limits
- Covered waste storage areas
- Avoid application of pesticides and herbicides before wet season
- Secondary containment and dykes in fuel/oil storage facilities

- Conducting routine inspection to ensure cleanliness
- Provision of slit traps in storm water drains
- Good housekeeping in the above areas

10.2.4 EMP FOR LAND ENVIRONMENT

Construction Phase

The waste generated from construction activity includes construction debris, biomass from land clearing activities, waste from the temporary make shift tents for the labors and hazardous waste. Following section discuss the management of each type of waste. Besides waste generation, management of the topsoil is an important area for which management measures are required.

Construction Debris

Construction debris is bulky and heavy and re-utilization and recycling is an important strategy for management of such waste. As concrete and masonry constitute the majority of waste generated, recycling of this waste by conversion to aggregate can offer benefits of reduced landfill space and reduced extraction of raw material for new construction activity. This is particularly applicable to the project site as the construction is to be completed in a phased manner.

Mixed debris with high gypsum, plaster, was not used as fill, as they are highly susceptible to contamination, and was send to designated solid waste landfill site.

Metal scrap from structural steel, piping, concrete reinforcement and sheet metal work was removed from the site by construction contractors. A significant portion of wood scrap was reused on site. Recyclable wastes such as plastics, glass fiber insulation, roofing etc was sold to recyclers.

Hazardous waste

Construction sites are sources of many toxic substances such as paints, solvents wood preservatives, pesticides, adhesives and sealants. Hazardous waste generated during construction

phase was stored in sealed containers and disposed off as per The Hazardous Wastes (Management & Handling) Rules, 1989.

Some management practices to be developed are:

- Herbicides and pesticide was not be over applied (small-scale applications) and not applied prior to rain
- Paintbrushes and equipment for water and oil based paints was cleaned within a contained area and was not be allowed to contaminate site soils, water courses or drainage systems
- Provision of adequate hazardous waste storage facilities. Hazardous waste collection containers was be located as per safety norms and designated hazardous waste storage areas was be away from storm drains or watercourses
- Segregation of potentially hazardous waste from non-hazardous construction site debris
- Well labeled all hazardous waste containers with the waste being stored and the date of generation
- Instruct employees and subcontractors in identification of hazardous and solid waste

Even with careful management, some of these substances are released into air, soil and water and many are hazardous to workers. With these reasons, the best choice is to avoid their use as much as possible by using low-toxicity substitutes and low VOC (Volatile Organic Compound) materials.

Waste from Temporary Makes Shift Tents for Labors

Wastes generated from temporary make shift labor tents was mainly comprise of household domestic waste, which was be managed by the contractor of the site. The wastewater generated was be channelized to the septic tank.

Top Soil Management

To minimize disruption of soil and for conservation of top soil, the contractor keet the top soil cover separately and stockpile it. After the construction activity is over, top soil was be utilized

for landscaping activity. Other measures, which would be followed to prevent soil erosion and contamination include:

- Maximize use of organic fertilizer for landscaping and green belt development
- To prevent soil contamination by oil/grease, leaf proof containers would be used for storage and transportation of oil/grease and wash off from the oil/grease handling area was drained through impervious drains and treated appropriately before disposal
- Removal of as little vegetation as possible during the development and re-vegetation of bare areas after the project.
- Working in a small area at a point of time (phase wise construction)
- Construction of erosion prevention troughs/berms.

Operational Phase

The philosophy of solid waste management at the proposed complex was be to encouraging the four R's of waste i.e. **Reduction, Reuse, Recycling and Recovery** (materials & energy). The Environmental Management Plan for the solid waste focuses on three major components during the life cycle of the waste management system i.e., collection and transportation, treatment or disposal and closure and post-closure care of treatment/disposal facility.

Collection and Transportation

- During the collection stage, the solid waste of the project was be segregated into biodegradable waste and non-biodegradable. Recyclable and non-recyclable wastes was be disposed through Govt. approved agency. A proper guideline for segregation, collection and storage was be prepared as per MSW Rules, 2016.
- To minimize littering and odour, waste was be stored in well-designed containers/ bins that was be located at strategic locations to minimize disturbance in traffic flow
- Care would be taken such that the collection vehicles are well maintained and generate minimum noise and emissions. During transportation of the waste, it was be covered to avoid littering.



Figure 5: Solid Waste Management Flow Diagram (During Operation Phase)

Disposal

With regards to the disposal/treatment of waste, the management will take the services of the authorized agency for waste management and disposal of the same on the project site during its operational phase.

10.2.5 EMP FOR ECOLOGICAL ENVIRONMENT

Construction activity changes the natural environment. But stadium complex also creates a built environment for its inhabitants. The project requires the implementation of following choices exclusively or in combination.

Construction Stage

- Restriction of construction activities to defined project areas, which are ecologically sensitive
- Restrictions on location of temporary labor tents and offices for project staff near the project area to avoid human induced secondary additional impacts on the flora and fauna species

- Cutting, uprooting, coppicing of trees or small trees if present in and around the project site for cooking, burning or heating purposes by the labors was be prohibited and suitable alternatives for this purpose was be made
- Along with the construction work, the peripheral green belt would be developed with suggested native plant species, as they was grow to a full-fledged covered at the time of completion.

Operation Stage

Improvement of the current ecology of the project site was entail the following measures:

- Plantation and Landscaping
- Green Belt Development
- Park and Avenue Plantation

The section below summarizes the techniques to be applied to achieve the above objectives:

Plantation and landscaping

Selection of the plant species would be done on the basis of their adaptability to the existing geographical conditions and the vegetation composition of the forest type of the region earlier found or currently observed.

Green Belt Development Plan

The plantation matrix adopted for the green belt development includes pit of 0.3 m × 0.3 m size with a spacing of 2 m x 2 m. In addition, earth filling and manure may also be required for the proper nutritional balance and nourishment of the sapling. It is also recommended that the plantation has to be taken up randomly and the landscaping aspects could be taken into consideration.

Plantation comprising of medium height trees (7 m to 10 m) and shrubs (5 m height) are proposed for the green belt. In addition creepers were planted along the boundary wall to enhance its insulation capacity.

Selection of Plant Species for Green Belt Development

The selection of plant species for the development depends on various factors such as climate, elevation and soil. The plants would exhibit the following desirable characteristics in order to be selected for plantation

1. The species should be fast growing and providing optimum penetrability
2. The species should be wind-firm and deep rooted
3. The species should form a dense canopy
4. As far as possible, the species should be indigenous and locally available
5. Species tolerance to air pollutants like SO₂ and NO_x should be preferred
6. The species should be permeable to help create air turbulence and mixing within the belt
7. There should be no large gaps for the air to spill through
8. Trees with high foliage density, leaves with larger leaf area and hairy on both the surfaces
9. Ability to withstand conditions like inundation and drought
10. Soil improving plants (Nitrogen fixing rapidly decomposable leaf litter)
11. Attractive appearance with good flowering and fruit bearing
12. Bird and insect attracting tree species
13. Sustainable green cover with minimal maintenance.

Parks and Avenue Plantation

- Parks and gardens maintained for a recreational and ornamental purpose was not only improve the quality of existing ecology at the project site but also were improving the aesthetic value.

- Avenue Plantation

1. Trees with colonial canopy with attractive flowering
2. Trees with branching at 7 feet and above
3. Trees with medium spreading branches to avoid obstruction to the traffic
4. Fruit trees to be avoided because children may obstruct traffic and general movement of public

10.2.6 EMP for Socio-Economic Environment

The social management plan has been designed to take proactive steps and adopt best practices, which are sensitive to the socio-cultural setting of the region. The Social Management Plan for stadium project focuses on the following components:

- **Income Generation Opportunity during Construction and Operation Phase**

The project would provide employment opportunity during construction and operation phase. There would also be a wide economic impact in terms of generating opportunities for secondary occupation within and around the complex. The main principles considered for employment and income generation opportunities are out lined below:

- Employment strategy was provide for preferential employment of local people
- Conditions of employment would address issues like minimum wages and medical care for the workers. Contractors would be required to abide to employment priority towards locals and abide by the labor laws regarding standards on employee terms and conditions.

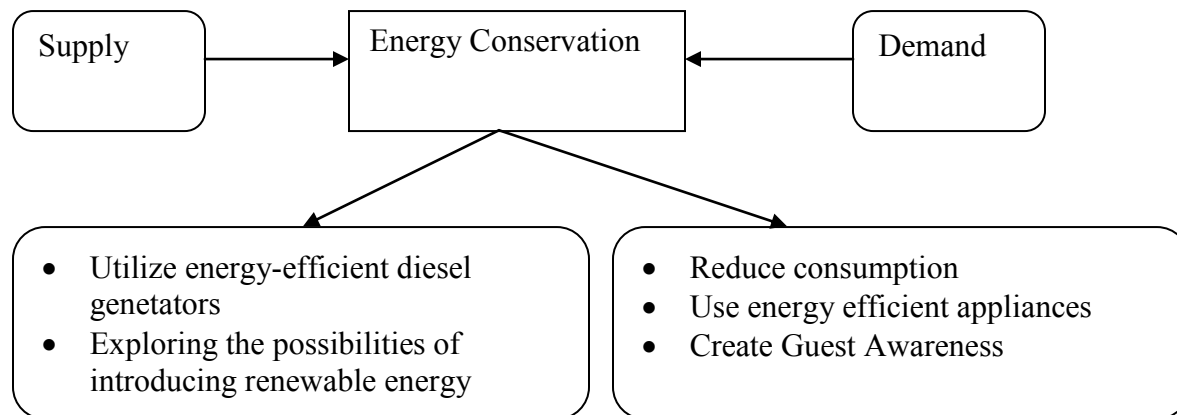
- **Improved Working Environment for Employees**

The project would provide safe and improved working conditions for the workers employed at the facility during construction and operation phase. With the proposed ambience and facilities provided, the complex was providing a new experience in living and recreations. Following measures would be taken to improve the working environment of the area:

- Less use of chemicals and biological agents with hazard potential
- Developing a proper interface between the work and the human resource through a system of skill improvement
- Provision of facilities for nature care and recreation e.g. indoor games facilities
- Measures to reduce the incidence of work related injuries, fatalities and diseases
- Maintenance and beautifications of the complex and the surrounding roads

10.2.7 EMP FOR ENERGY CONSERVATION

Energy conservation program was be implemented through measures taken both on energy demand and supply.



Energy conservation was be one of the main focus during the complex planning and operation stages. The conservation efforts would consist of the following:

❖ **Architectural design**

- Maximum utilization of solar light was be done.
- Maximize the use of natural lighting through design.
- The orientation of the buildings i.e. pavilions/stands was be done in such a way that maximum daylight is available.
- The green areas was be spaced, so that a significant reduction in the temperature can take place.

❖ **Energy Saving Practices**

- Energy efficient lamps were provided within the complex.
- Constant monitoring of energy consumption and defining targets for energy conservation.
- Adjusting the settings and illumination levels to ensure minimum energy used for desired comfort levels.

❖ **Behavioral Change on Consumption**

- Promoting public awareness on energy conservation
- Training staff on methods of energy conservation and to be vigilant to such opportunities.

10.3 ENVIRONMENTAL MANAGEMENT SYSTEM AND MONITORING PLAN

For the effective and consistent functioning of the complex, an Environmental Management system (EMS) would be established at the site. The EMS would include the following:

- An Environmental management cell.
- Environmental Monitoring.
- Personnel Training.
- Regular Environmental audits and Correction measures.
- Documentation – standards operation procedures Environmental Management Plan and other records.

10.3.1 ENVIRONMENTAL MANAGEMENT CELL

Apart from having an Environmental Management Plan, it is also proposed to have a permanent organizational set up charged with the task of ensuring its effective implementation of mitigation measures and to conduct environmental monitoring. The major duties and responsibilities of Environmental Management Cell is given below:

- To implement the environmental management plan.
- To assure regulatory compliance with all relevant rules and regulations.
- To ensure regular operation and maintenance of pollution control devices.
- To minimize environmental impact of operations as by strict adherence to the EMP.
- To initiate environmental monitoring as per approved schedule.
- Review and interpretation of monitored results and corrective measures in case monitored results are above the specified limit.
- Maintain documentation of good environmental practices and applicable environmental laws for a ready reference.
- Maintain environmental related records.

- Coordination with regulatory agencies, external consultants, monitoring laboratories.
- Maintenance of log of public complaints and the action taken.

Hierarchical Structure of Environmental Management Cell

Normal activities of the EMP cell would be supervised by a dedicated person who was report to the site manager/coordinator of the stadium. The hierarchical structure of suggested Environmental Management Cell is given in following Figure 6.

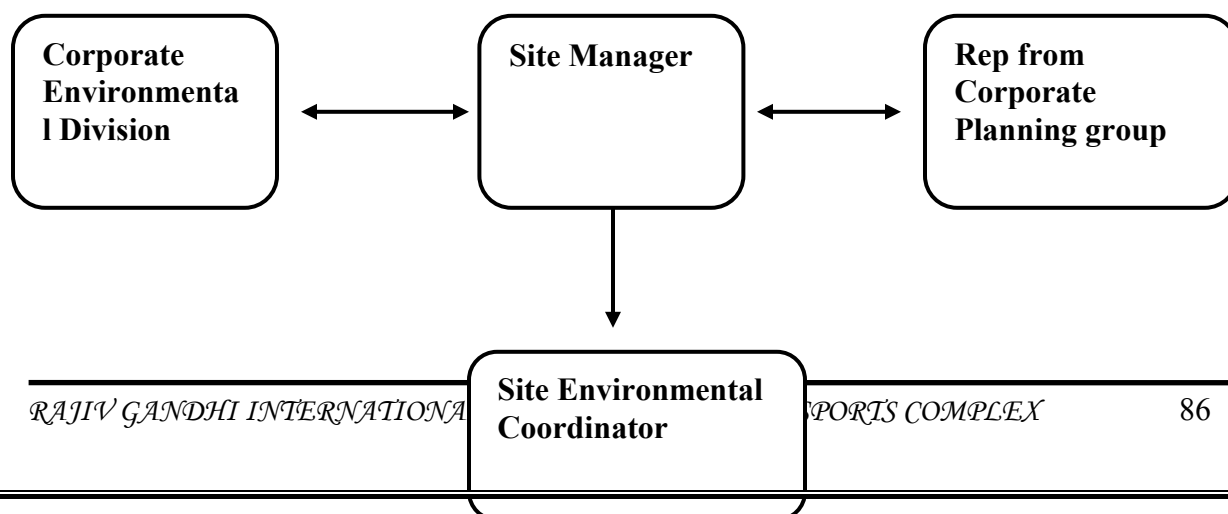


Figure 6: Environment Management Cell Structure

10.3.2 ENVIRONMENTAL MONITORING

The purpose of environmental monitoring is to evaluate the effectiveness of implementation of Environmental Management Plan (EMP) by periodic monitoring. The important environmental parameters within the impact area are selected so that any adverse affects are detected and time action can be taken. The project proponent was monitor ambient air Quality, Ground Water Quality and Quantity, and Soil Quality in accordance with an approved monitoring schedule.

Table 12: Suggested Monitoring Program for Stadium Project

S. No.	Type	Locations	Parameters	Period and Frequency
1.	Ambient Air Quality	Project Site	Criteria Pollutants: SO ₂ , NO ₂ , PM, CO	Twice in a Year as per EIA Notification 2006
2.	Groundwater (Potability testing)	Project site	Drinking water parameters as per IS 10500.	Twice in a Year as per EIA Notification 2006
3.	Ambient Noise	Project site	dB (A) levels	Twice in a Year as per

				EIA Notification 2006.
4.	Fresh water quality	Bore Wells	As per IS 10500 potable water standards	Twice in a Year as per EIA Notification 2006
5.	Soil quality	Project site	Organic matter, C.H., N, Alkalinity, Acidity, heavy metals and trace metal, Alkalinity, Acidity.	Twice in a Year as per EIA Notification 2006
6.	Waste Characterization	Commercial	Physical and Chemical composition	Daily
7.	Treated water	Outlet of STP	BOD, MPN, coliform count, etc.	Daily

10.3.3 Awareness and Training

Training and human resource development is an important link to achieve sustainable operation of the facility and environment management. For successful functioning of the project, relevant EMP would be communicated to:

Public and Contractors

Public must be made aware of the importance of waste segregation and disposal, water and energy conservation. The awareness can be provided by periodic Integrated Society meetings. They would be informed of their duties.

10.3.4 Environmental Audits and Corrective Action Plans

To assess whether the implemented EMP is adequate, periodic environmental audits was be conducted by the project proponent's Environmental division. These audits was be followed by Correction Action Plan (CAP) to correct various issues identified during the audits.