ENVIRONMENTAL MANAGEMENT PLAN

of

"INFRASTRUCTURE SECTOR OFFICE COMPLEX"
AMARAVATI, ANDHRA PRADESH

PICTORIAL VIEW OF INFRASTRUCTURE SECTOR OFFICE COMPLEX

MAY – 2018

PROJECT PROPONENT	ENVIRONMENTAL CONSULTANT
Andhra Pradesh Capital Region Development Authority Vijayawada, Andhra Pradesh	**B.S. ENVI-TECH PVT. LTD.,** Secunderabad, Telangana. NABET Accreditation: NABET/EIA/1316/RA002

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CHAPTER – 1: INTRODUCTION

1.0 INFRASTRUCTURE OFFICE BUILDING

ANDHRA PRADESH CAPITAL REGION DEVELOPMENT AUTHORITY (APCRDA) proposes to construct the Infrastructure Sector Office Complex for Government of Andhra Pradesh. The proposed building project is part of the Amaravati Capital City. The project is titled as "**Infrastructure Sector Office Complex**" forming Part of Survey Nos. on a Part of 99, 100, 101 of Kondamarajupalem Village and Part of 246, 253, 254, 259 of Rayapudi Village, Amaravati Capital City, Andhra Pradesh being developed by APCRDA, Andhra Pradesh.

1.1 GOVERNMENT OF INDIA – LEGISLATION - BUILDING/ CONSTRUCTION PROJECTS /AREA DEVELOPMENT PROJECTS AND TOWNSHIPS

Ministry of Environment, Forests and Climate Change (MoEF & CC) New Delhi, Government of India has issued Environmental Impact Assessment (EIA) Notification SO 1533, on 14th Sep 2006 and SO 3999 dated 9th Dec, 2016. As per the said notifications, all building/construction projects/area development projects and townships are identified as Category 'B', 8 (a)/8(b) which necessitates obtaining the Environmental Clearance (EC) from respective SEIAA. The notification has exempted the above category from Public Hearing. The Environmental Clearance for the Amaravati Master Plan had already been received from SEIAA-AP.

1.2 ENVIRONMENTAL MANAGEMENT PLAN

Towards complying with above statutory requirements of MoEF&CC, **APCRDA** has proposed to obtain the Environmental clearance for one of its proposed Building project titled **"Infrastructure Sector Office Complex"**, Amaravati Capital city, Andhra Pradesh. The proposed plot is falling in **Government Zone – S1** as per the Approved Master plan of Capital City – **'Amaravati'** by APCRDA. The following is the Environmental Management Plan formulated along with necessary budget for implementing the various mitigation measures.

1.3 PRESENT PROPOSAL

APCRDA proposes to construct the proposed building project titled "**Infrastructure Sector Office Complex**" on a plot area of 5.87 Ha. (14.50 Acres) forming Part of Survey Nos. on a Part of 99, 100, 101 of Kondamarajupalem Village and Part of 246, 253, 254, 259 of Rayapudi Village, falling in Government Zone – S1 as per approved Master Plan of Amaravati Capital City, Andhra Pradesh. The estimated cost of the project is Rs. 1058.85 Crores.

Total Plot area of the proposed project is 5.87 Ha. (14.50 Acres). The built-up area of project is 1,49,891.69 Sq.m. It is proposed to construct Infrastructure Sector Office Complex with Basement + Ground + 41 Floors & 4 Amenities Blocks. Proposed parking facility provided for two wheelers is about 450 and four wheelers it is about 500. The salient features of the proposed project are given in **Annexure – 1**.

Fig – 1 shows the Master Plan of Amaravati Capital City and the location of proposed Infrastructure Sector Office Complex in Govt. Zone – S1.

Fig – 2 shows the typical layout plan of Infrastructure Sector Office Complex

Fig – 3 depicts the perspective view of the proposed Infrastructure Sector Office Complex.

FIG -1- MASTER PLAN & MAP SHOWING LOCATION OF INFRASTRUCTURE SECTOR OFFICE COMPLEX

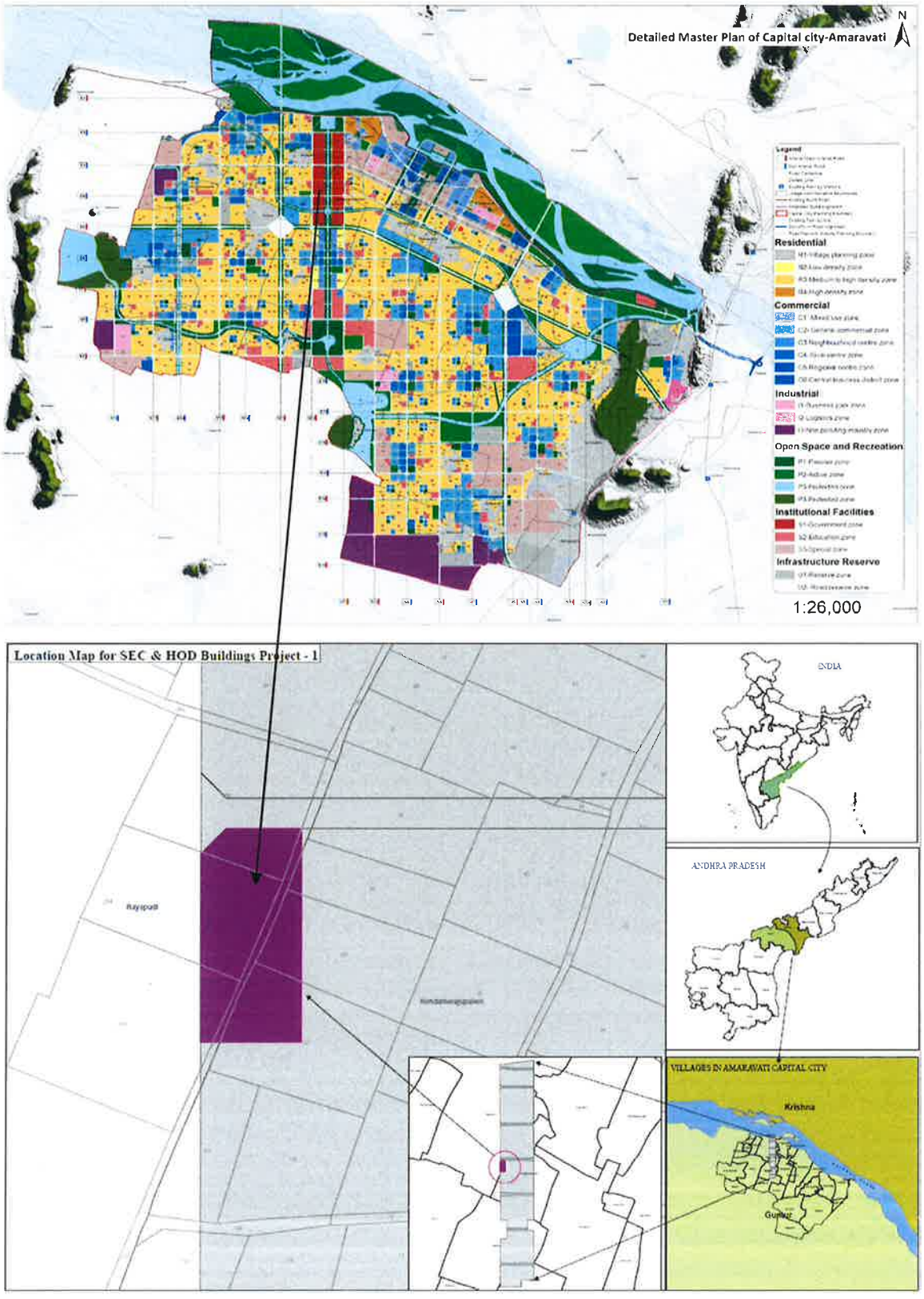


FIG – 2
TYPICAL LAYOUT PLAN
INFRASTRUCTURE SECTOR OFFICE COMPLEX

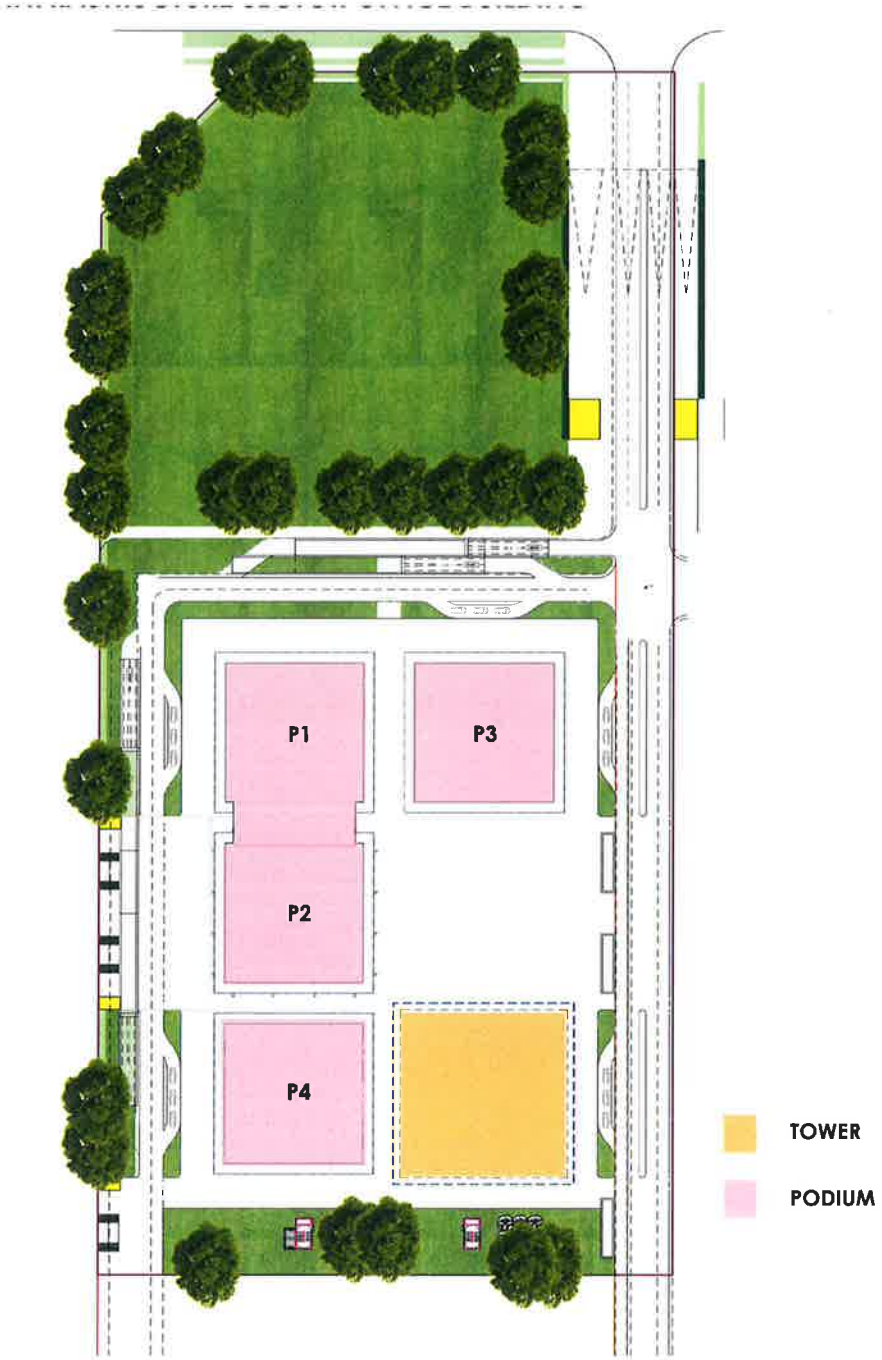


FIG -3

PERSPECTIVE VIEW OF INFRASTRUCTURE SECTOR OFFICE COMPLEX.

1.4 APPLICABLE ENVIRONMENTAL STANDARDS AND REGULATIONS

With respect to prevention and control of environmental pollution, the project is governed by the following Acts and Rules of MoEF&CC:

- Environmental Impact Assessment (EIA) Notifications SO 1533 dated 14-09-2006 and amendments thereof.
- Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.
- Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof.
- Environment (Protection) Act, 1986 amended 1991 and Environment (Protection) rules, 1986 and amendments thereof.
- The Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof.
- Plastic Waste Management Rules 2016, G.S.R. 320 (E) [18-03-2016]
- E-waste (Management) Rules, 2016, G.S.R. 338 (E) [23-03-2016] :

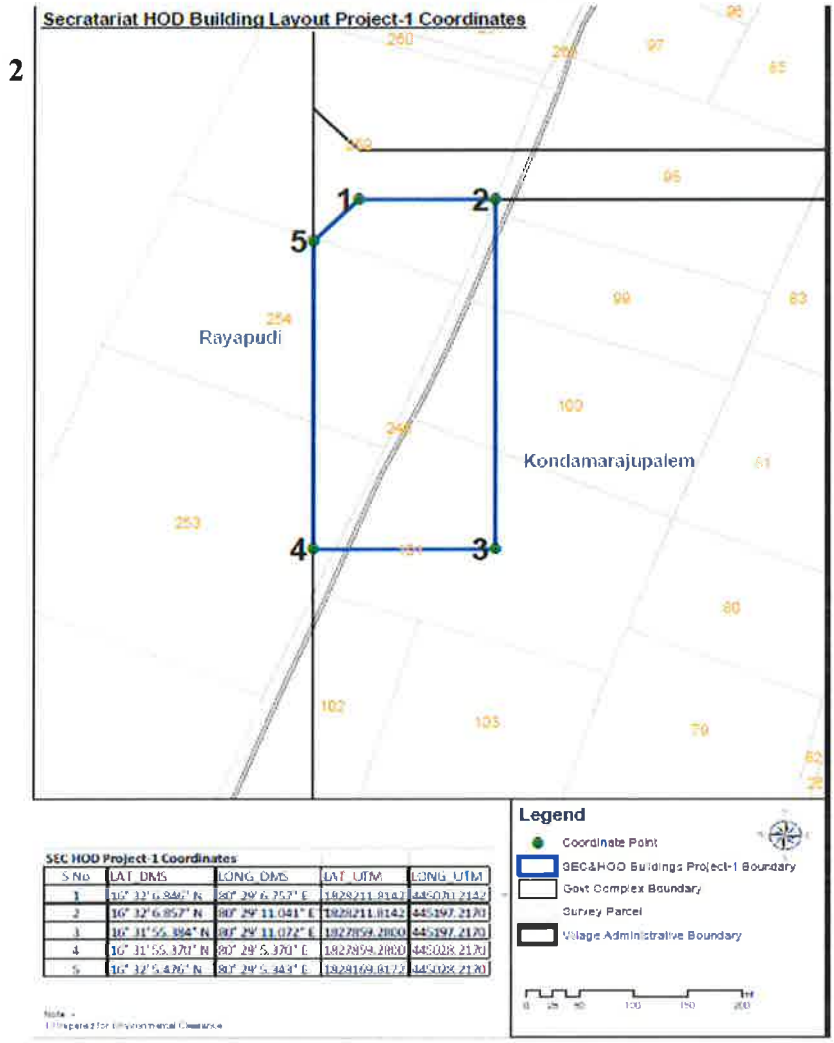
- Bio-Medical Waste Management Rules, 2016, G.S.R. 343(E). [28-03-2016]
- Construction and Demolition Waste Management Rules, 2016, G.S.R. 317(E). [29-03-2016]
- Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, G.S.R No. 395 (E)[04-04-2016]
- Solid Waste Management Rules, 2016, S.O. 1357(E) [08-04-2016]

1.5 LOCATION OF THE PROJECT

The coordinates of the proposed Infrastructure Sector Office Complex as per Master Plan of Amaravati Capital City are shown below in **Fig - 4**

FIG – 4

COORDINATES OF THE PROPOSED INFRASTRUCTURE SECTOR OFFICE COMPLEX



Salient features of 10 km radius in and around the project site are given in **Table – 1.**

TABLE – 1

SALIENT FEATURES OF THE PROJECT

FEATURE	DETAILS
Altitude	24 m above MSL
Temp., ^{o}C	9.4 - 47.2
Relative Humidity,%	35-83
Annual rainfall,	1031.6 mm
Nearest Water Bodies	Nakkaja Vagu – 6.9 km - N Krishna River – 3.2 km – NE Budameru Canal – 6.4 km – NE
Nearest Highway	The National Highway (NH-65) connecting Hyderabad - Vijayawada at a distance of 6.4 km in NE direction. The Nearest Major Road connecting from Rayapudi-Yerrabalem is at distance of 1.0 km in NE direction.
Nearest Railway Station	Krishna Canal Railway Station RS - 14.3 km - ESE
Nearest Industries	Vijayawada Thermal Power Plant – 9..2 km - NE
Nearest Village	Rayapudi – 1.0 – N Velagapudi – 2.4 km – ESE Nelapadu – 2.2 km – S Tulluru – 1.1 km – W
Nearest Town	Vijayawada - 17.6 km - E
Inter State Boundary	Andhra Pradesh – Telangana – 52.3 km – NW
Nearest Air port	Gannavaram (Vijayawada) – 33.2 km - E
Bird Sanctuary/National Parks	Uppalapadu Bird Sanctuary – 25.4 km – S
Nearest Forest	Kondapalle RF – 7.9 – NE Motadaka RF – 11.2 km – SW Karlapudi RF – 8.8 km – WSW Pedda Madduru RF – 8.9 km - W
Historical places	Undavalli Caves – 11.0 km - ESE

All distances mentioned in the above table are aerial distances from the Boundary of the project

1.6 RESOURCE REQUIREMENT

1.6.1 CONSTRUCTION PHASE

The duration of construction phase of the project is about 30 – 36 months from the date of commencement of the work after receipt of all statutory clearances.

The major requirements of the construction phase include:

a. Construction machinery
b. Power
c. Water
d. Manpower

A CONSTRUCTION MACHINERY

The typical construction machinery proposed to be used for construction of the project is given below.

1.	Bar bending	2.	Concrete Mixer truck
3.	Concrete Pumper	4.	Concrete vibrators
5.	Cranes – mobile	6.	Trucks
7.	Pile Driver	8.	Radial Arm saw
9.	Hammering	10.	Air Compressor
11.	Welding	12.	Pneumatic equipment

B POWER

About 1 MVA of power will be required for the project during construction phase, which will be sourced from 33 kV substation of APCPDCL or alternatively suitable number of DG set of 1 X 500 kVA will be utilized.

C WATER

The source of water for construction and operation phase is planned from Thulluru Lift Irrigation scheme being operated by Andhra Pradesh Irrigation Development Corporation (APIDC). Currently the Interim Government Complex (IGC) and other educational institutes like NID, VIT, SRM, AMRUTA are receiving the supply from the Thulluru Lift Irrigation scheme.

The water requirement during construction phase has been worked out considering concrete curing, Mortar mixing and curing for block work, Mortar mixing and curing for plastering, Floor finishes, Roof works/screed, sprinkling for dust suppression and Domestic use in

labour colony. The consumption of water per day during peak construction period is estimated to be about 600 - 700 kld.

D MANPOWER

The estimated manpower requirement during construction phase is given in below table.

	Male	Female
Direct	2000	1000
In-direct	400	150

Preference will be given to locals.

1.6.2 OPERATION PHASE

The major requirements in the operation phase are given below:

A POWER

The estimated total connected load is 5 MVA and the maximum demand is 4 MVA of power for the proposed Infrastructure Sector Office Complex and will be sourced from 33 kV substation of APCPDCL.

During periods of power outages, it is proposed to supply emergency power through 5 x 2000kVA and 1 x 1010 kVA capacity DG set.

B WATER SUPPLY

The total water requirement of the project during operation phase is estimated to be 289 KLD. This will be met from the Thulluru Lift Irrigation scheme which is in operation.

CHAPTER – 2: DETAILS OF PROJECT

2.0 DESCRIPTION OF THE PROJECT

The proposed project will be located in an area of 14.5 acres with a built up area of 1,49,891.69 sq.m. The construction will be completed in a period of 30 - 36 months. Adequate manpower and machinery will be used for construction. The details of the proposed project are discussed in detail under the following two heads.

a. Construction phase
b. Operation phase

2.1 CONSTRUCTION PHASE:

The major requirements in the construction phase will be

a) Sufficient area for storage of raw material
b) Power
c) Fuel
d) Water

2.1.1 STORAGE OF RAW MATERIAL

Sufficient storage space for storing the construction material has been identified within the plot. The list of raw materials proposed to be used for the construction project is presented below.

LIST OF MAJOR CONSTRUCTION MATERIALS STORED AT PROJECT SITE

Construction materials	Maximum storage (approx.)	Mode of storage
Reinforcement steel (MT)	12,000	Will be stored in open area
Structural Steel (MT)	12,225	
Cement (m^3)	28,900	Cement bags will stored separately under cover in bales.
Sand (MT)	49,000	Sand will be stacked under tarpaulin cover.

2.1.2 POWER

About 1 MVA of power will be required for the project during construction phase, which will be sourced from 33 kV substation of

APCPDCL or alternatively suitable number of DG set of 1 X 500 kVA will be utilized.

2.1.3 FUEL

High Speed Diesel (HSD) complying with BS IV specification would be used for DG sets, which shall be operated during the construction period.

2.1.4 WATER

It is estimated about 600 - 700 kld. of water is required during construction. This will be sourced from the Thulluru Lift Irrigation scheme

2.2 OPERATION PHASE

The proposed project will be built on a plot area of 5.87 Ha. (14.50 Acres). It is proposed to construct Infrastructure Sector Office Complex with Basement + Ground + 41 Floors & 4 Amenities Blocks. Estimated parking facility provided for two wheelers is about 450 and four wheelers are about 500.

2.2.1 POWER

The estimated total connected load is 5 MVA and the maximum demand is 4 MVA of power for the proposed Infrastructure Sector Office Complex and will be sourced from 33 kV substation of APCPDCL.

2.2.2 STANDBY POWER

During periods of power outages, it is proposed to supply emergency power through 5 x 2000kVA and 1 x 1010 kVA capacity DG set.

2.2.3 WATER SUPPLY SYSTEM

Total water requirement during the operation phase is about 289 kld which will be sourced from the Thulluru Lift Irrigation scheme.

CHAPTER – 3: ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan of the proposed project has been formulated keeping in view of current Environmental guidelines standard for Building Projects provided by Ministry of Environmental, Forests and Climate Change (MoEF&CC).

The following mitigation measures are proposed to synchronize the development of the project with the environmental protection. The construction phase impacts are mostly short term, restricted to the plot area and not envisaged on the larger scale. In the operation phase the environmental impacts are due to operation of the project and hence, the emphasis in the Environment Management Plan (EMP) is to minimize such impacts.

Following sections describe the environment management plan proposed for construction and operation phases.

3.1 ENVIRONMENTAL MANAGEMENT PLAN – CONSTRUCTION PHASE

3.1.1 LAND ENVIRONMENT

The following measures will be implemented to mitigate the impacts on land environment.

- Surplus construction debris will be used for backfilling or leveling at the site itself or sent to other areas of the Capital city for leveling or backfilling.
- Labour camp as per NBC code will be developed having proper potable drinking water facility and separate sanitation facilities for men and women
- First aid facility also will be provided at the construction site.

3.1.2 WATER ENVIRONMENT

The following measures will be implemented to control impact on water environment.

- ✓ Water requirement for construction is estimated to be 600 - 700 kld (peak requirement). This will be sourced from the existing

Thulluru Lift Irrigation Scheme. The water requirement during construction phase is mainly for concrete curing for block work, mortar mixing and curing for plastering, floor finishes, roof works/screed, sprinkling for dust suppression and domestic use.

- ✓ Domestic wastewater generated during construction phase will be disposed to a package STP.

3.1.3 AIR ENVIRONMENT

The construction activity will result in increase of fugitive dust.

The impact on air environment during the construction phase is due to:

- ✓ Emission of dust from clearing of the site.
- ✓ Emissions from vehicular movement.
- ✓ Emissions from handling of the construction material such as cement, sand and aggregate.

The following measures will be implemented to control dust emissions

- ✓ Construction material will be covered with tarpaulin sheets to prevent the material from being air borne.
- ✓ The construction site will be barricaded to prevent fugitive dust emission.
- ✓ The vehicle speed will be regulated.
- ✓ The workers will be provided with Personal Protective Equipment (PPE) such as nose masks and goggles to reduce impact on health.
- ✓ Periodical maintenance of construction machinery will be done to control emission.

3.1.4 NOISE ENVIRONMENT

The impact of noise during construction is mainly on the people who are working near sources. The following measures will be implemented to control noise levels.

- ✓ The earth moving equipment will be periodically checked and maintained for noise levels.

- ✓ Periodic maintenance of vehicles will be taken up to ensure vehicular emission is under control.
- ✓ There will be marginal increase in noise levels during construction phase which is temporary.
- ✓ Personnel Protective Equipment (PPE) such as ear plugs, fall protection equipment, High visibility safety vests with reflective striping, safety shoes and helmets will be provided to the construction workers.

3.1.5 FACILITIES FOR CONSTRUCTION WORKERS

During construction phase, a temporary labour colony will be constructed in the adjacent plot. The labour colony will be provided with drinking water facilities, separate toilets for men and women, package STP, Power supply. A first aid facility will be provided.

3.1.6 SAFETY ASPECTS

Safety is given utmost importance during the construction phase. All the construction workers are given proper training. It will be ensured that the workers use the Personal Protective Equipment given to them. Safety boards and placards in local language will be displayed, and construction zones will be barricaded.

3.2 ENVIRONMENTAL MANAGEMENT PLAN DURING OPERATION PHASE

The Environmental Management Plan to be implemented during operation phase is discussed under the following heads.

a. Land Environment
b. Water Environment
c. Air environment
d. Noise Environment
e. Solid waste generation

Details of management plan of each environmental component are given below:

3.2.1 LAND ENVIRONMENT

The proposed project will be located in an area of 5.87 Ha. (14.50 Acres). It is planned to develop landscaping in an area of 5.52 Acres (22359.41 Sq.m). Apart from the structure and parking area, lush landscaping will be done. The STP treated waste water will be used for landscaping purpose.

3.2.2 WATER ENVIRONMENT

WATER CONSUMPTION AND WASTEWATER GENERATION

Total water consumption in the operation phase is about 289 kld and the estimated waste water generation is 155 kld.

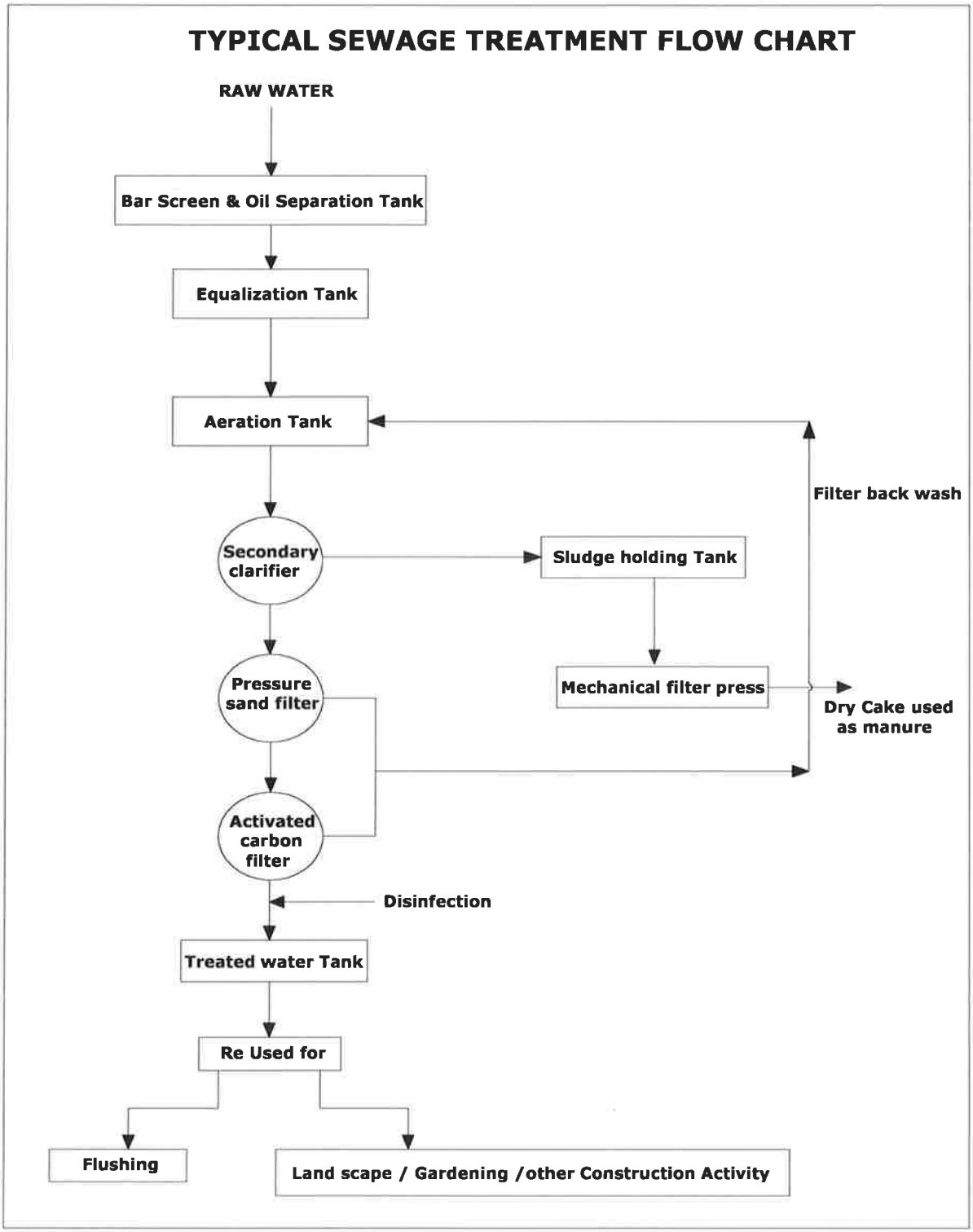
The wastewater generated from the Infrastructure Office building will be collected through network of pipes. The collected wastewater will be routed to the sewage treatment plant through pipes provided with inspection chambers. Wastewater generation from the project is about 155 kld. STP of 170 kld capacity comprising the following units is proposed is shown in **Fig – 5.**

a. Bar cum screen chamber
b. Oil & Grease Trap
c. Equalization Tank
d. Aeration Tank
e. Clarifier
f. Sludge Holding tank
g. Pressure Sand Filter
h. Activated Carbon Filter

About 132 kld of treated waste water will be reused for flushing and landscaping.

The details of the water balance and wastewater generation are given in **Annexure – 2.**

FIG - 5


TYPICAL SEWAGE TREATMENT FLOW CHART
RAW WATER
Bar Screen & Oil Separation Tank
Equalization Tank
Aeration Tank
Filter back wash
Secondary clarifier
Sludge holding Tank
Pressure sand filter
Mechanical filter press
Dry Cake used as manure
Activated carbon filter
Disinfection
Treated water Tank
Re Used for
Flushing
Land scape / Gardening /other Construction Activity

3.2.3 AIR ENVIRONMENT

The impact on air environment in the operation phase will be mainly due to the following

a. Vehicular movement
b. Operation of the DG sets which are the emergency power supply units

Vehicular movement

The emission from vehicular movement is mainly from the exhaust of two and four wheelers. However, all the vehicles will undergo pollution check to control vehicular emission.
The regular maintenance of vehicles will be done

Operation of the emergency power supply units - DG sets

5 No's of each of 2000 kVA and 1 No of 1010 kVA capacity of DG sets will be provided to meet emergency power supply requirement.

The following measures will be implemented for control of air pollution

- DG sets will be operated only during emergency and are not in continuous operation.
- CPCB approved DG sets conforming to noise and emission standard will be provided.
- Stacks of adequate height (3m above the building height will be provided to exhaust the flue gas emission.

3.2.4 NOISE ENVIRONMENT

DG sets will be provided with acoustic enclosure conforming to CPCB norms. Noise levels will be monitored as part of compliance.

3.2.5 STORM WATER MANAGEMENT - RAIN WATER HARVESTING

Rainwater harvesting is the accumulating and storing of rain water for reuse, before it reaches the Municipal/ External Storm water drain.

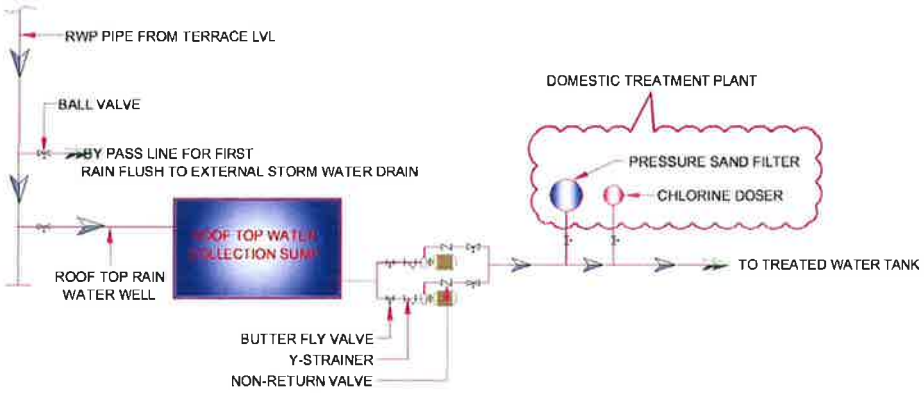
There are various techniques to achieve rain water harvesting. Broadly rainwater can be harvested for 2 purposes.

a) Store for ready use in containers/ tanks above or below ground (Rooftop Water Harvesting).
b) Charged into the ground for withdrawal later (ground water recharge).

- Rooftop Rain Water Harvesting is the technique through which rain water is captured from the roof catchments and stored in reservoirs.
- Usually the storm water that initially runs off an area will be more polluted than the storm water that runs off later, after the rainfall has 'cleansed' the catchment. The storm water containing this high initial pollutant load is called the 'first flush'.
- This polluted first flush will be discharging out to external storm water drain.
- Roof rain water from terrace is being diverted to Roof rain water collection sumps & used for domestic purposes after necessary treatment.

METEOROLOGICAL DATA & RWP

- Based on the annual rainfall at Vijayawada, as per the climatologically data, the intensity of rainfall is 100 mm/Hr.
- Design the Rooftop Water Sump, the intensity of rainfall considered as G.O.MS no.350
- Design the External drainage, the intensity of rainfall considered as 100 mm/hr.
- For Rain water harvesting & Recharging considered intensity of rainfall as 100 mm/hr.



Rooftop Rain Water Harvesting Flow Diagram

The design detail (As per local guide lines) is enclosed as **Annexure-3.**

3.2.6 GREENBELT DEVELOPMENT

Landscaping will be developed in an area of 5.52 Acres (22359.41 Sq.m). List of species proposed for plantation as per CPCB guidelines for this region are enclosed in **Annexure – 4.**

3.2.7 SOLID WASTE GENERATION

The solid waste generation from the project in the operation phase is mainly from the following areas:

a. Domestic Solid waste
b. Solid waste from sewage treatment plant

➲ **Domestic solid waste including Garbage**

The solid wastes generated during operation phase will consist of mainly papers, cartons, thermocol, plastics, polythene bags, glass, waste vegetables and foods etc.,
The quantity of solid waste generated from the Infrastructure Sector Office Complex is 1,565 kg/day.

The details of the solid waste generation calculation are given in **Annexure – 5.**

➲ **Sludge from waste-water treatment**

The STP sludge quantity (182 kg/day) will be conditioned and dried. The dried sludge cakes will be used as manure for greenery development.

SOLID WASTE DISPOSAL

The organic and inorganic waste will be collected and stored separately. These wastes (organic and inorganic) will be disposed to local Municipal Authority for further disposal till the solid waste facility of Amaravati Capital City is made operational.

3.2.8 ENERGY CONSERVATION

The following energy conservation measures are proposed to be implemented:

(a) Architectural Design
  i. Maximize the use of natural lighting through design
  ii. Passive solar cooling utilizing building shading.

(b) Energy Saving Practices
  i. Energy efficient light fixtures shall be used (LEDs).
  ii. Power factor of the complete electrical system shall be maintained close to unity. This will reduce electrical power distribution losses in the installation.
  iii. Energy Efficient V3F lifts
  iv. Higher efficient UPS shall be used (95%)
  v. Variable speed drives, wherever possible.
  vi. All ceiling fans shall be minimum BEE 3 star rated
  vii. Timers and Photo-electric sensors shall be used to switch ON/OFF lights used for landscaping
  viii. Providing LED lights everywhere as a part of conservation.

(c) Creating awareness to building users
  i. Sign boards shall be provided for promoting energy conservation where ever required
  ii. Training staff on methods of energy conservation and to be vigilant to such opportunities

3.2.9 UTILISATION OF SOLAR ENERGY

Provision shall be provided for Roof top solar PV installation for common area lighting and also for street lights.

3.2.10 FIRE FIGHTING SYSTEM

The required Fire protection systems such as fire extinguishers, hose reel, yard hydrant, automatic sprinkler system, manually operated electronic fire alarm system, UG tank, terrace tank and pumps with capacity will be provided as per NBC 2016.
Provision for overhead Fire Water reservoir pumping system and hydrant system will be provided as per as per NBC 2016 based on height of the building. External hydrants shall be provided at the street level from the Water supply distribution network as per norms.

- Fire Pumps & Accessories
- Fire Hydrant system
- Automatic Fire Sprinkler system
- Automatic Fire detection & alarm system
- Public Address system
- Portable Fire Extinguishers
- Gas Suppression system

It is to confirm that in any of the above mentioned suppression systems, it is NOT intended to use HALON based agents. However most of the cases WATER is used as base medium for suppression and in special case like Electrical panels, Computer Server room, it is proposed to use Gas Suppression system, where medium of suppression is FM 200 gas or NOVEC gas, the chemical composition of gases are "Hepta Fluro Propane (HFC-227ea) or Fluro Keton". Which is designed per NFPA 2000 standards.

Also Portable Fire Extinguishers are intended to be used per IS 15683 standards, majorly using ABC type extinguishers of different size/ capacity based on requirement.

FIRE ALARM & PUBLIC ADDRESS SYSTEM

- Conventional Fire Detection and Alarm System are envisaged with Manual call point & hooter to be provided at each floor.
- Hooter can be used as P.A. speaker during emergency.
- Tower will have a zonal panel located at stilt floor.
- The Zonal panels in each tower will be connected to Main F.A. Panel located at security gate for group of towers.
- Fire Alarm system shall be as per NBC 2016 and relevant IS codes.
- UPS system shall be provided for the entire system with minimum 60mins battery backup.

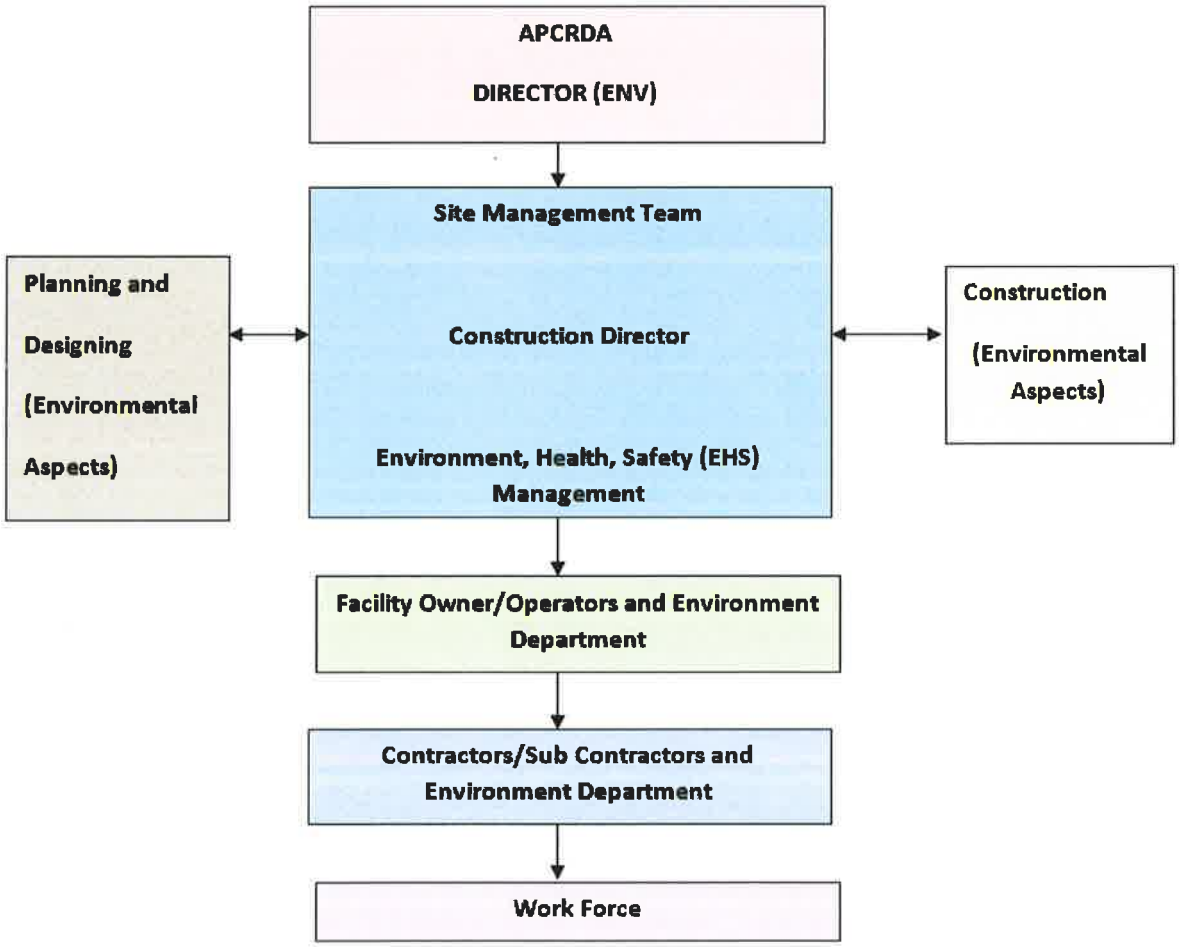
CHAPTER – 4: ENVIRONMENTAL MONITORING PROGRAMME & EMP BUDGET

4.0 ENVIRONMENTAL MONITORING PROGRAMME

Environmental monitoring programme has been drawn to ensure that all environmental resources which may be subject to contamination are kept under review for taking necessary measures to comply with the norms. APCRDA will take all measures to assess and analyze the data periodically.

APCRDA will establish an Environmental Cell to monitor the various environmental parameters and to comply with the Environmental Clearance conditions. The following is the organization structure for implementing the Environment Management Plan and monitoring of the various environmental parameters.

ENVIRONMENTAL CELL



4.1 CONSTRUCTION PHASE

Various components proposed for monitoring during construction phase are:

- Ambient Air Quality - PM_{10}, $PM_{2.5}$, SO_2, NO_2 and Ozone
- Fugitive Dust Level - Suspended Particulate Matter
- Ambient Noise Level – Day and Night Equivalent Noise levels

4.2 OPERATION PHASE

The various components proposed for monitoring during Operation phase are:

- Establish Automatic Ambient Air Quality &WeatherMonitoring stations network to monitor PM_{10}, $PM_{2.5}$, SO_2, NO_2 and Ozone
- Regular monitoring of ambient noise levels
- Regular monitoring water quality
- Regular monitoring waste water quality comprising inlet and outlet of STPs

4.2.1 AIR EMISSIONS

DG sets will be monitored for compliance to emission standards. APCRDA will ensure that prospective manufacturers will also comply with emission standards by way of routine inspections or audits and system of reporting the Environmental Compliance at scheduled intervals.

4.2.2 WATER / WASTE WATER

Regular monitoring of water and waste water quality as per CPCB/APPCB standards

4.2.3 STORM WATER NETWORK MONITORING

The effectiveness of the storm water drainage system depends on proper maintenance of all pipes/channels. Regular cleaning of drains will be done to remove accumulated sludge/sediments. The catch-pits linked to the storm water drainage system will also be regularly

cleaned to ensure their effectiveness. This exercise will be carried out during the pre- monsoon and at regular intervals.

4.2.4 GREENBELT DEVELOPMENT

APCRDA will monitor the green belt development as envisaged in the approved Master Plan for Amaravati Capital City. Trees survival rate will be monitored in the plantation areas and will be maintained at about 80% by replacement of dead trees.

4.3 ENVIRONMENTAL MANAGEMENT PLAN BUDGET

An amount of Rs. 6.69 Crores is budgeted as capital cost and Rs. 0.54 Crore/annum towards operation and maintenance cost for implementation of Environmental Management Plan. Details of the same are given below:

ENVIRONMENTAL MANAGEMENT PLAN (BUDGET)

S.No	Description	Capital Cost (Rupees in Crores)
1	Sewage Treatment Plant	0.68
2	Dual Plumbing	2.00
3	Landscaping	2.01
4	Storm water drains	1.00
5	Rain Water Harvesting	1.00
Total		**6.69**

ANNEXURES

ANNEXURE – 1

SALIENT FEATURES OF THE PROJECT

S.No	TITLE	DETAIL
1.	Project	**Infrastructure Sector Office Complex**
2.	Location	Amaravati government complex, Amaravati, Andhra Pradesh.
3.	Survey No.s	Part of 99, 100, 101 of Kondamarajupalem Village and Part of 246, 253, 254, 259 of Rayapudi Village
4.	Plot Area	58,696 sq.m/ 5.87 Ha/14.50 Acres
5.	Built-Up area	1,49,891.69 sq.m
6.	No. of Buildings	1 Tower and 4 Amenities Blocks
7.	Water Requirement	289 KLD
	Source	Thulluru Irrigation Scheme
8.	Power Requirement	4 MVA
	Source	APCPDCL
9.	DG sets	2000 kVA – 5No.s 1010 kVA – 1No

PERSPECTIVE VIEW OF INFRASTRUCTURE OFFICE BUILDING PROJECT.

ANNEXURE – 2

INFRASTRUCTURE SECTOR OFFICE COMPLEX

a. WATER REQUIREMENT (KLD)

S. No	Description	Number of persons	Domestic Water	Flushing Water	Total Water Requirement
1	Working Staff	3200	16	128	144
2	Visitors	2000	10	40	50
3	Swimming Pool	-	-	-	10
4	HVAC	-	-	-	35
5	Greenbelt requirement @ 22360 sq.m,	-	-	-	50
TOTAL		**5200**	**26**	**168**	**289**

Basis: Working staff (Domestic: 5 LPCD/Flushing: 40 LPCD)
Visitors (Domestic: 5 LPCD/Flushing: 20 LPCD)

b. Waste water generation

S. No	Description	Water Requirement	Waste Water Generation (80% of Domestic & Flushing)
1	Working Staff	144	115
2	Visitors	50	40
TOTAL		**194**	**155**

- **Total waste water generation = 155 KLD**
- **Proposed STP Capacity = 170 KLD**
- **Treated Waste Water from STP= 132 KLD**

Treated waste water is 132 m^3/day and will be totally utilized for flushing. Additional water required for flushing, Landscaping and HVAC Makeup is 121 m^3/day. Surplus treated wastewater generated from other buildings will be used for this purpose.

DESIGN DETAILS: (As per local guide lines):

DESIGN DETAILS

Land area say	58,696.00	Sqm
Garden area	5,869.60	Sqm
Open area	3,500.00	Sqm
Terrace area (Project-1)	2,209.00	Sqm
Other Podium / Hardscape / Driveways	47,117.40	Sqm

Rational formula for calculating runoff = Q = (C I A) / 360

Q = Runoff in m^3/sec

I = Intensity of rainfall in mm/ hr.

A = Drainage area in hectares.

C = Co-efficient of run off as below

Run-off co-efficient for various types of surfaces

Open grounds, unpaved street	0.30
Parks, lawns, gardens	0.20 to 0.50
Macadam roads, pavements	0.70
Asphalt pavements	0.85 to 0.70
terrace roof surface	0.95

Roof Top Rain water storage

Note:As per G.O. NO: 350, Total volume of structures shall not be less than 6 cum for each 100 sq.metres of roof top area.

Total Terrace area	2,209.000	Sqm
Total volume of water as per G.O NO:350	**133**	cum

The proposed capacity of Roof Water Collection Sump is 135 Cum and shall be diverted to STP through pumping and the same treated water used for flushing purposes.

Total Run-off : PODIUM AREA/HARDSCAPE & DRIVEWAY

Q = Runoff	0.458	m^3/sec
I = Intensity of rainfall	50.000	mm/hr
A = Drainage area in hectares.	4.712	Ha
C = Co-efficient of run off	0.700	

Data assumed:

Considering 15 min of rainfall

Volume of rainwater for recharging **412.277 Cum**

Total Run-off : GARDEN AREA

Q = Runoff	0.020	m^3/sec
I = Intensity of rainfall	50.000	mm/hr
A = Drainage area in hectares.	0.587	Ha
C = Co-efficient of run off	0.250	

Data assumed:

Considering 15 min of rainfall

Volume of rainwater for recharging **18.34 Cum**

Total Run-off : OPEN AREA

Q = Runoff	0.015	m^3/sec
I = Intensity of rainfall	50.000	mm/hr
A = Drainage area in hectares.	0.350	Ha
C = Co-efficient of run off	0.300	

Data assumed:

Considering 15 min of rainfall

Volume of rainwater for recharging **13.13 Cum**

Excess total volume of rain water in the site as 441.28 Cum

This run-off is being diverted to Rain water Harvesting sump/pits for the recharging and excess water sending to the external/existing storm water drain.

- The rain water storage provided based on the above design calculations.
- As per the Local guide lines required rain water storage is 135 cum
- Rain water storage provided for the proposed project is 135 cum.

External Storm Water Drainage:

- The drains to be designed in terms of run-off generated within the site only.
- Proposed to provide RCC Trench with perforated slab cover for site drainage system.

Basement Drainage:

- The drainage system for the basement at the lowest level is designed by providing R.C.C drain with perforated slab cover for collecting the floor wash water & Ramp water again that will be collected in the basement collection sumps & shall be pumped to External storm water drains.
- For Podium slab, drain out points to be provided in co-ordination with the landscape consultants.
- Provision of Subsurface drainage shall be planned in case of high water table. The same can be established from soil exploration or observations during excavation.

Brief on metering systems:

- Domestic water Meters:
  - Raw water from municipal / tanker supply shall be brought at approximately 1 m below ground level led into fire / Raw water storage tank.
  - Water meters shall be provided for each building to measure the Domestic water consumption.
  - Individual office will have a provision of water meter.
  - Also Separate meters shall be provided for Municipal water consumption.

- Recycled water Meters:
  - Sewage network comprises of horizontal & vertical stacks laid in the toilets and in the shafts. The vertical stacks are terminated into separate Soil & waste lines laid at Basement floor and then connected to STP located at the Basement.
  - After necessary treatment the treated grey water shall be stored in Recycled water storage tank.
  - Distribution of recycled Water to various fixtures in all user points is by Hydro pneumatic system.

- Land Scape Water Meters:
  - Land Scape water to be tapping off from the Recycled water sump with dedicated pump. Also metering system shall be provided for the same.

- Water Meters for Rain water reuse:
  - Water meters shall be provided for Rain water reuse.

- Water Meters for HVAC application:
  - Water meters shall be provided for HVAC cooling tower makeup water.

ANNEXURE -4

GREEN BELT SPECIES

S.No	Scientific Name	Common Name (Telugu)
1	*Adenanthera pavonina*	Bandiguruvenda
2	*Adina cordifolia*	Pasupa, kadamba
3	*Aegle mormelos*	Maaredu
4	*Alianthus excelsa*	Peddamaanu
5	*Anthocephalus chinensis*	----------
6	*Artocarpus heterophyllus*	Jack fruit tree
7	*Artocarpus lacucha*	Kammaregu
8	*Azadirachta indica*	Veepachettu
9	*Bridelia squamosa*	Bontha-yepi
10	*Butea monosperma*	Mooduga, palaasamu
11	*Casuarina equisetifolia*	Saravi sarugudu
12	*Cocos nucifera*	Narikelamu
13	*Cordia dichotoma*	Chinnanakkeru
14	*Dalbergia sissoo*	Errasissoo
15	*Delonix regia*	Seemasantkesula
16	*Emblica officinalis*	Amalakama, Raatausirika
17	*Erythrina variegata*	Baadita, Moduga
18	*Ficus benghalensis*	Peddamarri
20	*Ficus benjamina*	------
21	*Ficus elastica*	Indian Rubber tree
22	*Ficus glomerata*	Atti, Medichettu
23	*Ficus hispida*	Vettiyati
24	*Ficus religiosa*	Ashavathamu, Raavichettu
25	*Mangifera indica*	Maamidichettu,Maavi
26	*Millingtonia hortensis*	Indian cork- tree, Buch
27	*Phoenix sylvestris*	Peddaetta
28	*Mimuspos elengi*	Vakulamu
29	*Moringa oleifera*	Mulaga
30	*Pterygota alata*	--------
31	*Saraca asoka*	Asokamu
32	*Spathodea campalunata*	Indian Tulip tree
33	*Sterculia foetida*	Manjiponaku
34	*Syzygium cumini*	Neereedu
35	*Tamarindus indica*	Chintachettu
36	*Tectona grandis*	Adaviteeku
37	*Terminalia arjuna*	Yerramaddi
38	*Thespesia populnea*	Gangaraavichettu
39	*Kigelia africana*	Sausage tree
40	*Lagerstroemia speciosa*	Varagoogu
41	*Peltophorum Pterocarpum*	Copper pod tree

Shrubs & Small Trees		
1	*Acacia nilotica*	Nallatumma
2	*Abutilon indicum*	Botlabenda
3	*Achras sapota*	Sapota
4	*Acacia catechu*	Khadiramu
5	*Anona squamosa*	Seetaaphalam
6	*Anona reticulata*	Raamaphalamu
7	*Bambusa vulgaris*	The Golden bamaboo
8	*Barringtonia racemosa*	Kanapa
9	*Bauhinia racemosa*	Ari
10	*Bahinia varigata*	Devakanchanamu
11	*Caesalpinia pulcherrima*	Sankesula, Vatanarayana
12	*Calotropis gigantea*	Peddajilleedu
13	*Clerodendrum infortunatum*	Gurrapukattiyaku
14	*Cassia fistula*	Reelachettu, Vkoolaponna
15	*Citrus aurantium*	Mallikanarangi
16	*Duranta repens*	----------
17	*Hamelia patens*	Scarlet bush
18	*Lantana camara*	Puulikampa
19	*Lawsonia inermis*	Gorinta
20	*Sesbania sesban*	Samintha
21	*Tecoma stans*	Pachagotla
22	*Psidium gujava*	Goyya
23	*Trema orientalis*	Bundamuru
24	*Zizyphus maurtiana*	Reegu

ANNEXURE – 5

INFRASTRUCTURE SECTOR OFFICE COMPLEX

A.

	Number of Persons	Per-capita Waste Generation kg/person/day	Organic waste in kg/day	Inorganic waste in kg/day	Total waste in kg/day
Office Staff	3200	0.2	256	384	640
Visitors	2000	0.2	160	240	400
Street sweeping	5200	0.05	104	156	260
Garden waste	5.53 Acres	15 kg/Acres	83	-	83
TOTAL			**603**	**780**	**1383**

Source: NBC Code, 2016

B. Solid waste from STP = 182 Kg/day (@ 0.035 Kg/person/day)

SUMMARY OF SOLID WASTE GENERATION (Kg/Day)

Organic Waste Generation	:	603.0
Inorganic Waste Generation	:	780.0
STP Sludge	:	182.0
Total Waste generation	**:**	**1565.0**

SOLID WASTE DISPOSAL

- The organic and inorganic waste will be collected and stored separately, and will be disposed to local Municipal Authority for further disposal.

- The dried sludge cakes from STP will be used as manure for greenery development.