Pre-feasibility Report

Construction of New Integrated Terminal Building with Allied Works at Imphal International Airport, Imphal (Manipur)

NABET Accredited Environmental Consultant

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Existing Imphal Airport

Chapter 1

Existing at Imphal Airport

1.1 Background

Imphal Airport is the only Airport in the state of Manipur bordering Myanmar and is lying in the huge valley of Manipur. Imphal Airport (IATA: IMF, ICAO: VEIM) is the second largest airport built in the North-eastern region of India after Guwahati, and the third busiest airport in the north east region after Guwahati and Agartala, is located 6.5 km south-west of Imphal city, the capital of Manipur. Imphal International Airport connects north-eastern India with the country's major cities such as Bengaluru, Delhi, Kolkata, and with the Myanmar city of Mandalay. AirAsia India, Air India, Jet Airways, IndiGo and Alliance Air offer connection services from the airport to major cities and regional airports such as Agartala, Silchar, Aizawl and Jorhat with about 132 flight movements per week. The Imphal Airport belongs to Airports Authority of India and is suitable for "C'" type (A-320/321) of Aircrafts operations in all weather conditions.

It has been planned to develop Imphal Airport as an Intra-Regional hub with the facility of early morning/late night operations for better air connectivity of Imphal Airport.

The Airport was declared as International on 14th November 2013. As per the plan, AAI will develop the Airport to International Standards.

1.2 Location Details of Imphal Airport

Imphal airport approximately 6.5 km away from Imphal City. The geographical coordinates of airport are 24°45'36"N and 93°53'48"E. The location of Imphal Airport on google map is shown on **Figure 1.1.**10 km radius area around the site of the new integrated terminal building is shown in **Figure 1.2.**

1.3 Present Status & Facilities at Airport

At the Imphal Airport, the following facilities are available:

(a) Runway Dimension - 2746m x 45m
(b) Apron capacity - 3nos A -321 & 1 no. ATR-72 type aircraft at a time
(c) Terminal Building to handle 500 PAX. (250 arriving+250 departing)at a time
(d) Nav / Comns Aids like DVOR /DME, NDB, D-AITS, ILS,VHF
(e) ATC control Tower cum Technical Block and Fire Station of Cat-VII
(f) Night landing Facilities

Figure 1.1: Location of Imphal Airport on Google Map

1.4 Land Details with Imphal Airport

In 2009, on the south-east side of the runway, 644 acres of land has been handed over to AAI by state government for Construction of New Integrated Terminal Building and other associated services. Total land available with AAI for Imphal Airport 1102 Acres.

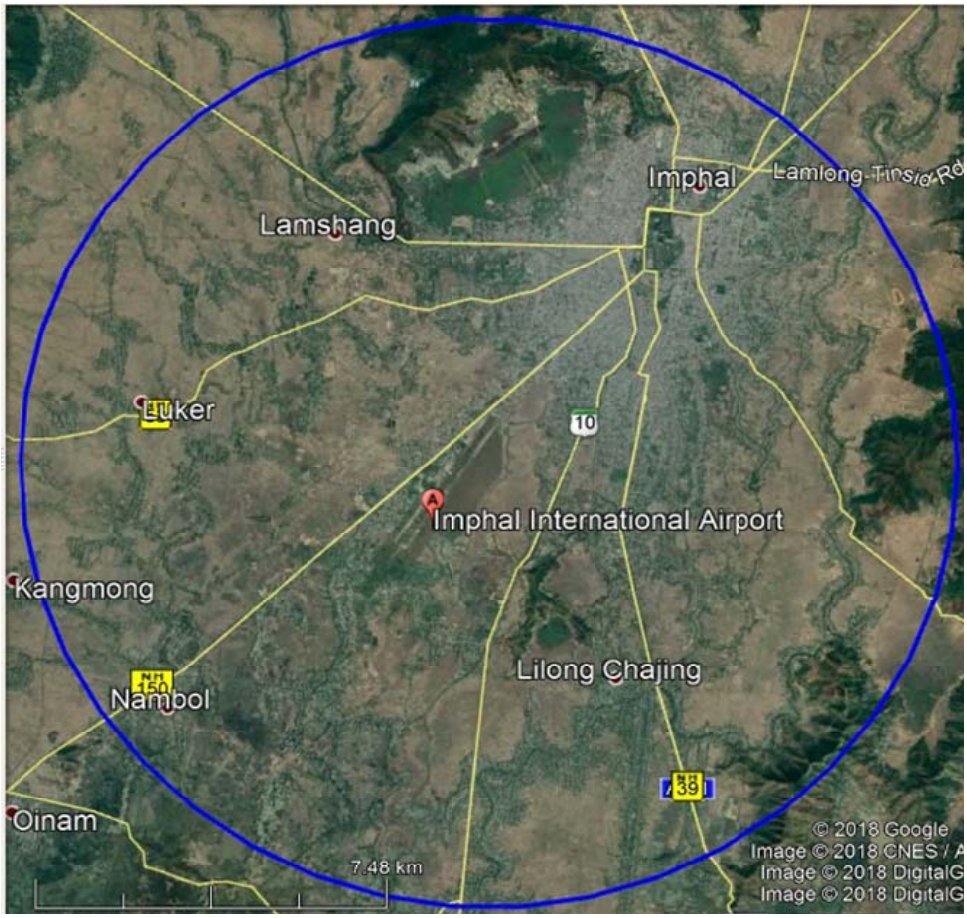

Figure 1.2: 10 Km Area on Google Map Around the Site

Chapter 2

Proposed Development At Imphal Airport

2.1 Need of Proposed Development at Imphal Airport

Existing Terminal Building (R.C.C Structure) at Imphal Airport has saturated. It was expanded in 2014, to cope up with the passenger growth. Annual capacity of the building is 0.6 million where, as the annual traffic of Imphal was 0.76 million in (2015-16). To overcome this gap and in view of the future traffic growth at Imphal Airport, AAI proposed the construction of a New integrated Building at Imphal. As per the Master Plan, Construction of New Integrated Terminal Building confirming to GRIHA 4 Star rating and associated facilities to be taken up in phase wise development.

2.2 Master Plan of Imphal Airport

The master plan for Imphal Airport is shown in **Figure 2.1.**

2.3 Proposed Development at the Existing Airport

At Imphal Airport, the following major works are proposed for development at the existing Airport:

- Construction of a centrally air-conditioned Modular New Integrated Terminal Building with all modern facilities and amenities. The Terminal Building with area of 28125 sqm shall be designed for 200 internationaland 1000 Domestic passengers at a time with swing operations.
- Construction of Apron suitable for (08) eight nos. parking bays for A321 as per lay out plan (Annex D) of approximate area 187m X 142m (22560 sqm) with 7.5 m shoulder on three sides suitable for operation of A321.
- Construction of two link taxiways of 144m X 23m with shoulder connecting the Apron with the Runway
- Construction of New Technical Block cum Control Tower of approx. 40 mtr. height and 4000 sqm area as per the design based on the requirements of the user Dte
- Other Allied Works including Electrical Work, CNS Works, IT & Airports Systems Works, etc.

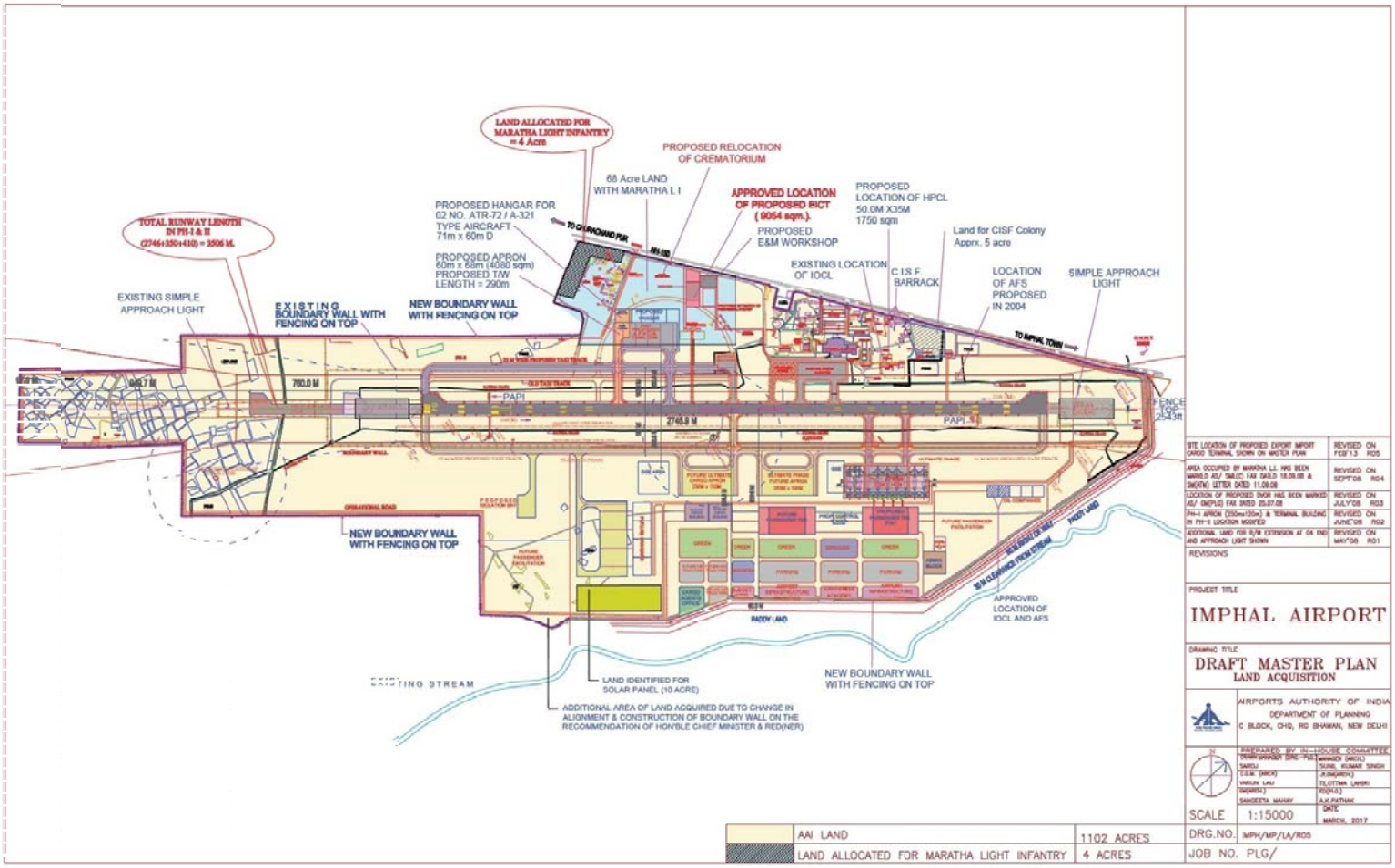

Figure 2.1: Master Plan for Imphal Airport

2.4 Scope of Work For Development at Imphal Airport

Detailed scope of work for development at Imphal Airport is given below:

2.4.1 New Integrated Terminal Building Conforming To GRIHA 4 Star Rating

Civil Works

i. Construction of a centrally air conditioned Modular New Integrated Terminal Building with all modern facilities and amenities as per the layout. The Terminal Building with all modern facilities and amenities as per the layout. The Terminal Building with area of 28125.00 sqm shall be designed for 200 international and 1000 Domestic passengers at a time with swing operations with the recommended area specifications and to match the level of service "B" as per IATA recommendations. The building should be provided with aesthetically appearing & soothing interior matching with the modern structure. Space planning should ensure that no dead space /area is created in the building.

ii. Departure Area, Arrival area, Security hold area and concourse are to be provided, with adequate no. of toilets for gents, ladies and differently–abled persons along with drinking water facilities. Suitable number of ramps to be provided for entry and exist of the differently abled persons in departure and arrival areas. Provision of battery operated buggies for senior citizens/ differently abled persons as per requirement.

iii. The design of Terminal Building should include Media planning, Retail area planning, F & B plan, etc. Overall planning of Building should capture local architectural features and it should be part of design features of terminal. The design should include the required arrangement for its regular maintenance so as to make it in-built part of execution. Solar power generation viz solar lighting, solar roofing system, etc. shall be provided. Maintenance friendly roofing & building façade system including provision of regular cleaning with maintenance hoists, hooks, etc including cat walk/ rope suspended platform/

gondola etc. to be provided. Latest Automation techniques in operations and building management to be incorporated.

iv. Departure Area

The Terminal Building with provision of departure concourse, check-in area with adequate number of check-in counters, back-up offices for Airlines, immigrations counters, baggage conveyor belts, queuing space with segregation railing, facilitation counters, weighing machines, counters etc.

v. Security Hold Area

a) Security hold area with Aerobridges and bus lounge with adequate seating arrangements and separate security check & holding area and associated facilities.

b) The Passenger frisking area in security hold with adequate space for locating required number of DFMDs, X-rays machines, frisking platform, Inspection tables for manual checking of hand baggage and adequate space/ room for security staff, isolated smoking area with proper ventilation in the security hold area.

vi. Duty Free /Retail Area/ Food & beverage Area

Creation of Retail Islands/ Shops along the passenger flow to encourage the generation of non-aeronautical revenue without affecting the passenger movement.

vii. Arrival Area / Baggage Claim Area

a) In the ground floor baggage claim area, adequate number of baggage conveyor belts of adequate size should be provided with sufficient space for storing baggage trolleys.

b) Adequate space should be provided be in the ground floor for required number of immigration and customs counters, back-up offices, space for storage of mishandle baggage for Airlines, Segregation railing and associated passenger amenities.

viii. Common Concourse Area

Provision for Snack Bar Counter, Drinking Water Facilities, Travel requisite & Curio Stall, Pharmaceutical Shops, Airlines Offices & Ticketing Counters, ATM/ Bank, Post Office, meet and Greet area, First Aid Room, Facilitation Counters, Caretaker Office with store, Airport Terminal manager office, Conference Room and other facilities at suitable locations.

ix. Airport Director's office with associated office space, Conference Hall, Retiring Rooms, staff toilets etc to be provided.

x. Development of four lane vehicular road from Terminal Building / Car parking with canopy covering two lanes in front of the Terminal Building on the city side and connecting the main approach road to the city.

xi. Provision of VIP/CIP lounges, with adequate number of chairs, furniture, furnishings etc in the departure lounge common concourse, check-in area, and security hold area and arrival lounge.

xii. Provision of water supply pumping arrangement system, Water Filtration, water cooler & R.O/U.V. Filters, Sewage Treatment Plant (STP) & Effluent Treatment Plant (ETP) as per norms and as per site conditions.

xiii. Horticulture-landscaping, drainage system, water supply, rain water harvesting etc.

xiv. Driver's canteen and toilet facility on the city side.

xv. Sub-station, A/C plant room and related service facilities.

xvi. Provision of acoustics for effective functioning of PA system.

Electrical Works

i. Internal and external electrification for Terminal Building Complex, associated buildings, Car Park and roads considering Energy Efficient solutions including renewable energy like Solar Power.

ii. Augmentation of main power supply including deposits to State Electricity Authorities etc., Substation Equipments, Procurement and Installation of standby DG sets of adequate capacity to provide essential 50 % power supply to terminal building and 100 % to Control Tower and Equipment Room and Fire Station.

iii. Central air-conditioning with provision of vertical air-conditioning concept & BMS. Unitary AC/Packaged A.Cs etc. of adequate capacity for Terminal Building. Provision to be made for the AC Plant Room vertical through AHU rooms, backup generators for essential services, etc.

iv. Procurement, installation and commissioning of conveyor belts with in-line X-ray inspection system and other equipment at departure area and inclined carousels at Arrival hall.

v. Provision of automatic sliding doors at exit & entry points of Terminal Building.

vi. Provision of water supply pumping arrangement system, Drinking water cooler and R.O/U.V. filter Passenger Terminal Building.
vii. Fire detection, alarm and protection system with Fire Control Room, Fire Hydrants & water sprinklers system as per standards along with Fire Extinguishers.

viii. Escalators & Elevators with matching staircase.

ix. Provision of Passenger Boarding Bridges (PBB) attached to fixed finger rotunda for the specified parking stands.

x. Provision of adequate number of Signages of world class standard, inside and outside the terminal building, car park area & City side approach road and air side area for guidance of passengers and visitors.

Airports Systems

i. Public address system and Voice alarm Systems with car calling system.

ii. Surveillance Close circuit TV system (SCCTV) with camera coverage of all areas of airport and provision of adequate number of close circuit TV monitors, in the Terminal Manager Room, Security Control Room, APD Office etc.

iii. Provision of Flight Information Display System (FIDS) with adequate number of Plasma TVs in all areas of departure, arrival, security hold area, Restaurant, VIP Room and air side & city side of Terminal Building for passenger facilitation.

iv. Provision of adequate number of inline XBIS (CTX Based) machines for scanning Registered Baggage (RB) / and XBIS for Hand Baggage (HB), including provision of required number of ETDs, DFMDs & HHMDs, as per BCAS norms.

v. Provision of adequate no. of VHF FM Sets (Walkie- Talkes, Base Stations & Mobile Stations).

vi. Provision of telephone Exchange/ digital EPABX/ IP EPABX system for Terminal Building including telephone/ intercom instruments, wiring etc.

vii. Provision of Equipment room cum workshop, UPS cum Battery Room, In-Line XBIS Equipment Room, In- Line XBIS Operator with Supervisor Room and CCTV Control Room with air conditioner.

IT System

i. Computer cable data networking.

ii. Passive and Active networking components such as OFC, UPT cabling, Routers, Core & Access switches and accessories. Provision of Raceways, cable trays and conducting and cabling. This should serve the requirement of CCTV & FIDS also.

iii. Server room and adequate space for keeping network switches along with electrical power points & UPS.

iv. Access Control System as per BCAS requirement.
v. Provision of Internet, VPN Bandwidth, Wi-Fi system.

Security Systems:

i. Fortified Nakas at Approach/Exit Road.
ii. Fortified Morchas and tyre-killeres at NAKAS.
iii. Perimeter road and Perimeter lighting.
iv. Watch Towers
v. Explosive Disposal Area or Cooling off Pit
vi. Security Operation Control Room
vii. Aerodrome Committee Control Room
viii. Santry Post at Access Control Point of vehicles Integrated Control Room for ASG/APSU in the terminal building having landside –airside access
ix. Crash Rated Electro – Hydraulic Bollard System
x. Crash Rated Electro – Hydraulic Tyre Killer
xi. Crash Rated Electro – Hydraulic Road Blocker

Miscellaneous Civil Works:

i. Provision of water storage and water supply, pump house for overhead water tanks and sump etc. for terminal building preferably by rain water harvesting system.

ii. Construction of sewerage treatment plant of adequate capacity (as per the requirement) with facility for future expansion.

iii. Construction of electrical sub-station building for housing DG sets, stepping down main power supply, transformers etc., Storage facility for diesel, equipment, spares parts etc.

iv. Provision of gates to segregate air side and city side area with security guard posts at the entry gate in consultation with ATM and Security Dtes.

v. Construction of approach road from fire station to runway and apron through shortest distance.

vi. Construction of CCR room at appropriate location as per Master Plan.

vii. Procurement of furniture, chairs 100% of Dep. PH (i.e. 10% for check –in and 90% for Sec. Hold), 10% of Arr. PH and baggage trolleys 60% of total PH. And adequate No. of Dust bins & Planters.

viii. Provision of covered drains and culvert (Pipe/Box) at appropriate location in the operational / non-operational area for crossing of electrical, communication cables, draining of storm water from runways, apron, terminal building and car park area.

ix. Horticulture and gardening works on city and airside.

x. Construction of 4 lane approach road from city main road upto the terminal building and internal circulation roads.

CNS Works:

i. Provision of communication and navigation aids including calibration and commissioning as per the requirement for VFR operations by CNS Dte., at the location indicated in the master plan.

Commercial Works:

Provision of CUSS and CUTE Systems.

2.4.2 Construction of Apron For 8 Nos. Parking Bays ForA321/B737-800/Q-400 Type Of Aircraft, To Parallel Taxiways And For Link Taxiways.

Civil Work

I. Construction of Apron suitable for (08) eight nos parking bays for A321 as per lay out plan (Annex D) of approximate area 187m X 142m (22560 sqm) with 7.5 m shoulder on three sides in Ph-I strength suitable for operation of A321 and strength of shoulder other than N-W side should be made of full strength to keep a provision of future extension of Apron.

II. Construction of two link taxiways of 144m X 23m with shoulder connecting the Apron with the Runway.

III. Provision of fillets at intersection of Taxiways with Runway and Apron for A321 type of aircraft.

IV. Development of Taxiway strips and grading of surrounding areas up to boundary wall as per DGCA CAR/Annex-14 specifications.

V. Provision of Apron, Taxiways, mandatory instruction marking and information markings as per DGCA CCAR/ Anex-14 specification.

VI. Provision of drainage system for the apron connecting the main storm water drains and culverts below the Taxiways or portions of Apron wherever required.

VII. Provision of hard stand for ramp equipment with mandatory clearances and three lane service roads between the Apron and the Terminal Building.

VIII. Provision of Pipe lines for future installation of fuel hydrant system.

Electrical Works:

I. Provision of Visual Docking Guidance Systems for parking stands with PBBs and remote nose – in stands.

II. Provision of Apron Edge Lights, Taxiway Edge light and lighted mandatory information/information Signs, etc. including cabling works.

III. Provision of high mast Apron Flood Lights to meet the required illumination standards along with raising and lowering device for easy maintenance. At appropriate locations without infringing apron safety lines/ clearance area for safety of aircraft operating on the apron with power-in/push-back parking stands.

2.4.3 Construction Of New Control Tower Cum Technical Block:

i) Construction of New Technical Block cum Control Tower of approx. 40 mtr. height (subject to NOC by ATM Dte.) and 4000 sqm area as per

the design based on the requirements of the user Dte .at the location indicated in the Master Plan.

2.5 Cutting & Filling

For construction of the proposed facilities at the Imphal Airport, tentatively 120000 cum filling will be required, which will be procured in authorized quarries.

2.6 GRIHA Rating

It is proposed that all works necessary will achieve 4 stars GRIHA Rating. GRIHA is an acronym for Green Rating for Integrated Habitat Assessment. GRIHA is a rating tool that helps to assess the performance of their building against certain nationally acceptable benchmarks. It evaluates the environmental performance of a building holistically over its entire life cycle, thereby providing a definitive standard for what constitutes a 'green building'. The rating system, based on accepted energy and environmental principles, will seek to strike a balance between the established practices and emerging concepts, both national and international.

2.7 Parking Facilities

The car park facility will be provided for cars, buses, separate car/ scooter park area.

2.8 Power Requirement

Total power requirement is estimated as 5250 kW for new terminal building and other facilitiesat Imphal Airport. For the power back-up, four DG sets of 1000 kVA, each will be provided to meet the power requirement in the event of grid power failure.

2.9 Project Cost

The estimated cost of the proposed development at the Imphal Airport is Rs 727Crores.

Chapter 3

BMS System for the Proposed IntegratedTerminalBuilding

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BMS System for the Proposed Integrated TerminalBuilding

3.1. HVAC Requirement

HVAC System requirement at the proposed Integratedterminal building at existing Imphal Airport is estimated as 700 TR. To meet the air conditioning requirement, three screw chilling tower unit of 350 TR will be installed. Microprocessor based control system (BMS) will alsoinstalled at the Airport.

3.2 Design Considerations

The system proposal is designed to fulfil the following objectives:

- Low capital cost.
- Energy efficient throughout the varying load patterns
- Minimum power demand.
- Providing required Indoor air quality (IAQ) with reduced operating cost.
- Maximum flexibility of operation.
- Use of highly responsive control system (BMS) to optimize system functioning.

3.3 Capital Cost

The selection of equipment is designed to achieve the lowest capital cost consistent with energy efficient modern technology. The choice of equipment and specifications will provide the best possible system at a reasonable price.

3.4 Energy Efficient

The air conditioning systems operate between a minimal demand of 40% and

up to a maximum demand of 95% for a major part of the year. Hence, the selection proposed is such that the overall power requirement remains consistent with the demand, avoiding all possible waste.

3.5 Flexibility

The use of air cooled chilling units has been proposed instead of water cooled chillers.

This will avoid use of cooling towers and condenser water pumps, thereby reducing by nearly 40% the number of equipments which have to be operated and maintained.The chiller will be fitted with air cooling pads to reduce power consumption and save 80% water as compared to water cooled system, the cooling pads will be used whenever Ambient temperature crosses 35°C. The use of air cooled chillers will thus simplify operation and also avoid worrying about availability of water in cooling towers at all times. There will be separate pumps for secondary circuit. In addition each floor will have independent Air handling Units (AHUs).This will ensure that the equipment in operations is as per demand without any wastage of power.

3.6 Control System

It is proposed to use microprocessor based control system (BMS) to optimize plant operation and minimize running costs.

The various systems are selected carefully to provide maximum benefits at a reasonable cost.

The BMS will also be used to integrate other services and control external lighting and monitor other services.

3.7 System design (Ventilation & Miscellaneous)

The ventilation of D.G. room and pump will be through the use of axial flow fans on the opposite side.

The HVAC plant room will be ventilated using propeller type fans.

3.8 Building Management System (BMS)

It is proposed to provide a Microprocessor Based Building Management and control system (BMS) for HVAC system and other services to create an intelligent building.

Chapter 4

Water Supply, Sewerage, Drainage And Fire Fighting

Chapter 4

Water Supply, Sewerage& Drainage

4.1 Introduction

The integrated terminal building will have Ground floor and first floor. Ground floor is used for air travels facilities like, ticketing, baggage claim, domestic and international arrivals, shopping, public concourse, ticket checking counters and immigration etc. First floor is used for departure lounges, security hold restaurant, and offices etc. According to National Building Code 2016 the complex falls under assembly building as per occupancy.

4.2 Expected Population per Day at Airport and Water Requirement

The expected population per day at the Airport is given below:

Arriving and Departing Passengers	-	7200
Airport staff	-	300
Drivers/Visitors	-	360

Water required as per National Building Code 2016 is given below.

International & Domestic terminal Staff	-	70 Litres/Head/Day
Air Passenger	-	70 Litres/Head
Floating population	-	15 Litres/Head

Table 4.1: Water Requirement for Proposed New Integrated Terminal Building

S. No.	Description	Total Population at Peak hour	Daily Population (Considering 6 hr Peak population per day)	LPCD for Potable water	LPCD for Flushing water	Potable Water Demand	Flushing Water Demand	Total Water Demand (l/day)
1	Terminal Building (Passenger Load)	**1200**	**7200**	**40**	**30**	**288,000**	**216,000**	**504,000**
2	Permanent Terminal Building Population (AAI, Airlines & O&M, Vendors)		**300**	**25**	**20**	**7,500**	**6,000**	**13,500**
3	Visitors etc.		**360**	**10**	**5**	**3,600**	**1,800**	**5,400**
	TOTAL in litre/day					**299,100**	**223,800**	**522,900**
	TOTAL in cubic metre /day					**300**	**224**	**524**
4	**Soft Water Demand for HVAC**							
	Soft water Make-up requirements for Cooling Towers (As per HVAC consultant)							200000
	Say in (Cum/day)							**200**
5	**Horticultural Water Demand**							
	30 % of Total Site area (Total Site =20 Acres @ 15,000 ltr./Acre)							90000
	Say in (Cum/day)							**90**
	Total Water Demand For All Purposes In m^3/day							**814**

Table 4.2: Water Balance Chart for New Integrated Terminal Building

A	**Total Water Demand**	**(In m^3/Day)**
1)	**DOMESTIC WATER DEMAND**	
(i)	Total Potable Water Demand	300
(ii)	Total Flushing Water Demand	224
	Total Domestic Water Demand	**524**
2)	Total Horticulture Water Demand	**90**
3)	Total Soft Water Demand	**200**
	Grand Total of Water Demands for all Purposes	**814**
B	**Total Available Treated Effluent for Recycling**	**(In m^3/Day)**
1)	Total Sewerage Generated (Total Domestic Demand x 0.9)	**472**
2)	Total Treated Effluent Water Available from STP for Recycling (90%)	**425**
	Total of Available Water for Re-use	**425**
C	**Total Utilized Treated Effluent**	**(In m^3/Day)**
1)	Total Amount Re-used for Flushing Water Purposes	**224**
2)	Total Amount Re-used for HVAC Purposes	**200**
3)	Balance Amount Reused for Horticulture Purposes	**90**
D	**Balance Water Requirements**	**(In m^3/Day)**
1)	**Daily Fresh Water Required per Day for Potable Purpose and Horticulture**	**389**
	Total Daily Net Fresh Water Demand in MLD	**0.39**
	Excess treated effluent disposed outside the site in m^3/day	**0**

4.3 Sources of Water

Water requirement will be met through rain water harvesting pond.

4.4 Sanitary Fixtures And Toilet Accessories

Water Closet: All water closets will be wall hung with concealed dual flushing cistern and in lodders and staff toilets WC will be provided with dual flushing cistern. Under counter/ circular above counter wash basins with battery operated auto sensor pillar taps will be provided.

- Flat back wash basins with CP brass self closing pillar tap will be provided in lodders and staff toilets.
- Semi stall urinal with battery operating auto sensor flush valves.
- Frosted Glass urinal portion with metal clips.
- CP adjustable shower with Diverter and spout in rest room's and VIP toilet.
- Vitreous china recess toilet paper holder.
- Automatic soap dispenser on wash basins (Stainless steel).
- Automatic air purifier (Stainless steel).
- Toilet tissue paper holder (Stainless steel).
- Automatic electrically operated hand drier (Stainless steel).

4.5 Water Distributions Pipe and Fittings

G.I. / composite Pipe and fitting for hot and cold water. Heavy class G.I. pipe and fitting in shaft and under floor. All external under ground water pipe will be cast iron Class LA conforming to IS:1536 with specials and lead joints.

4.6 Sewerage Treatment and Disposal

As per water balance diagram, 472kl/d sewage will be generated after the operation of new integrated terminal building which will be treated in STP of capacity 500 kl.

4.7 Sewage Treatment Plant

Sewage generated from the airport will be treated in well designed Sewage Treatment Plant (STP). It is proposed to installed Moving Bed Biofilm Reactor (MBBR) type sewage treatment plant of 500 kl capacity.

Design of STP

Approximately 472 kl per day sewage/waste water will be generated from the proposed airport. Sewage will be collected and treated in well-designed sewage treatment plant. After meeting stipulated standards, treated waste water will be utilized for flushing, HVAC and irrigation of greenery and landscaping.

Details of Sewage Treatment Process

The sewage from the proposed airport shall be collected by gravity into the collection tank/equalization tank of Sewage Treatment Plant (STP) via perforated screens to prevent the large particles into system. In equalization tank, pH and temperature of incoming sewage will be equalized. The sewage from equalization tank will be pumped to Moving Bed Biofilm Reactor (MBBR) reactor for biological treatment, where required quantity of air in presence of MBBR system will be supplied to meet the oxygen requirements by mean of blower and fine bubbles air diffusers. After MBBR reactor, sewage will flow by gravity to settler (tube type) where sludge will be settled at the bottom due to gravity. This settled sludge will be recycled through sludge pump to MBBR reactor to meet the mixed liquor suspended solids (MLSS) requirement, excess sludge will be discharged through filter press for final disposal. Final discharge of waste water from settler will be collected in chlorine contact tank, where some chlorine will be dosed for disinfections of treated waste water. Then, treated sewage will be pumped for tertiary treatment through duel media filter or it will be passed through or it will be passed through Ultraviolet (UV) disinfection system. Treated sewage will meet the norms prescribed by Gujarat Pollution Control Board and will be utilized for flushing, HVAC and for irrigation of greenery & landscaping purpose. Treated wasted water will not be discharged out side the boundary of proposed airport.

Design Parameters

Design parameters for proposed STP are given below:

Sl.	Parameters	Inlet	Outlet
1.	BOD	300 mg/l	Less than 20 mg/l
2.	COD	400 mg/l	Less than 150 mg/l
3.	Oil & Grease	50 mg/l	Less than 10 mg/l
4.	TSS	200 mg/l	Less than 50 mg/l
5.	PH	6.5-8.5 mg/l	6.5-8.5 mg/l

No treated waste water will be discharged outside the airport. Unit wise description of the proposed STP is given below and shown in **Figure 4.1.**

Screen Chamber

Prior to the actual treatment of the wastewater, a screen chamber will be provided. In this chamber removable type mechanical bar screens will be provided for removal of various large size elements, such as paper, cloth, plastic etc, etc, which may hamper the satisfactory functioning of subsequent units of the STP, if not removed at early stages.

Oil & Grease Trap

The oil & grease trap will be provided to collect oil and grease trace coming with sewage. Collected oil & grease will be stored in a drum and disposed of in environmental sound manner.

Equalization Tank

As the quantity of the flow is non-uniform in nature, an equalization tank will have to be provided. By the provision of an equalization tank, wastewater characteristics will become homogeneous in nature and, therefore, better treatment can be achieved in the subsequent units of the STP. Diffused aeration will be provided in this tank to stir the contents of the tank completely.

MBBR Reactor (Biological Treatment)

Moving Bed Biofilm Reactor (MBBR) technology employs thousands of polyethylene biofilm carriers operating in mixed motion within an aerated wastewater treatment basin. Each individual bio carrier increases productivity through providing protected surface area to support the growth of heterotrophic and autotrophic bacteria within its cells. It is this high-density population of bacteria that achieves high-rate biodegradation within the system, while also offering process reliability and ease of operation.

This technology provides cost-effective treatment with minimal maintenance since MBBR processes self-maintain an optimum level of productive biofilm. Additionally, the biofilm attached to the mobile biocarriers within the system automatically responds to load fluctuations.

The bacteria/activated sludge grow on the internal surface of the carriers. The bacteria break down the organic matter from the waste water. The aeration system keeps the carriers with activated sludge in motion. Only the extra amount of bacteria growth, the excess sludge will come separate from the carriers and will flow with the treated water towards the final separator. The system can consist of a one stage or more stage system (see underneath schedule), depending on the specific demands. The specific bacteria remain in their own duty tank because of the fact that the carriers remain in only 1 tank, protected by screens.

A bio-film develops on the media, which move along the effluent sewage in the reactors. The movement within the reactors is generated by providing aeration with the help of diffusers placed at the bottom of reactors. This thin film on the media enables bacteria to act up on the bio-degradable matter in the effluent sewage and thus reduce the BOD/COD content in presence of oxygen from the air used for fluidization. Aeration will be done with the help of twin lobe blowers. The MBBR reactors will increase the oxygen content of the sewage and thus, will help in the growth of the micro-organisms required to reduce the BOD. These micro-organisms will consume the organic matter and will convert it into active biomass, better known as sludge. The waste water, laden with sludge, will be transferred to tube settler for sludge separation.

Secondary Settling Tank Followed by Pre filtration Tank

The sludge formed will settle in the secondary settling tank followed by pre filtration tank. The settled sludge will be discharged in the Sludge Collection Tank and would be dewatered using sludge press. The clear supernatant from the outlet of the tube settler will be discharged as treated waste water and will be passed on to further treatment for final polishing. HDPE/PVC low maintenance tubes will be provided for trouble free operation of the tube settler.

Sludge Filter Press

The sludge from the settling tank of the STP will be collected in the tank and will be treated in the sludge press. This will be 24 plates CI sludge press completes with its pump and accessories. In sludge press, the sludge in the form of liquid slurry is fed into the press and dry solid cake of sludge is taken out from it. These dry cakes are used as manure for green belt and landscaping.

Pressure Sand Filter

For final polishing of the treated waste water, a Pressure Sand Filter (PSF) will be provided. The PSF comprises of a MS Vessel having filtering media sand topping for filtration of supernatant treated sewage water and thus ensuring clarity of water.

Activated Carbon Filter

For tertiary treatment, an Activated Carbon Filter (ACF) will be provided. This will be MS constructed tank in which activated charcoal/carbon will be filled as adsorbing media. This will not only adsorb impurities but will also act as the polishing tank for the final treated waste water. The resultant water shall be clear, odourless and will be reused for horticulture purpose.

Ultraviolet (UV) Disinfection System

Ultraviolet (UV) disinfection will use a UV light source. UV-rays are energy-rich electromagnetic rays that are found in the natural spectrum of the sunlight. They are in the range of the invisible short wave light having a wavelength ranging from 100 to 400 nm.

UV light source is mounted so that water can pass through a flow chamber, and UV rays are admitted and absorbed into the stream. When ultraviolet energy is absorbed by the reproductive mechanisms of bacteria and viruses, the genetic material is rearranged and they can no longer reproduce. They are therefore considered dead and the risk of disease has been eliminated.

UV plant will have following features:

- Stainless steel construction
- Single lamp
- Long life of the UV Lamp

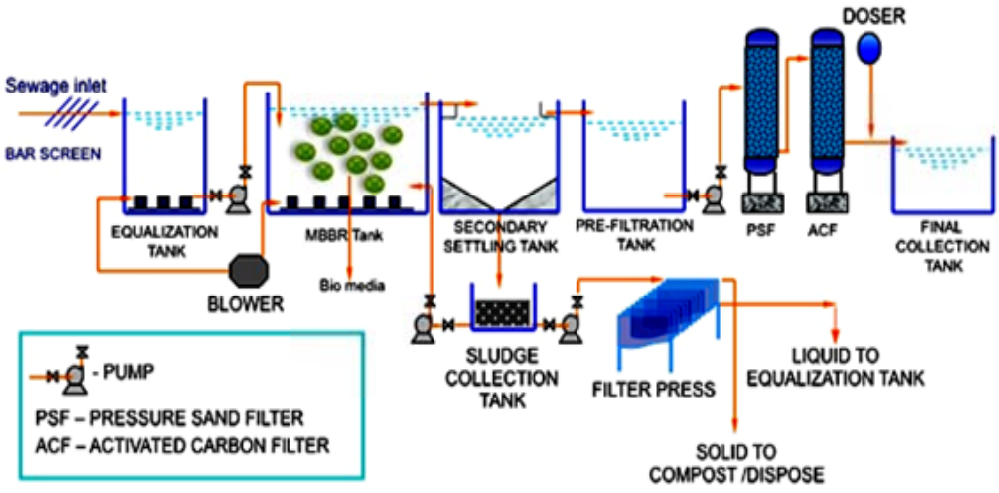

Figure 4.1: Schematic Diagram for MBBR Based STP

4.8 Rain Water Harvesting

Rainwater harvesting system for proposed terminal building will be developed based in Central Ground Water Board (CGWB) Guidelines and Construction Manual of Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India. Rainwater will be collected in the pond and reused to met the water requirement.

Chapter 5

Solid Waste Management

5.1 Solid Waste Generation

It is estimated that approx. 1575kg/d solid waste will be generated from the airport. From the new integratedterminal building, waste will be generated in the form of paper, plastics, polyethylene bags, and food waste, etc.

5.2 Solid Waste Management

The following measures will be taken for management of solid waste during operation phase of proposed airport.

- Solid wastes management will be carried out as per Solid Waste Management Rules, 2016.
- Wastes shall be collected in designated waste bins based on their types, placed at the strategic locations.

The solid waste handling and disposal services will be outsourced to authorized agency to ensure disposal of solid waste generated from the proposed airport. Solid waste generated in the aircrafts will also disposed off at the designated waste collection points from where the agency will pick up the garbage bags.

The agency will collect the garbage from designated bins, which will be spread over the area of proposed airport. The wet garbage of the aircrafts comprising of leftover food in the tray from the security gates of flight kitchens will be disposed off at the specified places. The collected garbage will be transported in covered container and will be arranged to dispose off after segregation of recyclable wastes as per provisions of Solid Waste Management Rules, 2016.. After collection of garbage, garbage bins will be disinfected every day by sprinkling disinfectant powder by the agency. Weekly washing of garbage bins will also be carried out by this agency.

After collection of waste, solid waste management plan to be followed by authorized agency is as given below:

- Segregation of recyclable and non recyclable wastes.
- Disposal of recyclable wastes for recycling.

- Composting of biodegradable organic of wastes for captive use
- Disposal of segregated wastes to common municipal waste landfill Site

Chapter 6

Energy Conservation

6.1 Energy Conservation Measures

During design and construction of new integrated terminal building at the Imphal airport necessary measures will be taken for conservation of energy in line with "Energy Conservation Building Code –2017" and "National Building Code 2016". The important energy conservation measures proposed for new integrated terminal building are described below:

- Integrated Terminal building will be designed and constructed for GRIHA Rating 4 star,
- Use of Energy Efficient building material & glass,
- Use of LED lamps instead of GLS lamps,
- Use of Solar Backed up Light Emitting Diode Lamps instead of par lamps,
- Energy efficient HVAC system,
- Solar passive techniques for integratedterminal building,
- Use of 5 star BEE energy efficiency rating electrical equipments,
- Microprocessor-based Building Management System (BMS) will be installed for minimization of energy consumption,
- Automatic lighting on/ off control system will be provided in the airport area for optimum utilization of energy.

It is proposed that 250 KW solar power generation plant will be established at the airport to produce clean energy.

By adopting above measures more than 30% energy will be saved.