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ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY OF NAVI MUMBAI INTERNATIONAL AIRPORT

Volume - IV

Chapter - 5 – Environment Impacts & Mitigation Measures
Chapter - 6 – Environment Management Plan
Chapter - 7 – Disaster Management Plan

June 2010

CENTER OF ENVIRONMENT SCIENCE & ENGINEERING,
INDIAN INSTITUTE OF TECHNOLOGY, MUMBAI.

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Chapter 5

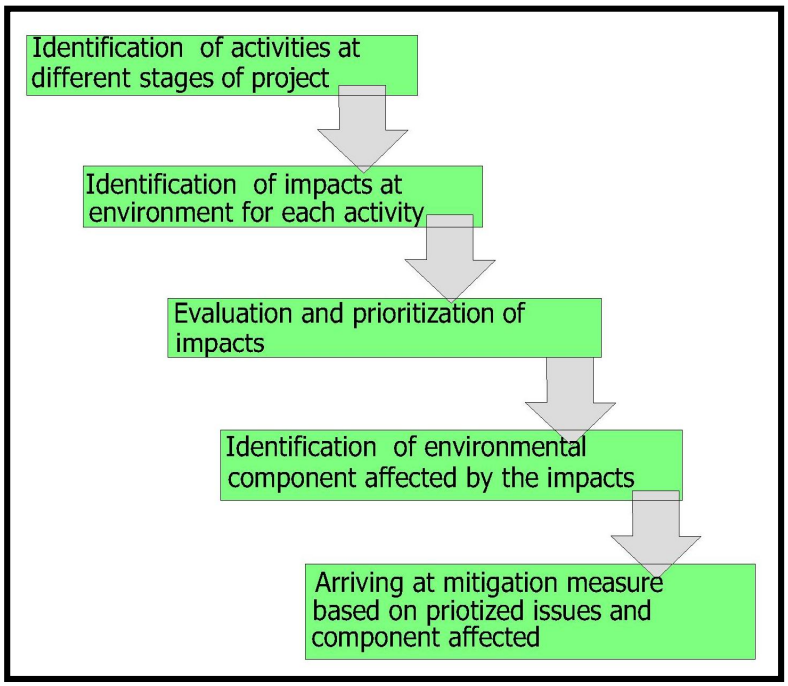
Environmental Impacts & Mitigation Measures

5.0 Background

This Chapter deals with the identification and evaluation of probable environmental impacts, likely to occur due to the NMIA project. Prior to the evaluation, a summary of activities with timelines is provided so as to provide with information as regards the way project activities are likely to proceed in stage-wise manner. Further, the Chapter details out the impacts at various stages of development, the linkages across activities with respect to impacts and the classification and evaluation of impacts across the affecting environmental components. The chapter also provides for the various mitigation options incorporated in the project design to minimize the impact and also the options which will be dealt with during the construction and operation period. The flow adopted for developing this chapter is depicted in **Figure 5.1** below:

Figure 5.1

Identification and Evaluation and Development of Mitigation Options -Flow Diagram



5.1 Impact Identification, Classification and Prioritization

For critical environmental impact assessment and timely mitigation of environmental issues, it is important that analysis of the project related activities along with anticipated environmental and social impacts prior to project inception is done.

5.1.1 Impact Identification

To help in / ease the impact evaluation process, the various activities of the NMIA which can have an impact on environment have been classified into four stages namely:

I. NMIA location

II. NMIA project design

III. NMIA construction phase

IV. NMIA operation phase

The project timelines are given in the **Figure 5.2**., **Table 5.1** gives the list of activities that are likely to take place at various stages of the project. While the NMIA location and NMIA design stage go hand in hand, the NMIA construction in various stages go hand in hand with the operation phase. With respect to environmental impacts, the impacts due to the project location and design have to be mitigated at the same time. While the 1st stage of Construction phase matches with the Design phase and therefore have to be mitigated simultaneously, the 2nd, 3rd, and 4th stages for construction add to the impact during the operation phase. While the impacts in the construction phases are often temporary and are remediated once the construction phase is completed, they never-the less add to the impacts during the operation stage which are more or less constant.

Figure 5.2

Project timelines

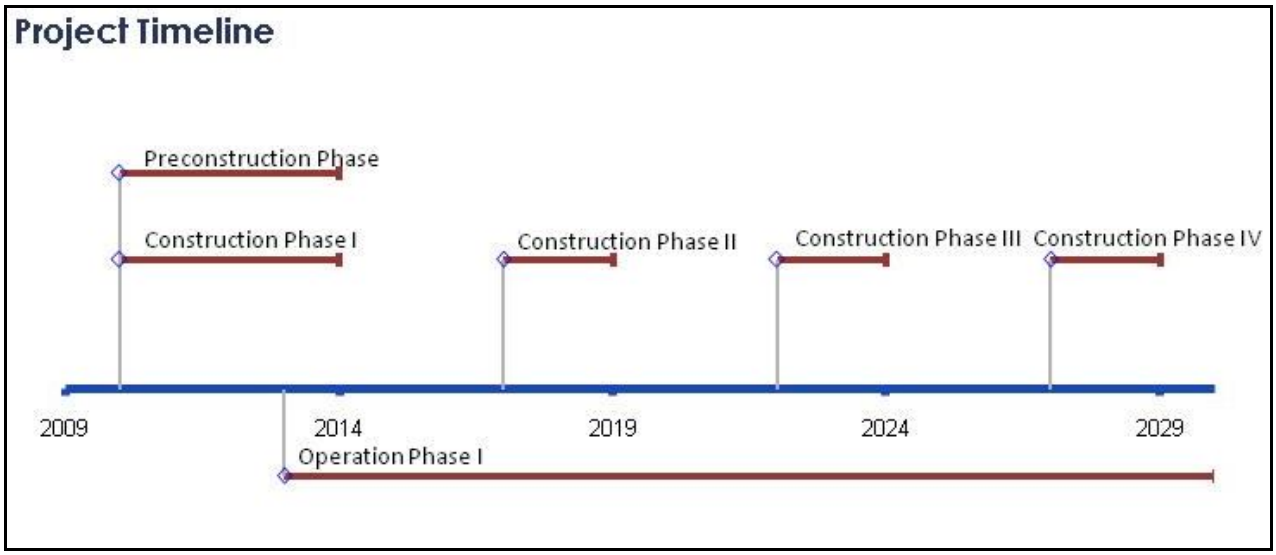


Table 5.1

Phasing of Activities

List of Activities-Facilities/Phasing	Pre-construction 2010-13	Construction Phase –I 2010-13	Operation/ Construction Phase –II 2017-18	Operation/ Construction Phase –III 2022-23	Operation/ Construction Phase –IV 2027-28
Land acquisition and R&R	√				
Diversion & Training of rivers	√				
Cutting of hillock	√				
Land Development	√				
Shifting of EHVT lines	√				
Construction of compound wall	√				
Runway		√	√		
Runway Exits		√	√		
Bypass Holding Bays		√	√		
Taxiway		√	√		
Navigational Aids		√	√		
Commercial Apron		√	√	√	√
Long-Term Aircraft Parking		√	√	√	√
General Aviation		√	√	√	√
Cargo Apron		√	√	√	√
Pass. Terminal		√	√	√	√
Air Cargo Building		√	√	√	√

Roadway system		√	√	√	√
Vehicular and Cargo Parking		√	√	√	√
Technical Building and ATC Tower		√			
Fuel Farm		√	√	√	√
Air Rescue and Fire Fighting		√	√	√	√
Catering		√	√	√	√
Ground Handling Equipment Maintenance		√	√	√	√
Aircraft Maintenance Hangar Facilities		√	√	√	√
Airfield Maintenance area		√	√	√	√
Development of Non-Aeronautical area	√	√	√	√	

i) Impacts due to NMIA Location

The site of Navi Mumbai airport is selected near Panvel town in an area admeasuring 2054 Ha. consisting of 1615 Ha. as airport zone and remaining for off-site infrastructure, such as; diversion & training of rivers, approach road, railways, interchange and utility lines, etc. The entire area of the airport zone falls in Raigad District in Panvel Taluka and is situated about 45 km away from the CBD of Mumbai. The activities to be carried out due to the NMIA location along with the impacting environmental sectors are given in **Table 5.2** below

Table 5.2

NMIA Location : Activities & Impact

No	Activities to be carried out	Description of Impacts
1	Removal of Mangroves & Biodiversity	The description of environment chapter, section 4.11.3 & 8.7 of this report assessed the mangroves in the project area and found that there majority of mangroves are sparse and are predominantly between the two Rivers and to the NE side of the site. The mangroves are dominated by Avicennia marina which in most of the places appears stunted and there are sparse Bruguira cylindrical syn. Bruguira caryophylloides and Aegiceros corniculata plants noticeable particularly towards the hillside of Ulwe River. Along the banks of Ulwe River there is a somewhat continuous and healthier growth of Avicennia marina with patches of Salvadora persica. At several places, the plants seem to be dying and dried stems are left behind. Wherever there has been considerable

No	Activities to be carried out	Description of Impacts
		degradation of the true mangroves, the associate mangroves, mainly Acanthus ilicifoiius has come up. Salt tolerant grasses like Settaria sp., Coix lachryma-joba, Scirpus maritimus, and Eleucine sp. are found to associate with the mangroves and mangrove associates. Away from the waterfront, these grasses that dominate the landscape replace the mangroves. A detailed study of Mangrove area in the project area, its plantations and management was carried out and details of which are given in Chapter 8. The study identifies for most successful species based on importance value index and further quantifies the presence of mangroves in the project area as 161.5 ha and proposes for compensatory afforestation by 200% at Dahanu, Thane Dist. With the project intervention, these mangroves (though in degraded form) will be totally lost forever. A total of 161.50 ha of mangroves will be lost due to the project.
2	Tree Clearance	There is no forest in the project site area, though there are naturally growing trees/plants/vegetation in the area. Most of the vegetation of trees in and around the villages are planted fruiting trees like mango, jamun, jackfruit, guava, custard apple etc. and the wood yielding trees like teak, arjun etc. The ornamental trees, bamboos and palms also have been planted and/or maintained by the villagers. The use of firewood is a common practice by the villagers which has resulted in the nearby degradation of vegetation and mangroves. This project will result in loss of all vegetation in the project site.
3	Roads and Infrastructure	The airport site is presently accessible by existing four lane road called National Highway-4B from the east side, State Highway-54 which runs on the southern boundary of airport as well as four lane concrete road called Aamra marg from the west side. The airport will be made accessible by constructing interchanges on the NH4B as well as on Aamra marg for smooth and speedy entry and exit from the airport. This could result is two impacts namely the over concretization resulting in increase temperature during the day time and summer time along the roads and diversion of agricultural land leading to issues of land use change and food security. It is worthwhile to note that the whole area surrounding the project area does exclusively rain-fed agriculture and grows only paddy which is salt tolerant. At most places during the non-monsoon period wild growth of grasses is observed. The fact that agriculture is not very productive/ profitable in the project and surrounding area is evident from the fact that the surface soil is being stripped off for brick making.

No	Activities to be carried out	Description of Impacts
		The primary road network providing access to airport is analyzed in the section 4.14.8 and section 4.14.9 provides the analysis of the major junctions in and around airport to assess their adequacy in meeting the traffic demand generated due to airport development in addition to the already existing traffic.
4	Railways Infrastructure	The existing Mankurd-Belapur-Panvel Commuter Railway line passes on the northeast of airport area and the nearest station is Khandeshwar located at a distance of less than 1 km. The airport zone is also proposed to be connected to Belapur, Khandeshwar, Mansarowar located on the above commuter railway line. The other commuter line called Nerul-Uran railway line is under construction and the nearest station to approach the airport is Targhar located at a distance of 1.5 km. from the airport boundary. Panvel railway station on Central/Konkan railway is located at a distance of 1.5 km. from the airport site which will provide the rail accessibility at the Regional, State and National level. This could result is two impacts namely the loss of mangroves & vegetation for rail and diversion of agricultural land leading to issues of land use change and food security. As stated above the state of mangroves and vegetation is in a highly degraded state. It is worthwhile to note that the whole area surrounding the project area does exclusively rain-fed agriculture and grows only paddy which is salt tolerant. At most places during the non-monsoon period wild growth of grasses is observed. The fact that agriculture is not very productive/ profitable in the project and surrounding area is evident from the fact that the surface soil is being stripped off for brick making. The fishing culture also seems to provide meager revenue so that the sand dredging activity which is obviously deleterious for the fishing activity has taken precedence in Ulwe River.
5	Water ways connectivity	Water transport by hovercrafts was in service between Gateway of India to Vashi and Belapur CBD in Navi Mumbai. The site is also proposed to be accessed from Mumbai by high-speed water transportation system abutting airport site. This could result in stress on the surrounding marine ecosystem and fishing. However, the fishing culture seems to provide meager revenue and the sand dredging activity which is obviously deleterious for the fishing activity has taken precedence in Panvel Creek.
6	Rehabilitation of the displaced villagers	Ten settlements belonging to seven villages are required to be resettled away from the project site. Approx 15000 people will be affected due to the project. Resettlement and rehabilitation will include apart from the substituted land, development of basic infrastructure such as water

No	Activities to be carried out	Description of Impacts
		supply, electricity, sewerage, roads, social infrastructure etc. CIDCO has assumed a proactive role towards the mitigation of the social impacts by the rehabilitation of the ten settlements in seven villages.
7	Archeological / Cultural / Historic Sites	The fringe area study i.e. study area around the proposed airport falling between 10 to 20 km. radius, revealed that there are 3 places of historic importance, aesthetic, cultural including sensitive area namely the Elephanta Caves, Karnala Bird Sanctuary and Matheran The Elephanta Caves is about 13.5 km form proposed project site and falls outside of core area. The island is named after a colossal elephant found in the island, which is popularly known as 'Gharapuri'. There are seven cave excavations in the Elephanta group and these are datable from circa 6th – 7th centuries A.D. The Elephanta site falls in the landing and takeoff funnel of Navi Mumbai International Airport. With its location from the airport site being about 13.5 km., the position of aircraft during takeoff/landing/missed approach/circling, would be more than 700 m. The Karnala Bird sanctuary is situated along the Mumbai-Goa-Konkan National Highway No.17 and is 12.5 km south of the proposed project site and falls outside of core area. The sanctuary is very rich in avifauna and harbors 147 species of resident and 37 species of migratory birds who visit the sanctuary during winters. Two rare birds i.e. Ashy Minimet and Spotted heart woodpeckers have been sighted here. The sanctuary is away from landing and takeoff funnel of Navi Mumbai International Airport. Moreover, the position of aircraft during missed approach and circling will be more than 750 m. The Matheran Eco-sensitive Zone is located at about 11 km East of proposed project site and falls outside of core area. The above site falls in the fringe of landing and takeoff funnel of Navi Mumbai International Airport based on its distance from the airport the position of aircraft during takeoff/landing/ missed approach /circling, will be more than 500 m.
8	Residential Facilities	The airport is likely to generate about 90,000 direct and indirect jobs which translate into a population of about 3.5 lakhs (average family size of 3.8 & Man power ratio of 1.33/family). With an assumption that about 80% of this man power would be residing in Navi Mumbai and 20% will commute from outside, about 65 thousand dwelling units would be required (keeping the service population also in mind). The total land requirement of these dwelling units would be about 300 ha net residential area (assumption of average dwelling unit area 50 m^2) . This housing needs to be supported by all the requisite social and cultural facilities as per the norms of CIDCO. Additional load on water and energy would have to be met, the details of which are given in Section-3.19.

ii) Impacts due to NMIA Project Design

The design of the NMIA projects also puts forth certain environmental issues which need to be overcome.

Table 5.3

NMIA Project Design – Activities & Impact

No	Activities to be carried out	Description of Impacts
1	Training of Gadhi River	The meandering creeklets of Gadhi/Panvel river falling in the airport area will be trained to meet Panvel creek directly thus maintaining the drainage pattern unchanged. The aquatic ecosystem will be affected temporarily due to channelization of part of Gadhi and Ulwe rivers flowing along the proposed site. Channelization leads to altering of original dimensions of the rivers along with extreme physical disturbances, alterations in river bed morphology, change in flow characteristics and elimination of bank cover. The impacts of channelization on the aquatic community mainly arise due to channel excavation, dredging, clearing and removal of vegetation. Vegetation in the riverine ecosystem, whether emergent, free floating, submergent or marginal, play a significant role in providing shelter, protection, breeding & nursery grounds for aquatic fauna such as benthos, fishes and aquatic birds. It also plays a vital role in protection from excessive temperature through shedding, organic leaf litter and oxygen input through photosynthesis. Immediate impacts of channelization are siltation due to river bed excavation or dredging. Siltation affects aquatic vegetation by increasing the turbidity of water. This interferes with light penetration which finally affects photosynthesis. Excess turbidity affects the aquatic fauna by interfering with the filter feeding mechanism of benthos and zooplankton. It adversely affects the respiratory mechanism of fishes through deposition of particles on their gills thereby leading to smothering effect on them. Also the fishes find it increasingly difficult to locate their prey and other food organisms. The secondary and long term impact of channelization is excavation/dredging, which involves direct removal of organisms from their habitat. The proposed channelization will lead to removal of degraded mangrove patch, aquatic flora, mud flat fishes and other benthic fauna. This will lead to loss and reduction in the number of organisms. The impacts due to channelization are limited to construction phase

No	Activities to be carried out	Description of Impacts
		only and the ecosystem will recover the loss over a period of time. The surrounding land use will have a temporary impact in terms of fugitive emissions from handling of construction material.
2	Diversion of Ulwe River	Ulwe river presently flowing through project area will be diverted to west into Thane Creek to maintain the existing drainage pattern. Ulwe river has a very small catchment of about 35-sq. km to the south of Vaghiwali island and joins the Panvel creek channel south of Vaghiwali island. The impacts of channelization is similar to that discussed in the point above ' Training of Gadhi river"
3	Hill Cutting (Quarrying / Blasting)	The study of the geology and soil characteristics have shown that the project area is composed of silty soil with little admixture of sand followed by murrum and weathered rock. The thickness of this layer is approximately 3.95 m below which amygdaloidal basalt exists. The hillocks in the airport area will be flattened and leveled to make the runway by controlled blasting in stages. The result of this will be generation of heavy quantity of dust which raises the SPM levels in the vicinity. Along with these, noise levels also will increase occasionally. Houses around the site (if any) may feel the intense acoustic waves. The material from the cut hills will be used to reclaim the airport zone. One positive point is that the material from the project area will be used inside the project area. The hills being basaltic will be good material for reclamation.
4	Shifting of Extra High Tension (EHT) Line by undergrounding	There are 4 Extra High Tension Lines existing in the Airport Operational Area and in the surroundings which are required to be re-routed to suitable place outside the horizontal surface of Airport area. These lines will be re-routed either over-head or underground by cables.
5	Reclamation of marshy lands	The entire land of 1615 ha of the airport zone consists of mudflats, firmland and hills and is required to be brought to a safe grade level varying from RL 7.0 to RL 8.5. by cutting of hills and reclaiming the land. The above said area lying within the airport will be reclaimed from the existing land cover. River training would take place on existing land cover. 1-D and 2-D mathematical model studies for prediction of changes in

		flow conditions in Panvel creek due to NMIA project activities was carried out by the CWPRS, Pune in 2009 (refer section 8.6 for details). The studies indicate marginal rise in the water levels in the Panvel creek reach along the proposed airport boundary. Along the Ulwe river however, the rise in the water levels will be slightly over 1.5 m due to diversion along the longer route with flatter slope. The safe-grade elevation of 7.0 m to 8.5 m AMSL was proposed for the airport complex and the guidelines for storm water drainage design and bank protection works were given.

iii) Impacts during Construction Phase of NMIA

Table 5.4

NMIA Construction Phase – Activities & Impacts

No	Activities to be carried out	Description of Impacts
1	Employment, Migration and Settlement	During the construction phase, a lot of migratory workers are expected to infiltrate in and surrounding areas of the project site. This would lead to a lot of stress in the area surrounding the project in terms of water requirement, power, increased ecological footprint, increased requirement for health and educational facilities and changes in the land use pattern and local culture. As CIDCO has been carrying out developmental activities in the surrounding area, it is quite competent to absorb the load arising out of such an activity.
2	Siting of construction camp for construction	During the construction period, camps for workers/laborers would be set up the project area leading to need for sewerage and sewage treatment facilities, stress on the local ecological resources like forests for firewood, disposal of solid waste, fire hazard at the camp, indoor air pollution in the camp, etc. Lack of Sewerage and Sewage Treatment Facilities could lead to water pollution, Misuse of local ecological resources like forests for firewood which would result in destruction of vegetation in the surrounding area, Improper handling of solid waste generated could lead to unhygienic conditions , Improper use of fuel could lead to fire hazard at the construction camp or leakage / spillage of fuel leading to soil contamination, Incomplete post-use clearance and rein-statement of base camp would lead to degradation of soil and use of biomass fuel for cooking would lead to indoor air pollution in the camp.
3	Excavation and Quarrying / Blasting of site	The study of the geology and soil characteristics have shown that the project area is composed of silty soil with little admixture of sand followed by murrum and weathered rock. The thickness of this layer is approximately 3.95 m below which amygdaloidal basalt exists. The hillocks in the airport area will be flattened and leveled to make the runway by controlled blasting in stages. The result of this will be generation of heavy quantity of dust

No	Activities to be carried out	Description of Impacts
		which raises the SPM levels in the vicinity. Along with these, noise levels also will increase occasionally. Houses around the site (if any) may feel the intense acoustic waves. The material from the cut hills will be used to reclaim the marshy land. One positive point is that the material from the project area will be used inside the project area and no outside material is necessary. The hills being basaltic will be good material for reclamation.
4	Leveling of site	The entire land of 1615 ha of the airport zone consists of mudflat, firmland and hills and is required to be brought to a safe grade level varying from RL 7.0 to 8.5. by cutting of hills and reclaiming the marshy land. The above said area lying within the airport will be reclaimed from the existing land cover. River training & diversion would take place on existing land cover. The leveling process would lead to an intense / heavy quantity of dust which would raises the SPM levels in the vicinity. Along with this the noise levels would be high due to the machinery used for leveling.
5	Construction Activity (list given in Table 5.1)	The construction phase also involves loading/unloading of different materials and its transportation particularly through the unpaved sections of the haul road which may result in spillage of material/oil and hence contaminates the soil and groundwater and also raise the ambient SPM levels.
6	Safety of Workers	During the construction activities, workers are exposed to a wide level of hazards arising due to the blasting activity, reclaiming activity, construction of various components of the project. Use of heavy equipments, high levels of dust and noise aggravate the issues of health and safety of the workers.

iv) Impacts during Operation Phase of NMIA

Table 5.5

NMIA Operation Phase – Activities & Impact

No	Activities to be carried out	Description of Impacts
1	Operation of airport	The operation phase will not trigger any appreciable impacts with regard to the physiography. Geologically, the study area lies in Deccan trap composed of hard massive basalt rocks. On a regional scale this area is very stable comprising the Peninsular Shield. Hence, the operation will not have any impact with regard to the stability of the structure. Drainage pattern suggested by CWPRS will remain unchanged during the operation phase, hence there is no impact. The impact during the operation phase will be due to surface traffic and air craft operations during landing, taxiing and takeoff. Air traffic is selected as a separate issue and discussed below. With respect to the air craft operations, two major impacts include that of air emissions and noise. To understand the level of both of these impacts, the following studies were carried out: • Emissions from Aircrafts • Noise Level Studies from Aircrafts Sections 8.8.2 and 8.8.3 deal with the matter and the same indicate the emission from aircrafts is well within the prescribed limit. Aircraft noise contribution is significantly low in range of 0.02 db(A) to 0.2 db(A)
2	Surface Traffic	Surface traffic increase would be of two types: • Traffic vehicles from and to the airport • Service vehicles operating inside the airport Impacts due to surface traffic have been assessed by simulation of air quality in respect of different pollutants based on the normal scenario as well as the projected traffic scenario from 2008 to 2030. Also, noise studies for the normal scenario as well as the projected traffic scenario from 2008 to 2030 has also been carried out. The emission from surface traffic is well within the prescribed limit – however surface traffic noise exceed the prescribed limit (ref section 8.8) The project design has identified that aerobridges would be used for passenger transportation at NMIA and the service vehicle numbers and duration of

		operation would be low for passenger transport . However surface transport for other ground services would still happen with use of fuel efficient vehicles.
3	Employment, Migration & Settlement	In the operation stage, there would be migration into the surrounding area which is of a more permanent nature. This would lead to a lot of stress in the area surrounding the project in terms of water requirement, power, increased ecological footprint, increased requirement for health and educational facilities and changes in the land use pattern and local culture. As CIDCO has been carrying out developmental activities in the surrounding area, it is quite competent to absorb the load arising out of such an activity.

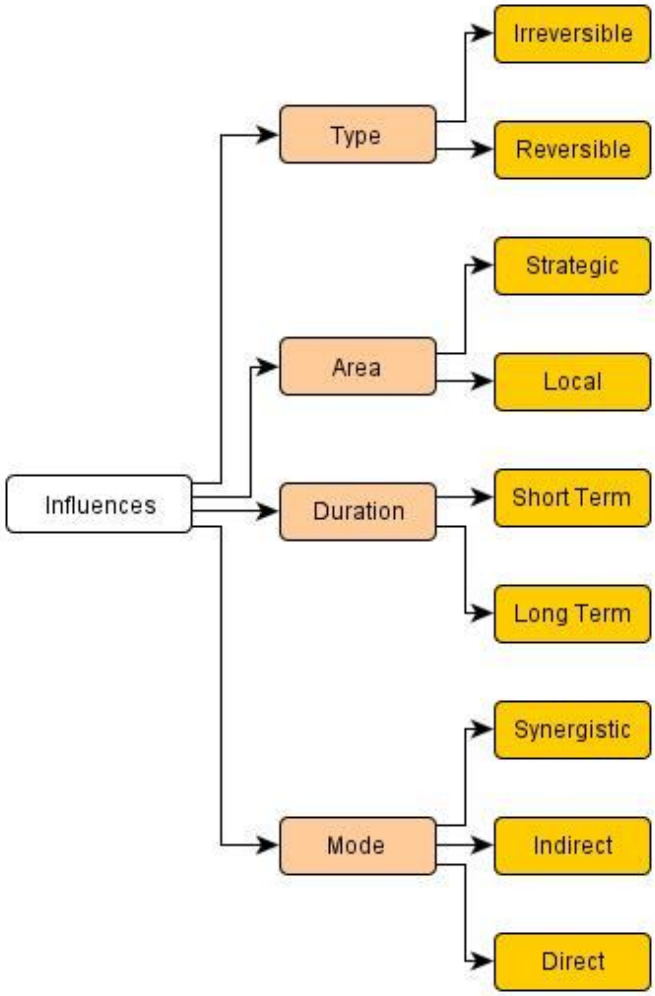
5.1.2 Evaluation and Classification of Impacts

Depending on the availability of data, a suitable approach is adopted in evaluating the environmental impacts. Some of the evaluation tools include the "Adhoc approach", the "Check list approach" and the "Matrix method". In the present case prediction of impacts of the proposed project has been done by modified Leopold interaction matrix method. In the conventional Leopold matrix method, an interaction matrix is compiled with project action on horizontal axis (X_i) and environmental parameters on which impacts can occur on the vertical axis (Y_i). Each cell (X_iY_i) represents the magnitude of the impact of action X_i on the environmental parameter Y_i. The type of magnitude of impacts depends on the location of specific attributes of the given environment. Qualitative judgments are arrived at by introducing a scale based on expert opinion, professional experience of similar projects which are already in operation.

The modified Leopold matrix created for NMIA activities portrays the anticipated intensity of positive and negative impacts for each of the activity. To estimate/classify, and prioritize severity of impact a multi-criteria analysis based on influences of the activity on the environment have been used. The various types of influences that have taken into consideration for the prediction study are given in **Figure 5.3**.

Figure 5.3

Project Activities – Influence & Impact Evaluation



The following are the definitions of the influences which have been used in Impact evaluation

Table 5.6

Details of Project Activities Influences

Influence		Definitions	Symbol	Weightage
Type	Direct	Direct impacts are those that are resultant directly due to the project activities. *For eg. Channelisation of river (activity is dredging) would lead to turbidity of water (water pollution).*	**D**	**4**
	Indirect	Indirect impacts are those that arise not directly due to project activity, but alter the surrounding system which in turn affect the environment. *For eg. Channelisation of river (activity is dredging) would lead to increase turbidity which would suffocate the water fauna's respiration thereby killing them.*	**ID**	**2**
	Synergistic	Impacts which have both direct and indirect impacts are called synergistic. These impacts are considered more serious	**Syn**	**6**
Area	Local	If the impacts are within the development zone, then it is termed as local. *For eg. Channelisation of river would lead to local drainage issues if not properly planned and executed.*	**L**	**2**
	Strategic	If the activities create an impact would affect the performance of the entire functional level of adjoining areas, downstream/upstream areas, it is termed as strategic impact, irrespective of their intensity. *For eg. If Channelisation of river is not carried out taking into the drainage quantity then it may cause flooding in the surrounding low lying areas (as the project site would be raised).*	**S**	**4**
Duration	Short Term	Some of the activities carried out are of short duration. During the construction activities, there would be some amount of inconvenience that would not be there in the operation phase and are termed as short run.	**ST**	**2**
	Long Term	During the operation stage there would be inconvenience and impacts that would be more of a regular nuisance to the people in the surrounding area. These are terms as long term. Impacts in this phase could also be positive like in this case socio-economic development of the region. However, this is case only the negative impacts are taken into account for counting.	**LT**	**4**
Mode	Reversible	Some of the impacts are reversible in nature i.e the negative impacts disappear once the causal factor is removed. Hence called reversible.	**R**	**2**
	Irreversible	Some impacts are irreversible i.e. the impacts are permanent. Most of the loss of biodiversity is lost forever and no mitigation option can bring them back to the pristine conditions	**IR**	**4**

Each of these influences has been given a weightage based on expert opinion and professional experience of evaluating similar projects. Most of the impacts have a probability of occurrence which has also been taken into account for this study. Where the probability of occurrence is very low then weightage is one, low probability weightage is 2; medium probability weightage is 4, high probability weightage is 6 and extremely high probability weightage is 8.

The next step followed was the calculation of the 'Overall Significance of Impact' parameter. The overall significance is calculated using the formula given below:

$$Overall\ significance\ of\ impact = [Mode + Duration + Area + Type] \times Frequency\ or\ Probability\ of occurance$$

For eg. :	The activity:	Hill Cutting (Quarrying / Blasting) during preconstruction (project design stage)
	Possible effect on environment	Extremely high dust levels
	Direct Influence	0
	Indirect	0
	Synergistic	6 (Both direct and indirect)
	Local	2 (of local nature)
	Strategic	0
	Short Term	2 (only during the preconstruction / design stage)
	Long Term	0
	Reversible	2 (the impacts will disappear once the activity is over
	Irreversible	0
Probability of occurrence		8 (extremely high chance that this activity will be taken up and the impacts will be experienced)

There the overall significance of impact = (6 + 2 +2 +2) x 8 = 96

Table 5.7

NMIA Evaluation– Overall significance of Impact

No		Action affecting Environmental Resources and Values	Possible Effects on the Environment	Influences									Frequency /Probability of Occurrence	Overall significance of Impact[1]
				Mode			Duration		Area		Type			
				D	ID	Syn	ST	LT	L	S	R	IR		
		Relative Weightage on a scale of 0 to 6		**4**	**2**	**6**	**2**	**4**	**2**	**4**	**2**	**4**		
I	***Impacts due to NMIA Location***													
	1	Mangroves & Biodiversity	Loss of mangroves in the project area	4	0	0	0	4	2	0	0	4	8	112
			Loss of local fauna	0	0	6	0	4	2	0	0	4	8	128
	2	Tree Clearance	Loss of trees & vegetation in the project area	0	0	6	0	4	2	0	0	4	6	96
	3	Roads and Infrastructure	Increase in concretization leading to increase local temperatures	0	2	0	0	4	2	0	0	4	1	12
			Diversion of agricultural land leading to issues of land use change and food security	4	0	0	0	4	2	0	0	4	1	14
	4	Railways Infrastructure	Loss of mangroves & vegetation for rail	0	2	0	0	4	2	0	0	4	2	24
			Loss of agricultural land to rail leading to issues of land use change and food security	0	2	0	0	4	2	0	0	4	1	12
	5	Water ways connectivity	Stress on the surrounding marine ecosystem	4	0	0	0	4	0	4	2	0	2	28
	6	Resettlement and Rehabilitation	Disruption of residences, cultural and livelihood patterns	4	0	0	0	4	2	0	0	4	4	56

[1] $Overall\ significance\ of\ impact = [Mode + Duration + Area + Type] \times Frequency\ or\ Probability\ of occurance$

No		Action affecting Environmental Resources and Values	Possible Effects on the Environment	Influences									Frequency /Probability of Occurrence	Overall significance of Impact[1]
				Mode			Duration		Area		Type			
				D	ID	Syn	ST	LT	L	S	R	IR		
		Relative Weightage on a scale of 0 to 6		**4**	**2**	**6**	**2**	**4**	**2**	**4**	**2**	**4**		
	7	Archeological / Cultural / Historic Sites	Loss of any archeological / cultural /historic site	4	0	0	0	4	2	0	0	4	1	14
	8	Residential Facilities	Change in land use pattern	0	0	6	0	4	2	0	0	4	2	32
			Increase in the water requirement for domestic purpose leading to stress on water availability	0	0	6	0	4	2	0	0	4	6	96
			Increase in power consumption	0	0	6	0	4	2	0	0	4	6	96
			Tensions amongst communities related to employment opportunities	0	0	6	2	0	2	0	2	0	1	12
			Loss of local culture	0	0	6	2	0	2	0	2	0	2	24
			Increased ecological footprint	0	0	6	0	4	0	4	0	4	6	108
			Increase requirement for health and educational facilities	4	0	0	0	4	2	0	0	4	2	28
II		***Impacts due to NMIA Project Design***												
	1	Training of Gadhi River	Interference with the natural drainage of the local ecosystem	0	0	6	0	4	0	4	0	4	6	108
			Loss of local estuarine biodiversity	0	0	6	0	4	2	0	2	0	6	84
			Changes in water quality reaching the Panvel Creek	4	0	0	2	0	2	0	2	0	6	60
			Likely rise in water levels in periphery area	0	0	6	0	4	2	0	2	0	1	14
			Sediment runoff leading to damage of local aquatic ecology	4	0	0	0	4	0	4	2	0	4	56
			Siltation of channels developed while training the Gadhi River	4	0	0	0	4	0	4	2	0	2	28

No		Action affecting Environmental Resources and Values	Possible Effects on the Environment	Influences									Frequency /Probability of Occurrence	Overall significance of Impact[1]
				Mode			Duration		Area		Type			
				D	ID	Syn	ST	LT	L	S	R	IR		
		Relative Weightage on a scale of 0 to 6		**4**	**2**	**6**	**2**	**4**	**2**	**4**	**2**	**4**		
			Changes in the groundwater hydrologic regime	4	2	0	0	4	2	0	0	4	1	16
	2	Diversion of Ulwe River	Interference with the natural drainage of the local ecosystem	0	0	6	0	4	0	4	0	4	6	108
			Loss of local estuarine biodiversity	0	0	6	0	4	2	0	2	0	6	84
			Changes in water quality reaching the Panvel Creek	4	0	0	2	0	2	0	2	0	6	60
			Likely rise in water levels in periphery area	0	0	6	0	4	2	0	2	0	1	14
			Sediment runoff leading to damage of local aquatic ecology	4	0	0	0	4	0	4	2	0	4	56
			Siltation while diverting the Ulwe River	4	0	0	0	4	0	4	2	0	2	28
			Changes in the groundwater hydrologic regime	0	0	6	0	4	2	0	0	4	1	16
	3	Hill Cutting (Quarrying / Blasting)	Change in land use pattern	0	0	6	0	4	2	0	0	4	1	16
			Vibration in adjacent areas	4	0	0	2	0	0	4	2	0	1	12
			Sediment runoff into the creek	4	0	0	0	4	0	4	2	0	6	84
			Changes in groundwater hydrologic regime in the surrounding area	0	0	6	0	4	0	4	0	4	1	18
			Safety of workers	4	0	0	0	4	2	0	2	0	6	72
			Air Pollution	0	0	6	2	0	2	0	2	0	8	96
			Extremely high dust levels	0	0	6	2	0	2	0	2	0	8	96
			Noise Pollution	0	0	6	2	0	2	0	2	0	8	96
			Disposal of excavated material	4	0	0	2	0	2	0	0	4	6	72
	4	Shifting of Extra High Tension (EHT) Line	Electromagnetic Interference with communication devices	0	2	0	2	0	2	0	2	0	1	8

No		Action affecting Environmental Resources and Values	Possible Effects on the Environment	Influences									Frequency /Probability of Occurrence	Overall significance of Impact[1]
				Mode			Duration		Area		Type			
				D	ID	Syn	ST	LT	L	S	R	IR		
		Relative Weightage on a scale of 0 to 6		**4**	**2**	**6**	**2**	**4**	**2**	**4**	**2**	**4**		
		by undergrounding	Safety hazard during the erection and operation	4	0	0	0	4	2	0	0	4	4	56
	5	Reclamation of lands	Flooding in other low lying areas	0	0	6	0	4	0	4	0	4	6	108
			Loss of Biodiversity	0	0	6	0	4	0	4	0	4	4	72
			Loss of marshy land ecosystem	0	0	6	0	4	0	4	0	4	6	108
III		***Impacts during Construction Phase of NMIA***												
	1	Employment, Migration and Settlement	Change in land use pattern	0	0	6	0	4	2	0	0	4	2	32
			Increase in the water requirement for domestic purpose leading to stress on water availability	0	0	6	0	4	2	0	2	0	6	84
			Increase in power consumption	0	2	0	0	4	2	0	2	0	2	20
			Tensions amongst communities related to employment opportunities	0	0	6	2	0	2	0	2	0	1	12
			Loss of local culture	0	0	6	2	0	2	0	2	0	2	24
			Increase ecological footprint	0	0	6	0	4	0	4	0	4	6	108
			Increase requirement for health and educational facilities	4	0	0	0	4	2	0	2	0	2	24
	2	Siting of construction camp	Lack of Sewerage and Sewage Treatment Facilities leading to water pollution	4	0	0	2	0	2	0	2	0	4	40
			Misuse of local ecological resources like forests for firewood	4	0	0	2	0	2	0	0	4	4	48
			Solid waste generation and inadequate disposal	4	0	0	2	0	2	0	2	0	4	40
			Fire hazard at the construction camp	4	0	0	2	0	2	0	0	4	2	24

No		Action affecting Environmental Resources and Values	Possible Effects on the Environment	Influences									Frequency /Probability of Occurrence	Overall significance of Impact[1]
				Mode			Duration		Area		Type			
				D	ID	Syn	ST	LT	L	S	R	IR		
		Relative Weightage on a scale of 0 to 6		**4**	**2**	**6**	**2**	**4**	**2**	**4**	**2**	**4**		
			Incomplete post-use clearance and rein-statement of base camp, leading to loss of land productivity	4	0	0	2	0	2	0	0	4	1	12
			Leakage / Spillage of Fuel used at the construction camp	4	0	0	2	0	2	0	0	4	2	24
			Indoor air pollution in the camp due to biomass fuel for cooking	4	0	0	2	0	2	0	2	0	6	60
	3	Excavation and Quarrying / Blasting of site	Vibration in adjacent areas	0	0	6	0	4	0	4	2	0	4	64
			Sediment runoff into the creek	4	0	0	0	4	0	4	2	0	8	112
			Safety of workers	4	0	0	0	4	2	0	0	4	6	84
			Air Pollution	0	0	6	0	4	0	4	2	0	8	128
			Extremely high dust levels	0	0	6	0	4	0	4	2	0	8	128
			Noise Pollution	0	0	6	0	4	0	4	2	0	6	96
			Disposal of excavated material	4	0	0	0	4	2	0	0	4	4	56
	4	Leveling of site	Loss of Biodiversity	4	0	0	0	4	2	0	0	4	2	28
			Loss of water bodies (open wells & ponds) in the project site	4	0	0	0	4	2	0	0	4	6	84
			Air Pollution due to equipment fuel usage	0	0	6	0	4	0	4	2	0	6	96
			Air Pollution due to leveling activity	0	0	6	0	4	0	4	2	0	6	96
			Extremely high dust levels	0	0	6	0	4	0	4	2	0	8	128
	5	Construction Activity (given in Table 5.2.2 & Table 5.2.3)	Pollution of land, ground water and surface water arising from wastes and spillages due to construction	4	0	0	0	4	2	0	2	0	4	48
			Contamination of estuarine bodies	4	0	0	0	4	2	0	0	4	1	14

No		Action affecting Environmental Resources and Values	Possible Effects on the Environment	Influences									Frequency /Probability of Occurrence	Overall significance of Impact[1]
				Mode			Duration		Area		Type			
				D	ID	Syn	ST	LT	L	S	R	IR		
		Relative Weightage on a scale of 0 to 6		**4**	**2**	**6**	**2**	**4**	**2**	**4**	**2**	**4**		
			Water logging and cross drainage issue during construction	4	0	0	0	4	2	0	2	0	4	48
			Air Pollution due to construction vehicle fuel usage	4	0	0	0	4	2	0	2	0	4	48
			Air Pollution due to construction activity	4	0	0	0	4	2	0	2	0	6	72
			Extremely high dust levels	4	0	0	0	4	2	0	2	0	6	72
			Noise Pollution	4	0	0	0	4	2	0	2	0	6	72
			Disposal of construction waste / debris	4	0	0	2	0	2	0	0	4	4	48
			Loss of Biodiversity	4	0	0	0	4	2	0	0	4	4	56
			Water availability issues	4	0	0	0	4	2	0	2	0	1	12
			Air pollution due to DG sets	4	0	0	2	0	2	0	2	0	2	20
	6	Safety of Workers	Accident during the construction stage	4	0	0	0	4	2	0	0	4	6	84
			Fire hazard during the construction stage	4	0	0	0	4	2	0	0	4	6	84
IV		***Impacts during Operation Phase of NMIA***												
			Noise pollution due to the air traffic	4	0	0	0	4	2	0	0	4	6	84
			Air pollution due to the air traffic	4	0	0	0	4	2	0	0	4	6	84
			Air pollution due to use of DG sets	4	0	0	0	4	2	0	0	4	2	28
	1	Operation of airport	Increase in power consumption due to DG	0	0	6	0	4	2	0	0	4	6	96
			Availability of water issues	4	0	0	0	4	2	0	0	4	2	28
			Sewage treatment issue	4	0	0	0	4	2	0	0	4	4	56
			Solid waste management issues	4	0	0	0	4	2	0	0	4	4	56

No		Action affecting Environmental Resources and Values	Possible Effects on the Environment	Influences									Frequency /Probability of Occurrence	Overall significance of Impact[1]
				Mode			Duration		Area		Type			
				D	ID	Syn	ST	LT	L	S	R	IR		
		Relative Weightage on a scale of 0 to 6		**4**	**2**	**6**	**2**	**4**	**2**	**4**	**2**	**4**		
	2	Surface Traffic	High air pollution along the various transport corridors leading to and away from the airport	4	0	0	0	4	2	0	0	4	6	84
			Noise pollution along the various transport corridors leading to and away from the airport	4	0	0	0	4	2	0	0	4	6	84
	3	Employment, Migration & Settlement	Change in land use pattern	0	0	6	0	4	2	0	0	4	2	32
			Increase in the water requirement for domestic purpose leading to stress on water availability	0	0	6	0	4	2	0	0	4	2	32
			Increase in power consumption	0	0	6	0	4	2	0	0	4	2	32
			Tensions amongst communities related to employment opportunities	0	0	6	2	0	2	0	2	0	1	12
			Loss of local culture	0	0	6	2	0	2	0	2	0	2	24
			Increase ecological footprint	0	0	6	0	4	0	4	0	4	6	108
			Increase requirement for health and educational facilities	2	0	0	0	4	2	0	0	4	2	24

5.1.3 Prioritization of Impacts and Identification of Environmental Sectors affected

Having evaluated the impacts, the impacts were prioritized into four different categories depending upon the numbers arrived at the NMIA evaluation of overall significance of impact for each of the impacts. Here again the expert opinion / professional experience of similar projects which are already in operation was used to categorize the impacts. The four different categories are given as follows:

Severity Legend	Massive	Substantial	Significant	Tangible
	>70	41-70	16-40	5-15

This prioritization is necessary to gauge the severity of impacts so as to arrive at appropriate mitigation options. In Tables 5.8 to 5.11, identified possible effects on the environment have been arranged along with the natural resources affected for the four phases namely project location, project design, construction and operation phase. The various natural resources (environmental components) which have been identified to be likely affected are air, biodiversity & forests, ecosystems, health & safety, land, noise, socio-cultural, waste and water & wastewater.

Table 5.8

NMIA Location – Impact Matrix

Stage of Project	Possible Effects on the Environment	Environment Component
NMIA Location	Increase in power consumption	Air
	Loss of mangroves in the project area	Biodiversity & Forests
	Loss of local fauna	Biodiversity & Forests
	Loss of trees & vegetation in the project area	Biodiversity & Forests
	Increased ecological footprint	Ecosystems
	Increase in the water requirement for domestic purpose leading to stress on water availability	Water & Wastewater
	Disruption of residences, cultural and livelihood patterns	Socio-Cultural
	Loss of mangroves & vegetation for related infrastructure	Biodiversity & Forests
	Stress on the surrounding marine ecosystem	Ecosystems
	Increased requirement for health and educational facilities	Health & Safety
	Change in land use pattern	Land
	Loss of local culture	Socio-Cultural
	Increase in concretization leading to increase local temperatures	Air
	Loss of /Diversion of agricultural land leading to issues of land use change and food security due to related infrastructure	Land
	Loss of any archeological / cultural /historic site	Socio-Cultural
	Tensions amongst communities related to employment opportunities	Socio-Cultural

Table 5.9

NMIA - Project Design Impact Matrix

Stage of Project	Possible Effects on the Environment	Environment Component
NMIA Design	Air Pollution	Air
	Extremely high dust levels	Air
	Loss of local estuarine biodiversity	Biodiversity & Forests
	Loss of Biodiversity	Biodiversity & Forests
	Sediment runoff into the creek	Ecosystems
	Loss of marshy land ecosystem	Ecosystems
	Safety of workers	Health & Safety
	Interference with the natural drainage of the local ecosystem	Land
	Flooding in other low lying areas	Land
	Noise Pollution	Noise
	Disposal of excavated material	Waste
	Sediment runoff leading to damage of local aquatic ecosystems	Ecosystems
	Safety hazard during the erection and operation	Health & Safety
	Changes in water quality reaching the Panvel Creek	Water & Wastewater
	Change in land use pattern	Land
	Siltation of channels developed while training the Gadhi River	Water & Wastewater
	Changes in the groundwater hydrologic regime	Water & Wastewater
	Siltation while diverting the Ulwe River	Water & Wastewater
	Electromagnetic Interference with communication devices	Air
	Vibration in adjacent areas	Noise
	Likely rise in water levels in periphery area	Water & Wastewater

Table 5.10

NMIA Construction Phase Impact Matrix

Stage of Project	Possible Effects on the Environment	Environment Component
Construction Phase	Extremely high dust levels	Air
	Air Pollution due to equipment fuel usage	Air
	Air Pollution due to leveling activity	Air
	Air Pollution due to construction activity	Air
	Increase ecological footprint	Ecosystems
	Sediment runoff into the creek	Ecosystems
	Safety of workers	Health & Safety
	Accident during the construction stage	Health & Safety
	Fire hazard during the construction stage	Health & Safety
	Noise Pollution	Noise
	Increase in the water requirement for domestic purpose leading to stress on water availability	Water & Wastewater
	Lack of Sewerage and Sewage Treatment Facilities leading to water pollution	Water & Wastewater
	Loss of water bodies (open wells and ponds) in the project site	Water & Wastewater
	Indoor air pollution in the camp due to biomass fuel for cooking	Air
	Air Pollution due to construction vehicle fuel usage	Air
	Misuse of local ecological resources like forests for firewood	Biodiversity & Forests
	Loss of Biodiversity	Biodiversity & Forests
	Water logging and cross drainage issue during construction	Land
	Vibration in adjacent areas	Noise
	Solid waste generation and inadequate disposal	Waste
	Disposal of excavated material	Waste
	Pollution of land, ground water and surface water arising from wastes and spillages due to construction	Waste
	Disposal of construction waste / debris	Waste
	Increase in power consumption	Energy
	Air pollution due to DG sets	Air
	Increased requirement for health and educational facilities	Health & Safety

Stage of Project	Possible Effects on the Environment	Environment Component
	Fire hazard at the construction camp	Health & Safety
	Change in land use pattern	Land
	Leakage / Spillage of Fuel used at the construction camp	Land
	Loss of local culture	Socio-Cultural
	Contamination of estuarine bodies	Biodiversity & Forests
	Incomplete post-use clearance and rein-statement of base camp, leading to degradation of soil	Land
	Tensions amongst communities related to employment opportunities	Socio-Cultural
	Water availability issues	Water & Wastewater

Table 5.11

NMIA Operation Phase Impact Matrix

Stage of Project	Possible Effects on the Environment	Environment Component
Operation Phase	Air pollution due to the air traffic	Air
	Increase in power consumption	Energy
	High air pollution along the various transport corridors leading to and away from the airport	Air
	Increase ecological footprint	Ecosystems
	Noise pollution due to the air traffic	Noise
	Noise pollution along the various transport corridors leading to and away from the airport	Noise
	Solid waste management issues	Waste
	Sewage treatment issue	Water & Wastewater
	Air pollution due to use of DG sets	Air
	Increase requirement for health and educational facilities	Health & Safety
	Change in land use pattern	Land
	Loss of local culture	Socio-Cultural
	Availability of water issues for airport zone	Water & Wastewater
	Increase in the water requirement for domestic purpose leading to stress on water availability in the region	Water & Wastewater
	Tensions amongst communities related to employment opportunities	Socio-Cultural

5.2 Mitigation Measures

The most probable issues identified in these sections for various activities have been found to stem from various sources like, project location, project design, project execution and project operation, and will depend on factors like awareness amongst the personnel implementing, finance, technologies and capacities of developmental and regulatory agencies. In the sections 5.1.2 and 5.1.3 above the evaluation and prioritization of environmental issues have been carried out as well cross linkages with environmental components. With the help of these section outputs, the current section has been developed to show case the various mitigation steps that have been arrived to minimize the environmental impacts. It must be noted that certain issues have been identified across the various stages of the project but the mitigation options may be different for different stages but affect the same natural resource sector. In such a case the mitigation options are placed across the issue but within the natural sector.

Table 5.12

Environmental sector – Air

<table>
<tr><th colspan="4">Environment Component - Air</th></tr>
<tr><td>NMIA Location</td><td>NMIA Design</td><td>Construction Phase</td><td>Operation Phase</td></tr>
<tr><td rowspan="7"></td><td colspan="2">Extremely high dust levels</td><td>Air pollution due to the air traffic</td></tr>
<tr><td rowspan="6"></td><td>Air Pollution due to construction activity</td><td>Air pollution along the various transport corridors leading to and away from the airport</td></tr>
<tr><td>Air Pollution due to equipment fuel usage</td><td rowspan="4"></td></tr>
<tr><td>Air Pollution due to leveling activity</td></tr>
<tr><td>Indoor air pollution in the camp due to biomass fuel for cooking</td></tr>
<tr><td>Air Pollution due to construction vehicle fuel usage</td></tr>
<tr><td colspan="2">Air pollution due to DG sets</td></tr>
<tr><td colspan="4">Increase in power consumption</td></tr>
<tr><td>Increase in concretization leading to increase local temperatures</td><td>Electromagnetic Interference with communication devices</td><td colspan="2"></td></tr>
</table>

MITIGATION OPTIONS

1. Appropriate dust suppression measures will be implemented within the project site during controlled blasting, construction, material handling and transportation. The prospective contractors shall make provision for water sprinkling at the construction site.
2. To help in abating the dust, formulation of compensatory plantation will be initiated as soon as MOEF clearance is obtained.
3. Use of dust extractors and spraying of water at source of dust emissions.
4. Trucks carrying earth, sand or stone will be duly covered with tarpaulin to avoid spilling.
5. Hi-tech equipment will be used for controlled blasting excavation and hauling of materials which will generate minimal noise as well as dust. This aspect will be covered as a tender condition.
6. Blasting to be carried out as per the best engineering practices and the use of modern technologies producing minimum dust and noise.
7. Construction machinery and equipment will be maintained in good working condition and construction materials and machineries will be handled with due precautions. All vehicles and construction equipment with internal combustion engines in use will be maintained for effective combustion to reduce carbon particles, CO and HC emission.
8. Proper maintenance of equipment will be undertaken with suitable enclosures and intake silencers.
9. Any vehicle not meeting the vehicular pollution standards will not be allowed within the construction site and for the construction activity.
10. Use of asbestos will be prohibited.
11. All the transport corridors leading to airport namely NH4, NH4B, Aamra Marg and Sion Panvel Highway have sufficient right of way to absorb the increase in traffic by widening the roads as and when required.
    - Background air quality will be maintained by reducing idling time and control on

Environment Component - Air
emissions. • The contribution from idling of engine at the signals would be minimized by providing wider roads and bridges (including over bridge) that connects to NMIA. • Vehicles that come to NMIA will be restricted (mandatory) by emission controlled certification and efficient engine conditions (Bharat III). • Chimney emission from industries and other activities will have to get emission control certification at regular interval 12. Air and Noise mitigation options will be implemented by defining the approach landing and takeoff procedures in a manner so as to minimize impact. 13. Aerobridges would be used for passenger transportation at NMIA and hence a very minimal amount of emissions are also likely to occur from the service vehicles operating inside the airport. The service vehicle numbers and duration of operation would be significantly low for passenger transport. Present day battery/electrically charged vehicles would be used by airport operators for ground service equipment and cargo and hence there no major impact on the air quality is expected.

Table 5.13
Environmental sector – Biodiversity and Forests

Environment Component - Biodiversity & Forests			
NMIA Location	**NMIA Design**	**Construction Phase**	**Operation Phase**
Loss of mangroves in the project area	Loss of local estuarine biodiversity	Misuse of local ecological resources like forests for firewood	
Loss of local fauna	Loss of Biodiversity		
Loss of trees & vegetation in the project area		Contamination of estuarine bodies	
Loss of mangroves & vegetation for rail			

MITIGATION OPTIONS

1. The alternative mangrove plantation site identification report based on the survey was carried out by Gujarat Ecology Commission, 2010. In case of loss of mangroves, alternate site for developing plantation of mangroves will be taken up. CIDCO has planned to take up approx 350 Ha. of plantation against the 161.50 Ha. loss (more than double the area). The mangrove plantation site identification study by GEC (Jan 2010) has identified potential mudflats at suitable site for mangrove plantation around the Dahanu area.
2. Loss of local estuarine biodiversity is a temporary phase during the construction of channels for diverting of Ulwe river and training of Gadhi rivers. The channelization activities are being designed to keep the eventual flow characteristics as close to the original natural flow. It is expected that the biodiversity would equilibrate and resettle.
3. In order to compensate for the loss of vegetation, compensatory vegetation and plantation programme will be undertaken within the airport area in the mandatory space required to be kept vacant for safety reasons as well as the space reserved for green belt in the vicinity of airport respectively. Species selected for plantation programme should be local, fast growing, ornamental and provide shade. The entire plantation undertaken will be non-fruit bearing so as to reduce any bird mishaps during the operation phase.
4. With respect to the trees from the displaced villages, CIDCO will take up the task of replanting the trees in their areas where they are carrying out developmental activities or along the highways.
5. There was no wildlife, observed during the field survey. There was no mention of rare or endangered wildlife species in the area in the reports of the State Forest Department. Hence, there will not be any displacement of wildlife as a result of project activities.
6. The contamination of estuarine body would occur mostly during the construction phase of the channels and airport due to resuspension of sediments or dust from construction site, both of which are temporary.

Table 5.14

Environmental sector - Ecosystems

Environment Component - Ecosystems			
NMIA Location	**NMIA Design**	**Construction Phase**	**Operation Phase**
Increased ecological footprint	Sediment runoff into the creek	Increase ecological footprint	
Stress on the surrounding marine ecosystem	Loss of marshy land ecosystem	Sediment runoff into the creek	
	Sediment runoff leading to damage of local aquatic ecosystems		

MITIGATION OPTIONS

1. In order to minimize the above impacts of dredging/channelization, proper route alignment will be selected and the dredging and excavation will be done in stages maintaining the water flow. This operation will result in minimum impact on siltation/turbidity on aquatic community. In order to minimize impact of siltation on aquatic community, the dredging/channelization of rivers would be undertaken during high tide. The proposed alignment will have similar physiographic characteristics. In order to minimize the impact on aquatic ecosystem efforts will be made to keep the existing characteristics of the regime in the new diverted alignment of the river. The enhanced turbidity is a temporary phenomenon occurring during the water course diversion.
2. The proposed project activity does not involve clearing of any forest areas which act as the habitat for wildlife, adverse effect on wildlife habitat (reduction / breaking). The project activities do not reduce or brake up wild life habitat.
3. The loss of marshy land is a permanent one. Alternate development of the mangroves is part of mitigation activity which will be taken up.
4. The project area does not have large animals whose ecosystems would be disrupted as the area surrounding the project is already under advanced stage of development. The proposed site and the study area do not include any migratory route of animals.

Table 5.15

Environmental sector – Energy

Environment Component - Energy			
NMIA Location	**NMIA Design**	**Construction Phase**	**Operation Phase**
Increase in power consumption		Increase in power consumption	Increase in power consumption
MITIGATION OPTIONS			
1. Increase in power consumption has been identified as an impact for two reasons namely the increased air pollution at its source of generation and the power availability issues which is prevalent in Maharashtra. To cater to the second, studies have been carried out to estimate the demand and also to check the availability of power (for details see Section-4.16). 2. In case of the operational phase of the projects, all efforts with respect to minimizing the use of power will be carried out. To the extent possible solar panels will be installed wherever possible for lighting purpose. 3. All the protocols of automatic diming of light where the human traffic is low/nil will be followed. Use of sunlight to the maximum extent to low the energy costs will be looked into while designing the airport. 4. Good insulators to lower the AC power consumption will be looked into. 5. Energy Conservation programs / protocols will be developed			

Table 5.16

Environmental sector – Health and Safety

Environment Component - Health and Safety			
NMIA Location	**NMIA Design**	**Construction Phase**	**Operation Phase**
	Safety of workers		
	Safety hazard during the erection and operation	Accident during the construction stage	
		Fire hazard during the construction stage	
Increase requirement for health and educational facilities			
MITIGATION OPTIONS			
1. Adequate security arrangement will be made to ensure that the local inhabitants and the stray cattle if any, are not exposed to the potential hazards of construction activities. 2. Safe and secure construction camp area will be provided for the migrant laborers during the construction period. At the camp site, the contractors will be directed to make adequate arrangements for water supply, sanitation and cooking fuels to the laborers. The construction site will be provided with sufficient and suitable toilet facilities for workers to allow proper standards of hygiene. These facilities would be connected to a septic tank and maintained to ensure minimum environmental impact. At the construction site, the contractor will be asked to provide following facilities to construction workforce:			

Environment Component - Health and Safety
a. First Aid: At work place, first aid facilities will be maintained at a readily accessible place where necessary appliances including sterilized cotton wool etc. shall be available. Ambulance facilities will be kept readily available at workplace to take injured person to the nearest hospital. The contractor would have a tie-up with the nearest hospital. b. Potable Water: Sufficient supply of cold water fit for drinking will be provided at suitable places c. Sanitary Facility: Within the precinct of very work place, latrines and urinals will be provided at accessible place. These will be cleaned regularly to maintain good sanitary condition. The contractor will conform to sanitary requirement of local medical and health authorities at all times. These facilities would be connected to a septic tank and maintained to ensure minimum environmental impact. d. Canteen: A canteen on a moderate scale will be provided for the benefit of workers; e. Security: Project Authorities will provide necessary security to work force in co-ordination with State authorities; and f. Facilities for Women: Facilities as per Factory Rules of the State government will be provided to the women working force. Separate toilets for women will be provided and marked in a vernacular language with conspicuous letters. 6. Adequate firefighting arrangement would be maintained by the contractor during the construction phase 7. During the operation phase, high level of fire – fighting equipments with adequate water and foam facility would be maintained as per the stipulated ICAO standards.

Table 5.17

Environmental sector – Land

Environment Component - Land			
NMIA Location	**NMIA Design**	**Construction Phase**	**Operation Phase**
	Interference with the natural drainage of the local ecosystem	Water logging and cross drainage issue during construction	
	Flooding in other low lying areas	Leakage / Spillage of Fuel used at the construction camp	
Change in land use pattern			
Diversion of agricultural land leading to issues of land use change and food security		Incomplete post-use clearance and rein-statement of base camp, leading to degradation of soil	
Loss of agricultural land to rail leading to issues of land use change and food security			

MITIGATION OPTIONS

1. Hillocks in the airport area will be flattened and leveled be to make the runway by controlled blasting in stages. The excavated material/construction debris would be used for land development of marshy land in the project site area. This would result in change of land use pattern apart from the dust generated and increased noise & air pollution (SPM levels) in the vicinity. Proper development and maintenance of the land is a prerequisite for the project activity and hence all efforts as per the airport standards would be carried out.
2. Geologically the project area lies in Deccan trap composed of hard massive basalt rock and will not initiate any instability problems – landslide/subsidence etc. This region is very stable portion of peninsular shield. Hence the operation will not have any impact with regard to the stability of the structure.
3. The excavated material/construction debris from hill cutting would be used for land development to the maximum extent and the surplus, if any, will be disposed off in a pre-designated approved sites.
4. The change of river flow is inevitable and during the development, due care will be taken so to maintain the required hydraulic flow to avoid water logging in the upstream and also any water logging in the project area either during construction or operation phases.
5. As per the study carried out by CWPRS, reclamations for development of International Airport at Ulwe on left bank of Panvel Creek will not have any significant effect on water levels predicted considering all CIDCO developments along different channels in Panvel Creek. The predicted water levels at different locations with and without the proposed airport are practically same. Therefore, there is no possibility of additional flooding due to airport.
6. Proper guidelines with respect to handling the waste generated from any untoward accidents of spillage of fuel or oil would be developed. This would include procedures for excavating the contaminated site and disposal to an authorized secured hazardous waste landfill.
7. The diversion of agricultural land leading to issues of land use change and food security is very insignificant in the present project scenario as the agricultural lands are very few. The whole regions surrounding the project area being a part of the Mumbai Metropolitan Region is already undergoing a rapid development and to a great extent agricultural lands are getting

Environment Component - Land
converted into sites for residential purpose. Also, the whole area surrounding the project area does exclusively rain-fed agriculture and grows only paddy. At most places during the non-monsoon period wild growth of grasses is observed. The fact that agriculture is not very productive/ profitable in the project and surrounding area is evident from the fact that the surface soil is being stripped off for brick making.

Table 5.18

Environmental sector – Noise

<table>
<tr><th colspan="4">Environment Component - Noise</th></tr>
<tr><th>NMIA Location</th><th>NMIA Design</th><th>Construction Phase</th><th>Operation Phase</th></tr>
<tr><td></td><td colspan="2">Noise Pollution</td><td>Noise pollution due to the air traffic</td></tr>
<tr><td></td><td>Vibration in adjacent areas</td><td>Vibration in adjacent areas</td><td>Noise pollution along the various transport corridors leading to and away from the airport</td></tr>
<tr><td colspan="4">MITIGATION OPTIONS

1. Noise will be generated due to blasting operations of Hills, on the western side of the runways. However, it will be a onetime activity lasting for short duration and even at the nearest settlements at Targhar and Kambad Bhuje (more than 1 km away), the impact of the generated noise level on the surrounding population will be negligible.
2. Hi-tech equipment will be used for controlled blasting excavation and hauling of materials which will generate minimal noise as well as dust. This aspect will be covered as a tender condition.
3. Best engineering practices and modern technologies producing minimum noise would be maintained during the blasting.
4. Blasting should be well planned with large numbers being fired infrequently than a few blasts daily. No blasting will be carried out at night.
5. Before controlled blasting, the surrounding villages will be alerted and the villagers and domestic animals will be offered safe place away from the project site.
6. Stationary equipment such as ready mix plant, hot mix plant, cement storage plant will result in noise generation. The minimum distance of operation from stationary source required for meeting CPCB standards is given below

<table>
<tr><td>Category</td><td>Permissible limits in day time (CPCB)</td><td>Distance required (m)</td></tr>
<tr><td>Silence zone</td><td>50 dB(A)</td><td>200</td></tr>
<tr><td>Residential</td><td>55 dB(A)</td><td>113</td></tr>
<tr><td>Commercial</td><td>65 dB(A)</td><td>36</td></tr>
<tr><td>Industrial</td><td>75 dB(A)</td><td>11</td></tr>
</table>

There are no residential areas within 113 m from the outer boundary of the project site and hence, no considerable impact is envisaged on the surrounding community during construction phase. However, the impacts will be significant on construction workers, working close to the machinery.

7. Construction activities involving operation of high noise generating machinery will be generally avoided between 10 p.m. and 6 a.m.
8. The construction personnel exposed to high noise levels will be provided with protective gears such as ear-muffs.
9. Construction machinery and equipment will be maintained in good working condition so as to reduce noise. Proper maintenance of equipment will be undertaken with suitable enclosures and intake silencers.
10. DG sets used during the construction phase would have the mandatory noise enclosures.
11. The use of damping materials such as thin rubber/lead sheet for wrapping the work places like compressors, generator sheds;
12. Control on the vehicular noise level – speed and vehicle conditions would be done by:
    a. Identification of structures and population vulnerable to noise level increase and remedial measures such sound proofing.
    b. Tree corridor and sound barrier at the NMIA boundary in containing noise level.
    c. Observation of no horn zone in NMIA
    d. Battery operated service vehicles within the airport.
13. Control on the aircraft noise level would be done by:
    a. Insistence of International code on noise level during takeoff and taxing by the Aircraft operators.
    b. Noise level contouring and identification of areas in the takeoff and landing sections.
    c. Discussion with people concerned over the run way operation and noise level reduction and execution of mandatory activities of DGCA and ICAO.
    d. Based on the community consensus and noise studies an implementation plan based on noise abatement plan and noise compatibility plan may be established.</td></tr>
</table>

Environment Component - Noise
14. The most effective method of mitigating noise sources - other than cessation of the source activity or use of source controls would include installation of sound barriers or also called noise barrier or sound wall or sound berm or acoustical barrier. Mostly sound barriers are exterior structure designed to protect sensitive land uses from noise pollution. Some of the barrier which could be looked into are: a. Earth berm constructed solely of excess earth from grading pads for a residential development. b. An elongated outdoor acoustic barrier erected around the periphery of the airport, for reflecting and absorbing sounds emanating from the airport. The acoustic barrier could be made of a variety of materials like wood, reinforced concrete or plastic materials, or combinations and placed zigzagged serpentine structures and parallel to longitudinal passages. It would have an elliptical cross-section and necessary to have a coating layer of sound absorbing material affixed to at least one face thereof facing the direction of a source of sound to be absorbed. Such a sound barrier must have a noise reduction factor of at least about 0.5, and preferably 0.8-0.85. The Sound absorbing noise barrier wall would be in-accordance with the current AASHTO ‘‘Guide Specifications for Structural Design of Sound Barriers’’. Various standards for sound absorbing characteristics (ASTM-423), sound transmission loss verification (ASTME 90-90), sound absorbing panel requirements (ASTM E- 84) need to be meet.

Table 5.19

Environmental sector – Socio-cultural

Environment Component - Socio-Cultural			
NMIA Location	**NMIA Design**	**Construction Phase**	**Operation Phase**
Disruption of residences, cultural and livelihood patterns		Loss of local culture	
Loss of local culture		Tensions amongst communities related to employment opportunities	
Loss of any archeological / cultural /historic site			
Tensions amongst communities related to employment opportunities			

MITIGATION OPTIONS

1 There is no historical and cultural site within 10 km distance from Navi Mumbai Airport site. Between 10 km to 20 km from the Airport, three historical and cultural sites namely the Elephanta Caves, Karnala bird Sanctuary with Fort and Matheran Eco-sensitive area fall. With its location from the airport site being more than 10 km for all the three sites, the position of aircraft during takeoff/landing/missed approach/circling, would be more than 500 m. All of the sites are far from the Airport site, no impact is envisaged even in the operation stage. However, during operation phase, proper flight directions can be provided so as to avoid flying over any of these sites.

2 Draft R &R Policy for rehabilitation of airport project affected people (APAP) based on the R&R policy of Govt of Maharastra, GOI and CIDCO is already in place with CIDCO. The draft has been approved by CIDCO Board of Directors and is now tabled for discussions with APAP. The three re-settlement sites viz. Vadghar, Dapoli and Vahal villages, which are close to their existing settlements, have been selected in consultation with the APAP. The R&R entitlements include, apart from the monetary compensation at replacement value of existing settlement, allotment of developed plot free of cost for residential and commercial settlement, additional developed land to nuclear family, financial assistance towards transport cost, reimbursement of no-refundable fee, charges, duties, free vocational training and preferential placement to APAP, right to collect / salvage structural material, one time financial grant of construction of house, free hold ownership with FSI 1.5 with 15% commercial, subsistence allowance for one year, reservation for job in unskilled and semi-skilled workers category and allotment of preferential equity. The implementation of the Resettlement and Rehabilitation action plan has financial implication to the tune of Rs. 369.85 Cr.

3 The issue of loss of local culture is an another impact which is felt wherever large developmental projects arise. The airport project area which comes under the MMR region has already been under stress for this impact.

4 The developmental impacts of the project are quite substantive in terms of the economic development of the region, the decongestion/ lessening the burden of transport of Mumbai Santacruz airport resulting in less time and energy requirement for reaching the airports, beneficial for people around the Pune city in accessing the airport.

Table 5.20

Environmental sector – Waste

Environment Component - Waste			
NMIA Location	**NMIA Design**	**Construction Phase**	**Operation Phase**
	Disposal of excavated material	Solid waste generation and inadequate disposal	Solid waste management issues
		Disposal of excavated material	
		Pollution of land, ground water and surface water arising from wastes and spillages due to construction	
		Disposal of construction waste / debris	

MITIGATION OPTIONS

1. The excavated material/construction debris from hill cutting would be used for land development to the maximum extent and the surplus, if any, will be disposed off in a pre-designated approved sites.
2. The construction waste / debris generated would also be disposed off in a pre-designated approved site.
3. During the construction phase, the municipal solid waste generated would those that arise from the construction camp and the workers canteen. Proper arrangements for transport of these solid wastes to the Chal landfill will be done.
4. During the operational phase, two types of waste would be generated namely the solid waste and the hazardous waste. Solid waste would be generated from the garbage/food waste from the restaurants and airport operations and paper and packaging waste generated in cargo section, while the hazardous waste that would be generated include sludge generated from STP, separated oil from oily wastewater treatment units and any waste generated due to spill containment in any untoward event. Proper arrangements with authorized transporters and authorized disposers would be done and proper records for the same would be maintained.
5. Adequate quantity and sizing of dustbins would be maintained throughout the airport area during the operation stage to receive solid wastes as and when generated. The collection bins are regularly sprayed with disinfectants. A proper solid waste management system would be put in place.
6. Vehicles transporting the solid waste are adequately covered to prevent any spillages during transportation. All stipulated procedures as per the Solid Waste Rules and the Hazardous waste Handling and management Rules would be adhered to.
7. Proper guidelines with respect to handling the waste generated from any untoward accidents of spillage of fuel or oil would be developed. This would include procedures for excavating the contaminated site and disposal to an authorized secured hazardous waste landfill.

Table 5.21

Environmental sector – Water and Wastewater

Environment Component - Water & Waste Water			
NMIA Location	**NMIA Design**	**Construction Phase**	**Operation Phase**
Increase in the water requirement for domestic purpose leading to stress on water availability	Changes in water quality reaching the Panvel Creek	Increase in the water requirement for domestic purpose leading to stress on water availability	Sewage treatment issue
	Siltation of channels developed while training the Gadhi River	Lack of Sewerage and Sewage Treatment Facilities leading to water pollution	Availability of water issues
	Siltation while diverting the Ulwe River	Loss of water bodies (open wells) in the project site	Increase in the water requirement for domestic purpose leading to stress on water availability
	Changes in groundwater hydrologic regime in the surrounding area	Water availability issues	
	Likely rise in water levels in periphery area		

MITIGATION OPTIONS

1. The dredging/channelization of rivers will be carried out in stages keeping the water flow intact except for the period during diversion of water course. This operation will result in minimum impact on siltation/turbidity on aquatic community. In order to minimize impact of siltation on aquatic community, the dredging/channelization of rivers should be undertaken during high tide. In order to minimize the above impacts of channelization, proper route alignment will be selected and the dredging and excavation will be done in stages maintaining the water flow. The proposed alignment will have similar physiographic characteristics. The enhanced turbidity is a temporary phenomenon occurring during the water course diversion.
2. Drainage pattern as achieved during construction phase by training/diversion of river will remain unchanged during the operation phase hence there will be no impact on the hydrology.
3. The water requirement for airport zone consisting of aeronautical and non-aeronautical area taking into consideration all requirement of passengers, visitors, staff, commercial facilities, air and land side facilities, residential, conference facilities, as well as AC Plant, irrigation for planted area, fire-fighting, etc. are to the tune of 9, 18, 30, 39 MLD for Phase I, II, III and IV respectively. The water requirement for the project is to be met from the water supply system of Navi Mumbai being maintained by City & Industrial Development Corporation (CIDCO), Navi Mumbai Municipal Corporation (NMMC), supplemented by Maharashtra Industrial Development Corporation (MIDC) and Maharashtra Jeevan Pradhikaran (MJP). The water supply for present population of the City of Navi Mumbai is being served mainly by CIDCO and NMMC having their own sources of Water Supply as well as partly MJP and MIDC. CIDCO has developed its own source at Hetawane which is presently supplying 100 MLD water and with the sanctioned capacity of 185 MLD. Similarly, CIDCO is in the process of developing a water source from the Balganga Dam with an installed capacity of 350 MLD with the sanctioned capacity of 250 MLD for Navi Mumbai. NMMC has already developed its own water source known as Morbe Dam which has installed capacity of 450 MLD and presently supplying 350 MLD to the city. The following Table gives the details of sources of Water, availability of water, daily water

Environment Component - Water & Waste Water

consumption and surplus water:

Year	MIDC	MJP	Hetawane	Morbe	Balganga	Total	Daily Consumption	Surplus
2009-10	30	60	100	350	-	540	390	150
2015-16	30	60	185	450	100	825	525	300
2020-21	30	60	185	450	250	970	650	320
2030-31	30	60	185	450	250	970	840	130

4. Though the total water requirement of the proposed project is to be met by CIDCO and there is ample available of water, it is proposed to minimize the water usage in the operational phase:
    a. Use of low flow fixtures and appliances for reduced water consumption such as low flush water closets and cisterns;
    b. Water saving shower head flow controls, spray taps and faucet aerators and photo-sensitive taps;
    c. Sewage generated will be treated in the sewage treatment plant and reused for green belt development, cooling system and floor washing to reduce the fresh water requirement;
    d. The storm water from paved areas will be routed to the water harvesting structures to reuse the water for gardening purpose (as recharging the ground water is not possible). The storm water treatment facility will be located at an appropriate site keeping in view the slope contours and collection point at the most convenient point;
    e. Use of dry cleaning process in workshop and maintenance area to clean the oil spillages.
    f. Continuous efforts to reduce the water consumption and thereby to reduce the wastewater generation would be done by fitting automatic flow meters for all major water inlets. Flow rates will be continuously monitored and periodic water audits will be conducted to explore the possibilities for minimization of water consumption.
5. The various water saving steps are to be made a part of the tender document
6. With respect to wastewater, STP would be installed on the project site apart from the underground drainage will be connect to CIDCOs other STPs.
    a. All STPs will have the Sequential Batch Reactor Technology for which CIDCO has developed its expertise in operation and maintenance.
    b. The treated wastewater would be recycled and reused. Reverse Osmosis plant to treat the wastewater to the required quality will be installed. Some of the areas where the wastewater can be utilized include make-up water in cooling system, floor washing and gardening. To the maximum extent the treated wastewater will be utilized and will not be discharged outside the airport boundary.
    c. Proper oil & grease interceptors will be installed at wastewater outlet from the maintenance hangers, fuel depots, hotels/restaurants and flight catering. The wastewater will be passed through oil and grease interceptors and then routed to STP.
    d. Settling tanks, blow down tanks and neutralization pits will be cleaned regularly in order to avoid clogging. Sludge will be removed regularly and sufficient time will be given for proper settling of solids; and
    e. The treatment units will be operated regularly.

Chapter - 6
Environment Management Plan

Chapter 6

Environmental Management Plan

6.1 Background

This Chapter details the environmental management plan which will be adopted at 'Navi Mumbai International Airport' (NMIA). It converses all the four stages, NMIA location, NMIA project design, NMIA construction phase and NMIA operation phase which have impacts on and are relevant to environment. The environmental issues that are likely to develop in project's various stages could be minimized by adopting EMP suggested herewith. Based on existing environmental conditions and impacts assessed in earlier sections (Chapter 5), the EMP enumerates the set of measures to be taken during implementation and operation to eliminate or offset adverse environmental impacts or to reduce them to acceptable levels together with allocation of responsibility.

6.2 Scope

This Environmental management Plan (EMP) details environmental management requirements to be followed for the Navi Mumbai International Airport project. It includes:-

- The requirements during planning, implementation, evaluation and review of airport construction activities.
- Responsibilities for implementing this EMP
- Complying environmental controls and limits to ensure that project objectives and targets are achieved.
- Physical planning consisting of work programme, time schedule and locations for putting mitigation and compensation systems in place
- An overview of the environmental monitoring program and associated management action
- Post construction requirements including monitoring and inspection
- Financial plan for implementing mitigation measures in the form of project budget estimates

This EMP applies to project activities described in later sections. CIDCO has the overall responsibility in implementation of NMIA in accordance with the requirements of EMP.

6.3 Objectives

The overall objectives of EMP are:

- Identify project specific activities that would have to be considered for investigation of the significant adverse impacts and mitigation measures required
- To operate and manage the airport in an environmentally responsible manner
- Eliminate adverse environmental impacts wherever possible
- Reduce impacts where elimination is not possible
- Continuously improve results of environmental monitoring from plans and programmes

6.4 Government Policies

The following legislations & policies of the Country and State with their latest amendments, which are relevant to the project, will be consulted during the preparation of EMP as well as implementation of the EMP

- The Wildlife (Protection) Act, 1972.
- The Water (Prevention and Control of Pollution) Act, 1974.
- The Maharashtra Water (Prevention and control of pollution) Rules, 1978.
- The Forest (Conservation) Act, 1980.
- The Air (Prevention and Control of Pollution) Act, 1981.
- The Maharashtra Air (Prevention and control of pollution) Rules, 1983.
- Environmental (Protection) Act, 1986 and notification there under
  - The Environment Impact Assessment Notification 1994 & 1997
  - The Noise Pollution (Regulation and Control) Rules, 2000
  - The Municipal Solid Waste (Management & Handling Rules), 2000
  - Hazardous waste (Management and Handling) Rules 1989
  - The Chemical accidents (Emergency planning, preparedness and Response) Rules, 1996

- Coastal Zone Management Plan (CZMP) of Maharashtra, 1996.

6.5 Key Players for Implementation of EMP

The responsibility for designing the mitigative measures are delegated to the Project Proponent (CIDCO), along with Special Purpose Company (SPC) to be formed for project execution and operation which in the present context is to mobilize the appropriate expertise to mitigate the adverse impact.

- Department of Horticulture, CIDCO Limited will implement the green belt development at the project site.
- The District Collector would grant necessary permission to the project proponent for acquiring the land and disbursing compensation to the project affected people.
- The Department of Environment, Government of Maharashtra, would guide the project proponent for sorting out various environmental issues.
- Revenue Department would cooperate with the project proponent in fixing up the compensation for the land acquisition and disbursal of compensation to the PAPs.
- Airport Authority of India, is the approving authority for the project as well as provide ATC facilities during operation.
- Construction Contractor, the problems arising out of the construction sites and labour camps are to be controlled by him. These include provision of fuel to the labourers and proper water supply and sanitation facilities at the project site. First aid facilities for the workers and suitable high-tech environment which will generate minimum noise and fugitive emissions will have to be procured to be used and has to adopt best handling practices executing the work.

6.6 Environmental Management Cell Structure

The Environmental Management Cell (EMC) would be set up at the NMIA to take care of all the environmental aspects and to maintain environmental quality in the project area. The main objective of EMC would be to implement the EMP effectively and closely supervise environmental monitoring programme and to co-ordinate with the

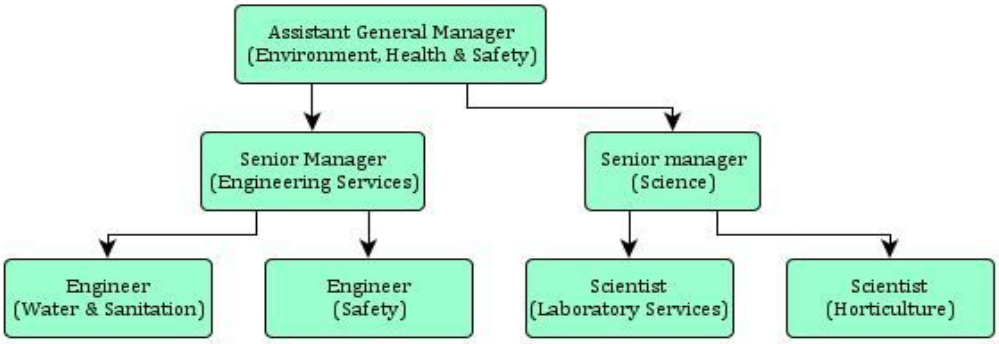
existing management system of CIDCO. EMC will undertake regular monitoring of the environment and conduct yearly audit of the environmental performance during the construction and operation of the NMIA. It will also check that the stipulated measures are being satisfactorily implemented and operated.

Environmental Management Cell will manage all environmental related activities on the site. This cell will be headed by an Assistant General Manager along with supporting staff. The cell will be responsible for regular environmental quality monitoring and co-ordinate with regulatory bodies like MPCB, CPCB &MOEF and some the main functions include:

- Continued monitoring & assessment of environmental parameters & regulations.
- To work for continuous & regular improvement in environmental performance.
- To ensure systematic and routine housekeeping to reduce generation of pollutants inside the airport core area.
- To develop & maintain green belt and plant nurseries.
- To keep close liaison with environmental regulating authorities i.e. MPCB, CPCB, MOEF to arrange required consent under Water, Air & Environment Protection Act.
- To conduct yearly monitoring and submit statement to MPCB.
- To manage post project-monitoring plan as per approved EIA & EMP.
- To follow proper documentation and monitoring practices and procedures, this will facilitate the NMIA to go for IS 14001 or equivalent environmental management systems at a later stage

The Organizational set-up of Environment Management Cell is given.

Figure 6.1:



The roles and responsibilities of each of the EMC officer is given below:

i) Assistant General Manager (AGM):

AGM will be the head of the Environment Management Cell and perform the following tasks:

- Overall In-charge of Department and will be reporting to the Executive Director (Engineering Services) about the functioning of the Department as well as submit the implementation report to PCB and to IAA/MOEF.
- Planning and execution of environmental monitoring.
- Review of the report submitted by the monitoring agency, checking the compliance of the results with respect to the baseline environmental conditions and also with the relevant standard.
- Regularly interact with the Environmental agencies, Health department and Fire services.
- Responsible for:
  - Proper smooth functioning of the Department and sort out their problems whenever it arises.
  - Procurement and testing of equipment used.
  - Overviewing the training programmes.

ii) Senior Manager (Engineering) SM(E):

SM(E) responsibilities will be to supervise,

- Supervise the implementation of water pollution control methods
- Water supply and sanitation

- Noise and Air Pollution control
- Safety aspects
- Smooth functioning of the department by sorting out problems
- Review of the report submitted by the Engineer (Water & Sanitation) and Engineer (Safety) and submit final monthly report to the Assistant General Manager.
- Reporting to Assistant general manager.

iii) Senior Manager (Sciences) SM(S):

SM(S) responsibilities will be to supervise,

- Laboratory services
- Monitoring services
- Health aspects
- Landscaping
- Greenbelt development
- Training programme
- Review of the report submitted by the Scientist (Lab. Services) and Scientist (Horti.) and submit final monthly report to the Assistant General Manager
- Reporting to Assistant General Manager (Head of the EMC)

iv) Engineer (Water & Sanitation) E(W&S):

E(W&S) responsibilities will be,

- Ensure the quality of water and sanitation during construction and operation.
- Ensure the functioning of wastewater treatment plant.
- Check the provision of sanitation facilities at the construction site and during operation.
- Preparation of monthly progress report and documenting all the activities
- Reporting to the Sr. Manager (Engineering)

v) Engineer (Safety) E(S):

E(S) responsibilities will be,

- Responsible to check –
  - Air and noise pollution control facilities

- Fire safety systems

- Interacting with the officials of fire services
- Check operation and maintenance of equipment
- Preparation of monthly progress report and documenting all the activities
- Reporting to Sr. Manager (Engineering)

vi) Scientist (Laboratory Services) S(LS):

S(LS) responsibilities will be,

- Responsible for pollution monitoring
- Laboratory analysis
- Preparation of monthly analysis and progress report & documenting all activities
- Looking after health aspects
- Reporting to Sr. manager (Sciences)

vii) Scientist (Horticulture) S(H):

S(H) responsibilities will be,

- Landscaping
- Greenbelt development
- Organizing training programmes
- Preparation of monthly progress report and documenting all the activities
- Reporting to Sr. Manager (Sciences)

An Environmental Management System would be put in place so as to help in smooth chain of action. As and when required contract with other agencies for monitoring (when sophisticated analysis is needed) or training / capacity building of staff will be made. Regular training programmes will be organized to train the airport staff in using various safety devices and other equipment. Specialists from various fields of environment, health and fire safety would impart the training. The training would mainly focus on how to handle emergency issues. Monitoring and analysis of various environmental parameters and fire safety measures will be carried out as per the guidelines laid down by Government of Maharashtra and Government of India.

The pollution emitted during the construction and operational stages will be regularly monitored by the project proponent through Environment Management Cell with occasional checks will be made by State Pollution Control Board (SPCB).

6.7 Environmental Management Action Plan

The detailed Environmental Management Action Plan is given below

Table 6.1

Environmental Management Action Plan

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
NMIA Location			
Tree Clearance	• Trees from the displaced villages, will be replanted in areas where CIDCO is carrying out developmental activities or along the highways.	• Re-plantation Costs will be borne by CIDCO. • EMC will prepare a detailed Transplantation and Plantation plan and monitoring the implementation	• Contractor
Increase in power consumption	• Energy Conservation programs / protocols will be developed	• EMC will prepare a detailed Energy Conservation plan and monitoring the implementation	• CIDCO/SPC
Loss of mangroves in the project area	• Compensatory plantation to the tune of 350 ha has been planned and the most appropriate mangrove plantation site as identified by GEC is the potential mudflats around the Dahanu area.	• Plantation Costs will be borne by CIDCO • EMC will prepare a detailed Mangrove Transplantation and Plantation plan and monitoring the implementation. Help from GEC/BU would taken while developing this	• CIDCO/ Contractor.

[1] *For detailed mitigation measures refer Chapter 5, Section 5.2, Table Nos 5.12 to 5.21*

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
Loss of local fauna	• As there was no wildlife, observed during the field survey as well no mention of rare or endangered wildlife species in the area in the reports of the State Forest Department, no detailed mitigation measure is envisaged. However, the EMC personnel would be trained to be sensitive to this rare issue	• EMC	• CIDCO/ SPC.
Loss of trees & vegetation in the project area	• Compensation for the loss of vegetation would be through compensatory vegetation and plantation programme It will be undertaken within the airport area and the species selected would be local, fast growing, ornamental, provide shade and above all non-fruit bearing so as to reduce any bird mishaps during the operation phase. • The proposed project activity does not involve clearing of any forest areas which act as the habitat for wildlife, adverse effect on wildlife habitat (reduction / breaking). The project activities do not reduce or brake up wild life habitat. However, the EMC personnel would be trained to be sensitive to this rare issue	• Plantation Costs will be borne by CIDCO/SPC • EMC will prepare a detailed Transplantation and Plantation plan and monitoring the implementation	• CIDCO/ SPC.
Increase in the water requirement for domestic purpose leading to stress on water availability	• This requirement is to be met by CIDCO. CIDCO has estimated and found that there is ample water available for the project and the related development.	• EMC to monitor and prevent the excess water consumption.	CIDCO/ SPC.
Disruption of residences, cultural	• The draft R & R Policy for rehabilitation of airport project affected people (APAP) based on the R&R policy of Govt of Maharastra, GOI and CIDCO is already	• CIDCO will see that the R & R policy once finalized is implemented in a fair fast	CIDCO/ SPC.

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
and livelihood patterns	in place with CIDCO. The draft has been approved by CIDCO Board of Directors and is discussed with APAP.	and transparent manner. • SPC to provide CSR to re-settlement area.	
Stress on the surrounding marine ecosystem	• The contamination of estuarine body would occur during the construction phase of the channels and airport due to resuspension of sediments or dust from construction site, both of which are temporary. • However, in order to minimize the above impacts of dredging/ channelization, proper route alignment, carrying out dredging and excavation in stages so as to maintain the water flow and during high tide will be done. The proposed alignment will have similar physiographic characteristics so as to keep the existing characteristics of the regime in the new diverted alignment of the river. The enhanced turbidity is a temporary phenomenon occurring during the water course diversion.	• EMC will plan the dredging and channelization in consultation with the contractor and see to it that the mitigation measures are implemented by the contractor	CIDCO/ SPC.
Change in land use pattern	• Though the change in land use is permanent, in the project area lot of landscaping and greenery would be developed resulting in a better landscape then what it is at present	• CIDCO/SPC will prepare the landscaping and greenery plan	CIDCO/ SPC.
Loss of local culture	• The issue of loss of local culture is another impact which is felt wherever large developmental projects arise. The airport project area which comes under the MMR region has already been under stress for this impact. CIDCO under its CSR program could take steps to at least minimize loss of culture.	• CIDCO to develop CSR programme and implement	CIDCO/ SPC.
Loss of /Diversion of	• The diversion of agricultural land leading to issues of land use change and food security is very insignificant	-	-

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
agricultural land leading to issues of land use change and food security due to related infrastructure	in the present project scenario as the agricultural lands are very few and already notified for new city development.		
Loss of any archeological / cultural /historic site	• Based on the location from the airport site for all the three sites (Elephanta Caves, Karnala bird Sanctuary with Fort and Matheran Eco-sensitive area), the position of aircraft during takeoff/ landing/ missed approach/circling, would be more than 500 m. All of the sites are far from the Airport site, no impact is envisaged even in the operation stage. • However, during operation phase, proper flight directions can be provided so as to avoid flying over any of these sites. This would be stipulated in the guidelines during the operation stage	• ATC., AAI to prepare the flight procedure for arrival and departure to avoid these sites.	ATC., AAI
Tensions amongst communities related to employment opportunities	• The R&R entitlements include, apart from the monetary compensations also will provide free vocational training and preferential placement to APAP. Also reservation for job in unskilled and semi-skilled workers category will be made. This would result in such an impact to the minimal extent	• CIDCO will see that the R & R policy once finalized is implemented in a fair fast and transparent manner	CIDCO and EMC
NMIA Design			
Air Pollution	• Appropriate dust suppression measures will be implemented within the project site during controlled blasting, construction, material handling and transportation. The prospective contractors shall make provision for water sprinkling at the	• CIDCO would see that these requirements are a part of the tender document for the contractor carrying out this activity	• The Contractor in charge of the blasting, site leveling, construction, material handling and

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	construction site. • To help in abating the dust, formulation of compensatory plantation will be initiated as soon as MOEF clearance is obtained.	• The EMC would look into the action of the contractor on a regular basis	transportation
Extremely high dust levels	• Blasting to be carried out as per the best engineering practices and the use of modern technologies producing minimum dust and noise. • Use of dust extractors and spraying of water at source of dust emissions. • Trucks carrying earth, sand or stone will be duly covered with tarpaulin to avoid spilling.	• CIDCO would see that these requirements are a part of the tender document for the contractor carrying out this activity • The EMC would look into the action of the contractor on a regular basis	• The Contractor in charge of the blasting, site leveling, construction, material handling and transportation
Loss of local estuarine biodiversity	• The contamination of estuarine body would occur mostly during the construction phase of the channels and airport due to resuspension of sediments or dust from construction site, both of which are temporary • However, in order to minimize the above impacts of dredging/ channelization, proper route alignment, carrying out dredging and excavation in stages so as to maintain the water flow and during high tide will be done. The proposed alignment will have similar physiographic characteristics so as to keep the existing characteristics of the regime in the new diverted alignment of the river. The enhanced turbidity is a temporary phenomenon occurring during the water course diversion.	• EMC will plan the dredging and channelization in consultation with the contractor and see to it that the mitigation measures are implemented by the contractor	• CIDCO
Loss of Biodiversity	• There was no wildlife, observed or mentioned in the reports of the State Forest Department. The proposed project activity does not involve clearing of any forest	• EMC	• CIDCO/SPC

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	areas which act as the habitat for wildlife, adverse effect on wildlife habitat (reduction / breaking). The proposed site and the study area do not include any migratory route of animals. • However, the EMC personnel would be trained to be sensitive to this rare issue		
Sediment runoff into the creek	• The contamination of estuarine body would occur mostly during the construction phase of the channels and airport due to resuspension of sediments or dust from construction site, both of which are temporary. • However, in order to minimize the above impacts of dredging/ channelization, proper route alignment, carrying out dredging and excavation in stages so as to maintain the water flow and during high tide will be done. The proposed alignment will have similar physiographic characteristics so as to keep the existing characteristics of the regime in the new diverted alignment of the river. The enhanced turbidity is a temporary phenomenon occurring during the water course diversion.	• EMC will plan the dredging and channelization in consultation with the contractor and see to it that the mitigation measures are implemented by the contractor	• CIDCO
Loss of marshy land ecosystem	• The loss of marshy land is a permanent one. • Alternate development of the mangroves is part of mitigation activity which will be taken up. Compensatory plantation to the tune of 350 ha has been planned and the most appropriate mangrove plantation site as identified by GEC is the potential mudflats around the Dahanu area.	• Plantation Costs will be borne by CIDCO • EMC will prepare a detailed Mangrove Transplantation and Plantation plan and monitoring the implementation. Help from GEC would taken while developing this	• CIDCO

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
Safety of workers	• Adequate security arrangement will be made to ensure that the project authorities will provide necessary security to work force • This will conveyed to the contractor in the tender document and made a part of the agreement with the contractor	• EMC to monitor and ensure the security and safety of workers.	• Contractor/CIDCO/SPC
Interference with the natural drainage of the local ecosystem	• The proposed alignment will have similar physiographic characteristics so as to keep the existing characteristics of the regime in the new diverted alignment of the river. • Hence the interference would be of a minor nature and would stabilize in the long run. It is in the interest of the life of the airport that regular monitoring is done	• EMC & CIDCO	• CIDCO
Flooding in other low lying areas	• The change of river flow is inevitable and during the development, due care will be taken so to maintain the required hydraulic flow to avoid water logging in the upstream and also any water logging in the project area either during construction or operation phases. • In the interest of the life of the airport regular monitoring of any flooding is done	• EMC to monitor the flood levels.	• CIDCO/SPC
Noise Pollution	• Noise will be generated due to blasting operations of Hills. It is a activity lasting for short duration and the nearest settlements are more than 1 km away, the impact of the generated noise level on the surrounding population will be negligible. However, following stipulations would be provided to the contractor in the tender document o Blasting to be carried out as per the best engineering practices and the use of modern technologies	• CIDCO to make provision in the contract to limit the noise pollution.	• CIDCO/SPC

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	producing minimum dust and noise. o Proper maintenance of equipment will be undertaken with suitable enclosures and intake silencers. o Blasting should be well planned with large numbers being fired infrequently than a few blasts daily. No blasting will be carried out at night. o Before controlled blasting, the surrounding villages will be alerted and the villagers and domestic animals will be offered safe place away from the project site. o Stationary equipment such as ready mix plant, hot mix plant, cement storage plant will result in noise generation. The minimum distance of operation from stationary source for residential areas required for meeting CPCB standards is 113m. There are no residential areas within 113 m from the outer boundary of the project site and hence, no considerable impact is envisaged on the surrounding community during construction phase. However, the impacts will be significant on construction workers, working close to the machinery. o Construction activities involving operation of high noise generating machinery will be generally avoided between 10 p.m. and 6 a.m. o The construction personnel exposed to high noise levels will be provided with protective gears such as ear-muffs. o Construction machinery and equipment will be maintained in good working condition so as to reduce noise. Proper maintenance of equipment will be		

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	undertaken with suitable enclosures and intake silencers. o DG sets used during the construction phase would have the mandatory noise enclosures. o The use of damping materials such as thin rubber/lead sheet for wrapping the work places like compressors, generator sheds.		
Disposal of excavated material	• The excavated material/ construction debris from hill cutting would be used for land development to the maximum extent and the surplus, if any, will be disposed off in a pre-designated approved sites.	• CIDCO to make available the land for disposal of excavated materials.	• CIDCO
Sediment runoff leading to damage of local aquatic ecosystems	• The contamination of estuarine body would occur mostly during the construction phase of the channels and airport due to resuspension of sediments or dust from construction site, both of which are temporary. • However, in order to minimize the above impacts of dredging/ channelization, proper route alignment, carrying out dredging and excavation in stages so as to maintain the water flow and during high tide will be done. The proposed alignment will have similar physiographic characteristics so as to keep the existing characteristics of the regime in the new diverted alignment of the river. The enhanced turbidity is a temporary phenomenon occurring during the water course diversion.	• EMC will plan the dredging and channelization in consultation with the contractor and see to it that the mitigation measures are implemented by the contractor	• CIDCO
Safety hazard during the erection and operation	• Safe and secure construction camp area will be provided for the migrant laborers during the construction period. At the camp site, the contractors will be directed to make adequate arrangements for water supply,	• CIDCO to make provision in the contract.	• SPC/CIDCO

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	sanitation and cooking fuels to the laborers. The construction site will be provided with sufficient and suitable toilet facilities for workers to allow proper standards of hygiene. These facilities would be connected to a septic tank and maintained to ensure minimum environmental impact. At the construction site, the contractor will be asked to provide following facilities to construction workforce: • First Aid: At work place, first aid facilities will be maintained at a readily accessible place where necessary appliances including sterilized cotton wool etc. shall be available. Ambulance facilities will be kept readily available at workplace to take injured person to the nearest hospital. The contractor would have a tie-up with the nearest hospital. • Potable Water: Sufficient supply of cold water fit for drinking will be provided at suitable places • Sanitary Facility: Within the precinct of very work place, latrines and urinals will be provided at accessible place. These will be cleaned regularly to maintain good sanitary condition. The contractor will conform to sanitary requirement of local medical and health authorities at all times. These facilities would be connected to a septic tank and maintained to ensure minimum environmental impact. • Canteen: A canteen on a moderate scale will be provided for the benefit of workers; • Security: Project Authorities will provide necessary security to work force in co-ordination with State		

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	authorities; and • Facilities for Women: Facilities as per Factory Rules of the State government will be provided to the women working force. Separate toilets for women will be provided and marked in a vernacular language with conspicuous letters. • Adequate firefighting arrangement would be maintained by the contractor during the construction phase • During the operation phase, high level of fire – fighting equipments with adequate water and foam facility would be maintained as per the stipulated ICAO standards.		
Change in land use pattern	• Though the change in land use is permanent, in the project area lot of landscaping and greenery would be developed resulting in a better landscape then what it is at present	• CIDCO to make provision in the contract	• CIDCO/SPC
Siltation of channels developed while training the Gadhi River	• The change of river flow is inevitable and during the development, due care will be taken so to maintain the required hydraulic flow to avoid water logging in the upstream and also any siltation in the channels	• CIDCO to make provision in the contract	• CIDCO/SPC
Siltation while diverting the Ulwe River		• CIDCO to make provision in the contract	• CIDCO/SPC
Vibration in adjacent areas	• Following stipulations would be provided to the contractor in the tender document: o Blasting should be well planned with large numbers being fired infrequently than a few blasts daily. No blasting will be carried out at night.	• EMC to set criteria for vibration for implementation.	• CIDCO/SPC

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	o Before controlled blasting, the surrounding villages will be alerted and the villagers and domestic animals will be offered safe place away from the project site.		
Likely rise in water levels in periphery area	• As per the study carried out by CWPRS, reclamations for development of International Airport at Ulwe on left bank of Panvel Creek will not have any significant effect on water levels predicted considering all CIDCO developments along different channels in Panvel Creek. The change of river flow is inevitable and during the development, due care will be taken so to maintain the required hydraulic flow to avoid water logging in the upstream and also any water logging in the project area either during construction or operation phases.	• EMC to monitor the flooding.	• CIDCO/SPC
NMIA Construction			
Extremely high dust levels	• Use of dust extractors and spraying of water at source of dust emissions. • Trucks carrying earth, sand or stone will be duly covered with tarpaulin to avoid spilling. •	• CIDCO would see that these requirements are a part of the tender document for the contractor carrying out this activity • The EMC would look into the action of the contractor on a regular basis	• Contractor/SPC/CIDCO
Air Pollution due to equipment fuel usage	• All equipments should comply with the Air Standards. This aspect will be covered as a tender condition.	• EMC to monitor the air pollution	• CIDCO/SPC
Air Pollution due to leveling activity	• Hillocks in the airport area will be flattened and leveled resulting in high dust generation and increased air pollution (SPM levels) in the vicinity. Proper	• CIDCO would see that these requirements are a part of the tender document for	• CIDCO/SPC

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	development and maintenance of the land is a prerequisite for the project activity and hence all efforts as per the airport standards would be carried out. • Hi-tech equipment will be used for excavation and hauling of materials which will generate minimal noise as well as dust. This aspect will be covered as a tender condition.	the contractor carrying out this activity • The EMC would look into the action of the contractor on a regular basis	
Air Pollution due to construction activity	• Use of dust extractors and spraying of water at source of dust emissions. • Trucks carrying earth, sand or stone will be duly covered with tarpaulin to avoid spilling. • Regular monitoring would be carried out	• EMC to monitor the air pollution and set the construction working schedule.	• CIDCO/SPC
Sediment runoff into the creek	• The change of river flow is inevitable and during the development, due care will be taken so to maintain the required hydraulic flow to avoid water logging in the upstream and also any siltation in the channels	• EMC to monitor water pollution.	• CIDCO/SPC
Safety of workers	• Adequate security arrangement will be made to ensure that the project authorities will provide necessary security to work force • This will conveyed to the contractor in the tender document and made a part of the agreement with the contractor	• CIDCO to make provision in the contract document	• CIDCO/SPC
Accident during the construction stage	• At work place, first aid facilities will be maintained at a readily accessible place where necessary appliances including sterilized cotton wool etc. shall be available. Ambulance facilities will be kept readily available at workplace to take injured person to the nearest hospital. The contractor would have a tie-up with the nearest hospital.	• CIDCO to make provision in the contract document	• CIDCO/SPC

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	• This stipulations would be provided to the contractor in the tender document		
Fire hazard during the construction stage	• Proper fire fighting facilities would maintained at the sight • This stipulations would be provided to the contractor in the tender document	• CIDCO to make provision in the contract document	• CIDCO/SPC
Noise Pollution	• Proper maintenance of equipment will be undertaken with suitable enclosures and intake silencers. • Construction machinery and equipment will be maintained in good working condition and construction materials and machineries will be handled with due precautions. All vehicles and construction equipment with internal combustion engines in use will be maintained for effective combustion to reduce noise.	• CIDCO to make provision in the contract document	• CIDCO/SPC
Increase in the water requirement for domestic purpose leading to stress on water availability	• This requirement is to be met by CIDCO. CIDCO has estimated and found that there is ample water available for the project and the related development	• EMC to monitor and prevent the excess water consumption.	• CIDCO/SPC
Lack of Sewerage and Sewage Treatment Facilities leading to water pollution	• The construction site will be provided with sufficient and suitable toilet facilities for workers to allow proper standards of hygiene. • The basic hygiene facilities to be provided by contractor are to be made a part of the tender document	• CIDCO to make provision in the contract document	• CIDCO/SPC
Loss of water bodies (open wells and	• CIDCO to make provision of water bodies in the R & R settlement colony as per the R & R Policy	• EMC to ensure the implementation of R & R Policy.	• CIDCO

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
ponds) in the project site			
Indoor air pollution in the camp due to biomass fuel for cooking	• The contractor will see to that either kerosene or LPG would be made available to the workers so that misuse of local trees does not take place. This stipulations would be provided to the contractor in the tender document	• EMC to monitor the air pollution.	• Contractor/CIDCO/SPC
Air Pollution due to construction vehicle fuel usage	• Construction machinery and equipment will be maintained in good working condition and construction materials and machineries will be handled with due precautions. All vehicles and construction equipment with internal combustion engines in use will be maintained for effective combustion to reduce carbon particles, CO and HC emission. • Any vehicle not meeting the vehicular pollution standards will not be allowed within the construction site and for the construction activity.	• EMC to monitor the air pollution.	• Contractor/CIDCO/SPC
Misuse of local ecological resources like forests for firewood	• The contractor will see to that either kerosene or LPG would be made available to the workers so that misuse of local trees does not take place. This stipulations would be provided to the contractor in the tender document	• CIDCO to make provision in the contract.	• Contractor/CIDCO/SPC
Loss of Biodiversity	• There was no wildlife, observed or mentioned in the reports of the State Forest Department. The proposed project activity does not involve clearing of any forest areas which act as the habitat for wildlife, adverse effect on wildlife habitat (reduction / breaking). The proposed site and the study area do not include any	• EMC	• CIDCO/ SPC.

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	migratory route of animals. • However, the EMC personnel would be trained to be sensitive to this rare issue		
Water logging and cross drainage issue during construction	• Proper care would be taken that no water logging in the construction phase. This stipulations would be provided to the contractor in the tender document	• CIDCO to make provision in the contract.	• Contractor/CIDCO/SPC
Vibration in adjacent areas	• This would be in the project area but with the workers in place, following stipulations would be provided to the contractor in the tender document: • Construction machinery and equipment will be maintained in good working condition and construction materials and machineries will be handled with due precautions. All vehicles and construction equipment with internal combustion engines in use will be maintained for effective combustion to reduce vibration.	• CIDCO to make provision in the contract.	• Contractor/CIDCO/SPC
Solid waste generation and inadequate disposal	• Proper guidelines with respect to handling the waste generated from any untoward accidents of spillage of fuel or oil would be developed. This would include procedures for excavating the contaminated site and disposal to an authorized secured hazardous waste landfill. • During the construction phase, the municipal solid waste generated would those that arise from the construction camp and the workers canteen. Proper arrangements for transport of these solid wastes to the Chal landfill will be done.	• CIDCO to make provision in the contract. EMC to monitor the adequacy of solid waste disposal.	• Contractor/CIDCO/SPC
Disposal of excavated material	• The excavated material/ construction debris from hill cutting would be used for land development to the	• CIDCO to make available the land for disposal of	• CIDCO

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	maximum extent and the surplus, if any, will be disposed off in a pre-designated approved sites.	excavated materials.	
Pollution of land, ground water and surface water arising from wastes and spillages due to construction	• Proper disposal of waste and spilled material would be carried out as per the Hazardous Waste Rules • This stipulations would be provided to the contractor in the tender document	• CIDCO to make provision in the contract. EMC to monitor the adequacy of waste disposal.	• Contractor/CIDCO/SPC
Disposal of construction waste / debris	• Proper disposal of waste material would be carried out as per the Hazardous Waste Rules • This stipulations would be provided to the contractor in the tender document	• CIDCO to make available the land for disposal of excavated materials.	• CIDCO
Increase in power consumption	• Energy Conservation programs / protocols will be developed	• EMC will prepare a detailed Energy Conservation plan and monitoring the implementation	• CIDCO/SPC
Air pollution due to DG sets	• DG sets complying with the standards would only be used. This stipulations would be provided to the contractor in the tender document	• EMC to monitor the air pollution.	• Contractor/CIDCO/SPC
Fire hazard at the construction camp	• Proper fire fighting facilities would maintained at the sight • This stipulations would be provided to the contractor in the tender document	• EMC to ensure the fire safety by making visit to site.	• Contractor/CIDCO/SPC
Change in land use pattern	• Though the change in land use is permanent, in the project area lot of landscaping and greenery would be developed resulting in a better landscape then what it is at present	-	-

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
Leakage / Spillage of Fuel used at the construction camp	• Proper disposal of waste and spilled material would be carried out as per the Hazardous Waste Rules • This stipulations would be provided to the contractor in the tender document	• CIDCO to make provision in the contract.	• CIDCO/SPC
Loss of local culture	• The issue of loss of local culture is an another impact which is felt wherever large developmental projects arise. The airport project area which comes under the MMR region has already been under stress for this impact. CIDCO under its CSR program could take steps to at least maintain some	• CIDCO to take CSR programme in and around airport.	• CIDCO/SPC
Incomplete post-use clearance and rein-statement of base camp, leading to degradation of soil	• Proper disposal of waste and spilled material would be carried out as per the Hazardous Waste Rules • This stipulations would be provided to the contractor in the tender document	• CIDCO to make provision in the contract.	• CIDCO/SPC
Tensions amongst communities related to employment opportunities	• The R&R entitlements include, apart from the monetary compensations also will provide free vocational training and preferential placement to APAP. Also reservation for job in unskilled and semi-skilled workers category will be made. This would result in such an impact to the minimal extent	• CIDCO will see that the R & R policy once finalized is implemented in a fair and fast transparent manner	CIDCO and EMC
Water availability issues	• This requirement is to be met by CIDCO. CIDCO has estimated and found that there is ample water available for the project and the related development	-	-
NMIA Operation			
Air pollution due to the air traffic	• Air and Noise mitigation options will be implemented by defining the approach landing and takeoff procedures in a manner so as to minimize impact.	• EMC to ensure the air pollution in the airport within the limit.	• CIDCO/SPC

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
Increase in power consumption	• In case of the operational phase of the projects, all efforts with respect to minimizing the use of power will be carried out. To the extent possible solar panels will be installed wherever possible for lighting purpose. • All the protocols of automatic diming of light where the human traffic is low/nil will be followed. Use of sunlight to the maximum extent to low the energy costs will be looked into while designing the airport. • Good insulators to lower the AC power consumption will be looked into. • Energy Conservation programs / protocols will be developed	• EMC will prepare a detailed Energy Conservation plan and monitoring the implementation	• CIDCO/SPC
High air pollution along the various transport corridors leading to and away from the airport	• All the transport corridors leading to airport namely NH4, NH4B, Aamra Marg and Sion Panvel Highway have sufficient right of way to absorb the increase in traffic by widening the roads as and when required. o Background air quality will be maintained by reducing idling time and control on emissions. o The contribution from idling of engine at the signals would be minimized by providing wider roads and bridges (including over bridge) that connects to NMIA. o Vehicles that come to NMIA will be restricted (mandatory) by emission controlled certification and efficient engine conditions (Bharat III). o Chimney emission from industries and other activities will have to get emission control certification at regular interval	• CIDCO/NHAI to take tree plantation along the transport corridors.	CIDCO/NHAI

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
Noise pollution due to the air traffic	• Air and Noise mitigation options will be implemented by defining the approach landing and takeoff procedures in a manner so as to minimize impact. • Control on the aircraft noise level would be done by: a. Insistence of International code on noise level during takeoff and taxing by the Aircraft operators. b. Noise level contouring and identification of areas in the takeoff and landing sections. c. Discussion with people concerned over the run way operation and noise level reduction and execution of mandatory activities of DGCA and ICAO. d. Based on the community consensus and noise studies an implementation plan based on noise abatement plan and noise compatibility plan may be established. • The most effective method of mitigating noise sources - other than cessation of the source activity or use of source controls would include installation of sound barriers or also called noise barrier or sound wall or sound berm or acoustical barrier.	• SPC in consultation with the ATC, AAI design the arrival and departure procedure of flat to minimize the noise. • CIDCO would control the land use by zoning regulation.	• CIDCO/SPC/AAI
Noise pollution along the various transport corridors leading to and away from the airport	• Control on the vehicular noise level – speed and vehicle conditions would be done by: • Identification of structures and population vulnerable to noise level increase and remedial measures such sound proofing. • Tree corridor and sound barrier at the NMIA boundary in containing noise level. • Observation of no horn zone in NMIA • Battery operated service vehicles within the airport.	• EMC to monitor the noise pollution.	• CIDCO/SPC

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
Solid waste management issues	• During the operational phase, two types of waste would be generated namely the solid waste and the hazardous waste. Solid waste would be generated from the garbage/food waste from the restaurants and airport operations and paper and packaging waste generated in cargo section, while the hazardous waste that would be generated include sludge generated from STP, separated oil from oily wastewater treatment units and any waste generated due to spill containment in any untoward event. Proper arrangements with authorized transporters and authorized disposers would be done and proper records for the same would be maintained. • Adequate quantity and sizing of dustbins would be maintained throughout the airport area during the operation stage to receive solid wastes as and when generated. The collection bins are regularly sprayed with disinfectants. A proper solid waste management system would be put in place. • Vehicles transporting the solid waste are adequately covered to prevent any spillages during transportation. All stipulated procedures as per the Solid Waste Rules and the Hazardous waste Handling and management Rules would be adhered to. • Proper guidelines with respect to handling the waste generated from any untoward accidents of spillage of fuel or oil would be developed. This would include procedures for excavating the contaminated site and disposal to an authorized secured hazardous waste	• SPC to adhere to standard solid waste management and EMC to monitor the same.	• CIDCO/SPC

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	landfill.		
Sewage treatment issue	• With respect to wastewater, STP would be installed on the project site apart from the underground drainage will be connect to CIDCOs other STPs. o All STPs will have the Sequential Batch Reactor Technology for which CIDCO has developed its expertise in operation and maintenance. o The treated wastewater would be recycled and reused. Reverse Osmosis plant to treat the wastewater to the required quality will be installed. Some of the areas where the wastewater can be utilized include make-up water in cooling system, floor washing and gardening. To the maximum extent the treated wastewater will be utilized and will not be discharged outside the airport boundary. o Proper oil & grease interceptors will be installed at wastewater outlet from the maintenance hangers, fuel depots, hotels/restaurants and flight catering. The wastewater will be passed through oil and grease interceptors and then routed to STP. o Settling tanks, blow down tanks and neutralization pits will be cleaned regularly in order to avoid clogging. Sludge will be removed regularly and sufficient time will be given for proper settling of solids; and o The treatment units will be operated regularly.	• SPC & CIDCO to maintain the STP as per the standard prescribed norms. • EMC to monitor the same.	• CIDCO/SPC
Air pollution due to	• DG sets with proper acoustic enclosures and complying with the standards would only be used. This	• EMC to monitor the air pollution.	SPC

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
use of DG sets	stipulations would be maintained by the operator of the airport		
Change in land use pattern	• Though the change in land use is permanent, in the project area lot of landscaping and greenery would be developed resulting in a better landscape then what it is at present	-	-
Loss of local culture	• The issue of loss of local culture is an another impact which is felt wherever large developmental projects arise. The airport project area which comes under the MMR region has already been under stress for this impact. CIDCO under its CSR program could take steps to at least maintain some	• CIDCO to take CSR programme in and around airport.	• CIDCO/SPC
Availability of water issues for airport zone	• This requirement is to be met by CIDCO. CIDCO has estimated and found that there is ample water available for the project and the related development, it is proposed to minimize the water usage in the operational phase: a. Use of low flow fixtures and appliances for reduced water consumption such as low flush water closets and cisterns; b. Water saving shower head flow controls, spray taps and faucet aerators and photo-sensitive taps; c. Sewage generated will be treated in the sewage treatment plant and reused for green belt development, cooling system and floor washing to reduce the fresh water requirement; d. The storm water from paved areas will be routed to	-	-
Increase in the water requirement for domestic purpose leading to stress on water availability in the region		-	-

Environmental Issues/Impacts	Enhancement/ Mitigation Measures[1]	Management Action	Implementation Responsibilities
	the water harvesting structures to reuse the water for gardening purpose (as recharging the ground water is not possible). The storm water treatment facility will be located at an appropriate site keeping in view the slope contours and collection point at the most convenient point; e. Use of dry cleaning process in workshop and maintenance area to clean the oil spillages. f. Continuous efforts to reduce the water consumption and thereby to reduce the wastewater generation would be done by fitting automatic flow meters for all major water inlets. Flow rates will be continuously monitored and periodic water audits will be conducted to explore the possibilities for minimization of water consumption. • The various water saving steps are to be made a part of the tender document		
Tensions amongst communities related to employment opportunities	• The R&R entitlements include, apart from the monetary compensations also will provide free vocational training and preferential placement to APAP. Also reservation for job in unskilled and semi-skilled workers category will be made. This would result in such an impact to the minimal extent	• CIDCO will see that the R & R policy once finalized is implemented in a fair and fast transparent manner	CIDCO and EMC

6.8 Monitoring Plan

The 'Navi Mumbai International Airport' project will result in significant environmental impacts. These impacts can be reduced to a great extent with the proper implementation of mitigation measures. To check the efficacy of the suggested and implemented mitigation measures, there is a need for regular monitoring. The monitoring will be done for various environmental components which are adversely (directly or indirectly) affected by the proposed project. The main objectives of environmental monitoring:

- To verify the results of the impact assessment study with respect to the proposed 'NMIA' project.
- To study the trend of concentrated values of the parameters, which have been identified as critical and then planning the mitigating measures.
- To check and assess the efficacy of pollution control equipment.
- To ensure that any additional parameters, other than those identified in the impact, do not turn critical after the commissioning of 'NMIA' project.

The mitigation measures suggested in the preceding sections require environmental monitoring of air quality, noise levels, seawater, sediment, groundwater quality, sand movement/erosion during the construction and operation phase of Navi Mumbai International Airport. Environmental surveys will be carried out to meet the monitoring requirements. The monitoring requirements would be carried out through sub-contracting the assignment to an approved agency with capabilities to undertake monitoring of environmental surveys.

The environmental attributes to be monitored during the construction and operation phase of, Navi Mumbai International Airport are listed below:

Table 6.2
Environmental monitoring Plan

Environmental Component	MONITORING							Institutional Responsibilities	
	Parameters[2]	Special Guidance	Standard	Location	Frequency	Duration	Method for Analysis	Implementation	Supervision
Air	• Suspended Particulate Matter (SPM) • Respirable Particulate Matter (RPM) • Sulphur Dioxide (SO2) • Oxides of Nitrogen (NOx) • Carbon Monoxide (CO)	• Respirable Dust Sampler & High Volume Sampler will be used for monitoring of RPM, SPM, SO2 & NOx • Organic Vapour Sampling kit will be used for sampling CO & HC	Air (Prevention and Control of Pollution) Rules , 1981	• Panvel, • Ulwe, • Vaghvli • Kopar	Twice a week at each monitoring station.	Continuous 24 hours/ or for 1 full working day	• SPM & RPM will be estimated gravimetrically • SO2 will be estimated by 'Modified West and Gaeke method' (IS-5182 part II, 1969) • NOx will be estimated by 'Jacobs-Hochheiser method' (IS-5182 part IV, 1975) • 'Indicating tube method' will be used for estimation of CO • Gas liquid Chromatography technique will be used for HC	Initially during the design and construction phase from outside laboratory Later on in- house laboratory	EMC/SPC/CIDCO

[2] *Kindly refer Table no. 6.6 for the List of Equipments*

Environmental Component	MONITORING							Institutional Responsibilities	
	Parameters[2]	**Special Guidance**	**Standard**	**Location**	**Frequency**	**Duration**	**Method for Analysis**	**Implementation**	**Supervision**
Noise	• Hourly noise level for 24 hours [L_{10}, L_{50}, L_{90}, L_{EQ}(24 hours), L_{EQ} (day) and L_{EQ}(night)]	• Cygnet integrating data-logging sound level meter	Air (Prevention and Control of Pollution) Rules , 1981	• Panvel, • Ulwe, • Vaghvli	Once in a month	Once in each season during construction	• Sound pressure level will be monitored using Sound Level Meter (SLM) over a period of 24 hours. The day time levels will be monitored during 6 AM to 10 PM and night levels during 10 PM to 6 AM.	Initially during the design and construction phase from outside laboratory Later on in- house laboratory	EMC/CIDCO/SPC

Environmental Component	MONITORING							Institutional Responsibilities	
	Parameters[2]	**Special Guidance**	**Standard**	**Location**	**Frequency**	**Duration**	**Method for Analysis**	**Implementation**	**Supervision**
Ground Water	• Physical parameters:- pH, Temperature, Turbidity, EC, Salinity • Chemical parameters:- DO, BOD, COD, Magnesium hardness, Alkalinity, Chloride, Sulphate, Fluoride, Sodium, Potassium, total nitrogen, Total phosphorus, Phenol • Heavy metals:- Fe, Zn, Mg, Mn, Cd, Cr, Hg • Bacteriological parameters:- Coliform count	• Ground water will be collected using bottom sampler (Nishkin sampler)	Water (Prevention & Control) Act, 1974	Gadhi, Taloja & Panvel.	Once in a month	During construction and operation	• The parameters will be tested as per IS: 2296, IS: 10,500 and EIA manual by MOEF. The test method will be adopted as per IS: 3025 and American Public Health Association (APHA)	Initially during the design and construction phase from outside laboratory Later on in- house laboratory	EMC/SPC/CIDCO

Environmental Component	MONITORING							Institutional Responsibilities	
	Parameters[2]	**Special Guidance**	**Standard**	**Location**	**Frequency**	**Duration**	**Method for Analysis**	**Implementation**	**Supervision**
Surface Water	• Physical parameters:- pH, Temperature, Turbidity, EC, Salinity • Chemical parameters:- DO, BOD, COD, Magnesium hardness, Alkalinity, Chloride, Sulphate, Fluoride, Sodium, Potassium, total nitrogen, Total phosphorus, Phenol • Heavy metals:- Fe, Zn, Mg, Mn, Cd, Cr, Hg • Bacteriological parameters:- Coliform count	• Grab sampler	Indian standards for Inland Surface Water (IS; 2296, 1982) and for Drinking water (IS; 10500,1991)	Panvel & Pargaon	Once in a month	Construction and Operation	• The parameters will be tested as per IS: 2296, IS: 10,500 and EIA manual by MOEF. The test method will be adopted as per IS: 3025 and American Public Health Association (APHA)	Initially during the design and construction phase from outside laboratory Later on in- house laboratory	EMC/SPC/CIDCO

Environmental Component	MONITORING							Institutional Responsibilities	
	Parameters[2]	**Special Guidance**	**Standard**	**Location**	**Frequency**	**Duration**	**Method for Analysis**	**Implementation**	**Supervision**
Marine Water	• Physical parameters:- pH, Temperature, Turbidity, EC, Salinity • Chemical parameters:- DO, BOD, COD, Magnesium hardness, Alkalinity, Chloride, Sulphate, Fluoride, Sodium, Potassium, total nitrogen, Total phosphorus, Phenol • Heavy metals:- Fe, Zn, Mg, Mn, Cd, Cr, Hg • Bacteriological parameters:- Coliform count • Marine biology: Phytoplankton & Zooplankton	• Marine water will be collected using bottom sampler (Nishkin sampler) • The plankton samples should be collected using plankton net of diameter of 0.35 m, No. 25 mesh size 63 micron	The tested samples will be compared with the primary water quality standards framed by Central Pollution Control Board and also with other relevant guidelines to assess the compliance during the entire phase of the construction activities and operational phase	Panvel Creek and Taloja Creek	The samples should be collected on a monthly basis both for low tide and high tide periods	During construction & Operation	• The parameters will be tested as per IS: 2296, IS: 10,500 and EIA manual by MOEF. The test method will be adopted as per IS: 3025 and American Public Health Association (APHA)	Initially during the design and construction phase from outside laboratory Later on in- house laboratory	EMC/SPC/CIDCO

Environmental Component	MONITORING							Institutional Responsibilities	
	Parameters[2]	**Special Guidance**	**Standard**	**Location**	**Frequency**	**Duration**	**Method for Analysis**	**Implementation**	**Supervision**
Wastewater	• Physical parameters – pH, Temperature, EC, Turbidity, Surface tension • Chemical parameters - TSS, TDS, BOD, COD, Ammonical nitrogen, Phosphorus, MLSS, MLVSS • Bacteriological analysis – Coliform count	• pH Meter, Thermometer, Turbidometer, TDS scan meter, BOD incubator, COD digester, Muffle furnace, weighing balance, UV-Visible Spectrophotometer, Flame photometer and glasswares	The treated wastewater quality should be in compliance with the standards laid down by MPCB	Aeronautical area and Non-aeronautical area	Once in fortnight	Construction and Operation	• As per the standard procedures given in APHA for every parameter	Initially during the design and construction phase from outside laboratory Later on in- house laboratory	EMC/SPC/CIDCO
Stormwater	• Cleaning of Drains and CD Structures	• All drains should be monitored under regular cleaning operations. • Records to be maintained	Cleaning shall be to the satisfaction of the PMC and DIAL	All storm water drains	Before every Monsoon	At least once a year	•	Initially during the design and construction phase from outside laboratory Later on in- house laboratory	

Environmental Component	MONITORING							Institutional Responsibilities	
	Parameters[2]	**Special Guidance**	**Standard**	**Location**	**Frequency**	**Duration**	**Method for Analysis**	**Implementation**	**Supervision**
Sediment Quality	• Physico-Chemical Properties: pH, Organic Matter, Nutrients, Oil and Grease • Heavy Metals: Fe, Zn, Mn, Cd, Cr, Hg, Ni, Pb • Benthic Communities: Macro and Micro Benthic Flora and Fauna	• Peterson's Grab Sampler	At present, there are no standards for sediment quality in India. However, there should not be marked variations in the sediment quality during the entire construction phase	Panvel & Taloja	Once in a month	Construction and Operation period.	• The collected sediment will be segregated on the site for analysis of physico-chemical parameters, heavy metals and benthic communities. • The sediment sample for benthic communities will be subjected to sieving to record the macro benthos and then the samples should be preserved with Rose Bengal and Formalin Solution for further analysis of Benthic communities	Initially during the design and construction phase from outside laboratory Later on in- house laboratory	EMC/SPC/CIDCO

Environmental Component	MONITORING							Institutional Responsibilities	
	Parameters[2]	**Special Guidance**	**Standard**	**Location**	**Frequency**	**Duration**	**Method for Analysis**	**Implementation**	**Supervision**
Meteorological Monitoring	• Wind speed • Wind direction • Temperature • Relative humidity • Rainfall	• Anemometer for wind speed • Wind vane with counter weight for wind direction • Temperature sensor • Humidity sensor • Rain gauge	As per the standard norms laid down by Bureau of Indian Standards (IS:8829) and India meteorological Department (IMD)	Aeronautical Area	Daily/ hourly values	Operation Period	The meteorological parameters will be recorded continuously through a micro-chip based data logger (Model WM-200, which is approved by CPCB). The data logger will be connected to meteorological sensors for collection of required data. The collected data will be transferred to the data logger via connecting cables and stored in its memory. The data will be retrieved at regular intervals by interfacing the data logger with a computer. The generated data will be also compared with the long term data collected from by India Meteorological Department (IMD), to identify the general meteorological regime of the region.	Initially during the design and construction phase from outside laboratory Later on in- house laboratory	SPC

Environmental Component	MONITORING							Institutional Responsibilities	
	Parameters[2]	**Special Guidance**	**Standard**	**Location**	**Frequency**	**Duration**	**Method for Analysis**	**Implementation**	**Supervision**
Plantation	• Survival rate of tress • Success of re-vegetation	• The number of trees surviving for each phase of construction	The survival rate should be at least 70% below which re-plantation shall be done	All places where compensatory plantation have be carried out as well as the project site where plantation have be carried out	Every year for initial five years for compensatory plantation of each planned phase.	Construction Operation period	• By manual contracting	EMC/SPC/CIDCO	EMC/SPC/CIDCO
Construction Site	• Monitoring of Construction material storage area. • Drainage arrangements • Sanitation at construction camp including solid waste management.	• Visual observations	-	At material storage area storage and construction camps.	Monthly	Construction period	• By inspection	Contractor	EMC/SPC/CIDCO

Environmental Component	MONITORING							Institutional Responsibilities	
	Parameters[2]	**Special Guidance**	**Standard**	**Location**	**Frequency**	**Duration**	**Method for Analysis**	**Implementation**	**Supervision**
Socio-Cultural Environment	• Periodic Surveys to monitor the Status of Health due to Pollution	Socio-economic survey	-	Affected employees and human settlements in the vicinity of the airport Maintenance of accurate registration data on population and business	Yearly	Post operation period	• Statistical technique	SPC/CIDCO	SPC/CIDCO

6.9 Financial Plan

The development of 'Navi Mumbai International Airport' is essential to meet the growing demands for air travel and for economic growth but at the same time the environment is to be preserved for future generations. The implementation of pollution control, environmental monitoring and management programmes is the basis of the mitigation of impacts. The environmental expenditures show commitment of the management on environmental front.

6.9.1 EMP budget estimates:

The budget of monitoring, implementation of mitigation and environment management plan to mitigate the potential adverse impact during construction and operation phase has been worked out. The approximate budgetary estimates for environmental measures during construction phase of NMIA will be Rs. 400.00 Crores. The annual budgetary estimate for environmental monitoring during operational phase of NMIA will be Rs. 20 lakhs The detail of the expenditure on environmental measures is presented in the table below:

Table 6.3

EMP cost during construction phase

Sr. No.	Item	Rate	Amount (Rs. In Lakhs)
1	Provision of sanitation at construction site	Lump sum	100.00
2	Plantation around the parking area	Lump sum	50.00
3	Plantation /Replantation around the boundary wall	Lump sum	500.00
4	Barrier around the construction yard	Lump sum	50.00

5	Procurement of monitoring and laboratory equipment	Lump sum	500.00
6	Rehabilitation and Resettlement	As per details in section 2.1.1	36985.00
7	Effluent treatment plant and disposal arrangement	Lump sum	400.00
8	Compensatory mangrove plantation	Lump sum	500.00
9	Firefighting equipment	Lump sum	500.00
10	Landscaping	Lump sum	300.00
11	Air and noise pollution safety gadgets	Lump sum	25.00
12	Water quality monitoring	Lump sum	25.00
13	Solid waste management (Dust bins and incinerators)	Lump sum	20.00
14	Mobile health unit	Lump sum	25.00
15	Accidents/Safty	Lump sum	20.00
Grand Total			40000.00
Total			**: Rs. 400.00 Cr**

Table 6.4

EMP cost during operational phase

Sr. No.	Parameters to be monitored	Rate	Amount (Rs. Lakhs)
1	Air pollution monitoring & control	Four locations	6.0
2	Noise level monitoring & control	Three locations	2.0
3	Water quality monitoring & control	Three locations	1.50
4	Meteorological monitoring	One location @ L.S	1.50
5	Miscellaneous	L.S	9.0
Total			**Rs. 20 lakhs**

6.10 Reporting Strategies:

As mentioned in the section 6.7 Environment Management Cell, the EMC shall include the Head of the EMC who will be the Assistant General Manager (Sr. Environmentalist: Environment, Health & Safety) along with the supporting staff. A team of Environmental Engineers, Environmental Scientist, Chemists, Horticultural Expert and biologist would maintain the cell. The entire staff will be given unique responsibilities and accordingly they will carry out specific activities. The reporting plan will be developed according to hierarchy which is created in the EMC cell structure. The junior staff or employees who are at lower level in the hierarchy will report to their senior officers.

The reporting strategy at the NMIA from lower to upper level in the hierarchy (based on their roles, responsibilities and designation) will be as follows:

- The Engineer (Water & Sanitation), the Engineer (Safety), Scientist (laboratory services) and Scientist (Horticulture) will be the junior staff and therefore at the lowermost position in the hierarchy. They will prepare monthly analysis and progress report of their work and will report to Senior Manager (Engineering) and Senior Manager (Sciences) respectively.
- Senior manager (Engineering) and Senior Manager (Sciences) will be senior staff and therefore at the upper level in the hierarchy. They will evaluate the monthly report submitted by their junior staff. They will prepare final monthly progress report and submit it to the Assistant General Manager (Head of the EMC).
- The Assistant General manager will be the head of the EMC and he will be reporting to the Executive Director (Engineering Services) about the functioning of the Department as well as submit the implementation report to PCB and to IAA/MOEF.

6.11 Responsible organizations for implementation of EMP:

The identified impacts, suggested mitigative measures and the organizations responsible for implementation of Environmental management Plan are presented in the following Table 6.1

Table 6.5

Organizations Responsibility

Impact	Mitigation measure	Organization In- charge
Loss of vegetation	Growing vegetation in the unused reserved area	CIDCO/SPC
Air Pollution	Water sprinkling and modern construction methods	Construction Contractor (SPC),& Project Proponent (CIDCO)
Increased noise levels	Building noise barriers, Growing vegetative cover and using noise absorbing material inside the terminal building	Construction Contractor (SPC),& Project Proponent (CIDCO)
Hill cutting and problems of dust	Dust suppressing methods will be adopted while cutting the hill	Construction Contractor (SPC),& Project Proponent (CIDCO)
Physical, morphological disturbance due to river diversion	Effect is temporary for a short period	Construction Contractor (SPC),& Project Proponent (CIDCO)
Displacement of the people	Disbursal of compensatory package to the displaced people	Project Proponent (CIDCO), revenue Department and the District Collector, Government of Maharashtra
Water Pollution	Wastewater generated due to the usage will be treated and recycled for plantation	Environmental management Cell of Project Proponent (CIDCO) & SPC and State Pollution control Board (SPCB)
Garbage and other solid waste management	Disposal of organic and canteen waste will be collected and incinerated	SPC, CIDCO & Maharashtra Pollution Control Board (MPCB)

Table No. 6.6

List of equipments needed

Sr. No.	Equipment	No. of equipments
1	Respirable dust sampler	2
2	High volume sampler	2
3	Organic vapor sampling kit	2
4	Sound level meter	1
5	Nishkin sampler (bottom sampler)	1
6	Peterson's Grab sampler	1
7	Anemometer	1
8	Wind vane with counter weight	1
9	Temperature sensor	1
10	Humidity sensor	1
11	Rain gauge	1
12	pH meter	2
13	Thermometer	2
14	Turbidometer	2
15	TDS scan meter	1
16	BOD incubator	1
17	COD digester	2
18	Muffle furnace	1
19	Weighing balance	1
20	UV- Visible spectrophotometer	1
21	Flame photometer	1
22	Glasswares (Pipettes, conical flask, round bottom flask, etc.)	Lump sum
23	Firefighting equipments	10

Chapter - 7
Disaster Management Plan

Chapter - 7

Disaster Management Plan

7.0 Introduction

Natural disasters and manmade disasters like aircraft accidents, fires, terror attack & aircraft hijacking do occur at airports; therefore, it is required disaster preparedness and management plan. As every installation, airports require specific installation protection and organization to meet theirs need for its onsite and offsite emergency management plan. In most cases organization planning is based on the number of workers and work environment as well as type of disaster, control facilities, and available equipments. In the disaster management plan preplanning is done to contain effects of indentified failure scenarios. Depending upon the degree of the severity, incidents may be classified into two groups a) the accident that could be local causing damage to airport, materials, work force & facility users i.e. passengers only and b) the incidents that may affect neighbouring environment including surrounding habitations. The emergency arising out of the first category of incident is termed as on-site emergency and emergency arising out of second category is termed as off-site emergency. This chapter identifies possible disasters that could occur at Navi Mumbai International Airport and draws a disaster management plan, which includes the emergency control measures, plan of coordination and interaction with various agencies including administrative agencies, rescue and relief operations, training and awareness to minimize the severity of disasters.

7.1 Natural Disasters

Natural Disasters are often sudden & intense and results in considerable destruction, injuries & death disrupting normal life as well as the process of development. Disasters due to natural calamity could be as follows:

- earthquake
- flood
- storms/cyclone
- cloud burst/lightning/extreme weather conditions
- fire

7.2 Aircraft Accident Related Disasters

Aircraft accident occurs near and within the airport during landing/take off/taxing due to malfunctioning of some mechanism like undercarriage, failure of hydraulic power supply, non-functioning of one or more engines, malfunctioning of landing gear, sudden fire in aircraft while enrouting, unforeseen circumstances in which pilot loses control over aircraft and improper signalling by air traffic control tower (ATC). Disasters due to emergencies could be as follows:

- aircraft accident at airport
- aircraft accident off airport
- Hazardous material emergency, hydrocarbon spills (ATF) followed by vapour dispersion and pool fire
- fire

7.3 Terror Attack, Plane Hijack, Sabotage

The threat of bombing vital installations by enemy action or sabotage can not be ruled out near and within the airport. Since airports are vital facilities prone to terror attack/sabotage or plane hijacking. The threat to an airport could be from ground as well as from the air. Disasters due to external factors are on account of unlawful seizure, sabotage and bomb threat.

7.4. Disaster Management Plan

Based on the identified disaster above, a disaster management plan needs to be prepared for Navi Mumbai International Airport for dealing with emergency situations. Aviation emergency occurs at or near airports; therefore, integrating the activities of local and airport emergency service becomes a major issue for planning and implementation. Planning of an effective response to disaster at or near an airport places a particular requirement for co-ordination between emergency services, for both short-term and long-term response.

A Disaster Management Plan (DMP) is an integral part of an airport operation for effective and safe management of technical and non-technical emergencies. This is important for effective management of an emergency situation to minimize losses to people, property and both at and around the airport.

The objectives of the emergency planning are to describe the airport's emergency response organization, the resources available and applicable response actions. Thus, the objectives of emergency response plan can be summarized as follows:

- Rapid control and containment of the hazardous situation;
- Minimizing the risk and impact of an event/accident; and
- Effective rehabilitation of the affected persons, and prevention of damage to property.
- .

The DMP plan should be prepared in accordance with the Civil Aviation requirement laid down by the Director General of Civil Aviation (DGCA), the National Disaster Management Act, 2005, the National Building Code as well as various code provisions of the International Civil Aviation Organization (ICAO) including other International conventions and acts.

Under the Aircraft Rule 1937 Part XI, Rule 81 and Civil Aviation Requirements (CAR) Section 4, series ‘B’ Part I, an aerodrome operator is required to establish a Disaster Management Plan (DMP) commensurate with airport operations and other activities conducted at the aerodrome. To meet this requirement and necessary obligations stipulated by DGCA, the Navi Mumbai International Airport should establish and promulgate the DMP based on standards set by DGCA in CAR, Section 4, Series ‘B’ Part I and ICAO guidelines in the Airport Service Manual, Part 7.

7.4.1 Purpose & Scope

The purpose of a DMP is to spell out the procedures for coordinating the response of different agencies and services, both on and off the airport, to cope with various aircraft related and non-aircraft related emergencies anticipated at the airport.

The procedures to deal and manage different types of emergencies anticipated at the airport will be drawn up in the DMP as follows:

- Section 1 - Local Standby
- Section 2 - Full Emergency
- Section 3 - Aircraft Crash within Airport Fire Service Turnout Area
- Section 4 - Aircraft Crash outside Airport Fire Service Turnout Area
- Section 5 - In-flight Mass Casualties
- Section 6 - Fires on the Ground (Aircraft Related Fires Occurring in Aircraft Movement Areas)
- Section 7 - Fires on the Ground (Fires Involving Airport Buildings and Installations, i.*e.* Non-Aircraft Related Fires)
- Section 8 - Dangerous Goods Accidents/Incidents
- Section 9 - Natural Disasters such as storms and earthquakes
- Section 10 - Salvage of Crashed or Disabled Aircraft on the Aerodrome

The procedures for dealing with sabotage such as bomb-threats and unlawful seizures of aircraft will be developed under separate plans as classified documents in the following manuals:

- Contingency Plan for Handling Hijack Situation; and
- Contingency Manual Bomb Threat.

7.4.2 Categorization of Emergencies

Emergencies at airports can be classified under several broad headings. These headings are listed below together with a description of the type of emergency.

i) Local Standby

Local standby will be declared when an aircraft approaching the aerodrome is known or is suspected to have developed some defect but the trouble does not normally involve any serious difficulty in effecting a safe landing.

ii) Aircraft Disabled/Immobilized on Runway/Taxiway

An incident such as bursting of tyres, hydraulic leakage/failure, undercarriage failure or any other technical problems, the aircraft can be disabled or immobilized on the runway or taxiway. Situation like this may require the pilot to disembark the passengers onboard *in situ* before the aircraft is removed or towed to its parking bay. To specifically deal with such a situation, a plan should be developed.

iii) Full Emergency

Full Emergency will be declared when an aircraft approaching the aerodrome is known or is suspected to be in such trouble that there is a possibility of an accident.

iv) Crash Action

Crash Action will be declared for aircraft accidents on the aerodrome as well as off the aerodrome. There are two types of Crash Action - for aircraft accidents that occur within the Airport Fire Service Turnout Area and for that occur outside the Airport Fire Service Turnout Area.

v) In-Flight Mass Casualties

Part 1 of ICAO Annexure 6 stipulates that the pilot-in-command shall be responsible for notifying the nearest appropriate authority by the quickest available means of any accident involving his aircraft, which results in serious injury or death to any person or substantial damage to the aircraft or property. Mass casualties onboard will usually result from incidents such as an encounter with air turbulence during flight and mass food poisoning.

vi) Fires on the Ground

Fires on the ground can be aircraft related and non-aircraft related. Fires involving aircraft can be at any location on the runway, taxiway or apron area where the aircraft is parked. Non-aircraft related fires involve mainly the airport buildings and installations.

vii) Natural Disasters

The natural disasters to which airport are likely to be subjected to are earthquake, flood, thunder and storms. Depending on the intensity, such acts of nature may cause severe destruction to the aircraft, airport buildings and installations, and even loss of life. While nothing can be done to avert them, there are actions that can be taken at design stage to minimize the impact and expedite restoration of airport operations during emergency using the emergency plan for the airport.

7.5 Emergency Procedures

i) Local Standby

Local Standby is declared when an aircraft approaching the aerodrome is known or is suspected to have developed some defect but the trouble is not such as would normally involve any serious difficulty in effecting a safe landing.

- The decision to declare Local Standby for an aircraft emergency rests with the Air Traffic Control; and
- The Air Traffic Control shall use the standard text and format for the declaration of Local Standby as follows:

AIRPORT LOCAL STANDBY:

- Aircraft Operator;
- Aircraft Type & Flight Number; Nature of Trouble;
- Number of Persons on Board (POB); Fuel on Board;
- Planned Runway;
- Estimated Time of Arrival (ETA); and
- Any Dangerous Goods On Board including quantity and location, if known.

ii) Full Emergency

Full Emergency is declared when an aircraft approaching the aerodrome is known or is suspected to be in such trouble that there is a possibility of an accident. The decision to declare Full Emergency rests with the Air Traffic Control.

The Air Traffic Control shall use the standard text and format for the declaration of Full Emergency as follows:

AIRPORT FULL EMERGENCY:

- Aircraft Operator;
- Aircraft Type & Flight Number; Nature of Trouble;
- Number of Persons on Board (POB); Fuel on Board;
- Planned Runway;
- Estimated Time of Arrival (ETA);
- Any Dangerous Goods On Board including quantity and location, if known.

iii) Aircraft Crash within Airport Fire Service Turnout Area

The Airport Fire Service turnout area shall include the entire airport area as well as the areas in the vicinity of the airport up to an arc of a circle centred at the runway threshold of 5 km radius, and 3 km from the perimeter of the airport.

Crash action is declared for aircraft accidents on the aerodrome as well as off the aerodrome. The Air Traffic Controller shall activate the crash alarm immediately if one of the following events occurs:

a) When the aircraft accident/crash is sighted by the Air Traffic Controller or the sighting is reported to the Air Traffic Control by any of the reliable sources such as the "Follow-Me" vehicles plying in the aircraft movement area;

b) During poor visibility- when the Air Traffic Controller is unable to sight the runway, and the aircraft, which has been cleared for take-off or land, fails to respond to the Air Traffic Control's repeated calls or the inputs from the Advanced Surface Movement Guidance and Control System (A-SMGCS) and other radar have indicated that the aircraft might have crashed; or

c) When the aircraft has been cleared to land and fails to land within 5 minutes of the estimated time of landing and the communication with the pilot is not able to be re-established. Or the inputs from ASMGCS and other radar have indicated that the aircraft might have crashed.

- The decision to declare Crash Action rests with the Air Traffic Control;
- If the crash is within the Airport Fire Service Turnout Area, the Air Traffic Control shall activate the crash alarm for at least one minute continuously, and the "Crash" message shall be broadcast over the Crash alarm communication system. The "Crash" message shall also be relayed to the Airport Fire Watch Tower;
- The standard text and format used for the "Crash Action" message for aircraft crash within the airport Fire Service Turnout Area shall be as follows:

  CRASH, CRASH, CRASH:
  - Aircraft Type & Flight Number; Location of Accident;
  - Grid Map Location [*SQUARE (Alpha-Numeric)];Time of Accident;
  - Number of Persons On Board (POB);
  - Fuel On Board;
  - Aircraft Operator;
  - Any Dangerous Goods On Board including quantity and: location, if known.

**The 'Square' is the alpha -numeric grid reference indicated on the Crash Map.*

If the aircraft accident occurs on the runway, the Air Traffic Control shall give clearance for the responding airport fire vehicles to enter the runway as soon as possible.

iv) Aircraft Crash outside Airport Fire Service Turnout Area

If an aircraft accident occurs outside the Turnout Area, the procedures for Crash Action outside the Airport Fire Service Turnout Area shall be as followed.

- The decision to declare the Crash Action rests with the Air Traffic Control.
- If it is clear to the Air Traffic Controller that the aircraft has crash and landed outside the Airport Fire Service Turnout Area, the standard text and format used for the "Crash Action" message shall be as follows:

AIRCRAFT CRASH OUTSIDE TURNOUT AREA;

- Aircraft Type & Flight Number; Location of Accident (approximate);
- Time of Accident;
- Number of Persons On Board (POB); Fuel On Board;
- Aircraft Operator;
- Any Dangerous Goods On Board including quantity and location, if known.

State Authorities/District Administration will be overall in charge of all ground operations at the scene. All the other agencies and services involved will activate their respective emergency operations plans to support the State Authorities/District Administration in the mitigation of the aircraft accident.

Local Fire Service will be fully in charge and resume command of the aircraft fire-fighting and rescue operations at the crash site.

v) Fires on the Ground (Aircraft Related Fires Occurring in Aircraft Movement Areas)

An aircraft can catch fire whilst it is taxing in the movement area or parked at an aerobridge or remote bay. Such a scenario can arise from a defect or malicious act, and may develop into a major disaster. The resources required to mitigate are thus identical to that of an aircraft crash within the Airport Fire Service Turnout Area.

When the aircraft on the ground catches fire and is sighted by the Air Traffic Controller or reported to the Air Traffic Control by any reliable sources, the Air Traffic Controller shall activate the Airport Fire Service through the crash alarm communication system and provide details of the aircraft fire, for example:

- Location of aircraft;
- Nature of fire (e.g. undercarriage fire, engine fire);
- Number of Passenger On Board (POB); and
- Presence of dangerous goods, if known.

The Air Traffic Controller shall give clearance to the responding fire vehicles to enter the runway/taxiway as soon as possible.

If the fire is large and has caused extensive damage to the aircraft and external resources are required to aid in the mitigation process, the Air Traffic Controller shall declare "Aircraft on Fire". The standard text and format used for the "Aircraft on Fire" message shall be as follows:

- AIRCRAFT ON FIRE;
- Aircraft Operator;
- Aircraft Type & *Flight Number; Location of Aircraft;
- *Nature of Fire (*e.g.* undercarriage fire, engine fire);
- *Number of Persons on Board (POB);
- *Any Dangerous Goods on Board.

*(*The information shall be provided if it is available and applicable.)*

The Sequence of Activation for "Aircraft on Fire" shall be similar to that of "Aircraft Crash within the Airport Fire Service Turnout Area". The use of the phrase "Aircraft on Fire" is to give distinction and therefore avoid confusion between aircraft crash and aircraft on the ground on fire.

vi) Fires on the Ground (Fires Involving Airport Buildings and Installations, *i.e.* Non-Aircraft Related Fires)

Fire may occur at any of the airport installations and buildings. If out of control, such a fire may cripple the key airport facilities and disrupt the normal airport operations. During a fire occurrence, however small it may appear to be, person who discovers it shall:

- Raise the fire alarm via the nearest manual call point. If no manual call point is readily available, raise the alarm by other available means;
- Inform the Airport Fire Service immediately of the exact location of the fire; and
- Operate a suitable fire extinguisher where readily available, or any water hose reel within range.

On receipt of a structural fire call, the Fire Watch Tower operator shall request the caller to provide the following details:

- Location of fire;
- Type of fire;

- Name of caller; and
- Telephone number of caller.

vii) Dangerous Goods Accidents/Incidents

Dangerous goods accidents/incidents may occur:

- During an "Aircraft Crash" in which the aircraft concerned is carrying dangerous goods;
- During a "Full Emergency" in which the aircraft concerned is carrying dangerous goods;
- During a "Local Standby" in which the aircraft concerned is carrying dangerous goods;
- During "Fires on the Ground" in which the aircraft is carrying or . in the process of loading/unloading dangerous goods; or
- When consignments of dangerous goods are damaged during loading or unloading from the aircraft or during delivery or collection from cargo terminals/warehouses within the airport.

viii) Emergency Response for Enemy Action or Sabotage

a) Bomb Alert on Aircraft

i) Any aircraft that is suspected of carrying a bomb should be parked in Isolated Bay Area

ii) All passengers should be evacuated immediately by the fastest means whilst the local or airport police arrange for bomb disposal experts to attend and search the aircraft. All baggage should be left on board until it has been searched and cleared. Airport rescue and fire services should be standby at point no less than 300m from air craft and predetermined procedure for bomb alerts should take into account the calling of local authority services of fire, police, ambulance and hospitals

iii) These types of incidents may occur on the ground or in the air including the seizure of an aircraft unlawfully, the placement of bomb on board or suspected bomb on board or armed attack on the aircraft which may include taking of hostage in such cases airport normally have

contingency plan which firstly demand positioning the aircraft away from the main runway and terminal building and secondly police and law enforcement agencies are contact as necessary

iv) Air traffic control must maintain continuous communication with the rescue and fire fighting services to ensure that they are kept updated in relation to any change in distressed aircraft condition.

v) To attend to bomb threat calls received to aircraft, terminal building, vital installations and arising from unclaimed observed insides/outside the airport and safe neutralization of explosives devices found.

vi) To conduct regular training of airport security police and staff, airline agencies working at the airport. This training is based for identification of explosives

ix) Emergency Response for Forced landing of Hijacked Aircraft

Every airport is faced with a threat of hijacked aircraft forced to land at the aerodrome all airports have standard operating procedures to deal with such eventualities. An outline of the procedure to be followed to manage this contingency is given below.

Essentially the plan of action is as follows:

- A separate isolated parking place away from the parking aprons and far away from the terminal complex is earmarked for parking such aircraft after it has landed
- All messages from the hijackers are to be relayed by air traffic control to the concern agencies
- Information must be promptly given to local police dept state government authorities and concern airline company
- Information will also be passed to neighbouring airports for alert through airport officials and IAF authorities
- Fire tender and ambulance be kept ready for emergency situations
- Local hospital, fire services and ambulance services made alert for possible aid

All the standards of pre embarkation security and anti sabotage measures in respect of civil aviation issued by Bureau of Civil Aviation Security will be followed.

TABLE NO: 7.1 ASSIGNMENTS OF RESPONSIBILITIES

S.No.	Task Allotted	Agency
1	Anti-hijacking Security	Central Industrial Security Force Bureau of Civil Aviation Security
2	Security of registered baggage	Airlines concerned Airlines catering and cargo
3	Access control & Issue of PICs/Temporary passes	AAI, APSU/ CISF & BCAS
4	Perimeter Security/Security of vital installations	AAI , APSU/CISF
5	Bomb Detection and Disposal Squad (BDDS)	BDDS / Local Police
6	Emergency intervention in contingency situation	AAI, APSU/CISF/NSG e.g. Hijacking incidents.
7	Law and Order, Crime, Intelligence, Traffic	Local Police

7.6 Role and Responsibility in Handling Emergencies

Table below summarizes the general key functions for the Navi Mumbai International Airport (NMIA) and other supporting organizations/ agencies/ services during an airport crisis.

Sl. No.	Organization/Agencies/Services	Key Function/Responsibility
1	NMIA - Airport Fire Service	• Aircraft rescue and fire fighting operation • Post-accident fire protection • Support for triage activities • Evacuate injured passengers to hospitals • Support for structural fire-fighting and evacuation • Support for mitigation and dangerous floods, accidents/ incidents

2.	NMIA – Airside Management/ Operation	• Activate key officials and ground handling agent concerned • Muster airline's and ground handling agent's resources • Provide and direct ground service supports • Provide inputs to air traffic control in regard to runway and taxiway closure • Coordinate aircraft recovery and salvage operation.
3.	NMIA – Air Terminal Management	• Activate key officials and other external agency/services such as hospitals, panel doctors, ambulance services, bureau of civil aviation security, immigration and customs • Activate the Emergency Response and Interaction Centre (ERIC) Group • Setup the Emergency Co-ordination Centre (ECC), Survivors Reception Centre (SRC), Friends and Relative Reception Centre (FRRC) and Re-union Area (RA) • Passengers facilitation and business recovery at terminal buildings • Support terminal building evacuation.
4.	NMIA – Engineering	• Provide technical support and assistance • Support recovery efforts
5.	NMIA – Corporate Communication.	• Media management • Facilitate press releases and • organization of press conferences
6.	Airport Authority – Air Traffic Service	• Activation and Termination of Crash Action, Full Emergency, Local standby, etc. • Air traffic management including issuing NOTAM (notices to airman)
7.	Police	• Guarding of aircraft wreckage and preservation of evidence at the accident site including eye-witness accounts and photography • Custody of flight data and cockpit voice recorders, cargoes onboard including dangerous goods, and baggage/passenger belongings • Investigation and management of dead bodies including their identity establishment, mortuary arrangements, and release of the bodies • Arrange medical examinations of the alive crew members and passengers as well as post-mortem examinations of the deceased crew members and passengers mob control.

8.	Airlines	• Support overall crisis mitigation efforts e.g. accountability of passengers, management of Next of Kin (NOK), aircraft accident investigation, etc. • Support media management • Passenger and NOK facilitation • Facilitate reunions of survivors and NOK • Prepare and provide passenger and cargo manifests. • Report the aircraft accident or serious incident to the authorities concerned as stipulated under Aircraft Rules, 1937, Part X Investigation of Accidents. • Salvage/removal of crashed or disabled aircraft
9.	Ground Handling Agent	• Provide ground service staff and facilities including passenger steps, coaches, and aircraft towing equipment.
10.	Director General of Civil Aviation (DGCA)	• Set standards and directions for dealing with all aviation related emergencies. • Aircraft accident/incident investigation. • Authorize release of dead bodies, cargoes onboard including dangerous goods, baggage, and removal of crashed/disabled aircraft.

7.7 Operation and Management Control:

7.7.1 Airport Emergency Managing Committee

To ensure coordinated action, an Airport Emergency Managing Committee will be constituted. The airport director will be the chairman of this Committee. The committee will comprise of members from various airport departments including the following.

- Airport Administration
- Air Traffic Control
- Airport Rescue and Fire Fighting
- Airport Security Services (CISF, BCAS)
- Safety Department
- Airport Medical Services
- Maintenance Department
- Environment Management Cell
- Representative from Airlines

- Transportation Department
- Cargo Facility
- Department of Information and Publicity
- Representative from local NGO's and Social Group

Also member from Airport Authority of India and district administration will be part of the committee.

Airport emergency managing committee will design the procedure the emergency action plan, evacuation plan and procedures for implementation based on local needs and facilities available. For effective implementation of emergency action; coordination, among the various agencies involved in Emergency Control Centre will be expected, emergency control centre will be established as the supreme command post for emergency action, for direct action and coordination at ground level mobile command post will be established. Emergency action committee will select officers in charge for emergency control centre.

7.7.2 Airport Emergency Operation/Co-ordination Centre

During a major airport disaster such as an aircraft crash or a severe fire outbreak at terminal building, the various emergency operations and coordination centres will be established immediately to mitigate the disaster. The Emergency Control Centre will be the top command for coordination and communication centre for all kinds of emergencies. The Chairman of Emergency Managing Committee will be the head of emergency control centre, under his direction; chief officer will operate and regulate all emergency operation. The centre will operate under the directions of Airport Emergency Managing Committee. Its location will be fixed, as per the requirement emergency situations.

The main features of this unit will be

- Its fixed location
- It acts to guide and support to the on scene commander in the mobile command post for aircraft accidents/incidents

- It will be operated by a specialised trained staff from Fire, Safety, Health and Environment department personnel of airport
- It will be the command, co-ordination and communication centre for unlawful seizure of aircraft and bomb threats
- It is operationally available 24 hours a day
- The location of the emergency operations centre should provide a clear view of the movement area and isolated aircraft parking position, wherever possible.

The Airport emergency operation centre should contain:

- Emergency alert and communication system.
- Adequate number of external telephones. The latest telephone directories with a separate list of important numbers.
- Adequate number of internal telephones and a P.A. system.
- Radio equipment, hot-lines and walkie-talkie.
- Plans of the airport to show various areas of airport
- Sources of sirens and safety equipments including fire, explosion, spill and gas controls.
- Stock of other fire extinguishing materials.

The airport emergency operations and coordination centres at the airport comprise Crisis Management Centre (CMC), Airport Emergency Response and Interaction Centre (AERIC), Emergency Coordination Centre (ECC), Mobile Command Post (MCP), Triage Area (TA), Survivors Reception Centre (SRC), Friends and Relatives Reception Centre (FRRC) and Reunion Area (RA). Each of them has its own functions and roles to perform during the crisis as described below:

i) Crisis Management Centre (CMC)

Established by the airport operator, the CMC is to function as an overall overseeing and controlling authority of the crisis mitigation process during an emergency. The committee of the CMC comprises the following permanent and supporting members:

Permanent members of CMC are:

a) Chief Operating Officer
b) Head (Engineering/Maintenance)
c) Head (Utility)
d) Head (Security)
e) Head (Airside Management)
f) Terminal Manager

Supporting members of CMC are*:*

a) Ministry of Civil Aviation representative
b) DGCA representative
c) Airline concerned representative
d) CISF representative
e) Police representative
f) Any other agencies required for proper handling of the crisis.

Functions of the CMC include:

a. Formulate strategic plans and policies, as well as engage in high level decision making for the mitigation of crisis;
b. Control, coordinate and support operations during an aircraft accident;
c. Oversee the work and progress of protracted fire-fighting & rescue, and salvage operations;
d. Liaise with the airline concerned, local authorities, ministries, and governmental departments for support;
e. Arrange and provide welfare to the staff involved in the mitigation of crisis;
f. Regulate the release of information to the public on the facts of the disaster;
g. Authorize the release of official passenger manifest and information pertaining to the aircraft accident;
h. Issue press releases and organize press conferences; and
i. Ensure that the post-accident operations are completed expeditiously so that the airport can resume normal operations in the shortest possible time.

ii) Emergency Response and Interaction Centre (ERIC)

When an accident occurs beyond the normal office hours, the CMC Committee may take longer-than-usual time to convene. As an interim arrangement, ERIC will be activated and its members will be notified as per the roster and convene within one hour of activation.

The ERIC group will carry out the general functions of the CMC until the latter comes into operation. When the CMC is operational, the ERIC will cease functioning and play the supporting roles as directed by the CMC. Before standing down the ERIC operations, the head of the ERIC group shall brief the CMC on the progress.

The ERIC Group comprises Officials on duty. The members are on a weekly rotation basis. All officials on the duty are required to have their mobile phones switched on at all times and be in a position to reach the airport within one hour of activation.

iii) Emergency Coordination Centre (ECC)

Located near to airport gate, the ECC will be established by the airport operator, in the event of a major disaster to coordinate the response and functions of the external supporting organizations, agencies, and services involved in the mitigation of the emergency. Functions of the ECC include:

a. Support crash site fire-fighting and rescue operations through liaison and coordination with the external organizations/agencies/ services;
b. Facilitate mobilization of external resources to the crash site, such as issuing emergency passes and arranging with Apron Control for "Follow-me" vehicles;
c. Friends and relatives facilitation at the airport; and
d. Arrange and facilitate visits by the VVIPs to the crash site.

iv) Mobile Command Post (MCP)

The MCP will be established at the accident site to serve as an on-scene command, coordination and communication centre for the accident. It is a point where the co-operating agencies heads/representatives assemble to receive and disseminate information and make decisions pertinent to the rescue operations.

The MCP will be deployed to the accident site by the Airport Fire Service and be positioned at a distance of not less than 90 m upwind from the aircraft.

The MCP will be headed by Head (Airside Operations), and Chief Airport Fire Service will be the alternate Head. When it is beyond the office hours, Duty Airport Manager (Shift-In-Charge) shall proceed to manage the MCP for the first hours until Head (Airside operations) or Chief Airport Fire Service arrives. Functions of the Mobile Command Post include:

a. Establish communication with CMC and ECC.;
b. Establish contact with other agencies reporting at the crash site. Establish a staging area for all ground services equipment such as tow tractors, passenger steps, and coaches reporting to the crash site;
c. Establish an Assembly Area for the uninjured survivors;
d. Secure and provide any assistance required by the doctors at the Triage Area;
e. Arrange speedy evacuation of injured casualties to the hospitals;
f. Liaise with the airline concerned to transport the uninjured and casualties; and
g. Maintain and update a record of casualty evacuation status including:
    - Number of casualties evacuated from the aircraft; and
    - Number of casualties evacuated to the Emergency Medical Centre, hospitals, and Survivors Reception Centre.

v) Triage Area (TA)

Triage area is a location established usually near to the accident site, where triage operations (*i.e.* sorting and classification of casualties to determine the order of priority for treatment and transportation) are performed. In an aircraft crash accident, the triage area is normally established at a distance of not less than 100 m upwind from the aircraft. In triaging, casualties are classified into four categories given below and explain in the Table below:

- Priority I : Immediate care
- Priority II : Delayed care
- Priority III : Minor care
- Priority 0 : Deceased

Table No 7.2

Medical Priorities in Triage Area

Category (priority)	Status	Arm band or identification	Description
P-I	Immediate case	Red	Serious injuries, haemorrhage, asphyxia, facial injuries open and compound fracture, extensive burns, crash injuries and sever shock symptoms
P-II	Delayed care	Yellow	Simple fracture, limited burns, cranial trauma, rapidly progressive shock. Injuries to sort parts burns less than 30%
P-III	Minor care	Green	Minor injuries-need only first aid on the spot.
P-0	Dead	Black	Declared dead by the doctor

To expedite the treatment of mass casualties in a triage situation and to permit more rapid evacuation of the injured to medical facilities, the casualty identification tags (also known as Met-Tags) as specified in ICAO Airport Services Manual, Part 7 shall be used.

vi) Assembly Area (AA)

The Assembly area is an area set up near the accident site to temporarily receive the survivors until the arrangements to transport them to the Survivors Reception Centre are made. Depending on the doctors' assessments of their medical condition, most priority III casualties will also join them and bring to the Survivors Reception Centre.

vii) Survivors Reception Centre (SRC)

The Survivors Reception Centre (SRC) is a designated area set up for receiving the survivors (except for the flight crew and flight attendants) involved in an aircraft accident, for the associated documentation designed to account for the survivors and for interviews by the police officers and accident investigators.

Upon receiving the "Crash" message, Terminal Manager will set up the SRC which shall be manned by the airline staff with the police taking charge of the security of the area, *i.e.* no unauthorized persons shall be allowed in this area. At the SRC, the airline staff shall:

- Perform head count, briefing and documentation;
- Provide care and comfort including refreshments;
- Arrange accommodations;
- Facilitate the survivors who plan to continue their journey; and
- Arrange for doctors and/or officers through ECC on need basis.

viii) Friends and Relatives Reception Centre (FRRC)

The FRRC serves as a secure area, away from the attentions of the media, for the friends and relatives of those involved in an aircraft accident. The documentation process within the FRRC helps to confirm who was on the aircraft and facilitates the reunion. On receiving the "Crash" message, the Terminal Manager will set up the FRRC.

The airline staff shall man the FRRC, and the police shall take charge of the security of the area. At the FRRC, the airline staff shall:

- Attempt to verify the identity of the visitors on entry;
- Conduct documentation and briefing;
- Update Next to Kin (NOK) with the latest information including passenger manifest, that has been officially cleared;
- Provide care and comfort including refreshments;
- Facilitate the NOK's requests or needs;
- Break the news of fatalities to the NOK concerned in the presence of the police; and
- Arrange for doctors and/or officers through ECC on a need basis.

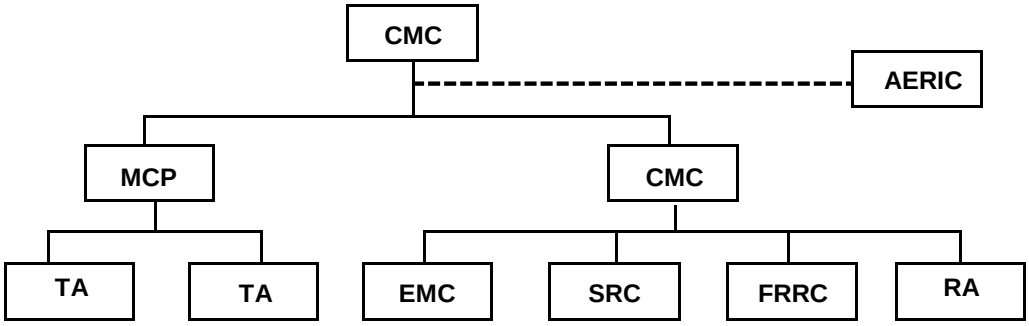
ix) Reunion Area (RA)

Reunion Area is an area for the reunions between survivors and their friends and relatives (reconciliation process) to take place. Once the matching is completed, the friends and relatives will be brought in batches under the

police's escort to the Reunion Area by the airline staff. Similarly, the uninjured survivors will be escorted by the police and airline staff to the Reunion Area to meet with their friends and relatives.

Command structure and communication flow among various emergency operations/ coordination centres is as per given below:

Command Structure and Communication Flow



7.8 Training and Education

Regular training would be provided to all personnel who have a role in planning and operational response to an emergency. The training objectives are:

- To familiarize personnel with the contents and manner of implementation of the plan and its procedures;
- To train personnel in the performance of the specific duties assigned to them in the plan and in the applicable implementation procedures;
- To keep personnel informed of any changes in the plan and the implementing procedures;
- To maintain a high degree of preparedness at all levels of the Emergency Response Organization;
- Train new personnel who may have moved within the facility organization;
- Test the validity, effectiveness, timing and content of the plan; and
- Update and modify the plan on the basis of experience acquired through exercises and drills.

7.9 Mock Drills and Exercises

Mock drills constitute another important component of emergency preparedness and refer to the re-enactment, under the assumption of a mock scenario, of the implementation of response actions to be taken during an emergency. Mock drills and integrated exercises have the following objectives.

- To test, efficacy, timing, and content of the plan and implementing procedures;
- To ensure, that the emergency organization personnel are familiar with their duties and responsibilities by demonstration;
- Provide hands-on experience with the procedures to be implemented during emergency; and
- Maintain emergency preparedness.

The frequency of the drills would vary depending on the severity of the hazard. However, drills would be conducted once in a year. Scenarios may be developed in such a manner as to accomplish more than one event objective. Drills and exercises will be conducted as realistically as is reasonably practicable. Planning for drills and exercises would include:

- Basic objectives;
- Dates, times and places;
- Participating organizations;
- Events to be simulated;
- Approximate schedule of events;
- Arrangements for qualified observers; and
- An appropriate critique of drills/exercises with participants.

Evaluation of drills and exercises would be carried out which include comments from the participants and observers. Discrepancies noted by the drill observers during the drill shall be pointed out.

The individual responsible for conducting the drill or exercise would prepare a written evaluation of the drill or exercise. The evaluation would include assessments and recommendations on:

- Areas that require immediate correction;
- Areas where additional training is needed;
- Suggested modifications to the plan or procedures; and
- Deficiencies in equipment, training, and facilities.
- Records of drills, exercises, evaluations, and corrective actions would be duly maintained.

7.10 Updating of Disaster Management Plan

The Disaster Management Plan and implementing procedures would be reviewed and updated to ensure compliance with relevant regulations and applicable state and local emergency plans.
The need for updating is based on following aspects:

- Written evaluations of mock drills exercises which identify deficiencies or more desirable methods, procedures, or organizations;
- Changes in key personnel involved in the organization;
- Changes in the facility organization structure;
- Changes in regulations;
- Recommendations received from other organizations and state agencies.